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2003

MTC / REPORT / 01
REPORT NO. 23 / 2003

IFFCO
KALOL UNIT
REPORT
ON
PLANT TURNAROUND
(MAY - JUNE - 2003)

INDIAN FARMERS FERTILISER CO - OPERATIVE LIMITED

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Plant Turnaround for the year 2003 was planned during May-June 2003, accordingly, Ammonia & Urea plants were stopped on 28th May 2003. Rotating and static equipment were taken up for routine overhaul and inspection. Preventive maintenance was carried out on all critical turbine/compressor trains. All the heat exchangers were also opened, cleaned and boxed up. All the critical RVs were overhauled, tested and were put back in place.

In Ammonia plant, Ultrasonic scanning was carried out of all the reformer tubes by M/s PDIL. During radiographic weld examination of C-Joint of catalyst tube; cracks were found in several catalyst tubes. Total 25 no.s of defective tubes and 1 no. of defective riser were removed. The defective weld joint of all the removed tubes were rewelded after solution annealing. All the 25 no. of tubes and 1 no. of riser tube were replaced with new / repaired tubes.

In addition to routine maintenance jobs LT Superheat Coil in convection section of primary reformer was replaced with new modified coil received from M/s L&T, Mumbai. Refrigeration compressor drive turbine (105-JT), BFW pump drive turbine (104-JAT) and aMDEA pump's drive Murray turbine (107-JT) were taken for major overhauling. Diaphragms of 104-JAT were replaced with new indigenous diaphragms received from M/s Triveni Engineering, Bangalore. Eroded diaphragms of last stages of 105-JT were also replaced with repaired diaphragms received from M/s Alstrom India Pvt.Ltd., Vadodara. Diaphragms for 107-JT were replaced with new diaphragms of OEM make. Both Auxiliary boiler as well as 112-C were offered for IBR inspection. RLA study for HP steam system of Ammonia was carried out by M/s L & T Sargent & Lundy, Vadodara

In Urea plant, Hitachi compressor (K-1801) L.P. & H.P. Case and gear box M-1801 was attended for high temperature problem through expert service of M/s. Hitachi, Japan. Prill tower ID Fans, Prill cooling system fans & scrapper taken for preventive maintenance. All heat exchangers were cleaned by hydrojetting & boxed up. Various RV's were overhauled & tested. Inspection of H. P. Vessels and L. P. Vessels were carried out. Overhauling and replacement critical high pressure valves. Corroded pipe lines were replaced as per requirement.

In Offsites plant, Q-5113 & P-4402 were taken for overhauling. Other pumps and turbines were also taken for preventive maintenance. Degasser tower was replaced in D.M.Plant. Various RV's were overhauled and tested.

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In B&MH plant major overhauling of Reclaim Machine M-2116 was carried out. Bucket elevator structure and tracker rollers , assembly including minor spare parts were replaced. Packer scales, Conveyor belt M-2110, M-2112, M-2117, M-2121, M-2122, & M-2124 (1-6) were also taken for preventive maintenance.

ELECTRICAL JOBS

In electrical section , preventive maintenance for MCC Panel , transformers , motors were carried out.

In MCC thoroughly cleaning of panel was carried out. All the connections for power and control cables were checked for tightness and repairing jobs were carried out for any burnt terminal. Damaged contractor, fuse bases, connectors, etc., were replaced. A good house keeping of the rooms was carried out.

All the transformers were thoroughly checked and any leakage found was attended by replacing Gaskets. Defective instrument/spares were replaced from all the transformers. Oil level of all transformer were checked and filled above fill-up level mark.

Complete overhauling of transformer TR-12, TR-14 & TR-17 were carried out. Oil of these transformers was replaced because of low BDV value of existing oil. Core and winding were cleaned with hot oil flush to improve IR value.

At 66 KV switchyard, all the isolators, insulator discs were thoroughly cleaned. Moving parts of isolators were lubricated and its jaw contacts settings were checked. Existing BOCB was replaced with new MOCB. Preventive maintenance was carried out for all the existing MOCBs. Its Closing and tripping mechanism were checked and all the leakage were attended.

All the critical motors were overhauled. Its worn out parts and bearings were replaced.

All the MOVs were checked for its proper operation and its settings. A continuous position indicator was installed on MOV 1203.

INSTRUMENT JOBS

During annual plant turnaround year-2003 Following instrumentation maintenance jobs were carried out.

In Ammonia plant DCS system was upgraded to migrate to Centum CS 3000 platform from obsolete centum XL platform. In first phase MIS platform was changed to LAN and open architecture by installing bus converters and HIS station. System was commissioned successfully by YBL engineers. All critical control valves were inspected and overhauled in order to ensure better reliability. Annual servicing of DCS system, PLC system, GE Fanuc system, Fuji make 60 KVA ups system was carried out. Various energy saving related schemes were incorporated with DCS and PLC as per requirements. Painting of DCS operator console was done.

Replacement of reformer damper cylinder of power distribution box, commissioning of air dryer control through DCS, enhancement of CV of control valve, provision of thermocouples for reformer tubes job in workshop etc. was carried out.

In urea plant radio active type level measurement system for autoclave was commissioned Omron PLC for Hitachi compressor was up graded by hooking up Citech software for on line visual monitoring. Painting of DCS operator console was done. Control valve which were passing were attended successfully. The anti surge and discharge control valve direction were changed to avoid metallic particles in trim causing passing and loss of energy. Servicing of DCS system was done. HICV – 1201, control valve was badly damaged in gland follower area, and this was repaired in work shop by inserting sleeve and machining. Various control valves were overhauled and preventive maintenance was carried out. Smart transmitter was installed in place of old pneumatic transmitter for LRC – 1421. Weep holes checking tubing was provided. Removed and reinstalled radioactive sources from stripper and autoclave.

In BHEL boiler new oxygen analyzer was installed, calibration of field and control room instruments was carried out. Checking of BMS interlock system was carried out. Painting of main control panels was done. In DM plant micro processor based controllers and flow totalisers were installed. In bagging plant new controller of PBL automatic bag weighing machine was commissioned. Following jobs were carried out in Ammonia, Urea, Utility, Offsite, Bagging plant areas.

- (1) Various instruments like vibration probes of rotary equipments, pressure gauges temp elements, Loadcell, proximity etc. etc. were removed and reinstalled to facilitate mechanical maintenance including replacement of the superheated coil in ammonia plant.

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- (2) Preventive maintenance jobs of various field critical instruments like pressure switches, transmitters' thermocouples, field controllers, panel wiring, control valve, JB, I/P converters, valve positioners switches, painting of panels etc. was carried out.
 - (3) Calibration of all ISO related instruments was carried out.
 - (4) Various EWR, Energy saving scheme, Safety enhancement related Instrument jobs were executed.
 - (5) Annual Maintenance services of Yokogawa DCS system , PLC's, UPSS, Weighing machines, Weigh bridge, Ammonia Tank level indicators, Reclaim belt weigher, etc. was carried out.

TECHNICAL DEPARTMENT JOBS :

In Ammonia plant, Desuperheater has been installed to reduce mixed feed coil outlet temperature in upstream of mixed feed coil. This will improve life of coils and reformer tubes and operational flexibility, reduce the process steam consumption and load on the Condensate Stripper, reduce S/C ratio. Other job in Ammonia plant include 12" NB vent gas line from 104-E to ID fan stack and provision of R-112 vent to flare stack by installing new line from R-112 inlet to D/S of PICV-1027.

In Urea plant, Carbamate pumps (P-1201 A/B/C) discharge lines rerouted on new erected platform. This will make easy for carrying out maintenance jobs & operation of valves. Other piping replacement / modifications / upgradation jobs were done related to various Schemes & EWRs.

Various instrumentation jobs carried out related to Desuperheating System and other schemes and EWRs.

It is to be placed on record that this year's shutdown was taken in peak summer in the month of May due to late arrival of LT Superheat Coil from M/s. L & T. However the shutdown could be completed as per the schedule due to proper planning and coordinated efforts by all section.

PLANT TURNAROUND - MAY - JUNE - 2003

GENERAL - DETAILS

SR. NO.	CATEGORY	QUANTITY
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01 EQUIPMENT UTILIZED :

(A) IFFCO :

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

(B) HIRED :

02 MANPOWER UTILIZED :

(A) IFFCO MANPOWER :

a) Mechanical	}	
b) Mechanical Services	}	Existing
c) Electrical	}	strength
d) Instrument	}	

(B) HIRED - CONTRACT MANPOWER :

<u>Sr.No.</u>	<u>Category</u>	<u>Man days</u>
01	Mill Wright Fitter	136
02	General Fitter	828.5
03	Rigger	1137.5
04	S.S. Rigger	2946
05	Fabricator	239
06	Grinder	326
07	IBR Welder	78
08	Non-IBR Welder	216
09	Carpenter	38.5
10	Mason	40
11	Forklift Operator	--
12	Instrument Fitter	85
13	Electrician	--
14	Machinist	66

THE PLANT TURNAROUNDS AT A GLANCE

SR. NO.	YEAR	AMMONIA PLANT				UREA PLANT				REASON IF ANY
		PERIOD FROM PRODUCTION TO PRODUCTION								
		FROM	TO	DOWN TIME		FROM	TO	DOWN TIME		
				DAYS	HRS			DAYS	HRS	
01	1975	06-05-75	21-05-75	16.00	-	06-05-75	21-05-75	16.00	-	Planned
02	1976	26-03-76	20-04-76	26.00	-	26-03-76	20-04-76	26.00	-	Planned
03	76-77	05-12-76	22-01-77	49.00	-	05-12-76	24-02-77	51.00	-	101-JT B/D
04	1978	21-02-78	15-03-78	23.00	-	21-02-78	25-03-78	31.00	-	101-BJ B/D
05	1979	21-05-79	30-06-79	41.00	-	10-05-79	01-08-79	82.00	-	K-1101/2, 3rd Stage Cylinder
06	1981	12-04-81	10-05-81	29.00	-	08-04-81	12-05-81	35.00	-	101-B Headers Planned
07	1984	01-01-84	25-01-84	25.00	-	01-01-84	25-01-84	25.00	-	Planned
08	1986	19-03-86	03-05-86	45.00	-	04-03-86	01-05-86	59.00	-	Reformer Revamping / HP Scrubber B/D
09	1987	12-04-87	03-05-87	21.00	-	12-04-87	02-05-87	20.00	-	Planned
10	1988	18-04-88	14-05-88	27.00	-	18-04-88	13-05-88	26.00	-	Planned
11	1990	05-02-90	05-03-90	29.00	688.67	31-01-90	07-03-90	35.00	829.00	Planned
12	1991	24-02-91	13-03-91	18.00	429.08	23-02-91	14-03-91	20.00	459.25	Planned
13	1992	03-11-92	03-12-92	30.60	734.91	03-11-92	04-12-92	31.00	744.75	Planned
14	1993	12-09-93	23-10-93	42.00	986.50	12-09-93	29-10-93	47.00	1120.58	Revamp-II
15	1995	14-01-95	27-01-95	14.00	311.34	11-01-95	26-01-95	16.00	352.18	Scrubber H-1203 -B/D
16	1996	14-06-96	13-07-96	30.00	712.00	13-06-96	13-07-96	30.00	694.25	Autoclave V-1201 Leakage
17	1997	12-05-97	17-06-97	35.60	875.00	12-05-97	17-06-97	36.20	870.50	Planned
18	1998	22-04-98	19-05-98	27.50	660.00	20-04-98	19-05-98	30.00	720.00	Planned
19	1999	12-04-99	30-04-99	18.00	434.50	11-04-99	28-04-99	17.00	409.75	Planned
20	2000	03-04-00	27-04-00	24.42	586.25	03-04-00	28-04-00	25.43	610.50	Planned
21	2001	25-03-01	14-04-01	20.90	501.50	25-03-01	15-04-01	21.26	510.25	Planned
22	2002	20-03-02	22-04-02	33.40	801.58	20-03-02	23-04-02	34.31	823.50	Planned
23	2003	28-05-03	25-06-03	28.04	673.00	28-05-03	25-06-03	28.33	679.83	Planned

MAINTENANCE JOBS CARRIED OUT BY OUTSIDE AGENCIES

SR. NO.	JOB'S CARRIED OUT	CONTRACTORS NAME	W.O.NO. & DATE
1	Overhauling & Preventive maint. of rotating machines	M/s. SPIC - SMO , Mumbai	9913261 22/04/03
2	Supervisory services for overhauling & testing of Relief valves	M/s. Flotec Engineering Service, Surat	9913189 25/04/03
3	Scaffolding & Blinding / Deblinding jobs during shutdown	M/s.General Engg. works, Bharuch	9913043 05/03/03
4	Repairs of 4 sets of diaphragms of 105JT	M/s. Alstrom Projects, Vadodara	9912667 16/01/03
5	LT SH Coil replacement	M/s.Neo-Structo, Surat	9913499 11/06/03
6	Refractory Repair LT convection section of Primary Reformer.	M/s. ACC, Ahmedabad	9913420 09/05/03
7	Replacement of LSSL &LSHH of 101F,SP1 & SP70	M/s Ganesh Engg., Ahmedabad	9913247 02/05/03
8	Transportation of LT Superheat Coil	M/s. Nabros Transport, Ahmedabad	9913528 27/06/03
9	Supply & apply of Ceramic fiber insulation of LT Coil section	M/s. Llyod's Insulation, Mumbai	9913603 02/07/03
10	In-situ removal of existing insulation & re-lining of Z-section module- A & B in Primary Reformer	M/s. Uni Frax, Mumbai	9913567 09/06/03
11	RLA study of HP steam system in Ammonia plant	M/s. L & T., Vadodara	9913472 10/05/03
12	Contract services for replacement of reformer tubes	M/s. Skywin erectors.,Ahmedabad	9913526 23/05/03
13	Services of Engineer for the overhauling &testing of RV	M/sFlotec Engg Services, Surat	9913187 28/04/03
14	Expert services of M/sHitachi Comp. Gear box from Japan	M/s Hitachi Business international Ltd, Japan	9913106 14/05/03
15	Supply erection and commissioning of outlet duct of K1701	M/sEngineers & Contractors, Delhi	9912448 07/02/03
16	Insitu Repair of 900mm diacooling water discharge gate valve	M/s Efco Maschinebau India Pvt Ltd., Hyderabad	9913051 04/04/03
17	Services for gland repacking of valves of various sizes and ratings.	M/s. Dandy Engineering Company, Ahmedabad	9913242 22/05/03
18	Reclaim machine (Repair) operator cabin cutting with Sintex PVC and Aluminium frame.	M/s. New Rajasthan Body Show Repairing work, Kalol	9913628 24/06/03

SR. NO.	JOBS CARRIED OUT	CONTRACTORS NAME	W.O.NO. & DATE
19	Overhauling of Elecon make Urea scrapper.	M/s EMTICI Engineering Co Ltd, Anand	9912810 10/03/03
20	Hiring of skilled manpower	M/s General Engg. Works, Bharuch	9912347 15/01/03
21	Hiring of skilled manpower	M/sRambahadur & co, Allahabad	9912351 15/01/03
22	Opening & box up of heat exchangers	M/sGeneral Engg. Works, Bharuch	9912915 11/02/03
23	Annual rate contract for hot & cold insulation	M/s.Lloyds Insulation (i)Ltd , Vadodara	9911878 06/08/02
24	Supply & application of anticorrosive paints	M/s B.Chauhan & co, Kalol	9910733 10/01/02
25	Supply & application of anticorrosive paints	M/s Ratendrasing, Surat	9910734 10/01/02
26	Rate contract for fabrication & erection of piping & steel structure	M/s Chaitanya contractors & Engineers Pvt Ltd , Navi Mumbai	9912301 01/11/02
27	Rate contract for fabrication & erection of piping & steel structure	M/sJ&J Engineers, Sheratha	9912302 01/11/03
28	Hydro jet cleaning of heat exchangers.	M/s New Tech Jetting Equipment Pvt. Ltd.	9912818 26/02.03
29	Automatic Ultrasonic Scanning of Primary Reformer Catalyst and Riser Tubes.	M/s Projects and Development(I) Ltd, Sindri.	9912509 22/01/03
30	Insitu Metallography of Plant Equipment	M/s. Deep Metallurgical Services, Thane	9912706 03/03/03
31	Radiography Work	M/s. N.D.T.Services, Ahmedabad	9912712 11/01/03
32	NDT Teams for Ultrasonic Flaw Detection	M/s. Engineering Inspection Services Mumbai	9912545 13/12/02
33	NDT Teams for Thickness Measurment.	M/s.S.R.Technical Services Pvt.Ltd Mumbai.	9912969 05/03/03
34	NDT Teams for Magnetic Particle Inspection	M/s. Engineering Inspection Services Mumbai	9912535 13/12/02
35	NDT Teams for Dye Penetrant Inspection	M/s.S.R.Technical Services Pvt.Ltd Mumbai	9912550 21/12/02
36	Repairs of refractory of primary reformer in Ammonia plant.	M/s. Associated Cement Co.Ltd., Ahmedabad	9913435 4/05/03

SR. NO.	JOBS CARRIED OUT	CONTRACTORS NAME	W.O.NO. & DATE
37	P/A Epoxy Monolithic plaster & Epoxy painting on RCC susponder, walkway for conveyor, beams, column & stair of transfer tower of SILO & Misc.work in B&MH Plant.	M/s.Shreeji Chem, Vadodra	9913338 22/04/03
38	P/A IP concrete protective coating on RCC wall of prill tower, conveyor gallery & other structural in plant.	M/s.Krishna Conchem, Mumbai	9913233 17/04/03
39	Repair & Maint.of BITUMASTIC acid lining in Water Treatment Weak Strong effluent pit etc.	M/s. Shreeji Chem, Vadodara	9912757 31/03/03
40	Maintenance of RCC structure & conveyer gallery bottom from silo to B&MH plant hopper	M/s. Vaidehi & Co., Vadodara	9913080 31/03/03
41	FRV lining on floor drain in water treatment plant & repairing of open channel near lagoon	M/s. Shreeji Chem, Vadodara	9912819 13/02/03
42	Shifting of debris	M/s.Sai Rang Ent. Kalol	9912820 31/01/03
43	Servicing of 66 KV MOCBs	M/s.Sun Gentech Ltd, Secunderabad	9913392 13/05/03
44	Replacement of BOCB with MOCB at 66 KV switch yard	M/s.Jitendra Electrical, Ahmedabad	9913309 04/04/03
45	Servicing & inspection of OLTC of Tr-1B	CTR manufacturing industries ltd. Pune	9913254 15/04/03
46	Supply and installation of continuous indicator on MOV	Rotork Controlgear P. Ltd, Chennai	9913179 01/07/03
47	Maintenance of transformer	Crompton Greaves P. Ltd , Ahmedabad	9913434 04/04/03
48	Study of power system and relay coordination	Elcon Engineers PvtLtd , VV Nagar.	9913402 04/04/03
49	Servicing of Weighbridge	M/s. Ashbee Systems Ltd.,A'bad	9910622 31/12/01
50	Servicing of HIMA PLC	M/s. Chemtrol Eng.,Mumbai	9901985 12/06/02
51	Installation of Level Instrument	M/s. Concord International,Chennai	9912354 07/12/02
52	Servicing of GE Fanuc PLC	M/s. Dynamic Innovation,A'bad	9911796 16/10/01
53	Servicing of Amm. Tank Level indicator	M/s. Toshbro Controls,Vadodara	9912227 22/10/02
54	Serve contract for control valves	M/s. High Tech Controls,Vadodara	9913066 10/03/03

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SR. NO.	JOBS CARRIED OUT	CONTRACTORS NAME	W.O.NO. & DATE
55	Servicing of UPS	M/s. Instrumentation Ltd., Kota	9909749 26/06/01
56	Upgradation of Omron PLC Software	M/s. Masibus, Gandhinagar	9912269 25/10/02
57	Commissioning of New Packer scale panel	M/s. PBL Ltd., VV Nagar	9912265 30/10/02
58	Servicing of DCS	M/s. Yokogawa Bluestar, Vadodara	9910060 11/10/01
59	Belt Weigher	M/s. EMTICI Eng. Ltd., VV Nagar	9911437 29/05/02
60	Installation of De-superheater & other Piping Jobs in Ammonia & Urea plant	M/s Skywin Erectors, Ahmedabad	9913601 19/06/03
61	Plant Piping Jobs in Urea plant	M/s Anesh Engineers, Kalol	9913602 19/06/03
62	Replacement/Upgradation of Piping / Vessels including supports (SOR contract)	M/s Chaitanya Engg. & Contractors Pvt Ltd, Mumbai	9911122 11/03/02
63	Supply & Application of Hot & Cold insulation	M/s Balaji insulation, Thane	9911006 14/02/02
64	Annual Rate Contract for Various Instrument Jobs in Different Plant	M/s Intek Instruments Pvt Ltd, Gandhinagar	9913471 19/05/03

MECHANICAL JOBS

AIR COMPRESSOR TRAIN

101-JT Air Compressor Drive Turbine Preventive Maintenance :

Turbine was decoupled and both the journal bearings and thrust bearing were inspected. Opposite thrust end journal bearing clearance was above recommended value and same was replaced by new one. Gauss measurement of rotor shaft and bearings carried out. Gauss reading of thrust end shaft journal (10.2 Gauss), bearing housing (21 Gauss) & journal bearing pads (5.2 gauss), thrust collar (13.7 Gauss), Opposite thrust journal bearing base ring (6 Gauss) was higher and the same was removed by degaussing. Governor was dismantled and its gaskets, O rings and bearings were replaced. All drain line flanges were provided with new gaskets. Greasing of governor linkages was carried out.

