

1
1986

IFFCO
Kalol Unit

P & S Section
Maintenance Deptt
Report No.8/1986

R E P O R T

D N

RE V. A M P T U R N A R O U N D - 1986
(19th March 1986 - 3rd May 1986)

INDIAN FARMERS FERTILISER CO-OPERATIVE LIMITED

30886/s

I N D E X

2

PLANT		PAGE	
		FROM	TO
<u>PREFACE</u>	-	01	07
<u>GENERAL DETAILS</u>	-	I	V
<u>AMMONIA</u>	- Mechanical	01	48
	- Inspection	49	53
	-- Civil	54	-
	- Electrical	55	
	- Instrument	56	58
	- Technical	59	-
<u>UREA</u>	- Mechanical	01	23
	- Inspection	24	26
	- Civil	27	-
	- Electrical	28	-
	- Instrument	29	33
	- Technical	34	-
<u>OFFSITES</u>	- Mechanical	01	07
	- Inspection	08	09
	- Civil	10	-
	- Electrical	11	12
	- Instrument	13	16
	- Technical	17	-
<u>B & M H</u>	-- Mechanical	01	03
	- Inspection	-	-
	- Civil	04	-
	- Electrical	05	06
	- Instrument	07	-
	- Technical	-	-

IFFCO
Kalol Unit

THE ANNUAL TURNAROUNDS AT A GLANCE

Sr No	Year	AMMONIA PLANT		UREA PLANT		Downtime in days	Reason if any
		PERIOD	PERIOD	From	To		
1	1986	19.03.86	03.05.86	04.03.86	01.05.86	45	Reformer Revamping
2	1984	01.01.84	25.01.84	01.01.84	25.01.84	25	Planned
3	1981	12.04.81	10.05.81	08.04.81	12.05.81	29	101-B Headers
4	1979	21.05.79	12.06.79	21.05.79	12.06.79	23	K-1101/2 3rd stage cylinder
5	1978	21.02.78	15.03.78	21.02.78	23.03.78	23	101-BJ Breakdown
6	1976-77	05.12.76	22.01.77	05.12.76	24.01.77	49	101-JT Breakdown
7	1976	26.03.76	20.04.86	26.03.76	20.04.76	-	Planned
8	1975	06.05.75	21.05.75	06.05.75	21.05.75	-	Planned

REVAMP TURNAROUND - 1986

P R E F A C E

The Reformer at IFFCO Kalol is designed and engineered by M.W. Kellogg U.S.A. In 1977 initial failures were observed in Header insulation. In 1979 initially building and leak was observed in outlet manifold Header of 8th Row. In 1981, leak was observed in Riser tube for the first time in 3rd Row. A detailed chart showing down time due to failures is attached at Annexure - I along with this preface. In 1981, after riser failure the problem was handed over for studies to departmental task force. Experience in similar Ammonia Plants in India and Abroad showed that retubing should be taken after a period of operation of 9 to 10 years. As there were other equipments needing attention apart from replacement of reformer tubes it was decided to do all the necessary maintenance work in the front end of Ammonia Plant comprising of Primary Reformer, Secondary Reformer and Waste Heat Boiler and it was also decided to incorporate the possible technological advancements made so far. This did not include Effluent Chamber (107-D). Meanwhile there were some more failures of reformer tubes as well as outlet manifold headers. This was further discussed with M/s Kellogg India Ltd. They informed that IFFCO Kalol may take help of M.W. Kellogg to incorporate latest improvement in technology.

The study of failed catalyst tube showed that retubing should be done at the earliest. Bids for engineering procurement and supervision for construction for revamping were invited in 1982 and M/s Kellogg submitted the proposals. This was further discussed with Kellogg, specifically, replacement of liners of Waste Heat Boiler and Transfer Line. It was decided to replace entire Transfer Line (107-D), and Waste Heat Boilers to save time rather than taking work of liner replacement at site during shutdown. It was also decided that M/s Kellogg will be responsible for engineering, procurement outside India, inspection schedules and procedure and schedule for construction work, while inspection in India and supervision at site will be done by Kellogg India Ltd.

The proposal for engaging Kellogg was submitted to Government for permission by IFFCO. The permission was granted in middle of 1984. The agreement was signed by M.W. Kellogg on 31st May 1984.

Planning and Execution of Revamping

As per the Kellogg proposal the entire project from engineering to procurement to construction was to take 15 months after signing of contract. Expected timing for major activities were as follows:-

- | | |
|--------------------------------------|------------|
| 1) Engineering work by Kellogg | : 4 Months |
| 2) Procurement of material | : 9 Months |
| 3) Pre-shutdown activity | : 1 Month |
| 4) Construction work during shutdown | : 1 Month |

The initial planned date for Reformer Revamp was in September 1985. However, due to problem of delivery of indigenous harps from M/s Nitin and M/s Uniabex the revamping was finally planned on 30th March 1986, but due to problem of leakage in HP Scrubber in Urea Plant the shutdown date for Reformer Revamp job was advanced to 19th March 1986 and Ammonia Plant was stopped for Revamping work for the construction. Contractors were asked to mobilise their resources and report at site in second week of March 1986. Accordingly almost all the contractors were at site by 19th March 1986. This was the major shutdown and apart from Reformer Revamping work for which M/s Petron Engineering were selected, there were other major jobs also in Ammonia, Urea, Offsites Plants as described in detail in the individual section of this report. These jobs were overhauling of Compressor Trains in Ammonia and Urea Plant in presence of De-Laval and Clark representatives for Ammonia Plant; Hydrojetting of coolers in Ammonia and Urea Plant; inspection of all the four HP Vessels in Urea Plant by representative of M/s Stamicarbon; replacement of Absorber trays in Ammonia Plant; maintenance work on cooling towers and overhauling of C.W. Pumps in Offsites Plant; fixing of channel gates in C.W. Sump in Offsites Plant; rubberlining of cation and Anion exchangers in Offsites plant; inspection of vessels and piping in Ammonia, Urea and Offsites Plant; inspection of Waste Heat Boilers and fired boiler by Chief Inspector of Boiler in Ammonia, Urea Plant, Offsite Plant; maintenance of conveyer and Bagging equipments; overhauling of MCCs; calibration of instruments and many other jobs including various modifications in Ammonia, Urea and Offsites Plants. The entire period of shutdown was planned for 31 days for construction work, excluding cooling down and startup of plant. The Ammonia production was obtained on 45th day as planned from the date of stopping of Ammonia Plant after completing all the activities. The expenditure incurred for Reformer Revamp and other job was approximately 7.6 crores.

Management of Revamping

The task force was responsible to co-ordinate all the activities of Reformer Revamping work. The final task force consisted of 8 persons with Manager(Maintenance) as convener of this task force.

Organisations involved

Following major organisations were involved apart from IFFCO:

- 1) M/s M.W. Kellogg Houston, U.S.A.
- 2) M/s Kellogg India Ltd
- 3) M/s FEDO
- 4) M/s Petron Engg, Co

Involvement of IFFCO

It was decided that IFFCO engineers would be associated during engineering phase, so that the specifications proposed by Kellogg can include IFFCO's special requirements. IFFCO's engineers were to be associated with Kellogg for issue of inquires, placement of orders and inspection and expediting the delivery of materials.

Scheduling of Reformer Revamp Work

The sequence of construction activities was prepared, and the whole work was divided into three blocks. The activities were divided as follows:

State	Equipment	Nature of activity	Responsibility
Pre-shutdown	-	-	IFFCO/Petron
Shutdown	Primary Reformer	Dismantling & erection	Petron
	Secondary Reformer	Dismantling & erection	Petron
	Waste Heat Boilers	Dismantling & erection	Petron

These activities were grouped into 3 blocks for planning and control purposes.

- Block - I Upper Furnace Area of Primary Reformer
- Block - II Lower Furnace Area of Primary Reformer
- Block -III Secondary Reformer and Waste Heat Boiler

Bar charts were prepared for all the activities. The activities were so planned as to complete all the construction work in 31 days. Taking this as a critical activity, bar charts for all the jobs for all plants were prepared and resources mobilised to carry out the jobs. Proper co-ordination among the contractors, IFFCO and consultants were possible with daily reports and meetings. Also all the activities of all the plants were fed into computer and bar charts were prepared manually as well as with the help of computers.

Use of Computer

All the jobs were broken into activities and they were fed into computer for preparing bar chart. Also all the activities were monitored daily and progress was noted. The latest position of each job was then daily fed into computer with necessary correction and corrected bar charts obtained daily from computer. This helped in knowing immediately the daily activities and for taking immediate corrective action wherever required.

Problems faced during construction

All the construction activities were planned in detail for completion during stipulated period of 31 days for construction to avoid any delay. However, some of the major problems faced are as listed below:

- (1) The insulation material despatched by M/s Babcock from U.S.A. was not traceable at Bombay Air-port. After due efforts by IFFCO and Babcock representative at Bombay Air-port the material was located.
- (2) Radium Source
M/s Petron did not bring the required and agreed Radium source at site and were working with small radium source. This caused many hardships at site for X-Ray work.
- (3) M/s Petron instead of bringing their 70 tonne crane brought 45 tonne and borrowed IFFCO crane for some of the activities. This made the working slightly difficult.
- (4) Clearance of Headers with Floor
While welding risers with transfer line, it was seen that clearance between furnace floor and outlet manifold header was less than required. This resulted in cutting the risers at site using pipe cutting machine.

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8

(5) Removal of Transfer Line

During the removal of Transfer Line, it was observed that removal is not possible as per the method suggested earlier by M.W. Kellogg. Hence IFFCO, M.W. Kellogg and Petron Engineers has to evolve new method for this and the job was done successfully.

CONCLUSION

The entire Turnaround work including Reformer Revamping was completed in time and production was obtained as scheduled. The planning for all the jobs including action for material procurement, arrangement of contractors services was done well in advance, except the unexpected occurrence of scrubber liner leakage which had some impact on the planning of work for Urea Plant jobs and mobilising services for leak detection work of scrubber liner and some difficulties as listed earlier in revamp work. The presence of Stamicarbon personnel at site proved to be of help in the leak detection of HP Scrubber liner. The details for jobs done in each plant is as given separately in this report.

With best efforts from all concerned employees and under valuable guidance of IFFCO Management entire Turnaround work was completed successfully and plant was back to production as planned.

ANNEXURE - I

101-B

PRIMARY REFORMER DOWN TIME AT A GLANCE

Sr No	Down Time Period		Down Time Hours	Reason
	From	To		
1	22.11.77	22.11.77	76	Collecting header insulation failure
2	25.02.79	10.03.79	297.5	8th row manifold header bulging & leak
3	26.12.80	07.01.81	297.5	6th row header leak
4	02.09.81	13.09.81	266.25	Riser leak Row No.3
5	09.10.81	15.10.81	148.25	8th header Transition cone failure
6	16.04.82	28.04.82	291.92	8th row bottom collecting header leak.
7	09.11.82	14.11.82	117.17	Tube leak <u>Row No.</u> <u>Tube No</u> 3 15 8 28, 29
8	27.11.82	01.12.82	101.84	3rd row 15th tube leak
9	02.12.82	12.12.82	248.03	Riser leak 1,6 & 7th row
10	04.07.83	08.07.83	114.42	Tube leak <u>Row No</u> <u>Tube No</u> 4 37
11	03.09.83	09.09.83	227.00	Tube leak <u>Row No</u> <u>Tube No</u> 2 34
12	06.02.84	11.02.84	109.83	Tube leak <u>Row No</u> <u>Tube No</u> 8 27

Sr No	Down Time Period		Down Time Hours	Reason										
	From	To												
13	16.11.84	23.11.84	138.00	8th Header insulation damaged										
14	12.12.84	17.12.84	116.5	Tube leak <table border="1"> <thead> <tr> <th>Row No</th> <th>Tube No</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>21</td> </tr> <tr> <td>2</td> <td>5, 11</td> </tr> </tbody> </table>	Row No	Tube No	1	21	2	5, 11				
Row No	Tube No													
1	21													
2	5, 11													
15	12.03.85	17.03.85	116	Riser leak Row No. 5th										
16	29.06.85	07.07.85	198	8th Header failure										
17	03.08.85	14.08.85	131.75	8th Header Tube No 24 weldolet joint leak										
18	06.10.85	12.10.85	153.5	Tube leak <table border="1"> <thead> <tr> <th>Row No</th> <th>Tube No</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>11, 34</td> </tr> <tr> <td>3</td> <td>08, 10</td> </tr> <tr> <td>4</td> <td>03</td> </tr> <tr> <td>8</td> <td>05, 15, 21, 52</td> </tr> </tbody> </table>	Row No	Tube No	2	11, 34	3	08, 10	4	03	8	05, 15, 21, 52
Row No	Tube No													
2	11, 34													
3	08, 10													
4	03													
8	05, 15, 21, 52													
19	05.12.85	10.12.85	134.25	Tube leak <table border="1"> <thead> <tr> <th>Row No</th> <th>Tube No</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>09</td> </tr> <tr> <td>3</td> <td>41</td> </tr> <tr> <td>7</td> <td>13</td> </tr> </tbody> </table>	Row No	Tube No	1	09	3	41	7	13		
Row No	Tube No													
1	09													
3	41													
7	13													
20	18.12.85	21.12.85	38.00	Tube leak <table border="1"> <thead> <tr> <th>Row No</th> <th>Tube No</th> </tr> </thead> <tbody> <tr> <td>7</td> <td>23</td> </tr> </tbody> </table>	Row No	Tube No	7	23						
Row No	Tube No													
7	23													

TOTAL 3367.73 Hours
(i.e. 140.32 days)

IFFCO
Kalol Unit

Maintenance Deptt.
P & S Section

REVAMP TURNAROUND - 1986

GENERAL DETAILS

Sr.No.	Category	Quantity
(1)	<u>EQUIPMENT UTILISED</u>	
	(A) <u>IFFCO</u>	
	65 T H.M. Crane	1
	15 T Coles Crane	1
	18 T TATA Crane	1
	03 T Forklifts	2
	02 T Forklifts	1
	Truck	3
	Generator welding set	12
	Transformer welding set	3
	Diesel generator	1
	Air Compressor Centrifugal portable	1
	(B) <u>HIRED</u>	
	2 T Forklifts	3
	Air Compressor Centrifugal portable (from Kandla)	1
	300 T Crane ("American") From M/s PETRON ENGG	1
	45 T Crane ("NISSAN") From M/s PETRON ENGG	1

Sr.No.	Category	Quantity
(2)	<u>MANPOWER</u>	
	(A) <u>IFFCO DEPARTMENTAL</u>	
	a) <u>MECHANICAL</u>	
	Engineer	13 Nos
	Technician	46 Nos
	Rigger	04 Nos
	Mazdoor	16 Nos
	b) <u>MECHANICAL SERVICES</u>	
	Engineer	07 Nos
	Technician	25 Nos
	Rigger	01 Nos
	Mazdoor	16 Nos
	MEO	05 Nos
	Welder	08 Nos
	Machinist	08 Nos
	c) <u>ELECTRICAL</u>	
	Engineer	03 Nos
	Technician	29 Nos
	Mazdoor	04 Nos
	d) <u>INSTRUMENTATION</u>	
	Engineer	06 Nos
	Technician	24 Nos
	Mazdoor	02 Nos

(B) HIRED

Sr.No.	Category	Mandays
1	Mill-wright	82
2	Fitter	972
3	Fabricator-cum-grinder	258
4	Rigger	1977
5	Welder	196
6	Mason	32
7	Mazdoors unskilled (from time office)	7000

A special mention about manpower supplemented by trainees available during shutdown is quite relevant. We had 96 Nos. of trainees of maintenance in various trades.

AGENCIES AND
IMPORTANT JOBS EXECUTED DURING
REVAMP TURNAROUND - 1986

13

Sr No	Name of the party	Job executed
<u>AMMONIA PLANT</u>		
(1)	M/s M.W. Kellogg U.S.A.	Reformer Revamp
(2)	M/s FEDO Cohin	Reformer Revamp
(3)	M/s De-Laval U.S.A	Overhauling of Compressor and Turbines.
(4)	M/s Dressers Clark, U.S.A. (Abu Dhabi)	Overhauling of Compressor 103J/JT
(5)	M/s Babcock & Wilcox U.S.A	Arch roof ceramic Modules
(6)	M/s Petron Engineering, Bombay	Reformer Construc- tion job.
<u>UREA PLANT</u>		
(1)	M/s Stamicarbon bv, Holland	Inspection of HP Vessels.
(2)	M/s IBP Co. Nasik	Leak test H-1203
(3)	M/s Industrial Marine and Oil Field Service, Bombay	Leak test H-1203
<u>OFFSITES PLANT</u>		
(1)	M/s Paharpur Pvt Ltd, Bombay	CT Repair work
(2)	M/s Industrial Lining, Baroda	Rubberlining of Cation Vessels.
<u>B & M H PLANT</u>		
(1)	M/s Rubcol, Ahmedabad	Lining in Hopper No.7
<u>OTHER MAJOT DETAILS</u>		
(1)	M/s H.B.B. Baroda	Rotary equipment overhauling A/U/O
(2)	M/s Randhawa Construction Co., Baroda	Fabrication jobs including insta- llation of 12"Ø gate valve in

Sr No	Name of the party	Job executed
		Ammonia Plant, plate type Heat Exchanger in Urea and Replacement of Rubber expansion bellows in Offsites.
(3)	M/s Usha Hydro Dynamics Ltd., New Delhi	Cleaning of Heat Exchanger by HPWJ unit in A/U Plant
(4)	M/s Swamina International Pvt Ltd., Calcutta	Supply of skilled manpower.
(5)	M/s Techno Engg, Bharuch	Supply of skilled manpower.
(6)	M/s Lloyed Insulation (I) Pvt,Ltd, Bombay	Maintenance insulation work.
(7)	M/s Mahavir Engineers, Baroda	Heat Exchangers opening and box up.

INSPECTION SECTION

(1) M/s NDT Services, Ahmedabad Radio graphy work

CIVIL

(1) M/s Chemi Sight Engineers Baroda Scraper Floor, Tiles Lining Urea Plant. Prill Tower

(2) M/s Dhiraj Painters Araldite coating of Silo Roof.

ELECTRICAL

(1) M/s Voltas Ltd., Baroda Servicing of TMG Breakers.

(2) M/s AEC, Ahmedabad Installation and testing of 8-MVA Transformer

(3) M/s Reunion, Bombay Testing of calibration of English Electric relays.

Sr No	Name of the party	Job executed
-------	-------------------	--------------

INSTRUMENT

(1)	M/s United Instrument, Baroda	Pannel painting job
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TECHNICAL

(1)	M/s SM Engineers, Ahmedabad	Urea Plant Desorber (H-1301) modification for increasing shell length.
(2)	M/s Randhawa Construction Co., Baroda	Modification and Fabrication jobs including LP Vent Scrubber tappings
(3)	M/s Radiant Engineers	Replacement of valves in C.T. Risers.

REVAMP TURNAROUND - 1986
AMMONIA PLANT
MECHANICAL JOBS

Ammonia Plant was stopped for the major planned shutdown on 19th March 1986. This shutdown had a great importance due to the fact that critical equipments were replaced since they were deemed to have given their service life at the operating conditions.

The major job of replacement of Primary Reformer Harp Assemblies, Transfer Line; Waste Heat Boiler shells and Tube Bundles, Major repairs on Secondary Reformer and other miscellaneous jobs were awarded on contract to M/s Petron Engineering Construction Pvt Ltd, Bombay.

Overhauling of equipments such as Air Compressor train, Refrigeration Compressor train and Synthesis Gas Compressor train was carried out in presence of supplier's field service engineer and executed by M/s Hindustan Brown Boveri, Baroda.

Cleaning of Heat Exchangers was carried out by M/s Usha Hydro Dynamics, New Delhi, while the opening and boxing up of Heat Exchangers partly was carried out by M/s Mahavir Construction, Baroda and partly carried out departmentally.

Replacement of Absorber Trays and Inspection and repairs on Stripper was carried out departmentally.

Modification/replacement of Auxiliary Boiler Front wall was carried out departmentally.

Job Code Job Description

DETAILS OF JOBS CARRIED OUT

1.0

PRIMARY REFORMER - 101-B

01 RADIANT SECTION AND PENTHOUSE

- i) Replacement of 8 Nos Harp assemblies each consisting of 42 Nos of catalyst tube one riser tube and outlet manifold.
 - a) Catalyst tube : Top portion- ASTM-A-105-
Bottom portion- ASTM-A-351 (Gr.HK 40)
 - b) Riser tube : ASTM-A-351 (Gr.HK 40)
 - c) Outlet manifold: ASME-SB_407 (INCOLOY-800H)

- ii) Replacement of transfer line 107-D
 - a) Pressure shell : SA-285 Gr.6
 - b) Liner : INCOLOY-800H
 - c) Castable : Light-Weight Bubble type

- iii) Replacement of transition assemblies assemblies - 8 Nos.
 - a) Transition cone: INCOLOY 800
 - b) Liner : INCOLOY 800H
 - (Gap between liner and transition cone is filled with castable material)

- iv) Replacement of floor insulation
 - Material used:-HOT FACE INSULATING FIRE BRICKS KWISER MK23
 - HYSIL INSULATING BLOCKS
 - FIRE BRICKS KC 405

- v) Replacement of outlet manifold insulation.

Ammonia (Mechanical)

Job Code Job Description

Material used:-B & W KAO WOOL N/F BLANKET
B & W KAO WOOL N/F STRIP
B & W KAO WOOL WET FELT
B & W CEMENT

vi) Replacement of wall No.3 insulation (Partially)

vii) Replacement of wall No.4 insulation approximately 4 feet by modular type insulation.

viii) Replacement of insulation on wall No 1,2,3 and 4 approximately 4 feet on the roof end by modular insulation material.

Material used:-B & W PYRO BLOC 'Y' Modules
B & W KAO WOOL Hi Purity strip (CERAMIC FIBER INSULATION)

ix) Replacement of Roof arch steel
Material used:-ASTM-SA-36

x) Replacement of arch insulation
Material used:-B & W PYRO BLOC 'Y' Modules
B & W KAO WOOL Np Strip (PYRO BLOC CERAMIC FIBER)

xi) Replacement of 126 Nos Burner blocks

xii) Replacement of all spring hangers for catalyst tubes and transfer lines

xiii) Insulation of carbon steel portion of catalyst tube.

Material used:-CALCIUM SILICATE MOULDED PIPE INSULATION

xiv) Insulation of inlet manifold and pig tails.

Material used:-MINERAL WOOL MATTRESS, HYDRATED CALCIUM SILICATE AMOSITE ASBESTOS FIBER

xv) Replaced tunnel slabs by hollow type slabs.

Ammonia (Mechanical)

Job Code Job Description

- xvi) Straightening and supporting of inlet manifolds.
- xvii) Changed reformer tube catalyst
C-11-9-02/C-11-9-03

SUPPLIERS

The suppliers for major equipment replacement and refractory material are as under:

- i) Harp Assemblies : M/s KOBOTA JAPAN
M/s NITIN CASTINGS
BOMBAY
M/s UNI-ABEX ALLOY
PRODUCTS, BOMBAY
- ii) Transition Assemblies : M/s KOBOTA JAPAN
- iii) Outlet manifold : M/s KOBOTA JAPAN
- iv) Transfer line (107-D) : M/s ELECTROWELD
JAPAN
- v) Spring hangers : M/s BERGMANSON
- vi-a) Arch material : M/s BABCOCK WILCOX
U.S.A.
- b) Outlet manifold: " " "
header insula-
tion
- c) Wall insulation: " " "
- d) Insulation for : " " "
catalyst tube
(Top portion)
- vii) Castable Refractories : M/s PILBRICO U.S.A
- viii) Tunnel slabs : M/s CRISTY FIRE
BRICKS CO U.S.A
- ix) Tunnel Wall Bricks: M/s A.C.C. BOMBAY
- x) Floor Bricks : M/s DETRIC PVT LTD
CULCUTTA
-

Job Code	Job Description	Ammonia (Mechanical)
	xi) Back up insulation	: M/s HYDERABAD ASBESTOS CEMENT, FARIDABAD.
	xii) Burner Blocks for Arch Burner	: M/s KINETIC TECHNOLOGY, NEW DELHI.

