

2000

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MTC / REPORT / 01

IFFCO
KALOL UNIT

PLANNING SECTION
MAINTENANCE DEPTT.
REPORT NO. 20 / 2000

REPORT
ON
PLANT TURNAROUND
(APRIL - 2000)

INDIAN FARMERS FERTILISER CO - OPERATIVE LIMITED

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P R E F A C E

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Plant Turnaround for the year 2000 was planned during April 2000, accordingly, Ammonia & Urea plants were stopped on 3rd April 2000. Rotating and static equipments were taken up for routine overhaul and inspection.

In Ammonia plant 104-JAT and 107- JAT were completely overhauled. West side panel of Auxiliary Boiler were replaced by new panels fabricated departmentally. In-situ casting of INSULYTE-11 was carried by M/S ACC. Preventive maintenance of Compressors, Turbines, including lube oil console was carried out. All heat exchangers were cleaned by hydrojetting and finally boxed up after hydrotesting. Critical RV's were overhauled, tested and installed back. Old foam glass cold insulation of all equipments and piping was replaced by new PUF insulation after 25 years of service. Hot insulation of some of the critical piping was upgraded by 150 kg/M3 density LRB mattresses as an energy conservation measure. Inspection of all critical vessels and piping was carried out.

In Urea plant Hitachi compressor K-1801 was overhauled. Rotor of H.P. case was replaced by New reconditioned rotor. Tray support brackets were replaced in Autoclave V-1201. Preventive maintenance of various critical rotary machines were carried out. RV's were overhauled, tested and installed back. Inspection of H.P. vessels and other static equipments were carried out.

In Offsites plant, C.W. Pump P-4401/B was taken for overhaul. Other pumps and turbines were also taken for preventive maintenance. 66 Nos of Down comer tubes of Y row of BHEL Boiler were replaced by new SA-192 Tubes by M/S. SKYWIN Erectors, Ahmedabad. Residual Life Assessment study of BHEL boiler was carried out by M/S. BHEL, Trichy. Boiler flue duct C.S. expansion bellows 2 Nos. were replaced by new S.S.304 expansion bellows.

In B&MH plant Reclaim Machine M-2116 was completely overhauled. All conveyor belts were 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

Various critical control valves of Ammonia, Urea and Offsites plant were overhauled and various pressure transmitters were also calibrated. All control room instruments were cleaned and inspected.

TECHNICAL DEPARTMENT JOBS :

In Ammonia plant, underground C.W. return pipelines were replaced by new one. Some of the aged pipelines were replaced by new one in Ammonia as well as urea plant. 131-JC Air compressor 3rd stage intercooler was replaced by new cooler procured from M/S. BASCO, USA. Various new schemes under EWR were installed and commissioned in Ammonia as well as Urea plant.

After completion of above jobs, the Ammonia plant was started and production was lined up on 27-04-2000 and urea production was lined up on 28-04-2000.

PLANT TURNAROUND - APRIL - 2000

GENERAL - DETAILS

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SR. NO.	CATEGORY	QUANTITY
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01 EQUIPMENT UTILISED :

(A) IFFCO :

55 T	HM Crane	01
15 T	Coles Crane	01
18 T	Tata Crane	01
55 T	TIL RT-760 Tyre mounted mobile Crane	01
10 T	ESCORT LIFT-N-SHIFT	01
03 T	Forklift	03
07 T	Truck	01

(B) HIRED :

100 MT	Coles 80/88 Crane with Hydraulic Telescopic Boom	01
--------	--	----

02 MANPOWER UTILISED :

(A) IFFCO MANPOWER :

a) Mechanical	}	Existing strength
b) Mecanical Services	}	
c) Electrical	}	
d) Instrument	}	
e) Trainees in various trade	}	

(B) OTHER IFFCO UNITS MANPOWER :

a) Maint. Supervisor	:	05
b) Maint. Technician	:	05
c) Inspection Technician	:	01
d) Electrician	:	-
e) Machinist	:	-
f) MEO	:	02

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SR. NO.	CATEGORY	QUANTITY
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(C) HIRED - CONTRACT MANPOWER :

<u>Sr.No.</u>	<u>Category</u>	<u>Mandays</u>
01	Mill Wright Fitter	145
02	General Fitter	1009
03	Rigger	1628
04	S.S. Rigger	4847
05	Fabricator	437
06	Grinder	454
07	IBR Welder	120
08	Non-IBR Welder	437
09	Carpenter	24
10	Mason	30
11	Forklift Operator	43
12	Instrument Fitter	253

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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

MAINTENANCE JOBS CARRIED OUT BY OUTSIDE AGENCIES

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SR. NO.	JOBS CARRIED OUT	CONTRACTORS NAME	W.O.NO. & DATE
1	Overhauling of rotating equipments	M/S. ABB, Vadodara	9901870 18/03/2000
2	Overhauling of rotating equipments	M/S. SPIC-SMO, Mumbai	9901869 18/03/2000
3	Aux.Boiler West wall repair	M/S. ACC, Ahmedabad	9901701 22/03/2000
4	Overhauling of RV's	M/S. Flotec Engg., Surat	9901418 15/02/2000
5	Retubing of 802-C	M/S. S.R. Engg., Vadodara	9901734 13/03/2000
6	Scaffolding & Blinding	M/S. Anu Engrs., Vadodara	9901754 13/03/2000
7	Reconditioning of Valves	M/S. Sebum Valves, Halol	9901834 25/03/2000
8	Reconditioning of Valves	M/S. EFCO, Hyderabad	9901949 19/04/2000
9	Retubing of Boiler side wall tubes	M/S. Skywin Erector, Ahmedabad	9901826 21/03/2000
10	Residual Life assesment study of BHEL Boiler	M/S. BHEL, Baroda	9900533 22/11/99
11	Service of one field Engineer from BHEL for RAH unit	M/S. BHEL, Ranipet	9901281 31/01/2000
12	Servicing & inspection of CW Pump Sluice Gate	M/S. Jash Engineering, Indor	9901317 23/02/2000
13	Overhauling of Reclaim M/C.	M/S. EMTICI, Vallabh Vidhya Nagar	9901251 23/02/2000
14	Opening & Box-up of Heat exchangers	M/S. Technocon Projects & Consultants, Baroda	9901434 02/03/2000
15	Upgradation of Hot Insulation	M/S. Associated Insulation Co, Baroda	9900926 30/12/99
16	Upgradation of Cold Insulation	M/S. Associated Insulation Co, Baroda	9901741 23/03/2000
17	Hydrojetting of Heat Exchangers	M/S. Deluxe Hydroblasting Services, Mumbai	04714/GC 24/03/98
18	Supply of skilled manpower	M/S. General Engg. Works, Bharuch	9900714 31/12/99
19	Hiring of Crane	M/S. Express Transport Co. Ltd., Mumbai	9901417 23/02/2000
20	Repair & Maint.of Acid / Alkalies proof brick lining	M/S. Shreeji Chem Enterprises	9901715 09/03/2000
21	Monolithic plaster & epoxy painting in B & MH Plant	M/S. Shreeji Chem Enterprises	9901713 13/03/2000

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2	Overhauling of rotating equipments	M/S. SPIC-SMO, Mumbai	9901869 18/03/2000
3	Aux.Boiler West wall repair	M/S. ACC, Ahmedabad	9901701 22/03/2000
4	Overhauling of RV's	M/S. Flotec Engg., Surat	9901418 15/02/2000
5	Retubing of 802-C	M/S. S.R. Engg., Vadodara	9901734 13/03/2000
6	Scaffolding & Blinding	M/S. Anu Engrs., Vadodara	9901754 13/03/2000
7	Reconditioning of Valves	M/S. Sebum Valves, Halol	9901834 25/03/2000
8	Reconditioning of Valves	M/S. EFCO, Hyderabad	9901949 19/04/2000
9	Retubing of Boiler side wall tubes	M/S. Skywin Erector, Ahmedabad	9901826 21/03/2000
10	Residual Life assesment study of BHEL Boiler	M/S. BHEL, Baroda	9900533 22/11/99
11	Service of one field Engineer from BHEL for RAH unit	M/S. BHEL, Ranipet	9901281 31/01/2000
12	Servicing & inspection of CW Pump Sluice Gate	M/S. Jash Engineering, Indor	9901317 23/02/2000
13	Overhauling of Reclaim M/C.	M/S. EMTICI, Vallabh Vidhya Nagar	9901251 23/02/2000
14	Opening & Box-up of Heat exchangers	M/S. Technocon Projects & Consultants, Baroda	9901434 02/03/2000
15	Upgradation of Hot Insulation	M/S. Associated Insulation Co, Baroda	9900926 30/12/99
16	Upgradation of Cold Insulation	M/S. Associated Insulation Co, Baroda	9901741 23/03/2000
17	Hydrojetting of Heat Exchangers	M/S. Deluxe Hydroblasting Services, Mumbai	04714/GC 24/03/98
18	Supply of skilled manpower	M/S. General Engg. Works, Bharuch	9900714 31/12/99
19	Hiring of Crane	M/S. Express Transport Co. Ltd., Mumbai	9901417 23/02/2000
20	Repair & Maint.of Acid / Alkalies proof brick lining	M/S. Shreeji Chem Enterprises	9901715 09/03/2000
21	Monolithic plaster & epoxy painting in B & MH Plant	M/S. Shreeji Chem Enterprises	9901713 13/03/2000

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SR. NO.	JOBS CARRIED OUT	CONTRACTORS NAME	W.O.NO. & DATE
22	Repiring of Insulating & fire brick in primary reformer	M/S. A.C.C.	9901822 23/03/2000
23	Automatic Ultrasonic scanning of Reformer tubes	M/S. PDIL, Sindri	9901350 07/03/2000
24	Radiography Work at site	M/S. NDT Services, Ahmedabad	9901679 27/03/2000
25	Insitu Metallography	M/S. TCR Advanced Engg., Baroda	9901742 27/03/2000
26	Services of NDT Teams	M/S. NDT Services, Ahmedabad	9901414 21/02/2000
27	Installation & Commissioning of operator station & preventive maint. of DCS	M/S. Yokogawa Blustar Ltd, Baroda	9901095 18/12/99
28	Modification in HINA PLC	M/S. Chemtrol Software Pvt.Ltd., Banglore	9901496 23/02/2000
29	Installation & Commissioning of Annunciater System	M/S. I. I. C., Mumbai	9900935 07/12/99
30	Loding of completely software in GE fanuc PLC	M/S. Simplex System, Hydrabad	9901000 15/12/2000
31	Maintenance of UPS	M/S. Instrumentation Ltd., Jaipur	9901972 19/04/2000
32	Cooling Water header replacement jobs.	M/S. U.B. Engineers, Pune	9901714 15/03/2000
33	Piping replacement of Ammonia & Urea Plant	M/S. Jacob H & GC, Mumbai	1555 04/06/99

PLANT TURNAROUND - APRIL - 2000

AMMONIA PLANT

MECHANICAL JOB

97

CODE NO JOB DESCRIPTION

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.
- 3) Overhauling of CM governor. All the bearings were replaced.
- 4) The servomotor was attended for oil leakage. Its' sealing bush (upper one) was replaced.
- 5) TTV was dismantled and inspected for spindle damage. The same was found O.K.

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) The bag filters as well as Roll-O-Matic filters were replaced.

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-JLP as a preventive measure:

- 1) Both the journal bearings as well as thrust bearings were inspected and found to be O.K.
- 2) The alignment of the 101-JHP case was checked and corrected after the installation and Hook up of new 131-JC.

JO

CODE NO JOB DESCRIPTION

The alignment of the complete train was checked and corrected wherever required.

The reading 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
DRIVE CONDENSING TUBINE (101-JT)				
Thrust end journal bearing	0175-0.225	0.22	0.2-0.3	0.27
Opposite thrust end journal bearing	0175-0.225	0.20		
L.P. COMPRESSOR (101-JLP)				
Thrust end journal bearing	0.15-0.20	0.20	0.275-0.375	0.32
Opposite thrust end journal bearing	0.15-0.20	0.20		
H.P. COMPRESSOR (101-JHP)				
Thrust end journal bearing	0.10-0.175	0.12	0.20-0.3	0.25
Opposite thrust end journal bearing	0.10-0.175	0.15		

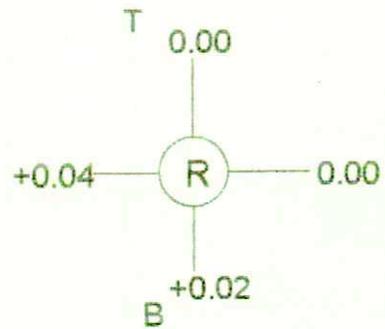
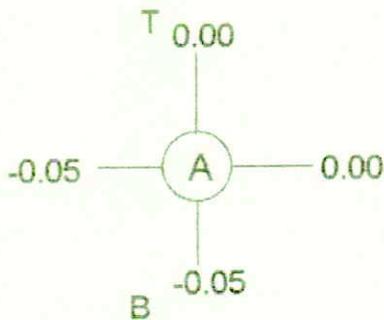
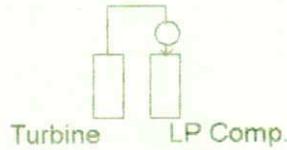
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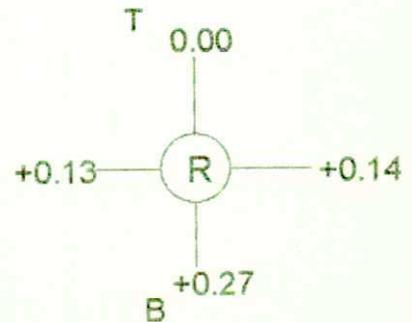
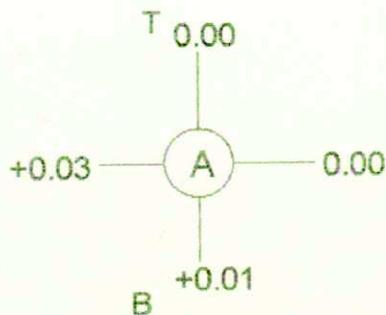
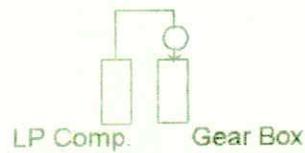
AIR COMPRESSOR TRAIN ALIGNMENT READINGS - 101

AFTER CORRECTION

(TURBINE - LP COMPRESSOR)



(LP COMPRESSOR-GEAR BOX)



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

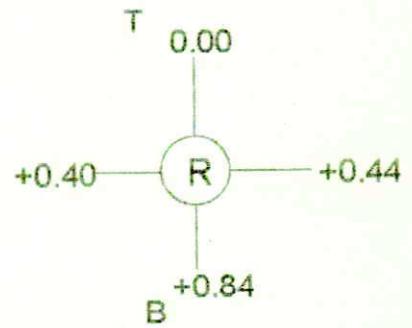
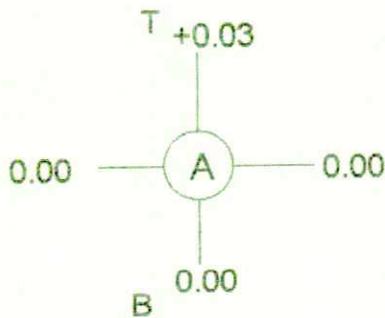
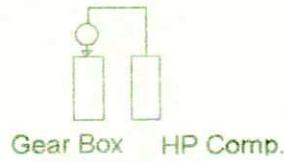
12

CODE NO JOB DESCRIPTION

AIR COMPRESSOR TRAIN ALIGNMENT READINGS - 101

AFTER CORRECTION

(GEAR BOX-HP COMPRESSOR)



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

23

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 and the oil leakages were rectified.
- 3) Governor was replaced with spare one and its' operation was checked. The connecting linkage from Governor to Amplifier was found fouling with the housing. The same was made 'Free'.
- 4) Governing oil filter was replaced.
- 5) An isolation valve was provided in the governing oil line.
- 6) Both the lube oil filters were replaced.
- 7) Turbine journal bearings at both the ends as well as thrust bearing were inspected and their clearances were noted in the next page.
- 8) The turbine was not getting latched during start up. After trouble shooting, the trip assembly was replaced as the sealing surfaces of the old trip assembly were found to be passing. The latching was checked after the replacement and the same was found to be O.K.
- 9) The exhaust end journal bearing oil guard (Towards turbine side) was provided with air connection at the bottom to avoid steam ingress into the oil.

102-J N. G. COMPRESSOR :

- 1) Both the journal bearing were inspected. The coupling side journal bearing was found having higher clearance hence the same was replaced.
- 2) The suction and discharge piping was disconnected and the lines were checked for the tension. The flange with the suction separator was found having offset and gap. The same was removed by providing a spacer flange.
- 3) The coupling was inspected and its float was checked.

24

CODE NO JOB DESCRIPTION

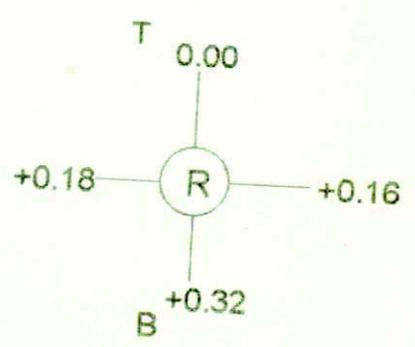
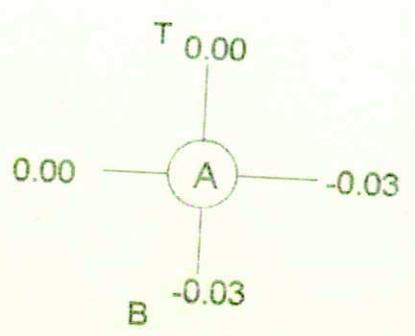
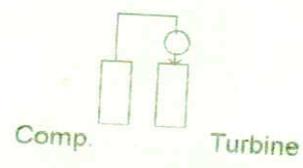
The reading taken during the preventive maintenance for all the machines in the train are recorded as under:

POSITION	RADIAL CLEARANCES		THRUST CLEARANCES	
	DESIGN (MM)	ACTUAL	DESIGN	ACTUAL
DRIVE CONDENSING TUBINE (102-JT)				
Thrust end journal bearing	0.12-0.139	0.14	0.16-0.24	0.18
Opposite thrust end journal bearing	0.15-0.172	0.14		
Thrust end oil cather		0.22		
Opposite thrust end oil catcher		0.17		
COMPRESSOR (102-J)				
Thrust end journal bearing	0.07-0.095	0.12	0.25-0.35	0.30
Opposite thrust end journal bearing	0.07-0.095	0.12		

N.G. COMPRESSOR TRAIN ALIGNMENT READINGS - 102

(TURBINE- COMPRESSOR)

AFTER CORRECTION



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

15

CODE NO	JOB DESCRIPTION
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01 01 03	<u>SYN. GAS. COMPRESSOR TRAIN 103-JAT/JBT , 103-JLP/JHP :</u>
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PREVENTIVE MAINTENANCE OF 103-JAT (BACK PRESSURE TURBINE) :

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

- Bearings checking
- Coupling cleaning and inspection.
- PRC 12 stroke checking
- Steam chest 103JAT opening and attend face damage to rectify leakage
- 103-JAT Strainer Flanges U/S , D/S & turbine body steam inlet leak
- Sealing steam flange leakage below the turbine casing was attended.
- Greasing of Nozzle operating gear linkages

Active side thrust bearing pads (6No.s) were replaced with new one.

OVERHAULING OF 103-JBT (CONDENSING TURBINE):

This machine was taken for major overhauling and rotor replacement job. Following were the major activities carried out during the overhauling.

The turbine was stopped and after cooling down the machine was dismantled and all the diaphragms were sand blasted as well as last two stage diaphragms were repaired at diaphragm seating faces as well as in partition plane areas. L&T's electrode 680 was used for the repairs.

New modified rotor assembly (TR#234 with Titanium blades with integral shrouddesign .) was cleaned and inspected for magnetism level. Also DP check was carried out on the same.

Assembly of the turbine was carried out with replacement of following components:

- 1 Rotor assembly TR#234
- 2 Thrust bearing base ring(PM-1025C)
- 3 Thrust pad shoes(active side PM-1025D)
- 4 Hydraulic Governor Assembly(TM Governor)
- 5 Crosby make Sentinel Valve--3/4" size
- 6 Steam gland Ring GJ141 AHX1(2sets)
- 7 Coupling O-ring/BU Washers(11-231,76-231,11-234,76-234)
- 8 O-ring for coupling guard
- 9 O-rings of the OST plunger

28

CODE NO JOB DESCRIPTION

The machine was reassembled and OST was carried out at 12000 R P M. The housing containing the trip lever was removed from the position and the gap between the lever and trip pin was adjusted to 0.100" and the housing was redoweled with the upper half of the bearing housing to avoid any play.

The reading taken during the overhaul are recorded as under:

FLOW PATH MEASUREMENT:

STAGE	A			B		
	DESIGN	ACTUAL		DESIGN	ACTUAL	
		L	R		L	R
1	1.375-1.625	1.95	1.95	1.375-1.625	1.95	1.95
2	1.375-1.625	1.95	1.75	1.375-1.625	1.9	1.85
3	1.375-1.625	1.7	1.75	1.375-1.625	1.65	1.7
4	1.375-1.625	1.9	1.85	1.375-1.625	1.95	1.9
5	1.375-1.625	1.95	1.95	1.375-1.625	1.95	1.95
6	1.375-1.625	1.75	1.75	1.375-1.625	1.95	1.3

NOZZLE CLEARANCES:

A			B		
DESIGN	ACTUAL		DESIGN	ACTUAL	
	L	R		L	R
1.375-1.625	1.55	1.6	1.375-1.625	1.55	1.55

NOTE: All dimensions are in mm.

27

CODE NO JOB DESCRIPTION

GLAND CLEARANCES

FRONT GLAND CLEARANCES

SR.N	DESIGN (DIAMETRICAL)	ACTUAL	
		L	R
1	0.325-0.475	0.18	0.15
2	0.325-0.475	0.29	0.13
3	0.325-0.475	0.28	0.11
4	0.325-0.475	0.28	0.04
5	0.325-0.475	0.25	0.15

REAR GLAND CLEARANCES

SR.N	DESIGN (DIAMETRICAL)	ACTUAL	
		L	R
1	0.325-0.475	0.15	0.20
2	0.325-0.475	0.20	0.25
3	0.325-0.475	0.20	0.25
4	0.325-0.475	0.20	0.15

DIAPHRAGMS CLEARANCES

STAGE	DESIGN (DIAMETRICAL)	ACTUAL	
		L	R
1	0.325-0.475	0.10	0.20
2	0.325-0.475	0.20	0.20
3	0.325-0.475	0.18	0.25
4	0.325-0.475	0.15	0.20
5	0.325-0.475	0.20	0.22
6	0.325-0.475	0.15	0.20

NOTE: All dimensions are in mm

18

CODE NO JOB DESCRIPTION

<u>DIAPH-RAGMS</u>	<u>BOTTOM</u>	<u>TOP</u>
1	0.31	0.22
2	0.07	0.13
3	0.21	0.09
4	0.20	0.10
5	0.10	0.33

NOTE: All dimensions are in mm.

Apart from overhauling, follwing jobs were also carried out.

- 1) Replacement of governor with new TM governor.
- 2) Replacement of TTV bypass valve with new one.
- 3) Attending of various oil leakages.

PREVENTIVE MAINTENANCE OF 103-JLP :

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

- Bearings checking of OTE bearing.
- Checking of thrust bearing clearance and setting of instrument probe.
- Coupling cleaning and inspection checking of coupling float.
- Oil guard between 103-JAT/JLP was modified by providing groove to arrest the oil leakage.

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 thust clearance.
- Coupling cleaning and inspection checking of coupling float.

Axial thrust clearance: 0.45mm

19

CODE NO	JOB DESCRIPTION
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The readings taken during overhaul of 103-JBT for all machines in the train are recorded as under.

POSITION	RADIAL CLEARANCES		THRUST CLEARANCES	
	DESIGN (MM)	ACTUAL	DESIGN	ACTUAL
<u>DRIVE CONDENSING TUBINE (103-JBT)</u>				
Thrust end journal bearing	0.25-0.3	0.24	0.2-0.3	0.23
Opposite thrust end journal bearing	0.25-0.3	0.25		
Thrust end oil catcher	0.20-0.35	0.25		
Opposite Thrust end oil catcher	0.20-0.35	0.24		
<u>BACK PR. TUBINE (103-JAT)</u>				
Thrust end journal bearing	0.25-0.30	0.23	0.2-0.3	0.27
Opposite thrust end journal bearing	0.15-0.20	0.17		
<u>L.P. COMPRESSOR (103-JLP)</u>				
Thrust end journal bearing	0.11-0.19	0.14	0.38-0.55	0.4
Opposite thrust end journal bearing	0.11-0.19	0.15		
<u>H.P. COMPRESSOR (103-JHP)</u>				
Thrust end journal bearing	0.11-0.19	0.13	0.38-0.55	0.45
Opposite thrust end journal bearing	0.11-0.19	0.14		

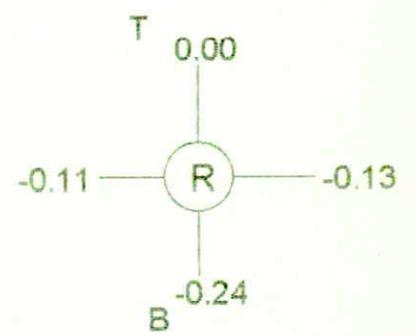
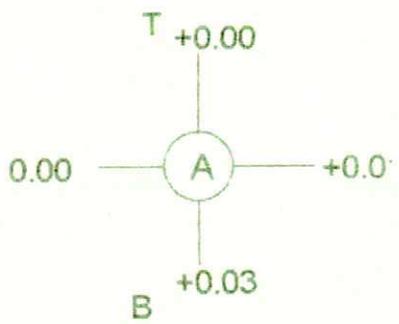
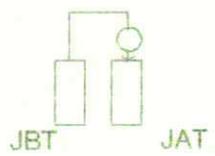
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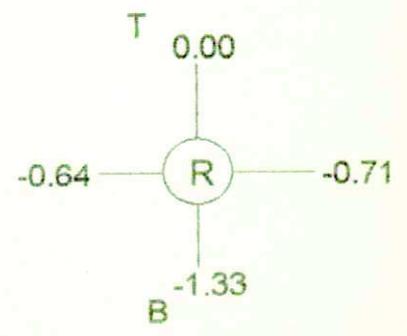
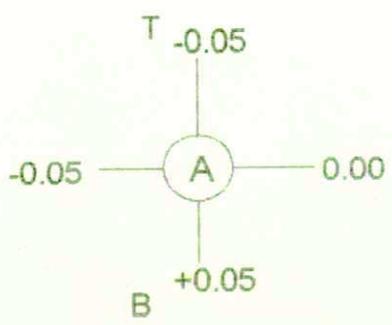
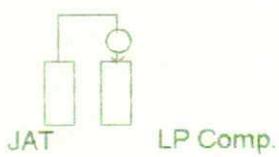
SYN GAS COMPRESSOR TRAIN ALIGNMENT READINGS - 103

AFTER CORRECTION

(103 JBT - 103 JAT)



(103 JAT-LP COMPRESSOR)



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

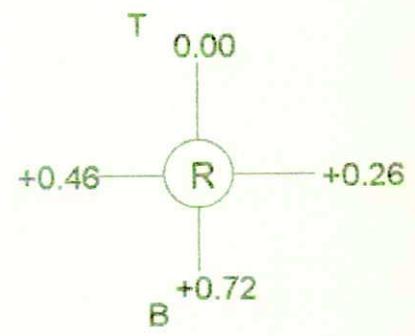
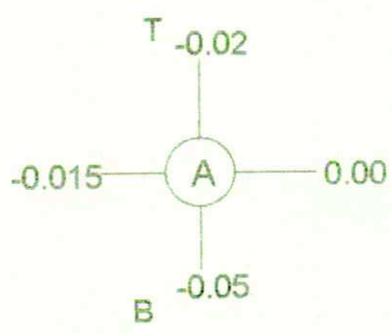
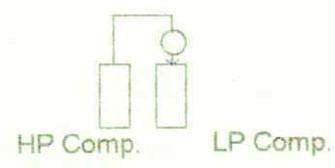
21

CODE NO JOB DESCRIPTION

SYN GAS COMPRESSOR TRAIN ALIGNMENT READINGS - 103

AFTER CORRECTION

(LP COMPRESSOR - HP COMPRESSOR)



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

22

CODE NO	JOB DESCRIPTION
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01 01 04 REFRIGERATION COMPRESSOR TRAIN 105-JT,105-JLP/JR/JHP:

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.

PRIVENTIVE MAINTENANCE OF 105-JLP/JR/JHP:

105-JLP:

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

- 1) The coupling 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.

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 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.

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	
	DESIGN (MM)	ACTUAL	DESIGN	ACTUAL
<u>DRIVE CONDENSING TUBINE (105-JT)</u>				
Thrust end journal bearing	0175-0.225	0.22	0.2-0.3	0.25
Opposite thrust end journal bearing	0175-0.225	0.22		
<u>L.P. COMPRESSOR (105-JLP)</u>				
Thrust end journal bearing	0.15-0.20	Not dismantled	0.275-0.375	0.35
Opposite thrust end journal bearing	0.15-0.20	Not dismantled		
<u>GEAR BOX</u>				
Thrust end journal bearing (Pinion)	0.25-0.30	0.30		
Opposite thrust end journal bearing (Pinion)	0.25-0.30	0.30		
Thrust end journal bearing (Gear)	0.25-0.275	0.27	0.35	0.35
Opposite thrust end journal bearing (Gear)	0.25-0.275	0.27		
<u>H.P. COMPRESSOR (105-JHP)</u>				
Thrust end journal bearing	0.10-0.175	Not dismantled	0.225-0.325	0.22
Opposite thrust end journal bearing	0.10-0.175	Not dismantled		

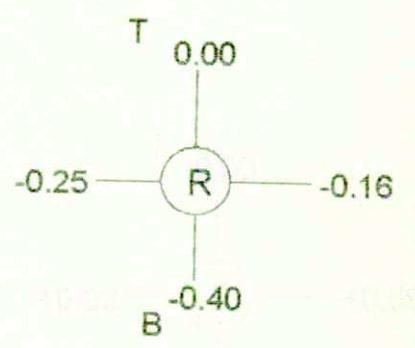
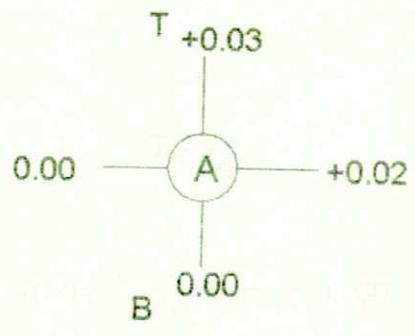
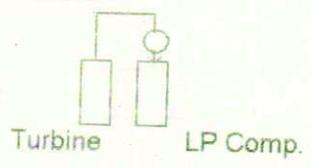
NOTE: All dimensions are in mm.

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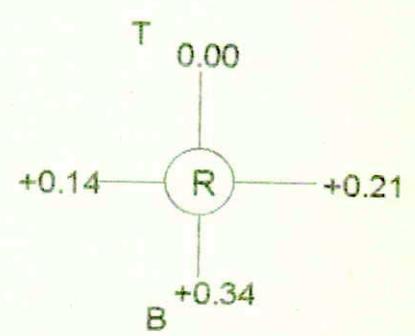
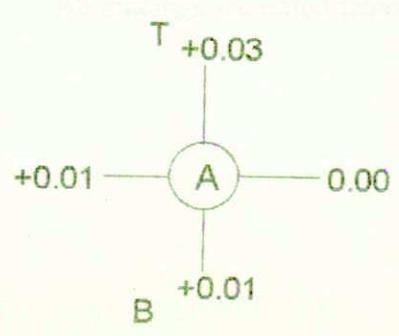
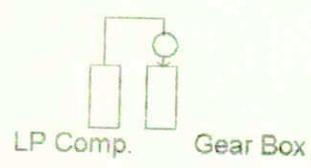
REFRIGERATION COMPRESSOR TRAIN ALIGNMENT READINGS - 105-J

AFTER CORRECTION

(TURBINE - LP COMPRESSOR)



(LP COMPRESSOR - GEAR BOX)



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

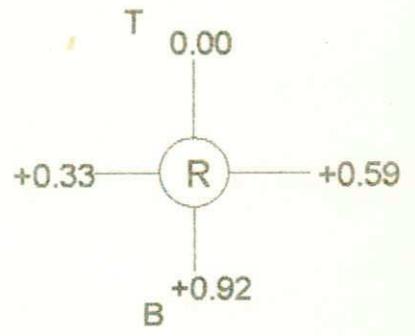
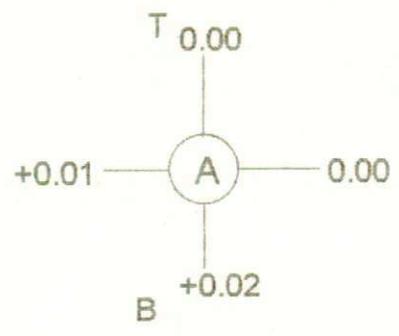
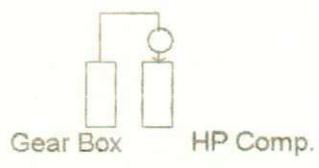
25

CODE NO JOB DESCRIPTION

REFRIGERATION COMPRESSOR TRAIN ALIGNMENT READINGS - 105

AFTER CORRECTION

(GEAR BOX - HP COMPRESSOR)



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

CODE NO	JOB DESCRIPTION
---------	-----------------

01 01 05

N.G. BOOSTER COMPRESSOR TRAIN - 800-J-NG-AG/800-JT:N.G. BOOSTER COMPRESSOR DRIVE TURBINE 800-JT:

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

- Bearings checking
- Coupling cleaning and inspection.
- Greasing of Nozzle operating gear linkages

800-J N.G. BOOSTER COMPRESSOR :

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

- Bearings checking of both the ends.
- Checking of thrust bearing clearance and setting of instrument probe.

800-J A.G. COMPRESSOR:

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

- Bearings checking of both the ends.
- Checking of thrust bearing clearance and setting of instrument probe.

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</u> (MM)	<u>ACTUAL</u>	<u>DESIGN</u>	<u>ACTUAL</u>
<u>DRIVE CONDENSING TUBINE</u>				
Thrust end journal bearing	0.15-0.21	0.20	0.16-0.24	0.18
Opposite thrust end journal bearing	0.15-0.20	0.20		
Thrust end oil catcher		0.15		
Opposite thrust end oil catcher		0.15		
<u>N.G. COMPRESSOR</u>				
Thrust end journal bearing	0.08-0.113	0.12	0.25-0.35	0.22
Opposite thrust end journal bearing	0.08-0.113	0.09		
<u>A.G. COMPRESSOR</u>				
Thrust end journal bearing	0.08-0.113	0.10	0.20-0.3	0.22
Opposite thrust end journal bearing	0.08-0.113	0.12		

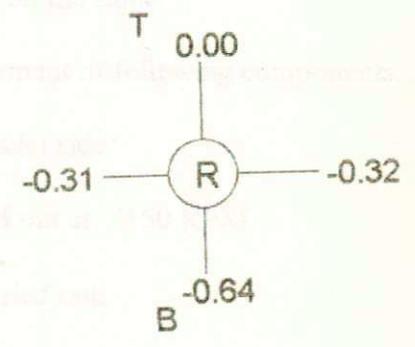
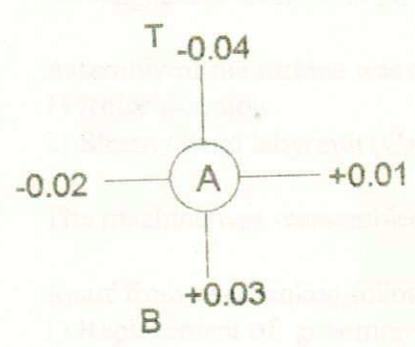
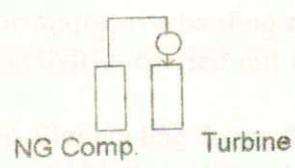
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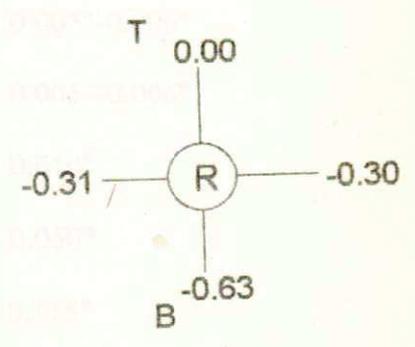
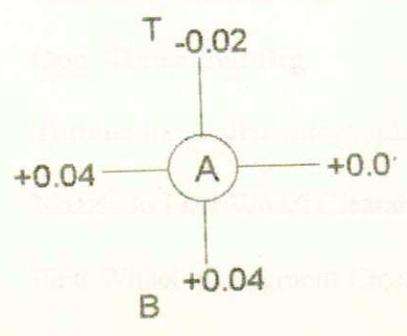
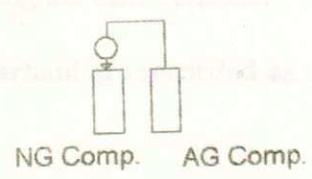
NG BOOSTER COMPRESSOR TRAIN ALIGNMENT READINGS - 800 - J

AFTER CORRECTION

(NG COMPRESSOR - TURBINE)



(NG COMPRESSOR - AG COMPRESSOR)



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:

This machine was taken for major overhauling and rotor replacement job. Following were the major activities carried out during the overhauling.