During start up activities of 101-JT turbine, the steam chest valve was found not opening from shut position. Turbine was decoupled and found free. TTV was opened and its operation was checked manually for jamming. Found normal. Later it was noticed that there was airlock in the governor oil system, and removed air lock by closing and opening of governor oil isolation valve . Turbine was started immediately.

101-J LP Air Compressor Preventive Maintenance :

Journal bearings and thrust bearings were inspected. Both Journal bearing clearance were on higher side. Hence both were replaced. Gauss measurement of rotor shaft and bearings carried out. Gauss reading of thrust end journal bearing base ring (6.6 Gauss), thrust collar (7 Gauss) was higher and the same was removed by gaussing. All the bag filters and Roll-O-Matic filters were replaced.

101-JR Gear box Preventive Maintenance :

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

101-J HP Air compressor Preventive Maintenance :

Journal bearings and thrust bearings were inspected. Clearance of thrust end journal bearing pads was on higher side hence the same was replaced. Gauss measurement of rotor shaft and bearings carried out. Opposite thrust end journal bearing housing (6 Gauss) was found higher and the same was removed by degaussing.

101 J Train alignment reading attached

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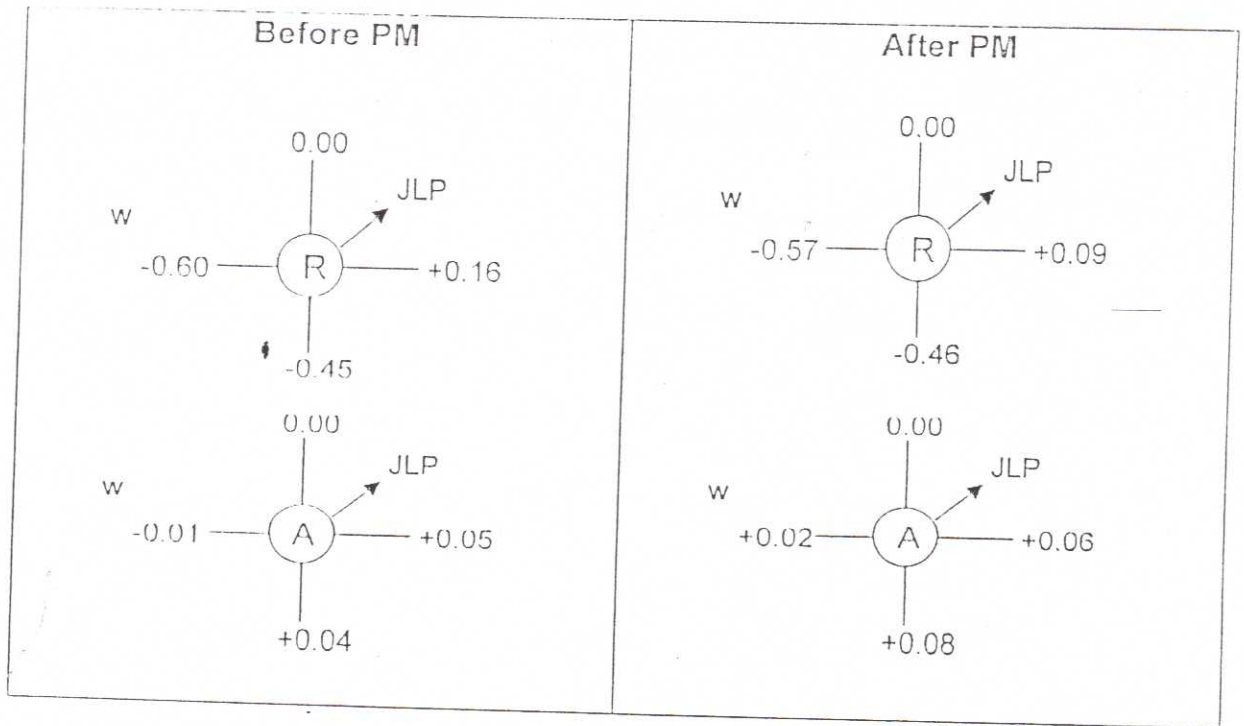
The readings taken during the preventive maintenance of 101J train are recorded as under :

Description	Design Clearances (Inch)	Before	After
101 JT			
Thrust end bearing	0.007 - 0.009	0.008 "	0.008 "
Opp Thrust end bearing	0.007 - 0.009	0.010 "	0.007 "
Axial Thrust	0.008 - 0.012	0.008 "	0.008 "
Thrust end Labyrinth		0.018 "	0.018 "
Opp. Thrust end Labyrinth		0.018 "	0.018 "
101 JLP			
Thrust end bearing	0.006 - 0.008	0.009 "	0.006 "
Opp Thrust end bearing	0.006 - 0.008	0.009 "	0.007 "
Axial Thrust	0.011 - 0.015	0.011 "	0.011 "
Thrust end Labyrinth		0.008 "	0.008 "
Opp. Thrust end Labyrinth		0.006 "	0.006 "
101 JR			
Drive gear North bearing	0.010 - 0.011	0.011 "	0.011 "
Drive gear South bearing	0.010 - 0.011	0.011 "	0.011 "
Axial Thrust	0.014 "	0.0115 "	0.014 "
Pinion North bearing	0.010 - 0.012	0.011 "	0.011 "
Pinion South bearing	0.010 - 0.012	0.011 "	0.011 "
Free float		0.044 "	0.044 "
Backlash		0.0075 "	0.0075 "
101 JHP			
Thrust end bearing	0.004 - 0.007	0.009 "	0.006 "
Opp Thrust end bearing	0.004 - 0.007	0.008 "	0.006 "
Axial Thrust	0.008 - 0.012	0.009 "	0.009 "

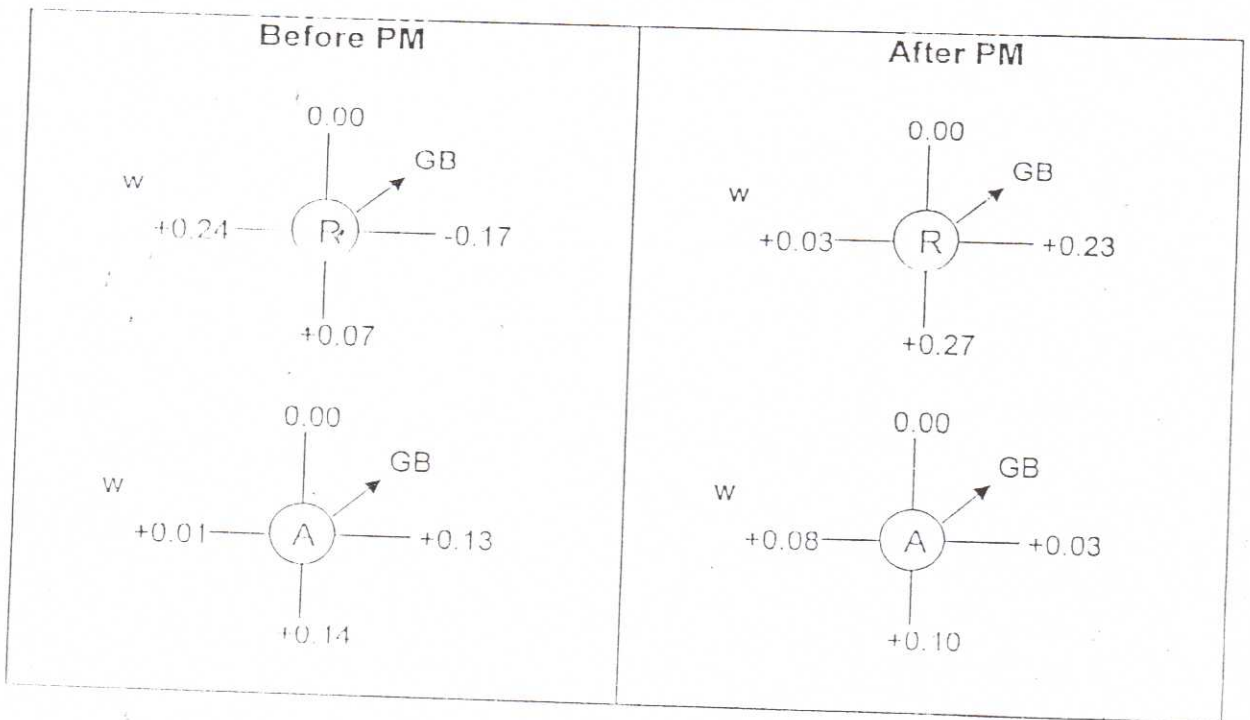
Alignment Readings (Dimns are in mm)

15

101 JT to JLP



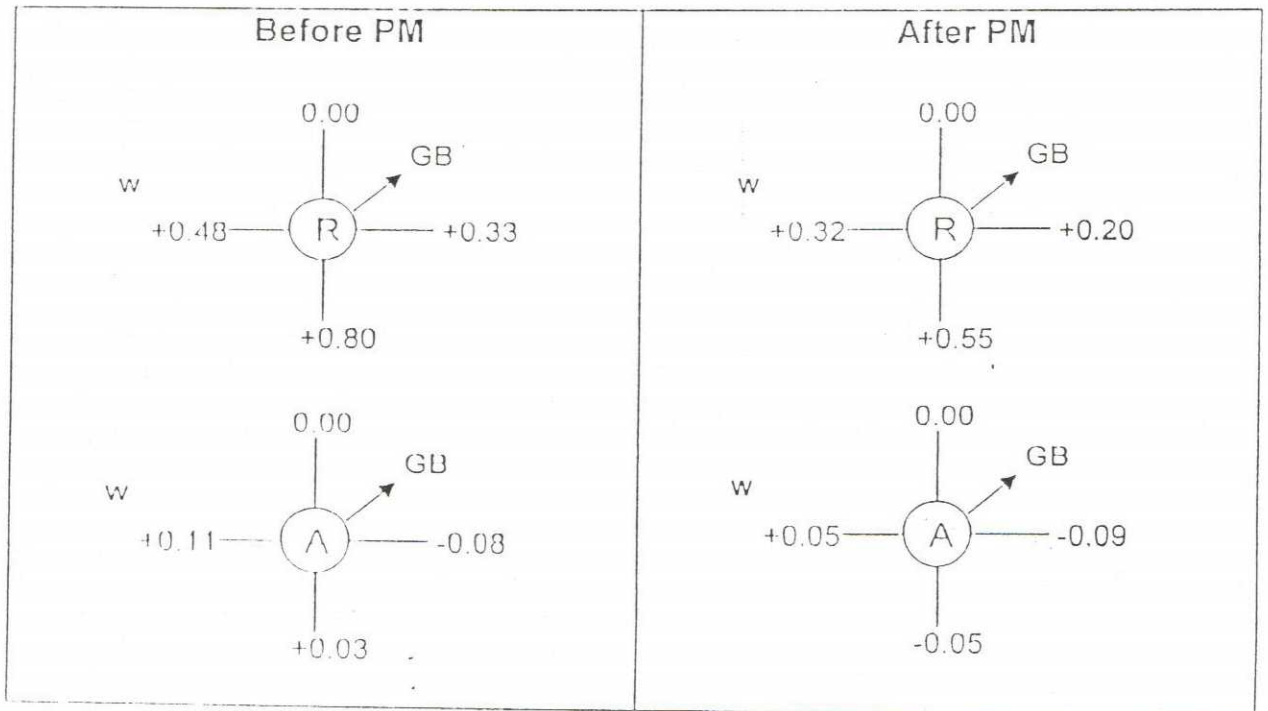
101 JLP to GB



Alignment Readings (Dimms are in mm)

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101 JHP to GB



N. G. COMPRESSOR TRAIN

N. G. Compressor Drive Turbine 102-JT Preventive Maintenance :

Turbine was decoupled and bearings were inspected. Coupling float was below recommendation due to sludge deposit in coupling gear. Coupling end journal bearing found to have crack in white metal lining of both halves, the same was replaced with reconditioned bearing. White metal lining of governor side journal bearing bottom was peeled off . Hence replaced with new one. 3 nos. thrust pads were found having crack and dent. Hence it was also replaced. Labyrinths at both ends were also replaced as it was damaged and clearances were on higher side. Gauss measurement of rotor shaft and bearings carried out. Thrust collar (7.9 gauss) and Opposite thrust end bearing base ring (36 Gauss) was above allowable limit and the same was removed by degaussing.

PG-PL Governor replaced with the spare governor. Governor drive gear box was opened. Damaged governor drive coupling shim (5 nos.) and coupling sleeve were replaced with new one. Leaky hydraulic cylinders for HP, LP1 & LP2 were replaced with spare assembly. Pilot valves , Governor tester, hand trip valve & tripping device were opened and cleaned. Dampeners were opened and O ring was changed. Both governing oil filters and lube oil filters were replaced with modified one (provided 0.5mm stiffener ring inside) procured from M/S Micro flow Ahmedabad.

N. G. Compressor 102J Preventive Maintenance :

Journal & thrust bearings were inspected. Coupling side journal bearing clearances were above the design value. Hence it was replaced. Both Journal bearing pads and journal portion of shaft found to have brownish sledge. It was cleaned. Axial thrust was more than required. Hence active side shim thickness was changed to 2.38 mm from 2.28 mm. Gauss measurement of rotor shaft and bearings was carried out. Gauss reading of thrust end journal bearing base ring (33 gauss), thrust collar (13 gauss) & opposite thrust end journal bearing base ring (44 gauss) were found above limit and the same were removed by degaussing.

102 J Train alignment reading is attached :

18

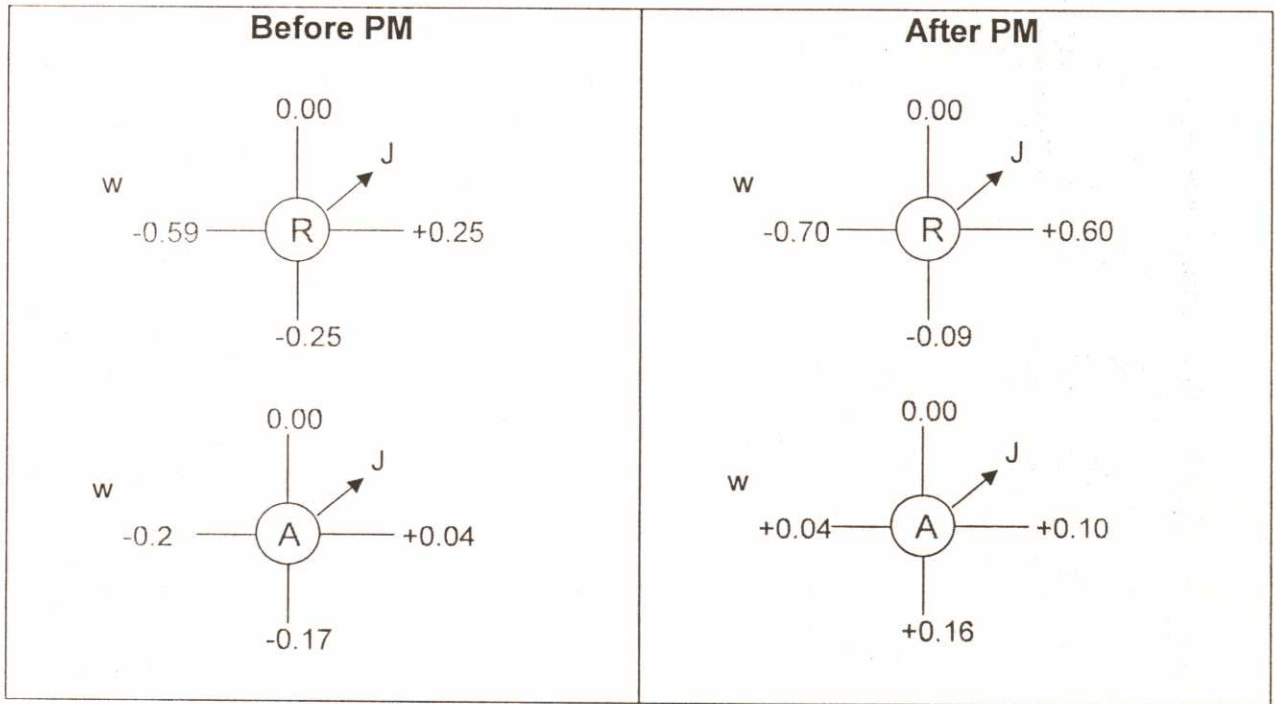
Readings recorded during the stroke checking of governor valve of 102 JT

