

1993

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KALOL UNIT

PLANNING SECTION  
MAINTENANCE DEPARTMENT  
REPORT No.14/1993

R E P O R T  
O N  
P L A N T T U R N A R O U N D  
S E P T E M B E R - O C T O B E R - 1 9 9 3

INDIAN FARMERS FERTILISER CO-OPERATIVE LIMITED

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P R E F A C E

Kaloi unit had taken a planned shutdown from 12th Sept, 1993 to 23rd October 1993. In this shutdown, reformer revamp - II was carried out wherein reformer harp assembly, pigtails, inlet manifold and connected piping were replaced with new modified material of construction for improved performance and reliability at enhanced future plant loads. This is the 2nd reformer revamp of IFFCO Kaloi. Reformer roof plates of C.S. were replaced with S.S.304 plates and the roof insulation of module type were modified to indigenously made ceramic blanket insulation. Burner blocks of M/s.Christy Refractories were replaced with indigenously made fibre blocks. Orientation of naphtha burners of reformer arch were changed in row nos 6 to 9 in order to avoid flame impingement on tubes. The reorientation of other rows were already carried out in 1992.

In order to increase the efficiency of H.T. and L.T. convection coils, H.T. Superheat coil and mixed feed preheat coil were replaced with new coils procured from M/s.L & T, Bombay. The material of construction of these coils were also upgraded to a better material. In addition, one new Boiler feed water coil was installed in L.T. convection section to utilise the waste heat of flue gas going to chimney as well as to reduce oil consumption for the BHEL boiler. The L.H.V. insulation on the side walls of hot well of Aux.Boiler were modified with ceramic fibre blanket insulation in order to eliminate the problem of cracking and subsequent hot spots with L.H.V.insulation.

Synthesis gas convertor internals were modified with mixed flow pattern bucket design of M/s.Ammonia Casale, U.S.A. in order to increase the conversion ratio as well as to obtain low system pressure of the loop. The use of smaller size catalyst of these beds lessened the pressure drop across the convertor.

This critical job of convertor retrofit alongwith catalyst changing was 1st of its kind undertaken in Kalol unit.

Air compressor drive turbine problem of wear and tear at diaphragm seating areas resulting in inter stage steam losses were repaired by machining and inserting new S.S.inserts at seating areas of diaphragms. This complete job on turbine casing was done at the works of M/s.L & T, Bombay under the supervision of IFFCO & Delaval representatives. Overhauling of the rotating equipments such as air compressor low pressure case (101-JLP), air compressor gear box (101-JR), murray turbine (107-JT) of MEA pump, refrigeration compressor drive turbine (105-JT), gear box (105-JR), Synthesis gas compressor condensing turbine (103-JBT) Preventive maintenance of N.G.compressor (102-J) and its drive turbine (102-JT), ID Fan train (101-BJ), Refrigeration compressor L.P.case (105-JLP), Syn.gas compressor back pressure turbine (103-JAT), BFW pumps and turbines (104-J/JT, 104-JA/JAT) were done.

CO2 Absorber (101-E) shell corroded portion was repaired by application of polymers by ITW signode. The old heat exchangers 124-C, 108-C (2 Nos), 109-C (2 Nos) were replaced by new ones. Also inlet and outlet channel covers of heat exchanger (103-C) were replaced by new covers manufactured with upgraded material of construction. All heat exchangers were cleaned by hydrojetting and finally boxed up after hydrotesting. Valve repair / overhaul / replacement were done as per requirement. Waste heat boiler GT-1631 and 1632 were inspected by C.I.B and hydrotested.

In Urea plant, old high pressure Carbamate Condensor was replaced by a new modified Condenser made of upgraded material of construction through M/s. L & T, Bombay. The new vessel is having dish ends welded with shell instead of bolted joints of the old vessel. The erection of this condensor was executed through M/s.L & T's Construction group.

Inspection of Autoclave (V-1201) and HP Stripper (H-1201) was carried out by Stamicarbon Engineers. Autoclave bottom hemisphere liner replacement was done. Waste heat boiler GT-1664 inspection was done by C.I.B. Important rotating equipments like CO<sub>2</sub> Centrifugal Drive Turbine (Q-1101/1) Drive Turbine for CO<sub>2</sub> Reciprocating Compressor (Q-1101/2) Ammonia Pump Turbine (Q-1102), Carbamate Pump Turbines (Q-1201/2 AB) were overhauled. Preventive maintenance was done on CO<sub>2</sub> Centrifugal Compressor (K-1101/1). David Brown gear box internals of CO<sub>2</sub> Reciprocating compressor (K-1101/2) was manufactured and installed through M/s. Elecon Engg. Prill Tower fans and Prill cooling system fans were overhauled. Vessels and Tanks inspection was done.

In Offsite overhauling was done for CW Pump Turbines (Q-4401/A&B), CW Pump (P-4401-A), Gear box of CW Pump (P-4401-A) and (P-4401/B). Overhauling of R.A.H. of BHEL Boiler was also done. BHEL Boiler GT-2068 was inspected by C.I.B. and hydrotest was done. Preventive maintenance of F.D.Fan, C.W.Pumps, and Turbines was done.

In B&MH, Naphtha Feed Pump and unloading Pump were overhauled. Reclaim machine was overhauled. Naphtha Tank (T-3301-A) roof was replaced. Inspection group carried out preshutdown inspections of materials, reformer harps, HT/LT coils, HPCC etc. During shutdown inspections of important vessels, pipings etc were carried out in Ammonia, Urea and Offsites. Casting of burner blocks for Auxiliary Boiler and refractory job was done by Civil Deptt. Scraper floor repair by epoxy coating was done. Painting inside the Urea Prill Tower was carried out.

Overhauls of electric motors MCCs and Transformers was carried out. Preventive maintenance was done on LT ACBS/TMS in all areas. Additional power connection and facilities were provided at critical work points like, Converter Reformer Autoclave etc. Control room and field instrument jobs were attended. Calibration of instrument was done. Upgraded materials and instruments were provided. Plant tappings and hook up in LTS catalyst heating and reduction system in Ammonia plant were made. NG Separators at metering system were relocated. Pipings were changed and upgraded materials were used. Additional Heat Exchanger H-1301/1-2 were installed parallel to existing Heat Exchanger. Vent condenser H-1502 was replaced by a new higher capacity Condenser.

Plant turnaround was completed as scheduled. Ammonia production started on 23-10-93. Urea plant was mechanically ready for start up. However Ammonia was urgently required by IFFCO Kandla unit, hence initial ammonia production was despatched to Kandla plant and Urea production was started only from 29-10-93.

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## MAJOR PROBLEMS ENCOUNTERED IN EXECUTION OF JOBS OF REVAMP SHUTDOWN

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Various teething problems were encountered in the execution of major jobs which had to be sorted out for timely completion of shutdown. We enumerate few of such problems as under :

### 1) TRANSIT DAMAGE OF HARP ASSEMBLY:

Reformer Harp Assembly ordererd on M/s. S+C, Germany, were found to have major damages in few of its components resulting in replacement of 10 Nos. of catalyst tubes and one number of riser tube.

### 2) COORDINATION WITH VARIOUS CONTRACTORS:

We had engaged 05 different contractors on various jobs to be executed on Primary Reformer. These jobs were inter-connected and the progress on job of one contractor was inter-dependent on the other contractors. It was indeed a difficult task to coordinate with all the five contractors for the ultimate progress of the jobs and timely completion. At times radiography work of one contractor to be scheduled with the stopping of other contractor job. The coordination among the contractors could be successfully met out with the coordination meeting on daily basis, jointly with all the contractors and representatives of M/s. MW Kellogg Co.

### 3) SPARES FOR ARCH BURNERS:

All 126 arch burners of the Primary Reformer were taken-up for overhauling and when dismantled required number of spares to be replaced which were not envisaged earlier and they were in addition to the spare parts already procured. Hence, emergency manufacturing of these spares was made from the local market.

### 4) TRANSPORTERS' STRIKE:

Nation-wide strike called by the Transport Operators in the country had virtually halted all the shutdown activities, resulting delay in mobilisation of various materials related to contractors or related to IFFCO's procurement.

### 5) NON-AVAILABILITY OF QUALIFIED WELDERS:

The contractors engaged in the Revamp job could not supply required number of qualified welders for the job. As such IFFCO had to make necessary arrangements from other Units of IFFCO, M/s. MFL, Madras, and M/s.SPIC-SMD, Bombay, for qualified welders to meet the requirement.

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6) BACKING OUT OF M/S. SCIL, BOMBAY FROM JOB:

M/s. SCIL, Bombay who had been awarded the job of erection of convection zone coils, had at the last moment withdrawn themselves. This withdrawal was subsequent to their actively participating in all the pre-shutdown meetings. IFFCO were left with hardly fortnight time to make necessary arrangement for awarding this job to alternate contractor. After a series of activities and negotiations with alternate party, M/s. Petron Engg. Construction Ltd., Bombay, the contract was finally awarded to them which was completed as per schedule.

7) DELAY IN SUPPLY OF COILS FROM M/S. L & T:

There was abnormal delay in supply of coils from M/s. L & T. At one stage, we had to wait for the arrival of HT Super Heater Coil from L & T Hazira works, for its installation at our site. The nation-wide transporters' strike had adversely affected the transportation of this coil from L & T Hazira works to Kalol Plant site.

8) DELAY IN MOBILISATION OF CONTRACTORS EQUIPMENTS:

Mobilisation of contractors' cranes was also adversely affected due to the transporters' strike and in some of the cases, IFFCO had to depute their engineer to follow-up contractors crane for their earliest arrival at plant site. Also the crane of M/s. Petron could not work at our site even after reaching at our site due to breakdown forcing IFFCO to spare their HM crane to M/s. Petron for the earliest completion of the job.

9) UNFORESEEN REFRACTORY JOB IN THE CONVERTER:

The partial repair of bottom bed refractory was planned in the converter. However, on inspection complete removal of the existing refractories and application of new refractories was required to be carried out.

- 10) Some of the critical alloy steel piping was planned for replacement. The contractor had some difficulties in mobilising their radiography work and stress relieving work for which IFFCO had to arrange some coordination work for the contractors. In addition to this, radiography on alloy steel piping was putting a stop to all other activities in some of the critical areas.



THE PLANT TURNAROUNDS AT A GLANCE

SR. NO.	YEAR	AMMONIA PLANT				UREA PLANT				REASON IF ANY
		PERIOD		FROM PRODUCTION TO PRODUCTION		PERIOD		FROM PRODUCTION TO PRODUCTION		
		FROM	TO	DOWN TIME DAYS	HRS	FROM	TO	DOWN TIME DAYS	HRS	
01	1975	06-05-75	21-05-75	16	-	06-05-75	21-05-75	16	-	Planned
02	1976	26-03-76	20-04-76	26	-	26-03-76	26-03-76	26	-	Planned
03	76-77	05-12-76	22-01-77	49	-	05-12-76	24-02-77	51	-	101-JT B/D
04	1978	21-02-78	15-03-78	23	-	21-02-78	25-03-78	31	-	101-BJ B/D
05	1979	21-05-79	30-06-79	41	-	10-05-79	01-08-79	82	-	K-1101/2, 3rd Stg. Cylinder
06	1981	12-04-81	10-05-81	29	-	08-04-81	12-05-81	35	-	101-B (Plnd) Headers
07	1984	01-01-84	25-01-84	25	-	01-01-84	25-01-84	25	-	Planned
08	1986	19-03-86	03-05-86	45	-	04-03-86	01-05-86	59	-	Reformer Revamp./HP Scrubber B/D
09	1987	12-04-87	03-05-87	21	-	12-04-87	02-05-87	20	-	Planned
10	1988	18-04-88	14-05-88	27	-	18-04-88	13-05-88	26	-	Planned
11	1990	05-02-90	05-03-90	29	638.67	31-01-90	07-03-90	35	829.0	Planned
12	1991	24-07-91	13-03-91	18	429.08	23-02-91	14-03-91	20	459.25	Planned
13	1992	03-11-92	03-12-92	30.6	734.91	03-11-92	04-12-92	31	744.75	Planned
14	1993	12-09-93	23-10-93	42	986.50	12-09-93	29-10-93	47	1120.58	Revamp-II

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PLANT - TURNAROUND - SEPT. - OCT. - 1993

GENERAL - DETAILS

SR.NO.	C A T E G O R Y	QUANTITY
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Equipment Utilised :

A) IFFCO :

55 T	HM Crane	01
15 T	Coles Crane	01
18 T	Tata Crane	01
03 T	Forklift	03
	Truck	01
	Hired - Forklift - 03 T	01

B) IFFCO - MANPOWER :

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

f) In addition to above, we have utilised manpower of Kandla, Aonia & Phulpur units.

C) HIRED - CONTRACT MANPOWER

Sr.No.	Category	Mandays
01	Millwright Fitter	130.5
02	Fitter	1216.5
03	Fabricator/Grinder	323.5
04	Rigger	1453.5
05	Welder NIBR	190.5
06	Carpenter	100.5
07	Manson	71.0
08	Semi Skilled labour	1663.5
09	Unskilled labour	3777.5
10	Welder IBR	13.0

D) HIRED - IFFCO TIME OFFICE :

Labour unskilled 2120 MAN DAYS

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MAIN MAINTENANCE JOBS CARRIED OUT BY OUTSIDE AGENCIES

SR. NO.	JOB	CONTRACTORS NAME	W.O.NO. & DATE
<b>(A) PLANT : AMMONIA :</b>			
01	Reformer Revamp	M/s.CEDCO, Baroda	E-2052 Dt.2-4-93
		M/s.J.M.Engineers,A'bad	E-147/B dt.23-10-92
		M/s.Orient Cerwool,B'bay	D-8354 dt.10-03 92
		M/s.United construction, Baroda	D-9627 dt.28-03-93
		M/s.Radiant Engineers, Baroda	D-9172 dt.27-03-93
		M/s.MW Kellogg, U.S.A.	Agreement
02	Convertor Retrofit	M/s.CEDCO, Baroda	D-8598 dt.17-2-93
		M/s.Ammonia Casale, Switzerland	Agreement
		M/s.Cat Tech.	Prdn.Deptt.job
03	HT/LT Coil Replacement	M/s.Petron Engg.	E-2053/B dt.24-09-93
		M/s.Murugappa ,Madras	D-8747 dt.26-09-92
04	101-JT Casing Repair	M/s.Delaval, U.S.A.	E-2781 dt.12-08-93
		M/s.L & T, Bombay	E-4885 dt.13-09-93
05	HEAT Exchanger opening & box up	M/s.Techno Engg.,Baroda	E-4159 dt.1-7-93
06	Hydrojetting of HE	M/s.Usha Hydrojetting	E-4156 dt.14-7-93
07	Manpower Supply	M/s.Techno Engg.,Baroda	E-4157 dt.07-7-93
		M/s.Saiyad & Co	E-4178/2 dt.11-9-93
		M/s.Sindhi & Co	E-4178/1 dt.11-9-93
08	Insulation	M/s.Balaji Insulation	E-4154 dt.21-6-93
09	Painting	M/s.Teacon Coating,B'bay	E-4155 dt.11-6-93
10	Services of Delaval Expatriate for O/H of Delaval Machines	M/s.IMO Delaval,U.S.A.	E-2773 dt. 5-7-93 E-4186 dt. 15-4-94
11	CO2 Absorber (101E)	M/s.L & T , Bombay	E-4898 dt.21-10-93

MAIN MAINTENANCE JOBS CARRIED OUT BY OUTSIDE AGENCIES 12

SR. NO.	JOB	CONTRACTORS NAME	W.O.NO. & DATE
<b>(B) PLANT : UREA</b>			
01	H.P.C.C.Replacement	M/s.E.C.C.Bombay.	E-654 dt. 28.12.92
02	Replacement of Autoclave liner	M/s.L & T,Bombay	E-4715 dt. 23.7.93
03	Testing,Repairing of Relief Valves.	M/s.Moorco India	E-4716 dt.04-08-93
04	Erection of Gear box of P B Compressor	M/s.Elecon Engg. Anand	D-9138 (P.O) dt. 24.1.92.
05	HP Vessels Insp.	M/s.Stamicarbon bv Netherland	Agreement dt.03-09-93
<b>(C) PLANT : OFFSITE</b>			
01	Repair of Cooling towers	M/s.Paharpur Cooling towers,Baroda	D-8680 dt. 29.11.91
02	Repair/Servicing of sluice gate	M/s.JASHI Engg,Indore	D-8687 dt. 16.1.92
03	Flood Coating of FRP Storage Tank.	M/s.Sunrise Industries Baroda.	D-4508 dt. 10.5.93
04	Overhauling of R.A.H. BHEL Boiler.	M/s. BHEL	D-4522 dt.31.5.93
<b>(D) PLANT : B &amp; MH</b>			
01	Servicing of Reclaim machine	M/s.EMTICI Engg.Ltd, Anand	E-5004 13-09-1993
02	Manpower supply for Reclaim m/c O/H	M/s.Nayan Engg.,Baroda	E-5004/B-1 13-09-93
03	Replacement of Naphtha tank roof	M/s.Technocon Engg.	E-2493/B
<b>(E) PLANT : INSPECTION</b>			
01	Ultrasonic Radiography, Magnetic particle checking,Welding thickness measurement etc.	M/s.N.D.T.Services, Ahmedabad.	E-4008 dt.23-07-93
<b>(F) PLANT : CIVIL</b>			
	Inside painting of Prill Tower	M/s.Arien New Delhi Pvt.Ltd,New Delhi	E-4057/SD dt.29-7-93

AMMONIA PLANTMECHANICAL JOBS

JOB CODE

JOB DESCRIPTION

01 12 01

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 \*REFORMER REVAMP\*  
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(A) PRE-SHUTDOWN ACTIVITIES

- (01) Harp installation tracks were made ready below reformer at grade level.
- (02) Beams for hanging scaffolding were made ready. Qty. 60 Nos
- (03) Wire ropes in required size were cut and tied to the hanging scaffolding with the help of bull dog clamps..
- (04) Fabrication below the bottom floor for facilitating rolling of harp was done.
- (05) Arrangement for supporting of harp section from top was fabricated (flange + Pipe ) Qty. 16 Nos.
- (06) Inlet manifold was prefabricated after collecting its two halves from store. - Qty. 8 Nos
- (07) Insulation of all new pigtails was carried out leaving 10" from both ends. Qty. 336 Nos.
- (08) Flushing of new pigtails and inlet manifolds was carried out.
- (09) Lifting beam + Clamping beams for harp section were fabricated.
- (10) New spring supports were collected from stores & were assembled. Quantity 126 Nos.
- (11) Penthouse roof (50% towards polisher unit) and vertical asbestos sheet was removed.
- (12) Hillman rollers were collected & serviced.
- (13) Fit up clamps for outlet manifold welding were fabricated.
- (14) Patch plates for bottom "I" beam were prefabricated.
- (15) Screw support for bottom "I" beam were prefabricated and installed.

- | JOB CODE | JOB DESCRIPTION   |
|----------|---|
| (16)     | Screw support for "I" beam at bottom were installed. Qty. 48 Nos.   |
| (17)     | Clamps for riser welding were be prefabricated.   |
| (18)     | Removal of insulation of pigtails from where it was to be cut was done during cooling down period.  |
| (19)     | The electrically operated winch near 101-C was overhauled and made ready for shifting material to the pent house and from the pent house to ground level. |
| (20)     | 1 No pulley was installed on East side of reformer for shifting material with the help of rope to & fro from pent house.                                  |
| (21)     | The marking of crane center line was done for moving the crane during harp erection.  |
| (22)     | A radiant tube rack was shifted to place near laboratory building for ease of harp section handling during erection.                                      |
| (23)     | All the harps were inspected for any weld defects & defects found were repaired by weldors of M/s.S & C at site.  |
| (24)     | 10 No bent tubes & 1 No bent riser tube were replaced with new ones from spares. These tubes were found bent during transit.                              |
| (25)     | All catalyst tubes were checked by Eddy current testing and the base data was obtained for further records.   |
| (26)     | The catalyst was filled to required level in all the new catalyst tubes.  |

01 12 01 (B) SHUTDOWN ACTIVITIES :

ABSETOS CORRUGATED SHEET REMOVAL

Half portion of the total A/c sheets of the reformer roof was removed from the control room side. This was done for making way for harp removal and installation from the top.

REMOVAL OF INSULATION OF PIGTAIL, TUBE AND TUBE CAP

The insulation of inlet manifold was removed at the weld joint near the cross over pipe. The hysil blocks used for insulation of catalyst tube top portion were also removed.

JOB CODE

JOB DESCRIPTION

The pigtail insulation was removed only at two places - One at the vertical portion coming out from inlet header & second near the catalyst tube to pigtail connection. All these removal was done during the cooling down period. Priority was given to row No.1 & 3 as these harps were tube removed first.

#### LOCKING OF SPRING HANGERS

Spring hangers of all old catalyst tubes were locked before taking out from their position so that their removal is easier. Spring hangers of transfer line were also locked for ensuring the same position of transfer line during riser welding. Locking of transfer line spring hangers was done before draining of water jacket.

#### FIXING OF SP-39 TRC - 10 BLINDS

On clearance from operation deptt., blinds were fixed in valve (SP-39) & valve (TRC-10) for giving clearance for entry into the reformer and for cutting and welding on the pre.parts of reformer.

#### REMOVAL OF TUNNEL BURNERS

All the nine tunnel burners were removed. This was done for proper ventilation inside the furnace and for making way for removal of floor and tunnel bricks through the opening of tunnel burners.

#### REMOVAL OF ARCH BURNERS FOR LIFTING OF SUSPENDED SCAFFOLDING

There are nine rows of burners in the pent house, each having fourteen burners. Six burners were removed per row for lifting of suspended scaffolding through their openings. Burner nos removed for this purpose were 1,5,6,9,10 and 14. These burners were removed on priority for hanging suspended scaffolding. However all the other burners were also brought to ground floor for complete overhauling. Again priorities were given from row No.1 to 8 during burner removal.

#### FIXING OF BOTTOM SUPPORTS

Structure of reformer was supported at 48 places from bottom by screw jacks. This was done as per the location plan made for the scw jacks. Because of this the load of the harps which was to come on the reformer floor sheet was transmitted to the foundation via these screw jacks.

JOB CODE

JOB DESCRIPTION

CUTTING OF PIGTAILS AND GUIDE PLATES

Every old pigtail was cut at two places. At top it was cut in the vertical portion just coming out from the inlet header and at bottom it was cut just near the catalyst tube. All guide plates of the tubes were removed by grinding the tackwelds for making way for rolling and removal of the harps.

MANHOLE OPENING

Manhole of the reformer as well as that of the convection zone were opened at 10 AM on 14th Sept. and entry into the furnace was obtained.

TUNNELS & FLOOR BRICKS REMOVAL

Just after the entry into the furnace, following clearances were measured.

- i) Clearance between refractory wall and both the ends of outlet manifolds of each harp.
- ii) Clearance between outlet header insulation and floor bricks at three positions for all the rows.

After recording the above clearances, the floor bricks and tunnel removal started. The bricks were removed from tunnel burner openings. Also an opening was made in wall No.3 of reformer for facilitating material removed & insertion. The size of this opening was around 2 mtr. x 2 mtr.

LIFTING OF SUSPENDED SCAFFOLDING

Rectangular frames were made in four different sizes, to cover the entire area under the arch roof.

- i) 14' - 4" x 3' - 4 Nos
- ii) 14' - 4" x 4' - 14 Nos
- iii) 13' - 4" x 3' - 2 Nos
- iv) 13' - 4" x 4' - 7 No

These were made of ISA 40 x 40 x 3 angles and covered with 1.6 mm thick. C.S. / G.I sheets. 8 MM size wire rope was tied to these frames with the help of bull dog clamps at 4 places where hooks were welded onto them. This was done in advance.

These scaffolding were entered into the furnace through an opening made in the centre of wall no.3. All these zoolas were then slid from the gap in between the outlet header and reformer floor to their respective positions.



JOB CODE

JOB DESCRIPTION

These were then pulled upto 6 1/2 feet below the arch roof plate with the help of pulley and manila ropes through the burner openings. The slings were then fixed on the hooks of the channels put on the burner openings with the help of 1 ton D - Shackles. Thus the load of these zoolas was transmitted on the angles which are supporting the arch burners.

#### DRAINING THE WATER JACKET

Water jacket for secondary reformer transfer line and risers of the primary reformer is common. The water inlet is from the secondary reformer. The water which circulates in the water jacket was drained after cooling down the secondary reformer. It was ensured before draining the water jacket that the transfer line spring hangers were locked in their position.

#### REMOVAL OF OUTLET HEADER INSULATION

Outlet header insulation was removed completely and again clearances were taken at following places.

- i) Between refractory wall and harp ends
- ii) Between outlet header and reformer floor at three places in each row.

#### SUPPORTING OUTLET HEADER FROM BOTTOM

Each o/l header was supported at six places on wooden slippers. These slippers were kept on the reformer floor, below the O/L header and just on the I - beam of the structure of reformer floor so that the load of the harps on removal of spring hangers does not come on the sheet of the reformer floor. All the slippers were placed in such a manner that every harp was supported equally at two places.

#### REMOVAL OF ARCH INSULATION

The arch panel insulation removal was done by M/s.Orient Cerwool Ltd.They removed the insulation of complete arch progressively. Again priority was given to row 1 to 8.While removing the insulation adjacement to the side walls about 6" insulation of side wall was also removed at all the places.

#### REMOVAL OF ARCH PANELS

All arch plates which were made of C.S. of replaced with SS 304 plates. This job was carried out by M/s.J.M.Engrs.A'bad First priority was given for removal of arch plates panels around the harps. After these were completely removed, complete arch plates were removed begining from row No.1 to 8 by cutting hanger rods by Oxy-acetylene flames.

JOB CODE

JOB DESCRIPTION

CUTTING OF OULET HEADER & DRAIN AS WELL AS THERMOWELS

The o/l manifold of each row was cut into three sections by cutting with cut rods at the weld joints. Also the 3 Nos protective sleeves and 1 No drain as well as 2 Nos thermowel connections were cut for the removal of harps.

REMOVAL OF OLD SPRING HANGERS :

For removing old spring hangers, each harp was pulled up with the help of 2 Nos, 5 Ton chain blocks. After lying the harp the spring hanger rods were cut by Oxy-acetylene flame and the harps were again lowered on either wooden slippers or on Hilman rollers. The free old spring hangers above section "C" of harp were removed alongwith the beam on which they were hanging as this beam was in any case required to be removed for facilitating harp removed from top. All 176 Nos spring hangers were removed and replaced by new ones.

RISER CUTTING AND ITS WELDING JOINT PREPARATION :

The riser of each harp was cut from the joint just below the transition cone assembly and above the RE-10 piece. This cutting was done with the help of porta tube cutting machine 2 No machines were deployed for simultaneous cutting on 2 risers. Also the excess length of all new risers was cut with the help of porta tools. A reference mark was made on riser for elevation. This elevation was transferred from reformer floor's known elevation. For all other risers reference mark was transferred by water level and marking was made for old riser cutting.

All new risers were also supplied with extra length of @ 100 MM. These were cut to maintain the elevation of outlet manifold as specified in the drawings after welding.

HARP REMOVAL AND INSTALLATION

Unlike Revamp - I, the harp removal & reinstallation during Revamp-II was carried out from top of the reformer. The basic advantages of changing the mode of erection were as follows.

- (a) To save the time consumed in catalyst filling in new catalyst tubes as it can be done as a pre-shut down activity, in case of harp installation from top of the reformer.
- (b) Ease of harp removal and installation
- (c) To save time of side wall (wall no.3) cutting & its refractory work.

JOB CODE	JOB DESCRIPTION
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- (d) To have maximum parallel activities like harp removal installation, rise welding, pigtail welding, arch insulation etc.

For harp removal/installation from top of the reformer, the basic idea was to cut one row of old harp in three segments i.e. section "C" (North side) section "B" (Middle) and section "A" (South side). Then harp section "C" was straight away lifted from the top by crane and thereafter other two segments were rolled to the furnace. The reinstallation of the harps was done in the exactly reverse manner.

For rolling the old harp sections to the position of harp section "C" the harp section "A" & "B" were lowered upto the grade level by removing the reformer floor below the harp row and by cutting its supporting cross beams.

A channel of ISMC 175 was supported just below each harp row in which Hilman rollers were placed. The harp section "A" & "B" were lowered straight away from spring hangers on 2 No. Hilman rollers and then were pulled with the help of pult lift of 3T capacity to the position of Harp section "C" from where it was lifted by crane and the crane boom was swung to 180 degree. Crane was then marched towards radiant tube rack and the harp section was lowered into it. First all three harp sections of a particular row were removed in this manner.

For installation of new harp sections, the new harp section "A" was lifted first from the radiant tube rack, the crane was then marched to its, position the boom was swung to 180 degree and the harp section was lowered on the Hill man roller at the position of harp section "C" of that particular row.

A pull lift of 3 T capacity was installed on the bottom beam towards south end of the primers reformer and the harp section "A" was pulled into its position by it. Meanwhile the crane marched back to radiant tube rack and lifted the harp section "B" and again came back in front of the respective row and lowered the harp section "B" on Hillman rollers in position of harp section "C". The harp section "B" was then pulled to its respective position.

Finally harp section "C" was inserted into the reformer. Orientation of pigtail position on harp was checked while inserting all three segments, Following sequence was followed for installation of harp rows consisting of three harp sections each.

JOB CODE

JOB DESCRIPTION

1 - 2 - 3 - 4 - 5 - 6 - 7 &amp; 8

THIS SEQUENCE WAS SPECIFICALLY ADOPTED FOR GIVING CLEAR FRONT FOR ARCH INSULATION IN MODULES. For proper marking of stud position on arch plates for fixing modules, it was required to have all arch plates to be in position from either wall No.1 (west side) or wall No.3 (east side), hence it was decided to install the new harps in a sequence from row no.1 to row No.8 so that all following jobs like riser welding burner block fixing arch plate fixing and insulation etc. can be progressively done from wall No.1 and further all the activities related with harp of row No.8 can be completed simultaneously.

After all the new harp section of respective row were installed immediately the floor plates below it were placed into respective position after lifting the harp sections on spring hangers. Also floor beams beneath the floor plates were welded back into position.

Crane used for harp installation was of following specification.

TYPE - HM 101 MB  
 Boom length - 140 feet  
 Radius - 41 feet  
 Counter weight - Maximum

#### FIXING OF SPRING HANGERS

This was done in parallel to the harp installation. All the new spring hangers and their stir-ups were hanged. Then the harps were lifted up with the help of 5 Ton chain block so that the stir-ups were hooked up below the trunions on catalyst tubes and wooden slippers or Hilman rollers, below the harp section were removed. Now the harps were freely suspended on the spring hangers.

#### ALIGNMENT AND WELDING OF O/L MANIFOLD

For alignment of outlet manifold following steps were followed.

Firstly the riser harp was centered under the transition cone assembly. The verticality of the spring hanger rods were brought nearest to plumb line. Then the riser harp was lifted to make approx. weld gap of 5 MM by putting hydraulic jacks below it and by turning spring hanger rods. Thenafter the spring settings of spring were also brought to appx. 937 Kgs keeping the weldgap of 5 MM. (The best way to do this is by keeping the spring hangers in locked conditions to the set load i.e.937 Kgs)

The water level of D/C section of stack section was brought to 0 (Max. permissible is (+) 10 MM per 2500 MM length. Lifting spring hangers with the help of spring hanger rods and not by turning top buckles.

The river section here was then blocked from bottom by welding other side / beams to floor plate so that it does not go out of alignment.

Now river section "A" and berg section "C" were lifted / lowered with the help of spring hanger rods / top buckles with their outlet manifold attached with that of berg section "B".

To make proper welds of 3.5M the berg section "A" & "C" were then moved towards / away section "B" by pushing the spring hanger / top rods of respective section. This was done by maintaining verticality of each individual hanger rod. After making proper welds both the berg sections were blocked for any movements.

Water level was again made 0 - 0 for the complete length of outlet manifold (around 12 meters) Max. permissible water level is (+) 10 MM / 2500 MM length.

While altering the bergs the catalyst tube springs were not to get slipping / bad settings and their settings were maintained while moving hence for weld fit ups.

As the work was over, soluble paper tags were prepared against the berg ends, purging tube was pulled from the still (point and root pass was carried by TIG welding). ER 6170 Co filler wires supplied by

Following steps were carried out for outlet manifold welds.

- (1) D.P. check & radiography of root run
- (2) D.P. check & radiography of final run

### RAISE THE HARP AND WELD THE RISER

Before the harp could be raised, the entire core was raised to match the old joints of riser tube to transition into assembly. This raise was done with the help of jacking rods. Before proceeding for welding after raising the joint, following points were checked.

- That the riser is vertically plumb to (+ -) 12 MM top to bottom.
- That the transfer line water jacket and secondary reboiler water jacket are filled up with water to the operating levels or the transfer line spring hangers are locked.
- That the catalyst tube spring load settings are set to required load settings after raising the entire harp by means of turn buckles for weld fit up and the weight of riser tube is equally distributed on all spring hangers.
- That the vertical clearance of manifold to floor and lateral clearance of manifold to wall is as specified.

After checking above points, riser welding was completed by TIG welding. The filler wire used was UTP 6170 Co. All the riser were checked by following inspection.

- D.P. Check & radiography for root pass
- D.P. Check and radiography for final pass.

### WELDING OF RISER INSULATION CAN

The insulation of riser (top portion) was applied and the same old insulation can of SS 316 was rewelded to cover this insulation. All the joints of riser insulation can were carried out by arc welding and were inspected by dye penetrant test.

### PLATES REPLACEMENT OF INLET MANIFOLDS

All the old inlet manifolds were replaced by new inlet manifolds of ASTM A 305 P 11 material and Sch. 80. These new manifolds were supplied in two halves by M/s. SIVV, Vishakhapatnam. The weld joint between these two valves was done at ground level. The root welding was carried out by TIG welding and final welding was done by arc welding. Following inspection were done for the welding of inlet manifold.

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JOB CODE                      JOB DESCRIPTION

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- (01) D.P.check & radiography for root welding
- (02) D.P.check & radiography for final welding

Finally the joint was stress relieved by heating at the rate of 50 degree C / hr upto 720 degree C & cooling at the rate of 50 degree C/hr upto 300 degree C & then cooling under insulation till 100 degree C.

All the inlet manifold were erected in a single piece with the help of one crane and 1 No chain block and 1 No. pull lift.

**REPLACEMENT OF ARCH PLATES**

The old C.S.arch plates were completely replaced by new ones made of SS 304.The design of arch plates was the same as old except the change of material.

Firstly all the old arch plates around all the 8 Nos Harp rows were removed for facilitating harp erection. Then after rest of the old arch plates were removed by cutting hanger rods, installation of new arch plates was done starting from wall No.1 to wall No.3 . This was done to facilitate arch insulation fixing from one wall.The arch plates around the harp rows were fitted after riser welding of particular harp was over.The arch plate around the riser was the last to be fitted after welding of riser insulation can. This job was done by M/s.J.M.Engineers, A'bad .

**ARCH BURNER OVERHAULING & BURNER BLOCK REPLACEMENT**

All the 126 Nos arch burner assemblies were brought down to ground floor and taken to the shed for overhauling. Before removing from the position all these burners and their connecting lines were properly tagged and then removed so that no problem of thread matching is faced while refixing the same.

The burner assemblies were dismantled and following jobs were done.

- (01) All naphtha guns were removed,cleaned & prepared for reuse.
- (02) All pilot burner tips were cleaned, missing pilot burner tips were replaced.
- (03) Pilot burner bracket, wherever missing or burnt were replaced with new ones.

JOB CODE

JOB DESCRIPTION

- (04) All gas burner tips and burnt feed pipes were replaced with new ones. The hood to which gas burner feed pipe is connected was also removed cleaned and fixed back.
- (05) Secondary air registers of all 126 Nos burner assemblies were roused and made free.
- (06) All 126 Nos muffle blocks were inspected for any damage. Around 25 Nos muffle blocks were fabricated in W/s and casting of refractory was done in civil section and replaced.
- (07) All mounting blocks for naphtha gun were inspected and if required were replaced with new ones.

After overhauling all these burner assemblies, the burners were fixed back into position.

WELDING OF GUIDE PLATES

Guide plates of a particular row were welded after fixing of its arch plates and fixing of tube insulation below the guide plates. Proper clearances as per the drawings were kept between guide plates and catalyst tubes. This was for taking up the expansions of the harp.

PIGTAIL WELDING

Every pigtail was welded at two positions. Upper joint welding was done between the pigtail socket (already and pigtail welded to Inlet manifold) while lower joint welding was done between the pigtail and catalyst tube. Both the fillet weld joints were inspected by dye penetrant testing. Also the verticality of pigtails was checked by plumb while welding.

WELDING OF DRAINS, THERMOWELLS & THEIR PROTECTIVE SLEEVES

All the drain points and thermowells were welded to the outlet manifold. Root pass and final welding for both drain line and thermowells was done with TIG welding. This was also dye tested. After welding all these three points, their protective sleeves were also welded by TIG welding.

For the drain valve welding, root pass and final welding was welded with TIG. This root pass, as well as final pass of all these joints were inspected by dye penetrant test. The root pass for drain pipe was also inspected by radiography. The guide plates were also welded on the reformer floor for guiding the protective sleeves.



JOB CODE

JOB DESCRIPTION

### REORIENTATION OF BURNERS

Reorientation of all Arch burners was done to avoid direct impingement of the flame of burner on catalyst tubes. Burner row Nos. 1 to 5 were already reoriented till Sept 93. Rest 4 rows (ie Row No.6,7,8 and 9) were to be reoriented during the Revamp turnaround. This job was awarded to M/s.Radiant Engrs.,Baroda.

All the burners assemblies of these rows were removed from their position & their orientation was changed by 90 degrees and after overhauling the same were again fitted back into the new position.

Before fitting the burner assemblies in all rows the new burners blocks were fitted into position. The new burner blocks are vacume formed ceramic fibre type in S.S. frame & are supplied by M/s.Orient Cerwool India Ltd, Bombay.

### INSULATION OF ARCH PLATES

The job of removal and installation of Arch plate insulation was awarded to M/s.Orient Cerwool India Ltd, Bombay. They did the job in following phases.

- 1) Removal of old insulation
- 2) Marking for location of studs
- 3) Welding of studs for fixing insulation
- 4) Wrapping of insulation blanket around S.S. plates of burner blocks for proper packing around the new burner blocks.

### REMOVAL OF SUSPENDED SCAFFOLDING

All the suspended scaffoldings were lowered on the reformer floor after completion of arch insulation by means of pulleys and manila rope and then removed out of the furnace from the cut portion on bottom floor of reformer furnace. After removal of suspended scaffoldings from the furnace, the plate cut for thier insertion was rewelded.

- 5) Installation of 1" thk. insulation blanket on arch plates.
- 6) Insulation of 8" thk.insulation modules on Arch plates.
- 7) Finishing of insulation modules and application of ceramic fibre packings for filling the gaps.

All these jobs were done sequentially from row no.1 to row No.8 of harps as soon as the clearance was obtained.

JOB CODE

JOB DESCRIPTION

AIR BLOWING

After all the harps & pigtails were erected, they were air blown by running air compressor. All individual catalyst tubes were individually blown by opening their tube top plugs one by one. Then individual harp was blown by opening end plugs of individual inlet manifolds.

All catalyst tube top plugs were finally boxed up after air blowing was done. Also hot tightening of all the bolts of catalyst tube top plugs was carried out during start up.

Leak test of burner connecting lines was done by charging Naptha lines of individual rows of burners by pressurising the same by I.G. The leaking union joints, threaded pipe line joints were then tightened to attend the leaks found.

D.P.CHECKING OF CATALYST TUBES

The differential pressure drop inside each catalyst tube was checked again in the erected condition. The catalyst tube was unloaded again if required and loaded with new catalyst till the differential pressure across it was found O.K. All the catalyst tube were boxed up after the D.P.checking.

LEAK TEST

The system was charged with I.G.for leak test of pigtail weld joints, catalyst tube flanges and inlet header end flanges. During the leak test 2 nos of pigtail weld joint were found leaking which were repaired and dye tested. Leak points of all the flanges were also attended.

FIXING BACK ALL THE REFRACTORY

The floor refractory was laid down again. Also the tunnels were prepared. The damaged portion of the wall refractory was also repaired. Proper care was taken to build the tunnels as per drg.

FIXING BACK ALL THE INSULATION

The insulation of all the tubes, pigtails and inlet manifolds was carried out. The insulation of pigtails was carried out progressively, leaving the portion of weld joints uninsulated for leak test. These parts were insulated after repairing the leak points, found during the leak test. The outlet manifold was also insulated by dry and wet cerafelt. Following thickness were kept for insulation of different parts pigtails.

JOB CODE

JOB DESCRIPTION

- i) 3" thk. Inlet manifold
- ii) 5" thk, Catalyst tube top portion
- iii) 2" thk, O/L manifold
- iv) 2" thk Grills were kept on the walkways in pent house after completing the insulation work. Insulation blanket used was OCIL dry ceramic fibre blanket of 1" thk. & 128 kg/cm<sup>3</sup> density. The insulation (drg. as well as wet) material for O/L manifold was supplied by M/S. Lloyds, Bombay

#### FIXING OF TUNNEL BURNERS

Tunnel burners were fixed when all the refractory work inside the furnace was over. Care was taken to see the concentricity of the burner blocks with burners. Also some of the burner blocks which were damaged were casted by civil section and replaced.

#### HARP BALANCING

All the catalyst tube springs were set to their net spring load settings for final cold harp balancing. This was done by pulling up or lowering down the catalyst tubes from turn buckles of their spring hangers. Again the same readings were obtained after stabilising the plant.

#### FINAL INSPECTION AND FURNACE BOX UP

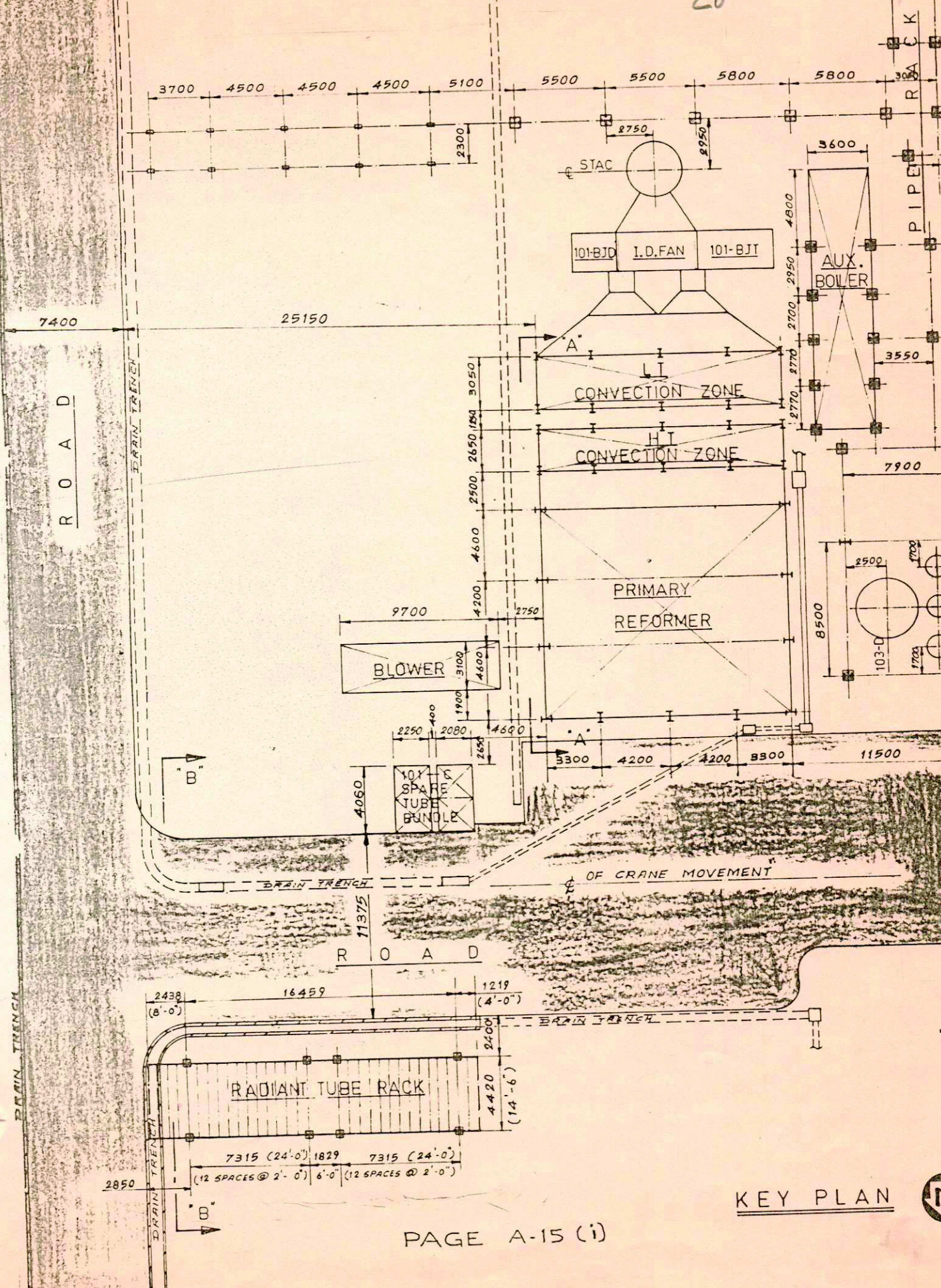
Before boxing up, the reformer furnace was checked for following :

- a) The condition of outlet manifold insulation
- b) Floor refractory wall refractory and tunnels
- c) Clearance between outlet manifold ends & furnace walls
- d) Clearance between O/L manifold & floor refractory

After checking all these, the furnace was boxed up on 12th October, 1993.