The turbine was stopped and after cooling down, the machine was dismantled and all the diaphragms were sand blasted. New rotor was cleaned and inspected for magnetism level. Also DP check was carried out on the same.

Assembly of the turbine was carried out with replacement of following components.

- 1) Rotor assembly
- 2) Steam Gland labyrinth (Carbon Rings) at steam inlet side

The machine was reassembled and OST was carried out at 4150 RPM.

Apart from overhauling, following jobs were also carried out:

- 1) Replacement of governor with new governor.
- 2) Oil Replacement of console.
- 3) Governor valve bushing leak attended.

The guide vanes in the diaphragms were found in severely eroded condition. The same require replacement during the next overhaul.

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"
Turbine Float after rotor replacement.	0.010"
Nozzle to First Wheel Clearance.	0.050"
First Wheel to Segment Clearance.	0.115"
Segment to Second Wheel Clearance.	0.105"
Inlet end Gland Carbon ring clearances. (Old carbon rings used)	0.005" 0.005" 0.005" 0.005" 0.005"

CODE NO JOB DESCRIPTION

Exhaust end Gland Carbon ring Clearances. (New Carbon rings used)	0.005" 0.005" 0.005" 0.005" 0.005"
Oil gaurd clearance :	0.003"

104-JA :

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

- 1) Both bearings were opened for inspection .It was found that coupling side bearing got damaged so the same was replaced by new one.
- 2) 104-JA minimum flow ARV/NRV valve passing attended.
- 3) The coupling was opened and regreased.
- 4) During start up, while governor function checking in coupled condition, all of a sudden the non drive end Mechanical seal (Dura Make) started leaking.The pump was stopped immediately and the oil pump assembly, thrust bearing assembly etc. were dismantled. The carbon of the mechanical seal was found to have sheared off from the anti rotation pin area. The same was replaced with a spare one of Dura make. The pump was again handed over to production and was taken in line successfully.

The reading taken during the overhaul are recorded as under:

Thrust End Journal Brg.	0.0065"-0.007"
Opp.Thrust End Journal Brg.	0.005"(New Brg. used)
Axial Float	0.013"

104-JT:

Both the journal bearings as well as thrust bearing were opened,cleaned, inspected and boxed up.The journal bearing on the thrust end was replaced with new one.

The reading taken during the overhaul are recorded as under

Thrust End Journal Brg.	0.008"-0.011"(New Brg. used)
Opp.Thrust End Journal Brg.	0.008"-0.011"
Axial Float	0.016"

CODE NO JOB DESCRIPTION

104-J:

Both the journal bearings as well as thrust bearing were opened, cleaned, inspected and boxed up.

The reading taken during the overhaul are recorded as under

Thrust End Journal Brg.	0.008"-0.010"
Opp. Thrust End Journal Brg.	0.007"-0.010"
Axial Float.	0.011"

01 02 02

aMDEA PUMP TURBINE (ELLIOT) - 107-JT :

ROTOR REPLACEMENT :

The Elliot turbine was opened for replacement of rotor.

The rotor of this turbine was machined in its' coupling end journal bearing area during the month of July'99 as the same was found damaged during routine inspection checking. This rotor with undersized bearing area was removed during the shutdown and spare repaired rotor.(shaft was replaced at M/s Gangotri Turbotech.) The carbon rings of both the ends were also indigenously manufactured at M/s Gujarat Carbon and the same were replaced.

The exhaust valve of the turbine (Butterfly type) was tried to attend by M/ SEBIM, Vadodara for passing however the same did not serve the pupose .

01 02 03

aMDEA PUMP - 107-JA :

PREVENTIVE MAINTENANCE :

The rotor assembly as well as both the mechanical seal for the Murray Turbine driven pump (Pump casing towards turbine) was replaced as the turbine side seal was found leaking.

CODE NO JOB DESCRIPTION

01 02 04 COLD AMMONIA PUMP 118-JB:

The pump was having loosened threads in its' base plate. The same was rectified and following activities were carried out to do the same.

- Removed the pump and motor
- Drilled over size hole and thread
- Fit suitable threaded plug
- Drilled and tapped for holding bolts
- Mounting of pump and motor
- Realigning.

The pump was then started and found to be O.K.

01 02 05 D. M. WATER PUMP TURBINE 2004-JT :

The turbine was overhauled and both the following bearings were replaced.

Governor end: SKF 6306

Coupling End: SKF 6307

The governor was found jammed during start up. The same was replaced with the governor of Medium Range (2400 - 4000 RPM) and CCW direction governor brought from GHH compressor's L.O. Turbine in Urea plant.

01 02 06 LUBE OIL PUMP TURBINE 102-JLT:

The turbine bearings were replaced with new ones.
(SKF 6309C3 -2No.s)

01 02 07 SEAL OIL PUMP TURBINE 102-JST:

The governor end bearing of the turbine was replaced.
(SKF-6307)

CODE NO JOB DESCRIPTION

01 02 08 LUBE OIL PUMP TURBINE/LUBE-SEAL OIL PUMP 103 JLT/JL/SOP :

The turbine bearings were inspected and both the bearings were replaced.
(SKF 6310, SKF 6309C3)

The seal oil pump was removed and new pump received from M/s Tushaco was installed. However the direction of rotation of the new pump (CW in place of CCW looking from driver end as required) was not found matching with the existing one. Hence the same was removed and old gear pump was reinstalled.

01 02 09 LUBE OIL PUMP TURBINE - 800 JLT/CEP TURBINE :

Following jobs were carried out :

- CEP suction strainer cleaning
- Oil filter cleaning.

01 03 01 I. D. FAN TRAIN 101-JBT/101-BJR/101-BJ :

I. D. FAN DRIVE TURBINE 101-BJT :

Following jobs were done on the I.D. fan Drive Turbine.

- 1) Both the bearings were inspected and their clearances were found to be O.K.
- 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.

<u>Pneumatic Signal</u>	<u>Speed(RPM)</u>
100 %	1450
75 %	1830
50 %	2525
25 %	3307
10 %	3850
5 %	4020
0 %	4185

- 3) The L.O. coolers were cleaned and the console oil was replaced.

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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. 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	
	DESIGN (MM)	ACTUAL	DESIGN	ACTUAL
<u>TUBINE</u>				
Front bearing	0.15-0.225	0.22		0.19
Rear bearing	0.15-0.225	0.22		
<u>GEAR BOX</u>				
Pinion front bearing	0.275	0.20		
Pinion rear bearing	0.30	0.18		
Gear front bearing	0.25	0.18	0.35	0.35
Gear rear bearing	0.275	0.18		
Pinion Gear backlash		0.22		
<u>I.D. FAN</u>				
Front bearing	0.2-0.30	0.30		0.52
Rear bearing	0.2-0.30	0.34		

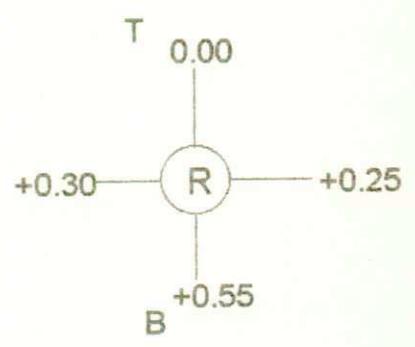
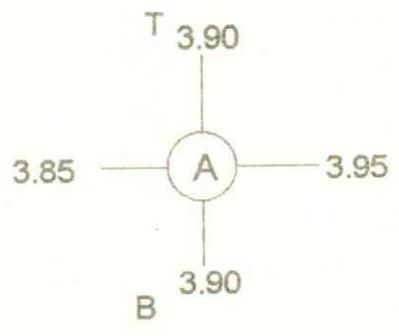
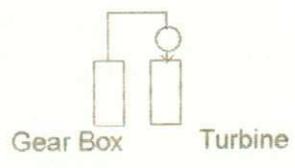
NOTE: All dimensions are in mm

CODE NO JOB DESCRIPTION

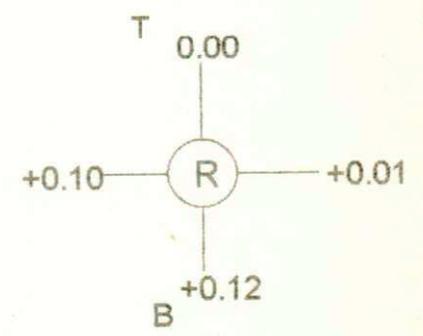
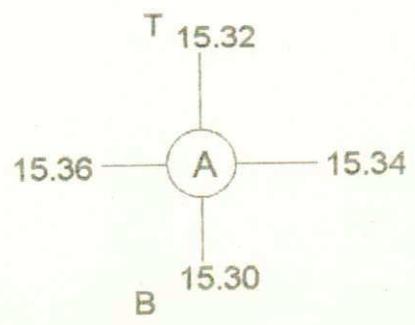
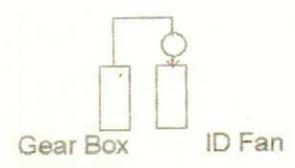
ID FAN ALIGNMENT READINGS - 101-BJ

AFTER CORRECTION

(TURBINE - GEAR BOX)



(GEAR BOX - ID FAN)



Note: All dimensions are in mm.
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) Arch burner blocks were inspected and 10 nos. were found in damaged condition and the same were replaced by new burner blocks.
- 2) East side brick wall refractory got damaged and the same was repaired by Civil Department.
- 3) Bottom header insulation in damaged areas was repaired by new insulation blanket and wet ceramic fibre.
- 4) Damaged Roof insulation was repaired with new module and insulation blanket.

01 12 02 AUXILIARY BOILER REPAIR JOBS :

REPAIR OF AUXILIARY BOILER WEST SIDE PANEL :

The west side wall of Auxiliary Boiler was found to have higher temperature on external surface. It also had several Hot spots. Hence it was decided to repair the refractory of the same. The west side panel of the Auxiliary Boiler is of Welded construction and hence only in-situ casting was possible. Also due to very less clearance was available between the waterwall and the refractory wall (about 6"), the in-situ repair was not possible without cutting the panels.

Hence it was decided to cut and remove the complete west side panel of the Auxiliary Boiler and carry out the In-Situ casting of INSULYTE-11 refractory.

Following were the various activities carried out for the purpose. The refractory job was awarded to m/s ACC, Ahmedabad whereas the panel cutting and rewelding of new panels (6mm thk. C.S Plate) was carried out departmentally by Mech.Maint.group. The I-beam and channels were retained in position and were not removed during the execution.

PRE FABRICATION ACTIVITIES :

16 No.s of panels were cut to the required size and SS 304 anchors welded to the same. 2" X 2" C.S. Chain link netting was also welded to the anchors.

CODE NO JOB DESCRIPTION

SHUT DOWN ACTIVITIES:

- 1) Cooling down furnace.
- 2) Shifting of all the fabricated panels to the site.
- 3) Removal of Insulation of the purge gas line and Instruments mounted on the panel.
- 4) Scaffolding at outside wall
- 5) Removal of 4 No.s of Bolteds panel at the top.
- 6) Cutting and removal of refractory from the top most panels(2no.s).Cutitng of the refractory was carried out with the help of Heavy Duty Pneumatic Chisel.
- 7) Removal of debris of the castable refractory as well Insulation bricks(MK-26) from the top 2 No.s of panels.
- 8) Cutting & removal of top 2 No.s of panels.
- 9) Removal of debris of the castable refractory as well Insulation bricks(MK-26) from the next(2nd from top) 2 No.s of panels.
- 10) Cutting & removal of next(2nd from top) 2 No.s of panels.
- 11) Removal of debris of the castable refractory as well Insulation bricks(MK-26) from the next(3rd from top) 2 No.s of panels.
- 12) Cutting & removal of next (3rd from top) 2 No.s of panels.
- 13) Removal of debris of the castable refractory as well Insulation bricks(MK-26) from the next(4th from top) 2 No.s of panels.
- 14) Cutting & removal of next(4th from top) 2 No.s of panels.
- 15) Removal of debris of the castable refractory as well Insulation bricks(MK-26) from the next(5th from top) 2 No.s of panels.
- 16) Cutting & removal of next(5th from top) 2 No.s of panels.
- 17) Removal of debris of the castable refractory as well Insulation bricks(MK-26) from the next(6th from top) 2 No.s of panels.
- 18) Cutting & removal of next(6th from top) 2 No.s of panels.
- 19) The bottom most panel was retained and only its' refractory was removed.
- 20) Building the portion of west wall (adjacent to front wall)with MK-26 Bricks.
- 21) Making of shuttering for the refractory casting for the bottom most 2 no.s of panels.(the shuttering was made out of a 12 mm thk. commercial plywood)
- 22) Pouring of the refractory castable in the bottom most 2 no.s of panels.
- 23) Curing of the castable for six to eight hours.
- 24) Welding of next 4 No.s of panels (2 + 2) from the bottom.
- 25) Building the portion of west wall (adjacent to front wall)with MK-26 Bricks.
- 26) Making of shuttering for the refractory casting.
- 27) Pouring of the refractory castable.
- 28) Curing of the castable for six to eight hours.
- 29) Welding of next 4 No.s of panels (2 + 2) from the bottom.
- 30) Building the portion of west wall (adjacent to front wall)with MK-26 Bricks.
- 31) Making of shuttering for the refractory casting.
- 32) Pouring of the refractory castable.
- 33) Curing of the castable for six to eight hours.
- 34) Welding of next 4 No.s of panels (2 + 2) from the bottom.

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CODE NO	JOB DESCRIPTION
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- 35) Building the portion of west wall (adjacent to front wall)with MK-26 Bricks.
- 36) Making of shuttering for the refractory casting.
- 37) Pouring of the refractory castable.
- 38) Curing of the castable for six to eight hours.
- 39) Welding of next 4 No.s of panels (2 + 2) from the bottom.
- 40) Building the portion of west wall (adjacent to front wall)with MK-26 Bricks.
- 41) Making of shuttering for the refractory casting.
- 42) Pouring of the refractory castable.
- 43) Curing of the castable for six to eight hours.
- 44) Repairing of the damaged roof refractory. The damaged portion of roof was provided with castable lining as the bricks were not available.
- 45) Fixing back the 4 no.s of bolted panels after pouring new refractory in the old panels.
- 46) Fixing back the removed instrument panels.
- 47) Final box up of the Aux. Boiler.

OTHER REPAIR JOBS :

- 1) Target wall was made.
- 2) The Burner block of Burner No.2 was found damaged which was replaced with new one.
- 3) Damaged Portion of the East wall refractory was repaired

01 12 03 SECONDARY REFORMER 103 - D :

Secondary reformer top nozzle was opened for inspection .It was removed and was found to be in condition .Hence it was boxed up with new gasket.The SS-310 liner for the protection of Refractory brick dome was found detached from the welding and was resting on the dome .The same requires replacement during next opportunity.

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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	109-C1A/ C2A	02	1150	-	30.58	46.50	5.29	8.0	Tube & shell side
2	109-C1B/ C2B	02	1150	-	30.58	46.50	5.29	8.0	- Do -
3	115-C	01	649"U"	-	29.90	-	10.60	16.0	- Do -
4	124-C	01	775"U"	-	158.0	-	17.60	27.0	- Do -
5	176-C	01	223 "U"	-	-	-	-	08.00	- Do -

(A) THIRD STAGE AIR COMPRESSOR INTER COOLER 131-JC :

131-JC Replaced with a new one by TECHNICAL DEPARTMENT.

This cooler was procured from M/S. BASCO USA.

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CODE NO JOB DESCRIPTION

(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	46.50	Tube side
02	105-CB	01	2790	-	05.27	Static	30.90	46.50	-Do-
03	108-C1A/ C2A	02	1415	-	05.27	8.0	05.27	08.00	-Do-
04	108-C1B/ C2B	02	1415	-	05.27	8.0	05.27	08.00	-Do-
05	110-CA /CB	02	763	-	05.60	-	05.27	-	-Do-
06	111-CA /CB	02	2790	-	05.27	Static	05.27	08.00	-Do-
07	127-CA	01	3100	-	05.60	-	21.10	31.50	-Do-
08	127-CB	01	3516	-	05.60	-	21.10	31.50	-Do-
09	128-C	01	1200	-	05.60	-	8.09	12.50	-Do-
10	129-JC	01	290"U"	-	-	-	-	-	-Do-
11	130-JC	01	-	-	-	-	-	-	-Do-
12	173-CA	01	294	-	10.60	-	5.30	08.00	-Do-
13	802-C	01	-	Done	-	-	-	-	-
14	803-C	01	-	-	-	-	-	-	Tube Side

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CODE NO JOB DESCRIPTION

- (A) 127 CA : Total 4 nos. of tubes were plugged..
- 127 CB : Total 1 no of tube was plugged..

Viewing from control room side.

	<u>RAW NO.</u> (From Top)	<u>TUBE NO.</u> (From Reformer side)
127 CA	3	4 And 19
	16	8
	11	38
127 CB	2	20

(B) N. G. BOOSTER AFTER COOLER 802 - C :

Tubes were found leaking during running of plant and plugged about 33 tubes mainly at bottom side. Existing tube C O M was SA 179. During S/D complete tubes were replaced with A 213 TP 304. Leakage in C S tubes were found to be due to stress corrosion cracking just after expansion at tube sheet back side.

(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

(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 - 5 no.s
- c) 107-J / JA Lube oil cooler - 2 no.s

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CODE NO	JOB DESCRIPTION
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(V) Following gland condensers, 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. | - 2 no.s |
| c) 101-JCB I/ A Cooler. | - 1 no. |
| d) 101-JT Gland Condensor. | - 1 no. |
| e) 102-JT Gland Condensor. | - 1 no. |
| f) 103-JBT Gland Condensor. | - 1 no. |
| g) 105-JT Gland Condensor. | -1 no. |
| h) 800-J Surface Condensor. | -1 no. |
| i) 800-JT Gland Condensor. | - 1 no. |
| j) 851-C I/ A Cooler. | -1 no. |

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

- | | | |
|-------------|----------------|---------|
| a) 104-J | - Seal Cooler. | -2 no.s |
| b) 104-JA | - Seal Cooler. | -2 no.s |
| c) 170-J/JA | - Seal COoler. | -2 no.s |

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

- 1) V-25 Valve G/L attended.
- 2) R-112 Sample valve G/L attended
- 3) New C.W.jump over valve gland bolt was welded and leakage attended.
- 4) 181-C IG header steam inlet bypass valve G/ L attended.
- 5) TRCV-10 sealing steam NRV bonnet leak & check valve cover leak attended.
- 6) PIC-14 Bypass vlve D/S trap I/V G/L attended.
- 7) Aux.boiler Br.No.4 Ato steam line block valve G/L attended.
- 8) AG Knock out drum at GAL LS to jacket I/V G/L attended.
- 9) 101-B Atomising steam float valve D/S thread leak 509
- 10) 107-JT TTV u/s drain valve G/L attended.
- 11) All Blowdown valve's gland packing was replaced/repacked.
- 12) 105-JT 5th stage casing drain 2nd isolation valve wheel was provided
- 13) LCV-14 u/s and d/s plug valve gland leakage was attended.
- 14) LC-3B c/v bypass valve was replaced for passing. 2" 800# SS SW Valve
- 15) 38 Kg steam to ARV-PV-02 d/s drain valve bonnet leakage was arrested.
- 16) 3.5 Kg steam to 102-J L.O.console degassing tank I/v gland leakage was attended.
- 17) K-1 outlet NH3 water to A.R.U. II nd I/V gland leakage was attended.
- 18) LC-21 Bypass valve was replaced for passsing & c/v d/s valve gland leak attended.
- 19) 103-JBT sealing steam valve was made operative
- 20) PT-502 i/v gland leak attended.
- 21) 112-JA C.W inlet line drain valve bush was replaced.
- 22) TRCV -10 Gland leak attended.
- 23) HCV-12 sealing steam both I/V G/L & check valveBonnet leak attended.1" X 800 # Valve.
- 24) 106-J discharge (BFW line D/S of orifice) gland leak. attended.
- 25) 101-F sample valve 3 nos gland leak attended.
- 26) 802-JLJT drain valve's gland leak attended.

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CODE NO	JOB DESCRIPTION
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01 17 01 VALVES REPAIR / REPLASMENT JOBS :

A) Following valves were replaced during the shut down.

- 1) R.W. line I/V at utility point near 106-J was replaced. 1 1/2 "CS GAV 800 # Threaded valve.
- 2) 2004-JT steam drain point was replaced.
- 3) 2004-JT steam inlet valve was relocated from rack to ground level.
- 4) 181-C Outlet block valve (2 Nos) were replaced for passing. (4" X 600# GAV)
- 5) 181-C Outlet front unit all trap & it's I/V were replced for passing. (1" X 800# GAV)
- 6) 105-JT 5th stage drain valve replaced.
- 7) 2004-JAT steam inlet line trap I/V replaced for passing. (1/2" X 1500 # Valve)
- 8) 2004-JAT Exhaust line trap I/V was replaced for passing.
- 9) 104-J Exhaust line vent valve was replaced for passing.
- 10) 38 ata steam header drain valve was replaced for passing. (1/2 " 800 # Valve)
- 11) LC3A bypass valve passing attended.

B) Following valves / check valves were attended for passing by M/s SEBIM India Limited, Halol.

- 1) 102-J discharge check valve
- 2) 102-J discharge bypass check valve
- 3) 800-J by pass check valve
- 4) 800-J discharge check valve
- 5) N.G. line at GAIL battery limit check valve
- 6) 107-JA discharge check valve
- 7) 105-JT steam inlet isolation valve
- 8) 101-JT steam inlet isolation valve

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CODE NO	JOB DESCRIPTION
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01 17 02 MOTOR OPERATED VALVES REPAIRS :

Following Motor Operated Valves were attended for passing by M/s EFCO by In-Situ lapping machine. These valves were also checked for their operation after the overhauling/lapping.

- 1) SP-3
- 2) SP-159 (Gear box of this valve was overhauled and all the antifriction bearings were replaced.
- 3) SP-152
- 4) SP-153
- 5) Gear box of SP-1 was overhauled and all the bearings were replaced.

01 17 03 FLANGE LEAKS :

Following flange leaks were attended.

- 1) 181-C Steam condensate drain line fig-8 blind flange leak.
- 2) 38 Kg. Steam to LTS block valve D/S flange leak. Check flange face (6"X 300 #)
- 3) 38 Kg. Steam to HTS inlet line orifice flange (3" X300) leakage.
- 4) USV 1108, 1110 Flange gaskets were replaced (P Reformer) 6"X 600 # Flexitallic
- 5) PIC-25 C/V U/S flange leak attended & its U/S isolation valve U/S & D/S gaskets were replaced.
- 6) MIC-22 Isolation valve flange leak was attended by repairing the flange face of the u/s flange of valve as well as pipeline.
- 7) 103-JAT Steam inlet TTV leak off line flange leak attended. 3" x 150 # Gasket.

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CODE NO JOB DESCRIPTION

01 17 04 RV'S OVERHAULING AND TESTING :

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

SR. NO.	TAG NO.	MATERIAL CODE	SERVICES	SET PRESS. Kg / Cm ²	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	
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		STEAM DRUM RV		Only Seat lapped
15	RV-101-F2		STEM DRUM R V		Only Seat lapped
16	RV-101-F3		STEAM DRUM RV		Only Seat lapped
17	RV-102-F		102-F OUTLET (PILOT OPERATED)	28.9	RV tested. However the same started passing at site.
18	RV-101-J	111,400,025	AIR COMP. DISCHARGE	36.9	

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CODE NO JOB DESCRIPTION

01 19 01 CO 2 STRIPPER 102 - EA/EB :

1) CO-2 STRIPPER(102-EA) :

All Stripper manholes (4 Nos.) were opened for inspection of trays, distributor header and demister pad. It was found that trays bolts were loosened and same was tightened. Some minor cracks were found on the top trays which were repaired and vessel was boxed up after thorough inspection of all the distributor trays.

2) CO-2 STRIPPER(102-EB) :

Stripper manholes were opened for inspection of trays, distributor header and demister pad. The distributor header was found totally damaged from 'Tee' joint. The flange at the inlet nozzle was found detached completely.

The demister pad centre piece (in front of the opening formed at the 'Tee' joint) was found damaged. The same was replaced with new one.

Distribution tray at the top was found having minor cracks which were repaired. The damaged pipe was replaced with new in-situ fabricated piece and the vessel was boxed up after thorough inspection of all the trays.

01 20 01 FABRICATION JOBS :

Following fabrication jobs were carried out during the shut down.

- 01) LC-14 by pass line was replaced alongwith the isolation valves, orifice and unions.
- 02) 123-J discharge line isolation valve, elbow, reducer and check valve were replaced with new one.
- 03) 101-U overflow line near 104-J pump was replaced.
- 04) 102-F outlet line upto the first flange was replaced with SS-321 material.
- 05) PRC-23 dampers were all replaced with 304 SS 6mm thk. Plates.
- 06) 121-J min. Flow line was rerouted for safety considerations.
- 07) P110 A/B pump's minimum flow lines were rerouted for facilitating removal of motor for overhauling. Also an I-beam was provided with mono rail for the same.
- 08) SP-71 discharge elbow was found leaking during shut down. The same was replaced .
- 09) Plate form for SP-71 vent valve was fabricated.
- 10) Old 123-C was removed from the position and shifted to scrape yard.
- 11) An isolation valve(flanged) was provided in 102-J gov. oil line(3"x150#)
- 12) Three no.s of lines passing through the stair case near 101-JCB were rerouted for safety point of view.
- 13) P 1 & P 2 Suction line pin hole was attended and Tee was removed.

PLANT TURNAROUND - APRIL - 2000

HS

AMMONIA PLANTINSPECTION JOBS

CODE NO	JOB DESCRIPTION
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01 41 01	<u>INSPECTION JOBS :</u>
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During April, 2000 Shutdown from 3.4.2000 to 23.4.2000, the following major inspection activities were performed in Ammonia Plant.

1. Automatic ultrasonic scanning of all the catalyst and 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. Magnetic Particle inspection of weld joints of selected pressure vessels of low temperature service.
6. Inspection of newly fabricated pipelines for replacement which mainly include Boiler Feed water Line, Process gas lines, small segments of synthesis gas and ammonia lines, Underground cooling water lines etc
7. Qualification tests of welders employed by contractors, visual inspection of equipment, magnetic field measurement on rotor of 103-JBT etc.

The detailed observations and recommendations for 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, and HT-LT convection zones etc. was carried out. The detailed report on observations made is enclosed herewith at Annexure-1.

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

- a) The brick lining on East wall 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 same was also replaced on west wall and other miscellaneous places 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 badly damaged causing direct exposure of outlet header to flue gases 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 thin sheet of SS-310. 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. Metallographic examination on the bare tube portion was carried out during this shutdown also. General deterioration of micro structure of the tube material has been observed.
- e) Aux. boiler furnace West wall panel replacement was done during this Shutdown where bulging was observed and the new refractory lining was carried out.
- f) Canister insulation holding plates of the risers were found detached/opened up which was attended during this shutdown.
- g) The Arch burner blocks(Ten nos)which were found damaged in visual inspection of the furnace were replaced by Maintenance group.

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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, 322 tubes were observed to be in 'C' category i.e. more deteriorated tube condition indicating voids, micro and macro fissures in the tube wall. Only one tube (no. 719) was detected to be in 'B' category and no tubes were found to be in 'A' grade. The summary of tube conditions is enclosed herewith at Annexure-2. All riser tubes are in 'C' category.
- b) Insitu metallography of catalyst tubes no.301 and 401 was carried out. Also, bottom collector header no. 3 and 4 were examined by insitu metallography. No major abnormalities were detected in the micro structure.
- c) DP test of all the 16 Nos. header field weld joints was carried out. Also, one segment of each joint was radiographed. No service defects were observed in any joint.
- d) DP test of catalyst tube to weldolet and weldolet to header weld-joints for the following Catalyst and Riser tubes was carried out. No defects were observed. 118, 207, 327, 442, 526, 614, 710, 836, Riser-1 and Riser-8.
- 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. Creep was found to be zero in 232 nos. of tube and creep was upto 0.73 % in 103 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 4.962" which corresponds to 0.48 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 5.620" which corresponds to 0.45 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.

CODE NO	JOB DESCRIPTION
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- j) Ultrasonic flaw detection of dissimilar metal weld joint of catalyst tubes No.506 and 507 (G-4852 to T-11 material) was carried out. No defect was observed in this weld joint. Weld joints of other tubes could not be made accessible to avoid damage to roof insulation as it was taking place while exposing this weld joint.
- 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 5.00 mm was observed against design thickness of 5.54 mm which is within safe limit.

01 41 02 VSSELS AND OTHER EQUIPMENT:

1) 103-D, SECONDARY REFORMER:

SECONDARY REFORMER BOTTOM:

Visual inspection of Secondary Reformer Bottom zone was carried out after removal of plug of bottom manhole. Also, the air mixer assembly was taken out for inspection. The following observations were made.

- A) The condition of the air mixer assembly was found to be satisfactory.
- B) After removal of the bottom plug, the bottom compartment of the vessel was inspected and the following observations were made.
 - a) The holes in the dome were found choked in appx. 50 % 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 8 to 10 inches in appx. 75 % circumference starting from West to south direction.
 - c) Refractory behind the shroud was found partially eroded.
 - d) At four different locations the dome bricks were found partially damaged.
 - e) Refractory around the nozzle openings of 101-CA/CB was found eroded in about 25 % circumference.
 - f) The distributor of 101-CB was found to have got cracked open along the complete length showing max. opening of about 4 inches.
 - g) The liner segment of 101-CB nozzle close to the distributor end was found bulged inward by about 4 to 6 inches restricting the gas passage in about 25 % 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, 1999. The following observations were made.

- a) Inward bulging by about 1 to 2 inch of liner was observed around all the riser stub ends except riser No.3.
- b) Around riser no.5,6,7 and 8 castable refractory found loose in the opening between riser stub end and liner.
- c) Top portion of riser no.7 and 8 found projected outside the liner by about 5 to 7 mm and the same found deformed in shape.

The overall condition of the transfer line is satisfactory.

3) 102-EA, CO2 STRIPPER:

In general the distributor pipe supports and header branch welds were observed to have cracks and fractures. However, distributor pipe and trays were found intact in position. The detailed observations are given below.

- a) South east support of the distribution header welded with the shell was found cracked at beam area. The beam fastening bolts were also missing.
- b) The distribution header was found cracked at four different locations which were marked for repairs.
- c) The header support plate and beam were found cracked at seven different locations which were marked for repairs.
- d) West side weir plate was found cracked at the weld joint with the shell and few cracks were also observed on the welding of the weir plate with the sieve tray which were marked for repairs.
- e) 1" dia stiffener pipe provided on west side leg of distribution header pipe piece was found sheared on its south end along with base plate.
- 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) Ultrasonic thickness measurement was carried out. No reduction in thickness was observed. Mini. thickness of the shell was measured to be 9.7 mm (Between tray 1 to 11) against design thickness of 9.525mm. Between tray 11 to bottom, thickness was found to be 16.2 mm against 15.9 mm.

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4) 102-EB, CO2 STRIPPER:

In general, severe damage to the distributor pipe and its supports was observed. The distributor pipe was broken into pieces at different locations. Also the demister pad at the top was found damaged. Major repair to the header was required to be carried out. The detailed observations of visual inspection are described below.

- a) The distributor pipe was found detached from the flanged end near the inlet nozzle. The 90 degree bend end of the distributor pipe was completely fractured and the distributor pipe was displaced from its position. The slip on flange welded with the distributor pipe inlet nozzle was found to have one pinhole and porosities at 14 different locations as observed in the dye penetrant test. Also, the flange of the nozzle was tack welded from the back side and full welded from inside. Full welding was carried out on the flange at the back side in view of heavy shock loading faced by this nozzle.
- b) The demister pad was found damaged at the centre as about 12 inch x 18 inch opening was found in it which might have happened after the header damage.
- c) The parent pipe of the distribution header in the remaining length was found to have through cracks at several locations.
- d) The support plate for distribution header welded with shell at North East end was found cracked at weld joint in about 4 inch length. Similarly, the support plate at South east end was found cracked in about 6 inch length in 'V' shape at support beam area.
- e) Similarly, on North West end, the cracks of 5 inch and 6 inch lengths were observed in the support plate.
- f) The weir plate on the East end was completely dislocated from its place and was found missing.
- g) The sieve trays in the centre near the opened tray for man entry were observed to have cracks of about 6 inch length max. at scattered locations.
- h) A few sieve tray central segments were found to have cracks of $\frac{1}{2}$ inch to 2 inch length on tray no. 2,4,9,14 and 15.
- i) A few bolts of downcomers on tray no. 3,15 and 17 were missing.

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- j) In general the colouration of the shell was dark grey except at scattered locations bright yellowish brown patches were observed.
- k) Grey coloured hard scales were observed in the shell which was particularly more in the bottom four trays length of the shell.

All the defective areas of distributor header & supports were D.P. tested before and after repairs. The distributor pipe segment was also replaced in 102-EB. All the new weld joints were also D.P. tested and necessary rectifications were got done before clearing the vessel for boxing up. In view of the frequent failure of the distributor headers it is recommended to check the design and make necessary modifications to avoid such failures.

Ultrasonic thickness measurement was carried out.No reduction in thickness was observed.Mini.thickness of the shell was measured to be 9.9 mm (Between tray 1 to 11) against design thickness of 9.525 mm.Between tray 11 to bottom, thickness was found to be 15.9 mm against 15.9 mm.

5) 101-E CO2 ABSORBER:

Visual inspection of the complete vessel from top manhole upto 20th tray and from bottom manhole 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 areas which were repaired during Sept-Oct-93 Shutdown are seen unaffected though the Ceramic coatipeeled off from this area. The following observations were made.

- a) Between 4th and 5 th tray,on West side, corrosion channeling was observed which was having depth of about 1 mm and 1 inch length.
- b) Between 7th and 8 th tray,on West side, corrosion channeling of 1 to 1.5 mm depth was observed at three different locations which had length of appx. 12", 8" and 2" respectively.
- c) Between 8th and 9 th tray,on West side, corrosion channeling was observed to have depth of about 1 to 1.5 mm in 24 inch length.
- d) 2 nos. of bolts of 9th tray downcomer were loose.
- e) On 10 th tray, the sample collection pipe alongwith its flange has got bent.
- f) Between 11th and 12th tray on West side, corrosion channeling of about 2 inch length and appx. 1 mm depth was observed.

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- g) 5 nos. of tray fixing bolts were found loose on 12th tray
- h) Between 14th and 15 th tray, the sample collection pipe flange has got bent. Also the external surface of the pipe has got pittings.
- i) Between tray no. 16 and 17, on North side, corrosion channeling of about 1.5 mm depth and 15 mm width was observed throughout the visible length of the shell in this compartment.
- j) Between 17th-18th tray as well as between 19th-20th tray, the ceramic putty layer applied to cover the shell surface was found partially cracked and peeled off. However, the shell surface was found free from any sign of corrosion in this area.
- k) 4 nos. bolts of the downcomer of 20th tray were found loose.
- l) Three nos. of tray supporting clamps were found lying loose on the bottom dished end.
- m) The colouration of the ceramic putty was observed to be reddish brown in 20 th tray and below. Below 20 th tray, the putty has got peeled off at scattered locations particularly more on East side at three locations of area 4 feet x 1 ½ feet, 2 feet x 8 inch and 6 inch x 6 inch. However, the shell surface was intact, free from any corrosion attack.
- n) The bottom outlet nozzle was found to be in good condition. No corrosion was found on the weld joint.
- o) Ultrasonic thickness measurement was carried out. Mini.thickness on shell was found to be 46.7 mm against 47.6 mm design thickness.

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. 7 Nos. of fastening bolts of West side separator plates were missing, and one bolt was found to be sheared off.
- 3. 5 nos. of fastening bolts of East side separator plates were found to be sheared off.

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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 and loose nut was found lying inside the nozzle.

5. Pinhole of appx. 3 mm dia was observed on the welding of 6" BFW distributor pipe near flange joint.

6. Ultrasonic thickness measurement was carried out. Mini.thickness on shell was found to be 108.3 mm and 104.6 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 found to have severe corrosion channeling and loss of wall thickness of appx. 2 to 5 mm during April, 99 shutdown was repaired by putting stainless steel sleeve. Also, the outlet piping which was of C.S. material was replaced by SS to avoid corrosion failure. All the weld joints were inspected by D.P test followed by radiography after fabrication.
2. Epoxy paint had got peeled off at scattered location. At some locations, previous coat was seen, however at about 7 different locations, shell metal had got exposed. It was recommended to carry out epoxy painting of this vessel.
3. Epoxy lining on the face of nozzle (from 106-C) had also got peeled off.
4. Demister pad at top was found intact in position.
5. Manhole nozzle welding (at bottom) inside the shell had got corrosion attack resulting in about 3-5 mm deep cavities. Same attack had been observed on the stub end of this nozzle.
6. Ultrasonic thickness measurement was carried out. Mini.thickness on shell was found to be 35.9 mm and 35.8 mm on top dished end / 36.6 mm on bottom dished end against design thickness of 34.925 mm and 33.33 mm for shell and dished end respectively.

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8) 106-F SECONDARY AMMONIA SEPARATOR:

1. The demister pads were intact in position. However, lot of oil and sludge were found on the demister pad surface.
2. There was no corrosion seen on the shell surface. However, oil layer was found on the entire shell surface.
3. All the weld joints of the vessel which were accessible were found to be satisfactory.
4. The shell had assumed blackish colouration.
5. Ultrasonic thickness measurement was carried out. Mini. thickness on shell was found to be 106.7 mm and 59.7 mm on East dished end /60.4 mm on West dished end against design thickness of 104.8 mm and 53.975 mm for shell and dished end respectively.