Zero Induction					
HP Nozzle		LP 1 Nozzle		LP 1 Nozzle	
Oil Pr. (Kg/ cm ²)	Valve Lift	Oil Pr. (Kg/ cm ²)	Valve Lift	Oil Pr. (Kg/ cm ²)	Valve Lift
1	0	0.85	-	0.85	-
1.25	0	0.95	-	1.05	-
1.5	0	1.1	-	1.25	-
1.75	0	1.45	2	1.3	0.5
2	1	1.65	5	1.5	2
2.25	3	1.9	7.5	1.7	5
2.5	4	2.1	10	1.95	7.5
2.75	5.5	2.3	12	2.1	10
3	6	2.5	15	2.3	11.5
3.25	7	2.7	17	2.5	13.5
3.5	8	2.9	19	2.75	15.5
3.75	9	3.1	21	2.95	17
4	9.5	3.4	22	3.15	19.5
4.05	10	3.4	22	3.25	20
100 % Induction					
1	0	0.95	-	0.9	-
1.25	0	1.1	-	0.95	-
1.5	0	1.25	-	1.1	-
1.75	0	1.5	2	1.3	0.5
2	1	1.7	5	1.55	3
2.25	3	1.9	7.5	1.7	5.5
2.5	3.5	2.1	10	1.95	7.5
2.75	5	2.3	13	2.15	10
3	6.5	2.5	15	2.3	12
3.25	7	2.7	17	2.5	13.5
3.5	8	2.9	19	2.7	15.5
3.75	9	3.1	21.5	2.95	17.5
4	9.5	3.35	22	3.1	19
4.05	10	3.5	22	3.2	20

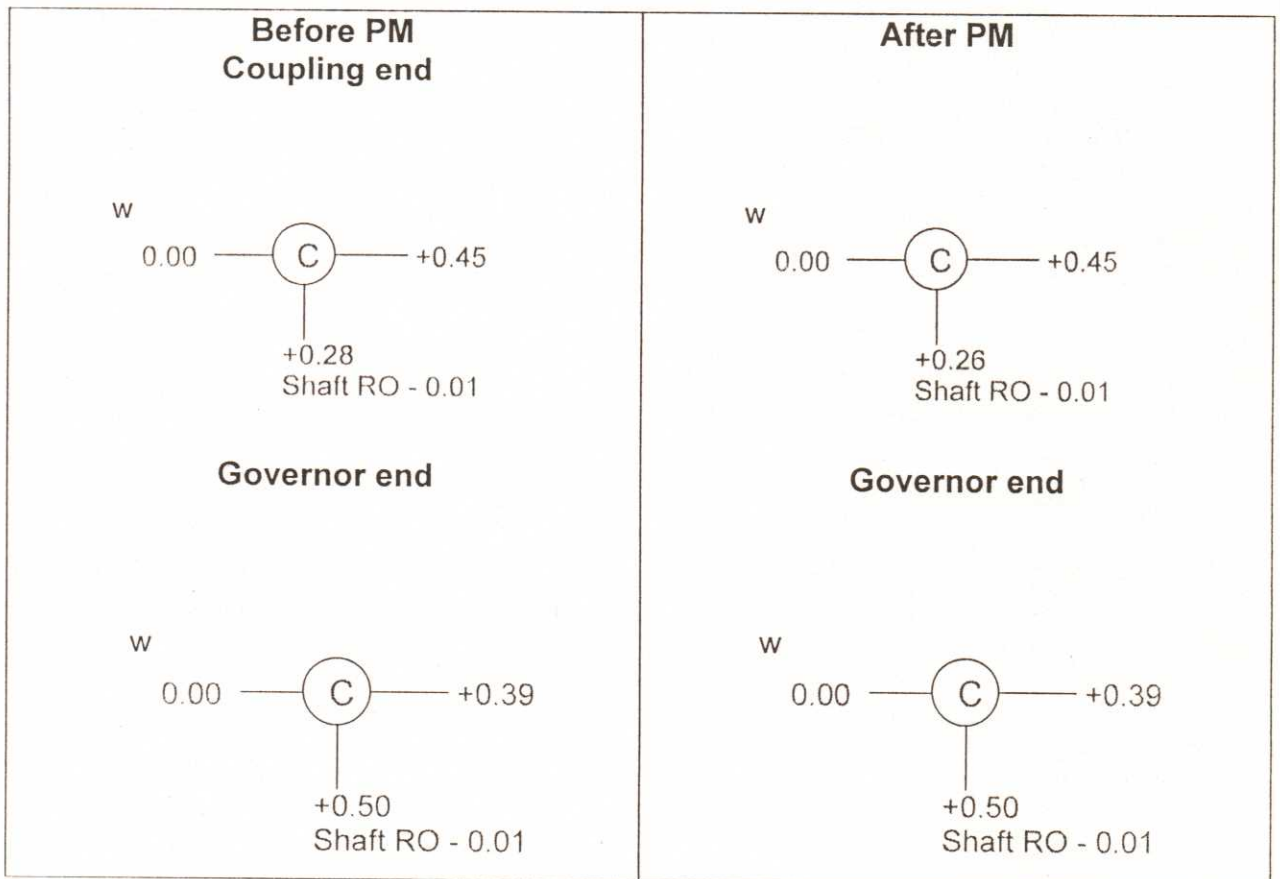
Alignment Readings (Dimms are in mm)

19

102 JT TO 102 J

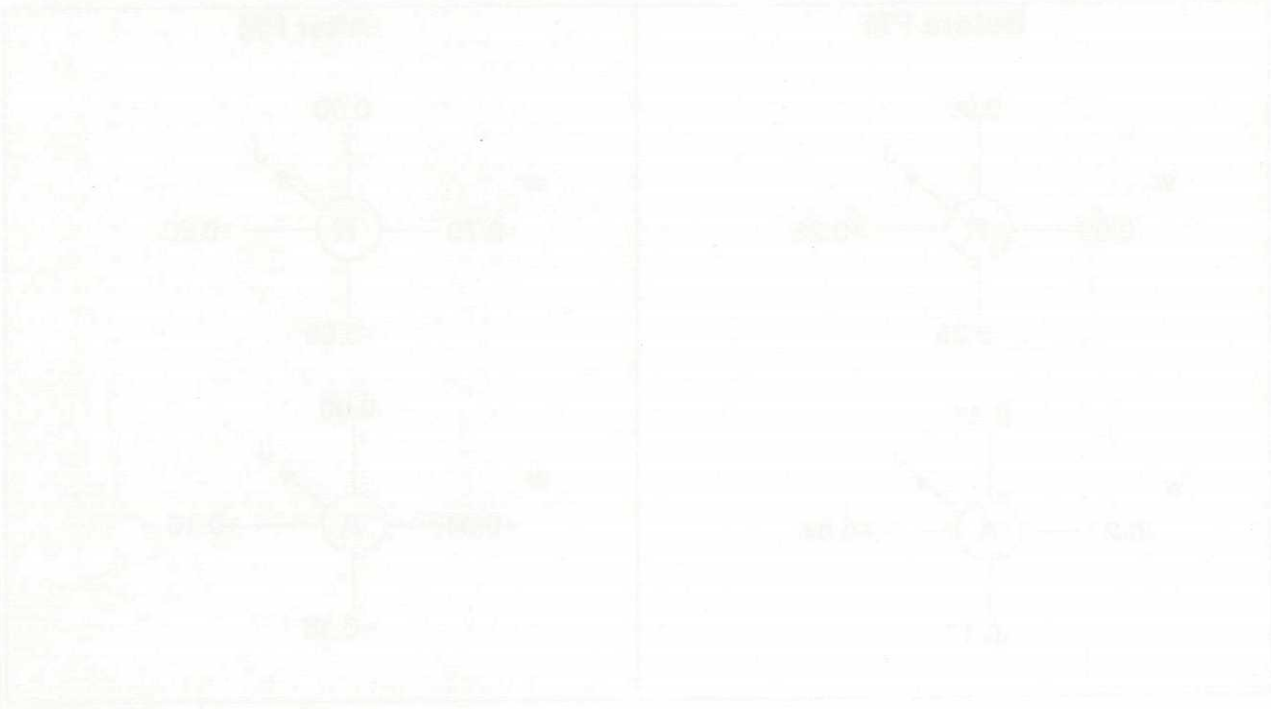


CENTERING READING OF 102 JT

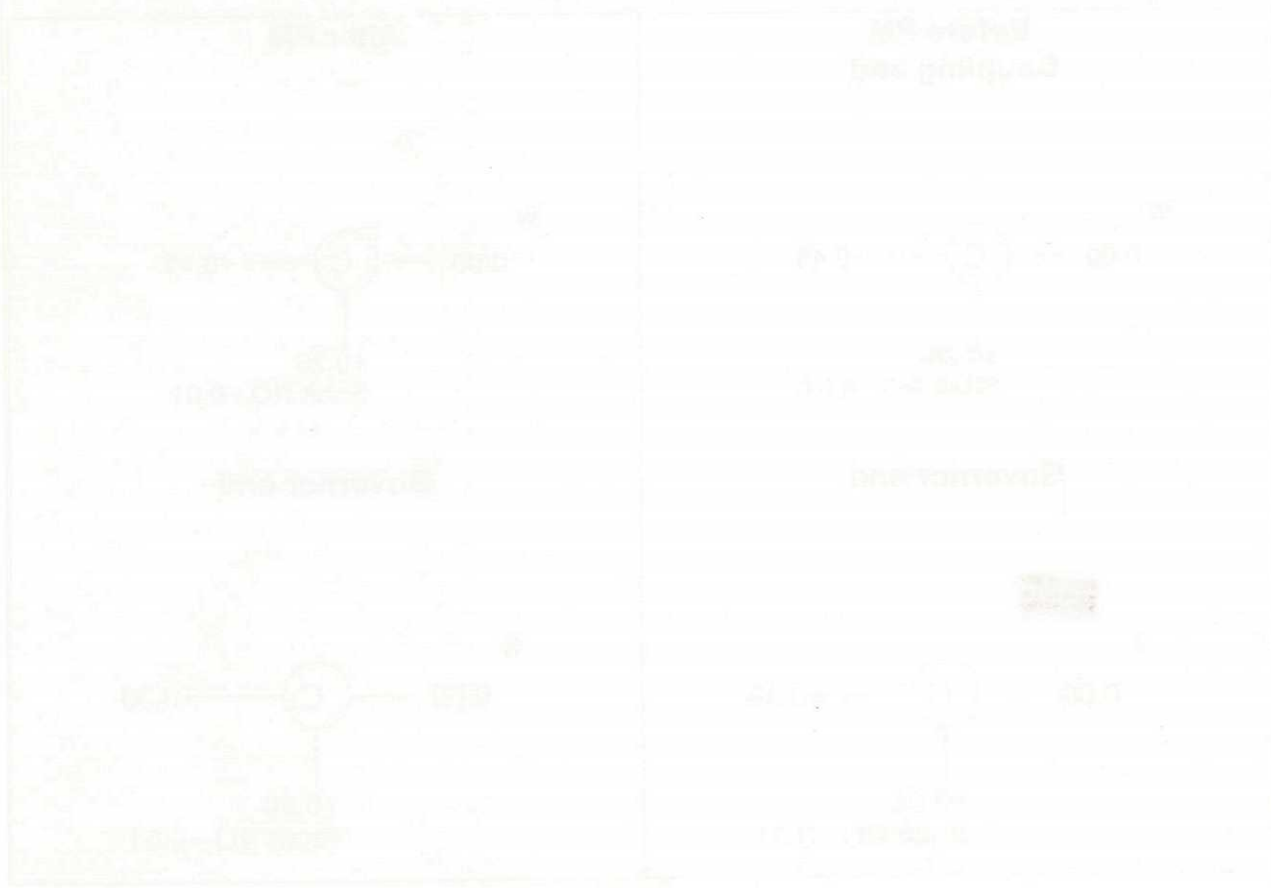


MECHANICAL SYSTEMS (PART I)

PROBLEM 1



PROBLEM 2



The reading taken during the preventive maintenance in 102 J train are recorded as under :

Description	Design Clearances (mm)	Before	After
102-JT			
Coupling Float	1.2 - 1.37	0.46	1.34
Thrust end bearing	0.12 - 0.139	Damaged	0.12
Opp Thrust end bearing	0.15 - 0.172	"	0.165:
Axial Thrust	0.16 - 0.24	0.18	0.18
Thrust end Labyrinth		0.3	0.25
Opp. Thrust end Labyrinth		0.45	0.3
102- J			
Thrust end bearing	0.07 - 0.095	0.09	0.095
Opp Thrust end bearing	0.07 - 0.093	0.12	0.092
Axial Thrust	0.25 - 0.35	0.37	0.26

SYNTHESIS GAS COMPRESSOR TRAIN :

103-JAT (Back Pressure Turbine) Preventive Maintenance :

Turbine was decoupled and journal and thrust bearings were checked. Opposite thrust end journal bearing clearance was above recommended value. Hence it was replaced. Axial thrust was also above recommended value. Inactive thrust ring was replaced as it was having crack. Greasing of governing linkages was carried out. Gauss measurement of rotor shaft and bearings was carried out. Gauss reading of thrust end shaft journal (10.1 gauss), were above limit and the same was removed by degaussing.

103-JBT (Condensing Turbine) Preventive Maintenance :

Journal & thrust bearings were opened and checked. Thrust end journal bearing pads was found hard. The same were replaced with new pads. Axial thrust was above limit. Inactive thrust ring was replaced. Gauss measurement of rotor shaft and bearings was carried out. Gauss reading of opposite thrust end journal base ring (6.1 gauss) and thrust end shaft (9.1 gauss) & journal base ring (13.2 gauss) were above limit and the same was removed by degaussing.

103-JLP Syn. Gas Compressor Preventive Maintenance :

Opposite thrust end Journal bearing was opened & cleaned and the clearance was found within limit. Gauss measurement of rotor shaft and bearings was carried out.

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103-JHP Syn. Gas Compressor Preventive Maintenance :

Opposite thrust end journal bearing was opened. As the clearance was above maximum limit, it was replaced with new set of pads. Thrust end journal was opened after removing the thrust collar. One journal pad found to have crack and hence it was replaced with new set of pads. O-ring's of thrust collar and bushing was replaced with new one. (2 nos. each). Gauss measurement of rotor shaft and bearings was carried out.

The readings taken during preventive maintenance of 103-J train for all machines in the train are recorded as under.

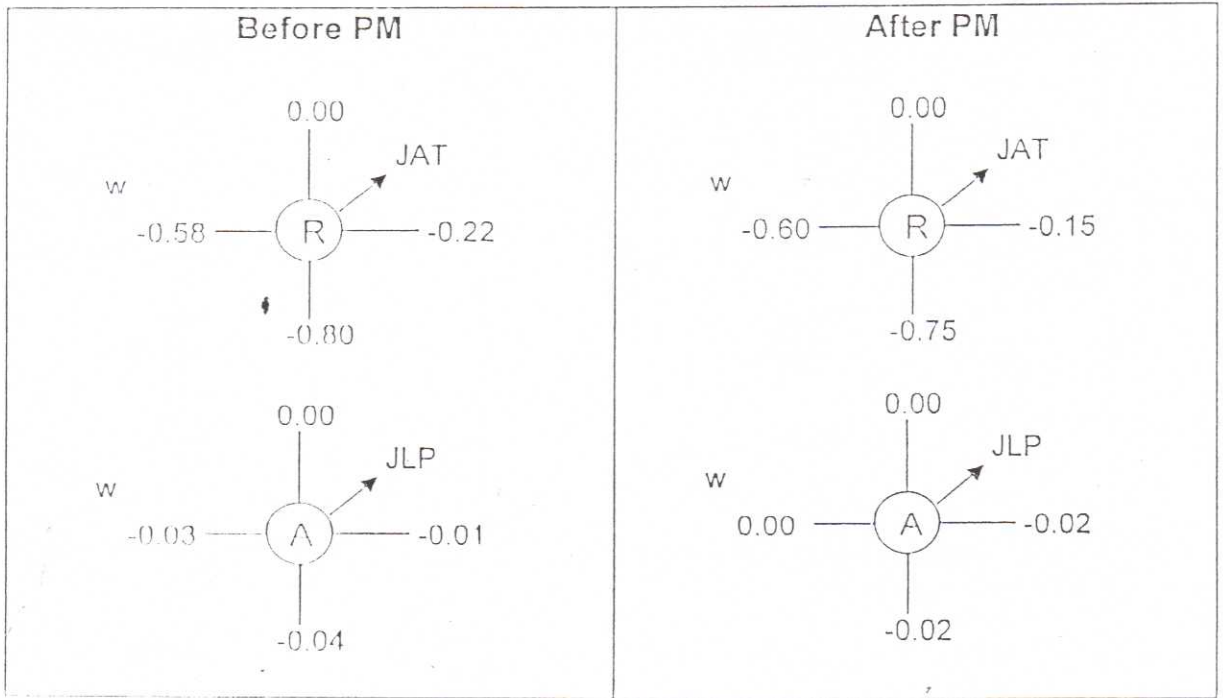
Description	Design Clearances (Inch)	Before	After
103 JAT			
Coupling float		4.37 mm	4.40 mm
Thrust end bearing	0.010 - 0.0012	0.011 "	0.011"
Opp Thrust end bearing	0.006 - 0.008	0.009 "	0.006 "
Axial Thrust	0.008 - 0.012	0.013 "	0.009"
103JBT			
Coupling float		6 mm	6 mm
Thrust end bearing	0.010 - 0.012	0.0115 "	0.010 "
Opp Thrust end bearing	0.010 - 0.012	0.011 "	0.011 "
Axial Thrust	0.008 - 0.012	0.0135 "	0.011 "
103 JLP			
Coupling float		4.90 mm	4.98 mm
Thrust end bearing	0.11 - 0.19 mm	-	-
Opp Thrust end bearing	0.11 - 0.19 mm	0.15 mm	0.15 mm
Axial Thrust	0.38 - 0.55 mm	0.33 mm	0.41 mm
103 JHP			
Thrust end bearing	0.11 - 0.19 mm	0.20 mm	0.175mm
Opp Thrust end bearing	0.11 - 0.19 mm	0.20 mm	0.175 mm
Axial Thrust	0.38 - 0.55 mm	0.33 mm	0.42 mm

REFRIGERATION COMPRESSOR TRAIN

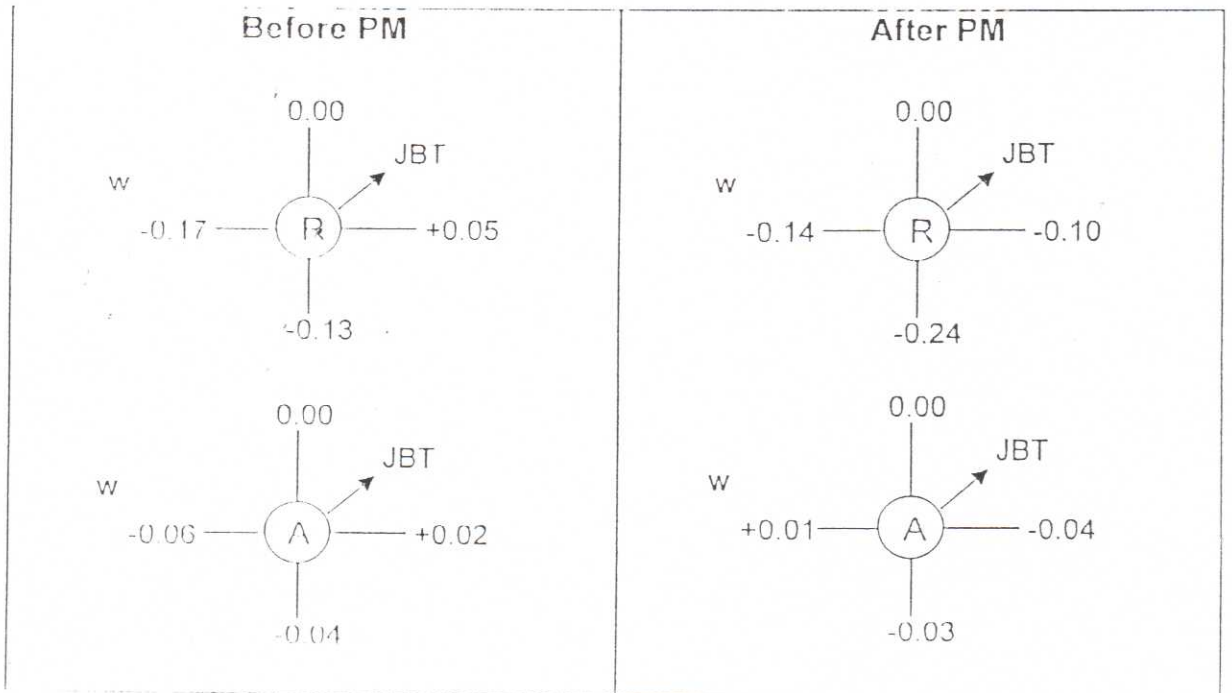
Refrigeration Compressor Drive Turbine 105-JT Overhauling :

Refrigeration Compressor drive Turbine was overhauled in the year 1997 Annual turnaround and since then it was running normal. This turbine was taken for overhauling during Annual turnaround in May - June 2003 after continuous 6 years running under preventive maintenance schedule.