SERVICES:

- i) Services of Installation Engineer Mr Arthur Moore Waldan Jr, of M/s Babcock & Wilcox U.S.A. were acquired for installation of Arch insulation and reformer wall insulation jobs.
- ii) Field services of following Kellogg/K.I.L./FEDO Personnel were acquired for the supervision of the field jobs listed above.
 - 1) Mr B. Manula
 - 2) Mr A. Edwards
 - 3) Mr L. Ryder
 - 4) Mr T. Ceaser
 - 5) Mr D. Morgan
 - 6) Mr J. Lothian
 - 7) Mr R. Allen
 - 8) Mr D. Foley
 - 9) Mr K. Charlton
 - 10) Mr M. Pugh
 - 11) Mr A. Macfarlane
 - 12) Mr R. Edah-Tally
 - 13) Mr Prasern Vongvisith
 - 14) Mr Sundram
 - 15) Mr MVS Namboodiri
 - 16) Mr Jay Singh

TOOLS AND EQUIPMENTS:

- i) M/s Petron has utilised the following for the construction work:
 - 1) 300 Tons Crane (AMERICAN)
 - 2) 45 Tons Mobile Crane (NISSAN)
 - 3) 65 Tons H.M. Crane (IFFCO)
 - 4) Tractor and Trolley
 - 5) Winch: Capacity 15 Tons.

----- Ammonia (Mechanical) -----
 Job Code Job Description

- ii) Special tools and tackles such as Hillman Rollers for transfer of Harp Assemblies, Load Blocks and shackles for lifting of Transfer Line were procured by IFFCO and supplied to M/s Petron as FREE ISSUE ITEMS.

02 CONVECTION SECTION (H.T. SECTION)

- i) H.T. Convection section was inspected for Refractory Repairs. The panels towards the cooling tower were opened out, cleaning of coils were carried out manually. Refractory wherever found damaged was repaired by gunnitting.
- ii) Mixed Feed Coil was found to have come down from its supports. Additional supports fabricated out of S.S. plates and Reformer Tubes were provided at three places to avoid any further sagging of the coil.
- iii) Distribution plates for distributing the flue gases coming from the Auxiliary Boiler were found to have fallen and bend. These plates were removed from the convection section.

03 CONVECTION SECTION (L.T. SECTION)

- i) Panels on the cooling tower side were removed for cleaning of coils.
- ii) Flue gas distribution plates which had fallen off were removed.
- iii) A third coil as Boiler Feed water coil (B.F. Water Coil) was installed below the existing two coils. This coil was supplied by M/s PIPING ENGINEERING CORPORATION U.S.A.

Installation of Boiler Feed Water Coil was taken on the basis of energy saving measures. Data collected after the installation of the B.F. Water Coil is as under:

Energy saved (G.cal) : 208.32/day
 Equivalent L.S.H.S(t): 19.84 (Average of July month)

I.D. Fan Stack temp : Before insertion of coil - 295°C
 After insertion of coil - 205°C

 Job Code Job Description

Temperature gain by : Approximately
 Boiler Feed Water 85°C to 90°C.

04 AUXILIARY BOILER AND HOT WELL

- i) Side panels of Auxiliary Boiler towards the silo side were opened. Refractory on these panels were repaired. One of the panel was completely recast.
- ii) Distribution plates on the outlet of Auxiliary Boilers were repaired.
- iii) Refractory wherever found damaged in the Hot Well was redone by gun-ting.

AUXILIARY BOILER

Auxiliary Boiler after the replacement of the old DA-21 gas fired Burner to DGN-26 dual fired burners in 1981 was having recurring problems of vibrations and damage to the burners. Vibrations at various occasions had resulted into the damage of Refractory of the Front wall and Burner Blocks. After lot of discussions with M/s Kellogg following modifications which were suggested by them were incorporated.

- (a) Complete replacement of Front Wall casing plate with 8 mm thick plate. Earlier casing plate was 5 mm thick.
- (b) Reinforcement of Front Wall casing plate from inside between the two burners since no space was available on the outside.
- (c) Specially designed cross bracing between each burners to carry the load of burners to the main column.
- (d) Complete relining of the Auxiliary Boiler Front Wall, necessary anchors were provided for the insulation work.

Material Used:

- a) INSULYTE - 9
- b) IFBMK - 23 Bricks
- (e) New S.S. lirtels were provided for supporting the insulation.

Ammonia (Mechanical)

Job Code	Job Description
	(f) Burner casing was rolled and fabricated and insulation material cast in the casing. Material used:- a) WHTHEAT b) PLICRST-40
	(g) All 5 Nos Burners were completely overhauled and arrangement for Naphtha firing was provided. All the Burner driving arms were cleaned and angle adjusted as below. a) Gas-arms :-55° angle with respect to the axis of rotation. --35° angle with respect to the plane of rotation b) Naphtha arms :-45° angle with respect to the axis of rotation -45° angle with respect to the plane of rotation

2.0

SECONDARY REFORMER

Following jobs were carried out on Secondary Reformer 103D

- i) Removal of Top Head along with Air Mixer.
- ii) Replacement of Refractory and shroud liner on the top head. The liners which were S.S.310 were replaced by Incoloy 800H material.
- iii) Replaced Air mixer by a modified Air Mixer.

The modified Air Mixer has 20 ports of 1.30 inch diameter as compared to old air mixer having 12 ports of 1.38 inch diameter. The installation of new modified Air Mixer would result into increased hole area at the nozzle thereby reducing velocity which would give a better mixing and would not disturb the catalyst bed.

- iv) Old S.S.310 liner of inlet Nozzle 'C' which was found buckled were replaced with new Incoloy 800H Liner.
- v) Shroud liner and vapour Barrier of nozzle 'A' connecting Secondary Reformer to Transfer Line were replaced.

Ammonia (Mechanical)

Job Code	Job Description
	vi) All Refractory work on the Nozzle 'A' and Nozzle 'C' where shroud liners were replaced was redone. Refractory used for top head, Nozzle 'A' and Nozzle 'C' was light weight Bubble type castable Pilbrico Plicast 696.
	vii) Secondary Reformer catalyst was removed and Alumina Balls 2" ϕ and 1" ϕ added from fresh lot to the extent of short-falls; complete catalyst was replaced; Top Target Bricks were replaced also some of the circular Bricks found broken were replaced. (Catalyst -C-11-4/C-15-1)
	viii) Dome was inspected and found in order on the Top. However, some cracks were noticed on the lower side which were left as such.
	ix) Liner underneath the Dome which had been removed in July 1985 was replaced by new Incoloy 800H liner.
	x) Bottom Manhole liner and Refractory were replaced. (Incoloy 800H)
	xi) Outlet Nozzle 'B' and 'H' liners were replaced upto Waste Heat Boilers 101 CA/CB.
	xii) All Refractories underneath the dome; on Bottom manhole; Nozzle 'B' and 'H' to the first vapour Barrier was redone by Dense Castable Pilbrico Plicast 40.
<u>NOTE:</u>	
	The liner materials received from M/s Electrowelding Corporation U.S.A. had to be modified to side conditions. None of the liner could be used as supplied.
	xiii) Transition pieces between 103D and 101 CA/CB were replaced by a new transition pieces received. Lot of problems were experienced in fixing the transition pieces since there was a mismatch in the orientation of Waste Heat Boiler Inlet Nozzle S-1. To take care of the mismatch transition pieces were cut to template prepared at site.
	xiv) Post weld Heat Treatment was done on the shell weld joints of Transition assemblies.

 Job Code Job Description

3.0 WASTE HEAT BOILERS (101 CA/CB)

- i) Complete Assembly of inner and outer tube bundle along with channel were removed with the help of 15 Tons capacity single drum electric operated winch and 300 Tons capacity American Crane.
- ii) New Pressure shell was installed after removal of old pressure shell.
- iii) Spare Tube Bundles were installed in the new shells.
- iv) Outlet Nozzle S₂ connecting 101 CA/CB to 102C distance piece liner was replaced by a new S.S. 310 liner.
- v) 102C bottom flange was opened to facilitate the liner job in the transition piece was reassembled.
- vi) Weld joints of 101 CA/CB (pressure shell) were Heat Treated.
 Temperature - 1150^oF ± 25^oF.
- vii) Refractory in the outlet Nozzle between the pressure shell and the liner was replaced by light weight bubble type castable plicast "606".

4.0 104D SHIFT CONVERTOR

H.T.S. Catalyst was replaced. To facilitate replacement of catalyst necessary manholes were opened. Grating and screen were removed and refixed after replacement of the catalyst (Catalyst C-12-1)

5.0 CO₂ ABSORBER 101-E

It was experienced on two occasions that the carbon steel sieve trays provided originally were getting corroded leading to bypassing and improper absorption of CO₂. On each of the earlier occasions trays were replaced with carbon steel trays.

It was planned to replace all the 20 Trays of carbon steel construction by trays in S.S. 304 material which were imported from M/s YOCH ENGINEERING CO U.S.A.

For replacement of these trays following preparations were made prior to shutdown.

Ammonia (Mechanical)

 Job Code Job Description

- i) Electrically operated hoist was installed for lowering of old trays and lifting of new trays.
- ii) All new trays shifted to site from stores and each tray was assembled to confirm about availability of all the components at site.
 - (a) All 20 Nos Trays were replaced.
 - (b) Vessel was inspected; lot of pittings were found which was severe between tray 12 to tray 20.
 - (c) M - Seal was applied at all points in the vessel wherever pitting was noticed.
 - (d) Gas inlet distributor was checked. All loose bolts were tightened.

Complete job was carried out on 24 hours working and was completed in 15 days time with the help of following manpower.

Manpower utilised per shift

Technician	: 1
Jr. Technician	: 1
Fitter (Contractor)	: 2
Rigger (Contractor)	: 5
Mazdoors	: 4

6.0

01 STRIPPER - 101EA

Inspection was carried out on stripper and following were the observations.

- i) Four of the sieve trays of the 1st tray on Reformer side were damaged and had fallen down.
- ii) Side stiffener plate of the distributor (towards reformer side) was found broken.
- iii) Supporting rod of the distributor (Reformer side one) found broken.
- iv) Distributor supporting plate found damaged.
- v) All the distributor clamps got loosened and studs got damaged.

Ammonia (Mechanical)

 Job Code Job Description

- vi) Some of the bolts of the distributor nozzle (towards silo side) were found missing.
- vii) On D.P. Test three pin holes were found at the weld joint on MEA inlet Nozzle with the liner pad.
- viii) A crack of around 5 cms length was found in the shell where distributor support plate was welded to the shell (Reformer side).
- ix) A long hair line crack of around 10 cms length was found on the longitudinal joint of shell at the top position.

JOBS CARRIED OUT

- i) Missing four sieve tray components were replaced by new, which were manufactured from M/s Zenith Engg. Works, Ahmedabad out of S.S.316 sheet.
- ii) The small cut piece from S.S.316 plate was welded at the damaged portion of the stiffener plate.
- iii) A new supporting rod was provided for the distributor.
- iv) The areas where cracks were noticed in the shell as well as at the weld joints were ground and rewelded.
- v) The pinholes in the MEA inlet nozzles were ground and rewelded.
- vi) Damaged studs and bolts were replaced by new.
- vii) All trays were thoroughly cleaned and descaled by wire brushing.

02 STRIPPER 102EB

Following jobs were carried out.

- i) Flange coupling bolts of MEA inlet line and distributor line were found loose. Gasket was also sheared. Replaced gasket and tightened bolts.
- ii) Bolts of demister pad supports were tightened.

Job Code Job Description

- iii) Support bolts of distributor pipes were tightened
- iv) All four support plate welding joints with shell were checked by D.P. Test found cracked, which were rectified by grinding and welding.
- v) Leakage point was found in MEA line nozzle and sleeve joint. Repaired by grinding and welding.
- vi) All the trays were cleaned and fixed back in their respective positions.

7.0

01 I.D. FAN 101BJ

Inspected both journal bearings, found in good condition. Boxed up the same after checking diametrical clearances.

- i) I.B. Bearing clearance : 0.012"
- ii) O.B. Bearing clearance : 0.011"

02 GEAR REDUCER FOR 101BJ - 101BJR

Lifted top cover for checking teeth of gear and pinion. Both were found in good condition. Wear and tear was observed in bearings, clearance was also increased. So all the four bearings were replaced by new ones. Checked diametrical clearance with new bearing found within allowable limit. Lub oil filter was cleaned and fitted back in its position.

CLEARANCE

	<u>Gear Shaft</u> <u>Bearings</u>	<u>Pinion Shaft</u> <u>Bearings</u>
Turbine side	0.007"	0.006"
I.D. Fan side	0.008"	0.006"

03 TURBINE FOR I.D. FAN 101BJT

Checked both the bearings found in good condition. Boxed up both the bearings after checking diametrical clearance.

- I.B. Bearing clearance : 0.009"
- O.B. Bearing clearance : 0.009"

----- Ammonia (Mechanical) -----

Job Code Job Description

8.0 AIR COMPRESSOR TRAIN --101J

Air Compressor and its drive was inspected during above Revamping Shutdown as a routine planned inspection. This inspection was carried out in presence of M/s De-Laval U.S.A field service engineer Mr John Postneik. Service of M/s Brown Boveri were acquired to accomplish the work of overhauling.

01 TURBINE FOR AIR COMPRESSOR - 101J

Turbine was completely dismantled. Major planned jobs on the turbine were replacement of Kingsbury thrust bearing of 6" size by a 7" thrust bearing supplied by M/s CENTRITECH U.S.A.

Following are the jobs carried on turbine:

- i) Rotor was removed, found in good condition cleaned by sand blasting.
- ii) All diaphragms removed, cleaned and were by sand blasting and fitted back.
- iii) Replaced all the inter stage seal rings.
- iv) Replaced suction side gland seals by new one.
- v) Discharge end gland box along with old seal rings was reused as it was found in good condition.
- vi) New 7" centritech thrust bearing was installed.
- vii) Old journal bearing was reused as the same was found in good condition.
- viii) Turbine Reassembled.
- ix) Trip throttle valve was inspected. All sliding parts were cleaned and lubricated and set to close and open fully.
- x) Nozzle valves were removed and inspected. Nozzle valve stems (Both) were replaced by new one. Two valves were replaced as some wear was noticed on the seating surface.
- xi) All oil pipe lines, orifices on the oil line were thoroughly cleaned and fixed back.

Ammonia (Mechanical)

 Job Code Job Description

- xii) Finally alignment was checked between L.P. case and turbine which was indicating L.P. Case 0.023" sideways towards 105-J side as against protocol reading of 0.018". Alignment was left as it was since Transamerica De-Laval Field Representative was not of the opinion to disturb the alignment.
- xiii) Before starting turbine oil was flushed by having a wire mesh of 100 mesh in the main oil inlet and was checked for dirt/dust particles.
- xiv) Turbine was tested for overspeed and was tripped at 7800 RPM against the design overspeed trip speed of 7700 - 7854 RPM.
- xv) Turbine coupled with L.P. Case.

PARTS REPLACED (DRG No. H-4484)

Sr No	Description of Item	Part No	Symbol No.	Qty	Code
1	Ring	24	KJ141BGx1U/L	1	104822024
2	Ring	9	HJ141AFx7	3	104822009
3	Ring	10	KJ141BGx1U/L	1	104822010
4	Spring	12	VGJ 235	160	104822012
5	Ring	30	KJ141BHx4	2	104822030
6	Ring	65	KJ141BJx3	3	104822065
7	Ring	66	KJ141BJx2	4	104822066
8	Ring	67	KJ141BKx2	1	104822067
9	Ring	69	KJ141BJx4	1	104822069
10	Centritech thrust bearing assembly	-	-	1	104822020

NOZZLE VALVE SPARES (DRG. NO. F-6461)

1	Stem	624	M-159H	2	104895624
2	Valve	667	KJ225Zx8	1	104895667
3	Valve	702	KJ225ABx30	1	104895702
4	Nut	700	RJ402Nx2	1	104895700

Ammonia (Mechanical)

Job Code Job Description

02 L.P. CASE

LP. Case of Air Compressor was not touched with the view point that this was overhauled in July 1985. Also overhauling of this unit was planned with a view point of demagnetisation through M/s M.F.L. which did not materialise.

03 INSPECTION OF SPEED INCREASER GEAR BOX

Gear box was opened out and inspected. All Gear and pinion teeth were found in good condition. Bearings were found in good condition.

CLEARANCES OF GEAR BOX BEARINGSGEAR SHAFT JOURNAL BEARING CLEARANCES

L.P. Case side 0.011" as against design value of 0.008" to 0.010"

H.P. Case side 0.008"

End play 0.014" as against design value of 0.014" to 0.024".

PINION SHAFT JOURNAL CLEARANCES:

L.P. Case side : 0.009" } As against design values of 0.009" to 0.011"

H.P. Case side : 0.012" }

End play 0.014" - As against design values of 0.014" to 0.024"

PARTS REPLACED: NIL04 H.P. CASE

Dismantled the compressor H.P. Case completely and following were inspected

i) Diaphragm bushing; oil guards were found in good condition.

ii) All case rings were replaced with new ones. Since their diametrical clearances were found excessive almost double than the design value.

iii) All diffusers and guide vanes were cleaned in position to the maximum extent.

Ammonia (Mechanical)

Job Code Job Description

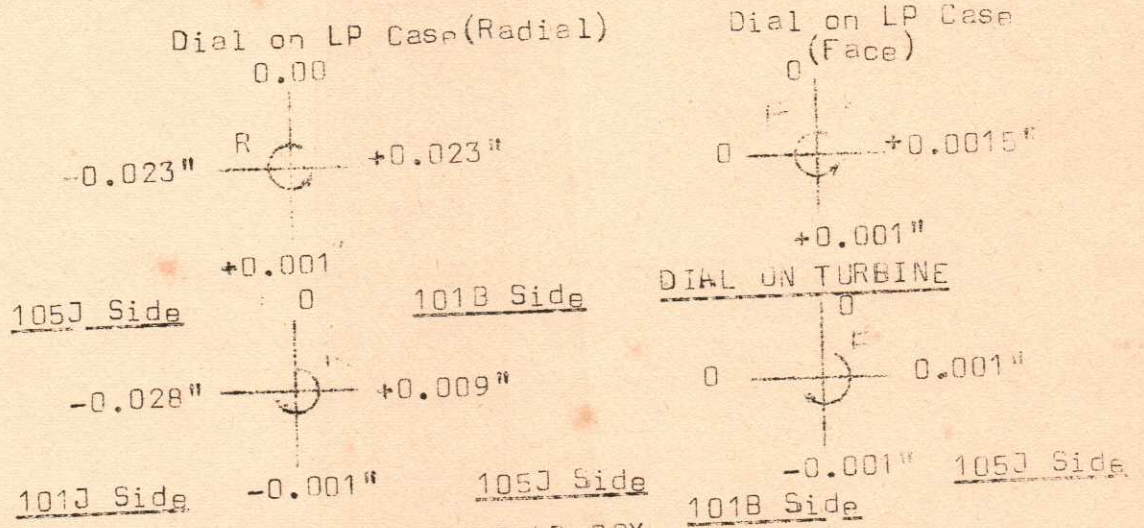
- iv) Compressor assembled after inspection of Journal Bearings; Thrust Bearing; Labyrinths clearances and axial float.
- v) All oil lines were cleaned thoroughly and refixed.
- vi) Compressor coupled with Gear Box.

PARTS REPLACED (DRG. NO.F)

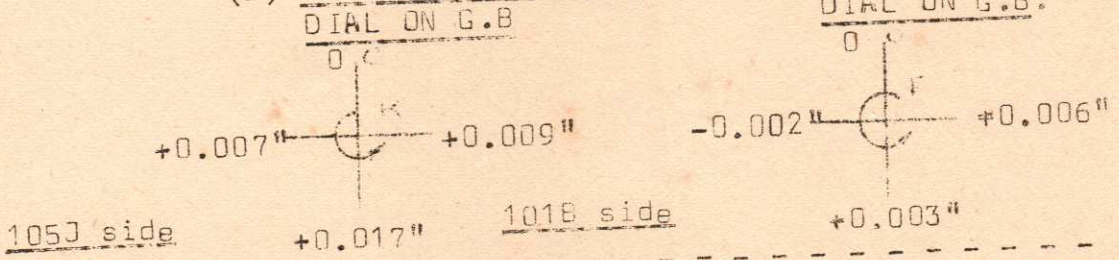
Sr No	Description or item	Part No	Symbol No	Qty	Code
1	Ring	088	AF2041AR U/L	1	104832008
2	Case Ring	042	AF2083BB U/L	1	104832042
3	Case Ring	046	AF2083BC U/L	2	104832046
4	Case Ring	050	AF2083BE U/L	4	104832050

ALIGNMENT READING ON 101J TRAIN

(A) TURBINE TO L.P. Case



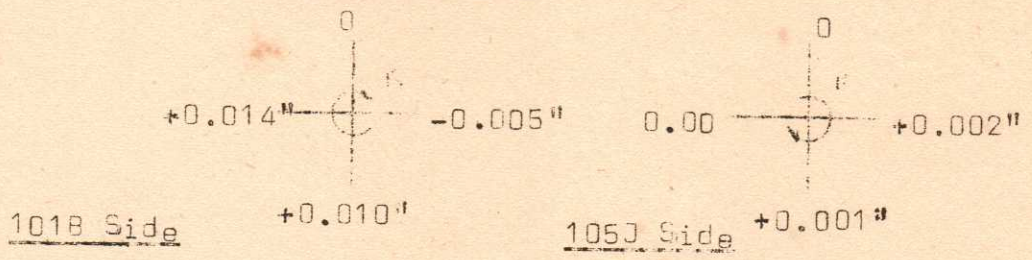
(B) L.P. CASE TO GEAR BOX



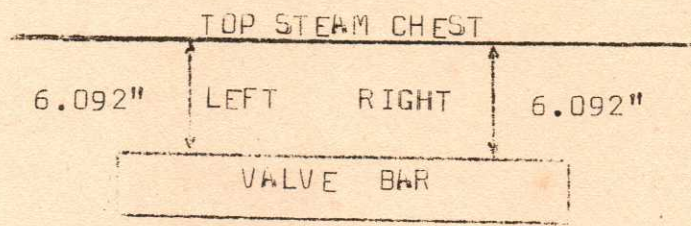
Ammonia (Mechanical)

Job Code Job Description

GEAR BOX TO H.P. CASE DIAL ON GEAR BOX
DIAL ON GEAR BOX SIDE



NOZZLE VALVE SETTINGS FOR 101JT



Valve No		1	2	3	4	5
Valve setting	A	0.690"	0.310"	0.100"	0.520"	0.890"
Cold Bar Clearance	B	0.100"	0.100"	0.100"	0.100"	0.100"
Valve seat error	C	0.011"	0.007"	0.004"	0.002"	0.000"
TOTAL	D	0.801"	0.417"	8.204"	0.622"	0.990"

Total Bar Lift = 1.200"
Bar Setting = 6.092" - 0.600" = 5.492"

Ammonia (Mechanical)

Job Code Job Description

LABYRINTH CLEARANCES

101JT AIR COMPRESSOR TURBINE

REFORMER SIDE		SILO SIDE
0.010"		0.009"
0.010"		0.009"
0.009"		0.010"
0.010"		0.008"
0.011"		0.009"
0.010"		0.009"
	WHEEL-1J	
0.010"		0.010"
	WHEEL-2J	
0.009"		0.008"
	WHEEL-3J	
0.008"		0.009"
	WHEEL-4J	
0.010"		0.009"
	WHEEL-5J	
0.009"		0.008"
	WHEEL-6J	
0.009"		0.010"
	WHEEL-7K	
0.008"		0.011"
	WHEEL-8AK	
0.012"		0.009"
0.010"		0.009"
	WHEEL-8B	
0.007"		0.004"
0.007"		0.004"
0.008"		0.005"
0.008"		0.006"
	BEARING	0.009"
	COUPLING	

Recommended
0.013-0.019

Ammonia(Mechanical)

 Job Code Job Description

9.0 01 TURBINE DRIVE FOR N.G. COMPRESSOR 102JT

Decoupled the turbine, checked condition of both the journal bearings found in good condition, checked end play of rotor found within allowable limit. Boxed up all the bearings after taking diametrical clearances.

All the oil lines were thoroughly cleaned and fitted back in their respective positions.

CLEARANCES:

- i) Journal bearing clearance (coupling side) : 0.010"
- ii) Journal bearing clearance (Governor side) : 0.008"
- iii) Axial thrust : 0.008"

02 N.G. COMPRESSOR 102J

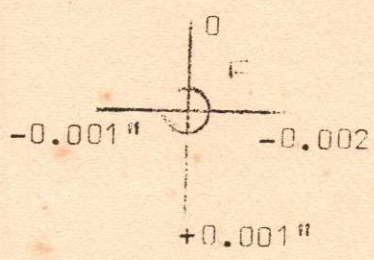
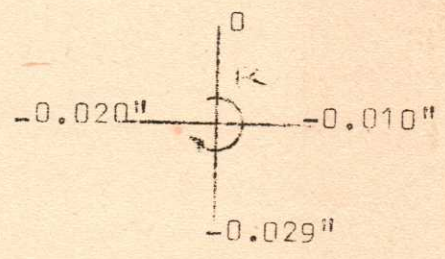
Checked both the journal bearings found in good condition, checked end play of rotor, found 0.015". Rubbing marks were observed on thrust shoes, some wear and tear at pivot points of base rings were also noticed. Assembled thrust bearings with new pads. Same base ring was reused.