#### REFERENCE DATA & DRAWINGS :

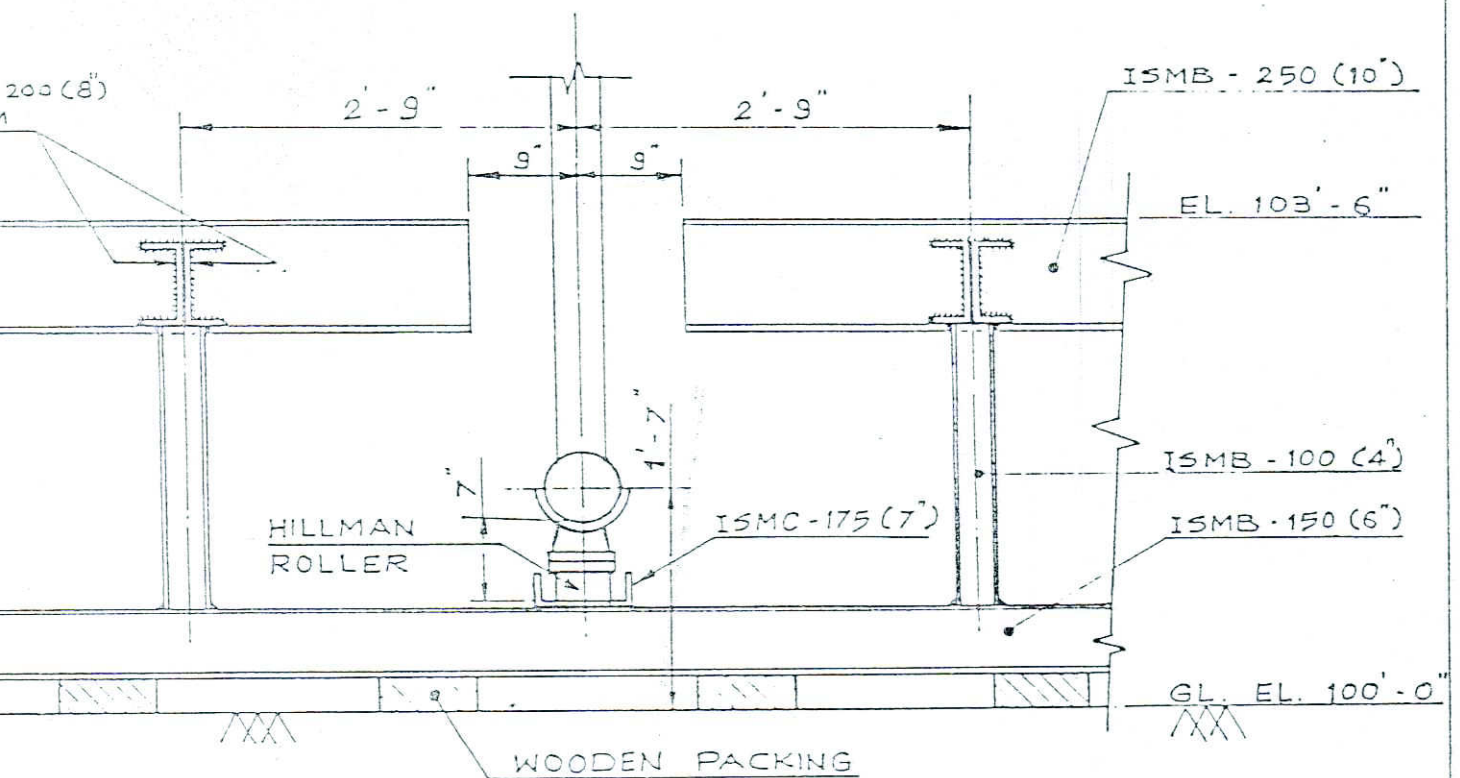
- 01) Key plan Page No. A-15 (i)
- 02) Supporting arrangement for Harp Assy. Page No. A-15 (ii)
- 03) Final Schematic Rigging arrangement for Harp Assy. Page No. A-15 (iii)
- 04) Electrodes & Field weld details for Reformer Harp Assy. No. A-15 (iv)
- 05) Dimension / Material data for Revamp - I & II (2 sheets) No. A-15 (v)
- 06) Chemical composition of catalyst tube & outlet manifold No. A-15 (vi)
- 07) Details of welding electrodes for Harp assy. Page No. A-15 (vii)



KEY PLAN

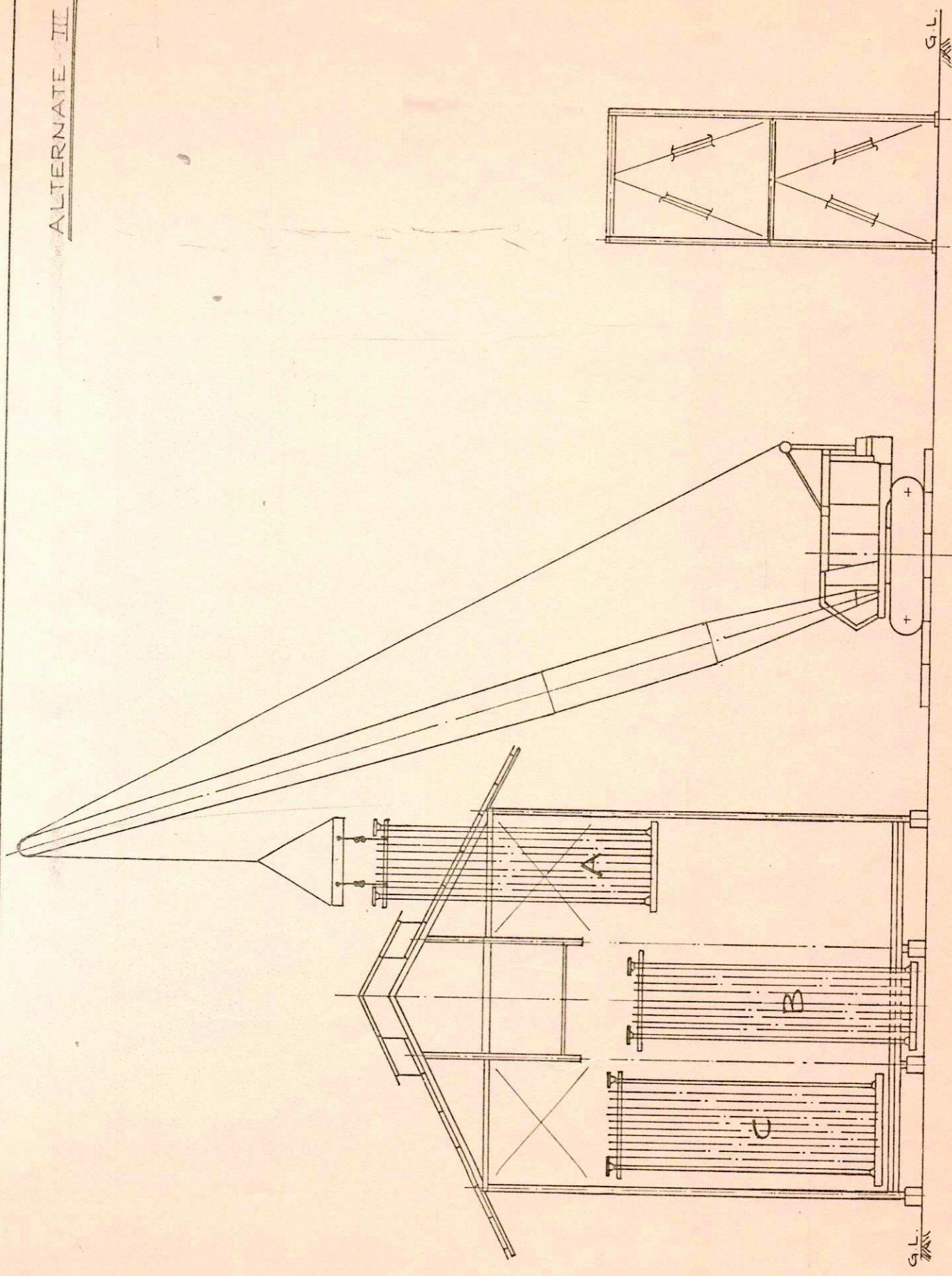






SUPPORTING ARRANGEMENT OF B & C SECTION OF  
HARP ASSEMBLY WHILE SHIFTING THE SAME  
TO POSITION A-SECTION

ALTERNATE - III



FINAL SCHEMATIC RIGGING ARRANGEMENT REVAMP - II

JOINT No.	FILLER WIRE		COATED ELECTRODE		REMARKS
	Ø	AWS No.	Ø	AWS No.	
A	2.4 3.2	ERNiCr-3	2.4 3.2 4.0, 6.0	ENiCrFe-2	
B, I	2.4 3.2	FILLER WIRE WITH COMPOSITION MATCHING THE BASE MATERIAL	2.4 3.2 4.0 5.0	ELECTRODE WITH COMPOSITION MATCHING THE BASE MATERIAL	
C, G, J	2.4 3.2	ERNiCrCoMo-1	2.4 3.2	ENiCrCoMo-1 (INCO 617)	INCO 617 / INCO 117
P	2.4 3.2	FILLER WIRE WITH COMPOSITION MATCHING THE BASE MATERIAL AS AN ALTERNATE, ERNiCrCoMo-1 (INCO 617)	2.4 3.2 4.0	ELECTRODE WITH COMPOSITION MATCHING THE BASE MATERIAL AS AN ALTERNATE, ENiCrCoMo-1 (INCO 117)	
E, K, X	2.4 3.2	ERNiCrCoMo-1	2.4 3.2	ENiCrCoMo-1	INCO 617 / INCO 117
H	2.4 3.2	ERNiCrCoMo-1	2.4 3.2 4.0	ENiCrCoMo-1	INCO 617 / INCO 117
Q1, R1	2.4 3.2	ERNiCr-3	2.4 3.2 4.0	ENiCrFe-2	
Q2, R2	2.4 3.2	ERNiCrCoMo-1	2.4 3.2 4.0	ENiCrCoMo-1	INCO 617 / INCO 117
Q3, R3	2.4 3.2	ERNiCrCoMo-1	2.4 3.2 4.0	ENiCrCoMo-1	INCO 617 / INCO 117
M, N, O, P, S, L	2.4 3.2	ER80S-B2	2.4 3.2 4.0, 6.0	E 8018-B2L	
C1, K1, T, Z, Q5	2.4 3.2	ER 80S-B2	2.4 3.2 4.0, 6.0	E 8018-B2L	

FIELD WELD JOINTS: D, Q1, R1, Q2, R2, Q3, R3, H, S, Z1, L, C2

**INDIAN FARMERS FERTILISER CO-OP. LTD. KALOI**

NAME: PLANT AMMONIA EWR NO. \_\_\_\_\_

DRN: PANCHAL, 27.7.92

CHD: \_\_\_\_\_

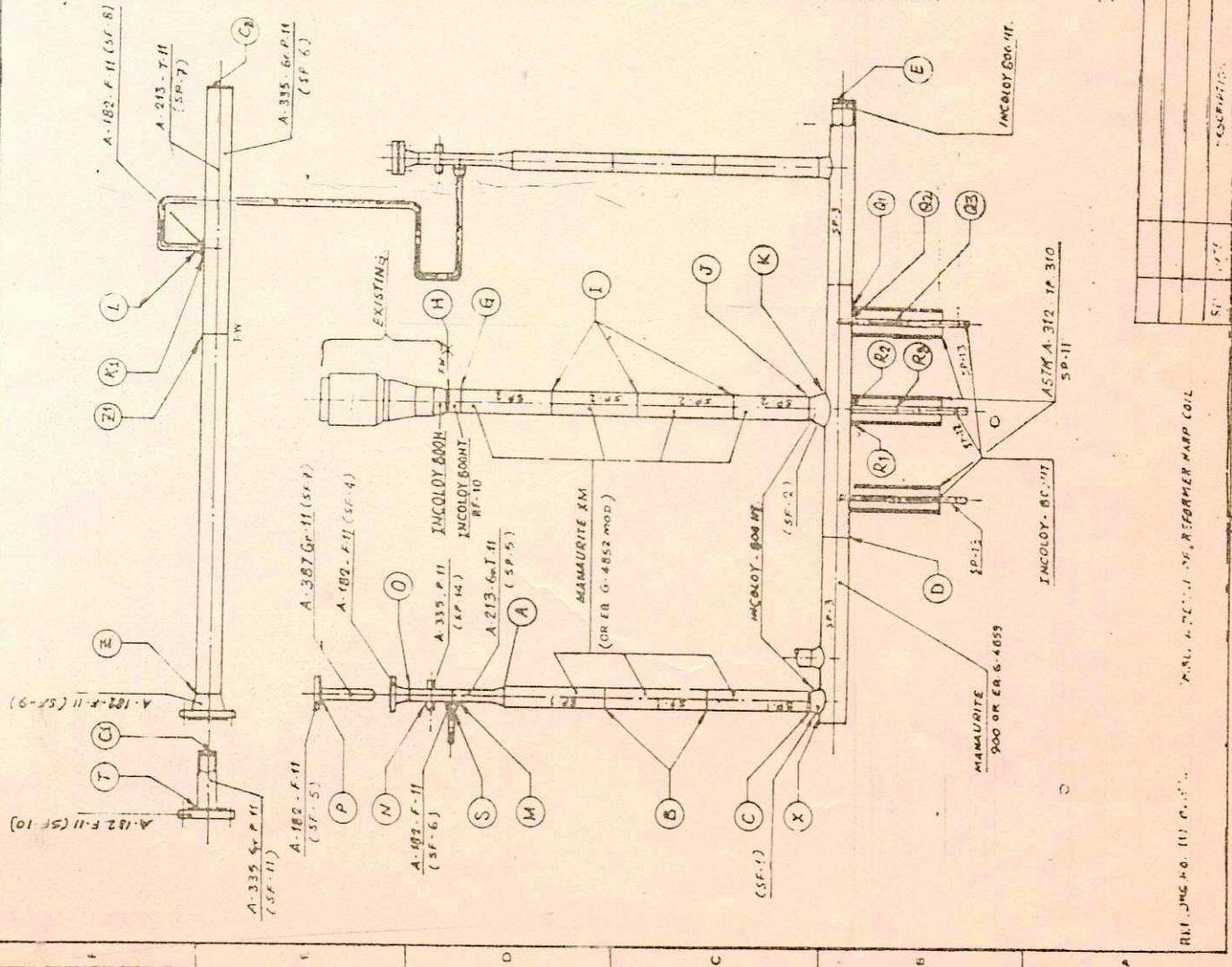
APD: \_\_\_\_\_

SCALE: ~

**REQUIREMENT OF ELECTRODE FOR REFORMER HARP ASSEMBLY AND FIELD WELD DETAILS.**

PLANT FORM NUMBER: (DL) 13335X3 (1) 0

DRAWING NO. \_\_\_\_\_



REF. JMC NO. (1) C. 11



CHANGES TO BE MADE DURING REVAMP - II

REM-II

SR NO	COMPONENT	R E V A M P - I		R E V A M P - II	
		MATERIAL	SIZE	MATERIAL	SIZE
01	CATALYST TUBE	ASTM A 351 GR. HK 40	2.91" I.D. X 0.615" MSW (MACHINED I.D.)	6 4852 (Mod.)	82 ID X 12 MSW X 9550.4 LG
02	TOP	ASTM A 106 Gr. B	3 1/2" OD X 0.571" AW X 3" .7 - 5/8" LONG	ASTM T-213, T 11	101.6 00 X 12.7 MA
03	TRUNNION	ASTM A 106 Gr. B	2 1/2" x SCH. 40	ASTM A 335, P 11	2 1/2" NPS X SCH. 40
04	TUBE FLANGE	ASTM A 105	3 1/2" X 600 # RF/AN SI B 16.5	ASTM A 182, F 11	3 1/2" X 600 # RF/AN SI B 16.5
05	TUBE BLIND FLANGE	ASTM A 105	3 1/2" X 600 # RF AN SI B 16.5	ASTM A 182, F 11	3 1/2" X 600 # RF AN SI B 16.5
06	SOCKOLET FOR PIGTAIL	ASTM A 105	3/4" X SCH. 40 X 3000 #	ASTM A 182, F 11	3 1/2" X 3/4" X SCH. XXS
07	RISER TUBE	ASTM A 351 Gr. HK 40	3.6" I.D. X 0.787" / 0.8125" MSW (MACHINED I.D.)	6 4852 (MOD)	91.4 I.D. X 16.5 MSW X 9538 LG (MACHINED I.D.)
08	RISER TUBE TOP PIECE	ASME SB 564 INCOLOY 800H		ASME SB - 564 UNS 8811	91.4 I.D X 20.64 MSW X 266 LG
09	MANIFOLD	ASTM SB - 407 INCOLOY - 800 H	5.5625" OD X 0.72 MA	6 4859	141.3 00 X 18 MSW X 3975.1 LG & 4118.8 LG
10	WELDOLET (CAT. TUBE)	ASME SB 561	5.5625" OD X 4.25" OD X 0.72MA X 0.615 MA	ASME SB - 564 UNS 8811	141.3" X 4"
11	WELDOLET (RISER TUBE)	ASME SB 564	5.5625" OD X 5.25" OD X 0.72MA X 0.787 MSW	ASME SB - 564 UNS 8811	141.3" X 5"

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8-a

CHANGE TO BE MADE DURING REVAMP - II

SR NO                      COMPONENT                      R E V A M P - I                      R E V A M P - II

		MATERIAL	SIZE	MATERIAL	SIZE
12	GUIDE PIPE	ASTM A 312 Gr. 304H	4", XXS SCH	ASTM A 312 TP-310	4" X SCH. XXS X 500 LG
13	DRAIN PIPE	INCOLOY 800 H	1" X SCH. XXS	ASME SB 407 ( 800 HT)	1" X SCH. XXS X 500 LG
14	DRAIN PIPE PIECE	INCOLOY 800 H	1" X SCH. XXS	ASME SB 407 ( 800 HT)	1" X SCH. XXS X 122.6 LG
15	THERMOCEL PIPE	INCOLOY 800 H	1/2" X SCH. 80	ASME SB 407 ( 800 HT)	1/2" X SCH. 80 X 500 LG
16	TOP OF THERMOCEL	INCOLOY 600	N.A	ASME SB 407 ( 800 HT)	22 DIA X 205 L6
17	PIG TAIL	ASTM A 335 Gr. P. 11	3/4" X SCH. 40	ASTM A 213 , T 11	0.D. 25 MM X 11 SAG
18	INLET MANIFOLD	ASTM A 106 Gr. B	6" X SCH 160	ASTM A 335 , P 11	6" NB X SCH. 120 X 13473 L6

C H E M I C A L - C O M P O S I T I O N S

CONTENT	CATALYST TUBE		OUTLET MANIFOLD	
	G 4852 Mod. (Revamp-II)	A 608 Gr.HK 40 (Revamp-I)	G 4859 (Revamp-II)	INCOLOY 800H (Revamp-I)
CARBON	0.4%	0.35 - 0.45%	0.10%	0.050 - 0.10%
NICKLE	35%	19.0 - 22.0%	32%	30.0 - 35.0%
CHROMIUM	25%	23.0 - 27.0%	20%	19.0 - 23.0%
MANGANESE	1.0%	1.5% Max	1.5%	1.5% Max
SILICON	1.5%	0.5 - 2.0%	1.5%	1.0% Max
SULPHUR	-	0.040% Max	-	0.015% Max
PHOSPHURUS	-	0.040% Max	-	-
MOLYBDENUM	-	0.50% Max	-	-
NIوبيUM	1.5%	-	1.0%	-
COPPER	-	-	-	0.75% Max
ALLUMINIUM	-	-	-	0.15 - 0.60%
TITANIUM	-	-	-	0.15 - 0.60%
IRON	Balance	Balance	Balance	Balance

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DETAILS OF WELDING ELECTRODES FOR HARP COMPONENTS (REVAMP - II)

DETAIL OF MATERIAL	FILLER WIRE		COATED ELECTRODES	
	(Dia)	A W S NO	(Dia)	A W S NO
(1) P.11 to P.11	2.4 3.2	ER 80 S - B2	2.4 3.2 4.0 5.0	E 8018 - B2L
(2) G 4852 Mod to G 4852 Mod	2.4 3.2	Matching composition with Base metal	2.4 3.2 4.0 5.0	Matching Composition with Base metal
(3) G 4859 to G 4859	2.4 3.2	Matching composition with Base metal OR ER Ni Cr Co Mo - 1 ( Inco - 617 )	2.4 3.2 4.0	Matching composition with Base metal OR E Ni Cr Co Mo 1 ( INCO 117 )
(4) Incolloy 800 HT to G 4859	2.4 3.2	ER Ni Cr Co Mo 1 ( Inco 617 )	2.4 3.2 4.0	E Ni Cr Co Mo 1 ( Inco 117 )
(5) Incolloy 800 HT to G 4852 Mod		----- DO -----		----- DO -----
(6) Incolloy 800 HT to Incolloy 800 HT (RE 10-piece)		----- DO -----		----- DO -----
(7) P.11 to G 4852	2.4 3.2	ERNiCr 3	2.4 3.2 4.0	ENiCrFe 2
(8) SS 310 to G 4859		----- DO -----		----- DO -----

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JOB CODE	JOB DESCRIPTION
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01 12 02 \*\*\*\*\*  
 \*HT & LT CONVECTION ZONES COIL REPLACEMENT\*  
 \*\*\*\*\*

01 INTRODUCTION :

In the primary reformer of ammonia plant the flue gases after radiant section pass through convection zone. The temperature of the flue gases remain at around 1022 degree C. In convection zone 7 coils are located. After exchanging heat, the flue gases at around 220 degree C are vented to the atmosphere through reformer stack.

Out of 7 coils, mixed feed coil, steam air coil and HT S.S.H coil are installed in HT convection zone and LT steam super heat coil, BFW (Ammonia ) coil, NG feed preheat coil and BFW (Offsite) coils are installed in LT convection zone. Except BFW (Offsite) coil, all coils are in services since the commissioning of plant for over 17 years. The BFW (Offsite) coil was installed in April, 1986. The heat duty of BFW (Offsite) coil is around 7.2 geal/h. The temperature of three gas in reduced from 300 degree C to around 220 degree C after the installation of (Offsite) BFW coil.

In the mixed feed preheat coil, the temp. of mixed feed remains at around 460 to 490 degree C as against design temperature of 524 degree C. In the steam super heat coils, the superheated steam temp. remains about 415 degree C to 420 degree C which is below the design temp. of 440 degree C. They were found rusted and fouled with the soot and dust during inspection.

02 PROPOSED MODIFICATION :

In view of above, it was proposed to replace following 2 coils.

- 01) Mixed feed preheat coil
- 02) H.T. Steam super heat coil

Also it was proposed to install additional offsite boiler feed water coil, just below the existing coil to reduce the stack temperature.

JOB CODE

JOB DESCRIPTION

**03 COIL REPLACEMENT IN CONVECTION ZONE OF PRIMARY REFORMER**

The coil replacement / insertion job was awarded to M/s.SCIL, Bombay however the contractor regreted to carryout the job about 15 days before the zero date of the shutdown. Immediately M/s.Petron and M/s.ECC were contacted for execution of this job. Finally M/s.Petron Engineering, Bombay agreed to execute the job with one week notice period for mobilisation of crane, tools and manpower.

Some activities which were supposed to be carried out during pre-shutdown activities could not be carried out before actual plant shutdown.

For replacement of mixed feed coil and HT Super heater coil in HT section removal of roof was must and air and steam preheater coil was also required to be taken out and to be re-installed. Since all 3 convection coils will be out from HT section, it was planned to reinstalled the HT section walls and pannels with ceramic fibre blanket with protective shielding of 0.5 mm thck SS 310 material in place of existing castable insulation. This part of insulation work was awarded to M/s.Murugappa Morganite, Madras.

Ammonia plant was stopped at 2000 hrs on 12.09.93 and entry to convection zone was permitted at 0900 hrs on 14.09.93.

M/s.Petron's original offer was to carry out the job with the help of 1 Goliath Crane and one 75 ton capacity crane. However during shorter mobilisation period Goliath crane was not possible to get assembled before 30.09.93. Hence they planned the removal of HT superheater coil, Air steam preheater coil, Mixfeed coil and erection of BFW coil, Mix feed coil and Air-steam pre heater coil with the help of one no 127 type mounted crane and 1 no. 75 ton capacity P&H 955 crane.

Mixed feed preheater coil, HT steam superheater coil and new BFW coil were manufactured by M/s.L & T, Bombay. After receiving these coils at site all these coils were connected to 38 ata steam line suitable piping was fabricated from ammonia plant to the place of yard where these coils were unloaded. After thorough flushing of these coils for removal of suspected foreign material, dust and dirt were drained and flushed with air and nitrogen.

JOB CODE

JOB DESCRIPTION

The details of modification in material and specification of above 3 coils as also existing coil material are enclosed as Annexure - I at page A - 26 (i)

Total job was carried out with the detailed activities as mentioned below.

- 01) Manholes of L.T & H.T section & HOT well area were opened.
- 02) H.T.section header box panels and east side panels of HT section were removed.
- 03) The existing insulation (Ceremic fibre blanket) insulation below mix feed coil was removed.
- 04) Structures on the top of HT section roof including monorail for hoist were removed.
- 05) Linkages of damper between hot well duct and convection zone were dismantled, actuator for damper was also removed. Steel structure, plate of actuator was also removed.
- 06) Hot well flue gas distributor plate inside the convection zone was dismantled and removed.
- 07) Complete header box was dismantled in pieces and removed.
- 08) Temporary vertical supports of ISMC 200 supporting the roof of LT,HT duct were provided.
- 09) HT section north side vertical columns were joined with primary reformer structure by using ISMB 200 at 5 different places to avoid distortion of convection zone structure after removal of HT suction roof.
- 10) 16 Nos of lifting lugs were welded on top plate of HT section and top duct.
- 11) HT section roof along with top and one vertical portion of duct was removed in 4 pieces by separating the convection zone duct connected to hot well duct. Damper assembly was also removed along with the convection zone duct. This job was done at the elevation of 134' and 144' and dismantling was done with the help of HM 101 crane.

JOB CODE

JOB DESCRIPTION

- 12) Top duct plate, side plate and HT section top plates removed in 4 pieces were earlier also had ceramic fibre insulation with 0.3 mm thick protective shielding of SS 304 plate.

This area was re-insulated on ground floor with fresh insulating material and face shielding of 0.5 mm thick SS 310 plate.

- 13) HT section side wall (west side) both at EL 128' - 8 1/2" and 134' - 4" above the HT superheater coil was removed by gas cutting and crane HM 101.

- 14) North & south side castable insulation on the wall above the HT superheater coil was removed.

- 15) Lifting lugs of old HT.S.S.H.coil was inspected thoroughly by DP test and found okay.

- 16) H.T.S.S.H.coil inlet header was separated from L.T.section coil by removing a spool piece by gas cutting.

- 17) HT S.S.H.coil outlet header was separated from inter connecting piping by gas cutting.

- 18) End tube support bolts fastened with HT section structure at header box end were removed by gas cutting.

- 19) HT S.S.H.coil lifting.

This coil consists of one End tube support and 6 Intermediate tube supports.

- a) Two lifting beams were fabricated by using ISMB 450 length material with lifting point pitch suitable for end tube support to 2nd intermediate support for one beam and pitch suitable to 4th and 6th intermediate tube support for another beam.
- b) These beams were hooked to the cranes by using 2 slings each.
- c) Each beam was connected to lifting lugs of tube supports by using 4 nos of slings
- d) Complete coil was hooked up to two cranes with 8 lifting points through 2 lifting beams.
- e) Crane used - 1 No. P & H 127 T capacity - PETRON  
1 No HM 101 M - 55 MT capacity - IFFCO



JOB CODE

JOB DESCRIPTION

- e) HT S.S.H coil was lifted and taken out on the ground floor and then it was placed on the trailer & shifted to yard where it was unloaded
- 20) On the ground bearing brackets of HT SSH coil was removed
- 21) Castable insulation on the 3 walls of HT section of HTSSH coil area was removed.
- 22) Lifting lugs of Air and steam preheater coil (coil "G" was inspected visually and DP test was also carried out to confirm it, soundness for lifting.
- 23) Inlet outlet header joints of coil "G" joining with piping was separated by gas cutting.
- 24) End tube support holding bolts of coil "G" was removed by gas cutting.
- a) There are four Intermediate tube supports and one End tube support in steam air coil (G)
- b) Lifting beam with pitch suitable for end tube support and 1st intermediate support was fabricated and another lifting beams with pitch suitable for 2nd intermediate and last intermediate tube support was fabricated.
- c) Each beam was hooked up to separate crane by 2 slings and three beam hooked up to 4 lifting lugs of tube support. By this way coil was hooked up to two cranes with 8 lifting points through 2 lifting beams.
- d) Crane used 1 No 127 T P & H crane - PETRON  
1 No 55 T HM 101 crane - IFFCO
- e) Steam air coil (G) was lifted out from convection zone and lowered on ground. This coil will be re-insulated after installation of new mixed feed coil.
- 25) Castable insulation of steam air coil was removed.
- 26) Lifting lugs of mixed feed coil was inspected. These intermediate tube supports were earlier manufactured at local foundry. Condition of lifting lugs were not found satisfactory for lifting the coil. Hence slings were encircled the tube supports at the location near lifting lugs.
- 27) Bearing brackets of steam air coil was removed.

JOB CODE

JOB DESCRIPTION

- 28) Inlet outlet header joints joining with interconnecting piping was separated by gas cutting.
- 29) a) Mixed feed coil also had one end tube support and 4 intermediate tube supports.
- b) Hence lifting, beams used for steam air coil was used for lifting the mixed feed coil also .
- c) Lifting arrangements were made same as done with steam air coil but not connecting the slings to the lugs of intermediate coil supports as mentioned in point No.26.
- d) While lifting the coil with the help of two cranes, some additional load on the crane due to suspected fouling of intermediate tube supports with convection zone walls was felt. Hence once again the area near the bearing brackets was inspected & found the intermediate supports manufactured & supplied by local foundry had some modifications carried out at that stage which was fouling with bearing brackets of this coil. Fouling & portion of intermediate tube supports were removed by gauging by using cut rods.
- e) Then the mixed feed coil was lifted out from the convection zone and lowered on the trailer and shifted to yard where it was lowered on the gland
- f) Cranes used is 127 T P&H - 1 No - PETRON  
75 T P&H 955 - 1 No - CECCO
- 30) Existing castable insulation in the area of mixed feed coil area was removed.
- 31) Existing ceramic fibre blanket insulation was already removed
- 32) New Anchors were welded for ceramic fibre insulation in the area up to the top level of mixed feed coil from bottom floor and new insulation of ceramic fibre blankets with protection shielding of 0.5 mm thick SS 310 sheet was done in the area below mixed feed coil. 25 mm dia holes were provided on its SS 310 sheet of 1 meter x 1 meter size and 40 mm x 40 mm size washer then 25 mm size washer of SS 310 material was provided on protective shielding before tightening the nuts on the anchor bolts area pitch of 300 mm was used for anchor bolts ceramic fibre blankets total thickness applied is 5 1/2 inches.

JOB CODE

JOB DESCRIPTION

- 33) All existing guide bars for intermediate support, bearing bracket & vertical brackets were removed and new guide bars made of 6.0 mm thick 120 mm wide plate was welded to the north end south wall of HT convection zone at pitches marked as per pitch of intermediate tube supports of mixed feed coil, steam air coil and HT S.S.H. coil. New mixed feed coil height is more in comparison to existing hence by calculating the difference in height new bearing brackets were welded at new locations. Accordingly new bearing brackets made of HK 40 material were welded for steam air coil and HT S.S.H coil.

Mixed feed coil area was insulated with 5 1/2 inch thick ceramic fibre blanket insulation in the same as done in the area below mixed feed coil.

New mixed feed coil was made ready with lifting arrangement in the same method utilised for removal of coil. Inlet and outlet header extra length was cut to the requirement and level was also prepared before lifting coil. C.S. angle of 50 x 50 x 6 were welded between each tube supports to maintain the actual distance required to suite the pitch of guide bars and bearing brackets.

- 34) New mixed feed coil was lifted with the help of 2 cranes and slowly lowered in the HT convection zone taking care while confirming the intermediate tube supports. Passing through guide bars which are already welded to south and north wall. At last this coil was lowered on new bearing brackets inside the HT convection zone. Angle iron spaces were removed by gas cutting.
- 35) Inlet header was aligned with inlet piping and outlet header was aligned with cross over piping which was also replaced by better material (P-11)
- 36) Insulation material was filled up in the annular space between end tube supports and guide bars.
- 37) Wall area up to the height of steam air coil was insulated with ceramic fibre insulation as done in the area of mixed feed coil.
- 38) Bearing bracket was placed in its position
- 39) Steam air coil which was removed earlier was made ready for lifting by providing angle iron spacers welded to intermediate supports with pitch suitable to match the guide bar pitches.

## JOB CODE

## JOB DESCRIPTION

- 40) End tube support which earlier had castable insulating was replaced by ceramic fibre blanket insulation and protective shielding of 0.5 mm thick SS 310 sheet.
- 41) Mixed feed coil was lifted with the help of two cranes with similar arrangement of lifting used for removal of this coil.
- 42) Mixed feed coil was lowered to its position on bearing brackets while taking crane of intermediate supports passing through guide bars welded on the south and north wall of HT convection zone.
- 43) Inlet outlet headers were aligned with connecting pipings and then end tube support bolts were fastened to HT section structure.
- 44) Annular space between intermediate tube supports and guide bars was filled up with insulating material.
- 45) Crane used : 127 T P&H - 1 No - PETRON  
55 T HM 101 - 1 No - IFFCO
- 46) Nos of de-superheating pipes were re-installed with new asbestos gaskets.
- 47) Area of HT Super heater coil above the mixed feed coil area was re-insulated with 5 1/2" thick ceramic fibre insulation as done earlier in the bottom portion of this coil. New bearing brackets were placed at its position.
- 48) New HT S.S.H coil was made ready with 50 x 50 x 6 angles spacers welded to intermediate supports to suit the pitches of welded guide bars on the south and north wall of HT convection zone.
- 49) Inlet outlet headers were cut to required size to suite the required length and levels were prepared.
- 50) HT S.S.H coil was lifted with lifting arrangement similar like the method used for removing the old coil and lowered in its positions on the bearing brackets, temporary spacers were removed.
- 51) Inlet outlet headers were aligned with inter connecting piping & end tube support was fasterned to convection zone structure with the help of bottls.
- 52) Annualar space between the intermediate supports and guides,both was filled up with insulating material.

JOB CODE	JOB DESCRIPTION
53)	HT section header box which was removed earlier at starting of the job fabricated with fresh structural steel material.
54)	Crane used : 127 T P&H - 1No - PETRON 75 T P&H - 955 - 1 No - CEDCO
55)	West side wall above the HT S.S.H coil was re-fixed
56)	Top roof of HT section was re-installed in two pieces
57)	Top duct joining HT & LT roof was placed in its position in two pieces alongwith damper.
58)	In top roof and duct all the angles, I beams, channels were rewelded with suitable splicing
59)	Temporary support provided inside the duct earlier while dismantling were removed
60)	Top duct and roof pieces were earlier re-insulated with 4 1/2" thk ceramic fibre insulation. After welding top duct and roof this area was also re-insulated.
61)	New flue gas distributor made of SS 310 material was installed in the duct.
62)	Auxiliary boiler hot well area and duct joining the convection zone was reinsulated with 4 1/2" thk ceramic fibre blanket insulation with protective shielding of 0.5 mm thk SS 310 sheet
63)	All header joints of mixed feed coil steam air coil and HT S.S.H coil were welded.
64)	Steam air coil outlet header joint - 1 No, HT S.S.H coil inlet header - 2 Nos and HT S.S.H coil outlet header joint were stress relieved.
65)	All the header weld joints of mixed feed coil, Steam air coil and HT SS H coil were radiographed mixed feed coil and steam air coil was flushed with plant air at 5 kg/cm <sup>2</sup> pressure. HT SS H coil was hydrotested at 135 kg/cm <sup>2</sup> in the presence of inspector of boiler.
66)	Damper actuator and other steel structures above the roof of HT section was re-installed.
67)	Header box pannels and east side pannels which earlier had castable re-insulation was re-insulated with ceramic fibre blanket insulation.

## JOB CODE

## JOB DESCRIPTION

- 68) HT Section header box and east side pannels were boxed up.
- LT Section :
- 69) Header box bottom portion was removed and the existing wall in east and west side of L.T. section below existing BFW (offsite) was removed.
- 70) LT section bottom floor castable insulation was removed and 2 nos of Box type tracks made of ISMB 100 was welded to the floor. Suitably 12 nos supports, below convection zone floor below tracks to ground floor was provided during the pre shutdown activity.
- 71) In east side of LT convection zone same tracks were extended outside the structure, with length 2 metre more than the length of new BFW coil.
- 72) Extended tracks were supported by fabricaing suitable steel structure
- 73) Existing BFW coil inlet outlet piping was removed from header joints.
- 74) The new BFW coil was brought to the sight from the yard and was kept on the extended tracks outside the LT convection zone.
- 75) All intermediate tubes supports were joined with 50 x 50 x 6 angle iron spacers made suitable to the recommended pitches.
- 76) Then coil was lifted with the help of two cranes with the lifting arrangement as explained in the case of HT SSH coil and specially designed rollers were placed on the tracks and coil was lowered while taking care of intermediate tube supports resting on rollers.
- 77) After thorough checking the positions of rollers with tube supports, rollers were welded to the intermediate tube supports.
- 78) Pulling arrangement with the help of wintch and wire rope was arranged.
- 79) An ISMB 300 was welded to the floor near north side wall in entire length from east west.
- 80) BFW floor was re-insulated with insulit 9 castable material.

## JOB CODE

## JOB DESCRIPTION

- 81) The coil was rolled into its position in the spaces available between existing BFW coil and the floor. The space available to accommodate this coil was only 350 mm in height.
- 82) In north side of LT conrection section ISMB 300 pieces of 300 MM length was tack welded to the floor below the intermidiate tube supports.
- 83) The available space between ISMB 300 and intermediate tube supports (400MM) was filled up suitable pieces of C.S.plates on both North and south side.
- 84) Inlet header of existing BFW coil was hooked up with outlet header of new BFW coil and the inlet header of new BFW coil was connected to inlet piping, there by making the existing and new coil in series.
- 85) Extended header box was reinsulated with ceramic fibre blanket insulation.
- 86) The existing bottom panel for header box was also extended and insulated with insulite 9 castable material.
- 87) East side new panel for new BFW coil was fabricated & insuilated with ceremic fibre blanket insulation.
- 88) All the weld joints of BFW piping which required modification were radiographed.
- 89) The new BFW coil in series with existing BFW coil was hydrottested at pressure of 85 kg/cm<sup>2</sup> and it was witnessed by inspector of boiler.
- 90) Header box panel and east side panel was boxed up.
- 91) Since the existing man hole opening was covered by new BFW coil a new man hole in the inlet duct to the ID fan was fabricated on east side.

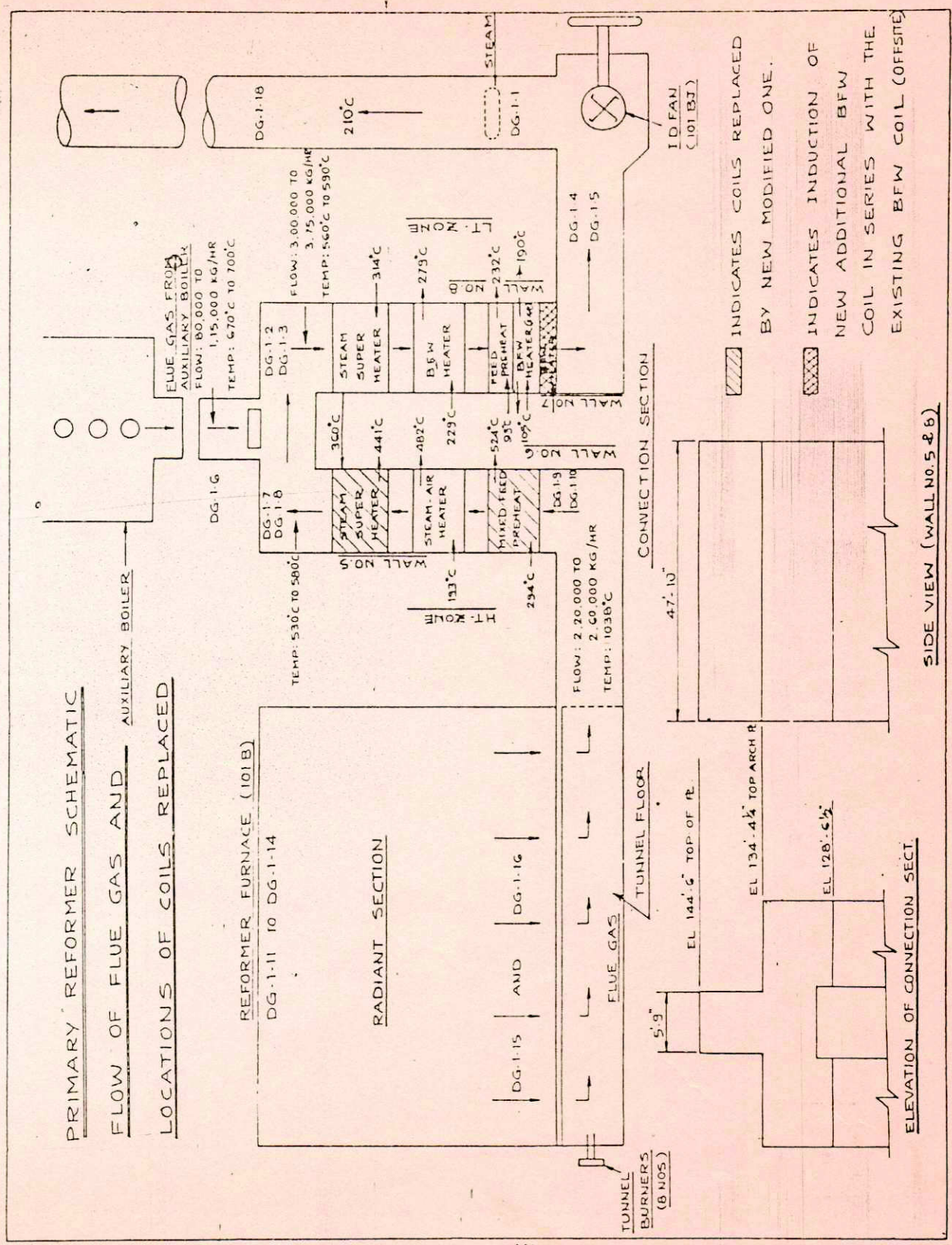
CONVECTION ZONE COILS REPLACEMENT AND INSERTION DETAILS  
ALONG WITH MATERIAL AND SIZES

ANNEXURE - I

DESCRIPTION OF ITEMS	EXISTING COILS		NEW COILS INSTALLED - SEPT. 1993		
	COIL - F MIXED FEED	COIL - H	COIL - F	COIL - H	NEW BFW
TUBE OD	5" (127MM) (0.40" MW)	2 7/8" (73.02MM) (0.29" MW)	152.4 MM (8.0 MM THICK)	88.9 MM (8.0 MM THICK)	60.3 MM
TUBE OD	4.2" (106.68MM)	2.295" (58.29 MM)	136.4 MM	72.9MM	49.25MM
BEND OD	5" U'BEND (0.40" MW)	2 7/8" U'BEND (0.29" MW)	152.4 MM (8.0 MM THICK)	88.9 MM (8.0 MM THICK)	--
NO. OF TUBES PER ROW	08	16	08	13	16
NO. OF ROWS	06	08	06	08	04
LENGTH	14.199 MTR	14.173 MTR	14.199 MTR.	14.173 MTR.	14.350 MTR
FIN HEIGHT	-	0.50	-	0.50"	01.00"
FIN THICKNESS	-	-	-	0.05"	00.05"
FIN TYPE	-	-	-	HELICALLY WOUND SERRATED	TRANSVERSE HELICALLY
FINS PER INCH	-	4	-	05	05
INTERMEDIATE SUPPORTS	25Cr. 12 Ni	25 Cr. 12 Ni	A-351 Gr. HK-40	A-351 Gr. HK-40	A-351 GR. HK-40
END SUPPORTS	CS	CS	CS A-36	CS A-36	CS A-36
TUBE	1 1/4 Cr. 1/2 Mo	1 1/4 Cr. 1/2 Mo	A-213 Gr. TP-304	A-213 Gr. T-22	A-106 Gr.B
BEND	1 1/4 Cr. 1/2 Mo	1 1/4 Cr. 1/2 Mo	A-351 Gr. CF-8	A-234 Gr. WP-22	A-234 WPB
FINS	-	-	-	11.13% Cr.	CS
HEADER SEAMLESS	-	-	A-213 TP-305	A-335 Gr. 22	A-106 Gr. B



48



JOB CODE

JOB DESCRIPTION

01 19 01

\*\*\*\*\*  
\*SYNTHESIS GAS CONVERTOR RETROFIT JOB\*  
\*\*\*\*\*

The Synthesis Gas Converter (105-D) Retrofit work at IFFCO Kalol was planned during the Annual Turnaround of the plant in Sept - Oct, 1993. The existing converter is a vertical Vessel having 4 Beds and axial flow type. This vessel is in operation for nearly 20 years. After modification the gas flow will be radial axial type. The Retrofit is Designed by M/s.Ammonia Casale, Switzerland. The modifications of the Internals would facilitate both radial & axial flow of gas in the Converter for better conversion. The modifications taken up were detailed by M/s.Ammonia Casale and were carried out under their specialists supervision. This job was awarded to M/s.CEDCO for carrying out the complete modification & loading of pre-reduced catalyst. The unloading of catalyst was under - taken by M/s.CAT TECH. under inert atmosphere.

#### ADVANTAGES OF CONVERTOR RETROFIT

- 01 Energy Saving of 0.27 G cal/t of Ammonia
- 02 Less pressure drop in the converter
- 03 Lower circulation rate and consequently reduction of the pressure drop in the loop.
- 04 Less duties at the chilling units
- 05 More ammonia conversion
- 06 Increase in temperature at converter outlet gas
- 07 Increase in Catalyst volume

#### MAJOR ACTIVITIES DURING CONVERTOR RETROFIT

- 00 Shutdown back and cooling of converter with Syn.gas
- 01 Depresurising and purging of Synthesis loop
- 02 Cooling of converter to 45 o C
- 03 Blinding of converter
- 04 Converter entry and catalyst unloading
- 05 Purging and washing of converter
- 06 Fixing of electrical connections & communication systems
- 07 Retrofit work
- 08 New catalyst loading
- 09 Deblinding converter and operators' leak test.
- 10 Reduction activity and some high lights.
- 11 Test run

JOB CODE

JOB DESCRIPTION

**00 SHUTDOWN BACK END & COOLING OF CONVERTOR WITH SYN.GAS**

- i) PGR was shutdown and Methane level was increased in syn.loop from 6% to 10%.
- ii) H<sub>2</sub>/N<sub>2</sub> Ratio was disturbed by keeping same Air against PGR shutdown along with increasing CH<sub>4</sub> level.
- iii) Quienches of Convertor bed (MIC-13,14,15 & 16) were made wide open alongwith opening startup heater inlet gas valve. HCV-11 was throttled to 50% to disturb flow equilibrium on synthesis Catalyst.
- iv) Convertor load was reduced by opening Kick Back flow control valves of Synthesis Compressor (FIC - 7 & 8)
- v) Keeping Refrigeration Compressor running and throttling HCV-10 tried to reduce convertor inlet temperature below 100 degree C but were unsuccessful.
- vi) 106-F and 108-F drained for liquid Ammonia totally in 107-F. Confirmed by rise in 107-F pressure.
- vii) 107-F was drained to 112-F, Refrigeration system and all liquid Ammonia was transferred to storage.
- viii) V-25 valve was opened alongwith SP-1 & SP-70 wide open and then by closing SP-70 to reduce Ammonia vapour concentration by taking fresh gas in syn.loop.
- ix) SP-1 was then closed and keeping bypass of SP-1 opened tried to cool down further in low pressure. Cool down convertor up to 90 degree C indicating on thermocouples.
- x) Stop Synthesis Compressor (103-J) and then Refrigeration Compressor (105-J) after transferring all the liquid Ammonia from Refrigeration system.

**01 DEPRESSURISING AND PURGING OF SYNTHESIS LOOP :**

- i) Depressurise Syn.loop maximum lowest possible with the help of V-25 vent valve and subsequently with vessels drain valves. Hot work permit in the loop area was restricted during this period.
- ii) Clearance was given to mechanical for opening alternate bolts of all the flanges to be opened & keep them on four nos of bolts. Also all the bolts were roused.

JOB CODE

JOB DESCRIPTION

- iii) I.G. was started at 117-C, 119-C, 102-B and MIC-13 D/S drain valve
- iv) After pressurising, depressurising was carried out at 123-C bottom drain valve, MIC-12, 125-C and 121-C drain all at convertor outlet.
- v) Each step of pressurising and depressurising was checked for H<sub>2</sub> and NH<sub>3</sub>.
- vi) I.G. Circulator loop was purged with N<sub>2</sub> and oxygen was already removed to less than 0.1% and blocked in advance.
- vii) Rapture disc and its bypass was dropped, and prefabricated piece was fixed between I.G. circulator discharge and HCV-11.
- RV-105-D was dropped during depressurising step and prefabricated piece was installed and was connected between I.G. circulator suction line alongwith V-25 distance piece. All these jobs were over by 17.15 Hr. on 13-09-93.

JOB CODE

JOB DESCRIPTION

02 COOLING OF CONVERTOR TO 45 DEGREE C :

i) No change had made in accordance with prescribed activity. BED Temperatures at 02.30 Hr on 14/09/1993.

Bed No.1	: 78 degree C	Bed No.2	: 78 degree C
Bed No.3	: 79 " "	Bed No.4	: 83 " "
Converter outlet	: 54 degree C		
Converter Bed No.1 Inlet	: 66 degree C		
I.G.Circulator Discharge	: 41 degree C		

ii) All the MIC's were opened one by one to cool down directly without heating in 122-C at the interval of 4 to 5 Hrs.

iii) Purging was carried out at only one drain valve i.e. at 123-C drain valve maintaining I.G.circulator operating conditions.

- H2 value had reduced from 4.47% at the start condition to 0.68% at the end condition.

- Ammonia value had reduced from 1000 ppm to 87 ppm

iv) At 15.20 Hr on 14/09/93 power failed for 15 minutes. I.G.failed cooling continue without purging.

v) At 10.30 Hr. on 15-09-93 circulator was stopped and isolated. I.G.was kept blocked at 5.5 Kg/cm2g as reserve against any I.G.failure.

vi) Following bed temperatures were observed at the end of this period (at 10.30 Hr on 15-09-93)

Bed No.1	: 42 degree C	Bed No.2	: 43 degree C
Bed No.2	: 45 degree C	Bed No.4	: 46 degree C
Converter outlet	: 40 degree C		
Converter Inlet	: 40 degree C		
Bed No.1 inlet	: 42 degree C		

Looking delta T across converter 0 degree C cooling was considered to be over. After stopping circulator it was observed that there is no rise in bed temperatures, confirming not to waste any more time for cooling.

03 BLINDING OF CONVERTOR :

On 15th Sept,93 at 08.00 Hr Cat-Tech people reported at site as per schedule. Looking into circumstances all the blinds were provided on syntesis loop,converter individual blind installation activity was dropped at this stage. It was decided to utilise this time at the end of unloading activity.

JOB CODE

JOB DESCRIPTION

Blinding job was started as a parallel activity on 19th Sept, 93 alongwith catalyst unloading of 4th Bed taking care to give one by one and suppling I.G. at the D/S of blinding work.

Only HCV-11 and SP-35 blinds were remaining. HCV-11 Blind took 8 hrs for installation due to job involve in it and its nature. Instead of providing blind at converter outlet, outlet line was dropped.