103 JAT to JLP

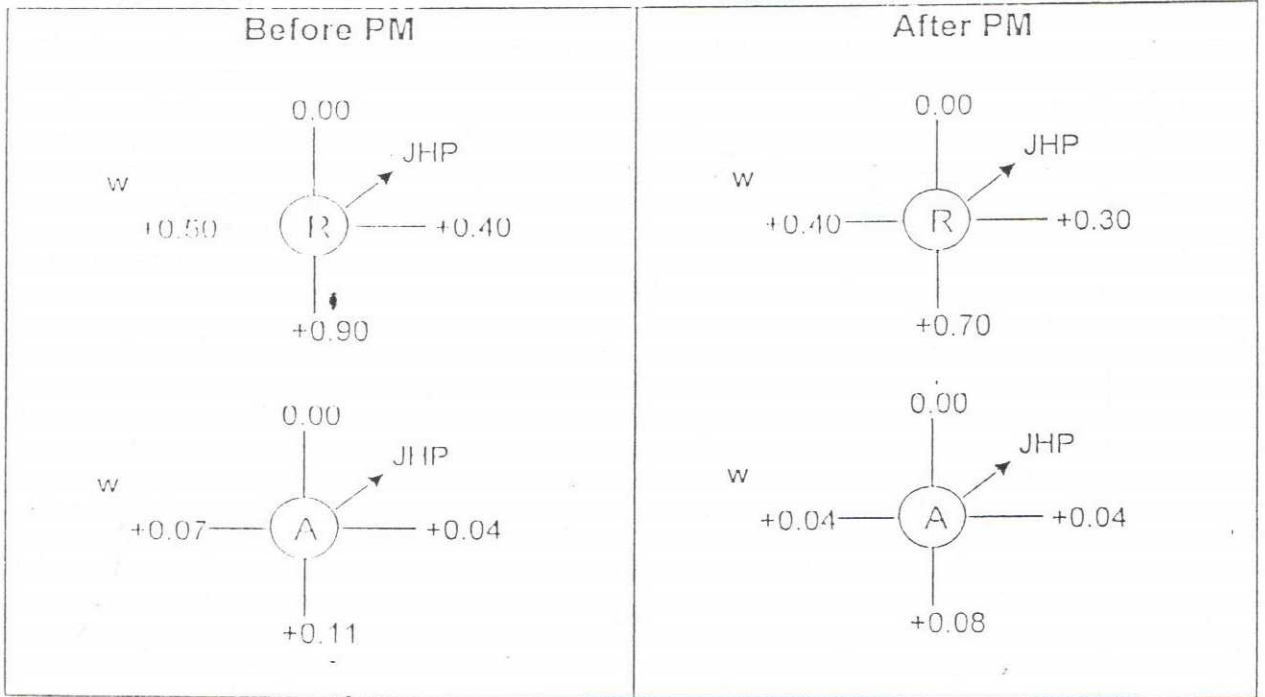


103 JBT to JAT



Alignment Readings (Dimms are in mm)

103 JLP to JHP



Following jobs were carried out in turbine 105-JT during the overhauling :

The turbine was handed over to Maintenance at 08 : 00 hrs. on 29/05/2003

1) Dismantling of Turbine :

Turbine was decoupled from LP Compressor. Removed exhaust pipe and bellow. Both journal bearing clearances and axial thrust was recorded. Linkages of governor was disconnected and governor was removed. Casing top cover along with the steam chest valve lifted after removing casing bolts. Diaphragm clearances and labyrinth clearances was recorded (Data sheet is attached) before removal of the same. Rotor and diaphragms were removed from casing.

2) Observation & Action taken :

Rotor :

- Pitting was found on rotor shaft portion between partition and 8th stage wheel.
- Pitting found on roots of blades in last two wheel
- Silica deposits were observed on rotor blades.
- The rotor was in good condition and reused the same rotor after cleaning.
- Gauss measurement was carried out. Thrust collar and shaft found to have 8 Gauss and it was removed by degaussing.

Diaphragm :

- Partition planes of all diaphragm except 2nd and 3rd stage, found corroded.
- Grooves formed on top and bottom ring of diaphragm blades due to erosion. Erosion was severe on 4th, 5th, 6th & 7th stage diaphragms.

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- Following diaphragms were replaced with reconditioned diaphragm :-

KJ 52 DDH - 5th stage diaphragm ,KJ 52 DDJ - 6th stage diaphragm & KJ 52 BBE - 7th stage diaphragm . These diaphragms were repaired by M/s Alstom Projects India Ltd., against our WO no. : 9912667 dtd. 16/01/2003. After assembling of diaphragms, it was observed that clearances was below recommended value. Hence machining of top and bottom ring of diaphragm blades on steam outlet end was carried out. For 6th stage a cut of 0.008" was taken and for 5th & 7th stage even though a cut of 0.014" & 0.022" was required respectively, maximum possible cut without cutting the edges of blades were taken. Spare for 4th stage diaphragm was not matching with the existing one. It is having part no. KJ BBB instead of KJ 52 BBB.

Casing :

- Corrosion observed on casing top and bottom halves on 4th,5th,6th & 7th stage diaphragm seating area.
- SS inserts on 6th and 7th stage diaphragm also found corroded. SS inserts were provided during Annual Turnaround April 1997.
- Following Labyrinths were replaced with new one :
32 - 2 nos, # 30 - 2 nos.,# 64 - 3 nos, # 65 - 3 nos, # 66 - 1 nos.,# 9 - 2 nos

3) Re-assembly of Turbine :

Top and bottom casing properly cleaned. Rotor was placed and all clearances recorded. Diaphragm clearances (After machining of 5th ,6th & 7th stage diaphragms) and labyrinth clearances were found within design limit. (Data sheet attached).

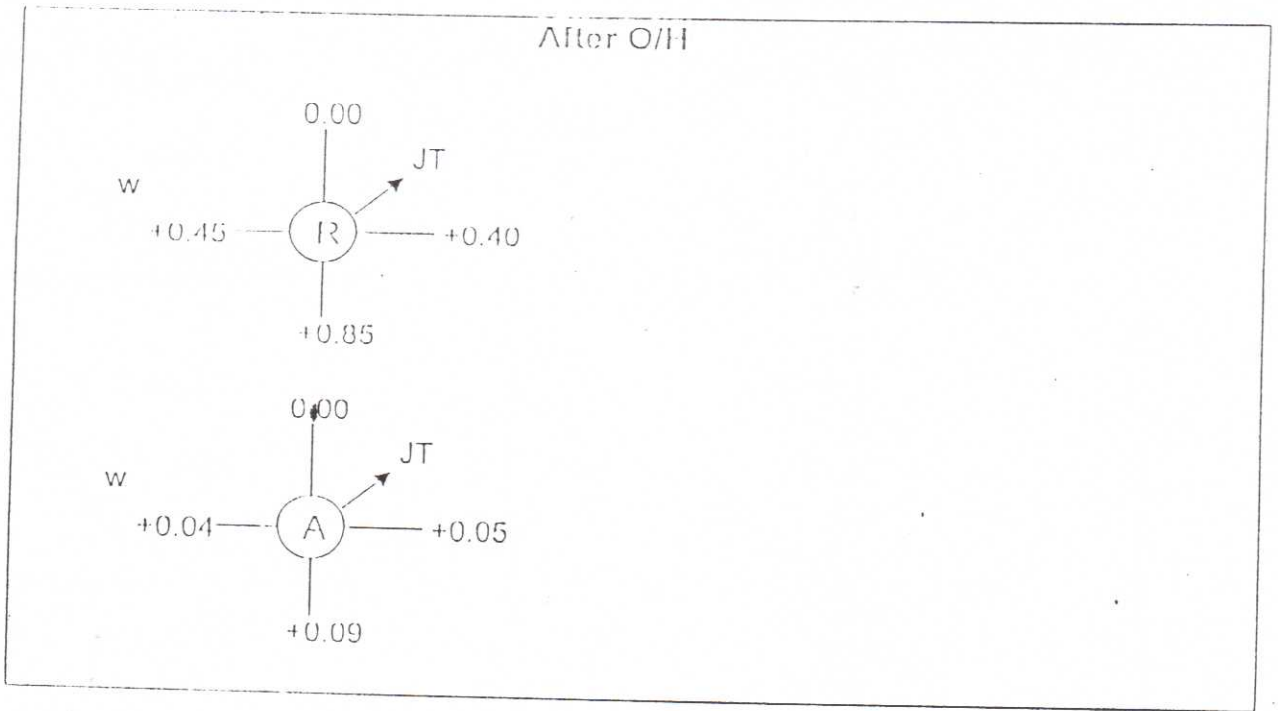
Nozzle clearance was found to be 0.056 ". Total float after placing top casing was 0.205". Journal bearing clearances were checked & recorded and found within limit. Inactive thrust ring was replaced with new one due to crack in the old one. Gauss measurement of bearings was carried out. Gauss reading of thrust end journal base ring was high. Hence it was removed.

Governor was dismantled and its gaskets, O rings and bearings were replaced. All drain line flanges were provided with new gaskets. Greasing of governor linkages was carried out.Overspeed trip was carried out at 7427 RPM.

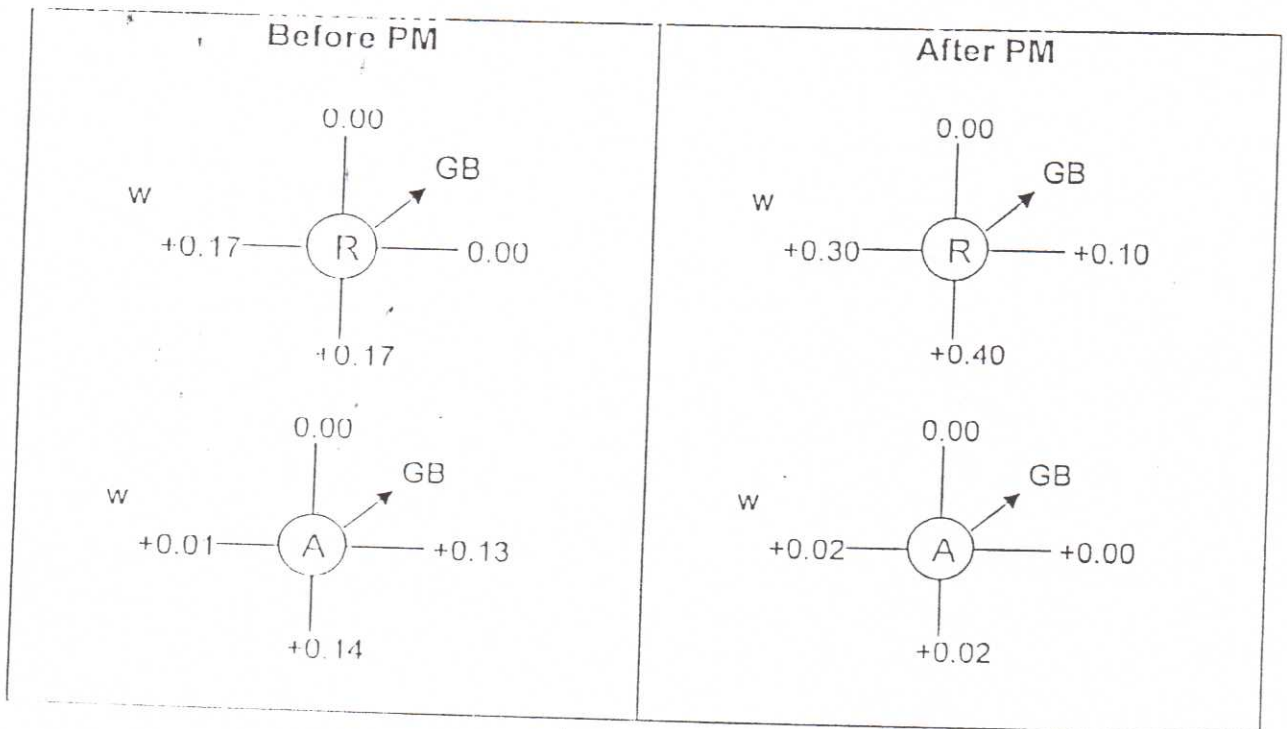
Alignment Readings (Dimms are in mm)

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105 JT to JLP



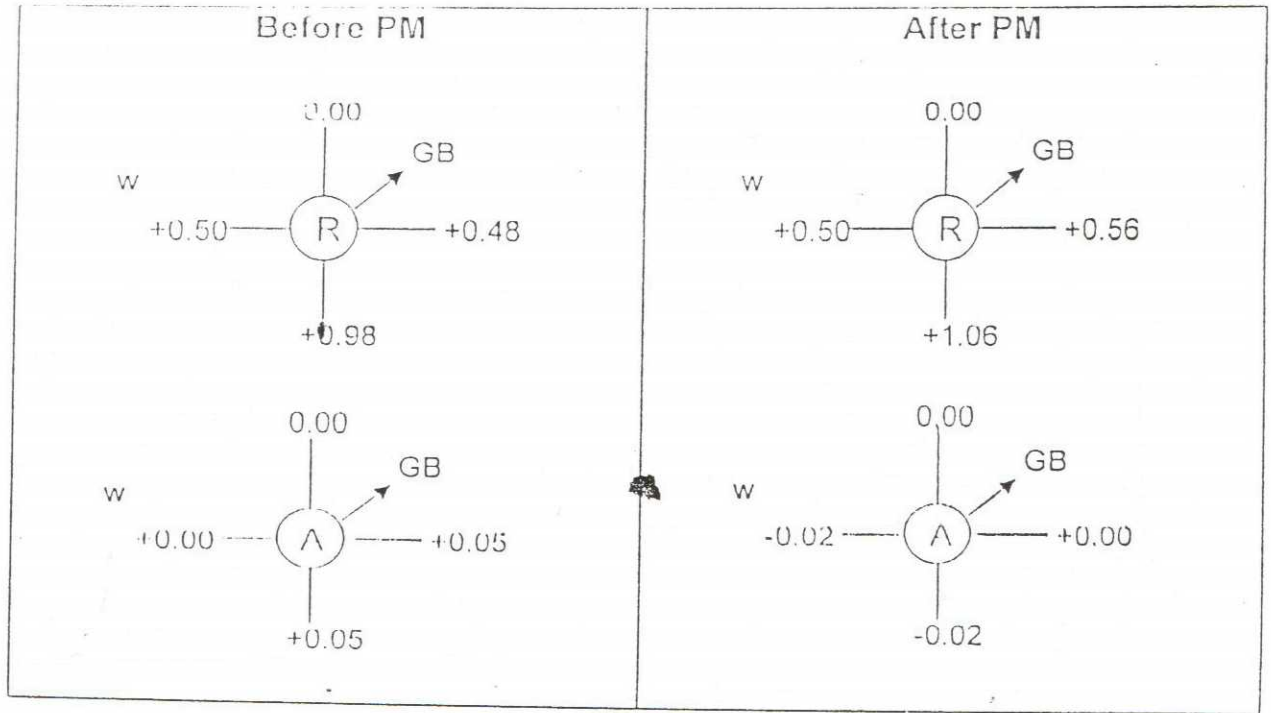
105 JLP to GB



Alignment Readings (Dimms are in mm)

27

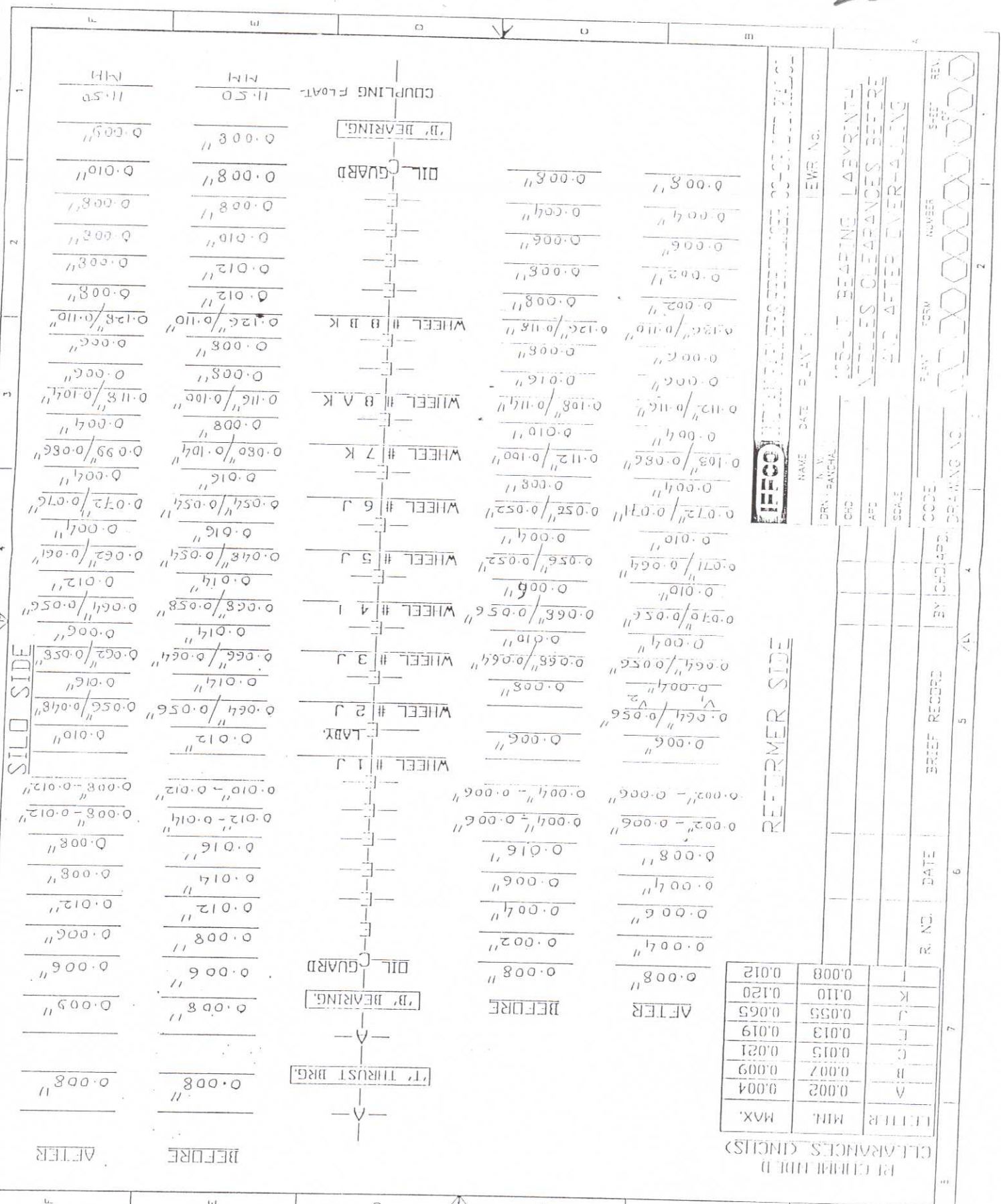
105 JIIP to GB



DRAWING MAY BE USED IN WHOLE OR IN PART, PROVIDED THE (IITCO) NAME AND LOGO ARE MAINTAINED IN ANY REPRODUCTION.