9) 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.
6. Ultrasonic thickness measurement of the vessel was carried out. Mini. thickness on shell was found to be 14.2 mm and dished end 17.1 mm against design thickness of 14.2875 mm for both shell and dished ends respectively.

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10) 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.
4. Ultrasonic thickness measurement of the vessel was carried out. Mini. thickness on shell was found to be 19.2 mm and dished end 19.1 mm against design thickness of 21.4 and 18.2 mm for shell and dished ends respectively.
5. Cold insulation of this vessel was removed and left uninsulated as per process requirements. The external visual inspection of shell and dished ends and magnetic particle inspection of all the nozzle welds were carried out. Pitting and Corrosion cavities 2 to 3 mm deep approx. were observed at few locations on external surface of shell. Rest of the surface found satisfactory

11) 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 10 mm and 12.9 on Dished ends against design thickness of 9.52 mm for both Shell and Dished ends. Also, one no. Circumferential weld joint between shell and East side Dished end was inspected by ultrasonic flaw detection as lamination on an area 1x1 sq.inch approx. was observed in the dished end during thickness measurement. No defect was detected in the weld joint.

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7. Cold insulation of this vessel was replaced with PUF insulation during this shutdown. The external visual inspection of Shell and Dished ends and magnetic particle inspection of all the nozzle welds were carried out. Pitting cavities 1 to 2 mm deep approx. were observed all around the external surface of shell and dished end.

12) 111-F, SECOND STAGE REFRIGERANT FLASH DRUM:

The following observations were made during visual examination.

1. The shell inside surface had assumed blackish grey colouration.
2. All the weld joints 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 intact in position and in good condition.
5. Ultrasonic thickness measurement was carried out. Mini. thickness on Shell was found to be 10 mm and 21.5 mm on Dished ends against design thickness of 9.52 and 19.05 mm for Shell and Dished ends respectively.
6. Cold insulation of this vessel was replaced with PUF insulation during this shutdown. The external visual inspection of Shell and Dished ends and magnetic particle inspection of all the nozzle welds were carried out. Minor scattered pitting and scales were observed in general on the external surface of the Shell. However, overall condition of vessel shell and weld joints is found satisfactory.

13) 112-F, THIRD STAGE REFRIGERANT FLASH DRUM:

The following observations were made during visual examination.

1. The demister pads were in good condition.
2. The colouration of the inside surface of shell was dark blackish.
3. Oil was found sticking to the vessel shell.
4. All the weld joints and shell internals were found to be free from corrosion.

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5. Hard scales were observed in the shell which were more prominent on the dished ends.
6. Overall condition of the vessel was satisfactory.
7. Ultrasonic thickness measurement was carried out. Mini. thickness on Shell was found to be 10.2 mm and 22.3 mm on East Dished end/12.3 mm on West Dished end against design thickness of 9.52 mm for Shell and 19.05 mm for East Dished end and 9.52 mm for West Dished end.
8. Cold insulation of this vessel was replaced with PUF insulation during this shutdown. The external visual inspection of Shell and Dished ends and magnetic particle inspection of all the nozzle welds were carried out. Pitting and score cavities 0.5 to 1 mm deep approx. were observed on North side of shell. Minor cattered pitting and scales were observed on rest of the external surface.

14) H-110 NAPHTHA PRE HEATER:

Visual inspection was carried out and observations were as under.

1. Loose insulation material of convection zone was found lying on two burners.
2. Floor cleaning was recommended as debris were lying on the floor.
3. On Refractory lining of shell, minor cracks were observed at several places mainly in vertical plane.
4. Coil support bolts were found loose at some places.
5. Insitu metallography was carried out. The observations are discussed separately in this report.
6. During January 2000, thickness measurement of the complete coil was carried out. Minimum thickness on the coil was found to be 8.0 mm against design thickness of 8.6 mm. However, 4"NB 90 degree elbow at the bottom of the coil was found to be Sch-40 instead of Sch-80, which has been recommended for replacement.

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15) H-111, NAPHTHA SUPER HEATER:

Visual inspection observations were as under.

1. Convection zone insulation material was found lying on burners.
2. Refractory pieces, which got eroded was found accumulated on the floor. The same was cleaned.
3. Several shallow cracks were observed on shell refractory.
4. A layer of refractory of shell had eroded at several places.
5. Coil support bolts were found loose at several places.
6. Insitu metallography was carried out. The observations are discussed separately in this report.

16) R-111, SULPHUR ABSORBER:

The vessel was internally inspected after removal of the catalyst. The following observations were made.

1. The shell inside surface was found silver bright in colouration.
2. Thin loose deposits of catalyst were observed adhered to the surface of the shell at scattered locations.
3. The gas inlet distributor was found choked.
4. Ultrasonic thickness measurement of the vessel was carried out. Mini. thickness on Shell was found to be 35.2 mm and 39.4 mm on Top Dished end against design thickness of 35 mm and 35 mm (Mini.) for Shell and Dished end respectively.

In view of the heavy rust and deposits observed in the absorber, the pipe line from Hydrogenator to Sulphur Absorber was inspected for thickness. The report on thickness measurement is separately enclosed. However, no appreciable loss of wall thickness was detected on the pipe line.

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01 41 03

INSPECTION OF COLD INSULATED EQUIPMENT:

Cold insulation of some of the equipment was decided to be replaced during this shutdown. Various inspection activities were performed on these equipment after removal of cold insulation. In addition to Magnetic Particle Inspection of the nozzle weld joints and Ultrasonic thickness measurement, Visual inspection of these vessels was carried out from outside after the removal of insulation. The followings were the observations:

(1) 104-F:

Vessel was inspected from outside. External surface found free from any sign of corrosion.

(2) 105F:

Pittings 0.5 to 1 mm deep approx. were observed all around on the external surface.

(3) 109-F:

Pitting and Corrosion cavities 2 to 3 mm deep approx. were observed at few locations on the external surface of the shell. Rest of the surface found satisfactory. This vessel has been left uninsulated as per process requirements.

(4) 110-F:

Pitting cavities 1 to 2 mm deep approx. were observed all around the external surface of shell and dished end.

(5) 111-F:

Minor scattered pittings and scales were observed in general on the external surface of the shell. However, overall condition of the vessel Shell and weld joints is found satisfactory.

(6) 112-F:

Pitting and score cavities 0.5 to 1 mm deep approx. were observed on North side of shell. Minor scattered pittings and scales were observed on rest of the external surface.

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(7) 117-C, FEED/RECYCLE GAS 1ST STAGE CHILLER:

Cold insulation of this exchanger was removed for replacement of insulation. External Visual inspection of Shell and Dished ends/Channels was carried from outside. External surface found free from any sign of corrosion. Ultrasonic thickness measurement was carried out. Min. thickness on Shell was found to be 10.7 mm, 11 mm for Dished end and 63 mm for Channel against design thickness of 11.11 mm for Shell/dished end and 63.5 mm for Channel.

(8) 118-C, FEED/RECYCLE GAS 2ND STAGE CHILLER:

Cold insulation of this exchanger was removed for replacement of insulation. External Visual inspection of Shell and Dished ends/Channels was carried from outside. External surface found free from any sign of corrosion. Ultrasonic thickness measurement was carried out. Min. thickness on Shell was found to be 10.7 mm, 10.9 mm for Dished end and 64.8 mm for Channel against design thickness of 11.11 mm for Shell/dished end and 63.5 mm for Channel.

(9) 119-C, FEED/RECYCLE GAS 3RD STAGE CHILLER:

Cold insulation of this exchanger was removed for replacement of insulation. External Visual inspection of Shell and Dished ends/Channels was carried from outside. External surface found free from any sign of corrosion. Ultrasonic thickness measurement was carried out. Min. thickness on Shell was found to be 11.7 mm and 11.6 mm for Dished end against design thickness of 12.7 mm for Shell and dished end.

(10) 120-C, NH3 CONVERTER FEED GAS & RECYCLE GAS EXCHANGER:

Cold insulation of this exchanger was removed for replacement of insulation. External Visual inspection of Shell and Dished ends/Channels was carried from outside. External surface found free from any sign of corrosion. Ultrasonic thickness measurement was carried out. Min. thickness on Shell was found to be 26.2 mm and 69 mm for Channel against design thickness of 24.6 mm for Shell and 65.08 mm for Channel. On top layer of the multilayered shell, thickness found to be 33.1 mm against multilayer thickness of 65.05 mm.

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(11) 125-C, PURGE GAS CHILLER:

Cold insulation of this exchanger was removed for replacement of insulation. External Visual inspection of Shell and Dished ends/Channels was carried from outside. External surface found free from any sign of corrosion. Ultrasonic thickness measurement was carried out. Min. thickness on Shell was found to be 7.7 mm and 16 mm for Dished end against design thickness of 8.18 mm and 15.88 mm for Shell and dished end respectively.

(12) 126-C, FLASH GAS CHILLER:

Cold insulation of this exchanger was removed for replacement of insulation. External Visual inspection of Shell and Dished ends/Channels was carried from outside. External surface found free from any sign of corrosion. Ultrasonic thickness measurement was carried out. Min. thickness on Shell was found to be 8.1 mm against design thickness of 8.38 mm.

(13) 129-C, SYN. GAS COMP. INTERSTAGE COOLER:

Cold insulation of this exchanger was removed for replacement of insulation. External Visual inspection of Shell and Dished ends/Channels was carried from outside. External surface found free from any sign of corrosion. Ultrasonic thickness measurement was carried out. Min. thickness on Shell was found to be 9.4 mm, 10.8 mm for Dished end and 26.2 mm for Channel against design thickness of 9.53 mm for Shell/dishedend and 28.5 mm for Channel.

(14) 141-C, SYN. GAS COMP. SUCTION CHILLER:

Cold insulation of this exchanger was removed for replacement of insulation. External Visual inspection of Shell and Dished ends/Channels was carried from outside. External surface found free from any sign of corrosion. Ultrasonic thickness measurement was carried out. Min. thickness on Shell was found to be 27.4 mm, 16.1 mm for East Dishedend, 15.6 mm for West Dished end against design thickness of 28 mm and 18 mm for Shell and dished end respectively.

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CODE NO	JOB DESCRIPTION
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01 41 04	<u>MISCELLANEOUS JOBS:</u>
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1. WELDER QUALIFICATION TESTS:

- a) Performance qualification tests of 37 Nos. welders offered by M/s General Engg. Bharuch was carried out. 12 Welders were qualified during the test. These welders were allowed to perform welding jobs in the plant. It has been observed that the quality of the welders offered by this agency is not satisfactory and involves a large quantum of work like preparations of welder test pieces, radiography work etc. It is proposed to engage only those welders who have been qualified by IFFCO in the past or the welders with minimum ten years experience on welding of pipelines.
- b) Performance qualification test for 10 Nos. welders was carried out for M/s UB Engg. Co. Out of 10 welders, 8 welders were qualified based on visual test, bend test and radiography results. The fabrication of cooling water lines in Ammonia plant was carried out by this agency.
- c) Welder qualification test of 2 Nos. welders of M/S. J & J Engineers was carried out. Two welders were qualified for performing welding jobs on DM water pipeline, BFW pump min. Flow lines FRC-2 connected pipings etc. in Ammonia plant.
- d) Welder performance qualification test for 4 Nos. welders was carried out for the fabrication of Process gas pipe lines, NH line, SG line, Condensate line etc. for fabrication jobs ordered on M/s Jacobs H&G Ltd. Four welders were qualified for these fabrication jobs.
- e) One welder was offered by M/s Aneesh Engrs for performance qualification for fabrication work of Hot Ammonia line in Ammonia plant. The welder was qualified for the job.

2. CRANE LOAD TEST:

One No. Crane was hired from M/s Express, Baroda. Load test of this Crane was carried out at 22 tonnes test load. The crane was found fit for use during load testing and on subsequent visual inspection of components.

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CODE NO	JOB DESCRIPTION
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3. D.P. TEST:

Dye penetrant examination of weld joints of all the pipelines fabricated by M/s U.B. Engineers for Underground Cooling Water pipings, M/s Aneesh Engineers, for Hot Ammonia piping from Ammonia Battery Limit to Urea Plant, M/s Jacobs H&G Ltd., Mumbai for different Process gas pipe lines, SG Line, NH line, SC line, Air line etc. and our Workshop group for 102-F outlet piping, 123-J discharge piping and other 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 of 102-B Startup heater outlet piping (SG-62A/B-4") near 102-B was also carried out to detect service defects, if any. No defects were observed. Also, both the tubesheets of 802-C Booster compressor cooler were D.P. tested after retubing to assess the quality of tube to tubesheet welds. Services of four Nos. of qualified Dye Penetrant examination technicians were availed from M/s NDT Services, Ahmedabad.

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 miscellaneous weld joints like 123-J discharge line, 102-F outlet line, Synthesis Converter (122-C) outlet piping, Primary Reformer Outlet Header weld joints etc. in Ammonia Plant. In addition to these, since the contractors M/s. Jacobs H & G, M/S. UB Engrs and M/s J & J Engineers could not arrange radiography teams at certain instances, the weld joints of the pipe lines fabricated by these parties were also radiographed on chargeable basis to avoid delay as they were falling in the purview of the contractor. Additional radiography source of high curie (20 Ci) was arranged through this party to reduce the radiography time.

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CODE NO JOB DESCRIPTION

5. INSITU METALLOGRAPHY EXAMINATION:

In order to evaluate the condition of certain critical plant equipment and pipelines, Insitu metallographic examination was carried out. The details of spots examined on individual equipment are given below. The services of M/S. TCR Advanced Engineering Pvt. Ltd, baroda were hired for the said job.

SL.NO	EQUIPMENT	DESCRIPTION OF WORK	RECOMMENDATION
1	NAPHTHA SUPERHEATER (H-111)	Oxalic acid etch test and general microstructure were examined on second coil from the bottom having material of construction ASTM A312 TP 316H. Oxalic acid etch test shows the carbide precipitation at grain boundary and microstructure shows the austenitic structure.	We should check the increase in thickness of grain boundary for carbide precipitation in service & should prepare the database for future decision. However, microstructure is normal.
2	NAPHTHA PRE HEATER (H-110)	Microstructure was examined on third coil from bottom on parent metal as well as on weld metal, having material of construction ASTM A335 GR P22. Microstructure shows ferrite and upper bainite/pearlite.	Microstructure is normal.
3	OUTLET PIPE FROM PRE REFORMER TO PRIMARY REFORMER	Microstructure was examined on parent metal of this pipe having material of construction ASTM A335 GR P22. Microstructure shows ferrite and upper bainite/pearlite.	Microstructure is normal.
4	PRIMARY REFORMER INLET HEADER	Microstructure was examined on 1st and 4th inlet header having material of construction A335 P11. In both the cases microstructure shows ferrite grains and also decarburization.	Decarburization could be from the manufacturing stage. By grinding of further 1mm (If thickness permit) depth of decarburization can be found out. To be exercised during next Shutdown.

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CODE NO JOB DESCRIPTION

5	PRIMARY REFORMER OUTLET HEADER	Oxalic acid etch test and microstructure was examined on outlet header of third and fourth row having material of construction G-4859 near tube no.321 and 421. In both places oxalic acid etch test shows carbide precipitation and microstructure shows worked austenitic grains, also at some places attack of carburization is seen.	Micro structure and Oxalic acid etch test should be carried out after further grinding of 0.5-1.0 mm (if thickness permit) on next opportunity.
6	REFORMER TUBES	Oxalic acid etch test and general structure was examined on the tube no.301 and 401 having material of construction G-4852-M. For both the tubes, oxalic acid etch test revealed carbide & general structure shows austenitic matrix with carbide network.	No abnormality is visible in oxalic acid etch test. General structure record has been taken as reference for future study.
7	H.T.STEAM SUPER HEATER COIL	Microstructure examination was carried out on coil no.5 and 7 on parent metal and on weld joint of coil no 9 having material of construction 1 1/4 Cr-1/2 Mo ferrite grains are visible on coil no 5 and 7 and ferrite + pearlite observed on coil no 9.	Decarburization is observed which needs evaluation after further grinding. This will be done during next turnaround.
8	L.T.STEAM SUPER HEATER COIL	Microstructure examination was carried out on coil no.3,5 and 10 on parent metal having material of construction CARBON STEEL. Ferrite and Pearlite is observed.	In situ spheroidization of Pearlite is observed. Needs monitoring.

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CODE NO JOB DESCRIPTION

9	START-UP HEATER (102B) COIL	Microstructure examination was carried out on the coil no.4(north),coil no.6(south), no.5(east) and no.5(west) having material of const. 2 ¼ Cr+1Mo.Microstructure shows Ferrite grains with carbides and also few grain shows initiation of grain boundry cracks.	Needs to be monitored in next opportunity.
10	S.G.-1-12" (106D TO 114C)	Microstructure examination was carried out at the inlet bend having material of construction P11 which shows tempered Upper bainite and Ferrite.	Normal structure observed.
11	S.G.-32-6" (S.G.-62A/B TO S.G.-25)	Microstructure examination was carried out which shows ferrite and carbides. The pipeline is having material of construction Carbon steel.	Insitu spherodization has occurred.Needs monitoring.
12	S.G-33-14" (122C TO 123C)	Microstructure examination was carried out at 11 locations i.e on weld joints and parent metal. The pipe line is having material of const. P22	At four locations on parent metal, intergranular micro cracks were detected in longitudinal direction. Out of these,at two locations grinding upto 1.5 mm depth was done and still micro crack was revealed in the structure at one location.It is recommended to re-examine these spots during next shutdown and to remove the pipe portion for RLA study by destructive testing. Normal structure was revealed on weld joints/HAZ.
13	S.G.34-14" (123C TO 121C)	Microstructure examination was carried out at 2 locations on parent metal. The pipe line is having material of const. P11.	No abnormality was observed in micro structure.

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CODE NO JOB DESCRIPTION

14	S.G.-2-14" (114C TO 115C)	Microstructure examination was carried at 1 location on parent metal. The pipe line is having material of const. Carbon steel.	No. abnormality was observed in microstructure.
15	S.G.-7-10" (103J TO 136C)	Microstructure examination was carried at 1 location on parent metal. The pipe line is having material of const. Carbon steel.	No abnormality was observed in micro structure.
16	S.G.-21-14" (121C TO S.G.-22/23)	Microstructure examination was carried at 1 location on parent metal. The pipe line is having material of const. Carbon steel.	No abnormality was observed in micro structure.
17	S.G.-22-12" (S.G.-21 TO 105D)	Microstructure examination was carried at 1 location on parent metal. The pipe line is having material of const. Carbon steel.	No abnormality was observed in micro structure.
18	S.G.-23-12" (S.G.-21 TO HEADER)	Microstructure examination was carried at 3 locations on parent metal. The pipe line is having material of const. Carbon steel.	No abnormality was observed in micro structure.
19	S.G.-25-8" (S.G.-23 TO 105D(MIC-13)	Microstructure examination was carried at 1 location on parent metal. The pipe line is having material of const. Carbon steel.	No abnormality was observed in micro structure.
20	S.G.-25-8" (S.G.-23 TO 105D(MIC-14	Microstructure examination was carried at 1 location on parent metal. The pipe line is having material of const. Carbon steel.	No abnormality was observed in micro structure.

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CODE NO JOB DESCRIPTION

21	S.G.-25-8" (S.G.-23 TO 105D(MIC-15	Microstructure examination was carried at 2 locations on parent metal. The pipe line is having material of const. Carbon steel.	No abnormality was observed in micro structure.
22	S.G.-25-8" (S.G.-23 TO 105D(MIC-16	Microstructure examination was carried at 1 location on parent metal. The pipe line is having material of const. Carbon steel.	No abnormality was observed in micro structure.
23	LTS-104D	Microstructure examination was carried out at 3 locations on parent metal and weld. The Shell is having material of construction.	No abnormality was observed in microstructure.

6. HARDNESS MEASUREMENT:

In view of the metallurgical degradations observed in the 122-C outlet piping, SG-33-14", hardness measurement was carried out on the weld joint, HAZ as well as on parent metal. The following observations were made. The hardness values were found to be satisfactory.

SR. NO.	LOCATION	HARDNESS(BHN)		
		WELD	HAZ	PARENT METAL
1	Horizontal Elbow joint at 1st Platform level.	245	165	150
2	Flange joint in Vertical pipe.	257/265	201	165
3	Vertical Elbow joint at top platform.	150	165	177

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CODE NO JOB DESCRIPTION

7. 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	BW-3H-12"	102-C	101-F	03
2	BW-30H-12"	101-F	COIL-E 101 B	05
3	MS-1-8"	MS-2	HEADER	01
4	MS-2-12"	HEADER	MS-1	01
5	MS-3-14"	MS-11	MS-2	02
6	MS-11-14"	103-J	MS-3	03
7	SG-25-8"	SG-32	105-D	02 **
8	SG-62A-4"	102-B	SG-32	02
9	SG-62B-4"	102-B	SG-32	02

** Lamination type indication were observed in the parent metal of the elbow during flaw detection and same was radiographed but no abnormality was observed in radiography. This type of indication was also observed during previous inspection carried out during April 1999.

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CODE NO JOB DESCRIPTION

8. ULTRASONIC THICKNESS MEASUREMENT:

During the shutdown, ultrasonic thickness measurement was carried out on various pipelines and equipment in the plant. The detailed results of inspection are attached herewith at Annexure-8 (for equipment) and Annexure-9 (for pipelines).

9. SPARK TESTING :

Spark testing of coating and wrapping applied on new underground cooling water/hot water lines was carried out. These lines were replaced by Technical department through M/S. UB Engineers. The defective areas were identified and got repaired followed by spark testing for confirmation.

10. MAGNETIC PARTICLE INSPECTION:

Weld joints of the following equipment were examined by Magnetic Particle Test after necessary surface preparation. No defects were observed during the test.

SL. No.	EQUIPMENT	DESCRIPTION	REMARKS
1	104-F	Syn Gas Comp. suction Drum	All nozzles tested. No defect observed.
2	105-F	103-J 1st stage separator	--DO--
3	109-F	Refrigerant Receiver	--DO--. Also, MPI of all weld joints was done from inside.
4	110-F	1st Stage Ref. Flash drum	All nozzles tested. No defect observed.
5	111-F	2nd Stage Ref. Flash drum	--DO--
6	112-F	3rd Stage Ref. Flash drum	--DO--

FH

CODE NO JOB DESCRIPTION

SL. No.	EQUIPMENT	DESCRIPTION	REMARKS
7	117-C	First stg.chiller	--DO--
8	118-C	2nd stage chiller	--DO--
9	119-C	3rd stage chiller	--DO--
10	120-C	Conv. feed/recycle gas exchanger	--DO--
11	125-C	Purge Gas chiller	--DO--
12	126-C	Flash gas chiller	--DO--
13	129-C	Syn Gas Interstage Cooler	--DO--
14	141-C	Syn.Gas Compressor Suction Chiller	--DO--
15	E-2	Cooler(PGR)	--DO--

11. 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

12. CHEMICAL ANALYSIS OF MATERIALS:

Using the portable Arcmet-930 SP optical emission spectrometer, chemical analysis of the converter outlet piping i.e. SG-33-14" was carried out due to the deformities observed in Insitu Metallography. Analysis was carried out at two different elevations where metallography was performed and the material was confirmed to be A335 Gr. P-22 as per the requirement. Also, the analysis of various pipe fittings received from vendors for the use in the plant piping replacement, soot blower pipe for BHEL boiler etc. was carried out as and when required.

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CODE NO	JOB DESCRIPTION
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13. OVERSPEED TRIP TEST:

Before startup, overspeed trip test speed measurement and vibration measurement of BFW pump Turbine, 104JAT, ID Fan Turbine 101-BJT and Synthesis Gas Compressor LP Turbine 103-JBT were carried out.

14. PRESHUTDOWN INSPECTION:

Some of the equipment operating at comparatively lower temperatures (approx. below 100 deg.C) which were accessible for inspection, were taken up for Ultrasonic thickness measurement and external visual inspection prior to shutdown. The results of thickness measurement are summarised and attached at Annexure-11.

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ANNEXURE-1

VISUAL INSPECTION REPORT DETAILS OF PRIMARY REFORMER RADIANT ZONE.

1) BURNER BLOCKS:

Ten nos. of burner blocks which were found to have partial damage, were replaced during this shutdown.

2) BOTTOM HEADER INSULATION:

<u>Row No.</u>	<u>Location of header insulation damage</u>
1	South side end plug
2	Below tube no.21, both end plugs
3	Below Catalyst tube no 1,40,41,42
4	Below Catalyst 15,16,27,32,42 and north end plug
5	Below tube no. 10,14,15,16,18,19,20,21, Riser, North end plug
6	Below tube no. 1,15,16,Riser
7	Below tube no. 1,4
8	Below tube no.28

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. shell on east wall. Partial repairs were also carried out at different locations in the furnace walls where erosion/ gap between the brick panels were excessive.

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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.

<u>ROW NO.</u>	<u>LOCATION OF DAMAGE</u>
1	Around tube no.6,7,8, 14, between 17 and 18, 30 and 31, and 38 to 40. A gap was observed near burner block no.13 and 14 (exposing the roof plate) and also between tube no. 41 and 42.
2	Between tube no. 7 and 8, 14 and 15, between burner block no. 9 and 10, 11 and 12, 13 and 14.
3	Between tube no. 37 and 38, near burner block no. 10
4	Between tube no. 31 and 32
5	Between tube no. 3/4, 8/9, 13/14, 23/24, and 37/38 near burner block no. 3,7,10, and 11
6	Between tube no. 9/10, 31, 34 to 38, 41/42
7	Between tube no. 20/21, Riser/22, 23/24, near burner block no. 10
8	Between tube no. 3/4,7/8,25/26, near tube no. 42, near burner block no. 1,2,4 and 13.

Visual Inspection Report of H.T. Convection Zone Bottom.

1. On west wall, the fiber blanket covering ss sheet had got completely removed exposing the fiber blankets in appx.2 metre x 3 metre area.
2. On South wall also the fiber blanket covering sheet had got completely removed in about 50 % height along the complete wall length. Also, at few spots, the layer of fiber blanket had got peeled off.
3. On East wall also, the fiber blanket had got exposed to flue gases due to removal of protective sheet in appx. 1.5 metre x 2 metre area.
4. The remaining portion of the wall also has got the protective sheet badly buckled and burnt out. The complete sheet is required to be replaced.
5. Overall condition of the mixed feed coil and its supports was found to be satisfactory.

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6. At some places, gunniting material was found peeled off, which was attended by Civil group.

LT Convection Zone:

- a) Between first column and east wall, gunniting castable material covering the side plate above the BFW coil elevation had got detached in appx. 5 metre x 0.5 metre area.
- b) Between first and second column, gunniting castable material on the side plate above the bottom coil elevation had got detached in appx. 1 metre x 0.5 metre area.
- c) Between second and third column also, the gunniting castable refractory material has got peeled off in about two metre length.
- d) Between third column and West wall, gunniting castable material was found peeled off in complete length.
- e) Minor damage of refractory at scattered locations was also observed near the I.D. fan suction port.

All the areas where refractory damage was observed were attended by civil group.

HT/LT ZONE TOP :

- a) All dampner plates had got fractured and badly distorted in auxiliary boiler to HT Zone duct.
- b) On south wall of the duct near the top dampner, the ss-310 covering sheet and ceramic fiber blankets had got detached in area appx. 2 feet x 1 foot exposing the metal plate.
- c) The distortion of the insulation covering sheets was observed on complete transition zone showing comparatively more distortion on the aux. boiler end. However, the sheets and the holding studs were intact in position except a few plates got dislocated slightly at a few places.
- d) Refractory of the south wall beneath the LT Steam superheater coil was found badly damaged and loose.
- e) Sagging of the LT steam superheater coil was observed as has been observed in the past. The fins of some of the tubes at scattered locations have also got peeled off. The supports of the coil have got burnt out in the top row.

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PDIL INVESTIGATION REPORT :

ANNEXURE -2

GRADATION OF TUBES BY AUS

GRADE	ROW NO.	TUBE NOS.	NO OF TUBES	TOTAL TUBES
A	1	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	NIL	NIL	NIL
	2	NIL	NIL	
	3	NIL	NIL	
	4	NIL	NIL	
	5	NIL	NIL	
	6	NIL	NIL	
	7	19	01	
	8	NIL	NIL	01

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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	10	01	
	6	NIL	NIL	
	7	17	01	
	8	02,07,10	03	
C2	1	11,12,15,16,20,26,29,31,40,41	10	86
	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	15,19,20,23,26,28,31,33,36,38,39	11	
	5	07,09,25,26,27,29,32,34,39,40,42	11	
	6	08,16,19,21,22,23,26,28,29,34,35,36,37	13	
	7	06,09,10,11,12,13,14,18,20,21,25,29,31,32,40	15	
	8	01,08,15,19,20,29	06	

8J

GRADTION 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, 25,27,28,30,33,36,39	24	221
	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, 22,24,25,27,29,30,32,35,37,40,41,42	29	
	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, 24,25,27,30,31,32,33,38,39,40,41,42	29	
	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	03,06,09,11,12,13,14,16,17,21,22,23,24,25,26,27,32, 33,34,35,37,39,40,41	24	
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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GRADTION OF TUBES BY AUS

GRADE	ROW NO.	TUBE NOS.	NO OF TUBES	TOTAL TUBES
NEW TUBE	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	04,05	02	
TOTAL NO. OF CATALYST TUBES			336	

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				
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					208	X			
109	X	X			209	X			
110	X				210	X			
111	X				211	X			
112		X			212	X			
113	X				213				
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	X			221				
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	26	16	0	0	TOTAL	34	8	0	0

Reported By

Approved By

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ANNEX. 3(2)

DATE: 5-4-2000

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				
302	X				402	X	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				
313	X				413		X		
314	X				414	X			
315	X				415	X			
316					416				
317		X			417	X	X		
318		X			418	X			
319	X	X			419	X			
320	X				420	X			
321	X				421	X			
322					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					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	80	12	0	0	TOTAL	36	4	0	0

Reported By

Approved By

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ANNEX.3(3)

DATE: 5-4-2000

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	26	16	0	0	TOTAL	27	15	0	0

Reported By

Approved By

86

ANNEX.3(4)

DATE: 5-4-2000

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		
701		X			801		X				
702	X				802		X				
703	X				803		X				
704		X			804	X					
705		X			805	X					
706		X			806		X				
707	X				807	X					
708	X				808		X				
709	X				809		X				
710	X				810		X				
711	X				811		X				
712		X			812		X				
713		X			813	X					
714	X				814		X				
715	X				815		X				
716	X				816	X					
717		X			817	X					
718		X			818	X					
719	X				819	X					
720	X				820	X					
721		X			821	X					
722	X				822	X					
723		X			823	X					
724	X				824	X					
725	X				825	X					
726	X				826		X				
727		X			827		X				
728	X				828	X					
729	X				829		X				
730	X				830		X				
731				X	831		X				
732		X			832	X					
733		X			833		X				
734	X				834		X				
735	X				835	X					
736	X				836	X					
737	X				837	X					
738	X				838	X					
739	X				839	X					
740	X				840	X					
741	X				841	X					
742	X				842		X				
TOTAL	28	13	0	1	TOTAL	23	19	0	0		

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ANNEX. 4

Date: 6-4-2000

CREEP MEASUREMENT OF RISER TUBES

Riser No	O.D. of Riser		Design O.D. Max.	Creep % GE
	E-W	N-S		
1	4.94205	4.94301	4.938	0.1
2	4.93195	4.9326	4.938	Nil
3	4.96035	4.96195	4.938	0.48
4	4.93781	4.93816	4.938	Nil
5	4.93291	4.93345	4.938	Nil
6	4.92775	4.92777	4.938	Nil
7	4.94145	4.94685	4.938	0.18
8	4.95565	4.95975	4.938	0.44

REMARK: 1) MAXIMUM DIAMETER OF 4.96195 OBSERVED CORRESPONDS TO 0.48% CREEP
2) ALL DIMENSIONS ARE IN INCH

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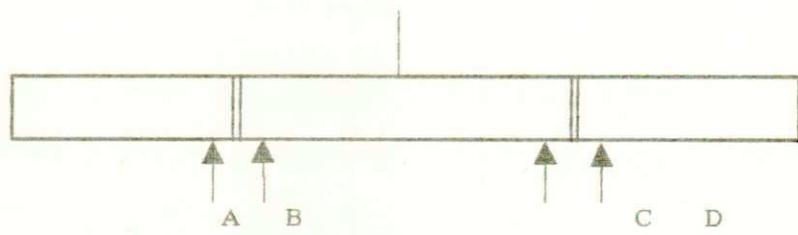
ANNEX. 5

EQUIP. NAME : Primary Reformer
 SHUTDOWN : April 2000
 DESIGN OUTSIDE DIA.: 141.3 to 142.1 mm

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	5.59165	5.59123	5.59591	5.59135	5.59485	5.59825	5.60521	5.60951
2	5.58685	5.58835	5.59315	5.59315	5.60509	5.58325	5.60509	5.59965
3	5.58531	5.58218	5.57912	5.59139	5.57975	5.58105	5.59315	5.58635
4	5.61489	5.61132	5.59815	5.60825	5.59535	5.60385	5.59435	5.59136
5	5.61325	5.61039	5.59316	5.58033	5.59437	5.59189	5.60834	5.60219
6	5.60116	5.60321	5.60415	5.61935	5.60151	5.60325	5.62015	5.60239
7	5.57915	5.59016	5.58913	5.59616	5.60323	5.59011	5.60993	5.60387
8	5.59131	5.59816	5.59183	5.60123	5.57869	5.59831	5.59873	5.59756

NOTE : (1) ALL DIMENSIONS ARE IN INCH.
 (2) MAXIMUM DIAMETER OF 5.62015" WAS OBSERVED WHICH
 CORRESPONDS TO 0.45 % CREEP.



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ANNEX. 6

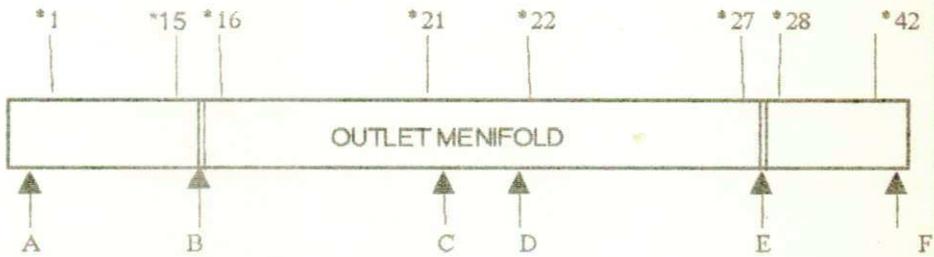
Inspection Section
Maint. Deptt.

EQUIP. NAME: PRIMARY REFORMER
SHUTDOWN: APRIL 2000

CLEARANCE OF OUTLET MANIFOLD FROM
GROUND FLOOR IN COLD CONDITION

HEADER NO.	LOCATION					
	A	B	C	D	E	F
1	320	315	310	310	305	310
2	325	290	310	305	300	295
3	320	270	295	290	290	310
4	320	300	300	290	310	290
5	310	300	320	330	320	320
6	300	280	275	280	270	300
7	320	315	320	320	310	330
8	345	330	310	320	310	315

NOTE: (1) ALL DIMENSIONS ARE IN MM.
(2) ALL READINGS ARE TAKEN WITHOUT INSULATION.



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90

READINGS TAKEN ON 16-04-2000

ANNEX-7

TIME 10.30 HRS.

OPERATING PARAMETERS:

- 1) AVERAGE SKIN TEMP. OF CATALYST TUBE
- 2) PLANT LOAD:
- 3) HOT TUBES:
- 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	15	5	0	0	-3	2	-12	-6	-15	-15	-12	-12	-13	-14	-15	0	-10	-15	-11	5	25	
2	40	5	0	-4	-6	0	-10	-12	-10	-14	-12	-18	-18	-15	-10	-15	-10	-6	-4	4	9	15
3	-6	10	10	0	-6	0	-4	-6	-13	-14	-12	-16	-15	-11	-4	-6	-9	-10	2	12	16	-10
4	30	10	6	-2	-3	-12	-12	-8	-6	-5	-8	-11	-12	-10	-15	-12	-12	-10	-3	0	10	5
5	25	0	-2	-5	-2	-10	-10	-11	-5	-11	-15	-4	-8	-15	-12	-12	-10	-8	0	0	5	10
6	24	0	-5	-11	-6	-10	-10	-14	-22	-20	-15	-15	-14	-15	-20	-24	-16	-5	-8	0	5	10
7	32	0	2	4	-5	-12	-14	-10	-10	-11	-10	-15	-18	-19	-10	-10	-4	-2	-2	0	0	25
8	0	4	5	0	-12	-15	-18	-22	-16	-14	-8	-4	-10	-15	-12	-15	-15	-12	-2	0	5	10

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 READINGS	1	2	3	4	5	6	7	8
	10	5	25	25	20	22	13	12

OBSERVATIONS/RECOMMENDATION

COPY TO:

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READINGS TAKEN ON 20-06-2000

ANNEX-7

TIME 11.00 HRS.

