

*2001 = I*MTC / REPORT / 01IFFCOKALOL UNIT

PLANNING SECTION

MAINTENANCE DEPTT.

REPORT NO. 21 / 2001

REPORTONPLANT TURNAROUND( MARCH - APRIL - 2001 )INDIAN FARMERS FERTILISER CO - OPERATIVE LIMITED

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## P R E F A C E

Plant Turnaround for the year 2001 was planned during March - April 2001, accordingly, Ammonia & Urea plants were stopped on 25th March 2001. Rotating and static equipments were taken up for routine overhaul and inspection.

In Ammonia plant, preventive maintenance was carried out on all critical turbine/compressor trains. All the heat exchangers were also opened, cleaned and boxed up. Leaking tubes of 127-CA / CB were replaced/plugged. All the critical RVs were overhauled, tested and were put back in place. Ultrasonic scanning was carried out of all the reformer tubes by M/s PDIL.

In addition to routine maintenance jobs, the ID Fan Drive Elliot Turbine was taken for major overhauling to solve its governor hunting problem. Turbine driven 103J Seal Oil Gear Pump was replaced with new Indegenous Screw Pump of Tushaco make for better reliability. Small capacity Cold Ammonia Pump (118-JB) was installed and commissioned. Secondary reformer bottom dome liner was replaced with new plates of Incolloy 800H. Both the distributors of the CO<sub>2</sub> stripper (102-EA / EB) were replaced with modified design to avoid frequent breakages. Also almost 50% holes of all the trays were blanked to reduce steam consumption. Alternate rows of tubes in both the 111-CA & 111-CB were also plugged. The Auxiliary Boiler as well as 112-C in Ammonia plant were offered for IBR inspection to Boiler Inspector.

In Urea plant, Hitachi compressor (K-1801) L.P. & H.P. Case along with its turbine (Q-1801) & gear box (M-1801) taken for preventive maintenance. CO<sub>2</sub> centrifugal compressor (K-1101-1) (Nuova Pignone) & its turbine (Q-1101-1), CO<sub>2</sub> reciprocating compressor (PB) turbine (Q-1101-2) also taken for preventive maintenance. Prill tower ID Fans, Prill cooling system fans & scraper taken for preventive maintenance. All heat exchangers were cleaned by hydrojetting & boxed up. Various RV's were overhauled & tested. M/S. Stamicarbon inspected H.P. Vessels of Autoclave (V-1201), H.P. Stripper (H-1201), H.P. Carbamate condenser (H-1202), H.P. Scrubber (H-1203), Various L.P. Vessels also opened for inspection & boxed up.

In Offsites plant, C.W. Pump P-4401/ B was taken for rotor inspection. Other pumps and turbines were also taken for preventive maintenance. As per recommendation of RLA study report & 5 years action plan approved by IBR authority, 03 nos. of water wall tube samples has been taken for review of deposit content, and new pieces were welded. Boiler flue duct C.S. expansion bellows 01 no. and Hot air duct expansion bellow 02 nos. were replaced by new S.S.304 expansion bellow. 24" N.B. punctured C.S. pipe line under railway track near railway gate no.2 replaced.

In B&MH plant preventive maintenance of Reclaim Machine M-2116 was carried out. Packer scales, Conveyor belt M-2110, M-2112, M-2117, M-2121, M-2122, & M-2124 (1-6) were also taken for preventive maintenance.

## ELECTRICAL JOBS

Preventive maintenance of transformers, feeder compartments and ACB's of Ammonia, Urea, Offsites and B&MH plants were carried out. Also certain critical motors were overhauled. Preventive maintenance of 66 KV, 11 KV, OCBs, MOCBs and VCBs were carried out.

## INSTRUMENT JOBS

During annual plant turnaround year-2001, Following instrumentation jobs were carried out.

Various critical control valves of all the plants were overhauled and all critical transmitter of all the plants were calibrated, various critical field instruments of various plants were checked, inspected and calibrated for preventive maintenance. Vibration probes and other instruments were removed and reinstalled in all the compressor of Ammonia plant and Hitachi compressor of Urea plant to facilitate mechanical maintenance jobs.

In Ammonia plant GE Fanuc PLC control room panel for NG / AG Booster compressor, 800J was rewired, separate MCB were provided for both CPUs, Input cards and Output cards, Logic and HMI were modified as per the requirement of production peoples.

New 8nos. alarm switches were replaced and 13 nos. thermocouples with thermowells were provided in Heat Exchangers, Various AMC & preventive maintenance jobs were carried out for HIMA PLC system, FUJI UPSS and Centum-XL DCS.

In Urea plant, trips of old centrifugal compressors and Hitachi compressor were checked. NC Ratio meter monoblock valve was overhauled, HICV-1422B, HICV-1424 & PICV-1424 control valves were installed and commissioned. All the HP vessels jobs were carried out as per the requirements of production/ maintenance deptt. requirements.

In Offsites & Utility plant, control room, field instruments were calibrated, termination of Boiler Burner Management System panel, Main Control Room panel of New Boiler, Storage Area, D.M. Plant and Cooling Tower were checked. Overall performance of Boiler UPSS was checked for reliability. All packer scales of Bagging plant, weighing machines and Main Gate Weigh Bridge were calibrated.

Various preventive maintenance jobs, Capital / Technical / Modification related jobs, AMC related were successfully carried out in different areas of plant. Painting, Cleaning and Overhauling of various instrument control panels etc. were carried out.

## TECHNICAL DEPARTMENT JOBS :

Job related to providing control valve on CCS-II, Cold ammonia supply from offsite ammonia preheater(H-1102), stoppage of lean carbamate pump for energy saving, ammonia loss reduction scheme etc completed.

After completion of above jobs, the Ammonia plant was started and production was lined up on 15-04-2001 and urea production was lined up on 16-04-2001.

PLANT TURNAROUND - MARCH - APRIL - 2001

GENERAL - DETAILS

SR. NO.	CATEGORY	QUANTITY
01	<u>EQUIPMENT UTILISED :</u>	
	(A) <u>IFFCO :</u>	
	55 T HM Crane	01
	15 T Coles Crane	01
	18 T Tata Crane	01
	10 T ESCORT LIFT-N-SHIFT	01
	03 T Forklift	03
	07 T Truck	01
	(B) <u>HIRED :</u>	
	120 MT TADANO Crane with Hydraulic Telescopic Boom ( Truck Mounted )	01
02	<u>MANPOWER UTILISED :</u>	
	(A) <u>IFFCO MANPOWER :</u>	
	a) Mechanical } Existing strength	
	b) Mecanical Services } Existing strength	
	c) Electrical } Existing strength	
	d) Instrument }	
	e) Trainees in various trade }	
	(B) <u>HIRED - CONTRACT MANPOWER :</u>	
	<u>Sr.No.</u> <u>Category</u> <u>Mandays</u>	
	01                      Mill Wright Fitter	65
	02                      General Fitter	1263
	03                      Rigger	1921
	04                      S.S. Rigger	3957
	05                      Fabricator	378
	06                      Grinder	489
	07                      IBR Welder	34
	08                      Non-IBR Welder	176
	09                      Carpenter	27
	10                      Mason	24
	11                      Forklift Operator	59
	12                      Instrument Fitter	100
	13                      Electrician	114
	14                      Machinist	36

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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

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MAINTENANCE JOBS CARRIED OUT BY OUTSIDE AGENCIES

SR. NO.	JOBS CARRIED OUT	CONTRACTORS NAME	W.O.NO. & DATE
1	Overhauling & Preventive maint. of rotating equipments in Ammonia plant	M/s. ALSTOM Power India Ltd., Baroda	9909306 15/03/2001
2	Overhauling & Preventive maint. of rotating equipments in Urea plant	M/s. SPIC-SMO, Mumbai	9909311 15/03/2001
3	Supervisory services for overhauling & testing of Relief valves in Ammonia & Offsite plants	M/s. Flotec Engineering services, Surat	9909136 23/02/2001
4	Scaffolding & Blinding / Deblinding jobs during shutdown	M/s. Anu Engineers, Vadodara	9909098 12/03/2001
5	Supply & Application of paints on primary reformer chimney & vent silencer	M/s. Ashish Decorators, Baroda	9909358 22/03/2001
6	Retubing of Ammonia Refrigerant condensor 127-CA & CB	M/s. Emkay constructions, Vadodara	9909265 13/03/2001
7	Fabrication & repair in CO2 stripper in Ammonia plant	M/s. Technocon Projects & Engineering, Baroda	9909325 15/03/2001
8	Replacement / Fabrication & erection of IBR pipings	M/s. Skywin Erectors, Ahmedabad	9909274 14/03/2001
9	Contract for pipe line Non-IBR pipe fabrication jobs	M/s. Technocon Projects & Engineering, Baroda	9908953 12/02/2001
10	Inspection of HP vessels	M/s. Stamicarbon BV, Netherlands (HOLLAND)	9909138 27/02/2001
11	Service of service Engineer for overhauling of Relief valves	M/s. Flotec Engineering services, Surat	9908930 30/01/2001
12	Replacement of Raw water CS pipe 24" dia under Railway Track near gate No.2	M/s. J & J Engineering, Shertha	9908811 20/12/2000
13	Replacement of mettalic expansion Bellows in BHEL Boiler	M/s. J & J Engineering, Shertha	9909111 26/02/2001
14	Replacement of Top conical Roof of LSHS tanks	M/s. Technocon Projects & Engineering, Baroda	9901903 19/04/2000
15	Overhauling of ELECON make Reclaim machine	M/s. EMTICI Engineering Ltd., Vallabh Vidhya Nagar	9909285 19/03/2001
16	Opening & Box-up of Heat exchangers	M/s. Technocon Projects & Engineering, Baroda	9909103 07/03/2001
17	Upgradation of Hot Insulation	M/s. Associated Insulation Co., Vadodara	9900926 30/12/99

SR. NO.	JOBS CARRIED OUT	CONTRACTORS NAME	W.O.NO. & DATE
18	Upgradation of Cold Insulation of Vessels, Heat exchangers & its associated piping in Ammonia plant	M/s. Associated Insulation Co., Vadodara	9901741 23/03/2000
19	Hydrojetting cleaning of Heat Exchangers	M/s. Deluxe Hydroblasting Services, Mumbai	9908912 16/01/2001
20	Supply of skilled manpower	M/s. Ram Bahadur & Co., Allahabad	9909298 15/03/2001
21	Supply of skilled manpower	M/s. Mahavir Engineering works, Vadodara	9909297 15/03/2001
22	Hiring of 100 / 120 TON capacity Crane services	M/s. Express Transport Pvt. Ltd., Vadodara	9909303 15/03/2001
23	Automatic Ultrasonic scanning of Reformer Catalyst & Riser tubes	M/s. Projects & Development (I) Ltd., Dhanbad (Bihar)	9909153 22/02/2001
24	Radiography Work at site on round the clock basis	M/s. NDT Services, Ahmedabad	9909088 01/03/2001
25	Insitu Metallography work of plant equipments at our site	M/s. Deep Metallurgical services, Thane	9908954 16/01/2001
26	Services of NDT Teams for Ultrasonic thickness measurement, Flaw detection, MPI & DP testing	M/s. Engineering Inspection service, Mumbai	9909247 08/03/2001
27	Repair & Maint.of BIUMASTIC Acid / Alkalies proof brick lining	M/s. CHEMISIGHT Engineer, Vadodara	9909262 21/03/2001
28	Monolithic plaster & epoxy painting in B & MH Plant	M/s. B.Chauhan & Co., Kalol	9909364 22/03/2001
29	Repairs of Insulating fire brick lining inside primary reformer	M/s. Associated Cement Co.Ltd., Ahmedabad	9909260 09/03/2001
30	Providing & Applying IP Net concrete protective coating on RCC wall of prill tower, conveyor gallery & other structural in plant	M/s. Krishna conchem products Pvt. Ltd., Mumbai	9909324 16/03/2001
31	FRV Lining in floor drain in water treatment plant	M/s. Western corrossion controller, Baroda	9909264 14/03/2001
32	Painting of outside surface of cooling tower & making IFFCO Monogram at top height of prill tower	M/s. Swati Corporation, Ahmedabad	9909236 09/03/2001
33	Providing & Applying Epoxy Monolithic plaster & epoxy painting work in B.& M.H. Building	M/s. ARCOY Industries, Ahmedabad	9909475 17/04/2001



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SR. NO.	JOBS CARRIED OUT	CONTRACTORS NAME	W.O.NO. & DATE
34	Service Representative for NICAD batteries	M/s. AMCO Power systems Ltd., Mumbai	9909398 27/03/2001
35	Servicing of DCS	M/s. Yokogawa Blustar Ltd, Vadodara	9902306 13/07/2000
36	Servicing of Hima PLC in Ammonia plant	M/s. Chemtrol Software Pvt.Ltd., Mumbai	9901985 25/04/2000
37	Rewiring & rectification of GE Fanuc PLC system for AG / NG Booster compressor	M/s. Dynamic Innovation, Ahmedabad	9909383 28/03/2001
38	Servicing of of UPS system in Ammonia plant	M/s. Instrumentation Ltd., Jaipur	9901972 19/04/2000
39	Calibration, Overhauling of Instruments & cabling, wiring etc.	M/s. A-Z Instruments services, Baroda	9908684 23/11/2000
40	Servicing & verification of 40T weigh bridge	M/s. Gujarat scale Industries, Ahmedabad	9900670 21/09/2000
41	AMC for Belt weigher system	M/s. EMTICI Engineering Ltd., Vallabh Vidhya Nagar	9902015 11/04/2000
42	Servicing & verification of "Libra" weighing machine	M/s. Mettler - Toledo India Pvt. Ltd., Ahmedabad	9901234 31/01/2001
43	Retrofitting of exiting Manual operated valves by providing Electrical Actuators for 4"x 1500 # Angle valve	M/s. ROTORK Control (India) Ltd., Mumbai	9901277 29/01/2000

PLANT TURNAROUND - MARCH - APRIL - 2001

AMMONIA PLANT

MECHANICAL JOB

CODE NO	JOB DESCRIPTION
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01 01 01     AIR COMPRESSOR TRAIN - 101-J / 101-JT :

AIR COMPRESSOR DRIVE TURBINE 101-JT :

Following jobs were carried out on 101-JT as a preventive measure:

- 1) Both the journal bearings as well as thrust bearing were inspected.
- 2) Greasing of Nozzle operating gear linkages.

101-JLP CASE :

Following jobs were carried out on 101-JLP as a preventive measure:

- 1) Both the journal bearings as well as thrust bearings were inspected and found to be O.K.
- 2) LP Compressor to Gear box coupling was replaced by new diaphragm type of coupling .
- 3) All the bag filters as well as Roll-O-Matic filters were replaced by new one.

101-JR (GEAR BOX) :

Following jobs were carried out on 101-JR as a preventive measure:

- 1) All the journal bearings were inspected and found to be O.K.
- 2) Both the gear as well as Pinion were inspected and found to be O.K.

101-JHP CASE :

Following jobs were carried out on 101-JHP as a preventive measure:

- 1) Both the journal bearings as well as thrust bearings were inspected and their clearances were found to be within the acceptable limits.
- 2) The HP case inter stage suction piping from 131-JC was loosened and it was observed that pipe got shifted by about 1.5" towards Northeast. In order to avoid the strain on the pipe line.Piping, was dismantled and was refabricated with tacking in position. After final welding the pipeline was reinstalled into the position and was found to have no strain .The machine was aligned and the readings are as shown below.
- 4) All the four expansion joints were also set to their correct cold settings.
- 5) During startup, south side (inboard) bearing started showing high vibrations from minimum governor speed (1.7 Mils in H direction) and the same reached at App. 3.7 mils at about 6000 RPM .

It was decided to stop M/c for investigation and following jobs were carried out:

CODE NO	JOB DESCRIPTION
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- 1) Doubting the vibrations beyond a particular RPM due to newly installed FR-4 orifice, the orifice was removed and machine was restarted. However there was no improvement in vibration levels.
- 2) Hence the machine was decoupled and the alignment was checked which was found to be slightly misaligned in horizontal direction with HP case moving towards siloside.
- 3) Both bearings which were found to have their clearances on higher side within the acceptable range (0.17mm) were replaced with new pads. The new clearances were 0.13 mm for both bearings.
- 4) Again all the flanges connected to compressor casing were checked for strain and no strain was found in them.
- 5) The orifice was reinstalled as no improvement was found by removing the same.

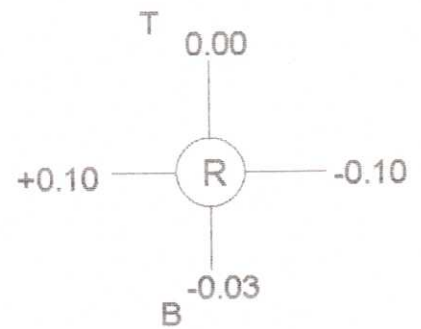
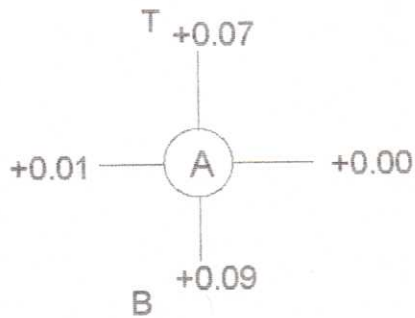
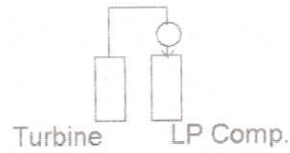
The machine was rolled again. However no improvement was found in the vibration levels. The readings taken during the overhaul of all the machines in the train are recorded as under.

POSITION	RADIAL CLEARANCES		THRUST CLEARANCES	
	DESIGN (MM)	ACTUAL	DESIGN	ACTUAL
<b><u>DRIVE CONDENSING TURBINE (101-JT)</u></b>				
Thrust end journal bearing	0175-0.225	0.22	0.2-0.3	0.21
Opposite thrust end journal bearing	0175-0.225	0.24		
<b><u>L.P. COMPRESSOR (101-JLP)</u></b>				
Thrust end journal bearing	0.15-0.20	0.25	0.275-0.375	0.36
Opposite thrust end journal bearing	0.15-0.20	0.23		
<b><u>H.P. COMPRESSOR (101-JHP)</u></b>				
Thrust end journal bearing	0.10-0.175	0.13	0.20-0.3	0.26
Opposite thrust end journal bearing	0.10-0.175	0.13		
<b><u>GEAR BOX</u></b>				
Drive gear North bearing		0.22		0.26
Drive gear South bearing		0.21		
Driven gear North bearing		0.21		
Driven gear South bearing		0.20		
Backlash of pinion gear		0.23		

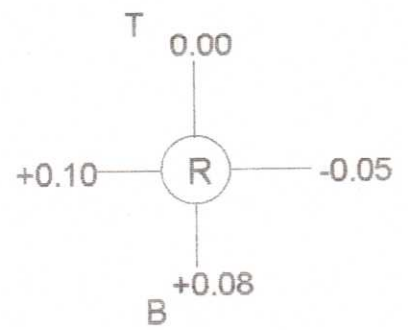
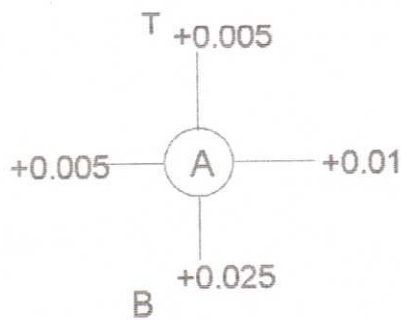
CODE NO      JOB DESCRIPTION

(TURBINE - LP COMPRESSOR)

Before Correction (Looking from Turbine End)

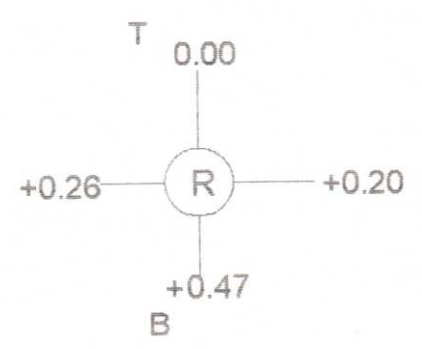
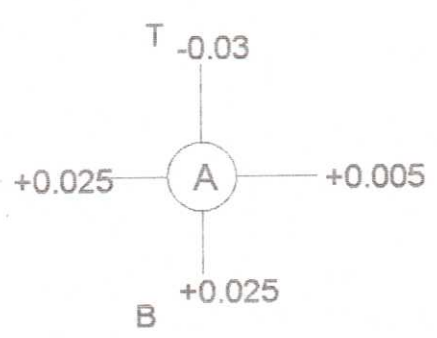
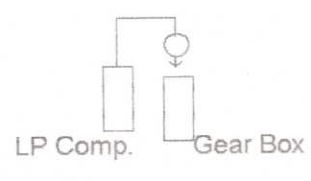


After Correction (Final Reading)

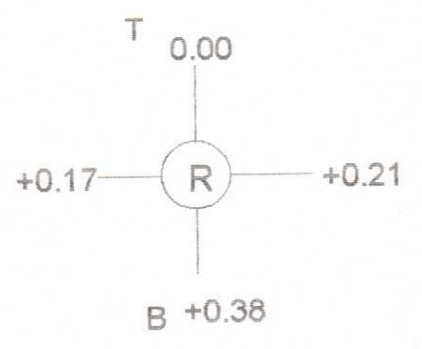
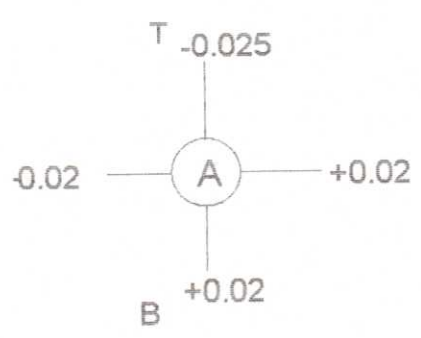


CODE NO      JOB DESCRIPTION

Before Correction (Looking from LP End)

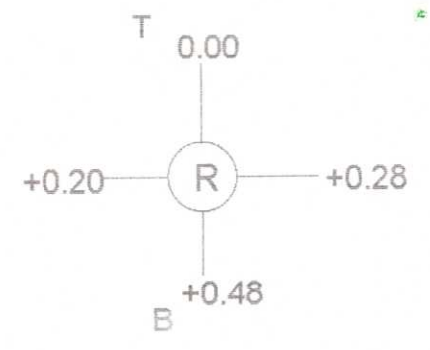
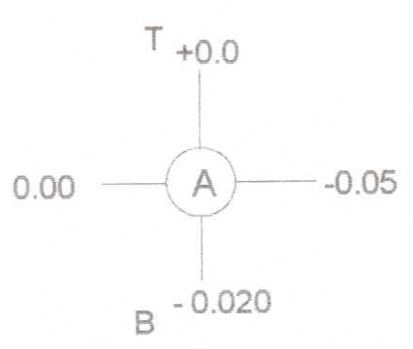
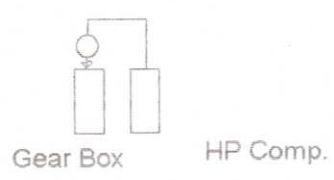


After Correction

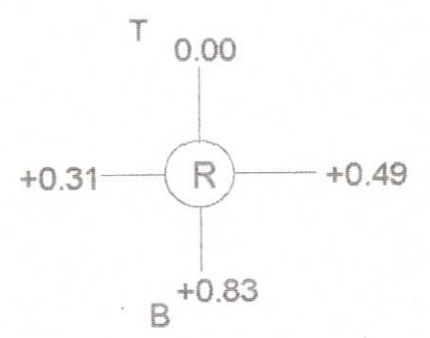
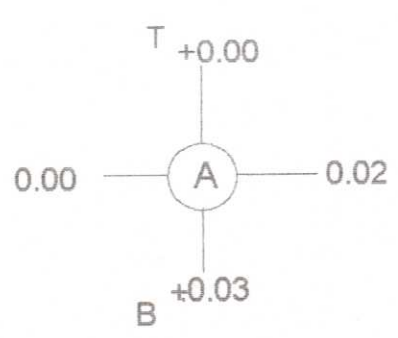


CODE NO      JOB DESCRIPTION

GEAR BOX-HP COMPRESSOR (Looking from H P Comp. End)  
Before correction



After Correction (Final Reading)



**CODE NO            JOB DESCRIPTION**

**01 01 02            N. G. COMPRESSOR TRAIN 102-J / JT :**

**N. G. COMPRESSOR DRIVE TURBINE 102-JT :**

**Following jobs were carried out on 102-JT during the shutdown.**

- 1) ESV was opened, cleaned and boxed up.
- 2) Servomotors as well as pilot valves for HP, LP1 & LP2 were overhauled.  
The clearance between piston and cylinder in the LP1 servo motor was found to be very high (1.5mm) hence the same was replaced with new assembly. However the new assembly was found operating very sluggishly and with jerks. Hence the same was opened and inspected. The ID of the cylinder was found to be oval and also clearance was found to be less. Again the old assembly was reinstalled and the operation was checked and was found to be O.K.
- 3) Governing oil filters were replaced.
- 4) Silo side lube oil filters were replaced.
- 5) Turbine journal bearings at both the ends as well as thrust bearing were inspected and their clearances were found to be O.K.
- 6) The ESV opening problem was attended by attending the overspeed tester. Now the opening of ESV is smooth and no trips are observed during opening.

**102-J N. G. COMPRESSOR :**

- 1) Both the journal bearing (Pads) were inspected. The pads of both side journal bearing were found having higher clearances hence the same was replaced by new one.
- 2) New N.G. separator was installed in compressor discharge line and has been taken into line and also make provision of an isolation valve for bypassing separator .

**Governor Drive Gear Box**

Drive gear bearing Radial clearance (Governor side ) ----- 0.05  
 Drive gear bearing Radial clearance (Turbine side ) ----- 0.05  
 Driven gear bearing Radial clearance (Governor side ) ----- 0.05  
 Driven gear bearing Radial clearance (Turbine side ) ----- 0.04  
 Backlash of gear : 0.08

**All dimensions are in MM**

**Note: The console oil of 102-J train was replaced with fresh oil Servoprime 68.  
 Total oil drums consumed were 37 Nos.**

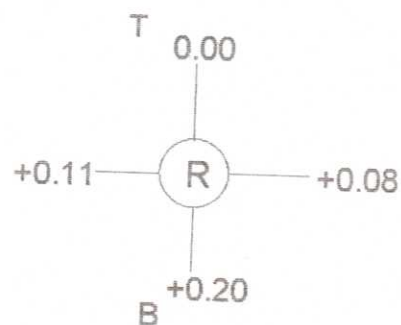
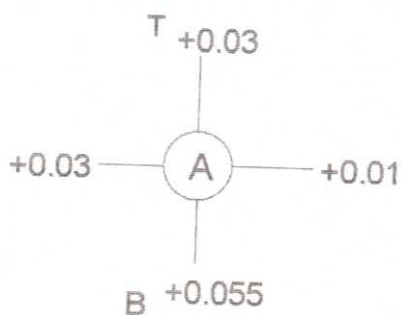
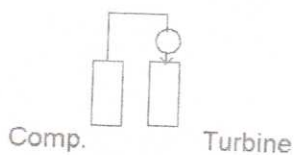
CODE NO      JOB DESCRIPTION

The reading taken during the preventive maintenance for all the machines in the train are recorded as under:

POSITION	RADIAL CLEARANCES		THRUST CLEARANCES	
	DESIGN (MM)	ACTUAL	DESIGN	ACTUAL
<b>DRIVE CONDENSING TURBINE (102-JT)</b>				
Thrust end journal bearing	0.12-0.139	0.16	0.16-0.24	0.18
Opposite thrust end journal bearing	0.15-0.172	0.22		
Thrust end oil catcher		0.22		
Opposite thrust end oil catcher		0.17		
<b>COMPRESSOR (102-J)</b>				
Thrust end journal bearing	0.07-0.095	0.08	0.25-0.35	0.30
Opposite thrust end journal bearing	0.07-0.095	0.09		

N.G. COMPRESSOR TRAIN ALIGNMENT READINGS - 102

( TURBINE- COMPRESSOR )



Note: All dimensions are in mm.  
All readings are noted from front side of the turbine.



CODE NO	JOB DESCRIPTION
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01 01 03

SYN. GAS. COMPRESSOR TRAIN 103-JAT / JBT , 103-JLP / JHP :

PREVENTIVE MAINTENANCE OF 103-JAT (BACK PRESSURE TURBINE) :

Following jobs were carried out on 103-JAT as a preventive measure:

- Bearings were checked and found to be O.K.
- Gear Coupling between 103JAT -JBT was found having pitting on inside surface of sleeves of both the hubs. Hence the complete coupling assembly was replaced by new one.
- PRC 12 stroke was checked and found to be O.K.
- 103-JAT Strainer Element and its' cover was removed for steam blowing arrangement of HS steam line and same was boxed up after blowing.
- 103-JAT Strainer Flange u/s gasket got damaged during start up of plant and same was replaced by new one.
- Sealing steam flange leakage below the turbine casing was attended.
- Greasing of Nozzle operating gear linkages was carried out.

PREVENTIVE MAINTENANCE OF 103-JBT (CONDENSING TURBINE):

- 1) Bearings were checked and found to be O.K.
- 2) The coupling guard between 103-JAT and 103-JBT was modified to have expansion bellow in between to take care difference in expansion of both the casings. The same has been found to be very effective and the oil leakage through the particular coupling guard after the machine start up is not observed.
- 3) The governing valve was removed and its' flange leakage from outlet flange connected to casing was attended.

PREVENTIVE MAINTENANCE OF 103-JLP :

Following jobs were carried out on 103-JLP as a preventive measure.

- Bearings checking of both the bearings.
- Thrust collar of LP compressor (Syn.Gas compressor train) was dismantled by hydraulic jack for inspection of inboard thrust pads and journal bearing. After inspection, same has been fitted back
- The antirotation pin for inboard thrust bearing was not found .The same was made from EN19 and installed.
- The coupling between both the compressors was cleaned and boxed up.

CODE NO      JOB DESCRIPTION

**PREVENTIVE MAINTENANCE OF 103-JHP :**

Following jobs were carried out on 103-JHP as a preventive measure.

- Bearings checking of OTE bearing.
- Checking of thrust bearing clearance and setting of instrument probe.
- The paper gasket was removed to adjust the thrust clearance.

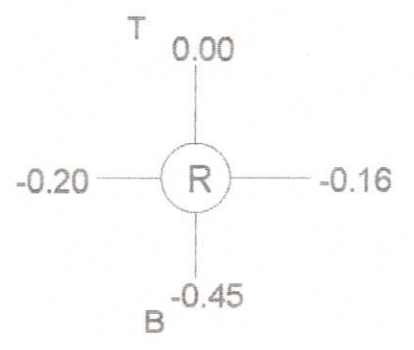
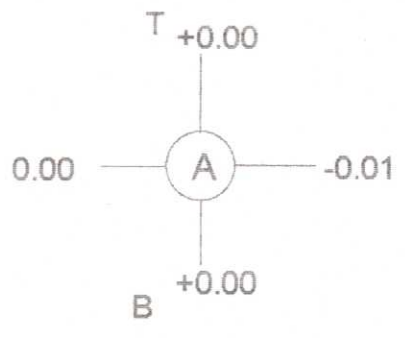
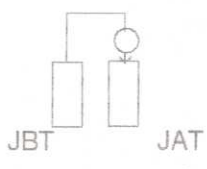
The readings taken during overhaul of 103-JBT for all machines in the train are recorded as under.

POSITION	RADIAL CLEARANCES		THRUST CLEARANCES	
	<u>DESIGN (MM)</u>	<u>ACTUAL</u>	<u>DESIGN</u>	<u>ACTUAL</u>
<b><u>DRIVE CONDENSING TURBINE (103-JBT )</u></b>				
Thrust end journal bearing	0.25-0.3	0.21	0.2-0.3	0.21
Opposite thrust end journal bearing	0.25-0.3	0.26		
Thrust end oil catcher	0.20-0.35			
Opposite Thrust end oil catcher	0.20-0.35			
<b><u>BACK PR. TURBINE (103-JAT)</u></b>				
Thrust end journal bearing	0.25-0.30	0.30	0.2-0.3	0.22
Opposite thrust end journal bearing	0.15-0.20	0.19		
<b><u>L.P. COMPRESSOR (103-JLP)</u></b>				
Thrust end journal bearing	0.11-0.19	0.20	0.38-0.55	0.39
Opposite thrust end journal bearing	0.11-0.19	0.14		
<b><u>H.P. COMPRESSOR (103-JHP)</u></b>				
Thrust end journal bearing	0.11-0.19		0.38-0.55	0.41
Opposite thrust end journal bearing	0.11-0.19	0.16		

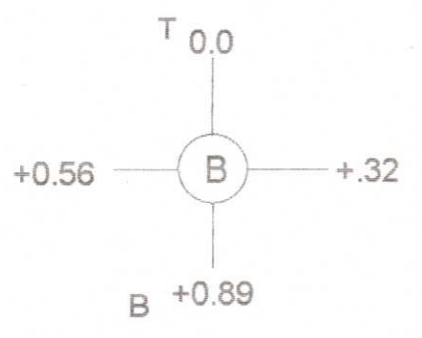
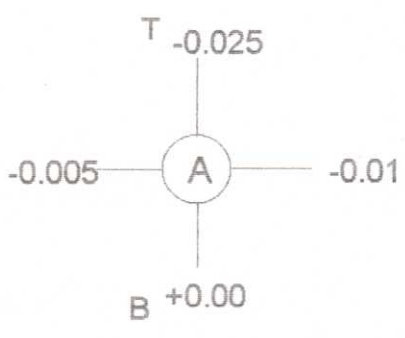
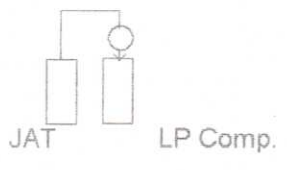
CODE NO      JOB DESCRIPTION

SYN GAS COMPRESSOR TRAIN ALIGNMENT READINGS - 103

( 103 JBT - 103 JAT : Looking From LP Turbine)



(103 JAT-LP COMPRESSOR : Looking From HP Turbine)

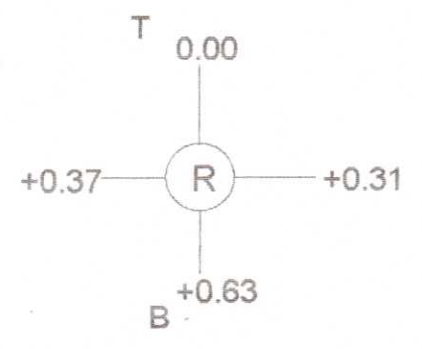
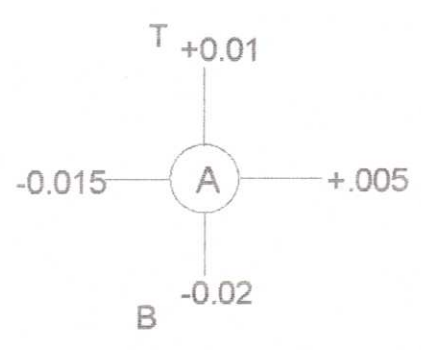
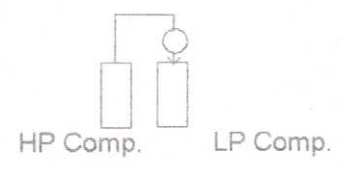


Note: All dimensions are in mm.  
All readings are noted from front side of the turbine.

CODE NO      JOB DESCRIPTION

SYN GAS COMPRESSOR TRAIN ALIGNMENT READINGS - 103

LP COMPRESSOR - HP COMPRESSOR (Looking From H P Compressor)



**Note:** All dimensions are in mm.  
All readings are noted from front side of the turbine.

CODE NO	JOB DESCRIPTION
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01 01 04	<u>REFRIGERATION COMPRESSOR TRAIN 105-JT, 105-JLP / JR / JHP:</u>
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PREVENTIVE MAINTENANCE OF TURBINE 105-JT:

Following jobs were carried out on 105-JT as a preventive measure:

- 1) Both the journal bearings as well as thrust bearing were inspected.
- 2) Greasing of nozzle operating gear linkages was carried out.

PREVENTIVE MAINTENANCE OF 105-JLP / JR / JHP:

105-JLP:

Following jobs were carried out on 105-JLP as a preventive measure:

- 1) Both the couplings between turbine and LP case as well as with gearbox were cleaned and inspected.
- 2) Both the sour oil traps were cleaned.
- 3) Thrust bearing was inspected and found to be O.K.
- 4) Both side journal bearing clearances were checked by lifting the rotor as the bearing housing is not of horizontally split design.

105-JR:

Following jobs were carried out on 105-JR as a preventive measure:

- 1) All the journal bearings were inspected and found to be O.K.
- 2) Both the Gear as well as Pinion were inspected and found to be O.K.

105-JHP:

Following jobs were carried out on 105-JHP as a preventive measure:

- 1) The coupling between turbine and HP case and gearbox was cleaned, inspected and found O.K.
- 2) Both the sour oil traps were cleaned.
- 3) Thrust bearing was inspected and found to be O.K.
- 4) Both side journal bearing clearances were checked by lifting the rotor as the bearing housing is not of horizontally split design.

The alignment of the complete train was checked and recorded.

**CODE NO      JOB DESCRIPTION**

The reading taken during preventive maintenance of all the machines of the train are recorded as under.

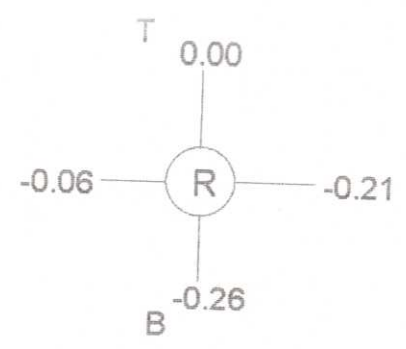
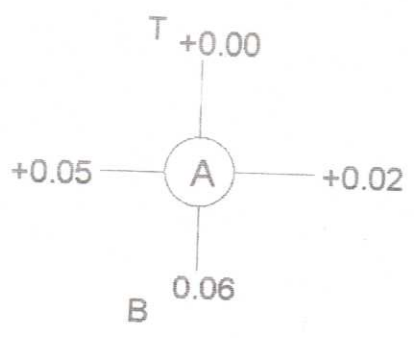
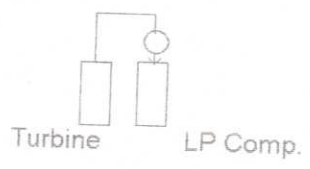
POSITION	RADIAL CLEARANCES		THRUST CLEARANCES	
	<u>DESIGN</u> (MM)	<u>ACTUAL</u>	<u>DESIGN</u>	<u>ACTUAL</u>
<b><u>DRIVE CONDENSING TURBINE (105-JT)</u></b>				
Thrust end journal bearing	0175-0.225	0.22	0.2-0.3	0.21
Opposite thrust end journal bearing	0175-0.225	0.22		
<b><u>L.P. COMPRESSOR (105-JLP)</u></b>				
Thrust end journal bearing	0.15-0.20	Dial G. Reading 0.21	0.275-0.375	0.34
Opposite thrust end journal bearing	0.15-0.20	Not dismantled		
<b><u>GEAR BOX</u></b>				
Thrust end journal bearing (Pinion)	0.25-0.30	0.34		
Opposite thrust end journal bearing (Pinion)	0.25-0.30	0.33		
Thrust end journal bearing (Gear)	0.25-0.275	0.33	0.35	0.35
Opposite thrust end journal bearing (Gear)	0.25-0.275	0.45		
<b><u>H.P. COMPRESSOR (105-JHP)</u></b>				
Thrust end journal bearing	0.10-0.175	Dial G. Reading 0.21	0.225-0.325	0.27
Opposite thrust end journal bearing	0.10-0.175	Dial G. Reading 0.21		

**NOTE:** All dimensions are in mm.

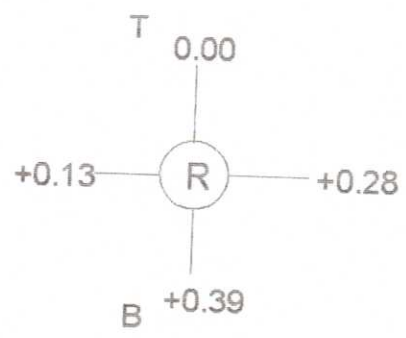
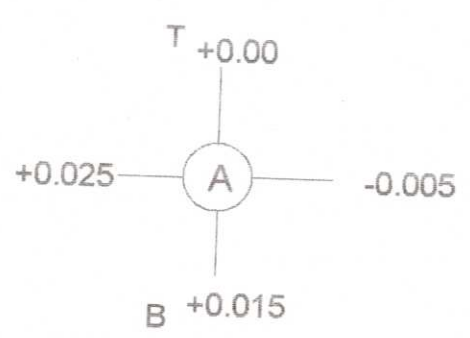
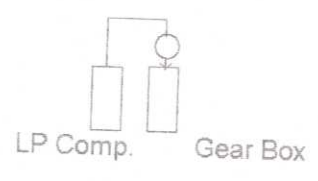
CODE NO      JOB DESCRIPTION

REFRIGERATION COMPRESSOR TRAIN ALIGNMENT READINGS - 105-J

(TURBINE - LP COMPRESSOR : Looking From Turbine End)



(LP COMPRESSOR - GEAR BOX : Looking From LP Compressor)



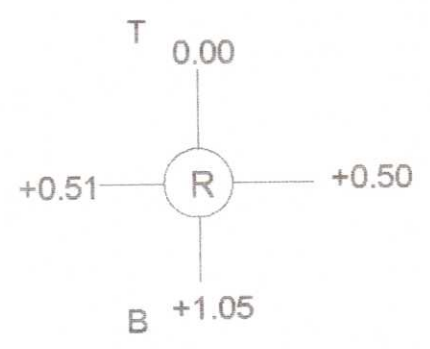
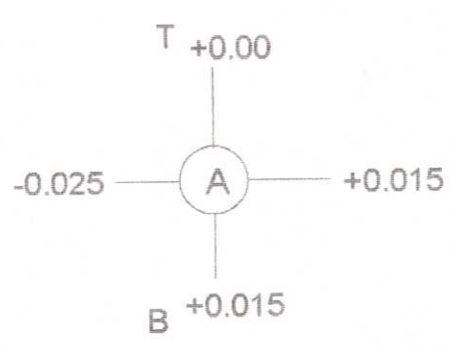
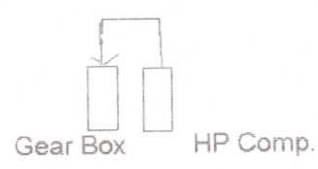
Note: All dimensions are in mm.

All readings are noted from front side of the turbine.

CODE NO      JOB DESCRIPTION

REFRIGERATION COMPRESSOR TRAIN ALIGNMENT READINGS - 105

(GEAR BOX - HP COMPRESSOR)



Note: All dimensions are in mm.

All readings are noted from front side of the turbine



CODE NO	JOB DESCRIPTION
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01 01 05      N.G. BOOSTER COMPRESSOR TRAIN - 800-J / 800-JT:

N.G. BOOSTER COMPRESSOR DRIVE TURBINE 800-JT:

Following jobs were carried out on 800-JT as a preventive measure.

- Front end journal bearing was inspected and found to be O.K.
- Turbine rear end bearing was found damaged in one pad .Hence the complete set of pads was replaced.
- Governing oil filter was cleaned and governing valve operation and lift wrt secondary oil pressure was checked and found O.K.
- The ESV seat was blue checked and was found O. K. Thenafter the opposite end cover steam chest was opened and it was confirmed that by tripping the ESV positive closure of ESV takes place.

800-J N.G. BOOSTER COMPRESSOR :

Following jobs were carried out on 800-JNG as a preventive measure.

- Journal bearings of both the ends were inspected and found to be O.K.
- Thrust clearance of N.G. Compressor was found excessive and active side thrust pads were replaced by new one.

800-J A.G. COMPRESSOR:

Following jobs were carried out on 800-JAG as a preventive measure:

- Journal bearings of both the ends were inspected and found to be O.K.
- Thrust bearing clearance was checked and found to be O.K.

CODE NO      JOB DESCRIPTION

The reading taken during preventive maintenance of all the machines in the train are recorded as under.