PERFORMANCE (INCHES) CLEARANCES (INCHES)

LETTER	MIN.	MAX.
A	0.002	0.004
B	0.007	0.009
C	0.015	0.021
E	0.013	0.019
J	0.055	0.065
K	0.110	0.120
L	0.008	0.012



REFORMER SIDE



NAME: DATE: EWR No.:

DR. SAATCHI

DESIGNED BY: CHECKED BY: SCALE: TITLE: PROJECT BEARING LAVENTIN VALVES CLEARANCES BEFORE AND AFTER OVERHAULING

PLANT: TOSW NUMBER: SHEET: REV: DRAWING NO.:

SILLO SIDE

1 2 3 4 5 6 7 8



105-J LP Refrigeration Compressor Preventive Maintenance :

Thrust bearing was opened and cleaned. Both journal bearing clearances were recorded by dial gauge since it is single piece design. Gauss measurement of bearings and rotor was carried out. Gauss reading of thrust end shaft (16.2 gauss) was above limit & hence it was removed.

105-JR Gear Box Preventive Maintenance :

All the bearings were inspected. Pinion South side bearing was replaced due to crack in bottom half. Both the gear as well as Pinion were inspected and found to be O.K. Gauss measurement of gear shaft and bearings carried out and found within limits.

105-J HP Refrigeration Compressor Preventive Maintenance :

Thrust bearing was opened and cleaned. Both journal bearing clearances were recorded by dial gauge since it is single piece design. Gauss measurement of rotor and bearings was carried out. Gauss reading of thrust end shaft (10.1 gauss) and thrust bearing base ring (7.2 gauss) was above limit & hence it was removed. Train alignment reading attached

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

Description	Design Clearances (Inch)	Before	After
105 JT			
Coupling Float		11.50 mm	11.50 mm
Thrust end bearing	0.007 - 0.009	0.008 "	0.009"
Opp Thrust end bearing	0.007 - 0.009	0.008 "	0.009"
Axial Thrust	0.008 - 0.012	0.008 "	0.008 "
105 JLP			
Coupling Float		8.90 mm	8.90 mm
Thrust end bearing	0.006 - 0.008	0.010" By dial gauge	
Opp Thrust end bearing	0.006 - 0.008	0.014" By dial gauge	
Axial Thrust	0.011 - 0.015	0.012 "	0.012 "
105 JR			
Drive gear North bearing	0.010 - 0.011	0.011 "	0.011 "
Drive gear South bearing	0.010 - 0.011	0.011 "	0.011 "
Axial Thrust	0.014 "	0.014 "	0.014 "
Pinion North bearing	0.010 - 0.012	0.012"	0.012 "
Pinion South bearing	0.010 - 0.012	0.010 "	0.010 "
Free float		0.055 "	0.055 "
Backlash		0.006 "	0.006 "
105 JHP			
Coupling Float		16.50 mm	16.50 mm
Thrust end bearing	0.004 - 0.007	0.005" By dial gauge	
Opp Thrust end bearing	0.004 - 0.007	0.007" By dial gauge	
Axial Thrust	0.008 - 0.012	0.011 "	0.011 "

N.G. BOOSTER COMPRESSOR TRAIN

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N.G Booster Compressor Drive Turbine 800-JT Preventive Maintenance :

Turbine was decoupled and Journal and thrust bearings were opened and checked. Clearances were within design limit. Coupling side labyrinth was damaged and hence it was replaced. Gauss measurement of rotor shaft and bearings was carried out. Gauss measurement of thrust end journal bearing base ring (52 Gauss), journal pads, thrust bearing pads, thrust bearing base ring (5.2 gauss) were above limit. Hence it was removed.

Pilot Valve, Governor tester, hand trip valve, tripping device & dampener were opened and cleaned. Servomotor Hydraulic cylinder was replaced with new one. Both governing oil filters were cleaned. Governing valve stroke w.r.t secondary oil pressure checked from 505 Governor.

Signal %	Secondary oil Pr. (Kg/ cm ²)	Valve Lift
0	1.2	-
10	1.4	0.05
20	1.65	1
30	1.95	5
40	2.25	9
50	2.5	10
60	2.85	11
70	3.2	12
80	3.5	13
90	3.85	14
100	4.25	16

800-J N.G Booster Compressor Preventive Maintenance :

Opened both journal bearings and thrust bearing. Axial thrust was on higher limit. Hence active thrust pads (6 nos.) were replaced with new pads. Gauss measurement of rotor shaft and bearings was carried out. Gauss measurement of thrust end journal bearing base ring (15.2 gauss), journal pads (5.2 gauss), opposite thrust end journal bearing base ring (22 gauss), journal pads (5.6 gauss) were above limit and removed the same by degaussing. NG suction strainer was opened and cleaned.

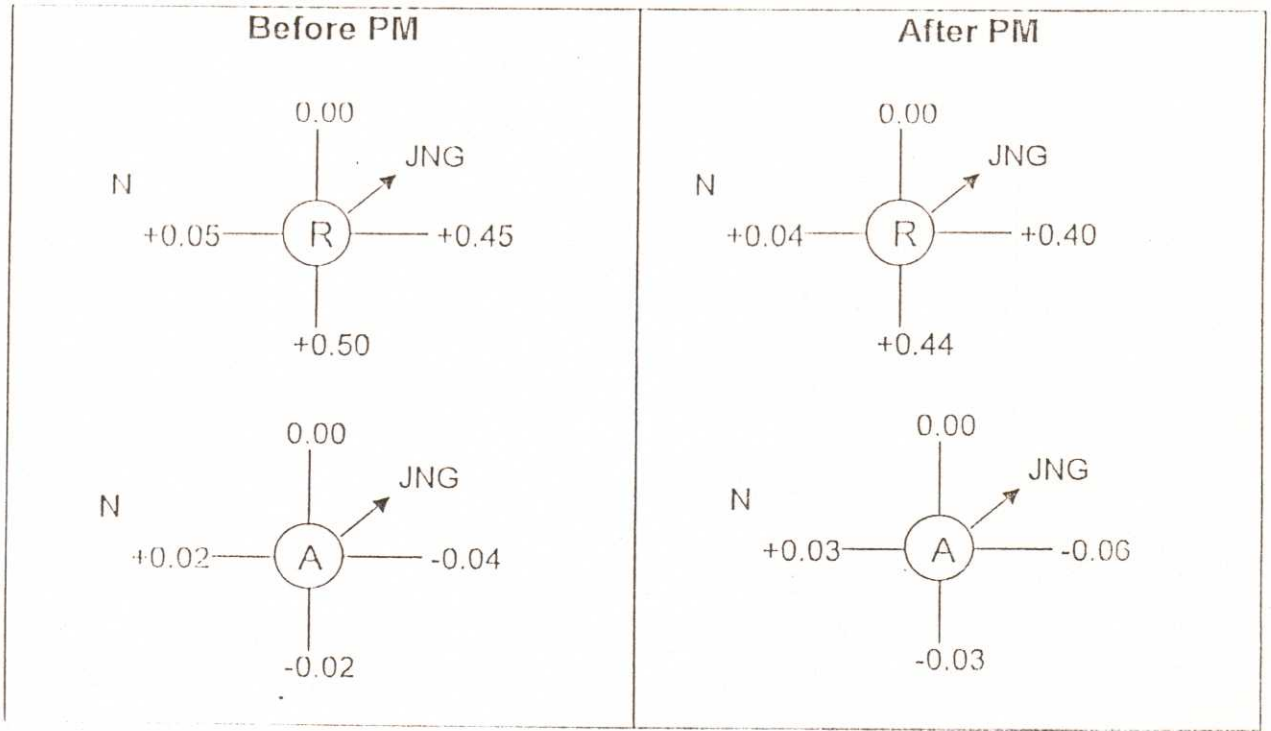
800-J A.G Compressor Preventive Maintenance :

Opened both journal bearings and thrust bearing. Clearances were within the limit. Gauss measurement of rotor shaft and bearings was carried out. Gauss reading of thrust side Journal base ring (15 Gauss) was found to be above limit and the same was removed. AG suction strainer was opened and cleaned. Train alignment reading attached

Alignment Readings (Dimms are in mm)

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800 JT to JNG



800 JNG to JAG

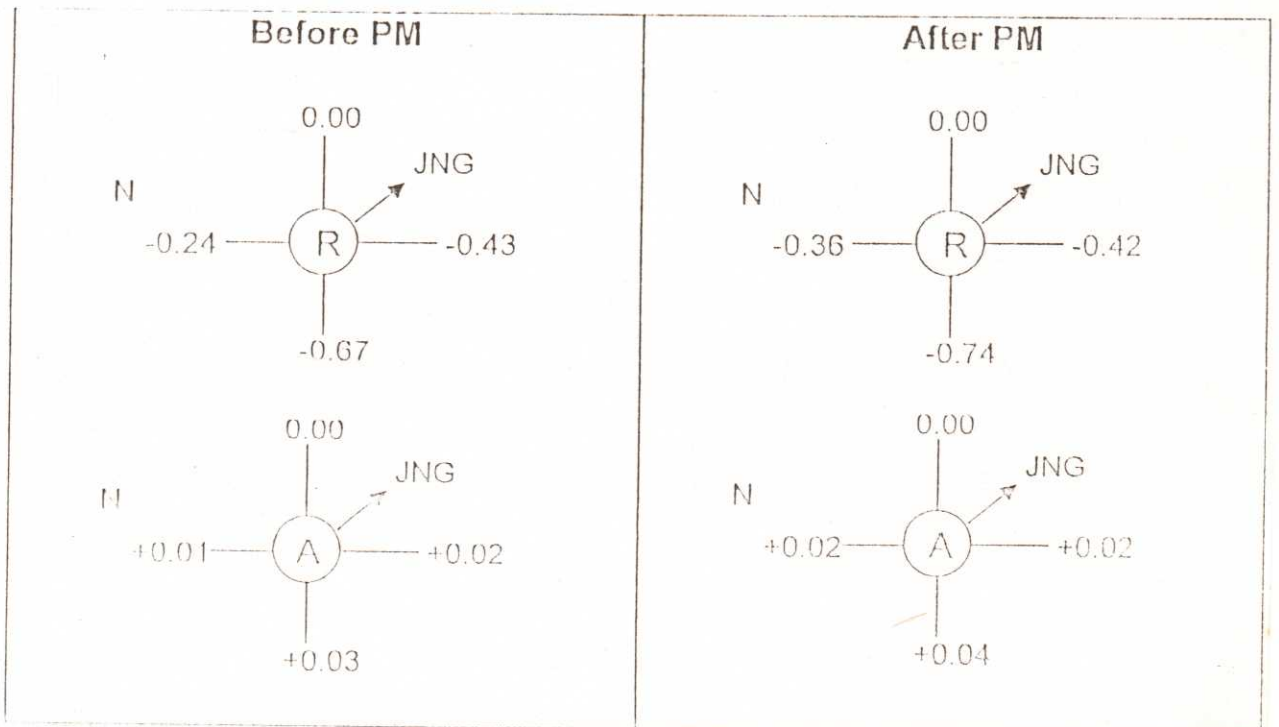
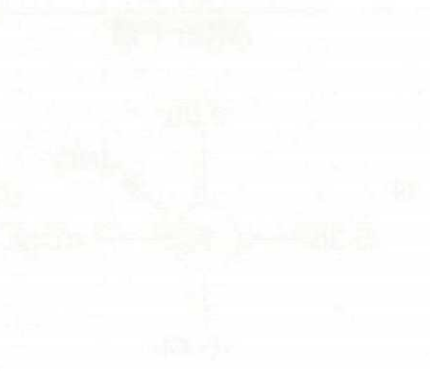


Diagram of a 2-Digit 7-Segment Display

Fig. 1.1



Diagram of a 4-Digit 7-Segment Display



The reading taken during preventive maintenance of 800J train is recorded as under :-

Description	Design Clearances (mm)	Before	After
800 JT			
Thrust end bearing	0.15 - 0.21	0.17	0.17
Opp Thrust end bearing	0.15 - 0.21	0.18	0.18
Axial Thrust	0.16 - 0.24	0.16	0.18
Thrust end Labyrinth		0.3	0.3
Opp. Thrust end Labyrinth		0.3	0.2
800 JNG			
Thrust end bearing	0.08 - 0.113	0.1	0.102
Opp Thrust end bearing	0.08 - 0.113	0.092	0.092
Axial Thrust	0.25 - 0.35	0.35	0.31
800 JAG			
Thrust end bearing	0.08 - 0.113	0.09	0.09
Opp Thrust end bearing	0.08 - 0.113	0.1	0.108
Axial Thrust	0.25 - 0.35	0.26	0.26

BOILER FEED WATER PUMP AND DRIVE TURBINE 104J/JT/JA / JAT) :

104-JAT BFW Pump Drive Turbine (Terry) Overhauling :

Turbine was opened for changing the diaphragms procured from M/s Triveni Engg., Bangalore against PO No. : 9911362 dtd. 04/05/2002. Turbine was decoupled. Exhaust bellow was removed. Journal bearing and thrust bearing clearances were checked and found within recommended value. Turbine top casing was opened and rotor was removed.

All 5 diaphragms were replaced with new one. Thickness of new set of diaphragms was 5 mm more than old diaphragm set. Hence 1st and 2nd diaphragms were machined on the steam exhaust end by 1.25 & 3.75 mm respectively. Final thickness is given below:

Description	Thickness of Old diaphragm in mm	Thickness of New diaphragm in mm
1st Diaphragm	37.85	57.45
2nd Diaphragm	58.75	58.8
3rd Diaphragm	58.75	66.6
4th Diaphragm	58.7	58.5
5th Diaphragm	58.7	31.2

New carbon rings were fitted at both glands and recorded the clearances found with in design value. Nozzle clearance and diaphragm clearances were recorded. (Data sheet is attached).

Gland repacking of TTV was carried out. Governor oil was flushed and governor was tested on test bench. LO & GO cooler was cleaned. LO console was cleaned and filled with new oil. LO filter cleaned. Gland repacking of extra nozzle valves was carried out. Turbine OST done at 4100 RPM.

104 -JA BFW Pump Preventive Maintenance :

Both the journal bearings as well as thrust bearing were inspected clearances found within recommended value. MOP replaced with new one. RV of MOP was replaced with new one. Pump Seal oil coolers & LO coolers were cleaned. MOP & AOP strainer and filters were cleaned. Alignment of AOP was checked. Coupled and greased the coupling.

Alignment reading attached

Description	Design Clearances (Inch)	Actual
104-JAT (Terry)		
Coupling Float		6 mm
Thrust end bearing	0.005 - 0.007	0.0065"
Opp Thrust end bearing	0.005 - 0.007	0.005"
Axial Thrust	0.011 - 0.016	0.014 "
104-JA		
Thrust end bearing	0.006 - 0.008	0.008"
Opp Thrust end bearing	0.006 - 0.008	0.006"
Axial Thrust	0.014 "	0.0135 "

104-JT BFW Pump Drive Turbine (Elliot) Preventive Maintenance:

Turbine was decoupled. Opened both the journal bearings cleaned recorded the clearance Thrust bearing deep ball bearing found in good condition. Governor replaced with new repaired governor. LO & GO cooler was cleaned. LO console was cleaned and filled with new oil. Oil filter and strainer cleaned. AOP alignment checked. Gland repacking of extra nozzle valves was carried out.

104-J BFW Pump Preventive Maintenance :

Both the journal bearings as well as thrust bearing were inspected clearances found within recommended value. Main oil pump drive gear replaced with new one. Pump Seal oil coolers & LO coolers were cleaned. MOP & AOP strainer and filters were cleaned. Alignment of AOP was checked. Coupled and greased the coupling.