CLEARANCES:

- i) Journal bearing clearance I.B.:0.005"
- ii) Journal bearing clearance O.B.:0.0045"
- iii) Axial thrust :0.012"

ALIGNMENT READINGS

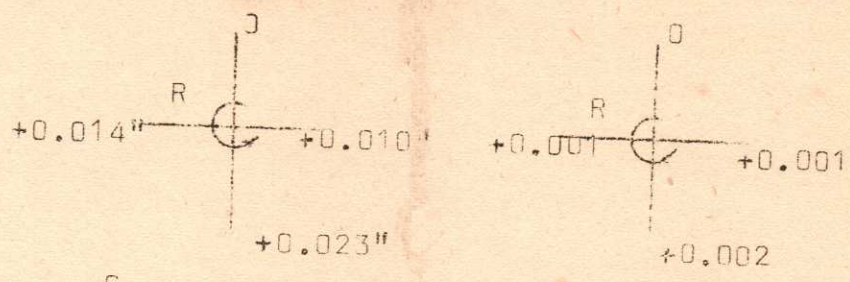
(i) Dial on 102J



Ammonia (Mechanical)

 Job Code Job Description

ii) Dial on 102JT



Spares used:

- i) Thrust pads : 1 Set
- ii) Coupling guard 'O' ring : 1 No

10

SYN.GAS COMPRESSOR TRAINS 103J

Syn.Gas Compressor and its drive was overhauled during revamp shutdown. Job was carried out in presence of M/s De-Laval U.S.A. field service engineer Mr John Postneik and M/s Dresser Clark service representative Mr R. Ikin. Services of M/s Hindustan Brown Boveri were acquired to accomplish the work of overhauling.

Following jobs were carried out.

01 103JAT - SYN GAS COMPRESSOR TURBINE

Decoupled the turbine from compressor. Inlet and exhaust steam pipe lines were removed. Loosened bolts of outer casing, bearing housing and nozzle valve assembly and lifted up. Finally lifted the complete inner casing with rotor assembly and shifted to workshop for dismantling. Out of 8 locking cap screws of top half inner casing. 7 were removed and one cap screw of gland box was also opened. Remaining screws were taken out by drilling on boring machine (inner casing screw $1\frac{1}{2}'' \text{ } \phi \times 3\frac{1}{2}''$ long UNC thread. Cap screw of gland box $7/8'' \text{ } \phi \times 2\frac{1}{4}''$ long UNC thread) Lifted the top half of the inner casing and gland box by pulling with suitable pulling arrangement.

OVSERVATIONS:

- i) Condition of rotor was found good.
- ii) Little cutting and bending was found for a length of 4 to 5 blades on top

----- Ammonia (Mechanical) -----
 Job Code Job Description

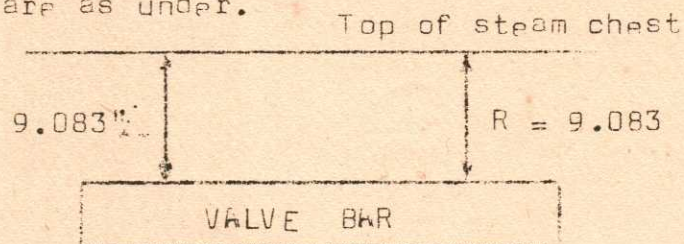
half of diaphragm.

- iii) Bending was observed for a length of 4 to 5 blades on top half of nozzle ring.

The cause for above defects may be due to flow of heavy particles along with steam.

ASSEMBLY

- i) Cleaned Rotor. Old coupling hub of LP Side was replaced as coupling assembly between LP Case to turbine has to be replaced by new one.
- ii) Nozzle ring blades were dye checked found okay
- iii) Assembled inner casing after thorough cleaning of rotor, diaphragm and nozzle ring.
- iv) Replaced all seal rings of gland box by new one checked clearances found okay.
- v) Inner casing assembly was shifted to site, and fixed in position. Journal bearings were positioned and firmly tightened.
- vi) Complete set of labyrinth seal rings were replaced by new one.
- vii) Assembled thrust bearing with new base rings and shoes.
- viii) Top half of outer casing was boxed up. While tightening nuts one of stud was not getting tightened. Same was removed by cutting nut with cutting torch and new stud was fitted which was machined in our workshop.
- ix) Nozzle valve assembly was put in position after setting the bar and valves. Valve setting readings are as under.



Ammonia (Mechanical)

 Job Code Job Description

Valve No	1	2	3	4	5
Valve setting A	0.900	0.460	0.100	0.680	1.180
Gold bar B	0.100	0.100	0.100	0.100	0.100
Valve seat error C	0.020	0.017	+ .198	0.012	0.018
			.000		
TOTAL D	1.020	0.577	0.398	0.792	1.298
			* 0.398		

Total bar lift 1.500

One half of the total bar lift = 0.750"

Hence bar setting = 9.083 - 0.750 = 8.333"

C = Pilot valve travel + valve seat error

Design valve of valve setting

Valve No.	1	2	3	4	5
	1.009	0.575	0.395	0.803	1.323

SPARES USED

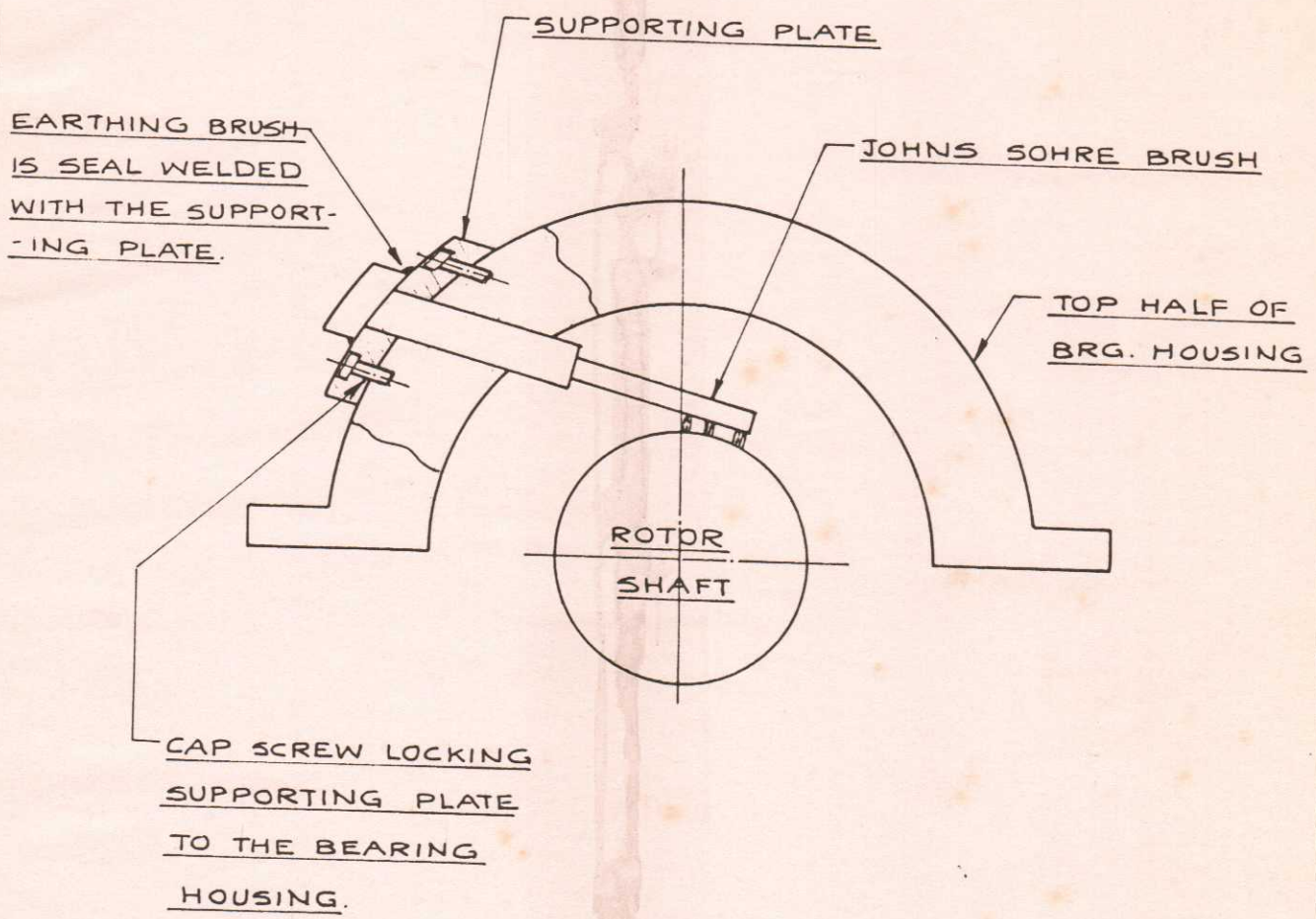
1. Spindle	GJ-159	623	2 Nos
2. Nut	RJ-402A2	621	2 Nos
3. Spacer	KJ-2978	620	2 Nos

02 FIXING OF EARTHING BRUSH ON 103JAT

In both 103JAT and 103JBT turbines there is no sufficient space to insert earthing brush. Finally it was decided to fix brush on 103JAT towards LP Compressor case side as it is easy to do any maintenance work on brush.

Top half of bearing housing was brought to workshop for making slot. Slot was made by drilling number of holes. A mandrel was made as per rotor diameter for proper brush fixing. By putting bearing housing on the mandrel and inserting brush in slot, it is possible to position the brush as per requirement.

Brush was locked directly on housing by cap screws. Earthing brush is seal welded to supporting plate. Then supporting plate is positioned on bearing housing by four cap screws, as shown in sketch.



DRN.	KAM	TITLE:- <u>SHAFT RIDING BRUSH FOR SYN. GAS COMPRESSOR TRAIN</u>			EWR NO.-	
CHD.						
APD.		DRAWING NO.	PLANT	FORM	NUMBER	SHEET
SCALE	N.T.S		01	ES	07077	1 OF 1
						REV. 0

Ammonia (Mechanical)

Job Code Job Description

03 103JBT SYN GAS COMPRESSOR TURBINE

Removed steam pipe lines checked end play of rotor. After loosening the top half casing bolts, casing was lifted up. Observations were as under.

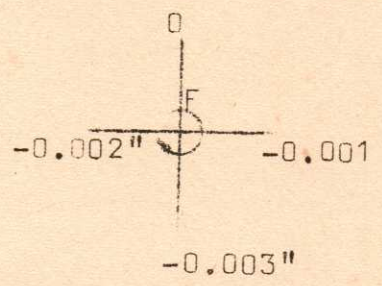
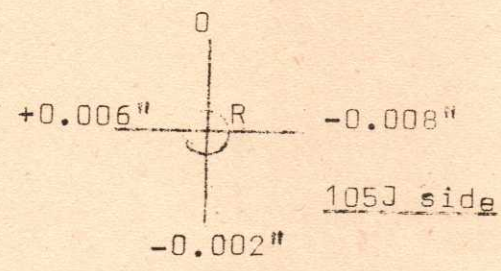
- i) Rotor was visually inspected found erosion at the face of fourth wheel.
- ii) Silica deposits on 3rd, 4th and 5th wheel,
- iii) Erosion was noticed at the places where moisture rings are tack welded to diaphragms.
- iv) Condition of labyrinths, journal bearings etc. was found good.

ASSEMBLY

- i) Rotor and all the diaphragms were removed and cleaned by sand blasting to remove deposits.
- ii) Additional fastening was provided on moisture rings with diaphragms by locking with cap screws (for diaphragms 6 and 7)
- iii) All the diaphragms were fitted in position and after fixing the rotor checked labyrinth clearance found okay.
- iv) Assembled journal and thrust bearings and checked clearances.
- v) Fixed governor assembly in position.
- vi) Connected inlet and exhaust lines.
- vii) Checked cold alignment readings which were as under

Dial on 103JAT

Dial on 103JAT



----- Ammonia (Mechanical) -----
 Job Code Job Description

04 OVERHAULING OF T.M GOVERNOR

Governor assembly was lifted and taken to maintenance shop for dismantling. After dismantling following were the observations.

-) Stem of pilot was found sheared.
- i) Wear and tear was found in weight assembly.
- ii) Wear and tear was found in guide plate
- i) Bushings were worn out.
-) Bearings was also found unserviceable.

All the parts were thoroughly cleaned and governor was assembled with following new items.

Sr No	Description	Item No	Symbol	Qty.
1	Pilot valve	093	M-1822FG	1 No
2	Weight Assembly	088	HC-253AV	1 No
3	N.D. Ball Bearing	115	H-20309x1A	1 No
4	Spring	118	HO-258BA	1 No
5	Bushing	095	M-215 MD	2 Nos
6	Sleeve	100	M-1825 CFx1	1 No
7	N.D. Ball Bearing	102	M-20300	1 No
8	N.D. Ball & Sep. assembly	087	ND-90-025-5602	2 Nos
9	Seat	109	M-271BT	1 No
10	Knife edge	123	M-271BT	2 Nos

Both turbines were coupled and checked for overspeed trip. Both turbines were tripped at 11,900 rpm. Design value is 11850 rpm - 12100 rpm. However, governor was functioning by manual operation, but it was not operable from control panel by pneumatic actuator. Although in spite of this problem it was decided to couple the turbine with compressor for normal run.

Turbine was started for taking load on 1.5.86, it was noticed that turbine speed was brought to normal operating speed by opening TTV of 103JBT only servo motor piston was not operated upto its full length and governor oil pressure was not increasing more than 3.5 kg/cm². The hand valves of 103JBT were

Job Code	Job Description
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kept opened for running the turbine on normal operating speed. As nozzle valve of 103JAT could not be operated from control panel by pneumatic actuator, it was found very difficult to control the turbine speed with any steam fluctuation of plant. It was decided to stop the turbine and to locate problem. Following two faults were found.

- i) One of the orifice in governor oil line was positioned wrongly. At the position of orifice 29A (5/32"Ø) the orifice 29C (7/16"Ø) was fixed which resulted in reduced oil pressure. After installing correct orifice, oil pressure increased to 7 kg/cm².
- ii) Diaphragm of PRC-12 Penumatic positioner was got punctuated resulting in insufficient air pressure to positioner. After above rectification, operation of PRC-12 found normal. Machine was handed over to production for normal running.

05 SYN GAS COMPRESSOR 103J

Syn Gas Compressor of make Clark Dresser, Sr.No.CT-20263 consisting of 2Bc9 and 2 BF 9.8 (LP & HP Casings) were overhauled in February-March 1978.

Because of limitation of crane facility, sand blasting going on in nearby location and dusty environment around, it was decided to overhaul both LP & HP units in centralised maintenance workshop.

Service representative Mr R. Ikin of M/s Clark Dresser from Abu Dhabi Center was present to supervise the job. Compressor overhauling contract was awarded to M/s Hindustan Brown Boverly Ltd Baroda.

L.P. CASE

Prior to removal of Compressor units from bed plates, alignment readings between 103 JAT and 103 JLP and 103 JHP, shim thickness under each bolt were recorded.

Ammonia (Mechanical)

Job Code Job Description

LP Compressor unit was completely dismantled in workshop. LP shaft 103 J&T end couplings scored the shaft ends during removal. Coupling portions of shaft found having corrosion pittings.

Thrust and journal bearings of suction, and discharge end clearances increased, free swivelling of thrust pads were disturbed, journal bearing pads had pitted surface etc. Thrust bearing pad load side was black having burnt oily marks. Suction and discharge side journal bearing diametral, clearances found increased, some pieces white metal lining indicated heating stress scoring and pinning. LP Rotor assembly sleeve developed groove which were filled by 'M' seal so same was planned for replacement.

After thorough cleaning of rotor assembly and diaphragm vanes labyrinths clearances measured and recorded. It was observed that all labyrinths bore became oversize and have developed grooves on shaft sleeves and impeller eyes and the clearances were far more than the recommended limits. Reviewing the conditions of the removed internals most of them found non-serviceable.

LIST OF IMPORTANT SPARES REPLACED IN LP COMPRESSOR ASSEMBLY

- 1) Rotor assembly complete, duly balanced with locknut washer.
- 2) Guide vane and diaphragm bundle assembly.
- 3) Labyrinth sets for complete rotor assembly's shaft sleeves, impeller eyes, balancing piston, gas seal etc.
- 4) Coupling assembly duly balanced with spool piece and coupling bolts. Coupling guard assembly complete with gaskets.
- 5) Seal Assembly: Ring floating (outer), Ring floating (inner) labyrinths, housing for floating rings, set of 'O' rings, gasket etc.

Ammonia (Mechanical)

Job Code Job Description

- 6) Bearing Assembly: Thrust bearing (out board), Thrust bearing (in board), Thrust disc, oil control ring, spacer, liners for journal bearing, pads for journal bearing, set of 'O' rings etc.
- 7) Misc: End cover casing main barrel gaskets, dowel pins, of bearing housing 'O' rings, etc.

Prior to assembly, run out and vibration of new and old rotor were checked and recorded.

Thrust bearing spacer width reduced from 0.750" to 0.718" for adjusting float within specified limit and centering of rotor.

After assembling the complete unit axial thrust/float adjusted and recorded.

Journal bearing clearance suction side 0.0065" and discharge side 0.0075" with new journal bearing pads. Final Axial Thrust = 0.0165" Run out of thrust disc. 0.000" to -0.00075" (minus)

H.P. CASE

Prior to removal of HP Compressor unit from bed plates, equipment alignment between LP - HP, HP - LP, Axial distance, shim thickness under each bed plate bolts etc. measured and recorded.

Compressor unit dismantled and thoroughly cleaned. Rotor assembly shaft sleeves, impeller eyes observed to have deep markings. Rotor shaft coupling ends scored during coupling removal and had corrosion pitting. Coupling oil was like black thick sludge. Wear and defects were observed as similar to LP Compressor.

LIST OF IMPORTANT SPARES REPLACED IN OVERHAULING HP COMPRESSOR

- 1) Rotor assembly complete unit duly balanced with coupling nut, locknut washer spacer etc.

----- Ammonia (Mechanical) -----
 Job Code Job Description

- 2) Labyrinth sets for complete rotor assembly shaft sleeves, impeller eyes, gas seal, balancing piston etc.
- 3) Coupling assembly duly balanced with spool piece and coupling bolts. Coupling guard assembly complete with gaskets.
- 4) Seals Assembly: Ring floating (inner), Ring floating (outer) Ring floating (middle), Housings for ring floating, labyrinths, set of (O) Rings, dowel pins etc.
- 5) Bearing Assembly: Thrust Bearings (in board), thrust bearing (out r board), spacer, oil control rings, liners of journal bearing, journal bearings pads, set of 'O' rings etc.

ASSEMBLING HP UNIT

Prior to assembling HP Unit with new rotor assembly rotor run out and vibrations checked and recorded. New rotor assembly was put in the old thoroughly cleaned vane bundle assembly.

Labyrinth Pt No. 435-852-004 clearances measured and recorded. It was observed that some of the new labyrinths removed from manufacturer's pack condition found having oversize/under size bore, labyrinth having twist or warping effect as under:-

<u>Bore of Labyrinth</u>	<u>Remarks</u>
5.473"	Undersize by 0.003"
5.386"	Undersize by 0.078" - 0.080"
5.487"	Oversize by 0.007"
5.490"	Oversize by 0.010"
5.489"	Oversize by 0.009"
5.488"	Oversize by 0.008"
5.487"	Oversize by 0.007"

Average shaft dia is 5.468" and oversize is considered beyond the recommended limit. Totally seven sets are not serviceable.

Labyrinth larger dia (for impeller eye) Pt No. 424-358-001 has bore size as

Ammonia (Mechanical)

 Job Code Job Description

9.766" and 9.768" having clearance beyond recommended limit on impeller eye of dia 9.746". Two labyrinth not acceptable due to bore oversize and another two had twist of 1/16" when measured on plain glass sheet. Totally four set of labyrinth Pt No. 424-358-001 are not serviceable.

Labyrinth Pt No. 424-358-003 one set is not serviceable due to bore under size. Rotor shaft sleeve OD-10.375", Bore of labyrinth 10.367".

Rotor assembly positioned in vane bundle, maximum axial free movement found to be 0.295". When impeller centres matched with discharge port of vane bundle, it was observed that 3, 7 and 8 stage impeller eye's labyrinths were just in contact of respective impeller's eye edge; so rotor assembly shifted 0.025" toward the suction end. While reassembling unit in future, ensure that rotor assembly position should not be less than 0.100" from suction.

JOURNAL BEARING CLEARANCE:

Suction end 0.0065"

Discharge end 0.0065"

Final Axial thrust/float 0.0165" and runout of thrust disc. \pm 0.000". Prior to install thrust disc and thrust bearing, spacer ring width reduced to 0.635" for setting the axial thrust/float within recommended limit.

Assembling both LP and HP Units only new/nondeteriorated 'O' rings, gasket were used. 'O' ring should be soft, and elastic for better performance of seal oils and bearings.

103 JAT TO 103 JLP, ALIGNMENT

Axial distance between two shaft coupling face set 17.500".

Both setting alignment adjustment tools were supplied by M/S Clark Aircraft.

Previously turbine 103JAT Rotor axis was in lower position recently suggested readings are positioning shaft axis of 103JLP in

Ammonia (Mechanical)

Job Code: Job Description

lower position. Discussing this matter with service representative Mr R. Ikin it was learnt that in normal operating condition, thermal expansion of LP casing will compensate the difference and LP Compressor shaft shall retain perfectly horizontal position without any misaligning with 103JAT.

Used stainless steel shims only. On tightening of suct. and discharge pipe flanges, lowering of shaft observed to be 0.001".

103JLP TO 103JHP ALIGNMENT

Axial distance between two coupling faces adjusted as 18.000" and thrust disc run out ± 0.0005 ".

Used stainless shims only, on tightening suction, discharge and recycle gas pipe flange bolts lowering in HP shaft axis observed to be 0.0012".