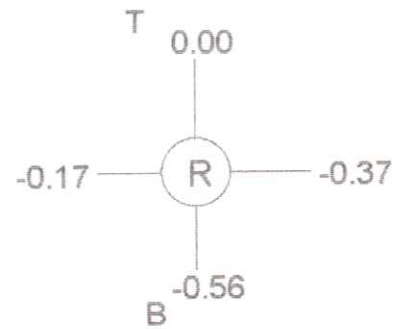
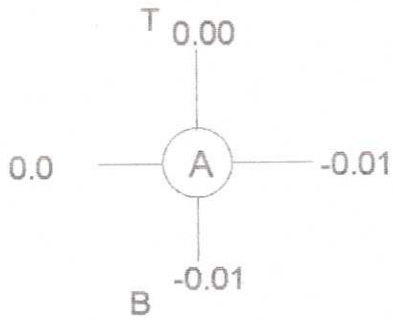
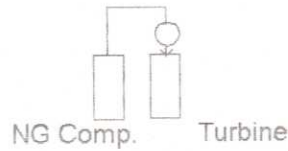
POSITION	RADIAL CLEARANCES		THRUST CLEARANCES	
	<u>DESIGN (MM)</u>	<u>ACTUAL</u>	<u>DESIGN</u>	<u>ACTUAL</u>
<b><u>DRIVE CONDENSING TURBINE</u></b>				
Thrust end journal bearing	0.15-0.21	0.18	0.16-0.24	0.19
Opposite thrust end journal bearing	0.15-0.20	0.18		
Thrust end oil catcher		0.15		
Opposite thrust end oil catcher		0.15		
<b><u>N.G. COMPRESSOR</u></b>				
Thrust end journal bearing	0.08-0.113	0.12	0.25-0.35	0.28
Opposite thrust end journal bearing	0.08-0.113	0.12		
<b><u>A.G. COMPRESSOR</u></b>				
Thrust end journal bearing	0.08-0.113	0.11	0.20-0.3	0.26
Opposite thrust end journal bearing	0.08-0.113	0.11		

**Note:** All dimensions are in mm.

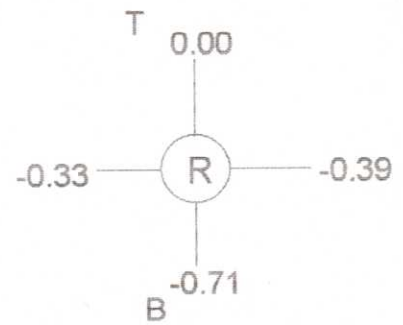
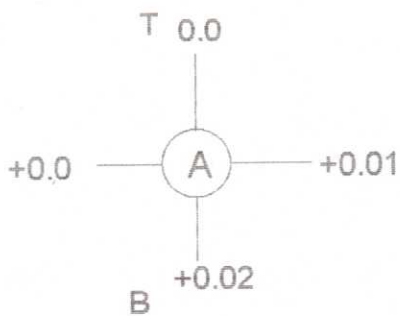
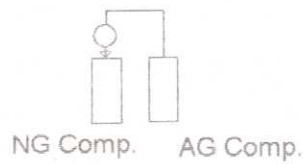
CODE NO      JOB DESCRIPTION

NG BOOSTER COMPRESSOR TRAIN ALIGNMENT READINGS - 800 - J

(NG COMPRESSOR - TURBINE : Looking From NG Comp.)



(NG COMPRESSOR - AG COMPRESSOR : Looking From A.G. Comp.)



Note: All dimensions are in mm.

CODE NO      JOB DESCRIPTION

01 02 01      BOILER FEED WATER PUMP AND DRIVE TURBINE (104-J / JA -- 104-JT / JAT) :

104-JAT TERRY TURBINE:

- TTV latching lever spring was replaced by new one
- TTV latching lever resting point was built by welding in order to firm holding.
- Replacement of governor coupling with new locally made.
- Console oil of the turbine was replaced .
- Governing valve bushing leak was attended.
- Journal bearing at inboard side due to pitting mark replaced by new.
- Thrust pads were replaced by new one (Thrust Pad thk .15.88mm (new ) ,15.66 mm (Old))

The reading taken during the overhaul are recorded as under:

Bearing Clearances:

Thrust end Journal Brg.	0.005"-0.006"
Opp. Thrust End Brg.	0.005"-0.006"
Thrust bearing clearance	

During start up, governor was not responding even after minimum governor speed. It was observed that governor drive coupling hub had got loosened .Its' lock screw was tightened and the pump was again handed over to production .The governor was checked in decoupled condition before taking the pump into line and was found to be performing well.

104-JA :

Pump was taken for preventive maintenance and following jobs were carried out.

- 1) Both the bearings were inspected and found to be O.K.
- 2) The coupling was dismantled and regreased.

The reading taken during the overhaul are recorded as under:

Thrust End Journal Brg.	0.21 mm
Opp. Thrust End Journal Brg.	0.15 mm (New Brg. used)
Thrust Bearing Clearance	0.38 mm
Axial Float	0.013"

30

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CODE NO	JOB DESCRIPTION
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104-JT:

Both the journal bearings opened, inspected and boxed up as were found O.K. However the clearance was found increased in both the bearings due to scoring on the turbine shaft.

The reading taken during the overhaul are recorded as under

Thrust End Journal Brg.	0.013"
Opp. Thrust End Journal Brg.	0.012"
Axial Float	0.30 mm

Note : The shaft of the turbine in journal area was found having scoring on both the sides. The scoring towards inlet end was more as compared to exhaust end .However the rotor was not replaced as bearings were found in good condition.

104-J:

Both the journal bearings as well as thrust bearing were opened, inspected and found O.K.

The reading taken during the overhaul are recorded as under

Thrust End Journal Brg.	0.009"
Opp. Thrust End Journal Brg.	0.009"
Axial Float.	0.39 mm

CODE NO	JOB DESCRIPTION
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01 02 02     aMDEA PUMP TURBINE (ELLIOT) - 107-JT :

- The exhaust valve of the turbine (Butterfly type) was replaced by new one due to old one had become non operable. The new valve installed was procured from M/s Keystone India with Imported valve components( from Italy) branded as Vennesa Triple offset design with metal to metal seat, torque seated.
- Both end journal bearing oil was flushed.

aMDEA PUMP TURBINE (MURRAY) - 107-JAT :

- The exhaust valve of the turbine (Butterfly type) was reported hard to operate and same was opened with the help of chain block .However exact amount of opening could not be identified as the machine was in operation .The operating gearbox was repaired and reinstalled after the valve was opened.
- Both end journal bearing oil flushed.

aMDEA PUMP - 107-JB :

Pump was decoupled from turbine to attend seal leakage and oil ring replacement .Following jobs were carried out.

- Pump coupling hub was removed by gas heating .
- Bearing housing was removed .
- Mechanical seal was removed and new mechanical sea l (Rotary carbon & stationary stellite) along with new 'O' rings were installed.
- Old deep groove ball bearing & brass oil ring were replaced by new one.
- Coupling hub was shrink fitted on shaft.
- Pump was coupled with grease packed gear coupling.

Pump was pressurised with DM water to check seal leakage and it was found to have no leakage.

CODE NO	JOB DESCRIPTION
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01 02 03 INSTALLATION OF NEW COLD AMMONIA PUMP 118-JB:

New pump was designed and supplied by M/S Ingersol- Rand (India ) Ltd and installed by Technical deptt. Pump has not been commissioned so far.

01 02 04 D. M. WATER PUMP TURBINE 2004-JT :

Pump was decoupled and alignment was checked same was coupled after flushing oil. suction strainer was also cleaned.

01 02 05 LUBE OIL PUMP TURBINE 102-JLT:

Pump decoupled and alignment was checked same was coupled after flushing oil. Suction strainer was also cleaned.

01 02 06 SEAL OIL PUMP TURBINE 102-JST:

Pump was decoupled and alignment was checked same was coupled after flushing oil. Suction strainer was also cleaned

01 02 07 LUBE OIL PUMP TURBINE 101/105-JLT:

- Pump was decoupled and its' coupling was greased. Coupling grid member was found minor damage and turbine was coupled with same one.
- The upper bearing of turbine was replaced by new ball bearing as the same was found having increased clearance.
- Steam inlet strainer element was replaced by new one as the perforation of old strainer element were found to have higher opening at some points.
- Governor oil was flushed.

01 02 08 NEW SEAL OIL PUMP 103 JLT/JL/SOP (TURBINE DRIVEN):

INSTALLATION OF NEW SEAL OIL PUMP :

The old turbine driven gear type seal oil pump drive turbine was removed and new screw type pump was installed at new foundation and suction & discharge piping were modified as per site requirement. Pump was successfully commissioned. Pump specifications are given below:

CODE NO	JOB DESCRIPTION
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SPECIFICATIONS FOR SEAL OIL PUMP FOR 103-J:

Make of pump	:	M/s Tushaco Pumps, Mumbai.
Model of pump	:	T3S 38/46 MHSXFS2LNJIBALC
Serial No. of Pump	:	999227/0671
Speed	:	3000 RPM
Direction of Rotation	:	CCW from coupling end
Discharge Pressure	:	84 Kg/cm <sup>2</sup>
Inlet Temperature	:	110 Deg. F.
Inlet Viscosity	:	28 cSt
Capacity	:	110 LPM
Power Required	:	40 HP

Problems faced during commissioning:

- During commissioning of the pump, the vibrations were found to be very high. The newly fabricated foundation was strengthened and the vibrations came down drastically.
- The lub oil pressure was not getting developed with turbine driven pump in line. as a result, the RPM of turbine were checked and it was found that the same were less (App. 2800RPM). On diagnosis it was found that the discharge flow of seal oil pump was higher than the design and hence the turbine was getting overloaded and the speed was getting reduced.

To overcome this problem a by pass line was given just at the discharge of the pump and this bypass valve kept open to maintain discharge pre. of seal oil to 85 kg/cm<sup>2</sup>, discharge pre. of lube oil to 11 kg/cm<sup>2</sup>g and turbine RPM to Appx. 2900. This way the turbine was run during start up and since then is running without any problem.

In case of emergency during change over to motor driven pump the dump valve shall have to be closed.

01 02 09

LUBE OIL PUMP TURBINE - 800 JLT/CEP TURBINE :

Following jobs were carried out :

- CEP suction strainers were cleaned
- Oil filter was cleaned.
- Suction strainer of lube oil pumps were cleaned.



CODE NO	JOB DESCRIPTION
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01 03 01	<u>I. D. FAN TRAIN 101-JBT/101-BJR/101-BJ :</u>
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I. D. FAN DRIVE TURBINE 101-BJT MAJOR OVERHAULING :

Turbine speed variation was observed during running Plant and continuous hunting in governor. Hence governing valve stem was fixed by provision of clamp. Machine overhauling was also due, hence it was decided to take m/c under overhauling and dismantle governing valve.

1) Governing was dismantled and following observations were made.

Governing Valve sheet (Part no.567) was free in housing and moved by 5mm to and fro without stem moving. Hence it was decided to tack weld valve sheet in housing to arrest free movement of the same in the housing. Now it is observed that machine is running without any speed variation and hunting of governor.

Following activities were carried out in the given sequence on the I.D. fan Drive Turbine.

- Disconnected the instrument probe.
- Decoupled both High speed and low speed gear coupling.
- Disconnected oil lines
- Removed governor assembly.
- Removed ESV & Control valves.
- Checked axial float and recorded
- Removed exhaust lines
- Removed exhaust bent and elbow.
- Removed top half bearing at both end
- Removed casing bolts
- Lifting of casing by crane
- Checked flow path
- Removed Rotor
- Removed all internals and cleaned.
- All internals were put in position
- Rotor put in positioned
- Checked labyrinth clearance and recorded.
- Measured axial float with thrust bearing and recorded
- Top casing boxed up
- Both bearings clearances were measured and recorded.

Alignment of turbine with gear box was carried out and alignment readings were recorded.

2) The PG-PL Governor was changed with new one as the old governor was having a complain of hunting during start-up / shut downs. The governor was installed during shut down only and the same was tested in solo run condition. Following were the results obtained.

CODE NO      JOB DESCRIPTION

<u>Pneumatic Signal</u>		<u>Speed(RPM)</u>
100	%	1760
90	%	1990
80	%	2240
70	%	2460
60	%	2700
50	%	2960
40	%	2960
30	%	3488
20	%	3760
10	%	4060
5	%	4170
0	%	4170

Turbine was Over Speed trip at 4250 RPM

NOZZLE CLEARANCE:

STAGE	Design	Actual	
		L	R
Nozzle to Rotor blades	0.0042" --0.0072"	0.052"	0.051"
Reversing segment to rotor	0.093" --0.095"	0.084"	0.085"

CARBON RING CLEARANCES:

Front side (Governor side)	Design Value	Actual
1st Carbon Ring (from Governor side )	0.001 to 0.0035"	0.0010"
2 nd Carbon Ring (from Governor side )	0.001 to 0.0035"	0.0020"
3 rd Carbon Ring (from Governor side )	0.001 to 0.0035"	0.0025"
4th Carbon Ring (from Governor side )	0.001 to 0.0035"	0.0035"
<b>Rear Side (Fan Side)</b>		
1st Carbon Ring (from Governor side )	0.001 to 0.0035"	0.0035"
2 nd Carbon Ring (from Governor side )	0.001 to 0.0035"	0.0035"
3rd Carbon Ring (from Governor side )	0.001 to 0.0035"	0.0035"
4th Carbon Ring (from Governor side )	0.001 to 0.0035"	0.0035"

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CODE NO      JOB DESCRIPTION

I. D. FAN GEAR BOX 101-BJR :

The I.D. Fan Gear Box was opened and following jobs were carried out.

- 1) All the bearings were inspected and their clearances were found to be O.K.
- 2) The condition of both the Gear as well as Pinion were found to be O.K.

I. D. FAN 101-BJ :

Both the bearings of the I.D. Fan were inspected .The CT side journal bearing was found having scoring marks. Hence the same was replaced with new one .The coupling end journal cum thrust bearing was found to be O.K.

The reading taken during overhauling of I.D. Fan Train are recorded as under.

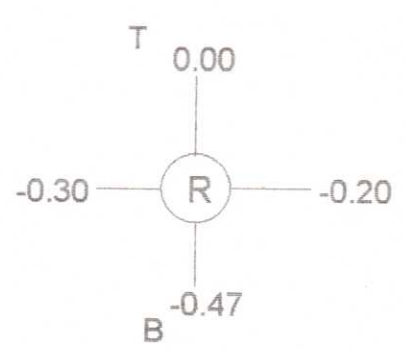
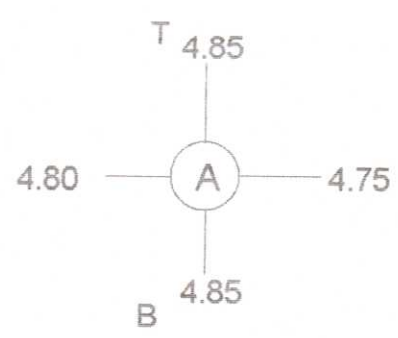
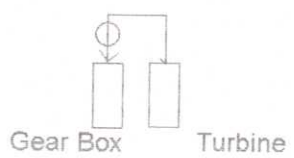
POSITION	RADIAL CLEARANCES		THRUST CLEARANCES	
	<u>DESIGN (MM)</u>	<u>ACTUAL</u>	<u>DESIGN</u>	<u>ACTUAL</u>
<u>TURBINE</u>				
Front bearing	0.15-0.225	0.23		
Rear bearing	0.15-0.225	0.24		
<u>GEAR BOX</u>				
Pinion front bearing	0.275	0.25		
Pinion rear bearing	0.30	0.22		
Gear front bearing	0.25	0.23	0.35	0.39
Gear rear bearing	0.275	0.24		
Pinion Gear backlash		0.22		
<u>I.D. FAN</u>				
Front bearing	0.2-0.30	0.30		0.85
Rear bearing	0.2-0.30	0.38		

CODE NO      JOB DESCRIPTION

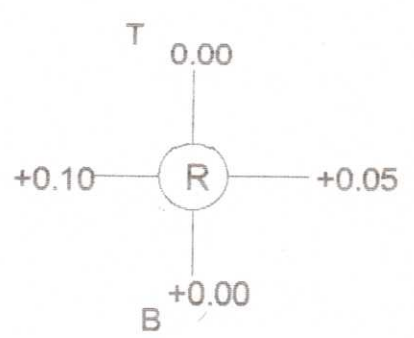
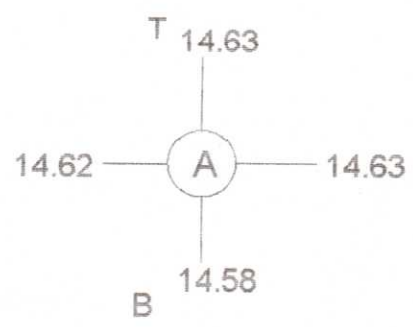
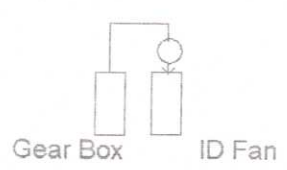
I D FAN ALIGNMENT READINGS - (101-BJ)

( TURBINE - GEAR BOX : Looking from Turbine End)

Final alignment Reading



GEAR BOX - ID FAN (Looking from Gear Box End)



All readings are noted from front side of the turbine.

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CODE NO	JOB DESCRIPTION
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01 12 01 PRIMARY REFORMER - 101-B :

PENT HOUSE AND RADIANT ZONE JOB :

Reformer radiant zone manway was opened after cooling for ultrasonic scanning of catalyst tubes. Following maintenance jobs were carried out as follow.

- 1) Reformer tube top plug were opened as per Production requirement for Catalyst charging specially those tubes in which continuous hot bends were observed.
- 2) Arch burner blocks were inspected and 4 nos. were found in damaged condition and the same were replaced by new burner blocks.
- 3) North side brick wall refractory got damaged and the same was repaired by Civil Department.
- 4) Bottom header insulation in damaged areas was repaired by new insulation blanket and wet ceramic fibre.
- 5) Damaged Roof insulation was repaired with new module and insulation blanket.
- 6) Burner No.504 steam line union leakage was attended.

01 12 02 AUXILIARY BOILER REPAIR JOBS :

Auxiliary Boiler manway was opened and following jobs were carried out.

- Burner No.2 (DGN-26) casing was replaced by new one and Tie rods were extended and locking nut was provided at the end.
- Burner block casting of burner no.2 &3 was replaced by new one.
- Damaged refractory was repaired by Civil Deptt.
- Water wall Tube thickness was measured by Inspection deptt and tube external cleaning was done.
- Damaged refractory of Front wall and west wall side at roof side near water wall tube D/E was repaired.

The water wall tubes C, D, and E of Auxiliary Boiler were found bend.

01 12 03 SECONDARY REFORMER ( 103 - D) :

The INCOLLOY -800 H liner for the protection of Refractory brick dome was found detached from the welding and was resting on the dome . The same was removed by plasma cutting machine into pieces due to limitation of manhole size. The liner replacement contract was awarded to M/S.Skywin Erectors,Ahmedabad .The liner was fabricated into 8 pieces of size 1500 mm length x 255 mm wide for facilitating insertion into the Secondary reformer manhole.

CODE NO      JOB DESCRIPTION

01 13 01      HEAT EXCHANGERS AND COOLERS HYDROJET CLEANING :

(I) Following heat exchangers were opened for pulling out the tube bundle and hydrojetting of tubes were carried out. Tube bundle and channel covers were boxed up. Hydrotest was carried out as mentioned below.

Sr. No.	Equip ment.	Qty. Nos.	No.of Tubes	Retu- bing	Tube side Kg/cm2		Shell side Kg/cm2		Hydrojet cleaning
					Design Prss.	Hydro tested	Design Prss.	Hydro tested	
1	108-C1A/ C2A	02	1415	-	05.27	08.00	05.27	08.00	Tube & shell side
2	108-C1B/ C2B	02	1415	-	05.27	08.00	05.27	08.00	- Do -
3	115-C	01	649"U"	-	29.90	-	10.60	16.00	- Do -
4	116-C	01	300"U"	-	73.10	-	10.50	16.00	- Do -
5	124-C	01	775"U"	-	158.0	-	17.60	26.50	- Do -
6	176-C	01	223 "U"	-	-	-	-	08.00	- Do -

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CODE NO	JOB DESCRIPTION
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(II) Following heat exchangers & coolers were opened & boxed up after hydrojetting from tube side. Exchangers were also hydrottested after assembly.

Sr. No.	Equip ment.	Qty. Nos.	No.of Tubes	Retu- bing	Tube side Kg/cm2		Shell side Kg/cm2		Hydrojet cleaning
					Design Prss.	Hydro tested	Design Prss.	Hydro tested	
01	105-CA	01	2790	-	05.27	Static	30.90	46.00	Tube side
02	105-CB	01	2790	-	05.27	Static	30.90	46.00	-Do-
03	110-CA /CB	02	763	-	05.60	-	05.27	-	-Do-
04	111-CA /CB	02	2790	-	05.27	Static	05.27	08.00	-Do-
05	127-CA	01	3100	Done	05.60	-	21.10	30.00	-Do-
06	127-CB	01	3516	Done	05.60	-	21.10	30.00	-Do-
07	128-C	01	1200	-	05.60	-	08.09	10.00	-Do-
08	129-JC	01	290"U"	-	-	-	-	-	-Do-
09	130-JC	01	-	-	-	-	-	-	-Do-
10	131-JC	01	348	-	10.54	-	17.54	-	-Do-
11	173-C	01	294	-	10.60	-	05.30	-	-Do-
12	175-C	01	222	-	03.20	-	-	-	-Do-
13	802-C	01	-	-	-	-	-	-	-Do-
14	803-C	01	-	-	-	-	-	-	-Do-

**CODE NO      JOB DESCRIPTION**

(A)      SECONDARY WASTE HEAT EXCHANGER 102 - C :

Bottom gasket was replaced. As the same was furmenited due to leakage observed during operation.

(B)      Co 2 STRIPPER REBOILER EXCHANGER 111 - CA / CB :

TUBES PLUGGING :

There are total 2790 tubes in each reboiler. After changing over to aMDEA system from MEA system, Energy requirement in Co 2 stripper has reduced considerably. So Both these exchangers were opened and 50 % of their tubes (1395 tubes) of each reboiler were plugged for redusing their capacity due to reduced heat load requarment to improve problem of thermosyphoning. All the remaining tubes were cleaned by hydrojetting.

(C)      REFRIGERANT CONDENSER 127 - CA / CB :

Many tubes were found leaking during running plant and plugged mainly at bottom side of both exchanger. Retubing of 127- CA/CB done. All plugged tubes as well as found leaking during hydrotest mainly at bottom side were replaced. The status of tubes are as follows.

	<u>127-CA</u>	<u>127-CB</u>	<u>TOTAL</u>
TOTAL NO. OF TUBES REPLACED :	136	105	241

MATERIAL : ASTM - 179      SIZE : 3/4" OD X 14 BWG X 7315 mm length

PARTY'S NAME : EMKAY CONSTRUCTION - BARODA

After replacement of tubes,Hydrojet cleaning done. The following tubes were found leaking during final hydrotest and same were plugged. The status of plugged tubes are as follows.

Viewing from cotrol room side

	<u>RAW NO.</u>	<u>TUBE NO.</u>
	( From Top )	( From Reformer Side )
127 - CA	4	1
	26	15
127 - CB	21	11



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CODE NO      JOB DESCRIPTION

STATUS OF TUBES REPLACED 127 - CA :		Viewing from cotrol room side	
RAW NO. (FROM BOTTOM)	TUBE NO. (FROM REFORMER SIDE)	RAW NO. (FROM BOTTOM)	TUBE NO. (FROM REFORMER SIDE)
1	1 - 12 ( Full Row )	44	60, 61
2	1 - 18 ( Full Row )	45	37, 44, 45, 58
3	1 - 19 ( Full Row )	48	23, 41
10	33	49	46
12	34	50	1, 25, 43, 60
17	8, 9, 12, 31	51	20
20	5	52	5, 6, 7, 24, 34, 42
26	6	53	5, 41
27	9	54	7, 8, 41
28	14, 45	55	41, 33
30	15, 45	56	9, 50
31	30	57	19
33	33, 45	58	6, 43
34	46, 47	59	4, 38
35	29, 45, 46, 61	60	3
36	9, 31, 39	63	24
37	7, 19, 27, 29	65	23, 39
38	31, 46	66	31, 37, 38
39	7, 47	67	2, 4, 19, 24, 37
40	47	68	32, 33, 34
41	7, 50	69	18
42	23		
STATUS OF TUBES REPLACED 127 - CB :		Viewing from cotrol room side	
1	1 - 12 ( Full Row )	46	24, 43
2	1 - 18 ( Full Row )	47	17
3	1 - 19 ( Full Row )	48	21, 28, 41
4	1 - 21 ( Full Row )	49	31
5	20	50	19
8	31, 33	57	18, 21
14	41	58	26
15	37, 38	61	40
16	37, 38	62	20, 21
17	38, 52	63	21
20	43	64	16
27	46	66	14
42	12	68	17, 20
43	45	69	15, 21

H3

CODE NO      JOB DESCRIPTION

(D) REFRIGERANT COMPRESSOR INTER COOLER 128 - C :

After hydrojet cleaning, Hydrottest done. The following tubes were found leaking and the same were plugged. The status of plugged tubes are as follows.

Viewing from cotrol room side :

	<u>RAW NO.</u>	<u>TUBE NO.</u>
	( From Top )	( From Reformer Side )
128 - C	1	4
( Upper Half )	2	1
	6	14
	7	24
128 - C	1	27, 30
( Lower Half )	8	18
	11	17
	12	9, 19
	16	7

(III) **Following Lube Oil Coolers were opened, cleaned by Hydrojetting and boxed up.**

- a) 101-JLC/ 1-2 & 3 - Lube oil cooler for 101 - J - 3no.s
- b) 102-JLC/ 1 & 2 - Lube oil cooler for 102 - J - 2no.s
- c) 103-JLC/ 1 & 2 - Lube oil cooler for 103 - J - 2no.s
- d) 800-JLC/ 1 & 2 - Lube oil cooler for 800 - J - 2no.s

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CODE NO	JOB DESCRIPTION
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(IV) Following Lube Oil Ccoolers were opened, cleaned by rod poking and boxed up.

- a) 101-BJ Lube oil cooler - 3 no.s
- b) 104-J / JA Lube oil cooler - 4 no.s
- c) 107-J / JA Lube oil cooler - 2 no.s

(V) Following gland condensors, I/A coolers were opened, cleaned by Hydrojetting and boxed up.

- a) 101- JCA / JCB Surface Condensor. - 2 no.s
- b) 101-JCA I/A Cooler. - 1 no.
- c) 101-JCB I / A Cooler. - 1 no.
- d) 103-JBT Gland Condensor. - 1 no.
- e) 105-JT Gland Condensor. - 1 no.
- f) 851-JC Surface Condensor. - 1 no.
- g) 800-JT Gland Condensor. - 1 no.

H5

CODE NO	JOB DESCRIPTION
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01 14 01	<u>STEAM LEAKS JOBS :</u>
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Following jobs were carried out during the shut down.

- 01) 104-J Common discharge valve gland repacked.
- 02) 108-F Level Troll drain valve gland repacked.
- 03) LTS O/L to 105-CA/CB gas inlet line I/V gland repacked .
- 04) TRC 10 sealing steam I/V gland repacked.
- 05) SP-39 north side gland leak attended.
- 06) FT 13 RT tapping I/V gland repacked.
- 07) 2004 JT steam inlet valve bonnet leak attended.
- 08) HCV-12 sealing steam line check valve thread leak attended.
- 09) 107-JT steam ejector I/V made operatable.
- 10) Condensate outlet of E 110 block valve flange gasket replaced.
- 11) 107-J discharge valve SP-156 gland repacked.
- 12) MIC 13/14/15/16 gland repacked.
- 13) 102-E Rupture disc I/V made operateble.
- 14) 112-JAT u/s drain valve replaced by new one(3/4")
- 15) 112 JAT steam stop valve valve gland repacked.
- 16) 107 JT Turbine inlet main I/V gland repacked.
- 17) 107-JT Turbine inlet top nozzle valve gland repacked.
- 18) 107-JT Turbine inlet drain valve gland repacked.
- 19) 105-JLO inlet main I/V gland repacked.
- 20) 101-JLO turbine steam inlet I/V 1st drain valve gland repacked.
- 21) 101-JLO motor driven LO pump discharge valve gland repacked(3Nos. valve)
- 22) Steam to stack drain valve (near 101 BJT)Gland repacked.
- 23) 103 JBT 3.5 ata steam for sealing valve gland repacked.
- 24) 102-JLO Pump Turbine steam outlet first I/V gland repacked .
- 25) HCV 11/13 Gland repacked .
- 26) 107 JA discharge valve (SP-159) gland repacked .
- 27) 3.5 kg steam trap isolation valve at Flare stack area (HIC 1005) gland repacked.
- 28) 3.5 kg steam trap 1st isolation valve at Flare stack area gland repacked
- 29) 38 ata steam trap 1st isolation valve near H-111 gland repacked.
- 30) LTS outlet to 105 CB dead end line main valve gland repacked.
- 31) 2004 JT cooling water inlet line I/V gland repacked.
- 32) 102 JLO Pump Turbine steam inlet Pr .gauge I/V gland repacked.
- 33) LC -22 by pass valve U/S flange gasket replaced.
- 34) 104 E Vent valve made free.
- 35) Pre-reformer 40 ata line flange (FT-201) gasket replaced (4" x600#)
- 36) HIC-1004 u/s chek valve top cover gasket replaced .
- 37) 102 JT block valve flange gasket repleced.
- 38) SP-39 North side gland repacked.
- 39) FRC2 Trap Isolation valve replaced .
- 40) 173-C condensate O/L valve gland repacked.
- 41) Steam drum L.G. isolation valve and PI I/V gland repacked.

CODE NO      JOB DESCRIPTION

01 17 01      RV'S OVERHAULING AND TESTING :

Following Relief Valve were tested and their set pressures are as under.

SR. NO.	TAG NO.	SERVICES	SET PRESSURE Kg / Cm2	RESET PRESSURE KG / Cm2	REMARKS
1	RV-LS-1	3.5 K STEAM HEADER	12.7		
2	RV-MS-9	38 K STEAM HEADER	42.2		
3	RV-102-D	102-D INLET	43.9		
4	RV-104-D-1	INLET LINE TO HTS	35.0		
5	RV-BFW-1	Offsite Coil RV	92		
6	RV-110-FA	110-F	7.0		New RV Installed
7	RV-110-F	110-F	7.0		
8	RV-111-F	111-F	6.3		
9	RV-112-F	112-F	6.3		
10	102-JLT-1	L.O.Turbine	4.0		
11	102-JLT-2	S.O.Turbine	4.0		
12	RV S-7	11 ATA Steam	14.8		
13	102-JLTA-2	S.O. Pump	46.0		
14	RV-101-F1 South Side	Steam	119.1	112.40	Seat lapped RV Floated
15	RV-101-F2 Middle	Steam	116.8	109.20	Seat lapped RV Floated
16	RV-101-F3 North Side	Steam	115.3	111.24	Seat lapped RV Floated
17	Super Heater Coil RV	Steam	112.0	106.0	New Flanged type RV Installed
18	RV-102-F	102-F OUTLET (PILOT OPERATED)	28.9		New RV Installed
19	RV-101-J	AIR COMP. DISCHARGE	36.9		
20	RV-112 C				

47

CODE NO	JOB DESCRIPTION
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01 17 02	<u>SUPER HEATER COIL R V MODIFICATION:</u>
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Old butt welded RV has been converted into Flanged type RV which was procured from M/S. Tyco Sanmar (Crosby Safety Relief Valve) along companion RTJ flange of 3" x 2500# .  
The detail of RV is given below.

Valve Type : 3M6 HCA-78 IBR  
 Sr.No. : 99-8241  
 Style : 3M6  
 Drawing No. : GA-6901 Rev.0  
 Heat No. : E5524  
 Material : A217 Gr. WC9  
 Working Prs. : 111.81 Kg/Cm2  
 Hydro Test Prs : 167.80 Kg/Cm2

Above Job was awarded to M/S.Skywin Erector Baroda ,IBR approved party and job was successfully done as per our WPS in stipulated time period.

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

Welding Process : GTAW + SMAW

Type : Manual

1. JOINT DESIGN (QW - 402)

Groove design : Single Butt weld as per drg. no.P1-CS-130 63  
 Sheet 1 of 1 Rev.0  
 Backing : N.A.  
 Others : N.A.

2. BASE METALS (QW - 403)

P.No. Group No. to P. No. 5 Group No.1  
 Specification : A 182 F 12 to F 22  
 Thickness Range : 5/8" TO 1.50 " (Groove )  
 Pipe dia Range : 2-7/8" and above

CODE NO	JOB DESCRIPTION
3.	FILTER METALS (QW - 404)
	Weld metal analysis : A No. 1
	Filler Metal F No. : As per QW -432.1 (SFA 5.5)
	AWS No. (Class) : Electrode SFA/AWS A 5.5-96 (E 9018 B3) Filler SF A5.28 /AWS A 5.28-96 (ER 90SB3)
	Size of electrode : 2.4 mm (Filler wire) 2.5, 3.15, 4 mm (Electrode)
	Type of electrode flux : Low hydrogen,heavy coated
4.	POSITION (QW - 405)
	Position of Groove : 6G
	Welding Progression : Uphill
	Other :
5.	PREHEAT (QW - 406)
	Preheat Temperature min. : 150 ° C
	Interpass Temperature min. : 300 ° C
6.	POST WELD HEAT TREATMENT (QW - 407)
	Temperature : 650° C
	Soaking time : One hour
	Heating Rate : 90 ° C / hr. max
	Cooling Rate : 60 ° C / hr. upto 250 ° C. Then natural cooling under asbestos.
7.	GAS (QW - 408)
	Shielding gas : Argon
	Gas consumption : 99.995 %
	Flow rate : 10 to 12 litres / min
	Purging gas : Argon
	Gas consumption : 99.995 %
	Flow rate : 6 to 10 litres / min
8.	ELECTRICAL CHARACTERISTICS (QW - 409)
	Current : DC
	Polarity : Straight for GTAW Reverse for SMAW
	Ampere (Range) : 80 to 130 for GTAW 70 to 190 for SMAW
	Other :

CODE NO	JOB DESCRIPTION
9.	TECHNIQUE (QW - 410)
	String or weave bead : String and weave
	Initial & Interpass cleaning : Grinding & brushing
	Oscillation :
	Method of back gouging : N.A.
	Contact tube to work distance : N.A.
	Single or multiple pass : Multiple
	Single or multiple pass : Single
	Travel Speed (Range) : 4 to 6 cm/min for GTAW 8 to 12 cm/min for SMAW
10.	WELD INSPECTION
	Bevel Edge : DP Test
	Root weld : DP Test
	Final weld : DP Test ,100 % radiography

01 17 03

FLANGE LEAKS ( FURMENTED ) JOBS :

- 103-JAT Steam inlet line Flange clamp was removed and boxed up with new gasket
- 101 CB down comer Flange clamp was removed and boxed up with new gasket
- 101 CB riser Flange clamp was removed and boxed up with new gasket
- Air to Mixed feed Preheater coil outlet D/S flange gasket was replaced by new one.
- 106-D inlet valve by-pass valve u/s Flange gasket was replaced by new one.
- 101 CB chemical flange gasket was replaced by new .
- Condensate outlet of E110 block valve flange gasket was replaced by new one.
- LC 22 by pass valve upstream flange gasket was replaced by new one.
- HIC 1004 u/s check valve top cover flange gasket was replaced by new one.
- MIC 16 flange gasket was replaced by new one.
- MS 102-JT Block valve flange gasket was replaced by new one.
- 136 C recycle valve to prereformer1 st valved/s flange gasket was replaced by new one.
- 103-JAT TTV Valve d/s drain line flange gasket was replaced by new one.



CODE NO	JOB DESCRIPTION
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01 19 01	<u>CO<sub>2</sub> STRIPPER (102-EA/EB) MODIFICATION :</u>
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Process study of CO<sub>2</sub> stripper and reboiler was carried out by M/S. Koch Glitsch India Limited (KGIL) Mumbai to remove operating problems and reduce steam consumption. They recommended following modification in CO<sub>2</sub> stripper.

- 01) Separate Slots for vapour to exit from top of the distributor arm with adequate slot area for Vapour and liquid.
- 02) Hood above the distributor arm to prevent entrainment of liquid in outgoing vapour.
- 03) Smooth / short radius elbow / 'T' in place fabricated one.
- 04) Blanking of 50% (alternate rows) of hole trays of CO<sub>2</sub> stripper.

On the basis of Koch Drg. No. DOO1 Sht 1 of 1 Rev.1 Following pipe and pipe fittings were procured.

SR. No.	MATERIAL DESCRIPTION
1	SS Seamless Pipe A312 TP 316 Size :12" xsch40 ANSI B 16.9 Solution Annealed
2	SS Seamless Pipe A312 TP 316 Size :10" xsch40 ANSI B 16.9 Solution Annealed
3	Short Radius 90 deg. BW Elbow A 403 WP 316 Size: 12" xsch 40 Non Standard as per IFFCO Drg. No. KV-045 /P1-ES-05056
4	Conc. Reducer A403 WP 316 BW Size :10"x12" sch40 ANSI B16.9 Solution Annealed
5	Equal Tee A403 WP 316 BW Size :12"x12"x10" sch40 ANSI B16.9 Solution Annealed
6	BW Cap A403 WP 316 BW Size:10" sch40 ANSI B16.9 Solution Annealed
7	SORF Flange A 182 F316 Size:10" x150# ANSI B16.5 Solution Annealed
8	'U'Clamp Bolt 1"BSW Thread SA.193 Gr.B8 TP 316/ Nut SA 194,8M TP 316 as per IFFCO Drg.No. KV-044 ES-05055
9	SS Plate A 240 TP 316 Solution Annealed 8 mm Thk. for Hood fabrication
10	SS Plate A 240 TP 316 Solution Annealed 10 mm Thk for support reinforcement

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CODE NO	JOB DESCRIPTION
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- # All Pipe and pipe fittings were procured of higher thickness schedule 40 instead of sch 10 old one to improve mechanical strength and avoid failure of distributor .Fittings were procured as per ANSI B 16.9 instead of fabricated old one .
- # Provided 12'' BW Caps as per ANSI B16.9 instead flat plate closure at the end of distributor arm
- # Supports were strengthen by providing plate of 10 mm thk. and extra support at I-Beam .
- # Hood was fabricated at our site as per Koch. Drg. No. D001 Sht1 of 1Rev.1 from 8mm SS Plate A240 TP 316 Solution Annealed.

**Prefabrication:**

- # Both side distributor arm with cap were prefabricated .
- # Slots were made in distributor Arm before welding cap.
- # Hood was prefabricated and holes were drilled as per Koch drawing from SS 316 Plate 8mm thk.

**CO<sub>2</sub> Stripper (102-EA/EB) tray holes blanking :**

As suggested by Koch 30 to 40 % tray holes blanking was done in order to reduce weeping in all 17 trays in both Strippers.

CODE NO      JOB DESCRIPTION

01 20 01      FABRICATION JOB:

(A) Blow down line replacement :

Blow down line were externally corroded as suggested by inspection deptt. and partially were replaced in last shut down and balance line were replaced by Maitenance deptt.in this shut down. Job was awarded to M/S. Skywin Erector, Baroda.

Following jobs were carried out.

SR. NO.	JOB DESCRIPTION	LINE NO.
1	B.O.Line of 101 f	610-E1-B-200
2	B.O.Line of 101 f	610-E1-B-203
3	B.O.Line of 101 f	610-E1-B-204
4	B.O.Line of 101 f	610-E1-B-216
5	B.O.Line of 101 f	610-E1-B-217
6	B.O.Line of 101 f	610-E1-B-218
7	B.O.Line of 101 f	610-E1-B-269

Other jobs were done byM/S Skywin Erector, Baroda are as follow

MS-49 drg. no 610 EZ 2" x Sch.40

M.S. Steam header to Prereformer isolation valve (10" x 300# ) location was shifted from rack (above 104-C ) to near Secondary reformer.

(B) Installation of N. G. Separator :

New N.G. Separator was installed and connected to N.G. Compressor final discharge for removal of oil and other debris. It will prevent oil and other debris in Desulphuriser and cause damage to Corbon activated catalyst.

CODE NO	JOB DESCRIPTION
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**(C) Other Fabrication Jobs :**

Job was awarded to M/S. Technocon ,Baroda

Sr.No.	Job Descriptions	Material used
1	PICV-846 Provision of Isolation Valve	CS Gate valve 8"x150#
2	HW-33 Line Replacement	CS Pipe 8" xSch 40
3	Hydrogen line 103-J to PGR Elbow Repl	CS Elbow 3" x Sch 40
4	E-4 to R1/R2 Pipe Replacement	CS Pipe 4" xSch 40
5	156-F(SC-17) 2"&3" Pipe Replacement	CS Pipe 2"&3" xSch 80
6	FIC 13/14 Stubend Flange replacement	SS 304 Flange 6"x300#/8"x300#
7	127 - CA/CB Hydrotest / Sample line arrangement	CS Gate Valve 3/4"x900# CS Pipe 3/4"
8	LTS Sample line Replacement	CS Pipe 3/4" xSch 40

**(D) DEPARTMENTAL FABRICATION JOBS :**

Following jobs were carried out out departmentally.

Sr.No.	Job Descriptions	Material Descriptions
1	H-110(Naptha Preheater) Out Let Line	Pipe A 335 P11 / 45 Elbow W P11
2	Interconnection of tail gas line to flare stack on top of prereformer	CS Pipe 1-1/2" Sch 40
3	Primary reformer outlet sample line pin	CS Pipe 1/2" NB
4	hole leakage Hydrogen to LTS Rotameter d/s second elbow leakage	CS Pipe 3/4" NB
5	106 c gas outlet drain line punctured	CS Pipe 3/4" NB
6	Plan air line pin hole leakage	CS Pipe 2" NB x Sch 40
7	103 JAT Steam inlet line TTV leakoff line rerout	CS Pipe 3/4" NB
8	131-JC O/L to 101-JHP Suction Line Fabricated for removal of line tension	C S

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PLANT TURNAROUND - MARCH - APRIL - 2001

AMMONIA PLANT

INSPECTION JOBS

CODE NO      JOB DESCRIPTION

01 41 01      INSPECTION JOBS :

During March-April,2001 Shutdown from 25.3.2001 to 16.4.2001, the following major inspection activities were performed in Ammonia Plant.

1. Automatic ultrasonic scanning of all the Catalyst and Riser tubes in Reformer Furnace.
2. Insitu metallography of selected equipment and pipelines.
3. Thickness measurement and visual inspection of equipment and pipelines.
4. Ultrasonic flaw detection on selected weld joints of critical pipelines.
5. Inspection of newly fabricated pipelines for replacement which mainly include Boiler Feed water Line, Boiler blow down lines, Process gas lines, small segments of hydrogen gas and ammonia vapour lines etc
6. Inspection of selected spring hangers to check their spring constant.
7. Qualification tests of welders employed by contractors.
8. Visual inspection of equipments.
9. Magnetic field measurement on rotor of N.G.Booster Compressor train etc.

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.

(A) PRIMARY REFORMER 101-B:

RADIANT ZONE AND CONVECTION ZONE:

1. VISUAL INSPECTION:

Visual inspection of the entire furnace radiant zone, including harp assemblies, refractory and insulation, burner-blocks, HT-LT convection zones and Hot well of Auxiliary boiler etc. was carried out. The detailed report on observations made is enclosed herewith at Annexure-1.

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CODE NO	JOB DESCRIPTION
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The following important observations were made during this shutdown.

- a) The brick lining on East wall at the South End of the Primary Reformer radiant zone which was found to have got bulged-inward causing gap between lining and metallic wall was replaced partly in the affected area during this shutdown. The metallic wall segment was also replaced. Selected brick panels were also replaced on North wall and West wall by Civil Section as per the observations made.

It is recommended to reinsulate the LT convection zone south wall also as the temperature on outside wall had "hot-spots" ranging from 253 deg.C to 425 deg.C. These areas are inaccessible for repairs from inside as these are beneath the LT steam Super heater Coil and BFW Coil.