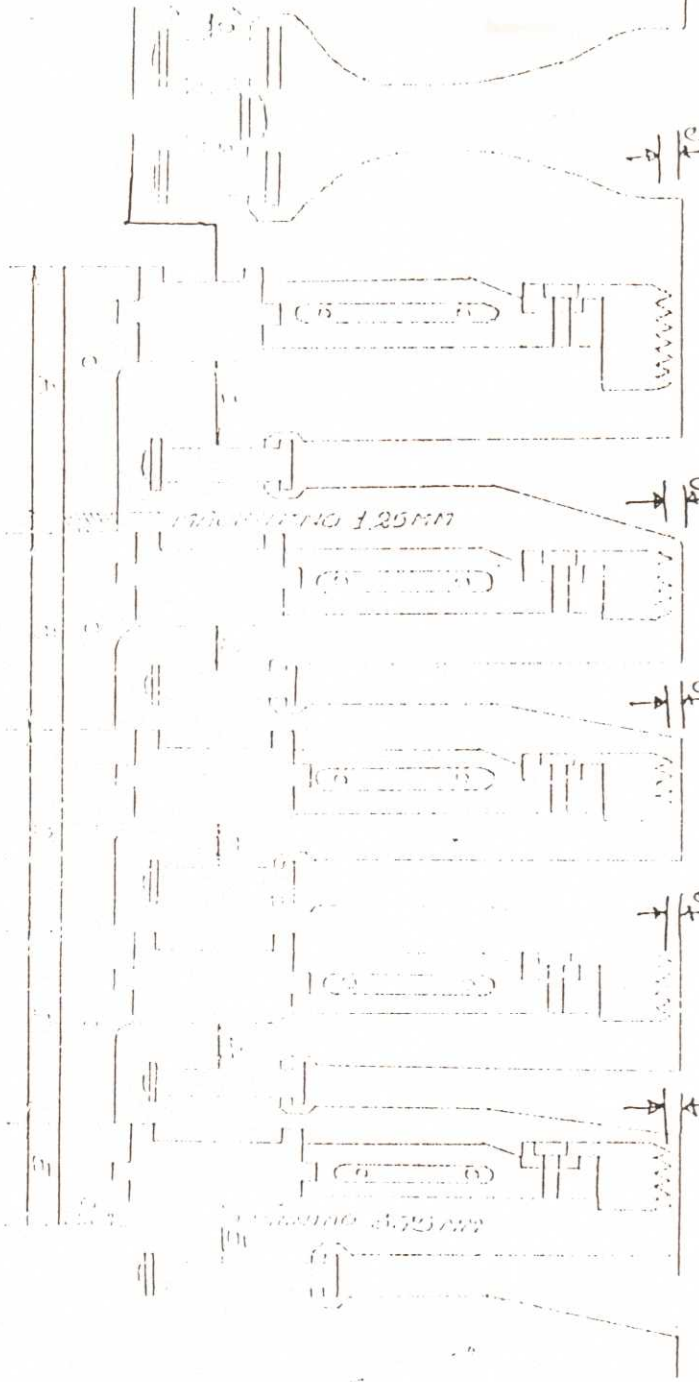
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TERRY TURBINE (104 JAT)
DIAPHRAGM SUPPLIED BY M/S TEL, BANGLORE

NEW DIAPHRAGM REPLACING

OLD DIAPHRAGM THICKNESS	NEW DIAPHRAGM THICKNESS	CLEARANCE	AXIAL GLAZE
58.75 mm	58.70 mm	0	0.00 mm
58.75 mm	58.80 mm	0	0.00 mm
58.70 mm	58.80 mm	0	0.00 mm
58.70 mm	58.56 mm	0	0.00 mm
58.70 mm	58.95 mm	4	0.00 mm
58.75 mm	58.75 mm	5	0.00 mm
OLD & NEW DIAPHRAGM DIFFERENCE = 5.00			

$X = \frac{OLD - NEW}{2}$
 $X = \frac{0.00 - 0.00}{2}$
 $X = 0.00$
 $E = 0.020$
 $F = 0.022$



REFERENCE DRAWING

- a) TB1SAM 3176 - 2nd stage diaphragm assembly
- b) TB1SAM 3177 - 3rd stage diaphragm assembly
- c) TB1SAM 3178 - 4th stage diaphragm assembly
- d) TB1SAM 3179 - 5th stage diaphragm assembly
- e) TB1SAM 3180 - 6th stage diaphragm assembly
- f) TB1SAM 3172 & 3170 - diaphragm inner ring
- g) TB1SAM 3171 - diaphragm inner ring
- h) TB1SAM 6655 - nozzle segment (1st stage)
- i) TB1SAM 6662 - spacer (3rd stage)
- j) TB1SAM 6661 - spacer (5th stage)
- k) TB1SAM 6664 - nozzle segment (3rd stage)
- l) TB1SAM 6650 - spacer (4th stage)
- m) TB1SAM 6653 - nozzle segment (4th stage)
- n) TB1SAM 6652 - nozzle segment (5th stage)
- o) TB1SAM 6659 - spacer (5th stage)
- p) TB1SAM 6658 - End Piece (2nd stage)
- q) TB1SAM 6607 - End Piece (2nd stage)
- r) TB1SAM 6656 - spacer (2nd stage)
- s) TB1SAM 6651 - nozzle segment (2nd stage)

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Alignment readings attached

The reading taken during maintenance of 104J Train are recorded as under :

Description	Design Clearances (Inch)	Actual
104-JT (Elliot)		
Coupling Float		mm
Thrust end bearing	0.007 - 0.010	0.010"
Opp Thrust end bearing	0.007 - 0.010	0.010"
Axial Thrust		0.016 "
104-JA		
Thrust end bearing	0.006 - 0.008	0.010"
Opp Thrust end bearing	0.006 - 0.008	0.011"
Axial Thrust	0.014 "	0.013 "

107-JT aMDEA Pump Drive Turbine (MURRAY) Overhauling :

aMDEA Drive Turbine was overhauled in the year 1997 Annual turnaround and since it was running normal. This turbine was taken for overhauling during Annual turnaround in May - June 2003 after continues 6 years running under preventive maintenance schedule.

Following jobs were carried out in turbine 107-JT during the overhauling

The turbine was handed over to Maintenance at 14 : 00 hrs. on 28/05/2003

1) Dismantling of Turbine :

Turbine was decoupled. Removed exhaust bellow. Journal bearing clearances and axial thrust was recorded. Both journal clearances were above recommended value. Casing top cover was removed using chain blocks. Nozzle clearance, interstage and gland carbon ring clearances were recorded. (Data sheet is attached). Control Valve was dropped , TTV and steam inlet valve was opened.

2) Observation & Action taken :

Rotor :

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- Steam inlet end face of 3rd wheel of rotor and the corresponding face of 2nd stage diaphragm found to have rubbing marks and metal has been chipped off on both. Hence decided to replace the rotor with repaired rotor available in store.

Diaphragm :

- Face of 2nd stage diaphragm have rubbing marks and metal has been removed .
- Cracks observed on parting planes of 2nd and 3rd stage diaphragm.
- Blades of final stage diaphragm having corrosion
- Decided to replace all diaphragms with spare one available in store.

Casing :

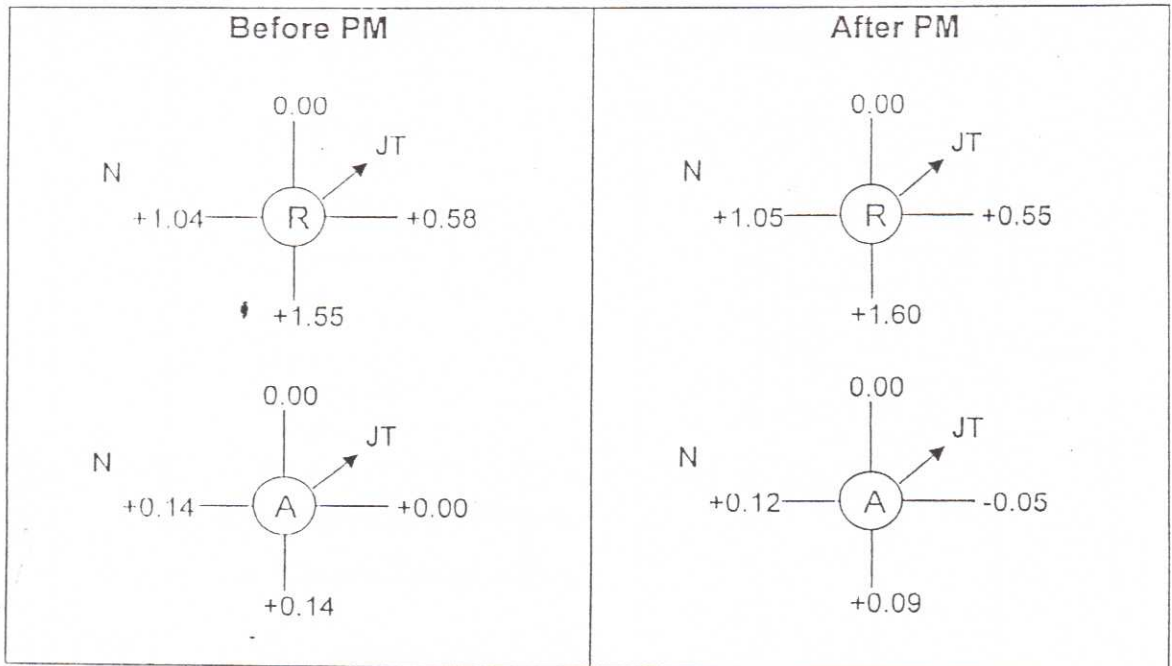
- Observed corrosion of casing in exhaust end after 3rd stage diaphragm.
- Casing drain line found having crack. The same was removed and new line was provided.
- Sector found broken at edge towards south side . Hence it was replaced with new one.
- Spindle of TTV found bend. It was replaced with new one. Gland nut was replaced with new one made from work shop. Gland repacking of TTV was also done.
- Steam inlet strainer found damaged, hence replaced with new one.

3) Re-assembly of Turbine :

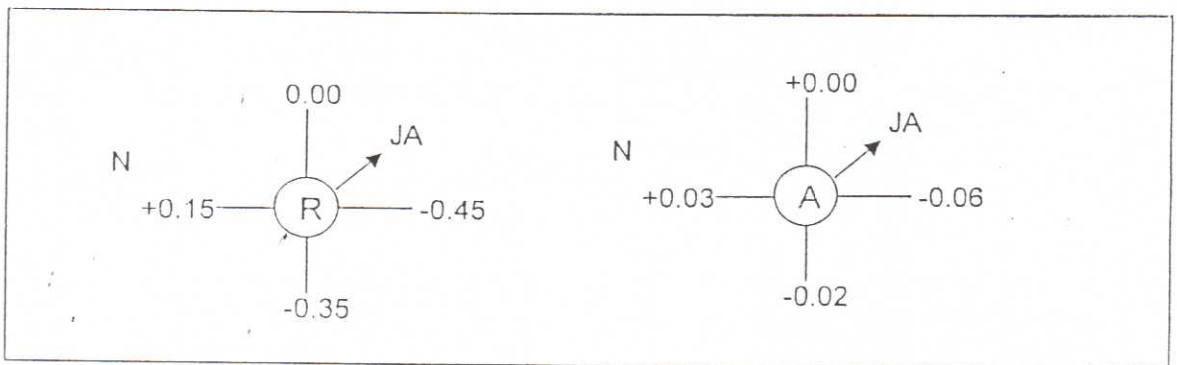
Top and bottom casing properly cleaned. Both journal bearings and thrust bearing pads were replaced with new one. All carbon rings were replaced with new one. Carbon ring clearances was less than recommended. Hence it was machined from work shop. Rotor was placed and all clearances recorded. Diaphragm clearances and axial thrust was less than design limit. Hence rotor was shifted by increasing the outboard shim thickness by 0.8 mm and reducing inboard shim thickness by 0.9 mm. Axial thrust was found within limit, but clearance of 2nd and 3rd stage diaphragm was found to be less then recommended. (Max clearance was 0.061" & 0.067" whereas the recommended clearance is 0.094 "). Hence the diaphragm clearance was increased by machining the steam inlet end face by 0.60 mm (+0.02, -0.00) and providing 10nos. button of same

Alignment Readings (Dimns are in mm)

107 JT to J



107 JA to JB



ANNUAL TURNAROUND - 2003

RECOMMENDED CLEARANCES		D1 = 0.004" TO 0.006"	D2 = 0.004" TO 0.006"	B1 = 0.0075" TO 0.010"	B2 = 0.0044" TO 0.007"	A = 0.007" TO 0.013"	C = 0.012" TO 0.016"	E = 3/32" (0.094")	F = 1/16" (0.0625")
ALTER	BEFORE	ALTER	BEFORE	STEAM FLOW		BEFORE	AFTER	BEFORE	AFTER
		0.0095"	0.010"	↓					
		0.0055"	0.010"	THRUST BEARING A					
		0.007"		BEARING D1					
		0.007"		CARBON RING					
		0.008"		B1					
		0.008"		B1					
		0.008"		B1					
		0.008"		B1					
		0.008"		B1					
		0.009"		B1					
		0.075	0.067	NOZZLE		0.071"	0.057"		
				WHEEL-1					
				WHEEL-2					
		C = 0.0145"	0.024"	DIAPHRAGM C		0.089"	0.075"		
		0.077"	0.098	WHEEL-3					
		C = 0.012	0.020	DIAPHRAGM C		0.035"	0.083"		
		0.057"	0.037"	WHEEL-4					
		C = 0.013	0.016	DIAPHRAGM C		0.045"	0.073"		
		0.075"	0.053"	WHEEL-5					
		C = 0.012"	0.018"	DIAPHRAGM C		0.080"	0.120"		
		0.026"	0.080"	WHEEL-6					
		0.006		CARBON RING					
		0.006"		B2					
		0.006"		B2					
		0.006"		B2					
		0.0055		B2					
		0.0055		B2					
		0.005"		B2					
		0.005"		B2					
		0.006"	0.0075	BEARING D2					
				COUPLING					
COUPLING FLOOR →		15.20	13.5						
		MM	MM						

107JT MURREY TURBINE

thickness on the exhaust end . Clearances were checked and found within limit. (Data sheet attached).

LO & GO cooler was cleaned. Lube oil console was cleaned and filled with new oil. LO filter was replaced with new one. Gland repacking of extra nozzle valves was carried out. Over speed trip of turbine was carried out at 4227 RPM.

Description	Design Clearances (Inch)	Before	After
107 JT			
Coupling Float		13.50 mm	15.20 mm
Thrust end bearing	0.004 - 0.006	0.010 "	0.0055"
Opp Thrust end bearing	0.004 - 0.006	0.0075 "	0.006"
Axial Thrust	0.007 - 0.013	0.010 "	0.009 "

107-JA & B aMDEA Pump Preventive maintenance :

aMDEA pump 107 JA was attended for mechanical seal leakage (Turbine side). aMDEA pump 107 JB was attended for mechanical seal leakage (Opp. Coupling end). All O rings and turbine side bearing was replaced with new one. Carbon & Tungston carbide was replaced with reconditioned one. Coupling greasing was carried out. aMDEA suction filter was cleaned.

107-JAT aMDEA Pump drive turbine & 107 J C & D Preventive maintenance :

Turbine was decoupled. Journal bearing clearances were checked and found within limit. Thrust bearing checked and found OK. Coupling greasing was carried out. Balance line of 107 J C & D was replaced with flexible hose. aMDEA suction filter was cleaned.

101 / 105 JLT Lube oil Pump Drive Turbine Overhauling :

Decoupled turbine from the pump. Removed the coupling hub and carbon packing. Both bearings were replaced by new one 7312 BECBM/6308 SKF. Carbon packing ring was replaced with new one and clearance checked :0.002" to 0.003". Nozzle clearance recorded as Turbine axial float after final assembly recorded as 0.10 mm.Pump axial float recorded as1.85 mm. Coupling gap between pump and turbine : 0.286". Pilot valve clearance with trip lever recorded as a 0.018". Governor was replaced with repaired governor. Overspeed trip was opened and valve was replaced with new one. It was observed that there was axial play of valve. Turbine and OST carried out at 1960 RPM. Coupled.

102 JSJT Seal oil Pump Drive Turbine Overhauling :

40

Decoupled turbine from the pump. Removed the coupling hub and carbon packing. Carbon ring was replaced with new one. Governor oil was flushed.

102 JLJT Lube oil Pump Drive Turbine :

Decoupled the turbine from pump. Governor oil was flushed. Alignment checked and found it was disturbed. It was corrected & coupled.

103-JLJT Lube oil / Seal oil Pump and drive Turbine :

Decoupled the turbine from the pumps. Overspeed trip assembly was opened as it was getting detached during running. OST spring was replaced with new one. Latch lever was replaced with lever made from M/s. Governor oil was flushed. OST was carried out at 3550 RPM.

103 J seal oil pump was replaced with new pump procured from M/s Tushaco Pumps Ltd., against PO No : 9909908 dtd 25/07/2001.

I. D FAN TRAIN :

101 BJT I.D Fan Drive Turbine Preventive Maintenance :

Turbine was decoupled. It was observed that turbine float was nil before decoupling as grease become hard. Both journal bearings were replaced with new one. Coupling teeth was worn out and hence it was replaced with new one.

Dimensional details of the turbine and gear box coupling shaft :-

Turbine shaft OD : 2.4305 " , Coupling Hub ID : 2.4300"
Gearshaft OD : 3.188 " , Coupling Hub ID : 3.187 "

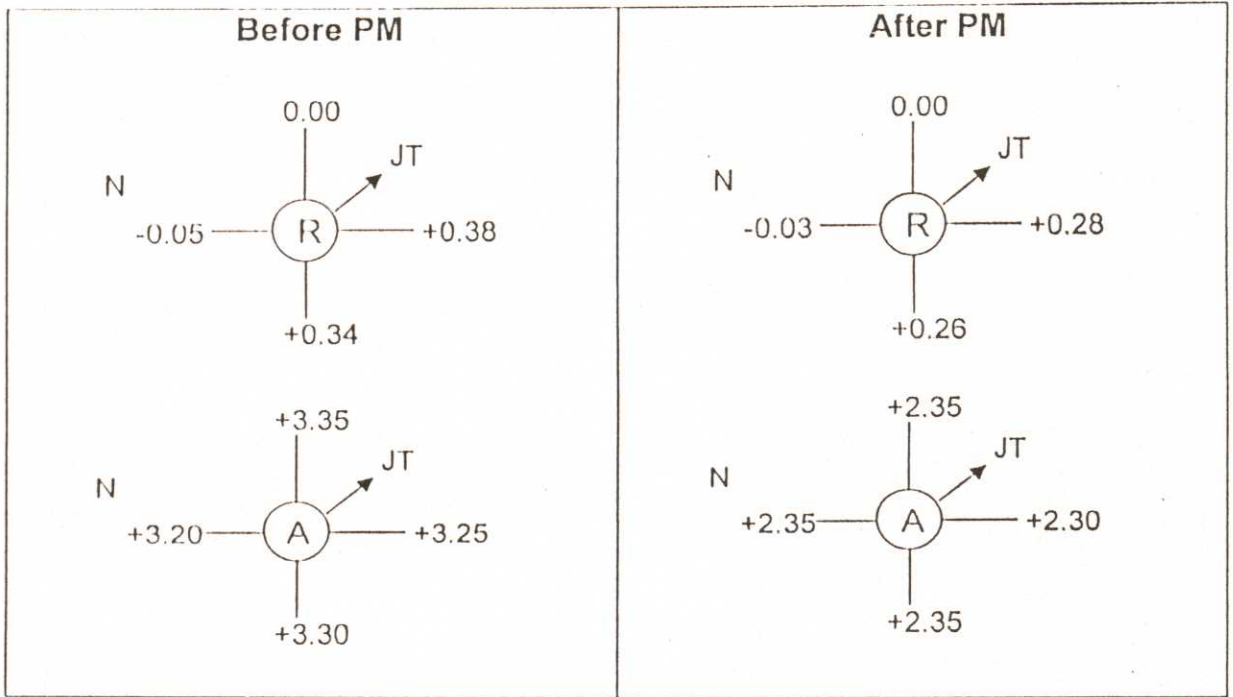
Governor was replaced with repaired governor after testing on test bench. Steam Inlet and exhaust spring support was replaced with new one. AOP was replaced with reconditioned pump and coupling spider was replaced with new one. CW strainer was cleaned. LO coolers were opened and cleaned.