#### 04 CONVERTOR ENTRY AND CATALYST UNLOADING :

- i) All the activities were carried out according to procedures already circulated in advance. Purging of vacuum blower sets was done in advance during cooling step. No separate time was spend for that.
- ii) Hooking of Cat-Tech equipments was carried out from 08.00 Hr. to 14.00 Hr on the same day. Meanwhile loop was depressurised and manhole opening was started at 14.00 Hr.
- iii) Manhole was already kept on four nos of blots after loosening & retight it. Manhole was opened at 15.00Hrs.
- iv) Hot work permit was issued to Cat-Tech after analysing

H2 : 2.8%  
 CH4 : NIL  
 O2 : Less than 0.1%  
 NH3 : 87 ppm

by Sr. Manager (Ammonia ) and Manager (F & S)

- v) All the vacuum hoses, Cat-Tech rope ladder, light fitting, 24V bulb connections, were transferred inside the vessel.

Catalyst unloading was started at 16.30 Hr. by IFFCO Kalol vacuum blower set.

#### PROBLEM FACED :

No problem faced during this period. Correct decision for shifting the time schedule for installation of blind alongwith proper planning had resulted in accumulation of 19.5 Hr.

#### CATALYST UNLOADING :

Time Allocated on Bar chart : 96 Hrs  
 Actual time spent : 99.5 Hrs  
 From 16.30 Hrs on 15/9/93 to  
 20.00 Hrs on 19/09/93  
 Cumulative advance time : 16.0 Hrs

JOB CODE

JOB DESCRIPTION

**BED NO.1 UNLOADING :**

TIME	DATE	ACTIVITY
16.30	15-09-93	Unloading started
22.45	15-09-93	Unloading over
Total time		06.25 Hrs

No major problem faced except rain for which half an hour was lost.

**BED NO.2 UNLOADING :**

TIME	DATE	ACTIVITY
23.30	15-09-93	Unloading started
15.45	16-09-93	Unloading over
Total time		17.00 Hrs

No major problem faced. Both Kaloi and Phuipur blower sets running alternatively and available at the requirement.

**BED NO.3 UNLOADING :**

TIME	DATE	ACTIVITY
17.00	16-09-93	Unloading started
23.45	17-09-93	Unloading over
Total time		32.00 Hrs

**PROBLEMS FACES :**

Catalyst carryover on both the filter was observed. Filters were fully filled up with catalyst material. Dumping of this catalyst was difficult as catalyst was not easily coming out of filter drain. This result in non availability of stand by set. Bed was hot enough for the personnel working inside the vessel.

**SOLUTION :**

Time for one charge of separator was established. that catalyst carryover can be avoided from separator. Also after total cleaning of the filter draining frequency was increased so that little amount of catalyst can be easily removed.

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JOB CODE	JOB DESCRIPTION
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Liquid Nitrogen injection line was given after attending all the practical problems for installation at the end of this unloading.

**BED NO.4 UNLOADING :**

TIME	DATE	ACTIVITY
03.00	18-09-93	Unloading started
20.00	19-09-93	Unloading over
Total time	44.25 Hrs	

**PROBLEMS FACED :**

- i) Bed No.4 manhole bolts were not opening by tools. So arrangement was made for grinding machine to run on Nitrogen from cylinder. All the required connections were made suitable to grind these bolts.
- ii) Liquid Nitrogen injection S.S.connections were made right from liquid tanker to inside the vessel.
- iii) IFFCO Kalol blower separator outlet was totally choked due to Oxygen ingress. This activity took 5 - 6 Hrs.

**05 PURGING AND WASHING OF CONVERTOR :**

After installation of blinds clearance was given to Mechanical to remove 122-C Gas outlet pipe, and removal of bottom dome. Purging of vessel with air was started simultaneously by connecting air hoses in place of I.G. Washing of convertor started at 02.30 Hrs with D.M.water. After attaining O2 level. Vacuum blower was taken in line with suction hose from first bed. Sampling was started for Oxygen and Ammonia. After attaining O2 level to 20% and more from first bed as well as annulus space and Ammonia concentration less than 50 ppm, one production man alongwith safety man went inside the vessel with portable Oxygen metre and checked all the bed for Oxygen content more than 20% . Keeping vacuum blower in line all the left out catalyst were removed from first bed and HOT WORK PERMIT was issued to mechanical on 20th Sept, 1993 night.



JOB CODE

JOB DESCRIPTION

**06 FIXING OF ELECTRICAL CONNECTION & COMMUNICATION SYSTEM**

On 20.09.93 night electrical connection and communication system were installed. One multicore cable was passing through manhole MH-1, upto bottom of 4th bed. From the cable one distribution board was provided on each bed for hand lamp, grinding machine and other electrical tools. Each distribution board was attached with electrical trip device.

For communication system each bed was provided with telephone connection. In addition to this there was a telephone on top and one at bottom of the convertor.

**07 RETROFIT WORK**

Clearance for opening of 122-C pressure shell and gas return pipe was obtained from production on 20.09.93 morning. Gas return pipe was removed at 12.30 PM with the help of one crane and 140 feet boom length.

122-C pressure shell was made free by opening 20 Nos bolts of 122-C expansion bellow connection. Before opening bellow connection reference points were marked. Lift cover was fixed at flange "G" 44" flange was opened to make pressure shell free for lifting. 122-C pressure shell was removed from its position with plateform and ladder at 18.00 on 20.09.93 with the help of two cranes of 140 feet boom length each. Spreader beam and "D" Shekals. No sling was used.

The annular spare between outer pressure shell and cartridge wall was covered with wooden circular ring cut in two parts. The studs of 44" flange were covered with 4" PVC pipe for protection with any mechanical damage. Ring joint was also covered to protect it from damage.

After removing 122-C pressure shell, the two lifting lugs of 122-C were checked for any welding cracks and found ok. Before grinding the 122-C weld support four reference readings were taken i.e.

WEST - 133 MM  
EAST - 134.5 MM  
NORTH - 133 MM  
SOUTH - 134 MM

The grinding of weld support was carried out to remove weld materials with the help of web tool grinding machine. Symaltaneously gas return pipe below weld joint was cut. Exchanger 122-C was removed from its position and put on pre-fabricated vertical stand near convertor.

JOB CODE

JOB DESCRIPTION

Inside convertor wire mesh around Gas return pipe in 1st, 2nd 3rd and 4th bed were removed so the gas return pipe became free to lift. Gas return pipe and two thermowells AT & BT were removed.

Removed Hold Down Pipe and wire mesh of Bed No.1,2 and 3 and plasma cutting of all gas collector and its arms of 4th bed were done. Removal of hold down pipe and wire mesh took 12 hrs. A piano wire was suspended to locat centre from the top with the help of cross fixed on the top of 122-C support and another cross at flange "H". Piano wire as centred and central hole of dia 14" increased to required dia of 890 dia in first bed 850 dia in second and third bed. A new slot for thermocouple AT was made in each bed.

A circumferential line was marked in 1st,2nd and 3rd bed bottom where new bottom segments would be welded. The nitride layer 15 mm, above and 15 mm below the marked circumferential line was removed by grinding the 30 mm surface. Removed nitride areas were checked with 10% Nitric acid. Nitride layer near manhole of 1st,2nd and 3rd bed were also removed. Nitride layer removal took 40 hrs. Removed nitrided area of all the three beds were locally heated with gas torch upto 500 degree C for dehydrogenation. The temperature was continuously monitored with temperature indicating crayon.

Scaffoldings were made wherever and whenever and removed after work was completed. Old distributor plates, quench ring, quench headers, quench pipes, baffles, baffle support plates drop out pipes, catalyst unloading rod thermowell AT etc.were cut with plasma machine and removed from the convertor. Imported asbestos free ceramic cloth was used for fire protection during cutting and heating of parts to protect the fire hazards.

New bottom segments were installed in 1st,2nd and 3rd bed. For outer collector position was marked and clits were tack welded to bottom segments for installation of outer collector. Outer collector segments were installed in respective beds and welded together. Proper welding sequence was followed to avoid any distotion of outer collectors.

The old refractory of 4th bed was not in good condition. There were multiple cracks and loose bounding. Complete old refractory material was removed from the position. Tine type lugs were intact in position. There was no difficulty for removal of old refractory material.

JOB CODE

JOB DESCRIPTION

New refractory TAB CAST - 94 of ACC make was applied and surface was finished to suit the template. The curing of the refractory was done with chilled D.M.Water first then natural atmospheric air curing.

After curing of refractory, forth bed bottom segments were installed and welded together with joint plate. One pipe with collar was installed in 4th bed and Kaowool blanket was filled between bottom segment and pipe collar. The pipe was pulled downward with chain block to compress the Kaowool maximum possible and collar was welded with bottom segment of 4th bed. Other end of pipe was welded with nozzle "H" after removal of nitride layer and dehydrogenation.

Pre-welded stiffeners of 4th bed bottom collector were cut to required size and support plate for outer collector of 4th bed were installed in position. The outer collector of 4th bed were installed in sequence and welded together as per procedure.

Stuffing boxes were installed on existing "BT" thermowell pipe. New thermowell pipe for "AT" was installed in position and welded. "AT" stuffing boxes were installed and welded.

Flange cover of nozzle "H" was boxed up with new gasket. All inside area was cleaned with vacuum cleaner and required quantity of alumina balls were loaded. The inner collector of 4th bed was installed in position, aligned it properly and welded at bottom with the collar.

Pre-assembled inner collector for 1st, 2nd and 3rd bed alongwith base ring, quench pipes, retaining ring, gas return pipe, wire mesh etc. was installed in position, aligned it properly and welded it wherever required.

Before installation of inner collector, the protecting and separating screens were placed in respective bed with proper care of its orientation during fixing in position.

Damaged wire mesh of outer and inner collector were repaired with high frequency low current machine.

By pass ring and expansion bellows were welded. Protection sleeves were provided on bellows to avoid any damage to bellows.

The Heat Exchanger 122-C was hydrostatically tested with D.M.Water. No leak was observed. The expansion

JOB CODE

JOB DESCRIPTION

bellow on the top of 122-C was inspected visually and DP test. No defect was observed. New baffles were provided on shell side slots after removal of nitrid layer and dehydrogenation. The exchanger was installed in position and re-welded at support and also with gas return pipe.

The groove of ring joint for 122-C pressure shell was cleaned properly and old gasket was installed in position after thorough inspection and cleaning. The pressure shell was installed in position with the help of spreader beam and two cranes. New nuts were put in position for 44" flange and tightened properly. 122-C top expansion bellow position was tightened with 122-C pressure shell with new gasket and studs. A new insulation sleeve was provided to protect gas out let elbow with high out let gas temperature.

All welding joints were DP tested. During retrofit work fresh air was being supplied from bottom nozzle "H" through a fan installed specifically for retrofit job. Also plant air was being supplied to individual beds to maintain breathing level and healthy working atmosphere inside the convertor.

08 NEW CATALYST LOADING :

ON Oct.7th,93 shift 3rd bed screen repairing was being carried out. Clearance was available for loading of 4th bed catalyst under following circumstances.

- 4th bed was clear for loading the catalyst.
- 3rd bed final screen repairing was over and scaffolding removal activity was going on.
- 2nd bed welding job continued at some places. Screen repairing was required.
- 1st bed welding job continue and screen checking and repair if any.
- 122-C tube bundle was kept at ground level after hydrotesting and with modified baffles welded at gas outlet.

JOB CODE

JOB DESCRIPTION

It was decided to place 122-C in position after loading of 3rd bed catalyst. This helped the movement of man and material from top of converter.

LOADING LAYOT :

- i) Two forklift were utilised, one from contractor and one from IFFCO. Contractor forklift was utilised for placement of drum on screen and handling hopper inside the store. IFFCO forklift was utilised for shifting the hopper from store site to Converter site on need basis.
- ii) Screening : Required quantity of weighted catalyst in drums and in batch wise was already shifted at Melathion store site as pre shutdown activity. Weight of each batch was made and net weight was marked on batch with nos. of drum and batch no and placed in order of loading sequence. Each batch was placed on to the same screen and catalyst was screened directly in to the loading hopper. Screen losses were accounted at the end of screening of each batch and net weight transferred to Converter was calculated. Four hoppers were prepared. Each batch require three hoppers, so one hopper was always available for one advance batch. During vibration activity batch was made available after screening at site. This continued through out loading activity.
- iii) Loading funnel was placed at 122-C plateform and 4" pvc hose was connected at the end of funnel up to bottom of converter with a free fall of not more than 2'. One person wearing dust mask was shifting hose as and when required. For uniform loading of catalyst . The person working inside were wearing cotton shoes.
- iv) Loading was done with the help of contractors "Crane. Each loaded hopper was shifted to and placed on to the funnel. With opening the shutter catalyst was transferred to bed via pvc pipe.
- v) Vacuum blower was continuously running for sucking dust during loading of unredused catalyst. It was also helping to provide fresh air inside the converter.
- vi) After loading exactly weighed quantity of catalyst to raise 250 mm approximate height levelling was done and templete was placed on to the bed. Templete was prepared in advance.
- vii) Vibration was carried out in sequence inserting vibrator for 10 second and taking out slowly slowly within 15 second. After finishing vibrations in the loaded batch, height of the loaded batch was recorded. From area of cross section and this height volume occupied.

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 JOB CODE                      JOB DESCRIPTION
 

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B.D = Weight of screened catalyst loaded /actual vol.achieved if bulk density was not achieved to the desired level then again vibrations were carried out to achive the required B.D. (2.8 kg/Lit for unreduced catalyst and 2.2 for reduced catalyst)

- viii) After loading smaller size catalyst separating screen was fixed at a depth of 100 mm from top of outer collector.
- ix) After fixing separating screen loading of 8 - 12 mm size (Bigger size) catalyst was done.
- x) After loading this catalyst Protection screen was placed and was tag welded. Outer collector sealing hose was then carefully taken out cleaning was done with vacuum cleaner and manhole cover was welded.
- xi) Loading of prerduced catalyst was done under atmospheric condition with following precautions.
- Vessel was connected with I.G.hoses and kept ready to charge I.G. under abnormal situation such as rise in bed temperature.
  - A digital thermocouple type indication was made available at site to measure accurately the temperature of the catalyst in side convertor.
  - Pannel mounted thermocouple indication was connected to alarm system in case temperature rise above 70 degree C.
  - All the precautions were made so that vessei cannot work as stack in any case.
  - All the personnel working inside were using line mask with built in communication system. First aid with ambulance and doctor was available near manhole.A spare crane was made available to remove the affected person from top to bottom.

**LOADING DETAILS (4TH BED ) :**

AS - 4 ( 1.5 - 3.00 MM SIZE )

Net weight of unscreened Catalyst : 86,282.8 Kgs  
taken (575 drum)

Screened losses : 435.55 Kgs

Screened catalyst taken inside : 85,847.25 Kgs  
vessel

Volume occupied : 30.437 M3

JOB CODE

JOB DESCRIPTION

BULK DENSITY ACHIEVED :

AS - 4 ( 8 - 12 MM ZISE )

Net weight of unscreend catalyst taken	: 1279.9 Kgs (8.5 drum)
Screened losses	: 11.50 Kgs
Screened catalyst taken inside vessel	: 1268.40 Kgs
Volume occupied	: 00.491 M3
Bulk density achieved	: 2.583 Kg/Lt

LOADING DETAILS ( 3RD BED ):

AS - 4 ( 1.5 - 3.0 MM SIZE )

Net weight of unscreend catalyst taken	: 52,395.10 Kgs (348.0 drum)
Screened losses	: 298.50 Kgs
Screened catalyst taken inside vessel	: 52,096.60 Kgs
Volume occupied	: 18.877 M3
Bulk density achieved	: 2.760 Kg/Lt

AS - 4 ( 8 - 12 MM SIZE )

Net weight of unscreend catalyst taken	: 1650.0 Kgs (10 drum)
Screened losses	: 17.50 Kgs
Screened catalyst taken inside vessel	: 1632.50 Kgs
Volume occupied	: 00.63 M3
Bulk density achieved	: 2.59 Kg/Lt

LOADING DETAILS (2ND BED ):

AS - 4 ( 1.5 - 3.0 MM SIZE )

Net weight of unscreend catalyst taken	: 38,120.5 Kgs (254 drum)
Screened losses	: 171.8 Kgs

JOB CODE

JOB DESCRIPTION

Screened catalyst taken inside vessel : 37,948.7Kgs

Volume occupied : 13.627M3

Bulk density achieved : 2.784Kg/Lt

AS - 4 ( 8 - 12 MM SIZE )

Net weight of unscreend catalyst taken : 1650.0 Kgs  
(10 drum)

Screened losses : 16.7 Kgs

Screened catalyst taken inside vessel : 1633.3 Kgs

Volume occupied : 00.63 M3

Bulk density achieved : 2.592 Kg/Lt

**LOADING DETAILS (1ST BED ) :**

AS - 4F ( 1.5 - 3.0 MM SIZE )

Net weight of unscreend catalyst taken : 18,570.1 Kgs  
(156 drum)

Screened losses : 27.3 Kgs

Screened catalyst taken inside vessel : 18,542.8 Kgs

Volume occupied : 8.581 M3

Bulk density achieved : 2.160 Kg/Lt

AS - 4 ( 8 - 12 MM SIZE )

Net weight of unscreend catalyst taken : 1166.0 Kgs  
(10 drum)

Screened losses : 24.0 Kgs

Screened catalyst taken inside vessel : 1142.00 Kgs

Volume occupied : 00.54 M3

Bulk density achieved : 2.114 Kg/Lt

09 DEBLINDING OF CONVERTER & OPERATOR'S LEAK TEST :

ON 19TH OCT,1993 at 6.00 Hr. Converter blinds were removed and at the same time Syn.gas was available at compressor suction. But during day time the vibrations



JOB CODE

JOB DESCRIPTION

on 107-JT (MEA PUMP), D.B. of turbine were high. So standby pump was taken in line. But this pump also developed seal leak forcing to run the previous pump. Syngas production was stopped during this time. System was normalised with 107-J pump with little high vibrations on turbine D.B. bearing. Stand by pump was handed over to attend its seal leak. Synthesis loop purging, pressurising and operators leak test activity was started with I.G. and all the leaks were attended.

**TIME ANALYSIS :**

DATE	TIME	ACTIVITY
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19-10-93	06.00	Syn.gas produced. Converter ready after deblinding.
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21-10-93	24.00	Converter Heating started
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ACTUAL TIME CONSUMED : 66 hrs.

Bar chart time : 52 Hrs (Including deblinding)

: 45 Hrs (Excluding deblinding Actual time)

Time loss occurred : 21 Hrs

Cumulative time loss : 224 Hrs

**REASON :**

HCV-11 Problem: From 20-10-93 at 23.00 Hrs  
To 21-10-93 at 15.00 Hrs, (16 Hrs)

**10 REDUCTION ACTIVITY AND SOME HIGH LIGHTS :**

Time allocated on Barchart : 120 Hrs

Actual time spent : 85 Hrs

From 00.00 Hr of 22-10-93 : Actual heating of catalyst started

To 13.00 Hr of 25-10-93 : V-25, closed, No gas venting

total time saved : 35 Hrs

Cumulative delay activity : 189 Hrs

**11 TEST RUN :**

After retrofit synthesis converter performance guarantee test run was conducted from 06.00 Hrs on Saturday the 30th October 1993 to 06.00 Hrs on 4th November 1993. Summary of data is attached here for ready reference.

JOB CODE	JOB DESCRIPTION	
1)	FR-40 Make-up gas flow rate	: 116,484 NM <sup>3</sup> /Hr
2)	FI-173,Hydrogen flow rate	: 5,211 NH <sub>3</sub> /Hr
3)	FI-100,Purge Gas flow rate	: 9,364 NH <sub>3</sub> /Hr
4)	103-J,Discharge pressure	: 125.8 Kg/cm <sup>2</sup> g
5)	103-J,Recycle suction pressure	: 115.0 Kg/cm <sup>2</sup> g
6)	PDI-51,Synthesis loop pres.drop	: 11.6 Kg/cm <sup>2</sup> g
7)	PI-26,Converter inlet pressure	: 120.6 Kg/cm <sup>2</sup> g
8)	PI-28,Converter outlet pressure	: 117.016 Kg/cm <sup>2</sup> g
9)	PDI-57,Converter pressure Drop	: 2.52 Kg/cm <sup>2</sup> g
10)	TI-32,Converter Inlet Temp.	: 132.8 degree C
11)	TI-98,Converter outlet temp	: 314.66 degree C
12)	105-J,Final disch.pressure	: 14 Kg/cm <sup>2</sup> g
13)	123-C,Inlet/Outlet Temp.(BFW)	: 112/225.5o C
14)	114-C,outlet temp	: 268 o C
15)	Coil outlet temp	: 275 o C
16)	Ammonia production rate	: 982 MTPD

On the bases of data collected following guarantee parameters were fixed from the curves supplied by M/S Ammonia Casale S.A.Test run data are also provided.

	Guarantee	Test Run
a) Increase in ammonia concentration	3.07%	2.75%
b) Decrease in pressure Drop across conv.	3.535 bar	4.5 bar
c) Energy saving,Gcal/MT	0.246	0.272
d) Steam saving Kg/MT	300	325.5

JOB CODE

JOB DESCRIPTION

**COST BENEFIT ANALYSIS :**

Project cost : (Actual committed )

Foreign currency : Rs. 2,30,07,000

Indian currency : Rs. 2,23,71,000

Total Rs. 4,53,78,000**Annual Saving :**

0.272 Gcal/MT Ammonia \* 3,00,300 Ammonia production

81,481.6 Gcal

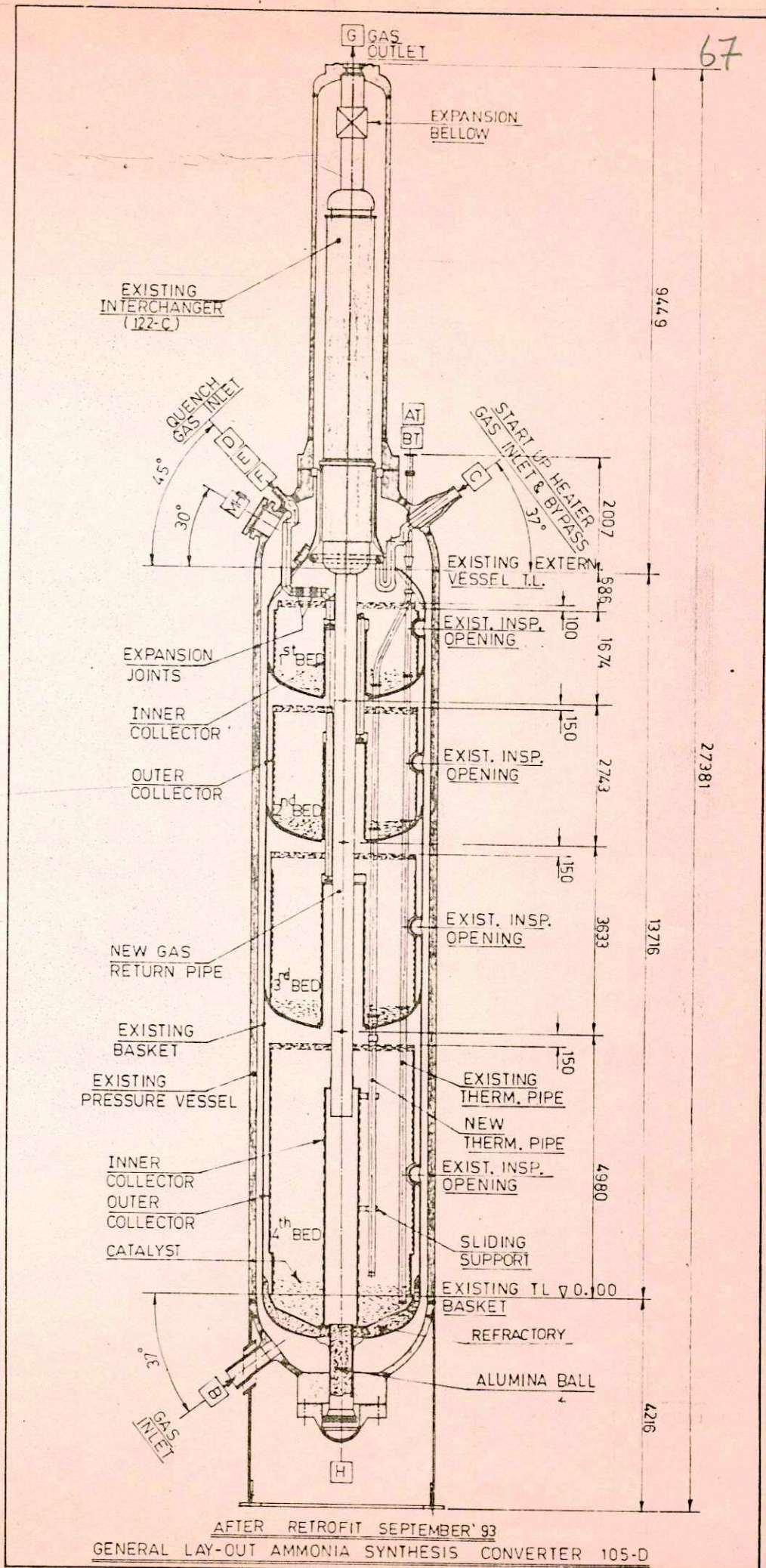
7735 MT Naphtha

Rs.3,77,25,838

**Pay back period :**

Project cost (Rs) / Annual Saving (Rs)

1.21 Year



AFTER RETROFIT SEPTEMBER '93  
GENERAL LAY-OUT AMMONIA SYNTHESIS CONVERTER 105-D

JOB CODE	JOB DESCRIPTION
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01 01 01 \*\*\*\*\*  
 \*AIR COMPRESSOR DRIVE TURBINE (101-JT)\*  
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Since last 2 to 3 years the following damages were being observed on Drive Turbine of Air compressor (101-JT) and Drive Turbine of Refrigeration compressor (105-JT).

- Erosion on the diaphragm faces at the parting plane
- Erosion in the casing beyond 4th stage
- Erosion on the diaphragm seating area in the casing leading to loose fitting.

The above damages was resulting into interstage leakages and finally affecting the performance. During previous overhauls, only diaphragm seating parting plane faces were being repaired by welding and filing process. However it was not possible to repair the erosion in the casing as well as the diaphragm seating area on the casing which required accurate and precision machining.

M/s.IMO Delaval, the original manufacturer of above turbines were consulted and they suggested to use premachined stainless steel inserts into the existing casing grooves and then final machining as per the standard dimension as per the drawing.

The following immediate actions were taken.

- (01) Obtained the quotation of stainless steel inserts of all the stages for 101-JT and 105-JT and order was placed on M/s.IMO Delaval for both 101-JT & 105-JT.
- (02) The order was placed on M/s.IMO Delaval for their field service engineer for overhauling of Delaval machiners which included the job of 101-JT and 105-JT also.
- (03) The order was placed on M/s.IMO Delaval for services of their field machining Supervisor for machining of turbine casing and fitting of stainless steel inserts.

JOB CODE	JOB DESCRIPTION
(04)	<p>The following parties were contacted for machining job of turbine casing.</p> <ul style="list-style-type: none"> <li>- M/s.S.L.M.Maneklal Vatva Ahmedabad</li> <li>- M/s.SPM Engineering Vatva Ahmedabad</li> <li>- M/s.S.B.Engineering, Ahmedabad</li> <li>- M/s.Patel Air Temp., Ahmedabad</li> <li>- M/s.J.M.Engineers, Ahmedabad</li> <li>- M/s.Turbomachinery Engineering Indu, Hyderabad</li> <li>- M/s.Triveni Engg. Bangalore</li> <li>- M/s.Jyoti Ltd, Baroda</li> <li>- M/s.Asea Brown Boveri Ltd, Baroda</li> <li>- M/s.GNFC Ltd, Bharuch</li> <li>- M/s.GSFC Ltd, Baroda</li> <li>- M/s.Spartan Engg., Bombay</li> <li>- M/s.New Standard Engg.Co.Ltd, Bombay</li> <li>- M/s.Spice SMD, Bombay</li> <li>- M/s.Tata Chemical, Mithapur</li> <li>- M/s. Elecon Engg, Vallabh Vidyanagar</li> <li>- M/s. Eimco Elecon Engg., VV nagar</li> <li>- M/s.L &amp; T, Powai works , Bombay</li> </ul>
	<p>The detailed feasibility study of above parties was done for the casing repair job and it was felt that M/s.L &amp; T had required facility of CNC machine and technical expertise for the subject precision job. Due to the time factor limitation of dismantling the casing, sending it to M/s.L &amp; T works Bombay and then bringing it to plant site and final boxing up activities, it was decided to carryout repair of Turbine casings of Air compressor drive turbine (101-JT) only. Hence the work order was placed on M/s.L&amp;T Powai works Bombay for casing repair job of 101-JT.</p>
	<p>The turbine was dismantled and the inspection of internals and rotor was done in presence of Delaval representative Mr.John H Denlea and it was decided to machine 3rd,4th 5th and 6th diaphragm seating grooves in casing as the same were having more erosion. It was also decided to send rotor to the works of M/s. L &amp; T so that after machining and insertion of S.S.inserts, the relevant clearances after putting the rotor in the casing, can be checked.</p>
01 01 01	<p>(A) <u>THE MAJOR SEQUENCE ACTIVITIES CARRIED OUT WERE AS UNDER :</u></p> <ul style="list-style-type: none"> <li>(01) Removal of exhaust pipe and top casing</li> <li>(02) Casing internals and rotor etc inspected and relevant clearances noted.</li> <li>(03) Alignment readings between 101-JT and 101-JLP case were taken</li> <li>(04) Internal connecting pipings were dismantled</li> </ul>

JOB CODE	JOB DESCRIPTION
(05)	Rotor and diaphragms were removed
(06)	Bottom casing was removed from position
(07)	Followings were sent to M/s.L&T Powai works <ul style="list-style-type: none"> <li>- All the diaphragms</li> <li>- All the interstage labyrinths</li> <li>- Both the journal bearings</li> <li>- Turbine rotor assembly</li> <li>- Required fastners for casing, bearings etc.</li> </ul>
(08)	Casing repair was done at M/s. L & T works Bombay on 3,4,5 and 6 diaphragm seating grooves under the Supervision of M/s.IMD Field Machining supervisor & IFFCO Engineer.For this two field machining supervisors of Delval were called.
(09)	The Turbine casings were brought to IFFCO site after repair.
(10)	Put the lower casing in position with the original shims.
(11)	Checked for the soft foot of lower casing (Allowable = 0.002" )
(12)	Assembled the diaphragms & labyrinths in lower casing as well as on top casing. The level of diaphragm faces w.r.t. casing face was checked with straight edge and confirmed that the diaphragm face should not be above the casing face.
(13)	Assembled the control valve assembly on top casing and the top casing was reversed for installation on the lower casing.
(14)	Both the journal bearings were put in position in lower casing and the "SAME ROTOR" was put in the lower casing nozzle clearance, total axial rotor position etc were maintained with reference to "Reference Point" which was marked on the rotor.
(15)	Put the top casing on the lower casing and checked the nozzle clearance with the same position of rotor. The tolerance is within plus / minus 0.005".If nozzle clearance does not match then diaphragm should be checked. If they touch the rotor, correction should be made accordingly.
(16)	Bearing clearance and bearing housing pinch on both the bearings were checked.
(17)	Put the Governor assembly in position

JOB CODE	JOB DESCRIPTION
	(18) Shaft to shaft distance (101-JT Rotor shaft end to 101-JLP rotor shaft end) was checked. It was maintained as 10 1/2" plus/minus 1/32"
	(19) Alignment between 101-JT to 101-JLP was done
	(20) Installed all pipings, Exhaust piping and expansion below.
	(21) Rechecked the alignment between 101-JT to 101-JLP
	(22) Boxed up coupling guard
	(23) Oil circulation started and leakages if any were checked and attended.
	(24) Heating of turbine casing was done and turbine was put on slow roll.
	(25) Overspeed trip checked and DST done at 7700 RPM
	(26) Coupling was done and coupling float was checked. It was within 3/16" plus/minus 1/32"

Note :- Please refer attached sheet at A-48 (i) for running clearances.

01 01 01 (8) REPAIR ACTIVITIES CARRIED OUT AT THE WORKS OF M/S.L & T, BOMBAY

The total repair activities were carried out under the Supervision of M/s.IMD Delaval field machining Supervisors Mr.LEE CORN WELL, MR.WILLIAM C.CAWTHON and IFFCO Engineer. The machining job was carried out on CNC SKODA FHB Machine.

- 01) Top and Bottom casings clamped rigidly against angle plates faces joining faces towards machine. The joining faces reversed with dial indicator with best possible readings on top and bottom casings.
- 02) Existing grooves location distances (at sealing faces were checked & recorded w.r.t. 1st groove on top and bottom casing.
- 03) On Bottom casing, groove nos 3,4,5, and 6 sealing faces machined on CNC Skoda and distances recorded w.r.t. groove No.1 prior to fixing of inserts.



# AIR COMPRESSOR TURBINE - 101 JT

RECOMMENDED CLEARANCES →		MIN.		MAX.		MIN.		MAX.		MAXI. PERMISSIBLE END FLOAT. 0.042"	101 JT		105 JT	
		A	0.002"	0.004"	J	0.055"	0.065"	TOTAL DESIGN END PLAY 0.180"			LOOKING FROM GOVERNOR END		LOOKING FROM GOVERNOR END	
		B	0.007"	0.009"	K	0.110"	0.120"			LOOKING FROM GOVERNOR END		LOOKING FROM GOVERNOR END		
		C	0.015"	0.021"	T	0.008"	0.012"							
E	0.013"	0.019"												
		FINAL				FINAL								
AFTER	BEFORE	SHROUD	BLADE	STEAM FLOW				BLADE	SHROUD	BEFORE	AFTER			
0.002	0.007			OIL RING A						0.002	0.002			
0.002	0.011			THRUST BRG. T 0.180"										
0.003	0.002			OIL RING A Axial play						0.002	0.002			
0.007	0.010			BRG. B										
(N.W.)				OIL GUARD C										
0.027	0.029			E						0.012	0.003			
0.023	0.009			E						0.012	0.007			
0.025	0.012			E						0.012	0.004			
0.024	0.012			E						0.012	0.004			
0.022	0.016			E						0.012	0.005			
0.022	0.014			E						0.012	0.005			
				NOZZLE				0.062						
				J WHEEL-1				0.060						
				DIAPH. LABYRINTH E				0.062	0.050	0.012	0.012			
0.020	0.020	0.045	0.040	J WHEEL-2				0.075	0.065					
		0.060	0.062	DIAPH. LABYRINTH E				0.072	0.055	0.012	0.012			
0.019	0.020	0.038	0.060	J WHEEL-3				0.080	0.065					
		0.056	0.080	DIAPH. LABYRINTH E				0.068	0.060	0.018	0.006			
0.019	0.016	0.040	0.070	J WHEEL-4				0.080	0.065					
		0.082	0.080	DIAPH. LABYRINTH E				0.070	0.060	0.018	0.012			
0.020	0.012	0.060	0.060	J WHEEL-5				0.070	0.070					
		0.055	0.065	DIAPH. LABYRINTH E				0.070	0.080	0.006	0.008			
0.002	0.009	0.065	0.060	J WHEEL-6				0.070	0.090					
		0.075	0.075	DIAPH. LABYRINTH E				0.083	0.115	0.008	0.005			
0.005	0.012	0.080	0.050	K WHEEL-7				0.120	0.160					
		0.147	0.115	DIAPH. LABYRINTH E				0.115	0.125	0.006	0.005			
0.010	0.011	0.108	0.106	K WHEEL-8a				0.115	0.130					
		0.115	0.115	DIAPH. LABYRINTH E						0.020	0.005			
0.033	0.009			DIAPH. LABYRINTH E				0.120	0.164	0.006	0.004			
0.011	0.009	0.156	0.108	K WHEEL-8b				0.128	0.165					
		0.160	0.120	E						0.008	0.004			
0.011	0.012			E						0.006	0.003			
0.009	0.012			E						0.004	0.004			
0.008	0.008			E						0.007	0.004			
0.011	0.009			E						0.007	0.004			
0.006	0.003			OIL GUARD C						0.003	0.003			
	0.007			BRG. B										
				GOVERNOR										

---

JOB CODE                      JOB DESCRIPTION

---

Groove No.	Distance of sealing faces w.r.t. groove No.1
3	7.4455"
4	9.9446"
5	13.8248"
6	17.5662"

After machining the groove, the deburring and chamfering of inserts were carried out. Then insertion and set up of new S.S. inserts was done in the grooves. Then welding of inserts was carried out. After welding, D.P. test was carried out.

Following procedure was adopted for welding of inserts.

Process : GTAW  
 Filler wire : ER 309  
 Current : 70 - 150 A  
 Preheat : 75 degree C  
 Interpass Temp.: 175 degree C

Precautions

- Cleaning with wire brush & acetone was done
- Tackwelding at 150 MM pitch
- Zero gap to be kept

(Refer Annexure - I ( 3 sheets) for IMD DeLaval Repair procedure & WPS )

After fixing / welding of inserts in groove No.3,4,5, & 6 sealing face and top face of above grooves were machined upto the existing inner groove diameter. The groove location distances w.r.t. 1st groove and groove width (at machined areas) were checked and recorded.

(Refer Annexure - II).

TMU DETEX DIV

Dave Cox - DLT Field Service

ANNEXURE-I

SHT. 1 OF 3

MAPS


ANNEXURE-I

QW-482 SUGGESTED FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS) SHEET 1 OF 3  
 (See QW-200.1, Section IX, ASME Boiler and Pressure Vessel Code)

Name: TURBOCARE-DELTEX/PROMAC DIV. By: HOWARD GOEHRING  
 Procedure Specification No: WPS-1045 Date: AUG. 20, 1993 Supporting PQR No.(s): PQR-1045  
 Revision No.: -0- Date: \_\_\_\_\_  
 Welding Process(es): GTAW Type(s): MANUAL  
 (Automatic, Manual, Machine, or Semi-Auto.)

Details  
 S (QW-402)  
 Design: FILLET  
 Welding (Yes) \_\_\_\_\_ (No) X  
 Welding Material (Type) \_\_\_\_\_  
 (Refer to both backing and retainers.)  
 Metal:  Nonfusing Metal  
 Other  
 Attach Production Drawings, Weld Symbols or Written Description and show the general arrangement of the parts to be welded. Where possible, the root spacing and the details of weld groove may be filled.  
 In addition to the Affgr., sketches may be attached to illustrate joint, weld layers and bead sequence, e.g. for notch toughness procedure for multiple process procedures, etc.)

SEE "PROCEDURE FOR INSTALLING INSERTS IN STEAM TURBINE CASE"



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BASE METALS (QW-403)  
 P-No. 1 Group No. 1&2 to P-No. 8 Group No. 1  
 OR  
 Specification type and grade: ASTM 240 TYPE 304L  
 Specification type and grade: ASTM 283 GRADE D  
 OR  
 Chem. Analysis and Mech. Prop. \_\_\_\_\_  
 Chem. Analysis and Mech. Prop. \_\_\_\_\_  
 Thickness Range: \_\_\_\_\_  
 Groove Metal: Groove TO 8" Fillet UNLIMITED  
 Groove Dia. Range: Groove \_\_\_\_\_ Fillet \_\_\_\_\_

BASE METALS (QW-404)	
Spec. No. (SFA)	_____
Spec. No. (Class)	<u>AWS 5.9</u>
Spec. No.	<u>FR309</u>
Spec. No.	_____
Spec. No. of Filler Metals	<u>1/16" DIA.</u>
Spec. No. of Deposited Weld Metal	_____
Thickness Range:	<u>UNLIMITED</u>
Groove	_____
Fillet	_____
Shielding Gas (Class)	_____
Trade Name	_____
Weldable Insert	_____
Other	_____

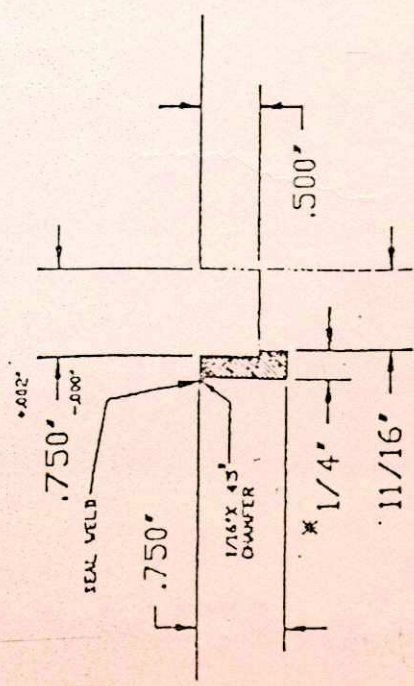
base metal/filler metal combination should be recorded individually.



PROCEDURE

1. OBTAIN 1/4" X 3/4" 304L S.S. KEYSTOCK LENGTH TO BE DETERMINED FROM CIRCUMFERENCE OF GROOVE IN CASE. PIECES TO BE 12" LONGER THAN GROOVE CIRCUMFERENCE.
2. ROLL KEYSTOCK TO DESIRED RADIUS WITH 6" OVERHANG ON BOTH ENDS
3. MACHINE GROOVE IN DIAPHRAGM GROOVE TO ACCEPT KEYSTOCK.
4. MACHINE CHAMFER ON GROOVE.
5. INSTALL INSERTS INTO GROOVE, CUTOFF, AND GRIND FLUSH WITH JOINT FACE OF CASE. SEAL WELD ENDS OF INSERTS AT JOINT FACE USING 309 S.S. WIRE AND GRIND WELD FLUSH WITH JOINT FACE OF CASE.
6. WELD ONE PASS IN 1/16" CHAMFER ALONG ENTIRE LENGTH OF INSERTS TO SEAL TO CASE. USE 309 S.S. WIRE.
7. MACHINE INSERTS PER CASE BORING AND GROOVING DRAWING TO GIVE PROPER GROOVE LOCATION AND WIDTH. BORE INSERTS TO BLEND WITH BORE OF CASE.

STEAM FLOW →



\* NOTE: FOR REFERENCE ONLY, TO BE DETERMINED FROM WIDTH OF INSERT. INSERT TO BE A SNUG FIT IN GROOVE

**IMD** **DELTEX**

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GASEINS

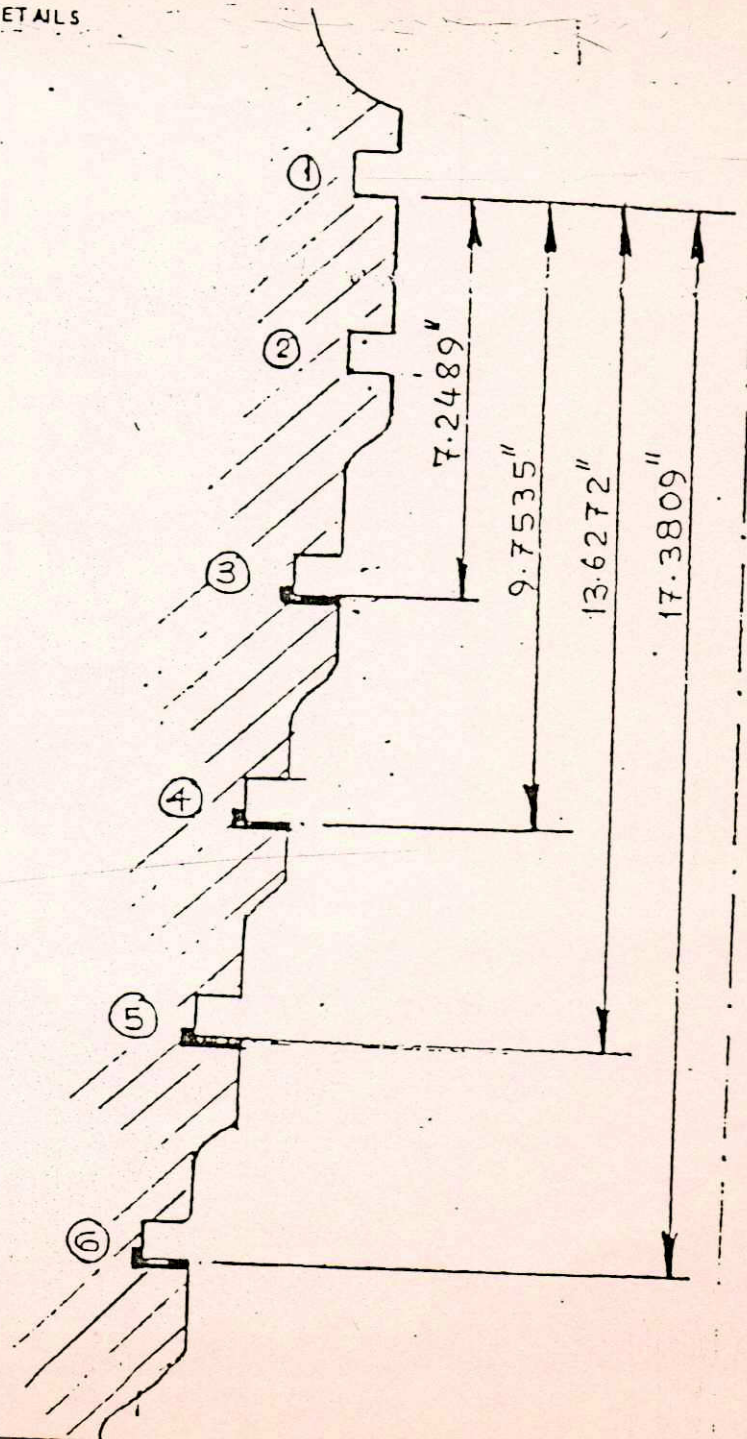
PROCEDURE FOR INSTALLING INSERTS  
IN STEAM TURBINE CASE

ANNEXURE - II

101 JT STEAM TURBINE CASING (BOTTOM) 77

REF. L & T. INSPECTION REPORT ANNEXURE - D

DETAILS



Groove width measured - as follows.

- Groove NO. 3 → 0.744" to 0.758"
- Groove NO. 4 → 0.749" to 0.753"
- Groove NO. 5 → 0.751" to 0.752"
- Groove NO. 6 → 0.750" to 0.752"

JOB CODE

JOB DESCRIPTION

(04) On Top casing , operation No.3 as above was repeated.

The distance recorded w.r.t. groove No.1 prior to fixing of inserts are as under.

Groove No.	Distances of sealing faces w.r.t. groove No.1
3	7.4437"
4	9.9462"
5	13.820"
6	17.5687"

(Refer Annexure - III for groove location distances w.r.t. 1st groove and groove width (at machined area) after fixing / welding of inserts)

(05) Assembly was checked for the following

Axial play of diaphragms when assembled in top and bottom casing was checked & found satisfactory except diaphragm No.3 in top half and diaphragm No.4 in top and bottom half. The same was corrected by weld build up and machining on button pads.

Bottom casing bore alignment was checked with bushings fitted in seal diameter with a ground boring bar and dial indicator.

(Refer Annexure - IV)

Total float of rotor assembly in bottom casing before assembly of top cover found to be 0.174" and after assembly of top cover found to be 0.170".

Axial clearance between diaphragms and rotor blades in normal running position of rotor (ie. 0.060" clearance from nozzle face) checked at 0 degree and 90 degree orientation.

(Refer Annexure - V & VI for Axial clearance)

(Refer Annexure - VII for final dimensions of Grooves after fixing of S.S.Inserts & machining).

01 01 01 (C) ACTIVITIES CARRIED OUT ON DIAPHRAGMS

- 01) All diaphragms were sand blasted
- 02) All diaphragms were flourescent Dye pentrant tested and found satisfactory.



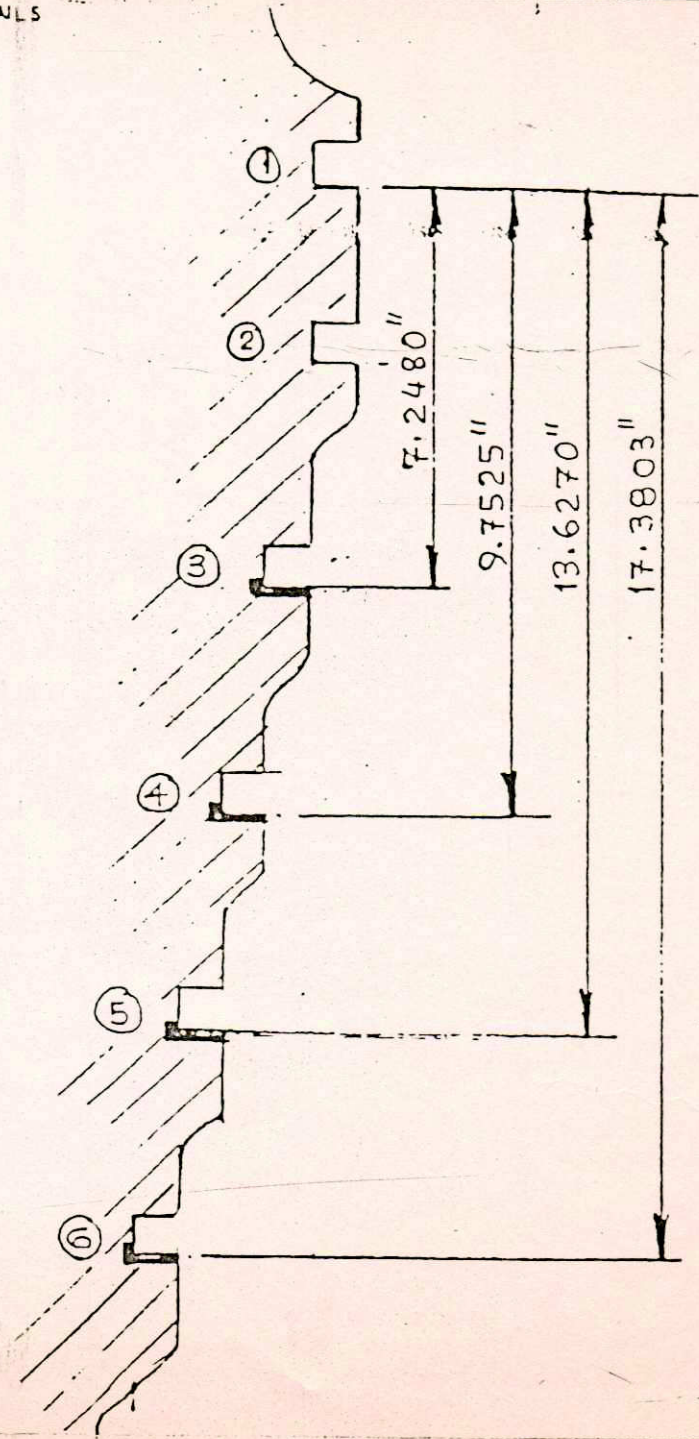
ANNEXURE - III

10 JT STEAM TURBINE CASING (TOP)

79

REF. L&T. INSPECTION REPORT ANNEXURE - F

DETAILS

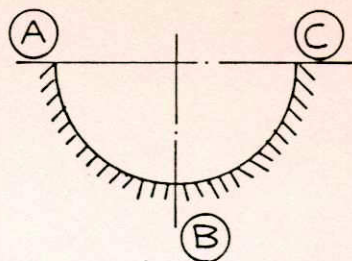


Groove width measured - as follows.