OPERATING PARAMETERS:

- 1) AVERAGE SKIN TEMP. OF CATALYST TUBES: 850 deg.C
- 2) PLANT LOAD : 90%
- 3) HOT TUBES : NIL
- 4) BOW TUBES : NIL
- 5) FIRING CONDITION : GOOD
- 6) AVERAGE SKIN TEMP. OF RISER TUBE : 890 deg.C

1. TUBE SPRING HANGER LOAD READINGS OF 101-B HOT 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	2	0	-2	-5	-3	5	-6	0	-5	0	2	2	0	0	-4	-9	2	-8	-19	-14	-5	15
2	28	-8	-9	-7	-6	6	-2	0	2	2	2	0	0	0	-8	-4	-5	-4	2	5	5	
3	-13	7	7	0	-2	3	0	3	0	2	2	0	0	0	8	0	-3	-7	2	7	7	
4	25	7	0	0	0	-10	-11	-3	0	2	4	5	6	0	0	-5	-2	-8	-2	-1	0	-5
5	21	-1	-3	-5	0	-2	-5	0	0	-6	-3	11	7	-1	-3	0	0	2	6	0	0	3
6	14	-8	-10	-12	-4	-3	0	0	-6	-3	2	0	1	0	-9	-13	-10	0	-6	-5	-3	-2
7	22	-5	0	2	-3	-8	-6	2	5	7	9	0	-2	-7	0	-5	0	-2	0	-6	-5	22
8	-15	-6	0	2	-10	-8	-8	-8	-2	3	6	8	8	-5	-5	-10	-12	-10	-4	-1	-3	0

2. BOTTOM DRAIN READINGS IN MM

ROW	1	2	3	4	5	6	7	8
READINGS	155	145	170	178	165	167	150	172

OBSERVATIONS/RECOMMENDATION

COPY TO:

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THICKNESS MEASUREMENT DATA OF THE VESSELS / EXCHANGERS INSPECTED DURING APRIL- 2000 :									
AMMONIA PLANT :									
SL. NO.	VESSEL NO.	DESCRIPTION OF VESSEL	DESIGN THICK.		MIN. MEASURED THICK.		% REDUCTION		REMARK
			IN MM		IN MM		SHELL	D.E.	
1	104 - D	SHIFT CONVERTER	SHELL	D.E.	SHELL	D.E.	SHELL	D.E.	
			60.32	60.32	62.8	66.3(TOP)			
						65.7(BOTTOM)			
2	101- E	CO2 ABSORBER (FROM TOP TO 20TH TRAY)	47.625	46.03	46.7	50.2(BOTTOM)			
		FROM 20TH TRAY TO BOTTOM	48.41						
3	102-EA	CO2 STRIPPER (TRAY 1 TO 11)	9.525 @	11.9(TOP)	9.7	-			
		(TRAY 11 TO BOTTOM)	15.9	15.9(B)	16	19.8(BOTTOM)			@1.98 mm thk SS304 cladding
4	102-EB	CO2 STRIPPER (TRAY 1 TO 11)	9.525 @	11.9(TOP)	9.9	10.9		8.4	@1.98 mm thk SS304 cladding
		(TRAY 11 TO BOTTOM)	15.9	15.9(B)	15.9	19.9(BOTTOM)			
5	101-F	STEAM DRUM	106.4	106.4	108.3	104.6			
6	102-F	RAW GAS SEPARATOR	34.925	33.33	35.9	35.8(TOP)			
						36.6(BOTTOM)			
7	104-F	SYN.GAS COMP. SUCTION DRUM	24.6	23.82	26.2	26.3(TOP)			
						25(BOTTOM)			
8	105 - F	SYN.GAS COMP. 1ST STAGE SEPARATOR	47.63	46.03	47.6	50.2(TOP)			
						51.1(BOTTOM)			
9	106 - F	SECONDARY AMMONIA SEPARATOR	104.8	53.975	106.7	59.7(EAST)			
						60.4(WEST)			
10	107-F	PRIMARY AMMONIA SEPERATOR	14.2875	14.2875	14.2	17.1			
11	109 - F	REFRIGERANT RECEIVER	21.4	18.2	19.2	19.1	10.28		
12	110 - F	I STAGE REFRIGERENT FLASH DRUM	9.52	9.52	10	12.9			
13	111 - F	II STAGE REFRIGERENT FLASH DRUM	9.52	19.05	10	21.5			
14	112 - F	III STAGE REFRIGERENT FLASH DRUM	9.52	19.05(E) 9.52(W)	10.2	22.3(EAST) 12.3(WEST)			
15	117 - C	FEED/RECYCLE GAS 1ST STAGE CHILLER	11.11	11.11	10.7	11	3.6		
				63.5 (C)		63(CHANNEL)			
16	118 - C	FEED/RECYCLE GAS 2ND STAGE CHILLER	11.11	11.11	10.5	10.9	5.5		
				63.5 (C)		64.8(CHANNEL)			
17	119 - C	FEED/RECYCLE GAS 3RD STAGE CHILLER	12.7	12.7	11.7	11.6	7.87	8.66	
18	120 - C	NH3 CONVERTER FEED GAS & RECYCLE GAS EXCHANGER	24.6	65.08(C)	26.2	69			
			65.05(ML)		33.1				
19	125 - C	PURGE GAS CHILLER	8.18	15.88	7.7	16			MULTI LAYER
20	126 - C	FLASH GAS CHILLER	8.38	-	8.1			5.86	
21	129 - C	SYN.GAS COMP.INTERSTAGE COOLER	9.53	9.53	9.4	10.8			3.34
				28.5(C)		26.2(CHANNEL)			8
22	141 - C	SYN. GAS COMP. SUCTION CHILLER	28	18	27.4	16.1(EAST)	2.14	10.55	
						15.6(WEST)		13.33	
23	R-111	SULPHUR ABSORBER	35	35 Min.	35.2	39.4(TOP)			
24	E-2	OIL SEPERATOR			9	18.2(NORTH)			
						18.3(SOUTH)			
25	102 - B	STARTUP HEATER (TUBES)	NA-TUBES		10				
26		WEST WALL TUBES OF AUXILIARY BOILER	7(TUBES)		6.6	26.8 (CAP)	5.7		
						32(HEADER)			
27		AMMONIA BFW COIL TUBES IN HEADER BOX	5.54	27(HDR)	5	25(INLET)	9.74	7.4	
						25.6(OUTLET)		5.18	

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THICKNESS MEASUREMENT DATA OF AMMONIA PLANT PIPELINES CARRIED OUT DURING APRIL - 2000 : ANNEXURE - 9

SR NO	LINE NO.	N.B. (in.)	SCH./MM	MAT.	LINE DESCRIPTION FROM	TO	LAST MEASURED	MIN THK. OBSERVED	% RED.	REMARK
BLOW DOWN LINES:										
1	BD-01	2	80/5.5	CS	110-F					
2	BD-08	2	80/5.5	CS	111-F	DRAIN	APRIL-2K	4		
3	BD-16	2	80/5.5	CS	112-F	DRAIN	APRIL-2K	5.5	27.27	
4	BD-21	1.5	80/5.1	CS	107-F	DRAIN	APRIL-2K	5		9
							APRIL-2K	5.2		
BOILER FEED WATER LINES :										
1	BF-02	10	20/6.35	CS	BF-1					
2	BF-03	10	20/6.35	CS	BF-1	104-J	APRIL-2K	6.3		
3	BF-04	6	80/10.97	CS	104-JA	104-JA	APRIL-2K	5.9(Jun'97)6.3	7.08	
4	BF-06	6	80/10.97	CS	BF-22	BF-22	APRIL-2K	10.5	4.29	
						123-C	APRIL-2K	9.8	10.66	
HOT WATER RETURN LINES:										
1	HW-04	2.5	40/5.16	CS	103-J GLAND CON.	HW-7				
2	HW-08	4	40/6.02	CS	101-J/105-J	HW-10	APRIL-2K	5	3.1	
3	HW-10	6	40/7.11	CS	HW-36	HW-15	APRIL-2K	4.4	26.9	
4	HW-11	8	20/6.35	CS	116-C	HW-5	APRIL-2K	6.1	14.06	REPANTING REQUIRED
							APRIL-2K	5.9	7.0	
MDEA LINES:										
1	MDEA-10A	12	20/6.35	CS	102-EA					
2	MDEA-10B	12	20/6.35	CS	102-EB	MEA-11	APRIL-2K	6.3(SEP93)		
3	MDEA-11	14	20/7.92	CS	MEA-19 A & B	MEA-11	APRIL-2K	6.4(SEPT93)		
						MEA-12 A& B	APRIL-2K	7.3	7.8	
MEDIUM PRESSURE STEAM LINES :										
1	MS-01	8	30/7.04	CS	MS-2					
2	MS-02	12	30/8.38	CS	HEADER	HEADER	APRIL-2K	6.8(JUN 97)	3.40	
3	MS-03	14	30/9.53	CS	MS-11	MS-1	APRIL-2K	8.2(JUN 97)	2.14	
4	MS-11	14	30/9.53	CS	103-J	MS-2	APRIL-2K	10.6		
5	MS-17	2	80/5.5	CS	MS-2	MS-3	APRIL-2K	9.2		
6	MS-29	12	30/8.4	CS	MS-2	2004-JA	APRIL-2K	5		9
7	MS-34	6	40/7.11	CS	MS-2	NG-8	APRIL-2K	11.1		
8	MS-37	3	40/5.5	SC	MS-28	S-7	APRIL-2K	6.6	7.17	
9	MS-60	10	30/7.8	CS	MS-2	104-D	APRIL-2K	4.6	16.36	
						HEADER	APRIL-2K	8.9		
NATURAL GAS LINES :-										
1	NG-14	3	40/5.5	CS	NG-6					
2	NG-15	4	40/6.0	CS	NG-7	NG-15	APRIL-2K	5.8		
3	NG-16	6/8	40/7.1/8.18	CS	BATT. LIMIT	S-11	APRIL-2K	5.9		
4	NG-22	6	40/7.11	CS	NG-16	151-C	APRIL-2K	6.9, 6.6	19.31	
5	NG-23	6	40/7.11	CS	NG-30	NG-30	APRIL-2K	6.9		
6	NG-26	6/8	40/7.1/8.18	CS	NG-23	NG-26	APRIL-2K	6.4		9.98
7	NG-27	2.5	40/5.2	CS	NG-63	BURNER	APRIL-2K	6.8, 7.6	7	
8	NG-28	2.5	40/5.2	CS	NG-27	NG-28	APRIL-2K	4.6	11.35	Re - insulated in April-2000
9	NG-32	2	40/3.9	CS	NG-23	102-B	APRIL-2K	4.1	21.15	Re - insulated in April-2000
						NG-33	APRIL-2K	5		

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THICKNESS MEASUREMENT DATA OF AMMONIA PLANT PIPELINES CARRIED OUT DURING APRIL - 2000 : ANNEXURE - 9

SR NO	LINE NO.	N.B. (in.)	SCH./MM	MAT.	LINE DESCRIPTION FROM TO	LAST MEASURED	MIN THK. OBSERVED	% RED.	REMARK
AMMONIA LINES									
1	NH-06	6	40/7.11	CS	125-C				
2	NH-07	24	20/9.52	CS	112-F	NH-10	APRIL-2K	7.1	
3	NH-08	8	20/6.35	CS	112-F	105-J	APRIL 2K	8.0(APRIL98)	15.9
4	NH-09	8	40/7.11	CS	NH-8	NH-9	APRIL 2K	6.4(JUNE 97)	
5	NH-10	20	20/9.52	CS		NH-114	APRIL 2K	6.3(JUNE97)	11.39
6	NH-12	6	40/7.11	CS	111-F	112-F	APRIL 2K	9.2	3.36
7	NH-16	6	40/7.11	CS	NH-15	NH-113	APRIL 2K	6.4(APRIL 98)	9.8
8	NH-18	2	80/5.54	CS	NH-119	110-F	APRIL 2K	6.9	
9	NH-19	16	20/7.9	CS	111-F	NH-15	APRIL 2K	5.5	
10	NH-21	18	20/7.92	CS	128-C	105-J	APRIL 2K	7.1(JULY98)	8.97
11	NH-23	12	20/6.4	CS	105-J	105-J	APRIL 2K	8.5	
12	NH-24 A	12	20/6.35	CS	NH-33	NH-33	APRIL 2K	5.7	10.9
13	NH-24 B	12	20/6.35	CS	NH-33	127-CA	APRIL 2K	6	5.5
14	NH-26	14	20/7.9	CS	105-JLP	127-CB	APRIL 2K	6.2	
15	NH-29A	6	40/7.11	CS	NH-113	NH-19	APRIL 2K	7.4	6.32
16	NH-29B	6	40/7.11	CS	NH-113	118-C	APRIL 2K	6.2	12.79
17	NH-32	12	20/6.35	CS	NH-98A&B	118-C	APRIL 2K	7.1	
18	NH-33	14	20/7.92	CS	HEADER	110-F	APRIL 2K	5.7	10.23
19	NH-34	6	40/7.11	CS	110-F	NH-24 A / B	APRIL 2K	7.4	6.6
20	NH-35	3	40/5.5	CS	126-C	NH-112	APRIL 2K	6.8	4.36
21	NH-36	1.5	80/5.1	CS	NH-56	NH-41	APRIL 2K	5.2	
22	NH-37	4	40/6.02	CS	NH-34	NH-35	APRIL 2K	4.6	9.8
23	NH-38	8	20/6.35	CS	CONTROL VALVE	NH-41	APRIL 2K	5.6(JUNE 97)	6.97
24	NH-39	2	80/5.5	CS	NH-37	NH-32	APRIL 2K	6	5.5
25	NH-40	3	40/5.5	CS	NH-39	NH-40	APRIL 2K	4.2(APRIL98)	16.3
26	NH-41	6	40/7.11	CS	129-C	129-C	APRIL 2K	4.6(APRIL 98)	16.3
27	NH-42	1	80/4.55	CS	NH-112	111-F	APRIL 2K	6.7	5.76
28	NH-45	10	20/6.35	CS	NH-70	126-C	APRIL 2K	4.4	
29	NH-46	12	20/6.35	CS	NH-78A&B	NH-46	APRIL 2K	6.4	
30	NH-47A	6	40/7.11	CS	NH-112	111-F	APRIL 2K	5.8	8.7
31	NH-47B	6	40/7.11	CS	NH-112	117-C	APRIL 2K	6.9	
32	NH-50	4	40/6.02	CS	NH-87	117-C	APRIL 2K	7.1(JUNE 97)	
33	NH-51	1	80/4.5	CS	108-F BOTTOM	107-F	APRIL 2K	5.6	6.66
34	NH-52	2	80/5.54	CS	CONTROL VALVE	NH-50	APRIL 2K	4.5	
35	NH-52	1.5	5.08	CS	107-F	NH-120	APRIL 2K	5.0(JUNE 96)	9.74
36	NH-55	4	40/6.0	CS	NH-12	CONTROL VALVE	APRIL 2K	4.9	
37	NH-56	2	80/5.54	CS	107-F	NH-121	APRIL 2K	5	16.9
38	NH-57	10	20/6.35	CS	110-F	NH-58	APRIL 2K	4.2(APRIL99)	18.6
39	NH-58	6	40/7.11	CS	NH-56	NH-21	APRIL 2K	5.2(APRIL98)	18.75
40	NH-66	2.5	40/5.16	CS	NH-15	112-F	APRIL 2K	5	29.67
41	NH-68	10	20/6.35	CS	NH-23	NH-67, NH-71	APRIL 2K	4.6	10.85
42	NH-69	6	40/7.11	CS	NH-68	NH-108	APRIL 2K	5.8	8.66
43	NH-70	6	40/7.11	CS	NH-68	NH-38	APRIL 2K	7.1	
44	NH-71	2	80/5.54	CS	NH-56	CONTROL VALVE	APRIL 2K	6.5	8.57
45	NH-75	10	20/6.4	CS	NH-108	NH-45	APRIL 2K	5	5.5
46	NH-78A	10	20/6.35	CS	118-C	NH-10	APRIL 2K	6	6.25
47	NH-78B	10	20/6.35	CS	118-C	NH-46	APRIL 2K	6.3(JUNE 97)	
48	NH-79A	6	7.11	CS	NH-114	NH-46	APRIL 2K	6.6(JUNE 97)	
49	NH-79B	6	7.11	CS	NH-114	119-C	APRIL 2K	6.5	8.57
50	NH-80A	16	20/7.9	CS	119-C	119-C	APRIL 2K	6.4	9.98
					NH-10	APRIL 2K	7.2	8.86	

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THICKNESS MEASUREMENT DATA OF AMMONIA PLANT PIPELINES CARRIED OUT DURING APRIL - 2000 : ANNEXURE - 9

SR NO	LINE NO.	N.B. (in.)	SCH./MM	MAT.	LINE DESCRIPTION FROM	TO	LAST MEASURED	MIN THK. OBSERVED	% RED.	REMARK
AMMONIA LINES:										
51	NH-80B	16	20/7.9	CS	119-C	NH-10	APRIL 2K	7.3	7.6	
52	NH-98A	8	20/6.35	CS	117-C	NH-32	APRIL 2K	6.1	3.93	
53	NH-98B	8	20/6.35	CS	117-C	NH-32	APRIL 2K	6	5.8	
54	NH-109	2	80/5.54	CS	NH-71	NH-38	APRIL 2K	5.2	-	
55	NH-112	8	20/6.35	CS	HEADER	117-C	APRIL 2K	7.2	-	
56	NH-113	8	20/6.35	CS	HEADER	118-C	APRIL 2K	6.3	-	
57	NH-114	8	20/6.4	CS	HEADER	119-C	APRIL 2K	5.9	7.8	
58	NH-116	6	40/7.1	CS	112-F	NH-117A&B	APRIL 2K	6.3	11.26	
59	NH-117A	6/4	40/7.1/6.02	CS	NH-116	GATE	APRIL 2K	7.5 & 6.0	-	
60	NH-117B	6/4	40/7.1/6.02	CS	NH-116	GATE	APRIL 2K	7.1	-	
61	NH-118A	3	40/5.5	CS	118-J	NH-119	APRIL 2K	5	9	
62	NH-118B	3	40/5.5	CS	118-JA	NH-119	APRIL 2K	5.6 (JUNE 97)	-	
63	NH-119	3	40/5.5	CS	118-A&B	CONTROL VALVE	APRIL 2K	5	9	
64	NH-119	4	40/6.0	CS	SWAGE	B.L.	APRIL 2K	5.3 (JUNE 96)	11.6	
65	NH-121	6	40/7.1	CS	NH-55	112-F	APRIL 2K	6.1 (JUNE 97)	14.08	
66	NH-122	1.5	80/5.08				APRIL 2K	4.9	-	
67	Cold Amm. Line	6	40/7.11	CS	Ammonia Bat. Limit	Urea Bat. Limit	APRIL 2K	6.7	5.63	
PROCESS GAS LINES:										
1	PG-03	18	14.27	CS	PG-4	104-D TOP	APRIL 2K	13.4	6.09	REPLACED JUNE 1997
2	PG-15	14	XS/12.7	CS	102-F	101-E	APRIL 2K	12.0 (SEP 93)	5.5	
PROCESS WATER LINES :										
1	PW-04	2.5	160/8.7 (5.2)	CS/S	PW-1	106-J	APRIL 2K	7.0 (3.8)	19.5 27	
2	PW-20	6	80/10.97	CS	104-E	170-J	APRIL 2K	10.6	3.4	MRT = 0.42MM
3	PW-20A	6	80/10.97	CS	PW-20	170 JA	APRIL 2K	8.3 (APRIL 98)	27.0	MRT = 0.42MM
4	PW-22	4	120/11.13	CS	170-C	173-C	APRIL 2K	8.6 (APRIL 98)	22.7	MRT = 0.29MM
5	PW-24	4	120/11.13	CS	173-C	CONTROL VALVE	APRIL 2K	5.3	52.38	MRT = 0.29MM
6	PW-29	10	80/12.7	CS	171-C	PW-30	APRIL 2K	9.1 (APRIL 98)	28.3	MRT = 0.68MM
7	PW-29A	10	60/12.7	CS	171-C	PW-30	APRIL 2K	9.0 (APRIL 98)	29.1	MRT = 0.68MM
8	PW-30	14	40/11.13	CS	PW-29	PW-31	APRIL 2K	10.9	-	
9	PW-31	12	40/10.31	CS	PW-30	104-E	APRIL 2K	9.8 (NOV 92)	4.8	
STEAM CONDENSATE LINES :										
1	SC-30	2	80/5.5	CS	101-J	SC-34	APRIL 2K	5.3	-	
2	SC-32	2	80/5.5	CS	SC-9	SC-34	APRIL 2K	5.5	-	
3	SC-33	2	80/5.5	CS	105J	SC-34	APRIL 2K	5.2	5.45	
SYN. GAS LINES :-										
1	SG-01	12	30/8.4	P-11	106-D	114-C	APRIL 2K	8.4 (JUNE 96)	-	REPLACED IN SEP-93
2	SG-05	14	20/7.92	CS	115-C	104-F	APRIL 2K	7.4 (JUNE 97)	6.56	
3	SG-07	10	80/12.7	CS	103-J	136-C	APRIL 2K	12.1	4.72	
4	SG-08	10	40/9.27	CS	136-C	116-C	APRIL 2K	9.4	-	
5	SG-10	10	40/9.27	CS	129-C	105-F	APRIL 2K	9.1	-	
6	SG-15	10	100/18.24	CS	117-C	118-C	APRIL 2K	16.2 (JUNE 97)	11.19	
7	SG-16	10	100/18.24	CS	118-C	SG-17	APRIL 2K	15.6	14.47	
8	SG-17	14	100/23.8	CS	SG-16	119-C	APRIL 2K	22	7.56	
9	SG-18	14	100/23.8	CS	119-C	106-F	APRIL 2K	23.0 (APR 99)	3.36	
10	SG-19	14	100/23.8	CS	106-F	120-C	APRIL 2K	22.8	4.2	

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THICKNESS MEASUREMENT DATA OF AMMONIA PLANT PIPELINES CARRIED OUT DURING APRIL - 2000 : ANNEXURE - 9

SR NO	LINE NO.	N.B. (in.)	SCH. MM	MAT.	LINE DESCRIPTION	FROM	TO	LAST MEASURED	MIN THK. OBSERVED	% RED.	REMARK
11	SG-32	6	7/8"/22.22	CS	SG-62 A&b		SG-25	APRIL 2K	21.3(JUN96)		
12	SG-33	14	120/31.75	P-11	122-C		123-C	APRIL 2K	32.4		
13	SG-34	14	100/23.8	P-11	123-C		121-C	APRIL 2K	24.4		REPLACED IN SEP-93
14	SG-37	2.5	80/7.01	CS	125-C		108-F	APRIL 2K	5.6	20.11	REPLACED IN SEP-93
15	SG-38	2.5	80/7.01	CS	108-F		SG-39	APRIL 2K	6.8	4.22	
16	SG-39	4	40/6.02	CS	121-C		FG-3	APRIL 2K	5.6(APR99)	6.97	
17	SG-41	10	100/18.24	CS	120-C		SG-17	APRIL 2K	16.9	7.35	
18	SG-42	3	80/7.62	CS	CONTR. VALVE			APRIL 2K	13.6		
19	SG-42	4	80/8.56	CS	SG-51		SG-11	APRIL 2K	7.1	17.05	
20	SG-47	1	80/4.5	CS	104F		LC-8DRAIN	APRIL 2K	4.0(JUN96)	12.5	
21	SG-51	8	100/15.06	CS	CONTR. VALVE		FICA-15	APRIL 2K	13.8	8.4	
22	SG-51	8	100/15.06	CS	SG-13		SG-35	APRIL 2K	13.7(JUN96)	9.27	
23	SG-54	3	40/5.49	CS	INST. SEAL VALVE		SG-6	APRIL 2K	6		
24	SG-77	6	40/7.11	CS	C.V. PIC-A		SG-78	APRIL 2K	6.9		
25	SG-77	6	40/7.11	CS	SG-6			APRIL 2K	6.9		
26	SG-78	8	20/6.35	CS	PIC-A		V-36	APRIL 2K	6.1	3.93	
27	SG-79	1	80/4.5	CS	105F		LC-10	APRIL 2K	4.4		
LETDOWN VALVES UP STREAM & DOWN STREAM :											
1	PICV-1027	6/12	7.11/6.35	CS	R-112		VENT STACK	APRIL 2K	6.6, 6.6		
2	PICV-1101	6/4	7.11/6.02	CS	R-111		NAPHTHA COND.	APRIL 2K	5.5, 6.2	22.6	
3	FIC - 7	6/4/3	7.1/6.02/5.5	CS	103-JLP DISCH.		103-JLP SUCT.	APRIL 2K	7.5, 5.7, 5.6	5.3	
4	FIC - 8	4/3/2	6.56/7.62/	CS	103-JHP DISCH.		103-JHP SUCT.	APRIL 2K	8.0, 14.1, 14.3	6.5	
5	PIC - 5	12/6	40/9.53/7.11	CS	V-6		V-7(SP-73)	APRIL 2K	8.7, 7.0	8.7	
6	FIC V- 200	6/4/2	7.1/6/3.91	CS	102-J DISCHARGE		102-J SUCTION	APRIL 2K	5.7, 5.9, 4.0	19.8	
7	PIC-17	6/4/8	7.11/6/6.35	CS	11 ATA		3.5 ATA	APRIL 2K	7.7, 6.8, 7.5		
8	PIC-14	4/6	6.02/7.11	CS	38 ATA		11 ATA	APRIL 2K	5.7, 6.6	5.3, 7.1	
9	FCV-801	4/6	6.02/7.11	CS	800-J DISCH. (NG)		800-J SUC. (NG)		5.4, 6.9	10.29	
10	FCV-802	4/6	6.02/7.11	CS	800-J DISCH. (AG)		800-J SUC. (AG)		4.9, 7.0	18.6	
11	PRC - 1	6/2/3	7.11/5.54	CS	101/102-D INLET		VENT (SP-73)		5.9, 5.8, 5.3	17	
12	PRC-6	6/10	10.97/6.35	CS	V-27		V-29 (SP-75)		10.3, 5.4	15	
13	PICV-005	3/6/2	5.5, 7.11/5.5	CS	NG HEADER		AG HEADER		4.3, 5.6, 4.5	22, 21, 16	
14	FICV-12	6/8	7.11/8.18	SS	MDEA-9A		102-EA		4.7, 5.1	33.9, 37.6	Replace Stub Ends
15	FICV-14	6/8	7.11/8.18	SS	MDEA-9B		102-EB		4.7, 6.5	33.9, 20.5	Replace Stub Ends
VENT LINES :											
1	V-28	10	40/9.26	CS	V-28		V-8	APRIL 2K	8	11.4	
2	V-28	6	40/7.11	CS	PG-3		V-28	APRIL 2K	6.3	13	
PRE REFORMER AREA :											
1	6"NV.1102.01F34	6	40/7.11	CS	R-110, HYDROGENATOR		R-111, SULPHER ABSORBER	APRIL 2K	6.3	11.4	

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Annexure-10

Replacement of the following pipelines was carried out by technical 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.	PG-10-20"/18"	104-D	PG-21-20"(105-C)
2.	PG-9-18"	157-F	LTS(104-D)
3.	PG-35-18"/20"	LTS	112-C
4.	PG-16-14"	101-E	136-C
5.	DM-7-6"	Bat.Lmt	DM Water tank
6.	DM-8-6"	DM Water Tank	2004J/JA
7.	BF-9-2"	BF-7	101-U
8.	BF-10-2"	BF-4	BF-9
9.	SC-44-2"	171-C	Drain
10.	SC-51-2"	150-C	Drain
11.	SC-53-2"	151-C	Drain
12.	PW-17-4"	102-F	170-C
13.	Drain Line-3"	Ammonia recovery	Strong effluent
14.	BF-15-8"	123-C	Check valve near BFW Coil
15.	NH-87-3"	106-F Outlet	spool Piece
16.	SG-52-3"	SG-22	Bypass Line
17.	SG-53-3"	SG-22	Bypass Line

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Sl.No.	Line no.	From	To
18.	121-J/JA suction	109-F	121-J
19.	121-J/JA	Discharge 121-J/JA	Urea Plant
20.	HW-5-36"	CW Header	Cooling Tower
21.	HW-16-30"	110CA/CB	HW-5
22.	HW-20-24"	HW-20/21	HW-5
23.	HW-22-16	108-C	HW-20
23.	HW-21-16	108-C	HW-20

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Annexure-11

PRESHUTDOWN THICKNESS MEASUREMENT DATA OF THE VESSELS / EXCHANGERS INSPECTED DURING JAN-MARCH-2000 IN AMMONIA PLANT :

SL. NO.	VESSEL NO.	DESCRIPTION OF VESSEL	DESIGN THICK.		MIN. MEASURED THICK.		% REDUCTION		REMARK
			IN MM		IN MM				
			SHELL	D.E.	SHELL	D.E./COVER	SHELL	D.E.	
1	2006-UF2	ACID MEASURING TANK	N.A.	N.A.	9.4	8.1(Top) 8.2(Bottom)	N.A.	N.A.	
2	2013-U	ACID TANK	N.A.	N.A.		5.4	N.A.	N.A.	0.5 mm deep(approx.) pittings were observed on bottom half of the tank.
3	2001-LF	HYDRAZINE MIX TANK	N.A.	N.A.	2.8	2.5(Bottom)	N.A.	N.A.	
4	2004-LF	MIX TANK	N.A.	N.A.	2.7	2.1(Bottom)	N.A.	N.A.	
5	2006-UF2	SALT STORAGE TANK	N.A.	N.A.	4.6	8.2(Top) 8.1(Bottom)	N.A.	N.A.	
6	2012-U	RESIN TRAP	N.A.	N.A.	6.3	6.0(Top) 5.8(Bottom)	N.A.	N.A.	
7	2007-U	RESIN TRAP	N.A.	N.A.	7.8	8.6(Top) 8.5(Bottom)	N.A.	N.A.	
8	101-JCA	SURFACE CONDENSER	N.A.	N.A.	13.2	11.3(East) 11.0(West)	N.A.	N.A.	
9	101-JCB	SURFACE CONDENSER	N.A.	N.A.	12.8	12.7(East) 12.4(West)	N.A.	N.A.	
10	101-JLT	L.O. TANK FOR AIR/REF. COMP	N.A.	N.A.	6.4	6.6(Top) 6.8(East)	N.A.	N.A.	
11	101-JLC2	LUBE&SEAL OIL COOLER FOR 101-J&105-J	N.A.	N.A.	7.2	7.0(West) 6.3(East)	N.A.	N.A.	
12	101-JLC1	LUBE&SEAL OIL COOLER FOR 101-J&105-J	N.A.	N.A.	7.2	6.2(West) 13.8(North)	N.A.	N.A.	
13	801-JLCA	TWIN OIL COOLER	N.A.	N.A.	12.4	12.5(Channel)	N.A.	N.A.	
14	801-JLCB	TWIN OIL COOLER	N.A.	N.A.	12.5	13.8(North) 12.5(Channel)	N.A.	N.A.	
15		AG SEPARATOR PHASE-II	N.A.	N.A.	10.6	9.9(Top) 10.5(Bottom)	N.A.	N.A.	
17	2002-F	DM WATER STORAGE TANK	4.8	4.8	4.4	4.7(Roof)	8.33	—	
18	101-D	DESULPHURISER	60.3	60.3	62.1	68.7(Top) 66.4(Bottom)	—	—	

PLANT TURNAROUND - APRIL - 2000AMMONIA PLANTCIVIL JOBS

Job

CODE NO	JOB DESCRIPTION
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01 51 01	<u>CIVIL JOBS :</u>
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(A) AUXILIARY BOILER :

Repairing of face blocks of burners no. 3 and 4. Repairing of ceiling of the boiler damaged while replacement work of silo pannels of boiler wall on south side.

(B) PRIMARY REFORMER :

- (a) Replacement of insulation brick lining up to 3 met. height on East and West side wall of reformer. Repairing of cracks developed in the insulation bricks was also carried out.
- (b) Replacement of fire broken tunnel blocks.
- (c) Replacement of all damaged A.C. sheets of top roof and cladding.
- (d) Repairing of refractory surface of L.T. zone carried out by castable - 11.
- (e) Concrete flooring below primary reformer to avoid accumulation of water during moonsoon completed.

PLANT TURNAROUND - APRIL - 2000AMMONIA PLANTELECTRICAL JOBS

101

CODE NO	JOB DESCRIPTION
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01 61 01 ELECTRICAL JOBS :

1. Preventive maintenance carried out on TR-6, TR-18, TR-19 for
 - a) Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.
 - b) Testing of oil in marshaling boxes on primary and secondary transformers and cleaning of chamber and replacement of oil if required.
 - c) Checking of trip alarm circuit and cleaning of all emergency trip boxes.
 - d) Checking of IR value primary and secondary windings of the above trans
2. Preeventive maintenance was carried out on all feeder compartments mounted on the following MCC-15.
3. Maintenance of all lighting distribution boards and replacement of burnt out fuse fittings.
4. Overhauling job carried out of following critical motors : 101 BJT, MK 218A & MK 218B.
5. Preventive maintenance, cleaning and checking of all motor operated valve and local control panels.
6. Checking of terminal boxes for loose connections, burning of cables etc. of all motors above 20 HP.
7. Checking of all push button stations and replacing wherever required.

PLANT TURNAROUND - APRIL - 2000AMMONIA PLANTINSTRUMENTATION JOBS

102

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

Following control valve maintenance carried out.

- 1) FRCV-1 : Repaired the handjack assembly. General cleaning, gland packing and overhauling were carried out and checked the stroke.
- 2) TRCV-10 : Removed old gland packings. General cleaning, gland packing and overhauling were carried out and checked the stroke. Sealing steam tubing nipple found broken in body, removed it and new ss tubing done.
- 3) TRCV-11: All the tubings were removed and refixed to facilitate Tech. dept. Removed old gland from front and back end. General cleaning, provided gland packing and overhauling were carried out and checked the stroke.
- 4) LCV-10 : Opened seat and plug from control valve as the the control valve reported for passing. Required machining job was carried out in the plug of the valve and installed back. Gland packing and overhauling were carried out and checked the stroke.
- 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 : Opened control valve from bonnet. Inspected the plug and seat and box up. Gland packing and overhauling were carried out and checked the stroke.
- 7) 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.
- 8) LCV-200 : Opened the control valve for flushing the line as request of p/p.
- 9) FICV-12 & 14 : General cleaning, gland packing and overhauling were carried out and checked the stroke. Tightened all fittings and actuator accessories.
- 10) KV-120-5 & 6 : Opened the ball valves and replaced the seat ring by new one as passing problem was reported.

103

CODE NO JOB DESCRIPTION

- 11) MIC-22 : Removed all tubing to facilitate to mech people for tightening the flanges to attend leakage, reconnected the same.
- 12) LCV-3A : Control valve actuator was dropped to attend the diaphragm leakage, changed the stem seal o ring and refixed.
- 13) V-3 : Opened the Butter fly control valve from line and inspected the baffle and shaft. It was ok ,so box up it and checked stroke.
- 14) PRCV-23: Opened the power cylinder and changed the piston "o" rings and stem seal "o" rings. General cleaning was carried out.
- 15) LCV-2 : Control valve dropped from line and disassembled plug/seat and refixed after completion the jobs from Tech.Dept.

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

- | | |
|-------------|--------------|
| FRCV-1, | TRCV-10, |
| FRCV-2, | TRCV-11 |
| FRCV-3, | PICV-14 |
| FRCV-5, | PICV-25 |
| PICV-13A&B, | PRCV-4 |
| MICV-22 | FICV-9,10,11 |
| MICV-14, | FICV-7,8,15 |
| FRCV-12&14, | FICV-200 |
| LCV-13, | PICV-139 |
| V-18 | PRCV-18 |

(C) Replaced gland packings of following control valves.

- | | |
|-------------|-----------|
| TRCV-10, | LCV-14, |
| TRCV-11, | V-15, |
| LCV-13, | MICV-22 , |
| FRCV-2, | LCV-13 , |
| PICV-13A&B, | LRCV-70 |
| V-5 | LCV-17 |

(D) Replaced the Air regulators of following instruments.

- | | |
|---------|----------|
| PRC-23 | MIC-101J |
| V-5 | PT-151 |
| TRCV-11 | PDI-104 |
| LCV-8 | FIC-102 |
| LRC-1 | PDI-152 |
| LC-14 | PIC-7 |

204

CODE NO	JOB DESCRIPTION
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01 71 02 COMPRESSOR HOUSE JOBS :

(A) 101-J, Air compressor :

- 1) 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 Mechanical maintenance job and refixed after physical inspection and set gap voltage.
- 3) EA & EB axial probe was replaced by new one.
- 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.
- 2) Bearing thermocouples of turbine and compressor were removed and refixed. Soldered the wires of t/c of comp. thrust bearings
- 3) FIC-200& PIC-300 controller were checked.
- 4) Removed all TI / PI to facilitate Mechanical maintenance job and refixed after physical inspection .

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

- 1) General cleaning , overhauling of governor positioner PRC-12 and MIC-23 were carried out and checked stroke. Changed the air tubings of MIC -23 as it was replaced with new model positioner with governor by Mech.
- 2) All probes were opened to facilitate Mechanical maintenance job and refixed after physical inspection and set gap voltage.
- 3) 2V & 2H radial probes and extension cable were replaced by new one. Also replaced 7H probe. Extension cable of AA & AB were replaced by new one.
- 4) Removed all TI / PI to facilitate Mechanical maintenance job and refixed after physical inspection.

205

CODE NO JOB DESCRIPTION

(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.
- 3) EA & EB axial and 7V radial probes were replaced by new one.
- 4) Removed all TI / PI to facilitate Mechanical maintenance job and refixed after physical inspection .