ID Fan Gear Box Preventive Maintenance :

Gear box cover was removed. All bearings were inspected and their clearances were recorded. The condition of both the Gear as well as

Alignment Readings (Dimns are in mm)

101 BJT to GB



101 GB TO FAN

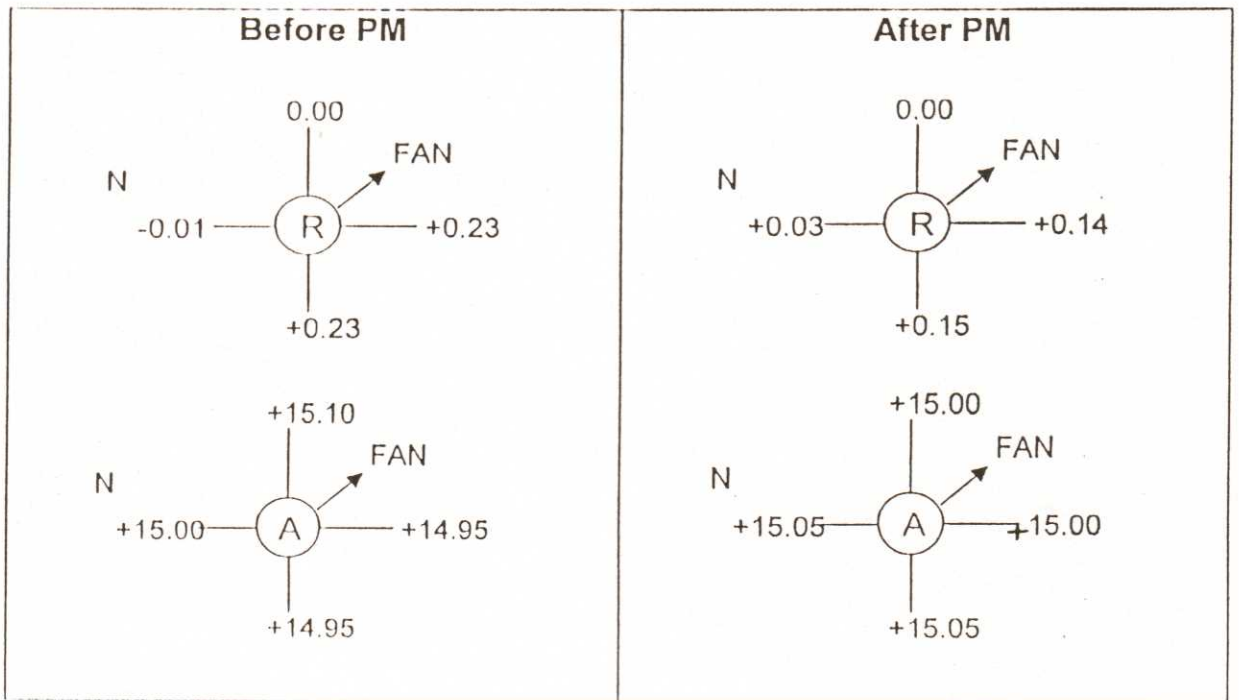


Diagram of a two-stage amplifier circuit

Fig. 1.1

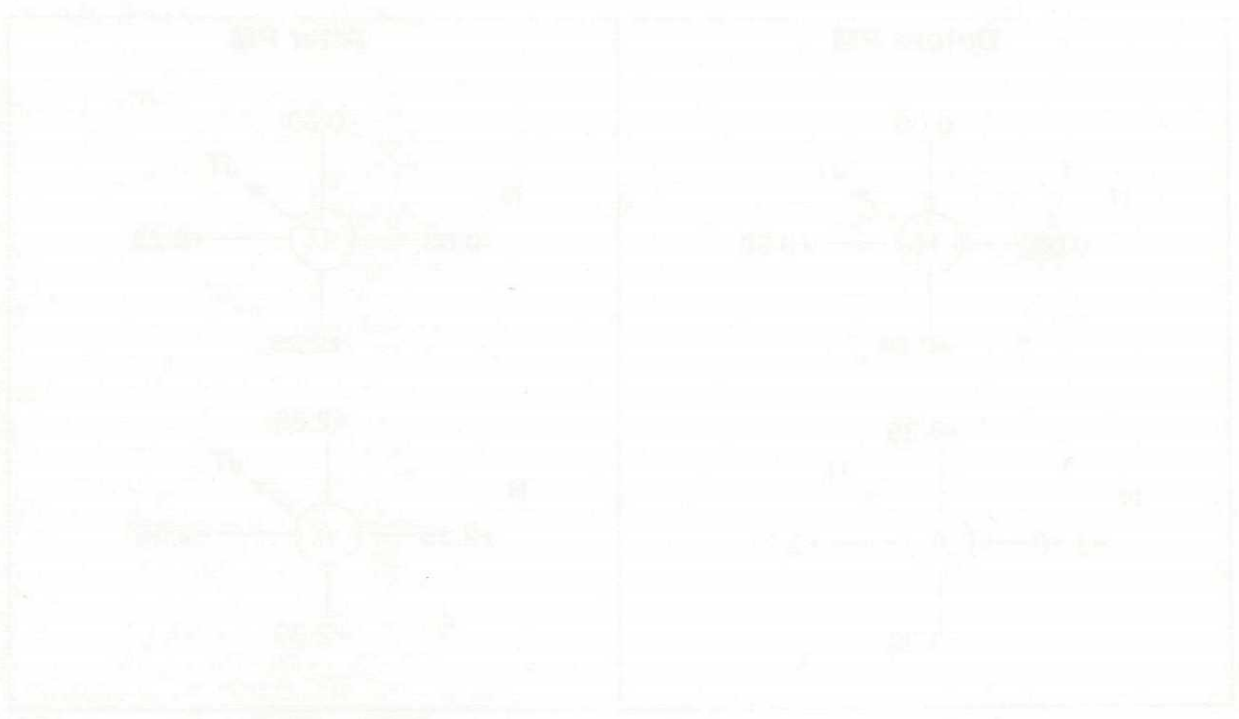


Fig. 1.2



Pinion were found to be O.K. Gear box was cleaned and filled with new oil. Oil filter was cleaned.

101-BJ I.D Fan Preventive Maintenance :

Both the bearings of the I.D. Fan were inspected and found to be OK. Oil seal of bearing housing was replaced with new one. The reading taken during overhauling of I.D. Fan Train are recorded as under.

Description	Design Clearances (Inch)	Before	After
101 BJT			
Coupling Float		-	8.27 mm
Thrust end bearing	0.006 - 0.009	0.010"	0.009"
Opp Thrust end bearing	0.006 - 0.009	0.010"	0.008"
Axial Thrust	0.0014 "	0.014 "	0.014 "
101 BJR			
Coupling Float			3.10 mm
Pinion Turbine side bearing	0.010 - 0.012	0.011"	0.011"
Pinion Fan side bearing	0.010 - 0.012	0.010"	0.010"
Free float		0.85 mm	0.85 mm
Gear Turbine side bearing	0.010 - 0.011	0.011"	0.011"
Gear Fan side bearing	0.010 - 0.011	0.010"	0.010"
Gear Thrust		0.50 mm	0.54 mm
101 BJ			
Thrust end bearing	0.008 - 0.012		
Opp Thrust end bearing	0.008 - 0.012		
Axial Thrust		0.8 mm	0.8 mm

PRIMARY REFORMER - 101-B :

During the annual inspection 100% radiography was carried out in all 336 catalyst tubes and 8 riser tubes of Primary reformer (101-B). It was noticed weld cracks in 'C' joints of catalyst tubes and 'D' joints of riser tubes at inner surface of weld. Out of 55 defective catalyst tubes and 2 riser tubes, based upon severity of the cracks, 25 catalyst tubes and 01 riser tube were replaced.

16 Nos. spare catalyst tubes and 01 No. Riser tube were available in our store. Remaining 9 catalyst tubes were salvaged from used tubes removed Primary Reformer.

REPLACEMENT OF CATALYST TUBES :

Locked the spring hangers and removed the L plates

Removed the catalyst from the tubes

Cut out the tube (G 4852 mod.) from the weldolet joint at out let manifold end

Disconnected the spring hanger and removed the tube from the furnace one by one with the help of HM crane (120 ft. boom)

Removed old weld material from the weldolet (incolloy 800 HT) edge by grinding

Edge preparation in the weldolet as per the WPS of S+C Ltd. Germany.

All the new 16 spare tube assembly (G 4852 mod.) inserted from top one by one with the help of HM crane.

Fit up with 3-4mm gap and welding of new tube with the weldolet by filler wire UTP 6170 CO (ER Ni Cr Mo 1) supplied by S + C Germany carried out as per WPS of S+C Ltd. Germany.

DPT & radiography carried out for both root run and final weld.

9 removed tubes were salvaged at our work shop as per repair procedure suggested by M/S S+C Ltd.

Cut the tube at the defective weld 'C' joint
Remove old weld material from the edges cleared by DPT

Carried out solution annealing in our electrical furnace available in our work shop by heating the ends up to 75 mm length to dissolve the carbides improving ductility and weld ability

Heat up rate of 150 deg.C/ hour
Socking temperature 1150 deg. C
Socking Time 1 hour
Cooling with Forced Air
Fit up with 3-4mm gap

Welding with UTP 2535 Nb filler wire supplied by S + C Germany as per the WPS above followed by DP and radiography for root and final weld

Work contract was awarded to M/s.Skywin Erector , Ahmedabad for 15 Nos. Catalyst tube replacement (Contact No.12/00759/9913526 dtd. 23/05/2003. Remaining 9 catalyst tubes & 1 riser tube were replaced departmentally. 1 Welder 1 fabricator were called from Aonla also.

Catalyst tubes were changed with new one in place of following tubes :

Tube No. 104, 107, 122, 130, 229, 238, 342, 406, 801, 806, 807, 808, 809, 831,832,834

Catalyst tubes were changed with salvaged tubes in place of following tubes :

Tube No.127(808) ,136(801) ,140(806),502(832) ,508(834) ,602(238) ,736(107) , 738(104), 704(809). Within bracket indicates the used tube Nos.

Finally Pig tail tubes were welded with top T-11 top piece (welding rod E-8018-B2L) with preheating 150-180 °C.

REPLACEMENT OF RISER TUBE IN ROW No. 2 :

During radiography of weld joint, it was found that internal crack in weld joint "D" below replaced the same with new one (G 4852 mod.) as below :

Before cutting the riser, confirmed that all 42 tubes filled with catalyst and cooling water (DM water) filled in transfer lines upto the operating level

Unlocked all spring hangers in row No.2 and confirm the harp assembly freely suspended by the spring hangers

Recorded the spring readings in mm before cutting riser

Total load from the spring reading was calculated and tabulated in table 1. Preset load in 202 to 221 is 937 kg and in 201 & 222 498 kg. The recorded load is 19282 kg After equal distribution and initial load in 202 to 221 is 939 kg and in 201 & 222 is 469 kg.

Cut out the riser tube below RF-10 joint i.e. G 4852 to Incoloy 800 HT joint. 19 mm gap found after separation of the riser from top transition piece.

Recorded the spring hanger readings in mm after cutting riser from RF-10

Total load from the spring reading was calculated and tabulated in table 2. The total recorded load is 20089 kg (approx.).

Cut out the riser from bottom weldolet by means of grinding and removed the riser through roof opening by means of the HM crane

Edge preparation of the weldolet and RF 10 for set up of new riser
Inserted the new riser tube keeping the flared dia at top

Placed the riser on the weldolet holding by clamp with adjacent catalyst tube

Checked the riser is vertically in plump to +/- 12mm top to bottom and harp assembly is free from any scaffoldings.

Checked the vertical clearance of manifold to floor and lateral clearance manifold to wall

Fit up with gap 4-5mm

Riser welding was completed with UTP 6170 CO supplied by S+ C Germany at bottom with weldolet followed with D.P. check and radiography for root pass and final pass

Recorded the spring readings in mm after welding of new riser with bottom weldolet

Total load from the spring reading was calculated and tabulated in table 4. The recorded load is 20112 kg (including the riser weight 444 kg.)

Raised the harp assembly by hydraulic jack to maintain gap of 4-5mm and checked verticality of riser by plump as mentioned above before welding the riser with RF-10 incoloy 800 HT at top.

Riser welding was completed with filler wire UTP 6170 CO supplied by S+ C Germany at top followed with D.P. check and radiography for root pass and final pass

Cold balancing of the harp assembly was carried out finally after removing all supports and jacks from bottom of the manifold. From table 4 after subtracting riser weight 444 kg total weight without the riser is 19668 kg which was equally divided and initial load in 202 to 221 spring hanger 937 kg and in 201 & 222 is 469 kg. Riser weight 444 kg was added to adjacent 3 springs from riser on both side equally. Final cold setting was recorded in table 5.

INSULATION OF ARCH ROOF :

Roof insulation was opened for inspection of the dissimilar joint of catalyst tubes in primary reformer.

Insulation work of Arch roof of Primary Reformer (101-B) was awarded to M/s Unifrax India Ltd, Mumbai along with supply of Z-module "A" & "B" vide W/O.No.9913567 dtd. 28/05/03.

Cereline Ceramic Fibre modules Z section with centrally anchored were used for relining the roof insulation

Insulation Grade : Z (1425 °C) Density : 160 Kg/m³

Size	Qty.
A - 200 x 305 x 305	49 Nos.
B - 200 x 240 x 305	32 Nos.

All above Z - modules have special anchoring in which M-6 stud to be welded at Arch roof plate and then modules are to be tightened.

ARCH BURNER BLOCK :

During shut down total 9 broken burner blocks were replaced with new one (Christy USA make). The gap around the burner block was filled with ceramic fiber blankets to avoid air gap.

HARP ASSEMBLY :

After replacement of catalyst tubes and riser, new catalyst was filled in all 336 tubes . Bottom header - Damaged outlet manifold top piece & pig tail insulation was replaced All 336 tubes were boxed up with new flexitalic gasket with inner and outer center rings End plugs of 8 headers were also boxed up with new gasket after blowing the header. Insulation was carried out by M/S Lloyd Insulation Ltd.

REFRACTORY WALL REPAIR :

This job was awarded to M/s.ACC. through Civil depts. Damaged panel at West wall near Br.No.5 & 6 and East wall panel north wall panel were replaced by new insulation bricks ACC-PSL-500 with back up insulation diatomaceous.

TRAP INSTALLATION IN AFTER COOLER OF AIR COMPRESSOR (131-JC)

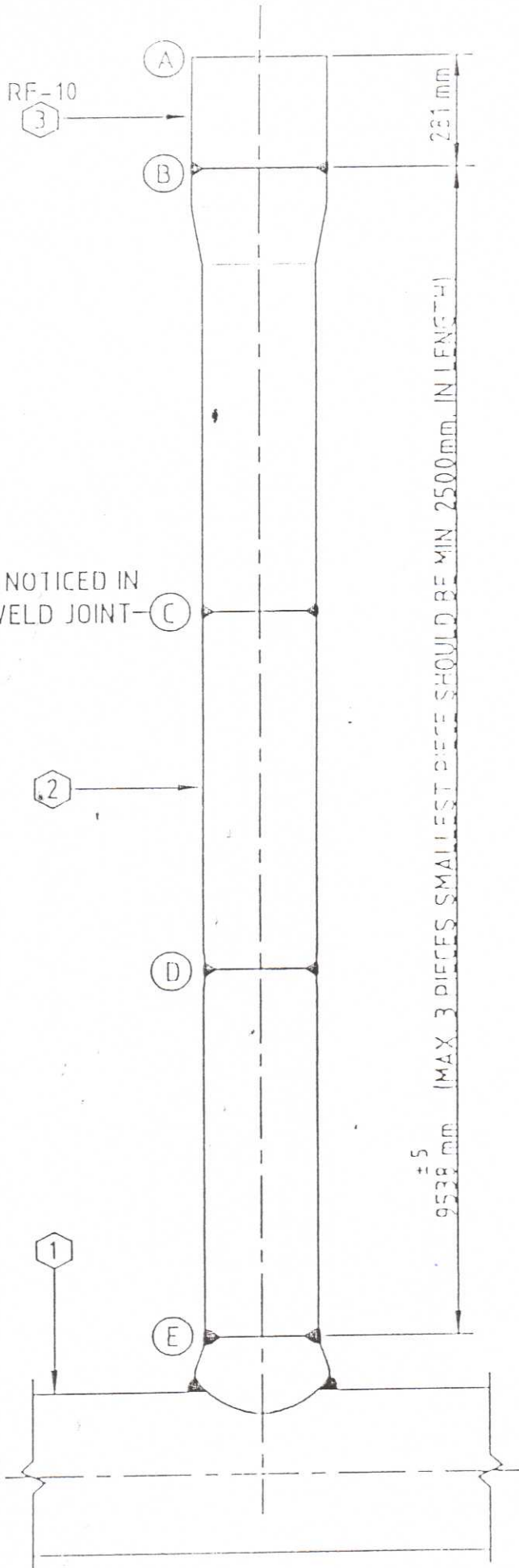
Additional condensate trap was installed in 131-JC . Dee Greaves Inverted bucket type with discharge capacity 1500 kg/hr was procured from M/S Net work Agencies Baroda.

SPRING READINGS OF ROW NO.2 (BEFORE CUTTING RISER NO.2)							
Spring No. (North to South)	Spring constant KG/MM	Calibrated load KG	Spring scale reading MM	Load deviation from calibrated load	Actual load recorded on spring	Initial balanced load per spring	Initial balanced load setting MM
201	1.8	496	-4	-7.2	489	496	0
202	4.0	937	9	36.0	973	939	0.5
203	4.0	937	2	8.0	945	939	0.5
204	4.0	937	-4	-16.0	921	939	0.5
205	4.0	937	-6	-24.0	913	939	0.5
206	4.0	937	-11	-44.0	893	939	0.5
207	4.0	937	-15	-60.0	877	939	0.5
208	4.0	937	-15	-60.0	877	939	0.5
209	4.0	937	-9	-36.0	901	939	0.5
210	4.0	937	-12	-48.0	889	939	0.5
211	4.0	937	-6	-24.0	913	939	0.5
212	4.0	937	-6	-24.0	913	939	0.5
213	4.0	937	-5	-20.0	917	939	0.5
214	4.0	937	-6	-24.0	913	939	0.5
215	4.0	937	-6	-24.0	913	939	0.5
216	4.0	937	-7	-28.0	909	939	0.5
217	4.0	937	-3	-12.0	925	939	0.5
218	4.0	937	-7	-28.0	909	939	0.5
219	4.0	937	-2	-8.0	929	939	0.5
220	4.0	937	-3	-12.0	925	939	0.5
221	4.0	937	2	8.0	945	939	0.5
222	1.8	496	-15	-27.0	469	496	0
				Total Load Kgs.	19258	19719	

SPRING READINGS OF ROW NO.2 AFTER BOTTOM FINAL WELDING NEW RISER NO.2 (BEFORE WELDING OF NEW RISER WITH TRANSFER LINE RF-10)					
Spring No. (North to South)	Spring constant	Calibrated load	Spring scale reading	Load deviation from calibrated load KG	Actual load recorded on spring
	KG/MM	KG	MM		KG
201	1.8	496	-10	-18.0	478
202	4.0	937	3	12.0	949
203	4.0	937	2	8.0	945
204	4.0	937	2	8.0	945
205	4.0	937	3	12.0	949
206	4.0	937	3	12.0	849
207	4.0	937	3	12.0	949
208	4.0	937	5	20.0	957
209	4.0	937	6	24.0	961
210	4.0	937	5	20.0	957
211	4.0	937	5	20.0	957
212	4.0	937	10	40.0	977
213	4.0	937	9	36.0	973
214	4.0	937	8	32.0	969
215	4.0	937	8	32.0	969
216	4.0	937	8	32.0	969
217	4.0	937	7	28.0	965
218	4.0	937	6	24.0	961
219	4.0	937	4	16.0	953
220	4.0	937	4	16.0	953
221	4.0	937	3	12.0	949
222	1.8	496	-10	-18.0	478
				Total Load Kgs.	20112

FINAL SPRING READINGS OF ROW NO.2 AFTER COMPLETION OF INSTALLATION OF RISER AFTER WELDING THE RISER WITH RF 10 IN TRANSFER LINE						
Spring No. (North to South)	Spring constant. KG/MM	Calibrated load. KG	Balanced load per Spring. KG	Balanced load setting.	Final load after Riser Wt.distributed to adjusant springs.	Final reading after Riser Wt.distributed to adjusant springs. MM
201	1.8	496	496	-14.4	496	-14.4
202	4.0	937	937	0.5	937	0.5
203	4.0	937	937	0.5	937	0.5
204	4.0	937	937	0.5	937	0.5
205	4.0	937	937	0.5	937	0.5
206	4.0	937	937	0.5	937	0.5
207	4.0	937	937	0.5	937	0.5
208	4.0	937	937	0.5	937	0.5
209	4.0	937	937	0.5	1011	19.0
210	4.0	937	937	0.5	1011	19.0
211	4.0	937	937	0.5	1011	19.0
212	4.0	937	937	0.5	1011	19.0
213	4.0	937	937	0.5	1011	19.0
214	4.0	937	937	0.5	1011	19.0
215	4.0	937	937	0.5	937	0.5
216	4.0	937	937	0.5	937	0.5
217	4.0	937	937	0.5	937	0.5
218	4.0	937	937	0.5	937	0.5
219	4.0	937	937	0.5	937	0.5
220	4.0	937	937	0.5	937	0.5
221	4.0	937	937	0.5	937	0.5
222	1.8	496	496	-14.4	496	-14.4
		Total Load Kgs.			20121	