Job Code Job Description

LABYRINTH CLEARANCE - 103JBT

	0.006"	BOTTOM-F	0.006"
	0.008"	TOP-E	0.006"
	0.007"		0.006"
	0.006"		0.005"
	0.009"		0.006"
	0.007"		0.006"
	0.008"		0.006"
	0.006"		0.007"
	0.007"		0.008"
	0.006"		0.005"
		II WHEEL	
	0.007"		0.009"
	0.005"		0.006"
	0.009"		0.007"
Recommended clearance	0.007"		0.005"
		I WHEEL	
Bottoms-F-	0.013"-0.019"	0.008"	0.009"
Top-E	0.007"		0.008"
0.010"-0.022"	0.007"		0.007"
	0.008"		0.009"
	0.007"		0.009"
	0.007"	BOTTOM	0.007"
	0.008"		0.008"
	0.009"		0.006"
	0.007"		0.007"
	0.008"		0.007"
	0.007"		0.006"
	0.007"		0.007"
	0.006"		0.007"
		BEARING	0.011"

AXIAL THRUST
0.010"

COUPLING

103JBT
SIDE

Ammonia (Mechanical)

Job Code Job Description

LABYRINTH CLEARANCE 103JBT

0.008"	0.008"
0.006"	0.010"
0.007"	0.009"
0.006"	0.010"
0.006"	0.009"
	WHEEL-1H
0.006"	0.006"
	WHEEL-2H
0.011"	0.010"
	WHEEL-3H
0.011"	0.010"
	WHEEL-4H
0.010"	0.009"
	WHEEL-5H
0.010"	0.010"
	WHEEL-6H
0.011"	0.010"
	WHEEL-7H
0.007"	0.012"
0.007"	0.005"
0.008"	0.010"
0.009"	0.007"

a) AXIAL FLOAT
-0.500"

b) THRUST-0.009"

Recommended
Clearance
-0.013"-0.019"

Ammonia (Mechanical)

Job Code Job Description

103-JLPLABYRINTH CLEARANCESNEW ROTOR

Guide Vane No		OD	ID	Clearance	Recommended clearance
1	Small	4.874"	-	-	-
	Large	9.764"	9.764"	0.015"	0.012" - 0.016"
2	Small	5.375"	5.383"	0.008"	0.008" - 0.012"
	Large	9.750"	9.764"	0.014"	0.012" - 0.016"
3	Small	5.375"	5.387"	0.012"	0.008" - 0.012"
	Large	9.750"	9.763"	0.013"	0.012" - 0.016"
4	Small	5.375"	5.386"	0.011"	0.008" - 0.012"
	Large	9.750"	9.766"	0.016"	0.012" - 0.016"
5	Small	5.375"	5.386"	0.011"	0.008" - 0.012"
	Large	9.749"	9.764"	0.015"	0.012" - 0.016"
6	Small	5.375"	5.387"	0.012"	0.008" - 0.012"
	Large	9.750"	9.765"	0.015"	0.012" - 0.016"
7	Small	5.375"	5.387"	0.012"	0.008" - 0.012"
	Large	9.749"	9.767"	0.018"	0.012" - 0.016"
8	Small	5.375"	5.382"	0.007"	0.008" - 0.012"
	Large	9.749"	9.761"	0.012"	0.012" - 0.016"
9	Small	5.375"	5.383"	0.008"	0.008" - 0.012"
	Large	9.760"	9.760"	0.011"	0.012" - 0.016"
	Balance Drum	9.498"	9.510"	0.012"	0.010" - 0.014"

Ammonia (Mechanical)

Job Code Job Description

103-JHP

LABYRINTH CLEARANCENEW ROTOR

Guide Vane No		OD	ID	Clearance	Recommended Clearance
1	Small	5.625"	-	-	
	Large	9.746"	9.764"	0.018"	0.006" - 0.016"
2	Small	5.468"	5.479"	0.011"	0.008" - 0.012"
	Large	9.746"	9.758"	0.012"	0.008" - 0.016"
3	Small	5.466"	5.476"	0.010"	0.008" - 0.012"
	Large	9.7465"	9.762"	0.0155"	0.008" - 0.016"
4	Small	5.468"	5.475"	0.007"	0.008" - 0.012"
	Large	9.746"	9.761"	0.015"	0.008" - 0.016"
5	Small	5.468"	5.476"	0.008"	0.008" - 0.012"
	Large	9.7465"	9.765"	0.0185"	0.008" - 0.016"
6	Small	5.467"	5.475"	0.008"	0.008" - 0.012"
	Large	9.249"	9.263"	0.014"	0.008" - 0.016"
7	Small	5.467"	5.476"	0.009"	0.008" - 0.012"
	Large	9.247"	9.262"	0.015"	0.008" - 0.016"
8	Small	5.465"	5.478"	0.013"	0.008" - 0.012"
	Large	10.375"	10.387"	0.012"	0.012" - 0.016"
	Balance Drum	9.748"	9.766"	0.018"	0.015" - 0.016"

ID Indicates bore of labyrinth after fitting in
respective guide vane.

Ammonia (Mechanical)

Job Code Job Description

NEW OIL SEAL CLEARANCES 103JLP & 103JHP

Position	103JLP Suction Clearance	103JHP Discharge Clearance	Recommended
Labyrinth	0.010"	0.010"	0.008" to 0.010"
Inner seal	0.003"	0.003"	0.002" to 0.003"
Outer seal	0.007"	0.007"	0.006" to 0.007"

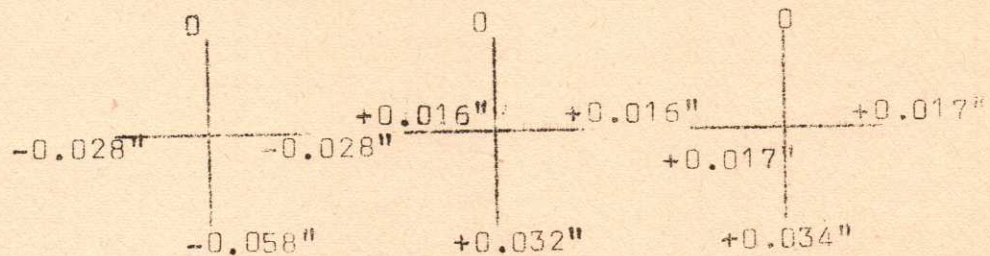
	103JLP Suction Clearance	103JHP Discharge Clearance	
Labyrinth	0.012"	0.012"	0.008" to 0.012"
Inner seal	0.002"	0.002"	0.002" to 0.003"
Middle seal	0.006"	0.006"	0.0056" to 0.0066"
Outer seal	0.005"	0.005"	0.004" to 0.0051"

Ammonia (Mechanical)

 Job Code Job Description

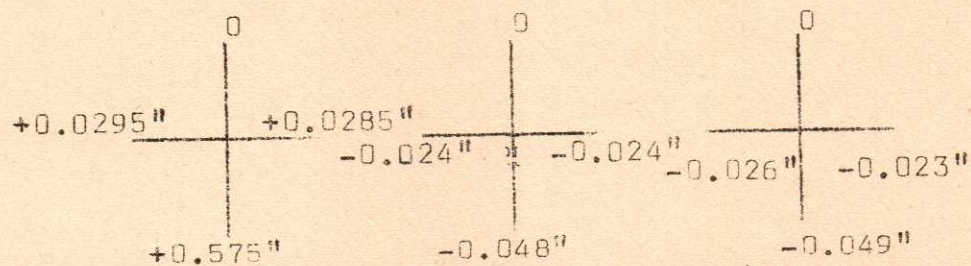
COLD SET ALIGNMENT READINGS BETWEEN 103JAT &
 103JLP

- (A) Bracket mounting on turbine, dial pointer on 103JLP, rotating both shafts together in clockwise looking towards turbine.



- i) As per 26.2-74 ii) As recommended by M/s Dresser Clark on 16.4.86 Telex iii) Final reading of cold set alignment 20.4.86 at 7.20 AM

- (B) Bracket mounting on 103JLP, dial point on turbine shaft rotating both shaft together clockwise and looking towards turbine.



- i) As per 26.2.74 ii) As recommended by M/s Dresser Clark on 16.4.86 Telex iii) Final reading of cold alignment 20.4.86 at 7.20 AM

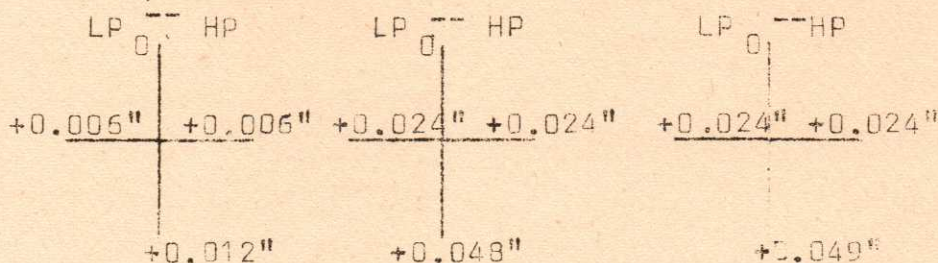
NOTE: Previously 103JAT Turbine axis was in lower position. Now compressor 103JLP Shaft is in lower position.

Ammonia (Mechanical)

Job Code Job Description

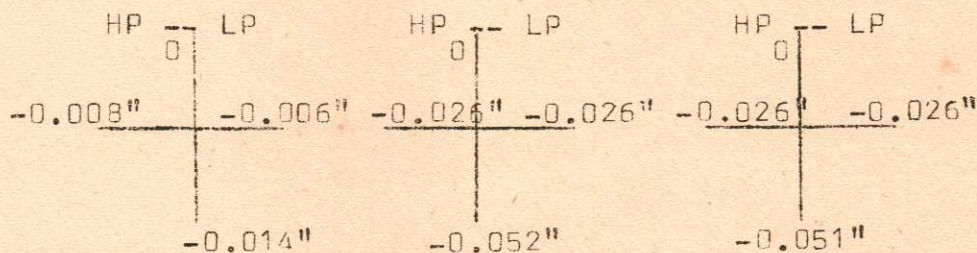
COLD SET ALIGNMENT BETWEEN 103JLP & 103JHP

- (A) Bracket on 103JLP coupling, dial point on 103JHP coupling, Rotating both shafts in clockwise direction looking towards turbine.



- i) As per 26.2.74 ii) Correct as suggested by M/s Clark Dresser iii) Actual readings of cold set alignment on 22.4.86 at 05.00 AM

- (B) Bracket on 103JHP coupling, dial on 103JLP coupling, rotating both shafts in clockwise direction looking towards turbine.



- i) As per 26.2.74 ii) Correct as suggested by M/s Clark Dresser iii) Actual readings of cold set alignment on 22.4.86 at 05.00 AM

Ammonia (Mechanical)

 Job Code Job Description

06 TURBINE FOR LUB OIL AND SEAL OIL PUMP
FOR 103-J

Turbine was decoupled from lube oil and seal oil pumps after checking alignment reading. Turbine was found down by 0.020" radially. After removing top casing half, rotor was lifted and taken to maintenance room along with governor assembly for dismantling, a conversion kit was issued consisting of following material:

- 1) Hydraulic governor assembly with : 1 No
 necessary linkages
- 2) Turbine shaft : 1 No
- 3) Worm and worm wheel : 1 No each
- 4) Worm wheel shaft : 1 No
- 5) Gov. side bearing bracket : 1 No
- 6) Ball bearing (SKF-6310) : 1 No
- 7) Spacer between turbine body to : 1 No
 governor side bearing bracket
- 8) Governor base : 1 No
- 9) Spacer between governor base : 1 No
 to bearing bracket
- 10) Necessary fastening devices : 1 Set
 i.e. screws and bolts

Complete rotor assembly was dismantled, after thorough cleaning of parts, rotor wheels were assembled with new shaft. Inside diameter of worm gear was found loose on shaft which was machined to required size after remetalising. Rotor was assembled with new bearings and carbon rings with dia clearance of 0.003" to 0.004".

There was mismatch found between spacer plate and bearing bracket holes whereas holes of governor base plate and spacer plate were matching. So holes in bearing bracket was redrilled according to PCD on spacer plate. After rectification Hydraulic governor was fixed in its position. Complete assembly shifted.

Ammonia (Mechanical)

 Job Code Job Description

to site and fixed in position. Due to change in Governor position, steam inlet line was slightly modified.

Trial run was taken, found turbine speed was not increasing more than 1800 rpm. It was noticed that steam was passing badly from pilot valve of overspeed trip assembly. Pilot valve assembly was removed and new assembly was fitted. in position as valve seat in old pilot valve found damaged.

Coupled seal oil and lube oil pumps with turbine and checked for over speed trip, it was tripped at 3550 rpm.

11

REFRIGERATION COMPRESSOR TRAIN 105J

Refrigeration Compressor and its drive turbine is designed and supplied by M/s De-Laval U.S.A. During shutdown following major jobs were carried out in presence of M/s De-Laval U.S.A. field service engineer Mr John Postneik. Services of M/s Hindustan Brown Boveri were acquired to accomplish the work of overhauling.

01 105JT REFRIGERATION COMPRESSOR DRIVE
TURBINE

Turbine was completely dismantled and following jobs were carried out.

- i) Rotor was inspected found some silica deposition on last 3rd stages of rotor.
- ii) Overheating observed in 5th stage blades and on its shroud.
- iii) Rotor and diaphragms were removed and cleaned by sand blasting.
- iv) Erosion was observed at the place where moisture rings are tack welded with its diaphragms. Additional fastening of moisture ring with diaphragm by locking with cap screws was done on 5th, 6th and 7th diaphragms.

Ammonia (Mechanical)

 Job Code Job Description

- v) Complete set of labyrinth seal rings were replaced by new one.
- vi) All cleaned diaphragm and rotor was fixed in position. Checked journal bearing and labyrinth clearances found within acceptable limit.
- vii) Boxed up top casing.
- viii) Inspected TTV by opening end cover, disc and steam strainer found okay. All sliding parts were well lubricated. Boxed up the same.
- ix) Checked nozzle valve, found valve bar was not parallel to the chest cover surface. Same was made parallel by adjusting spindle nut. Also checked the lift of power piston found okay.
- x) All oil lines were flushed by putting fine mesh in main lube oil inlet flange, governor oil inlet flange and governor oil outlet flange.
- xi) Finally cold alignment was checked.

02 INSPECTION OF SPEED INCREASE

Gear Box was opened out and checked gear and pinion teeth for any damage, Found okay. Checked bearing and its journal portion on all the four bearings. Found high spots on Gear shaft bearings. Bedding was done and checked by applying blue.

Assembled the same, checked clearances and end float.

CLEARANCES

- i) Gear Shaft
 - a) Journal bearing L.P. Case side: 0.017"
 - b) Journal bearing H.P. Case side: 0.017"
- ii) Pinion shaft
 - a) Journal bearing L.P. Case side: 0.014"
 - b) Journal bearing H.P. Case side: 0.014"
- iii) End play : 0.018"

Ammonia (Mechanical)

Job Code Job Description

LABYRINTH CLEARANCES 105-JT

	0.007"	-----	0.005"	
	0.009"	-----	0.006"	
	0.011"	-----	0.007"	
	0.012"	-----	0.010"	
	0.006"	-----	0.006"	
	0.006"	-----	0.004"	
		-----	WHEEL 1J	
	0.005"	-----	0.005"	
Reformer		-----	WHEEL 2J	
Side	0.007"	-----	0.004"	Silo
		-----	WHEEL 3J	side
	0.004"	-----	0.008"	
Recommended		-----	WHEEL 4J	
clearance	-0.013" - 0.019"	0.005"	0.005"	
		-----	WHEEL 5J	
	0.005"	-----	0.005"	
		-----	WHEEL 6J	
	0.006"	-----	0.005"	
		-----	WHEEL 7J	
	0.004"	-----	0.006"	
		-----	WHEEL 8AK	
	0.004"	-----	0.006"	
	0.005"	-----	0.005"	
		-----	WHEEL 8BK	
	0.005"	-----	0.005"	
	0.009"	-----	0.007"	
	0.008"	-----	0.005"	
a) TOTAL FLOAT	0.009"	-----	0.003"	
	-0.204"			
b) NOZZLE CLEARANCE		BEARING	0.010"	
	-0.060"	COUPLING		
c) AXIAL THRUST				
	-0.011"			

Ammonia (Mechanical)

Job Code Job Description

12 01 FEED WATER PUMP 104JA

Earlier rotor caused frequent inboard bearing failure due to high radial vibrations, journal portion of shaft was also worn out, so it was planned to replace complete rotor assembly. Following jobs were carried out.

- i) Decoupled the pump, dismantled journal and thrust bearings and removed coupling hub from rotor.
- ii) Pulled out rotor assembly from barrel and shifted to workshop for dismantling.
- iii) New rotor assembly was dismantled and checked shaft run out found 0.002" max at the centre.
- iv) Assembled impellers and rotors on new shaft and checked wearing ring clearances (0.023" to 0.024")
- v) Rotor assembly was inserted in the barrel, assembled journal bearings with new sleeves.
- vi) Assembled thrust bearing with new thrust collar. To reduce end play gasket thickness of end cover was increased to 0.020" from 0.012".
- vii) Coupled the pump after fixing coupling hub.
- viii) Cleaned filters and console was charged with fresh oil.

CLEARANCE:

- 1) Journal bearing clearance I.D.: 0.0065"
- 2) Journal bearing clearance O.B.: 0.0065"
- 3) Axial thrust : 0.019"

02 TURBINE DRIVE FOR FEED WATER PUMP 104JAT

Turbine was decoupled and both the journal bearings were inspected found in good condition. End play of rotor was found excessive checked thrust bearings and rubbing marks on thrust pads and wear and tear at pivot points of bearings of

Ammonia (Mechanical)

 Job Code Job Description

Complete thrust bearing assembly was replaced by new one, again checked end play found 0.013" coupled the turbine after cleaning of coupling teeth.

SPARES USED

Thrust bearing assembly

CLEARANCE

- 1) Journal bearing clearance I.B.: 0.006"
- 2) Journal bearing clearance O. B: 0.005"
- 3) Axial thrust : 0.013"

13

04 FEED WATER PUMP - 104J

Checked journal and thrust bearings found in good condition. Boxed up the same after taking diametrical clearances.

CLEARANCE:

- 1) Journal bearing clearance I.B. : 0.006"
- 2) Journal bearing clearance O.B. : 0.006"
- 3) Axial thrust : 0.024"

02 TURBINE DRIVE FOR FEED WATER PUMP 104JT

Bearings were checked found excessive clearance and journal portions of shaft were also worn out, so it was decided to replace complete rotor assembly by new one. Top casing half was removed and fixed new rotor assembly with new journal bearings and carbon packing rings after removing old rotor.

Fixed governor in position and checked turbine for over speed, tripped at 4200 rpm.

SPARES USED:

- 1) Complete rotor assembly : 1 No
- 2) Journal bearings : 2 Nos
- 3) Carbon packing rings : 1 Set

CLEARANCE

- 1) Journal bearing clearance: 0.006" to 0.007"

Ammonia (Mechanical)

 Job Code Job Description

14 01 TURBINE DRIVE FOR MEA CIRCULATION PUMP 107JAT

Checked both journal bearings found in good condition. Boxed up the same after checking diametrical clearance. Replaced governor bearing oil by fresh oil.

Journal bearing clearance : 0.09"
 (for both journal bearings)

02 TURBINE DRIVE FOR MEA CIRCULATION PUMP 107JAT

Checked journal bearings found scoring on coupling side journal bearing and diametrical clearance was 0.010" (Recommended 0.004" - 0.006"). Replaced journal bearing by new one. Bearing towards governor side was found in good condition. Boxed up the same after checking diametrical clearance.

CLEARANCES

- 1) Journal bearing clearance I.B. : 0.005"
- 2) Journal bearing clearance O.B. : 0.006"
- 3) Axial thrust : 0.78"

15 Heat exchangers of ammonia plant were cleaned by high pressure water jet, hydrotested and boxed up after necessary tube plugging/retubing wherever required.

Job of opening, removing of tube bundle to ground floor for cleaning, reinsertion of tube bundle in shell, boxing up and hydrotesting was given to M/s MAHAVIR ENGG. Cleaning of shell and tube bundle by hydrojetting was carried out by M/s USHA HYDRODYNAMICS LTD.

01 108Cs (4 Nos) MEA SOLUTION COOLERS

End covers of heat exchangers were opened and cleaned tube bundles. Shell side of each heat exchanger was hydrotested at 6 kg/cm².

02 109Cs MEA SOLUTION EXCHANGERS

Pulled out tube bundles from shells and cleaned shell and tube bundles of each exchanger. Hydrotested at 42 kg/cm². Found okay.

----- Ammonia (Mechanical) -----	
Job Code	Job Description
03	<u>106C SHIFT EFFLUENT FEED WATER HEATER</u> End covers were opened and cleaned the tube bundle by hydrojetting. Hydrotested at 60 kg/cm ² found no leakage.
04	<u>115C METHANATOR EFFLUENT COOLER</u> Opened end covers and cleaned tube bundle. Hydrotested at 12 kg/cm ² found no tube leakage.
05	<u>116C SYN GAS COMPRESSOR INTERSTAGE COOLER</u> Opened end covers and cleaned shell and tube bundle. Hydrotested at 10 kg/cm ² . Four leaky tubes were plugged.
06	<u>124C SYN GAS COMPRESSOR AFTER COOLER</u> Tube bundle was pulled out of shell and cleaned. Shell side was hydrotested at 12 kg/cm ² found no tube leakage.
07	<u>127-CA/CB REFRIGERANT CONDENSER</u> Opened the end covers and cleaned the tubes. Shell was hydrotested at 28 kg/cm ² . One leaky tube was plugged in 127CA.
08	<u>136C SYN GAS METHANATOR FEED EXCHANGER</u> End covers were opened and cleaned tube bundle. 83 Nos of plugged tubes of bottom three rows were retubed and hydrotested at 45 kg/cm ² found okay.
09	<u>151C FUEL PREHEAT EXCHANGER</u> Opened end covers, cleaned tubes and boxed up after hydrotesting on shell side.
10	Covers of following coolers were opened and boxed up after cleaning with new gaskets wherever required.
105-CA	CO ₂ Stripper gas exchanger
110CA/CB	Stripper condenser
1013C A/B	Surface condenser
113C	MEA Vaporiser
129C	SYN GAS Compressor interstage cooler
129JC	Air Compressor interstage cooler-1
130JC	Air Compressor interstage cooler-2

Job Code	Job Description
128C	Refrigerant compressor intercooler
173C	Stripped condensate cooler
175C	MEA solution cooler
101JLC	Lube oil cooler of Air Compressor
101JCC	Air Compressor gland condenser
101BJ	I.D. Fan lube oil cooler
102JLC	N.G. Compressor lube oil cooler
103C	Primary shift effluent Waste Heat Exchanger

16 Following relief valves were removed, overhauled and installed in their respective positions after testing at required pressures.

- | | |
|-----------|----------|
| RV-102-C | RV-112-F |
| RV-107-FI | RV-5-7 |
| RV-107-62 | RV-101-D |
| RV-110-F1 | RV-102-D |
| RV-110-F2 | RV-MS-9 |
| RV-111-F | |

All three RV's of 101-F were lapped in position. Popping of steam system RV's done as below:

	Lifted (kg/cm ²)	Reset (kg/cm ²)
1) 101-F Middle RV	118.5	111.9
2) 101F North RV	117.0	108.0
3) 101F South RV	115.0	109.5
4) Super heater RV	115.5	103.5
5) MS header RV	41	40.5

17 VALVE REPLACEMENT

- 01 FRC-2 CONTROL VALVE V/S BLOCK VALVE
Valve was passing badly. Replaced by new one.
PACIFIC: 12"Ø . 400 # butt weld ends.
- 02 103 JAT DISCHARGE LINE ISOLATION VALVE
Valve was passing badly, replaced the same by new one.
PACIFIC: 12"Ø 400 # butt weld ends.
(both jobs were carried out by M/s Randhawa Construction Company)
- 03 3 kg/cm³ CHAIN DRIVE VALVE TO MEA REBOILERS
Replaced valve by new one of 14"Ø 150 # rating large end. Job was done departmentally.

Ammonia (Mechanical)

Job Code Job Description

04 SP-71 MOTOR OPERATED VALVE
Valve was passing badly. Spare valve was tested pneumatically found passing at 150 psi. Valve was dismantled found under cut at seat portion. It was decided to put existing valve after lapping. Disc was lapped and tested found okay. Size: 6"Ø 300 # flange ends

05 107JA MEA PUMP DISCHARGE VALVE
Valve was passing. Replaced the same by new one. Job was done departmentally. SIZE: 14"Ø 300 # flange ends.

06 101-E GAS INLET VALVE
Valve was hard to operate. Replaced by new one departmentally. SIZE: 14"Ø 300 # flange ends.

07 VENT VALVE (V-5-611) INLET TO LTS
Valve was passing. Dismantled the valve found scoring on the valve disc. After lapping the disc assembled the valve end installed in position. Job was done departmentally. SIZE: 6"Ø 300 # rating.

18

INSULATION JOBS

- 01 Due to retubing of reformer complete new insulation of pigtails was carried out.
02 Insulation of outlet manifold header.
03 Insulation of all compressor turbines including steam piping.
04 Insulation of various condensate valves and piping.
05 Insulation of CO2 stripper 102 EA/FB.
06 Following Heat Exchangers/Vessels were reinsulated after removing old insulation.
103-C
113-C
105-C
136-C
109Cs (4 Nos)
101 CA/CB
101 F

Ammonia (Mechanical)

Job Code Job Description

19 BOILER INSPECTION

01 101-CA/CB PRIMARY WASTE HEAT EXCHANGER

The Boiler No GT-1632 was first hydrotested departmentally on 14.04.86. It was offered for inspection in presence of Chief Inspector of Boilers on 19.04.86 at 125 kg/cm² pressure. Visual inspection was done on 02.04.86.

02 112-C LOW TEMPERATURE SHIFT CONVERTER INLET BOILER

The Boiler No GT-1631 was hydrotested in presence of Chief Inspector of Boilers on 15.04.86 at 12.5 kg/cm² pressure. Earlier visual inspection by Chief Inspector of Boilers was done on 02.04.86.

20 PAINTING JOBS

The following painting jobs were done during shutdown by various painting contractors.

01 PRIMARY REFORMER

Radiant Box, Convection Section zones Auxillary Boiler, Primary Waste Heat Boiler etc.

02 I.D. FAN

I.D. Fan ducting, I.D. Fan and its chimney.

Painting job was also done on CO₂ Absorber, Start Up Heater, Converter, 102F and 103F.