- Groove No. 3 → 0.746" to 0.759"
- Groove No. 4 → 0.751" to 0.753"
- Groove No. 5 → 0.750" to 0.751"
- Groove No. 6 → 0.749" to 0.751"

101JT BOTTOM HALF

ANNEXURE - IV



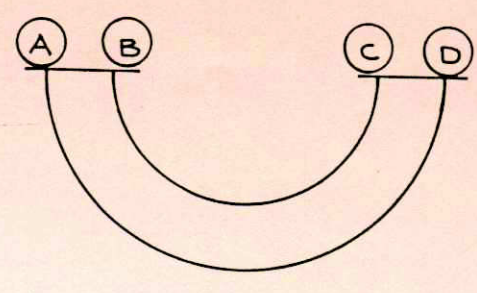
BORE ALIGNMENT READINGS  
(LOOKING FROM OUTLET SIDE)

DIAPHRAGM NO.	(A)	(B)	(C)
1	00"	-0.0185"	-0.0067"
2	00"	-0.035"	-0.038"
3	00"	-0.0275"	-0.012"
4	00"	-0.0358"	+0.037"
5	00"	-0.038"	-0.024"
6	00"	-0.030"	-0.018"
7	00"	-0.039"	-0.0137"
8	00"	-0.018"	+0.004"
9	00"	-0.020"	-0.002"

REF. L & T. INSPECTION REPORT ANNEXURE - G

DRN	KAM	TITLE :- STEAM TURBINE CASING (BOTTOM)			EWR No.	
CHD		BORE ALIGN. READINGS SEPT. OCT. 1993				
APD		DRAWING No.	PLANT FORM NUMBER	SHEET OF	REV	
SCALE	N.T.S.		(C) 1 (E) 5 0 8 0 7 4	1 OF 4	0	

101 JT CASING



ANNEXURE-V

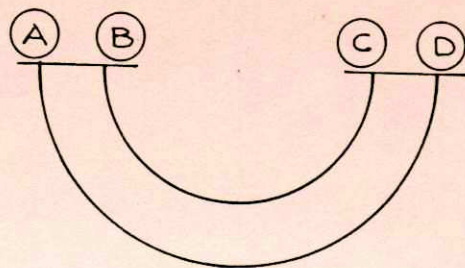
VIEW LOOKING FROM INLET SIDE  
(i.e. SMALL END SIDE)

AXIAL CLEARANCE AT 0° ORIENTATION BETWEEN  
DIAPHRAGM AND ROTOR BLADES IN NORMAL  
RUNNING POSITION OF ROTOR CHECKED IN  
BOTTOM CASING AND RECORDED AS BELOW.

DIAPHRAGM NO.	LOCATIONS			
	(A)	(B)	(C)	(D)
1	0.076"	0.078"	0.059"	0.063"
2	0.079"	0.094"	0.071"	0.065"
3	0.079"	0.087"	0.075"	0.073"
4	0.083"	0.067"	0.067"	0.073"
5	0.087"	0.087"	0.079"	0.077"
6	0.132"	0.128"	0.108"	0.112"
7	0.114"	0.118"	0.112"	0.096"
9	0.126"	0.122"	0.122"	0.122"

REF. L & T. INSPECTION REPORT ANNEXURE - H

DRN	KAM	TITLE:- STEAM TURBINE CASING WITH ROTOR LOCATION READINGS SEPT. OCT. 1993				EWR No.	
CHD							
APD		DRAWING No.	PLANT	FORM	NUMBER	SHEET OF	REV
SCALE	N.T.S.		(0) (1)	(E) (S)	(0) (8) (0) (7) (4)		

101 JT CASINGANNEXURE-VI

AXIAL CLEARANCE AT 90° ORIENTATION BETWEEN DIAPHRAGM AND ROTOR BLADES IN NORMAL RUNNING POSITION OF ROTOR CHECKED IN BOTTOM CASING AND RECORDED AS BELOW.

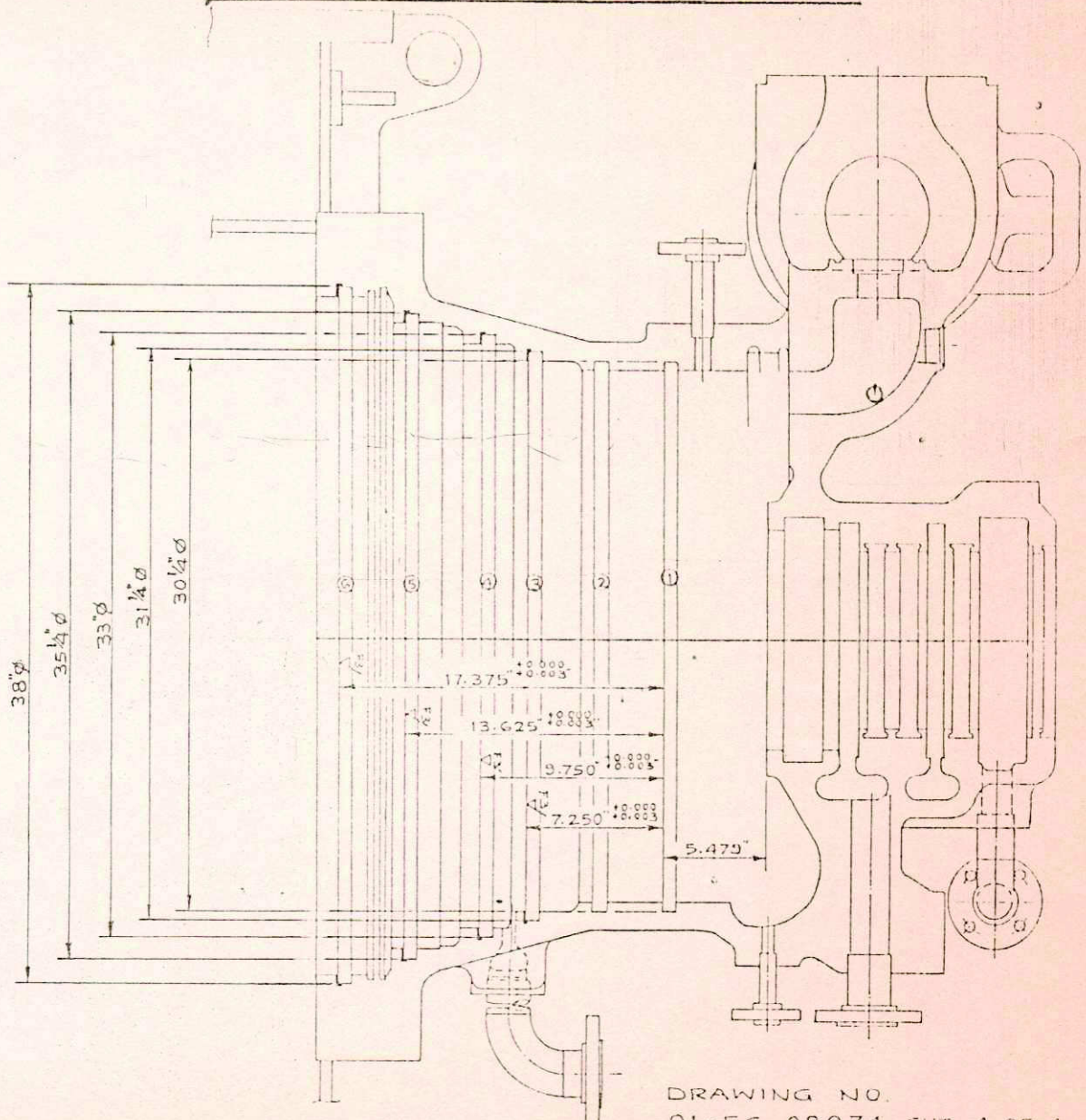
DIAPHRAGM NO.	LOCATIONS			
	(A)	(B)	(C)	(D)
1	0.080"	0.080"	0.060"	0.064"
2	0.080"	0.092"	0.071"	0.063"
3	0.081"	0.085"	0.077"	0.073"
4	0.082"	0.068"	0.065"	0.071"
5	0.086"	0.086"	0.077"	0.075"
6	0.128"	0.124"	0.110"	0.114"
7	0.122"	0.122"	0.110"	0.098"
9	0.122"	0.130"	0.122"	0.122"

GAP BETWEEN A BUTTON AND BLADE (BEHIND DIAPHRAGM NO.1 LOCATION) CHECKED AND FOUND TO BE 0.110"

REF. L & T. INSPECTION REPORT ANNEXURE - I

DRN	KAM	TITLE :- <u>STEAM TURBINE CASING WITH ROTOR LOCATION REPORTS SEPT. OCT. 1993</u>	EWR No.				
CHD							
APD		DRAWING No.	PLANT	FORM	NUMBER	SHEET OF	REV
SCALE	N.T.S.		01	ES	08074		

ANNEXURE-VII  
101JT CASING REPAIR SEPT. -OCT. 1993



DRAWING NO.  
01-ES-08074 SHT. 4 OF 4

---

JOB CODE                      JOB DESCRIPTION

---

(03) Diaphragm No.4 & 5 were found to be damaged on seating surface. Hence the same were weld build up and machined as per original height dimensions and found acceptable. The welding was done by electrode Supercito E 7018 (Advani orlikon)

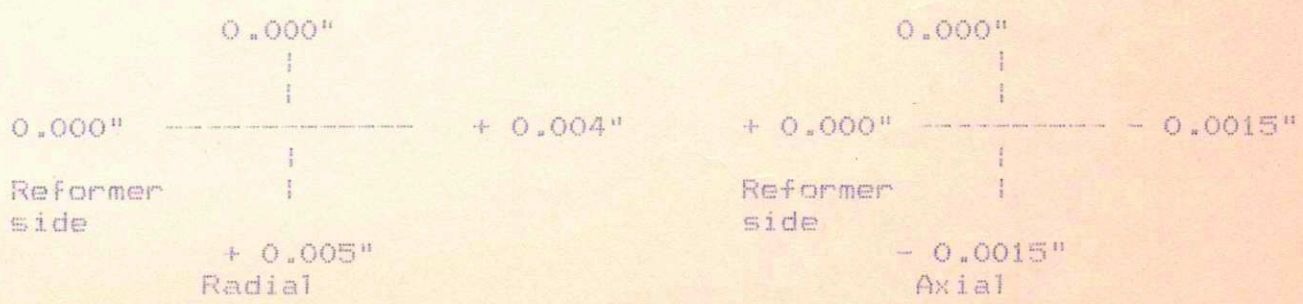
(D) TIME SCHEDULE OF TOTAL JOB :

- (01) Job of dismentling started - 13.09.93
- (02) Turbine casings, Rotor - 15.09.93  
& required spares sent to M/s.L&T Powai works,Bombay
- (03) Turbine casings,Rotor & - 02.10.93  
required spares received duly repaired from M/s.L&T Bombay back to plant site.
- (04) Assembly of top/bottom - 08.10.93  
casing at site & final O.S.T.finished.

(E) FINAL BEARING CLEARANCES

- (01) Journal Brg.Governor side - 0.007"  
(new Brg.)
- (02) Journal Brg. Coupling side - 0.007  
(old one)
- (03) Axial thrust - 0.008"
- (04) O.S.T. - 7700 RPM

Final alignment reading (101-JT to 101-JLP)  
( Dial on 101-JLP case )



JOB CODE

JOB DESCRIPTION

01 01 01 (02) AIR COMPRESSOR LP CASE (101-JLP) :

Since last 2 years we were facing problem of high housing vibration of thrust side journal bearing. The problem was communicated to M/s. IMO Delaval. During the current Sept.93 shutdown it was decided to carryout complete overhauling of LP case in presence of IMO Delaval service Engineer.

The compressor was dismantled and following jobs were carried out.

- 01) Rotor (ST 14) condition was found to be okay (Rotor No. CF 20520). The rotor was cleaned thoroughly by sand blasting.
- 02) The condition of diaphragms were found okay. The same were cleaned thoroughly by sand blasting.
- 03) The internal clearances were checked and found to be okay.
- 04) Some foreign particles ( pieces of aluminium wire mesh of air filter ) were found at 4th stage inlet guide vanes, which were removed.
- 05) It was noticed that rotor position at inlet was not matching as per design specification and it was found that the rotor was operating towards inlet end. This would result in less efficiency of the machine.

The required shimming adjustment on thrust bearing was done as follow to maintain rotor position as per specification to avoid aerodynamic resonance.

- 0.397" thk shim towards 101-JT side and
- 0.358" thk shim towards 101-J GB side

After adjustment of shims as above required axial play was not coming and hence again correction of above shims were made as follows to achieve axial thrust of 0.011".

- 0.397" thk shim towards 101-JT side
- 0.363" thk shim towards 101-JGB side

06) Both the journal bearings were found okay

06) Gear box side journal bearing housing was replaced by new one as one of the tilting pad was not free in the old housing.

---

JOB CODE                      JOB DESCRIPTION

---

- 07) Final clearances
- Journal bearing (GB side) - 0.006"
  - Journal bearing (Thurst ) - 0.005"
  - Axial thrust                      - 0.011"
- 08) Bolts of bottom outer housing (G.B. side journal and thrust bearings) connected with bottom casing were found loose, which were tightened.
- 09) All oil lines and orifices were thoroughly cleaned.
- 10) All expansion joints connected with Air compressor were adjusted as per specification i.e. proper clearance at tie rod fastners.
- 11) M/s.IMO Delaval Service Engineer inspected a spare rotor (ST-15) and advised that the spare rotor needs " At speed balance " as per the latest Delaval practice.

Note :- Please refer attached sheet at page A-53 (i) for running clearances.

01 01 01    (03) AIR COMPRESSOR GEAR BOX (101-J GB) :

The gear box was overhauled as preventive maintenance. Following jobs were done.

- 01) Bearings were inspected and found okay.

	<u>LP side</u>	<u>HP side</u>
Pinion	0.008"	0.008"
Gear	0.009"	0.009"
Axial thrust - 0.014"		

- 02) Gear and pinion condition were found okay.
- 03) Both gear and pinion were checked by D.P.test and found okay.

01 01 02    NATURAL GAS COMPRESSOR (102-J)/(102-JT) :

(01) NG COMPRESSOR (102-J) :

Following preventive maintenance jobs were carried out.

- 01) Both the journalbearings and thrust bearings were inspected and found in good condition.



RECOMMENDED CLEARANCES

REF.	CLEARANCE	BETWEEN
A	0.021" TO 0.027"	OIL GUARD (7.44)
C	0.013" TO 0.015"	BEARING HSG. (9)
D	0.005" TO 0.008"	BEARING PAD (10)
E	0.010" TO 0.013"	RING (11)
J	0.025" TO 0.025"	BUSHING (54)
L	0.025" TO 0.025"	BUSHING (54)
M	0.002" TO 0.004"	OIL GUARD (49)
S	0.002" TO 0.004"	OIL GUARD (49)
T	0.018" TO 0.022"	RING (14)
U	0.030" TO 0.035"	RING (19, 23, 25)

Rotor No. CF-20520 **87**

Shims interchanged to attain proper rotor position.

Turbine side H.P. case side  
 0.357" 0.358" + Before  
 0.363" 0.357" + After.

Rotor position with rotor in centre of thrust bearing

	BEFORE	AFTER	RECOMMENDED
Before			
↓			
			0.006
			0.006
			0.010
0.076	0.122	0.121	0.016
0.015	0.057	0.057	0.012
0.126	0.162	0.158	0.020
0.133	0.195	0.190	0.008
			0.010
			0.010
			0.018
			0.013

COUPLING TO 101-J HP BEFORE AFTER

OIL GUARD (7)-A

JOURNAL BRG C AND D CLEARANCE 0.005" TO 0.008" (53.10)

OIL GUARD (7)-A

RING (11)-E

BALANCE DRUM RING (14)-T

WHEEL (18)

RING (19)-U

BUSHING (20)-J

WHEEL (22)

RING (23)-U

BUSHING (60)-L

WHEEL (28)

RING (29)-U

BUSHING (54)-J

WHEEL (33)

RING (11)-E

OIL GUARD (7)-A

JOURNAL BRG C AND D CLEARANCE 0.004" TO 0.008" (53.10)

OIL GUARD (49)-M

TOTAL FLOAT WITHOUT SHOES 5/16"

THRUST BEARING

END PLAY 0.011" TO 0.015"

OIL GUARD (49)-S

OIL GUARD (44)-A

COUPLING TO 101-JT

Coupling gap = 268mm.

3.050	SCALE	DATE	INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL
DRAWING NO.	NAME	DATE	PLANT
	KAD		RUNNING CLEARANCES OF BEARING LABYRINTH BEFORE AND AFTER OVERHAULING OF 101-J
			LP CASE
			FORM
			NUMBER
			SHEET
			REV.

JOB CODE

JOB DESCRIPTION

- 02) Coupling was checked. The sludge was found which was cleaned. The coupling condition was good.
- 03) All oil lines were cleaned.
- 04) Final clearances
- |                                     |   |         |                                  |
|-------------------------------------|---|---------|----------------------------------|
| Journal bearing -<br>(coupling end) | - | 0.10 MM | (0.093 - 0.07 MM<br>Recommended) |
| Journal bearing -<br>(turbine end)  | - | 0.09 MM | (0.093 - 0.07 MM<br>Recommended) |
| Axial thrust                        | - | 0.28 MM | (0.25 - 0.35 MM<br>Recommended)  |
- 05) Suction separator was showing high pressure drop due to chocking. The separator was taken to workshop and its top and bottom dished ends were cut and heavy chocking of foreign material was removed. After cleaning the dished end were rewelded and the separator was installed back in position.

(02) NG COMPRESSOR TURBINE (102-JT) :

Following preventive maintenance jobs were carried out.

- 01) Both the journal bearings and thrust bearing were inspected. The condition of bearing were found okay.
- 02) All oil lines were cleaned
- 03) Governor oil was flushed and fresh oil charged
- 04) L.O. and Governor oil filter elements were replaced.
- 05) Final clearances
- |                              |   |         |                                 |
|------------------------------|---|---------|---------------------------------|
| Journal bearing -<br>(front) | - | 0.12 MM | (0.125 MM Recommended)          |
| Journal bearing -<br>(Rear)  | - | 0.16 MM | (0.185 MM Recommended)          |
| Axial thrust                 | - | 0.18 MM | (0.16 - 0.24 MM<br>Recommended) |
- 06) The exhaust butterfly valve of turbine was taken for complete overhauling. Since it was very hard to operate. For dismentling, the spindle had to be cut for removal of flapper. The new spindle was made in workshop from SS 410 material. The valve was then assembled with new spindle and new packing.

JOB CODE

JOB DESCRIPTION

- 02) Coupling was checked. The sludge was found which was cleaned. The coupling condition was good.
- 03) All oil lines were cleaned.
- 04) Final clearances
- |                                |   |         |                               |
|--------------------------------|---|---------|-------------------------------|
| Journal bearing (coupling end) | - | 0.10 MM | (0.093 - 0.07 MM Recommended) |
| Journal bearing (turbine end)  | - | 0.09 MM | (0.093 - 0.07 MM Recommended) |
| Axial thrust                   | - | 0.28 MM | (0.25 - 0.35 MM Recommended)  |
- 05) Suction separator was showing high pressure drop due to chocking. The separator was taken to workshop and its top and bottom dished ends were cut and heavy chocking of foreign material was removed. After cleaning the dished end were rewelded and the separator was installed back in position.

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Following preventive maintenance jobs were carried out.

- 01) Both the journal bearings and thrust bearing were inspected. The condition of bearing were found okay.
- 02) All oil lines were cleaned
- 03) Governor oil was flushed and fresh oil charged
- 04) L.O. and Governor oil filter elements were replaced.
- 05) Final clearances
- |                         |   |         |                              |
|-------------------------|---|---------|------------------------------|
| Journal bearing (front) | - | 0.12 MM | (0.125 MM Recommended)       |
| Journal bearing (Rear)  | - | 0.16 MM | (0.185 MM Recommended)       |
| Axial thrust            | - | 0.18 MM | (0.16 - 0.24 MM Recommended) |
- 06) The exhaust butterfly valve of turbine was taken for complete overhauling. Since it was very hard to operate. For dismentling, the spindle had to be cut for removal of flapper. The new spindle was made in workshop from SS 410 material. The valve was then assembled with new spindle and new packing.

JOB CODE

JOB DESCRIPTION

01 01 03 (01) SYN.GAS COMPRESSOR BACK PRESSURE TURBINE-103-JAT :

The front end bearing was inspected for showing high radial vibration on Bently Pannel. The problem was studied by M/s.IMO Delaval Engineer. On checking it was noticed that there was a 0.001" clearance between bearing shell to bearing housing fit. The recommended interference is 0.001" - 0.003". The condition of journal bearing pad and thrust pads were found to be okay. To maintain 0.001" - 0.003" interference between bearing shell to bearing housing, a shim of 0.003" thk was assembled and finally 0.002" fit was measured.

Finally the bearing was boxed up with old bearing. Read end bearing (103-JLP side) was replaced by new one as the existing one was found damaged.

Final clearances

Journal bearing (front end) - 0.012"  
Journal bearing (out board end) - 0.007"  
Axial thrust - 0.008"

01 01 03 (02) SYN.GAS COMPRESSOR CONDENSING PRESSURE TURBINE - 103-JBT:

As a preventive measure, the turbine was overhauled. Following jobs were carried out.

- 01) Turbine was dismantled and rotor TR.234 was removed. The rotor was having heavy moisture erosion at inlet side of 6th stage at base disc to rotor. Also M/s.IMO Delaval expert informed that the rotor TR 234 does not have latest modification at 5th and 6th stages. He advised to replace the rotor with a spare rotor.
- 02) Heavy erosion was noticed across diaphragm joint surfaces of 4th thro 7th stages. After cleaning the diaphragm grooves of casing visual inspection revealed that erosion in general to be less than 101-JT and 105-JT. M/s.IMO Delaval expert told that excessive tight fit in casing grooves may be contributing to lack of good seat. He also advised that diaphragm should not be tight in the casing grooves.
- 03) New spare Rotor TR-443 was issued from store. Mounted the coupling on the rotor. Then rotor was put on the lower casing. After thorough checking it was noticed that axial length of step adjacent to the front oil guard (HJ.588C) was more than required as compared to old rotor TR 234. The axial length of step on new rotor TR 443 was interfering with oil guard HJ-588C

JOB CODE

JOB DESCRIPTION

The reasons for above deviation and balancing specifications were asked from M/s.IMO Delaval,USA by Mr.John Denlea, IMD expert camp at Kalol site. M/s.IMO Delaval faxed all the data alongwith drawing. As per the drawing it was found that new rotor TR-443 dimensions were okay. So old TR-234 rotor was removed and compared the dimensions. It was concluded that old TR 234 Rotor might have been machined in the step length to suit casing internals.

It was decided to correct the dimensions of new Rotor TR 443 to suit old Rotor TR 234 by machining and then balancing. Finally necessary correction on new rotor TR 443 was done by machining and check balance was done at 250 RPM. The check balancing data were studied by M/s.IMO Delaval expert and after consultation with IMO Delaval,USA advised following.

New Rotor TR.443 should be sent to IMO Deltex works for Balancing at operating speed.

Also it is descirable to carry out modification on 5th & 6th stage of new TR 443 Rotor at IMO Deltex works.

Rotor TR 234 should be considered suitable for short terms use only due to as found conditions of rotor after twenty years of service.

- 04) Finally it was decided to assemble the turbine with old Rotor TR 234. Hence the turbine was assembled with old Rotor TR 234. A new trip assy.was assembled as the old one was found damaged.
- 05) Both journal bearings and thrust bearings were found in good condition and hence reused.

#### Final clearances

Journal bearing (coupling end)	-	0.007"
Journal bearing (In board end)	-	0.008"
Axial thrust	-	0.008"
O.S.T. done at	-	11800 RPM
(With new trip assy.fitted with old pin & old spring and washer of 0.130" thickness)		

Note :- Please refer attached sheet at page A-56 (i) for running clearances.

01 01 03 (03) 103-JBT GOVERNOR OVERHAULING :

It was reported that the TM governor of 103-JBT was not responding to the manual knob off the governor. Hence the governor assembly was taken for overhauling.

RECOMMENDED CLEARANCES		MIN.		MAX.		MIN.		MAX.		MAX. PERMISSIBLE	
		A	0.001"	0.003"	H	0.055"	0.065"	END FLOAT = 0.042"			
		B	0.005"	0.008"	J	0.115"	0.125"	TOTAL DESIGN END PLAY = 0.180" L = (0.160")			
		C	0.008"	0.014"	T	0.008"	0.012"				
E	0.013"	0.019"									
AFTER	BEFORE	FINAL		STEAM FLOW		FINAL		BEFORE	AFTER		
		SHROUD	BLADE			BLADE	SHROUD				
				OIL RING	A						
				THRUST BRG	T			0.009	0.008		
				JOURNAL BRG	B			0.007	0.008		
0.005	0.004			OIL GUARD	C			0.002	0.003		
0.006	0.003				E			0.006	0.006		
0.006	0.006				E			0.007	0.007		
0.005	0.005				E			0.008	0.007		
0.007	0.006				E			0.008	0.008		
0.006	0.006				E			0.008	0.007		
				NOZZLE		0.060					
				WHEEL-1		0.060					
0.006	0.004	0.075	0.075	LABYRINTH DIAPHRAGM				0.009	0.008		
				WHEEL-2		0.078	0.068				
0.005	0.003	0.075	0.075					0.007	0.006		
				WHEEL-3		0.070	0.085				
0.006	0.004	0.075	0.075					0.009	0.008		
				WHEEL-4		0.075	0.075				
0.007	0.004	0.075	0.065					0.009	0.009		
				WHEEL-5		0.070	0.075				
0.007	0.004	0.055	0.065					0.009	0.005		
				WHEEL-6		0.060	0.060				
0.007	0.006	0.070	0.075					0.009	0.008		
				WHEEL-7		0.055	0.100				
0.006	0.008							0.007	0.007		
0.007	0.008							0.008	0.008		
0.006	0.005							0.006	0.006		
0.006	0.008							0.005	0.004		
0.005	0.005			OIL GUARD	C			0.002	0.003		
				JOURNAL BRG	B			0.007			
				COUPLING							

JOB CODE

JOB DESCRIPTION

While overhauling, it was found that there were no lower or upper speed stop for restricting the movement of the manual speed adjustment lever. Also

the fully weight assembly had fallen down and it was thought that this was the reason why the governor was not responding to the speed signals. All required internals of the TM governor assembly including the weight assembly & speed stops were drawn from the stores & governor was assembled back & put into the position.

After charging oil into the governor oil circuit, the governor speed adjusting knob was moved up and down and it was seen that the governor linkage operated for full range thereby closing and opening the steam control valve of 103-JBT.

Also by operating on pneumatic signal the governor linkage operated for full range thereby closing and opening the steam control valve of 103-JBT.

However while operating in solo run in decoupled condition with steam, the governor came into action at around 8700 rpm with steam inlet valve full open. Thereafter the speed of the governor can be further increased by pneumatic signal, however it was not possible to increase the speed by manual knob and it used to increase without achieving a steady state.

M/s.IMO Delaval expert at site, Mr.Denlea advised that governor oil pressure is high (140 psi) which should be 100 psi maximum. This pressure should be controlled by a control valve which should be located just before the hydraulic accumulator and should maintain the required flow and required oil pressure of the governing oil. He advised IFFCO to procure such control valve and install the same.

Also the increase in speed at no load operation demands for checking the steam control valve or its by-pass valve of 103-JBT for any passing.

The pilot valve setting of TM governor also should be checked on next opportunity to ensure its proper operation.

01 01 04 REFRIGERATION COMPRESSOR TRAIN 105-JT/105-JR/105-JLP :

01) REFRIGERATION COMPRESSOR DRIVE TURBINE - 105 JT :

Turbine was overhauled as preventive measure. Following jobs were carried out.

REFRI. COMPRESSOR TURBINE - 105JT 93

RECOMMENDED CLEARANCES		MIN.	MAX.	MIN.	MAX.	MAXI. PERMISSIBLE	101JT	105JT
A		0.002"	0.004"	J	0.055"	0.065"	LOOKING FROM GOVERNOR END	LOOKING FROM GOVERNOR END
B		0.007"	0.009"	K	0.110"	0.120"		
C		0.015"	0.021"	T	0.008"	0.012"	TOTAL DESIGN END PLAY = 0.180	
E		0.013"	0.019"					
AFTER	BEFORE	FINAL		STEAM FLOW		FINAL	BEFORE	AFTER
		SHROUD	BLADE			BLADE	SHROUD	
	0.011			OIL RING	A			
	0.010			THRUST BRG.	T			
0.007				OIL RING	A			
0.006	0.010			BRG.	B			0.006
0.008	0.012			OIL GUARD	C			0.004
0.009	0.014				E			0.007
0.010	0.011				E			0.006
0.011	0.010				E			0.014
					E			0.005
					E			0.006
			0.050	NOZZLE				
0.015	0.018			J	WHEEL-1			
		0.075	0.028	DIAPH.	LABYRINTH E	0.058	0.065	0.009
0.007	0.009	0.076	0.068	J	WHEEL-2	0.062	0.058	
		0.075	0.058	DIAPH.	LABYRINTH E	0.065	0.068	0.010
0.012	0.011	0.072	0.058	J	WHEEL-3	0.068	0.068	
		0.080	0.058	DIAPH.	LABYRINTH E	0.063	0.080	0.010
0.012	0.013	0.055	0.062	J	WHEEL-4	0.065	0.076	
		0.056	0.062	DIAPH.	LABYRINTH E	0.055	0.055	0.008
0.017	0.014	0.062	0.058	J	WHEEL-5	0.055	0.050	0.014
		0.057	0.061	DIAPH.	LABYRINTH E	0.050	0.050	0.012
0.015	0.017	0.110	0.108	J	WHEEL-6	0.055	0.050	
		0.115	0.120	DIAPH.	LABYRINTH E	0.090	0.110	0.009
0.014	0.015	0.130	0.120	K	WHEEL-7	0.098	0.118	0.015
		0.132	0.120	DIAPH.	LABYRINTH E	0.103	0.120	0.010
0.012	0.011	0.132	0.120	K	WHEEL-8A	0.110	0.132	0.010
		0.130	0.128	DIAPH.	LABYRINTH E	0.117	0.130	0.004
0.004	0.007	0.130	0.135	K	WHEEL-8B	0.120	0.134	0.013
0.006	0.010				E			0.014
0.004	0.005				E			0.007
0.004	0.010				E			0.005
0.009					E			0.009
	0.010			OIL GUARD	C			0.009
				BRG.	B			
				COUPLING				

A-57(i)



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JOB CODE                      JOB DESCRIPTION

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- 01) The condition of 4th thru 7th stages at diaphragm and adjacent casing surfaces was not good due to moisture erosion. However moisture erosion was to a lesser extent as compared to 101-JT condition.
  - 02) The rotor (TR 460 / D 1260) condition was found in good condition.
  - 03) Rotor and diaphragms were thoroughly cleaned by sand blasting
  - 04) The condition of journal bearing and thrust bearing were found okay.
  - 05) The turbine was assembled with all the old components.
  - 06) Final clearance
    - Journal bearing (Governor side) - 0.010"
    - Journal bearing (coupling side ) - 0.010"
    - Axial thrust - 0.011"
  - 07) All the oil lines and orificers were thoroughly cleaned
  - 08) Overspeed trip done at 7705 rpm on 8.10.93
- Note:- Please refer attached sheet at page A-58 (i) for running clearance.

02) REFRIGERATION COMPRESSOR G.B.(105-JR) :

The gear box was overhauled as preventive check up. Following jobs were carried out.

- 01) Bearings were inspected & found okay. Following were the clearances found.
 

	<u>LP side</u>	<u>HP side</u>
Pinion	0.012"	0.012"
Gear	0.015"	0.014"
Axial thrust pinion	0.052"	
Axial thrust gear	0.017"	
- 02) Gear and pinion condition were found okay
- 03) Both gear & pinion were checked by D.P.test & found OK
- 04) Radial vibration probe location of north side bearing of gear shaft was shifted as a step on the shaft was facing the probe which inturn was giving a false indication.

JOB CODE

JOB DESCRIPTION

03) REFRIGERATION COMPRESSOR LP CASE (105-JLP) :

The problem of oil carry over through mechanical seals was persisting. It was confirmed that the oil carry out was due to mechanical seal of LP case only. Hence it was decided to inspect the mechanical seal of 105-JLP case.

The compressor LP case was dismantled & following jobs were carried out.

- 01) The condition of Rotor was found okay
- 02) Both journal bearings & thrust bearings were found okay
- 03) Both the mechanical seals were found to be in good condition, however there was a physical evidence indicative of oil passing through inlet end seal in particular.

Both the carbon faces were properly lapped and assembled the old seal with new rubber components. As per IMO Delaval Engr. the inlet end seal was loaded slightly more compared to discharge end seal.

- 04) The complete seal system was reviewed and studied in detail. It was traced out that there was no hole for Buffergas inlet in top casing half (towards turbine side). Hence the required Hole was drilled for entry of buffergas.
- 05) Cleaning of the seal oil traps was carried out and proper adjustment was done.
- 06) All the buffer gas lines and oil lines were thoroughly cleaned.
- 07) Finally the assembly of LP case was done and seal leak test with I.G. was carried out and found to be okay.
- 08) Final clearance
  - Journal bearing (BB side) - 0.007"
  - Journal bearing (turbine side) - 0.008"
  - Axial thrust - 0.012"

Note :- Please refer attached sheet at page A-59 (i) for running clearances.

01 02 01 BFW PUMP (104-J) AND ELLIOT TURBINE (104-JT) :

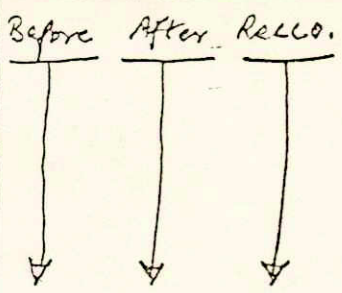
- (01) 104-J :

RECOMMENDED CLEARANCES

REF.	CLEARANCE	BETWEEN
A	0.020" TO 0.026"	SHAFT (45) & GUARD (13)
C	0.002" TO 0.004"	SHAFT (45) & GUARD (10)
E	0.014" TO 0.017"	SHAFT (45) & HOUSING
F	0.006" TO 0.008"	SHAFT (45) & JOUR. BRG.
G	0.005" TO 0.007"	SHAFT (45) & BUSHING
H	0.018" TO 0.021"	SHAFT (45) & RING (17)
K	0.018" TO 0.022"	RING (19) & RING (20)
N	0.030" TO 0.035"	WHEEL & RING
R	0.025" TO 0.029"	WHEEL & BUSH
T	0.020" TO 0.026"	SHAFT & GUARD (44)

Thrust bearing skirts (New)  
 Turbine side → 0.0392"  
 H.P. Case side → 0.0373"

Rotor positions



AFTER BEFORE

<u>0.014</u>	<u>0.012</u>
-	-
-	-
-	-
<u>0.009</u>	<u>0.005</u>
<u>0.009</u>	<u>0.005</u>
<u>0.008</u>	<u>0.013</u>
<u>0.095</u>	<u>0.128</u>
<u>0.090</u>	<u>0.123</u>
<u>0.130</u>	<u>0.159</u>
<u>0.140</u>	<u>0.177</u>

COUPLING G.B. END

BEFORE AFTER

GUARD (73)-A	<u>0.013</u>	<u>0.013</u>
THRUST BEARING TOTAL END PLAY 0.011" TO 0.015"	<u>0.012</u>	<u>0.012</u>
GUARD (10)-C	<u>0.003</u>	<u>0.003</u>
JOURNAL BEARING F	-	<u>0.007</u>
BUSHING G	<u>0.008</u>	<u>0.005</u>
RING (17)-H	<u>0.008</u>	<u>0.005</u>
BALANCE DRUM RING (20)-K	<u>0.012</u>	<u>0.018</u>
IV WHEEL (22)	-	-
RING (65)-N	<u>0.014</u>	<u>0.014</u>
BUSHING (64)-R	<u>0.005</u>	<u>0.010</u>
III WHEEL (26)	-	-
RING (86)-N	<u>0.015</u>	<u>0.020</u>
BUSHING (80)-R	<u>0.006</u>	<u>0.007</u>
II WHEEL (32)	-	-
RING (61)-N	<u>0.0015</u>	<u>0.018</u>
BUSHING (60)-R	<u>0.005</u>	<u>0.010</u>
I WHEEL (85)	-	-
RING (58)-N	<u>0.015</u>	<u>0.022</u>
RING (17)-H	<u>0.006</u>	<u>0.010</u>
BUSHING-G	<u>0.006</u>	<u>0.010</u>
JOURNAL BEARING F	-	<u>0.008</u>
GUARD (44)-T	<u>0.010</u>	<u>0.012</u>

COUPLING TURBINE END

DRAWING NO.	SCALE	APP.	CHK.	ENR	DATE	PLANT	INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL	L.H.O.	QTY.	DLE.	SIZE	MATERIAL	EWR NO.
RUNNING CLEARANCES OF BEARING LABYRINTH BEFORE AND AFTER OVERHAULING OF 105-I L.P. CASE													
01 02 03 04 05 06 07 08 09 10 11 12													

JOB CODE

JOB DESCRIPTION

Following preventive maintenance jobs were carried out.

- 01) Both the journal bearings and thrust bearing were checked and found okay.
- 02) Fresh oil charged in the oil sump.
- 03) Oil filter cleaned
- 04) L.O.coolers and Mech.seal coolers cleaned
- 05) Head gasket (casing cover ) was replaced by new one
- 06) Coupling was checked and regreasing was done
- 07) Final clearances found were as follows
  - Journal bearing (coupling side ) - 0.0065"
  - Journal bearing (thrust side ) - 0.006"
  - Axial thrust - 0.012"

(02) 104-JT :

Following preventive maintenance jobs were done.

- 01) Both journal bearings and thrust bearing were checked and found okay
- 02) Oil sump was cleaned and fresh oil charged
- 03) Cleaned L.O.filters and L.O.coolers
- 04) Woodward governor oil flushed
- 05) Final clearance
  - Journal bearing (coupling side ) - 0.011"
  - Journal bearing (governor end ) - 0.011"
  - Axial thrust - 0.010"

01 02 01 BFW PUMP (104-JA) AND TERRY TURBINE (104-JAT) :

(03) 104-JA :

Following preventive maintenance jobs were carried out.

- 01) Both journal brgs & thrust bearing were checked & found okay.
- 02) Fresh oil charged in the oil sump

JOB CODE	JOB DESCRIPTION
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- 03) Oil filter cleaned
- 04) L.O.coolers and Mech.seal coolers were cleaned
- 05) Final clearances found were as follows
  - Journal bearings (coupling side ) - 0.007"
  - Journal bearing (Thrust side ) - 0.007"
  - Axial thrust - 0.016"
- 06) Coupling was checked and regreasing done.

(04) 104-JAT (TERRY TURBINE ) :

Following preventive maintenance jobs were carried out.

- 01) Both journal bearings and thrust bearing were checked and found okay.
- 02) Oil sump was cleaned and fresh oil charged
- 03) Cleaned L.O.filters & L.O.coolers
- 04) Woodward governor oil flushed
- 05) Final clearances
  - Journal bearing (coupling end ) - 0.005"
  - Journal bearing (Governor end ) - 0.007"
  - Axial thrust - 0.019"

01 02 02 MEA PUMP TURBINES OVERHAULING - 107-JT & 107-JAT :

(01) MURREY TURBINE (107-JT) FOR MEA PUMP :

The turbine was overhauled as a preventive maintenance. Following jobs were carried out.

- 01) Turbine was dismantled
- 02) Rotor was found okay however some silica deposition was noticed on the wheels. Hence the rotor was thoroughly cleaned by sand blasting.
- 03) Nozzle fixing 6 nos of bolts were found broken. The same were replaced by new one.
- 04) Thinning was observed on the blades of all the diaphragms. Internal threads were found damaged of bottom half diaphragms to which top half of diaphragm is being fastned.

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JOB CODE                      JOB DESCRIPTION

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- 05) All the diaphragms were cleaned by sand blasting.
- 06) All the sealing carbon rings were replaced by new one.
- 07) Oil pump and its coupling set was replaced by new one.
- 08) Final clearances.
  - Out board bearing - 0.006"
  - In board bearing - 0.005"
  - Axial thrust - 0.011"
- 09) After assembly overspeed trip done at 4250 rpm, on 8.10.93.

(02) ELLIOT TURBINE FOR MEA PUMP (107-JAT) :

The turbine was taken for overhauling as preventive maintenance. Following jobs were carried out.

- 01) Turbine was dismantled
- 02) Rotor was found okay and the same was cleaned manually.
- 03) Same carbon rings were reused
- 04) Both the journal bearings were replaced by new one
- 05) Final clearances
  - Journal bearing (out board) - 0.011"
  - Journal bearing (Inboard ) - 0.011"
  - Axial thrust - 0.012"

01 02 03 PUMPS :

- 01) 2004-J Pump changed with spare one due to high vibration in existing pump.
- 02) 109-J , 110-J and 113-J were decoupled for motor overhauling and realigned and coupled after motor replacement.

01 03 01 ID FAN TRAIN (101-BJT/BJR/BJ) :

Following preventive maintenance jobs were carried out.

JOB CODE	JOB DESCRIPTION
----------	-----------------

(01) TURBINE :

- 01) Turbine was overhauled
- 02) Rotor was found okay
- 03) Thrust bearing replaced by new one
- 04) All carbon rings replaced by new one
- 05) Journal bearings were found okay
- 06) LO coolers were cleaned
- 07) Woodward governor oil was flushed
- 08) Final clearance
  - Carbon seats 0.003"
  - Journal Brg. (coupling side) - 0.0105"
  - Journal brg. (governor side) - 0.011"
  - Thrust - 0.013"
- 09) Overspeed trip was done at 4300 rpm on 7.10.93

(02) GEAR BOX :

- 01) Gear box was opened
- 02) Gear condition was found okay
- 03) All the bearing condition were found okay
- 04) Oil filters were cleaned
- 05) Fresh oil was charged in gear box
- 06) L.O.coolers were cleaned
- 07) Following were the journal bearing clearances

	Turbine side	Fan side
	-----	-----
Pinion -	0.0075 to 0.008"	0.007"
Gear	0.0065"	0.0075"

(03) FAN :

- 01) Both the journal bearings were inspected and found okay.
- 02) C.W.jacket area of journal bearing was thoroughly cleaned.
- 03) Rubber pad of outboard journal bearing end cover was replaced by new one.
- 04) Oil of both the bearings was flushed and charged with fresh oil.
- 05) Final clearances
  - Journal bearing (GB side) - 0.013"
  - Journal bearing (Out board side) - 0.0125"

JOB CODE

JOB DESCRIPTION

01 13 01 HEAT EXCHANGER REPLACEMENT JOBS :

Following heat exchangers/vessels were replaced by new one.

- 1) MEA Vapouriser - 113-C shell
- 2) MEA solution coolers - 108-C2A, C2B - 2 Nos
- 3) MEA solution exchanger 109-C1A, C2A - 2 Nos.
- 4) Synthesis gas compressor after cooler - 124-C

In Existing Syn.gas after cooler (124-C) several tubes were plugged due to damage of tubes because of vibration and corrosion. To minimise this vibration and arresting corrosion it, following modifications were carried out while procuring new after cooler from M/s.Godrej & Boyce, Bombay.

- a) The straight length up to tangent line of tube bundle has been extended from 3052.8 mm to 3400 mm
- b) To accommodate additional length of tubes the shell length has also been increased from 3788 mm to 4131 mm.
- c) Material of construction for tubes, longitudinal baffle, cross baffle, Tie rods & nuts spacer tubes have been changed from C.S to SS 304 composition.
- d) Design of cross baffle has been changed from single segmented to double segmented type with proper sealing strips on each cross baffle.
- e) The spacing of cross baffles have been changed from 476.25 mm to 390 mm.

01 13 02 REPAIR ON HEAT EXCHANGER:

- 1) 129-JC & 130-JC Air compressor interstage coolers

Finned tube bundle were pulled out and chemical cleaning was carried out to clear the choked fins for improving its efficiency. Coolers were boxed up with new sealing strips.

- 2) 105-CB gland leakage

Bottom channel cover was removed and gasket was replaced by new one.Gland re-packed then hydrotested at 35 kf/cm<sup>2</sup>.



JOB CODE

JOB DESCRIPTION

3) Heat Exchangers (103-C)

About one year back inch crack was observed in inlet channel cover which was repaired by welding. Hence during this occasion the inlet channel and outlet channel covers were replaced by new manufactured by M/s.BHPV, Vishakhapatnam.

During visual inspection leakage was suspected from 3 tubes in tube to tube sheet joint. Hence these three tubes were expanded. During hydrotesting of boiler GT-1631 at 130 kg/cm<sup>2</sup> no leakage was observed. hence channel covers were boxed up with new gaskets.

01 13 03 Following coolers were cleaned by rod pocking and water flushing.

- 1) BFW pumps 104-J/JA / JAT - 4 Nos
- 2) ID fan 101-BJ/BJT - 3 Nos
- 3) MEA Turbine 107-JT - 1 No
- 4) BFW pumps 104-J/JA seal coolers - 4 Nos
- 5) 170-J/JA seal coolers - 2 Nos

01 15 01 BOILER INSPECTION BY C.I.B. (GT-1631 & 1632 )

- a) Open inspection was carried out on 27/09/93
- b) Hydrotest of GT-1632 was carried out on 4.10.93
- c) Hydrotest of GT-1631 was carried out on 11.10.93
- d) Hydrotest pressure of GT-1632 14.0 Kg/cm<sup>2</sup>  
GT-1631 - 130 kg/cm<sup>2</sup>

e) RV's GT-1632 were tested at 12.5 kg/cm<sup>2</sup> on 5.10.93

On 16.10.93 RV floating of 101-F was started north side RV of boiler drum was popped and re-set as per requirement. However middle and south side RV's were not re-setting as per our requirement. However drum pressure was brought down to zero and both the RV's were opened and re-lapped.

Following spares were replaced in RV's

Middle

South

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1) New yoke</li> <li>2) New lock bolt</li> <li>3) New washer for spring</li> <li>4) New spindle</li> <li>5) Lapped disc insert</li> </ol> | <ol style="list-style-type: none"> <li>1) Existing lock bolt was machined</li> <li>2) Existing washer for spring after machining</li> <li>3) New spindle</li> <li>4) New disc holder</li> <li>5) New disc insert</li> </ol> |
|--|---|

JOB CODE                      JOB DESCRIPTION

Final setting of RV's of 101-F (GT-1631)

	Set pre.	Reset pre.	Tested on
North	116.0	111	16.10.93
Middle	114.5	109.5	17.10.93
South	111.0	109	17.10.93
Superheater	110.0	107.5	16.10.93

01 16 01 FILTERS / STRAINERS / DEMISTER PAD :

- 1) 102-J L.O.pipe and auxiliary boiler burner strainers were cleaned.
- 2) Following strainers of C.W.were also cleaned
  - a) 104-J/JA C.W.inlet line
  - b) 101-BJ C.W.inlet line
  - c) 107-J C.W.inlet line

01 17 01 VALVES REPAIR / REPLACEMENT :

- 01 110-F,111-F,112-F PI tapping isolation valves made operable and gland repacked.
- 02 Steam to NG coil - valve replaced with 2" x 800 # S.W.globe valve.
- 03 SP-75 snuffing steam valve replaced with new 2" x 800 # S.W.globe valve.
- 04 PIC-5 Vent snuffing steam to SP-71 valve replaced by new one 2" x 800 # S.W.globe valve.
- 05 107 JAT bypass valve replaced by new one - 1/2" x 1500 # S.W.globe valve
- 06 38 ata steam - II fan turbine isolation valve gland was re-packed.
- 07 NG coil outlet to FRC-2 D/S line Ist block valve gland was repacked.
- 08 TRC-12 drain valve replaced by new one 3/4" x 800 # S.W.gate valve
- 09 Steam drum outlet steam I/V spindle repaired and made operable freely.
- 10 107-JAT sealing steam I/V location was changed for operational convinience.