- b) The Reformer outlet Collector header insulation was found damaged at different locations indicated at Annexure-1. The insulation was repaired at these locations after completion of header clearance and creep measurement job.
- c) The fiber blankets in the HT convection zone are covered by SS-310 sheets. This sheet has got badly buckled and burnt off losing its strength. The exposed fiber blankets have got the erosion effect due to high velocity of flue gases and therefore it is recommended to replace the protective sheet with incolloy sheet particularly in the wall area below Mixed Feed Coil.
- d) The LT steam super heater coil has got sagged as has been observed in the past. The intermediate supports of this coil have got badly damaged. Also, at three different locations, the fins of the top row of tubes have got detached.
- e) On Aux. boiler furnace West wall one panel refractory replacement was done during this Shutdown where refractory lining was peeled off and the new refractory lining was carried out.
- f) The Arch burner blocks(two no) 901 & 902 which were found damaged in visual inspection of the furnace were replaced by Maintenance group.

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CODE NO	JOB DESCRIPTION
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## 2. OTHER NDT ACTIVITIES:

- a) Automatic ultrasonic scanning of all the 336 Catalyst tubes and 8 Risers tubes was carried out during Shutdown. In all, 13 tubes were detected in 'D' grade category, i.e. more deteriorated tube condition indicating voids, micro and macro fissures in the tube wall. 318 tubes were observed to be in 'C' grade category [C1-10 nos, C2- 85 nos, C3- 223 nos] ,05 tubes were detected to be in 'B' grade category which were replaced during April-98 . All riser tubes are in 'C' grade category. There is no further deterioration in condition of the tubes has been detected though some tubes operated with hot bands for long time. The summary of tube conditions is enclosed herewith at Annexure-2.
- b) Insitu metallography of outlet manifold no. 1 & 8 and on inlet header no. 3 & 7 was carried out. No major abnormalities were detected in the micro structure.
- c) Riser tube to weldolet joints were radiographed for all the eight rows. No service defects were observed in any joint.
- d) DP test of all the 16 Nos. header field weld joints was carried out. DP test of riser tube to weldolet and weldolet to header weld-joints was carried out for all the risers. Also DP test of five nos. of randomly selected catalyst tube to weldolet and weldolet to outlet header joints in each row was carried out. No defects were revealed.
- e) Creep measurement of all the catalyst tubes in appx. upto 7 feet length above tunnel slab level was carried out using GO-NOGO Gauge. No recordable Creep was found in 214 nos. of tubes and creep was upto 0.73 % in 121 nos of tube. Only one tube no. 731 was in the creep range of 1.3 to 2.5 % which was also observed in the past. The details showing the creep of individual tubes is attached at Annexure-3.
- f) Creep measurement of Riser Tubes was also carried out. The report is attached herewith at Annexure-4. Max. Riser O.D. was measured to be 4.9623" which corresponds to 0.49 percent creep.
- g) Creep measurement of outlet headers was carried out. The report is attached herewith at Annexure-5. Max. header O.D. was measured to be 5.62512" which corresponds to 1.12 percent creep.
- h) Bottom header clearance was taken (without insulation). The report is attached at Annexure-6. The clearance was found to be adequate.
- i) Spring hanger readings of catalyst tubes, transfer line and collector header drain readings in cold condition were taken. The report is attached herewith at Annexure-7.
- j) East wall panels of HT and LT Zone were opened for thickness measurement of coils. The detailed thickness reports attached at Annexure-8 .

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CODE NO	JOB DESCRIPTION
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- k) West wall header box panel segment of L.T. Convection Zone was opened for thickness measurement on Ammonia BFW Coil tubes.No considerable reduction in thickness was observed.Minimum thickness of 5.0 mm was observed against design thickness of 5.54 mm which is within safe limit.

(B) AUXILIARY BOILER :

(1) HOT WELL AREA:

VISUAL INSPECTION: Visual inspection of hot well area of auxiliary burner was carried out. The observations were as under.

- a) Top most panel of castable refractory on the west wall was found to have half portion of the castable fallen down/detached.
- b) The distributor plate for the flue gas has got slightly distorted. However, the stiffeners had badly damaged. The anchoring bolts at the bottom end of the distributor plate were found loose. It was recommended to check and tighten the fasteners at top and bottom.
- c) Loose refractory castable/bricks were lying on the floor of the hotel, particularly on the north side.
- d) Castable behind/near the coil, at East wall had got peeled off by half thickness at several locations.
- e) Cladding sheet of ceramic fiber blankets has got burnt off and distorted but it is intact in position.

(2) FURNACE AREA :

- a) Insitu metallography was carried out on tube of coil-A ,B and C which has got deformed. Microstructure was observed to be normal.



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01 41 02 VESSELS AND OTHER EQUIPMENT:

1) 103-D, SECONDARY REFORMER:

SECONDARY REFORMER BOTTOM:

Visual inspection of Secondary Reformer Bottom dome was carried out after removal of plug of bottom manhole. The following observations were made.

BOTTOM DOME AREA :

- a) The holes in the dome were found choked in appx. 10 % area with 1 inch dia. alumina balls and the dust. These were cleared by production group before boxing up.
- b) The skirt liner shroud was found bulged inward by about 1 inch Min. to 10 inches max. in appx. 80 % circumference starting from West to south direction. The complete skirt liner was replaced and all the weld joints of the same were DP tested.
- c) Refractory behind the shroud was found partially eroded and has got fallen in about half of its circumference having width of approx. 8 to 10 inches.
- d) Cracks / erosion of the top dome bricks was observed at few locations .
- e) Refractory around the nozzle openings of 101-CA/CB was found eroded in about 25 % circumference.
- f) Refractory around bottom manhole nozzle has got cracked and loosen from inside.

101-CA GAS INLET NOZZLE :

- a) A gap of about 8-10 inches has been observed between 1st and 2nd segment of liner counting from 103-D side, resulting in exposure of refractory.
- b) Liner segment close to diffuser has got bulged inside by about 8-10 inches. Refractory has got exposed in this area.

101-CB GAS INLET NOZZLE:

- a) The distributor of 101-CB was found to have got cracked open and bulged along the complete length.
- b) The liner segment of 101-CB nozzle close to the distributor end was found bulged inward by about 8 to 10 inches restricting the gas passage in about 25 to 30 % circumference.

CODE NO	JOB DESCRIPTION
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2) 107-D, TRANSFER LINE:

Visual inspection of Transfer line (107-D) was carried out. In general, there was no change in the condition of the liner as compared to that observed during previous shutdown April, 2000. The following observations were made.

- a) The reinforcement pad provided on the transition cone inner pipe of 8th riser was observed to have bulged inward and a gap of about 1 inch was observed on half of its circumference. The castable refractory has got exposed in this area which has become porous and broken in to pieces. Same bulging was observed on liner plate with corrugation on its surface.
- b) Liner segment between 7th, 8th and 6th, 7th riser observed to have 1 inch gap throughout the circumferential length. The transition cone inner pipe has got oblonged in both 7th and 8th riser.
- c) Similarly, on 6th, 5th and 4th riser, the reinforcement pad surrounding the transition cone inner pipe was found to have bulging on its ID and an opening of approx. 1 inch was observed all around its circumference.
- d) 1st, 2nd and 3rd transition cone inner pipe reinforcement pads were found to have severe bulging all around its circumference on its ID and has caused reinforcement pads to get lifted upward which has resulted in exposure of castable refractory.

3) 101-E CO2 ABSORBER:

Visual inspection of the top and bottom compartment was carried out. In general, it has been observed that there is no further corrosion attack on shell and dished end after switching over to mDEA solution. The following observations were made.

TOP COMPARTMENT :

- a) The demister pads were found intact in position.
- b) External surface of all the three L shaped distributor pipes were found to be corroded / eroded on approx. 40 % of its area by a depth of about 1 mm.
- c) Shell surface surrounding the mDEA inlet header was found to have corrosion / erosion attack in triangular shape of approx. 2 mtrs. length and 1 mtr. height with a depth of about 1 mm.
- d) Corrosion attack was observed on welding joints of inlet header with distributor pipes, flange and flange surface

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CODE NO	JOB DESCRIPTION
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- e) M-seal which was provided to cover corrosion cavities were found peeled off at few locations.
- f) Some of the fasteners of distribution header supports were found loose.
- g) Ultrasonic thickness measurement was carried out on corrosion affected area surrounding mDEA inlet header. Mini.thickness on shell was found to be 49.0 mm against design thickness of 47.6 mm.

BOTTOM COMPARTMENT :

- a) One no. loose bolt and nut was found.
- b) Thick layer of mDEA solution was observed on shell.

4) 102-EA, CO2 STRIPPER:

Visual inspection of vessel from inside was carried out after installation of newly fabricated modified inlet distributor assembly and plugging of selected holes of all the trays. Weld joints of modified inlet distributor were inspected by DP test. The detailed observations are given below.

- a) Welding of the perforated plate provided on west side of distributor pipe was not complete at its north end and welding was carried out from out side only.
- b) Welding of stiffener plate provided below the west side of the distribution header was found to have many pinholes which was marked for repair.
- c) Weld spatters and slags were found at many places which were marked for proper cleaning.
- d) East side weir plates holding bolts were found sheared at seven locations which were marked for replacement and proper fastening.
- e) Demister pads were found intact in position.
- f) The colouration of the shell and dished end was found partly greyish and partly brownish grey.
- g) Hard scales were observed at scattered locations on the shell and dished end.
- h) Tray holding bolts were found loose at few locations which were marked for proper fastening.

CODE NO	JOB DESCRIPTION
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- i) Few trays were found to have cracks of 1 inch to 5 inch length which were marked for repairs.
- j) Lots of scales/deposits debris were found collected in seal pan , cleaning of the same was recommended.

5) 102-EB, CO2 STRIPPER:

Visual inspection of vessel from inside was carried out after installation of newly fabricated modified inlet distributor assembly and plugging of selected holes of all the trays. weld joints of modified inlet distributor were inspected by DP test. The detailed observations are given below.

- a) Welding of the perforated plate provided on distributor pipe was not complete on east side and welding was carried out from out side only.
- b) one no. weir plate holding bolt was found loose on east side .
- c) Demister pads were found intact in position
- d) A few sieve tray central segments were found to have cracks of ½ inch to 5 inch length which were marked for repairs.
- e) Tray holding bolts were found loose at few locations which were marked for proper fastening.
- f) In general the colouration of the shell was dark grey except at scattered locations bright yellowish brown patches were observed.
- g) Grey coloured hard scales were observed in the shell which was particularly more in the bottom four trays length of the shell.
- h) Weld spatters and slags were found at many places which were marked for proper cleaning.
- i) Lots of scales/deposits debris were found collected in seal pan , cleaning of the same was recommended.

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CODE NO	JOB DESCRIPTION
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**6) 101-F, STEAM DRUM:**

Visual inspection of Steam Drum was carried out. The following observations were made.

1. The Drum had greyish black colouration from inside.
2. 6 Nos. of fastening bolts of West side separator plates were missing/broken..
3. 7 nos. of fastening bolts of East side separator plates were found to be sheared off/missing.
4. Between 4th and 5th downcomer (counting from South to North) there is a nozzle of 1" NB size at bottom portion of the shell ( Intermittent blow down line) which was found choked.
5. Pinhole of appx. 3 mm dia was observed on the welding of 6" BFW distributor pipe near flange joint.(East side of shell)
6. All the cyclone separator were found intact in position.
7. Demister pads located at top were found intact in position.
8. Pittings of approx. 0.5 to 0.75 mm depth were observed on south dished end on its west side on a circular area of approx. 15mm (Min. thickness around this area was 116.82 mm)
9. Scattered minor pittings were also observed on East side of shell on an area of approx. 450 mm x 300mm (Min. thickness around this area was 110.59 mm)
10. Clamping bolt of boiler feed water line south end of 6" NB distribution header was found corroded.
11. Ultrasonic thickness measurement was carried out. Mini.thickness on shell was found to be 110.74 mm and 108.34 mm on dished end against design thickness 106.4 mm for both shell and dished end.

**7) 102-F, RAW GAS SEPARATOR**

Visual inspection of Raw Gas Separator was carried out.The following observations were made.

1. Liquid outlet nozzle at bottom which was repaired by putting stainless steel sleeve during April - 2000 shutdown was found satisfactory from inside.
2. Epoxy paint had got peeled off at scattered location and metal surface got exposed. Application of suitable coating was recommended at such locations.

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CODE NO	JOB DESCRIPTION
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3. Epoxy putty applied at bottom side of inlet nozzle had got peeled off. It was recommended to reapply suitable coating.

4. Demister pad at top was found intact in position.

8) 103-F REFLUX DRUM :

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

1. North side demister pad was found open in one segment.
2. On North-West side at a height of about 1.5 mtrs. from bottom paint was found peeled off in approx. 600 mm x 600 mm area. It was also observed on few scattered locations.
3. Bottom dished end painting has got swollen at various places. Blackish material deposition was found at the places from where paint was swollen and broken.
4. CO2 inlet nozzle has got signs of erosion in approx. 25 % circumference on west side including nozzle face of CS material.

9) 104-F SYN. GAS COMPRESSOR SUCTION SEPARATOR :

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

1. Coloration of the vessel bottom was observed to be grayish black where as brownish coloration was observed on remaining surface.
2. Demister pad were found intact in position.
3. All the weld joints as seen visually from inside were found free from any sign of corrosion/erosion.

10) 107-F PRIMARY AMMONIA SEPARATOR:

The vessel was offered for inspection of its internals after necessary purging. The observation were as under.

1. Colouration of vessel internals was found to be greyish black.
2. Scattered thin scales were observed on the shell and dished end.
3. All the weld joints were found free from any corrosion attack.
4. The shell surface was found covered with thin layer of oil.
5. The overall condition of the vessel was found to be satisfactory.

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CODE NO	JOB DESCRIPTION
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11) 109-F REFRIGERANT RECEIVER:

1. The shell had assumed greyish black colouration.
2. The condition of all the weld joints of the shell, dished ends and nozzles was found to be satisfactory.
3. Overall condition of the vessel was found to be satisfactory.

12) 110-F, FIRST STAGE REFRIGERANT FLASH DRUM:

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

1. The shell had assumed brownish black colouration.
2. Oil layer was found on the surface of shell.
3. The Demister pad was found intact in position.
4. All the weld joints were found free from any sign of corrosion.
5. Scattered mill scales were observed on dish ends and shell.
6. Ultrasonic thickness measurement was carried out. Mini. thickness on Shell was found to be 9.0 mm and 11.3 mm on Dished ends against design thickness of 9.52 mm for both, Shell and Dished ends.

13) 111-F, SECOND STAGE REFRIGERANT FLASH DRUM:

The following observations were made during visual examination.

1. The shell inside surface had assumed blackish gray coloration.
2. All the weld joints as seen from inside were found to be free from any corrosion.
3. Thin layer of oil was observed on the complete inside surface and oil sludge was found accumulated in the shell.
4. The demister pads were found intact in position and in good condition.
5. Thin loose scales and rusting was observed on west side dished end where as hard scales were observed on east side dished end.

CODE NO	JOB DESCRIPTION
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14) 112-F, THIRD STAGE REFRIGERANT FLASH DRUM:

The following observations were made during visual examination.

1. The demister pads were found intact in position.
2. The coloration of the inside surface of shell was dark blackish.
3. Oil was found sticking to the vessel shell.
4. Hard scales were observed in the shell which were more prominent on the dished ends.
5. Overall condition of the vessel was satisfactory.

01 41 04 MISCELLANEOUS JOBS:

1. WELDER QUALIFICATION TESTS:

- a) Performance qualification test of 15 Nos. welders offered by M/s Mahavir Engrs., and Ram bahadur & Co. was carried out. 09 Welders were qualified during the test. These welders were allowed to perform various miscellaneous non-critical departmental welding jobs in the plant.
- b) Performance qualification test for 13 Nos. welders was carried out for M/s PTPL, out of which 9 welders were qualified. The fabrication of PG-5, PG-8, Boiler feed water coil inlet line, Boiler blow down lines in Ammonia plant was carried out by this agency.
- c) Welder qualification test of 6 Nos. welders of M/S. Skywin Engrs., was carried out. Two welders were qualified for performing welding jobs of Secondary reformer skirt liner replacement, BHEL boiler tubes, Superheater RV nozzle etc.
- d) Welder performance qualification test for 08 Nos. welders of M/S Technocon Engrs., was carried out. 06 nos of welders were qualified. The fabrication of CO2 stripper inlet distributors, partial replacement of ammonia lines in urea plant etc., was carried out by this agency.
- e) Three welders were offered by M/s Garcem Engrs., for performance qualification for fabrication work of cold Ammonia line in Ammonia plant. One welder was qualified for the job.
- f) One welder was offered by M/S Smitha Engrs., and has got qualified.



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CODE NO	JOB DESCRIPTION
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2. CRANE LOAD TEST:

One No. Crane was hired from M/s Express, Baroda. Load test of this Crane was carried out at 36 tonnes test load at party's site. The crane was found fit for use during load testing and on subsequent visual inspection of components.

3. D.P. TEST:

Dye penetrant examination of weld joints of all the pipelines fabricated by M/s PTPL, for PG lines, Blow down lines, Boiler feed water lines, M/s Garcem Engineers, for cold Ammonia piping, M/s Technocon, for different SG Line, ammonia lines, CO2 stripper inlet distributor, M/S Skywin for Air line, Secondary reformer skirt liner etc. and our Workshop group for miscellaneous fabrication jobs was carried out after root run welding and after final welding. Any defects observed during the tests were rectified in the presence of inspector followed by DP test for acceptance. D.P test of the weld joints at the upstream of 105 ata steam line near letdown station was also carried out to detect service defects, if any. No defects were observed.

4. RADIOGRAPHY:

In order to ensure immediate radiography work and urgent processing of films, teams from M/s NDT Services, Ahmedabad, 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. Also radiography was carried out on riser to weldolet joints of primary reformer. Source of high curie was arranged through this party to cover large quantum of job in less time.

CODE NO      JOB DESCRIPTION

5. INSITU METALLOGRAPHY EXAMINATION:

In order to evaluate the condition of certain critical plant equipment and pipelines operating at high temperatures, Insitu metallographic examination was carried out. The details of spots examined on individual equipment are given below. The services of M/S. Deep Metallurgical Services, Thane were hired for the said job.

SL	EQUIPMENT	MATERIAL	OBSERVATIONS	COMMENTS
1	AUXILIARY BOILER TUBES (West Wall)	CS	Microstructure examination was carried out on tube no. 30 Microstructure consists of ferrite and pearlite in low carbon steel. No decomposition of pearlite or spherodisation of carbide is seen.	Microstructure is normal.
2	AUXILIARY BOILER TUBES (North wall)	CS	Microstructure examination was carried out on tube no. 9 counting from west side.  Outer surface of the tube is covered with thick scales. The tube also shows bend at the center. Microstructure of the tube contains ferrite and pearlite. No low temperature transformation products like martensite or bainite indicating overheating and subsequent cooling of tube is seen. As expected no decomposition of pearlite or spherodisation is seen.	Microstructure is normal.
3	AUXILIARY BOILER TUBES (East wall)	CS	--- Do ---	Microstructure is normal.
4	BFW COIL (AMMONIA) INLET HEADER	CS	Microstructure examination was carried out on north side surface of inlet header in header box.  Microstructure contains ferrite and pearlite. No abnormalities in the structure are seen.	Microstructure is normal.

CODE NO      JOB DESCRIPTION

SL	EQUIPMENT	MATERIAL	OBSERVATIONS	COMMENTS
5	START UP HEATER (102-B) COIL	P-22	<p>Microstructure examination was carried out on coil no.4 (silo side),coil no.5(NG Comp. side)</p> <p>Microstructure shows tempered bainite and pearlite. The structure is free from coarsening. No grain boundary cracks or coarsening is seen.</p>	Microstructure is normal.
6	105 ATA STEAM LINE	CS	<p>Microstructure examination was carried out on elbow at the up stream of control valves PICV 13-A, PICV 13-B and up stream pipe of MIC-22</p> <p>Structure consists of uniform diatribution of ferrite and pearlite. No abnormalities such as pearlite decomposition, carbide coarsening, grain sliding or void, intergranular cracks are seen.</p>	Microstructure is normal.
7	114-C OUTLET BOILER FEED WATER LINE BF-17-3"	CS	<p>Microstructure examination was carried out on side surface and at the top of the pipe.</p> <p>Structure contains ferrite and pearlite. Some beginning of carbide coarsening is seen at one spot out of two.</p>	Microstructure is normal but needs attention.
8	S.G.-33-14" (122-C OUTLET LINE TO 123-C)	P-22	<p>Microstructure examination was carried out at four locations i.e. on east and west side at the upstream of flange joint (vertical pipe line) at South side of converter and at the top bend.</p> <p>At one spot i.e. west side of the upstream of flange joint , tempered structure consists of bainite containing precipitation of carbides and pearlite. Few inter granular cracks were seen. However, no carbides coarsening or cavitation ahead of the crack tip were seen.</p> <p>The cracked surface of the pipe was ground to a depth of 0.5 mm for microstructural examination. Microstructure contains ferrite and pearlite. No abnormalities in the structure were seen.</p>	Microstructure is normal but needs periodic inspection.

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CODE NO	JOB DESCRIPTION
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SL	EQUIPMENT	MATERIAL	OBSERVATIONS	COMMENTS
		P-22	On the remaining spots, examination was carried out after little grinding of appx. 0.5 mm depth. Microstructure of the pipe showed tempered bainite and pearlite with no inter or transgranular cracks.	Microstructure is normal.
9	SG-32-6" (SG 62 -A/B TO SG-25)	CS	Microstructure examination was carried out on pipe surface which has shown normal structure of ferrite and pearlite.	Microstructure is normal.
10	NAPHTHA SUPER HEATER (H-111)	316H	Microstructure examination was carried out at two locations on the surface of the outlet line.  Structure contains equiaxed grain of austenite with practically no carbides at the grain boundary. Annealing twins are seen. Stress induced martensite, heavy deformation marks or slip are not observed.	Microstructure is normal.
11	PRIMARY REFORMER OUTLET HEADERS	G-4859	Microstructure examination was carried out at one location each on header no. 1 and 8.  Cast structure shows usual dendritic cell network with carbides. There is no crack, pitting or grain boundary void.	Microstructure is normal.

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CODE NO      JOB DESCRIPTION

SL	EQUIPMENT	MATERIAL	OBSERVATIONS	COMMENTS
12	PRIMARY REFORMER TUBE	G-4852	Cast structure shows usual dendritic cell network with carbides. There is no crack, pitting or grain boundary void.	Microstructure is normal.
13	NG-9-12" (MIXED FEED COIL OUTLET LINE)	CS	Microstructure examination was carried out at two spot i.e. on elbow and pipe.  Structure consists of normal ferrite and pearlite. No abnormalities such as spherodisation, pearlite decomposition , grain boundary voids are seen.	Microstructure is normal.
14	PRIMARY REFORMER INLET HEADER	P-11	Microstructure examination was carried out on south side of inlet header no. 3 and 7 near elbow at the top of the pipe.  Structure contains tempered bainite and pearlite. No abnormalities are seen.	Microstructure is normal.
15	HS-2H-12" (105 ATA STEAM OUTLET NEAR STEAM DRUM.)	P-11	Microstructure examination was carried out at two locations  As expected structure contains ferrite and pearlite with no abnormalities. .	Microstructure is normal.

CODE NO      JOB DESCRIPTION

SL	EQUIPMENT	MATERIAL	OBSERVATIONS	COMMENTS
16	METHANATOR - 106 D	CS	<p>Microstructure examination was carried out at seven locations of the bottom dished end i.e on weld metal, parent metal and heat effected zone.</p> <p>The structure showed inter granular cracks with branching in the matrix of ferrite and pearlite. However, no grain boundary voids or decomposition of pearlite was seen.</p> <p>The same was further examined after grinding up to a depth of 1 mm. No inter granular cracks in the matrix of ferrite and pearlite were seen.</p>	Type IV crack is always associated with excess metal temperature and stress at the inter critical HAZ. Therefore periodic inspection shall be carried out.
17	MIXING TEE (PG-24-	P-11	<p>Microstructure examination was carried out on the surface of mixing tee at four locations.</p> <p>As expected structure shows tempered bainite and pearlite. Some grain coarsening was seen. The structure consists of uniform distribution of ferrite and pearlite. No abnormalities such as pearlite decomposition, grain sliding or void, inter granular cracks were seen.</p>	Microstructure is normal but needs frequent inspection.
18	101- CA RISER TO STEAM DRUM	CS	<p>Microstructure examination was carried out on the top surface of the pipe.</p> <p>Normal structure contains ferrite and pearlite. No abnormalities were seen.</p>	Microstructure is normal.

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**CODE NO      JOB DESCRIPTION**


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**6. ULTRASONIC FLAW DETECTION OF WELDS:**

Weld joints (selected only) of the following pipe lines 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. Discontinuities detected during Ultrasonic Flaw Detection were counter checked with spot radiography for finding out their nature and deciding the further course of action. No discontinuity was required to be repaired.

SR. NO	LINE NO	FROM	TO	NOS. OF JOINTS EXAMINED
1	A-28-4"	A-20	A-21	3
2	BF-3H-3"	BF-17	BF-2H	2
3	BF-17-3"	114-C	BF-3H	6
4	BW-40HA/HB-12"	BW-1H	101-F	2
5	BW-41HA/HB-12"	BW-35H	101-F	2
6	BW-43HA/HB-12"	BW-5H	101-F	2
7	HS-2-12"	HS-2H	101-B	4
8	HS-2H-12"	101-F	HS-2	2
9	HS-10-6"	HS-5	PIC-13A	02
10	HS-11-6"	HS-9	PIC-13B	02
11	HS-12-6"	HS-9	MICA-22	02
12	NG-9-12"	101-B	NG-11TH	07
13	SG-26-6"	SG-23	MICA 14	03
14	SG-27-6"	SG-23	MICA 15	03
15	SG-28-4"	SG-23	MICA 16	04
16	SG-32-6"	SG-62 A/B	SG-25	06
17	SG-76 A/B-4"	SG-27	101-B	06
18	6"NV-1101.1-F34	H-110	R-110	20
19	14"PG-1102.01-G36	H-111	R-112	04
20	14"PG-1103.01-G36	R-111	101-B	08

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CODE NO	JOB DESCRIPTION
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7. 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-8 (for equipment) and Annexure-9 (for pipelines).

8. REPLACEMENT OF PIPELINES:

During this shutdown, various pipelines in Ammonia Plant were replaced by Technical Group. Inspection activities viz. DP Test, Radiography review and repairs etc. were carried out on the weld joints as per fabrication Specifications of individual lines. The list of pipelines replaced has been attached at Annexure-10

9. CHEMICAL ANALYSIS OF MATERIALS:

Using the portable Arc met-930 SP Optical Emission Spectrometer, chemical analysis of 4"NB Sch 80 P-22 elbows, SS 316L pipe, SS 316l bolts for autoclave tray fixing, the analysis of various pipe fittings received from vendors for the use in the plant piping replacement etc. was carried out as and when required.

10. OVER SPEED TRIP TEST:

Before startup, over speed trip test speed measurement and vibration measurement of BFW pump Turbine, 104JAT, ID Fan Turbine 101-BJT were carried out.



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CODE NO      JOB DESCRIPTION

ANNEXURE-1

VISUAL INSPECTION REPORT DETAILS OF PRIMARY REFORMER RADIANT ZONE.

1) BURNER BLOCKS:

One no. of burner block which was found to have partial damage, was replaced during this shutdown.

2) BOTTOM HEADER INSULATION:

<u>Row No.</u>	<u>Location of header insulation damage</u>
1	Below tube no. 1, 2, 15, 16, 17, 27, 28.
2	Below tube no. 2, 6, riser, 27, 28.
3	Below Catalyst tube no. 15, 16, 27, 38 to 42.
4	Below Catalyst 2, 3, 4, 17, 28, 31, 38 to 42.
5	Below tube no. 7 to 11, 15, 16, 24, 40.
6	Below tube no. 15, 16, 22.
7	Below tube no. 22, 26, 28.
8	Below tube no. 1, riser, 28, 35, 36.

3) REFRACTORY WALL:

East wall was partially opened out by Civil section due to looseness of the bricks and rebuilt after replacement of deformed segment of furnace C.S. wall on south side at tunnel slab level wall. Partial repairs were also carried out at different locations in the furnace walls where erosion / gap between the brick panels were excessive particularly on north wall and west wall .

---

CODE NO      JOB DESCRIPTION

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4) ROOF INSULATION:

The roof insulation had minor damage at a few locations as described below. The places where the insulation damage resulted in exposure of the roof plate, the insulation was repaired by maintenance group after making necessary scaffolding approach.

ROW NO.    LOCATION OF DAMAGE

- |   |  |
|---|--|
| 1 | Around tube no. 38 to 42. A gap of about 4 inch was observed .   |
| 2 | Between tube no. 7 and 8 and between burner block no. 13 and 14. |
| 3 | Near burner block no. 02   |
| 4 | Between tube no. 406,408   |
| 5 | Near burner block no. 07   |
| 8 | Near tube no. 801, near burner block no. 13 and 14.              |

76

CODE NO      JOB DESCRIPTION

**PDIL INVESTIGATION REPORT :**

ANNEXURE -2

GRADATION OF TUBES BY AUS

GRADE	ROW NO.	TUBE NOS.	NO OF TUBES	TOTAL TUBES
A	1	NIL	NIL	NIL
	2	NIL	NIL	
	3	NIL	NIL	
	4	NIL	NIL	
	5	NIL	NIL	
	6	NIL	NIL	
	7	NIL	NIL	
	8	NIL	NIL	
B	1	32,34,37	03	05
	2	NIL	NIL	
	3	NIL	NIL	
	4	NIL	NIL	
	5	NIL	NIL	
	6	NIL	NIL	
	7	NIL	NIL	
	8	4,5	02	

77

CODE NO      JOB DESCRIPTION

GRADATION OF TUBES BY AUS

GRADE	ROW NO.	TUBE NOS.	NO OF TUBES	TOTAL TUBES
C1	1	06,08	02	10
	2	04	01	
	3	NIL	NIL	
	4	14,34	02	
	5	NIL	NIL	
	6	NIL	NIL	
	7	17,19	02	
	8	02,07,10	03	
C2	1	11,12,15,16,20,26,31,40,41	09	85
	2	03,06,15,16,17,18,24,28,36,37,39	11	
	3	04,15,17,30,32,34,35,37,42	09	
	4	15,19,20,23,26,28,31,33,36,37,38,39	12	
	5	07,09,10,25,26,27,29,32,34,39,40,42	12	
	6	08,16,19,21,22,23,26,28,34,35,36,37	12	
	7	06,09,10,11,12,13,14,18,20,21,25,29,31,32,40	15	
	8	01,08,15,19,20	05	

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CODE NO      JOB DESCRIPTION

GRADATION OF TUBES BY AUS

GRADE	ROW NO.	TUBE NOS.	NO OF TUBES	TOTAL TUBES
C3	1	01,02,03,04,05,07,09,10,13,14,17,18,19,21,22,23,24, 25,27,28,29,30,33,36,39	25	223
	2	01,02,05,07,08,09,10,11,12,13,14,19,20,21,22,23,25, 26,27,29,30,31,32,33,34,35,38,40,41,42	30	
	3	01,02,03,05,06,07,08,09,10,12,13,14,16,18,19,20,21, 22,23,24,25,26,27,28,29,31,33,36,39,40,41	31	
	4	01,02,03,04,05,06,07,08,09,10,11,12,13,16,17,18,21, 22,24,25,27,29,30,32,35,40,41,42	28	
	5	01,02,03,04,05,06,08,11,12,13,14,15,16,17,18,19,20, 21,22,23,24,28,30,31,33,35,36,37,38,41	30	
	6	01,02,03,04,05,06,07,09,10,11,12,13,14,15,17,18,20, 24,25,27,29,30,31,32,33,38,39,40,41,42	30	
	7	01,03,04,05,07,08,15,16,22,23,24,26,27,28,30,33,34, 35,36,37,38,39,41,42	24	
	8	03,06,09,11,12,13,14,16,17,21,22,23,24,25,26,27,29,32, 33,34,35,37,39,40,41	25	
D	1	35,38,42	03	13
	2	NIL	NIL	
	3	11,38	02	
	4	NIL	NIL	
	5	NIL	NIL	
	6	NIL	NIL	
	7	02	01	
	8	18,28,30,31,36,38,42	07	

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## ANNEX.3(1)

DATE: 27-03-2001

## CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES:

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	23	19	0	0		TOTAL	32	10	0	0

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ANNEX. 3(2)

DATE: 27-03-2001

**CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES:**

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	27	15	0	0	TOTAL	38	4	0	0

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ANNEX.3(3)

DATE: 27-03-2001

**CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES:**

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	22	20	0	0	TOTAL	23	19	0	0



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ANNEX.3(4)

DATE:27-03-2001

**CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES:**

TUBE NO					CREEP IN PERCENTAGE					
	0	0-0.73	0.73-1.3	1.3-2.5		TUBE NO.	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		
<b>TOTAL</b>	<b>28</b>	<b>13</b>	<b>0</b>	<b>1</b>		<b>TOTAL</b>	<b>21</b>	<b>21</b>	<b>0</b>	<b>0</b>

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**ANNEX. 4**

Date: 29-03-2001

CREEP MEASUREMENT OF RISER TUBES

Riser No	O.D. of Riser		Design O.D. Max.	Creep % GE
	E-W	N-S		
1	4.94	4.94145	4.938	0.06
2	4.9329	4.93125	4.938	Nil
3	4.96169	4.9623	4.938	0.49
4	4.941	4.94	4.938	0.06
5	4.9377	4.93015	4.938	Nil
6	4.9357	4.93075	4.938	Nil
7	4.9399	4.94565	4.938	0.15
8	4.95705	4.9607	4.938	0.45

REMARK: 1) MAXIMUM DIAMETER OF 4.9623 OBSERVED CORRESPONDS  
TO 0.49% CREEP  
2) ALL DIMENSIONS ARE IN INCH

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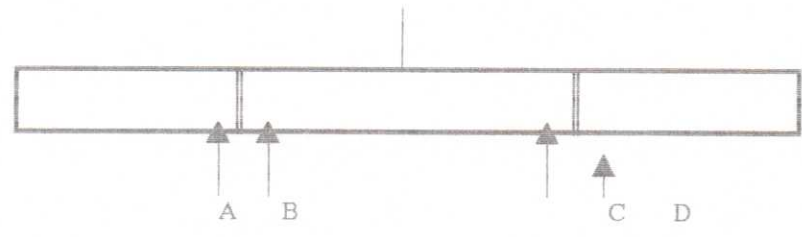
ANNEX. 5

EQUIP. NAME : Primary Reformer  
 SHUTDOWN : March-April 2001  
 DESIGN OUTSIDE DIA.: 141.3 to 142.1 mm(5.5629" to 5.5551")

CREEP MEASUREMENT OF OUTLET MANIFOLD

HEADER NO.	LOCATION							
	A		B		C		D	
	X-X	Y-Y	X-X	Y-Y	X-X	Y-Y	X-X	Y-Y
1	5.59765	5.59201	5.5881	5.6012	5.5864	5.6101	5.6125	5.6126
2	5.56495	5.57476	5.56385	5.56335	5.62512	5.61162	5.62512	5.62161
3	5.5912	5.58328	5.58916	5.60126	5.59166	5.59215	5.62326	5.61875
4	5.976	5.59216	5.61723	5.61721	5.60246	5.59485	5.61341	5.60234
5	5.62261	5.61245	5.58221	5.58313	5.58346	5.61261	5.61732	5.61152
6	5.59775	5.5881	5.5929	5.5945	5.5877	5.5835	5.592	5.60435
7	5.58426	5.59334	5.59143	5.60243	5.60164	5.60485	5.60886	5.60411
8	5.60248	5.60776	5.60138	5.60288	5.59479	5.61255	5.6135	5.6136

NOTE : (1) ALL DIMENSIONS ARE IN INCH.  
 (2) MAXIMUM DIAMETER OF 5.62512" WAS OBSERVED WHICH CORRESPONDS TO 1.12% CREEP.



**ANNEX. 6**

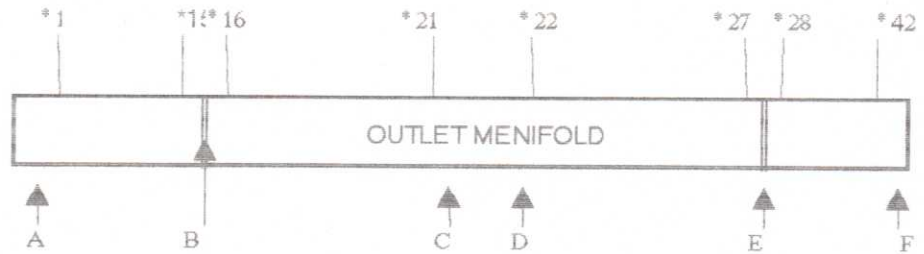
Inspection Section  
Maint. Deptt.

EQUIP.NA PRIMARY REFORMER  
SHUTDOWN MARCH-APRIL 2001

**CLEARANCE OF OUTLET MANIFOLD FROM  
GROUND FLOOR IN COLD CONDITION**

HEADER NO.	LOCATION					
	A	B	C	D	E	F
1	310	315	295	296	310	315
2	325	305	315	310	310	300
3	315	280	305	300	305	315
4	325	285	305	300	315	300
5	315	305	325	325	315	315
6	320	285	285	290	280	310
7	325	315	325	325	315	325
8	335	330	315	315	310	320

NOT: (1) ALL DIMENSIONS ARE IN MM.  
(2) ALL READINGS ARE TAKEN WITHOUT INSULATION.



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READINGS TAKEN ON 01-04-2001  
TIME 23.00 HRS

**ANNEX-7**

OPERATING PARAMETERS:

- 1) AVERAGE SKIN TEMP. OF CATALYST TUBES: )
- 2) PLANT LOAD: ) COLD
- 3) HOT TUBES: ) CONDITION
- 4) BOW TUBES: )
- 5) FIRING CONDITION: )
- 6) AVERAGE SKIN TEMP. OF RISER TUBE: )

1. TUBE SPRING HANGER LOAD READINGS OF 101-B

COLD LOAD READINGS IN MM

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

2. TRANSFER LINE SPRING HANGER LOAD READINGS IN MM

SPRING HANGER(W-E) READINGS	1	2	3	4	5	6	7
	-10	28	25	13	0	22	10

3. BOTTOM DRAIN READINGS IN MM

ROW	1	2	3	4	5	6	7	8
READINGS	35	10	30	15	22	30	10	22

OBSERVATIONS/RECOMMENDATION : SCALES WERE NOT FOUND IN POSITION FOR HEADER NO. 2,3 AND 4 WHICH MAY BE PROVIDED.