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

- 1) FIC-801 controller for NGBC antisurge valve was provided in control room console panel and FIC-802 of AGBC was shifted to comp.local panel.
- 2) Cimplicity logic software was loaded in new PC by PLC engr. and necessary wiring and soft work job was caaried out.
- 3) Reset Push Button for antisurge control valve was provided on operator console.
- 4) All probes were opened to facilitate Mechanical maintenance job and refixed after physical inspection and set gap voltage. Replaced turbine radial probe(Horizontal)by new one
- 5) Removed all the RTD elements and fixed back after completion of Mech. Works.
- 6) TI-853:-Changed MTL-3073 isolator in comp.local panel.

01 71 03 FIELD INSTRUMENTS JOBS :

- 1) Inspeected all the tunnel thermocouple/Thermowell.Replaced TI-0068 T/C with T/W as it was doubtful.
- 2) Instrument Air Dryer: Removed both the vessels heater elements, checked and replaced two nos.1.5KW heater elements of vessel-A and installed back with new gaskets.
- 3) LIC-1 Torque tube was replaced by new one and checked calibration.
- 4) LT-1(Electronic Tx)New Tx. mounting,impulse tubing,cabling wiring job was carried out.

206

CODE NO	JOB DESCRIPTION
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- 5) PGR :TI-120G Replaced new RTD elements
- 6) Neptha Prerformer:- -USY-1108 & USY-1110 Sol.valve and Limit switches burnt cables were replaced.
 - a) Impulse tubing of following Tx's were changed.
LT-1003, LT-1007, FT-1004, FT-1005, PT-1036
 - b) R-112 Catalyst unloading/loading, provision done for safety air mask and low air pressure alarm system.Total job was carried out as per requirement and guide line of safety and prod.dept.
- 7) Sec.Reformer metal T/C were removed and refixed after completion of mech.work
- 8) C.G.Compressor: FI-650, Rotameters ,440 controller, control valves general cleaning jobs were carried.
- 9) V-5 Shifted the control valve air header and retubing done.
- 10) TI-853 Termowell was removed to attend leakage refixed after machining work provided new gaskets.
- 11) 103J oil console pressure gauges panel: All the gauges were removed and refixed after cleaning and calibration.
- 12) Auxiliary boiler : Removed following instruments with impulse tubes and cables and refixed after completion of mech.work:
PT-12, PY-18, FSL-218, THIC-131, FI-182, FSL-219
- 13) Jobs attended to facilitate technical department in cooling water line, LTS, 112c line replacement jobs. Removed the T/Cs with T/Ws and refixed.
- 14) 104J: In BFW pumps removed local press.gauges panel, sol.valve to facilitate mech.work and refixed after completion of that jobs.
- 15) General preventive cleaning/checking of LC-13, 14, 15, 16, 17, 18, 19 were carried out.
- 16) Air header was flushed at various points.
- 17) Attended all the start up jobs (Ammonia, PGR, Prerformer) i.e Flushing of transmitters, provision of low/high range pressure gauges to check pressure, comp.trip ckt. checking, calibration of analysers (H₂, CH₄, O₂) etc.
- 18) Provided high range pr.gauges for hydro test as per requirement of mech.sec.

207

CODE NO	JOB DESCRIPTION
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01 71 04 FUJI UPSS :

- 1) General cleaning and serviceing were done by I/L Engr. as per AMC.
- 2) AVR/UPSS on DC Auto change over was checked , found ok.
- 3) Plant load was diverted on batteries & checked for half an hour and found performance of batteries were satisfactory.
- 4) Two new alarm provided in control room IIC Annunciator for the following,
(a)AC Mains input Fail UPSS-1
(b)AC Mains input Fail UPSS-2
- 5) ACDB panel was lifted to match the false flooring level.

01 71 05 CONTROL ROOM JOBS :**1. YBL DCS:**

- a) All the cards of EFCD,EOPS and EFMS were removed from panel and cleaned all the cards and panel.
- b) All the jobs related with AMC were attended
- c) New provision done in DCS for Primary reformer Naptha& Gas headers Pressure transmitters

PI-114A, PI-115 to 122	Naptha header
PI- 48 to 56	Gas header
- d) Provided new electronic Txs and I/P convertor for FICV-12&14 and loops were taken in DCS.
- e) Insallation of ELCO,isolators,terminal strips and wiring jobs were carried out.
- f) New MAC2 (2nos.), VM1 (2 nos.) and Mx2 (1no.) cards were installed in EFCD and EFMS.

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CODE NO	JOB DESCRIPTION
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2. HIMA PLC:

- a) Nine no. of DO cards F3322 were installed in PLC (128 DO) for new annunciator to facilitate operators.
- b) Rewiring in PLC-1,2,3 cabinets were done
- c) Wiring changed on relay contacts for De energized to trip logic
- d) Installed new MTL isolators in cabinets and done necessary wiring for new electronic transmitters in trip logic(2 out of 3 logic)

3. GE FANUC PLC FOR 800- J :

A Cimplicity software was loaded to PC and necessary wiring and soft work done to installed the PC in control room.Finally checked it from PLC input and output.

4. Others Jobs Implemented, Related With Safety Committee Guide Lines :

- a) New DCS operator console has installed and commissioned(now there are 4 number of operator console).
- b) PLC Engineering station installed and commissioned.
- c) NGBC antisure controller relocated from field local panel to control room and AGBC antisure controller relocated from control room to field local panel .
- d) Four nos. IIC make annunciators were installed on control room panel and necessary cabling and wiring from HIMA PLC panel and NGBC local panel to ann. completed. Relocated the Temp.Monitor, Eye-Hye, Woodward controller on control room panel for the installation of the annunciators.
- e) Following new electronic Transmitters(30nos.) were installed and impulse tubing, cabling & wiring in DCS/PLC cabint and related soft work done.
 - 1) PT-48 to PT-56 (In Primary reformer AG line) (9 Pressure Transmitters)
 - 2) PT-114 to PT-122 (In Primary reformer Neptha line) (9 Pressure Transmitters)

PLANT TURNAROUND - APRIL - 2000AMMONIA PLANTTECHNICAL DEPARTMENT JOBS

720

CODE NO	JOB DESCRIPTION
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01 81 01 TECHNICAL DEPARTMENT JOBS:

The following jobs were carried out during shut-down of April, 2000.

(A) REPLACEMENT OF PIPE LINES:

- (1) DM - 7/8 - 6": i.e. from battery limit to control valve and from DM tank 2002-F to Pump 2004-J / JA respectively.

The material of construction changed from Aluminium to SA-213 TP 304, Sch.10, ERW pipe.

Approx. length - 21 meters.

The job was done through M/s. J & J Engineers.

- (2) BF-9/10 - 2": i.e. Boiler feed water line from 104-J to 101-U & from 104-JA to 101-U.

The Material of construction for above line is SA 106 Gr.B, Sch.160.

Approx. length - 20 Mtrs.

The Job was carried out through M/s. J & J Engineers.

- (3) BF-15 - 8": i.e. from 123-C to check valve (6" NB) Line No. BF-1H.
Line size increased from 6" NB to 8" NB for reducing pressure drop.

Approx. length - 115 Mtres.

The Hydrotest was witnessed by IBR Inspector.

Hydrotest pressure - 145 Kg / cm² g

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

The job was done by M/s. Jacob H&G Ltd., Mumbai, through M/s. Urvashi Engg. & Utility Services, Ahmedabad.

- (4) PG - 9 - 18": i.e. process gas line from 157-F to LTS (104-D)

Material of construction - CS A-106 Gr.B

Size - 18" NB, Sch. STD.

Approx. length - 9 Mtrs.

Job was done through M/s. Jacob H&G Ltd., Mumbai.

III

CODE NO JOB DESCRIPTION

- (5) PG - 10 - 18" / 20": i.e. Process gas line from LTS (104-D) to PG-21 - 20".
The line size increased from 18" NB to 20" NB from the down stream of MOV for pressure drop reduction.

Material of construction - CS - A-106 Gr.B
Size - 18" / 20", Sch. STD.
Approx. length - 16 Mtrs.
Hydrotest pressure - 42 Kg cm² (g).
Job was done through M/s. Jacob H&G Ltd., Mumbai.

- (6) PG - 16 - 14": i.e. Process Gas line from 101-E to 136-C.
The line size increased from 12" NB to 14" NB for reducing pressure drop.

Material of construction - CS - A - 106 Gr.B
Size - 14" Sch.20
Approx. length - 78 Mtrs.
Hydrotest pressure - 42 Kg / cm² (g).
The job was done through M/s. Jacob H&G Ltd., Mumbai.

- (7) PG - 35 - 18"/20": i.e. Process Gas line from 112-C to 157-F.
The line size increased from 18" NB to 20" NB for reducing pressure drop.

Material of construction - A-106 Gr.B, Sch. STD.
Approx. length - 37 Mtrs.
Hydrotest pressure - 42 Kg / Cm² (g).
The job was done through M/s. Jacob H&G Ltd., Mumbai.

- (8) NH - 87 - 3": i.e. Corroded spool pieces of 106-F outlet replaced.

Material of construction - CS, A-106 Gr.B,
Size - 3", Sch. 80.
Approx. length - 1 mtr.
The job was done through M/s. Jacob H&G Ltd., Mumbai.

- (9) SC-44,51,53 - 2": i.e. Steam condensate lines of 171-C, 150-C & 151-C were replaced.

Material of construction - CS, A-106 Gr.B,
Size - 2" Sch. 80,
Approx. length - 28 Mtrs.
The job was done through M/s. Jacobs H&G Ltd., Mumbai.

112

CODE NO	JOB DESCRIPTION
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- (10) SG-52, 53 - 1.1/2", 3": i.e. Syn. Gas line from SG-22 to equipment discharge along with its bypass replaced.

Material of construction - CS, A-106 Gr.B
Size - 1.5"NB, 3"NB, Sch. 160
Approx. length - 3" - 4 Mtrs.
1.5" - 1.3 Mtrs.

The job was done through M/s. Jacob H&G Ltd., Mumbai.

- (11) EWR - 199: i.e. New 3" NB Ammonical water Drain Header from Ammonia Recovery System to strong effluent (connected to 102-F Drain) was laid.

Header size - 3" NB, Sch. 10S.
Branch connection - 1" NB, Sch. 40.
Material of construction - SS -304, Sch.10S
Approx. length - 3" - 156 Mtrs.
1" - 98 Mtrs

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

- (12) PW - 17: i.e. Process condensate line replaced from 102-F to 170-C.

The material of construction changed from CS. to SS-304
Size - 4" NB, Sch. 40.
Approx. length - 92 Mtrs.
Hydrotest pressure - 40 Kg / cm² (g).

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

- (13) Upgradation of Hot Ammonia line: i.e. from 109-F to 121-J/JA. (NH-88 / 88A - 8")

The line size increased from 6" NB to 8" NB. (Sch-40) for reducing pressure drop.
NH-89 / 89A - from 121-J / JA to control valve and from Battery limit to Urea plant.

Material of construction - CS, A-106 Gr.B, Sch. 40.
Size - 6" NB, Sch-40.
Approx. length - 200 Mtrs.
Hydrotest pressure - 30 Kg./cm² g.

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

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CODE NO	JOB DESCRIPTION
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(B) REPLACEMENT OF UNDER GROUND COOLING WATER RETURN HEADER IN AMMONIA PLANT:

HW-21-16", HW-22-16" - Approx. 18 mtr
 HW-20-24" - Approx. 24 mtr
 HW-16-30" - Approx. 50 mtr
 HW-5-36" - Approx. 140 mtr
 CWR-4410-1050-B13 (42") - Approx. 16 mtr
 CWR-4409-1200-B13(48") - Approx. 54 mtr
 The job was done through M/s UB engineers.

(C) REPLACEMENT OF AIR COMPRESSOR 3RD STAGE INTER COOLER 131-JC :

Air compressor 3rd stage intercooler 131-JC was replaced by a new one. The salient features of new cooler are that it has SS-304H tubes with Aluminium fins and integral moisture separator. The air is on shell side & cooling water on tube side. The cooler was manufactured by M/s. API, BASCO, USA. The cooling water & air line connected with the cooler were also modified. The replacement job was carried out through M/s. Jacob H&G Ltd., Mumbai.

(D) REPLACEMENT OF AMMONIA CONVERTOR BFW HEAT EXCHANGER 123 - C (OLD) :

Old Ammonia convertor BFW Heat Exchanger i.e. 123-C (old) was removed. Spring support to Line No. SG-33-14" (from 122-C to 123-C) was provided from this heat exchanger. Hence after removal of this heat exchanger, new structure was erected and spring support was provided from this new structure. The job done through M/s Jacobs H & G Ltd, Mumbai.

(E) REPLACEMENT OF STEAM EJECTOR 101-JCA :

A new steam jet ejector assembly with 25 % higher capacity was procured from the original Principal supplier - M/s. Graham Mfg. Co., USA. Old ejector assembly replaced with newly procured Steam Ejector. Connected Steam, Vapour, Cooling Water lines were modified. This was done through M/s J & J Engineers.

(F) REPLACEMENT OF ISOLATION VALVE :

Additional 12" NB. isolation valve installed at the down stream of FRC-2 on Line No. NG-8. The job was carried out thru' M/s. J & J Engineers.

PLANT TURNAROUND - APRIL - 2000

UREA PLANT

MECHANICAL JOB

JJA

CODE NO JOB DESCRIPTION

02 01 01

CO2 CENTRIFUGAL COMPRESSOR (HITACHI) TRAIN
K-1801 HP/LP CASE AND Q-1801 :

(A) OVERHAULING OF HITACHI COMPRESSOR K-1801 H.P.CASE :

Following jobs were carried out.

- Coupling between the Gear Box to HP Compressor was decoupled after recording the necessary match marks.
- Initial alignment readings were measured and recorded.
- Coupling end and thrust end bearing clearances were measured using lead wire and recorded.
- After removing all the necessary pipe lines, the head flange was pulled out.
- Coupling hub was removed using hydraulic tool at a pressure of 17000 PSI (G).
- Gas seals on both sides were removed and cleaned.
- Using special pulling tool the bundle was pulled out slowly and supported on wooden logs.
- The bundle was then split open and the rotor taken out.
- All the diaphragms were removed, thoroughly cleaned with kerosene and then assembled.
- Two rollers in the bottom bundle was replaced with new one as the old (One No.) was found to be in damaged condition.
- The inter stage hub labyrinth was changed from Aluminium material of construction to Stainless Steel.
- All the clearance values between the labyrinths and the rotor were measured and recorded.
- New reconditioned rotor was then assembled and the bundle boxed up with new split face teflon O-rings.
- New Teflon O-rings and back up rings were assembled after heating the same in hot water to a temprature of 85-90 deg. C.
- Bundle inserted in to the outer casing using the special tool and the head flange boxed up.
- Both end gas seals were assembled after measuring and recording the clearances.
- Bearing pads were cleaned and polished using green rouge.
- Thrust collar and the bearings assembled and the clearance checked and recorded.

225

CODE NO JOB DESCRIPTION

- Coupling hub was then assembled using hydraulic tool.
 - Expansion Pressure = 16000 PSI (G)
 - Thrust Pressure = 5500 PSI (G)
 - Coupling hub OD = 100.00 MM (Before inspection)
 - Coupling hub OD = 100.06 MM (After inspection)
 - Distance Travel = 2.15 MM.
- All removed pipe lines connected after air flushing with new gaskets.
- Gear Box and HP compressor was then aligned.

OBSERVATIONS :

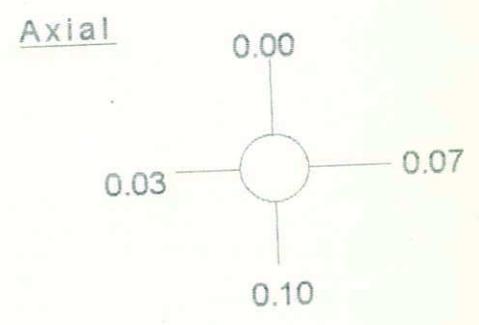
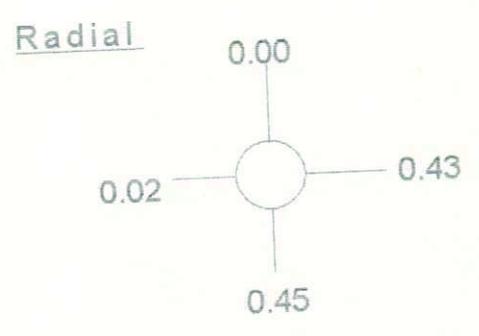
1. Journal and Thrust bearing pads were found to be in good condition.
2. All the labyrinths were in good condition and are within limits.
3. One roller in the bundle (inner casing) was found to be in damaged condition and the same was replaced.

ALIGNMENT DATA :

Gear Box to HP Compressor

Before Overhauling

Dial on HP Coupling



Value in MM

226

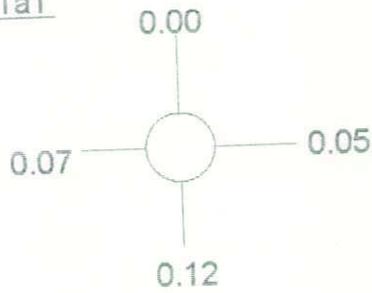
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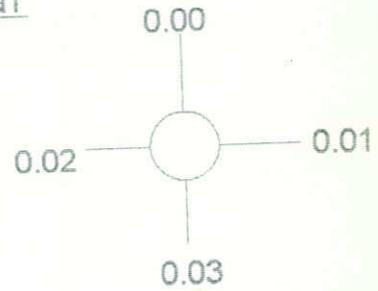
After Overhauling

Dial on HP Coupling

Radial



Axial

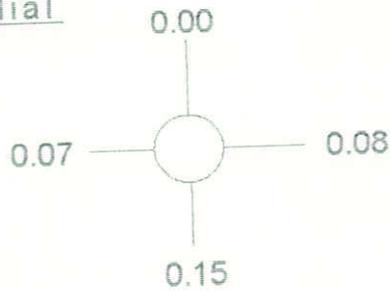


Value in MM

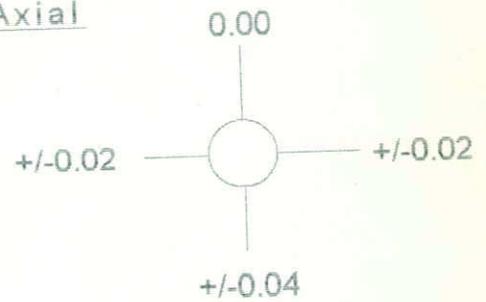
Design Value

Dial on HP Coupling

Radial



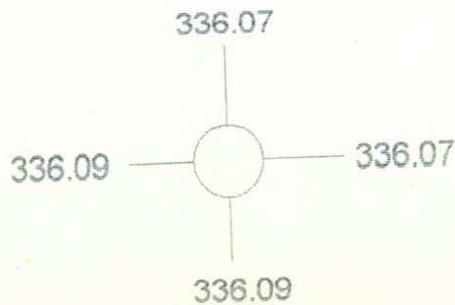
Axial



Value in MM

Distance Between the Coupling Flange

Design = 336.04 to 336.54 MM



Value in MM

117

CODE NO JOB DESCRIPTION

Rotor Axial Float :

Sl. No.	Description	Design Value	Actual Value BOH	Actual Value AOH
1	Thrust bearing axial Float (P)	0.25 ~ 0.35	0.33	0.28
2	With out Free end side pads	1.5	2.95	2.9
3	With out Compressor side	1.7	2.75	2.75
4	Total Float with out pads	2.85 ~ 2.95	5.4	5.37

CLEARANCE DATA :

Value indicate the Diametral clearance

Value in MM

Symbol	Description	Design value	Maximum Allowable	Before Overhauling	After Overhauling
A	1 st stage impeller eye Laby	0.72 - 0.96	1.16	0.73 - 0.80	0.69 - 0.80
B	2 nd stage impeller eye Laby	0.72 - 0.94	1.1	0.67 - 0.73	0.71 - 0.79
C	3 rd stage impeller eye Laby	0.72 - 0.94	1.1	0.72 - 0.83	0.73 - 0.80
D	4 th stage impeller eye Laby	0.72 - 0.94	1.1	0.70 - 0.87	0.74 - 0.86
E	5 th stage impeller eye Laby	1.02 - 1.26	1.4	1.03 - 1.08	0.98 - 1.05
F	6 th stage impeller eye Laby	1.02 - 1.26	1.4	1.10 - 1.17	1.09 - 1.19
G	1 st inter stage Laby	0.20 - 0.44	0.56	0.3	0.29
H	2 nd inter stage Laby	0.20 - 0.44	0.56	0.37	0.35
I	3 rd inter stage Laby	0.20 - 0.44	0.56	0.4	0.38
J	4 th inter stage Laby	0.20 - 0.44	0.56	0.32	*0.35 - 0.42
K	5 th inter stage Laby	0.20 - 0.42	0.54	0.29	0.27
L	Balance Laby	0.20 - 0.44	0.56	0.44 - 0.50	0.32 - 0.53
M	Gas seal Laby Coupling end Thrust end	0.30 - 0.48	0.6	0.37 0.38 - 0.40	0.37 0.38 - 0.40
N	Oil seal Laby Coupling end Thrust end Thrust collar	0.30 - 0.48	0.6	0.37 - 0.40 0.38 0.30	0.37 - 0.40 0.38 0.30
O	Radial Bearing Coupling end	0.11 - 0.14	-	0.165 - 0.18	0.17 - 0.175
Q	Radial Bearing Thrust end	0.11 - 0.14	-	0.17 - 0.175	0.15 - 0.16

* Stainless Steel Labyrinth installed in the 4th inter stage.

778

CODE NO JOB DESCRIPTION

SPARES CONSUMED :

Sl.No.	Part No.	Description	Quantity
1	490/01	O-Ring for Head Flange casing (Viton)	1 No.
2	490/02	O-Ring for casing (Viton)	1 No.
3	490/03	O-Ring for inner casing (Teflon)	1 No.
4	490/04	O-Ring for inner casing (Teflon)	1 No.
5	490/05	O-Ring for inner casing (Teflon)	1 No.
6	490/06	Back-up ring for Head Flange casing (Teflon R)	1 No.
7	490/07	Back-up ring for casing (Teflon R)	1 No.
8	490/08	Back-up ring for inner casing (Teflon R)	1 No.
9	490/09	Back-up ring for inner casing (Teflon R)	1 No.
10	490/10	Back-up ring for inner casing (Teflon R)	1 No.
11	565/19	O-Ring for Labyrinth holder (Viton)	4 Nos.
12	562/10	Inter stage labyrinth 4th stage (Stainless Steel)	1 Set.

779

CODE NO	JOB DESCRIPTION
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(B) PREVENTIVE MAINTENANCE OF HITACHI COMPRESSOR
K-1801 L.P.CASE :

Following preventive maintenance jobs were carried out.

- Both sides Coupling decoupled and alignment checked.
- Radial bearing clearance was checked using lead wire. Since the clearance was more in both turbine side and gearbox side bearings all the pads of these bearings were replaced with new one. Thrust pads were found to be in good condition and the same was polished using green rouge and assembled.
- Both sides alignment carried out and coupled.

Spares consumed : 2 Sets of pads for radial bearings.

CLEARANCE DATA :

Sl. No.	Description	Design Value	Actual Value BOH	Actual Value AOH
1	Turbine end radial bearing	0.11 - 0.15	0.26	0.13
2	Gearbox side radial bearing	0.11 - 0.15	0.22	0.13
3	Thrust bearing	0.28 - 0.38	0.43	0.45
4	Total float with out pads		4.5	4.5
5	Float with out compressor side pads		2.44	2.45
6	Float with out gearbox side pads		2.49	2.5

220

CODE NO JOB DESCRIPTION

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

Following preventive maintenance jobs were carried out.

- Both end radial bearing clearance measured using micrometer and the same are within limit.
- All the radial and thrust pads were polished using green rouge and assembled.
- All the linkages of the main regulating valve servomotor and the extraction valve servomotor were cleaned, easened and re-lubricated.
- Both ESV outer cover and piston rods were cleaned.

CLEARANCE DATA :

Sl. No.	Description	Design Value	Actual Value
1	Free end radial bearing	0.188 - 0.307	0.24
2	Coupling end radial bearing	0.240 - 0.363	0.318 - 0.358
3	Thrust bearing	0.30 - 0.43	0.32
4	C/E oil seal clearance (Radial) - SR	0.085 - 0.285	0.18
5	C/E oil seal clearance (Axial) - SA	1.6 - 4.0	4.5
6	F/E oil seal clearance (Radial) - SR	0.085 - 0.285	0.23
7	Emergency trip gear clearance - SR	0.80 - 1.00	0.95

221

CODE NO JOB DESCRIPTION

(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

222

CODE NO

JOB DESCRIPTION

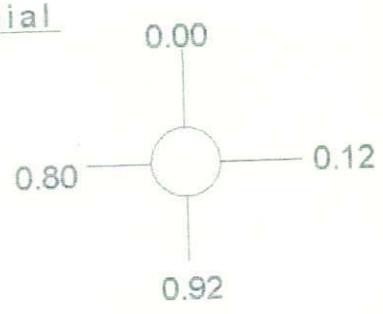
ALIGNMENT DATA FOR HITACHI COMPRESSOR TRAIN :

LP Compressor to Turbine :

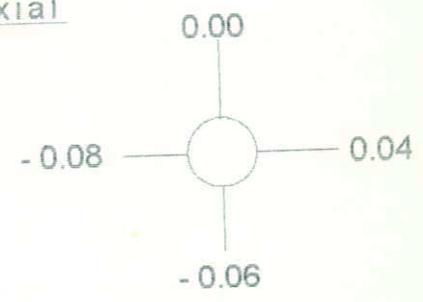
Befor Overhauling

Dial on Turbine Coupling

Radial



Axial

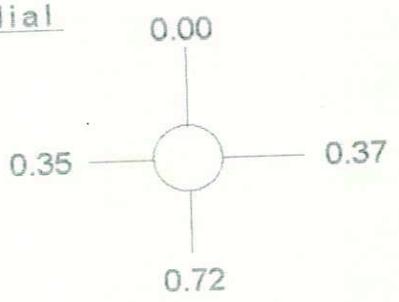


Value in MM

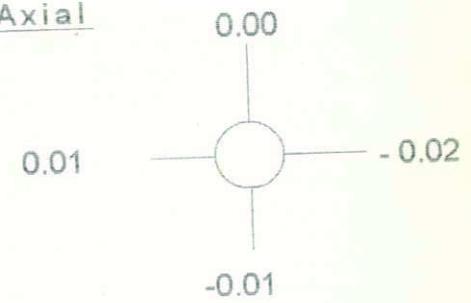
After Overhauling

Dial on Turbine Coupling

Radial



Axial



Value in MM

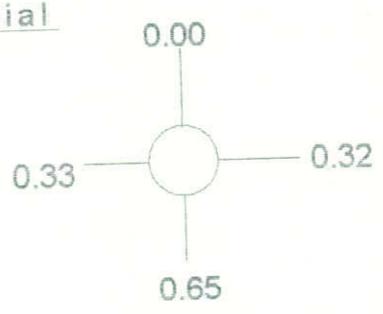
123

CODE NO JOB DESCRIPTION

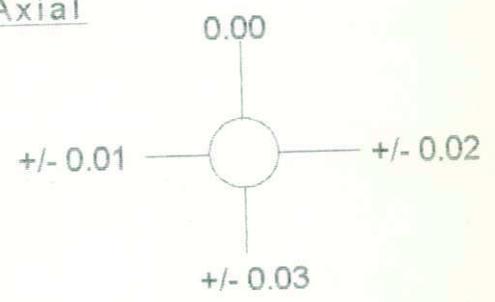
Design Value

Dial on Turbine Coupling

Radial



Axial

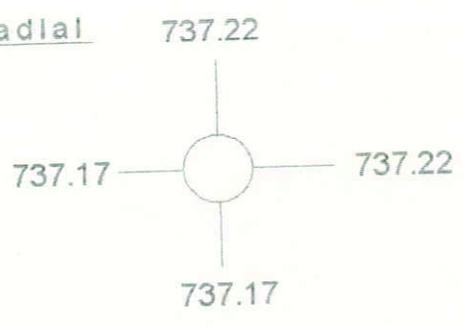


Value in MM

Distance between the coupling Flange

Design = 737.50 to 738.00 MM

Radial



Value in MM

J24

CODE NO

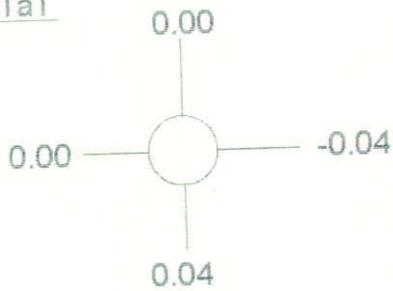
JOB DESCRIPTION

Gear Box to LP Compressor :

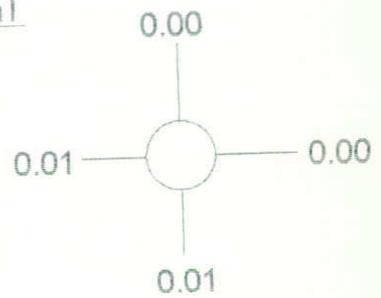
Befor Overhauling

Dial on LP Compressor Coupling

Radial



Axial

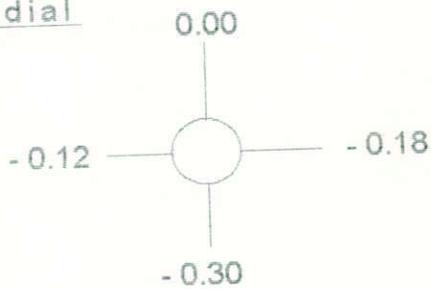


ValueinMM

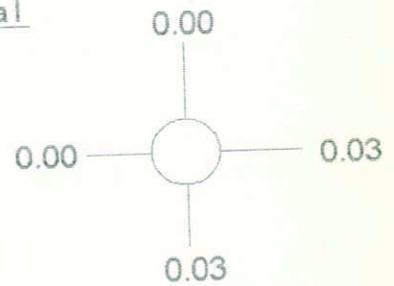
After Overhauling

Dial on LP Compressor Coupling

Radial



Axial



ValueinMM

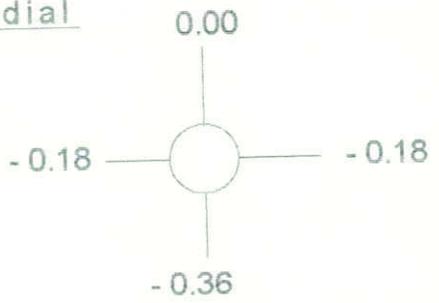
225

CODE NO JOB DESCRIPTION

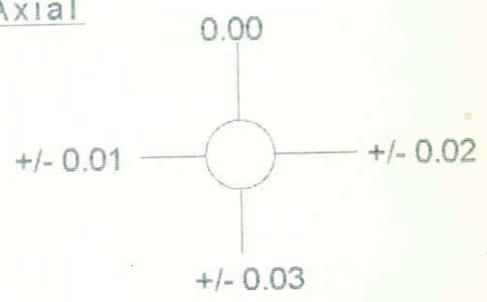
Design Value

Dial on LP Compressor Coupling

Radial



Axial

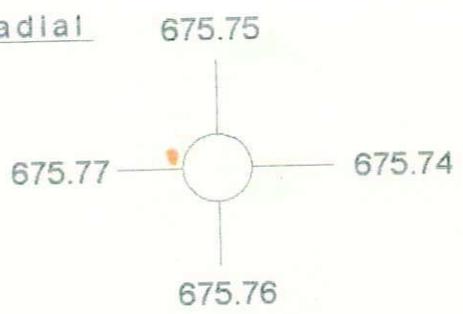


Value in MM

Distance between the coupling Flange

Design = 675.50 to 676.00 MM

Radial



Value in MM

226

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

Following jobs were carried out.

- Special washers were provided at the compressor base to arrest the movement of the compressor.
- Oil lines were removed and coupling decoupled.
- Bearing top covers were removed and the bearing inspected.
- Casing top cover bolts removed and cover lifted up using crane.
- Top casing turned for inspection and positioned in ground floor for cleaning.
- Old rotor labyrinth clearances were checked and recorded.
- Old rotor removed and supported on stand.
- The first stage Eye labyrinth clearance was more than the design, the same was removed in the bottom casing. It was observed that the labyrinth got fully adhered with the diaphragm. Due to this the labyrinth was removed by chipping with chisel and grinding. This process took long time as it was difficult to remove the material present in the locating grooves. Hence it was decided to replace only in bottom half.
- Old coupling half was removed and assembled in the new reconditioned rotor.
- New bearings positioned (Radial & Thrust) after checking the clearance with the new rotor.
- New rotor positioned in the bottom casing and labyrinth clearances checked and corrected.
- Top casing positioned and checked for free rotation.
- Top cover boxed up with the " Steam Seal Red " compound and the casing bolts tightened.
- Bearing top covers were boxed up and Alignment was made
- Old coupling assembled.

OBSERVATION :

1. Water Was observed inside the F/E and C/E bearings and the clamps were found to be in rusted condition.
2. the end seal labyrinth in the C/E and F/E in the top casing got corroded and sharpened. The same needs replacement in the next opportunity.
3. Severe corrosion was observed in the Bottom casing, Top casing and Split faces of the Diaphragm.
4. Lub oil filter (1 no.) was found to be filled with water.
5. A gap of 1.75 mm was observed between the sleeves in the new compressor shaft.
6. Compressor New rotor Journal areas C/E & F/E and Thrust collar has severe pittings and surface finish were not in good condition. This may be re-conditioned in the next opportunity.

227

CODE NO JOB DESCRIPTION

CLEARANCE DATA :

Value indicate the Diametral clearance

Value in MM

Symbol	Description	Design value	Maximum Allowable	Befor Overhauling	After Overhauling
A	Comp. Journal Brg. C.E/F.E	0.15 - 0.20	-	0.25 / 0.24	0.24 / 0.24
D	Comp. Thrust bearing	0.3	-	0.26	-
E	Bearing Housing Oil Laby	0.35 - 0.55	1.1	0.3 - 0.45	0.3 - 0.4
F	F.E shaft end Laby	0.4 - 0.6	1.2	0.45 - 0.9	0.5 - 0.8
L	1 st stage impeller eye Laby	1.1 - 1.4	2.8	1.8 - 2.5	0.9 - 1.5
M	2 nd stage impeller eye Laby	1.0 - 1.3	2.6	0.65 - 0.8	0.7 - 0.8
N	3 rd stage impeller eye Laby	0.95 - 1.25	2.5	0.55 - 0.95	0.5 - 0.85
O	4 th stage impeller eye Laby	0.85 - 1.1	2.2	0.9 - 1.25	0.9 - 1.1
O	5 th stage impeller eye Laby	0.85 - 1.1	2.2	0.55 - 1.10	0.6 - 0.9
O	6 th stage impeller eye Laby	0.85 - 1.1	2.2	0.4 - 0.8	0.9 - 1.0
O	7 th stage impeller eye Laby	0.85 - 1.1	2.2	0.3 - 0.8	0.4 - 0.7
G	I st stage Hub Laby	0.5 - 0.7	1.4	0.35 - 0.8	0.45 - 0.50
G	II nd stage Hub Laby	0.5 - 0.7	1.4	0.9 - 1.4	0.6 - 0.95
I	Inter stage Laby	0.5 - 0.7	1.4	0.95 - 1.15	0.7 - 0.85
H	IV stage Hub Laby	0.45 - 0.65	1.3	0.7 - 1.25	0.35 - 0.6
H	V stage Hub Laby	0.45 - 0.65	1.3	0.55 - 0.85	0.4 - 0.55
H	VI stage Hub Laby	0.45 - 0.65	1.3	0.65 - 0.85	0.5 - 0.65
F	C/E shaft seal	0.4 - 0.6	1.2	0.4 - 0.55	0.4 - 0.6
E	C/E Bearing oil Laby	0.35 - 0.55	1.1	0.4 - 0.6	0.4 - 0.65
	Free float of compressor	4	-	3.91	3.01
	Coupling float			3.4	
	Distance between Shaft ends	649		605.9	607.22

CODE NO JOB DESCRIPTION

(B) PREVENTIVE MAINTENANCE OF CO2 CENTRIFUGAL COMPRESSOR DRIVE TURBINE Q -1101 - 1 :

Following preventive maintenance jobs were carried out.

- Front end and rear end journal bearings were opened, cleaned and checked. Journal bearings found to be in good condition. Journal bearing clearance of both end bearings were checked and recorded, and boxed up.
- Thrust was checked and found more than the designed value. Thrust bearing was replaced by new one.
- LP and HP Servo motor was opened and cleaned.
- All the linkages were oiled.

OBSERVATION :

1. Water Was observed inside the both end bearing and the clamps were found to be in rusted condition.
2. Oil inside the governor box got deteriorated. Water was observed.