REVAMP TURNAROUND 1986AMMONIA PLANTINSPECTION JOBS

<u>Job Code</u>	<u>Job Description</u>
1.0	<u>PRIMARY REFORMER 101-B</u> <u>(A) FEED INLET MANIFOLD</u> Thickness measurement of the inlet manifold in all the eight rows was carried out at various points. Visual inspection of inside was done and no pitting or corrosion was observed.
	<u>(B) PIG TAILS</u> The thickness measurement of the new pig tail coils (336 Nos) at and around four to five bend joints in each coil were done.
	<u>(C) HT CONVECTION ZONE COILS</u> Hardness as well as thickness measurement of the following coils in HT Zone was carried out. Found within limits <ul style="list-style-type: none"> i) Mixed feed preheating coil ii) Steam and air heating coil iii) Steam superheater coil
	<u>(D) LT CONVECTION ZONE COILS</u> Thickness measurement of following coils in LT zone was done. Found within limits <ul style="list-style-type: none"> i) Steam superheater coil ii) BFW Heater coil (middle one) iii) Feed preheater coil iv) New BFW Heater coil Hardness measurement was also done for (iii) and (iv)
	<u>(E) AUXILIARY BOILER TUBES</u> Thickness measurement on the tubes was carried out. Found within limits.
2.0	<u>101-CA/CB NEW TUBE BUNDLE</u> Thickness measurement of tube at various accessible points at random was done. <u>Radiography including capweld was carried out.</u>

Ammonia (Inspection)

 Job Code Job Description

3.0 VESSEL INSPECTION

Following vessels were opened and offered for inspection:

(A) 101-D DESULPHURISER

The overall internal condition of the shell and assembly was sound.

(B) 104-D HIGH TEMP SHIFT CONVERTOR

The shell in general was in good condition except uneven surface which it contains from the original fabrication stage.

(C) 102-EA CO₂ STRIPPER

The vessel was opened for visual inspection and wall thickness measurement, and found okay. The observations are as under:

- i) The support bolts of the distributor were loose. The support pipe was found broken.
- ii) All the four distributors supporting plates welding with shell were found cracked. The same was repaired and DP tested.
- iii) A few segments of the first top tray were found broken. The same were replaced by new ones. Also tightened loose bolts.
- iv) There was a leak in the inlet MEA line butt weld with sleeve. It was rectified by grinding and welding also air tested at 5 psi, found okay.
- v) The overall condition of the demister pad along with its support was found good.

(D) 102EB CO₂ STRIPPER

Internal visual inspection as well as the thickness measurement of the vessel was carried out, found okay. The observations are as under:

- i) Flange coupling bolts of MEA inlet line and distributor line found loose and tightened it after replacing gasket.

Job Code Job Description

- ii) All support plate welding joints checked by DP test and rectified by grinding and welding.
- iii) A leakage point was found in MEA line nozzle and sleeve joint by air test at 5 psi, which was repaired by grinding and welding, and it was dye checked and airtasted.
- iv) Tightened loose bolts.

(E) 101-E: CO2 ABSORBER

The vessel was opened for replacement of carbon steel trays with S.S. trays. It was inspected visually in all the portion of tray fixing area and measured wall thickness of the vessel. Found within available limits

4.0

PIPE LINES

(A) Magnetic particle test of following lines weld joints was carried out.

- i) 107-D to 103-D distance piece of pressure shell of transfer line - 2 Nos Butt joint.
- ii) 101-CA/CB to 102-C - 2 Nos of plugs fillet weld joint.
- iii) 103-D to 101-CA/CB - 2 Nos of plugs fillet weld joint each.

The fillet weld of pouring nozzle plug on water jacket shell was observed to have a surface crack of about 15 mm length. The crack was ground and rewelded and again checked with magnetic particle test.

(B) THICKNESS MEASUREMENT

- i) Steam letdown line 105 ata to 38 ata (Designed thickness - 21.41 mm measured - 189 mm)
- ii) MEA pipe line 102E to 109E
 - MEA - 12A - 12"
 - MEA - 11 - 14"
 - MEA - 10B - 12"
 - MEA - 12B - 12"
 - MEA - 10A - 12"

iii) PW-31-12", PW-30-14", PW-29-10"

Ammonia (Inspection)

Job Code	Job Description
	iv) PG-14-16" 102F to 106C (Designed - 12.7mm Measured - 9.5 mm)
	v) CO-6A-18" CO-61B-18" CO-7-24" 101 CA18 to CO2 knock out drum
	vi) PW-19-4"
	vii) PG-15-14" 102F to 101E
	viii) PW-20-6" 104E to 107J (Designed 10.97mm measured 8.2 mm)
	ix) PG-13-6" PG-26-18", PG-12A-14" PG-12-B-14" (Reboilers to 106C)
	x) SG-35-12", SG-11-10", SG-6-12"
	xi) PW-1-6", PW-4-2½", PW-17-4"
	xii) MEA-25-3", MEA-26A-2½", MEA-26B-2½"
	xiii) MEA-2-12", MEA-8-12", MEA-21-12" 107J to 101E
	xiv) PG-6-18", PG-18-12", PG-3-18"
	xv) SG-13-12", SG-33-14", SG-12-14"
	xvi) SG-18-18", SG-34-14", SG-21-14" SG2B-12", SG-25-8"
	xvii) SG-11-10", SG-42-4" (Designed - 8.55mm measured - 7.0 mm)
	xviii) MEA-1-12", MEA-2-4", MEA-3-14"
	xix) MEA-61-12", MEA-7-10", MEA-9B-8" MEA-9A-8",
	xx) SG-6-12", PG-11A-16", PG-11B-16", PG-21-26", PG-10-18"
	xxi) CO2 Stripper to Reboilers
	xxii) BO-10H-2", BO-11H-2", BO-12H-2", BO-13AH-2", BO-144-2"
	xxiii) CO-1-18", CO-16-20", CO-1B-18" and CO-17-20"
	xxiv) Thickness measurement at straight portion and pipe bends was carried out of 103JAT steaminlet valve by-pass line. (Thickness of above pipe lines found within allowable limits)

5.0

101-F STEAM DRUM

DP test of 37 Nos of approachable and accessible nozzles was carried out and found okay.

6.0

102-F RAW GAS SEPARATOR

Thickness measurement of shell courses, top and bottom dished end was carried out.

Ammonia (Inspection)

Job Code	Job Description
7.0	<u>10J-F CO₂ STRIPPLR REFLUSH DRUM</u> Thickness measurement at various points on shell courses as well as on top and bottom dished ends was done, found within limits.
8.0	<u>110-CA/CB CO₂ STRIPPER CONDENSER</u> Thickness measurement and visual inspection of the above coolers were done, found okay.

REVAMP TURNAROUND - 1986

AMMONIA PLANT

CIVIL JOB

Job Code	Job Description
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- | | |
|-----|--|
| 1.0 | <p><u>AUXILIARY BOILER</u></p> <p>Front wall refreractory was fixed departmentally as per the drawings. Flooring and side walls were also reconstructed during shutdown.</p> |
| 2.0 | <p>The castable refractory of hot well and convection zone was damaged. It is repaired with guniting departmentlly.</p> |
| 3.0 | <p>A.C. Corrugated sheets of primary reformer were removed for revamp jobs. Damaged sheets were replaced by new ones and fixed back after completion of jobs.</p> |

REVAMP TURNAROUND - 1986

AMMONIA PLANT

ELECTRICAL JOBS

Job Code Job Description

1.0 PREVENTIVE MAINTENANCE

Carried out preventive maintenance of all feeder compartments mounted on the following MCCs. Defective parts were replaced wherever required.

- i) MCC - 5
- ii) MCC - 5A
- iii) MCC - 5B

2.0 FOLLOWING MOTORS WERE OVERHAULED

102-L	121-JA	2002-LJ
108-J	104-JA	P1 (PGR)
108-JA	104-JB	P2 (PGR)
111-J	110-JA	C1 (Comp PGR)
120-J	112-J	Vacuum Blower
101-BJT	112-JA	
104-JTB	2001-LC	
170-JTA	2002-LL	

3.0 Carried out cleaning and maintenance of all lighting distribution boards.

4.0 In addition to above temporary flood lights, hand lamps with 24 Volt Transformers, switch boards, cables etc. were provided wherever required.

REVAMP TURNAROUND - 1986

AMMONIA PLANT

INSTRUMENT JOBS

Job Code	Job Description
1.0	Painting of complete instrument panel in control room was carried out.
2.0	Following taylor indicating/recording/controlling 90-J series instruments were cleaned and overhauled. FRC/FIC/FR - 1,2,3,5,13,18,15,16,18,32,35,40 PRC/PIC/PR - 2,4,5,9,12,13,18,19,23,25,28,35,68. TRC/TIC/TR - 10,11,12 PDR - 26, 27,34,35,36,37,101 LIC/LR - 1,4,70,88
3.0	Calibrated important receiver switches and panel mounted gauges.
4.0	Following trips and interlocks were cleaned FA - 81,82,84,89 LA - 104,129,141 P - 81 Tack pack etc.
5.0	Following field mounted controllers were overhauled and calibrated. PIC - 7,8,10,14,15,16,17,20,24,26,27,44 FIC - 7,8,9,10,11,12,14,19,102 THIC - 13 and 60 Level controls- 2,3,5,7,8,10,12,13,14,15,16,18,19,20,21,23,26,27,70,103J HP and LP
6.0	Following flow and pressure transmitters were checked and calibrated. FRC - 1,2,3,4,5 and 6 FIC - 7,8,9,10,11,12,13,14,15,16,17,18,19,102 FI - 2,46,49,50,51,62,63,64,65,98 FR - 95
	A-56

Ammonia (Instrument)

Job Code	Job Description
	PDRS - 26,34,35,36,37,27 pdia -53
	PRCa - 2,4,5,8,12,16,18, PIC-28,PR-35
	PIa - 62,80,81,82,83,84
7.0	Following electronic recorders were cleaned overhauled and calibrated.
	TR - 5,6,7,13,14,15,16
	VR - 1,2,34, PR - 1, ARC - 3, SR - 1, and SR - 105J
8.0	Calibration of complete panel monitoring instruments was carried out (Bently & Nevada Panel)
9.0	Checked all lube oil/seal oil difference pressure for alarm/aop and trips for 101J, 105J and 103 compressors
10	Primary Reformer Naphtha control valves from MIV - 24 to 32 were removed, checked their diaphragms, guard, stroke and put back after completion of revamping jobs.
11	All Primary Reformer bottom header thermowell assemblies were replaced by new one.
12	Thermowell assemblies of 103D Secondary Reformer for bed temperature and inlet and outlet were replaced by new one.
13	FRCV - 1,3,12 and 14 were opened out from bonnet for checking seat, plug etc. and assembled after overhauling and stroke checking.
14	PICV - 13 A/B and MICV-22 control valves were overhauled.
15	Diaphragms of FRCV-2, TRCV-10 and V3 were inspected.
16	LCV 13 was opened for inspection of seat and plug.
17	MICV-13 to 16, convertor inlet butterfly valves were checked for their performance.
18	Tunnel outlet thermowells were replaced by new one (9 Nos)
19	PRC-12, 103J-HP turbine controller/positioner lockout relay etc. complete system were checked thoroughly.

Job Code	Job Description	Ammonia (Instrument)
20	105J and 105J Bailly governor positioners were overhauled.	
21	Numbering of field junction box wiring was done properly by PVC Ferrules.	
22	101F EYE - HYE Electrode chamber assembly was replaced by new one.	
23	FRCV-2 valve plug and seat inspected plug was replaced by new one.	
24	Following PGR valves were opened for inspection overhauled and replaced spare parts wherever required. FIC - 100A/B, PIC - 137, LV-134, HIC-134 HIC - 109, PIC - 141, KV - 120, 9, 10, 11	
25	Following PGR valves were cleaned and checked for operation. KV - 120, 1, 2, 3, 4, 5, 6, 7, 8 PIC - 139, PIC - 178	
26	Following valves were opened for inspection overhauled and replaced spare parts wherever required. FIC - 13, 16, 17, 18 PIC - 14, 16, 71, 20, 28 PRC - 1, 2, 4, 18, 23, 25 LC - 2, 2A, 14, 23 V - 1, 2, 4, 5, 7, 15, 17, 2 TRC - 10, 11, 12 ARC - 3 Steam to air coil valve, MEA Pump 2 steam valve	
	Following valves were cleaned, checked the positioner and calibrated. FIC - 7, 8, 9, 11, 11, 15 LC - 16, 17, 19	

REVAMP TURNAROUND - 1986

AMMONIA PLANT

TECHNICAL JOBS

Job Code	Job Description
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1.0 CONDENSATE RECOVERY SYSTEM

Earlier steam condensate from relief valves in exhaust lines of steam turbines was being drained. With installation of this system all the condensate from RVs is collected and sent to cooling towers as a make up. Hence load on water treatment plant is reduced.

2.0 DEBOTTLENECKING OF AMMONIA STORAGE SYSTEM

Two inch (2") ammonia liquid line from urea plant to 109F of ammonia plant, is fabricated and installed. By providing this ammonia plant startup time is reduced.

3.0 6" \varnothing vapour line from Ammonia storage tank

to inlet of Refrigerant Compressor 105-J in Ammonia Plant is laid to reduce vapour load of storage tank. In shutdown a 6" \varnothing control valve is provided near Refrigerant Compressor 105-J in Ammonia Plant. This valve will prevent back flow of vapour in line from compressor or 112 F.

REVAMP TURNAROUND - 1986

UREA PLANT

MECHANICAL JOBS

Job Code	Job Description
1.0	CO ₂ CENTRIFUGAL COMPRESSOR K-1101/1 <u>OVERHAUL</u>

Compressor was overhauled departmentally. After opening following were observations:

- i) Moderate sealing like rust formation was found on top and bottom casing.
- ii) Deposition on rotor was comparatively less.
- iii) Condition of labyrinths, bearings and internals was found okay.

Assembly:

Rotor was thoroughly cleaned with high pressure water jet.

Both suction and discharge drain lines were dismantled for facilitating, cleaning of bottom casing.

Top and bottom casing with diffusers were cleaned with high pressure water jet.

Rotor was put in position and final assembly carried out.

For sealing, linseed oil was applied between top and bottom casing.

Spares consumed - NIL

Final Clearances:

- i) Journal bearing clearance inboard : 0.22 mm
- ii) Journal bearing clearance outboard : 0.22 mm
- iii) Total float without thrust bearing pads : 0.16"
- iv) Axial thrust : 0.014"

Overspeed Trip : 7200 RPM

LABYRINTH CLEARANCE (K-1101-1)

AFTER OPENING COVER
17.03.1986

DURING ASSEMBLY
OF THE COVER
22.03.1986

(0.20-0.30)	E	(0.20-0.25)
(0.10-0.14)	F	(0.10-0.90)
(0.12-0.60)	O	(0.20-0.50)
(0.10-0.50)	H	(0.20-0.35)
(0.10-0.80)	O	(0.30-0.50)
(0.13-0.25)	H	(0.25-0.30)
(0.13-0.45)	O	(0.30-0.45)
(0.10-0.30)	H	(0.20-0.40)
(0.18-0.50)	O	(0.30-0.50)
(0.18-0.40)	I	(0.20-0.50)
(0.16-0.68)	N	(0.35-0.70)
(0.15-0.40)	G	(0.25-0.50)
(0.28-0.65)	M	(0.35-0.55)
(0.20-0.55)	G	(0.30-0.60)
(0.50-0.52)	L	(0.50-0.95)
(0.50-0.27)	F	(0.10-0.30)
(0.25-0.30)	E	(0.20-0.35)

RECOMMENDED CLEARANCES:

E - 0.35-0.55	M - 1.00-1.30
F - 0.40-0.60	L - 1.10-1.40
O - 0.85-1.10	
H - 0.45-0.65	
I - 0.50-0.70	
N - 0.95-1.25	
G - 0.50-0.70	

2.0

TURBINE FOR CO₂ CENTRIFUGAL COMPRESSOR
Q-1101/1

Turbine overhauling was done by Hindustan Brown Boveri Ltd., Baroda

Following observations were made during overhauling:

Job Code Job Description

- i) Rotor condition was good having little silica deposition.
- ii) Condition of labyrinths and all other internals was found good.
- iii) Condition of LP and HP steam chest internals was found good.
- iv) Metal strip was found in LP chest which was a broken part of 4 ata steam strainer.

Following jobs were carried out

- i) Rotor was thoroughly cleaned by high pressure water jet.
- ii) LP and HP relay cylinder assemblies, control valve linkages were thoroughly cleaned and lubricated.
- iii) Quick shut off valve, starting device and complete control desk with linkages were thoroughly cleaned and overhauled.
- iv) Control valve stuffing box glands were repacked with alternate grafoil and graphited asbestos powder pressed packing rings.
- v) All oil lines were thoroughly cleaned and boxed up.

BEARING CLEARANCES

- i) Journal bearing clearance 0.8.- 0.22mm
- ii) Journal bearing clearance 1.8.- 0.21 to 0.22mm
- iii) Axial thrust - 0.014"

Job Code Job Description
 3.0 CO2 RECIPROCATING COMPRESSOR (PETER BROTHER HOOD)
 K-1101/2

01 First Stage Cylinder Replacement

Cylinder bore of existing one was found to have increased by about 1 mm in diameter. Hence it was decided to replace complete cylinder by new a modified one supplied by M/s PD England.

A new piston with piston rod fitted with wearing pads was assembled with new cylinder. Cylinder was levelled in range of 0.001" in 10" length, at head end side.

Final Clearances:

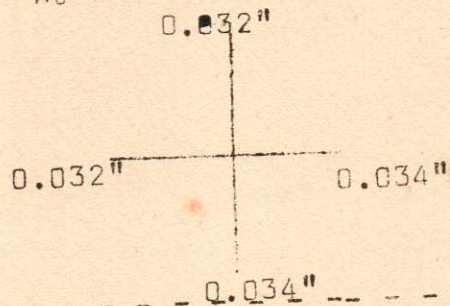
i) Cylinder bore at	TDC	539.77 mm ∅
	Middle	539.70 mm ∅
Vertical	BDC	539.70 mm ∅
	TDC	539.72 mm ∅
Horizontal	Middle	539.77 mm ∅
	BPC	539.73 mm ∅
ii) Piston diameter	TDC	538.39 mm ∅
	Middle	538.61 mm ∅
	BDC	538.00 mm ∅

Piston rod dia - 152.37 mm ∅
 Piston ring end gaps

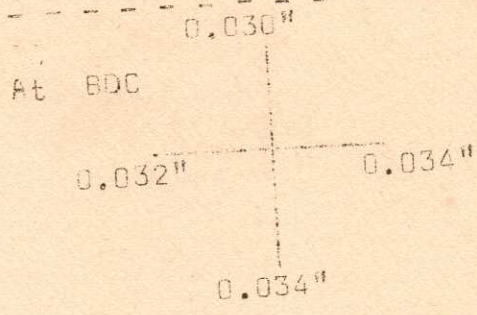
- 1st stage piston ring end gap
- 1) 0.100"
 - 2) 0.104"
 - 3) 0.107"
 - 4) 0.084"

iii) Clearance between piston and cylinder

At TDC & Middle
 0.032"



Job Code Job Description



Piston cone clearance
 at TDC - 1.20mm at top
 - 1.15mm at bottom
 at BDC - 1.50mm at top
 1.35mm at bottom

TDC - 4.32 mm
 BDC - 4.60 mm

iv) Crosshead clearance
 at TDC - 0.022" to 0.023"
 Middle - 0.022" to 0.024"
 BDC - 0.020" to 0.023"

v) Piston rod runout

	Vertical	Horizontal
TDC	0.000"	0.000"
Middle	0.000"	0.000"
BDC	0.0015"	0.000"

Spares Used:

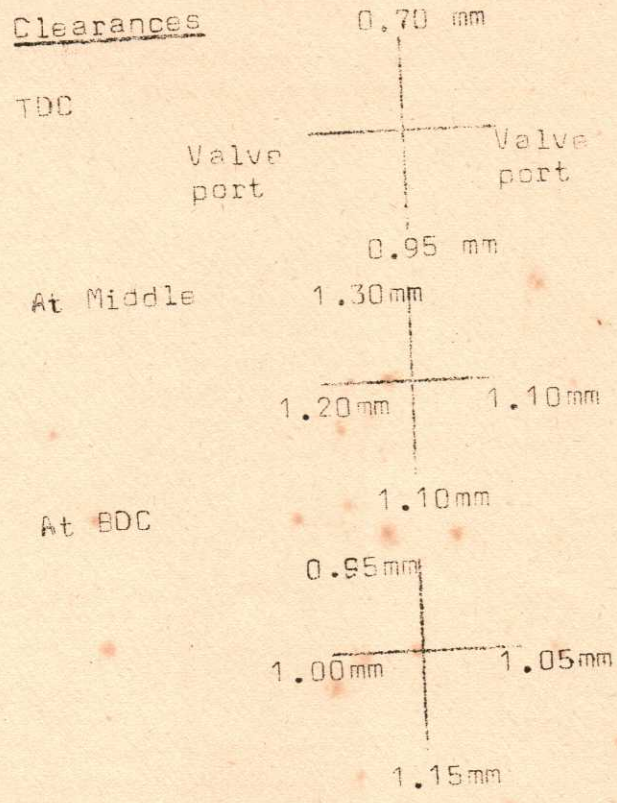
- i) Modified cylinder assembly : 1 No
- ii) Piston with piston rod, piston rings, wearing pads : 1 No
- iii) Gas packings : 1 Set
- iv) Wiper packings : 1 "
- v) Gas packing cups : 1 "

02 THIRD STAGE

Previous readings of piston rod runout indicated necessity of wear band replacement. New wear bands were assembled with old piston and machined to required size (247.10 mm). Same was assembled with new piston rings and gas packings.

Job Code Job Description

Clearances



Piston rod runout

	Vertical	Horizontal
TDC	0.005"	0.0025"
Middle	0.005"	0.0025"
BDC	0.000"	0.000"

Spares Used:

- i) Wear band : One set
- ii) Piston rings : Seven Nos
- iii) Gas packings : One set

03 LUBE OIL CONSOLE

Console and lube oil tank were cleaned thoroughly. Same Lub Oil duly centrifuged was changed back.

- Total oil quantity : 50 Drums Reused
- Prime - 57 : 10 Drums fresh oil

Urca (Mechanical)

 Job Code Job Description -----
 4.0 Q-1101/2 TURBINE FOR CO₂ RECIPROCATING
 COMPRESSOR OVERHAUL

Overhauling of turbine was done departmentally after opening the turbine. Following were the observations.

- i) Rotor condition was good and had little silica deposition.
- ii) Condition of labyrinths, bearings and internals was found okay.
- iii) Condition of steam chest internals was found okay.

Assembly:

Rotor was thoroughly cleaned manually.
 Relay cylinder assembly was overhauled.
 Quick shut off valve was overhauled.

Starting device and complete control disc with inter linkages cleaned and overhauled.

Control valve linkages and link pins were thoroughly cleaned and lubricated.

Control valve stuffing box glands were repacked with grafoil tape pressed packing rings made with suitable die.

All oil lines were thoroughly cleaned and boxed up.

Both journals bearings were replaced by new ones.

FINAL CLEARANCES:

Journal bearing clearance : 0.16 mm
 (Thrust side)

Journal bearing clearance : 0.16 mm
 (Coupling side)

Total axial thrust : 3.007"

OVER SPEED TRIP : 10,200 rpm

SPARES USED:

Journal bearings : 2 Nos

Job Code Job Description

LABYRINTH CLEARANCES

Control room side

0.15	0.20 oil seal ring
10.35	0.25-0.30
0.25-0.30	0.35
0.30	0.30 balance drum
0.25	0.30 wheel No.1
0.30	0.50-0.60
0.20	0.30
0.20-0.30	0.55-0.60
0.20-0.25	0.55
0.25-0.30	0.55-0.60
0.25	- -
0.25-0.30	0.55
0.30	- -
0.35	- -
0.30-0.35	0.55
0.30	- -
0.20-0.25	0.40-0.50
0.20-0.25	- -
0.20-0.25	0.40
0.10-0.20	- -
0.20-0.25	0.40-0.45
0.20	- -
0.25	- -
0.25-0.30	0.40-0.45 No.9

Job Code	Job Description
5.0	<p><u>BUCKET CHANGING MECHANISM (M-1401)</u></p> <p>It was very hard to rotate, an arrangement was made to lift the mechanism before shut-down..</p> <ol style="list-style-type: none"> i) Assembly was lifted and both bearings were thoroughly cleaned and lubricated. ii) Bucket lifting chains were thoroughly cleaned and lubricated. iii) Greasing point of top side bearing was extended and brought down to workable level. iv) Alignment of speed variator was checked/corrected.
6.0	<p><u>PRILL TOWER I.D. FANS (K-1401/1 to 4)</u></p> <p>Following jobs were carried out.</p> <ol style="list-style-type: none"> i) Cleaned fan blades with steam. ii) Removed bearing covers checked condition and boxed up with fresh grease. iii) Alignment of fan with motor was checked/rectified wherever required.
7.0	<p><u>PRILL TOWER SCRAPER (M-1402)</u></p> <p>Scraper assembly has never been overhauled since its installation, hence it was decided to carry out complete overhauling.</p> <p>Scraper blade assembly is in three parts. Middle portion weight 3.5 tonnes, side portion are bolted to middle portion. There is no provision to lift middle portion. Temporary structure of channels with monorial was fabricated to lift middle portion. Scraper blade assembly was dismantled and middle portion was lifted, it was shifted to nearby place with help of the arrangements made. Condition of gears and bearings was found okay. The same were cleaned and reassembled. Rubber seal to prevent urea dust entry into gear assembly was replaced by new one. Finally complete assembly of scraper was made and painted with epoxy paint.</p> <p>Spare used : Rubber seal - 1 No</p>
8.0	<p><u>HEAT EXCHANGER CLEANING</u></p> <p>01 Required end covers along with inter-connecting pipings of following coolers were dismantled and same were boxed up.</p>

Urea (Mechanical)

Job Code Job Description

after cleaning by high pressure water jetting with new gaskets wherever required.