JOB CODE	JOB DESCRIPTION
11	106-F drain valve replaced by new one - 3/4" x 1500 # S.W.gate valve.
12	106-P Try-cock valve replaced by new one 1/2" x 1500 #
13	FIC-19 drain valve bonnet replaced by new one
14	103-D jacket water flushing line valves of row no. 2,5,6 and 8 were made operable.
15	Drain valve of LA-119 level switch and LA-18 level trol made operable.
16	Blow down valves which were passing badly were repaired by opening the bonnet, lapping seat and body seating surface by making specially designed arrangement. No.of valve reconditioned - 10 Nos
17	103-JAT steam inlet valve bonnet leak (10" x 1500#) was repaired by replacing the bonnet gasket.
18	108-F level trol bottom drain valve gland was re-packed.
19	Replaced passing upstream block valve at PIC-253 (172-F blanketing line) by 3/4" x 800 #.
20	C.W.jump over valve (MOV) near I.D.Fan was hard to operate. Dismantled the valve and made freely operable.
21	HTS oxidation water inlet valve was made operable by overhauling.
22	Waste heat boiler blow down valves were repaired by lapping.

01 17 02 CHECK VALVES :

- |    |   |
|----|---|
| 01 | 121-JA suction check valve was opened, inspected and found okay.                    |
| 02 | 101-J discharge line check valve near FR-4 transmitter was inspected and found okay |
| 03 | 103-J cjeck valve between HP & LP case (105-F) was opened inspected and found okay. |
| 04 | 123-C outlet BFW linecheck valve opened, inspected and found okay                   |
| 05 | 114-C outlet BFW line check valve found okay during inspection                      |

JOB CODE	JOB DESCRIPTION
	06 FRCV-2 down stream check valve was inspected and found oaky
	07 MEA pump 107-J/JA discharge line check valves (2 Nos) inspected and found oaky.
01 17 03	Following RV's were removed , overhauled and tested and installed back in its position.  1) RV-BFW-1 (BFW coil for offsites) Replaced by spare one  2) RV-107-F (1) primary Amm - separator popping pressure - 270 PSI rest pressure - 240 PSI  3) RV-101-J Air compressor discharge popping pressure - 530 PSI rest pressure - 490 PSI  4) RV-103-JAT (1) 103-JAT exhaust (North) (2) 103 JAT exhaust (south) Popping pressure - 48.0 kg/cm <sup>2</sup> Reset pressure - 43.5 kg/cm <sup>2</sup>  5) RV-103-JAT sentinel popping pressure - 43.0 kg/cm <sup>2</sup> reset pressure - 38.6 kg/cm <sup>2</sup>  6) RV-50 off gases compressor Test pressure - 75 PSI Reset pressure - 66 PSI
01 19 02	<u>VESSEL INSPECTION / REPAIR :</u>  01 106-F, 107-F, 109-F,110-F,111-F,112-F,103-F manholes opened for inspection and boxed up after cleaning / inspection with new gaskets.  02 R-1 & R-2 manholes and hand holes were opened for catalyst unloading. Repaired the catalyst supporting screen and boxed up manhole and hand holes after loading the catalyst.  03 104-JAT ejector elbow leak was attended by welding  04 Opened top cover of degassing tanks of 102-J, 103-J and 105-J for cleaning and boxed up with new gaskets.  05 103-D bottom plug opened and boxed up after inspection of refractory dome.  06 107-F, 109-F, 110-F, 111-F and 112-F level glasses cleaned.

JOB CODE

JOB DESCRIPTION

01 19 03 CO2 ABSORBER 101-E :

The internal inspection of the complete vessel was carried out by inspection section and report of the same is enumerated in inspection report. Severe erosion / pitting was observed between 19th and 20th tray and also below 20th tray which resulted into reduction in wall thickness.

The above damaged areas were repaired by grinding and welding. The preheating was done from out side by LPG burners and temperature of 125 o C was maintained. The welding was done by E-7018-1 electrode and interpass temperature of 225 o C was maintained. Post heating was done up of 300 - 350 o C with a soaking period of 3 hrs.

M/s.ITW Signode representative was called for suggesting application of their appropriate product. As per his advise Titanium putty was applied on the shell support plate on complete periphery tray to prevent leakage through those area.

Complete area below 20th tray and partial area between 19th and 20 th tray was coated first by applied plastic steel liquid "B" and than by applied brushable ceramic to avoid further corrosion.

Qty used - Titanium putty - 6 Kg  
 Plastic steel liquid "B" - 4 Kg  
 Brushable ceramic - 6 Kg

01 20 01 FABRICATION JOBS :

01 103-D jacket overflow tray material was replaced by SS material since existing C.S.material was badly corroded.

02 108-C C.W.line. Clamp provided on leaky portion of line was removed. 500 mm length of this 14" line was replaced by fabricated SS 304 pipe piece.

03 131-JC C.W.outlet under ground line was replaced by 6" x Sch.40 C.S.material.

Material used - 6" x Sch.40 pipe - 6 meters  
 6" x Sch.40 elbow - 2 Nos

04 I.G. to PGR filter No.F-1 down stream 1/2" dia line. Flange joint was provided in this line for facilitating blinding if required.

JOB CODE

JOB DESCRIPTION

05 Piping replacement (103-C)

01 31 01 HEAT EXCHANGERS HYDROJET CLEANING :

I) Following heat exchangers channel covers and inter connecting pipings 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 also carried as mentioned below.

- 1) 108-C1A , 108-C1B  
No.of tube - 1415 Nos each  
Hydrotest - Tube side - 8.0 Kg/cm<sup>2</sup>  
Shell side - 8.0 Kg/cm<sup>2</sup>
- 2) 109-C2B, 109-C2B  
No.of tubes - 1150 tubes each  
Hydrotest - Tube side - 46.0 Kg/cm<sup>2</sup>  
Shell side - 8.0 Kg/cm<sup>2</sup>
- 3) 116-C  
No.of tubes - 300  
Hydrotest - Tube side
- 4) 115-C Methanator effluent cooler  
No.of tubes - 649 "U" - Hydrotest  
- shell side 15.8 kg/cm<sup>2</sup>

II) Following heat exchanger channel covers and interconnecting pipings were opened and boxed up after hydrojetting from tube side. Exchangers were hydrotested after assembly.

- 1) 113-C  
No.of tubes  
Hydrotest - tube side = 14.5 kg/cm<sup>2</sup>
- 2) 127-CA/CB (2 Nos)  
No. of tubes - 3100  
Hydrotest - shell side - 31.5 Kg/cm<sup>2</sup>
- 3) Inter/ after condenser of 101-JCA - 2 Nos  
No.hydrotest
- 4) Inter/after condenser of 101-JCB - 1 No  
No.hydrotest
- 5) Gland condenser of 101-JT, 103-JT & 105-JT  
( 3 Nos) - No hydrotest
- 6) CO<sub>2</sub> condensers 110-CA/CB - 2 Nos  
No.of tubes - 763

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- 7) Stripped condensate coolers - 173 -C  
No.of tubes - 294
- 8) UAG MEA cooler - 175-C  
No.of tubes - 222
- 9) Surface condensers - 101-JCA/JCB (2 Nos)  
No.of tubes - 4670  
No hydrottest
- 10) Syn.gas compressor interstage cooler -116-C  
No.of tubes - 300 "U"  
Hydrottest pressure - 15.8 kg/cm<sup>2</sup>
- 11) a) Lube oil cooler of air compressor - 3 Nos  
b) Lube oil cooler of Syn.gas compressor - 2 Nos  
c) Lube oil cooler of NG Compressor - 3 Nos

01 31 02

**PAINING :**

Painting of all available equipment and piping was carried out including the following.

- 1) Converter 105-D
- 2) Primary Reformer - 101-D
- 3) Exhaust piping of 101-J etc.

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INSPECTION JOBS

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JOB CODE	JOB DESCRIPTION
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01 41 00 INTRODUCTION:

During Revamp-II Plant Shutdown, the following major jobs have been planned in Ammonia Plant. The necessary inspection activities have been carried out for these major jobs. The details of major jobs undertaken are as follows:

- A) Revamp of Primary Reformer Furnace (101-B)
- B) Converter Retrofit (105-D)
- C) Replacement and modification of pipeline loops
- D) Vessel Inspection Jobs
- E) Inspection of rotating equipments
- F) Miscellaneous jobs.
- G) Thickness measurement of various pipelines in Ammonia plant.

Details of inspection activities which have been carried out during this Revamp -II Plant Shutdown are as under.

01 41 01 Revamp-II of Primary Reformer Furnace:(1) Pre-Shutdown inspection activities:(a) HARP ASSEMBLY :

On receipt of the harp segments, Visual Inspection of catalyst and riser tubes assemblies including bottom header and their weld joints was carried out. Defective weld joints and damages to catalyst tubes, riser tubes, bottom header and its bevel end etc. were repaired in presence of representative of M/S S&C Germany in July, '93. The following bent tubes i.e. nine nos. of catalyst tubes and one no. of riser tube and one no. of catalyst tube having deep scoring were replaced by new spare tubes. Detailed report of repairs carried out has been prepared.



JOB CODE

JOB DESCRIPTION

**(b) INLET MANIFOLD :**

All the 16 nos. of Inlet manifold segments were visually checked and wall thickness was measured by ultrasonic thickness tester. In general the overall condition of all the manifold segments were found to be in good condition, however rubbing marks and scoring marks were noticed in the outer surface on some of the manifold segments. Two manifold segments were welded together and made totally eight Inlet manifold headers out of 16 nos. of segments. Weld joint of all the manifold headers were inspected by DPT, followed by radiography. These weld joints were stress relieved as per standard practice and again inspected the weld joints by MPT after stress relieving.

**(c) PIGTAIL TUBES :**

All the 342 nos. (336 nos for installation and 06 nos spare) of pigtail tubes were visually inspected and measured the wall thickness by ultrasonic thickness tester. The overall condition of all the pigtail tubes were visually found to be good condition and the thickness observed at bend locations was varying between 2.86mm to 3.19mm and on straight portion thickness was varying between 3.07mm to 3.38mm against designed value of 2.87 mm.

**(d) SPRING HANGERS :**

All the spring hangers of primary reformer catalyst tubes i.e. 16 nos. of single tube spring supports and 160 nos. of double tube spring supports were visually inspected and taken for load and travel test on test stand for measurement of spring constant and calibration of scale readings at various loads have been carried out.

**(2) SHUTDOWN ACTIVITIES :****(a) RADIANT SECTION :**

Each harp assembly was inspected for the followings :

- (1) Root welding of bottom header (outlet manifold) joint was D.P. tested and final welding was Radiographed after DPT.
- (2) Bottom drain pipe weldjoint was inspected by DPT and Radiography.
- (3) Thermowell pipe weldjoint was inspected by DPT.

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JOB DESCRIPTION

- (4) Drain pipe outer sleeve weldjoint was inspected by DPT.
- (5) Drain valve weldjoint was inspected by DPT.
- (6) Root welding of riser weldjoint was inspected by DPT and finalwelding was radiographed after DPT.

The above inspection activities were carriedout for all the eight harp segment.

The table I at page A-74 (i) shows the filler wire / electrode which were used for different weldjoints in the reformer harp assembly.

**(b) PENT HOUSE :**

- (1) The root welding and final welding of all 336 Pigtails were inspected by DPT.
- (2) Weldjoints of the Naphtha valves which have been replaced was inspected by DPT.

**(c) WELDER QUALIFICATION TEST :**

Welder qualification test of 24 Nos. of welders including welders invited from M/S. Madras Fertiliser Ltd, Madras, M/S. Spic, Bombay and M/S. Kribhco, Surat was taken to check the capability to produce sound welding during reformer revamp as per WPS suggested by M/S. Kellogg, USA and M/S. S & C, Germany.

01 41 02

**(B) CONVECTION COILS :**

During this revamp-II shutdown two coils in HT-convection zone were replaced by new one i.e. (1) Mixed feed pre-heat coil and (2) HT-superheater coil.

In LT-convection zone one additional BFW coil was installed. All these new coils are supplied by M/S. L & T Bombay. Following inspection activities were carriedout on these three coils.

**PRE-SHUTDOWN ACTIVITIES :**

**(1) BFW Coil :**

Fabrication of the coil was done by M/S ECC, Hazira work of L & T. Stage inspction was carriedout as follows:

- (i) Routine inspection activities like raw material inspection, welder qualifiction tests, welding inspection etc. were performed by third party inspection agency of viz. SGS (India) Ltd.

TABLE-I

WELDING DETAILS OF PRIMARY REFORMER PARTS:

SL. NO.	SECTION	MATERIAL		ROOT	ELECTRODE	WELD OUT	HEAT TRT.			NDT EXAM.	
		To					PREHEAT	S.R.	DPT	HPT	RADIOGRAPHY
1.	Outlet Manifold to Outlet Manifold (Butt Weld)	G-4859	G-4859	ER-NiCrCoMo-1 GTAW	ER-NiCrCoMo-1 GTAW	RT	None	Done	--	Done	
2.	Riser Tube to top Piece(RF-10)	G-4852 Mod.	SB-564	ER-NiCrCoMo-1	ER-NiCrCoMo-1	RT	None	Done	--	Done	
3.	Drain Pipe Piece to Drain Pipe (Butt Weld)	SB-407	SB-407	ER-NiCrCoMo-1	ER-NiCrCoMo-1	RT	None	Done	--	Done	
4.	Thermowell Pipe piece to thermowell pipe(Butt Weld)	SP-407	SB-407	ER-NiCrCoMo-1	ER-NiCrCoMo-1	RT	None	Done	--	--	
5.	Outlet Manifold to Guide Pipe(Fillet Weld)	G-4859	A-310 TP-310	ER-NiCr-3 GTAW	ER-NiCr-3 GTAW	PT	None	Done	--	--	
6.	Inlet Manifold to Inlet Manifold (Butt Weld)	A-335 Gr P-11	A-335 Gr P-11	Er-80S-B2 GTAW	E-8018-B2L SMAW	Yes	Yes	Done	Done (After SR)	Done	
7.	Pig tail to Catalyst Tube Sockolet(Fillet Weld)	A-335 Gr P-11	A-182 Gr F-11	Er-80S-B2	E-8018-B2L	RT	None	Done	--	--	
8.	Pig Tail to Inlet Header Sockolet (Fillet Weld)	A-335 Gr P-11	A-182 Gr F-11	Er-80S-B2	E-8018-B2L	RT	None	Done	--	--	

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- (ii) Review of radiograph was done partly by IFFCO.
- (iii) Hydro-test of the complete assembly was witnessed by IFFCO and boiler inspector at party's works.

(2) MIXED FEED COIL :

- (i) Fabrication was not done as per drg. but as per mirror image of tube layout by mistake of ECC, Hazira which was further rectified by changing the header cap and spool piece orientation after consultation of IFFCO and M/S M.W.Kellogg, U.S.A.
- (ii) All the radiographs were reviewed by IFFCO in addition to review by the inspection agency.
- (iii) Hydrotest with DM water was done at party's works and was witnessed by IFFCO.
- (iv) One no. lug of last intermediate tube sheet (counting from header side) was found defective. Coldshut + cracks observed got repaired. Final dye-penetrant test revealed, no defect on outer periphery of the lug, however crack/coldshut on inner surface of the lug hole couldnot be attended. M/S ECC, L & T supplied one set of fixture suitable for lifting the coil by fitting at this lug's location.

(3) HIGH TEMP. SUPERHEATER COIL :

- (i) Raw material inspection, welder qualification test etc. were carried out by SGS (India) Ltd. an inspection agency appointed by M/S L&T.
- (ii) 180 degree return bend of size 88.9 OD x 8mm thick x 179 c/c were found to have thickness lower than specified 8 mm except for two bends. M/S ECC, L & T replaced one no bend and repaired one more bend which were having thickness 6.39 mm and 5.98 mm respectively out of 37 bends asked for replacement by IFFCO due to nonavailability of bends in ready stock.
- (iii) All the radiographs were reviewed by IFFCO and Boiler Inspector in addition to SGS (India) Inspector.
- (iv) Final hydrotest of the coil was witnessed by IFFCO, Boiler Inspector and L & T.

JOB CODE

JOB DESCRIPTION

01 41 03 AMMONIA SYNTHESIS CONVERTER RETROFIT :

The following inspection activities were performed during converter retrofit.

(a) PRESHUTDOWN ACTIVITIES :

Qualification test of welders offered by the contractor M/s Cedco were conducted on s.s. pipes and plates in various positions. Test pieces were cut and fracture test were performed on fillet weld/lap weld test pieces. Total 16 nos. of welders were offered for qualification test by the contractor out of this seven welders were qualified for both TIG and SMAW welding and three welders were qualified for only SMAW for the converter retrofit job.

(b) SHUTDOWN ACTIVITIES :

During plant shutdown, the following activities were performed.

- (1) Grinding of 122-C tube bundle to 105-D was carried out. Extent of grinding was monitored by Dye Penetrant Testing to avoid excessive grinding which otherwise may cause damage to 105-D resting surface.
- (2) Both the lifting lugs of 122-C tube bundle were D.P. Tested at their root welds before lifting.
- (3) Removal of nitriding layer was performed in all the beds where welding was required to be done due to modification. Complete removal of nitriding layer was ensured with the help of 10 % HNO<sub>3</sub> solution. This was followed by heating the ground area to 500 C for dehydrogenation.
- (4) All the new weld joints were tested by dye penetrant examination.
- (5) All the existing joints of quench line, start up line, 122 C tube bundle weld joints-3 nos., socket weld joints of thermowells, edge preparation of quench pipe nozzles etc. were checked by D.P. Test
- (6) Magnetic particles testing and D.P. test of 122-C shell (Top dome cover) multilayer plates fillet welds was carried out. Cracks were observed at fillet welds A & B (as revealed in past) and also in fillet weld 'X' above the flange. Crack length of all the fillet welds were repaired by grinding and welding. D.P. Test followed by magnetic particles test were carried out on repaired areas. No defect observed.

JOB CODE	JOB DESCRIPTION
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(7) Service of outside agency were availed for undertaking the following inspection activities.

- (a) Visual inspection of converter internals.
- (b) Hardness measurement of basket from inside and on SG-22-12" pipe were carriedout.
- (c) Metallographic examination of the bottom dished end of 122-C tube bundle assembly at four different locations and also on pipe line from 105-D to 123-C(Removed pipe)done. A separate report has been prepared.
- (d) Magnetic particle testing of 122-C top dome circumferential fillet welds of multilayers and circumferential seam C and C of 105-D shell assembly was carriedout. Defects observed were marked for repairs on 122-C multilayer shell fillet welds. No defect was observed on 105-D shell circumferential seams C and C.
- (e) Ultrasonic thickness measurement was carriedout for following pipings connected to the Converter.

- (1) SG-35-12" (2) SG-23-12" (3) SG-40-10" (4) SG-29-4" (5) SG-12-14" (6) SG-7-10" (7) SG-14-10" (8) SG-18-14" (9) SG-26-6" (10) SG-27-6" (11) SG-25-8" (12) SG-28-4" (13) SG-16-10" (14) SG-15-10" (15) SG-22-12" (16) SG-13-12" (17) SG-21-14".

Also thickness measurement was done for :

- (1) 122-C Dome Upper portion
- (2) Thermowell pipe B-T
- (3) 105-D Inne3r Shell(Basket)
- (4) 122-C Exchanger.

Thickness observed on all the above pipe lines was within the acceptable limits.

(f) Ultrasonic flaw detection of weld joints was carriedout for the following critical pipings.

- (1) SG-21-14" ..... 6 JOINTS
- (2) SG-22-12"..... 9 JOINTS
- (3) SG-23-12"..... 3 JOINTS
- (4) SG-35-12"..... 8 JOINTS
- (5) SG-13-12"..... 12 JOINTS
- (6) SG-40-10"..... 6 JOINTS

JOB CODE

JOB DESCRIPTION

The condition of all the pipeline weld joints scanned by the party were found to be free from service defects.

A detailed report was also prepared indicating the details on various inspection work carried out inside the Converter for future reference and records.

01 41 04 REPLACEMENT OF PIPELINE LOOPS IN AMMONIA PLANT:

- (a) Eight pipeline loops (details at Annex-I) were replaced with new pipings having better material of construction for increasing the reliability of ammonia plant. Before pre-fabrication of piping, the contractor welders were qualified for welding alloy steel pipings like A335, p11 and p22 material and also for welding ss-304 material.

The root run of all the weld joints were inspected by DPT and the final welds were checked by DPT and radiography. The alloy steel pipe weld joints were stress relieved wherever necessary as per standard practice. Details of eight pipeline loops which were replaced is mentioned in the Annexure I.

- (b) Replacement of HTS to 103-c piping was done departmently. DP test of bevel ends and root run and final weld joints were performed. Radiography of final welds before stress relieving was done. The detailed sketch has been prepared.

- (c) Modification in Natural gas piping at metering station and also fabrication of new C.G. lines was undertaken through contractors by CPIG. DP test of weld joints and radiography (10 % for 150# piping and 100% for 300# and above ) were carried out. Joints to be repaired were marked and informed to CPIG Engineers for attending.

01 41 05 Vessel Inspection Jobs :

[a] 101-E CO2 ABSORBER:

The vessel was offered for internal inspection after removal of single tray segments on either side (i.e. East and West side) of all trays. The followings are the observations of visual inspection:

- (1) In general the shell has assumed grayish black colouration.
- (2) The condition of demister pad and its holding supports were found to be good.

JOB CODE

JOB DESCRIPTION

- (3) All the S.S.sieve trays were found to be intact in position and in good condition.
- (4) Between tray nos. 1 to 10, the extent of Erosion/ pittings on the shell internal surface, tray supports fillet weld joints was quite less.
- (5) The areas of weld joint (near HAZ) and shell surface which were covered with M-seal during previous shutdown were thoroughly checked and it was found that M-seal has peeled off at different locations. These were marked and new M-seal was applied after cleaning.
- (6) The extent of erosion / pittings in shell surface and weld joints was found increasing after 10th tray towards bottom most tray. The shell surface and the fillet welds of tray supporting clits were observed to have considerable pitting and erosion resulting in wall thickness reduction of shell by 1.5 to 2.0mm approximately.
- (7) Below 19th and 20th tray severe erosion/pittings was observed on shell internal surface and metal was eaten away about 2.0 feet wide and 2.5 feet long between 19th and 20th tray resulting in wall thickness reduction of about 7.00 mm approximately. Thickness measurement was carried out at this location and it was observed as 38.80 mm on east side against the designed value of 46.04 mm (thickness reduction of 7.24mm)
- (8) Similarly below 20th tray severe erosion/pitting was observed on shell internal surface at seven locations with different dimensions (refer fig.2) The thickness measurement was carried out at these areas and minimum thickness observed at one eroded location was 36.7 mm as against designed value of 46.80 mm (i.e.thickness reduction of 10.10 mm)

It was decided to repair these damaged area on shell internal below 19th and 20th tray by welding. Accordingly, a procedure was framed in consultations with M/S L&T welding engineer, who was present at our site for Autoclave relining job. Accordingly all the eight eroded areas were repaired by rewelding with proper preheating and post heating methods. The details of repair welds are as follows



JOB CODE

JOB DESCRIPTION

Repair Weld Procedure

- (1) clean the area by slight grinding and wire brushing
- (2) Preheat to Min. 125 C near the weld area from outside and temperature measured on inside surface.
- (3) Weld using E.7018-1 electrodes preferably give stringer beads max. interpass temp. shell be 225 C.
- (4) Inter pass layers cleaned with wire brush or by grinding.
- (5) Continuous welding is preferable by maintaining preheat temp. at all the time.
- (6) After completion of welding, post heat at 300 to 350 C for 3 hours minimum.
- (7) Finally, smoothly grind the weld area and check by DPT or MPI and measure hardness of weld deposit.

The above procedure was adopted for the repair welding at eroded area below 19th and 20th tray. After completion of welding on each spot (i.e. totally 8 spots were repaired), post heating was done using special gas torch and LPG cylinder. The heating was done from outside of shell. After attaining the shell inside surface temp. 300 to 350 degC, it was maintained for three hrs. Then stopped the heating and covered the outersurface with asbestos cloth. The repair weldings were cleaned and checked by DPT and found to be defect free. Hardness measurement was carried out on buildup area, HAZ and on parent metal after post heating.

The following are the readings.

1. Hardness on weld deposit- 161 to 185 BHN.
2. Hardness on Heat Affected Zone- 163 to 165 BHN.
3. Hardness on sound portion of parent metal- 155 to 163 BHN.

- (8) Thickness measurement of the shell from inside the vessel was carried out. The readings were recorded.

[b] DRYING VESSEL (R1) IN PGR UNIT :

Visual inspection and ultrasonic thickness measurement was carried out from inside the vessel. The following are the observations.

JOB CODE

JOB DESCRIPTION

- (1) Wire mesh grid to support molecular sieves of the top compartment were found to have got slightly torned out / damaged at many scattered places.
- (2) The shell had assumed brownish colouration with the slight rusting on the surface.
- (3) Minor damage was also observed on the grids supporting alumina balls in bottom compartment.
- (4) Ultrasonic thickness measurement was carried out which revealed min. thickness of the shell as 36.5 mm in bottom and top compartment.

[c] DRYING VESSEL (R2) IN PGR UNIT :

- (1) The shell was found to have slight rusting on the surface with brownish colouration in top and bottom compartments.
- (2) Molecular sieve supporting grid wiremesh was found damaged on south side.
- (3) Alumina ball supporting grid wiremesh of bottom compartment was found torned out at three locations.
- (4) Ultrasonic thickness measurement of bottom and top compartment shell was done.

[d] LETDOWN DRUM, 107-F :

Visual inspection, ultrasonic thickness measurement, magnetic particle testing of weld joints were carried out from inside of the vessel. Following are the observations.

- (1) Minor pittings were observed particularly on the bottom half of the shell.
- (2) All the weld joints were visually inspected followed by magnetic particles testing except for manhole nozzle weld and north dished end, where dye penetrant testing was carried out, No defect was observed.
- (3) Overall condition of the vessel was found to be good.
- (4) Ultrasonic thickness measurement of the shell and dished ends was carried out. Detailed report has been prepared.

JOB CODE

JOB DESCRIPTION

[e]FIRST STAGE REFRIGERANT FLASH DRUM ,110-F :

Visual inspection,magnetic particle testing of weldjoints and ultrasonic thickness measurements were performed from inside .The following are the observations:

- (1) The shell was found to be brownish black in colouration.
- (2) Hard thick milliscales were observed on dished ends.
- (3) The demisterpad was found to be intact in position without any damage.
- (4) All the weldjoints were found to be in good condition in visual inspection. No defects were revealed during MPI of all the weldjoints performed after buffing of weld seams.
- (5) Ultrasonic thickness measurement of the shell and dished ends was carriedout. Detailed report has been prepared.
- (6) Overall condition of the vessel was found to be good.

[f]AMMONIA SEPARATOR,106-F :

Visual inspection,magnetic particle testing of weldjoints and ultrasonic thickness measurements were performed from outside .The following are the observations:

- (1) Condition of demister pad was found satisfactory.
- (2) Due to varicus fittings inside the vessel like demisterpads, impingement baffels, gas box etc, hidden portions of the weld joints could not be inspected. All exposed weldjoints were tested by MPI and no defect was found.
- (3) Ultrasonic thickness measurement of the shell was carriedout.

Detailed report has been prepared.

[g]SECOND STAGE REFRIGERANT FLASH DRUM,111-F :

Visual inspection,magnetic particle testing of weldjoints and ultrasonic thickness measurements were performed from inside.The following are the findings:

- (1) The shell has assumed brownish black colouration in general.
- (2) Milliscales were observed on both the dished ends.

JOB CODE

JOB DESCRIPTION

- (3) Condition of demisterpad assembly was found to be satisfactory. No damages were observed.
- (4) Overall condition of all weldjoints were found to be satisfactory by visual inspection. Magnetic particle test was performed on all welds.No defects were observed.
- (5) The impingement plate of east side nozzle was found intact in position.
- (6) Ultrasonic thickness measurement was carriedout. Detailed report has been prepared.

**[h]THIRD STAGE REFRIGERANT FLASH DRUM ,112-F :**

Visual inspection , magnetic particle testing of weldjoints and ultrasonic thickness measurements were performed from inside. The following are the observations:

- (1) The shell had assumed brownish black in colouration.
- (2) East side dished end had got minor scaling and mill scales also.
- (3) The impingement plate on first nozzle from eastside was found detached from some places due to broken weld tacks with nozzle extension pipe.
- (4) Thick corrosion scaling was observed on the outer surface surrounding manway nozzle and on the dished end where cold insulation was not existing.
- (5) The overall condition of nozzle welds & shell joints was found satisfactory.MPI did not reveal any defect.
- (6) The condition of demisterpad was good.
- (7) Ultrasonic thickness measurement of shell and dished end was carriedout. Detailed report has been prepared.

01 41 06

**Inspection of Rotating Equipments**

**[a]** Visual inspection,dye penetrant test of blades and journals,thrust collars and Gauss measurement of the rotors of the following machines was undertaken.

- (a) 101-JR Gear box of Air Compressor
- (b) 101-JT Turbine of Air Compressor
- (c) 103-JBT Turbine Rotor
- (d) 105-JT Turbine Rotor.

Detailed reports on measurements are attached herewith.

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JOB CODE	JOB DESCRIPTION
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(b) Balancing check runs were taken for 103-JBT New and Old rotors. New rotor check balancing was done before and after machining of oilguard area of the shaft.

01 41 07 MISCELLANEOUS JOBS:

The following miscellaneous activities were carried out.

- (i) Load testing of cranes brought by the contractors for various jobs.
- (ii) DP Test after root run and final weld as well as radiography of both the Dished ends to shell weld joints of 174-F NG Comp. Suction Knockout Drum was performed.
- (iii) 124-C Synthesis Gas Compressor Aftercooler was replaced during the shutdown. Welding of Shell Inlet and Outlet nozzles was carried out. DP Test of prepared bevelled edges, root run, final run followed by radiography was carried out for nozzles to pipings weld joints.
- (iv) Root run and Final weld DP test and Radiography of 105-J LP Case Discharge weld joints were performed.

01 41 08 THICKNESS MEASUREMENT:

Ultrasonic thickness measurement of the critical pipelines was carried out. A detailed report has been prepared.

A N N E X U R E - I

DETAILS OF CRITICAL PIPE LINE LOOPS REPLACED IN AMMONIA PLNAT

SR. LINE NO.	NUMBER	DESCRIPTION OF LINE		PIPE SIZE AND SCHEDULE	MATERIAL OF CONSTRUCTION	
		FROM	TO		OLD PIPE LINE	NEW PIPE LINE
01	SG-1-300	105-D	114-C	12" X SCH-30	NA	A-335-P.11
02	SG-33-350	105-D	123-C	14" X SCH-140	A-335 P.1	A-335 P.22
03	SG-34-350	123-C	121-C	14" X SCH-120	A-53 GR.B	A-335-P.11
4(a)	PG-18-12"	104-C	106-D	12" X SCH-30	A-335-P1	A-335-P.11
	(b) PG-24-10" (BRANCH LINE)	----- DO	----	10" X SCH-30	A-53 GR.B	-- DO --
	(c) V-6-6" (BRANCH LINE)	--- DO	--	06" X SCH-40	A-335 P1	-- DO --
	(d) V-9-2"	----- DO	----	02" X SCH-80	A-53 GRB	-- DO --
5(a)	NG-9-300	MIXED FEED PRE.HEAT COIL	PRIMARY REF. 101-B	12" X SCH-100	A-53 CR.B	A-335-P.11
	(b) NG-11A-150 TO NG-11H-150	----- DO	----	06" X SCH-120	--- DO --	-- DO --
	(c) A-22-4" (BRANCH LINE)	----- DO	---	04" X SCH-100	--- DO --	-- DO --
6(a)	PG-12 A/B-14"	105-CA/CB	106-C	14" X SCH-30	A-53 GR.B	A-312 TP-304
	(b) PG-26-18"	----- DO	----	18" X SCH-30	--- DO --	-- DO --
	(c) PG-13-16"	----- DO	----	16" X SCH-30	--- DO --	-- DO --
	(d) PG-34-6"	----- DO	----	06" X SCH-40	--- DO --	-- DO --
	(e) PG-33 A/B-4"	----- DO	----	04" X SCH-40	--- DO --	-- DO --
7(a)	MEA-1-300	101-E	109C2A/ C2B	12" X SCH-30	A 53 GR.B	A-312 TP-304
	(b) MEA-4-A/B-250	---- DO	----	10" X SCH-30	--- DO --	-- DO --
	(c) MEA-3-100	---- DO	----	04" X SCH-40	--- DO --	-- DO --
	(d) MEA-2-100/80	--- DO	----	04" / 3" X SCH-40	--- DO --	-- DO --
	(e) MEA-70-80 (BRANCH LINE)	---- DO	----	3" X SCH-40	--- DO --	-- DO --
	(f) RV-19-40	--- DO	----	1 1/2" X SCH-40	-- DO --	-- DO --
8(a)	PG-21-500	QUENCH LINE	105-CA/CB	20" X SCH-30	A-53 GR.B	A-312 IP-304
	(b) PG-11A/B-400	--- DO	---	16" X SCH-30	--- DO --	-- DO --

DETAILS OF PIPELINE THICKNESS SURVEY IN AMMONIA PLANT DURING

SEPTEMBER-OCTOBER (1993) REVAMP-II SHUTDOWN

SR NO	LINE NUMBER	DESCRIPTION	DESIGN THICKNESS (MM)	MEASURED THK (MM) (MINI.)	MINI.REQD. THK.AS PER REL.CELL	% REDUCTION CAL.FROM MINI.THK.
1.	MEA-6A-8"	109C1A TO 102 EA/B	8.17	7.6	NA	7.0 %
2.	MEA-6B-8"	109C1B TO 102-EA/B	8.17	8.5	NA	--
3.	MEA-7-10	109C1A/B TO 102-EA/B	9.37	8.5	4.88	9.3 %
4.	MEA-9A-8"	109C1A/B TO 102-EA	8.17	8.3	3.92	--
5.	MEA-9B-8"	109C1A/B TO 102-EB	8.17	8.6	3.92	--
6.	MEA-10A-12"	102EA TO 109C1A	6.35	6.3	3.0	--
7.	MEA-10B-12"	102EB TO 109C1B	6.35	6.5	3.0	--
8.	MEA-11-14"	102EA/B TO 109C1A/B	7.92	7.3	3.0	7.8 %
9.	MEA-12A-12"	102EA/B TO 109C1A	6.35	6.6	3.0	--
10.	MEA-12B-12"	102EA/B TO 109C1B	6.35	6.3	3.0	--
11.	MEA-19A/B-8"	107JA/B TO 101E	7.02	9.8	NA	--
12.	MEA-19C/D-8"	107JC/D TO 101E	7.02	6.0	NA	--
13.	MEA-18-12"	107JA/B TO 101E	8.38	8.2	3.9	--
14.	MEA-20-12"	107J TO 101E	8.38	8.0	3.9	14.5 %
15.	MEA-21-12"	107JC/D TO 101E	8.38	8.3	3.9	2.1 %
16.	MEA-23-3"	LCV-2 TO 102-E	5.48	4.5	3.0	17.5 %
17.	MEA-26A-2.5"	LCV-2 TO 102EA	5.15	3.5	3.0	32.0 %
18.	MEA-26B-2.5"	LCV-2 TO 102EB	5.15	5.0	3.0	2.91 %
19.	MEA-28A/B-12"	102EA/B TO 105CA/B	6.35	5.8	3.0	8.0 %
20.	MEA-29A/B-12"	102EA/B TO 111CA/B	6.35	6.1	3.0	3.93 %
21.	MEA-33A-16"	102EA TO REBOILERS	7.92	9.5	3.0	--
22.	MEA-33B-16"	102EB TO REBOILERS	7.92	8.3	3.0	--
23.	FW-1-6"	102-F TO 170-C	10.97	7.9	3.0	28 %

DETAILS OF PIPELINE THICKNESS SURVEY IN AMMONIA PLANT DURING  
SEPTEMBER-OCTOBER (1993) REVAMP-II SHUTDOWN

SR NO	LINE NUMBER	DESCRIPTION	DESIGN THICKNESS (MM)	MEASURED THK (MM) (MINI.)	MINI.REDD. THK.AS PER REL.CELL	% REDUCTION CAL.FROM MINI.THK.
24.	PW-4-2.5"	106-J TO 170-C	5.07	4.6	3.0	9.27 %
25.	PW-17-4"	106-J TO 170-C	11.20	6.6	3.0	41.07 %
26.	PW-20-6"	104-E TO 107-J	10.97	11.3	3.0	--
27.	PW-19-4"	LC-3A TO 104E	11.00	10.2	3.0	8.0 %
28.	BO-10H-2"	BLOWDOWN	11.07	10.8	3.5	2.43 %
	BO-11H-2"	LINES FROM				
	BO-12H-2"	AUX. BOILER				
	BO-13AH-2"					
	BO-14H-2"					
29.	CO-1A-18"	102EA TO 110CA	11.10	9.7	3.0	12.6 %
30.	CO-1B-18"	102EB TO 110CB	11.10	10.2	3.0	8.1 %
31.	CO-15-25"	103F TO UREA PLANT		15.8	N.A.	--
32.	CO-6A-18"	110CA TO 103F	12.50	9.5	3.0	24.0 %
33.	CO-6B-18"	110CB TO 103F	12.50	9.9	3.0	20.8 %
34.	CO-7-24"	110CA/B TO 103F	12.70	13.7	3.0	--
35.	SG-6-12"	104F TO 103J	6.25	5.7	3.58	9.0 %
36.	PG-10-18"	104D TO 105CA/B	9.53	7.0	6.23	26.5 %
37.	SG-18-14"	119C TO 106F	23.80	22.7	20.08	4.6 %
38.	SG-23-12"	105D TO 121C	25.40	23.4	19.55	7.8 %
39.	SG-25-8"	105D TO 121C	18.24	25.5	N.A.	--
40.	PG-14-16"	102F TO 106C	12.70	9.5	5.32	25.2 %
41.	PG-15-14"	102F TO 101E	12.70	12.0	4.01	5.5 %
42.	HS-9-8"	STEAM LETDOWN LINE.	23.00	23.3	18.75	--



DETAILS OF PIPELINE THICKNESS SURVEY IN AMMONIA PLANT DURING  
SEPTEMBER-OCTOBER (1993) REVAMP-II SHUTDOWN

SR NO	LINE NUMBER	DESCRIPTION	DESIGN THICKNESS (MM)	MEASURED THK (MM) (MINI.)	MINI. REQD. THK. AS PER REL. CELL	% REDUCTION CAL. FROM MINI. THK.
43.	HS-10-6"	STEAM LETDOWN LINE	18.24	16.5	14.41	9.5 %
44.	HS-11-6"	-----DO-----	18.24	17.3	14.41	5.15 %
45.	HS-12-6"	-----DO-----	18.24	18.0	14.41	1.3 %
46.	MS-12-8"	-----DO-----	15.06	13.4	5.95	11.0 %
47.	MC-13-8"	-----DO-----	15.06	14.5	5.95	3.7 %
48.	MS-14-8"	-----DO-----	15.06	14.8	5.95	1.72 %
49.	MS-9-10"	-----DO-----	21.41	17.5	6.23	18.0 %

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PLANT TURNAROUND - SEPT. - OCTOBER - 1993

AMMONIA - PLANT

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CIVIL JOBS

JOB CODE	JOB DESCRIPTION
01 51 01	<u>AUXILIARY BOILER</u>
01	Dismantling damaged burner wall and blocks of Burner number 2,3, & 4 and replacing with new burner blocks and Refractory work with insulating refractory and brick including shuttering.
02	Header Refractory Casting
03	East & West side Refractory patch work at 10' above header height.
04	Target wall fixing.
05	<u>L.T. Zone :-</u> Insulite refractory casting around support, Header side wall floor with gunniting insulite - 9. <u>H.T. Zone :-</u> Refractory gunniting by Insulite - 9 on ceiling and column of Transition area from Radiant to HT Header sides and Bottom.
06	Making 3 Nos of Baffle wall.
07	Brick curbing (Nossing) besides Cera Insulation on sides.
08	HT & LT Zone common passage flooring done with Insulite.
01 51 01	<u>PRIMARY REFORMER :</u> Casting 16 Nos of Burner blocks for Auxilary boiler 60 Nos. of ceiling burner, Primary reformer and 16 Nos for Tunner burner.
01 51 03	<u>MISC.WORK :</u> - Excavation for opening underground cooling water pipe line near 103-JC & 108-CA/B ; Sand filling and re-conc- reting the same. - Concrete flooring near spare tube bundle waste heat boiler. - Replacement of A.C sheet & Ridges in pent house.

PLANT TURNAROUND - SEPT. - OCTOBER - 1993

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A M M O N I A - P L A N T

ELECTRICAL JOBS

JOB CODE	JOB DESCRIPTION
01 61 01	<p><u>CARRIED OUT MAINTENANCE ON TRANSFORMER 6 :</u></p> <ul style="list-style-type: none"> <li>a) Checked and tightned the primary/secondary end terminals of the cables.</li> <li>b) HT Marshalling box was found rusty inside. Oil value was very low. Cleaned and filled with new oil having BDV valve of 70 KV.</li> <li>c) Reactivated silicagel in dehydrating breather.</li> <li>d) Checked trip circuits and protection system of transformer.</li> <li>e) Measured IR values of primary and secondary windings of the transformer.</li> </ul>
01 61 02	<p><u>CARRIED OUT FILTERATION OF OIL OF ABOVE TRANSFORMER</u></p>
01 61 03	<p><u>CARRIED OUT PREVENTIVE MAINTENANCE OF TMG MAKE LT ACBS INSTALLED IN MCC - 5</u></p> <ul style="list-style-type: none"> <li>- Replaced defective parts and worn out contacts.</li> <li>- Lubricated the mechanism.</li> <li>- Checked trip and close timings of CB for uniform closing and opening of breather poles.</li> <li>- Checked contact pressure and adjusted as required.</li> </ul>
01 61 04	<p><u>PREVENTIVE MAINTENANCE CARRIED OUT ON MCC-5, 5A/5B :</u></p> <ul style="list-style-type: none"> <li>- Checked all feeder compartment and replaced defective contactors, contacts, timers, elemex connectors, fuse fittings isolators etc.</li> <li>- Cleaning and tightening of bus bars &amp; cable connections.</li> <li>- Carried out modification of control wiring in feeder No. 14,15,16,17 &amp; 18.</li> </ul>
01 61 05	<p>Overhauled the following motors</p> <p>103-J, 110-J, 113-J, 109-J &amp; 101-JBT</p>

JOB CODE	JOB DESCRIPTION
01 61 06	Relocated the On/OFF control station of 101/105-J Lube oil pump motor.
01 61 07	Carried out preventive maintenance of all motors operated valve control panels.
01 61 08	Checked terminal boxes of all motors above 15HP, for loose connections, burnt out cable leads and rectified.
01 61 09	Provided connections to Vacuum Blowers, Hydrojetting machines, air Blowers in Ammonia plant.
01 61 10	Provided floor light fittings, Halogen fittings, Hand lamps, welding generator connections in Reformer, Converter and other places in Ammonia plant.
01 61 11	Provided telephone connections and other communication equipments in Converter, Reformer etc in Ammonia plant.

AMMONIA PLANTINSTRUMENT JOBS

JOB CODE	JOB DESCRIPTION
01 71 01	(A) <u>CONTROL ROOM INSTRUMENT JOBS:</u>
	01) <u>PdI-57</u> : Mounting provision for digital indicator is made at original pneumatic receiver gauge on panel.
	02) Calibrated Barks Dale receivers switches like FA-81-82-83-84-89 and LA-129. Overhauled the multipoint recorders TR-13 & TR 15.
	03) <u>LRCA-4</u> : Receiver controller is cleaned and calibrated.
	04) <u>TR-6</u> : Overhauled the complete recorder. Some components like slide wire, brush, selector switch and alarm-trip mercury switches were giving troubles. Replaced all the above components by new ones. Calibrated the recorder, checked alarm !& trip.
	05) By pass switches (FA-81 & "FA-83) : Provided both the toggle switches on front panel for operational facility as required by Sr. Manager(Prod)Ammonia FA-81 is for N.G. and FA-83 is for steam flows.
	06) <u>II-1</u> : Two units of J-type multipoint switches were loose and defective. Replaced them by new units and tested them.
	07) Panel checking/Cleaning : Cleaned completely all the vib.monitor units of B/N panel of 101-J,102-J,103-J & 105-J. Similarly all the instruments of PCR panel are also cleaned. All the instruments of main panel and back side/front side panels are also cleaned.
	08) <u>Air Header</u> : Flushed out Inst. Air header including main regulators.
	09) <u>PdI-53/55</u> : Conncted power supply and signal wires coming from electronic press transmitters to PI-7,8& 10 digital pressure indicators of primary & secondary reformer inlet/outlet gas pressures for measuring the differential pressures.
	10) <u>Taylor 90J 2 Pen Recorder</u> : Removed cold ammonia totaliser counter and fixed new Taylor two pen recover for 104-E modification parameters from PT-195 & LT-22 (tentatively).

JOB CODE

JOB DESCRIPTION

- 11) 172-J/JA(PGR) : Ammonia production asked for pump(172-J/JA) trip device at low level of ammonia liquer tank (172-F). Provided new receiver switch (LALL-172) behind control room and given contacts to MCC. Setting of LALL-172 is done at 20% level. Trip alarms are available in PGR "Au window Nos 28 & 29.
- 12) Trip Relay Box : Replaced all the 110V AC, OEN relays by new relays for better reliability.
- 13) Circulating Gas Compressor : Connected the pressure signal from PT-651 (suction) and flow signal from FT-650 (final disch).to FR-35 (original - cold ammonia) Taylor 90-J recorder.
- 14) Naphtha Burner Panel : Disconnected the power supply wires related to burner No.s 3,4 &5. Cleaned the impulse lines of PdI-20 and other D.G. lines related with auxiliary boiler.
- 01 17 01 (B) Field Insts. Jobs:
- 01) Reformer (101-B) Revamping work : Following jobs are carried out.
- a) Removed 16 Nos.Thermocouples alongwith conduit pipes and extension cables from bottom headers and refixed them alongwith new thermowells of new tube headers.
  - b) Removed mutual safety tubes from burners (pent house) and refixed after completion of mechanical work.
  - c) Removed and refixed PRC-9TX,PdI-68(P/S) PIC-28TX, PRC-23 valve positioner piston cylinder, duct line T/Cs with T/Ws and DG tubes related with duct lines. PRC-23 v/p cylinder was cleaned and adjusted for damper stroke and replaced Air Regulator.
  - d) Tunnel area
    - i) Removed all the nine T/Cs with T/Ws and refixed the same after reconditioning the damaged conduct pipes. Provided new extension wires wherever found broken due to pipeline replacement work.
    - ii) Removed damaged 1/4" copper tubes of DG sample points and replaced by new tubes. All the 9 tubes of sample points are replaced by 1/4" SS tubes and extended them upto sample collection point.

JOB CODE

JOB DESCRIPTION

- e) Oxygen Analyser was disconnected and refixed complete set after the completion of mechanical jobs in Chimney area
- f) The TIs and PIs from entire reformer area including ID Fan area were removed and refixed for mechanical work facility. Given tubing connection to draft gauge (inclined manometer).
- g) Auxiliary Boiler - Cleaned the pilot burner points as they were found blocked. Changed air & gas regulators and started the ignitors for pilot burners.
- h) ID Fan steam F.E. up stream side leakage was observed. Welded tapping near tube fitting and stopped it.

01 17 02 Converter(105-D) Retrofit work :

Following jobs are carried out.