THICKNESS MEASUREMENT DATA OF AMMONIA PLANT PIPELINES CARRIED OUT DURING MARCH-APRIL 2001:										ANNEXURE-9
SR NO	LINE NO	N.B (in.)	SCH	NOM THK MM	MAT	LINE DESCRIPTION FROM	TO	MIN THK OBSERVED	% RED	REMARK
<b>PROCESS AIR LINES:</b>										
1	A-20	10	20	8.35	CS	101 J	101 B	5.5	13.38	
2	A-21	10	120	21.41	CS	101 B	103 D	17.5	19.26	
3	A-22	4	40	6.02	P-11	A 20 SPEC.BRK	SPEC. BRK NG-9	5.2	13.62	
4	A-25	8	40	7.11	CS	CONT. VALVE	FICA-4	6.7	5.77	
5	A-27	8	40	7.11	CS	A-25	SILENCER	6.9	2.95	
6	A-28	4	80	9.5	CS	A-20	A-21	8.9	--	UFD
7	A-31	1.5	80		CS	A-20	SPEC BRK	8	--	
<b>BOILER FEED WATER LINES:</b>										
1	BF-01	12	20	8.35	CS	101-U	HEADER	6.4	--	
2	BF-17	3	80	7.8	CS	114-C	BF-3H	7	7.89	UFD
3	BF-3H	3	80	7.8	CS	BF-17	BF-3H	6.8	8.21	UFD
<b>BOILER WATER LINES:</b>										
1	BW-40HA	12	100	21.41	CS	BW-1H	101-F	20	6.59	UFD
2	BW-40HB	12	100	21.41	CS	BW-1H	101-F	19	11.26	UFD
3	BW-41HA	12	100	21.41	CS	BW-35H	101-F	20	6.59	UFD
4	BW-41HB	12	100	21.41	CS	BW-35H	101-F	20	6.59	UFD
5	BW-43HA	12	100	21.41	CS	BW-5H	101-F	19	11.26	UFD
6	BW-43HB	12	100	21.41	CS	BW-5H	101-F	19	11.26	UFD
<b>CARBON D-OXIDE LINES:</b>										
1	CO-1A	18	80	11.13	CS	102-EA	CO-17	9.6	13.75	
2	CO-1B	18	80	11.13	CS	102-EB	CO-16	9.2	17.34	
<b>HIGH PRESSURE STEAM LINES:</b>										
1	HS-2	12	100	21.41	CS	HS-2H	101-B	18	15.93	UFD
2	HS-2H	12	100	21.41	CS	101-F	HS-2	20	6.59	UFD
3	HS-04	12	100	21.41	P-11	HS-3H	HS-7	20.1	6.12	
4	HS-05	10	100	18.3	CS	HS-4	HS-8	19.2		
5	HS-07	10	100	18.3	CS	HS-4	103-J	17.8	2.73	
6	HS-10	6	100	13	CS	HS-5	PIC-13 A	12.4	4.82	UFD
7	HS-11	6	100	13	CS	HS-8	PIC-13 B	12.3	5.38	UFD
8	HS-12	6	100	13	CS	HS-8	MICA-22	12.6	3.06	UFD
<b>LOW PRESSURE STEAM LINES:</b>										
1	LS-01	12	20	8.35	CS	LS-2	LS-4	8	5.51	
2	LS-02	3	40	5.48	CS	HEADER	LS-1	5.4	1.64	
3	LS-03	12	20	8.35	CS	HEADER	LS-4	6.1	3.94	
4	LS-3A	12	20	8.35	CS	HEADER		6	5.51	
5	LS-04	14	20	7.92	CS	LS-3	HEADER	9.2		
6	LS-10	8	20	8.35	CS	LS-8	LS-1	7.7	--	
7	LS-24	8	20	8.35	CS	101-B	LS-3	6.1	3.94	
8	LS-25	8	20	8.35	CS	112-C	SPEC BRK	6.1	3.94	
9	LS-27	3	40	5.48	CS	LS-3A	HEADER	5.7		
10	LS-75	6	40	7.11	CS	LS-4	LS-75	7.2		
<b>MDEA LINES:</b>										
1	MDEA-02	4	40	6.02	SS-30	MDEA-1	101-L	4.7	21.63	
2	MDEA-06A	10/8	40S	9.27/8.18	SS	109-C1A	MDEA-61	7.8		
3	MDEA-06B	10/8	40S	9.27/8.18	SS	108-C1B	MDEA-61	8.8	--	
4	MDEA-07	12/10	40S	9.5/9.27	SS	MDEA-61	MDEA-6A & B	8.9	9.47	
5	MDEA-08	12	30	8.38	CS	MDEA-19 & 18	MDEA-20	8	8.47	
6	MDEA-08A	10/8	40S	9.27/8.18	SS	MDEA-7	CON VALVE	7.5	8.34 & 8	
7	MDEA-09B	10/8	40S	9.27/8.18	SS	MDEA-7	CON VALVE	6.2	8.12 & 4	
8	MDEA-12A	12	20	8.35	CS	MDEA-11	108C1A	6.8	--	
9	MDEA-12B	12	20	8.35	CS	MDEA-11	109C1B	5.5	13.38	
10	MDEA-13A	12	20	8.35	CS	108C2A	MDEA-60	8	5.51	
11	MDEA-13B	12	20	8.35	CS	109C2B	MDEA-60	5.9	7.09	
12	MDEA-14	14	20	7.92	CS	MDEA-16	MDEA-15 A & B	6.8	14.14	
13	MDEA-15A	12	20	8.35	CS	MDEA-14	108C1A	8.3	--	
14	MDEA-15B	12	20	8.35	CS	MDEA-14	108C1B	8.4	--	
15	MDEA-16A	12	20	8.35	CS	108C2A	MDEA-62	5.9	7.09	
16	MDEA-16B	12	20	8.35	CS	108C2B	MDEA-62	5.9	7.09	
17	MDEA-17	18	20	7.92	CS	MDEA-62	MDEA-41	7.4	6.57	
18	MDEA-18A	10	20	8.35	CS	MDEA-41	107-JA	8.4	--	
19	MDEA-18B	10	20	8.35	CS	MDEA-41	107-JB	8	--	
20	MDEA-18C	10	20	8.35	CS	MDEA-42	107-JC	8.8	--	
21	MDEA-18D	10	20	8.35	CS	MDEA-42	107-JD	8.8	--	
22	MDEA-19A	8	30	7.04	CS	107-JA	MDEA-B	6.4	9.09	
23	MDEA-19B	8	30	7.04	CS	107-JB	MDEA-C	6.5	7.67	
24	MDEA-19C	8	30	7.04	CS	107-JC	MDEA-21	7	0.57	
25	MDEA-19D	8	30	7.04	CS	107-JD	MDEA-21	6.9	1.99	
26	MDEA-20	12	30	8.38	CS	MDEA-21A+B	101-E	8	4.53	
27	MDEA-21	12	30	8.38	CS	MDEA-19C+D	MDEA-20	8	4.53	
28	MDEA-22	4	40	6.02	CS	103-F	MDEA-23A,B	5.6	6.88	
29	MDEA-23A	4	40	6.02	CS	MDEA-22	108-J	5.6	6.88	
30	MDEA-23B	4	40	6.02	CS	MDEA-22	108-JA	5.5	6.64	
31	MDEA-36	2	80	5.5	CS	111-J	CO-7	5.1	7.27	
32	MDEA-41	16	20	7.92	CS	MDEA-17	MDEA-18A+B	7.3	7.83	
33	MDEA-42	16	20	7.92	CS	MDEA-17	MDEA-18C+D	7.5	5.30	
34	MDEA-60	14	20	7.92	CS	HEADER	MDEA-14	7.4	6.57	
35	MDEA-61	14/12	40S	8.5	SS	MDEA-CA/CB	MDEA-7	9.8		
36	MDEA-62	16	20	7.92	CS	HEADER	MDEA-17	7.3	7.83	
37	MDEA-63	2	80	6.5	CS	114-F	111-J	5.1	7.27	

THICKNESS MEASUREMENT DATA OF AMMONIA PLANT PIPELINES CARRIED OUT DURING MARCH-APRIL 2001:										ANNEXURE-9
SR NO	LINE NO.	N.B. (in.)	SCH.	NOM. THK. MM	MAT.	LINE DESCRIPTION FROM	TO	MIN THK. OBSERVED	% RED.	REMARK
<b>MEDIUM PRESSURE LINES :</b>										
1	MS-12	8	100	15.08	CS	MICA-22	MS-9	13.6	9.89	
2	MS-13	8	100	15.08	CS	PIC-13B		13.4	11.02	
3	MS-14	8	100	15.08	CS	PIC-13A		14.3	5.05	
4	MS-19	8	40	7.11	CS	MS-1	107-JAT	5.8	18.42	
5	MS-23	8	30	7	CS	MS-60	104-J	6	14.29	
6	MS-24	8	30	7	CS	MS-60	104-JA	7	0.00	
7	MS-32	4	40	6.02	CS	MS-38	101-EJ	5.5	6.98	
<b>NATURAL GAS LINES :</b>										
1	NG-01	8	40	7.11	CS	BATT LIMIT	NG-2	7	1.55	
2	NG-02	8	40	7.11	CS	NG-1	101-D	6.9	2.95	
3	NG-03	8	40	7.11	CS	NG-1	102-D	5.8	4.36	
4	NG-04	8	40	7.11	CS	101-D	NG-8A	5.5	22.64	
5	NG-05	8	40	7.11	CS	102-D	NG-8A	6.2	12.80	
6	NG-07	8	20	8.4	CS	101-B NG FDPHT COIL	NG-8	5.9	7.81	
7	NG-08	12	30	8.4	CS	NG-7	101-B MFD COIL	8	4.76	
8	NG-09	12	100	21.4	P-11	101-B	NG-11 TH	18	16.89	UFD
9	NG-11A	6	120	14.3	P-11	NG-9	101-B	13.8	3.50	
10	NG-11B	6	120	14.3	P-11	NG-9	101-B	13.6	4.90	
11	NG-11C	6	120	14.3	P-11	NG-9	101-B	13.8	3.50	
12	NG-11D	6	120	14.3	P-11	NG-9	101-B	13.9	2.80	
13	NG-11E	6	120	14.3	P-11	NG-9	101-B	13.5	5.59	
14	NG-11F	6	120	14.3	P-11	NG-9	101-B	13.2	7.89	
15	NG-11G	6	120	14.3	P-11	NG-9	101-B	13.1	8.39	
16	NG-11H	6	120	14.3	P-11	NG-9	101-B	14	2.10	
<b>AMMONIA LINES:</b>										
1	NH-14	6	40	7.11	CS	109-F	NH-25A/B	6.7	5.77	
	NH-15	4	40	6.02	CS	NH-17	NH-16	8.2	--	
2	NH-17	8	40	7.11	CS	109-F	NH-15	8.2	12.80	
4	NH-25A	6	40	7.11	CS	127-CA	NH-14	9.9	--	
5	NH-25B	6	40	7.11	CS	127-CB	NH-14	10.3	--	
6	NH-88	8	40	7.11	CS	109-F	121-J	7.3	--	
7	NH-88A	8	40	7.11	CS	NH-88	121-JA	5	29.68	
8	NH-88	4	40	6.02	CS	121-J	CONTROL VALVE	5.3	11.96	
9	NH-88A	4	40	6.02	CS	121-JA	NH-88	6.1	--	
10	NH-119	4	40	6.02	CS	AMMONIA PLANT	STORAGE TANK			
<b>PROCESS GAS LINES:</b>										
1	PG-06	18	0.3125	7.93	CS	104-D TOP	103-C	14.4	--	
2	PG-11A	16	30	9.52	SS	PG-21	105-CA	9.2	3.36	
3	PG-11B	16	30	9.52	SS	PG-21	105-CB	9.9	12.82	
4	PG-12A	14	30	9.52	SS-30	105-CA	PG-26	9.2	3.36	
5	PG-12B	14	30	9.52	SS-30	105-CB	PG-26	9.2	3.36	
6	PG-14	16	40	12.7	CS	106-C	102-F	9.5	25.20	MRT=4.87 MM
7	PG-17	14	20	7.9	CS	136-C	104-C	7.8	1.27	
8	PG-18	12	30	8.4	P-11	104-C	106-D	7.9	5.95	
9	PG-19	18/14	STD		CS	PG-8	PG-9	9.3		
10	PG-20	8	20	8.4	CS	PG-9	PG-10	5.8	9.98	
11	PG-22	6	80	11	CS	PG-15	RV-102F	10.2	7.27	
12	PG-24	10	30	7.8	P-11	PG-17	PG-18	6.2	20.51	
13	PG-1101-01-F34	8	40	7.11	P-11	H-110	R-110	6.6	7.17	UFD
14	PG-1102-01-G36	14	80	19.05	P-11	R-111	R-112	18.6	2.38	UFD
15	PG-1103-01-G36	14	80	19.05	P-11	R-112	101-B	18.6	2.96	UFD
<b>PROCESS WATER LINES:</b>										
1	PW-01	6	80	10.97	CS	102-F	PW-4	10.1	7.93	
2	PW-12	16	80	21.41	CS	PW-2+3	PW-13	12.1	43.48	
3	PW-13	6	80	10.97	CS	PW-12	SEWER	7.2	34.37	
4	PW-17	4	120/40	11.13/6.02	CS/SS	PW-1	170-C	9.6/4.7	15/21	
5	PW-16	4	120	11.13	CS	170-C	LC-3A	9.8	11.05	
6	PW-27	6	80	10.97	CS	PW-20	PW-28	10.6	3.37	
<b>RELIEF VALVE LINES:</b>										
1	RV-001	3	40	5.49	CS	NG-2	RV-101D	5.4	1.84	
2	RV-003	3	40	5.49	CS	A-20	RV-102J	4.8	12.57	
3	RV-010	2	80	6.5	CS	RV-104D2	V-34	5.2	5.45	
4	RV-012	8	20	5.35	CS	RV-102F	V-28	7.4	--	
5	RV-015	4	40	6.02	CS	RV-103J	V-28	5.9	1.33	
6	RV-016	4	40	6.02	CS	RV-105D	V-28	5.9	1.99	
7	RV-052	1.5	180	7.14	CS	SG-19	RV-106F	7	1.96	
8	RV-111	12	20	5.35	CS	VE-4	RV-103JT	7	--	
9	RV-115	4	40	6.02	CS	MS-2	RV-MS8	5.9	1.99	
10	RV-117	6	40	7.11	CS	LS-21	RV-104JA	6.9	2.95	
11	RV-160	2	40	3.9	CS	106-C	R-D	2.8	28.21	
12	RV-161	2	60	6.5	CS	115-C	SP-16	5.1	7.27	
13	RV-162	3	40	5.49	CS	118-C	SP-17	5.1	7.10	
14	RV-163	4	40	6.02	CS	124-C	SP-18	5.6	6.96	



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THICKNESS MEASUREMENT DATA OF AMMONIA PLANT PIPELINES CARRIED OUT DURING MARCH-APRIL 2001:										ANNEXURE-9
SR NO	LINE NO.	N B (in.)	SCH.	NOM. THK MM	MAT.	LINE DESCRIPTION FROM TO		MIN THK OBSERVED	% RED.	REMARK
<b>11 ATA STEAM LINES:</b>										
1	S-8	6	40	7.11	CS	S-5	LS-10	6.3	11.39	
2	S-13	4	40	6.02	CS	S-10	NG-44S	5	16.94	
<b>STEAM COND. LINES:</b>										
1	SC-04	4	40	6.02	CS	111-CB	SC-6	4.9	18.60	
2	SC-07	2.5	90	7.01	CS	SC-42	101-JC	4.9	30.10	
3	SC-41A	4	40	6.02	CS	112-J	SC-42	7.1		
4	SC-41B	4	40	6.02	CS	112JA	SC-41A	6.7		
5	SC-42	4	40	6.02	CS	SC-41A	CV	6.1		
7	SC-47A	10	40	9.27	CS	101-JC	112-J	6.1	34.20	
8	SC-47B	10	40	9.27	CS	101-JC	112-JA	5.8	36.35	
<b>SYN. GAS LINES:</b>										
1	SG-06	12	20	6.36	CS	104-F	103-J	6	5.51	
2	SG-09	10	40	9.27	CS	118-C	129-C	9.3	--	
3	SG-11	10	40	9.27	CS	105-F	103-J	9.1	1.83	
4	SG-26	6	120	14.3	CS	SG-23	MICA-14	13.5	5.58	UFD
5	SG-27	6	120	14.3	CS	SG-23	MICA-15	13.5	5.58	UFD
6	SG-28	4	120	11.1	CS	SG-23	MICA-16	10	8.91	UFD
7	SG-32	6		22.2	CS	SG-62A/B	SG-25	20	9.91	UFD
8	SG-44	4	40	6.02	CS	SPEC.BRK		5.8	3.65	
9	SG-62A	4	xx	17.11	CS	102-B	SG-32	18	--	
10	SG-62B	4	xx	17.11	CS	102-B	SG-32	17.4	--	
11	SG-76A	4	120	11.1	CS	SG-27	101-B	10.5	5.41	UFD
12	SG-76B	4	120	11.1	CS	SG-27	101-B	10.5	5.41	UFD
						---X---	X---			

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CODE NO      JOB DESCRIPTION

Annexure-10

REPLACEMENT OF THE FOLLOWING PIPELINES (PARTLY OR FULL) WAS CARRIED OUT BY TECHNICAL DEPTT./ MAINT.DEPTT. DURING THIS SHUTDOWN.

The weld joints of these pipe lines were inspected by dye penetrant examination and radiography as per the fabrication specifications of the individual pipe lines.

Sl.No.	Line no.	From	To
1.	BO LINES	AUX. BOILER	BLOWDOWN
2.	BF-15-8"	CHECK VALVE	BFW COIL INLET
3.	BLOWDOWN	101-F	BLOWDOWN
4.	HW-33-8"	129-JC	HW-15
5.	H2 LINE-3"	PGR	103-J
6.	MS-49-2"	MS-29 (HEADER)	NG-6 ( FEED PREHEATER COIL INLET )
7.	PGR LINE-4"	E-4	R1/R2
8.	PG-5-14"	102-C	PG-4
9.	PG-8-20"	104-C	112-C
10.	SC-17-3"	156-F	SEWER
11.	SC-17-2"	LC-21	SEWER

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PLANT TURNAROUND - MARCH - APRIL - 2001

AMMONIA PLANT

CIVIL JOBS

CODE NO	JOB DESCRIPTION
01 51 01	<u>CIVIL JOBS :</u>  (A) <u>AUXILIARY BOILER :</u>  (a) Repairing of burner for burner no. 4 and 5.  (b) Repairing of Header and other refractory work in side auxiliary boiler.  (B) <u>PRIMARY REFORMER :</u>  (a) Replacement of insulation brick lining inside Primary Reformer for north side and west side bottom portion.  (b) Replacement of burner blocks for burner no. 1, 2, and 3.  (c) Repairing of tunnel wall and replacement of insulating bricks with insulation block on east side of primary reformer.  (C) <u>SECONDARY REFORMER :</u>  (a) Repairing of cracks developed inside the secondary reformer carried out by department.

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PLANT TURNAROUND - MARCH - APRIL - 2001

AMMONIA PLANT

ELECTRICAL JOBS

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CODE NO	JOB DESCRIPTION
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01 61 01 ELECTRICAL JOBS :

1. Preventive maintenance carried out on TR-6 for
  - a) Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.
  - b) Insulation resistance measurement of winding in primary and secondary side.
  - c) Breakdown value of oil of secondary side marshalling box is taken.
  
2. Preeventive maintenance was carried out on all feeder compartments mounted on the following MCC-5 and MCC-16 ( Normal Section ).
  - a) Checking the tightness of outgoing terminal.
  - b) Cleaning the feeder compartment.
  - c) Replacement of damaged connectors, etc.
  
3. Overhauling of following motors were carried out :  
101 BJT, 102 J, 102 JA, 104 JA, 104 JB, 106 J, 107 JT.
  
4. Preventive maintenance of following MOV were carried out :  
SP 155, SP 159 & SP 152.

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PLANT TURNAROUND - MARCH - APRIL - 2001

AMMONIA PLANT

INSTRUMENTATION JOBS

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CODE NO	JOB DESCRIPTION
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01 71 01 (A) CONTROL VALVE :

Following control valve maintenance jobs carried out.

- 1) FRCV-2 : General cleaning, gland packing and overhauling were carried out and checked the stroke.
- 2) TRCV-10 : Actuator removed and fixed back after completion of technical work. Removed old gland packings. General cleaning, gland packing and overhauling were carried out and checked the stroke.
- 3) TRCV-12 : Removed old gland packings. General cleaning , gland packing and overhauling were carried out and checked the stroke. Actuator removed and refixed after inspected by production people.
- 4) LCV-70 : Opened control valve from bonnet. Inspected the plug and seat and box up. Gland packing and overhauling were carried out and checked the stroke. Changed air regulator.
- 5) LCV-13 : Opened control valve from bonnet. Inspected the plug and seat and box up. Gland packing and overhauling were carried out and checked the stroke.
- 6) LCV-14 : Gland packing and overhauling were carried out and checked the stroke.
- 7) FRCV-15 : Provided new Gland packing and overhauling were carried out and checked the stroke.
- 8) LRCV-70 : Opened control valve as gland leakage was heavy ,provided total new Gland packings and overhauling were carried out and checked the stroke and box up.
- 9) LCV-200 : Opened the control valve for flushing the line as request of p/p.
- 10) FICV-12 & 14 : General cleaning , gland packing and overhauling were carried out and checked the stroke. Tightened all fittings and actuator accessories. Cleaned the orifice/nozzle I/p converter. Also changed the pilot relay of positioner.
- 11) MIC-22 : General cleaning , gland packing and overhauling were carried out and checked the stroke. Tightened all fittings and actuator accessories.
- 12) PRCV-23 : Changed air regulator and stroke checked after general cleaning.

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**CODE NO            JOB DESCRIPTION**

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- 13) FRCV-3 : General cleaning, Overhauling were carried out and checked the stroke. Tightened all fittings and actuator accessories. Removed bottom flange for flushing and cleaning and refixed it.
- 14) LCV-2 : 1/4" SS Tubing done and repaired the hand jack and adjusted stroke.( New installed c/v by Tech.dept.)
- 15) PRCV-4 : General cleaning ,greasing and stroke checking were carried out and Provided new s s tubing for air supply.
- 16) PICV-24 : General cleaning ,greasing and stroke checking were carried out and Replaced air supply tubing.
- 17) MICV-24 TO 32 (Ref. Pent house valve) : General cleaning ,greasing and stroke checking were carried out and changed diaphragm of MIC-29.
- 18) PICV-13A &B: General cleaning ,greasing and stroke checking were carried out and replaced I/ P converter by new one.
- 19) FICV-200 : General cleaning ,greasing and stroke checking were carried out and Stroke was adjusted.
- 20) MICV- 57 : General cleaning ,greasing and stroke checking were carried out and Replaced the air supply regulator.

**(B) General cleaning , greasing and stroke checking were carried out for following control valve.**

FRCV-1,	MICV-56,	MICV- 57,	PRCV-1,	PICV-14,	FICV-5,
PICV-25,	MICV-22,	FICV-9,	FICV-10,	FICV-11,	V-18,
FICV-7,	FICV-8,	FICV-15,	PRCV-18,	V-102,	TRC-142 A&B.

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CODE NO	JOB DESCRIPTION
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01 71 02 COMPRESSOR HOUSE JOBS :

(A) 101-J, Air compressor :

- 1) HIC-101J: General cleaning , overhauling of governor positioner was carried out and checked stroke. Changed air regulator of Gov. positioner.
- 2) All probes were opened to facilitate Mech. main. job and refixed after physical inspection and set gap voltage. Replaced the probe of monitor channel Pt.No. EA, Changed probe connector of probe pt.no. 5V.
- 3) EA & EB axial probe has to relocated as original location was not proper because of the new coupling installation by mech.
- 4) Removed all TI / PI to facilitate Mechanical maintenance job and refixed after physical inspection.

(B) 102-J, NG compressor :

- 1) All probes were opened to facilitate Mechanical maintenance job and refixed after physical inspection and set gap voltage. Replaced probe pt. no. 5H.
- 2) Bearing thermocouples of compressor were removed and refixed.Soldered the wires of t/c of comp. Thrust bearings.
- 3) FIC - 200 : New electronic tx. was installed and controller was shifted to control room.
- 4) Removed all TI / PI to facilitate Mechanical maintenance job and refixed after physical inspection .
- 5) PIC - 315 : New controller was installed and checked the stroke as the diaphragm of the old controller was damaged.

(C) 103-J, Syn. Gas compressor :

- 1) MIC-23 : General cleaning, overhauling of governor positioner done checked stroke. changed signal and supply tubing.
- 2) PRC-12 : Checked stroke after general checking of Air lock relay, air regulator, positioner / piston cylinder.
- 3) All probes were opened to facilitate Mech. maint. job and refixed after physical inspection and set gap voltage. Replaced the extension cable of probe Pt.No. 5V and 5H. Changed probe connector of probe pt.no.10A

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CODE NO	JOB DESCRIPTION
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4) Removed all TI / PI to facilitate Mechanical maintenance job and refixed after physical inspection.

(D) 105-J, Ref. Gas compressor :

- 1) General cleaning , overhauling of governor positioner (PRC-9) was carried out and checked stroke.
- 2) All probes were opened to facilitate Mechanical maintenance job and refixed after physical inspection and set gap voltage. Replaced the probe of monitor channel Pt.No. 3V. Changed probe connector of probe pt.no. 7V & 7H.
- 3) Removed all TI / PI to facilitate Mechanical maintenance job and refixed after physical inspection .
- 4) PSSL - 65, 66, : Retubing of impulse line with 1/2" ss tube was done.

(E) 800-J, NG/AG Booster compressor :

- 1) All probes of compressor were opened to facilitate Mech. maint. job and refixed after physical inspection and set gap voltage. Also opened all the RTD of AG/NG compressor and refixed after mech.work over. Provided 3 nos. of new RTDs and checked in RTD monitor in control room.
- 2) Removed all the RTD elements and fixed back after completion of Mech. Works.
- 3) LSSL - 812 : AG Seal oil O.H.T : Opened the switch from top flange and tighten and checked it as there was oil leakage problem.
- 4) Replaced new I/H converter and checked the calibration from woodward governor.
- 5) NGBC local panel illumination : 230 Vac supply was isolated from instrument JB and provided new separate JB and terminations were done.
- 6) All the logic ckt of Lube oil, CEP pump and Barring motor were checked from MCC to local panel terminals.



CODE NO	JOB DESCRIPTION
01 71 03	<p><u>FIELD INSTRUMENTS JOBS :</u></p> <ol style="list-style-type: none"> <li>1) Inspected all the tunnel thermocouple / Thermowell. Replaced TI-0074 T/C with T/W as t/w was punctured.</li> <li>2) Instrument Air Dryer : Checked vessel-A heater elements, and terminals and measured the heater resistances. Tightened all connections.</li> <li>3) Steam drum instruments ( LIC-1, Eye-hye, PI-18, PRC-18, Level switches ) : General cleaning was carried out.</li> <li>4) PGR : TI-120 Removed and refixed after completion of Tech. E - 4 line changing jobs.</li> <li>5) Sec.Reformer metal T/C were removed and refixed after checking.</li> <li>6) Auxiliary boiler : ON/OFF valves of Naptha, Gas, Bypass line of Burner-1 &amp; 2 : All the six valves operation was checked through PLC and indication part was checked. Replaced two nos. Of solenoid valves of VS-104,105.</li> <li>7) Jobs attended to facilitate technical department in FR-4, PT-109, LCV-2 and jobs.Removed the T/Cs with T/Ws and refixed after completion of line replacement jobs in LTS/HTS . Also Temp. recorder power supply, t/c connections were made for measurement temp. As per requirement of tech.staff.</li> <li>8) 104J : In BFW pumps replaced trip solenoid valve coil and checked trip okt. ID Fan : Also provided manual loader in field for turbine OST checking in both.</li> <li>9) General preventive cleaning/checking of LC-13, 14, 15, 16, 17, 18, 19 were carried out.</li> <li>10) Air header was flushed at various points.</li> <li>11) Flare Stack : "K" type two pair t/c cable was laid from flare stack top to control JB on ground floor and terminated in JB. At both end. Also provided two nos. T/C on top to flare temp. Measurement. Checked calibration of temp. switches. TSL-1048 : Laid one signal cable from JB to flare control panel and Provided alarm in DCS.</li> <li>12) 101JCB: thermowell was removed and inspected and refixed with new temp.gauge.</li> <li>13) GAIL instruments calibration was carried out by them in presence of us.</li> <li>14) Air compressor for Inspection sect.: Provided one calibrated pressure switch in compressor</li> <li>15) 117C, 118C, 120C : Removed the thermowell and provided permanent plug as per decided in s/d meeting.</li> </ol>

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CODE NO	JOB DESCRIPTION
16)	TI-0017 : Thermowell and themocouple was removed and fixed back after inspection.
17)	MIC-22 snap controller: Checked the calibration of on/off controller and set at 3.5 Kg/cm2.
18)	PI-125 (Cooling water) : Provided new electronic transmitter and cabling, wiring in DCS cabinet was carried out.
19)	Provided high range pr, gauges for hydro test as per requirement of mech. and calibration checked of six nos. of pressure gauges of mech.for safety valve testing.
20)	Trip circuit of 101J, 102J, 105J, 103J, 800J : Checking of all the compressor was carried out with production staff.
21)	Attended all the start up jobs (Ammonia, PGR, Prerformer) i.e. Flushing of transmitters, provision of low/high range pressure gauges to check pressure,
22)	Startup Heater : Ignitor system was checked and checked performance, found O.K.and kept ready for plant start up.
23)	Old and obsolete Gas Chromatograph was removed from room and provided plug in sample line.
24)	D.S : 101D & 102D : Replaced inlet isolation valves and new installed pneumatic dp TX. was taken in line.
25)	Boiler inspection jobs : provided ss tubing and high range pr. Gauges on HP pump and on steam drum as per requirement of boiler inspector.
26)	PIC-28 : Tx. Impulse main isolation valve was checked so provided new impulse tubing near MIC-24
27)	125C : cooler choking : Provided 1/2" ss tubing for flushing purpose as per requirement of production people.

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CODE NO	JOB DESCRIPTION
01 71 04	<p><u>FUJI UPSS :</u></p> <ol style="list-style-type: none"> <li>1) ACDB panel : provide new MCBs, Fuse holders and new wiring was done with 10 sq.mm wires. Power supply to control panel was isolated during that period provided separate Temp. Recorder to measure the temperature of LTS/HTS and syn.conveter as per requirement of production people.</li> <li>2) Laid 4 nos. of 6 sq.mm cables from UPSS to control room, DCS and HIMA PLC cabinet.</li> <li>3) General cleaning and servicing were done by I/L Engr. as per AMC.</li> <li>4) AVR/UPSS on DC Auto change over was checked, found ok.</li> <li>5) Plant load was diverted on batteries &amp; checked for half an hour and found performance of batteries were satisfactory.</li> <li>6) Provided new Battery no.51 as it was removed due to low voltage.</li> </ol>
01 71 05	<p><u>CONTROL ROOM JOBS :</u></p> <ol style="list-style-type: none"> <li>1. <u>YBL DCS:</u> <ol style="list-style-type: none"> <li>a) All the cards of EFCD, EOPS and EFMS were removed from panel and cleaned all the cards and panel.</li> <li>b) All the jobs related with AMC were attended</li> <li>c) New provision done in DCS : PIC-14, LIC-116, LIC-117 and for FIC-16 &amp; 17.</li> <li>d) PIC-14 : Provided new electronic TxS and I/P converter and loop was taken in DCS.</li> </ol> </li> <li>2. <u>HIMA PLC:</u> <ol style="list-style-type: none"> <li>a) Checked the voltage level of the all PLCs and cleaned the cabinets and put back the system in line.</li> <li>b) All the logic blocks which were given by SM (Ammonia) to modify, carried out.</li> <li>c) Both the operating station were made equal by loading the software using PACKED version of project.</li> <li>d) The Solenoid power supply going to solenoid valves in the plant were made independent from the PLC power using a separate MCB of 30A capacity , installed in the PLC cabinet, after drawing separate power supply from the ACDB of UPS cabinet.</li> </ol> </li> </ol>

CODE NO	JOB DESCRIPTION
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01 71 06	<u>CAPITAL JOBS CARRIED OUT IN ANNUAL TURNAROUND:</u>
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(a) Following jobs were carried out in GE-Fanuc PLC

- i) All unused hardware were removed from the panel and all required hardware were arranged on one side of panel
- ii) Panel was totally rewired as per standard GE-FANUC Layout.
- iii) Separate MCBs were provided for PLC-A, PLC-B, DROP PLC1, I/O Rack-2, Input cards, output Cards, Cabinet Fan and Jaquet Speed Indicator.
- iv) Indications were provided for the identification of controlling PLC.
- v) All Field termination were made proper at both PLC and local panel ends.
- vi) Modifications in logic and HMI software were carried out as per the requirement of Sr.Mgr (Ammonia).
- vii) New cable with SNP converter was provided for communication with PC
- viii) Redundancy was extended upto bus level also.
- viii) PLC was completely tested for operation after rewiring

(b) Following alarm switches were replaced with new ones.

For that necessary impulse tubing, cables glanding and calibration of switches were carried out.

- (1) PAL-65      (2) PAL-71      (3) PAL-72      (4) PAL-96      (5) PAL-70      (6) PAL-97  
 (7) PAH-94      (8) PAH-93.

(c) Following New Thermowells/Thermocouples were installed in Heat exchangers and connected to DCS.

For above job followings jobs were carried.

Cables layout from T/C head to Junction boxes and J.B to Control room

Mounting of Junction box and cable trays

- |                                     |                          |                          |
|-------------------------------------|--------------------------|--------------------------|
| TI-122 - 136-C shell out            | TI-123 - 129JC shell out | TI-124 - 130JC shell out |
| TI-125 - 131JC shell out            | TI-126 - 115-C tube out  | TI-127 - 109CA tube out  |
| TI-128 - 109CB tube out             | TI-129 - 109CB tube out  | TI-130 - 109C tube in    |
| TI-131 - 109-C shell out            | TI-132 - 105 CA gas out  | TI-133 - 105CB gas out.  |
| TI-134 - NG Feed to Pre-heater coil |                          |                          |

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CODE NO	JOB DESCRIPTION
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- (d) The pneumatic control loop for NG Compressor Anti surge control (FIC-200) was changed to Electronic control loop with dedicated electronic controller mounted in main control room.  
Hardwired Reset PB was provided for I-102A (102J ASV open interlock) in MCR.
- (e) Local pneumatic loop of PIC-14 was taken in DCS.
- (f) Two Nos. Pressure switches. PSSL-887B & PSSL-887C were installed.
- (g) New Orifice Plates as per the requirement of Chief Manager (Process) were installed for FIC-16 & FIC-17 and transmitter range was changed accordingly.
- (h) All the jobs, for cascading Stripper reboilers level controller (LT-116 & LT-117) with FIC-16 & FIC-17 were completed.
- (i) Overspeed alarm from Jaquet Speed Indicator was provided on Alarm Annunciator in MCR.
- (j) Level switch for Level High Alarm (LSH-216) was installed on new discharge separator for NG compressor and alarm was provided on local Panel alarm Annunciator.
- (k) Interface JB was provided in field between MOVs SP-152, SP-158 & SP-159 & HIMA PLC.
- (l) Alarm for 102J Mech. Trip was provided on Annunciator in MCR.
- (m) Local Push button trip was provided for 107JT.
- (n) Control circuit for stopping 118 JB from panel was provided in PLC. The run indication for the same was provided in DCS. Both the circuits were hooked up with MCC.

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PLANT TURNAROUND - MARCH - APRIL - 2001

AMMONIA PLANT

TECHNICAL DEPARTMENT JOBS

CODE NO	JOB DESCRIPTION
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01 81 01 TECHNICAL DEPARTMENT JOBS:

(01) MECHANICAL JOBS :

(A) Replacement of following pipe lines were carried out :

(1) PG-5 : Pipe line from 102-C to Mixing Tee (Drawing No. 01-DL- 13423,Sht 1of1, Rev01).  
The material of construction - SA 335 P11, Sch-100.

Approximate length - 11 Mtr.

Welding :	Root	-	TIG
	Filler Wire Used	-	ER 80 B2
	Fill Up	-	Stick Welding
	Electrode Used	-	E - 8018 B

(2) PG-8 : Pipe line from 104-C to 112-C (Down stream of MOVSP-4 to upstream of branch connection PG-19-14"). (Ref Drawing No. 01-DL- 13424,Sht 1of1,Rev 01).

Line size was changed from 18" NB to 20" NB for reducing pressure drop.

Material of construction - CS, A-106 Gr.B, Sch-STD

Approximate length - 46 Mtr.,

Hydrotest Pressure - 47 Kg/cm<sup>2</sup>g,

Welding :	Root	-	TIG
	Filler Wire Used	-	ER 70 SL
	Fill Up	-	Stick Welding
	Electrode Used	-	E 7018

(3) BF-1H : Pipe line from check valve to BFW Coil (8" nozzle of 101-B)  
(Ref Drawing No. 01-DL- 13430,Sht 1of1,Rev 01).

Line size increased from 6" NB xSch- 80 to 8" NB x Sch-100, for reducing pressure drop.

Material of construction - CS, A-106 Gr.B, Sch-100

Approximate length - 11 Mtr.

Hydrotest press - 145kg/cm<sup>2</sup>g. The hydrotest was witnessed by IBR Inspector,

Welding :	Root	-	TIG
	Fill Up	-	Stick Welding
	Filler Wire Used	-	ER 70 SL
	Electrode Used	-	E 7018

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CODE NO	JOB DESCRIPTION
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**(4) Blow Down Lines :**

Following Blow Down Lines were replaced.

- i. BO-6-1", Size-1" Sch-80 & BO-12H, Size- 2" Sch-XXS,(Ref Drwg No. 610-E1-B211)
- ii. BO-26-1", Size-1" Sch-80 & BO-14AH, Size- 2" Sch-XXS,(Ref Drwg No. 610-E1-B212)
- iii. BO-25-1", Size-1" Sch-80,BO-11-1 1/2" Sch-80 & BO-11H, Size- 2" Sch-XXS, (Ref. Drwg No. 610-E1-B213)
- iv. BO-9-1"& BO-10-1", Size-1" Sch-80, BO-10H, Size- 2" Sch-XXS &BO-11HSize- 2" Sch-XXS (Ref Drwg No. 610-E1-B214)
- v. BO-11-11/2", Size-1 1/2" Sch-80 ,(Ref Drwg No. 610-E1-B215)
- vi. BO-7-1", Size-1" Sch-80 & BO-14BH, Size- 2" Sch-XXS,(Ref Drwg No.610-E1-B290)
- vii. BO-8-1", Size-1" Sch-80 & BO-13BH, Size- 2" Sch-XXS,(Ref Drwg No.610-E1-B291)

Material of construction - CS, A-106 Gr.B

Overall, an APPROX. 41 MTRs BO LINES WAS REPLACED

Welding :	Root	-	TIG
	Filler Wire Used	-	ER 70 SL
	Fill Up	-	Stick Welding
	Electrode Used	-	E 7018

**(5) INSTALLATION OF VENT HEADER CONNECTING RELIEF VALVES OF FLASH VESSELS 110-F, 111-F & 112-F (Drawing No. 01-CL-1300,Sht 1of1,Rev P). ( EWR NO. A-219)**

A new RV vent header was installed from Relief Valves of Flash drums of 110-F,111-F & 112-F and hookedup to Vent Silencer SP-74.

Header size - 12' NB x sch-20

Material of construction - A-106 Gr.B, Sch.20 Approx. length - 55 Mtr.

Welding :	Root	-	TIG
	Filler Wire Used	-	ER 70 SL
	Fill Up	-	Stick Welding
	Electrode Used	-	E 7018

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CODE NO	JOB DESCRIPTION
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(6) INSTALLATION OF SPECTACLE BLIND (Figure-8 Blind) on PG-3 Line - 18" NB.

(Drawing No. 01-CA- 12231, Sht 1 of 1, Rev P).

Spectacle Blind was provided on PG-3 line along with a pair of flanges.

Flange size & rating - 18" x 300#, Sch- STD, WNRF flange.

Spectacle Blind : 18" x 300#

Material of construction - A182F 11

A New working platform was also provided for this.

Welding :	Root	-	TIG
	Filler Wire Used	-	E 8018 B2
	Fill Up	-	Stick Welding
	Electrode Used	-	ER 80 B2

ALL THE ABOVE JOBS WERE DONE THROUGH M/s PROJECT TECHNOLOGIST PVT. LTD. (PTPL ), BARODA.

(7) Installation of New Cold Ammonia Pump 118-JB :

(Drawing No. 01-CL- 13451, Sht 1 of 1, Rev P1).

New Cold Ammonia pump (118-JB) of following specifications was installed.

Type : Horizontal centrifugal pump

Capacity - 15M<sup>3</sup>/hr.

Discharge press : 6.3 kg/cm<sup>2</sup>g

Total Differential Head - 94 Mtr

RPM - 2900 rpm

Suction Line for pump was replaced from 6" NB to 8" NB - 13.5 Mtrs.

The material of construction for piping CS, A-106 Gr.B

Welding :	Root	-	TIG
	Filler Wire Used	-	ER 70 SL
	Fill Up	-	Stick Welding
	Electrode Used	-	E 7018

The job was done through M/s Garcem Engrs, Ahmedabad.



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CODE NO	JOB DESCRIPTION
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(02) INSTRUMENTATION JOBS :

- EWR NO.A-201 - FR-4 (Air compressor Discharge) primary flow element replaced with newly procured orifice set. Also its transmitter replaced with other 0-5000 MMWC calibrated transmitter. Its associated tubing were done and commissioned the system.
- EWR NO.A-196 - Old HICV-109 control valve is replaced by newly procured (IL-make) control valve to achieve fine control of DM water to wash tower K-1 in PGR plant.
- EWR NO.A-203 - Conductivity meter in ammonia recovery plant cabling was done.
- LCV-2 Control Valve was replaced by old LCV-1201 (Serk-make) control valve as per SGM's approval No.TM/02/1217 dated 20.03.2001.

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PLANT TURNAROUND - MARCH - APRIL - 2001UREA PLANTMECHANICAL JOB

CODE NO	JOB DESCRIPTION
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02 01 01      CO2 CENTRIFUGAL COMPRESSOR (HITACHI) TRAIN  
K-1801 HP/LP CASE AND Q-1801 :

(A) PREVENTIVE MAINTENANCE OF HITACHI COMPRESSOR  
K-1801 L. P. CASE :

- Proper clearance and work permit were obtained.
- Coupling guards were removed
- Coupling bolts were removed . HP and LP Compressor was decoupled from Gear Box and Turbine was decoupled from LP Compressor after match marking.
- Alignment readings were taken and noted.
- Journal bearing of LP compressor Gear Box end was opened.
- After cleaning & polishing the bearing was reassembled for checking the bearing clearances with lead wire.
- Bearing clearances were measured found to be 0.15mm
- Journal bearing of GB side boxed up.
- The same was cleaned , polished and reassembled.
- Journal bearing on Turbine side of LP compressor was opened
- After cleaning , polishing the same was assembled.
- Bearing clearance was checked and found to be 0.165mm by lead wire method.
- Final box up of LP Compressor bearing on either side completed.
- Removed the thrust bearing and found to be in good condition.
- Thickness of thrust pads was checked as 19.83mm
- Axial float was checked after cleaning , polishing and assembly and noted as 0.48mm.
- New thrust pads are checked for thickness and found to be same i.e. 19.83mm.
- Then thrust liner was removed and thickness of split liner was found to be 10.29mm.

Hence, it was decided to replace the liner with a new liner made in our workshop with a thickness of 10.44 mm.

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CODE NO            JOB DESCRIPTION

FINAL READINGS OF LP COMPRESSOR

Sr No	Description	Design Value	Actual Value BPM	Actual Value APM
1	Axial Float	0.28 ~ 0.38	0.48	0.32~0.33
2	Turbine End Bearing Clearance	0.11 ~ 0.15	0.165	0.165
3	Gear Box End Bearing Clearance	0.11 ~ 0.15	0.15	0.15

( B ) PREVENTIVE MAINTENANCE OF HITACHI COMPRESSOR  
K-1801 H. P. CASE :

- HP Compressor journal bearings on coupling end and free end were opened.
- Thrust bearing was removed on free end and cleaned , polished and reassembled.
- The journal bearings were cleaned, polished and reassembled back and checked the bearing clearances with lead wire.
- Bearing Clearance of coupling end            : 0.175mm
- Bearing Clearance of Free end                 : 0.165mm
- Since the clearances are beyond the designed limits it was decided to replace with new bearing pads.
- New bearing pads were collected , cleaned and assembled and checked the clearances on either side after assembly.

Clearances with New pads  
 On coupling end                                    : 0.11mm  
 On free end                                         : 0.12mm  
 Axial clearance                                   : 0.28mm/0.29mm  
 All the bearings were boxed up.  
 Alignment readings were taken and recorded as existing.

FINAL READINGS OF HP COMPRESSOR

Sr No	Description	Design Value	Actual Value BPM	Actual Value APM
1	Axial Float	0.25 ~ 0.35	0.30	0.30
2	Gear Box End Bearing Clearance	0.11 ~ 0.14	0.175	0.11
3	Free End Bearing Clearance	0.11 ~ 0.14	0.165	0.12

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CODE NO	JOB DESCRIPTION
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(C) PREVENTIVE MAINTENANCE OF HITACHI COMPRESSOR DRIVE TURBINE Q - 1801 :

- Coupling end bearing top cover removed after instrument lines are opened.
- Free end bearing top cover removed. Care taken to remove all the oil lines, instrument lines, side plates etc. Free end side instrument air pipe was checked for air pressure. No air pressure was observed, after checking the valve was found to be closed just below the deck. After opening it was found to be ok.
- Turbine float was measured and recorded. Turbine float : 00.18 mm
- Free end bearing was opened and cleaned, polished and the dimensions are recorded.  
 Bearing Pad Thickness : 17.47 mm / 14.48 mm  
 Journal dia is measured and found : 124.80 mm  
 Bearing housing ID : 159.99 mm  
 Clearance was found to be : 00.24 mm  
 New bearing are also checked for thickness and found to be same.
- Thrust bearing was removed and cleaned, polished and reassembled since the float was as per the requirement.
- Free end bearing cover boxed up after cleaning of the cover.
- Turbine coupling end bearing was removed cleaned, polished and reassembled .  
 Bearing dimensions are recorded as follows.  
 Bearing Pad Thickness : 22.48mm  
 Journal dia is measured and found : 159.71mm/159.72mm  
 Bearing housing ID : 204.99mm/205.00mm  
 Clearance was found to be : 0.32mm
- Turbine free end and coupling end top covers boxed up by applying Hylomer blue compound to the split face.
- Alignment readings were taken for LP to Turbine

FINAL READINGS OF TURBINE :

Sr No	Description	Design Value	Actual Value BPM	Actual Value APM
1	Axial Float	0.25 ~ 0.35	0.31	0.31
2	Free End Bearing Clearance	0.18 ~ 0.31	0.24	0.24
3	Coupling End Bearing Clearance	0.24 ~ 0.36	0.32	0.32

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**CODE NO      JOB DESCRIPTION**


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**(D) PREVENTIVE MAINTENANCE OF GEAR BOX M-1801 :**

Following preventive maintenance jobs were carried out.

- Top cover of gear box opened.
- Radial bearing clearance of gear shaft and pinion shaft were checked using lead wire. Radial bearing clearance of both journal bearing of pinion shaft were found more than the designed value and the same were replaced by new bearings. Radial bearing clearance of gear shaft was found within design limit.
- Other component of gear box was also checked and found OK.
- Top cover of gear box boxed up.

**CLEARANCE DATA :**

Sl. No.	Description	Design Value	Actual Value BOH	Actual Value AOH
1	Gear Shaft - L.P. Side	0.15 - 0.21	0.15	0.15
2	Gear Shaft - H.P. Side	0.15 - 0.21	0.15	0.15
3	Pinion Shaft - L.P. Side	0.15 - 0.20	0.26	0.15
4	Pinion shaft - H.P. Side	0.15 - 0.20	0.24	0.15

CODE NO	JOB DESCRIPTION
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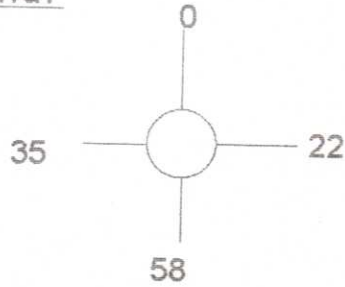
ALIGNMENT DATA FOR HITACHI COMPRESSOR TRAIN :

LP Compressor to Turbine :

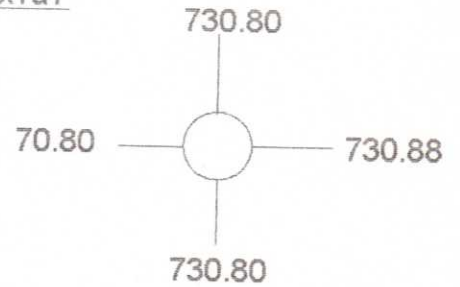
Before Overhauling

Dial on Turbine Coupling  
1 Div = 0.01mm

Radial



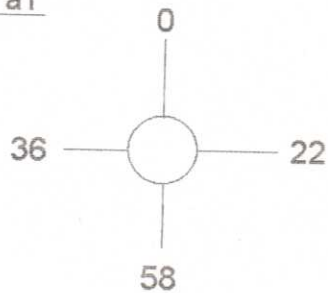
Axial



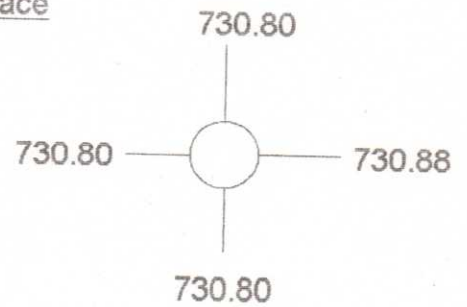
After Overhauling

Dial on Turbine Coupling  
1 Div = 0.01mm

Radial



Face

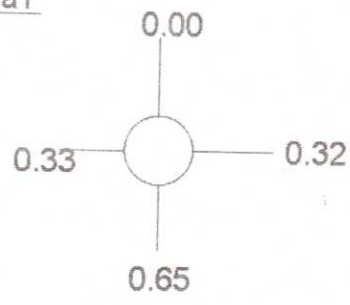


CODE NO	JOB DESCRIPTION
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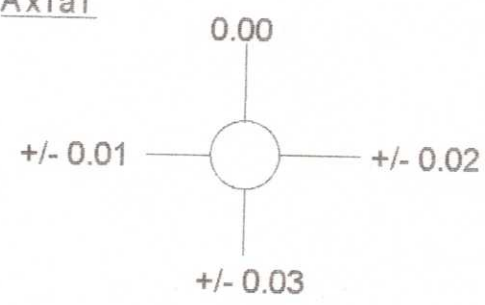
**Design Value**

Dial on Turbine Coupling  
Value in MM

Radial



Axial



**Distance between the coupling Flange**

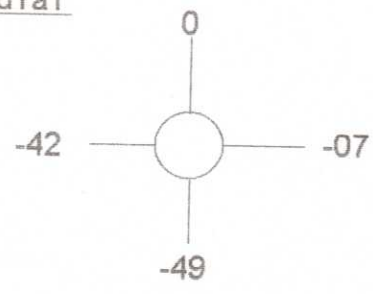
Design = 737.50 to 738.00 MM

Gear Box to LP Compressor :

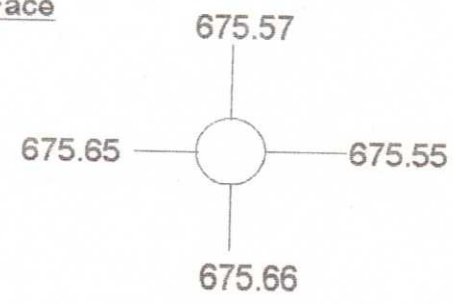
**Before Overhauling**

Dial on LP Compressor Coupling  
1 Div = 0.01mm.