(Job was carried out by M/s Usha Hydro Dynamics Ltd., New Delhi & M/s Randhawa Construction, Baroda).

- i) H-1421 Flash tank condenser
- ii) H-1423 1st stage evaporator/condenser
- iii) H-1425 (2nd stage evaporator/condenser)
- iv) H-1426 (2nd stage evaporator/2nd condenser)
- v) H-1114 (steam condenser)
- vi) H-1201 HP Stripper
- vii) H-1502 Vent condenser
- viii) H-1123 Crank case lube oil cooler of PB Compressor.
- ix) H-1113 Lube oil cooler of lube oil console.
- x) H-1204 Recirculation heater.

02 Following lube oil coolers were mechanically cleaned and boxed up.

- i) L.O. Coolers of carbamate pumps P-1201 A/B
- ii) L.O. Coolers of ammonia pumps P-1102 A/B.
- iii) L.O. Coolers of BHLL Turbine.
- iv) L.O. Coolers of GHH Compressor crank case.

2.0

VESSELS AND TANKS INSPECTION/REPAIR

- 01 V-1101 CO₂ KNOCKOUT DRUM
Opened man hole for inspection of demister and its internals. Demister condition was found good. Boxed up the same after complete inspection.
- 02 V-1111 INTER COOLER SEPARATOR OF K-1101/1
Opened manholes and boxed up the same after replacing demister assembly.
During D.P. test about 3" long crack was detected in discharge end nozzle

Urea(Mechanical)

Job Code Job Description

which was repaired by grinding and welding.

03 V-112 AFTER COOLER SEPARATOR OF K-1101/1

Denister assembly was replaced by new one.

One detective spot was repaired by grinding and welding.

Vacuous cracks were found in discharge end. Complete nozzle along with flange was replaced by new one.

04 V-1202 RECTIFYING COLUMN

Top dished end was having various cracks so it was decided to replace the same. Nozzle portion from damaged dish end was removed and welded with new fabricated dish end. Installed the same in position with new gasket.

05 V-1203 L.P. SCRUBBER

Top and bottom manholes were opened and removed rasching rings for inspection. Top rasching ring bed support was replaced by pre-fabricated one. Boxed up the same after inspection.

06 V-1502-23 ATA STEAM SEPARATOR

Manholes were opened and boxed up after inspection and ceaning of vessel.

07 V-1503-9 ATA STEAM SATURATOR

Opened manholes for inspection. A distributor made from 4" C.S. pipe was provided for distributing 23 ata steam condensate to avoid direct impingement on the shell.

08 V-1102 AMMONIA FILTER

Replaced filter cloth by new one.

09 V-1409 A/B UREA SOLUTION FILTER

Filter assembly was found damaged; same was replaced by new fabricated cage. Filter cloth was also changed.

10 H-1104 CO2 SPRAY COOLER

Manholes were opened. Rasching ring bed supports were removed for inspection.

Job Code Job Description

Two coats of epoxy paint was applied inside the vessel. Boxed up the same after inspection and cleaning.

After sand blasting outer surface of vessel was painted with two coats of polyurethane.

11 T-1501 STEAM CONDENSATE TANK
Manhole covers were opened for inspection and cleaning.

12 T-1301 NH₃ H₂O TANK
Opened manholes for inspection and cleaning. For some period MEA from Ammonia plant was stored in this tank for isolation purpose of strippers and CO₂ absorber as per Ammonia Plant requirement.

13 T-1401 UREA STORAGE TANK
Manholes were opened for general inspection and cleaning.

14 V-1423 FIRST EVAPORATOR SCRUBBER
Bottom most tray assembly was replaced by new fabricated one (S.S.-304). Other two sets of tray assemblies were inspected and reinforced wherever necessary. Demister pad was also adjusted with additional supports.

15 V-1501 4 ATA STEAM DRUM
BOILER INSPECTION
Open inspection was done on 02.04.86. After providing necessary blinds steam drum was hydro tested at 11 kg/cm² by Chief Inspector of Boilers on 15.04.86.

10

INSTALLATION OF NEW PLATE HEAT EXCHANGER

01 H-1301 DESORBER HEAT EXCHANGER
Existing 4 Nos (Shell and tube type) exchangers along with pipings were removed. New plate type heat exchanger supplied by M/s Vulcan Laval Ltd., Pune was installed in position. Required S.S. Piping along with by pass connection in process water side was fabricated and placed in position.

Job Code: Job Description

Hydrotest of new PHE including piping was carried out.
(Job was carried out by M/s Randhawa Construction Co Baroda)

02 H-1206 CCS I WATER COOLER

Existing coolers were removed and new plate heat exchanger weighing 4 ton installed in position. Required carbon steel piping along with necessary fittings were fabricated and placed in position. A 14" butterfly valve was provided in condensate inlet line and 16" size butterfly valve in cooling water inlet line. Suitable fittings were provided for temperature and pressure measurements. Fabricated strainer of about 1.2 m long was provided in inlet line. Finally Hydro-test was carried out at 12 kg/cm² along with pipings.
(Job was carried out by M/s Randhawa Construction Co Baroda)

11

RVs REPAIR/TESTING:

01 Following RVs were dismantled and assembled after overhauling. Testing was carried out at required pressures.

		Test Pressure
1)	RV-1201 A/B/C HP System	161.00 kg/cm ²
2)	RV-1202 A/B/C LP System	86 PSI
3)	RV-1203 X	8.5 kg/cm ²
	RV-1204 X Carbamate pumps	8.5 kg/cm ²
	RV-1205 X	161 kg/cm ²
	RV-1206 X	161 kg/cm ²
4)	RV-1504 9 ata Saturator	156 PSI
5)	RV-1102 Ammonia Suction Vessel	31 kg/cm ²
6)	RV-1108 X Cold Ammonia Line	31 kg/cm ²
7)	RV-1110 X	31 kg/cm ²
8)	RV-1501 X 4 ata steam drum	92 PSI
	RV-1502 X	92 PSI

02 Following NRV were opened and overhauled:

- i) CO₂ to HP Stripper (H-1201)

Urea (Mechanical)

 Job Code Job Description

- ii) NH₃ to HP Condenser (H-1202)
- iii) NH₃ to autoclave
- iv) Carbamate to HP Condenser
- v) Carbamate to HP Scrubber

12

Following high pressure vessels were opened for inspection and necessary repairs/modifications was done as suggested by Stamcarbon personnels. (Mr C. CLEVEN & Mr V.D. WIJNGAERT)

01 V-1201 AUTOCLAVE

Top cover was opened along with inter connecting pipes one segment of each tray assembly was removed to facilitate inspection.

Following defective spots were repaired by grinding and TIG welding using ther-manite electrode 19/15 H filler wire.

- (a) Compartment No.2 : 1 Clamp
- (b) Compartment No.3 : 5 Clamps
- (c) Compartment No.4 : 2 Clamps
- (d) Compartment No.7 : 4 Clamps
- (e) Compartment No.8 : 1 Clamp
- (f) Compartment No.10: 2 Clamps

One selective corroded spot to previous clamp location.

Top cover was boxed up after refixing tray segments by hydraulic tensioning device at 500 kg/cm² pressure.

A pair of flanges (S.S. 316L W.N. flange 4" ϕ 1500 lbs) was replaced on outlet off-gas line near top cover which were affected by corrosion.

Spares consumed

- i) S.S. 316L W.N. flange : 2 Nos
4" ϕ x 1500 lbs
- ii) Tray fixing bolts : 15 Nos
- iii) Top cover gasket of : 1 No
Aluminium

 Job Code Job Description

02 H-1201 H.P. STRIPPER

Top and bottom covers with inter connecting pipings were removed. Dummy tube sheet along with ferrules (2100 Nos) were removed. Corrosion was noticed on liquid inlet nozzle flange to HICV 1201. Sealing face was machined in position with help of porta tool machine. Flange matching with HICV 1201 inlet flange was machined in the workshop.

Defective weld seam of liquid dividing plate was repaired by grinding and welding by coated electrode (Thermonite 19/15H)

Differential pressure measurement of all the ferrules was carried out. A new false tube sheet made in our workshop was fixed in position after necessary grinding. Ferrules with new teflon seal rings were fixed in position prior to tube sheet assembly. Bottom cover was boxed up first for differential pressure testing of ferrules in position. Covers were tightened by hydraulic tensioning device at 500 kg/cm².

SPARES USED:

- | | |
|---------------------------|------------|
| i) Tie rods | : 25 Nos |
| ii) Ferrules | : 10 " |
| iii) False tube sheet | : 1 Set |
| iv) Teflon seal rings | : 2100 Nos |
| v) Top and bottom gaskets | : 2 Nos |

03 H-1202 H.P. CONDENSOR

Top and bottom covers were opened with inter connected pipings. Liquid distributor tray and baskets were removed. Top gasket seating face was affected by corrosion which was build up TIG welding (Thermanite 19/15H) and then machined in position with help of MTR machine.

Two pin holes were found which were repaired by grinding and welding. On probolog thickness measurement of tubes, 28 Nos tubes found having less than or equal to 1.9 mm thickness. It was suggested by Stamcarbon personnel

Urea (Mechanical)

Job Code Job Description

to plug all these tubes. Reason for such type of corrosion may be due to non-uniform distribution of liquid due to high gas velocities in that particular portion. Modification in distribution tray was done as suggested by Stamicarbon personnel. This was done by putting a 50 mm wide horizontal S.S.-316L ring of 1753 mm OD x 5 mm thick at 100 mm above liquid distribution tray, to break high gas velocities and thereby achieving uniform distribution of liquid to avoid starvation of tubes all around in that area. All 28 Nos tubes were drilled to a depth of 30 mm on top tube sheet with suitable drilling jig using \varnothing 25 mm drill bit. Suitable plugs made from 25:22:2 Cr, Ni, Mo were welded to plug these tubes.

Since drilling was not feasible on bottom tube sheet, bottom tubes were simply plugged without drilling (Electro-Thermanite 19/15H). Boxed up top and bottom covers with new gaskets by using hydraulic tensioning device at 500 kg/cm².

DRAWINGS ATTACHED

- i) 02 ES05039 Tube plugging details.
- ii) 02 ES04052 Tray modification.
- iii) Sketch showing tube plugged.

04 H-1203 H.P. SCRUBBER

The leak was observed through weep holes No.2 and No.3 of HP Scrubber on 04.03.86. Plant was shutdown to attend the same. For detection of leak it was required to enter into the shell. This required removal of the tube bundle which was possible only by lowering vertically downwards. This job was to be done for the first time. Fortunately, however, a scheme was available with sketches to meet such contingency. This scheme was primarily prepared for replacement of leaking three piece aluminium gasket by solid S.S. gasket and necessary chain blocks had been procured in 1982 and load bearing brackets etc. were designed and fabricated and were

Urea (Mechanical)

Job Code	Job Description
	<p>available at site. The same scheme was of great help with slight modification in guiding of the tube bundle downward etc. This has saved considerable time in deciding the method of removal of tube bundle as well as procurement of material. The scheme was duly approved by M/s Stemicarbon. This was necessary taking into account the height at which the vessel is mounted, the limitation of space available the nature of installation of the vessel and risk involved in such job to the personnel working at site as well as the tube bundle itself. The vessel is mounted at an approximate height of 72 m on top of urea prill tower. The job was done as described below.</p>

First of all top shell was removed and placed on wooden sleepers on top of prill tower floor, keeping partial load on chain pulley blocks. It was decided to lower tube bundle keeping shell in position. Necessary rigging arrangement was made for lowering tube bundle. Bottom channel cover bolts were loosened and tube bundle was lowered with help of 2 Nos 10 ton 15 meter travel chain blocks mounted on two trunions on the shell. For safety purpose 2 Nos 10 ton capacity chain blocks were also mounted on the top I-Beam structure, complete tube bundle was lowered carefully keeping following precautionary measures.

- i) 6 Nos guide pipes (2" NB Sch.40 C.S) were provided to check twisting of tube bundle.
- ii) Bottom guiding fixture was fixed on channel to prevent toppling of tube bundle.
- iii) For proper guiding of last baffle, guiding structure was made.

Urea (Mechanical)

 Job Code Job Description

- iv) Structural supports were provided on bottom of channel cover with existing structure for safety purpose. Lowering of tube bundle was started on 05.03.86 and completed on 12.03.86. (8 days Approx.)

LEAK DETECTION

For inspection inside shell a suitable cage was fabricated and following tests were carried out to detect leak.

- i) Visual Inspection: Visual inspection of liner with help of magnifying glass revealed quite large number of longitudinal cracks on middle liner segment longitudinal weld.
- ii) Dye Penetrant Test: Dye penetrant test of all vertical and circumferential weld joints was carried out, about 60 Nos. of cracks in middle liner vertical weld joint were observed.
- iii) Air and Soap Solution Test: Annular space between shell and liner was pressurised by 3 PSI air pressure and soap solution was applied on whole of liner. No leakage found.
- iv) Eddy current crack detection: Eddy current crack detector probe was scanned on liner. No defect was observed.
- v) Ammonia pressure test: Annular space between shell and liner was pressurised by ammonia gas to 300 mm of water and ammonia sensitive paper was applied on liner. Ammonia pressure was maintained for about 8 hours, and found no leakage. Test was repeated wherein annular space was pressurised to 3 PSI. Before the ammonia test, shell was heated to 150°C by electrical coil to dry out any moisture and carbamate entrapped and to facilitate opening of cracks. No leakage was observed.
- vi) Helium Test: Prior to helium test, shell was heated to a temperature up to 170°C and liner was tapped with mallet.

----- Area (Mechanical) -----

----- Job Code Job Description -----

- (a) Annular space was evacuated to about 10^{-5} mm of Hg, then helium was sprayed on the liner weld joint and at the random suspected area on the liner but no helium leakage through the liner, was sucked in the indicating leakage point.
- (b) Annular space between liner and shell after evacuation was pressurised by helium to 3 PSI. The welds and suspected areas were covered with adhesive tape and about 3 hrs. time was allowed before sniffing the helium accumulation if any with sniffer probe. But no helium leakage through liner was found. (Test was carried out by I.B.P. Company Ltd, Nasik)

vii) Flourescent D.P. Test

This test was carried out by M/s Industrial Marine and Oil Field Services, Bombay. No specific results were obtained by the above method.

The actual determination of leak

As advised by M/s Stamicarbon personnel chemical etching was done on top removed basket area with HCl (30%) 2 part; HNO_3 (65%) - 1 part and H_2O_2 (30%) - 1 part. The above D.P. Test revealed a number of \sphericalangle which were thus cracks visible.

viii) Ammonia Test:

The wrole of the liner and all the weld joints were cleaned with D.M. Water. Annular space between the shell and liner was pressurised by ammonia gas to 300 mm water gauge pressure after evacuating the annular space. Then ammonia sensitive papers were placed over all the weld joints. Following were the observations.

No leakage of ammonia was observed through the visible cracks in the liner below the basket weld area.

The leaky spots were revealed in the heat affected zone (one on either side) of middle verticle weld seam of liner.

----- Urea (Mechanical) -----
 Job Code Job Description

Leak Repair:

Following three major areas were repaired as per welding procedure given by Stamicarbon personnel.

- a) 2 Nos cracks actually detected by ammonia test near middle vertical seam were repaired by TIG welding using Thermanite 19/15 H filler wire.
- b) Middle vertical seam which was ground to a depth of 3.5 mm was repaired in 7 alternate sections each of 300 mm length by using preheated coated electrode of Thermanite 19/15H.
- c) A new patch plate of large size was fabricated from 5 mm thick S.S. 316 L material so as to cover existing suspected crack detected near basket area. A hole of 5 mm was drilled on the liner for leak detection purpose from new patch plate. The new patch plate along with basket was welded with liner by TIG welding using thermanite 19/15H. Filler wire.

FOLLOWING LEAK TESTS WERE CARRIED OUT AFTER REPAIR WORK

- i) Compressed air and soap solution test.
- ii) After providing necessary blinds, shell was pressurised upto 7 kg/cm² by compressed air and then further pre-pressurised by nitrogen upto 16 kg/cm². No leakage was observed.
- iii) No leak was observed at 70 kg/cm² during CO₂ passivation period.
- iv) Finally, vessel was taken in service without leakage at operating pressure 145 kg/cm².

REPAIR OF TOP DOME STACK MODIFICATION PLATE ASSEMBLY:

Stack modification plate assembly was found bent on downward side. The same was replaced by a newly, fabricated assembly from S.S.-316 L plate and new studs.

----- Urea(Mechanical) -----
Job Code Job Description

INSERTION OF TUBE BUNDLE INTO THE SHELL

Before inserting tube bundle, shell I.D. was checked by suitable fabricated gauges to ensure that baffles may not foul inside.

Tube bundle was successfully inserted and endless gasket wrapped with teflon tape was placed. Tightened both the covers with help of hydraulic tensioning device at 500 kg/cm².

RIGGING MATERIAL USED

- a) 10 tonne, 15 meter travel chain block with required slings 4 Nos
- b) 10 tonne, 10 meter travel chain blocks with required slings 2 "
- c) 5 tonne, 10 meter travel chain blocks with required slings 2 "
- d) Lifting brackets 4 "
- e) Tube sheet holding brackets 4 "
- f) Guide pipe 2" NB Sch 40 CS pipe, with connector 6 "
- g) Top guiding structure 1 No
- h) Bottom guiding structure 1 "
- i) Special guide at the time of final one meter portion of tube bundle insertion 4 Nos

<u>DRG NO</u>	<u>DESCRIPTION</u>
1) 02-BS-04049	Arrangement of tube bundle lifting HP Scrubber H-1203
2) 02-CS-04051	Location of crack detected/repaired.

13

VALVE REPAIR REPLACEMENT/STEAM LEAKS

Passing gate, globe, high pressure BEL valves of various sizes were replaced as per list furnished by production department. Valve gland leakages and various steam leaks were also attended. Steamtraps of 1/2" sizes were replaced by new one wherever required.

14

FABRICATION JOBS

- 01 REPLACEMENT OF 2ND SUCTION PIPE OF K-1101/1
S.S.-304 piping connecting V-1111

Job Code Job Description Urea (M. U. S. S. S.)

- out let to centrifugal compressor - -
2nd suction was kept prefabricated in 4 pieces. Flanges from old pipe lines were removed and reused for new piping.
- 02 4" ϕ 40SC, long distributor pipe with 4 rows of drilled holes of $\frac{1}{4}$ " ϕ was fabricated and installed in V-1503 9-ATA steam saturator for distribution of 23 ATA steam condensate.
- 03 Supports of following lines were repaired/strengthened.
 - i) 6 Nos guide supports of carbamate to H.P. Scrubber line.
 - ii) Off gas line from Autoclave V-1201 to H.P. Scrubber.
 - iii) C.C.S. II line to and from H.P. Scrubber.
 - iv) NH₃ line to H.P. Condensor.
- 04 4" ϕ 400 mm long flanged spool piece for ammonia pump P-1102 & discharge line was fabricated and fitted in position.
- 05 P-1501 suction line elbow replaced by new one C.S. 3" - 40 Sch L.R. 90° elbow.
- 06 4 ATA steam header 3" ϕ with 5 Nos. $\frac{3}{4}$ " tapping was provided on 1st floor.
- 07 Cooling water lines connecting to lube oil coolers of P-1201 A/B and P-1102/A were modified and fabricated.
- 08 Replaced 3" Sch 10 S.S. 304L Urea melt return line along with steam tracing lines.
- 09 Replaced 2.5 kg/cm² steam line for urea melt line 2" ϕ NB 40 Sch C.S. 85 meters (approx.)
- 10 Existing prill tower cowl G.I. Sheetting was found corroded at various places, to prevent further damage aluminium sheet of 20 gauge was riveted on vertical as well as on slanted positions.

Urea (Mechanical)

Job Code Job Description

- 15 PAINTING JOBS
 - 01 Red oxide primer was applied on vessels before insulation.
 - 02 All cooling water headers and branches were painted by green shade synthetic enamel.
 - 03 Ammonia pipings were painted with yellow shade synthetic enamel.
 - 04 Top structure on prill tower and H.P. Scrubber structure were painted with grey shade epoxy paint.
 - 05 Prill bucket room and its internal structures were painted with grey shade epoxy paint.

- 16 INSULATION JOBS
 - 01 Following exchangers/vessels were insulated after removing old insulations and covered with aluminium sheets. Top dome, bottom dome, trunnions and high pressure flanges were insulated with double layers of mineral wool blankets.

H-1201	V-1503
H-1202	V-1501
H-1203	V-1301
H-1204	V-1201
 - 02 Insulation on high pressure piping and other miscellaneous pipings were removed for maint. work and were reinsulated after completion of maintenance jobs.
 - 03 Following turbines were insulated with magnesium silicate.

Q-1101/1	Pignone turbine for centrifugal and
Q-1101/2	Siemens turbine for P.B. Compressor

REVAMP TURNAROUND - 1986UREA PLANTINSPECTION JOBS

Job Code Job Description

1.0 Following vessels and tanks were opened and inspected. Following parameters were checked.

- (a) Corrosion, erosion or pitting.
- (b) Weld joints (D.P. Test was carried out)
- (c) Thickness measurement.
- (d) Condition of internals i.e. demister pads, trays etc.
- (1) V-1101 - CO₂ knock out drum
- (2) V-1104 - CO₂ Spray cooler.
- (3) V-1202 - Rectifying column (top dish end replaced)
- (4) V-1421 - Flush tank separator
- (5) V-1502 - 23 ATA steam saturator drum
- (6) V-1503 - 9 ATA steam drum
- (7) V-1501 - 4 ATA steam drum
- (8) V-1111 - Inter stage separator
- (9) V-1122 - After cooler separator
- (10) T-1301 - Ammonia water tank
- (11) T-1401 - Urea solution tank
- (12) T-1501 - Condensate tank

2.0

NOTE: Thickness of above vessels found within limits
 Thickness measurement of following pipe lines was carried out and found within limits

- (1) PR-1219-8"
- (2) PR-1205-8"
- (3) GA-1201-6"
- (4) PR-1205-6"
- (5) PR-1206-6" } Designed : 6 mm
 } Measured : 4 mm
- (6) PR-1207-14"
- (7) PR-1215-16" } Designed : 4.57 mm
 } Measured : 3.7 mm
- (8) PR-1214-12"
- (9) PR-1201-8"
- (10) PR-1226-2"
- (11) GA-1203-1"

Area (Inspection)

Job Code	Job Description
----------	-----------------

- (12) GA-1202-4"
- (13) PR-1230-6"
- (14) PR-1202-10"
- (15) PR-1203-8"
- (16) PR-1204-8"
- (17) PR-1208-4" X Designed : 10 mm
- (18) PR-1212-4" Measured : 8.2 mm
- (19) MA-1201-3"
- (20) MA-1203-4"
- (21) MA-Disch line of D-1102 ACB
- (22) PR-1223-4"
- (23) GP-1122-6"
- (24) PR-1224-3"
- (25) PR-1225-3"

3.0

(26) Suction line of P-1152 ACB
 (Thickness found within allowable limits)
 Following high pressure vessels were inspected along with Stamicarbon personnel.