CLEARANCE DATA :

Sl. No.	Description	Design Value	Befor Overhauling	After Overhauling
1	Turbine float	0.2 - 0.3	0.37	0.22
2	Turbine bearing Front end	0.12 - 0.161	0.12 - 0.13	0.12 - 0.13
3	Turbine bearing rear end	0.15 - 0.194	0.17 - 0.185	0.17 - 0.185

229

CODE NO JOB DESCRIPTION

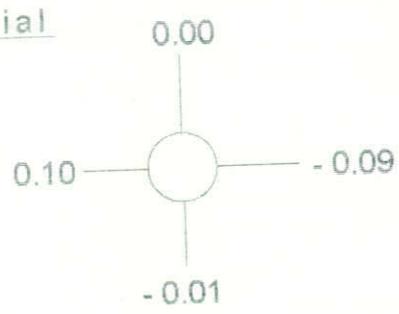
ALIGNMENT DATA FOR CO2 CENTRIFUGAL COMPRESSOR TRAIN:

Befor Overhauling

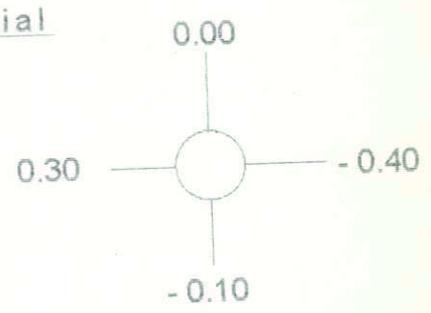
Dial on Turbine Coupling

Dial on Compressor Coupling

Radial



Axial



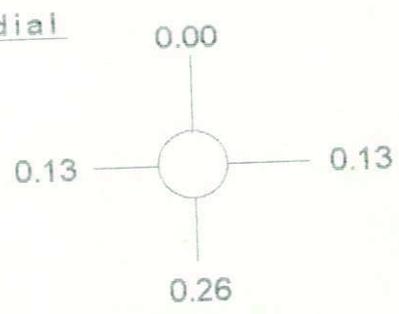
Value in MM

Design Value

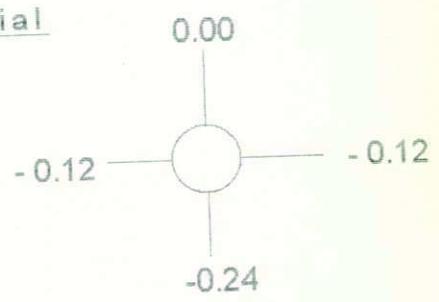
Dial on Turbine Coupling

Dial on Compressor Coupling

Radial



Axial



Value in MM

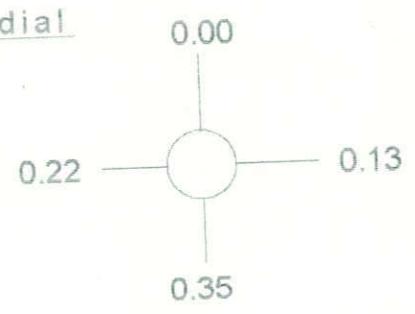
J30

CODE NO JOB DESCRIPTION

After Overhauling

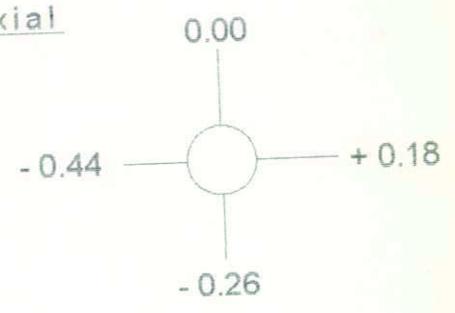
Dial on Turbine Coupling

Radial



Dial on Compressor Coupling

Axial



Value in MM

J31

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

(A) OVERHAULING OF K-1401/1 :

Following jobs were carried out.

- Opened inspection cover.
- Cleaned fan blades and angle of fan blades were changed to 15 deg.
- Opened bearing covers and both bearings were replaced.
- Labyrinth and rotary seal of the fan replaced.
- Bearing covers boxed up with fresh grease.
- V - belt replaced by new set of belts.
- Alignment of fan with motor checked and rectified.

(B) OVERHAULING OF K-1401/2 AND 4 :

Following jobs were carried out.

- Opened inspection cover.
- Replace fan blades along with hub. The angle of fan blades changed to 15 deg.
- Opened bearing covers and both bearings were replaced.
- Labyrinth and rotary seal of the fan replaced.
- Bearing covers boxed up with fresh grease.
- V - belts replaced by new set of belts.
- Alignment of fan with motor checked and rectified.

(C) PREVENTIVE MAINTENANCE OF K-1401/3 :

Following preventive maintenance jobs were carried out.

- Cleaned fan blades.
- Angle of fan blades changed to 15 deg.
- Removed bearings covers, checked condition of bearings and found to be ok. Bearings covers boxed up with fresh grease.
- V - belts replaced by new set of belts.
- Alignment of fan with motor done.

732

CODE NO	JOB DESCRIPTION
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02 03 02	<u>PRILL COOLING SYSTEM FANS (K-1701 / K-1702) :</u>
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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.

02 03 03	<u>SCRAPPER (M-1402) :</u>
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Following preventive maintenance jobs were carried out.

- Fluid Coupling of scrapper replaced by spare coupling.
- Scrapper arm cleaned and new alluminium sheet provided over scrapper arm.
- Gear Box checked. Oil of gear box flushed.

02 03 04	<u>BUCKET CHANGE OVER MECHANISM (M-1401) :</u>
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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.

J33

CODE NO	JOB DESCRIPTION
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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. Surface condenser (H-1114).
2. Main L.O. Coolers of Hitachi Compressor Train (H-1814 A/B).
3. Main L.O. Coolers of P.B. Compressor Train (H-1113 A/B).
4. Flash tank Condenser.
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. Pre evaporator Condenser (H-1419).
12. L.O. Coolers of P-1102 A/B.
13. L.O. Coolers of P-1201 A/B.
14. Pre evaporator Condenser (H-1419).
15. CCS II Cooler (H-1207).
16. Reflux Condenser (H-1352).
17. Effluent Cooler (H-1303).

(B) DRY ICE PLANT :

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

734

CODE NO JOB DESCRIPTION

02 14 01 STEAM LEAK JOBS :

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

Material Consumed:

- Gate valve 1/2" x 800 # - 4 nos.
- Gate valve 3/4" x 800 # - 10 nos.
- Steam trape 1/2" Size - 9 nos.
- Gate valve 4" x 150 # - 1 no.
- C.S. Pipe 1/2" NB - 12 mtr.
- C.S. Pipe 3/4" NB - 30 mtr.

2. Complete tracing line of Carbamate from H.P. Scruber to Autoclave (V-1201) line was replaced by 4 set of new tracing line.

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

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

- I) Co2 to H-1201.
- II) H-1201 liquid outlet Ist isolation valve - body replaced.
- III) H.P. Stripper (H-1201) - Carbamate outlet line BEL Valve.

2. Co2 to H-1203 drain I/V (last) replaced.

3. H-1205 bottom, near H-1201 top, three nos. body plug leaks were attended.

4. P-1204 A/B Suction and Discharge I/V - gland replaced.

735

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.13/00290/KLL/990163 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	7.5	OK
2	RV-1204	P-1201 B Suction RV	8.5	7.5	8.5	7.8	OK
3	PSV-1201 C1	P-1201 C Suction RV	8.5	7.5	8.5	7.5	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	Liquid NH3 line from NH3 storage tank	31	28	31	28	OK
7	RV-1101	Liquid NH3 line from H-1102 to V-1102	31	28	31	28	OK
8	-	Hot NH3 inlet line RV	31	28	31	30	OK
9	RV-1351	V-1351	24	23.5	24	22	OK
10	RV-1352	V-1352	6	5.4	6	5.4	OK
11	RV-1209	V-1203-LP Scrubber line	10	9.06	10	9	OK
12	RV-1501	4 ata steam drum (V-1501)	7.5	6.5	7.5	6.8	OK
13	RV-1502	4 ata steam drum (V-1501)	7.5	6.5	7.5	7	OK
14	RV-1503	23 ata steam drum (V-1502)	25	22.5	25	22.5	OK
15	RV-1130	23 ata steam Header	25	22.5	25	22.5	OK

736

CODE NO JOB DESCRIPTION

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)	
16	RV-1301	II nd Desorber (V-1301)	6	5.4	6	5.4	OK
17	RV-1202 /A	V-1202 to H-1205 line	6	5.4	6	5.5	OK
18	RV-1202 /B	V-1202 to H-1205 line	6	5.4	6	5.6	OK
19	RV-1202 /C	V-1202 to H-1205 line	6	5.4	6	5.5	OK
20	RV-1201 /A	V-1201 to V-1203 off gas line	2350 PSI	2200 PSI	2350 PSI	2200 PSI	OK
21	RV-1201 /B	V-1201 to V-1203 off gas line	2350 PSI	2200 PSI	2350 PSI	2200 PSI	OK
22	RV-1201 /C	V-1201 to V-1203 off gas line	2350 PSI	2200 PSI	2350 PSI	2250 PSI	OK
23	RV-1205	P-1201 A Discharge RV	2350 PSI	2200 PSI	2350 PSI	2250 PSI	OK
24	RV-1206	P-1201 B Discharge RV	2350 PSI	2200 PSI	2350 PSI	2250 PSI	OK
25	PSV-1201/C2	P-1201 C Discharge RV	2350 PSI	2200 PSI	2350 PSI	2100 PSI	OK

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
- Carbamate to H-1203
- Co2 to H-1203
- 4 ata steam to V-1352
- 23 ata steam to V-1351

237

CODE NO	JOB DESCRIPTION
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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. The following jobs were carried out after completion of inspection.

- (I) All old tray support brackets except for tray no.10 were replaced by new (Modified) tray support brackets as per replacement procedure given as under.

REPLACEMENT PROCEDURE OF TRAY SUPPORT BRACKET IN AUTOCLAVE (V-1201) :

1. Removed tray segments one by one which were bolted to each other.
2. Cut and removed old tray support bracket by grinding without any damage to the original liner.
3. Flushed old weld deposit from liner by grinding.
4. Visual inspection and DPT of liner surface carried out. Defects detected during visual inspection and DPT were repaired by grinding and welding followed by DPT.
5. Place for new tray support brackets were marked and tack welding of new tray support brackets to liner were done.
6. Root run completed by TIG welding using 25-22-2 Lmn filler wire.
7. DP Check of root run done.
8. Remaining weld pass completed by TIG welding using 25-22-2 Lmn filler wire.
9. DP Check of final run done and if any defect observed same was repaired by welding and grinding followed by DP Check.
10. New weld were cleaned and passivated by washing with 4% HNO₃ and plenty of water.
11. Tray segments were put back in position.

738

CODE NO	JOB DESCRIPTION
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(II) Insert liner of Compartment no.8 was replaced as per insert liner replacement procedure given as under.

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. Bevelling of shell liner done without any damage to loose liner and back up strip.
4. DPT of bevelled face carried out as per standard inspection procedure.
5. Pressurised argon at 0.2 kg/cm² 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.
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 TIG welding using filler wire 25-22-2 Lmn filler wire. Interpass 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. Cleaned new weld property and passivated by washing with 4% HNO₃ and rinsed with plenty of DM Water.

(III) Down commer line between reduser and nozzle of about 8" Dia x 4" Long of Compartment No. 12 i.e. bottom compartment was replaced as thickness of this portion of the line was reduced below it's allowable limit.
Thickness of old pipe line : 3.0 mm.
Thickness of new pipe line : 6.0 mm.

After Completion of repair job Autoclave was cleaned throughly by DM water. Autoclave top cover boxed up with new gasket after final inspection and getting clearance from production department.

739

CODE NO	JOB DESCRIPTION
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(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 inspection section for inspection. Delta P measurement and repairing of ferrules were done as a parallel activity. After completion of inspection the ferrules were fixed in position with new sleeve gasket. False tube sheet put back in position and tackwelded with ferrules. Precaution was taken to entrance of any foreign particale inside the stipper. Delta P measured by production department. Top and bottom covers were boxed up with new gasket. Co2 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.

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.
- Top layer of the paint was getting peeled off. Repainting of cooler was done.
- Some foreign loose particles were found inside the cooler and the same were removed.
- Some tray clamps were found loose and same were tightened.

Manhole cover of the cooler was boxed up with new gasket.

(B) CO2 KNOCKOUT DRUM (V-1101) :

Manhole cover of Co2 Knockout drum was opened for inspection. Some oily substance found at bottom dished end and the same was cleaned properly. Overall condition of Co2 knockout drum found satisfactory. 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 cloath pieces and asbestos gasket pieces were found inside the suction filter and the same were removed. Ammonia suction filter boxed up with new gasket.

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CODE NO	JOB DESCRIPTION
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(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 damaged and the same was repaired. 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.

(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 damaged, found broken from it's support legs. Gratings found bend and broken at no. of places. Reinforcing ring found broken from it's weld joint. Above damage were repaired. 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) :

Manhole cover of L.P. Vent scrubber was opened for inspection. Visual inspection was carried out. Condition of demister pad and fastners were found in good condition. Manhole cover boxed up with new gasket.

(H) AMMONIA SCRUBBER (V-1207) :

Top cover, top and bottom handhole covers were opened. Rasching ring removed and vessel was handed over for inspection. Damaged grating was repaired. New nut provided in place of missing nut of support grating. Loose bolts of inlet pipe flange were tightened. Rasching ring put back in position. Top cover and hand hole covers were boxed up with new gasket.

(I) 1ST. 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.

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CODE NO	JOB DESCRIPTION
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(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. Top and bottom manhole covers were boxed up with new gaskets.

(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. 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. All demister pad and fasteners were found intact. 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 demister pads and fasteners were found intact in position. Manhole covers were boxed up with new gaskets.

(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. Visual inspection was carried out. Overall Condition of 9 ata steam saturator was found satisfactory. Manhole cover boxed up with new gaskets.

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

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

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CODE NO	JOB DESCRIPTION
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(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. 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. Overall condition of the tanks found satisfactory. Manhole cover boxed up with new gasket.

02 20 01

FABRICATION JOBS :

1. Replaced BEL valve body of 1 st isolation valve of urea solution outlet line from H.P.Stripper.
2. New control valve was provided in Co2 to H.P. Scrubber line as per EWR. NO. U-164.
3. Temperature indicator was provided at exit of 3rd stg. Intercooler (H-1813) of CO2 Centrifugal compressor (K-1801)
4. New skirt board sealing system was provided at conveyor belt no. M-1403.
5. TI-1283 thermowell welding leak attended by welding.
6. P-1304 A/B discharge modified line P-1304 C/D joint leak attended by grinding and welding.

J43

CODE NO	JOB DESCRIPTION
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02 21 01 BELT CONVEYORS :

(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.

244

CODE NO JOB DESCRIPTION

02 31 01 UPGRADATION OF INSULATION :

Upgradation of insulation of following line / vessel were carried out by M/S. Associated Insulation Co.

SR. NO.	LINE NO. / VESSEL NO.	ACTUAL THK. DONE	LENGTH
1	SC-1213-6"-C1 Condensate from H.P. Stripper (H-1201) to V-1502	125 mm	17 mtr.
2	ST-1409-4"-B4 9 ata steam to II nd evap. (H-1424)	75 mm	21 mtr.
3	ST-1525-3"-B4 9 ata steam tracing header to RV-1201-A/B/C jacket and PR-1231 jacket.	75 mm	71.25 mtr.
4	PR-1212- 4" x 1 H.P. scrubber carbamate to Autoclave	75 mm 50 mm	10 mtr. 50 mtr.
5	PR-1216-18" x 6 from PR-1216-16" x 6 to LPCC bottom	75 mm	42.20 mtr.
6	PR-12040-6 x 3 LP absorber (V-1203) RV Outlet to atmospheric	100 mm	12 mtr.
7	HP Scrubber (H-1203)	100 mm	94.29 m2 (Area)
8	First evaporator (H-1422)	125 mm	126.91 m2 (Area)
9	Atmospheric steam condensate tank (T-1501)	100 mm	116.34 m2 (Area)
10	Autoclave (V-1201) top dome	125 mm	40.32 m2 (Area)

PLANT TURNAROUND - APRIL - 2000UREA PLANTINSPECTION JOBS

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CODE NO	JOB DESCRIPTION
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02 41 01	<u>INSPECTION JOBS :</u>
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During this Shutdown, the following major Inspection activities were performed.

1. Inspection of HP vessels viz; (1) H-1201 HP Stripper (2) V-1201, Autoclave. H-1202 HP Condenser and H-1203, HP Scrubber were not opened for inspection during this Shutdown.
2. Internal inspection and ultrasonic thickness measurement of other vessels in the Plant.
3. Ultrasonic thickness measurement of various pipelines including HP lines in the Plant.
4. Dye penetrant examination and radiography of weld joints of the following modified/replaced pipe lines viz;
 - (1) Discharge line of P 1201 A/B (PR-1225-3") 5 nos. 90 deg. elbows, 2 nos. 45 deg elbows.
 - (2) PR-1206-12" (3) ST-1105-4" (4) ST-1213-2" (5) St-1215-2"

These replacement jobs were carried out by M/s Jacobs H&G Ltd.

HIGH PRESSURE VESSELS :(1) AUTOCLAVE (V-1201) :(A) VISUAL INSPECTION :

Thorough visual inspection of the liner and its welds, trays and internals was carried out. The following observations were made.

1. In general, the corrosion attack on liner welds was more as compared to liner parent material as has been observed during previous inspections.
2. All the remaining tray support clits of tray no 1 to 9 of old design 'C' shaped were replaced as detailed below during April 2000 shut down with new supports as these were observed with heavy corrosion and thinning. Procedure for replacement of tray support is given at annexure 'A'.

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CODE NO JOB DESCRIPTION

Tray No.	No. of supports replaced in April 2000	No. of supports already replaced	Remarks
1	NIL	15	
2	NIL	15	
3	7	8	
4	11	4	
5	12	3	
6	11	4	
7	7	8	
8	13	2	
9	13	2	
10	NIL	6	Replacement was not done because of bulging of liner on complete circumference of support area.
11	NIL	15	

3. Observations made on individual compartments were recorded and the defects which were to be repaired were marked at position, as detailed below.

i) Compartment No.1 :

a) Top dome was found with scattered oil deposits on oxide layers and were recommended to be cleaned with wire brush.

b) 5 nos. of brownish patches of approx .40 cm.in diameter were observed. These were indicated to be due to the damaged insulation of top platform support from outside. The insulation of the top dome was replaced during this shutdown.

ii) Compartment No.3 :

(a) At two locations of approx. 70 mm and 50 mm length of circumferential weld seam, weld material was found to be flushed with the liner.

iii) Compartment No.4 :

a) One No. of undercut of approx. 0.3 mm deep and 500 mm length was observed on circumferential joint.

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CODE NO	JOB DESCRIPTION
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iv) Compartment No.5 :

- a) Convex bulging of liner plate was observed just above the circumferential weld joint in approx.3.0 mtrs.length and of approx.4 - 7 mm height.
- b) One No.of undercut of approx.0.5 mm deep and 8 mm length was observed on circumferential joint.
- c) Thinning of clit no 1 & 2 (counting from manway in clockwise direction) was observed.

v) Compartment No.6 :

- a) Convex bulging of liner plate was observed on above the circumferential weld joint in approx. 50 % of the total length and of approx.5 - 10 mm height.
- b) Thinning of clit no 1 & 2 (counting from manway in clockwise direction) was observed.

vi) Compartment No.10 :

- a) High corrosion was observed on insert liner plate visually.
- b) Concave bulging of liner on South West T joint corner in approx.2 " dia and 2 mm deep was observed.

vii) Compartment No.11 :

- a) On West side just below circumferential seam concave bulging of main liner in approx.6" dia area and 10 mm deep was observed. The same was observed in North East corner in approx.2"-3" dia.
- b) Convex bulging of main liner just above the circumferential seam of approx.10 mm height was observed on complete circumference.

viii) Compartment No.12 :

- a) Weld joints of all nozzles to bottom dished end liner as well as patch plates were DP tested. No significant indication were observed.
- b) Roughening of downcomer pipe surface was observed .Thickness of the same was measured during April 2000 shut down . Thickness reduction was observed in 4" distance piece between reducer and 8" sleeve.Min thickness was observed to be only 2.8 mm against design thickness of 6.00 mm. Therefore this distance piece was replaced.

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CODE NO JOB DESCRIPTION

(B) LINER THICKNESS MEASUREMENT :

Ultrasonic thickness measurement was carried out on liner in all the compartments.
The readings are summarised as follows:

	Min.Thk (mm)	Max.Thk (mm)	% Red	Remarks
Manway liner	4.20	5.40	16.00	Installed thickness of liner is 5.00 mm.
Top Dome	3.60	3.80	28.00	
Compartment - 1 Top Course	3.20	4.10	36.00	
Compartment - 1 Bottom Course	4.30	5.00	14.00	
Compartment - 2	4.30	4.90	14.00	
Compartment - 3	4.30	4.90	14.00	
Compartment - 4	4.30	4.80	14.00	
Compartment - 5	4.80	5.40	4.00	
Compartment - 6	4.60	5.00	8.00	
Compartment - 7	4.60	4.90	8.00	
Compartment - 8	4.60	4.90	8.00	
Compartment - 9	4.30	4.90	14.00	
Compartment - 10	4.70	4.90	6.00	
Compartment - 11	4.50	4.80	10.00	
Compartment - 12	4.60	4.70	8.00	
Insert liner Plate in Comp.3	6.80	7.00	nil	Replaced in 1997
Insert liner Plate in Comp.4	6.30	6.40	nil	Replaced in 1999
Insert liner Plate in Comp.8	6.40	6.50	nil	Replaced in this S/D as per procedure at Annexure 'B'
Insert liner Plate in Comp.9	3.20	4.20	36.00	Recommended for early replacement
Insert liner Plate in Comp.10	3.90	4.50	22.00	
Bottom Dish	6.30	6.70	nil	

I50

CODE NO JOB DESCRIPTION

(C) TRAY THICKNESS MEASUREMENT :

Tray no.	Min.thickness mm	Max.thickness mm	Installed thickness mm
1	8.1	8.7	8
2	8.2	8.6	8
3	8.1	8.5	8
4	8.3	8.4	8
5	8.2	8.3	8
6	8.2	8.5	8
7	8.2	8.3	8
8	8.3	8.6	8
9	8.4	8.7	8
10	8.3	8.8	8
11	8.6	8.7	8

(2) HP STRIPPER (H-1201) :

(A) VISUAL INSPECTION :

Visual inspection of top channel, top and bottom tube sheets, bottom channel and cover was carried out. Heavy oxide layer was observed particularly on top dome overlay welding which was found peeled off from scattered locations. Ferrite measurement was carried out in this area and was found to be NIL. As has been noticed during previous inspections, the top tubesheet overlay welding was observed to have undergone significant corrosion. Also, tube to tubesheet seal welds showed heavy corrosion resulting in loss of weld metal and flattening of fillet bead near the tubes.

Dye penetrant examination of tube to tubesheet seal welds was also carried out on randomly selected tubes. The irregular surface of the weld metal due to corrosion attack posed difficulty in carrying out D.P.test. However, no defects were observed during the test.

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

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CODE NO JOB DESCRIPTION

(B) OVERLAY WELD THICKNESS :

The thickness of the overlay weld metal in the top and bottom domes of the Stripper was carried out using permascope M11D. The following readings were recorded.

Top Section :

	Minimum Thk. (mm)		Maximum Thk. (mm)	
	April 2000 S/D	Min. observed so far	April 2000 S/D	Max. observed so far
On manway cover	9.2	9.2 (2000)	14.6	14.6 (2000)
Manway	11.1	9.9 (1998)	16.1	16.1 (2000)
Top dome (Gas phase)	9.14	8.2 (1998)	13.6	13.6 (2000)
Gas phase in Cylindrical Dome	10.98	8.8 (1998)	16.7	16.7 (2000)
Liquid phase in cylindrical Dome	8.21	6.8 (1998)	12.3	12.3 (2000)
Tube sheet	9.34	9.34 (2000)	11.35	13.92 (1999)

Bottom Section :

	Minimum Thk. (mm)		Maximum Thk. (mm)	
	April 2000 S/D	Min. observed so far	April 2000 S/D	Max. observed so far
On cover	12.46	9.2 (1998)	13.83	15.5 (1999)
Manway	10.39	10.2 (1998)	14.81	14.81 (2000)
Dome	12.56	9.5 (1998)	14.9	14.9 (2000)
Cylindrical Area Of Bottom Dome	11.93	9.9 (1998)	13.09	14.8 (1999)

CODE NO	JOB DESCRIPTION
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02 41 02 OTHER VESSELS :

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

- a) Demister pad was found intact.
- b) Top layer of epoxy paint was peeled off at various locations. However, paint layer below these was found satisfactory.
- c) At few spots paint was removed.
- d) On perforated hole area of tray foreign / loose particles were found.
- f) Few tray clamps were found loose.

(2) H-1114 (SURFACE CONDENSER) :

- a) Visual inspection was carried out after hydrotesting.
- b) South side Channel was found to have deposits of hydrojetting. Drain line of the same was found choked.
- c) Tube cleaning was found to be satisfactory.
- d) Ultrasonic thickness measurement was carried out before shut down. Minimum thickness of 8.8 mm, 9.4 mm, 9.9 mm, 6.1 mm, and 5.7 mm were observed on North side channel, shell, Exhaust steam zone (Top), Exhaust steam zone (East), Exhaust steam zone (West), respectively. Design thickness is not available. Refer Annex. C.

(3) H-1352 (REFLUX CONDENSER) :

- a) Visual inspection was carried out after hydrotesting.
- b) Bottom channel was having heavy rusting / scaling especially on C.W. outlet side.
- c) Hydrojetting was not proper in first attempt. Therefore it was done again and the equipment was boxed up after proper hydrojetting and cleaning of the tubes.
- d) Ultrasonic thickness measurement carried out. Minimum thickness of 7.6 mm, 13.0 mm and 14.3 mm was found on shell, dished end and channel respectively against design value of 8.0 mm on shell, 12.0 mm on dished end and 14mm on channel. Refer Annexure- C.

CODE NO	JOB DESCRIPTION
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(4) CRANK CASE L.O. COOLER OF P - 1102-A :

- a) Pittings up 1 to 1.5 mm deep were observed on cooling water side.
- b) Overall condition was satisfactory.
- c) Ultrasonic thickness measurement carried out. Minimum thickness of 5.9 mm and 3.8 mm was found on channel and dished end respectively. Design thickness is not available. Refer Annex. 'C'

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

- a) Channel side had excessive corrosion pittings upto 2 to 3 mm deep.
- b) Bonnet cover had pittins upto 1 mm deep.
- c) Tubesheet of bonnet side had pittings up 2 to 3 mm deep.
- d) Ultrasonic thickness measurement was carried out. Minimum thickness of 2.9 mm and 6.9 mm was found on channel and dished end respectively. Design thickness is not available. Refer Annex. 'C'

It is recommended to replace this cooler in near future.

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

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

- a) The shell and Dish ends colouration was blakish brown.
- b) I.D. of tubes were found to have minor scaling.
- c) Overall condition of equipment was found to be satisfactory.
- d) Ultrasonic thickness measurement was carried out. Minimum thickness of 12.0 mm, 5.0 mm and 13.4 mm was found on shell, bottom dished end and top dished end respectively against design value of 12.0 mm on shell, 7.0 mm on bottom dished end and 12.0 mm on top dished end. Refer Annexure- C.

CODE NO	JOB DESCRIPTION
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(7) H-1424 (2 ND STAGE EVAPORATOR) :

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

- a) Inner portion of bottom end had brownish colouration.
- b) Tubes were full of water.
- c) Tube to tubesheet weld joints were in good condition.
- d) All other weld joints were found satisfactory.
- e) Overall condition of equipment was found satisfactory.

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

- a) Visual inspection of the coolers was done after hydrotesting.
- b) Overall condition of equipment was found satisfactory.
- c) Minimum thickness of 11.1 mm, 11.4 mm were observed on shell, and Channel respectively against design value of 12.0 mm for shell. Design value of channel is not available. Refer Annex 'C'.

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

- a) Visual inspection of the coolers was done after hydrotesting.
- b) Overall condition of equipment was found satisfactory.
- c) Minimum thickness of 11.3 mm and 11.4 mm were observed on shell and channel respectively against design value of 12 mm for shell. Design value of channel is not available. Refer Annex 'C'

CODE NO	JOB DESCRIPTION
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(10) T-1301 (AMMONIA WATER TANK) :

- a) Brown colouration 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 as has been observed in past.
- c) 3" NB nozzle connection provided on the West side of tank was found without welding from inside.

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

- a) Brown colouration on bottom plate and bottom half of shell and silver bright colouration on top half of shell was observed.
- b) Welding of support (2" flat) at bottom with both the 4" dia pipes was found to have crack throughout its length.
- c) No other defect was observed. In general, the overall condition of the tank was found satisfactory.

(12) 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.
- c) Dark brown colouration was observed .

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

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

CODE NO	JOB DESCRIPTION
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(14) T-1501 (CONDENSATE TANK) :

Visual inspection of internals as well as ultrasonic thickness measurement was carried out. No abnormality was observed.

- a) The internals (shell and dished ends) had assumed brownish colour.
- b) Scattered minor scales were observed on tank internal surface.
- c) Condition of the reinforcement plate provided earlier at the location of tank support was found satisfactory.

(15) V-1101 (CO₂ KNOCK OUT DRUM) :

- a) Condition of epoxy paint was found satisfactory
- b) Demister pad was found intact.
- c) Oily substance was found accumulated at bottom dished end just below the inlet line.

(16) V-1102 (NH₃ SUCTION FILTER) :

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

- a) Cloth pieces and asbestos pieces were found inside.
- b) Overall condition of the equipment was found satisfactory.

(17) V-1103 (NH₃ SUCTION VESSEL) :

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

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

CODE NO	JOB DESCRIPTION
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(18) V-1202 (RECTIFYING COLUMN) :

Top Compartment :

- a) Colouration of shell top portion was observed gray where as grayish brown colouration was observed on bottom portion.
- b) Perforated grating was found intact in position.
- c) Hard thick scales were observed all around.

From Bottom manhole :

- a) Colouration of top cone was silver with black patches where as brownish colouration was found on bottom dished end.
- b) Loose sticky scales and mud were found all around the surface.
- c) Min thickness of 10.1 mm on shell and 11 mm on dished end were observed against design value of 9.52 mm for shell and dished end both.

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

From Top End

- a) Colouration of shell top portion was observed blackish/ brownish.
- b) Support grating was found damaged, broken from its two support legs. Grating was bent and broken at number of places. Reinforcing ring was broken from one of weld joint at support leg.
- c) Inlet pipe was found bent in upward direction. The pipe was observed to have fractured from the reducer weld joint.

From Bottom End:

- a) Colouration of shell bottom portion was observed blackish/ brownish. Below inlet line whitish colour was observed on shell.
- b) Rasching ring support grid was found intact.
- (c) Thickness on shell and dished ends were 6.0mm and 8.0mm respectively. Design thickness is not available. Refer Annex. C.

CODE NO	JOB DESCRIPTION
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(20) 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 colouration was grayish black.

(21) V-1207 (L. P. SCRUBBER) :

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

- a) Colouration of shell top portion was observed blackish/ brownish.
- b) One nut of support grating was missing.
- c) 2 nos. of bolts of outlet pipe flange were found loose.
- d) One wire mesh piece was laying loose on rasching rings.
- e) Thickness of Top dished end and top course of shell were 8.8 and 5.8 mm respectively. Design thickness is not available Refer Annex. C.

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

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

Bottom Compartment :

- a) The shell had assumed brownish colouration.
- b) Bottom nozzle and nozzle on South side were observed to be in satisfactory condition.
- c) All clamps were found intact.
- d) Trays condition was found satisfactory.

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CODE NO	JOB DESCRIPTION
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Top Compartment :

- a) Shell Colouration was found brownish.
- b) All fasteners were intact.
- c) Thick oily sludge was found adhered on the trays ,shell and D.E.
- d) Thickness of 6.1mm on shell and 8.2 mm dished end were observed against the design thickness of 6.0mm of shell and dished end. Refer Annex.C

(23) V-1351 (HYDROLYSER) :**Top Manhole :**

Visual inspection of V-1351 from inside was carried out. Central manway tray was opened upto 4th tray from top. Therefore inspection of trays and shell was carried out up to 5th tray. Following observations were made.

- a) On fourth tray one tray clamp was found loose.
- b) On 2nd and 3rd tray asbestos cloth gasket ring was loose and displaced from its position at around 5 clamp areas.
- c) Top dish end and shell of top section had blackish colouration.
- d) Trays had brownish colouration.
- e) No other defect was observed.
- f) All other fasteners were found intact.

Bottom Half :

- a) Blackish brown colouration was observed.
- b) Perforated distributor pipe's clamp bolts were missing and all bolts of flanged joint were loose.
- c) No other defect was observed.

CODE NO	JOB DESCRIPTION
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- d) Thickness was taken from inside. Minimum combined thickness of (shell and clad plate inclusive) 30.1 mm and 29.2 mm was found on shell and dished end respectively against design value of 28.0 mm on shell and 28.0 mm on dished end. Minimum thickness of clad plate was observed to be 4.63 mm and 5.84 mm on dished end and on shell respectively against design thickness of 5.0 mm. Refer Annexure-C.

(24) V-1352 (FIRST DESORBER) :

Top Manhole :

- Visual inspection was carried out from top manhole.
- Shell and dish end had brownish colouration.
- On top tray, blackish colouration was observed on South side but was bluish towards North side.
- Inlet pipe colour was brownish but at few places & at inner radius of elbow it was bright bluish.
- All fasteners were found intact.
- Overall condition of equipment was good.

Bottom Manhole :

- Shell and dish end had brownish colouration.
- All fasteners were found intact.
- Oily layer was found on shell.
- All holes of level gauges and thermowells were partly filled with deposits.

(25) V-1423 (1 ST STAGE EVAPORATOR SCRUBBER) :

- Visual inspection was carried out from top manhole.
- Dark brown w colouration was observed.
- All segment of demister pads were intact.
- All fasteners were found O.K.
- Overall condition of equipment was satisfactory.

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CODE NO	JOB DESCRIPTION
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(26) V-1501 (4 ATA STEAM DRUM) :

- a) Colouration of shell was observed to be blackish.
- b) Demister pads were found intact and in good condition.
- c) Minor pittings were observed on both side of dished end.
- d) On both dished ends hard scales were found deposited at various locations.
- 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 14.3 mm and 16.4 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.

(27) 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) Ultrasonic thickness measurement was carried out. Minimum thickness of 29.6 mm and 34.8 mm was found on shell and dished end respectively against design value of 30.0 mm on shell and 37.0 mm on dished end. Refer Annexure-C.

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

Visual inspection and Ultrasonic thickness measurement of vessel was carried out. The observation were as under.

- a) Colouration of Shell and dished end was observed grayish black.
- b) Overall condition of the vessel was found satisfactory.
- c) Ultrasonic thickness measurement was carried out. Minimum thickness of 11.9 mm and 13.2 mm was found on shell and dished end respectively against design value of 13.0 mm on shell and 15.0 mm on dished end. Refer Annexure-C.

CODE NO JOB DESCRIPTION

02 41 03 THICKNESS MEASUREMENT :

Thickness measurement of following heat exchangers and tanks was also carried out. The readings are given at the table, annexure C.

SR. NO.	EQUIPT.NO.	EQUIPMENT NAME
1	H-1113 A	Main lube oil cooler for K-1101/1 & 2
2	H-1113 B	Main lube oil cooler for K-1101/1 & 2
3	H-1123	Crank case lube oil cooler for K-1101/2
4	H-1205	LP Carbamate condenser
5	H-1205A	Additional LPCC
6	H-1207A	CCS II Surface condensate heat exchanger
7	H-1209	LP absorber circulation cooler
8	H-1301 A	Additional desorber heat exchanger
9	H-1301 B	Desorber heat exchanger
10	H-1301 C	Desorber heat exchanger
11	H-1303	Effluent cooler
12	H-1305	Feed cooler for V-1203
13	H-1351A,B & C	Hydrolyser feed preheater
14	H-1418	Pre evaporator seperator
15	H-1419	pre evaporator condenser
16	H-1420	Final condenser
17	H-1427	Circulation cooler for V-1423
18	H-1502	Vent condenser
19	T-1701A & B	Urea dust dissolving tank
20	T-1815	Main lube oil tank for K-1801
21	V-1200	Lean Carbamate seperator
22	V-1205	LP carbamate seperator

CODE NO	JOB DESCRIPTION
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02 41 04 PIPE LINES THICKNESS MEASUREMENT :

During this shutdown, a large no. of pipe lines were examined for remainder thickness. The detailed report on thickness measurement is enclosed herewith at Annexure-D attached here with.

02 41 05 PRE SHUTDOWN THICKNESS MEASUREMENT :

In addition to the above, ultrasonic thickness measurement was carried out on such equipments which could be approached from the outside and their service temperature permitted the thickness measurement. These equipments were inspected visually from outside and the condition was found to be satisfactory. Subsequently, thickness measurement was performed, the results of which are described below.

(A) H-1113 -A Main Lube oil cooler for K-1101/1 & 2 Centrifugal Compressor :

Ultrasonic thickness measurement carried out. Minimum thickness of 10.0 mm, 8.6 mm and 7.7 mm were observed on shell, North and South Channel Covers respectively. Design thickness is not available.

(B) H-1113-B Main Lube oil cooler for K-1101/1 & 2 Centrifugal Compressor :

Ultrasonic thickness measurement carried out. Minimum thickness of 10.0 mm, 8.6 mm and 8.0 mm were observed on shell, North and South Channel Covers respectively. Design thickness is not available.

(C) H-1123 Crank Case Lube oil cooler for K-1101/2 :

Minimum thickness of 10.5 mm was found on shell. Design value is not available.

(D) T-1111 Main Lube oil tank for K-1101/1 & 2 :

Minimum thickness of 7.6 mm was found on shell. Design value is not available.