Radial



Face

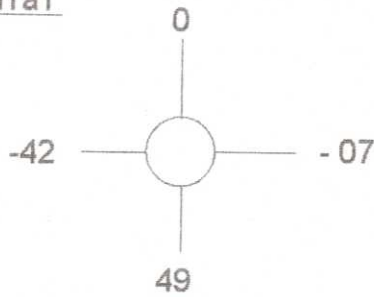


CODE NO      JOB DESCRIPTION

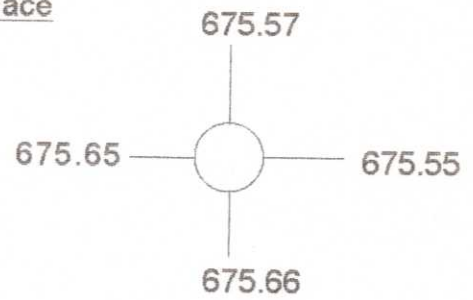
**After Overhauling**

Dial on LP Compressor Coupling  
1 Div = 0.01mm.

Radial



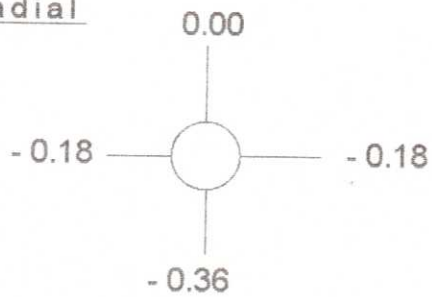
Face



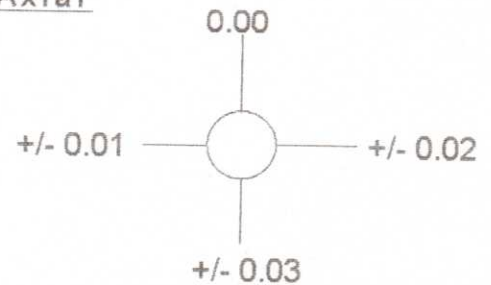
**Design Value**

Dial on LP Compressor Coupling  
Value in mm.

Radial



Axial



**Distance between the coupling Flange**

Design = 675.50 to 676.00 MM



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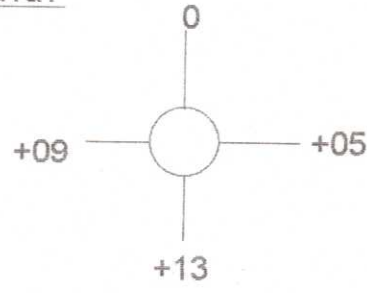
CODE NO	JOB DESCRIPTION
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**Gear Box to HP Compressor**

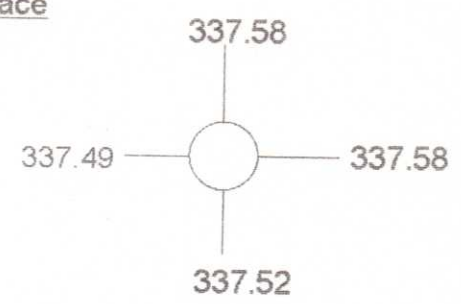
**Before Overhauling**

Dial on HP Coupling  
1 Div = 0.01mm

Radial



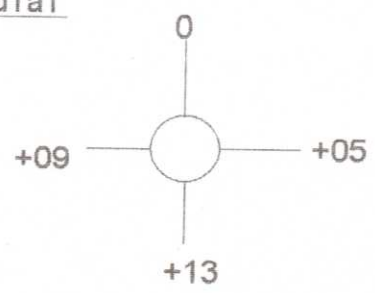
Face



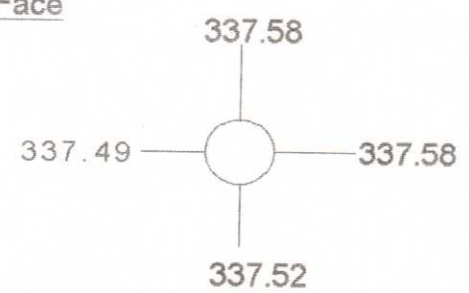
**After Overhauling**

Dial on HP Coupling  
1 Div = 0.01mm

Radial



Face

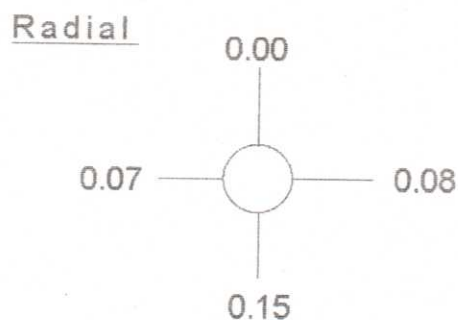


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CODE NO	JOB DESCRIPTION
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**Design Value**

Dial on HP Coupling  
Value in mm.

**Distance Between the Coupling Flange**

Design : 336.04 to 336.54 mm

After alignment all the coupling spacers are assembled after cleaning with the correct match marks.

All the covers are boxed up including guards etc.

All bearing covers are boxed up after cleaning them thoroughly and applying Hylomer blue compound to the split face.

**SPARES REPLACED**

**LP Compressor : Thrust Liner replaced with new.**

**Liner diamensions**

Thickness of old liner : 10.29mm

Thickness of new liner : 10.43mm

**HP Compressor : Journal Bearing pads replaced**

Gear Box end Bearing : 1 Set

Free End Bearing : 1 Set.

CODE NO	JOB DESCRIPTION
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02 01 02	<u>CO2 CENTRIFUGAL COMPRESSOR (NUOVO PIGNONE) TRAIN K - 1101-1 / Q - 1101 -1 :</u>
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(A) PREVENTIVE MAINTENANCE OF COMPRESSOR K - 1101-1 :

Following jobs were carried out.

1. Compressor float was measured and recorded. Float : 0.22 mm
2. Compressor coupling end bearing housing was removed and the bearing opened.  
Observations :
  - a. Heavy rust was observed on the bearings.
  - b. Scratches were observed in the bearing bottom half. The bearing was cleaned, polished and then boxed up. The bearing clearance was measured.

Coupling end bearing clearance : 0.24 mm – 0.25 mm

3. Compressor free end bearing housing was removed and the journal and the thrust bearings were opened.  
Observations :
  - a. Heavy rust was found deposited over the Bearings.
  - b. Scratches were observed in the bearing bottom half. (not as severe as the coupling end bearings)
4. The bearings were cleaned, Polished and boxed up. The thrust bearings were stripped down to the individual pads and was cleaned. The free end journal clearance was measured.  
Free end bearing clearance : 0.25 mm – 0.26 mm
5. The bearing housings were boxed up using Hylomar Blue compound for the split faces.
6. The gear coupling sleeves were provided for both the turbine and he compressor. The coupling spacer was boxed up and the coupling float was recorded.  
Coupling float : 5.0 mm  
The coupling was centered at 2.5 mm and the coupling guard and the oil lines were provided. The same O-Ring which was removed was used for the coupling guard.
7. Other clearances which were measured in the compressor :
  - a. Coupling end oil labyrinth : 0.60 mm - 0.65 mm (diametrical)
  - b. Free float of the compressor : 3.08 mm - 3.10 mm
  - c. Free end oil labyrinth clearance : 0.50 mm (diametrical)

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CODE NO	JOB DESCRIPTION
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**(B) PREVENTIVE MAINTENANCE OF CO<sub>2</sub> CENTRIFUGAL COMPRESSOR DRIVE TURBINE Q -1101 - 1 :**

Following preventive maintenance jobs were carried out.

Turbine float was measured and recorded. Turbine float : 0.22 mm

- 1 Coupling end bearing housing of the turbine was removed.  
Observation : a. Both the dowel pins of the housings was found damaged in the threaded portion.  
b. Heavy rust was found deposited over the bearing.
- 2 Free end side, Governor along with the bearing housing end cover was dropped after disconnecting the necessary oil lines. Over speed trip latch clearance with the shaft was measured and recorded before removing the housing. OST latch clearance : 1.35 mm  
Here again heavy rust was found deposited on the bearing.
- 3 Turbine coupling end bearing opened. The bearings were taken out, cleaned and polished and then boxed up. The clearance was measured. The physical condition of the bearing was found good.  
Coupling end bearing clearance : 0.18 mm
- 4 Turbine free end bearing was opened, cleaned, polished and boxed up. The clearance was measured. The physical condition of the bearing was found good.  
Free end bearing clearance : 0.13 mm – 0.14 mm
- 5 Turbine thrust bearing was removed. The bearings were found heavily rusted. The bearing was stripped to individual pads and cleaned, polished and boxed up. The condition of the bearing was found good.
- 6 Both the coupling end and the free end bearing housings were boxed up after cleaning them thoroughly and applying Hylomar Blue compound to the split faces.
- 7 The other clearances which were measured and recorded were
 

a. Free end oil labyrinth clearances	:	0.35 mm
b. Coupling end oil labyrinth (Turbine side)	:	0.60 mm
c. Coupling end oil labyrinth (coupling side)	:	0.35 mm

 ( All diametrical )
- 8 The dowel pins on the coupling end bearing housing were renewed with the ones machined at workshop.
- 9 The governor oil was flushed.
- 10 The linkages were cleaned and eased. The trip valve spindle was cleaned.

CODE NO	JOB DESCRIPTION
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- 11 The casing washers were cleaned.
- 12 The self cleaning filter in the governor oil circuit was removed cleaned and boxed up with new O-Rings.

GENERAL COMMENTS ( By M/s SPIC - SMO ):

- a. The compressor bearings both the free end and the coupling end clearances are on the higher side.
- b. Lube oil circulation to be maintained at all times even if the equipment is not being operated continuously. This will prevent the rust formation.
- c. During lube oil circulation when the equipment is not being operated, the temperature of the oil has to be maintained. If it goes too low the coolers are to be by passed. This will again prevent rust formation.
- d. Barring of the unit to be done at least once in a day without fail.
- e. Proper bird repellents may be used to improved the house keeping of the compressor house.

ALIGNMENT DATA FOR CO2 CENTRIFUGAL COMPRESSOR TRAIN:

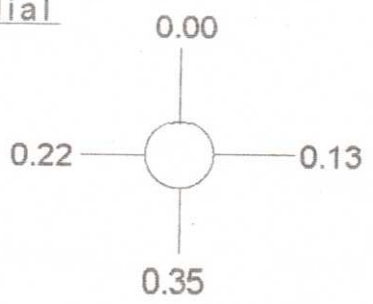
Before PM job

Value in mm.

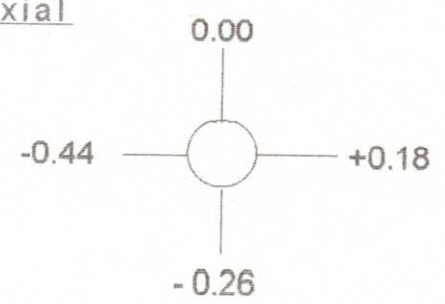
Dial on Turbine Coupling

Dial on Compressor Coupling

Radial



Axial



CODE NO      JOB DESCRIPTION

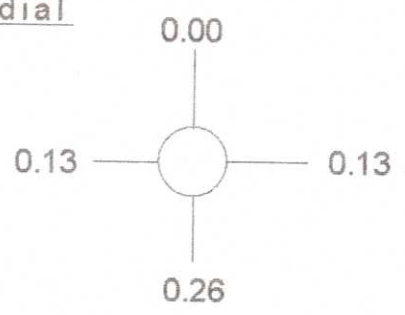
**Design Value**

Value in mm.

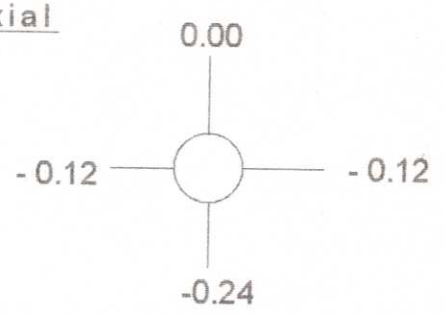
Dial on Turbine Coupling

Dial on Compressor Coupling

Radial



Axial



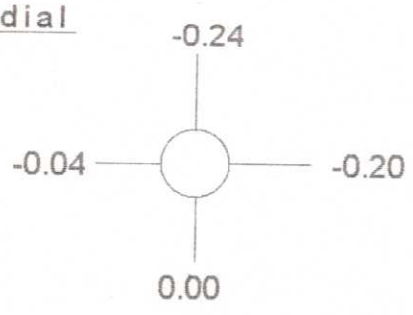
**After PM Job**

Value in mm.

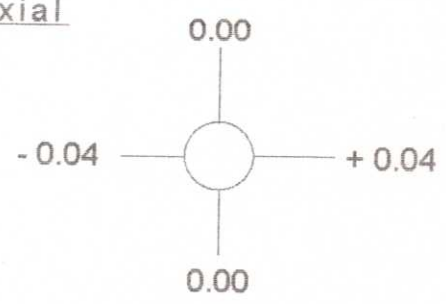
Dial on Turbine Coupling

Dial on Compressor Coupling

Radial



Axial



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**CODE NO            JOB DESCRIPTION**

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02 01 03      DRIVE TURBINE FOR CO2 RECIPROCATING COMPRESSOR (PB) - Q - 1101 -2 :

PREVENTIVE MAINTENANCE OF Q - 1101-2 :

1. Proper clearance and work permit was obtained.
2. Coupling guard was removed. [Guard was able to be removed only after removing the gear box side end covers (2 halves) and loosening the coupling end bearing housing of the turbine.]
3. Coupling was inspected.

**Observations :**

- a. Sleeve fixing circlip on the gear box side was found missing.
  - b. The sleeve had moved to the turbine side and had damaged the oil line. (the one provided for coupling lubrication.)
  - c. Two teeth in the sleeve was found damaged in the gear box side and three teeth were found damaged in the turbine side.
  - d. The coupling guard O-ring was found cut.  
(Due to the above mentioned condition the float of the coupling could not be measured.)
4. Turbine float was checked and recorded. **Float 0.28 mm**
  5. Alignment readings were taken and recorded.
  6. Coupling end bearing housing was removed.

**Observations :**

- a. Heavy rust was observed in the housing.
- b. Little amount of water was also seen in the housing.

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CODE NO	JOB DESCRIPTION
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7. The governor was removed. The free end bearing housing end cover was removed.

**Observations :**

- Heavy rust was observed.
- Water contamination was found.
- Bearing housing end cover fasteners two numbers were found missing.

8. Over speed trip latch clearance was measured and the bearing housing top cover was removed.

OST latch clearance : 1.54 mm.

9. Free end journal bearing top clamp was removed and the bearing was opened.

**Observations :**

- The bearing halves fixing allen bolt – one number was found sheared.
- The bearing was found damaged heavily.  
Since the bearing was damaged the clearance was not measured.

10. The thrust bearing was removed. The bearing was found good physically.  
The same was cleaned, polished and then boxed up.

11. The coupling end bearing top clamp was removed and the bearing opened.

**Observations:**

The bearing was found heavily damaged similar to the pattern in which the free end bearing has damaged.

By seeing the pattern of damage in the bearing, the reason of failure of the bearing is not because of lube oil failure or due to any foreign particle getting in between the babbitt layer. It might be because of the electric current getting grounded through the bearing. Later it was learnt that there was a welding job carried out in the reciprocating compressor II stage end cover when the machine was in service just before the shutdown.

Proper earthing has to be ensured before welding on such critical machineries.



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CODE NO	JOB DESCRIPTION
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12. New journal bearing were drawn for both the coupling end and the free end side. The dimension of same were checked.

Shaft diameter in the coupling end	:	79.87mm
New bearing ID	:	79.45mm
Shaft diameter on free end	:	69.90mm
New bearing on free end	:	69.70mm

Therefore the bearings were sent for machining the ID. The required dimensions were,  
 Coupling end ID : 79.97mm+0.02/-0.00 to maintain a clearance of 0.10 mm to 0.12 mm  
 Free end ID : 70.00mm+0.00/0.02 to maintain a clearance of 0.10 mm to 0.12 mm.

13. After machining the dimensions were checked.

Coupling end bearing ID	:	79.97 mm – 79.98 mm
Free end bearing ID	:	70.50 mm

14. The coupling end bearing was assembled and the contact was checked and found good.

15. The coupling end bearing clearance was measured. It was found to be 0.10 mm – 0.11 mm. The clearance was increased to 0.13 mm by scrapping.

Coupling end bearing clearance	:	0.13 mm
Crush	:	0.02 mm (clearance)

The bearing was boxed up. The bearing top clamp had to be reversed due to the difference in the dowel pin location in the new bearing. The oil hole for the thermowell location was confirmed while reversing the clamp. The bearing housing top cover was boxed up by applying Hylomar Blue in the split face after all the instrument probes were connected.

16. While boxing up the free end bearing, it was found that the turbine lost its free rotation as soon as the bottom half was boxed up. Therefore the dimensions of the bearing vis-à-vis the old bearing was checked. It was found that the thickness of the bottom half bearing was 0.2 mm more than the old bearing. It might have occurred because of non-uniform babbitting or because of error in centering while machining the ID. Therefore the bearing bottom clamp in the housing was removed and the shims were adjusted so as to suit this new bearing. The rotor free rotation was ensured and also the rotor axis position was ensured and the bearing boxed up. Clearance was measured.

Free end bearing clearance	:	0.15 mm
Crush	:	0.03 mm (clearance)

Bearing housing was boxed up after all the instrument probe connection have been made. Hylomar Blue was used as the split face gasket.

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CODE NO	JOB DESCRIPTION
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17. Turbine float was checked. Float : 0.22 mm
18. The oil labyrinth clearances on either side was checked and was found to be 0.35 mm – 0.40 mm (diametrical)
19. One of the missing bolt in the free end bearing housing, out of two, was provided and the other bolt which was found sheared was left as such.  
(It required welding on the equipment).
20. The alignment readings were taken and recorded.
21. New circlips were provided for the coupling sleeve. (The procured circlips required correction to suit the coupling ).
22. The damaged portion of the coupling lube oil line was repaired by welding.  
Thoroughness was ensured by blowing air.  
**Coupling float 9.3 mm.**
23. Coupling guard was provided. The removed O-Ring was used after winding with Teflon. All the oil lines were boxed up.
24. Governor was boxed up. Governor oil was flushed. The self cleaning filter in the governor oil circuit was removed cleaned and boxed up.
25. The lube oil pump suction strainer was cleaned (2 Nos.). The discharge strainer cartridges were renewed in one strainer.

GENERAL COMMENTS ( By M/s. SPIC - SMO ) :

- a. Earthing of the equipment to be ensured. Welding on the equipment's to be done with great care.
- b. Oil circulation to be maintained even if the equipment is under shutdown.
- c. Lube oil coolers may be checked for any leak.
- d. Bearing of the turbine to be done at least once in a day for a few minutes without fail.
- e. Residual magnetism may be checked in the turbine rotor and demagnetized, if any.
- f. Since the welding was done on the reciprocating compressor, the compressors main bearing may also be inspected.

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CODE NO	JOB DESCRIPTION
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Details of Servo motor inspection

During operation of the equipment before S/D, hunting was observed. So it was decided to inspect the servo motor during this S/D opportunity.

Servo motor was opened, the pre loading screw spring and the thrust bearing were inspected. Piston, cylinder and Pilot piston were also inspected.

1. Cylinder bore : 160.09 mm to 160.11 mm
2. Piston to cylinder clearance : 0.60 mm
3. Thrust bearing condition was good and was reused.
4. Spring condition checked and found good.
5. Pilot valve to bush clearance checked : 0.05 mm
6. Cam follower movement about its pivot checked and found good.
7. Cam and the Piston rod were found rusted and was cleaned.
8. Bottom cover gasket (2 mm thick) was renewed.

As per the above results it was decided to renew the piston (0.6 mm actual clearance as against design clearance of 0.05 mm) during next opportunity after getting the spare ready.

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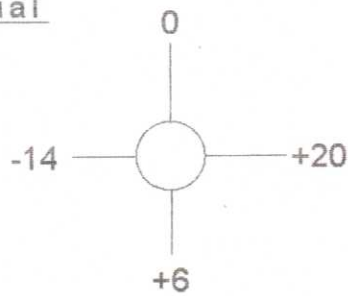
CODE NO      JOB DESCRIPTION

ALIGNMENT DATA FOR CO2 RECIPROCATING COMPRESSOR TRAIN :

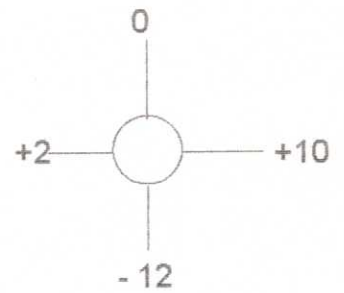
Before PM job

Dial on Gear Box  
1Div = 0.01mm.

Radial



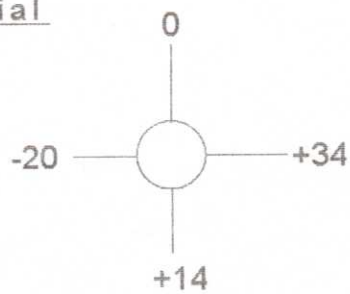
Face



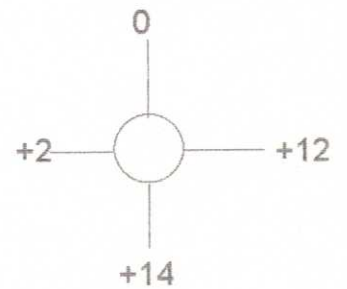
After PM job

Dial on Gear Box  
1Div = 0.01mm.

Radial



Face



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CODE NO	JOB DESCRIPTION
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02 03 01     PRILL TOWER I D FANS ( K- 1401/ 1,2,3 & 4 ) :

Following jobs were carried out.

- Opened inspection cover.
- Cleaned fan blades
- Opened bearing covers and cleaned & checked ,both bearings found to be ok.
- Bearing covers boxed up with fresh grease.
- Alignment of fan with motor checked and rectified.

02 03 02     PRILL COOLING SYSTEM FANS ( K-1701 / K-1702 ) :

Following preventive maintenance jobs were carried out.

- Bearing of Inlet air fan (K-1701) opened, Cleaned and checked. Bearings found in good condition and boxed up.
- Bearing of K-1702 opened, Cleaned and checked, Bearings found in good condition and boxed up.
- Lube oil of bearings flushed.
- Fan pulley of K-1702.

02 03 03     SCRAPPER ( M-1402 ) :

Following preventive maintenance jobs were carried out.

- Fluid Coupling of scrapper replaced by spare coupling.
- Scrapper arm cleaned , damaged portion of scrapper arm repaired by welding and new aluminium sheet provided over scrapper arm.
- Gear Box checked.
- Bottom oil seal of gear box replaced.
- Oil of gear box flushed.

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CODE NO	JOB DESCRIPTION
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02 03 04     BUCKET CHANGE OVER MECHANISM ( M-1401 ) :

Following preventive maintenance jobs were carried out.

- Bucket change over mechanism was cleaned thoroughly.
- Belt and pulley of the mechanism checked and found OK.
- Greasing of chain done.

02 13 01     HYDROJET CLEANING OF HEAT EXCHANGERS :

Following heat exchangers were opened, Hydrojet cleaning done and boxed up with new gasket.

(A) UREA PLANT :

1. Main L.O. Coolers of Hitachi Compressor Train (H-1814 A/B).
2. Main L.O. Coolers of P.B. Compressor Train (H-1113 A/B).
3. Lube oil cooler ( H-1123 )
4. Flash tank condensor ( H-1421 )
5. 1 st evaporator (H-1422) with DM Water.
6. I st evaporator Condenser (H-1423).
7. II nd evaporator I st Condenser (H-1425).
8. II nd evaporator II nd Condenser (H-1426).
9. Final Condenser (H-1420).
10. Recirculation Heater (H-1204) with DM Water.
11. L.O. Coolers of P-1102 A/B.
12. L.O. Coolers of P-1201 A/B.
13. Pre evaporator Condenser (H-1419).
14. CCS II Cooler (H-1207).
15. Effluent Cooler (H-1303).

(B) DRY ICE PLANT :

1. Inter stage coolers of Khosla Compressor (K-4705 A/B).

CODE NO      JOB DESCRIPTION

02 14 01      STEAM LEAK JOBS :

I. Steam / Condensate leak jobs were attended as per production list.

Material Consumed:

- Gate valve 1/2" x 800 # - 8 nos.
- Gate valve 3/4" x 800 # - 19 nos.
- Gate valve 4" x 150 # - 2 no.
- C.S. Pipe 1/2" NB - 10 mtr.
- C.S. Pipe 3/4" NB - 22 mtr.

02 17 01      VALVE REPAIR / INSPECTION / TESTING / REPLACEMENT :

1. The following isolation valves were dismantled, Checked and Overhauled.

- Co2 to H-1201.
- NH3 to H-1202.
- NH3 to V-1201
- Carbamate to H-1202
- 4 ata. steam to V-1352
- 23 ata. steam to V-1351
- Cold Ammonia Inlet Ball valve was replaced
- HICV-1202 I/V

CODE NO      JOB DESCRIPTION

02 17 02      Rv'S OVERHAULING AND TESTING :

Following Rv'S were removed, overhauled and tested at our test bench by M/S.Flotech Engineering Services,Surat. against W.O. No.13/00352/KLL/9908930 and installed back in it's position.

Sr. No.	Tag No.	Equipment No and Name	Required Test Pr.		Actual Test Pr.		Remarks
			SET PR. (kg/cm2)	RESET PR. (kg/cm2)	TEST PR. (kg/cm2)	RESET PR. (kg/cm2)	
1	RV-1203	P-1201 A Suction RV	8.5	7.5	8.5	7.65	OK
2	RV-1204	P-1201 B Suction RV	8.5	7.5	8.5	7.65	OK
3	PSV-1201 C1	P-1201 C Suction RV	8.5	7.5	8.5	7.6	OK
4	RV-1102 /A	V-1103 Ammonia Suction Vessel	31	28	31	28	OK
5	RV-1102 /B	V-1103 Ammonia Suction Vessel	31	28	31	28	OK
6	RV-1108 -1	Liquid NH3 line from NH3 storage tank	31	28	31	28	OK
7	RV-1108 -2	Liquid NH3 line from NH3 storage tank	31	28	31	28	OK
8	RV-1351	V-1351	24	23.5	24	22	OK
9	RV-1352	V-1352	6	5.4	6	5.4	OK
10	RV-1501	4 ata steam drum (V-1501)	7.5	6.5	7.5	6.75	OK
11	RV-1502	4 ata steam drum (V-1501)	7.5	6.5	7.5	6.75	OK
12	RV-1503	23 ata steam drum (V-1502)	25	22.5	25	22.5	OK
13	RV-1130	23 ata steam Header	25	22.5	25	22.5	OK



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CODE NO      JOB DESCRIPTION

Sr. No.	Tag No.	Equipment No and Name	Required Test Pr.		Actual Test Pr.		Remarks
			SET PR. (kg/cm <sup>2</sup> )	RESET PR. (kg/cm <sup>2</sup> )	TEST PR. (kg/cm <sup>2</sup> )	RESET PR. (kg/cm <sup>2</sup> )	
14	RV-1301	II nd Desorber (V-1301)	6	5.4	6	5.4	OK
15	RV-1202 /A	V-1202 to H-1205 line	6	5.4	6	5.4	OK
16	RV-1202 /B	V-1202 to H-1205 line	6	5.4	6	5.4	OK
17	RV-1202 /C	V-1202 to H-1205 line	6	5.4	6	5.4	OK
18	RV-1205	P-1201 A Discharge RV	2350 PSI	2200 PSI	165	150	OK
19	RV-1206	P-1201 B Discharge RV	2350 PSI	2200 PSI	165	150	OK
20	PSV-1201/C2	P-1201 C Discharge RV	2350 PSI	2200 PSI	165	150	OK
21	RV-1352	Ist. desorber	6	5.4	6	5.4	OK
22	RV-1504	V-1503 9 ata. steam header	12	11	12	11	OK
23	PSV-1901	2nd suction of Hitachi Compressor	7	6.3	7	6.3	OK
24	PSV-1902	3rd Suction of Hitachi Compressor	27	24.5	27	24.5	OK
25	PSV-1903	4th. Suction of Hitachi Compressor	110	99	110	101	OK
26	PSV-1181	Final disch. of Hitachi Compressor.	176	155	176	155	OK
27		New liquifier RV of Dry Ice Plant.	11	10	11	10	OK
28		CCS-II RV	31	28	31	28	OK

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CODE NO	JOB DESCRIPTION
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02 17 03      INSPECTION OF CHECK VALVES (NRV'S) :

The following Check valves were dismantled, Overhauled and fixed up back in position.

- Co2 to H-1201
- NH3 to H-1202
- NH3 to V-1201
- Carbamate to H-1202
- 4 ata steam to V-1352
- 23 ata steam to V-1351

02 18 01      CLEANING /SERVICING OF LEVEL GAUGES:

Gauge glass of following vessels were replaced / cleaned

- 4 ata steam drum            ( V-1501 )
- 23 ata steam drum        ( V-1502 )
- 9 ata steam drum         ( V-1503 )
- Rectifying column        ( V-1202 )
- L.P Condensor Separator ( V-1205 )
- Ist Desorber                ( V-1352 )

02 19 01      HIGH PRESSURE VESSEL JOBS :

(A) AUTOCLAVE ( V-1201 ) :

Top cover of Autoclave was opened for inspection and to carry out maintenance job. Autoclave was handed over to M/s. Stamicarbon for inspection.

I) Findings of Stamicarbon

1. In the gas phase the reactor liner and welds shows severe corrosion and cold spots. The corrosion of the liner in the liquid phase is low.
2. In a lot of compartments the liner show some bulging just above the circumferential and below the tray clip weld. In compartment no. 11 the bulging is very severe( up to 15 mm ) and urgent repair actions is required.
3. The old Insert liner strips show high overall corrosion , minimum thickness 3.7mm.
4. The HE- trays including clips, down comer line , inlet nozzles of bottom compartments and it's welds are in good condition.

CODE NO	JOB DESCRIPTION
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## II ) LINER THICKNESS AND OTHER MEASUREMENTS:

The thickness of liner was checked with a Panametric Ultrasonic tester model 26DL *plus*. The accuracy of the measurement is 0.1 mm . The measurements have been taken at the same location as during previous inspection.

### Top Section ( Compartment no. 1 )

Minimum : 4.8 mm    Maximum : 5.3 mm    Average : 5.0mm  
Average corrosion since last shut down is 0.008 mm/y

### Middle Section ( Compartment no. 5 )

Minimum : 5.1 mm    Maximum : 5.6 mm    Average : 5.3mm  
Average corrosion since last shut down is 0.008 mm/y

### Bottom Section ( Compartment no. 9 )

Minimum : 5.0 mm    Maximum : 5.2 mm    Average : 5.0mm  
Average corrosion near to zero and is within accuracy of measurement

### Top Cover

- Overlay welding : Min. - 7.0mm                      Max. - 9.0mm

### Top Compartment

- Liner man way :    Min. - 4.1mm                      Max. - 5.4mm
- Liner dome :        Min. - 3.6mm                      Max. - 6.0mm
- Liner below dome:Min. - 3.9mm                      Max. - 4.3mm

### Bottom Compartment

Liner bottom :            Min. - 7.6mm                      Max. - 8.2mm

### Wall thickness of Insert liner strip

- Compartment no. 3 : Min 7.0mm ( New strip )
- Compartment no. 4 : Min 6.6mm ( New strip )
- Compartment no. 8 : Min 6.7mm ( New strip )
- Compartment no. 9 : Min 3.7mm ( old strip ) - Replaced during S/D by new strip of SS 2RE69 material - Min 6.9mm
- Compartment no.10 : Min 4.6mm ( old strip )

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CODE NO	JOB DESCRIPTION
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### III.) REPAIR JOBS INSIDE AUTOCLAVE

#### Compartment no 2.

One pin hole of more than 5 mm marked by M/s Stamicarbon was repaired by grinding and welding by using 25-22-2 L Mn electrode . DP check of repaired weld was carried out and found to be OK.

#### Compartment no 5.

In the circumferential weld one area over about 100 mm shows some deeper pits marked by M/s Stamicarbon was repaired by grinding and welding by using 25-22-2 L Mn electrode . DP check of repaired weld was carried out and found to be OK.

#### Compartment no8.

6 Nos. repairs ( pits and open dip craters ) in new installed liner ( in 1999 ) marked by M/s Stamicarbon were repaired by grinding and welding by using 25-22-2 L Mn electrode . DP check of repaired weld were carried out and found to be OK.

#### Compartment no9.

Old insert liner was replaced with new liner material SS 2RE69 as per procedure given as under.

#### Insert Liner Replacement procedure.

1. Removed old insert liner in segments by grinding the welding seam without any damaged to loose liner/back up strip/carbon steel body.
2. Removed old weld material from shell liner by grinding.
3. Beveling of shell liner done without any damage to loose liner and back up strip.
4. DPT of beveled face carried out as per standard inspection procedure.
5. Pressurised argon at 0.2 kg/cm<sup>2</sup> from nearby weep hole to ensure clear air passage.
6. New insert liner was fabricated as per required dimension and to suit curvature profile of the shell.

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CODE NO	JOB DESCRIPTION
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7. DP Check and ferrite check of new fabricated liner was carried out.
8. New insert liner was put in position and tack welded with shell liner by TIG welding.
9. Root run completed by TIG welding using filler wire 25-22-2 LMn.
10. DP Check and ferrite measurement of root run carried out.
11. Remaining weld pass completed by MAW using 25-22-2 Lmn welding electrode. Inter pass temperature was maintained below 120 deg. C.
12. DP test and ferrite measurement of final run was carried out.
13. Air and soap solution test of new insert liner and it's weld were carried out.
14. New weld cleaned properly and passivated by washing with 4% HNO<sub>3</sub> and rinsed with plenty of DM Water.

**Compartment no 11.**

Crack marked in four clips for repair by M/s Stamicarbon were repaired by grinding and welding by using 25-22-2 L Mn electrode . DP check of repaired weld were carried out and found to be OK.

**(B) H P STRIPPER (H-1201) :**

Top and bottom covers of HP Stripper (H-1201) were opened. False tube sheets and ferrules were removed after grinding the tack weld between the false tube sheets and ferrules. Stripper was handed over to M/s Stamicarbon for inspection. Delta P measurement and repairing of ferrules were done as a simultaneous activities. After completion of inspection the ferrules were fixed in position with new sleeve gasket. False tube sheet put back in position and tack welded with ferrules. Precaution was taken to prevent entry of any foreign particles inside the stripper. Delta P measured by production department. Top and bottom covers were boxed up with new gasket. Co<sub>2</sub> inlet line, Urea solution outlet line and off gas outlet line boxed up. steam tracing line rewelded and stripper was handed over to production department.

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I) Findings of Stamicarbon

- The top portion shows severe corrosion of the overlay welding in top compartment.
- The triangle between the tube -to tube sheet welds in top show severe undercut and repair is impossible .
- Burn through defects at tube-to-tube sheet welds are found and also can cause tube leaks in near future.
- The Stripper tube show a normal corrosion rate of 0.06 mm / year.
- The minimum wall thickness of tube is 1.95 mm.
- In bottom channel the Stripper show normal overall corrosion.
- The thickness of oxide layer inside the stripper tube is less than 1 mm.

(C) HP Carbamate Condenser (H-1202):

Top and bottom cover of HPCC were opened and handed over to M/s Stamicarbon for inspection. Top and bottom covers boxed up with new gaskets after completion of inspection and repair jobs.

I) Findings of Stamicarbon

- Overall the condenser shows some minor overall corrosion.
- No corrosion found in tubes of HPCC.
- Inside the tubes near the tube sheet weld in top and bottom a lot of burn through spots are found.
- In top compartment few pin holes are found.
- In bottom compartment one seem weld of the gas outlet pipe show severe corrosion.
- Both tube sheets were checked for missing carbon steel . No voids could be detected.

II) REPAIR JOBS INSIDE HP CARBAMATE CONDENSER.

Top Compartment

Top channel -

- i. On one patch plate weld two pinholes were marked for repair by M/s Stamicarbon were repaired by grinding and welding by using 25-22-2 L Mn filler wire . DP check of repaired weld carried out and found to be OK.
- ii. In the knuckle radius manual overlay welding two pinholes were ground open.

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Bottom Compartment

Top channel -

- i. Heavy corroded weld seem of the gas outlet nozzle marked marked M/s Stamicarbon were repaired by grinding and welding by using 25-22-2 L Mn filler wire . DP check of repaired weld carried out and found to be OK.

(D) HP Scrubber (H-1203):

Opened all flange joint of pipeline connected to HP Scrubber. Top half shell of HP Scrubber was removed . Tube bundle was lowered down . Tube bundle and shell of HP Scrubber were handed over to M/s Stamicarbon for inspection.

I) Findings of Stamicarbon

- The Scrubber upper part behind the rupture disc shows no corrosion.
- The gas outlet pipe is somewhat bent.
- The scrubber channel shows normal overall corrosion.
- Some mechanical damage observed on shell liner.
- On the liner few spots with crater like attack were found. After grinding one spot for about 0.5mm the indication were gone.
- Two tubes in area just above the first baffle are mechanically damaged . The minimum wall thickness at damaged area is about 3.2 mm.

Tube bundle inserted back in position and tightened with new gasket. Top half shell of the Scrubber put back in position and tightened with new gasket. All pipe lines were assembled back in position and tightened.

02 19 02

LOW PRESSURE VESSEL JOBS :

(A) CO2 SPRAY COOLER (H-1104) :

- Manhole cover of Co2 spray cooler was opened for inspection of the cooler. Following observation were made and repair jobs carried out.
- Demister pad was found OK.
- Bottom trays found intact in position.
- Epoxy paint coating peeled off. Repainting of cooler was done. Manhole cover of the cooler was boxed up with new gasket.

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CODE NO	JOB DESCRIPTION
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(B) CO2 KNOCKOUT DRUM (V-1101) :

Manhole cover of Co2 Knockout drum was opened for inspection. Following observation were made and repair jobs carried out.

- Overall condition of Co2 knockout drum found satisfactory.
- Epoxy paint coating peeled off at some location and epoxy paint applied at that location.
- Loose supporting ring and fastener of Demister pad were tightened.
- Oily substance found accumulated at bottom and cleaned the same .

Manhole cover boxed up with new gasket.

(C) AMMONIA SUCTION FILTER (V-1102) :

Cover of Ammonia suction filter was opened for inspection. Visual inspection was carried out and overall condition of Ammonia suction filter found to be OK. Some insulation waste , a piece of wood and one electrode were found inside the suction filter and the same were removed. Ammonia suction filter boxed up with new gasket.

(D) AMMONIA SUCTION VESSEL (V-1103) :

Cover of Ammonia suction vessel was opened for inspection. Visual inspection was carried out. Oil layer observed on shell and bottom end. Vessel was cleaned properly and boxed up with new gasket.

(E) RECTIFYING COLUMN (V-1202) :

Top cover, Manhole cover and handhole of the rectifying column were opened. Rasching ring removed from the column and cleaned properly. Visual inspection of rectifying column was carried out. Perforated grating was found intact in position. Top and bottom compartments were cleaned properly. Rasching ring put back in position. Top cover, Manhole cover and handhole covers were boxed up with new gasket.



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CODE NO	JOB DESCRIPTION
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(F) L.P. ABSORBER (V-1203) :

Top cover and Manhole cover of L.P. Absorber were opened for inspection. Rasching ring removed. Visual inspection was carried out. Support gratings at top end was found distorted. Spray nozzle (1-1/2" dia ) pipe of ammonia water inlet from P-1304 C/D has got pinched flattened just near the 8" dia nozzle. The damaged portion of pipeline replaced by new pipe.

In bottom compartment gas inlet nozzle located in south east direction of shell , seal welding observed to have corrosion cavity approx.1 mm deep at one spot and the same was repaired. Missing bolt of tray were provided. Rasching ring put back in to L. P. Absorber. Top cover and manhole cover were boxed up with new gasket.

(G) L.P. VENT SCRUBBER (V-1206) :

Complete LP Vent scrubber was replaced by new identical Scrubber fabricated in our W/S.

(H) AMMONIA SCRUBBER (V-1207) :

Top cover, top and bottom handhole covers were opened. Rasching ring removed and vessel was handed over for inspection. Ammonia water spray nozzle found removed from it's position and fallen down it's inside flange bolts found loosened . Nozzle was fixed back in position and tightened. Damaged grating was repaired. New nut provided in place of missing nut of support grating. Rasching ring put back in position. Top cover and hand hole covers were boxed up with new gasket.

(I) I' ST. DESORBER (V-1352) :

Top and bottom manhole covers of Ist desorber were opened for inspection. Visual inspection was carried out. Condition of Ist desorber found to be ok. Top and bottom manhole covers were boxed up with new gaskets.

(J) II DESORBER (V-1301) :

Top and bottom manhole covers were opened for inspection. Visual inspection was carried out. Condition of II nd desorber found satisfactory. Loose clamping fasteners of trays were tightened . Top and bottom manhole covers were boxed up with new gaskets.

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(K) HYDROLYSER (V-1351) :

Top and bottom manhole covers of hydrolyser were opened. Manway trays were opened up to 4 th tray and hydrolyser was handed over for inspection. Some tray clamps were found loose and the same were tightened. 2nos. located in top most compartment of on east side were found choked with oily sludge and the same were cleared. Overall condition of the hydrolyser was found to be ok. Manway trays were boxed up. Top and bottom manhole covers were boxed up with new gaskets.

(L) I EVAPORATOR SCRUBBER (V-1423) :

Manhole cover of I st evaporator scrubber was opened for inspection. Visual inspection was carried out. New fasteners provided in place of missing fasteners and loose fasteners were tightened. Damaged portion of demister pad were repaired. Manhole cover was boxed up with new gaskets.

(M) 4 ATA STEAM DRUM (V-1501) :

Manhole cover of 4 ata steam drum were opened for inspection. Visual inspection was carried out. All loose bolts (14 nos.) of baffle plates were tightened. New bolts & nuts were provided in place of missing bolts of baffle plates. Demister pads found intact in position. Hydrotest of steam drum carried out in presence of IBR inspector at 11.0 kg / cm<sup>2</sup> on 3/4/2001.

(N) 23 ATA STEAM SATURATOR (V-1502) :

Manhole covers were opened for inspection. Visual inspection was carried out. Overall Condition of 23 ata steam saturator was found satisfactory. Manhole covers were boxed up with new gaskets.

(O) 9 ATA STEAM SATURATOR (V-1503) :

Manhole cover was opened for inspection. Vessel was cleaned properly. Visual inspection was carried out. Overall Condition of 9 ata steam saturator was found satisfactory. Clamp provided on distribution header found loose and the same was tightened. Manhole cover boxed up with new gaskets.