01 H-1203 H.P. SCRUBBER

Liner leakage of H.P. Scrubber through weep holes No.2,3 was noticed on 4.3.86. In order to detect leakage spot following tests were carried out.

- i) Visual inspection by magnifying glass.
- ii) Dye penetrant test
- iii) Air and soap solution test
- iv) Eddy current crack detection
- v) Ammonia pressure test
- vi) Helium leak test
- vii) Fluorescent dye-penetrant test
- viii) Ammonia retest.

Two leakage spots were revealed in the heat affected zone during ammonia retest. These two leakage spots were ground off up to 3 mm depth and repaired by tig welding. (THERMANITE -19-15H, 1.6 mm dia filler wire) Cracked area below basket filler welds were repaired by putting patch on which basket was welded.

----- Urea (Inspection) -----
 Job Code Job Description

After necessary repair following tests were carried out.

- i) Compressed air and soap solution test.
- ii) After reassembly of vessel shell was pressurised upto 7 kg/cm² by compressed air and then pressure was increased upto 6 kg/cm² by Nitrogen - No leakage through weep holes was noticed.
- iii) Finally vessel successfully with stood operating pressure (145 kg/cm²) without any leakage.

02 H-1202 H.P. CONDENSER

Top and bottom covers were opened and vessel was inspected along with stamcarbon personnel. Jobs carried out are listed below:

- (a) Suspected pin hole was ground off and welded and final D.P. Test was done.
- (b) D.P. Test of flange gasket seating area after repair work.
- (c) 58 tubes were inspected for minimum wall thickness over full length. Wall thickness of 28 tubes found equal or below 1.9 mm. All 28 tubes were plugged as suggested by Stamcarbon personnel.
- (d) D.P. Test of all plug welds of 28 Nos of tubes was carried out after first run and final weld.

03 H-1201 H.P. STRIPPER

Top and bottom manholes were opened. Visual inspection, probolog testing of tubes etc. were carried out by Stamcarbon personnel.

REVAMP TURBINE HALL - 1986UREA PLANTCIVIL JOBS

Job Code	Job Description
1.0	<p><u>SCRAPER FLOOR</u></p> <p>There was heavy leakage underneath the scraper floor slabs from top of slab. Repair was carried out as suggested by PDIL, 20 mm thick bitumatic lining over that 38 mm thick acid/alkali proof tiles lining with araldite jointing was provided.</p> <p>(CONTRACTOR - M/s CHEMISIGHT ENGINEERS, BARODA)</p>
2.0	<p><u>GROUND FLOOR</u></p> <p>Urea ground floor flooring was badly damaged and hence entire flooring was removed. New flooring is provided with mandana-stone with araldite jointing.</p> <p>(CONTRACTOR - HIREN CONSTRUCTION CO, AHMEDABAD)</p>
3.0	<p>Foundation for first stage discharge dampener of P.B. Compressor was broken and it is recast with R.C.C. providing extra reinforcement.</p>
4.0	<p>New R.C.C. foundations were cast for plate type heat exchangers H-1301 & H-1206 and old foundations were removed.</p>

REVAMP TURNAROUND - 1986UREA PLANTELECTRICAL JOBS

Job Code	Job Description
1.0	Carried out preventive maintenance of MCC-6
2.0	Following motors were overhauled
	P-1114/A P-1231/A M-1401/A K-1401/1
	P-1113/B P-1231/B M-1401/B K-1401/3
	P-1122 P-1232/A M-1201/1 K-1401/4
	P-1123 P-1232/B M-1402/2
	P-1124 P-1408 M-1419
	P-1132/B P-1505/B
3.0	Carried out cleaning and maintenance of all lighting distribution boards.
4.0	In addition to above temporary flood lights, hand lamps with 24 volt transformers, switch boards, cables etc. were provided wherever necessary.

REVAMP TURNAROUND - 1986UREA PLANTINSTRUMENTATION JOBS

Job Code	Job Description
1.0	<p><u>PANEL JOBS</u></p> <p>Following instruments were cleaned, overhauled and calibrated in control room panel and compressor panels.</p> <ul style="list-style-type: none"> (a) Taylor receivers, recorders and controllers. (b) E/P converters. (c) Servo trans (d) Temperature recorders. (e) Temperature indicators. (f) Receiver Switches. (g) Manual loaders. (h) Radiactive Relay and Radiac Relay (i) Receiver gauges (j) Air Header Regulators.
2.0	<p><u>FIELD JOBS</u></p> <p>Following field instruments were cleaned and calibrated.</p> <ul style="list-style-type: none"> (a) Level controllers. (b) 44CR Taylor controllers. (c) Flow Transmitters. (d) Level Transmitters. (e) Level pressure and temperature switches (f) Air regulators (i) Techometers (Pumps, Turbine and prill buckets). and all brooks Rotameters.
3.0	<p>Overhauling, checking of all control valves, positioners, Actuators, Auto manual switches, Hand jack assemblies and strok checking was done.</p>
4.0	<p>Checked and cleaned all Thermo couples covering head assembly etc.</p>

----- Urea (Instrumentation) -----

Job Code	Job Description
5.0	Checked old and new Battery charger.
6.0	Checked Autoclave Radioactive level instrument Tag No. LR1201 Model III and stripper level switch checked Tubes, preamplifier and Relay circuits and calibrated unit.
7.0	<p>Following control valves were checked and overhauled.</p> <p>(a) PICV-1129 - Replaced body, plug & seat</p> <p>(b) PICV-1129 - Replaced Plug & seat</p> <p>(c) FRC-1421 - Replaced plug & seat</p> <p>(d) FRCV-1201</p> <p>(e) FRC-1 - 1</p> <p>(f) FICV-1203</p> <p>(g) PICV-1130 - Passing arrested</p> <p>(h) HICV-1201 } Replaced plug & seat also</p> <p>(i) LRCV-1201 } provided stopper for over</p> <p style="margin-left: 10em;">travel on HICV-1201</p> <p>(j) HICV-1202 - Replaced plug & seat</p> <p>(r) PRCV-1201 - Replaced plug & seat</p> <p>(l) PICV-1201</p> <p>(m) PICV-1502 - A&B-Replaced plug & seat</p> <p>(n) LCV-1501</p> <p>(o) LCV-1502 A-Replaced plug & seat</p> <p>(p) PRCV-1202</p> <p>(q) HICV-1121</p> <p>(r) FRC-1-1</p> <p>(s) PICV-1202 - Replaced plug & seat</p> <p>(t) LCV-1201 - Replaced plug & seat</p> <p>(u) TRCV-1422</p> <p>(v) LLRCV-1421</p> <p>(w) HICV-1421 - Replaced plug & seat</p> <p>(x) MICV-1101 - Replaced plug & seat</p> <p>(y) HICV-1205</p> <p>(z) FICV-1102</p> <p>Also checked all butterfly valves and moscot valves.</p>

Job Code	Job Description
8.0	Checked all wiring and fixed new compressor panel trip relay box.
9.0	Checked trips wiring and fix new trip box for Ammonia Pump.
10	Checked following trip circuits (a) P.B. Compressor (b) GHH Compressor (c) Centrifugal Compressor (d) NH ₃ Pumps (e) Carbamate pumps (f) Prill divert valves
11	Checked and overhauled following solenoid valves. (a) FRC 1-1 Valve replaced (b) Carbamate pumps (c) Prill divert (d) New Blower (e) HCV 1102 (f) GHH Compressor & L.D. Cooler.
12	Installed new isolation valve for vacuume gauges on centrifugal compressor ejector system.
13	Flushed complete air header.
14	FS 1101 cleaned, checked and overhauled.
15	All high pressure thermowells were inspected and pressure tested.
16	Filled oil in FRC 1201 implusse line.
17	Cleaned, painted and inspected all pneumatic and electrical junction boxes.
18	Checked vibration monitoring system of all compressors.
19	Arrested leakage of PHCO - 1126 implusse line
20	Dressed compressor panel wiring

Work (Instrumentation)

Job Code	Job Description
21	Inspected and pressure tested transmitter drain pots of GHH Compressor.
22	Provided tubings for leak detection test of H.P. Scrubber liner.
23	Removed and reinstalled instruments connections of the following equipments to facilitate maintenance jobs. (a) Desorber shell modification job (b) Compressor and turbines instrument connections. (c) Auto-clave and stripper level transmitter dip tube etc. Radioactive source .
24	Replaced IB of carbamate pumps solenoid valves.
25	Provided new trip relays after testing on test stand on CPTRB AND MPTRB.
26	Installed new low range FIC-1204 in place of old meter after fabrication of distance piece etc.
27	Replaced mains of 110V 60 Amp isolation switch in Urea Plant.
28	Checked and cleaned L & T Annunciator power supplies.
29	Provided pressure indication of 40 ATA and Inst. Air Pressure on receiver gauge of main panel and put out.
30	Provided cable for Ammonia Pump trip switches up to battery room and 230V A/C supply for solenoid valve.
31	Made provision for trip by pass alarm and installation commissioning of new annunciator.
32	Provided catpots on vacuume instruments on surface condenser PI-1133, PHCO-1133 and PH-1133
33	Shifted location of Distac speed indicator of Q-1101/2.
34	Inspected and flushed PRC-1-1 impulse lines.
35	Fabricated new impulse line for PH-1144

----- Urea(Instrumentation) -----

Job Code Job Description

- 36 Overhauled Annunciator sirens.

- 37 Following jobs were done in Dry Ice Plant.
 - i) Cleaned panels.
 - ii) Checked trip circuits
 - iii) Calibrated pressure flow level and temp instruments
 - iv) Checked solenoid valves

REVAMP TURNAROUND - 1986

UREA PLANT

TECHNICAL JOBS

Job Code Job Description

1.0 V-1301 DESORPTION COLUMN MODIFICATION

As per obigined design, the number of trays were 15 (valve type). After modification valve type trays were replaced by sieve type trays and number of trays were increased from 15 to 20 Nos. Height of desorber column was increased by 1.5 meters and pipings were modified accordingly. This was done to improve effluent quality and to reduce steam consumption.

Hydrotest of vessel after modification along with pipings was carried out at 7.5kg/cm².

TRAY DETAILS

Top 5 trays: 6 mmØ, 1550 Nos Holes
Middle 5 trays; 6 mmØ, 1600 Nos Holes
Bottom 10 trays: 6 mmØ, 1850 Nos Holes

Tray material: ASTM 240, 304L
Shell material: ASTM 240, 304L

(Job was carried out by M/s SM Engineers, Ahmedabad)

2.0 V-1206 L.P. VENT SCRUBBER

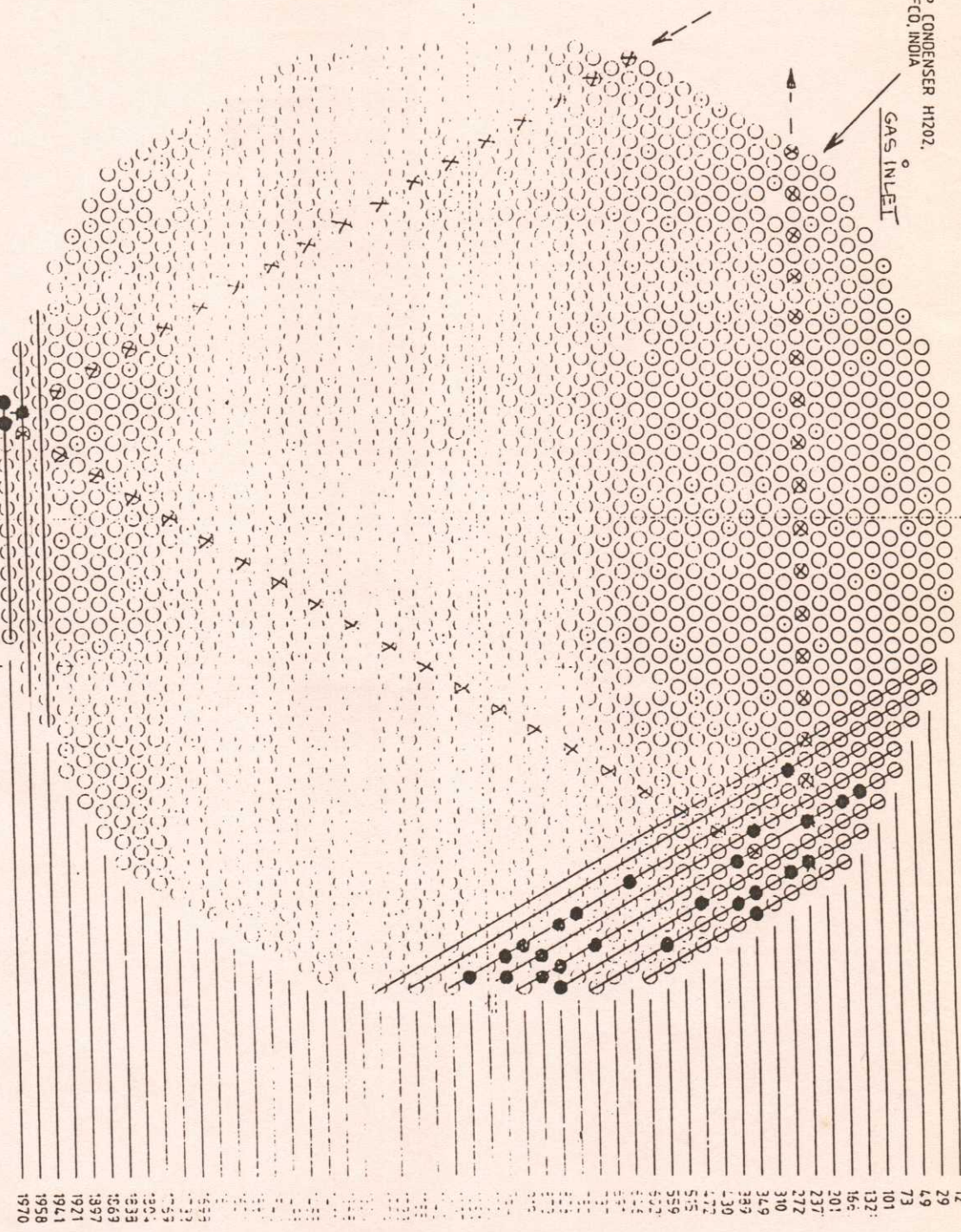
A new vent scrubber was intalled. Before its installation CO₂ gas and ammonia vapours of L.P. System were continuously vented in the atmosphere. After its installation ammonia vapours are being scrubbed with recirculating ammonia water for recovery of ammonia. Vessel was manufactured from ASTM - 240 304L material by M/s GMM Karamsad, and erected by M/s Randhawa Construction Co., Bombay

3.0 AMMONIA FLOW METER

Existing oval wheel flow meter goes out of order very frequently due to wear and tear of oval wheels. Hence it was decided to replace the same by turbine type flow meter having provisions of digital readings and to read flow in control room directly. All piping work was completed during shutdown. Flow meter and strainers are received and will be installed in available opportunity.

HP CONDENSER H1202.
IFFCO, INDIA

GAS INLET



- ⊗ - measured tubes with freq. 1 KHz
- ⊕ - measured tubes with freq. 10 KHz
- - wall thickness in top tubesheet area ≤ 1.9 mm (2.8)

enclosure 1

Specification No. HP Cond. H. 1202

Issued by: CHEMICAL BR. PLANT

Checked by: PIPPARADON

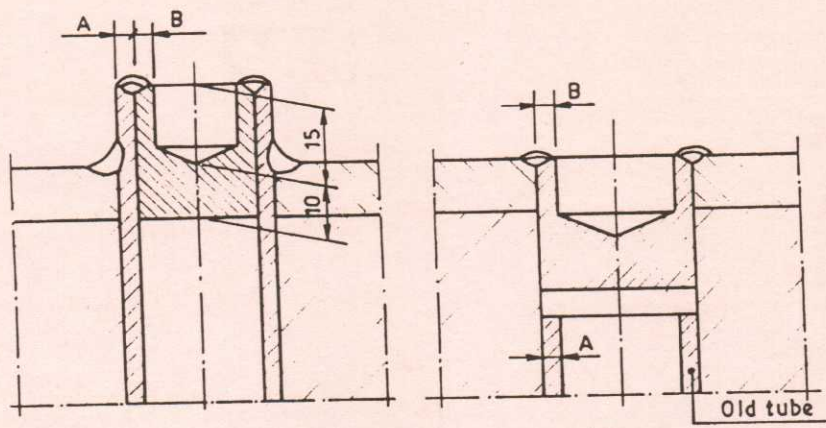
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Date: 10/10/70

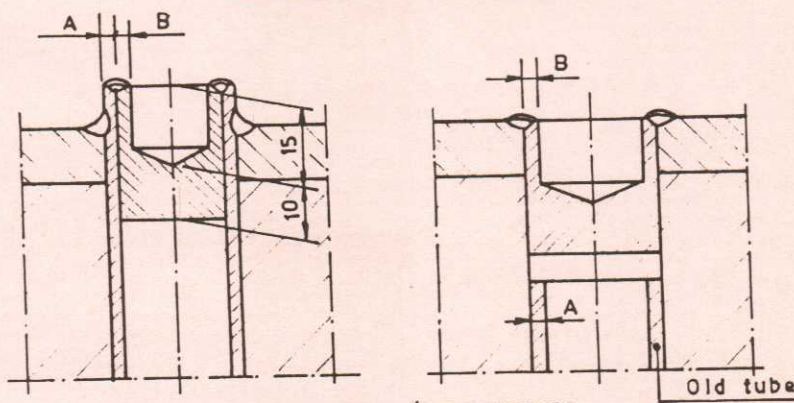
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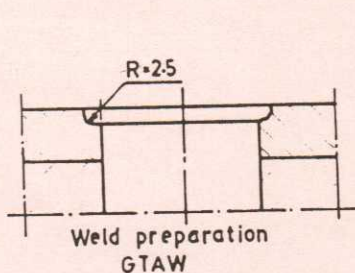
A equal to B
Dimensions in mm



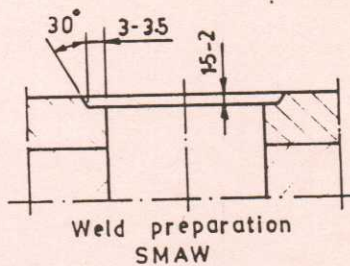
H.P. HEAT EXCHANGER



H.P. CONDENSER/SCRUBBER



Weld preparation
GTAW

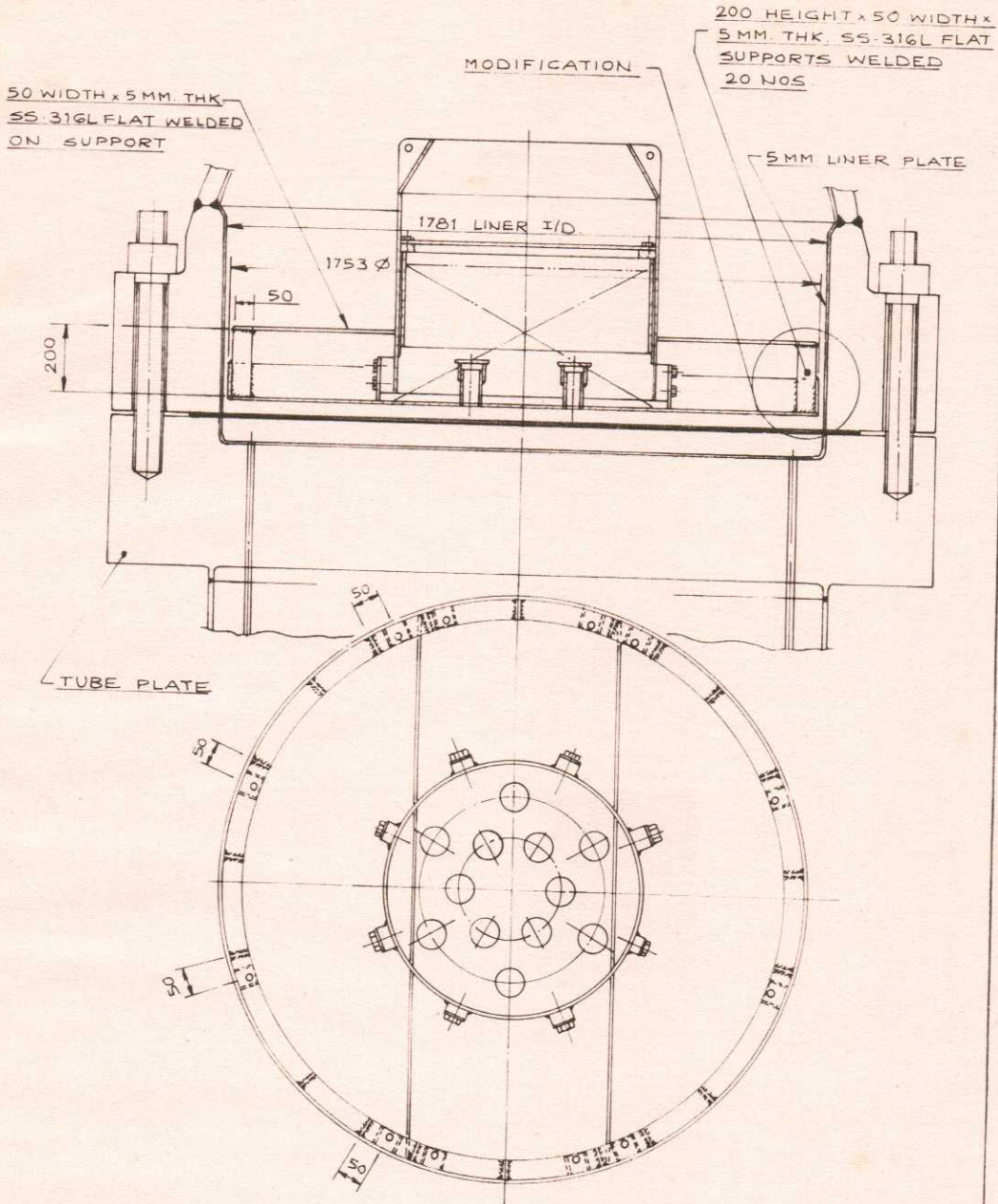


Weld preparation
SMAW

METHOD: 'A'

METHOD: 'B'

DRN	KAM	TITLE :- TUBE PLUGGING DETAILS FOR H.P.				EWR No.	
CHD		HEAT EXCHANGER/CONDENSER/SCRUBBER					
APD		DRAWING No.	PLANT	FORM	NUMBER		SHEET OF
SCALE	NTS		02	ES	05039		11
							REV 0



DRN.	KAM	TITLE:- MODIFICATION- APRIL '86 IN LIQUID DISTRI- - BUTOR SUGGESTED BY STAMICARBON - H-1202	EWR NO.-	
CHD.				
APD.		DRAWING NO.	PLANT FORM NUMBER	SHEET REV.
SCALE	N.T.S		02 ES 04052	1 OF 1

REVAMP TURNAROUND - 1986OFFSITES PLANTMECHANICAL JOBS

Job Code Job Description

.0 COOLING TOWER AREA

01 COOLING WATER PUMPS

OVER HAUL P-4401/A; P-4401/B; P-4402; P-4403

Following jobs were carried out.

- a) Decoupled the pump removed top casing and bearing covers.
- b) Lifted rotor assembly, cleaned rotor, top and bottom casing halves.
- c) On inspecting rotors it was found that all the impellers were affected by phenomenon of pitting. These were repaired by welding. One blade of P-4401/A rotor assembly was found broken so complete rotor assembly was replaced by a new one.
- d) Replaced worn out/damaged shaft sleeve wearing ring and lock nuts
- e) Pump rotors were placed in respective positions, top casing halves were tightened with gaskets of required thicknesses.
- f) Boxed up bearing covers, checked bearing clearances and axial floats.
- g) Aligned all the four pumps with prime movers and coupled the same.
- h) Repacked stuffing boxes with new gland packings.
- i) Provided gland cooling connections on all four pumps.