(E) T-1815 Main Lube oil tank for Hitachi Compressor :

Minimum thickness of 5.7 mm was found on shell. Design value is not available.

CODE NO	JOB DESCRIPTION
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ANNEXURE - A

PROCEDURE FOR REPLACEMENT OF TRAY SUPPORT IN AUTOCLAVE

- (1) Initially old cleats were cut using cutting wheel.
- (2) Welding seams of these cleats to liner were ground off i.e. flushing was done using grinding wheel.
- (3) Visual inspection and DPT was performed at flushed area.
- (4) After removing all the defects new cleats were tack welded using approx. 2.0 mm root gap.
- (5) Root was made by TIG welding at all around the cleats using 2RE69 filler rod.
- (6) DPT of root weld was carried out.
- (7) After removing all the defects final welding was done by TIG welding.
- (8) DP test and ferrite test of final weld was performed and defects, if any, were removed. Ferrite was found 'Nil'.

CODE NO	JOB DESCRIPTION
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ANNEXURE - B

PROCEDURE FOR REPLACEMENT OF INSERT
LINER OF EIGHTH 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/cm² 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 level using same filler wire while maintaining interpass 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% HNO₃ followed by rinsing with plenty of DM water.

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ANNEX. C										
THICKNESS MEASUREMENT REPORT OF UREA PLANT EQUIPMENTS CARRIED OUT IN S/D MARCH/APRIL 2000:										
SL.NO.	EQUIPMENT NUMBER	MIN. MEASURED THICK. IN MM			DESIGN THICK. IN MM			% REDUCTION		
		SHELL	CHANNEL	D. E.	SHELL	CHANNEL	D. E.	SHELL	CHANNEL	D. E.
* 1	H-1113/A	10	-	7.7	-	-	-	-	-	-
* 2	H-1113/B	10	-	8	-	-	-	-	-	-
* 3	H-1114	9.4	8.8	-	-	-	-	-	-	-
* 4	H-1123	10.5	-	-	-	-	-	-	-	-
5	H-1205	7.6	-	8.7	7	-	7	-	-	-
6	H-1205/A	-	8	10.2	12	8	10	4.16	-	-
7	H-1207/A	8.4	9.8	7.7	10	8	8	16	-	-
8	H-1209	9.2	6.8	7.7	10	6	7.5	8	-	3.7
9	H-1301/A	9.5	9.4	12	10	10	12	5	6	-
10	H-1301/B	7	4.8	5	7.92	5	5	-	4	-
11	H-1301/C	6.6	5.1	5	7.92	5	5	-	-	-
12	H-1303	9.9	10	10	10	-	12	1	-	16.6
13	H-1305	9.1	5.6	8	-	-	-	-	-	-
14	H-1351/A	11.9	11.1	10.7	12	-	12	0.8	-	10.8
15	H-1351/B	12	11.6	10.7	12	-	12	-	-	10.8
16	H-1351/C	12.3	11.4	10.7	12	-	12	-	-	10.8
17	H-1352	7.6	14.3	13	8	14	12	5	-	-
18	H-1418	11.7	-	-	12	-	-	2.5	-	-
19	H-1419	9.5	9.6	11	-	-	-	-	-	-
20	H-1420	-	-	9	-	-	-	-	-	-
*** 21	H-1422	12	-	5/13.4	12	-	7/12	-	-	28.5/---
22	H-1427	8.4	7.1/5.9	10 / 5.3	8	-	8 / 4	-	-	-
23	H-1502	9.9	-	9	10	10	10	1	-	10
* 24	H-1503	11.1	11.4	-	12	-	-	7.5	-	-
* 25	H-1504	11.3	11.4	-	12	-	-	5.8	-	-
26	CRANK CASE L.O. COOLER OF P-1102/A	-	5.9	3.8	-	-	-	-	-	-
27	CRANK CASE L.O. COOLER OF P-1102/A	-	2.9	6.9	-	-	-	-	-	-
* 28	T-1111	7.6	-	-	-	-	-	-	-	-
29	T-1701A	6.1	-	-	-	-	-	-	-	-
30	T-1701B	6.1	-	-	-	-	-	-	-	-
* 31	T-1815	5.7	-	-	-	-	-	-	-	-
32	V-1200	4.8	-	6.2	5	-	6	4	-	-
33	V-1201 (MANWAY LINER)	4	-	-	5	-	-	20	-	-
34	V-1202	10.1	-	11	9.52	-	9.52	-	-	-
35	V-1203	6	-	8	-	-	-	-	-	-
36	V-1206	7.6	-	8.7	7	-	7	-	-	-
37	V-1207	5.8	-	8.8	-	-	-	-	-	-
38	V-1301	6.1	-	8.2	6	-	6	-	-	-
** 39	V-1351	30.1	-	29.2	28	-	28	-	-	-
40	V-1501	14.3	-	16.4	15	-	18	4.6	-	8
41	V-1502	29.6	-	34.8	30	-	37	1.3	-	5.9
42	V-1503	11.9	-	13.2	13	-	15	8.4	-	12

NOTE: * = THICKNESS MEASUREMENT CARRIED OUT DURING PRE-SHUTDOWN
 ** = SHELL AND DISHED END THICKNESS INCLUSIVE OF CLAD PLATE THICKNESS
 *** = TO BE RECHECKED DURING S/D 2001

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ANNEX.D								
THICKNESS MEASUREMENT OF UREA PLANT PIPELINES CARRIED OUT IN MARCH 2000								
SR. NO.	LINE NO.	N.B. (IN.)	DESIGN THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERVED	REDUCTION %	
				FROM	TO			
1	GA-1112	6	14.2	K-1101-2	GA-1201	10.3	27.46	**
2	GA-1201	6	15.24	GA-1112	H-1201	12.0(MAY97)	21.25	
3	GA-1202	1	6.3	GA-1112-6"	CHECK VALVE	5	20.63	**
4	GA-1203	1	4.5	GA-1112-6"	SCRUBBER	3.7	17.7	**
5	MA-1105	6	7.11	V-1103	P-1102A	5.8(APRIL98)	18.42	
6	MA-1106	4	8.55	P-1102A	MA-1605	6.8(APRIL98)	20.46	
7	MA-1116	4	6.0	MA-1106	V-1103	7.1	-	
8	MA-1122	6	7.11	MA-1105	P-1102/B	6	15.61	
9	MA-1123	4	8.56	P-1102/B	MA-1605	8	6.54	
10	MA-1126	4	8.56	MA-1123	MA-1116	7.6	11.21	
11	MA-1201	3	7.62	MA-1605	MA-1202	6.5	14.69	
12	MA-1202	3	7.62	MA-1201	V-1201	8.2	-	
13	MA-1203	4	8.55	MA-1106	PR-1230	7.1(APRIL99)	16.95	
14	MA-1604	3	7.62	P-1102 /C DIS.	MA-1604-4"	5.1	33.07	*
15	MA-1604	4	8.56	MA-1604-3"	MA-1605-6"	8	6.54	
16	MA-1605	6	14.27	MA-1106	MA-1203-1"	13.2	7.49	
17	MA-1607	4	6.02	MA-1604-4"	MA-1116-4"	6.5	8.63	
18	PR-1201	8	19.58	V-1201	H-1201	16	18.28	
19	PR-1202	10	24.33	HP-STRIPPER	HP-CONDENSER	22.4	7.93	
20	PR-1203	8	19.58	HP-CONDENSER	V-1201(VAPOR LINE)	16.9	13.68	
21	PR-1204	8	19.58	HP-CONDENSER	V-1201(LIQUID LINE)	17.2	12.15	
22	PR-1205	6	15.2	STRIPPER	RECTIFYING COLUMN	12.3	19.07	
23	PR-1205	8	19.5	STRIPPER BOTTOM	PR-1205-6"	17.3	11.28	
24	PR-1208	4	10.4	AUTOCLAVE TOP	SCRUBBER	8.4	19.23	
25	PR-1211	1.5	5.08	PR-1208	PR-1212	4.7	7.48	
26	PR-1212	4	10.4	SCRUBBER	AUTOCLAVE BOTTOM	8.4(APRIL98)	19.23	
27	PR-1213	2	5.54	PR-1201	PR-1205	4.7	15.16	
28	PR-1224	3	7.62	P-1201B	PR-1638-4"	6.2	18.63	
29	PR-1225	3	8.55	DISCHARGE LINE OF	P-1201 A/B	6.8(MAY97)	20.46	
30	PR-1226	2	5.53	PR-1224	LP CONDENSER	4.6(JUNE96)	16.81	
31	PR-1228	4	3.05	RV-1206	PR-1229	3.1	-	
32	PR-1230	6	15.24	HP-CONDENSER TOP		14.1	7.48	
33	PR-1231	3	8.13	H-1203	PRCV-1201	6.4	21.27	**
34	PR-1232	4	10.41	PRCV-1201	LP CONDENSER	8.6(MAY97)	17.38	
35	PR-1233	4	3.05	PR-1229	T-1301	3.2	-	
36	PR-1234	3	7.62	P-1201A	PR-1638-4"	6.3	17.32	
37	PR-1333	2	2.77	P-1305A/B	H-1305	2.6	6.13	
38	PR-1334	2	2.77	H-1305	PR-1635	3.2	-	
39	PR-1447	3	3.05	V-1421	PR-1330	2.7	11.47	
40	PR-1608	2	2.77	H-1421	V-1200	2.9	-	

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ANNEX.D							
THICKNESS MEASUREMENT OF UREA PLANT PIPELINES CARRIED OUT IN MARCH 2000							
SR. NO.	LINE NO.	N. B. (IN.)	DESIGN THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERVED	REDUCTION %
				FROM	TO		
41	PR-1625	4	3.05	T-1301A	P-1302A/B	2.9	4.91
42	PR-1625	6	3.4	T-1301A	P-1302A/B	3.2	5.88
43	PR-1632	2	2.77	P-1200 A	PR-1617	2.8	-
44	PR-1637	3	7.62	P-1201C	PR-1638-4"	6.8	10.76
45	PR-1638	4	10.4	P-1201A/B/C	PR-1230-6"	12.5	-
46	SC-1201	2	5.54	SC-1510	MA-1202	5	9.74
47	SC-1202	1	4.55	SC-1201	PR-1224	4	12.08
48	SC-1203	1	4.55	SC-1201	GA-1201	4.3	5.49
49	SC-1204	1	4.55	SC-1201	MA-1203	4.4	3.29
50	SC-1205	1	4.55	SC-1201	PR-1208	4.44	2.41
51	SC-1206	1	4.55	SC-1205	PR-1231	4	12.08
52	SC-1209	10	9.27	H-1207	H-1203	8.33	10.14
53	SC-1210	8	8.18	P-1204	SC-1210	7.5	8.31
54	SC-1210	10	9.3	P-1204	H-1207	7.2	22.58
55	SC-1211	10	9.27	H-1203	P-1204	7.9	14.77
56	SC-1212	10	9.27	SC-1210	SC-1209	9	2.91
57	SC-1212	8	8.2			9.36	-
58	SC-1212	4	6			9.3	-
59	SC-1222	14	9.52	H-1205	P-1202A/B	8	15.96
60	SC-1223	1	4.55	SC-1201	PR-1213	4.3	5.49
61	SC-1228	14	9.5	P-1202	H-1202	8.1(APRIL98)	14.73
62	SC-1247	1	4.55	PR-1208	PR-1212	4.4	3.29
63	SC-1507	3	5.48	P-1505	T-1501/DEARATOR	4.6	16.05
64	SC-1510	2	5.5	P-1502	PCV-1501	4.2(APRIL98)	23.63
65	ST-1123	14	9.52	PICV-1129	ST-1106	7.4(MAY97)	22.26
66	ST-1124	6	10.97	ST-1104	PICV-1128	9.7	11.57
67	ST-1125	10	9.27	ST-1116	PICV-1129	7.0(JUNE96)	24.48
68	ST-1129	10	9.27	PICV-1128	ST-1116	7.8	15.85
69	ST-	8	8.2	BYPASS OF PICV-1129		7.3	10.97
70	ST-	8	8.2	BYPASS OF PICV-1129		8.9	-

NOTE: (1) * = 6 NOS. OF ELBOWS TO BE REPLACED WITH SCH. 80 THICKNESS.
 (2) ** = TO BE RECHECKED IN S/D 2001

PLANT TURNAROUND - APRIL - 2000UREA PLANTCIVIL JOBS

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CODE NO	JOB DESCRIPTION
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02 51 01 CIVIL JOBS :

1. Painting with epoxy paint of RCC structure of Hydrolyser, and precooling system structure complete. Painting with epoxy paint up to 2 mt. height in side prill tower, Urea scrubber floor completed. Epoxy painting of prill room on top of prill tower completed.
2. Repairing of floor tiles with the help of epoxy materials on prill tower scrubber floor.

PLANT TURNAROUND - APRIL - 2000UREA PLANTELECTRICAL JOBS

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CODE NO	JOB DESCRIPTION
02 61 01	<u>ELECTRICAL JOBS :</u> <ol style="list-style-type: none">Maintenance job carried out on following transformers. TR-7A, 7B, TR-17, TR-21 and TR-22.<ol style="list-style-type: none">Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.Testing of oil in marshaling boxes on primary and secondary transformers and cleaning of chamber and replacement of oil if required.Checking of trip alarm circuit and cleaning of all emergency trip boxes.Checking of IR value primary and secondary windings of the above transformer.Preventive maintenance was carried out on all feeder compartments mounted on the following MCCs : MCC 6, MCC 14 and MCC 16.Maintenance of all lighting distribution boards was carried out and burnt out fuse fittings were replaced.Overhauling job carried out of following critical motors : P-1131-A, P-1131-B, P-1131-C, P-1231-A, P1231-B, M-1419, M-1421, P1131-A (spare motor).Preventive maintenance, cleaning and checking of all motors operated valve and local control panels.All push button stations were checked and damaged parts were replaced.Terminal boxes were checked for loose connections and burnt cables etc. of all motors above 20 hp.

PLANT TURNAROUND - APRIL - 2000UREA PLANTINSTRUMENTATION JOBS

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CODE NO	JOB DESCRIPTION
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02 71 01 (A) HITACHI (CO2) COMPRESSOR :

The following preventive maintenance jobs were carried out in the Hitachi Compressor area :

1. Continuity and resistance Checking of all Vibration Probes and extension cables, was carried out. Checked the proximeters and Vibration Monitors.
2. Coordinated with mech. maint. dept. for maintenance of compressor.
3. FR-1801 and FR-1803 :

New orifice plates for FR-1801 and FR-1803 supplied by "Hitachi" Japan with measurement range of 0-2000 mm WC were installed in place of existing orifice with 0-1563 mm WC range old orifice. Calibrated flow transmitters to new range of 0-2000 mm WC.
4. All RTD wires were provided with lugs for better contact and easy maintenance.
5. All RTD connection boxes inlet side from the gear box side were provided sealing bushes to avoid oil leakage.
6. TI-1837 RTD was some times showing wrong in running condition. The RTD element was replaced with new one.
7. All the instruments in the area, Local Control Panel and TLC Box were cleaned.
8. A spare new I/H converter was installed in place of existing one and its performance was checked. The original one was reinstalled, in its place after checking the new I/H Converter.

(B) OLD CENTRIFUGAL COMPRESSOR :

7. Checked all Vibration probes, proximeters and Vibration monitors.
8. Coordination with mech. Maint. Staff for maintenance of compressor.
9. Replaced vibration probes.

CODE NO JOB DESCRIPTION

02 71 02 CONTROL VALVE AND OTHER FIELD JOBS :

1. N/C Ratio meter monoblock valve overhauling and new gland packing.
2. Calibrated massflow meter at Fisher-Rosemount Flow Lab Vatawa.
3. LIC-1101 control loop taken in DCS.
4. LIC-1502 : installed DP smart transmitter and control loop taken in DCS.
5. FIC-1202 : Installed a spare (old PRCV-1201) control valve, provided I/P Convertor and taken the loop in DCS.
6. LRCV-1201: The valve body was replaced because of the d/s flange siezing. Changed plug, seat, and diaphragm.Provided new gland packing.Checked I/P converter, Positioner, air regulator and stroke checking.
7. LICV-1204 : Welded the seat with the body of the valve, provided new bolts for bonnet.Checked I/P converter,Positioner, air regulator and stroke.
8. LICV-1502B : Plug seat were lapped. changed seat gasket.Checked I/P converter, Positioner, air regulator and stroke.
9. PRCV-1504 : Changed valve dome O ring. Checked I/P converter, Positioner, air regulator and stroke .
10. Carried out the servicing of Actuators and checked I/P converter, Positioner, air regulator and stroke of the following control valve.

PICV-1129	PICV-1504	PICV-1502A	PRCV-1201	TICV-1201
PICV-1201	FICV-1301	PICV-1425	PICV-1422	TRCV-1421
LICV-1201	HICV-1202	LRCV-1421	LICV-1351	FICV-1385
TRCV-1422	PICV-1221	TICV-1808	PICV-1501	

11. Changed thermocouple of TR-1210.
12. Provided new impulse tubings for following transmitters. FRC-1201, FR-1121.
13. HICV-1801 : The control valve was opened for inspection and maintenance.The plug, seat,and cage were in good condition but he plug seal-rings were not in good condition,the same were replaced by spare ones and the valve was boxed up.The air regulator, valve positioner, and hand jack assembly were cleaned.Valve stroke was checked after the valve positioner was calibrated.

CODE NO JOB DESCRIPTION

14. PICV-1810 : The control valve was opened for inspection and maintenance. The plug and seat were in good condition, but the cage and the plug seal-rings were not in good condition. The seal rings and cage were replaced by spare ones and the valve was boxed up. The air regulator, valve positioner, and hand jack assembly were cleaned. Valve stroke was checked after the valve positioner was calibrated.
15. PR-1421 : Complete Jacket Assmbly was taken out and replaced the 1/2" size impulse pipe with 1" size pipe. Transmitter was directly mounted on the pipe. Needfull arrangement for steam tracing and air purging was also made.
16. PICV-1128 : The old piston operated type "Serk" made control valve was replaced by new "Fisher" make diaphragm operated control valve.
17. FRC1-1 : Provided P/I & I/P Cnvertor and complete loop was taken in DCS.
18. PIC-1101 : Provided P/I & I/P Cnvertor and new loop was taken in DCS.
19. PR-1128 : Provided P/I convertor and taken in to TR-1, local panel.
20. LIC-1425 : Level transmit, Control valve, and I/P converter were installed, and the loop was taken in DCS.
21. FR-1201 and PR-1201 Transmitters : Frequently long impulse lines were getting chocked. The transmitters were relocated and new shorter length impulse ubing were provided with steam tracing.
22. The following control valves were opened for servicing, maintenance and inspection purpose. Cleaned and checked valve positioner, I/P Converter and air regulators. The control valve positioner calibration and stroke were checked after maintenance.

FICV-4801	PRCV-1202
LICV-1501	PICV-1130
PICV-1481	PICV-1131
23. Removed old pneumatic Junction boxes and copper tubings which were not in use.

02 71 03 HP VESSELS JOBS :

1. Checked all weephole 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.

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CODE NO	JOB DESCRIPTION
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02 71 04 CONTROL ROOM - DCS MARSHALLING ROOM JOBS :

1. Installed Minilec Annunciator on auxiliary console 81 and removed old IIC annunciator.
2. Antisurge Parameter Monitoring : A PC was installed in DCS Room for monitoring of Antisurge parameters. "Toolbox" was installed in PC & communication was established between antisurge controller and the PC through appropriate convertor. Tested the performance and found alright.
3. To facilitate false flooring and roof of DCS Room, removed all old and useless cables, cable trays, structures, junction boxes and distribution boxes in DCS Marshalling cabinet room.
4. Cleaned PLC panel, AC Distribution Box, DCS Power distribution box<121> and DCS Marshalling Cabinet.
5. Old power distribution boxes of 110 VAC and 24 VDC in DCS Marshalling cabinet Room were relocated.
6. Input and output wiring in DCS I/O cabinets were arranged, routed properly and dressing of the wiring was carried out.
7. To facilitate false flooring of DCS, PD, PLC, ACDB and Vibration Cabinets were lifted up to the required height.
8. A 4 -20 mA analog output from antisurge controller was taken and given to DCS as HIC-1801A., for monitoring purpose.
9. A digital output was taken and given to DCS for alarm as " HICO-1801 open" for the monitoring purpose.

PLANT TURNAROUND - APRIL - 2000UREA PLANTTECHNICAL DEPARTMENT JOBS

175

CODE NO	JOB DESCRIPTION
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02 81 01 UREA PLANT JOBS :

The following jobs were carried out during APRIL-2000 shut-down.

(A) REPLACEMENT OF PIPE LINES :

(1) PR-1225-3" - HP Carbamate pump discharge to HP Scrubber 2 Nos. 45 deg. 316 L elbows replaced by M/s Jacobs H & G Ltd, Mumbai.

(2) ST-1105-4" - From 60 ata header (ST-1104) to Q-1101/1 inlet nozzle.

Material of Construction - CS- A-106 Gr.B
Size - 4" NB, Sch-80.
Length - approx. 37 Mtrs
Hydrotest Pressure - 94 kg/cm² (g).

Hydrotest was witnessed by IBR Inspector.
This was done through M/s Jacobs H & G Ltd, Mumbai.

(3) MA-1106-4" - From Line No. MA-1605- 6" to H-1202. BEL valve of this line also replaced with new angle valve of PACIFIC make with MOV.

Material of Construction - CS- A-106 Gr.B
Size - 4" NB, Sch-80.
Length - approx. 10 Mtrs
Hydrotest Pressure - 175 kg/cm² (g).

(B) MOTOR OPERATED VALVES :

Under EWR No.U-172, the following MOV's were retro fitted and provided with electrical actuator. These valves were converted into MOV.

(1) Ammonia to HP condensate MOV-1202

(2) Carbamate to HP condensate MOV-1203

(3) Hot Ammonia inlet to ammonia suction Vessel MOV-1101.

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CODE NO	JOB DESCRIPTION
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02 81 02 DRY ICE PLANT JOBS :

- (1) 17.5 MT capacity New CO2 Process tank (T-4801) parallel to existing tank installed.
- (2) Interconnecting SS Pipe lines between two process tanks (T-4701 & T-4702) provided.
- (3) The cooling water connections of inter/after coolers of Khosla Compressors (K-4705 A/B) were in series. The C.W. connections are now made parallel. All the new tappings are taken from headers and installed separate cooling water lines for three inter / after coolers to reduce CO2 suction temp. at different stages to improve efficiency of the compressor.
- (4) 2 Nos.of tappings taken for new CO2 dryer.
- (5) New control valves (PICV-4701 A/B) in vent lines of both the coolers (H-4701 & H-4702) installed along with their transmitter & controllers.

02 81 03

The following jobs have been completed in Urea Plant during the plant S/D taken from 01/03/2000 to 20/03/2000

- (1) 18" NB 4 ata steam valve replaced & commissioned with MOV-1501.
- (2) Under EWR No. U-190, the following jobs were carried out.
 - (i) 10" x 300 # gate valve provided on 23 ata let-down line downstream of control valve PICV-1128.
 - (ii) 6"x 900 # gate valve provided on upstream of PICV-1128.
 - (iii) 2" x 1500 # (PICV-1128) is replaced by 3" x 1500# New control valve.
- (3) New 12" x 150 # Butterfly Control Valve (PICV-1101) i.e. CO2 compressor suction vent control valve installed & its associated pressure transmitter & hookup with DCS completed.

CODE NO	JOB DESCRIPTION
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(4) Piping replacement :

- (i) PR-1225 - 3" : From HP Carbamate pump discharge to HP Scrubber.
Out of 8 elbows 6 Nos. got replaced.
Material - SS 316 L
Size - 3" NB, Sch-80
- (ii) SC-1513 - 4" line replaced. (23 to 9 ata condensate line)
Material of Construction - CS- A-106 Gr.B
Size - 4" NB, Sch- 40.
Length - approx. 7 Mtrs
Hydrotest Pressure - 14 kg/cm² g.
- (iii) SC-1512 - 4" line replaced. (23 to 9 ata condensate line)
Material of Construction - CS- A-106 Gr.B
Size - 4" NB, Sch- 40.
Length - approx. 29 Mtrs
Hydrotest Pressure - 14 kg/cm² g.
- (iv) PR-1206 - 6" (316L) line replaced (Rectifying column outlet liq. to flush tank inlet)
Material of Construction - SS 316 L
Size - 6" NB, Sch- 10S.
Length - approx. 36 Mtrs
Hydrotest Pressure - kg/cm² g.
- (5) Old C.W. return header near Urea Cooling Tower from road culvert to risers, including one riser towards Lab. side were replaced.
- a) Main header - 42" NB - 25 Mtr.
b) Main header - 30" NB - 20 Mtr.
c) Riser - 30" NB - 18 Mtr.
d) Riser - 8"/6" NB - 15 Mtr. (Total)

The above job was done by M/s U.B. Engineers, Pune.

- (6) Condensate pot for 2" NB Evaporator Condensate outlet with associated piping, instrument control valve, level transmitter, I/P convertor etc. installed as per Process Scheme (Ref:TM/02/1308 dated 08.10.99)
- (7) Parallel C.W. connection for jacket of hydrolyser feed pump changed from series CW connection.
Line size - 2" as per Process Scheme (Ref:TM/02/1308 dated 19.07.99)

J78

CODE NO	JOB DESCRIPTION
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- (8) Removal of C.C.S - II circulation line completed along with removal of control valve (TICV - 1207-A) and necessary modification done to include heaters as per Process Scheme.
- (9) Piping modifications done for Recovery of low level heat piping system from H-1204 as per Process scheme.
- (10) Cation outlet conductivity meters installed for stream No. II & IV. Commissioning of conductivity meters on both stream of DM Water Plant completed (EWR No. WT-63).
- (11) 60 to 40 ata steam let-down control valve along with piping for fuel oil pump turbine in BHEL Boiler is installed and commissioned as per Process scheme.
- (12) 4"x 900 # Globe valve provided on BHEL boiler 60 ata super heater drain line.
- (13) 12 Pair instrument signal cable from cooling tower to DM water plant and from DM plant to boiler area laid along with junction boxes in connection with level instrument for cooling tower basin.
- (14) 1 No. 8" tapping taken in Ammonia plant and 1 No. 8" tapping taken from 4 ata header in Utility (CT area on pipe rack) under the Scheme of LP steam export to ammonia plant.

PLANT TURNAROUND - APRIL - 2000

OFFSITE & UTILITY PLANT

MECHANICAL JOBS

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CODE NO JOB DESCRIPTION

03 02 01 COOLING WATER PUMP (P-4401/A) :

PREVENTIVE MAINTENANCE :

(a) Both the journal Bearings were checked. Coupling side journal bearing's white metal lining was found slightly damaged.

The coupling side journal bearing was replaced with new one issued from store.
store code no.:333200024

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

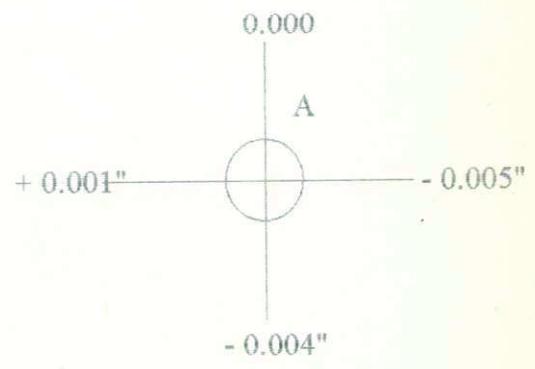
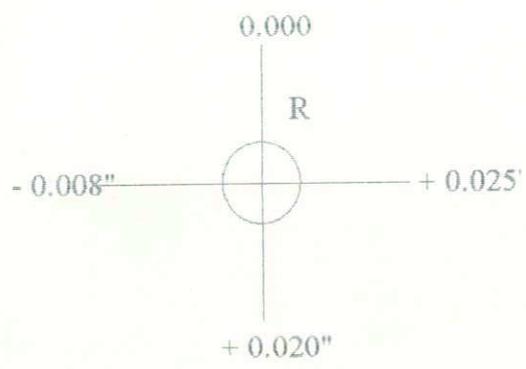
Free end side : 0.008"

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.



(d) Cleaning the coupling of pump with gear box & greasing done.

(e) New Gland packings (25 mm) both side repacked.

(f) NRV Gland follower made free, Gland packing repacked.

780

CODE NO JOB DESCRIPTION

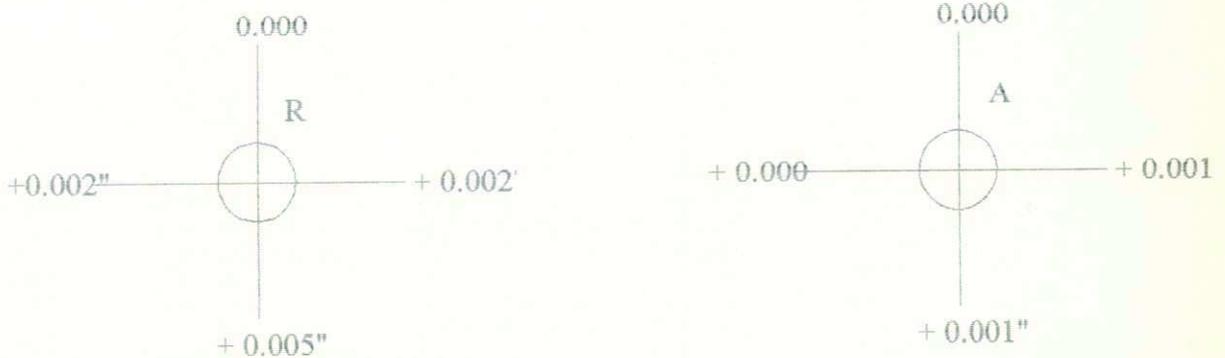
03 02 02 COOLING WATER PUMP (P-4401/B) :

OVERHAULING OF PUMP :

The pump was reported for not moving i.e. Rotor was jam. It was decided to open the pump & overhaul.

- (a) Pump decoupled.
- (b) Top casing removed.
- (c) Rotor was found jamed.
- (d) Finally Rotor was removed. The condition of Rotor was good except some portion of vane area at suction eye, where the vanes were erroded.
- (e) The same rotor was placed in the pump & it was decided to replace the rotor in next opportunity.
- (f) Journal bearings inspection done & general condition of the bearing was found okay. Clearance were checked & the readings are as follows.
Free end side : 0.006" Coupling side : 0.006"
- (g) Cleaned the turbine coupling & greasing done.
- (h) Pump & Turbine alignment was done. Following are the readings.

Dial indicator fixed on gear box



- (i) New Gland packing (25 mm) both side repacked.
- (j) N.R.V. Gland follower made free, gland replaced.

787

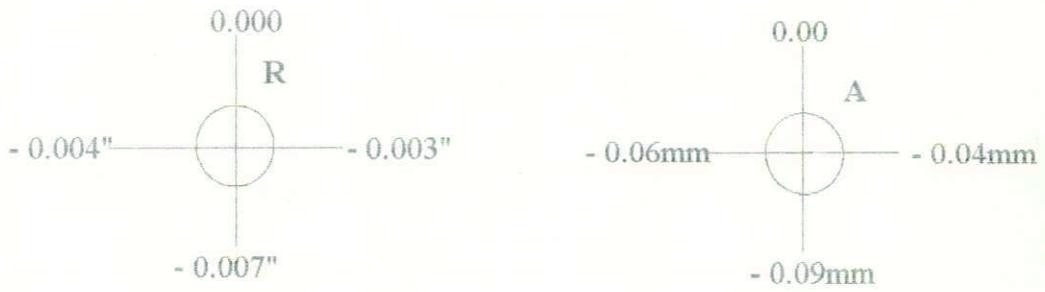
CODE NO JOB DESCRIPTION

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

PREVENTIVE MAINTENANCE :

- (a) Euroflex coupling Elements between pump & motor was replaced manufactured by M/s Zenith's engg. works, Ahmedabad.
- (b) Both the radial bearings were flushed with oil & fresh oil servoprime 68 charged in the both bearing housing.
- (c) Alignment was checked & followings are the readings.

Dialindicator fixed on motor

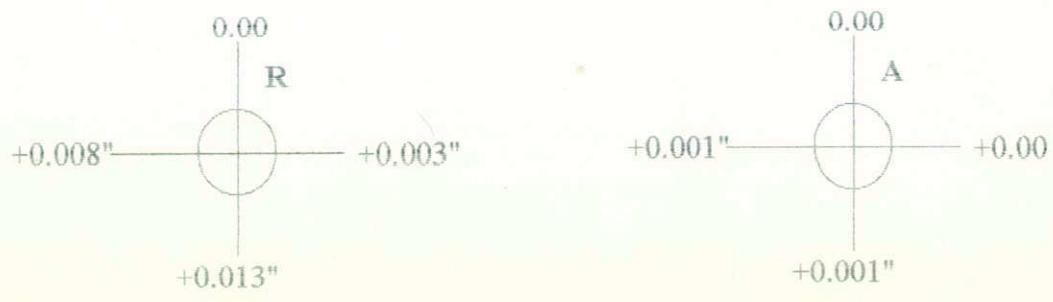


03 02 04 COOLING WATER PUMP (P-4402) :

PREVENTIVE MAINTENANCE :

- (a) Both the journal bearings were checked & found okay.
- (b) The clearances were checked & following are the readings.
Free end side : 0.008" Coupling side : 0.007"
- (c) Gland packing (25 mm) both sides repacked.
- (d) N.R.V. Gland follower made free & new Gland packings repacked.
- (e) Pump & Motor alignment was checked following are the readings.

Dialindicator fixed on motor



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CODE NO	JOB DESCRIPTION
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03 02 05 B F W PUMP (TURBINE DRIVEN) P-5111 :

PREVENTIVE MAINTENANCE :

- a) Thrust brg. inspection done, General condition of brgs. found okay. Thrust measured & it was coming 0.040". Thrust Pad replaced.
A brass shim of 0.020" was provided. Now total thrust was checked & followings are the readings.

Thrust = 0.010"
Journal Bearing clearances
Free end = 0.10 mm
Coupling End = 0.12 mm

- b) Oil cooler opened, cleaned from tube side & boxed up. Fresh oil charged.
- c) Oil console was drained, Cleaned & fresh oil charged.
- e) Duplex filter was cleaned.
- f) Oil cooler opened, cleaned & boxed up.

03 02 06 B F W PUMP TURBINE (SHIN NIPPON) Q-5111 :

PREVENTIVE MAINTENANCE :

It was found that turbine did not completely stop at the time of Shutdown of the M/C.
Oil cooler opened, cleaned & boxed up.

- a) Bearing Inspection done & general condition of bearings were found okay.
Following are the clearances.
Coupling side Radial : 0.17 mm
Governor side Radial : 0.15 mm.
Thrust : 0.23 mm.
- b) Coupling of the Turbine found wornout. So it was decided to replace the wornout coupling with new one. Coupling was issued from Store against store code no. 335001052, Flexible Gear coupling 123-B 51138, 2-1/2 inch.
- c) It was found that there was not proper tension in the spring of quick shut off valve.
2 nos. SS 304 washers, 6 mm thk. provided to give tension in the spring of the quick shut off valve.
- d) Oil console was drained, cleaned and fresh oil charged.

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CODE NO JOB DESCRIPTION

03 02 07 B F W PUMP (MOTOR DRIVEN) P-5112 :

PREVENTIVE MAINTENANCE :

(A) B F W PUMP :

- 1) Bearing Inspection done & general condition of bearing was found okay.
Followings are the clearances.
a) Motor side : 0.09 mm
b) Free End side : 0.10 mm
c) Thrust : 0.50 mm
- 2) Lube oil console oil drained, cover opened, cleaned & fresh oil charged.

(B) GEAR BOX :

- 1) Oil Cooler opened. General condition found okay. Cleaned from tube side & boxed up. Fresh oil charged.
- 2) Oil Console opened, cleaned and boxed up.

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

PREVENTIVE MAINTENANCE :

- 1) F.D. Fan bearings were opened, Inspection done, found in good condition.
Oil flushed & fresh oil charged.
- 2) Lube oil console oil drained, console cleaned & fresh oil charged.
- 3) Suction filter of Q-5113 cleaned & boxed up. Coupling pads changed with new one.
Store code no. 335413010.
- 4) Clutch oil Servo Transfluid - 'A' drained & replaced with fresh one.
Store code no. 459100150.
- 5) Governor was not responding, Governor Housing was opened. Helical wheel driven (Part no.310 01 08 as per drg. no. 4950001 0012 0 BI.2) teeth were found broken. The same was replaced with new one issued from the store against Store code no.335401026.

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.

J82

CODE NO	JOB DESCRIPTION
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03 15 01 BHEL BOILER JOBS (F-5111) :

(A) BOILER SIDE WALL DOWN COMER (RAW-Y)
TUBE REPLACEMENT JOB :

The boiler side wall down comer (Raw - Y) Tubes (66 nos.) were to be replaced with new one, manufactured & supplied by B H E L , TRICHI,. Replacement of Tubes job done by M/s Skywin Erectors, Ahmedabad.

a) Tubes Material : SA - 192, 0.18% c maxm. size 76.1 mm OD x 4.5 mm thick, 6 m. long
Both End swaged to 63.5 mm dia.

b) For replacement of Tubes, following activities were carried out.