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(P) II EVAPORATOR SEPARATOR (H-1424) :

Manhole cover of II evaporator separator was opened for inspection. Visual inspection was carried out. Overall Condition of equipment was found satisfactory. Manhole cover boxed up with new gaskets.

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

Manhole cover of urea solution tanks were opened for inspection. Visual inspection was carried out. Bulging of bottom plate of tank T-1401 was observed at several locations in upward direction. Old and new tank interconnecting pipe welding of shell to pipe provided at bottom were found without seal welding and the same was repaired by welding. Overall condition of the tanks were found satisfactory. Manhole cover boxed up with new gasket.

(R) AMMONIA WATER TANK (T-1301 / T-1301 A) :

Manhole cover of ammonia water tanks were opened for inspection. Visual inspection was carried out. Bottom plate of tank T-1301 found bulged at four location, the same was observed in past also. Drain pipe of tank T-1301A was found choked from inside and the same was cleaned. Overall condition of the tanks found satisfactory. Manhole cover boxed up with new gasket.

(S) FIRST STAGE SEPARATOR ( V-1811 )

Manhole cover of separator was opened for inspection. Visual inspection was carried out. Top and bottom nozzles of level troll LSHH -1804 & LT-1803 are having cavities of approx. 1/2" to 1" and the same were repaired by welding. Manhole cover boxed up with new gasket.

(T) SECOND STAGE SEPARATOR ( V-1812 )

Manhole cover of separator was opened for inspection. Visual inspection was carried out. Damaged tack weld of support plate of demister pad drain pipe was repaired by welding. Manhole cover boxed up with new gasket.

(U) THIRD STAGE SEPARATOR ( V-1813 )

Manhole cover of separator was opened for inspection. Visual inspection was carried out. Over all condition of the separator was found satisfactory. Manhole cover boxed up with new gasket.

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02 20 01	<u>FABRICATION JOBS :</u>
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1. Following lines / Fittings were replaced

- a. Balancing line from V-1205 LP Carbamate separator to H-1205  
Material consumed : Pipe ASTM A-106 GR B, 8" sch 10 - 2300 mm. Elbow 90Deg ,  
8" sch 10 - 2 nos. Weldolet 1" x 3000 # - 1 no.
- b. Discharge line of Ammonia Pump C (Line no. MA 1604 - 3") from pump to  
MA 1604 - 4".  
Material consumed : Pipe ASTM A-106 GR B, 3" sch 80 - 8000 mm  
90 Deg. elbow 3" sch 80 - 9 nos.  
Flange RTJ 3" X 1500 - 3 nos.
- c. Ammonia to Autoclave line ( From Ammonia header to 1st I/V)  
Material consumed : Pipe ASTM A-106 GR B, 3" sch 80 - 6000 mm  
Pipe ASTM A-106 GR B, 1 1/2" sch 80 - 3000 mm  
90 Deg. elbow 3" sch 80 - 2 nos.  
Weldolet - 3" X 1-1/2" -6000 # - 2 nos.  
Reducer 3" X 1-1/2"- 2 nos.  
Flange 1-1/2" X 1500 # - 2 nos.  
Flange RTJ 3" X 1500 - 1 nos.  
Gate valve SW 1-1/2" X 1500 - 1 no.
- d. Replaced 2 nos. 90 Deg. Sch. 40 elbow of condensate line at first floor.
- e. Replaced TR-1201 fitting on H-1201 to V-1201 line.
- f. Replaced TR-1206 fitting on V-1201 off gas to H-1203 line.
- g. Replaced TR - 1209 fitting on H-1201 off gas to H-1202 line.
- h. Repaired TI - 1209 fitting ( Carbamate pump discharge line to HPCC ) by grinding and  
rewelding.
- i. Replaced gas Chromatograph sample point on V-1201 off gas line to HP Scrubber.

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**2. Following redundant lines / Fittings were removed**

S.No	Description	Location	Approx recovery of material
1	Line between discharge of P-1302 A/B going up to Autoclave top for LR-1201 flushing	Ground floor	0.75" SS Pipe - 20M
2	Ammonia water flushing line to P-1102C	Ground floor	1" SS Pipe - 10 M 1"X150 # Gate vlv- 2 Nos.
3	H-1303 cooling water inlet / outlet lines.	Ground floor	6"X 150# Gate vlv.- 2Nos. 6" CS Pipe - 6 M
4	H-1425 Barometric leg to P-1305 A/B	Ground floor	4"X150 # SS flange - 1 No
5	Line between disch. of P-1302 A/B and dich. of P-1302 C/D	Near Urea filter	4"X150# SS Gate vlv.-1No
6	P-1205 to CCSII and connecting piping	first floor	2" CS line - 10 m 2"x150# CS Gate vlv- 2 No
7	P-1304 A/B Suction/ discharge line	First floor	2" SS pipe - 5 m 2"X150# SS Gate vlv.7Nos
8	P-1302 A/B discharge to strong effluent.	First Floor	1" SS Pipe - 20 M 1"X150 # Gate vlv- 1 Nos
9	2" Tapping on LPCC drain line to T-1301	First floor	2"X150# SS Gate vlv.2Nos
10	2" Tapping from 23 ata header down stream of PRCV-1504.	First floor	2"x150# CS Gate vlv- 1No
11	Ammonia water to reflux condenser inlet / outlet	First floor	2" SS pipe - 65 m 2"X150# SS Gate vlv.4Nos 2"X150#SS check vlv.2Nos
12	PRCV-1202 down stream vapour to H-1421	Second floor	2"X150# SS Gate vlv.1No 8"X150# SS Gate vlv.1 No, 8" SS Pipe - 15 M
13	23 ata steam tracing to hydrolyser vapour line.	Hydr. System	0.75" CS Pipe - 3M
14	Desorber effluent line for CORDET	Hydr. System	4" PVC pipe.- 15 m
15	H-1209 liquid outlet to P-1302C/D	Second Floor	4"X150# SS Gate vlv.1No 4"X150# SS Flange .1No 6"X150# SS Flange .1No

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02 21 01	<u>BELT CONVEYORS :</u>
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(A) PRILL TOWER CONVEYOR SYSTEM ( M-1403 ) :

Following jobs were carried out.

- Belt joints were checked and found to be ok.
- New skirt board sealing system was installed.
- Damaged rollers were replaced.
- Alignment of motor to gearbox and gearbox to pulley were checked/rectified.
- Replaced gear box oil.

(B) LINK CONVEYOR SYSTEM ( M-1419 ) :

Following jobs were carried out.

- Belt joints were checked and found to be ok.
- Damaged rollers were replaced.
- Alignment checked/rectified. Greasing of chain done.
- Gear box checked and oil of gear box flushed.

(C) NEW LINK CONVEYOR SYSTEM ( M-1421 ) :

Following jobs were carried out.

- Belt joints were checked and found to be ok.
- Damaged rollers were replaced.
- Greasing of bearings were done.
- Gear box checked and oil of gear box flushed.
- Alignment of motor to gear box checked/rectified.

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UREA PLANT

INSPECTION JOBS

CODE NO	JOB DESCRIPTION
02 41 01	<p><u>INSPECTION JOBS :</u></p> <p>During this Shutdown, the following major Inspection activities were performed.</p> <ol style="list-style-type: none"> <li>1. Inspection of HP vessels viz; (1) H-1201, HP Stripper (2) V-1201, Autoclave. (3) H-1202, HP Condenser and (4) H-1203, HP Scrubber was carried out alongwith a team of M/S Stamicarbon BV.</li> <li>2. Radiography of butt weld joints and DP test of parent metal and butt weld joints of fittings of H.P. Lines.</li> <li>3. Internal inspection and ultrasonic thickness measurement of other vessels in the Plant.</li> <li>4. Ultrasonic thickness measurement of various pipelines including HP lines in the Plant.</li> <li>5. Dye penetrant examination and radiography of weld joints of the following replaced pipe lines viz;             <ol style="list-style-type: none"> <li>a. Discharge line of P 1102 C (MA-1604-3") , Short loop of @ 5 mtrs. length including its fittings.</li> <li>b. PR-1220-8"</li> </ol> </li> </ol>

These replacement jobs were carried out by M/s Technocon Engrs.

HIGH PRESSURE VESSELS :

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.

(1) AUTOCLAVE ( V-1201) :

(A) VISUAL INSPECTION :

Thorough visual inspection of the liner and its welds, trays and internals was carried out alongwith the Stamicarbon engineers. Observations made on each compartments are mentioned as below. Repairing on marked locations was carried out and inspected by D.P. test followed by ferrite content checking .

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01 TOP COVER :

The overlay welding was covered with a blue oxide layer of about 1 mm. The blind pipe of nozzle R3 showed some condensation corrosion inside and around the weld to cover. Pipe liner thickness reduces locally from 6 to 2.5 mm. Repair may be necessary in the near future.

02 Compartment No.1 (Top Compartment) :

A fine blue oxide layer covers the manway liner. Condensation corrosion patches were seen on overlay welding. Improvement in the insulation of cover was recommended. Some cold spots from the lifting lugs and from radioactive source nozzle were observed, hence improvement in insulation quality was recommended. Top dome was found with scattered oil deposits on oxide layers and were recommended to be cleaned with SS wire brush. Liner in the top gas phase was covered with an overall blue oxide scale.

03 Compartment No.2 :

One no. clit weld was found to have a pinhole of more than 5 mm depth which was marked for repair.

04 Compartment No.3 & 4 :

Insert liner plate which was replaced during previous shutdown had shown almost no corrosion attack.

Just above the circumferential weld, liner was found bulged outward by amount of approx. less than 5 mm in compartment no.3.

05 Compartment No.5 :

Convex bulging of liner plate was observed just above the circumferential weld joint by approx. less than 5 mm.

Some deeper pits were observed on circumferential weld in @ 100 mm length which was marked for repair.

06 Compartment No.6 & 7:

Convex bulging of liner plate was observed above the circumferential weld joint by approx. less than 5 mm in compartment no.6.

07 Compartment No.8 :

Welding of the insert liner plate which was replaced during April 2000 shutdown showed weld defects at six locations which were marked for repair.



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08    Compartment No.9 :

Insert liner plate was replaced by new one as the old one has got thickness reading of 3.2 mm against design value of 5 mm.Procedure adopted for replacement of insert is enclosed at annexure-B.

09    Compartment No.10 :

Old insert liner had shown high corrosion rate and weld undercuts. Min. thicknes of insert liner was found to be 4.6 mm. In one of two longitudinal weld a pinhole was observed which was marked for repair.

10    Compartment No.11 :

Severe Convex bulging of liner just above the circumferential weld seam was observed on complete circumference by approx. 15 mm height. Repairing of the same is recommended during next shutdown.

Just below circumferential seam concave bulging of liner in approx. 6" dia. area and about 8 mm max. depth was observed at three locations. Carbon steel shell in these area was checked using dualscope and no sign of leakage was observed and was found smooth and regular.

Six locations were marked on clit welding for repairs. Nine nos. of old U-clits are still present in this compartment which could not be replaced due to bulging of liner.

11    Compartment No.12 (Bottom Compartment.) :

Weld joints of all nozzles , petal plates and crown plates of bottom dished end liner as well as patch plates were DP tested. No significant indication were observed.

**(B) LINER THICKNESS MEASUREMENT :**

Ultrasonic thickness measurement was carried out on liner and overlay welds. The readings are summarised as follows:

(1) LINER THICKNESS :

	Min.Thk. (mm)	Max.Thk (mm)	Remarks
Top Section , Compartment 1	4.80	5.30	Installed thickness of liner is 5.00 mm.
Middle Section, Compartment 5	5.1	5.60	Average corrosion rate of 0.08 mm/yr was observed since last shutdown for top and middle section of vesse
Bottom Section Compartment 9	5.0	5.20	

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(2) TOP COMPARTMENT :

- a. Minimum thickness of overlay welding on top cover was found to be 7 mm where as max.thickness was found to be 9 mm.
- b. Min. and Max. thickness of liner in man way was found to be 4.1 mm and 5.4 mm respectively.
- c. Min. and Max. thickness of liner in dome was found to be 3.6 mm and 6.0 mm respectively.
- d. Min. and Max. thickness of liner below dome was found to be 3.9 mm and 4.3 mm respectively

Replacement of liner in top compartment in near future was recommended.

(3) INSERT LINER :

- a. Min. thickness of 7mm, 6.6mm and 6.7mm was observed for compartment no. 3,4 and 8 respectively.
- b. Min. thickness of 6.9mm was observed for compartment no.9 which was being replaced during this shutdown.
- c. Min. thickness of 4.6 mm was observed for compartment no. 10

(4) DOWN COMER AND TRAYS :

	Thickness Downcomer(mm)	Thickness Trays(mm)	Dia. of Tray holes (mm)	Gap between Tray & liner
Top Section , Compartment 1	--	7.8 - 8.2	8.7 - 8.9	4 - 12
Middle Section, Compartment 5	10.3 - 10.7	8.2 - 8.6	8.7 - 8.9	3 - 12
Bottom Section Compartment 9	10.6 - 10.7	8.4 - 8.8	8.6 - 8.8	4 - 10

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**(2) HP STRIPPER (H-1201) :**

The following inspection activities were performed.

- a. Visual Inspection
- b. Eddy current testing of tube sheets
- c. Thickness measurement of all the tubes by Eddy current testing .
- d. Thickness Measurement of overlay welds.

The observations on above inspections are as under. :

**(A) VISUAL INSPECTION :**

Top Cover : Some corrosion had taken place on overlay welding where lot of craters and pores up to 4mm depth were noticed. Sealing face was found satisfactory.

Bottom Cover : The overlay weld and internals of connected piping were found slightly rough.

Top Channel : Heavy oxide layer was observed particularly on top dome overlay welding. The overlay welding had shown severe corrosion attack with lot of open craters and pits of approx. 4mm depth. This was found more predominant at the area between the overlay strips.

Tube to tubesheet seal welds showed heavy corrosion resulting in loss of weld metal and flattening of fillet bead near the tubes.

The overall condition of bottom tubesheet and overlay welding, tube to tubesheet seal welds etc. was satisfactory.

**(B) OVERLAY WELD THICKNESS :**

The thickness of the overlay weld metal in the top and bottom domes of the Stripper was carried out using Fisher Dual scope MP4. The following readings were recorded.

**Top Section :**

	Minimum Thickness, mm	Maximum Thickness, mm
Cover	10	13
Man way	9	14
Dome	8	12
Cylindrical area-Gas phase	8	14
Cylindrical area- Liquid phase	6	10
Tube sheet	7	9

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**Bottom Section :**

	Minimum Thickness, mm	Maximum Thickness, mm
Cover	9	12
Man way	8	12
Dome	9	12
Cylindrical area	7	13
Tube sheet	9	12

**(C) Eddy Current Testing :**

**(a) Tube Sheet Inspection :**

Bottom Tube Sheet : No voids could be detected at the transition of carbon steel and stainless steel.

Top Tube Sheet : Same void was detected as found in April 1998.  
No increase in void could be measured since last inspection.

**(b) Tubes :** All the tubes were checked for its thickness in the top 3 to 4 mtrs . Minimum wall thickness of 1.95 mm was observed for one tube where as max. thickness of 2.6 mm was recorded for six tubes with average wall thickness of tube is 2.28 mm against design value of 3.5 mm. Average calculated corrosion rate was found to be 0.06 mm per year.

**(D) Scaling Measurement :**

The scaling was measured in about 30 tubes. The thickness of the scaling in the tube was below 1 mm.

**(3) H.P. CONDENSER H-1202:**

The following inspection activities were performed.

- a. Visual Inspection    b. Eddy current testing of tube sheets    c. Thickness measurement of tubes by Eddy current testing.

The observations on above inspections are as under. :

**(A) VISUAL INSPECTION :**

Top Cover & Bottom Cover : Sealing face was found satisfactory. Liner & welds were found smooth.

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Top Channel : The J-bolts showed some crevice corrosion on the screw thread. Use of double nuts on these J-bolts was recommended. The sealing face was satisfactory. The overlay weld of tube sheet had shown some minor pitting. Tube to tube sheet welds were smooth. Some tubes were found to have burn through defects which were since manufacturing. Four nos. of pinholes were marked for repairs.

Bottom Channel : The sealing face was satisfactory. On gas inlet nozzle, heavy corrosion of one of the two weld seams was observed having a depth of approx. 3 mm. Repairing of the same was carried out. Tube to tube sheet weld and tube sheet overlay weld was found smooth. Few tube were found to have burn through defects as observed on top tube sheet. Tube no. 982 and 983 had shown a wall thickness reduction of approx. 0.5mm at the burn through spot.

(B) Eddy Current Testing :

(a) Tube Sheet Inspection :

Bottom & Top Tube Sheet : No voids could be detected surrounding the tubes in the carbon steel tube sheet at the transition of carbon steel and stainless steel.

(b) Tubes : 220 tubes were checked for its thickness over the entire length. Minimum wall thickness of 2.45 mm was observed for one tube where as max. thickness of 2.6 mm was recorded for four tubes. Average wall thickness of 2.52 mm against design value of 2.5 mm was measured. Average calculated corrosion rate was found to be nil.

(C) Overlay weld and Liner thickness measurement :

Top Section :

	Minimum Thickness, mm	Maximum Thickness, mm
Cover	19.3	20
Man way	6.9	7.5
Dome area	6.7	7
Cylindrical area	6.4	7.1
Tube sheet-Overlay weld	8	16 (Knuckle radius)

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Bottom Section :

	Minimum Thickness, mm	Maximum Thickness, mm
Cover	19.4	19.7
Man way	5.1(On grinded spot)	7.1
Dome area	6.5	7
Cylindrical area	6.5	6.9
Tube sheet-Overlay weld	8	16 (Knuckle radius)

(4) H.P. SCRUBBER H-1203 :

The following inspection activities were performed.

- a. Visual Inspection. b. Ultrasonic Thickness measurement of liner .

The observations on above inspections are as under. :

(A) VISUAL INSPECTION :

- (a) Tube Bundle : The U-tubes were brown and had shown some light etching. Two tubes just above the top baffle plate had shown mechanical damage . After slight grinding thickness measurement was carried out on that area which had shown a thickness of 3.2 mm against design value of 3.6 mm.
- (b) Shell : The top and bottom liner plates were gray in coloration and had shown some roughening along circumferential and longitudinal welds. In top liner plate small crater like indications were observed at eleven locations . One indication was checked for its depth by slight grinding (less than 1 mm )followed by DP test. No indication was revealed . Therefore other indications were left as they were.  
The middle liner plate was brown in coloration and was found smooth including its longitudinal weld.  
Scratches were observed on liner at few places which seemed to be due to rubbing of tube bundle while inserting / removing the same from shell. Special attention was recommended during removing / installing the tube bundle.
- (c) Top chamber behind rupture disc : As far as could be inspected ,the liner & the welds were smooth. The gas outlet pipe was slightly bent.

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(B) THICKNESS MEASUREMENT : Ultrasonic thickness measurement was carried out on the liner.

The results are summarised as under.

<u>Shell Liner</u> :	(a) Top	:	Min. 5.5 mm ,	Max. 5.7 mm
	(b) Middle	:	Min. 5.4 mm ,	Max. 5.7 mm
	(c) Bottom	:	Min. 5.1 mm ,	Max. 5.3 mm

<u>Top Chamber Liner</u> :	Bottom Portion :	Min. 5.0 mm ,	Max. 5.4 mm
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02 41 02 HIGH PRESSURE PIPING INSPECTION :

(A) DYE PENETRANT TEST :

D.P. Test on the parent metal and butt weldjoints of the the fittings of H.P. Lines was carried out to find out to find out occurrence of service defects if any as mentioned below. :

1. Liquid outlet line(PR-1204-8") from H-1202 to V-1201 : 02 Elbows
2. Autoclave Off gas line (PR-1208-4") : 01 Elbow.
3. V-1201 to H-1201 (PR-1201-8") Liquid line : 01 Elbow Weldolet of N.C. Ratio meter.
4. H-1203 to V-1201 Scrubber Overflow line(PR-1212-4") : 01 Tee , 01 Reducer, 01 Elbow
5. Weldolets of following Thermocouples :

TR-1201, 1202, 1203, 1205, 1206, 1207, 1210 and elbolet of TR-1209

OBSERVATIONS :

Minor crack was revealed on elbolet joint of TR-1209 which was marked for repair whereas rest of the joints were found satisfactory in DP test. However, due to severe corrosion from inside of weld joint, was revealed during radiography, the complete elbolet of TR-1209 was replaced with new one.

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**(B) RADIOGRAPHIC EXAMINATIONS :**

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.	Fitting Identification	Line Where Installed	Observation	Remark
1	TR-1201	V-1201 to H-1201 liquid	Sever corrosion detected	Replaced with new one
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	Sever corrosion detected	Replaced with new one
6	TR-1207	CO2 to HP Stripper	Found satisfactory	----
7	Elbolet TR-1209	Stripper offgas to HPCC	Sever corrosion detected	Replaced with new one
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	Lack of fusion detected in one joint	Cut & rewelded joint
11	Gas chromatograph sample point	V-1201 offgas line to H-1203	Sever corrosion detected	Plugged this point as it is not in service.
12	HPF to PRCV-1201	H-1203 offgas to V-1203	Found satisfactory	----
13	HPF to HICV-1202	V-1201 offgas to H-1203	Found satisfactory	----
14	HPF to FICV-1204	Carbamate pump discharge to HP scrubber	Found satisfactory	----
15	HPF to Seal isolation valve	Liquid outlet from V-1201	Weld corrosion detected	To be replaced during next shutdown
16	HPF to carbamate line to HPCC	Carbamate pump discharge line to HPCC	Initiation of corrosion detected	To be replaced during next shutdown
17	HPF to Ammonia line to HPCC	Ammonia pump discharge line to HPCC	Mild corrosion seen	Replacement recommended within two/three years



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02 41 03 OTHER VESSELS :

(1) H-1104 ( CO2 SPRAY COOLER ) :

- a) Demister pad was found intact in position.
- b) Top layer of epoxy paint was peeled off at various locations.  
However, paint layer below the top layer was found satisfactory.
- c) Bottom trays were found intact in position.

(2) H-1123 (CRANK CASE COOLER OF K-1101/2) :

- a) Tube sheet observed to have considerable corrosion attack and also thinning of stub ends of tubes was detected.
- b) Minor pitting corrosion was observed on channel cover .

(3) H-1352 (REFLUX CONDENSER) :

- a) Tube to tube sheet welding was found satisfactory.
- b) Channel covers inside surface observed to have minor scattered pitting.

(4) CRANK CASE L. O. COOLER OF P - 1102-A :

- a) Pitting of 1 to 2.0 mm depth were observed on dished end.
- b) Pittings up to 1 mm depth were observed on tube sheets
- c) 0.5 to 1 mm deep pittings were observed on channel.

(5) CRANK CASE L. O. COOLER OF P - 1102-B :

- a) Channel had excessive corrosion pittings up to 2 to 3 mm depth.
- b) Bonnet cover had pittings upto 1 mm depth.
- c) Tube sheets were also found badly corroded.

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(6) L. O. COOLERS OF P - 1113 A/B :

- a) Tube cleaning was found satisfactory.
- b) South side bonnet of bottom cooler was found badly corroded having pittings of 3 to 4 mm depth.

Note : Repair / replacement may be planned for all heat exchangers having high corrosion. It is recommended to apply epoxy paint/suitable coating on CS portion of the cooling water side of heat exchangers to avoid further corrosion.

(7) L. O. COOLERS OF P - 1201 A/B :

- a) Tube cleaning was found satisfactory.
- b) 0.5 to 1 mm deep pittings were observed on tube sheets.
- c) Corrosion on cooler of P-1201 B was found more than that of P-1201 A.

(8) H-1207 (CIRCULATION SYSTEM-II COOLER):

- a) Scaling was observed in most of the tubes.

(9) H-1422 ( 1 ST STAGE EVAPORATOR ) :

Visual inspection of shell and Dish end were carried out as mentioned below.

- a) The shell and Dish ends have assumed brownish coloration.
- b) Intrnal surface of tubes were found to have minor scaling.
- c) Lot of urea lumps were observed inside the baffle chambers located on the top of vessel.
- d) Other fittings like impingement cone and condensate distributors were observed to be satisfactory.

(10) H-1424 ( 2 ND STAGE EVAPORATOR ) :

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

- a) Coloration of the shell was bright shiny.
- b) Tubes were filled up with water.

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- c) Tube to tubesheet weld joints were found satisfactory.
- d) All other weld joints were found satisfactory.
- e) Lots of urea lumps were found lying on the bottom portion of vessel.
- f) Impingement cone was found intact in position.

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

- a) Tubes and tube sheet were found satisfactory.
- b) Epoxy coating was found peeled off at scattered locations from the inside surface of channel cover and was found predominant on and near partition plate of west side channel cover resulting in corrosion cavities up to depth of 0.5 mm.

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

- a) Tubes and tube sheet were found satisfactory.
- b) Epoxy coating has been peeled off at scattered locations from the inside surface of channel cover and was found predominant on and near partition plate of west side channel cover resulting in corrosion cavities up to depth of 2 to 3 mm on circumferential weld of stiffener ring plate.

(13) T-1301 (AMMONIA WATER TANK) :

- a) Brown coloration on bottom plate and bottom half of shell and silver bright colouration on top half of shell was observed.
- b) Bottom plate was found bulged up-side at different locations. Same has been observed in past.
- c) 3" NB tank drain nozzle connection and 4" NB nozzle for P-1426 A/B suction were found without welding with shell from inside. Welding of the same was recommended.

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

- a) Brown coloration on bottom plate and bottom half of shell and silver bright coloration on top half of shell was observed.
- b) Tank drain nozzle was found choked from inside.
- c) No other defect was observed. In general, the overall condition of the tank was found satisfactory.

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(15) T-1401 ( UREA SOLUTION TANK ) :

- a) Bottom plate is having bulging upside as has been observed in the past.
- b) Old and New tank interconnection pipe welding of shell to pipe provided at bottom were found without welding from inside as observed during April 2000 shutdown. Welding of the same was recommended.
- c) Dark brown coloration was observed .
- d) Stiffner provided on top roof plate was found intact in position.

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

- a) Brownish gray coloration was there on bottom half of the vessel and top half was observed having bright silver coloration.
- b) Interconnection piping between T-1401 & T-1401A was found with sludge inside.
- c) Overall condition of the tank was satisfactory.

(17) T-1501 ( CONDENSATE TANK ) :

Visual inspection of internals was carried out. No abnormality was observed.

- a) The internals (shell and dished ends) had assumed brownish colouration.
- b) Scattered minor scales were observed on tank internal surface.
- c) Overall condition of the tank was found satisfactory.

(18) V-1101 ( CO2 KNOCK OUT DRUM ) :

- a) Condition of epoxy paint was found satisfactory except at three locations, from where it was peeled off . Rectification of the same was advised.
- b) Demister pad supporting ring fasteners were found loose at two places, however Demister pads were found intact in position.
- c) Oily substance was found accumulated at bottom dished end just below the inlet line nozzle near bottom drain.

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(19) V-1102 (NH<sub>3</sub> SUCTION FILTER) :

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

- a) Insulation waste, a wooden piece and a welding electrode were found inside.
- b) Wire mesh filter was found in good condition
- c) Overall condition of the equipment was found satisfactory.

(20) V-1103 (NH<sub>3</sub> SUCTION VESSEL) :

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

- a) Coloration of shell was blackish gray.
- b) The condition of longitudinal and circumferential weld joints was satisfactory.
- c) Oil layer was found on the shell and bottom dished end.
- d) Overall condition of the equipment was found satisfactory.

(21) V-1202 (RECTIFYING COLUMN) :

**Top Compartment :**

- a) Coloration of shell top portion was observed gray where as grayish brown coloration was observed on bottom portion.
- b) Perforated grating was found intact in position.

**From Bottom manhole :**

- a) Coloration of top cone was silver with black patches where as brownish coloration was found on bottom dished end.
- b) Condition of bottom nozzle was found satisfactory.

(22) V-1203 (L. P. ABSORBER) :

**From Top End**

- a) Coloration of shell was observed greyish black.
- b) Grating was found distorted.

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- c) Spray nozzle (1 1/2" dia.) of NH<sub>3</sub> water inlet from P-1304 C/D has got pinched/flattened just near the 8" dia. nozzle.

**From Bottom End:**

- a) Coloration of shell was observed grayish black.
- b) Seal welding of gas inlet nozzle with shell was found to have corrosion cavity of approx. 1 mm depth at one spot.
- c) One no clamping bolt of sieve tray was found missing.

**(23) V-1206 (ATMOSPHERIC VENT SCRUBBER) :**

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

- a) Demister pads were found intact.
- b) All fasteners were found intact.
- c) The shell coloration was grayish black.

**(24) V-1207 (L. P. SCRUBBER) :**

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

- a) Coloration of shell top portion was observed blackish grey.
- b) Corrosion attack was observed on the second circumferencial weld seam from top.
- c) 2" dia. pipe located on south-east direction was found without seal welding with the shell from inside.
- d) Sieve tray was found damaged particularly near the clamping bolt holes. Some fasteners were found loose and few were found missing.
- e) Grill supporting plate fasteners were found loosened and one was found missing.
- f) Ammonia water inlet spray nozzle was found fallen down and its inside flange bolts were found loose.

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(25) V-1301 ( 2ND DESORBER ) :

Visual inspection of vessel was carried out from Bottom and Top manhole.  
The observations were as follows.

Bottom Compartment :

- a) The shell had assumed brownish coloration.
- b) Bottom nozzle and nozzle on South side were observed to be in satisfactory condition.
- c) All clamps were found intact in position One no. clamping bolt was found loose.
- d) Condition of trays was found satisfactory.

Top Compartment :

- a) Shell Coloration was found brownish.
- b) All fasteners were intact except one which was found loose.
- c) Thick oily sludge was found adhered on the trays ,shell and dished end.
- d) All the trays were found satisfactory
- e) Top nozzle was found intact in position.

(26) V-1351 ( HYDROLYSER ) :

Visual inspection of vessel top and bottom compartment only was carried out .

Top Compartment :

- a) Top dish end and shell of top section has assumed brownish black coloration.
- b) Trays had brownish coloration.
- c) Oil sludge was found in two nozzles.
- d) Few fasteners of the tray were found loosened.
- e) Condition of trays was found satisfactory.

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**Bottom Compartment :**

- a) Brownish coloration was observed.
- b) Perforated distributor pipe's clamp bolts were missing.
- c) One no. clamping bolt of tray was found missing.
- d) Oil layer was observed all around.

**(27) V-1352 ( FIRST DESORBER ) :**

Visual inspection was carried out from top and bottom manhole.

**Top Manhole :**

- a) Shell and dish end had brownish coloration.
- b) All fasteners were found intact

**Bottom Manhole :**

- a) Shell and dish end had brownish coloration.
- b) All fasteners were found intact.

Ultrasonic thickness measurement was carried out. Minimum thickness of 8.3mm and 9.1 mm was found on shell and dished end respectively against design value of 8.0 mm on shell and 10.0 mm on dished end. Refer Annexure-C.

**(28) V-1423 ( 1 ST STAGE EVAPORATOR SCRUBBER ) :**

Visual inspection was carried out from top manhole.

- a) Dark brown coloration was observed.
- b) Demister pads were observed to have sagging at few scattered locations and partial damage was also observed.
- c) Few fasteners were found missing and some fasteners were found loose.
- d) Overall condition of the vessel was satisfactory.



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(29) V-1501 ( 4 ATA STEAM DRUM ) :

- a) Coloration of shell was observed to be blackish in general , south side dished end top portion had reddish colouration.
- b) Demister pads were found intact and in good condition.
- c) Minor pittings were observed on both side of dished end.
- d) 14 nos of bolts/nuts were found loose and 9 nos. were missing on baffle plates.
- e) All the baffle plates were found in good condition.
- f) Distribution pipe and its supports were found in satisfactory condition.
- g) Weld joints of all the nozzles with vessel were found satisfactory visually.
- h) Ultrasonic thickness measurement was carried out. Minimum thickness of 14.5 mm and 17.0 mm was found on shell and dished end respectively against design value of 15.0 mm on shell and 18.0 mm on dished end. Refer Annexure-C.

(30) V-1502 ( 23 ATA STEAM DRUM ) :

- a) All the internal fittings were found in good condition.
- b) Overall condition of the vessel was found satisfactory.
- c) Vessel inside has assumed brownish black in colouration.

(31) V-1503 ( 9 ATA STEAM DRUM ) :

- a) Colouration of Shell and dished end was observed grayish black for the bottom half where as brownish gray for top half.
- b) Complete internal surface of vessel was found covered with fine dust particles.
- c) Clamp provided on distribution header was found loose and one of its nut was found missing.
- d) Scattered scales were observed on both the dished ends.
- e) Overall condition of the vessel was found satisfactory.

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**(32) V-1811 (Ist STAGE SEPERATOR):**

- a) Top and bottom nozzles of level troll LSHH-1804 were found to have corrosion cavities in approx. 15 to 25 mm length and bottom nozzle of level troll LT-1803 was also found with some corrosion cavities. The same were marked for repairs.
- b) Demister pads holding bottom plate was found to have tack weld with shell, complete seal welding was recommended.

**(33) V-1812 (Iind STAGE SEPARATOR):**

- a) Tack weld of support plate of demister pad drain pipe was found broken.
- b) Overall condition of the vessel found satisfactory.

**(34) V-1813 (IIIrd STAGE SEPARATOR):**

- a) Overall condition of the vessel found satisfactory.

**02 41 04 THICKNESS MEASUREMENT :**

In addition to the vessels, thickness measurement of following heat exchangers and tanks was also carried out. The readings are given at the table, Annexure - B.

SR. NO.	EQUIPT.NO.	EQUIPMENT NAME
1	H-1102	Ammonia Preheater
2	H-1104	CO2 Spray Cooler
3	H-1815	Surface condenser
4	V-1204	Condensate pot
5	V-1352	First desorber
6	V-1353	Level tank for Reflux condenser

**02 41 05 PIPE LINES THICKNESS MEASUREMENT :**

During this shutdown, a large nos. of pipe lines were examined for thickness. The detailed report on thickness measurement is enclosed herewith at Annexure - C attached here with.

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ANNEXURE - A

PROCEDURE FOR REPLACEMENT OF INSERT  
LINER OF NINTH COMPARTMENT IN AUTOCLAVE

1. Remove old insert liner by grinding the welding without damaging the loose liner / back up strip plate kept behind the insert liner.
2. After removal of corroded insert liner, old weld metal deposit from shell liner face shall be removed carefully by smooth grinding.
3. Prepare beveling of shell liner end face by grinding.
4. Pressurise air from nearby weep hole to ensure clear air passage.
5. Inspection of bevel face of liner by DPT.
6. Ferrite check and thickness measurement of loose liner segments to be done.
7. Cut the new insert liner plate to the required profile. Plate shall be checked for thickness and ferrite before installation. The plate material shall be 2RE69. Thickness shall be 6.0 mm Minimum.
8. Root welding by TIG welding using 25-22-2 L Mn filler wire. No air pressure shall be present in the annular space. Remove air connections to weep holes, if any. Argon shall be pressurised at 0.1 Kg/cm<sup>2</sup> for purging in the annular space to prevent oxidation of weld metal.
9. Ensure no welding is done on carbon steel portion of shell.
10. Offer root run for DPT and Ferrite measurement.
11. After clearance of above tests, fill up the bevel using same filler wire while maintaining inter pass temperature less than 150 degree C.
12. DPT and Ferrite measurement of final weld shall be carried out Ferrite shall be less than 2 %.
13. Air and soap solution test of new insert liner welding shall be carried out at 0.2 Kg/Sq.Cm. pressure in the annular space.
14. On satisfactory completion of the job, passivate new weld joints with 4% HNO<sub>3</sub> followed by rinsing with plenty of DM water.

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ANNEXURE-B

## THICKNESS MEASUREMENT REPORT OF UREA PLANT EQUIPMENTS CARRIED OUT IN S/D MARCH-APRIL 2001:

SL.NO.	EQUIPMENT NUMBER	MIN. MEASURED THICKNESS IN MM			DESIGN THICKNESS IN MM			% REDUCTION		
		SHELL	CHANNEL	DISHED END	SHELL	CHANNEL	DISHED END	SHELL	CHANNEL	DISHED END
1	H-1102	9.6	13.7	10.8	10	14	10	4	2.14	---
2	H-1104	10.1	---	11.2	10	---	10	---		
3	H-1815	15.3	---	---	n.a.	n.a.	n.a.			
4	V-1204	8.4	---	8.4	n.a.	n.a.	n.a.			
5	V-1352	8.3	9.1	---	8	10		---	9	
6	V-1353	5.7	---	5.6	6	---	6	5		
7	V-1501	14.5	---	17	15	---	18	3.33		5.56

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							ANNEXURE - C	
PIPELINE THICKNESS MEASUREMENT OF UREA PLANT DURING MARCH-APRIL-2001 S/D.:								
SR NO	LINE NO.	N.B. (in.)	DESIGN THK. (MM)	LINE DESCRIPTION		MIN.THK. OBSERVED (MM)	%GE RED	REMARKS
				FROM	TO			
<b>GA- ACID / GAS LINES:</b>								Page 1 of 2
1	GA-1101	30	6.35	BL	H-1104	6.3	0.8	
2	GA-1105	8	3.76	GA-1104	HICV-1121	3.6	4.3	
3	GA-1106	18	4.78	HICV-1121	GA-1103	5		
4	GA-1201	6	13.33	GA-1112	H-1201	12.0(MAY97)	9.9	
<b>MA-AMMONIA LINES:</b>								
1	MA-1101	6	7.11	B/L	H-1102	6.3	11.4	
2	MA-1102	6	7.11	MA-1107	H-1102	6.7	5.8	
3	MA-1107	6	7.11	MA-1102	MA-1104	7	1.5	
4	MA-1108	3	4.85	RV-1108	PR-1309	4.2	13.4	
5	MA-1115	3	4.85	RV-1102	MA-1108	4.6	5.2	
6	MA-1117	4	6.02	RV-1103	MA-1105	5.4	10.3	
7	MA-1125	4	6.02	RV-1112	MA-1122	5.3	12.0	
8	MA-1203	4	9.14	MA-1106	PR-1230	7.1(APRIL99)	22.3	
<b>PR - UREA / CARBAMATE LINES:</b>								
1	PR-1201	8	19.58	V-1201	H-1201	15.1	22.9	
2	PR-1202	10	24.33	HP-STRIPPER H-1201	HP-CONDENSER	24.1	0.9	
3	PR-1203	8	19.58	HP-CONDENSER H-	V-1201(VAPOR LINE)	17.7	9.6	
4	PR-1204	8	19.58	HP-CONDENSER	V-1201(LIQUID LINE)	18.9	3.5	
5	PR-1205	6	15.2	STRIPPER	RECTIFYING COLUMN	12.3(APR-2K)	19.1	
6	PR-1205	8	19.5	STRIPPER BOTTOM	PR-1205-6"	17.3(APR-2K)	11.3	
7	PR-1206	6	3.4	V-1202	PR-1207	3.2	5.9	
8	PR-1208	4	10.4	AUTOCLAVE TOP	SCRUBBER	8.4(APR-2K)	19.2	
9	PR-1210	10	4.19	HICV-1202	L.H.V.	4.2		
10	PR-1212	4	10.4	SCRUBBER	AUTOCLAVE BOTTOM	8.4(APRIL98)	19.2	
11	PR-1214	8	4.57	V-1202	H-1204	3.6	21.2	
12	PR-1214	12	4.57	V-1202	H-1204	5		
13	PR-1230	6	15.24	MA-1203	H-1202	15.3		
14	PR-1234	4	9.14	PRC-1201(H-1203)	V-1203	8.5(APR-2K)	7.0	
15	PR-1302	3	3.05	P-1302	H-1301	2.3(MAY97)	24.6	
16	PR-1359	4	3.05	P-1351A/B	H-1351C	2.1(APR-2K)	31.1	
17	PR-1373	4	3.05	P-1351B DIS	PR-1361	2.4	21.3	
<b>PW - PROCESS WATER LINES:</b>								
1	PW-1301	4	2.77	V-1301	H-1301	2.5	9.7	
2	PW-1302	4	6.02	H-1301	H-1303	5.6	7.0	
3	PW-1303	3	5.49	H-1303	B/L	4.7	14.4	
4	PW-1303	4	6.02	H-1303	B/L	4.5	25.2	

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ANNEXURE - C								
PIPELINE THICKNESS MEASUREMENT OF UREA PLANT DURING MARCH-APRIL-2001 S/D.:								
SR NO	LINE NO.	N.B. (in.)	DESIGN THK. (MM)	LINE DESCRIPTION FROM TO		MIN.THK. OBSERVED (MM)	%GE RED	REMARKS
<b>SC - STEAM CONDENSATE LINES :</b>								
Page 2 of 2								
1	SC-1106	4	6.02	H-1116	B/L	5.9	2.0	
2	SC-1101	14	9.52	H-1102	H-1206	8.5	10.7	
3	SC-1102	14	9.52	SC-1228	SC-1101	8.4	11.8	
4	SC-1239 III FROM NE	16	9.525	H-1202	V-1501	7.2	24.4	
5	SC-1243 III FROM NW	16	9.525	H-1202	V-1501	6.8	28.6	
6	SC-1245	10	4.19	H-1202	BD-1201	4	4.5	
7	SC-1407	6	6.55	H-1422	T-1501	5.7	13.0	
8	SC-1408	2	5.54	H-1422	SC-1530	4.6	17.0	
9	SC-1421	2	3.9	HEADER	SC-1409	5.1		
10	SC-1501	4	6.02	T-1501	P-1501/6	5.4	10.3	
11	SC-1509	3	5.49	SC-1507	B/L	5.5		
12	SC-1514	4/3	6.02/5.49	T-1501	SEAL POT	5.8/4.9		
13	SC-1522	3	5.49	SC-1529	SC-1409	*3.4, 5.6		*BEND REPLACED
14	SC-1525	3	5.49	SC-1536/7/8	SC-1522	*1.7, 5.0	10.0	*BEND REPLACED
15	SC-1534	2	3.91	25-4 ATA COND.	SC-1409	4.6		
<b>ST - STEAM LINE</b>								
1	ST-1103	0.5	3.73	ST-1508	V-1103	2.7	27.6	
2	ST-1104	8	12.7	B/L	Q-1101-2	9.8	22.8	
3	ST-1105	4	8.56	ST-1104	Q-1101-1	7.7	10.0	
4	ST-1106	14	9.52	B/L	Q-1101-1	7.5	21.2	
5	ST-1107	2	3.91	ST-1106	V-1113	4		
6	ST-1108	4	6.02	Q-1101/2	ST-1106	6	0.3	
7	ST-1109	2	3.91	ST-1106	P-1119	4.2		
8	ST-1110	4	6.02	P-1119	ATM	7.4		
9	ST-1116	12	9.52	Q-1101-2	V-1502	8.5	10.7	
10	ST-1116	8	8.18	23 ATA EXHAUST.		7.7	5.9	
11	ST-1119	2	3.91	ST-1101	Q-1113	4.3		
12	ST-1120	6	7.11	Q-1113	ST-1106	7.1(SEPT-93)		
13	ST-1128	24	9.52	ST-1106	PICV-1130	9.5		
14	ST-1128	20	9.52	ST-1106	PICV-1130	10		
15	ST-1205	12	9.525	V-1502	H-1201	8.9	6.6	
16	ST-1211	2	3.91	ST-1409	H-1202	3.7	5.4	
17	ST-1212	6	7.11	H-1201	BD-1202	6.6	7.2	
18	ST-1302	6	7.11	ST-1504	V-1301	7.9		
19	ST-1502	8	8.18	ST-1116	PICV-1502A	7.6	7.1	
		4	6.02	ST-1116	V-1503	6.6		
		3	7.62	ST-1502	V-1503	5.7	25.2	
		2	5.54	PICV-1502	V-1503	5.1	7.9	
20	ST-1503	12	9.525	PICV-1502A	V-1503	9.1	4.5	
21	ST-1504	6	7.11	V-1503	ST-1302	8.9		
		10	9.27			8.8/6.3		
22	ST-1505	14	9.52	PICV-1502B	ST-1506	8.6	9.7	
23	ST-1506	14	9.52	V-1501	ST-1106	8.9	6.5	
24	ST-1506	18	9.52	V-1501	ST-1106	9.2	3.4	
25	ST-1507	6	7.11	V-1506	ST-1302	8.8		
26	ST-1507	6	7.11	V-1506	ST-1302	8.8		
27	ST-1508	2	5.54	ST-1506	PCV-1502	5.1	7.9	
		3	5.49	ST-1506	PCV-1502	4.4	19.9	
		4	6.02	ST-1506	PCV-1502	5.1	15.3	
28	ST-1509	10	9.27	T-1501	H-1502	8.2	11.5	
29	ST-1510	10	9.27	T-1501	H-1502	8.8	5.1	
30	ST-1527	3	5.49	ST-1506	HEADER	5.9		

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UREA PLANTCIVIL JOBS

CODE NO	JOB DESCRIPTION
02 51 01	<u>CIVIL JOBS :</u> <ol style="list-style-type: none"><li>1. Repairing of scrapper floor by filling the joints of existing tiles / replace damaged acid proof tiles etc.</li><li>2. Providing and laying bitumastic on the top of Prill tower and prill bucket room.</li><li>3. Epoxy painting of RCC structure Prill bucket room, Lift cabin room, Stair case at Prill tower top level / inside scrapper floor etc.</li><li>4. Concreate protection taken by IP net coating outside surface of prill tower up to 8 meter height from ground floor.</li></ol>

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PLANT TURNAROUND - MARCH - APRIL - 2001

UREA PLANT

ELECTRICAL JOBS

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CODE NO	JOB DESCRIPTION
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02 61 01     ELECTRICAL JOBS :

1. Maintenance job carried out on following transformers.  
TR-7A, 7B.
  - (a) Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.
  - (b) Insulation resistance measurement of winding in primary and secondary side.
  - (c) Breakdown value of oil of secondary side marshalling box and main tank were taken.
  - (d) Replaced the 2 single core cable between TR-7B secondary and MCC breaker incoming.
  