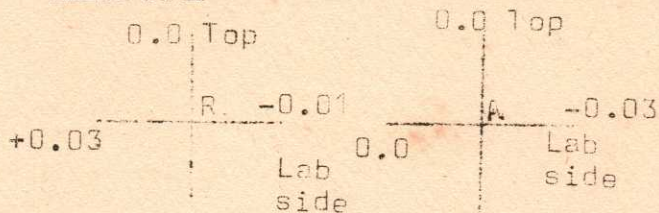
SPARES USED

- i) Complete rotor assembly : 1 No
- ii) Shaft sleeve : 6 Nos
- iii) Ball/thrust bearings : 2 Nos
- iv) Lantern ring : 1 No
- v) Gun metal valves for gland cooling line : 8 Nos
- vi) All casing studs were replaced by new ones :

Job Code Job Description

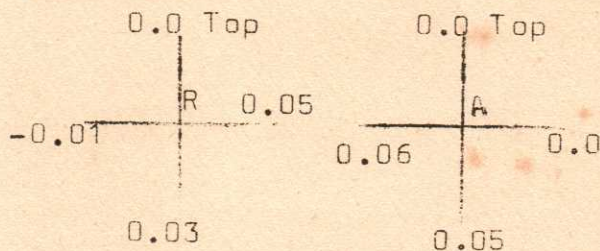
ALIGNMENT READINGS/BEARING CLEARANCES

(A) P-4401/A (All readings are in mm)



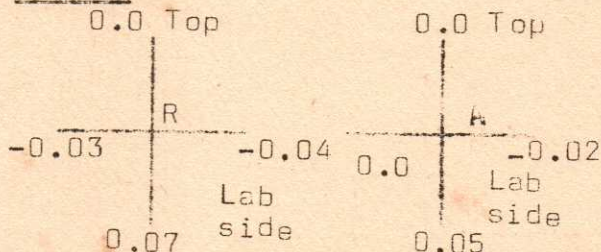
- a) Journal bearing clearance (coupling side) (in board) :0.010"
- b) Journal bearing clearance (out board) :0.008"
- c) Thrust :0.018"

(B) P-4401/B



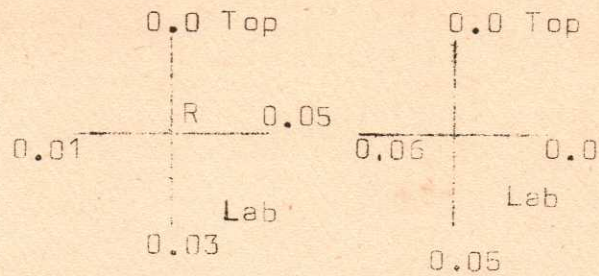
- a) Journal bearing clearance (in board) :0.010"
- b) Journal bearing clearance (out board) :0.009"
- c) Thrust :0.011"

(C) P-4402



- a) Journal bearing clearance (in board) :0.010"
- b) Journal bearing clearance (out board) :0.009"
- c) Thrust :0.011"

 Job Code Job Description

(D) P-4403

- a) Journal bearing clearance :0.011"
 (in board)
- b) Journal bearing clearance :0.010"
 (out board)
- c) Thrust :0.021"

NOTE: DIAL INDICATOR WAS MOUNTED
 ON PUMP IN ALL THE CASES.

02 COOLING WATER PUMP TURBINES

01 Q-4401/A, Q-4401/B

OVERHAUL

Both turbines were overhauled under a programme of pre-shutdown preventive maintenance and overhauling of same was completed before shutdown.

02 Q-4403 TURBINE FOR C.W. PUMP

OVERHAUL

Following jobs were carried out

- i) Turbine was decoupled and top casing was lifted after removing steam inlet line.
- ii) Removed rotor assembly and placed on stand. It was cleaned by sand blasting to remove soot deposits.
- iii) During inspection rotor was found unbalanced some material was ground off to balance the same.
- iv) After balancing rotor was placed in position. Boxed up the top casing after fixing new carbon sealing rings in position.
- v) Quick shut off valve, throttle valve and complete governor assembly was also overhauled

Offsites (Mechanical)

 Job Code Job Description

vi) Oil cooler was opened and boxed up
 the same after cleaning

SPARES USED

i) Carbon sealing ring : 14 Nos
 ii) Spring : 14 Nos
 iii) Gear box side coupling : 1 No

CLEARANCES:

i) Journal bearing Out board : 0.12 mm
 ii) Journal bearing in board : 0.15 mm
 iii) Carbon ring clearance
 steam inlet side

<u>Carbon Ring No</u>	<u>Clearance</u>
1,2	0.014"
3	0.012"
4	0.010"
5	0.008"
6,7	0.008"

Exhaust side

<u>Carbon Ring No</u>	<u>Clearance</u>
1,2	0.012"
3,4	0.010"
5	0.008"
6,7	0.006"

(Job was done by M/s Hindustan
 Brown Boverly Ltd., Baroda)

- 03 Following repair work was carried out
 by "PAHARPUR MARLEY" Staff on cooling
 towers (Urea & Ammonia)
- Repairing of drift eliminators.
 - Repaired damaged fills and fills
 grids.
 - Repaired/replaced damaged louvers.

04 COOLING TOWER FANS (UREA, AMMONIA)

- Blades of all cooling tower fans
 were cleaned to remove sludge etc.

Offsites (Mechanics)

 Job Code Job Description

- b) Replaced rusted bolts of fan blade clamps.
- c) Checked gear box internals, oil condition foundation bolts etc.
- d) Repaired fan cylinders which were fouling with fan blades.

05 VALVE REPAIR/REPLACEMENT AND REPAIR WORK

- 01 700 mm and 900 mm cooling water header isolation valves were opened and overhauled as these were passing in isolated condition.
- 02 Removed control valve of inlet line of Q-4403 and made direct connection
- 03 Butterfly valve of P-4402 line opened and checked.
- 04 Replaced bonnet gaskets of Taylor valves provided on steam inlet line to Q-4401A/B and Q-4403.
- 05 C.W. isolation valves to offsite from ammonia and urea were overhauled.
- 06 Repaired/replaced distribution valves of urea and ammonia cooling towers (22 Nos)
- 07 Replaced ammonia side hot water return line with new one.
- 08 Replaced damaged rubber expansion bellows.
- 09 Replaced multidoor check valve by 1050 HB sluice check valve of P-4402
- 10 Girders on cooling water sump and basin to support wood work were corroded. These were replaced with R.C.C. beams.
- 11 Replaced channel gates and screens in cooling water sumps. Previously there was no provision to isolate these pumps for carrying out maintenance jobs. After installation of these gates, it is possible to isolate each individual pump for maintenance jobs. (LG Gates were supplied by M/s JASH ENGINEERING)

Job Code Job Description

2.0

WATER TREATMENT PLANT01 CATION II & III ANION II & III

All the four vessels were relevelled for which Anion-V and Cation-V were taken as reference. Before lifting, these vessels were emptied out for rubber lining. Vessels were lifted one by one at each leg and metal shims of required thicknesses were placed below sole plates and finally all the plates tagged and grouted for stability.

- ii) Distributor nozzles changed in all the four units. Inlet nozzle of cations were removed and new fabricated nozzles were welded in position.
- iii) Rerubber lining of Cation II&III & Anion II&III

Following activities were carried out

- 01 Removal of headers and laterals
- 02 Removal of damaged rubber lining
- 03 Removal of damaged supports
- 04 Fixation of new supports
- 05 Grinding of welded places for rubber lining.
- 06 Sand blasting.
- 07 Applying solution and adhesive
- 08 New rubber lining.
- 09 Steam curing
- 10 Spark test and repair of damaged parts.
- 11 Lateral and nozzle fixation

CATION AREA : 115 m²
 ANION AREA : 87 m²

CATION WEIGHT : 11.45T
 ANION WEIGHT : 8.65T

Rubber used - NATURAL

Thickness : At nozzles and :3mm
 lateral supports

: Other areas :5mm

Defolios (Mechanical)

Job Code Job Description

(The work was assigned to M/s INDUSTRIAL LINING, BARODA for Cation II & III, and to M/s SIMPLEX RUBBER WORKS, A for Anion II & III.)

- 02 Replaced corroded raw water header by modified one.
- 03 Effluent trench in D.M. Plant was modified. Acid resistant bricks were used in place of old tiles. Coating was applied to prevent seepage which is mixture of araldite, Hardner and silica powder.
- 04 NaOH line and acid line to RMB and SMB rerouted.
- 05 Repaired/replaced old corroded pipes, Tee elbow, reducers, etc in D.M. Plant.
- 05 Old distributor nozzles of Cation II & III Anion II & III were changed with slit type nozzles (Mark V-Strainer)

3.0

STEAM GENERATION PLANT

- 01 F-5111 NEW BOILER (BHEL)
(HYDRO TESTING)
 - a) Provided necessary blinds to isolate boiler.
 - b) - Opened manholes of steam drum and mud drum and cleaned the same.
 - c) Furnace manhole cover was also opened for cleaning purpose.
 - d) Repaired damaged refractories.
 - e) Boiler was hydraulically tested by Chief Inspector of Boiler at pressure of 70.6 kg/cm² on 16.04.86.
 - f) Attended gland and steam leaks as per list provided by production department.
 - g) Manhole cover of deaerator was opened. Found all tray bolts in loose condition. Removed all the trays and refixed in position after cleaning. Welding was done on the plates.
- 02 Water level gauge glass of both the boilers were changed F-5101/A, F-5101/B.

REVAMP TURNAROUND - 1986OFFSITES PLANTINSPECTION JOBS

<u>Job Code</u>	<u>Job Description</u>
1.0	<u>INSPECTION JOB D.M. PLANT</u>
01	<u>CATION NO.2</u> Rerubber lining of vessel was carried out. After full curing, hardness of the rubber lining was measured and found to be 55 shore 'A'. Spark test was carried out and defective spots were repaired and rechecked for soundness.
02	<u>CATION NO.3</u> Rerubber lining was done, after full curing hardness checked found 55 shore 'A'. The spark test was also carried out and defective spots repaired and checked again found okay.
03	<u>ANION No.2</u> After rerubber lining hardness was checked found to be 75 to 80 shore 'A'. Spark test was carried out found acceptable.
04	<u>ANION NO.3</u> After rerubber lining hardness was checked found to be 77 to 80 Shore 'A'. Spark test was carried out, three spots were found defective. After repairing the same again spark test was carried out, no defect was observed.
2.0	<u>STEAM GENERATION PLANT</u>
01	<u>STEAM DRUM (F-5111 BHEL BOILER)</u> Steam drum was visually inspected following were the observations. i) Shell colour was brownish black. ii) There was no corrosion or pitting on feed water inlet pipe. iii) Fillet weld of separator was free from corrosion. iv) All inlet and outlet pipe fillet weld joints were free from pitting and corrosion.

----- Offsites (Inspection) -----
 Job Code Job Description

v) No pitting or corrosion on the shell.

02 MUD DRUM (F-5111 BHEL BOILER)

Visual inspection was carried out
 observations were as under:

- i) Drum was blackish brown in colour
- ii) Water wall tubes were checked from inside, found to be free from corrosion or pitting.
- iii) Outlet header pipe fillet weld was checked by D.P. Test and found okay.
- iv) Fillet weld of blow down line was checked by D.P. Test and found okay.
- v) Fillet weld of phosphate dosing line was checked by D.P. and found okay.
- vi) Welding inside shell was free from corrosion and pitting.
- vii) Internal wall of shell was free from pitting and rust.

3.0

Thickness measurement of followings were carried out. Found within allowable limits

- i) F-5101 B Mud drum
- ii) F-5101 B Steam drum
- iii) Acid Tank No.3 (Rubber lined)
- iv) F-5111 new boiler bank tubes

REVAMP TURNAROUND - 1986

OFFSITES PLANT

CIVIL JOBS

Job Code	Job Description
1.0	All volute chambers of cooling towers of ammonia and urea were repaired departmentally by providing new water proof plywood.
2.0	Flooring of water treatment plant was badly damaged due to uneven settlement. Entire flooring was removed and recast with R.C.C. slabs in the entire area of cation 1 to 5.
3.0	Weak effluent drain lining was damaged very badly. It is replaced by acid/alkali proof brick lining in the furen jointing.
4.0	Installed four number gates in cooling water sumps (JASH ENGINEERING)
5.0	Platform on cooling water sump and channel was supported by girders (10" x 5") which were found corroded. These were replaced by R.C.C. girders in sump area and channel platform was supported by wooden girders. Old platform was removed and refabricated from new wooden members and planks.

OFFSITES PLANT
ELECTRICAL SECTION

Job Code	Job Description
1.0	<p>01 <u>PREVENTIVE MAINTENANCE OF MCC'S</u> Carried out preventive maintenance of all feeder compartments mounted on the following MCCs. Defective parts were replaced, wherever necessary: MCC1 MCC4D MCC2 MCC3 MCC2A MCC5 MCC2F MCC11 MCC3</p> <p>02 Carried out preventive maintenance of TMG/SIEMENS make LT ACBs installed at various MCCs and replaced damaged parts and worn out contacts.</p> <p>03 Hooked up emergency panel at new SGP plant and commissioned all feeders.</p> <p>04 Inter connected control cables for indicator and alarm for new SGP plant to all individual motor feeders and old SGP plant.</p>
2.0	<p>Carried out preventive maintenance of all transformers installed at 66KV switchyard and MCC.</p> <p>01 Checked and tightened connections at primary secondary and at incoming of MCC/switch gear.</p> <p>02 Tested the oil in marshalling boxes on Secondary/Primary of transformers and replaced wherever necessary.</p> <p>03 Replaced silica gel in dehydrating breathes of all transformers</p> <p>04 Checked and rectified trip/alarm circuits.</p>
3.0	<p>Carried out preventive maintenance of 66KV OCBs potential transformers and isolators at 66KV switch yard.</p>

Job Code	Job Description
4.0	Carried out preventive maintenance of 11KV switch gear (GEC/TMG/KIRLOSKER) installed at MPSS including cleaning, tightening of Busbar connections, replacement of oil etc.
5.0	Dismantled the existing GEC make 11KV OCBs and reinstalled, retested and recommissioned the same OCBs including laxing 4 terminating of 1x3x185 Sq.mm. x LPE cables between incoming TMG 11KV ACBs to GEC OCB and reterminating and reconnecting control cables. Commissioning of tie breaker.
6.0	Installed LT ACB panel with existing MCC 2F incomer thro' 1500 KVA 11000/433V 'BB' make transformer including cable end terminations to above LT ACB panel. Tested and commissioned.
7.0	Tested all protective relays mounted on 66KV/11KV switch gear and in all MCCs.
8.0	Carried out overhauling of AMF set and its control panel.
9.0	Commissioned 11KV Volt ACB for MCC-13.
10.	Carried out maintenance of Battery charger/batteries.
11	Carried out cleaning and maintenance of all lighting distribution boards.
12	Painted all structures and gantries in 66KV switch yard.
13	Carried out painting of transformers installed at units/sub-stations.
14	Following motors were overhauled. P - 3302/B K-5302 P - 4301/A K-5402 P - 4307/B Const.water pump

REVAMP TURNAROUND - 1986
OFFSITES PLANT
INSTRUMENTATION JOBS

Job Code Job Description

STEAM GENERATION JOBS

1.0 BHEL BOILER AREA

- (a) Checked all internal wiring of BMS, BNR I & II and main panel.
- (b) Checked all trip interlocks of boiler safety system of different process variable.
- (c) Checked calibration of all recording receivers/indicating receivers after overhauling.
- (d) Checked calibration of all integrator
- (e) Checked calibration of all square root extractors after cleaning.
- (f) Calibrated all E/P transducers.
- (g) Checked calibration of all temp recorders after overhauling.

2.1 FIELD JOBS

- (a) Following control valves and dampers were overhauled and checked for its performance.
 - (1) PICV - 2
 - (2) TICV - 001
 - (3) PICV - 5111
 - (4) V - 5111
 - (5) HCV - 5111
 - (6) PCV - 5154
 - (7) LCV - 5101
 - (8) ICV - 4
 - (9) TICV - 9
 - (10) FRCV - 1(a)
 - (11) FRCV - 1(b)
 - (12) FCV - 2
 - (13) CCV - 21

----- Quantity of Instruments -----
Job Code Job Description

- (14) CCV - 22
- (15) PCV - 1
- (16) LCV - 3
- (17) PICV - 001
- (18) BTV - 1 to 6
- (19) HTV
- (20) HoTRV
- (21) BTV - 7 & 8
- (22) IGTV
- (23) IGTV
- (24) PC 1 to 6 A&B
- (25) DPICV - A
- (26) PDICV - B
- (27) Boiler feed water by pass valve

- (b) Checked calibration of all flow transmitter, level transmitter and pressure transmitter after overhauling and cleaning.
- (c) Flused impulse line of F.O header and filled with fresh glycol.
- (d) Ignitor D.P. Switch impulse line flushed and overhauled solenoids.
- (e) Checked flame scanner for its proper viewing.
- (f) Flushed impulse line of draft gauge.
- (g) Inspected Eye-Hye electrodes and its connections
- (h) Checked boiler feed water control valve trip inter lock.
- (i) Attended F.O. steam inlet thermowell for leaking.
- (j) L.S.H.S. Day tank level indicator rope replaced with new and scale repainted and graduated.
- (k) Checked trip inter locks of F.O.

3.0

IOT BOILER AREA

- (a) PICV - 5151 overhauled and inspected and rerouted air supply header.
- (b) Installed new pressure transmitter for ~~at F.O~~ steam header.

- (c) Inspected and overhauled 14 ATA control valve.
- (d) Inspected and overhauled Deserator control valves
PICV-5101 and LCV-5101
- (e) New copper tubing completed for 40 ATA steam pressure impulse line IJT Boiler and BHEL Boiler.

4.0 COOLING TOWER AREA

- (a) All flow transmitter, level transmitter and pressure transmitter were calibrated overhauled.
- (b) Raw water tank level indicator rope replaced with S.S. wire and made temporary arrangement for guj-wire grouting as the supports were broken.
- (c) Following control valves were overhauled and inspected.
PICV - 4101 - Replaced plug and seat
HICV - 5151
HICV - 5154

5.0 WATER TREATMENT PLANT AREA

- (a) Modified overhead traws and rerouting of tubing done.
- (b) Modified tubings and relocated all flow transmitters of CATION & ANION Units.
- (c) All tubings were modified according to mechanical modification jobs.
- (d) Replaced diaphragm and ON-OFF solenoid valves actuators nut/bolts etc.
- (e) Removed raw water inlet orifice plate
- (f) Degasser control valve overhauled and inspected.

6.0 STORAGE AREA

- (a) Overhauled and inspected TICV 3111 A&B.

7.0 COMPRESSOR HOUSE

- (a) Oxygen analyser power supply box replaced with new box.

Job Code	Job Description
(b)	Modified and reinstalled jacket water controller. Impulse dip tube.
(c)	Removed SPC unit old level.

OFFSITES PLANT

TECHNICAL JOBS

Job Code Job Description

1.0 C.W. AREA

Replaced 1050 mm CI multistage check valve with CS fabricated single gate check valve in cooling water line for P-4402.

Earlier there was check valve having four gates which were not functioning properly resulting in heavy leakage. It was also not possible to maintain adequate flow to urea plant whenever standby pump was in service. In order to overcome these difficulties it was replaced by single gate check valve.

REVAMP TURNAROUND - 1985
BAGGING AND MATERIAL HANDLING PLANT
MECHANICAL JOBS

Job Code	Job Description
1.0	<u>PLANT TRANSFER CONVEYOR M-2112</u> Following jobs were done 01 Cleaning and overhauling of all carrying and return idlers 02 Renewing of skirt rubber 03 Replacing of bearing of flapper valve 04 Repairing of one defective joint of belt. 05 Painting of conveyor structure 06 Replacing of head pulley and main drive gear box.
2.0	<u>FRESH UREA SHUTTLE CONVEYOR M-2112</u> 01 Cleaning and overhauling of all carrying and return idlers 02 Providing of window in chute from M-2110 03 Replacing/tail end pulleys and bearings. 04 Replacing of tripper pulleys and bearings. 05 Overhauled tripper gear box and conveyor drive gear box. 06 Painting of conveyor structure. 07 Changed skirt rubber.
3.0	<u>RECLAIM CONVEYOR M-2117</u> 01 Cleaning and overhauling of all carrying and return idlers. 02 Replacing bend pulley and bearings. 03 Painting of conveyor structure.
4.0	<u>BAGGING BUILDING FEED CONVEYOR M-2121</u> 01 Cleaning and overhauling of all carrying and return idlers. 02 Provided opening in chute from M-2110 03 Completed the skirt guard widening job and changed skirt rubber

2 of

Bagging (Mechanical)

Job Code	Job Description
	04 Changed gravity pulley
5.0	<u>BAGGING BUILDING HOPPER CONVEYOR M-2122</u>
	01 Cleaning and overhauling of all carrying and return idlers.
	02 Replaced tail end pulley and bearings
	03 Overhauled tripper and packer scales 7/8 damper system.
6.0	<u>BAGGING MACHINE (PACKER SCALE) M-2101/1-8</u>
	01 Overhauled all packer scales machine.
	02 Overhauled all loading chutes
	03 Replaced 2" ϕ air pipe line from main air receiver to all packer scale machines and also provided one air point for tablet machine cleaning.
7.0	<u>RECLAIM MACHINE M-2116</u>
	01 Replaced imported bucket elevator scraper drive gear box with indigenous one.
	02 Replaced all buckets and bucket elevator chain guide liners.
	03 Replaced scraper chain
	04 Corrected alignment of travelling gear box with wheel sprockets.
	05 Corrected tie rod pilot.
	06 Painting of machine
	07 Repaired all cable supports for reclaim machine.
8.0	<u>DUST EXTRACTION SYSTEM</u>
	01 6" duct lines divided in six feet pieces, to facilitate easy cleaning.
	02 Dust blower near 2-111 overhauled.
9.0	<u>NAPHTHA UNLOADING PUMP P-3301-B</u>
	Overhauled the pump
10	<u>VALVES</u>
	C1 Replaced Naphtha Feed Pump suction valves
	C2 Repaired minimum rise valves of Naphtha Feed pumps

Job Code	Job Description
11	<u>GENERAL</u> Provided steam trap vent pipes.
12	<u>INSULATION JOBS</u> Following jobs were carried out i) LSMS Header insulation (complete) ii) NH ₃ Loading line (Partly)
13	<u>PAINTING JOBS</u> i) Painting of Conveyor Structures of following conveyor belts were carried out. M-2110 M-2121 M-2112 M-2122 M-2117 ii) Painting of Dust Extraction system 1 and 2. iii) Transfer tower structure iv) Bagging Hoppers v) Naptha Tanks A and B. (Contractors: 1. B. Chauhan & Co 2. Jyotindra Anubhai)

REVAMP TURNAROUND - 1986
BAGGING AND MATERIAL HANDLING PLANT
CIVIL JOBS

Job Code	Job Description
	<u>SILO</u>
1	The concrete beams and suspenders of the conveyor belt inside the silo were thoroughly cleaned and painted with two coats of araldite. (contractor - Dhiraj Painters)
2	All hoppers were painted inside with two coats of araldite and hardner mixed with quartz silica in proportion 1:2.
3	The outside concrete work of hoppers, ceiling of hopper floor, etc were plastered with cement mortar in proportion 1:2 departmentally through guniting machine.

REPORT TO BE FORWARDED - 1986
LOADING AND MATERIAL HANDLING PLANT
ELECTRICAL JOBS

 Job Code Job Description

Following jobs were carried out.

- 1.0 Preventive maintenance of MCC-4 and 4A were carried out.
- 2.0 a) Shifted stitching machine DB from outside to MCC-4A.
 b) Replaced cables of 3 stitching machines.
 c) Cleaned and checked stitching machine control box.
- 3.0 a) Overhauled M-2122 tripper control box and provided flanges for closing.
 b) Reinstalled trailing cable supports
- 4.0 Overhauled control box and removed excess cables on M-2112 tripper
- 5.0 a) Replaced reclaim machine cable drum with a new one
 b) Replaced reclaim machine link conveyor drum motor.
 c) Provided limit switch for cable drum of reclaim machine to avoid over-run resulting in flashing.
 d) Replaced broken heavy duty plug sockets.
 e) Overhauled Reclaim Machine MCC
- 6.0 Overhauled lighting DBS
- 7.0 Provided local on-off switch for delumper and vibrator at the delumper.
- 8.0 Shifted the M-2117 trip indication neon lamps to suitable place and replaced with new one.
- 9.0 Removed push-button station on all conveyor motors.
- 10 Cleaned and checked all rope switches of conveyors.
- 11 Provided Hooter "Start alarm" on M-2110, 2112, 2117 and on M-2121.
-

Bagging (Electrical)

Job Code Job Description

12 Replaced/repaired light fittings installed on all conveyors and on grilling room.

13 Following motors were overhauled.

M-2110

M-2112

M-2117

M-2121

M-2122

M-2124

In addition to above, temporary flood lights hand lamps with 24 volt transformers, switch boards, cables etc. were provided wherever required.

LEVELLING AND REPAIRS
ENGINE AND MATERIAL HANDLING PLANT
INSTRUMENT JOBS

137

Job Code	Job Description
01	Overhauled, cleaned and modified switches of all the pecker scales.
02	Made pecker scale level supports as per requirements.