- a) Provided the necessary Instruments like P/Gs, TIs, Vacuum switch with digital TI for measuring inside temp. of vessel and oxygen analyser for measuring O<sub>2</sub> content at the time of unloading the catalyst. Removed all these after completion of job.
- b) Removed original AT & BT thermocouples with T/W assemble and fixed new T/C element bunches supplied by M/s Casale for both AT & BT locations. AT thermowell is newly constructed inside the vessel and old thermowell is used for 'BT' - T/C points. 16 pairs new extension cable is used for AT points and directly connected with TR-7 in Cont. room. Original extension wires are used for BT elements BT extension wires are also connected to TR-7 through JB T/C-1 and TI-1 backside terminal strips. As per retrofit modification the total 13 nos. of T/C elements ( i.e. 9 Nos. with AT and 4 Nos. with BT) are used for converter beds temp. measurement . The old AT thermowell with T/C bunch is sent to stores by ISRV. The old T/C bunch of BT is also sent to Stores.
- c) Skin temp. points : All the 12 MTE assemblies were removed and reconditioned the defective assemblies. Fixed back them and provided new (2pair type-J) extension cable for MTE-1&2 elements as original wires were found damaged. Overhauled the local TI for MTE points.
- d) JB T/C-1: The J.B. was corroded. Replaced it by new one.
- e) MICV-13, 14,15, & 16 were removed for overhauling & fixed back. Overhauling of HCV-11.

JOB CODE

JOB DESCRIPTION

- f) Air safety device- Provided necessary inst. with air safety device provided by Fire & Safety section for loading the catalyst.
- g) Converter outlet sample line was reconnected and provided additional valves near sample cooler.
- h) PdI-57 : Removed old defective PdI-50 and installed new electronic type PdI-57 (Range 0-10 kg/cm<sup>2</sup>) TX.
- i) Three new sample points are provided at 106-F, 107-F & 108-F.

01 71 03 Replacement of existing pipes by upgraded materials:

The instruments related with the following pipes were removed and refixed after overhauling with necessary changes/modifications.

<u>Pipeline Name/No.</u>	<u>Related Insts.</u>
a) SG-1-12" (106-D to 114-C)	: PI-42
b) NG-9-12" (Mixedfeed coil to inlet manifold)	: TI-13, PI-7/PdIa-54
c) PG-18-12" (104C TO 106-D)	: TI-1-26/TRC4-12, PICA-5TX
d) SG-33-14" (105-D TO 123-C)	: PI-27, TR-7-6/TI-1.98, pDI-50
e) SG-34-14" (123-c TO 121-c)	: ThI - 56
f) MEA-1-12" (101-E TO 109-C)	: ThI-17, FIa-46TX, PI on 1" line.
g) PG-21-20" (Quench to 105-C)	: TI-1-19, ThI-65, TA-82
h) PG-26-18" (105-C to 106 C)	: Thw-9, ThI-74

01 71 04 Replacement of Heat Exchangers/Coolers:

Removed overhauled and refixed the related instruments with following equipments.

- a) 108-C & 109-C : ThI P/Gs & Diff. PIs
- b) 113-C : ThI, P/G and LC-7 level, controller, FI-49 TX.
- c) 124-C : TI & PI
- d) TI & PI on 114-C, 104-C and 105 CA.



JOB CODE

JOB DESCRIPTION

e) N.G. line oil separator/knockout drum in gas metering station:

It is shifted and installed before gas filters in GAIL metering station. Level transmitter was removed, calibrated and refixed. The air supply and output signal tubes were extended upto new location.

01 71 05 Inspection of T/Cs & T/Ws :

- a) Removed T/Ws of TI-1-107 and ThI-88. Taken hydro test and found O.K.
- b) The T/C head terminal strips of TI-I-88 & TI-1-44 were corroded. Replaced them and connected the wires.
- c) TI-1-75 T/C head connection wire was broken, so rectified it.
- d) TI-1-46, TI-1-23 T/C connection found open due to cutting of wires, connected them.
- e) TIA-84 & TI-1-42 T/Cs found open as cables were cut. Provided new cables upto JB T/C-3 and connected with T/Cs.

01 71 06 Installation of Electronic Transmitters: (PdI-53/55/57)

Installed three Taylor elect transmitters at feed gas inlet of Primary Reformer (near PI-7), Primary Reformer outlet (near PI-8) and at secondary reformer outlet for gas pressure measurement, in place of PdI-53 & 55 (Range of all the three TXs = 0 to 40 kg/cm<sup>2</sup>). The Yokogawa DP-TX is installed in place of PdI-50/57 (Range 0 to 10 kg/cm<sup>2</sup>). Signal cables are laid out upto all the transmitters from new J.B. near Air compr. (ground floor). One signal cable is laid out upto steam drum for PT-80 elect. TX and one signal cable is also laid out upto Naphtha flow. TX for P/I converter to be connected with Rockwine flow counter/totaliser. The Reformer pressure transmitters and PdI-57 are taken in line.

01 71 07 Inspection of Pitot Venturie Tubes ( FIC-7,9,10&11) :

Removed the pitot venturie tubes from lines and found O.K. All the tubes are flushed out and cleaned the internal grooves by WD-40. Fixed them back.

01 71 08 Instrument Air Dryer (New) :

Checked power supply and found some bulbs fused. Changed them by new bulbs. Cleaned the local panel of air dryer and flushed out the header.

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JOB CODE	JOB DESCRIPTION
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01 71 09 Pneumatic PdI-53/55 TXs :

Flushed out the impulse lines and filled up water in all the three impulse lines and then adjusted the zeros of PdI-53 & 55 as per the instruction of GM.

01 71 10 Field transmitters :

- a) Methanator Delta P transmittter is calibrated.
- b) FR-4TX , FI-51TX : The impulse line SS tubes replaced by new ones as they were found punctured due to welding spark.
- c) FRC-18TX Replaced broken air filter pressure regulator by new one.
- d) PIa-150Tx. Internal tube was found punctured, replaced it by new one.
- e) PIC-7815 : Controller outputs were not coming. Overhauled the relays.
- f) FIa-62TX : Calibrated the transmitter (0 to 2500 mmH2O) for confirmation and replaced three valve manifold as equalizing valve was not operatable.
- g) LR-88 TX : Cleaned relay & F.N. as output was not developing.
- h) FR-40TX : Flushed out and checked for zero. Found it O.K.
- i) FRC-5TX : Removed and refixed orific plate connected the impulse lines
- j) LIC-1 (/steam Drum) - Cleaned leveltrol including pilot relay.

01 71 11 Control Valves :

Attended the following control valves for the jobs carried out with each valve.

- a) General checking, cleaning, greasing, overhauling of hand jacks- air sets - valve positioner and stroke checking are carried out for the main control valves like FRCV-1-2-3-12-14-15, PICV-5,PRCV-4-25, FICV-7-8-9-10-11 etc.
- b) LCV-3A : Opened from body and found the stem broken. Replaced the complete set of valve plug seat and valve body by new one. Also overhauled complete actuator, air set & Valve positioner and checked the stroke for 3 to 9 PSI signal.

## JOB CODE

## JOB DESCRIPTION

- c) PICV-28 : Rectified the AUT-MAN bypass switch by changing the 'O' rings. Overhauled VIP and checked stroke.
- d) LCV-19 : Removed for checking seat & plug. The plug was found damaged. Replaced it by new one. Overhauled complete valve & changed diaphragm. Fixed back.
- e) MICV-13-14-15 & 16 : Removed valves from lines. Replaced the gland packings for both the ends of butterfly. Overhauled the complete actuators including hand jacks and valve positioners. Replaced the actuator diaphragms of MICV 14,15 & 16 by new ones. Changed air regulators. Fixed back and adjusted the strokes.
- f) LCV-16 : Overhauled complete actuator and valve positioner. checked seat & plug and found o.k. Replaced air set.
- g) PICV-15 : Opened from bonnet. Found the seat & plug o.k. Changed bonnet gasket as it was found damaged.
- h) TRCV-10 : Checked actuator diaphragm for leakage and found o.k. changed airset by new one.
- i) Gland packings are provided in FRCV-2,V-3,V-5,PCV-181,LRCV-70 & THICV-131. New tubing is done for V-3 as it is shifted to new location by Tech. Deptt.
- j) MICV-22,PICV-13 A/B: Overhauled all the d/p regulators, booster relays, valve positioners and changed all air regulators. Cleaned transfer valves and AUT-MAN switches. Removed all the pneumatic tubings with accessories for removal of valves from lines for pipeline flushing by steam. Fixed back all the accessories and adjusted strokes.
- k) TRCV-142 was reported for not giving the water flow. Opened from bonnet and found the metallic and non metallic foreign particles. Cleaned it and fixed back.
- l) PRCV-1 : Shifted the valve mounting location by Tech. Deptt. Necessary tubing is carried out.
- m) MICV-24 & 28 : Overhauled VIPs for proper stroke.
- n) FICV-13 V/P relay was defective changed it by new one.

01 71 12

Leveltrols :

Cleaned FN and pneumatic relays and flushed out the float chambers of the following leveltrols.

LC-16,LS-116,LA-117,LS-118,LA-119, LS-120,LT-185 (PGR),  
LC-18, LC-19

JOB CODE	JOB DESCRIPTION
01 71 13	ARC-3 : Analyser is cleaned and carried out the calibration.

01 71 14 COMPRESSORS :

i) 101-J (Air Compressor) :

- a) Removed all the probes, SI, T/Cs., PIs, This etc., to facilitate the mechanical jobs on turbine and compr. Overhauled & fixed back them after the completion of mechanical jobs on main equipments.
- b) Probe No.4H on LP compr. north bearing was found damaged. Replaccd it by new one.
- c) Lube oil press switches : Provided new mounting stand for new switches to separate out the combined switch of alarm, A.O.P. start & trip. All the three switches are mounted with necessary tubing and calibrated/adjusted for the following set values.

PS-76 - Alarm : 0.86kg/cm2

PS-77 - A.O.P. start : 0.86 kg/cm2

PS-78 - Trip : 0.56 kg/cm2

Separate 10 core cable is laid out from the switches. JB to JB A5. The wires of new switches are to be connected in JBA-5 and then switches will be taken in line.

- d) Oil console A.O.P. electrical switch mounting is shifted from ground floor to compr. floor. Related instrument cable is also rerouted accordingly.
- e) Lube oil regulator 1/2" pipe/nipple was broken. Changed by new one.

ii) 103-J (Syn Gas Compressor ) :

- a) Removed all the probes, SI, T/Cs, PIs, This etc., for mechanical jobs on main equipment. Overhauled all the !Insts. and fixed back alongwith the completion of mechanical jobs.
- b) Probe Nos. 3H-3V on HP turbine south bearing were found broken. Probe No.BA on H.P. turbine axial was defective and so deleted. Changed all the three probes.
- e) MIC-23 : Overhauled the governer positioner and adjusted for required stroke of turbine valve.

JOB CODE

JOB DESCRIPTION

iii) 105-J (Ref. Compressor ) :

- a) Removed all the probes, SI, T/Cs, PIs etc., to facilitate for the mech. jobs on main equipment. Refixed them.
- b) PRC-9 : Governer positioner is overhauled and adjusted for required stroke.
- c) Trip sol valve was found sluggish. changed it by new one.
- d) Probe No. AV Gearbox North bearing was found broken. Changed it by new one.

iv) N.G. Compressor :

- a) Removed all the probes, SII, T/Cs with pads, PIs etc for the mech. jobs on main equipment. Overhauled and refixed all. Broken T/C wires are connected with pads.
- b) 174-F suction separator was removed. So removed LT-200 LSHI 300 and IHI & PIs, fixed back them after completion of mech. job.
- c) PSH-320 (Ext. Steam - Vacuum) switch utilised with blower and then it was taken back, calibrated for 304 mmHg and fixed back.
- d) FICV 200 Antisurge valve : changed solenoid valve by new one.

01 71 15 Misc & Start up jobs :

- a) Flushed out the field air headers and some regulators.
- b) JB-T/C-2 : The conduit pipe bend joint was damaged due to pipeline modification. Covered the damaged part and separated the conduit line from main pipeline by providing insulation.
- c) Given connections to start up heater ignitor.
- d) Attended PIs & TIs as asked by production people.
- e) Flushed out the following field transmitters/impulse lines.  
PIC-5, FI-46, FIX-102, PdI-54, FI-98, FI-62, FRC-1, PRC-1, LRC-4.
- f) Carried out the jobs related with boiler inspection.
- g) C.G. Compressor : Checked trip system including trip relay (C-14).

JOB CODE

JOB DESCRIPTION

- h) Mech. Workshop TR : Made ready new 12 pt.K-type multipoint recorder for workshop use.
- i) FIC-12/14 : Field controller relay cleaning & checking is carried out.
- j) UPS & Power supply - Charger checking, battery charging-discharging etc., are carried out.

PLANT TURNAROUND - SEPT. - OCTOBER 1993

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AMMONIA PLANTTECHNICAL DEPARTMENT JOBS

JOB CODE	JOB DESCRIPTION
01 81 01	<u>VENT DRAIN (SEAL POTS) SEALS :</u>
	Two nos water seal pots were installed and commissioned on the following vent lines to safeguard the system during the upset condition of the plant, against ingress of air, which may lead to fire / explosion etc.
	01 PRC-1 vent (near 101-CA/CB) on line V-8-300
	02 NG Compressor suction vent (PIC-1) near the PGR plant
	The steam traps were provided on to nos seal pots already installed during the TA - 1992 for SP-74 and SP-75.
01 81 02	<u>HOOK UP OF LTS CATALYST HEATING &amp; REDUCTION SYSTEM :</u>
	The above system was hook up for cooling of the synthesis convertor during the first week of shutdown, by connecting the CG - 23 - 150 and CG-24-150 to circulate the N2 gas for cooling.
	The following tappings were taken up during the shutdown for hook up the above system in line TP-26, TP-27, TP-28, TP-29 and TP-35.
	Now the above system is totally completed and can be operated for heating and cooling of the catalyst.
01 81 03	<u>RELOCATION OF THE NG SEPARATOR FOR NG SUPPLY IN THE GAIL METERING STATION :</u>
	The existing two nos NG separators in line to the down stream of the NG filters. Because of this oil separation takes place after filters.
	These two separators were relocated to upstream of the NG filters alongwith the necessary pipings, because of this the oil separation will take place before filters, this will reduce the chocking frequency of gas filters.
01 81 04	Provided one no tapping of 3/4" to 1 1/2" NB for liquid naphtha and one 3" NB X 600 # for the vapour naphtha inlet to MIC-5 taken for the use of the vapourise naphtha to row no.5 in the reformer pent house.

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U R E A - P L A N TM E C H A N I C A L J O B S

JOB CODE	JOB DESCRIPTION
02 01 01	<u>NUOVO PIGNONE CO2 CENTRIFUGAL COMPRESSOR K-1101/1</u> Preventive maintenance Front and rear journal bearings were opened. Thrust bearing also opened for inspection. Condition of the bearings was found good. Clearances were as under. Both main bearings clearance = 0.21 MM Thrust before overhauling = 0.30 MM Thrust after overhauling = 0.30 MM Bearings were boxed up after thorough cleaning
02 01 02	<u>CO2 CENTRIFUGAL COMPRESSOR DRIVE TURBINE - Q-1101/1</u> Overhauled the turbine 01) Noted all the governing system oil pressure reading before taking overhauling. Decoupled and checked the bearings. Front brg. white metal found peeled off. Coupling end bearing thrust bearing found in good condition. 02) Locked the bottom half of turbine casing. 03) Disconnected the interconnecting piping ; HP. LP relay cylinders from position. 04) Removed chest valve assembly. Found chest valves in good condition. 05) Loosened at top half casing and lifted it. 06) Rotor was found in good condition. Seals found in good condition. 07) Measured the seal clearance before lifting the rotor. Found within limits. 08) Lifted the rotor. 09) Inspected the seal halves of bottom casing. Found in good condition.



JOB CODE

JOB DESCRIPTION

- 10) At the exhaust end, few shallow scratches were found on top half and bottom half of casing (this may be reason for steam leakage) These scratches were filled up by cold welding process.
- 11) Cleaned rotor and casing halves.
- 12) In the exhaust piping a piece of plate (around expansion bellow) 100 MM x 200 MM was noticed detached /missing. This was removed from inside of Surface condenser and a new SS patch of 2 MM thick x 150 x 300 MM was welded with mother plate.
- 13) Put back the rotor in the bottom casing half and measured seal clearances.
- 14) Assembled top half casing after applying double boiled linseed oil on the casing jointing surfaces.
- 15) Assembled chest valves. Overhauled overspeed trip mechanism.
- 16) Assembled bearing and measured clearances.
- 17) Put back the woodward governor. Renewed its oil.
- 18) Overhauled HP - LP cylinder. Fixed back starting device ; quick shut off valve assembly.
- 19) Locked coupling hub for overspeed testing.
- 20) Run the oil pump. Noted governing oil pressure and other readings.
- 21) Unlocked the bottom half of casing.
- 22) Taken overspeed testing. It tripped at 7200 RPM.
- 23) While coupling, it showed zero float. Turbine coupling half was replaced with new one. Now float is 3.00 MM

Note :- All clearance readings are attached at page U-2 (i) in annexure - I.

02 01 03

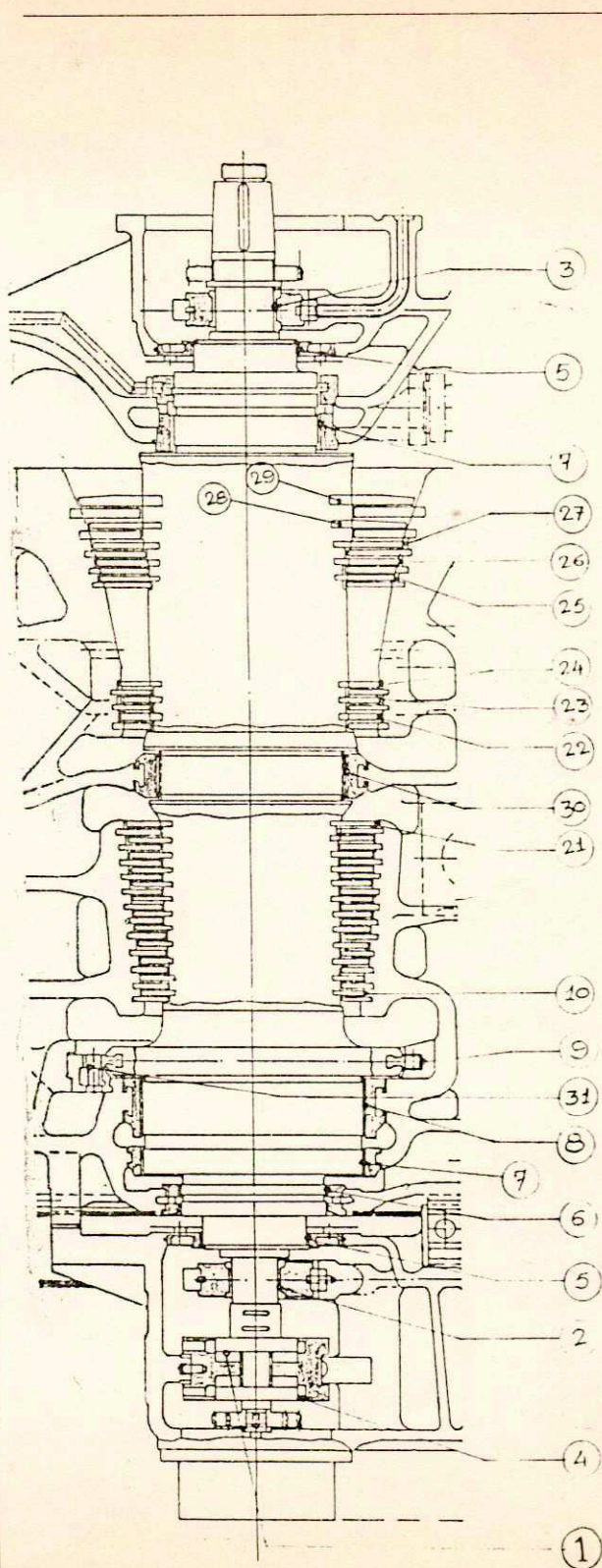
CO2 RECIPROCATING COMPRESSOR (PB) K-1101/2

Replaced 2nd stage head end cover studs.

ANNEXURE - A

NUOVO PIGNONE-Q-1101-1 243

STEAM TURBINE CLEARANCE DATA SHEET



SR NO	DENOMINATION	RECOMENDED CLEARANCE	BEFORE O/H/AULING	AFTER O/H/AULING
1	THRUST BEARING END CLEARANCE	MIN. 0.20 MAX. 0.30		
2	FORWARD JOURNAL BEARING CLEARANCE	MIN. 0.120 MAX. 0.161		
3	BACKWARD JOURNAL BEARING CLEARANCE (TOTAL)	MIN. 0.150 MAX. 0.194		
4	THRUST BEARING OIL RING CLEARANCE	MIN. 0.0 MAX. 0.10		
5	FORWARD AND BACKWARD OIL RING CLEARANCE	MIN. 0.0 MAX. 0.15		
6	OUTER FRONT STEAM SEAL RING CLEARANCE	MIN. 0.0 MAX. 0.10		
7	FORWARD AND BACKWARD STEAM SEALS CLEARANCE	MIN. 0.30 MAX. 0.35		
8	BALANCING DRUM SEALS CLERANCE	MIN. 0.40 MAX. 0.45		
9	OPERATING WHEEL CLERANCE	MIN. 0.60 MAX. 0.66		
10	ROTARY BLADES AND CASING CLEARANCE STAGE - 1	MIN. 0.40 MAX. 0.45		
11	STAGE - 2	↑		
12	STAGE - 3			
13	STAGE - 4			
14	STAGE - 5			
15	STAGE - 6			
16	STAGE - 7	SAME		
17	STAGE - 8			
18	STAGE - 9			
19	STAGE - 10			
20	STAGE - 11			
21	STAGE - 12	↑		
22	STAGE - 13	MIN. 0.50 MAX. 0.55		
23	STAGE - 14	"		
24	STAGE - 15	"		
25	STAGE - 16	MIN. 0.50 MAX. 0.56		
26	STAGE - 17	"		
27	STAGE - 18	MIN. 0.60 MAX. 0.66		
28	OPEN WHEEL STAGE - 19	MIN. 2.00 MAX. 2.06		
29	OPLN WHEEL STAGE - 20	MIN. 2.00 MAX. 2.06		
30	INTERNAL STEAM SEAL RING CLEARANCE	MIN. 0.40 MAX. 0.45		
31	NOZZLE BLOCK AND OPERATING WHEEL CLEARANCE			
32	NOZZLE BLOCK AND OPERATING WHEEL CLEARANCE			
33	ROTAR FLOAT WITHOUT THRUST PINS			
34	COUPLING FLOAT			

JOB CODE	JOB DESCRIPTION
02 01 04	<u>C02 RECIPROCATING COMPRESSOR (PB) K-1101/2</u>
	Replacement of gears of P.B.Compressor.
	Replaced the D.B.Gear box with indigeneous gear box manufactured by M/s.Elecon Engineering Co. Following activities were involved.
02 01 04	<ul style="list-style-type: none"> <li>01) Decoupled the turbine gear box</li> <li>02) Removed Holset coupling pads (both shore 45 and shore 60)</li> <li>03) Removed the barring gear box.</li> <li>04) Removed top cover</li> <li>05) Inspected bearings. Measured clearances</li> <li>06) Removed top half of bearings</li> <li>07) Removed gears</li> <li>08) Removed bottom half of bearings</li> <li>09) Assembled bottom half of bearings after cleaning.</li> <li>10) Placed new gears in the gear box casing</li> <li>11) Assembled top half of bearing and thrust bearings</li> <li>12) Measured clearances</li> <li>13) Taken blue matching. It showed 40% contact on wheel (out put shaft gear) and 50% on first stage pinion</li> <li>14) Assembled barring gear box</li> <li>15) Assembled Holset coupling pads. Assembled shore A 45 new pads and shore A 60 old pads.</li> <li>16) Coupled with turbine (after tripping of turbine)</li> <li>17) Run gear box with compressor on air (2 valves in 2nd and 3rd stage ; and 4 valves in first stage removed) for 6 hrs.</li> <li>18) Assembled valves after air run</li> </ul>

JOB CODE

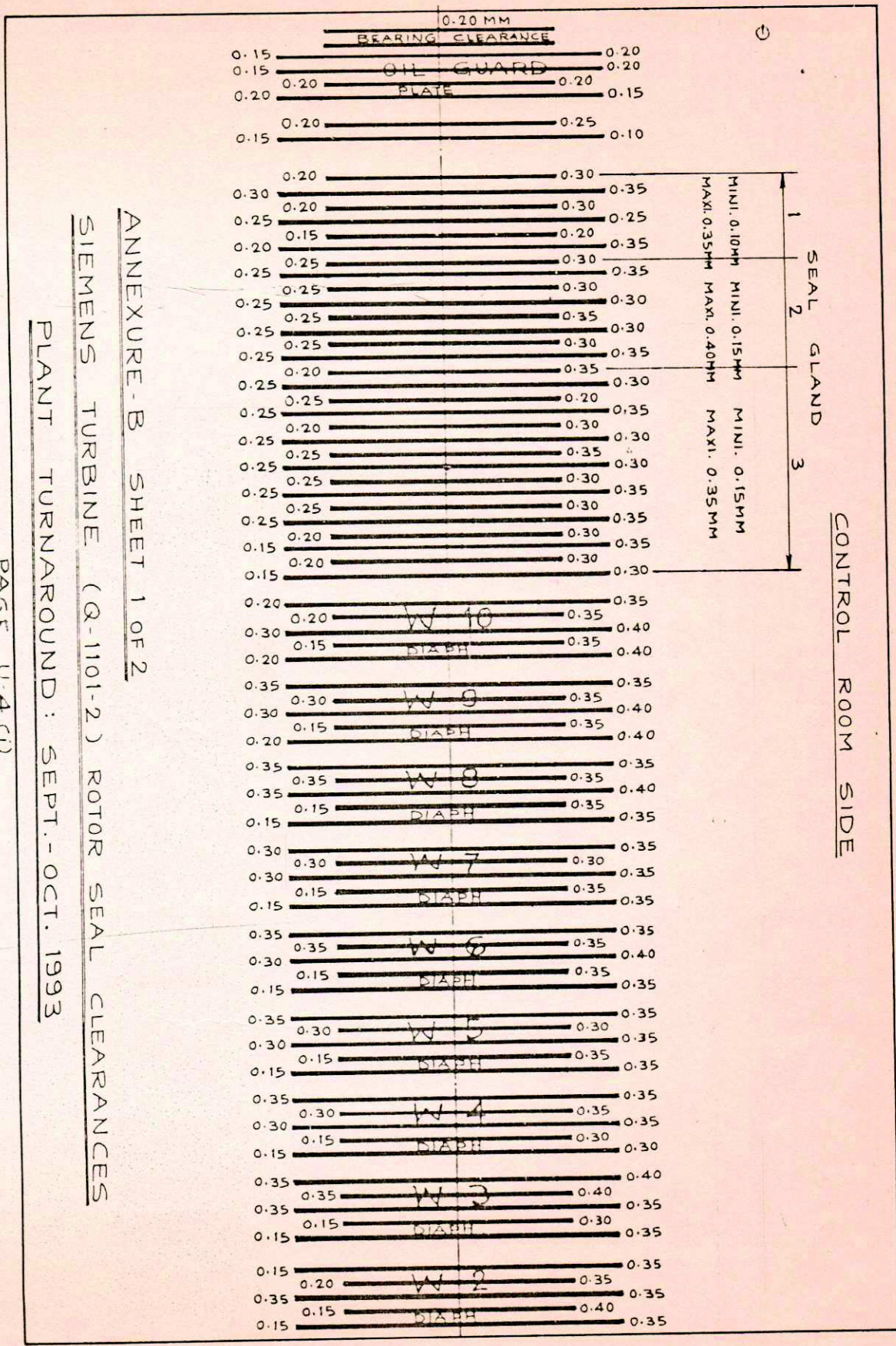
JOB DESCRIPTION

02 01 05 DRIVE TURBINE FOR CO2 RECIPROCATING COMPRESSOR Q-1101/2

Complete overhauling of the turbine was carried out. Activities.

- 01) Noted all the governor system oil pressure readings.
- 02) Decoupled
- 03) Measured bearing clearances. Bearings were found in good condition.
- 04) Locked bottom casing half
- 05) Disconnected piping. Removed relay cylinder
- 06) Removed chest valve assembly
- 07) Removed top half of the casing
- 08) condition of the rotor was found good.
- 09) Measured labyrinth clearances. All clearances found within acceptable limit. Seal top half casing found in good condition.
- 10) Lifted the rotor
- 11) Inspected seals in the bottom half casing. Found in good condition.
- 12) Cleaned rotor and casings
- 13) Put back rotor. Measured seal clearances.
- 14) Assembled top half casing. Assembled brgs.
- 15) Assembled chest valve assembly
- 16) Assembled Relay cylinder and quick shut off valve after overhauling
- 17) Checked bearing clearances
- 18) Overhauled emergency governor, starting device and hand cut out and overspeed tripping mechanism.
- 19) Overspeed test. Tripped at 9700 RPM
- 20) Coupled with gear box

Note :- Readings taken are enclosed at page U-4 (i) and (ii) as annexure - B.



ANNEXURE-B SHEET 1 OF 2

SIEMENS TURBINE (Q-1101-2) ROTOR SEAL CLEARANCES

PLANT TURNAROUND : SEPT.-OCT. 1993

PAGE U-4 (1)

WHEEL-1 IMPULSE

0.20	0.20	0.35	0.40
0.15	0.20	0.35	0.30
0.20	0.15	0.35	0.30
0.15	0.15	0.35	0.30
0.15	0.15	0.35	0.30
0.10	0.15	0.40	0.35
0.15	0.15	0.40	0.30
0.15	0.15	0.35	0.35
0.15	0.15	0.35	0.30
0.10	0.10	0.35	0.30
0.15	0.10	0.35	0.35
0.15	0.10	0.35	0.30
0.15	0.15	0.35	0.30
0.20	0.15	0.35	0.30
0.25	0.20	0.25	0.30
0.20	0.20	0.30	0.35
0.15	0.20	0.30	0.35
0.10	0.10	0.30	0.35
0.10	0.15	0.30	0.25
0.15	0.10	0.30	0.25
0.15	0.15	0.35	0.25
0.10	0.15	0.30	0.25
0.15	0.15	0.30	0.25
0.15	0.10	0.35	0.30
0.15	0.10	0.35	0.30
0.15	0.10	0.35	0.30
0.15	0.10	0.35	0.30
0.20	0.10	0.25	0.35
	0.10	0.20	
0.20		0.30	
0.15	0.05	0.20	0.20
0.10	0.05	0.30	0.15
	0.10	0.25	
0.15		0.15	0.15
0.20		0.20	0.20
0.20		0.20	0.20 (0.10)
	0.15	0.15	0.15 (0.10)
0.20		0.20	0.20 (0.15)

MINI. 0.10MM  
MAXI. 0.35MM

MINI. 0.10MM  
MAXI. 0.40MM

MINI. 0.10MM  
MAXI. 0.40MM

DRUM

3

SEAL<sup>2</sup> GLAND

1

CONTROL ROOM SIDE

PLATE

OIL GUARD

BEARING CLEARANCE

ANNEXURE-B SHEET 2 OF 2

PAGE U-4 (11)

JOB CODE

JOB DESCRIPTION

02 01 06 MAIN LUBE OIL TANK Q-1113

Flushed governor oil and bearing oil

02 02 01 AMMONIA PUMP TURBINE Q-1102

Overhauling of the turbine was carried out. Carbon rings were found with 0.012" clearance. Made this clearance to 0.004" and assembled. Overspeed test was carried out Turbine tripped at 4600 RPM. Coupled with fresh grease. Renewed grease of pump gear box coupling also. Replaced governor end journal bearing, Since clearance was 0.012".

Reading are as below

- Coupling gap : 0.0155"
- Thrust : 0.018"
- Coupling side brg. clearance : 0.004" to 0.006"
- Governor side brg. clearance : 0.004" to 0.006"
- Nozzle clearance : First wheel 0.087"  
Second wheel 0.107"
- total float (without brg.) = 0.140"

02 02 02 CARBAMATE PUMP TURBINE Q-1201/A

Overhauled the turbine Carbon rings showed clearance 0.008" to 0.009". Repaired these rings. Readings are as below.

- Journal dia at governor end : 66.54 MM
- Journal dia at coupling end : 53.79 to 53.82 MM
- Dia of shaft at Carbon seal Rings
- (a) at governor end : 60.35
- (b) at coupling end : 60.53 MM
- Bearing clearance ) governor end : 0.15 to 0.17 MM  
                              ) coupling end : 0.10 to 0.12 MM
- Oil seal clearance = 0.006" to 0.008"
- Thrust = 0.014"
- Gap between coupling halves = 0.084"
- Tripped at 4500 RPM

JOB CODE

JOB DESCRIPTION

02 02 03 CARBOMATE PUMP TURBINE Q-1201/B

Complete overhauling was carried out. Old carbon ring were found with clearance 0.010" to 0.011". Replaced them. Made the clearance 0.003" to 0.004". Bearings were found in good condition. Over speed test was carried out. Turbine tripped at 4400 RPM.

Readings are as below

Journal dia at coupling end : 53.87 MM  
Journal dia governor end : 66.54 MM  
Brg.clearance ) coupling end : 00.17 MM  
                  ) governor end : 0.20 to 0.22 MM  
Oil seal clearance : 0.004" to 0.007"  
Thrust : 0.010"  
Gap between coupling halves : 0.156"  
Clearance between nozzle and wheel :  
First wheel : 0.075"  
Second wheel : 0.116"  
Total float : 0.132"

02 03 01 PRILL TOWER FANS & P.C.SYSTEM FAN K-1401/1 TO 4

Overhauling

**P.T.Fans** : Bearing covers of all the 4 fan bearings removed. Old grease was removed. Inspected bearings. Found in good condition packed with fresh grease.

**P.C.SYSTEM** : Drained out the oil. Charged fresh oil. Rotor of K-1702 cleaned with water and that of K-1701 with diesel and condensate. Charged the expansion bellow in the suction of K-1702 and in the discharge of K-1701.

02 13 01 CCS - I WATER COOLER H-1206

Strainer cleaned

02 14 01 STEAM LEAK JOBS

Various steam leak jobs carried out as per list furnished by Production department.



JOB CODE	JOB DESCRIPTION
02 15 01	<u>4.5 ATA STEAM DRUM BOILER TEST V-1501</u> HFCC shell side & Boiler drum V-1501 were hydraulically tested as statutory requirement in presence of Boiler Inspector. Hyd.test pressure was 11.00 Kg/cm <sup>2</sup> .
02 17 01	<u>INSPECTION OF CHECK VALVE</u> Following HP check valves were inspected / repaired CO <sub>2</sub> to H-1201 Carbamate to H-1202 Carbamate to H-1203 Ammonia to H-1202 Ammonia to V-1201 23 ata Steam to V-1351, 4 ata Steam to V-1301
02 17 02	<u>RV'S TESTING</u> HP System RV's RV 1201 A/B/C reconditioned Set pressure : 165 Kg/cm <sup>2</sup> Reset pressure : 151 Kg/cm <sup>2</sup> Cold NH <sub>3</sub> line RV 1108 and RV 1110 Valves replaced with reconditioned valves.
02 17 03	<u>ROTARY VALVES</u> Rotary valves of prill cooling system were overhauled. Greasing of bearings, changing of oil, greasing of chain was done.
02 17 04	<u>VALVE REPAIR ,REPLACEMENT ETC</u> Passing gate , globe , high pressure B&L valves of various sizes were repaired / replaced as per list furnished by Production department. Valve gland leakages & various steam leaks were also attended. Steam traps of various sizes were replaced by new one wherever required .
02 19 01	<u>VESSELS</u> Following vessels were opened for inspection ; inspected ; repaired and boxed up. 01 Hydrolyser V-1351 oil traces were found. Cleaned and boxed up. 02 1st Desorber V-1352 opened, manhole inspected, boxed up. No abnormality noticed.

JOB CODE	JOB DESCRIPTION
03	2nd Desorber V-1301 opened for inspection ; Boxed up after inspection.
04	1st Evaporator H-1422 opened manhole. Hydrojetting was done of tubes. Lot of scaling (rule like) was found on tubes. After pressure test, boxed up.
05	2nd Evaporator H-1422 : Opened ; hydrojetting of tubes was done. No deposit was found. Boxed up after pressure test.
06	Flash tank scrubber H-1421 : opened manhole
07	1st Evaporator scrubber V-1423 : opened manhole, Removed tray segments for inspection, inspected demister pad. Found in good condition. During air test vapour outlet flange was found leaking (32" NB). It was repaired by welding and machining.
08	LP Condensor V-1203 :- Opened manhole rectified ring grill support. Boxed up.
09	23 ata steam seperator V-1502 : Opened manhole inspected cleaned and boxed up. No abnormality noticed.
10	9 ata steam seperator V-1503 : opened mahole : inspected. No abnormality found. Boxed up after cleaning.
11	Dehydrators G-4701-A/B : Dry ice plant opened, replaced packing material, boxed up.

JOB CODE

JOB DESCRIPTION

02 19 02

\*\*\*\*\*  
\*H.P.CONDENSER H-1202 REPLACEMENT\*  
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INTRODUCTION & BRIEF HISTORY :

High pressure Carbamate Condenser (HPCC) was in operation since 1974. The HPCC was originally supplied by M/s.Foster Wheeler John Brown Boiler Ltd, U.K. The condenser had given trouble free service upto 1986. Since 1986, we observed thinning of tubes in the upper tube sheet area. The matter was also referred to M/s.Stamicarbon.During the inspection in the year 1990 by M/s.Stamicarbon , stress corrosion cracks were noticed on the outer faces of tubes near the bottom end of upper tube sheet. As per M/s.Stamicarbon recommendations 87 Nos of tubes were plugged.Also 112 nos of tubes were stretched to avoid failure due to stress corrosion cracking / tube thinning. The process of stretching was done for the first time in Indian Industry

To avoid plant shutdown and production loss due to HPCC tube failure in future action was initiated for replacement of existing HPCC by a new HPCC.

TECHNICAL DETAILS OF HPCC :

- (a) Elevation : Foundation at 25 Meters Elevation  
(Ref.ground level 100 meter)
- (b) Position : Vertically mounted fixed tube sheet
- (c) Piping connection
- Shell side : To 4 ata drum V-1501 (Down comers and risers)
- Tube side (Top): To discharge line of pump P-1201/  
P-1102 & to off gas line from  
H- 1201 top.
- Tube side (Bottom) : To Urea Autoclave V-1201

JOB CODE

JOB DESCRIPTION

(d)	Description	Shell side	Tube side
-	Fluid	Steam/Condensate	Carbamate solution
-	Total fluid Entering	22,10,000 Kg/hr	29,500 Kg/hr Liqd. 102000 Kg/hr Vapour.
-	Fluid vapour- ised or condensed	52900 Kg/hr	70400 Kg/hr
-	Temp. In	147 deg C	170 deg C
-	Temp. Out	147 deg C	170 deg C
-	Operating pressure	4.5 kg/cm <sup>2</sup> A	141 kg/cm <sup>2</sup> A
-	Design Press.	9 kg/cm <sup>2</sup> A	161 kg/cm <sup>2</sup> A
-	Test press.	As per code	As per code
-	Design Temp.	174 deg C	190 deg C

(e) SALIENT FEATURES BETWEEN EXISTING & NEW HPCC:

	Existing HPCC	New HPCC
1)	Manufactured by M/s.FosterWheeler John Brown Boilers Ltd,U.K.	Manufactured by M/s.L&T Bombay.
2)	Inlet & outlet channels are bolted with tube sheet	Inlet & outlet channels are welded with Tube sheets.
3)	Tube material & internals are of S.S.316L material.	Tube materials & internals are of HR 3ELM 25 Cr: 22 Ni: 2 Mo Tubes supplied by M/s.Sumitomo,Japan
4)	Channels are having combination of Liner and cladding	Channels are having Liner constructions
5)	Gas Inlet & outlet nozzles are Inclined	Gas inlet nozzle is horizontal with stub. Gas outlet is Inclined with stub.
6)	Total weight = 97 Tons	Total weight = 90 Tons

JOB CODE

JOB DESCRIPTION

RIGGING SCHEME :

The job of removal of Existing HPCC and erection of New HPCC was awarded to M/s. Larsen & Toubro Limited - ECC construction group. They proposed the rigging scheme with 300 MT BOOM DERRICK. The removal of old HPCC & erection of new HPCC was done with BOOM DERRICK Scheme as follows.

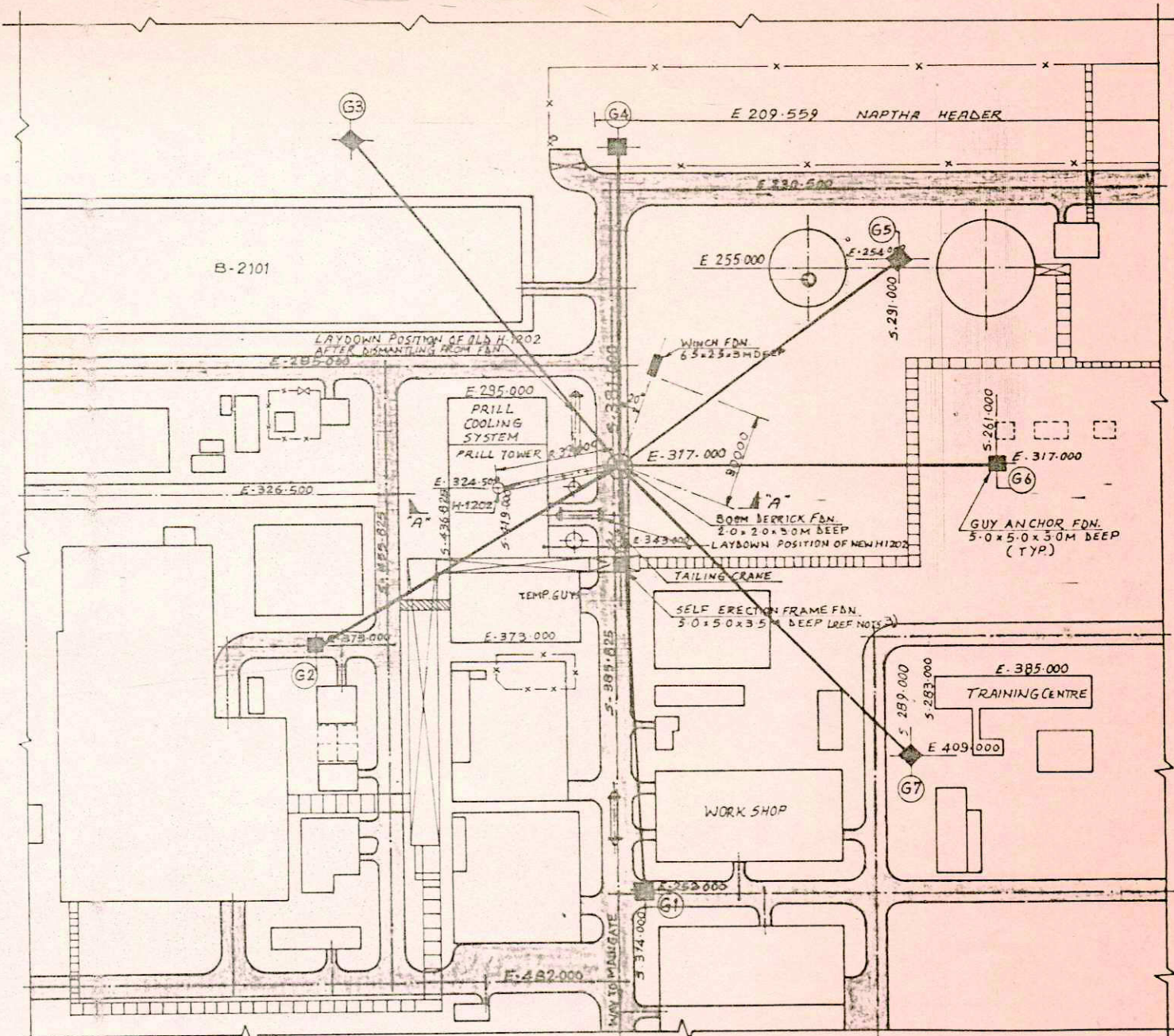
- (a) A Mast of 66 Mtr. height was erected on a base on road. This Mast was anchored to the ground by means of Guy wires attached to Guy Anchors located at proper places. There were 7 Nos of Guy Anchors with removable steel structure buried under ground. The location of Guy Anchors is shown at sketch - A at page U-11(i).
- (b) The 60 Mtr. long Boom was connected to the bottom of the Mast. The Boom was derricked by means of the Luffing line connecting to the tip of the boom. The hoisting and derricking operation were carried out by a double drum diesel winch anchored to the ground by means of a steel structure buried underground. The rotation of Boom & Mast with lifted load by 360 deg was possible because of ball and socket arrangement at the bottom and a guy cap with a bearing on top of the mast. The 7 Mtr diameter Bull Wheel driven by same diesel winch enabled the above rotation.

(c) Assembly of Guy Derrick Crane :

The 66 Mtr Mast and 60 Mtr boom were assembled one over the other with pivot connection on the sill block and the Luffing line was reeved. The boom was lifted to an angle of 45 deg by an assisting crane of 75 T capacity and luffing line was temporarily clamped. The boom and Mast were pulled together by the winch with the help of temporary anchor and held back from another anchor. Then all the 7 nos Guy ropes were assembled to the mast before lifting. When the mast became vertical, the permanent guy ropes were connected to the anchors, tightened and the mast was aligned. The boom was extended to its full length and the hoisting line with swivel block and the other accessories were fitted. The bull wheel was assembled to the mast and the Derrick was made ready for operation.

- Erection activities of Derrick : 17-08-1993 started on
- Erection of Derrick completed on : 25-09-1993

- (d) New HPCC was unloaded from trailer near the derrick with the help of two cranes ie. 55 T (IFFCO crane) and 75 T (ECC crane) on 05/08/1993.



SKETCH - A U-11 (i)

LOCATION OF GUY ROPES FOR 300 T  
 GUY DERRICK FOR HPCG ERECTION (SEPT. 1993)  
 REF. DRG. NO. M70-1-02 REV. 0 (L & T LIMITED)

JOB CODE

JOB DESCRIPTION

(e) Removal of old HPCC & Erection of New HPCC :

All piping connections of Existing HPCC were dismantled. The condensor were rigged to the derrick with heavy duty slings, lifted and brought out from the position. When the condensor was brought on to the road, it was made horizontal with the help of 75 T Crane (ECC crane)

The new HPCC was made vertical with the help of 75 T crane (ECC crane) and then it was taken through the same route and erected on the structure, aligned and bolted. The dismantled structures, process piping, risers and down comers were connected with new HPCC.

- Old HPCC Removed & New HPCC erected on : 26/09/93
- Piping Job completed on : 10/10/93
- Hydrotest done at 12 Kg/cm<sup>2</sup> in presence of CIB, Gujarat  
The Schematic arrangement of Derrick is shown at sketch - B at page U-12 (i)

02 19 03

AUTOCLAVE V-1201 INSPECTION & BOTTOM HEMI END LINER REPLACEMENT01 ) INSPECTION AND REPAIR

Inspection of the vessel has been performed from 04.10.93 to 10.10.93 by M/s.Stamicarbon on request of IFFCO.

Stamicarbon inspection engineers - Mr.P.Kuijpers & J.Thoelen. Report as under given by Stamicarbon. Original report with Urea Mtce.may also be seen.

VESSEL DATA

Manufacturer : Foster Wheeler John Brown Boilers Ltd,USA  
Fabrication date : 1972  
Liner material : X2CrNiMo 17 13 2  
Liner thickness : 5 mm  
Number of trays : 10

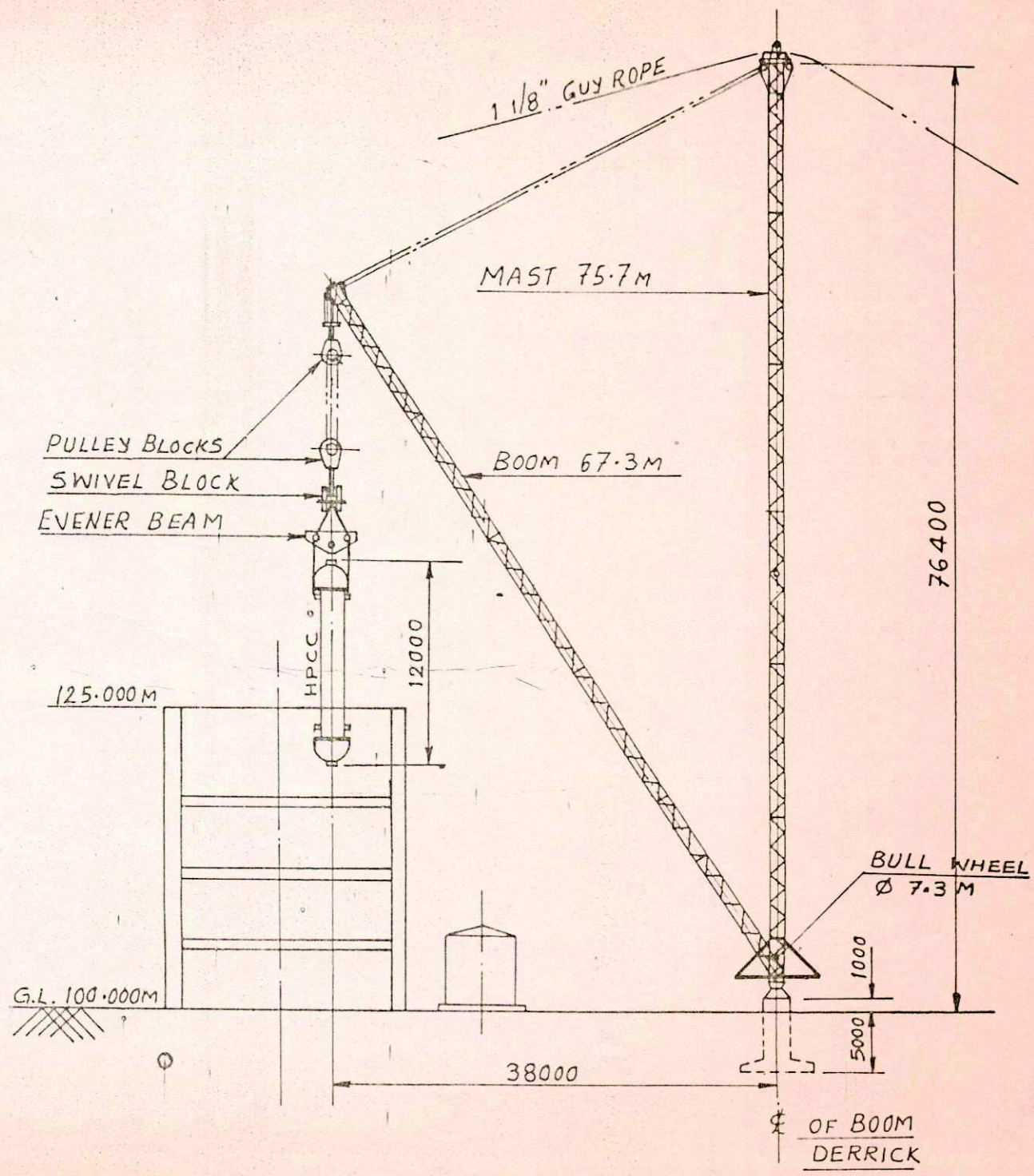
Visual inspection :

Following was observed during inspection.