2. Preventive maintenance was carried out on all feeder compartments mounted on the following MCCs : MCC 6, MCC 14 and MCC 15 (Normal Section) were carried out :
  - (a) Checking and tightness of outgoing terminal.
  - (b) Cleaning the feeder compartment.
  - (c) Replacement of damaged connectors, etc.
  
3. In MCC 14, ACB panel is installed as a second incomer. Power fed from MCC 15 section A FDR.
  
4. Overhauling of following motors were carried out:  
M 1401/A, M 1401/B, M 1402/A, M 1402/B, M 1403/2, M 1419, M 1421,  
P 1131/A, P 1131/B, P 1131/C, P 1231/A, P 1231/B, P 1302/A, P/1408.



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PLANT TURNAROUND - MARCH - APRIL - 2001

UREA PLANT

INSTRUMENTATION JOBS

CODE NO	JOB DESCRIPTION
02 71 01	<p>(A) <u>HITACHI (CO2) COMPRESSOR:</u></p> <p>The following preventive maintenance jobs were carried out in the Hitachi Compressor area :</p> <ol style="list-style-type: none"> <li>1. Continuity and resistance Checking of all Vibration Probes and extension cables, was carried out. Checked the proximeters and Vibration Monitors.</li> <li>2. Coordinated with mech. maint. dept. for maintenance of compressor.</li> <li>3. Continuity and resistance Checking of all RTDs and checked all thermocouples.</li> <li>4. All the instruments in the area, Local Control Panel and TLC Box were cleaned.</li> <li>5. Calibrated following trip switches PAHH-1843 A/B/C, PAHH-1839 A/B/C, PALL-1818 A/B/C.</li> <li>6. Calibrated PT-1802 transmitter (ISO quality affecting instrument).</li> </ol> <p>(B) <u>OLD CENTRIFUGAL COMPRESSOR :</u></p> <ol style="list-style-type: none"> <li>1. Checked following trips of the compressor.               <ol style="list-style-type: none"> <li>(1) PLCO-1101, (2) PHCO-1127, (3) PHCO-1133, (4) PLCO-1145,</li> <li>(5) PLCO-1153, (6) PLCO-1160, (7) PLCO-1201, (8) PL-1102,</li> <li>(9) PH-1124, (10) PH-1132</li> </ol> </li> </ol>
02 71 02	<p><u>CONTROL VALVE AND OTHER FIELD JOBS :</u></p> <ol style="list-style-type: none"> <li>1. overhauled N/C Ratio meter monoblock valve and provided new gland packing.</li> <li>2. Rerouting of Cables of junction Boxes AJB-08, AJB-14 and AJB-15.</li> <li>3. Installation of Smart transmitter for LIC-1501 ( 4 ata steam drum).</li> <li>4. Installation of P/I converters in field for VPIH-1201 and VPIL-1201.</li> </ol>

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CODE NO	JOB DESCRIPTION
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5. Replacement of old LIC-1101 pneumatic transmitter by electronic transmitter.
6. Installation and commissioning of control valves HICV-1422B, HICV-1424 and PICV-1424.
7. HICV-1201 : Overhauling of actuator, replacing of diaphragm and positioner cleaning, stroke checking.
8. HICV-1202 : General overhauling of actuator and replace the diaphragm.,
9. PICV-1130 : was opened for passing problem. Top seat ring and gaskets were replaced. Slight finishing cut and lapping was carried out for getting the control valve tight shut off. Actuator was opened. Internal parts of the actuator were inspected and found alright. After overhauling and cleaning the complete valve was assembled. Valve stroking was carried out.
10. PICV-1131: It was opened for passing problem. gaskets were replaced. slight finishing cut and lapping was carried out for getting the control valve tight shut off. Actuator was opened. Internal parts of the actuator were inspected and found alright. After overhauling and cleaning the complete valve was assembled. Valve stroking was carried out.
11. LRCV-1201: The control valve was dropped from line. Opened trim of C/V. Found all right. actuator Overhauled and replaced the diaphragm. Gland packing was made up with spare packings. Refixed with help of mech. maint. people.
12. CO2 flow computer's Tx - FR-1201 and PR-1201 to be calibrated.
13. Following control valves' actuators were overhauled/serviced & checked I/P converter, Positioner, air supply regulator and the valve stroke.
 

PICV-1129	PICV-1504	PICV-1502A	PRCV-1201	TICV-1201
PICV-1201	FICV-1301	PICV-1425	PICV-1422	TRCV-1421
LICV-1201	PICV-1481	LRCV-1421	LICV-1351	FICV-1385
FICV-4801	PRCV-1202	LICV-1501	PICV-1131	
TRCV-1422	PICV-1221	TICV-1808	PICV-1501	
14. HICV-1421: Prill divert valve actuator is was replaced by a spare one. Peripheral items were checked and new pilot valve assembly was taken in line.
15. PICV-1128 : Control valve was opened for trim inspection. Trim were found all right.

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CODE NO            JOB DESCRIPTION

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16.    Calibrated following ISO 9002 quality affecting instruments.
- |         |         |         |          |          |         |
|---------|---------|---------|----------|----------|---------|
| PT-5303 | PT-4405 | PT-1121 | PT-1145  | PT-1201  | PT-1202 |
| PT-1422 | PT-1421 | PT-1105 | SI-1401A | SI-1401B | FT-1201 |
| FS-1101 |         |         |          |          |         |

17.    Overhauled LICV-1201 control valve

02 71 03    HP VESSELS JOBS :

1. Checked all weepole tubings and provided air supply arrangements as per requirements of Prod./Maint. Dept.
2. Removed and refixed thermocouples and other field instruments as required to open and box-up the various HP and LP vessels.
3. Provided necessary arrangement for weepole and liner purging in all four HP vessels.

02 71 04    CONTROL ROOM - DCS MARSHALLING ROOM JOBS :

1. Instalation, Cable laying, Termination and commissioning of MOV panel (Aux Cons. 81) and MOV Junction Box. Shifting of all MOVs, Prill Bucket I/Os from DCS Marshaling Room to MOV JB.

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UREA PLANT

TECHNICAL DEPARTMENT JOBS

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CODE NO	JOB DESCRIPTION
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02 81 01 (A) MECHANICAL JOBS :

- ◆ EWR NO. U-198 DATED 07/03/2001
- ◆ Under the scheme provision of control valves on CCS-II to pre evaporator in urea plant job completed by :
  - providing HICV-1422 / A&B
  - removing 10" blind upstream of isolation valve of condensate going to HP scrubber
  - capping of 10" bypass line
  
- ◆ EWR NO.U-199 DATED 07.03.2001
- ◆ Under the scheme provision of cold ammonia supply from offsite storage to 109-F upstream of isolation valve and ammonia pre heater H-1102 job completed by :
  - inter connection of 6" header to 2" header (i.e. MA-1101-6" to MA-1121-2")
  - removing MA-1122-2" dia line alongwith RV
  - capping of 2" line in between two isolation valves of H-1102
  - providing 2" isolation valve at the upstream of drain of 109-F
  
- ◆ Scheme No.TM-02-1307 dated 14.08.2000
- ◆ Under the scheme, stoppage of lean carbamate pump for energy saving was completed by :
  - modifying H-1421 liquid outlet line and hooked up with suction line of P-1305/A&B
  - providing 2" dia line on ammonia water tank
  - capping of 2" dia line outlet of H-1305 to P-1302/A&B discharge
  - H-1305 discharge hooked up at the common discharge of P-1200/A&B
  - H-1305 dishcharge to reflux condensor line modified

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CODE NO	JOB DESCRIPTION
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- ◆ Scheme No. TM-02-1300 dated 14.10.2000
- ◆ Under the scheme ammonia loss reduction in urea plant job was completed by :
  - H - 1421 cooling water inlet line CW-1401-8" and outlet line CW-1402-8" size increased to 12" from main cooling water headers CW-1609-30" and CW-1610-30". On cooling water return line thermowell provided.
  - H -1421 to V-1206-6" SS line modified by providing PICV-1424 (3" x 300 #) and HICV -1424 (4" x 300 #). HICV-1424 with manual isolation valve and loop hooked up with V-1206.
  - PICV-1424 hooked up with new 6" dia line to H-1422 outlet PR-1440-32".
  - Necessary platform modified.

(B) INSTRUMENTATION JOBS :

- ◆ Provision of control valves HICV-1422 A&B on CCS-II to pre evaporator in Urea Plant alongwith their I/P converters, Air filter regulators, necessary tubings and new wiring was done for hooking up with DCS & successfully commissioned the scheme.
- ◆ Provision of PICV-1424 and HICV-1424 control valves for ammonia loss reduction scheme in urea plant was made alongwith their I/P converters, Air filter regulators, necessary tubings and new wiring was done for hooking up with DCS and successfully commissioned the scheme.
- ◆ Provision of push button panel (YBL-make) for MOV's in urea plant with additional capacity was installed.

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OFFSITE & UTILITY PLANT

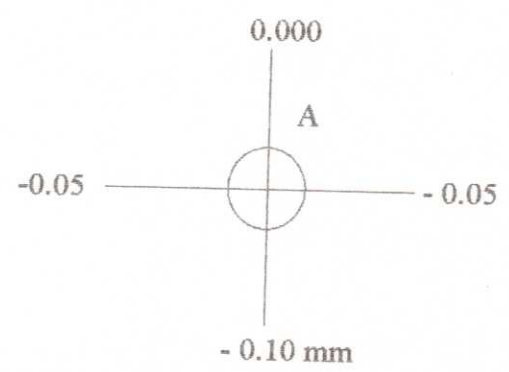
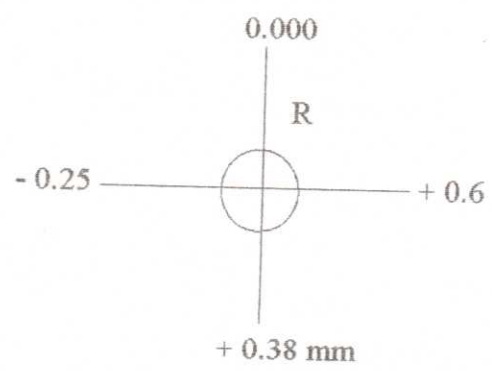
MECHANICAL JOBS

CODE NO	JOB DESCRIPTION
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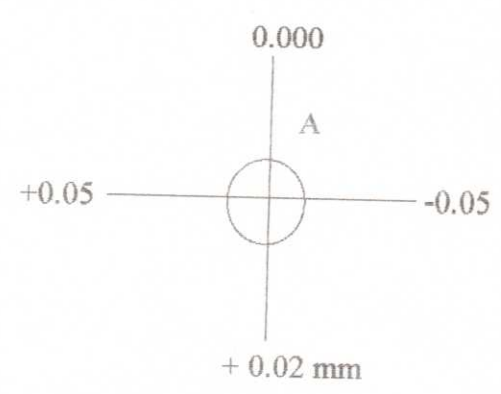
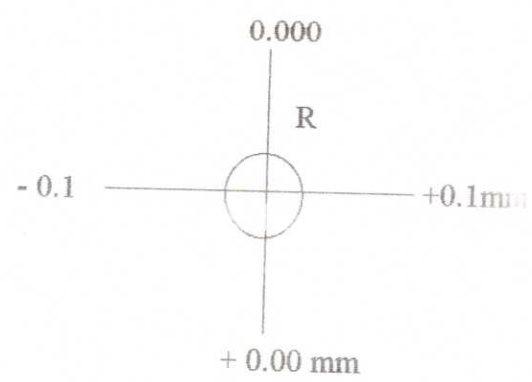
03 02 01 COOLING WATER PUMP (P-4401/A) :

PREVENTIVE MAINTENANCE :

- (a) Both the journal Bearings were checked and found okay.
- (b) The clearances were checked & following are the readings:  
Free end side : 0.008"  
Coupling side : 0.007"
- (c) Pump with gear box of Elliot Turbine alignment was checked  
Following are the readings:  
Dial indicator fixed on gear box (Dial indicator on Pump Shaft)



Alignment was corrected,  
Following are the readings:  
Dial indicator fixed on gear box (Dial indicator on Pump Shaft)



CODE NO	JOB DESCRIPTION
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- (d) Cleaning the coupling of pump with gear box & greasing done.
- (e) New Gland packing (25 mm) both side repacked.
- (f) NRV Gland packing repacked.

03 02 02 COOLING WATER PUMP ELLIOT TURBINE ( Q-4401/A ) :

PREVENTIVE MAINTENANCE :

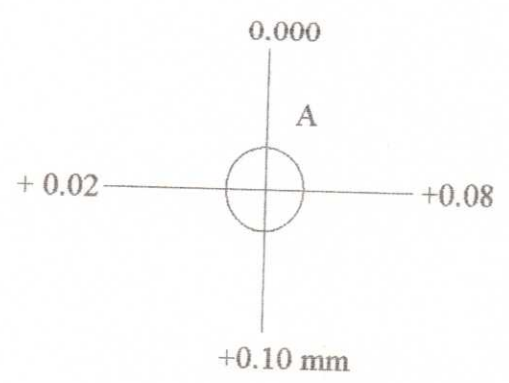
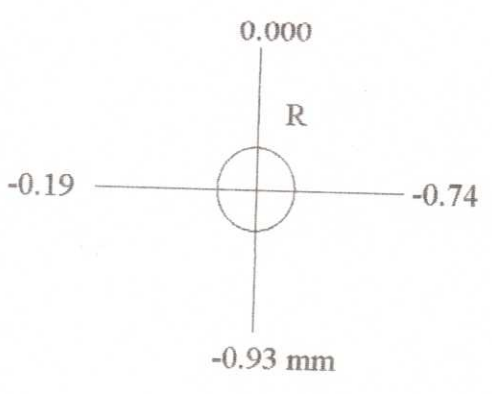
- (a) Both the journal Bearings and thrust bearing were checked. Coupling side journal Bearing and Governor side thrust bearing were found okay. Governor side journal Bearing white metal found pilled off.

The Governor side journal Bearing was replaced with new one issued from store. store code no. : 336000012, Item part no. 603360-23 - two halves.

- (b) The clearances were checked & following are the readings:

Governor side journal Bearing	:	0.012"
Coupling side journal Bearing	:	0.013"
Governor side Thrust Bearing	:	0.012"
Pinion Shaft Thrust	:	1.05 mm

- (d) Governor oil flushed and fresh oil charged.
- (e) Oil console level gauge glass properly screwed to avoid any leakage.
- (f) Oil console was drained, Cleaned & fresh oil charged.
- (g) Turbine to Gear Box alignment was checked  
Following are the readings:  
Dial indicator fixed on gear box (Dial indicator on Turbine Shaft)

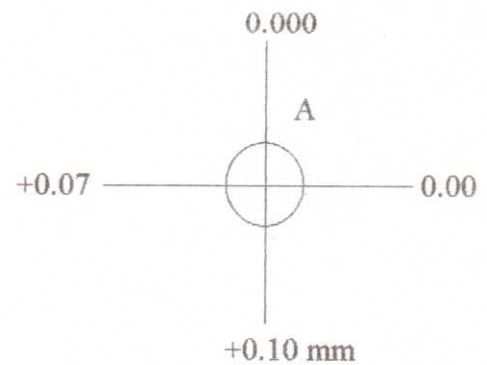
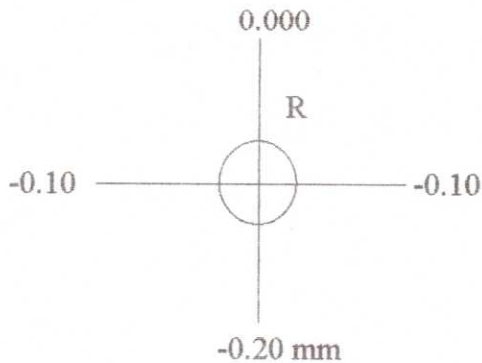


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CODE NO	JOB DESCRIPTION
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Alignment was corrected, Following are the readings:

Dial indicator fixed on gear box ( Dial indicator on Turbine Shaft )



03 02 03 COOLING WATER PUMP ( P-4401/B ) :

OVERHAULING OF PUMP :

- Pump decoupled.
- Top casing removed.
- Rotor taken out.
- Condition of Rotor was good except some portion of protective coating on vane area at suction eyes were pilled off.
- The same rotor was placed in the pump.
- Journal bearings inspection done & general condition of the bearing was found okay.

Clearance were checked & the readings are as follows.

Free end side : 0.15 mm

Coupling side : 0.15 mm

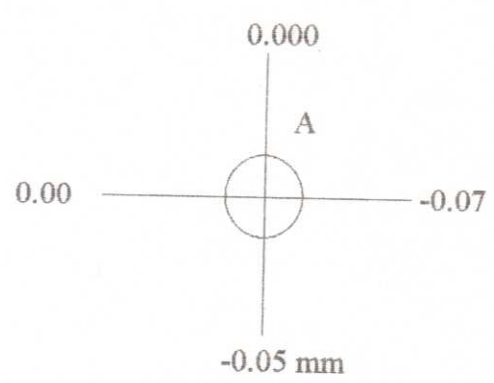
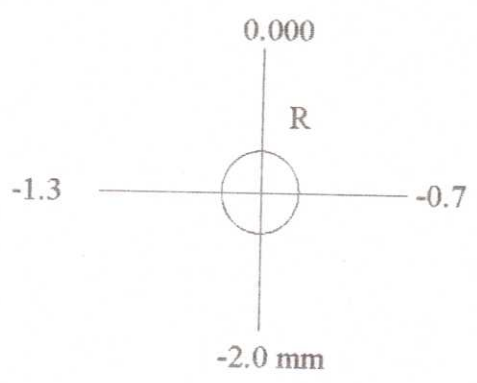
- Decoupled the turbine coupling , cleaned & greasing done.



CODE NO      JOB DESCRIPTION

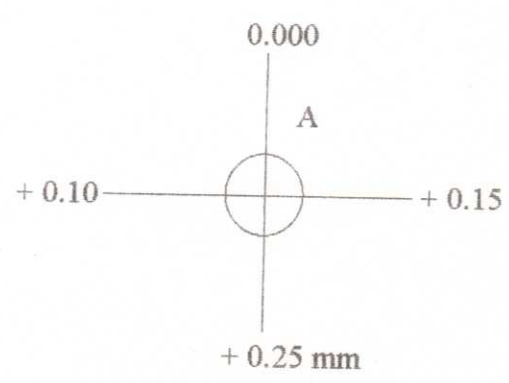
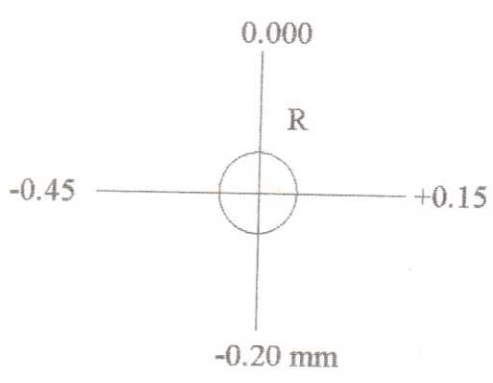
(h) Pump & Turbine alignment was checked.  
Following are the readings.

Dial indicator fixed on gear box (Dial indicator on Pump Shaft)



Alignment was corrected by lifting the turbine base assembly completely,  
Following are the readings:

Dial indicator fixed on gear box (Dial indicator on Pump Shaft)



- (i) New Gland packing (25 mm) both side repacked.
- (j) N.R.V. Gland replaced.

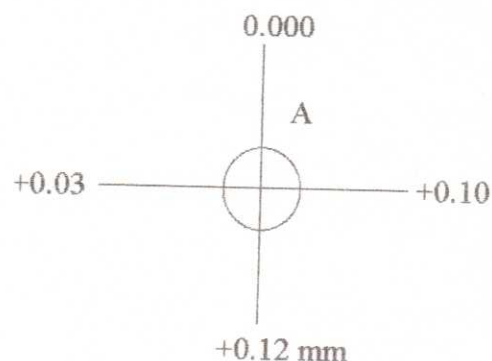
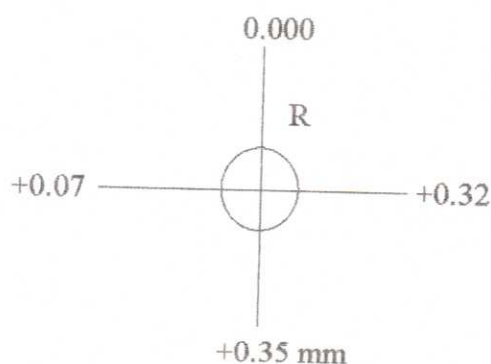
CODE NO	JOB DESCRIPTION
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03 02 04 COOLING WATER PUMP (P-4402):

PREVENTIVE MAINTENANCE:

- Both the journal bearings were checked & found okay.
- The clearances were checked & following are the readings.  
Free end side : 0.20 mm                      Coupling side : 0.17 mm
- Decoupled the turbine coupling , cleaned & greasing done.
- Gland packing ( 25 mm) both sides repacked.
- N.R.V. Gland packing repacked.
- Pump & Motor alignment was checked following are the readings.

Dial indicator fixed on motor (Dial indicator on Pump Shaft)



03 02 05 COOLING WATER PUMP (P-4403):

PREVENTIVE MAINTENANCE:

- Both the journal bearings were checked & found okay.
- The clearances were checked & following are the readings.  
Free end side : 0.25 mm                      Coupling side : 0.22 mm
- Decoupled the turbine coupling , cleaned & greasing done.
- Gland packing ( 25 mm) both sides repacked.
- N.R.V. Gland packing repacked.

03 02 06 COOLING WATER PUMP (P-4401/C):

PREVENTIVE MAINTENANCE:

- Both the journal Bearings were checked . Coupling side journal Bearing found okay.  
Pump free end journal Bearing bottom half white metal lining found pitted / pilled off.

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CODE NO	JOB DESCRIPTION
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- (b) New repaired bearing installed issued from store against store code no. 333200024.
- (c) Two drills of 10 mm dia. and 10 mm deep were made on journal Bearing bottom half to facilitate the easy removal of the bearing.
- (d) The damaged journal Bearing bottom half white metal lining repaired by applying Eutectic -157P paste & deposit white metal filler wire Eutectic-157
- (e) The clearances were checked & following are the readings.  
Free end side : 0.17 mm                      Coupling side : 0.22 mm
- (f) Both the bearing housing were flushed with oil & fresh oil servo prime 68 charged in the both bearing housing.
- (g) Decoupled the pump coupling , cleaned & greasing done.
- (h) Alignment was checked & followings are the readings.

Dial indicator fixed on motor (Dial indicator on Pump Shaft)



Alignment was corrected by lifting the turbine base assembly completely,  
Following are the readings:

Dial indicator fixed on motor (Dial indicator on Pump Shaft)



CODE NO      JOB DESCRIPTION

03 02 07      COOLING WATER PUMP ( P-4401 / D ) :

PREVENTIVE MAINTENANCE :

- (a) Both the journal bearings were checked & found okay.
- (b) The clearances were checked & following are the readings.  
Free end side : 0.25 mm                      Coupling side : 0.17 mm
- (c) Decoupled the pump coupling , cleaned & greasing done.
- (d) Gland packing ( 25 mm) both sides repacked.
- (e) N.R.V. Gland packing repacked.
- (f) Pump & Motor alignment was checked following are the readings.

Dial indicator fixed on motor (Dial indicator on Pump Shaft)



03 02 08      B F W PUMP ( TURBINE DRIVEN ) P - 5111 :

PREVENTIVE MAINTENANCE :

PM jobs on this equipment was carried out as per the details given below :

- (a) Removal of coupling spacer - Match marks was checked.
- (b) Checking of alignment & axial play of pump and gear shafts
- (c) Removal of DE & NDE bearings top halves
- (d) Cleaning of radial & Thrust bearings
- (e) Checking radial clearances of bearings using lead wire.
- (f) Alignment readings and bearings clearances.
- (g) Same bearings were assembled after polishing

**CODE NO      JOB DESCRIPTION**

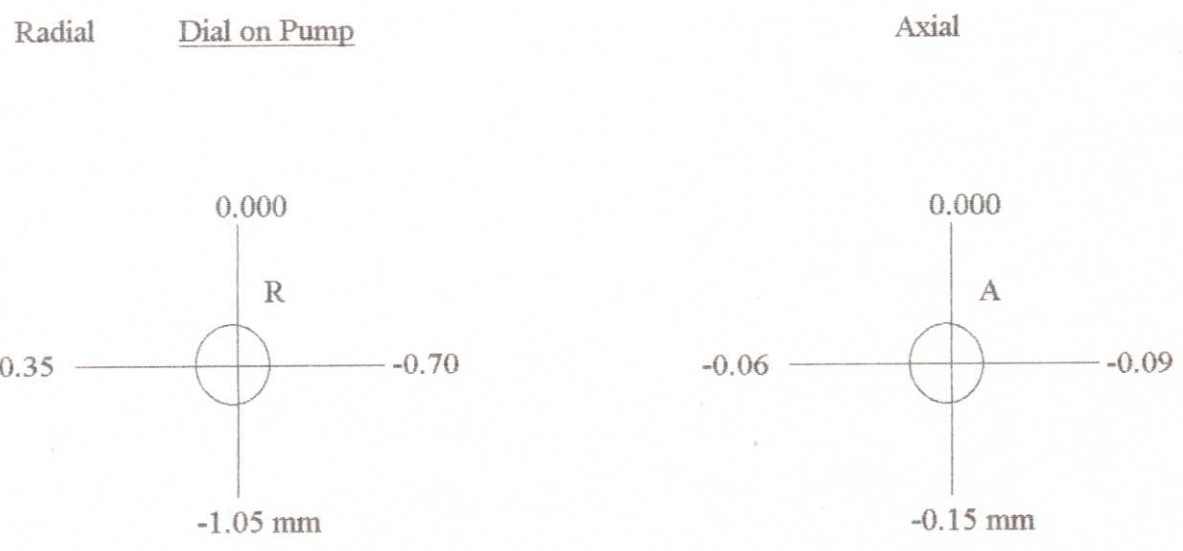
- (h) Install coupling spacer with reference to match marks.
- (i) Cleaning/replacing oil filters and oil in the console /tank.
- (j) Checking oil line, water line for leaks.
- (k) NDE end cover oil leak was rectified by replacement of gasket.

**OBSERVATION :**

(1) Conditions of coupling assembly.

- (a) Type of coupling                      :      Gear                      Float : 9.90 mm
- (b) Gear Box Shaft Hub                :      Good
- (c) Bolt Holes in Hubs                 :      -do-
- (d) Pump shaft Hub                      :      -do-
- (e) Condition of Coupling Bolts      :      -do-

(2) Alignment Readings :



(3) Axial Play of Pump Shaft (Pump thrust) : 0.20 mm

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**CODE NO      JOB DESCRIPTION**

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- (4) Bearing Condition :
- (a) Type : Plain  
DE : Good  
NDE : - do -  
Thrust Bearing : - do -
- (b) Oil Quality : Good
- (c) Bearing Clearance  
DE : 0.12 - 0.15 mm  
NDE : 0.16 - 0.17 mm  
Thrust Bearing : 0.20 mm
- (d) Oil Console & Filters cleaning : Done
- (e) Renewals : Gaskets

**03 02 09      B F W PUMP TURBINE ( SHIN NIPPON ) Q-5111 :****PREVENTIVE MAINTENANCE :**

PM jobs on this equipment was carried out as per the details given below :

- (a) Disconnecting oil lines running over and /or connected to the bearing housings top and side covers.
- (c) Removing Governor from its position and keeping safely in upright position.
- (d) Removing bearing housing top cover and cleaning of housing and bearings.
- (e) Checking bearings conditions.
- (f) Polishing the bearings and assembling .
- (g) Checking bearing clearances.
- (h) Draining Lube Oil and cleaning of sump and filters.
- (i) Mounting the Governor and connecting pipe lines in position after flushing thoroughly with dry air ( about 4-6 Kg/Cm<sup>2</sup>).
- (j) Filling up of fresh oil and checking of oil flow to bearings.
- (k) Checking of misalignment and installing coupling bolts.
- (l) Checking free rotation of the rotor.

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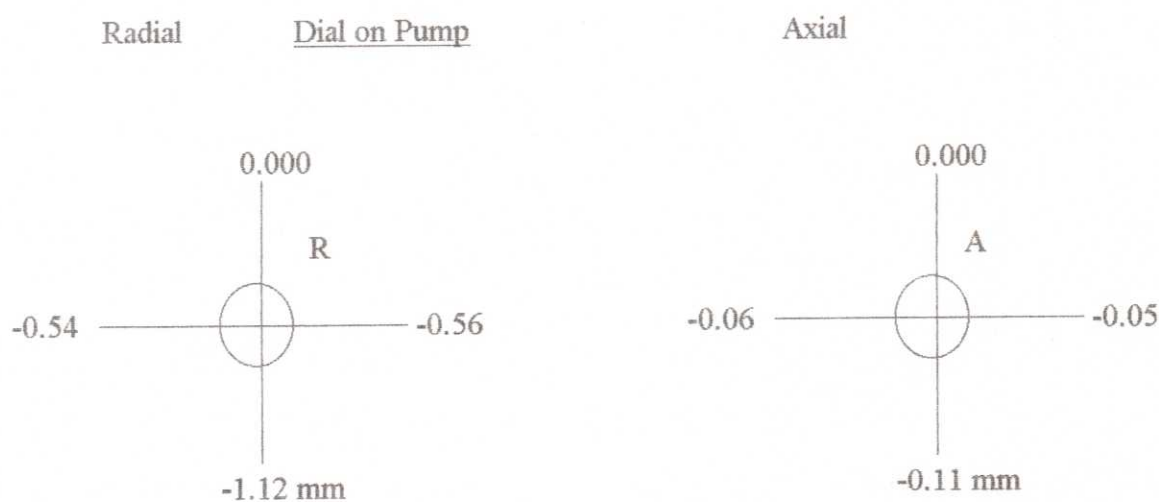
CODE NO	JOB DESCRIPTION
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OBSERVATIONS :

(1) Conditions of coupling assembly :

(f) Type of coupling	:	Gear,	Total Float : 9.9 mm
(g) Bolt Holes in Hubs	:	Good	
(h) Turbine Shaft Hub	:	Good	
(i) Condition of Coupling Bolts	:	Re -usable	

(2) Alignment Readings :



(3) Axial Play of Turbine Shaft : 0.22mm

(4) Bearing Condition :

Type	: Plain
DE	: Good
NDE	: - do -
Thrust Bearing	: - do -

(5) Oil Quality : Good

(6) Bearing Clearance ( On Assembling ) :

DE	: 0.16 to 0.17 mm
NDE	: 0.16 to 0.17 mm
Thrust Bearing	: 0.24 mm

Thickness of Thrust adjusting ring of Thrust Bearing :

Turbine Rotor side	: 1.8 mm & Governor Side : 4.17 mm.
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(7) Governor linkages : Serviced

(8) Oil lines flushing : Done

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<b>CODE NO</b>	<b>JOB DESCRIPTION</b>
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- (9) Renewals : Gaskets
- (10) Checking free rotation of the rotor : Done

**03 02 10 B F W PUMP ( MOTOR DRIVEN ) P-5112 :**

**PREVENTIVE MAINTENANCE :**

PM jobs on this equipment was carried out as per the details given below :

- (a) Removal of coupling spacer - Match marks was checked.
- (b) Checking of alignment & axial play of pump and gear shafts
- (c) Removal of DE & NDE bearings top halves
- (d) Cleaning of radial & Thrust bearings
- (e) Checking radial clearances of bearings using lead wire.
- (f) Alignment readings and bearings clearances .
- (g) Same bearings were assembled after polishing
- (h) Install coupling spacer with reference to match marks.
- (i) Cleaning/replacing oil filters and oil in the console /tank.
- (j) Checking oil line, water line for leaks.
- (k) NDE end cover oil leak was rectified by replacement of gasket.

**OBSERVATIONS :**

- (1) Conditions of coupling assembly :

Type of coupling	:	Gear,	Total Float : 4.20 mm
Gear Box Shaft Hub	:	Good	
Bolt Holes in Hubs	:	- do -	
Pump shaft Hub	:	- do -	
Condition of Coupling Bolts	:	- do -	



CODE NO	JOB DESCRIPTION
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(2) Pump To Gear Box alignment was checked following are the readings.

Dial indicator fixed on Gear Box Shaft (Dial indicator on Pump Shaft)



Motor to Gear Box alignment was checked following are the readings.

Dial indicator fixed on Gear Box Shaft (Dial indicator on Motor)



(3) Axial Play of Pump Shaft (Thrust) : 0.44 mm Corrected to 0.29 mm by shim 0.15 mm

(4) Bearing Condition :

Type	:	Plain
De	:	Good
NDE	:	- do -
Thrust Bearing	:	- do -

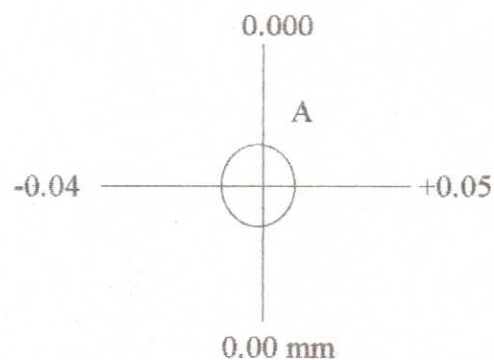
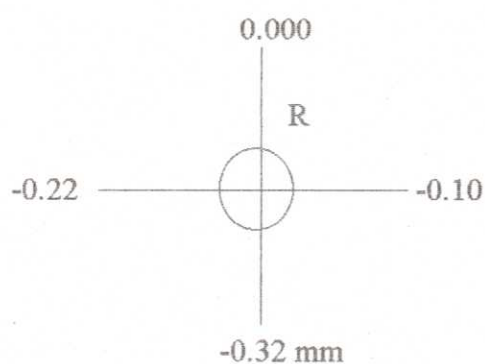
(5) Oil Quality : Good

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CODE NO	JOB DESCRIPTION
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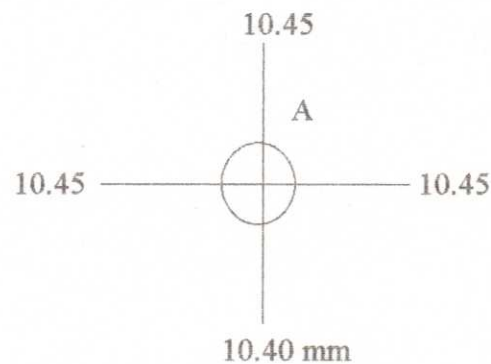
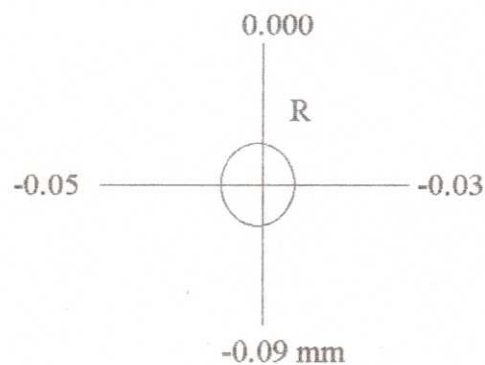
- (6) Bearing Clearance  
 DE : 0.13 - 0.15 mm  
 NDE : 0.13 - 0.14 mm  
 Thrust Bearing: 0.29 mm (provided shim of 0.15 mm )
- (7) Oil Console & filters cleaning : Done
- (8) Renewals : Gaskets
- (9) Final Alignment was checked at the time of doing coupling  
 Following are the readings:

Dial indicator fixed on Gear Box Shaft (Dial indicator on Pump Shaft)



Motor to Gear Box alignment was checked following are the readings.

Dial indicator fixed on Gear Box Shaft (Dial indicator on Motor)



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CODE NO      JOB DESCRIPTION

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High Speed Gear Box - BFW Pump :

OBSERVATIONS :

(1) Conditions of coupling assembly :

(f)	Type of coupling	:	Gear
	Total Float	:	GB to Motor - 4.92 mm GB to Pump - 4.20 mm
(g)	Gear Shaft Hub	:	Good
(h)	Bolt Holes in Hubs	:	- do -
(i)	Motor Shaft Hub	:	- do -
(j)	Condition of Coupling Bolts	:	- do -

(2) Bearing Condition :

(a)	Type	:	Plain
	DE	:	Good
	NDE	:	- do -
	Thrust Bearing	:	- do -
(b)	Oil Quality	:	Good
(c)	Bearing Clearance	:	
	<b>Input Shaft</b>		
	DE	:	0.18 - 0.20 mm
	NDE	:	0.14 - 0.13 mm
	Thrust Bearing	:	0.70 mm
	<b>Output Shaft</b>		
	DE	:	0.19 - 0.21 mm
	NDE	:	0.17 - 0.25 mm
	<b>Coupling Float</b>	:	
	Motor To Gear Box	:	7.5 mm
	Pump To Gear Box	:	7.2 mm

03 03 01      F. D. FAN TURBINE Q-5113 :

PREVENTIVE MAINTENANCE :

PM jobs on this equipment was carried out as per the details given below :

- (a) Checking of coupling floats on Motor to clutch and Clutch to fan.

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CODE NO      JOB DESCRIPTION

- (b) De - coupling & checking alignment of Turbine to Fan, Motor to clutch and Clutch to fan.
- (c) Cleaning of housings and bearings and checking bearing clearances using feeler gauge.
- (d) Checking of quality of Clutch oil and replacing with fresh oil.
- (e) Drain Lube oil and cleaning of filters.
- (f) Correction of mis -alignment between Motor to clutch and install coupling bolts.
- (g) Cleaning of oil sump and flushing all oil lines with dry air ( about 4.6 Kg/Cm<sup>2</sup>)
- (h) Filling up of fresh oil and checking of oil flow to bearings.
- (i) Check free rotation of the rotor.

**OBSERVATIONS :**

(1) Conditions of coupling assembly :

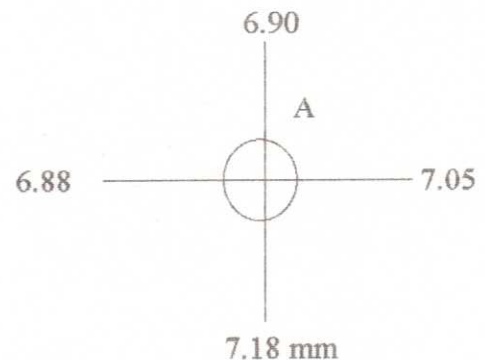
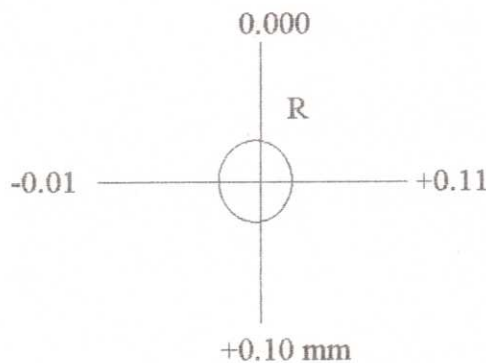
(a) Type of coupling	:	Turbine to fan - Love joy	
		Motor to clutch - Gear	Float : 3.6 mm
		Clutch to fan - Gear	Float : 2.2 mm

(b) Bolt Holes in Hubs : Good.

(c) Condition of coupling bolts : Good

(2) Turbine to fan alignment was checked following are the readings.

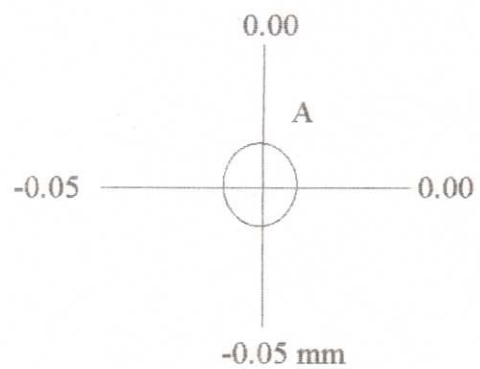
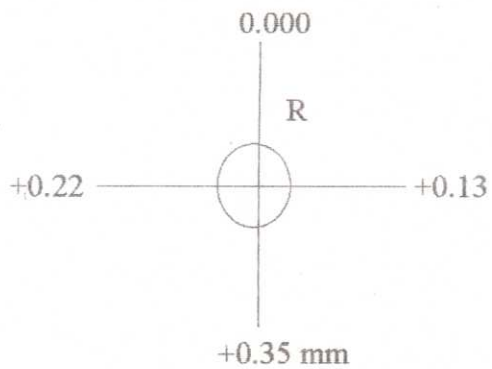
Dial indicator on Fan



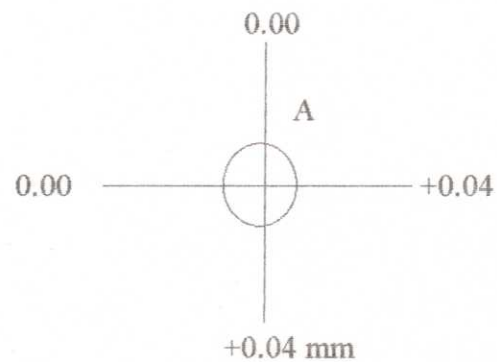
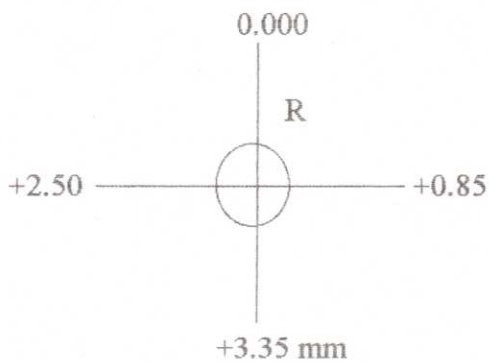
190

CODE NO      JOB DESCRIPTION

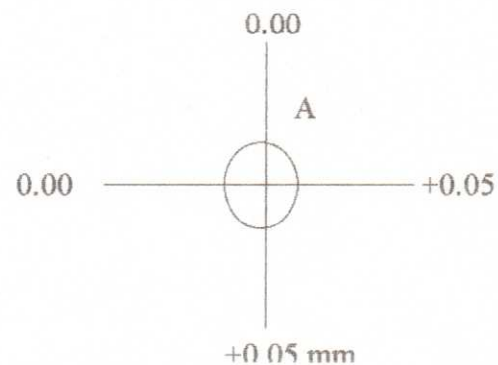
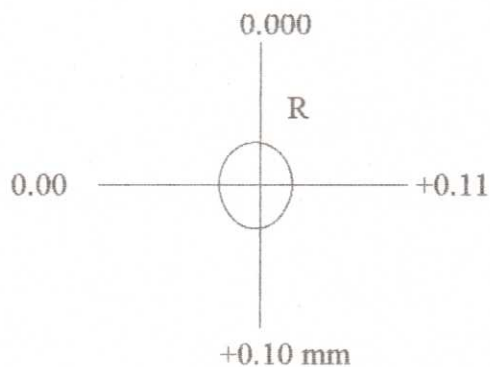
- (3) Clutch to fan alignment was checked following are the readings.  
Dial indicator on Fan



- (4) Motor to Clutch alignment was checked following are the readings.  
Dial indicator on Motor



- (5) Motor to Clutch Alignment was corrected following are the readings.  
Dial indicator on Motor



CODE NO	JOB DESCRIPTION
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(6) Bearing condition for fan :

Type : Self align spherical roller bearings  
Fan bearing turbine side : okay.  
Fan bearing motor side : okay.