- Removal of Insulation sheet & Insulation mattresses.
- Cutting of M S Ducting bottom plates.
- Removal of Refractories.
- Removal of long Retractable soot blowers and Rotary soot blowers.
- Cutting of Tubes by Gas - cutting.
- Removal of Stubend by Hammering from inside the Mud drum & Steam drum.
- Insertion of Tubes, Total 66 Nos.
- Expansion of swaged tube end in the Mud Drum & steam drum by 4% expansion for locking / tacking of the tubes.
- Final expansion 5% done after all fins welding.
- Leak test of the expansion of the tubes.
- Again final expansion 6% of few tubes which were leaking.
- Installation of soot Blowers. Burnt out blowing element of the Rotary soot blower No.4 was replaced with SS 310 material. Blowing element was fabricated in our work shop from 2" N.B. Sch.80 SS 310 Pipe. (Length of Blowing element - 3 Mtr.)
- LRB NO-1 : LANCE TUBE was found corroded and it was repaired by grinding and welding.
- Necessary refractory repair work was done.
- Bottom M.S. ducting fixed and rewelded.
- Insulation work of side wall tubes and other areas were removed for RLA study was carried out.

c) RESIDUAL LIFE ASSEMENT (RLA) STUDY :

R.L.A study was conducted by M/s BHEL. The following activities were carried out.

I) As per Annexure " A "

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CODE NO	JOB DESCRIPTION
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II) The following pieces were cut for further analysis at BHEL, Trichi lab, And new peices were also welded.

- 1) Front wall tube - 1 No.
Size : 76.10D x 4.5 mm thick, SA 192 Mat.
Length : 400 mm (Approx.)
- 2) Cut Corner Tube - 1 No.
Size : 76.1 OD x 4.5 mm thick, SA 192 Mat.
Length : 400 mm (Approx.)
- 3) Rear Wall Tube - 1 No.
Size : 76.1 OD x 4.5 mm thick, SA - 192 Mat.
Lenght : 400 mm (Approx.)
- 4) Baffle wall tube - 1 No.
Size : 76.1 OD x 4.5 mm thick SA 192 Mat.
Length : 400 mm (Approx.)
- 5) Bank Tube - 1 No.
Size : 63.5 OD x 4 mm thick, SA - 192 Mat.
Length : 400 mm (Approx.)
- 6) Primary Super Header (Inlet) (From Topmost coil)-1 No.
Size : 51 OD x 7.1 thick., SA - 213 Mat.
Length : 400 mm (Approx.)
- 7) Primary Super Heater (Outlet)(From topmost coil)-1 No.
Size : 51 OD x 7.1 thick., SA - 213 Mat.
Lenth : 400 mm (Approx.)
- 8) Secondary Super Heater (Inlet) - 1 No.
Size : 51 OD x 5.6 thick, SA - 213 Mat.
Length : 400 mm (Approx.)
- 9) Secondary Super Heater (Outlet) - 1 No.
Size : 51 OD x 5.6 thick, SA - 213, Mat.
Length : 400 mm. (Approx.)

1818

CODE NO	JOB DESCRIPTION
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- d) For desuper Heater Header and desuper heater nozzle & lining plates inspection, 1" dia. pipe from top of the bends of Primary Super Heater and De-Superheater header cutted for fibrosscopic examination.

Secondary super heater coil from outside of the furnace nearest to the superheater outlet header 1 No., 400 mm. long piece cutted for fibrosscopic examination of secondary super heater outlet header.

- e) 100% B F W Isolation valve and 30 % isolation bonet less valve steam leak were attended by replacing the chevron packings.

(B) BHEL BOILER INSPECTION :

- Boiler was inspected by Boiler Inspector in open test condition on 10.04.2000. Hydrotest at 90 Kg/cm² pressure was done and witnessed by Boiler Inspector on 20.04.2000.
- All the three relief valves were overhauled & tested on 22.04.2000 and their readings were as follows.

	<u>Popping Pr.</u> <u>Kg/cm²g.</u>	<u>Reset Pr.</u> <u>Kg/cm²g.</u>
Drum Front R.V.	71.70	69.00
Drum Rear R.V.	69.00	67.00
Super Heater R.V.	64.00	61.50

Provision made (3/4" NPT threaded) with Isolation valve for IBR Inspector's pressure gauge at rear side of the Steam drum.

- Damper of burner made free and greasing done.
- All remaining dampers were made free by greasing.
- Up-graded insulation of the boiler done.

207

CODE NO JOB DESCRIPTION

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

PREVENTIVE MAINTENANCE :

- 1) Cold End baskets were supplied in the form of three different segments for one piece. The three segments were welded and made one piece. The same one no. of old basket was removed for checking. New welded basket segments, inserted and it was found o.k.
- 2) General condition of Hot End Baskets and Cold 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.
- 4) Cold End Radial Seals (3 Nos.) were replaced with new one, as the old seals were corroded. The seal were issued from Stores against Store Code No.: 335701018.
- 5) 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

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CODE NO	JOB DESCRIPTION
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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

- 6) Steam nozzle for swivel type soot blower of RAH unit was found heavily corroded. The same was replaced with new one issued from Store against store code no. 335704150

03 20 01 FABRICATION JOBS :

(A) BHEL BOILER DUCT EXPANSION BELLOW :

Both the Expansion Bellows of flue gas duct before RAH inlet were cracked and flue gas leakage was observed. Hence both the C.S. expansion bellows were 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.

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

(B) The drain line of washing water from RAH unit was found chocked. Hence it was repalced with new C S pipe 6" NB x sch 40.

For Boiler filling, D.M. Water line size changed from 1" to 1-1/2" dia. C.S. Pipe.

Before Modification Boiler Filling Time = 08 Hrs.

After Modification Boiler Filling Time = 02 Hrs.

ANNEXURE - 'A'

Project : IFFCO-KALOL 1 X 80 t/hr TYPE 27 VP Boiler

Condition Assessment Study of Boiler

Scope of work

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SL. NO.	Component	Test required	Remarks
01 02	Upper drum and Lower drum	<ul style="list-style-type: none"> • Visual • Dimensional • NDT Checks on cirseam welds and long seam welds • NDT Checks on all stub welds • Drum deposit analysis of steam drum 	LPI, MPI, UT. Replication on welds
03	WW 'D' Panel	<ul style="list-style-type: none"> • Visual • Dimensional • Tube sampling 	Wt. Loss analysis Deposit analysis and Metallurgical analysis
04	Bank tubes including side wall tubes and rear wall tubes	<ul style="list-style-type: none"> • Visual • Dimensional • Tube sampling 	Wt. Loss analysis Deposit analysis and Metallurgical analysis
05	Super heater coils - 2 Stages	<ul style="list-style-type: none"> • Visual • Dimentional • NDT on attachment welds • Tube sampling 	Limited to approach Metallurgical analysis
06 07 08 09	SH Stage 1 Outlet header SH Stage 2 Inlet and Outlet Header DESH Link pipe MS line up to MS stop valve	<ul style="list-style-type: none"> • Visual • Dimentional • Header internal inspection • NDT on stub joints • Metallography 	Header inspection through Fibroscope
10 11	Front and Rear water wall headers SH Stage 1 Inlet header	<ul style="list-style-type: none"> • Visual • Dimentional • NDT on stub joints 	
12	Feed pipe after Isolation valve	<ul style="list-style-type: none"> • Visual • Dimentional 	

- Replication spots approx. 15 nos.

PLANT TURNAROUND - APRIL - 2000OFFSITE & UTILITY PLANTINSPECTION JOBS

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<u>CODE NO</u>	<u>JOB DESCRIPTION</u>
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INSPECTION JOBS :

During April-2000 Shutdown, inspection of BHEL Boiler was carried out. The BHEL Boiler downcomer tubes of 76.1 MM O.D. x 4.5 mm wall thickness, Boiler side wall Row-Y tubes-66 nos.were also replaced during this shutdown due to heavy external corrosion observed during previous shutdown.Also, thickness measurement of CW lines, BFW pipelines and steam lines was carried out. RLA Study of the BHEL boiler was carried out by M/S. BHEL during this shutdown.

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 99.5 MM against nominal specified thickness of 97 MM in cylindrical shell area and 78.3 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 81.8 MM in cylindrical shell area against nominal specified thickness of 78 MM and 57.5 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	4.6	4.5	-
(B)	D-PANNEL TUBES	4.6	4.5	-
(C)	CUT CORNER TUBES	5.1	3.2	-
(D)	REAR WALL TUBES	4.8	4.5	-
(E)	FRONT WALL TUBES	5	4.5	-
2	NORTH MANHOLE:			
(A)	BANK TUBES	3.6	3.6	-
(B)	BAFFLE TUBES	4.8	4.5	-
(C)	NORTH SIDE WALL TUBES	4.7	4.5	-
3	PRIMARY SUPERHEATER TUBES INSIDE FURNACE	6.4	7.1	9.89
4	SECONDARY SUPERHEATER TUBES INSIDE FURNACE	5.2	5.6	7.12
5	PRIMARY SUPER HEATER INLET HEADER	22.8	-	-
6	TUBES OF PRIMARY SUPER HEATER NEAR INLET HEADER	6.7	7.1	5.63
7	PRIMARY SUPER HEATER OUTLET HEADER	31.2	-	-
8	TUBES OF PRIMARY SUPER HEATER NEAR OUTLET HEADER	7.4	7.1	-

792

CODE NO JOB DESCRIPTION

SL. NO	DESCRIPTION	MIN. THK. (MM)	DESIGN THK.(MM)	% RED.
9	SECONDARY SUPER HEATER INLET HEADER	26.2	-	-
10	TUBES OF SECONDARY SUPER HEATER NEAR INLET HEADER	5	5.6	-
11	SECONDARY SUPER HEATER OUTLET HEADER	24.2	-	-
12	TUBES OF SECONDARY SUPER HEATER NEAR OUTLET HEADER	5.8	5.6	-

- (4) During this shutdown, all the 66 nos. downcomer tubes on the boiler shield wall were replaced by new ones. The stub ends of all the tubes were D.P. tested in 4 inch length from each end and found to be free from any defects.
- (5) Nine nos. sample pieces were cut in the furnace including Primary and Secondary Superheater tubes for destructive testing by M/S. BHEL for RLA Study. These include four nos. furnace tubes, one no. bank tube, two nos. Primary superheater tubes and two nos. Secondary superheater tubes. 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.
- (6) Performance qualification test of the welders employed by the agency m/s. Skywin erectors was carried out. total six welders were qualified for the welding of tube fins and two welders were qualified for butt welding of the tubes, necessary bend test and radiography were carried out on the test pieces.
- (7) During hydrotest of the BHEL Boiler, leakage was observed from the One no. bank tube which was plugged at the Steam Drum and Mud Drum. D.P. test was carried out on the plug weld after first and final layer welding.
- (8) In the Boiler area, thickness measurement of the following pipelines was carried out:
 - a) 60 Ata steam line
 - b) BFW line
 - c) Flue Gas ducting .

793

CODE NO	JOB DESCRIPTION
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03 41 02	<u>PIPE LINES THICKNESS MEASUREMENT IN COOLING TOWER AREA :</u>
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Following pipelines were inspected for thickness in the Cooling Tower area.

- a) CW Distribution Headers on UREA Cooling Tower.
- b) CW Supply and Return Headers for UREA Plant.
- c) P-4401 A and B Suction and Discharge lines.

The detailed summary on thickness measurement is enclosed herewith at Annexure-1. Three nos. elbows in the BFW line have been identified to have thickness reduction more than 25 % which are recommended for replacement during next shutdown.

ANNEXURE-1

**THICKNESS MEASUREMENT REPORT OF UTILITY PLANT (BOILER AND PIPELINES)
CARRIED OUT DURING SHUTDOWN MARCH-APRIL, 2000:**

J94

SR. NO.	LINE DESCRIPTION	FROM	TO	DESIGN THK. MM	MIN. THK. OBSERVED, MM	% AGE RED.
BHEL BOILER AREA						
1	Primary Superheater inlet header	Steam drum	Primary Super heater tubes	N.A.	22.8	—
2	Primary Superheater tubes	Primary Super heater inlet header	Primary Super heater outlet hdr	7.1	6.7	5.6
3	Primary Superheater outlet header	Primary Super heater tubes	Secondary Super heater inlet hdr	32	31.2	2.5
4	Secondary Superheater inlet header	Primary Super heater outlet hdr	Secondary Super heater tubes	N.A.	26.2	—
5	Secondary Superheater tubes	Secondary Super heater inlet header	Secondary Super heater outlet hdr	5.6	5	10.7
6	Secondary Superheater outlet header	Secondary Super heater tubes	60ATA header	25	24.2	3.2
PIPELINES						
7	60 ATA Steam line, 10"	Secondary Super heater outlet hdr	Urea plant Battery limit.	25	22.3	10.8
8	BFW Dis charge line, 6"	P-5111/P-5112	BFW Coils (Utility) in LT Conv. Zone in Ammonia plant	10.97	6.2	43.4
9	BFW Suction line, 10"	Dearator	P-5111/5112	9.27	8.8	5
10	BFW line, 6"	BFW Coils (Utility) in LT Conv. Zone in Ammonia plant	BHEL Boiler	10.97	9.1	17.04
11	Steam line, 2" and 4"	Boiler Outlet	Q-5113 Inlet	4" Sch 80(8.02) 2" Sch 80(5.54)	7.4 5.5	7.7 —
12	BHEL Boiler fuel gas ducting plates	RAH	Chimney	N.A.	5	—
13	C.W. Distribution header of Urea Cooling tower (East side)	C.W. Return Header	Cooling Tower Top	N.A.	4.9	—
14	C.W. Distribution header of Urea Cooling tower (West side)	C.W. Return Header	Cooling Tower Top	N.A.	5	—
15	C.W. Supply header of Urea Plant	Cooling Tower	Urea Plant	9.525	8	15.7
16	C.W. Return header of Urea Plant	Urea	Utility Cooling Tower	9.525	7.8	17.8
17	C.W. Pump(P-4401/A) Discharge line	P-4401/A	Under ground	9.525	9.2	3.2
18	C.W. Pump(P-4401/B) Discharge line	P-4401/B	Under ground	9.525	9.5	—
19	C.W. Pump(P-4401/A) Suction line	C.T. Sump	P-4401/A Suction	9.525	9.1	—
20	C.W. Pump(P-4401/B) Suction line	C.T. Sump	P-4401/B Suction	9.525	9.4	—

PLANT TURNAROUND - APRIL - 2000

OFFSITE & UTILITY PLANT

CIVIL JOBS

795

CODE NO	JOB DESCRIPTION
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03 51 01 CIVIL JOBS :

(A) WATER TREATMENT PLANT :

- 1) Repairing/replacement of acid brick linings in effluent treatment pit completed.
- 2) FRV lining job in the drains in water treatment plant completed.
- 3) Making new pit for strong effluent tank A.
- 4) Repairing of wooden plan of ammonia and urea side combined tank and replacement of A/C sheet looking in combined tank.

(B) BOILER HOUSE :

- 1) Replacement of damaged A.C. sheet from top and side clading completed.
- 2) Replacement of castable material for refractory and doing the same as original after replacement boiler tubes completed.
- 3) Repairing of refractory lining inside boiler completed.

PLANT TURNAROUND - APRIL - 2000OFFSITE & UTILITY PLANTELECTRICAL JOBS

296

CODE NO	JOB DESCRIPTION
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03 61 01	<u>ELECTRICAL JOBS :</u>
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(A) UTILITY AREA :

- 1) Maintenance job carried out on following transformers.
TR-1A, 1B, 1C, 2A, 2B, 3A, 3B, 4A, 4B, 8, 11, 12, 13 and 14 for
 - a) Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.
 - b) Testing of oil in marshaling boxes on primary and secondary transformers and cleaning of chamber and replacement of oil if required.
 - c) Checking of trip alarm circuit and cleaning of all emergency trip boxes.
- 2) Alignment of all isolators at 66 KV Yard were checked for proper opening and closing.
- 3) Preventive maintenance of BHEL make OCB and MOCBs and replacement of damaged parts and oil were carried out.
- 4) Preventive maintenance of " JYOTI " VCBs installed at KEP MPSS and replacement of damaged parts were carried out.
- 5) Preventive maintenance of TMG/Siemens make LT ACBs installed at various MCCs and of damaged parts and worn out contacts were replaced.
- 6) Preventive maintenance of new MPSS breakers panel were carried out.
- 7) Preventive maintenance carried out on all feeder compartment mounted on the following MCCs.
MCC-1, MCC-2, MCC-2A, MCC-2B/2E, MCC-2F, MCC-8, MCC-11, MCC-12 and MCC-13.
- 8) Maintenance of lighting distribution boards and defective/ burnt out fuse fittings were replaced.

797

CODE NO	JOB DESCRIPTION
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- 9) Overhauling of critical motors. : E-5119, E-5117, P-4206/1 were carried out.
- 10) Terminal boxes were checked for loose connections and burnt cables etc. of all motors above 20 hp.

(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) Testing of oil in marshaling boxes on primary and secondary transformers and cleaning of chamber and replacement of oil if required.
 - c) Checking of trip alarm circuit and cleaning of all emergency trip boxes.
- 2) Preventive maintenance were carried out on all feeder compartment mounted on MCC-3 and new AMF control and breaker panel.
- 3) Preventive maintenance of TMG make LT ACBs installed at MCC and replacement of damaged parts and worn out contacts.
- 4) Maintenance of lighting distribution boards and defective/burnt fuse fittings were replaced.
- 5) Terminal boxes were checked for loose connections and burnt cables etc. of all motors above 20 hp.
- 6) All push button stations were checked and damaged/burnt out parts were replaced.

PLANT TURNAROUND - APRIL - 2000

OFFSITE & UTILITY PLANT

INSTRUMENTATION JOBS

798

CODE NO JOB DESCRIPTION

03 71 01 NEW BOILER JOBS :

CONTROL ROOM PANEL INSTRUMENTS :

- (1) Following Receiver / Recorders were cleaned and checked the calibration..
(Cleaning of Orifices, Flapper Nozzle)
PR1 , PR2, FR3, FR4, TRC4, TRC5, LRC3, FRC1, FR2, LRC3, FRC1, LRC2,
FR1, PRC5, FRC11, PR15, FRC21, FRC22, PIC5151, Raw Water Tank Level Tx.
- (2) Following Set point Tx. were cleaned and checked the calibration.
TRC4, TRC5, LRC3, FRC1, LRC2, PRC5, FRC11, FRC21, PIC5151
LRC 3 --- Change the 'O' Ring of Auto-Manual Switch of LRC3
LRC 2 --- Replace worn shaft by new one.
- (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,
PIC 22 -- Controller was replaced by new one as it was not working properly.
PIC 5151-- Controller output port was replaced by new one as there were found
leakage of air.
- (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, CRA 1.
- (6) Air regulators behind Control Panel were cleaned , overhauled.
- (7) One new 7.0 Kg/cm2 Air Header provided at the back of Control Panel.
- (8) UPS System : Following Points were checked
 - (1) Checked the Battery Reliability by switching OFF & ON the charger for 10 minutes.
 - (2) Checked static switch
 - (3) Checked/Measured Battery voltage.

799

CODE NO	JOB DESCRIPTION
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- (9) All wiring terminals of BMS Panel & Main Panel were cleaned and tightened.
- (10) HORV valve open indication provided on BMS Panel in place of panel heater ON indication. (Contactor CRH 19 used for HORV indication)
- (11) Following Square Root Extractor 's relay, flapper - Nozzle were cleaned and checked the calibration the calibration of square root extractor together with the recorder.
FSQ 1, 2, 3, 4, 11, 21, 22,

03 71 02

FIELD INSTRUMENTS JOBS :

- (1) Following Flow transmitters and their regulators were cleaned and checked the calibration of Tx and Receiver gauge.
FT 1(Pneumatic & Electronic Both), FT 3, FT 4, FT11, FT 13, FI(BFW steam turb. flow) , DPT 1, DPT 14, DPT 12, FRC 21
- (2) Following Pressure transmitters and their regulators were cleaned and checked the calibration of Tx and Receiver gauge
PT 1, PT 2, PT 3, PT 4, PT 5, PT 7, PT 22, PT 5151.
- (3) Following Level Transmitter and their regulators were cleaned and checked the calibration of Tx and Receiver gauge
LT 1, LRC 2, LRC 4, Blow Down Level Tx, Day Tank Level Tx.
- (4) Following pneumatic Controllers (440R) were cleaned and checked their calibration.
DPC 1, TIC 2, PIC 1, Blow Down Tank level controller, Soot Blower steam pressure controller, Oil Header Pressure controller, PIC 50 , PIC 2
- (5) Following pressure & level switch were cleaned and checked their set values.

LAL 3, LAH 4, LAH 2, Day Tank High/Low Level , Drum level Extra low level (LSLL 1), PAL 5114, PLCI 5112, PLCO 5111, PAL 5115, PLCI 5114, PLCO 5113, PAL 5114, PLCI 5113, PLCO 5112, PS 1, PSH 12, PAH 11(LSLL 1 / LAH 2 / LAL3 --- Replaced the micro switch element with new one.)
(PS1 --- set value 7.8 kg/cm², reset value 8.8 kg/cm²)
- (6) Limit Switches
 - (a) Burner no 1 & 2 main gun engagement switch replaced with new one.
 - (b) All BTV's limit switches were cleaned and checked it's operation.
 - (c) CCV 21, CCV 22 limit switches were cleaned and checked their operation
 - (d) All Fuel Air Damper's limit switch were cleaned and checked their operation.

CODE NO JOB DESCRIPTION

(7) Control Valves

Following control valves & their positioners were cleaned and checked their stroke.

- (1) FCV 1, FCV 2, FCV 1A, 100% BFW, BFW Bypass Valve, PCV 2, LCV 4, PCV 1, TCV 2, TCV 1, PCV 50, Oil Header Pr.c/v, Soot Blower Valve.
- (2) BTV 1-1, BTV 1-2, BTV 1-3, BTV 2-1, 2-2, 2-3, CCV 21, CCV 22, HORV, HOHTV

(8) Dampers.

Following dampers overhauled and checked their operation

- (a) F.D. fan inlet damper and its valve positioner.
- (b) F.D. fan outlet damper.
- (c) Air heater inlet damper.
- (d) Air heater outlet damper.
- (e) Both fuel air damper and its valve positioners.

(9) Ignitors

- (1) Both Burner's ignitor gun & spark plug cleaned and checked.
- (2) Ignitor gas solenoid valve was overhauled and checked.
- (3) Both gas & Oil flame scanners were cleaned and checked.

(10) All furnace draft impulse lines were flushed with 7.0 kg/cm² air.

(11) Following solenoid valves were cleaned and checked for operation.

- BFW Turbine governor oil trip.
- FD Fan turbine governor oil trip.

(12) PICV 5151

- (1) New Volume Booster provided at PT 5151 Tx output and done necessary tubing.
- (2) Flushed the output tube of Tx. Inspected control valve diaphragm (found ok)
- (3) Checked the valve stroke from boiler control room. Tighten the c/v gland packing.

(13) Did all instrument related job as per mech. requirement.
(4 nos. K Type mineral insulated thermocouple were provided for stress relieving job)

(14) Attended plant start up jobs.

207

CODE NO JOB DESCRIPTION

03 71 03

D.M. WATER PLANT :

- (1) Control Valves
 - (a) Weak Effluent Segregation valve was removed from line and replaced soft seat by new one. Replaced the valve stem with new one.
 - (b) Following control valves(BDK) were serviced (replaced the diaphragm) by BDK service engineer. Cation 1- V1, Cation 1- V3, Cation IV - V3.
 - (c) Anion I, II, III, IV, V (Stroke checked and cleaned the v/p)
- (2) Local Controllers
 - (a) D.M. Buffer tank level controller were cleaned and checked.
- (3) Level Switches
 - (a) Alkali preparation tank level switch cable was terminated in junction box as it was found open.
- (4) Dressing and removing unwanted pvc tubes of c/v signals between cation and anion cable tray.
- (5) Dressing and removing unwanted pvc tubes of c/v signals between PMB and SMB cable tray.
- (6) Following Flow Tx. were cleaned and calibrated.
 - (a) Cation I, II, III, IV, V
 - (b) Raw Water to DM Plant Flow.
 - (c) Decation water flow
- (7) Following Level Tx. were cleaned and calibrated.
 - (a) HCL (M1) Tank Level,
 - (b) HCL Loading / Unloading Tank Level
- (8) All BDK make Control valve cleaned and painted.
- (9) Air Header Regulators behind control room panel (30 psi, 50 psi) were overhauled and cleaned.

202

CODE NO JOB DESCRIPTION

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 (Air regulator replaced with new one)
 PICV 5154 (gland packing provided and tightened, cleaned the hand jack assembly)
 LCV 01, LCV 02.

- (2) Following Flow/Pressure/Level Tx. were cleaned / overhauled and calibrated

Raw Water Inlet Flow Tx.(Annubar - cleaned the flow element)
 C.T. Basin level Tx, Q-4401A/B Steam Flow To Turb Tx(FT 1090). (replaced the manifold), Raw Water Tank to C.T. Flow Tx., FT 1091 Condensate flow, Dilution Water Flow Tx. , Borewell 10 & 13 FT (replaced the manifold) , Drinking Water Flow , Raw Water Level Tx.(replaced with spare one), PT 01 Exhaust Pr. of Q-4401A. LT 1 surface cond . Lvl Tx.

- (3) Following Pressure/ Level Switch were cleaned and checked the set value.

PSH 1 Exhaust pr. high of Q 4401A, LSHHT 01, LSAH 02, LSAL 03

- (4) Q- 4401A Governor side radial vib. probe was removed & installed as per mech. requirement.

- (5) Vibration Monitor Power Supply card was replaced by new one as it was found defective
 (Dual Radial Vib. monitor output volt for Proximitor was coming -31 Vdc t in place of -21 Vdc)

03 71 05 I.G. PLANT :

- (1) Instrument Air Pressure Low Trip Switch replaced with new one(Set value 3.3 kg/cm2). Replaced Cantactor D11 as it's coil was found burn out.

- (2) Old IG Main Gas Solenoid valve coil was replaced with new one.

- (3) O2 Analyzer electrolyte solution was replaced by fresh one after cleaning of electrode and stirring chamber.

- (4) Attended all running jobs.

203

CODE NO	JOB DESCRIPTION
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03 71 06 EFFLUENT TREATMENT PLANT :

- (1) Pit well level controller was cleaned and checked.
- (2) LICV 4511 Pit well level control valve and it's positioner were cleaned and checked the stroke.
- (3) cleaned the sample system and external filter of Ammonia analyzer.

03 71 07 D.G. SET :

PLC

- (1) Cleaned all I/O cards, cpu card, power supply card.
- (2) Hooked up the PLC with computer and checked the communication between plc and PC.
(Service Engineer from M/S Pima Controls Pvt. Ltd. was called to execute the W/O)

03 71 08 WEIGH BRIDGE (MAIN GATE) :

Following jobs has been done .

- (1) Removed the platform and cleaned the load cell assembly.
- (2) Replaced 6 nos. of loadcell mounting distance pieces and ball.
- (3) Calibrated the weigh Bridge with standard weights.
(checked the calibration upto 24 tonnes)
- (4) Cleaned the digital indicator and painted it.

03 71 09 NH3 STORAGE :

- (1) K-3001 A/B NH3 Compressor

Following control valve and it's positioner were cleaned ,checked the c/v stroke, and painted.

LCV 3055A/B, PCV 3064A/B, LCV 3053A/B, PCV 3065A/B, LCV 3058A/B,
LCV 3051A/B,PCV 3009, PCV 3008, PCV 3015, EMV 3001.

204

CODE NO	JOB DESCRIPTION
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- (2) K-3101 NH3 Compressor
Following control valve and it's positioner were cleaned ,checked the c/v stroke, and painted.LCV 3101, LCV 3102.
- (3) Following Flow/ Pr. Tx. were cleaned and calibrated.
PT 3101, PT 3103
- (4) PIC 3103 Local Controller were cleaned and synchronized.
- (5) Old Ammonia vapor compressor load / unload valve instrume tubes were removed and reinstalled as per mech. requirement.
- (6) New Ammonia Tank (T 3001) M/S Enraf make level indicator were cleaned , serviced and checked the calibration in presence of service engineer from M/S Toshbro Ltd.
- (7) K-3101 NH3 Compressor Full / Half Load Pressure switch were calibrated.
- (8) All control valves & it's local controller related 3 LSHS Tank were overhauled and checked the operation
- (9) All SLPC indicator/controller/recorder, Hybrid Recorder were cleaned and checked the Back up Battery. (2 nos. of back up battery were replaced with new one)

PLANT TURNAROUND - APRIL - 2000

OFFSITE & UTILITY PLANT

TECHNICAL DEPARTMENT JOBS

205

CODE NO	JOB DESCRIPTION
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03 81 01 TECHNICAL DEPARTMENT JOBS :

(A) MECHANICAL JOBS :

- (1) 40 ata isolation valve provided to isolate 40 ata steam header towards urea plant in front of Maintenance shift office.

(B) CIVIL JOB :

- (1) Modifications of Suction screens of all the three cells of New Cooling Tower (EWR NO. - 662 T) completed for cleaning during normal Plant running.

PLANT TURNAROUND - APRIL - 2000B&MH PLANTMECHANICAL JOBS

206

CODE NO	JOB DESCRIPTION
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04 03 01 RECLAIM MACHINE M-2116 :

Following jobs were carried out during plant turnaround-2000.

1. Main drive bottom structure of Elevator and Scrapper assembly replaced with main shaft, elevator shaft, idler pins, bearing housings (inner & outer), pinions and bearings.
2. Link conveyor boom holding pivot assembly (upper & lower) replaced.
3. Link conveyor gear box overhauled, Coupling bolts, bushes, oil-seals and oil replaced after cleaning of gear box.
4. Link conveyor carrier rollers removed, serviced for easy movement and replaced.
5. Link conveyor skirt rubber removed and replaced by new one.
6. Link conveyor Tail pulley adjusting mechanism serviced and belt is adjusted.
7. Bucket elevator chain attended for replacement of damaged pins and circlips.
8. Swing rack pins attended for cleaning and grinding of sharp edges.
9. Scrapper chain adjusting mechanism at front side serviced.
10. Damaged gratings of 1st floor of R/M replaced by chequered plates.
11. Complete cleaning and painting of R/M done.

04 03 02 PREVENTIVE MAINTENANCE OF PACKER SCALES :

Following preventive maintenance jobs were carried out.

1. Packer scale no.3 bucket is replaced by new bucket with eye-bolts, bearings, tie-rods and cylinders.
2. Packer scale no. 2 and 7 attended for servicing and calibration.
3. Packer scales no. 1,4, and 8 attended for servicing.
4. Complete cleaning and painting of all packer scales done.

207

CODE NO	JOB DESCRIPTION
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04 21 01	<u>PLANT TRANSFER CONVEYOR M-2110 :</u>
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Following jobs were carried out

1. Gear Box of M-2110 conveyor serviced for replacement of oil-seals, coupling bolts, coupling rubber bushes and oil. Coupling is done after proper alignment.
2. M--2111 Flapper valve attended for proper sealing and easy operation. Bearings were serviced.
3. Head pulley brush roller serviced.
4. All damaged return rollers removed, serviced for free rotation and refixed after replacement of rubber disks and sleeves.
5. No easy troughing idlers removed, serviced and refixed in position.
6. All guide rollers replaced by new rollers.
7. Tail portion skirt rubber replaced.
8. Greasing job in all bearings completed.
9. Complete cleaning and painting of structure done.

04 21 02	<u>FRESH UREA SHUTTLE CONVEYOR M-2112 :</u>
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Following jobs were carried out

1. Gear box attended for cleaning, replacement of oil seals, oil, coupling bolts and bushes. Alignment job completed.
2. All damaged return rollers removed, repaired and replaced after changing rubber discs and sleeves.
3. All damaged carrier rollers removed, repaired and refixed in position.
4. All guide rollers replaced by new rollers.
5. FC - 7 Coupling of gear-box (motor to gear box) replaced.
6. Greasing of all bearings completed.
7. Complete cleaning and painting of conveyor completed.

208

CODE NO	JOB DESCRIPTION
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04 21 03	<u>RECLAIM CONVEYOR M-2117 :</u>
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Following jobs were carried out

1. Gear Box attended for cleaning, replacement of oil seals, oil, coupling bolts and bushes. Alignment job completed.
2. Coupling (FC-9) between Motor and Gear-Box replaced with new bolts and rubber bushes.

04 21 04	<u>BAGGING FEED CONVEYOR M-2121 :</u>
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Following jobs were carried out

1. Complete Head pulley with MPG-85 Bearings and FC-16 coupling replaced.
2. Gear-Box FSM-10.5 (Elecon make) overhauled and assembled with new bearings and FC-16 coupling.
3. Flapper valve of M-2121 conveyor attended for free and easy operation.
4. Head pulley scrapper rubber (12 mm thk.) replaced and serviced for free operation.
5. Coupling bolts, rubber bushes, oil-seals and oil replaced in gear box. Alignment job done.
6. Return rollers, Carrier rollers, removed, repaired for free operation and replaced.
7. Damaged guide rollers, replaced by new rollers.
8. Complete cleaning, painting and greasing of all bearings done.

04 21 05	<u>BAGGING HOPPER FEED CONVEYOR M-2122 :</u>
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Following jobs were carried out

1. 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. Alignment job between motor and gear box completed.
2. Complete cleaning and painting of conveyor belt done.

209

CODE NO	JOB DESCRIPTION
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04 21 06	<u>SLAT CONVEYOR M-2124 (1 - 6) :</u>
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Following jobs were carried out

1. All six slat conveyors attended for :
 - a) Damaged wooden slats.
 - 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.

PLANT TURNAROUND - APRIL - 2000B&MH PLANTCIVIL JOBS

270

CODE NO	JOB DESCRIPTION
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04 51 01	<u>CIVIL JOBS :</u>
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Following jobs were carried out during plant turnaround-2000.

1. Ipnet protective painting with putty provided on RCC surface of Transfer tower.
2. Monolithic plaster and epoxy painting on corroded RCC structure of silo conveyor gallery, hopper floor, first floor of bagging plant, column, beams and bottom of slab completed.
3. Ironite flooring work on the bagging plant loading platform completed.
4. Epoxy painting of RCC beam, columns, slab bottom at Ground floor and first floor of bagging plant completed.

PLANT TURNAROUND - APRIL - 2000B&MH PLANTELECTRICAL JOBS

277

CODE NO	JOB DESCRIPTION
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04 61 01	<u>ELECTRICAL JOBS :</u>
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1. Maintenance job carried out on following transformers.
TR-5A, and 5B.
 - (a) Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.
 - (b) Testing of oil in marshaling boxes on primary and secondary transformers and cleaning of chamber and replacement of oil if required.
 - (c) Checking of trip alarm circuit and cleaning of all emergency trip boxes.
 - (d) Checking of IR value primary and secondary windings of the above transformer.
2. Preventive maintenance of TMG/Simens make LT ACBs installed at MCC and replacement of damaged parts and worn out contact.
3. Preventive Maintenance carried out on all feeder compartments mounted on the following MCCs.
MCC- 4, MCC- 4A and MCC-9.
4. Maintenance of all lighting distribution boards.
5. Overhauling of critical motors : M2112, M2117, M2121, and M2122 were carried out.
6. Reclaim control panels was inspected and cleaned.
7. Checking of controls of entire conveyor system for proper operation.
8. All push button stations and junction boxes of all conveyor motors were checked.
9. Terminal boxes for loose connections and burnt cables etc of all motors above 20 hp were checked.

PLANT TURNAROUND - APRIL - 2000B&MH PLANTINSTRUMENT JOBS

222

CODE NO	JOB DESCRIPTION
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04 71 01	<u>INSTRUMENT JOBS :</u>
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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) Provided proper locking arrangement on panel door for All P/S Panels, Local Panel of All P/S, Solenoid Box os all P/S .

- (4) Soldered the Load cell cable of P/S 4 as it was found broken.

- (5) checked calibration of P/S No. 1,2,3,4,7,8 after the completion mechanical jobs.

273

CODE NO	JOB DESCRIPTION
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(6) Computpak Panels

- All Pcb's inside the computpak panels were removed and cleaned
- Calibrated the Both UBM 9A, UBM 9B.

(7) Conveyor Belt Interlock PLC.

- Hooked the Bag Conveyor Interlock PLC with the Computer and checked the PLC.
- cleaned all I/O cards, CPU card, power supply card.

(Service Engineer from M/S Pima Controls Pvt. Ltd. was called to execute the W/O)

(8) LIBRA WEIGHING SCALE :

Following work has been done for Libra Weighing Scale of PS 1,2,3,4,7,8,UBM 1, UBM 2, F & S, Spare, W/S.

- Removed the Load Cell Assembly from platform, cleaned the other assembly of platform, scraped the color, painted the platform assembly, assembled the loadcell.
- Cleaned the Pcb's of indicator.
- Calibrated the Weighing scale.

(Service Engineer from M/S Metter Toledo India Ltd was called to execute the AMC)

(9) SILO

Following jobs has been done in Belt Weighing System

- Removed the Load cell assembly for inspection of loadcell.
- Removed the Fixed support (provided by welding plates between fulcrum and link conveyor) on weighing fulcrum as per instruction of PBLservice Engineer.
- Removed the loadcell safety bolt (which maintain the gap between loadcell and conveyor belt) as per instruction of service engineer.
- Overhauled the Teco meter
- Replaced the Loadcell junction box with new one.
- Checked the load meter program and calibrated it.

(Note : service engineer from M/S Power Built Ltd was called to execute the job).

(10) Dust Extraction System.

- Cleaned the Dust Extraction Panel.
- Cleaned all field instruments(C/V, Flow Tx, Level Tx etc.) related the DES