Top cover :

The liner of the cover is totally covered by blue / grey oxide layer except in the area near the sealing face.

SKETCH - B



RIGGING SCHEME FOR HPC ERECTION  
WITH 300T GUY DERRICK (SEPT. 1993)  
REF. DRG. NO. M70-1-02 REV.0 (L&T. LIMITED)



JOB CODE

JOB DESCRIPTION

The sealing face is in good condition  
The nozzle to the blind plate shows severe cross cut end attack. Keep this nozzle well insulated

Top compartment (1) :

The sealing face is in a good condition.  
The area of man way right beneath the sealing face does not show any oxide layer indicating condensation corrosion.

The liner in the gas phase is covered by a blue / grey oxide layer . At three locations condensation slight corrosion has taken place (lifting lugs). At the location of the radioactive source holder condensation corrosion has taken place due to bed insulation.

The liquid level is at the tangent line  
The liner in the liquid phase is blue / brown is rather smooth from top to bottom of the vessel. The liner welds are grey and rough and slight weld decay can be noticed. No cracks visible next to the welds.

The downcomer funnel plate as well as the welds are grey and rough. Some weld decay in the longitudinal welds of the funnel has been noticed. The circumferential welds are rough, neither pin holes nor weld decay. The sieve trays are in good condition. A few bolts and nuts, holding the sieve plates, show crevice corrosion and were loose.

Remark : Next to the longitudinal weld at the north side 2 x 6 weld spots are noticed. Reason unknown.

Compartment 2 :

A few supports have been replaced in 1970 due to severe corrosion. The new supports are according to recent Stamicarbon design. The corroded supports have not been removed. A few J-bolts are loose and one is mounted wrong. In the circumferential weld 1 spot with undercut has been noticed and 1 pin hole in the longitudinal weld. Three supports are marked for repair of pin holes and one of the corroded support is marked for removing.

No cracks along the welds and a slight weld/decay. The plates used for fabrication of the sieve trays are from varying material as they show varying coloration due to corrosion.

JOB CODE

JOB DESCRIPTION

Compartment 3 :

On the boundry from the second to the third compartment a heavy corroded insert liner plate can be noticed. Wall thickness has been measured and found to be rather low. The minimum wall thickness is 3.6 mm. This is a point for special attention ; replacement must be considered during next turn around if the wall thickness is lower than 3 mm. The welders rough and slight weld decay next to the welds can be noticed. 1 support has been marked for repair of a pin hole.

Compartment 4 :

One J- bolt shows a crack end needs to be replaced. Slight weld decay is visible. Three supports marked for repair of pin holes and undercut of the welds.

One support at the south side has bad welds and need to be repaired.

The liner is slightly bulged in this compartment. Wall tickness measurements show no change of wall thickness in this area. One bolt of the seive trays is heavily corroded and needs to be replaced.

Compartment 5 :

The condition of the supports becomes worsen further down in the reactor. It is advised to remove at next opportunity all the unused supports to prevent corrosion by pin holes. At one location in the circumferential weld under cut must be repaired. Six supports are marked for repair and one support is marked for removing.

The liner is bulged all around the circumference. No change of wall thickness in this area.

Compartment 6 :

Two supports are marked for repairs and one is marked for removing. The condition of the welds in the J-bolts is getting worse. One J-bolt should be replaced now. You can consider to replace or repair all of them during next turn around. One location marked for repair of undercut.

Compartment 7 :

The liner is still very smooth. Two supports are marked for repair and one is marked for removing. Slight crevice corrosion of the bolts and nuts.

JOB CODE

JOB DESCRIPTION

Compartment 8 :

In this compartment, as well as in the next two compartments an insert liner plate can be noticed all along the circumference. This plate is heavily corroded. Wall thickness however is sufficient for now.

A weld on the linerplate has heavily been corroded and has to be grinded. If neither pin holes can be found by PT check nor if grinding is less than 1 mm rewelding is not necessary. The J-bolts and welds of the supports are in a minor condition.

Compartment 9 :

One J-bolt is marked for replacement. Again weld on the liner plate surface has heavily corroded and must be grinded and rewelded if necessary, see compartment 8.

Compartment 10 :

In this compartment all the supports have been moved 100 mm upwards. The welds at the first locations have been grinded. Due to weld decay pits up to 1.5 mm can be found. These are marked for repair. One pin hole is marked for repair.

Compartment 11 :

The bottom of this compartment has been relined by and under responsibility of Larsen and Toubro (Bombay). The reason for this relining are cracks near the welds of the carbamate inlet nozzle.

Wall thickness measurement of the liner :

The liner thickness has been checked with a Krautkramer Ultrasonic tester type DM2. The measurements have been taken at the same location as during previous inspection.

Results from top to bottom :

## Compartment 1 :

Maximum 5.4 mm	Minimum 5.1 mm	Average 5.2 mm
----------------	----------------	----------------

## Compartment 5

Maximum 5.7 mm	Minimum 5.3 mm	Average 5.5 mm
----------------	----------------	----------------

## Compartment 9

Maximum 5.5 mm	Minimum 5.0 mm	Average 5.3 mm
----------------	----------------	----------------

JOB CODE

JOB DESCRIPTION

The average wall thickness of compartment 1 in 1990 was 5.3 mm average corrosion rate 0.03 mm / year (1095 days eff. on stream) the corrosion in the other compartments is nihil.

Seive tray thickness varies from 4.6 mm in the top to 5.8 mm in the bottom. The diameter of the holes in the seive trays varie from 10 mm in the top to 8.0 mm in the bottom.

Wall thickness insert liner plates :

Compartment	3	: Minimum 3.6 MM	Maximum 4.4 MM
Compartment	4	: Minimum 4.0 MM	Maximum 4.5 MM
Compartment	8	: Minimum 4.1 MM	Maximum 4.9 MM
Compartment	9	: Minimum 4.6 MM	Maximum 4.9 MM
Compartment	10	: Minimum 4.8 MM	Maximum 5.2 MM

Wall thickness top cover overlay welding

Minimum : 8.0 MM                      Maximum : 9.1 MM

#### REPAIRS CARRIED OUT :

In general take care of good insulation of top cover, lifting lugs and nozzles.

Tighten the loose J-bolts and repaice the missing bolts.

#### Top compartment

No repairs

#### Compartment - 2

- Circumferencial weld
- One undercut and one pinhole
- Longitudinal weld - one pinhole
- Three supports marked with pinholes
- One support marked for removing

#### Compartment - 3

- One support marked for repair pinhole

#### Compartment - 4

- Replace the marked J-bolt
- Three supports marked for repair for pinholes & undercut
- One support is marked the welds are in a bad condition and need to be repaired

JOB CODE	JOB DESCRIPTION
	<u>Compartment - 5</u>
	<ul style="list-style-type: none"><li>- One undercut in circumferencial weld</li><li>- Six supports marked for repair of pinholes</li><li>- One support marked for removing</li></ul>
	<u>Compartment - 6</u>
	<ul style="list-style-type: none"><li>- Two supports marked for repair of pinhole</li><li>- One support marked for removing</li><li>- Longitudinal weld one spot marked for repair of undercut</li></ul>
	<u>Compartment - 7</u>
	<ul style="list-style-type: none"><li>- Two supports marked for repair of pinhole</li><li>- One support marked for removing</li></ul>
	<u>Compartment - 8</u>
	<ul style="list-style-type: none"><li>- Grind carefully the weld on the liner plate marked for grinding. Check this area of the liner by PT check after grinding. If no cracks or pinholes can be found rewelding is not necessary.</li></ul>
	<u>Compartment - 9</u>
	<ul style="list-style-type: none"><li>- Replace one more J-bolt</li><li>- Grind the marked weld on the liner plate. Proceed as mentioned for compartment 8.</li></ul>
	<u>Compartment - 10</u>
	<ul style="list-style-type: none"><li>- One support marked for repair of pinhole</li><li>- Two affected areas marked for repair</li><li>- 2 weld defects in the tray support welds</li></ul>
	<u>GENERAL REPAIR PROCEDURE FOR MINOR REPAIRS (PORES, FITTING WELD DEFECTS, CRACKS, END CRATERS ETC )</u>
	For repair work the following instruction may be useful.
	Welding method : TIG - welding (GTAW)
	Filler wire : Thermanite 19/15 H
	<b>Procedure :</b>
	<ul style="list-style-type: none"><li>- Brush area with stainless steel brush</li><li>- Remove defect with pencil grinder</li><li>- Clean carefully</li><li>- Reweld by TIG method, using fillerwire Thermanite 19/15</li><li>- H or other appropriate fillerwire</li></ul>

JOB CODE

JOB DESCRIPTION

- Keep the heat input low
- Interpass temperature < 150 degree Celsius
- Do not apply extra weld material
- Grind the end crater (stop position)
- Check by Dye penetrant testing
- Check ferrite content (maximum ferrite content 0.6%)
- Clean the repair by washing with 10% HNO3 and rinse with chloride free condensate.

**Conclusions :**

The reactor is in a good condition except for the supports and the J-bolts of the sieve trays. The corrosion rate decreases from 0.03 mm/year in the top to nihil in the bottom. The internals are in a good condition. The insert liner plates are heavy corroded and need attention during next turnaround. The liner in the gas phase shows a slightly corroded area due to condensation corrosion (insufficient insulation of the radioactive source holder). The bottom liner is being replaced.

**RECOMMENDATIONS :**

- 1) Remove at next opportunity all the remaining unused supports.
- 2) Grind & reweld at next opportunity the circumferential welds of the downcomer pipe.
- 3) be prepared for replacing the insert liner plate of compartment 3. It should be replaced when the thickness of this plate reaches values lower than 3 mm.
- 4) Consider replacement of all the supports of the old design and the replacement of the J-bolts
- 5) Take care for a open leak detection system.

**02) BOTTOM HEMI END LINER REPLACEMENT:**

Bottom Hemi end liner replaced by M/s.L & T, Bombay. Detailed job report is as under .

- 01) All the petals and crown plate removed from position by grinding the weld seams and then chiselling to take out them from their position.
- 02) Liners of nozzles C1A, C1B, C3, C4 and C5 removed by using hydraulic jack.
- 03) Bottom Hemi end inspection :- All the weld seams were Dye checked. Magnetic particle testing of complete bottom hemi end carried.

JOB CODE	JOB DESCRIPTION
	Shallow corrosion channels observed in the bottom hemi end were repaired by welding with 309 MO electrode keeping a preheat of 125 - 150 degree C.
	04) Prefomed crown plate piece could not be taken inside through the manhole hence pieces it was cut taking it inside. The two pieces were butt welded inside and radiographed before set up of crown plate.  Then the two halves of crown plate were set up in position with backing strips & then tacked in position.
	05) Fixture arrangement was made through C5 nozzle so that all the petals can remain in position.
	06) First of all petal behind C1B nozzle was tacked in psotion and then rest all the petals were set up in position. After set up of all petals in position fixture bolts were tightened so that gap between lines and dish end in minimum.
	07) Welding sequence of petals is shown in attached figure. This was adopted to minimise shrinkage and distortion due to welding.
	08) All the weld seams were dyechecked after root run, hot pass and final run. Ferrile content of all weld seams was within permissible limits.
	09) Nozzle liner inserted by using jack and then welding of nozzle liners carried out.
	10) All the pipe line connections were welded and radiographed.
	11) Air soap solution of nozzle liners and bottom end carried out at 3 psi, which was satisfactory.
02 19 03	(03) Unidentified weep holes of Autoclave were traced out - 2 Nos

02 19 04 HP STRIPPER H-1201

Inspection of the vessel has been performed from 04/10/93 to 10/10/93 by M/s.Stamicarbon on request of IFFCO. Stamicarbon Engineers Mr.P.Kuijpers & J.Thoelen.Following was observed and corrective action were taken on that.Report as given by Stamicarbon. Original report with Urea Maint.may also be seen.

JOB CODE

JOB DESCRIPTION

Vessel data

Manufacturer : RHEINSTAHL  
Fabrication date : 1972  
Tube material : X2CrNiMon 25 22 2  
Amount of tubes : 2100  
Tube dimension : 32 OD x 25 ID MM

Visual inspectionManway cover

The strip overlay welding is covered by a regular perforated oxide layer of about 2 mm thick. The sealing face is visually in a good condition. In the gas outlet line this scaling is missing and some corrosion has taken place. Take care of good insulation.

Top chamber

The sealing face of the manway is visually in a good condition. The overlay welding in the gasphase has a blue oxide layer of about 4 mm. Some intergranular corrosion can be seen on the location where the scaling is missing ; mostly on the transition between two welds.

The overlay welding in the liquid phase is rough. The liquid level is about 21 - 23 cm at the walls. The liquid level in the center of the stripper is about 17 - 20 cm. The liquid level next to the liquid inlet decrease over a distance of 60 cm from 50 cm to 23 cm. The tie rods are in a good condition. No crevice corrosion. Two supports of the hold down plate are showing crevices and are marked for repair.

The hold down plate needs to be cleaned since paint can be noticed at many locations. The gastubes show more corrosion in the gasphase compared to the liquid phase. Minor scaling can also be noticed.

A random check of the liquid divider holes has been performed. Minimum 2.4 mm , Maximum 2.6 mm , average : 2.50 mm. The diameter according to drawing is 2.30 mm. According delta P test performed by IFFCO 95% of the gastubes fall in the tolerance of 20%. The remaining tubes are advised to repair. Weld the existing holes of the tubes with low delta P end drill new holes with the adjusted diameter. Adjust the diameter of the holes of the tubes with high delta P. New gastubes can be used if the diameter of the holes are adjusted. It might be considered to renew all the liquid divider holes of the gastubes during next turn around since the liquid level is rather low.



JOB CODE

JOB DESCRIPTION

The overlay welding on the tubesheet and the tube to tubesheet weldings are seriously corroded, special in the area of the liquid inlet. Be prepared for rewelding tube to tubesheet welds during next turn around. As for now four tubes are marked for repair of the tube to tubesheet welding tubes 103,131,161 and 342.

Tube 33 is oval shaped and needs to be rounded. The plates of the liquid divider box show severe cross cut end attack. One pin hole on the weld of the box to the overlaywelding has been marked for repair.

The frontplate of the liquid inlet has been removed for inspection of the repair of the liquid inlet nozzle. This repair has been performed in 1991. After 2,5 years service time this repair is still in a good consition.

Thickness of the elctrode overlay welding is 14 - 17 mm. The overlay welding in the nozzle increases from 7.5 mm near the stripper to 14 mm at a location of 50 cm in the nozzle. The corrosion of the overlay welding behind the liquid inlet box the same as the corrosion of the overlay welding in the liquid fase in the rest of the stripper top. The area next to the connecting weld of the liquid inlet box to the tubesheet overlay welding is sericously corroded. A crack can be noticed. It is advised to repair this crack. Replacement of the plate can be considered for next turn around in relation to a possible modification of the design of the liquid inlet box.

#### Bottom chamber

The tubesheet is covered by a blue grey oxide layer, as well as the liner over a height of abt. 5 - 10 cm from the tubesheet.

The tube ends are grey and smooth at the inside and show minor to slight cross cut end attack. The overlay welds are grey and slightly rough. Some pits can be seen in the HAZ of the transition of two weld strips.

The sealing face is visually in a good condition.

#### Bottom cover

The strip overlay welding is grey and rather rough. No defects noticed. The plates and welds of the CO2 inlet are corroded ; no repair needed. One support of the baffle over the liquid outlet is marked for repair of a pin hole.

The sealing face is in a good condition but needs to be protected during the shutdown period.

JOB CODE

JOB DESCRIPTION

Tube wall thickness measurement

All 2098 tubes have been measured over the first 3 meters from the top for remaining wall thickness using eddy current technique (two tubes have been plugged)

Results :	2 tubes	2.95 mm
	8 tubes	2.90 mm
	63 tubes	2.85 mm
	171 tubes	2.80 mm
	507 tubes	2.75 mm
	475 tubes	2.70 mm
	370 tubes	2.65 mm
	264 tubes	2.60 mm
	159 tubes	2.55 mm
	51 tubes	2.50 mm
	27 tubes	2.45 mm
	1 tube	2.40 mm

The average wall thickness calculated is 2.68 mm. The average wall thickness measured during the previous inspection in 1988 was 2.97 mm. Based on a effective on stream time of 1660 days we calculated an average corrosion rate of 0.06 mm/year which is a normal figure for this material. Accuracy of the measurement is 0.05 mm.

Scaling thickness in the stripper tubes

The scaling in the stripper tubes has been measured by caliber probe and random

The scaling thickness appeared to be 2 mm. Chemical cleaning is advised during next turnaround.

Thickness measurements of overlay welding

The thickness of overlay welding was measured by Fischer Permascope type.

Top cover	13 - 16 mm
Manway	11 - 13 mm
Top dome (gas phase)	10 - 11 mm
Top channel (gas phase)	12 - 14 mm
Top channel (liquid phase)	7.5 - 10 mm
Tubesheet	9 mm
Bottom manway	8 - 12 mm
Bottom channel	9 - 12 mm
Bottom cover	9 - 11.5 mm

Tube sheet check

Both tube sheets have been checked for corrosion of the C-steel surrounding the tubes at the transition to the stainless steel overlay welding. No cavaties could be detected.

I F F C O - K A L O L

T A B L E - 1

EQUIPMENT NO. H-1202

MAINTENANCE DEPARTMENT  
INSPECTION SECTION

PIPE LINE NOS.	WELD JOINT NOS.	MATERIAL			ELECTRODE		EXAMINATION	
		TO	ROOT PASS		WELD OUT	ROOT DPT	FINAL DPT	X-RAY
<u>WELD JOINTS</u>								
<u>(IBR JOINTS)</u>								
12"-C4 A-SC1233	J1, J2 & J3	SA 106 GR.B	SA-106 GR.B	ER705-2 (GTAW)	E-7018 (SMAW)	DONE	DONE	DONE
12"-C4B-SC1234	J1	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -
12"-C4C-SC1235	J1	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -
12"-C4D-SC1236	J1	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -
16"-C5A-SC1244	J1 & J2	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -
16"-C5B-SC1243	J1 & J2	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -
16"-C5C-SC1242	J1 & J2	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -
16"-C5D-SC1241	J1	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -
16"-C5E-SC1237	J1	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -
16"-C5F-SC-1238	J1	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -
16"-C5G-SC1239	J1	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -
16"-C5H-SC1240	J1, J1A & J2	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -

U-22 (i)

I F F C O - K A L O L

T A B L E - 1 A

EQUIPMENT NO. H-1202

MAINTENANCE DEPARTMENT  
INSPECTION SECTION

PIPE LINE NOS.	WELD JOINT NOS.	MATERIAL		ELECTRODE		EXAMINATION		
		TO		ROOT PASS	WELD OUT	ROOT DPT	FINAL DPT	X-RAY
<u>SS WELD JOINTS</u>								
6"-C1A-PR-1230	J1	NOZZLE C1A OF H-1202 (SS 316L MODI)	SS316L PIPING	ER-A 121 LF OERIL KONEFON (G T A W)	THERMANITE 25/22 H (SMAW)	DONE	DONE	DONE
6"-C1A-PR-1230	J1 A, J8 & J9	SS316L	SS316L	SS316L FILLER WIRE (GTAW)	THERMANITE 19/15 H (GTAW)	- DO -	- DO -	- DO -
10"-C1-B-PR1202	J1	SS316L MODI. NOZZLE C1B OF H-1202	SS316L PIPING	ERA.121LF (GTAW)	THERMANITE 25/22 H (SMAY)	- DO -	- DO -	- DO -
10"-C1-B-PR-1202	J3, J6A & J10	SS316L	SS316L	SS316L FILLER WIRE (GTAW)	THERMANITE 19/15 H (GTAW)	- DO -	- DO -	- DO -
8"-C2-PR-1203	J1	-DO-	-DO-	-DO-	-DO-	- DO -	- DO -	- DO -
8"-C3-PR-1204	J1	SS316L MODI NOZZLE C3 OF H-1202	SS316L	ER A.121F (GTAW)	THERMANITE 25/22 H (SMAY)	- DO -	- DO -	- DO -
10"/1 1/2" C1 B-PR-1203	J2A	SS316L	SS316L	SS316L FILLER WIRE (GTAW)	THERMANITE 19/15 H (GTAW)	- DO -	- DO -	- DO -

JOB CODE

JOB DESCRIPTION

**REPAIRS CARRIED OUT :****Top stripper**

- Tube 33 has an oval shape and needs to be repaired.
- The tube to tubesheet welds of tubes 103,131,161 and 342 contain pin holes. Grind and repair using TIG welding.
- Repair the two marked supports of the hold down plate.
- Repair marked pin hole in the weld of the liquid dividing box to the liner as well as the crack near the connection weld of the liquid inlet box to the tubesheet overlay welding.

**Bottom stripper**

- Repair marked pin hole in bottom cover plate.

**Conclusions**

The HP Stripper is in a good condition except for the overlay welding and tube to tubesheet weldings next to the liquid inlet. The repair of the liquid inlet nozzle is still in a good condition.

The average remaining wall thickness of the X2CrNiMoN 25.22.2 stripper tubes amounts to 2.68 mm with a maximum of 2.95 mm and a minimum of 2.40 mm.

The corrosion rate of the stripper tube is 0.06 mm/year. The diameter of the liquid divider holes in the gastubes is rather high resulting in a rather low liquid level in the top.

The oxide scaling inside the tubes is about 2.0 mm ;  
Chemical cleaning advisable.

**RECOMMENDATIONS**

- 1) Take care for a proper installation of the gas tubes.
- 2) Take care for a proper installation of tierods in relation to sealing by the teflon ring.
- 3) Clean the holding down plate, take care for removing the paint.
- 4) Check all gastubes for proper tack welding

JOB CODE	JOB DESCRIPTION
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5) Perform a chemical cleaning to remove the scaling inside the stripper tubes at next turn around.

6) Consider rewelding tube to tubesheet welding next to the liquid inlet region during next turnaround.

02 19 05 TANKS

Following tanks opened, inspected, cleaned and boxed up.

T-1301, T-1401, T-1501

02 20 01 FABRICATION JOBS

Following fabrications jobs were carried out.

01) 4" SS 316L HP piping at the bottom of HP Condensor ( Autoclave off gas line)

02) 8" NB, SS 304L pressure balance piping between H-1205 and V-1205

03) 2 Nos 4" NB C.S. bends replaced in ST 1503 and SC-1504 - 4" B4 line.

04) Removed inlet air duct of prill tower bottom.

05) Modified oil separator piping in the P.B.separator drain tanks to avoid spillage of oil.

02 21 01 CONVEYOR BELTS

M-1403 : Repaired joint by vulcanizing. Rectified oil seal leakage of gear box.

M-1419 : Replaced gear box since oil was leaking thru oil seal.

M-1421 : Replaced gear box since oil was leaking thru oil seal.

02 31 01 HYDROJETTING OF HEAT EXCHANGERS

Following Heat Exchanger were opened, Hydrojetted and boxed up.

H-1114, H-1123, H-1421, H-1422, H-1423, H-1424, H-1425

H-1426, H-1204, P-1201-AB, Lub oil coolers, P-1102 A/B

Lub oil coolers ; lub oil cooler of main console (T-1111)

U R E A - P L A N TINSPECTION JOBS


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JOB CODE                      JOB DESCRIPTION

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02 41 00    INTRODUCTION:-

During Revamp-II plant shutdown the following major jobs were undertaken in urea plant, the details of which are as under.

- (1) Removal and Replacement of High Pressure Carbamate Condenser (H-1202).
- (2) Relining of Bottom dished end in Autoclave (V-1201).
- (3) Inspection of High pressure vessels like Autoclave, H.P. Stripper by M/S Stamicarbon Engineer.
- (4) Vessel Inspection.
- (5) Pipeline Thickness measurement.
- (6) Miscellaneous jobs.

The details of various Inspection activities carried on different jobs are as follows.

02 41 01    REPLACEMENT OF HIGH PRESSURE CARBAMATE CONDENSER :-

The complete job of removing and replacement of HPCC Exchanger was done by M/S E.C.C. Bombay. After erection of new HPCC Exchanger all the connecting pipelines (i.e. C.S. and S.S. 316 pipelines) field weld joints were inspected by DPT and 100% Radiography. Finally the HPCC was Hydrotested

from shell side at 11.0 Kg/cm<sup>2</sup> in presence of Boiler Inspector. The Table 1 & 1A indicates the welding details & NDT examinations carried out on C.S. & S.S.-316L pipe lines of New HPCC. Please refer attached table - I and I(A) at page U-22 (i) & (ii).

02 41 02    RELINING OF BOTTOM DISHED END LINER IN AUTOCLAVE (V-1201):-

The Complete job of supply of new lining material, removal of old liner and installation of new liners of Autoclave (V-1201) bottom dished end was carried out by M/S Larson & Toubro, Bombay.

After the removal of old liner petal plates, crown plates & nozzle sleeves etc of Bottom dished end, various Inspection activities were undertaken viz. Visual Inspection, Cladding thickness measurement, Ferrite measurement, Ultrasonic thickness measurement, Magnetic particle testing & Dye-Penetrant testing of dished end etc. The observations are as follows.

JOB CODE

JOB DESCRIPTION

VISUAL INSPECTION AFTER REMOVAL OF OLD LINER:-

- (a) Shallow corrosion channeling was observed on dished end at various places. This was marked indicating depth of corrosion cavities, width of the channeling and approximate length of it.
- (b) Both the weep holes of the bottom dished end had got choked, which were required to be cleaned prior to fixing up the liner plates.
- (c) 1.5 mm wide x 25 mm long cut mark was observed in the cladded area of ammonia inlet nozzle (C3).
- (d) On the inner surface of Ammonia Inlet nozzle (C3), three nos of ring grooves and one no. pinhole were noticed. Also below buffer layer an opening was observed for 2 to 3 inches circumferential length.
- (e) The overall condition of all other nozzles was found to be good.
- (f) Depressions on dished end inner surfaces was observed on east side near C1B nozzle and on south side near petal to crown plate weld joint. These seemed to be from the fabrication stage of the vessel.
- (g) The condition of dished end surface below the backing strip at shell to dished end joint, was found to be good at accessible areas.
- (h) Measurement of distance of weep holes from centre nozzle (C5) had been done for future reference. This is as shown below.

DESIGN DEVIATIONS OF NEW LINER :

As per original design the bottom dished end liner was made with six segments of petal plates and single piece of centre crown plate. But, now it was fabricated and installed with twelve segments of petal plates and the centre crown plate with four segments in order to facilitate the entry of new liner segments through top manhole.

WELDING INSPECTION OF NEW LINERS AND NOZZLES:

- (i) All the new prefabricated petal plate segments (12 nos.), backing strips and crown plate segments were visually inspected and ferrite measurement was done. The overall condition of new liner segments was found to be good.



JOB CODE

JOB DESCRIPTION

- (2) The centre crown plate was installed in the four segments. Root pass (i.e. 1st run) of both the side long seam welds and central long seam weld joints were inspected by dye penetrant test and ferrite measurement. Similarly after final welding these three weld joints were checked by dye penetrant test and ferrite measurement was done. Radiographic examination was carried out for both the side long seam butt weld joints (ie J1 & J2) and found defect free. As these two weld joints were not welded with backup strip, it was decided to put a covering strip above these butt-weld joints and weld the strip with crown plate. Both side top strip weld joints were inspected by DPT. The centre long seam welding (Butt weld) was done with backup strip and hence this joint was not radiographed.
- (3) After positioning all the petal plates, welding of individual plates both long and circumferential weld seam was done. Root pass (i.e. 1st Run) welding of all the petal plate weldings were inspected by DPT and ferrite measurement. Root pass was done by GTAW method. The remaining weldout was completed by SMAW method. The final welding of all the petal plates were inspected by DPT and ferrite measurement was carried out.
- (4) After positioning all the five nozzle sleeves, seal welding of sleeve with cladding and liner with cladding were carried out. These seal weldings were inspected by DPT. Then, final welding of all the sleeves were checked by DPT and ferrite check was done. Similarly sleeves seal welding and final welding from outside was checked by DPT & ferrite measurement was done for all nozzles except ammonia inlet nozzles.
- (5) For 8 inches diameter nozzle sleeves ( i.e nozzle C1A, C1B & C4 ) the connecting pipe root weld joints were inspected by DPT & Radiography. Then the final welds of these joints were checked by DPT & Radiography. The other two nozzle sleeves (ie nozzle C3 & C5) connecting pipe root Weld joints were checked by DPT and final welds were Inspected by DPT & Radiography.

JOB CODE

JOB DESCRIPTION

## (6) AIR LEAK TEST :-

Compressed air was passed at 0.20 Kg/cm<sup>2</sup> from both the weep holes of bottom hemi-end & from all the nozzle weepholes in the annular space. Soap solution was applied on new liner weldings in hemi-end and liner integrity was confirmed in all respects. But the compressed air from the hemi-end annular space was found to leak in the annular space between C.S. nozzle & S.S. sleeve of ammonia inlet nozzle (i.e nozzle C3).

It was indicating that the compressed air put in the annular space of the hemi-end had an opening to the annular space at C.S. nozzle & S.S. sleeve through some pinhole or lack of fusion type weld defect in the weld of liner and buffer welding. However the fillet weld joint around the S.S. sleeve was ground off up to the buffer weld and re-welding was done properly at the weld junction of the liner and buffer welding. After putting the seal welding deposit, DPT & ferrite measurement was carried out. Pneumatic test was done at 0.2

Kg/cm<sup>2</sup> air pressure passing from both the weepholes of bottom hemi-end, soap solution was applied on new seal welding and found defect free. Also, the tubing taken from the ammonia sleeve nozzle was connected to air bubbler and found no air leakage through ammonia sleeve nozzle. After confirming this, welding was done between buffer layer, liner and the nozzle sleeve. D.P. Test and ferrite check was performed after final run. Interpass temperature was always maintained within 150 C.

Again compressed air and soap solution test was carried out for ammonia nozzle and found the air pressure in the annular space was completely holding at 0.2 Kg/cm<sup>2</sup> and the same exercise was done for each nozzle and hemi-end.

Finally the Autoclave was boxed up after cleaning and passivation of the new welds by 10% nitric acid solution & rinsed with DM water.

02 41 03

INSPECTION OF AUTOCLAVE (V-1201) AND H.P. STRIPPER BY M/S. STAMICARBON ENGINEERS.

M/s. Stamicarbon had been requested by IFFCD to carry out the inspection of HP equipments viz. Autoclave (V-1201) and HP-Stripper (H-1201) during this Revamp-II plant shutdown. Accordingly the representatives of M/s. Stamicarbon have carried out inspection of Autoclave and HP-Stripper. The details of inspection & repairs carried out are as follows.

JOB CODE

JOB DESCRIPTION

## 01) AUTOCLAVE :

Tray segments were removed from top to bottom for internal inspection of the liner and weldjoints. Thorough visual inspection and ultrasonic thickness measurement of the liner were carried out.

The following are the observations. The Tray supporting clits welding was found to be eroded/corroded at various locations. The spots to be repaired were marked for repairs by the representative of M/s. Stamicarbon. A comprehensive list of the defective clit welding, unused clits and other observations were made for repairs. The same is reproduced below.

COMPARTMENT NUMBER FROM TOP	OBSERVATIONS
1.	No Repairs.
2.	(a) One undercut & one pinhole on circumferential weld were marked for repair.  (b) One pinhole on longitudinal weld was marked for repair.  (c) Three clit supports were marked for pinhole defects.
3.	(a) One clit was marked for pinhole repair.  (b) Two nos. of unused clits were marked for removal.
4.	(a) One no. of J-bolt was marked for replacement.  (b) Three clits were marked for pinhole repair & undercut.  (c) One clit was marked for putting additional weld deposit, since the weld was in bad condition.

JOB CODE	JOB DESCRIPTION
5.	(a) One undercut on circumferential weld marked for repair. (b) Six clits were marked for pinhole repairs. (c) Two unused clits were marked for removal.
6.	(a) Two clits were marked for pinhole repairs. (b) One unused clit was marked for removal. (c) One undercut on longitudinal weld seam was marked for repair.
7.	(a) Two clits were marked for pinhole repairs (b) One unused clit was marked for removal.
8.	(a) The weld on the liner plate was marked for grinding & DPT check after grinding.
9.	(a) One J-bolt was marked for replacement. (b) Weld on the liner plate was marked for grinding & DPT check after grinding.
10.	(a) One clit was marked for pinhole repair.

All the above repairs were attended by grinding, welding and DPT check. Also ferrite check was done on all the repair welds and found satisfactory. Passivated the repair welding by 10 % HNO<sub>3</sub> and rinsed with DM water. Ultrasonic

3

thickness measurement of the liner was carried which are as follows:- (Results from Top to bottom.) Design thickness of liner is 5mm.

COMPARTMENTS NOS	MEASURED THICKNESS IN MM		
	MAX.	MINI.	AVERAGE
1.	5.4	5.1	5.2
5.	5.7	5.3	5.5
9.	5.5	5.0	5.3

JOB CODE

JOB DESCRIPTION

Seive tray thickness varies from 4.6 mm in the top to 5.8 mm in the bottom. The diameter of the holes in the seive trays varies from 10 mm in the top to 8 mm in the bottom. Wall thickness of insert liner plates (Design thickness is 5 mm)

COMPARTMENTS NOS	MEASURED THICKNESS IN MM	
	MINI.	MAXI.
3	3.6	4.4
4.	4.0	4.5
8.	4.1	4.9
9.	4.6	4.9
10.	4.8	5.2

Minimum Wall thickness of top cover overlay was 8.0 mm and Maximum was 9.1 mm.

#### CONCLUSIONS:

- (a) The reactor is in good condition except for the tray supporting clit welding and J-bolt of the seive trays which were found to be eroded/corroded at various locations.
- (b) The corrosion rate decreases from 0.03 mm per year in the top to nil in the bottom.
- (c) The internals are in good condition.
- (d) The insert liner plates are heavily corroded and wall thickness reduction has been observed. Needs attention during next turnaround.
- (e) The liner in gas phase found slightly corroded at few places due to condensation corrosion. (insufficient insulation of the radioactive source holder.)
- (f) Re-lining of bottom dished end liner was carried out.

#### 02) H.P.STRIPPER -(H-1201) INSPECTION:-

Visual inspection, Tube wall thickness measurement by eddy current, technique thickness measurement of overlay welding and ferrite content measurements were carried out by the representative of M/S Stamicarbon. The detailed site report submitted by them is attached. (Annexure I)

JOB CODE

JOB DESCRIPTION

**CONCLUSIONS:-**

- (a) The H.P.Stripper is in good condition except for the overlay welding on the tubesheet and the tube to tubesheet weldings are seriously corroded particularly in the area of liquid inlet.
- (b) The liquid inlet nozzle repair welding done in July'90 is still in good condition.
- (c) The average remaining wall thickness of the X CrNiMo<sub>2</sub> 25:22:2 stripper tubes amounts to 2.68 mm with a max. of 2.95 mm and a min. of 2.4 mm.
- (d) The corrosion rate of stripper tube is 0.06 mm/year.
- (e) The diameter of the liquid divider holes in the gas tubes is rather high resulting in a low liquid level in the top.
- (f) The oxide scaling inside the tubes is about 2.0 mm. Chemical cleaning advisable.

02 41 04

**[D] INSPECTION OF VESSELS:-**

The following vessels and tanks were opened and offered for inspection in urea plant. Visual inspection and thickness measurement etc. were carried out. The observations are given below.

**(a) V-1101 (CO Knockout Drum):-**

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- (1) Condition of demister pad was found satisfactory.
- (2) Peeling of epoxy paint was observed on the west side of shell internal surface in apprx. 5 Sq. Inch area.
- (3) In general the condition of the vessel was good.
- (4) Ultrasonic thickness measurement of the shell was carried out from outside. A separate report has been prepared.

**(b) H-1104 (CO Spray Cooler):-**

2

- (1) Demister pad assembly was found in good condition.
- (2) All internal fittings were intact in position.
- (3) Condition of the epoxy paint was found satisfactory.
- (4) Thickness measurement was done, a report has been prepared.

JOB CODE

JOB DESCRIPTION

**(c) V-1203 (L.P.Absorber):-**

- (1) No corrosion/erosion was observed in shell surface.
- (2) The shell has assumed blackish colouration.
- (3) Condition of supporting grill was good.
- (4) All the weldjoints were found to be in good condition.

**(d) V-1206 (Vent Scrubber):-**

- (1) The demister pad was found in good condition, however its supporting plate was found bent at two locations.
- (2) Grills covering rasching rings were intact in position.
- (3) In general, the vessel was found in good condition.

**(e) V-1351 (Hydrolyser):-**

- (1) In third tray counting from top, the gasket below the tray has came out from its position on west side. This was informed to maint. crew for rectification.
- (2) Minor pitting were observed in the circumferential weldjoint between 11<sup>th</sup> & 12<sup>th</sup> tray.
- (3) The shell cladding has assumed brownish colouration.
- (4) All the tray fastening bolts were intact in position.
- (5) Thickness measurement of shell cladding was carried out using Permascope. A separate Report has been prepared.

**(f) V-1352 (First Desorber):-**

- (1) The shell inside has assumed brownish colouration.
- (2) Minor pittings were observed in the weldjoint of tray supports.
- (3) The condition of the vessel was found to be satisfactory.

**(g) V-1422 (First stage Evaporator Separator):-**

- (1) The shell has assumed blackish colouration.
- (2) Minor scaling was observed inside the tubes.

JOB CODE	JOB DESCRIPTION
	(3) The vessel weldjoints condition was good.
	(4) The vessel internals were intact and in good condition.
	(5) The seal welding of the tubes with the top tube sheet of the exchanger was found to be free from any defects.
	(6) The overall condition of the vessel was found satisfactory.
<b>(h)</b>	<b>V-1423 (First stage Evaporator Scrubber):-</b>
	(1) Demister pad segments was found to have displaced/sagging.
	(2) Minor pitting was observed on tray supports weldjoint in scattered area.
	(3) In bottom most tray, 14 bolts were found missing and in IInd tray 6 bolts were missing.
	(4) The shell inside surface has assumed brownish red colouration.
	(5) During air leak test, Vapour Outlet flange connected to pipe line (32"size) was found leaking from its weld. It was repaired by machining & welding. Complete welding was inspected by DPT.
<b>(i)</b>	<b>V-1501 (4 ata Steam drum):-</b>
	(1) The colouration of the shell was observed to be blackish.
	(2) Some bolts of riser plates were found missing and informed the Maint. crew for providing the same.
	(3) Condition of the demister pad was good.
	(4) Slight pittings were observed on the dished ends.
	(5) Ultrasonic thickness measurement was done and a separate report has been prepared.
	(6) MPT of longitudinal and circumferential weld seams was carried and found defect free.



JOB CODE	JOB DESCRIPTION
(j) V-1502 (23 ata Steam drum):-	<ol style="list-style-type: none"><li>(1) The vessel has assumed brownish black colouration.</li><li>(2) The weld joints were found satisfactory. However underflushing was noted on HAZ (i.e of parent metal) on circumferential and longitudinal weld seams.</li><li>(3) The weld joints of the top &amp; bottom distributor pipes were found to be in good condition.</li><li>(4) MPT of the vessel weld seams and nozzle weld joints was carried out. No defect was observed on shell weld seams. However, lack of fusion/crack like defect was observed on west side manhole cirseam from inside of the vessel. This was confirmed after shallow grinding &amp; DPT. The defect length was found to be 12" approximately as it was observed during Shutdown-Nov.1992.</li><li>(5) Ultrasonic thickness measurement was done and a separate report has been prepared.</li></ol>
(k) V-1503 (9 ata Steam drum.):-	<ol style="list-style-type: none"><li>(1) In general the internal colouration of the steam drum was observed to be brownish black.</li><li>(2) Top and bottom distributor pipe weld joints were found to be in good condition.</li><li>(3) All internal fittings were found intact and in good condition.</li><li>(4) Scattered pittings were observed on both the dished ends.</li><li>(5) MPT of cirseams and longseams were carried out. No defect was revealed</li><li>(6) Ultrasonic thickness measurement was done and a report has been prepared.</li></ol>
(l) T-1501 (Condensate tank):-	<ol style="list-style-type: none"><li>(1) The internal colouration of the shell was found to be brownish black.</li><li>(2) Supporting plate (Strip supports) of first inlet pipe from east side was found missing.</li><li>(3) Impingement plate below both the inlet pipes got detached from shell. The above findings were communicated to Maint. crew for rectification.</li></ol>

JOB CODE

JOB DESCRIPTION

- (4) Overall condition of the vessel weld seams was satisfactory as seen visually.
- (5) The Ultrasonic thickness measurement of the shell and dished ends was carried out. A separate Report has been prepared.

**(m) T-1301 (Ammonia water tank):-**

- (1) All the weld joints were found to be in good condition and free from corrosion/erosion.
- (2) Tank bottom plates were found buckled upward approximately 3/4 inch at the centre. However, this has also been observed during previous inspection.
- (3) The Top 1/4th area of the tank shell has assumed greyish colouration. Rest of the area has assumed brownish grey colouration.

**(n) T-1401 (Urea Solution tank):-**

- (1) The Tank shell has assumed brownish colouration.
- (2) The weld joints were found in good condition and free from corrosion/erosion.
- (3) The tank bottom was found to have buckled upward at centre by 1/2" approximately, which was observed in the past.

**(E) Pipe line thickness measurement:-**

Ultrasonic thickness measurement was carried out for the following pipe lines in urea plant. The detailed thickness measurement report is attached herewith. Also, the attached annexure gives the minimum thickness observed on individual pipelines, Design thickness and minimum thickness required as per the calculations made by Reliability Cell. The detailed report on Isometric sketches is also attached herewith.

- |                 |                  |
|-----------------|------------------|
| (1) PR-1201-8"  | (35) ST-1101-4"  |
| (2) PR-1226-2"  | (36) ST-1209-3"  |
| (3) PR-1230-6"  | (37) ST-1210-6"  |
| (4) PR-1202-10" | (38) ST-1102-8"  |
| (5) PR-1203-8"  | (39) ST-1120-6"  |
| (6) PR-1204-8"  | (40) ST-5151-8"  |
| (7) PR-1205-6"  | (41) ST-1407-12" |
| (8) PR-1205-8"  | (42) ST-1409-4"  |
| (9) GA-1201-6"  | (43) ST-1402-3"  |

JOB CODE

JOB DESCRIPTION

- (10) PR-1206-6"
- (11) PR-1207-14"
- (12) PR-1208-4"
- (13) PR-1215-16"
- (14) PR-1214-12"
- (15) PR-1219-8"
- (16) PR-1223-4"
- (17) PR-1224-3"
- (18) PR-1225-3"
- (19) PR-1230-6"
- (20) GA-1112-6"
- (21) GA-1203-1"
- (22) GA-1202-1"
- (23) MA-1106-4"
- (24) MA-1201-3"
- (25) MA-1203-4"
- (26) ST-1105-4"
- (27) ST-1106-14"
- (28) ST-1125-10"
- (29) ST-1125-8"
- (30) ST-1104-6"
- (31) ST-1116-8"
- (32) ST-1116-12"
- (33) ST-1129-10"
- (34) ST-1119-2"
- (44) ST-1406-1 1/2"
- (45) ST-1411-8"
- (46) ST-1412-6"
- (47) ST-1413-1 1/2"
- (48) ST-1503-8"
- (49) SC-1501-4"
- (50) SC-1502-3"
- (51) SC-1504-4"
- (52) SC-1233-12" TO SC-1236-12"
- (53) SC-1237-16" TO SC-1244-16"
- (54) SC-1506-4"
- (55) SC-1507-3"
- (56) SC-1210-10"

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PLANT TURNAROUND - SEPT. - OCTOBER - 1993

U R E A - P L A N T

CIVIL JOBS

JOB CODE	JOB DESCRIPTION
02 51 01	01 Floor levelling done near operator cabin on back side of P-1352 A/B
	02 Repair of Scrapper floor by Epoxy Analdite/Hardner and Scrapper blade adjustment.
	03 P-1102/A Pump area floor repaired
	04 FICV-1204 floor surfacing has been completed
	05 P.B.Compressor roof drain lines repaired (T-1111 side)
	06 Inside painting of Urea Prill Tower carried out with five coats
	07 Epoxy painting (with five coats) done at Prill Tower top and T-1111 Sump and outside painting Red & White chequered at Prill Tower top
	08 Foundation for old HPCC made
	09 Opening of reinforcement for providing platform at 2 1/2 floor.
	10 Replacement of Prill tower louvers plank
	11 Providing and fixing alluminium door in MCC-6
	12 Repairing and refixing of alluminium door at Scrapper floor and P.C.S. room.

PLANT TURNAROUND - SEPT. - OCTOBER - 1993

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U R E A - P L A N TELECTRICAL JOBS

JOB CODE	JOB DESCRIPTION
02 61 01	<u>CARRIED OUT MAINTENANCE OF TRANSFORMER 7A,7B ABD 17</u>
	<ul style="list-style-type: none"> <li>a) Checked and tightned the primary / secondary end terminals of the cables</li> <li>b) HT Marshalling box checked and replaced the oil with new oil.</li> <li>c) Reactivated silicagel in dehydrating breather.</li> <li>d) Checked trip circuits and protection system of transformer.</li> <li>e) Measured IR values of primary and secondary windings of the transformer.</li> </ul>
02 61 02	<u>CARRIED OUT PREVENTIVE MAINTENANCE OF TMG MAKE ACBs INSTALLED IN MCC-6 &amp; SIEMENS ACBs INSTALLED AT MCC-14</u>
	<ul style="list-style-type: none"> <li>- Replaced defective parts and worn out contacts.</li> <li>- Lubricated the mechanism.</li> <li>- Checked trip and close timings of CB for uniform closing and opening of breather poles.</li> </ul>
02 61 03	<u>PREVENTIVE MAINTENANCE CARRIED OUT ON MCC-6 &amp; MCC-14</u>
	<ul style="list-style-type: none"> <li>- Checked all feeder compartment and replaced defective contactors, contacts, timers, elemex connectors, fuse fittings isolators etc.</li> <li>- Cleaning and tighening of bus bars &amp; cable connections.</li> </ul>
02 61 04	<u>PREVENTIVE MAINTENANCE CARRIED OUT ON CONVEYOR CONTROL PANEL (KONEL PANEL )</u>
	<ul style="list-style-type: none"> <li>- Replaced defective contactors, timers, worn out Elemex connectors etc.</li> </ul>
02 61 05	<u>OVERHAULED THE FOLLOWING MOTORS :</u>
	<p>P-1160A, K-1102A, P-1114A, P-1114B, P-1131A, P-1132A, P-1231A, P-1231B, P-1232A &amp; P-1232B.</p>
02 61 06	Carried out preventive maintenance of all motor operated valves and control panels.

JOB CODE	JOB DESCRIPTION
02 61 07	Checked terminal boxes of all motors above 15HP, for loose connections, burnt out cable leads and rectified.
02 61 08	Replaced the corroded/damaged lighting distribution boards in Compressor House & near Ammonia plant pump with new LDBs.
02 61 09	Provided connections to Vacuum Blowers, Hydrojetting machines, air Blowers in Urea plant.
02 61 10	Provided floor light fittings, Halogen fittings, Hand lamps, welding generator connections in HPCC, Autoclave, Stripper, Prill tower top & other places in Urea plant.
02 61 11	Provided telephone connections in HPCC, Autoclave, Prill tower etc in Urea plant.