Bearing clearances :  
Fan bearing turbine side : 0.007".  
Fan bearing motor side : 0.006".

(7) Oil quality : Good

(8) Oil console and filters cleaning : Done.

(9) Renewals : Gaskets

(10) Check free rotation of the rotor.

(11) 6 nos. coupling pads were replaced with new one.

(12) Coupling Float : Motor to Clutch : 3.6 mm  
Clutch to Fan : 2.2 mm

03 14 01 STEAM LEAK JOBS :

(1) All Steam leak jobs attended as per the Shutdown job list.

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

03 15 01 BHEL BOILER JOBS (F-5111) :

(A) BHEL BOILER WATER WALL SAMPLING JOB :

M/s BHEL had conducted R.L.A study in the 2000 annual turn around. As per recommendations of RLA study report & 5 years action plan approved by IBR authority, the following water wall sample has been taken for review on deposit content at BHEL, Trichi, and new pieces were welded :

(1) Front wall tube - 1 No.  
Size : 76.10D x 4.5 mm thick, SA 192 Mat.  
Length : 500 mm ( Approx. )

(2) Cut Corner Tube - 1 No.  
Size : 76.1 OD x 4.5 mm thick, SA 192 Mat.  
Length : 500 mm ( Approx. )

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CODE NO	JOB DESCRIPTION
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- (3) Rear Wall Tube - 1 No.  
Size : 76.1 OD x 4.5 mm thick, SA - 192 Mat.  
Length : 500 mm ( Approx.)

**(B) BHEL BOILER INSPECTION :**

- (1) Boiler was inspected by Boiler Inspector in open test condition on 31.03.2001. Hydrotest at 90 Kg/cm<sup>2</sup> pressure was done and witnessed by Boiler Inspector on 03.04.2001.
- (2) All the three relief valves were overhauled & tested on 06.04.2000 and their readings were as follows.

		<u>Popping Pr.</u> <u>Kg/cm<sup>2</sup>g.</u>	<u>Reset Pr.</u> <u>Kg/cm<sup>2</sup>g.</u>
Drum Rear	R.V.	72.20	67.90
Drum Front	R.V.	68.90	66.10
Super Heater	R.V.	64.70	62.80

- (3) Damper of burner made free and greasing done.
- (4) All remaining dampers were made free by greasing.
- (5) Up -graded insulation of the boiler done by calcium silicate (200 mm thick) for flue gas outlet duct from furnace up to RAH inlet and hot air duct from RAH outlet up to furnace by mineral wool.

**(C) BHEL BOILER DE SUPER HEATER BFW INLET LINE :**

For de super Heater Header , BFW feed line to spray nozzle was replaced by 1½" X Sch. 80, CS 106 Gr. B. pipe.

**(D) BHEL BOILER LONG RETRACTABLE SOOT BLOWERS (LRB'S) & ROTARY SOOT BLOWERS (RB'S) :**

Both the LRB'S LRB-1 & LRB-2 were overhauled. Lance tube and feed pipes were replaced with new one, Store Code : 335810130 & 335810533 respectively.  
All the four RB'S were overhauled and boxed up.

**(E) BHEL BOILER DEAERATOR :**

- (i) Man holes of Deaerator (V-5111) & BFW Feed storage tank (V-5112) were opened for inspection .

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CODE NO	JOB DESCRIPTION
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- (ii.) In the Deaerator column out of 5 , 4 nos. trays were found dislocated and damaged. All trays were repaired in our main workshop and the same boxed up.  
Material of construction of the tray : 304 L  
Thickness : 3 mm.

**(F) BHEL BOILER DUCT EXPANSION BELLOW :**

One Expansion Bellow of flue gas duct after RAH was replaced with new SS 304 Expansion bellow.

Size : 1 meter width x 2.5 meters height x 300 mm. long with 3 mm thick SS 304 pleats.

Two nos. of Expansion Bellows of hot air duct before RAH were replaced with new SS 304 Expansion bellows.

Size : 1 meter width x 2 meters height x 300 mm. long with 3 mm thick SS 304 pleats.

(The expansion bellows supplied by M/s Lone Star, Chennai. Type of corner joints : Camera type.)

**03 15 02 RE -GENERATIVE AIR PRE-HEATER H-5111 :**

**PREVENTIVE MAINTENANCE :**

- (1) All the 12 segments of Cold End baskets were replaced with new one.

Store Code : 335701018.

- (2) General condition of Hot End Baskets was found o.k.

- (3) 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 charged.

Bearings Clearances were checked and this is the readings :

Clearance hot end bearing : 0.025"

Clearance cold end bearing : 0.020"

- (4) Cold End Radial Seals were replaced with new one, as the old seals were corroded.

- (5) Radial seal clearances of Hot End side & cold end side adjusted.

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



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CODE NO      JOB DESCRIPTION

(7) Radial seal clearances of Hot End side & cold end side adjusted & following is the readings.

R.A.H. COLD END

		<u>INBOARD</u>	<u>OUTBOARD</u>
<u>DESIGN CLEARANCE</u>		<u>0.00 MM</u>	<u>4.5 MM.</u>
BASKET	NO.1	0.5 MM	4.0 MM
	NO.2	0.4 MM	4.5 MM
	NO.3	0.5 MM	4.5 MM
	NO.4	0.5 MM	4.5 MM
	NO.5	1.0 MM	5.0 MM
	NO.6	1.2 MM	5.0 MM
	NO.7	1.0 MM	5.25 MM
	NO.8	0.75 MM	5.25 MM
	NO.9	0.60 MM	5.00 MM
	NO.10	0.70 MM	5.5 MM
	NO.11	0.5 MM	5.5 MM
	NO.12	0.5 MM	5.6 MM

R.A.H. HOT END

		<u>INBOARD</u>	<u>OUTBOARD</u>
<u>DESIGN CLEARANCE</u>		<u>3.80 MM</u>	<u>0.00 MM.</u>
BASKET	NO.1	5.0 MM	1.5 MM
	NO.2	6.0 MM	1.6 MM
	NO.3	5.0 MM	1.6 MM
	NO.4	5.5 MM	1.6 MM
	NO.5	5.5 MM	1.6 MM
	NO.6	4.7 MM	1.5 MM
	NO.7	5.25 MM	1.6 MM
	NO.8	5.5 MM	1.7 MM
	NO.9	5.16 MM	1.5 MM
	NO.10	5.5 MM	1.5 MM
	NO.11	5.5 MM	1.5 MM
	NO.12	0.6 MM	1.6 MM

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**CODE NO      JOB DESCRIPTION**

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**03 20 01      FABRICATION JOBS :**

- (1) Surface condenser outlet cooling water line main isolation 12" valve bypass line 4" X Sch 40 with cs 4" gate valve provided for controlling of cooling water flow.
- (2) Bypass arrangement for atomizing steam pressure control valve (PICV-2) at BHEL Boiler provided.
- (3) 3" NB CW tapping supply and return taken for W.S A/C Plant for Ammonia Storage area as per scheme TM/02/1600 at pipe rack at back side of Boiler.
- (4) RAH Washing pump suction line modification done ( tapping taken from Deaerator drain line ) as per EWR NO. SG-54.
- (5) Suction line of P-4418 - A/B (10" NB SCH. 40 CS Pipe) replaced with new one as the thickness reported was more than 31%.
- (6) 4 nos. Elbows of BFW Pump P-5111 / P-5112 Discharge line (6" NB X SCH. 80 , SA 106 DR. B) to Ammonia plant LT Convection zone BFW Coil were replaced with new one as the thickness reported was more than 25%.
- (7) P-4401 C/D Cooling Water discharge header tapping for instrument impulse line was removed 6" NB SCH. 40 CS Pipe extended up to ground level provided for de watering or draining out the main under ground Cooling Water header.
- (8) Condensat drain line before 40 ata steam inlet valve (1/2" NB ) provided in the LSHS Pump Turbine (Q-5114) to facilitate draining out the condensate at the time of startup of the LSHS Pump Turbine.
- (9) 4" sch. 10 , SS 304 Line with sparger was provided for strong effluent tanks T-4501 A & B to facilitate draining of ammonium hydroxide fro ammonia plant.
- (10) Corroded Instrument Air Header for cation in DM plant was replaced with new header of SS 304.
- (11) 6" NB CS Sch 40 with isolation valve interconnection provided for Bore well no. 11 to Raw Water Pump C suction line at RAW water tank area.
- (12) 24" NB , 6 MM Thick corroded / punctured cs line under railway track near railway gate no.2 replaced with new 24" NB , 10 MM Thick fabricated pipe.
- (13) Torque Tube assembly of cooling tower fan A-8 was replaced with new one supplied by M/S Paharpur.

PLANT TURNAROUND - MARCH - APRIL - 2001

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OFFSITE & UTILITY PLANTINSPECTION JOBS

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CODE NO	JOB DESCRIPTION
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INSPECTION JOBS :

During March-April-2001 Shutdown, inspection of BHEL Boiler was carried out. Also, thickness measurement of CW lines, BFW pipelines and steam lines was carried out.

**03 41 01** BHEL BOILER ( GT-2068 ) :

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

**(1)** STEAM DRUM :

- a) The internal surface of the drum had assumed blackish colouration.
- b) All the weld joints were found in good condition and free from any corrosion attack.
- c) All the internal fittings were found intact.
- d) The stub ends of the tubes were found free from defects.
- e) Overall condition of the steam drum was found to be satisfactory.

Ultrasonic thickness measurement was carried out. Min. thickness was observed to be 100.9 MM against nominal specified thickness of 97 MM in cylindrical shell area and 78.7 MM on dished end against nominal specified thickness of 77 MM.

**(2)** MUD DRUM:

- a) The shell had assumed blackish colouration.
- b) The condition of the weld joints was found satisfactory.
- c) The tube stub ends were free from any defect.
- d) In general, the overall condition of the mud drum was found satisfactory.

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CODE NO      JOB DESCRIPTION

Ultrasonic thickness measurement was carried out. Min. thickness was observed to be 82.2 MM in cylindrical shell area against nominal specified thickness of 78 MM and 53.3 MM on dished end against nominal specified thickness of 57 MM. ( 54 MM min. specified ).

(3) FURNACE TUBES:

In general, the condition of the furnace tubes and superheater tubes exposed to flue gases is satisfactory. The thickness measurement of Stage-I & II Primary and Secondary Superheater tubes, Bank tubes, Sidewall tubes, Baffle wall tubes, D-Panel tubes, Cut corner tubes, Rear wall tubes and Front wall tubes, boiler side wall tubes below shield wall tubes was carried out. The detailed report indicating the thickness of individual type of the tubes is mentioned below :

SL. NO	DESCRIPTION	MIN. THK. (MM)	DESIGN THK.(MM)	% RED.
1	SOUTH MANHOLE:			
(A)	BAFFLE WALL TUBES	4.8	4.5	-
(B)	D-PANNEL TUBES	4.8	4.5	-
(C)	CUT CORNER TUBES	5	3.2	-
(D)	REAR WALL TUBES	4.7	4.5	-
(E)	FRONT WALL TUBES	4.7	4.5	-
2	NORTH MANHOLE:			
(A)	BANK TUBES	3.5	3.6	-
(B)	BAFFLE TUBES	4.8	4.5	-
(C)	NORTH SIDE WALL TUBES	4.4	4.5	-
3	PRIMARY SUPERHEATER TUBES INSIDE FURNACE	6.2	7.1	9.89
4	SECONDARY SUPERHEATER TUBES INSIDE FURNACE	5	5.6	7.12

- (4) Three nos. sample pieces were cut from the furnace tubes for destructive testing and deposit analysis by M/S. BHEL as desired by them based on the RLA Study carried out during April,2000 shutdown.The replacement of the cut segments of the tubes was carried out with new tube pieces. The root and final welds were DP tested followed by radiography. Necessary repairs were carried out and DPT & Radiography were carried out subsequently.
- (5) Performance qualification test of the welders employed by the agency m/s. Skywin erectors was carried out.total two welders were qualified for butt welding of the tubes. Necessary bend test and radiography were carried out on the test pieces.

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CODE NO	JOB DESCRIPTION
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(6) In the Boiler area, thickness measurement of the following pipelines was carried out :

- a) BFW line: Four nos. of bends were replaced during this shutdown due to thickness reduction. Min. measured thickness was 7.7 mm against 10,97 mm installed thickness.
- b) Superheater header feedwater inlet pipe, 1.5" NB: 29 % thickness reduction was observed and hence a segment of this pipe line was replaced during this shutdown. It is recommended to replace the complete length of this pipe line during next shutdown.

03 41 02 PIPE LINES THICKNESS MEASUREMENT IN COOLING TOWER AREA :

The following pipelines were also inspected for thickness in the Cooling Tower area.

- a) Cooling water basin drain pipe : Heavy external corrosion was observed on this pipe. The spool piece was covered with the patch plate to avoid chances of leakage. The drain pipe may be replaced during next opportunity.
- b) 52" Cooling water interconnection line between Cooling water pump P-4401/E and P-4401 / D sumps : Thickness was found to be normal. However, surface scaling / corrosion as observed on this pipe line inside surface.
- c) P-4401E (P-4404) Suction line : Min. thickness was found to be 8.3 mm.

03 41 03 G I D C WATER PIPE LINE :

GIDC water pipe line, 24" NB near the Security Gate no. 2 ( Near 66 KV station) was partly replaced during this shutdown due to the leakages observed in the past. DP Test of the weld joints after the root run and after the final pass were carried out. The defects detected during the test were rectified and DP test was carried out again till the joints were acceptable.

03 41 04 OFFSITES AREA :

During Shutdown, March-April, 2001, the following jobs were carried out:

- 1) LSHS Tank, T-3201B Roof replacement job was carried out by M/S. Technocon, Baroda. All the joints of the newly fabricated roof plate were examined by Dye penetrant test after welding. The defects detected during the test were rectified followed by dye penetrant test.
- 2) Thickness measurement of the following pipe lines was carried out:
  - (a) Ammonia Loading pump, P-3102 A/B Discharge line: Min. thickness was observed to be 6.6 mm. During this shutdown, the cold insulation of this pipe line was replaced partially.
  - (b) Ammonia circulation pump, P-3103 A/B Suction and Discharge line: Min. thickness was observed to be 3.5 mm in the discharge line and in the suction line, it was 5.0 mm. During this shutdown, the cold insulation of these pipe lines was replaced partially.

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PLANT TURNAROUND - MARCH - APRIL - 2001

OFFSITE & UTILITY PLANT

CIVIL JOBS

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CODE NO	JOB DESCRIPTION
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03 51 01     CIVIL JOBS :

(A) WATER TREATMENT PLANT :

- 1) Repairing of acid proof brick linings in strong effluent tank no. A & B.
- 2) Replacement of acid proof brick lining of top of wall weak effluent sump.
- 3) Repairing of supports for pipeline in Water treatment plant & floor of H<sub>2</sub>SO<sub>4</sub> tank near cooling tower sump side.
- 4) Repairing of floor by bitumastic lining for SB assembly unit and around Anion tank in water treatment plant.
- 5) Maintenance of strong and weak effluent channel and repairing of strong as well as weak effluent chambers in water treatment plant upto effluent tank.

(B) BOILER HOUSE :

- 1) Repairing of casting refractory for burners side, floor and superheater zone inside BHEL boiler.

(C) NAPHTHA HANDLING AREA :

- 1) Bitumastic lining around old ammonia storage tank.

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OFFSITE & UTILITY PLANT

ELECTRICAL JOBS

CODE NO	JOB DESCRIPTION
03 61 01	<p><u>ELECTRICAL JOBS :</u></p> <p>(A) <u>UTILITY AREA :</u></p> <ol style="list-style-type: none"><li>1) Maintenance job carried out on following transformers. TR- 2A, TR- 2B and TR- 8 for<ol style="list-style-type: none"><li>a) Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.</li><li>b) Insulation resistance measurement of winding in primary and secondary side.</li><li>c) Breakdown value of oil of marshalling boxes and main tank were taken.</li></ol></li><li>2) Preventive maintenance carried out on all feeder compartment mounted on the following MCCs. MCC-1, MCC-2, MCC-2A, MCC-2B/2E, MCC-2F.<ol style="list-style-type: none"><li>a) checking the tightness of outgoing terminal.</li><li>b) Cleaning the feeder compartment.</li><li>c) Replacement ofvdamaged connectors, etc.</li></ol></li><li>3) Overhauling of following motors were carried out : P-5111, P-5112 / A, P-5112 / B, P-5117 and P-5119.</li><li>4) Preventive maintenance jobs were carried out in 66 KV switch yard. :<ol style="list-style-type: none"><li>a) Cleaning of insulator of all the CT &amp; PT units, bus bar supports, lighting arrester, breakers, etc.</li><li>b) All the moving parts of isolators were cleaned and lubricated.</li></ol></li></ol>

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CODE NO	JOB DESCRIPTION
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- c) 11 KV VCB panels were cleaned and outgoing cable terminals were checked for its tightness or hot spot.
- d) Out door breakers were cleaned and checked its operation.
- e) Meggar value of all the CT unit were measured .
- 5) In the 11 KV sub station, Siemens panel were opened for cleaning. All the joints were checked for its tightness and busbar were provided with 'KBLDON' insulating tape.

**(B) OFFSITES AREA :**

- 1) Maintenance job was carried out on following transformers.  
TR-4A and TR-4B for
  - a) Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.
  - b) Insulation resistance measurement of winding in primary and secondary side.
  - c) Breakdown value of oil of primary & secondary side marshalling box is taken.
- 2) Preventive maintenance were carried out on all feeder compartment mounted in MCC-3.
  - a) Checking the tightness of outgoing terminal.
  - b) Cleaning the feeder compartment.
  - c) Replacement of damaged connectors, and lyra contacts, etc.
  - d) One compartment from section B was removed and shifted to MCC 14.
  - e) Vertical bus bar adopter was replaced with new one in FDR 5R.



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OFFSITE & UTILITY PLANT

INSTRUMENTATION JOBS

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CODE NO	JOB DESCRIPTION
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03 71 01      NEW BOILER JOBS :

CONTROL ROOM PANEL INSTRUMENTS :

- (1) Following Receiver / Recorders were cleaned and checked the calibration..  
(General cleaning, Cleaning of Orifices, Flapper Nozzle, seal checking was done)  
PR1, PR2, PRC5, PR15, PRC22, PIC5151, FR2, FR3, FR4, TRC4, TRC5, LRC2,  
LRC3, LRC 4, FRC1, FRC11, FRC22, FRC21, FR 22 .
- (2) Following Set point Tx. were cleaned and checked the calibration.  
PR1/PR2, FR3/FR4, TRC4, TRC5, LRC3, FRC1, LRC2, PRC5, FRC11, FRC21,  
FRC22, PIC5151.
- (3) Following Controllers were cleaned and checked the Synchronization.  
(Cleaning of Orifices, Flapper Nozzle)  
TRC4, TRC5, LRC3, FRC1, LRC2, PRC5, PIC 22, FRC11, FRC21, PIC 5151,  
( PRC 5, LRC 2 - Controller was replaced with repaired one as it was not working  
properly.) ( PIC 5151 - Controller was replaced with repaired one as air leakage  
was found from seal port. )
- (4) Following Receiver switch set value were checked  
PSL2, PSL 7, LAL 3, LAH4, PSL 8, FSL 5111, PSL 6, FSL 2, FSL 11, FSL 2,  
PSL 4, PSL 41, TIA 6.
- (5) Following Temp. Indicator / Recorder were cleaned and checked.  
TIA 6, TIA 7, TIA 14, TR 13.
- (6) Air regulators behind Control Panel were cleaned , overhauled.
- (7) Following Square Root Extractor 's relay, flapper - Nozzle were cleaned .  
FSQ 1, 2, 3, 4, 11, 21, 22.
- (8) All wiring terminals of BMS Panel & Main Control Panel were cleaned and tighten.

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**CODE NO      JOB DESCRIPTION**


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**03 71 02      UPS SYSTEM :**

- (1) Replaced the CR4 Contractor ( Mains to UPS Load Transfer in Inverter panel) with new one as it sometimes got stuck-up ( while checking) when load transferred from Mains to Inverter.
- (2) Removed the Battery bank ( both A and B ) of UPS M/s Keltron and replaced with new Battery Bank of M/s IL UPS as all batteries of Bank -A and Bank - B of M/s Keltron UPS got defective. (UPS got tripped in Under Voltage when UPS load comes on Batteries. Batteries didn't get charged by UPS charger and got discharged within 2 sec.)
- (3) Checked the performance of batteries ( New Battery Bank of M/s IL UPS) by putting charger OFF/ON for 5 minutes. It found o.k.
- (4) Checked the overall performance of UPS. It found o.k.
- (5) New alarm "Load on Mains" provided on annunciator ( AU-1 , W-14) as per requirement of production. Checked the alarm by putting UPS load on Mains. found o.k.
- (6) Cleaned the whole UPS panels with air.

**03 71 03      FIELD INSTRUMENTS JOBS :**

- (1) Following Flow transmitters and air regulators were cleaned and checked the calibration of Tx / Receiver gauge. FT 1 (Pneumatic & Electronic Both), FT 2, FT 3, FT 11, FT 13, DPT 1, DPT 14, DPT 12.  
Note : Calibration range of FT 3 -- 0-325 " H<sub>2</sub>O (earlier it was 0-850 " H<sub>2</sub>O)
- (2) Following Pressure transmitters and air regulators were cleaned and checked the calibration of Tx / Receiver gauge  
PT 1, PT 2, PT 4, PT 5, PT 22.
- (3) Following Level Transmitter and regulators were cleaned and checked the calibration of Tx / Receiver gauge. LT 1, LRC 2, LRC 4, Blow Down Level Tx, Day Tank Level Tx. (range - 62.44 to 145.7 " H<sub>2</sub>O).  
Note : Glycol was filled in Day tank level tx. impulse line.
- (4) Following pneumatic Controller (440 R) & air regulator were cleaned and checked the calibration. DPC 1, TIC 2, PIC 1, LRC3 (Blow Down Tank level controller), Soot Blower steam pressure controller, Oil Header Pressure controller, PIC 50.

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- (5) Following pressure & level switch were cleaned and checked/Calibrated the set value.  
 Day Tank High/Low Level , Dearator Extra low level, low level, High level, Drum level  
 Extra low level (LSLL 1),LAL 2, LAH 3, LAH 4,PAL 5114, PLCI 5112, PLCO 5111,  
 PAL 5115, PLCI 5114, PLCO 5113, PAL 5114, PLCI 5113, PLCI 5112, PSH 12,  
 PAH 11, PSL 2, PSL 7, PAL 4, PSL 6, PSL 8, FSL 2, FSL 11, PSL 41, PSL 24,  
 PSL 25, PSL 26, PSL 27.

[ LAL2 ( Drum Lvl low) ----- Replaced the micro switch element with new one.]

(6) Limit Switches

- (a) Burner no 1 & 2 main gun engagement limit switches replaced with new one.
- (b) All BTV's limit switches( BTV 1-1, 1-2,1-3,BTV 2-1,2-2,2-3)were cleaned and checked it's operation.
- (c) HOHTV, IGTV, CCV21,CCV22 limit switches were cleaned and checked it's operation
- (d) All Manual Main Gun Oil/Atomising Valve limit switch were cleaned and checked the operation.
- (e) All Fuel Air Damper's limit switch were cleaned and checked it's operation.

(7) CONTROL VALVES :

(1) PICV 5151

- \* Dropped the control valve for inspection of Plug & Seat , valve passing and to check the C/v response.
- \* Overhauled the hand wheel ,grease gun, valve body with actuator, Air Lock Relay, Air Regulator.
- \* Replaced the Plug , Seat, Cage, Valve positioner , Actuator Diaphragm with new one.
- \* Removed the all gland packing and refilled new packings.
- \* Assembled the whole valve and Checked/Adjusted the valve stroke.
- \* Replaced the Air tubing with 3/8" S.S. tube for better performance.
- \* Checked the Control valve response from control room as well as from local.found o.k.

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\* Flushed the signal tube with 7.0 Kg/cm<sup>2</sup> air pressure from boiler control room to valve.  
(Note :opening/closing time -15 to 20 sec,earlier it was in between 30 to35 sec.)

\* Painted the control valve.

(2) PCV 1( 60 to 14 ata Atomising steam let down)

\* Control valve removed from line for Plug/ Seat Inspection. Found o.k.

\* Gland packing was filled. Overhauled valve positioner, Air Regulator.

\* Checked/adjusted the valve stroke.

(3) 30 % BFW C/v

\* Replaced the valve actuator with positioner, Hand Jack assembly with new one.  
(Old was broken from yoke)

\* Cleaned / overhauled the air regulator, valve. Provide 3/8" S.S. tubing for valve positioner.

\* Gland packing was filled. Checked/adjusted the valve stroke.

(4) BTV 1-2 valve as removed from line for steam flushing as requirement of production and installed back after flushing.

(5) PCV 2 control valve down stream flange leakage attended by providing proper gasket.

Following control valves & it's positioner were cleaned and checked the stroke.

(a) FCV 1(100% BFW), BFW Bypass Valve, PCV 2, LCV 4, PCV 1, TCV 2  
(Gland packing was done, changed the air regulator) , TCV 1, PCV 50,Oil Header  
Pr.c/v, Soot Blower Valve, Dearator overflow C/v.

(b) BTV 1-1, BTV 1-2, BTV 1-3, BTV 2-1, 2-2, 2-3, CCV 21, CCV 22, HORV,  
HOHTV, GHTV, IGTV.

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## (8) DAMPERS.

Following dampers overhauling and checked its operation.  
(Checked / overhauled limit switches, solenoids, air regulators etc.)

- (a) Fuel Air Damper : Replaced the actuator for both fuel air damper with new one. Overhauled the damper positioner, limit switches, air regulator, solenoid. Checked the performance. Found o.k.
- (b) F.D. fan inlet damper and its valve positioner.
- (c) F.D. fan outlet damper.
- (d) Air heater inlet damper.
- (e) Air heater outlet damper.

## (9) IGNITORS :

Both Burner's ignitor gun & spark plug cleaned and checked.  
Ignitor gas solenoid valve was overhauled and checked.  
Both gas & Oil flame scanners were cleaned and checked.

- (10) Following Drum Pressure gauges were calibrated for production requirement for Boiler hydro testing.  
PI-2, PI-3, PI-4, PI-5, LI-1 (Receiver Gauge)
- (11) All furnace draft impulse lines were flushed with 7.0 kg/cm<sup>2</sup> air.
- (12) Following solenoid valves were cleaned and checked for operation.  
  
BFW Turbine governor oil trip.  
FD Fan turbine governor oil trip.
- (13) Modified the FE-3 (60 ata steam to FD Fan turbine) flow element (orifice) diameter (in Mech w/s) as per the requirement of production/process dept after removal of orifice by m/m.
- (14) Furnace Temp t/c with t/w was replaced with new one as it was found burnt.
- (15) O<sub>2</sub> analyser sample tube, filter and whole system were cleaned from inside as well as outside of air duct.

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CODE NO	JOB DESCRIPTION
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(16) Done all instrument related job as per mech. requirement BFW pump ( Motor / Turbine driven) pressure switches, Techo generator, THI & PI where removed and installed back.

(17) Attended plant start up jobs.

\* Steam header thermowell leakage attended. provided new copper gasket.

\* PT-4 Steam Pr.(60 kg/cm<sup>2</sup>) Tx. impulse line leakage attended.

\* Oil Burner No.1 ON indication attended.( adjusted the limit switch.)

\* Raw water flow indication attended( signal tube was found leakaged)

03 71 04 COOLING TOWER :

(1) Control Valve

Following c/v and it's positioner, Air Regulator were cleaned and checked the stroke PICV 5153.

- \* Drooped the control valve for inspection of Plug & Seat , heavy gland leakage. ( Plug was found in cracked position )
- \* Overhauled the hand wheel ,grease gun, valve body with actuator, Valve positioner, Air Regulator.
- \* Replaced the Plug , Seat, Cage , with repaired one.
- \* New Yoke tightening check nut ( prepared in w/s ) provided as original got cracked / corroded.
- \* Removed the all gland packing and refilled it.
- \* Lapping was done on seating portion of plug to stop passing at tight shut off.
- \* Checked the actuator response. Assembled the C/v and installed it back Checked / adjusted the stroke.
- \* Assembled the whole valve and Checked / Adjusted the valve stroke.

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CODE NO	JOB DESCRIPTION
	<ul style="list-style-type: none"> <li>(2) Following Flow/Pressure/Level Tx. were cleaned / overhauled and calibrated Raw Water Inlet Flow Tx.( Annubar - 24 " line cleaned the flow element ), C.T. Basin level Tx, Q-4401A/B Steam Flow To Turb Tx (FT 1090).Q-4403 Stea Flow to Turb, Raw Water Tank to C.T. Flow Tx., FT 1091 Condensate flow, Surface cond . Lvl Tx.</li> <li>(3) Following Pressure/ Level Switch were cleaned and checked the set value. Surface cond. High, Low, High.- High level switch.</li> <li>(4) Q- 4411 Turb. North and south side radial vib probes , speed pick-up unit was removed &amp; installed as per mech. requirement.</li> <li>(5) Q-4401B &amp; Q-4403 techo generator were cleaned and checked.</li> <li>(6) Checked and tightened all wiring terminals of control panel.</li> </ul>
03 71 06	<p><u>I.G. PLANT :</u></p> <p>Attended all running jobs.</p> <ul style="list-style-type: none"> <li>(1) K-5305 Inst. Air Comp. Lube oil pr. Switched was replaced by new one as it was found leakaged.</li> <li>(2) Replaced the solenoid valve of ammonia vapouriser lvl. C/v.</li> </ul>
03 71 07	<p><u>NH3 STORAGE :</u></p> <ul style="list-style-type: none"> <li>(1) K-3001 A / B NH3 Compressor</li> </ul> <p>Following control valve and it's positioner were cleaned ,checked the c/v stroke, and painted. EMV 3001, ESDV, PCV 3008( New Tank Flare Stack c/v)</p> <ul style="list-style-type: none"> <li>(2) PIC 3103 Local Controller were cleaned and synchronized.</li> <li>(3) K-3101 NH3 Compressor Full / Half Load Pressure switch were setting value checked.</li> <li>(4) All control valves &amp; it's local controller related 3 LSHS Tank A ,B and C were overhauled and checked the operation</li> <li>(5) New level float was installed in LSHS tank -B as old float was got damaged. New Float rope and Guide rope was provided.</li> <li>(6) All electrical JB , RTD JB were cleaned and tightened all wiring terminals.</li> <li>(7) All SLPC indicators / controllers / recorders , Hybrid Recorders were cleaned and checked the Back up Battery.</li> </ul>

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CODE NO	JOB DESCRIPTION
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(8) Cleaned, checked and tightened all terminals inside old panel, new panel, PLC panel.

03 71 08 WEIGH BRIDGE (MAIN GATE) :

Following jobs has been done .

(1) Following jobs has been done .

( Service engineer From M/s Gujarat Scale was came to attend the job )

- \* Removed the platform and cleaned the whole weigh bridge.
- \* Checked / Done the alignment of load cell mounting assembly. Overhauled the load cell mounting assembly.
- \* Replaced the distance pieces (6 nos.) one by one with new one.
- \* Calibrated the corners of weigh bridge with std. weight.
- \* Calibrated the weigh Bridge with standard weights.  
(checked the calibration upto 28 tones)
- \* Cleaned the power stabilizer / digital indicator / Computer.
- \* Painted the weigh bridge after scrubbing it.( inside as well as outside)



PLANT TURNAROUND - MARCH - APRIL - 2001

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OFFSITE & UTILITY PLANTTECHNICAL DEPARTMENT JOBS

CODE NO	JOB DESCRIPTION
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03 81 01 TECHNICAL DEPARTMENT JOBS :(A) MECHANICAL JOBS :◆ EWR NO.IG-21 DATED 13.08.1999

Shifting of SPC Unit from IG Plant to DM Plant with inter connected piping.

◆ EWR NO.SG-53 DATED 21.09.1999

Shifting of H-5113/C & related piping work, tappings for proposed new heater (H-5113/D), modification of steam condensate and oil drain lines job completed on 08.04.2001.

(B) INSTRUMENTATION JOB :◆ EWR NO.CW-78

- i. Raw water level indication in DM Plant and new boiler job was completed.
- ii. SPC Unit two number flow transmitter shifted alongwith its primary elements to new location in DM water plant with their local indication.
- iii. Thermowell alongwith its temp. gauge removed from H-5113/C outlet & fixed in H-5113/C outlet after shifting it to new location in Boiler Area.

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B&MH PLANTMECHANICAL JOBS

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CODE NO	JOB DESCRIPTION
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04 03 01 RECLAIM MACHINE M-2116 :

Following jobs were carried out during plant turnaround-2001.

- Centering of king-post with respect to pivot centre done .
- All six rollers of upper king-post serviced .
- Link conveyor gear box overhauled by replacing Coupling bolts, bushes, oil-seals and oil.
- Link conveyor carrier rollers removed, serviced for easy movement and replaced.
- Link conveyor return rollers removed, serviced and replaced.
- Link conveyor Tail pulley adjusting mechanism serviced and belt is adjusted.
- New skirt rubber with clamping structure provided in link conveyor.
- Lower pivot assembly replaced by repaired one with new mounting plates.
- Tie - rope replaced.
- Both idler pins of gear-train replaced with new MS spacer and bearings.
- Scraper shaft of Gear-train dismantled and assembled with new bearings ( inner and outer brg. housing) and MS spacers.
- Bucket elevator chain attended for replacement of damaged pins, circlips and chain-links.
- Top bucket elevator shaft, chain sprockets, end bearings and helical spring washers inspected and found o.k.
- Thruster oil replaced and brake shoes checked.
- Fluid coupling oil replaced.
- Coupling bushes of FC-16 of main gear - box replaced.

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CODE NO	JOB DESCRIPTION
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- Swing gear box attended for replacing coupling bushes and tightening of cover bolts.
- Hub and lantern pinion assembly dismantled and assembled after checking the gap and shear pins.
- All swing rack pins cleaned and greasing done.
- Cardium compound provided in wire rope.
- Pedestal bearings of both rear and front axle checked and greasing done.
- Limit switch set for maximum up and down movement of scrapper arm. (Upper - 65 deg and Lower - 5 deg.)
- Scrapper chain adjusting mechanism at front side serviced.
- Complete greasing of all greasing points and bearings of reclaim machine carried out.
- Complete cleaning and painting of R/M done.

04 03 02

PREVENTIVE MAINTENANCE OF PACKER SCALES :

Following preventive maintenance jobs were carried out.

- Packer scale no.1 attended for replacement of brgs. of bottom flapper and bottom rubber gasket. Gate assy. and bucket assy. overhauled. All air cylinders serviced and replaced. Sack grip assy. replaced.
- Packer scale no. 2 attended for replacement of gate assy. and air cylinders. Sack grip assy. overhauled.
- Packer scale no. 3 attended for overhauling of gate assy., bucket assy., and air cylinders. Sack grip assy. repaired by replacing both side bearings.
- Packer scale no. 4 attended for replacement of both brgs. of bottom flapper. Air cylinders replaced. Coarse and fine feed gate assy. and sack-grip assy. overhauled.
- Packer scale no. 7 attended for overhauling of gate assy., bucket assy. and air cylinders. Both bearings of bottom flapper replaced. Sack grip assy. replaced.
- Packer scale no. 8 attended for replacement of complete bucket assy. and coarse & fine feed gate assembly. All air cylinders overhauled. Both bearings of bottom flapper replaced. Sack grip assy. overhauled.

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CODE NO	JOB DESCRIPTION
04 21 01	<p><u>PLANT TRANSFER CONVEYOR M-2110 :</u></p> <p>Following jobs were carried out</p> <ul style="list-style-type: none"> <li>• All packer scales calibrated.</li> <li>• Sliding metal doors provided in all four side openings of gate assy. structure to prevent spillage of urea.</li> <li>• Complete cleaning and painting done.</li> </ul>
04 21 02	<p><u>FRESH UREA SHUTTLE CONVEYOR M-2112 :</u></p> <p>Following jobs were carried out</p> <ul style="list-style-type: none"> <li>• Gear box attended for cleaning, replacement of oil seals, oil, coupling bolts and bushes. Coupling done after proper alignment.</li> <li>• Snub pulley fitted with pedestal bearings near head pulley replaced.</li> <li>• Greasing done in all brgs. of head pulley, tail pulley, snub pulley, and gravity pulley.</li> </ul>
04 21 03	<p><u>RECLAIM CONVEYOR M-2117 :</u></p> <p>Following jobs were carried out</p> <ul style="list-style-type: none"> <li>• Gear Box attended for cleaning, replacement of oil seals, oil, coupling bolts and bushes. Coupling done after proper alignment.</li> </ul>

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CODE NO	JOB DESCRIPTION
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- Pedestal bearing of snub pulley near head pulley replaced.
- All damaged return rollers replaced with repaired rollers.
- Complete greasing done of all bearings of head pulley, tail pulley, snub pulley and gravity pulley.

04 21 04 BAGGING FEED CONVEYOR M-2121 :

Following jobs were carried out

- Gear box attended for cleaning, alignment and coupling.
- Diverter flapper valve of M-2121 conveyor attended for free and easy operation. Air cylinders overhauled.
- Head pulley scrapper rubber (12 mm thk.) replaced and serviced for free operation.
- Complete skirt rubber with inner rubber sheet replaced.
- Return rollers removed, repaired for free operation and replaced.
- Complete greasing of all pedestal bearings done.
- Complete cleaning and painting of structure done.

04 21 05 BAGGING HOPPER FEED 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.
- Pedestal bearing of head pulley ( G.Box side) replaced.
- Hopper structure strengthened.
- Diverter plate of 3 and 4 hopper overhauled.
- Skirt rubber with inner rubber sheet replaced.
- Gear box of tripper of M2122 conveyor overhauled.

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CODE NO	JOB DESCRIPTION
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- All damaged return rollers replaced by repaired rollers.
- Complete greasing in all bearings done.
- Complete cleaning and painting of conveyor structure done.

04 21 06 BELT CONVEYOR, M 2122 A/B :

Following jobs were carried out :--

- Both gear boxes overhauled.
- All damaged return rollers replaced with repaired rollers.
- Skirt rubber replaced.

04 21 07 DUST CONVEYOR :

Following jobs were carried out :--

- G.Box attended for replacement of oil, oil-seals, coupling bolts and bushes.
- FC-8 coupling assembly of G.Box-motor side replaced.
- All damaged return rollers replaced after repairing.
- All carrier rollers attended for free operation.
- New skirt rubber with inner rubber sheet provided.
- Complete greasing of all bearings done.
- Complete cleaning and painting of conveyor structure done.

216

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CODE NO	JOB DESCRIPTION
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04 21 08      SLAT CONVEYOR M-2124 ( 1 - 6 ) :

Following jobs were carried out

1. All six slat conveyors attended for :
  - a) Damaged wooden slats replaced.
  - b) Gear box servicing.
  - c) MPG and MHT-60 bearing servicing.
  - d) Conveyor adjusting mechanism servicing.
  
2. Complete cleaning and painting of all slat conveyors completed.

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PLANT TURNAROUND - MARCH - APRIL - 2001

B&MH PLANT

CIVIL JOBS

CODE NO	JOB DESCRIPTION
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04 51 01     CIVIL JOBS :

Following jobs were carried out during plant turnaround-2001.

1. Repairing of Walk way for conveyor belt inside the Silo.
2. Epoxy painting of Transfer tower / room and other RCC structure / conveyor gantry.
3. Repairing of Hopper floor / packer scale floor with the use of monolithic plaster.
4. Epoxy painting of RCC columns, ceiling, slab, beams, and other RCC structure in Bagging plant completed.
5. Replacement of A. C. sheet roofing on truck loading area and wagon loading area of bagging plant ( Only damaged sheet shall be replaced ).
6. Concrete protection for outside surface of conveyour gantry from transfertower towards B & MH Plant.



PLANT TURNAROUND - MARCH - APRIL - 2001

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B&MH PLANT

ELECTRICAL JOBS

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CODE NO      JOB DESCRIPTION

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04 61 01      ELECTRICAL JOBS :

1. Preventive Maintenance carried out on all feeder compartments mounted on the following MCCs.  
MCC- 4, MCC- 4A and MCC-9.

(a) Checking the tightness of outgoing terminal.

(b) Cleaning the feeder compartment .

(c) Replacement of damaged connectors, etc.

2. Overhauling of following motors were carried out.:

M 2116/3, M 2116/5, M 2122, M 2122/A1, M 2122/A2, M 2121, M 2117,  
M 2112, M 2110.

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PLANT TURNAROUND - MARCH - APRIL - 2001

B&MH PLANT

INSTRUMENT JOBS

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CODE NO	JOB DESCRIPTION
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04 71 01

INSTRUMENT JOBS :

BAGGING & MH PLANT :

- (1) Color scraping and re-painting of following panels were done.
  - Packer Scale panel of bag filling machine P/S No.1, 2, 3, 4, 7, 8
  - Local panel of bag filling machine P/S No.1, 2, 3, 4, 7, 8
  - Solenoid box of bag filling machine P/S No 1, 2, 3, 4, 7, 8
  - All Oil Lubricator inside solenoid box were overhauled and checked.
  - Common alarm panel of bag filling machines.
  - Load cell junction box of all bag filling machines.
  - New Bagging operator panel, Computpak panels, All PLC (JRSL) Panels, Local panels.
  
- (2) Following jobs were done inside the panel of bag filling machine P/S No 1, 2, ,3, 4, 7, 8.
  - Cleaned and tighten all wiring terminals and replaced the broken terminal strips.
  - Provided lugs and ferrule on terminal wire wherever required.
  - Provided wire straps and routed properly.
  - Checked all relays, fuses.
  - Cleaned RIC Card, DataPond and checked it's operation .
  
- (3) checked calibration of P/S No. 1,2,3,4,7 & 8 after the completion of mechanical jobs.

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CODE NO	JOB DESCRIPTION
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(4) Computpak Panels

- All PCB's inside the computpak panels were removed and cleaned
- Calibrated the Both UBM 9A, UBM 9B.

(5) LIBRA WEIGHING SCALE :

(Note : Service Engineer from M/S Mettler Toledo India Ltd was called to execute the AMC)

Following work has been done for Libra Weighing Scale of PS 1,3,7,8, Platform Weighing Scale, UBM 1, UBM 2, Spare weighing scales ( 3 nos. )

- Removed the Load Cell Assembly from platform, dismantled the whole scale, cleaned the other assembly of platform, scraped the color, painted the platform assembly, assembled the load cell and whole scale.
- Cleaned the PCB's of indicator by air.
- Calibrated the Weighing scale.
- 2 nos. of M/s. Metler-Toledo make weighing scales ( P/S-2, P/S-4 ) were cleaned overhauled and checked the calibration.

(6) SILO :

Following jobs has been done in Belt Weighing System

- Removed the Micro-Tech load indicator, cleaned / checked the whole electronics, replaced the terminal strips as it's got corrded. After off-line checking of this indicator, installed it back.
- Key pad assembly of the was replaced with new one as some of keys are not functioning properly.
- Checked the load cell performance by actually putting standard weights and checking milli volts, the performance was found satisfactory.
- Performance of Load Indicator, Techometer was checked and found all right.
- Overhauled the techometer. Techometer coupling allen screw (2 no.) was provided new one.

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CODE NO	JOB DESCRIPTION
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- Loadcell frame assembly alignment was checked after mounting the load cell back in position and found all right.
  - Actual performance of the system was checked by running belts and putting standard weights and was found O.K.
  - Calibration of weigh scale was done for 200 T/hr.  
(Note : Service engineer from M/S Power Built Ltd. was called to execute the job)
- (7) Dust Extraction System.
- Cleaned the Dust Extraction Panel.
  - Cleaned all field instruments(C/V, Flow Tx, Level Tx etc.) related the DES.