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U R E A - P L A N TI N S T R U M E N T J O B S

JOB CODE

JOB DESCRIPTION

02 71 01 (A) FIELD JOBS :

01 The following control valves were removed from line and completely overhauled including A/S regulators and V/P. Detailed maintenance carried out is separately prepared.

LRCV-1201, PICV-1128, HICV-1121, PICV-1129, FRCV-1421  
 FRCV-1201, PICV-1502B, HICV-1122, LICV-1203, PICV-1501  
 PRCV-1202, FRCV-1-1, FICV-1203, PICV-1421, PICV-1422,  
 PRCV-1504, PICV-1502A, PICV-1221, PICV-1201, LICV-1504

02 General cleaning and calibration of the following leveltrolls carried out.

LIC-1203, LIC-1502, LIC-1501, LC-1501, LC-1123

03 The following pad type level transmitters were removed from line and calibrated. Gaskets changed and put back in line.

LRC-1421, LIC-1201, LI-1421, LC-1401, LIC-1202

04 The following flow transmitters calibrated.

FRC-1-1, FRC-1102, FRC-1201, FR-1201, FE-1122, FE-1124  
 FE-1501, FE-1502, FR-1502, FR-1503, FR-1504, FI-1060  
 FR-1203

05 General cleaning and performance checking of the following field switches carried out.

PLCO-1101, PLCO-1124, PILO-1132, PH-1133, PHCO-1133  
 PH-1140, PH-1144, LLA-1123, LLCO-1123, PL-1167, PLCO-1167  
 PL-1166, DPH-1152, PLCO-1153, PLCI-1151, PLCI-1162,  
 PLCI-1163.

06 General cleaning and performance checking of the following receiver switches carried out.

PH-1124, PHCO-1127, PL-1128, PLCO-1126, PHCO-1145, PH-1145

07 The following pressure transmitters calibrated.

PT-1133, PIC-1422, PR-1424, PIC-1421

JOB CODE	JOB DESCRIPTION
08	The following H.P.thermowells were inspected and put back in line. TR-1202, TR-1210, TR-1209, TR-1206
09	General cleaning, gland filling, overhauling of A/S regulator and V/P and stroke checking of the following valves was carried out. LCV-1123A, LCV-1123B, HICV-1022, TRCV-1421, TRCV-1422 LICV-1201, HICV-1221A, HICV-1221B, HICV-1222A, HICV-1222B TRCV-1202, LCV-1502B, PRCV-1501, HICV-1201
10	The following brokks rotameters were removed from line, float inspected and sketch prepared. FRC-1421, FIC-1203, FI-1421, FI-1423
11	The following 210 series transmitters replaced with 300 series Taylor. Provided air header. Impulse tubing changed to 1/2" S.S. Isolation valves replaced with 1/2" S.S. PIC-1130, PIC-1131, PIC-1121
12	The following trnasmitters signal tubing changed. PIC-1129, FR-1502
13	FRC-1201 :- Orifice removed from line and found damaged. Replaced with new spare.
14	Electronic transmitters mounted for FT-1351, FT-1302. Wiring and tubing done.
15	48 P.T. Temperature scanner mounted in place of TI-1. Wiring done. It was calibrated and taken in line.
16	H.P.Stripper radioactive source was replaced with new source of original activity 35 mci as the half life was over. Monitor calibrated accordingly and taken in line.
17	5 Nos of terminal junction boxes mounted behind the control panel and all the existing field termination was done through them in a systematic way.
18	Autoclave radioactive source was removed to faciiitate mechanical maintenance and put back in line.
19	Vibration probes and T/C removed from the compressor and the filed sections to facilitate mechanical maintenance and put back in line.
20	New H.P.Condenser weep hole connections were provided as per the requirement of production.



JOB CODE	JOB DESCRIPTION
21	Purge beam & HP-LP 1" piping assembly used for purge type of level sensing in HP Stripper were removed and blinded.
01 71 02	<b>(B) CONTROL VALVES :</b>
01	LRCV-1201 : Smooth cut taken on plug valve body (bottom and side flanges) and the distance piece.
02	PICV-1128 : Complete internal assembly changed.
03	PICV-1129 : Plug reconditioned. Seat & gland packing changed.
04	HICV-1121 : Internals inspected. Found o.k.
05	FRCV-1421 : Smooth cut taken on plug and seat. Gland packing changed.
06	FRCV-1201 : Smooth cut taken on plug and seat. Gland packing changed.
07	HICV-1122 : Diaphragm changed
08	LICV-1203 : Smooth cut taken on plug & seat
09	FICV-1203 : Smooth cut taken on plug and seat
10	PCV-1501 : Seat and plug reconditioned.
11	PRCV-1202 : Smooth cut taken on plug and seat.
12	FRCV-1-1 : Internals inspected. Found o.k. Volume booster changed.
13	PIVC-1421 : Internals inspected. Found o.k. Steam guide and gland packing changed.
14	PICV-1422 : Internals inspected. Found o.k. Steam guide and gland packing changed.
15	PRCV-1504 : Smooth cut taken on the seat resting portion of the valve body. Top flange facing was taken down by 1 mm by machine cutting. Changed the bottom seat, bottom cut gasket, top spiral gasket, V/P and gland packing.
16	PICV-1502A : Valve body gland portion found damaged. Reconditioned by inserting a cylindrical sleeve of S.S.gland follower changed.
17	PICV-1502B : Plug and seat inspected. Found ok
18	PICV-1201,PICV-1221,LICV-1504 :
	Smooth cut taken on plug and seat

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U R E A - P L A N TTECHNICAL DEPARTMENT JOBS

JOB CODE	JOB DESCRIPTION
02 81 01	<p>01) <u>THE ADDITIONAL HEAT EXCHANGER:</u></p> <p>Two nos H-1301/1-2 were installed in parallel to the existing plate type heat exchanger (H-1301) in the hydrolyser system in the Urea plant alongwith the necessary piping.</p> <p>This has provided the Flexibility in the operation.</p>
	<p>02) <u>REPLACEMENT OF H-1502 :</u></p> <p>The Vent Condenser H-1502 was replaced by the new Higher size Condenser in the Urea plant. New D.M.Water heating piping was also hooked up with the new H-1502. C.W.was used in the existing system for cooling steam condensate. In new Heat exchanger D.M.Water is used as the cooling media, whereby this was the D.M.Water will be heated and the cooling water is saved.</p>
	<p>03) <u>MISCELLANEOUS JOBS :</u></p> <p>a) The Orifice plate one no.provided on the Steam injection line to reflux drum and one no. to steam injection line to the Effluent Vapour Inlet to V-1201 IInd Desorber. These facilitate the steam control.</p> <p>b) 2" NB Tapping from the outlet of Vent Scrubber V-1203 taken for new L.P.Scrubber (V-1207)</p> <p>c) 2" N.B.Tapping from the D.M.Water line to H-1502 taken for D.M.supply to V-1207 (new) system.</p> <p>d) 3" N.B.Bypass line with Isolation valve provided on the Atmospheric condensate tank seal bypass in the Urea plant, to improve the Condensate Sealing</p> <p>e) 2" N.B.Tappings taken from V-1206 for Ammonical Water Inlet from the Ammonia plant (104-E condensate) and also one tapping of 2" for the same service on the Hydrolyser plant drain line to Ammonia water tank in the Urea plant.</p> <p>f) 2 Nos 3" NB control valve along with the necessary piping provided on the Effluent discharge from the Hydrolyser system into the strong Effluent tank in the Offsites.</p>

JOB CODE

JOB DESCRIPTION

- g) 1" NB minimum flow line with the safety relief valve, Isolation valve and check valves provided on 2 Nos Hydrolyser Feed pumps, from the feed pumps to the second disorber outlet for pumps safety.

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OFFSITE - PLANTMECHANICAL - JOBS

JOB CODE

JOB DESCRIPTION

03 02 01 COOLING WATER PUMP TURBINE Q-4401/A :

(01) Overhauling the Turbine

- a) Fitting marks were found on both (small & big) carbon ring portions of the rotor. A machine cut is taken to smooth it. Balancing of the rotor could not be done.
- b) Carbon rings were loose and on checking by filler gauge in big rings clearance was maxi. 0.014" and in small rings it was 0.008".
- c) Corn of governor and M.O.P. found worn-off on teeth.
- d) Steam nozzles found eroded badly on few tips should be replaced in next opportunity.
- e) Governor overhauling is done
- f) Quick shut off valve overhauled. Found badly jammed and rusted. This was cleaned and boxed up.
- g) All oil strainers and filler cleaned / replaced and oil sump cleaned and oil changed.

03 02 02 COOLING WATER TURBINE Q-4401/B :

(01) Overhauling the turbine.

Rotor found in good condition.

Carbon rings found broken.

Brg. found okay

Overhauling of relay cylinder, governor and quick shut off valve is done.

JOB CODE                      JOB DESCRIPTION

ANNEXURE - I

Q-4401-A

Q-4401-B

(01)            JOURNAL BEARINGS CLEARANCE

After dis mantling		Before Assembly		After dis mantling		Before Assembly	
Coup. side	Gov. side	Coup. side	Gov. side	Coup. side	Gov. side	Coup. side	Gov. side
0.008"	0.008"	0.008"	0.008"	0.008"	0.008"	0.008"	0.008"

(02)            THURST IN DECOUPLE CONDITION

After dis mantling	Before Assembly	After dis mantling	Before Assembly
0.013"	0.013"	0.009"	0.009"

(03)            NOZZLE CLEARANCE

After dis mantling	Before Assembly	After dis mantling	Before Assembly
0.082"	0.082"	0.092"	0.092"

(04)            CARBON RING CLEARANCE

Q-4401-A

Q-4401-B

(a) Big Carbon rings steam exhaust side		(a) Big Carbon rings steam exhaust side	
(i) Rotor size - 106.32 MM		(i) Rotor size - 106.95 MM	
(ii) Carbon ring size	clearance	(ii) Carbon ring size	clearance
(01) 106.57 MM	0.25 MM	107.20 MM	0.25 MM
(02) 106.57 MM	0.25 MM	107.20 MM	0.25 MM
(03) 106.52 MM	0.20 MM	107.15 MM	0.20 MM
(04) 106.52 MM	0.20 MM	107.15 MM	0.20 MM
(05) 106.49 MM	0.17 MM	107.125 MM	0.175 MM

JOB CODE		JOB DESCRIPTION	
Q-4401-A		Q-4401-B	
(b)	Big Carbon rings steam exhaust side	(b)	Big Carbon rings steam exhaust side
(i)	Rotor size - 106.32 MM	(i)	Rotor size - 106.92 MM
(ii)	Carbon ring size      clearance	(ii)	Carbon ring size      clearance
(01)	106.62 MM              0.30 MM	107.22 MM              0.30 MM	
(02)	106.62 MM              0.30 MM	107.22 MM              0.30 MM	
(03)	106.57 MM              0.25 MM	107.17 MM              0.25 MM	
(04)	106.52 MM              0.20 MM	107.12 MM              0.20 MM	
(05)	106.52 MM              0.20 MM	107.12 MM              0.20 MM	
(c)	Small Carbon rings steam exhaust side	(c)	Small Carbon rings steam exhaust side
(i)	Rotor size - 96.35 MM	(i)	Rotor size - 96.88 MM
(ii)	Carbon ring size      clearance	(ii)	Carbon ring size      clearance
(01)	96.48 MM              0.12 MM	97.05 MM              0.125 MM	
(02)	96.48 MM              0.12 MM	97.05 MM              0.125 MM	
(d)	Big Carbon rings steam exhaust side	(d)	Big Carbon rings steam exhaust side
(i)	Rotor size - 96.35 MM	(i)	Rotor size - 96.82 MM
(ii)	Carbon ring size      clearance	(ii)	Carbon ring size      clearance
(01)	96.50 MM              0.15 MM	97.97 MM              0.15 MM	
(02)	96.50 MM              0.15 MM	96.97 MM              0.15 MM	
(05)	<u>OIL GUARD CLEARANCE</u>		
	HP side -	HP side -	0.003" to 0.006"
	LP side -	LP side -	0.003" to 0.005"
(06)	<u>OVER SPEED TRIP AT</u>		
	6400 RPM	6600 RPM	
(07)	<u>PARTS - CHANGED</u>		
(i)	Worm      -      1 No	(i)	Throttle valve spindle Code - 333202296 - 1 No
(ii)	Brg.for linkage to Gov.Brg. No.IR/416/1816 needle roller	(ii)	Connection cross bar code 33202025 - 1 No

JOB CODE	JOB DESCRIPTION
(iii)	Brg.for linkage between Gov. & relay cylinder.Bgr.No U-109 Double row ball brg. Code - 455006030 - 2 Nos
(iv)	Oil seal for throttle valve Power piston - 19 x 32 x 7 - 1 No. Pilot valve 35 x 25 x 7 - 1 No
(v)	Oil labyrinth Part No.105/1 Code No.333202239
(vi)	Carbon rings Code - 333202126 - 10 Nos Code - 333202134 - 04 Nos
(iii)	Oil seal 19 x 32 x 7 - 1 No
(iv)	Carbon rings Code - 333202126 - 10 Nos Code - 333202134 - 04 Nos
(v)	Oil filter elements
(vi)	Brgs.for linkages to Gov.Brg No.RIR 1416/B-1816, Needle roller brg.code -455010040 - 2 Nos
(vii)	Brg.for linkage between Gov. and relay cylinder. Brg.No. U- 109 Code - 455006030 - 2 Nos
(viii)	Oil filter elements code No.332202040 - 2 Nos

03 02 03 FD FAN TURBINE Q-5113

Preventive maintenance

- a) General condition of the turbine and gear box was found okay.
- b) Clearance of journal brg.
  - a) General condition of the turbine & gear box was found okay.
  - b) Clearances of journal brg.
    - i) Turbine shaft
 

(1) F.D.Fan side	- 0.004"
(2) Turbine side	- 0.004"
(3) Thrust	- 0.010"
    - ii) F.D.Fan shaft
 

(1) High speed coupling side	- 0.005"
(2) Turbine side	- 0.004"
(3) Thrust	- 0.006"

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JOB CODE                      JOB DESCRIPTION

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c) Parts changed.

i) Toothed rubber ring for coupling - 335413010 - 6Nos

ii) Oil filter insert - 335412010 - 2 Nos

iii) Casing cover bolts - 2 Nos (One no.of each type)

d) Oil cooler cleaned & boxed up & oil sump cleaned and oil changed.

03 02 04    BFW PUMP TURBINE Q-5111

Preventive maintenance.

a) Emergency trip valve spring changed as the valve was not resetting after tripping as the stiffness of the spring was lost.

b) Journal bearings clearance

i) Free end side        - 0.25 MM

ii) Coupling side       - 0.30 MM

iii) Thrust                - 0.22 MM

c) Lube oil cooler & boxed up. Sump also cleaned & fresh oil changed

03 02 05    LSHS PUMP TURBINE Q-5114

Preventive maintenance

a) Inspection of the bearings done, found okay

b) Over speed trip checked & cleaned

c) Governor drive wheel & worn checked and found in good condition. Oil of governor flushed and refitted.

03 02 06    D.M.FEED WATER PUMP TURBINE Q-4202

Preventive maintenance

a) Vibration reported high at speed of 2900 rpm

b) Journal brgs.opened and found okay.

clearance        i) Free end side - 0.008"

ii) Coupling side - 0.008" - 0.010"

c) Distance between governor spring adjusting nut and first thread - 13.7 MM

d) Fine adjustment bearing holder changed as it was loose in the brg. O.D.



JOB CODE

JOB DESCRIPTION

e) Cooling water line for cooling the oil of the journal bearing found chocked. This was cleaned. However free end brg. side part of the cooling line which is built in the body could not be cleaned, hence bypassed.

f) Alignment done.

03 02 07 COOLING WATER PUMP P-4401/A

Overhauling the pump

a) Pitting observed in casing & cover of the pump. This was building up and ground to the level.

b) Gland portion of the sleeve was found worn off and the sleeve was changed.

c) Thrust brg. No.6318 - 455001124 - 1 No changed

d) Journal brg. of coupling side changed as white metal lining found damaged badly.

e) Journal brg. clearance of both the brg. 0.008"

03 02 08 JACKET WATER PUMP - 5301-B (AKAY PUMP)

Overhauled the pump.

This pump was installed after fixing new foundation. On starting the pump was found jammed. On opening, the bushes were found damaged and were free on out side diameters.

Following parts changed.

i) Both spiders and coupling bush - 1 No each.

03 02 09 DRINKING WATER PUMP P-4301 (KIRLOSKAR MAKE )

Overhauled the pump.

Abnormal sound was heard from this pump. On opening the pump was totally found damaged as bearings were badly damaged.

Following parts changed.

- i) Shaft - 333001180 - 1 No
- ii) Bearing - 6305 - 1 No (455001111)
- iii) Sleeve - 333001311 - 1 No
- iv) Oil seal - 1 3/4" x 9" x 3/8" - 1 No

JOB CODE

JOB DESCRIPTION

03 02 10 BOILER FEED WATER PUMP P-5112 (MOTOR DRIVEN)

Preventive maintenance was done.

## a) Journal bearing clearance

- 1) Coupling side - 0.12 MM
- 2) Free end side - 0.11 MM

## b) Thrust was found 0.54 MM

c) Oil cooler and gear box opened, cleaned & boxed up.

d) Oil of oil sump was changed after cleaning the sump.

03 02 11 BOILER FEED WATER PUMP P-5111 (TURBINE DRIVEN)

Preventive maintenance was done.

## a) Journal bearing was done.

- 1) Coupling side - 0.12 MM
- 2) Free end side - 0.12 MM
- 3) Thrust - 0.68 MM

Thrust was found more than recommended (0.28 MM to 0.30 MM). This was reduced by putting oil paper of 0.2 MM in place of 0.4 MM thick gasket. Thrust came 0.48 MM. But leakage of oil observed from gasket. So again 0.25 MM thick oil paper used and no oil leak observed. Final thrust was 0.53 MM.

Thrust bearing also found worn off at the point of contacts should be replaced in the next opportunity.

03 02 12 GEAR BOX OF PUMP P-4401-A

Overhauling the gear box.

## a) Gear box found in good condition

## b) Journal bearings clearance

High speed	}	- Pump side - 0.013 MM
Shaft	}	Turbine side - 0.012 MM

Thrust - (0.040") - 1.00 MM

Low speed	}	- Pump side - 0.13 MM
Shaft	}	Turbine side - 0.20 MM

Thrust - (0.010") 0.25 MM

It was boxed up after general cleaning.

JOB CODE	JOB DESCRIPTION
03 02 13	<u>GEAR BOX OF PUMP P-4401-B</u> Overhauling the gear box a) Teeth condition was okay but high spots due to seizure of metal particles observed on few teeth. These were match to the surface of the teeth by stonning. b) High speed shaft journal brg. clearance - 0.17 MM on both sides. c) Low speed shaft journal brg. clearance 1) Turbine side - 0.28 MM 2) Pump side - 0.20 MM d) High speed pinion thrust - 0.034" e) Low speed shaft thrust - 0.009" f) Oil guard clearance - 0.003" to 0.005" g) Oil of the sump changed after cleaning it.
03 02 14 & 03 02 15	<u>C.T.FAN GEAR BOX NO. U-3 AND A-7</u> Overhauled the gear box 1) A-7 - In this gear box the high speed shaft top bearing housing found damaged. Hence needed replacement. Another gear box brought from stores and installed after replacing the hub. Painting of the structure between gear box and motor is also done. Blades were also cleaned. 2) U-3 - The hub holding the blades found badly corroded and might brake during service. Hence, this gear box was replaced with a gear box duly fitted with hub. Coupling bushes changed. Blades cleaned. Painting of the structure between gear box and motor is also done.
03 02 16 & 03 02 17	<u>A-6,U-1 &amp; U-2 TAKEN FOR PREVENTIVE MAINTENACE</u> All blades were cleaned. Oil level hose flushed with steam. Gear box oil changed. Internals of gear box checked, found okay. Painting of structure between gear box and motor done only in A-6.
03 14 01	All steam leak jobs attended as per list.
03 15 01	<u>BHEL BOILER</u> Boiler inspection is done. Open inspection was done on 22/09/93 followed by Hydrotest at 90 Kg/cm <sup>2</sup> on 05/10/93. Relief valve tested on 06/10/93 at following pressures.

JOB CODE

JOB DESCRIPTION

	Popping pressure	Reset pressure
Drum front RV	71.8	69.5
Drum Rear RV	69.8	67.8
Super heater RV	65.5	63.0

For doing above job necessary gland packing done and all steam leaks attended as per list given by production.

a) DEAREATOR

On opening of vertical portion of deareator the inside trays found badly damaged. It was understood that this was due to no support in the middle of the trays and the trays were bent and damaged from the middle portions only. Hence middle portion was further strengthened by providing S.S. angles. Following parts changed.

- i) Tray - 337100001 - 1 No
- ii) Angle - 337100009 - 4 Nos

b) REGENERATIVE AIR HEATER

This was overhauled and report is as under.

ANNEXURE - II

03 15 01 OVERHAULING OF REGENERATIVE AIR HEATER AT BHEL BOILER

- 01 Cold end heating elements (baskets) were removed and changed with new one (12 Nos), as they were filled with carbon dust and were found choked.
- 02 All the studs on the rotor shell plate were cut and new studs welded as these were badly rusted and could not be opened.
- 03 All radial seals and seal holding strips of hot and cold side were replaced with new as the old seals were found bent, damaged, rusted & with uneven clearance and thickness. Seal clearance was adjusted as below.
  - a) Hot end in-board seal clearance - 3.79 mm
  - b) Hot end out-board seal clearance - 0.5 mm
  - c) Cold end in board seal clearance - 0.5 mm
  - d) Cold end out-board seal clearance 3.94 mm
- 04 Inside hot end basket - 02 Nos. and outside hot end basket - 01 No changed with new as these were badly damaged.
- 05 Pin rake and pin root gap checked and found within the allowable limit of 13 mm. Also all the pins were cleaned.

JOB CODE

JOB DESCRIPTION

- 06 Hot end bearing side water cooling system cleaned.
- 07 Both the hot and cold end rotor radial bearings were checked. No oil leakage observed.
- 08 Both hot and cold end circumferential seals checked and cleaned and found okay.
- 09 Rotor drive gear box opened. Gears and bearings found in good condition and oil changed.
- 10 Bibby coupling checked and found okay. The gap between input shaft and air motor shaft found 3 mm i.e. within the limits.
- 11 Cleaning device (soot blower) and its movements checked and found okay.
- 12 Rotor post seal found okay.
- 13 Air motor also serviced.

The list of spares recommended by the representative of BHEL is as under.

- a) Radial bearing of the rotor.
- b) Circumferential seals and special bolts.

The performance of the air pre-heater, after overhauling shall be intimated to the Additional General Manager, Engineering, BHEL Ranipet as a feed back.

- c) All dampers of hot and cold air and gasduct made free by greasing and cleaning.
- d) F.D.FAN K-5113

Clutch coupling oil on both side (Motor - automatic transmission (TYA) and turbine - 150 Servomesh) flushed and charged new oil.

- e) AIR BLOWER

It is removed and piping fabricated direct for air supply.

- f) SOOT BLOWER

All 8 soot blowers were taken for preventive maintenance. Also all steam valves were taken for overhaul and boxed up after lapping the seals.

JOB CODE	JOB DESCRIPTION
03 19 01	<p><u>NEW SAND FILTER</u></p> <p>This was opened for inspection. The wiremesh found torn and broken. This was replaced with new.</p>
03 19 02	<p><u>REACTION VESSEL AND NUTRALISER TANK</u></p> <p>Opened and boxed up after cleaning.</p>
03 19 03	<p>Flood coating of complete outside including nozzles, stair case, hand rails &amp; other piping of HCl storage tank No.2 is done.</p>
03 19 04	<p>Raw water suction line of FRP replaced with M.S. line. The flange of the nozzle of tank made of FRP was found very thin. This was made 35 MM thick by FRP mates and then connection made.</p>
03 31 01	<p><u>COOLING TOWER</u></p> <p>a) Wood work of all three cells of Urea cooling tower done by M/s. Paharpur cooling tower. All small repairs in other cooling towers is done. Side wall asbestos sheets which were broken were replaced by new ones - 21 Nos. New hangers for chlorine line made and installed.</p> <p>b) All actuators were overhauled</p> <p>c) Gland packing of all the valves done.</p> <p>d) C.T. distribution valves overhauled</p> <p>e) All found sluice gates overhauled as per Annexure - III</p>
03 31 02	<p>Following vessels taken for rubber lining repair work.</p> <p>1) <u>B-II &amp; SMB-II</u></p> <p>Both vessels were rubber lined after removing old rubber. However, bottom of SMB-II was not done as it was found okay. Set of nozzles also removed from the centre of PMB and plugged the space before new rubber lining.</p> <p>2) <u>.M. WATER BUFFER TANK</u></p> <p>Blisters were found in the tank. These were removed and patches of different sizes made of new rubber lining.</p> <p>3) <u>C1 STORAGE BUFFER TANK</u></p> <p>On spark testing 20 points were showing non continuity. hence, those were repaired by patches.</p>
03 31 03	<p>New foundation for J.C. Pumps made. New cooling water line made for giving cooling water to its gland and bushes.</p>

JOB CODE

JOB DESCRIPTION

03 31 04 SERVICING OF SLUICE GATE - SIZE 20000 MM X 1400 MM

- 01) Job of servicing started on 19/09/93 and completed on 24/09/93
- 02) Job could not be started on full swing as the cooling water sump was not empty. Cooling water sump got emptied on 22/09/93.
- 03) Overhauled the head stock gear housing all 4 nos, cleaned and greased. In gate No.1 & 2 thrust bearing No.51116 (code No.455011016) found damaged, hence replaced with new one.
- 04) In gate No.1 wedge block of bottom side found damaged This was repaired by welding. In other wedge block copper strip was found broken. This was replaced with new one.
- 05) Clearance of 0.1 MM between seat facing and wedge block both horizontal and vertical was made and checked by filler gauge.
- 06) All the 04 Gates duly serviced, handed over to production on 24-09-1993.

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O F F S I T E - P L A N TINSPECTION JOBS

JOB CODE

JOB DESCRIPTION

03 41 01 DEARATOR OF BHEL BOILER :

- 01) No corrosion or erosion was observed in the shell.
- 02) Top portion of the deaerator head assumed blackish brown colouration.
- 03) Colouration of the bottom portion of the deaerator head was observed to be reddish brown.
- 04) All the weld joints of Deaerator head were in good condition.
- 05) The middle segment of the bottom most tray was found distorted from its tack weld and it was informed to Maint. crew for rectification.
- 06) Similarly supporting angle of third tray was found distorted from its tack weld and it was rewelded.

ii) Deaerator Drum :

- a) Rusting and scaling was observed in both the dished ends.
- b) Shell assumed blackish brown colouration.
- c) Overall condition of the weld joints were visually checked and found to be good.

03 41 02 DM WATER BUFFER TANK :

- 01) Spark testing of rubber lining was carried out. Rubber lining was found damaged at two locations. Marked for repair and the same was informed to Maint. crew.
- 02) Hardness of rubber lining was noted to be in the range of 78 to 80 shore-A.
- 03) Small blisters (approx 5 mm dia) having partial cracks were observed in the bottom portion of the lining.
- 04) Similarly blisters of 1" to 2" dia were found in the first bottom pipe of the tank from south side.



JOB CODE

JOB DESCRIPTION

The above finds have been reported to maint. crew for necessary repair.

03 41 03 DEGASSER BUFFER TANK :

01) Spark testing of Rubber lining was carried out. Rubber lining was found damaged at the following locations i.e.

(a) one defect has observed on north side of the shell lining in approx 2"x1" area at 3.5 feet height from the bottom base

(b) Two defects were observed in southside nozzle (6" and 2" in size approx).

02) Overflow pipe was found to be corroded.

03) Superficial cracks were noticed in the complete shell lining.

04) Lining hardness was measured to be 75 to 80 shore A.

All the above finds have been informed to concerned Maint..Engir for necessary rectification.

JOB CODE

JOB DESCRIPTION

03 41 04 HCL BUFFER TANK :

Spark testing and shore 'D' Hardness measurements were carried out in the rubber lining of HCL Buffer tank. The observations are as follows :-

- (1) Shell lining was found defective at 20 locations (approx) and the same was marked for repair.
- (2) Bulging was observed near manhole on 4" wide x 10" circumferential length area. Also rubber lining got detached from the plate near bulging area.
- (3) Hardness measurement was done. The readings are as under :-
  - a) Top side - 35 to 40 shore 'D'
  - b) Bottom side - 50 to 60 "
  - c) East and west side - 55 to 60 "
  - d) North & South side - 60 to 65 "

All the above findings have been informed to concerned Maint. Engineer for necessary rectification.

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OFFSITE - PLANT

CIVIL JOBS

JOB CODE

JOB DESCRIPTION

03 51 01 WATER TREATMENT PLANT :

01 Epoxy plaster by Araldite/Hardner and Silica on the surface of weak Effluent and strong effluent channel of Water treatment plant, Acid, NaOH storage and measuring area.

Acid/Alkali Proof Brick Lining in NaOH storage area

Dismantling RCC, filling hollow gaps in floor by sand and re-casting RCC slab near Anion III and II and near cooling water make up sump (Pump area)

03 51 02 EFFLUENT TREATMENT PLANT :

01 Acid proof lining in strong effluent "A" & "B" and weak effluent "A" & "B"

03 51 03 NEW BOILER :

01 Refractory lining on header of super heater & combustion area.

02 Manhole opening and closing the same.

03 51 04 COOLING TOWER :

01 Repairing of wooden flooring on sump area and channel area of cooling tower.

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OFFSITES - PLANT

ELECTRICAL JOBS

JOB CODE	JOB DESCRIPTION
03 61 01	<p><u>CARRIED OUT MAINTENANCE ON TRANSFORMERS 2A,2B,3A,3B, 4A,4B, 8,11,12,13 AND 14</u></p> <p>a) Checked and tightened the primary/secondary and termination of cables.</p> <ul style="list-style-type: none"> <li>- HT side vertical bushing insulator was found loose resulting into oil leakage in Marshalling box of TR 4-A. Bushing tightened and cleaned the oil chamber and replaced with new oil.</li> <li>- Secondary cable leads were found over heated in TR 12 &amp; 14. Fresh terminations were made in both the transformers.</li> <li>- TR-8 Secondary (3.3 KV) bushing insulator found loose. Oil was leaking in cable box. Tightened the bushings and found oil leakage stopped. HT Marshalling box was completely corroded. Cleaned and filled with new oil.</li> </ul> <p>b) Carried out testing of oil in main tank, Marshalling boxes of the above transformers.</p> <p>c) Reactivated the silica gel in dehydrating breathers of the above transformers.</p> <p>d) Checked the trip circuits and protection system of all the above transformers.</p> <p>e) Measured IR values of primary and secondary windings of the above transformers.</p>
03 61 02	<p>Carried out filtration of oil of transformers of 3A, 3B 8, 9 and 13.</p>
03 61 03	<p>Checked earth resistance of all earthing installation at 66 KV yard.</p>
03 61 04	<p>Preventive maintenance carried out of all 11 KV switch gear (GEC/TMG/KIRLOSKAR) installed at 66 KV S/S and MPSS</p> <p>a) Checking of main and earthing contacts, mechanism, close &amp; trip operations, lubrication of moving parts.</p> <p>b) Replaced oil in all BOCBs broken level indicator glasses in MOCBs.</p> <p>c) Replaced defective spring charge mechanism of BFW pump motor MOCB at new MPSS.</p>

JOB CODE

JOB DESCRIPTION

d) Measured IR value of all HT cables connected to the unit transformers.

03 61 05

PREVENTIVE MAINTENANCE CARRIED OUT OF ALL LT ACBS/TMG/SIEMENS INSTALLED IN MCCs

- Replaced defective parts and worn out contacts.
- Lubricated the mechanism.
- Checked the trip and close timings of CBs for uniform closing and opening of breaker poles.
- Checked contacts pressure and adjusted wherever required.

03 61 06

PREVENTIVE MAINTENANCE CARRIED OUT OF FOLLOWING MCCS :

MCC 1	MCC 2	MCC 3	MCC 8
MCC 2A	MCC 11	MCC 2B/2E	MCC 13

- Checked all feeder compartment and replaced defective contractors, contacts, timers, Elemex connectors, fuse fittings, isolators etc.
- Cleaning and tightening of Bus bars and cable connections.
- All 125 HP feeder compartments & modified by providing 400-A Iyra contacts in place of 250-A Iyra contacts to avoid flash overs.
- 160-A isolators were replaced with the latest 125-A switch fuse units in the feeder compartments of MCC-1 (Feeder No.15, 19 & 29)
- Modification carried out in all full feeder compartments of above MCCs by covering entire bus bar chamber in view of safety of personnel.

03 61 07

OVERHAULED THE FOLLOWING MOTORS :

P-3302A, P-4405A, P-4405B, E-5111, E-5115A, E-5115B,  
P-3302B, P-3301A & P-3301B

03 61 08

Carried out maintenance of all lighting distribution boards installed in the plant for replacement defective switches, burnt out fuse fittings, connectors, cables etc.

03 61 09

Carried out checking of terminal boxes of all motors above 15 HP for loose connections, burnt out cable leads and rectified.

03 61 10

Provided temporary connections of flood lights, hand lamps in boiler, water treatment, cooling tower etc.

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OFFSITE - PLANTINSTRUMENT JOBS

JOB CODE	JOB DESCRIPTION
03 71 00	Following instrumentation jobs were carried out in each area of offsites plant.
03 71 01	<b><u>BHEL NEW BOILER :</u></b>  01) Dropped the 100% BFW Control valve FCV1 from the line. Inspected the trim for passing. In FCV1 valve lapping was done. Changed the gland packing, checked the seating of plug and set with blue, replaced the set of gaskets and the valve was mounted back in line. Checked the stroke of control valve.  02) Dropped the 30% BFW control valve FCV2 from the line. Changed the gland packing, changed the asbestos gasket with copper gasket and assembled the valve. Checked the stroke of the control valve.  03) Changed the annunciator 1 and 2 with the new IIC Annunciator. Changed the wiring and checked the wiring for AU1. Checked the alarm for all the windows, changed the logic from break to alarm to make to alarm for BFW pump/Day tank. New alarm points for DC aerator level high and low was provided from the recorder.  04) Inspected all thermowells, draft gauge points. Cleaned the furnace thermocouples, pressure tapping points, new tapping point was provided for the gas draft gauge.  05) Checked the Inverter, Battery and batter charger. Checked the functioning of static switch. Checked the performance of the batter by taking the battery in to line. Cleaned the Auto changeover relay and put back in line.  06) Ignitor gun was removed and checked for both the burners. For burner No.1 new Ignitor was provided. Gun engagement switch was removed, cleaned and checked. Gun engagement Alarm was provided in AU4.  07) Calibrated all pressure gauges.  08) Checked stroke for the burner air dampers. Checked its wiring and regulators.

## JOB CODE

## JOB DESCRIPTION

- 09) Checked the BMS panel, changed the faulty contactors, checked the wiring. Provided an extra contactor for trip of Gun engagement and checked the sequence. Changed the scavenging timer since the old one was faulty. Checked all the sequence.
- 10) Calibrated all receiver indicators, checked the controllers for seal leak and balancing.
- 11) LLA & LHA for drum level microswitch assembly was replaced and calibrated. Alarm level high = 84% and low level alarm = 32%.
- 12) Provided 1/2" Nipples for pressure tappings and fixed gauges.
- 13) Checked the Inst. air header for leakage.
- 14) Removed all FD fan turbine instruments to facilitate mech. maintenance and mounted back. Checked the trip logic of FD fan turbine circuit. Changed the probe for speed indicator.
- 15) GBTV-2 control valves solenoid valve was changed and checked its operation.
- 16) Filled glycol in the impulses lines of flow and pressure transmitters of LSHS instruments.
- 17) Checked the stroke, positioner F/N cleaning, air regulator cleaning, gland leakage for the following valves.
- i) TCV1 & TCV 2
  - ii) Atomising steam pressure control valve
  - iii) Oil pressure control valve
  - iv) 60 to 14 ata let down valve
  - v) PCV2 14 to 7 ata let down valve
  - vi) Deaerator level and pressure control valve
- Changed the diaphragm for Deaerator level control valve.
- 18) Cleaned the relay and synchronisation was done for all local 440 R controllers
- 19) Inspection of eye-eye electrode wiring was done.
- 20) Calibrated all the Drum pressure gauges.

JOB CODE	JOB DESCRIPTION
03 71 01	<p><b><u>OLD BOILER :</u></b></p> <ol style="list-style-type: none"><li>01) Ignitor gun was tested for both the burners of boiler No.1</li><li>02) All the ball valves of the boiler No.1 burner No.2 were dropped from the line and over hauled thoroughly &amp; replaced the "O" ring and installed back in the line.</li><li>03) The vent valves were overhauled and fixed back.</li><li>04) Changed the ignitor gun for the bottom burner.</li><li>05) Oil control valve in the oil boiler was dropped and checked. Changed the diaphragm and fixed back in the line.</li></ol>
03 71 03	<p><b><u>DM PLANT :</u></b></p> <ol style="list-style-type: none"><li>01) Installed power distribution box in DM Plant and connected the fuse, and shifted the switches in PMB &amp; SMB section.</li><li>02) Replaced terminal strips 1 to 145 with the new one. Painted new tags.</li><li>03) All the control valves were checked for top plate leakage and replaced diaphragms wherever necessary.</li><li>04) Shifted the stream selector switches in the panel.</li><li>05) Replace 110V main terminal strips in DM plant and checked P/S switch.</li></ol>
03 71 04	<p><b><u>NEW AMMONIA STORAGE :</u></b></p> <p>Replaced the level trols with new head assemblies, PCBS, Sensor and recalibrated.</p>
03 71 05	<p><b><u>EFFLUENT TREATMENT PLANT :</u></b></p> <ol style="list-style-type: none"><li>01) Checked and calibrated the PH Sensors.</li><li>02) SBA control valve was dropped from the line, cleaned, overhauled and mounted back in the line.</li></ol>
03 71 06	<p><b><u>IG PLANT :</u></b></p> <ol style="list-style-type: none"><li>01) New IG Dryer change over solenoid cleaned &amp; changed.</li><li>02) Checked and repaired the temperature controllers and over temperature blind controller.</li><li>03) Air dryer change over soleniod valve, piston was removed overhauled and mounted back.</li></ol>



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JOB CODE                      JOB DESCRIPTION  
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03 71 07    WEIGHBRIDGE :

- 01) All the Avery scales were overhauled and checked.
- 02) All the LIBRA scales were overhauled, platform was cleaned, painted and calibrated.
- 03) Weighbridge plates were removed cleaned & painted.

PLANT TURNAROUND - SEPT. - OCTOBER 1993OFFSITE - PLANTTECHNICAL DEPARTMENT JOBS

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JOB CODE

JOB DESCRIPTION

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01 81 03	The interstage cooler for I.G.Compressor and Air Dryer for the I.G.Plant (old) shifted to provide the accommodation for the Cracker unit of the new I.G.Plant.
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B&MH PLANT

MECHANICAL JOBS

JOB CODE	JOB DESCRIPTION
04 02 01	<u>NAPHTHA UNLOADING PUMP P-3301-A/B</u>
	Cleaning of well of A & B pump was carried out. Rust was removed.
04 02 02	<u>NAPHTHA FEED PUMP</u>
	Overhauling of Naphtha unloading pump - B (Truck side) changed the shaft top and bottom, Bowl bushes, coupling of shafts and one impeller and reassembled.
04 02 03	<u>NAPHTHA UNLOADING PUMP P-3201-B</u>
	Overhauling of naphtha unloading pump - A (Naphtha tank side ) changed the bushes of bowl and one impeller and reassembled.
04 03 01	<u>RECLAIM MACHINE M-2116</u>
	<p>a) General checking, lubrication overhauling of scraper system, Main gear box, scraper chain drive, Fluid coupling, slewing gear box, travelling gear box, king post bearings, link conveyor system was done by M/s.Nayan Engineering Services, Baroda in supervision of M/s.EMTICI ENGINEERING LTD, Vallabh Vidhyanagar a service group of M/s.ELECON.</p> <p>b) Made windows in link conveyor for driving out Urea prills.</p>
04 03 02	<u>DUST EXTRACTION SYSTEM</u>
	<p>a) FRP patch work in tank of D.E.system</p> <p>b) Cleaning of all dust lines</p> <p>c) Provided flexible hose at tripper</p> <p>d) Provided flexible dust extration funnel alongwith flexible hoses at slat conveyer 1,2,3,4 &amp; 8.</p> <p>e) General repair work on Blower plates and lines were done.</p> <p>f) Provided dampner butterfly valve in suction of blower</p>

JOB CODE	JOB DESCRIPTION
04 14 01	<u>STEAM LEAK JOBS</u> a) Changed steam traps at LSHS Tank - A & B by modifying it with common collecting header & drainage to drains b) Changed the glands of different leaky steam valves.
04 19 01	<u>NAPHTHA TANK T-3301-A :</u> Naphtha tank roof was replaced.
04 20 01	<u>VIBRATING SCREEN</u> a) Replaced damaged springs b) Repairing & welding of vibrating screen body c) Welding of dust collecting funnel
04 20 02	<u>BUILDING &amp; STRUCTURE</u> a) Cutting of old air line at M-2121 b) Cutting of superfluous angles & structure at M-2122 c) Cutting of diesel pipe line support near silo d) Cutting of damaged old doors and hinges etc.
04 21 01	<u>PLANT TRANSFER CONVEYOR M-2110</u> a) Gear box 6" size FSS 25 : 1 Ratio opened and found damage on worm shaft seal portion. Replaced gear box with reconditioned one. b) Bend pulley bearing was damaged and hence replaced pulley alongwith 2 Nos new pillow block bearings of 50 MM dia. c) Return roller and carrying roller reconditioning done. d) Skirt rubber replaced
04 21 02	<u>FRESH UREA SHUTTLE CONVEYOR M-2112</u> a) Overhauled gear box 9" size FSWR 30 : 1 Ratio and reassembled after due check up. b) Changed worn out return roller and reconditioned carrying rollers. c) Skirt rubber replaced

JOB CODE

JOB DESCRIPTION

TRIPPER UNIT

- Overhauling of gear box 5" size 60 : 1 Ratio and reassembled after dye checking
- Greasing & lubrication of bearings and chain.

04 21 03

RECLAIM CONVEYOR M-2117

- a) Gear box 12" size FSWR 40 : 1 Ratio overhauled and reassembled after due check up.
- b) Overhauled head end magnet pulley and found severe damages on keyways and shaft. Job is given to work - shop for repairing however due to urgency in providing services of M-2117 we had installed new plain pulley (reconditioned)
- c) Carrying rollers reconditioning done.

04 21 04

BAGGING FEED CONVEYOR M-2121

- a) Overhauling of gear box 12" size FSWR 30 : 1 done and reassembled after due check up.
- b) Reconditioned return roller and carrying rollers.
- c) Repairing of two nos of joints by hot vulcanising done
- d) Skirt rubber replaced

04 21 05

BAGGING HOPPER FEED CONVEYOR M-2122

- a) Overhauled gear box 8" FSWR 25 : 1 Ratio and found worm bearing damaged. Replaced 2 Nos bearing RHP 7311 and reassembled the gear box.
- b) Repairing of belt joint by hot vulcanising done
- c) Overhauled tripper gear box 5" FSS ration 60 : 1 and reassembled after due check up.
- d) General lubrication & cleaning of flaps done

04 21 06

BAG STITCHING SLAT CONVEYOR M-2124

- a) Overhauling of gear box 4" FSS 40 : 1 ration of SLAT No.1,2,3,4,7 & 8 was done & reassembled after due check up.
- b) Damaged slats of 1,2,3,4,7 & 8 was replaced with new one.

04 21 07

CHUTE 1,3, 7 & 8

Freed all the revolving rollers on chutes. Replaced damaged roller with new one.

INSPECTION JOBS

220

JOB CODE

JOB DESCRIPTION

04 41 01 NAPHTHA STORAGE TANK T-3301-A :

This tank was taken for maintenance for replacing the floating roof assembly with new one. Following inspection activities/checks were done and the details are as follows

- 01) Visual inspection of the internals was carried out from inside.
- 02) Visually inspected all the circumferential and longitudinal weld joints of shell courses from inside. Overall condition of all the weld joints was found to be satisfactory. There was no pitting or corrosion on shell inside.
- 03) Thickness measurement of bottom bracing plates and float drums were carried out.
- 04) Weld joints of both the floats were inspected by DPT and found defect free.
- 05) Weld joints of bottom bracing plates found to be fully coated with rust and deposits. In order to check the condition of weld joints, it was decided to clean the weld joints and HAZ (2" width on either side of the welds) by sand blasting. After sand blasting, the complete weld joints and HAZ were visually inspected. It was observed in most of the places the lap weld material was eaten away due to corrosion and rusting. In order to ensure complete sealing and to strengthen these weld joints it was decided to slightly grind and reweld the corroded weak seal welding lap joints. Approximately 255 meters length of weld joints was rewelded. All the new weld joints and old existing joints were inspected by vacuum leak test with 150 mm of Hg vacuum and found to be defect free.
- 06) The outer circumferential fillet weld joint of shell bottom was thoroughly cleaned and checked by DPT and found to be defect free. Similarly all nozzle weld joints were visually inspected from inside and also DP test was carried out.
- 07) All the weld joints of newly fabricated floating roof deck, panton were visually inspected both from outside and inside and checked by Dye penetrant test.
- 08) After completion of all the internal inspection the roof was tested for its floating by filling the water upto 4.0 meter height. After water fill up, checked for any leakage at the roof top and found no leakage.

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B & MH - P L A N T

CIVIL JOBS

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JOB CODE	JOB DESCRIPTION
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04 51 01 CIVIL JOBS :

- 01 Epoxy painting on RCC suspender and Railing of 2114 Conveyor gantry in Silo.
- 02 Alluminium Door and partition fixing work at Tail end of 2117 and at ground floor.
- 03 Epoxy Monolithic plaster at first floor (Machine floor) and junction near 2121 & 2122 gantry.
- 04 Strengthening of RCC column at Platform level by increasing section area in RCC 1 : 1 : 3  
Epoxy painting and Monolithick plaster work upto 1.2 metre
- 05 Epoxy painting of all RCC colums at Platform level
- 06 Removing damaged plaster and replastering the same at Hopper floor and platform level
- 07 Alluminium door fixing work at first floor level.

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BAGGING & MATERIAL HANDLING - P L A N T

ELECTRICAL JOBS

JOB CODE	JOB DESCRIPTION
04 61 01	<p><u>CARRIED OUT MAINTENANCE ON TRANSFORMER 5A &amp; 5 B</u></p> <p>a) Checked and tightened the primary/secondary end terminals of the cables.</p> <p>b) Carried out testing of oil of main tank, Marshalling boxes of above transformers &amp; replaced oil in IR 5B LT marshalling box.</p> <p>c) Reactivated silicagel in dehydrating breather.</p> <p>d) Checked trip circuits and protection system of transformer.</p> <p>e) Measured IR values of primary and secondary windings of the transformer.</p>
04 61 02	<p><u>CARRIED OUT PREVENTIVE MAINTENANCE OF TMS MAKE LT ACBS INSTALLED IN MCC - 4 &amp; MCC-9</u></p> <p>- Replaced defective parts and worn out contacts.</p> <p>- Lubricated the mechanism.</p> <p>- Checked trip and close timings of CB for uniform closing and opening of breather poles.</p> <p>- Checked contact pressure and adjusted as required.</p>
04 61 03	<p><u>PREVENTIVE MAINTENANCE CARRIED OUT ON MCC-4, 4A &amp; 9 :</u></p> <p>- Checked all feeder compartment and replaced defective contactors, contacts, timers, elemex connectors, fuse fittings isolators etc.</p> <p>- Cleaning and tightening of bus bars &amp; cable connections.</p>
04 61 04	Painted the entire panel of MCC-4 to avoid corrosion.
04 61 05	<p>Overhauled the following motors</p> <p>M-2121, M-2117, M-2110, M-2112, M-2122</p>
04 61 06	Repaired/replaced all light fittings installed on conveyors.
04 61 07	Overhauled the tripper cable drum and its control panel.
04 61 08	Cleaning and carried out preventive maintenance of Reclaim machine control panel.



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BAGGING & MATERIAL HANDLING - P L A N T

INSTRUMENT JOBS

JOB CODE

JOB DESCRIPTION

04 71 01 INSTRUMENT JOBS :

- 01) Bagging P/S M/C No.8 RIC was changed and local junction box wiring was done. Checked in all respects and calibrated.
- 02) Load cell in P/S No.7 was changed, alignment was checked and calibrated.
- 03) All P/S M/C were cleaned, solenoid wirings, field connections were checked and tested.
- 04) Belt weigher techogenerator mounting was changed and calibrated.