CRACK NOTICED IN THIS WELD JOINT

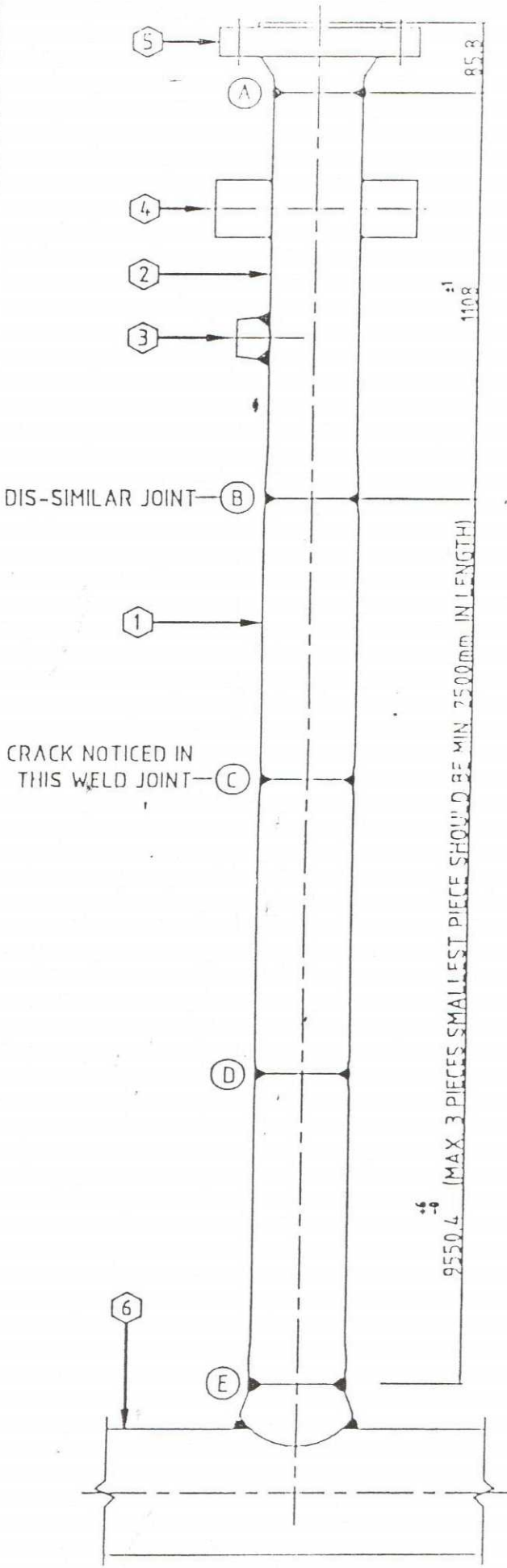


± 5 9538 mm (MAX 3 PIECES SMALLEST PIECE SHOULD BE MIN 2500mm IN LENGTH)

SER. NO	ITEM DESCRIPTION	MATERIAL	QTY.
3	RF-10 Distance piece I.D. 91.44 ϕ x 20.64 M.W x 281 mm.	ASME SB-564	01
2	Riser Tube I.D. 91.44 ϕ x 16.5 M.S.W x 9538 mm.	G 4852 Modified	01
1	Outlet Manifold O.D. 14.13 ϕ x 18 M.S.W	G 4859	01

RISER TUBE FOR PRIMARY REFORMER (101-B)

DATE: 12.06.2003

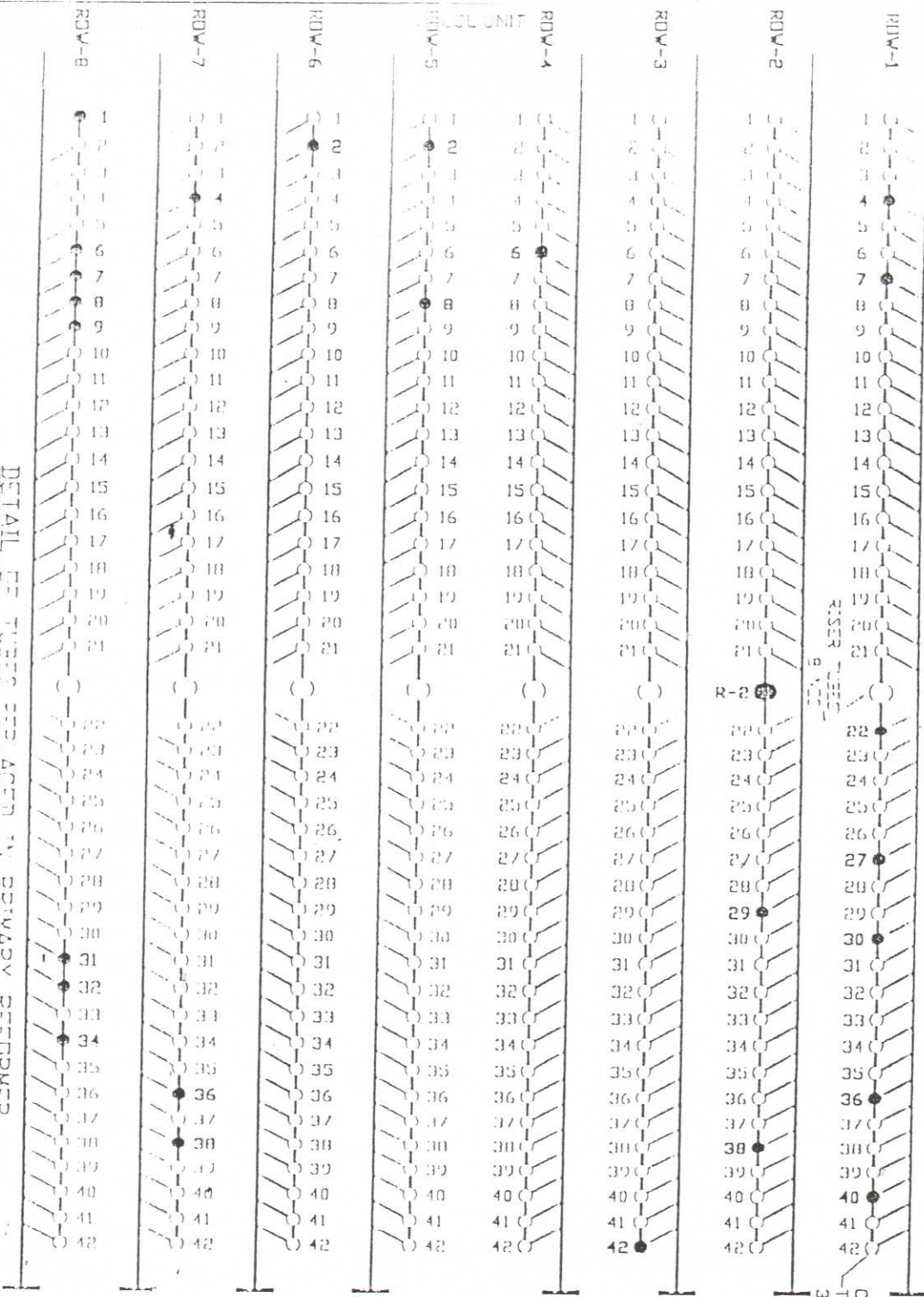


6	Outlet Manifold O.D. 14.13φ x 18 MSW	G 4859	01
5	WN. Flange 3 1/2" - 600 # RF ANSI B-16.5	ASTM A 182 Gr. F-11	01
4	Trunnion 2 1/2" NPS Sch. 40	ASTM A 335 Gr. P-11	02
3	Socketlet 3 1/2" x 3/4" NPS Sch. XXS	ASTM A 182 Gr. F-11	01
2	Top Pipe O.D.: 31.6φ x 12.7 MW x 1108mm.	ASTM A 213 Gr. T-11	01
1	Catalyst Tube I.D. 8.2φ x 12 MSW x 9550mm.	G-852 Modified	01
S.R. NO.	ITEM DESCRIPTION	MATERIAL	QTY.

CATALYST TUBE FOR PRIMARY REFORMER (101-B)

13-06-2003

DATE: 13.06.2003



DETAIL OF TUBES REPLACED IN PRIMARY REFORMER
 BASED ON ON LINE DIAGRAM DURING SHUTDOWN
 13-JUNE-2003

ROW NO.	TUBES REPLACED
1	7 NOS.
2	2 NOS.
3	1 NO.
4	1 NO.
5	2 NOS.
6	1 NO.
7	3 NOS.
8	8 NOS.
TOTAL	25 NOS.



Schweißtechnik GmbH
Edelstahlwerk Kalsberg
Postfach 1140
D-5253 Lindlar

0000955

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QW-482 Welding Procedure Specification (WPS)

No. 1782

W 1

G 4852mod - G 4852mod
tube - tube
flam SP-1 - flam SP-1

-designation see drawing KA 15320-03-2

WELDING PROCEDURE SPECIFICATION NO. 1782 DATE 13.11.91 SUPPORTING PQR NO(S) V 478

REVISIONS 1 see rev. 1 DATE 12.08.92

WELDING PROCESS (ES) G T A W and S H A W TYPES manual

JOINTS (QW-402)

Groove design V-groove 70°, without gap

Backing without strip or ring, back gas Argon

Other ---

BASE METALS (QW-403)

P No. similar 45 to P No. the same

Thickness range 5 to 13 mm

Other G-X 40 NiCrNb 3525 (G 4852mod)

FILLER METALS (QW-404)

	root pass	filler passes	final pass
F.No.	HA	HA	HA
A.No.	HA	HA	HA
Spec. No. (SFA 5.9)	HA	HA	HA
AWS No. (Class)	HA	HA	HA
Other	manufacturer: Thyssen / UTP type: Theraanit 2535R / 2535NbSH (GTAW) 2535NbSH (SHAW)		
Size of Electrode	rods 2,4 mm	coated electrodes 4,0 + 5,0 mm	electrodes 4,0 + 5,0 mm

POSITION (QW-405)

Position of Groove 1 G, rotated

Welding progression ---

Other ---

PREHEAT (QW-406)

Preheat Temp. RT

Interpass Temp. max. 200° See Lloyd's Register Certificate No. DSF

Preheat Maintenance ---

Other ---

20707U/1

Flux Composition ---

Particle Size ---

Electrode Flux Composition ---

Consumable Insert ---

Other ---

POSTWELD HEAT TREATMENT (QW-407)

Temperature none

Time Range ---

Other ---

54

OW-402 Welding Procedure Specification (WPS) (Cont'd)

No. 1782

GAS (OW-408)	ELECTRICAL CHARACTERISTICS (OW-409)		
	root pass	filler passes	final pass
Shielding Gas(es) <u>Argon</u>	DC	DC	DC
Percent Composition <u>99,999</u> (mixtures)	-	+	+
Flow Rate <u>0 to 10 liter/min.</u>	GTAW	SAW	SAW
Gas Backing <u>Argon</u>	150 - 180	100 - 180	100 - 180
Trailing Shielding Gas Composition <u>99,999%</u>	--	--	--
Other <u>---</u>	Travel Speed (Range)	4-8cm/min.	8-12cm/min. 0-12cm/min.
	Other <u>---</u>		

TECHNIQUE (OW-410)

String or Weave Bead string and weave beads

Orifice or Gas Cup Size GTAW 3/8"

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

Method of Back Gouging ---

Oscillation 4 to 10 mm

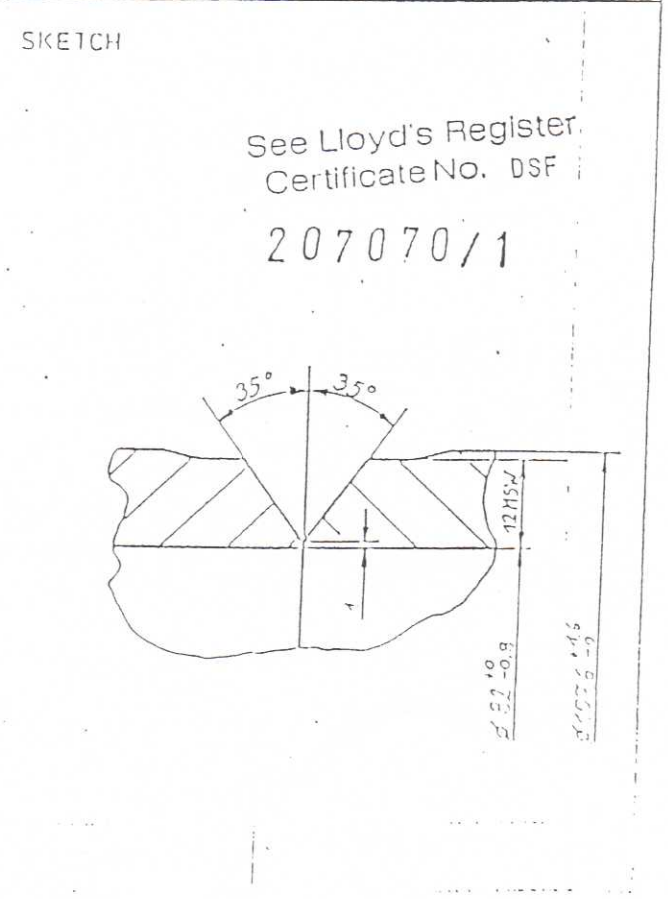
Contact Tube to Work Distance ---

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

Single or Multiple single electrodes
Electrodes

DATE: 15-11-94

SIGNATURE: [Signature]



QW-482 Welding Procedure Specification (WPS)

No. 1789

W 8

2

G 4852mod - SB-564
 r-laser tube - top piece
 11mm SP-2 - 11mm RI-10

designation see drawing KA 15320-04-1

WELDING PROCEDURE SPECIFICATION NO. 1789 DATE 13.11.91 SUPPORTING PQR NO(S) P 395

REVISIONS 1 mod added DATE 31.03.92
2 see rev. 2 12.08.92

WELDING PROCESS (ES) G T A W and S H A W TYPES manual

JOINTS (QW-402)
 Groove design Y-groove 75/30° with gap
 Backing without strip or ring, back gas Argon
 Other ---

BASE METALS (QW-403)
 P No. similar 45* to P No. 45
 Thickness range 19 to 51 mm
 Other * G-X 40 NiCr11b 3525 (G 4852 mod)

FILLER METALS (QW-404) 2

	root pass	filler passes	final pass
E. No.	--	--	--
A. No.	--	--	--
Spec. No. (SFA, SFB)	SFA 5.14	SFA 5.11	SFA 5.11
AWS No. (Class)	ER NiCrCoMo-1	E NiCrCoMo-1	E NiCrCoMo-1
Other	manufacturer: UTP type: A6170C (GTAW) 6122C (SHAW)		
Size of Electrode	rods 2,4 mm	coated electrodes 4,0 mm	electrodes 4,0 mm

POSITION (QW-405) 2
 Position of Groove 1 G, rotated
 See Lloyd's Register
 Welding progression --- Certificate No. DSE
 Other --- 207070/1

Flux Composition ---
 Particle Size ---
 Electrode Flux Composition ---
 Consumable Insert ---
 Other ---

PREHEAT (QW-406) 2
 Preheat Temp. RT
 Interpass Temp. max. 200°C
 Preheat Maintenance ---
 Other ---

POSTWELD HEAT TREATMENT (QW-407)
 Temperature none
 Time Range ---
 Other ---

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

No. 1789

GAS (QW-408)

Shielding Gas(es) Argon

Percent Composition 99,999
(mixtures)

Flow Rate 8 to 10 liter/min.

Gas Backing Argon

Trailing Shielding Gas Composition 99,999%

Other ---

ELECTRICAL CHARACTERISTICS (QW-409)

	root pass	filler passes	final pass
Current (AC or DC)	DC	DC	DC
Polarity	- GTAW	+ SMAW	+ SMAW
Amps (Range)	70 - 100	100 - 180	100 - 180
Volts (Range)	--	--	--
Travel Speed (Range)	3-6cm/min.	8-12cm/min.	8-12cm/min.
Other	---		

TECHNIQUE (QW-410)

String or Weave Bead string and weave beads

Orifice or Gas Cup Size GTAW 7/8"

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

Method of Back Gauging ---

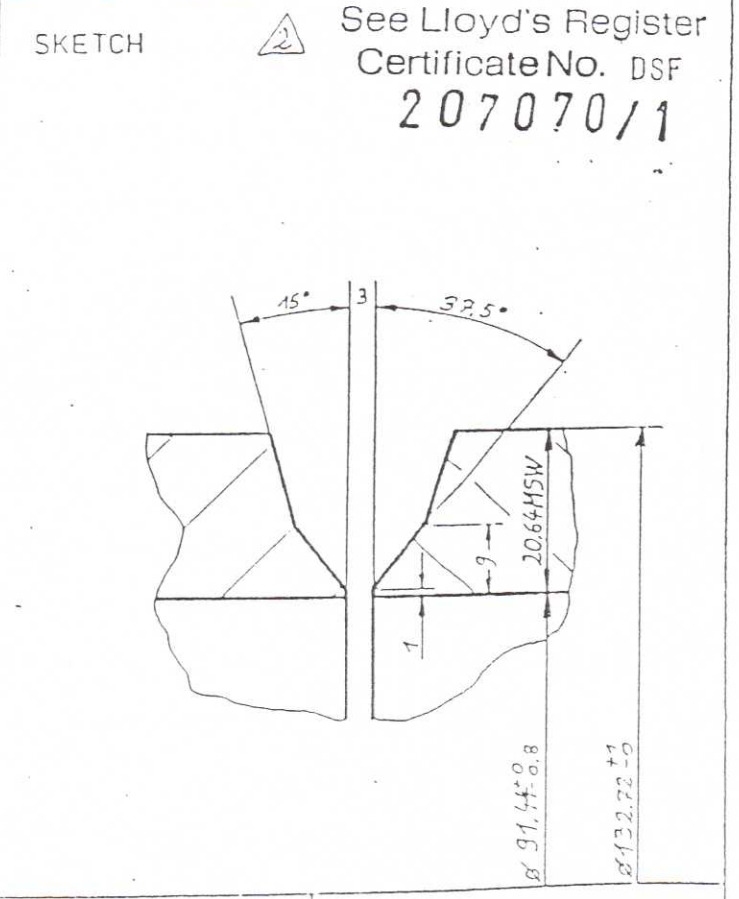
Oscillation 4 to 10 mm

Contact Tube to Work Distance ---

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

Single or Multiple single rods and electrodes
Electrodes

Other SCHMIDT • CLEMENS GmbH • Co
Edelstahlwerk Kalsruhe
Schweißtechnik *R. K. Brant*
D-5253 Lindlar *15.11.92*





Schmidt + Clement GmbH + Co.
Edelstahlwerk Kaiserrod
Postfach 1140
D-5253 Lindlar

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QW-402 Welding Procedure Specification (WPS)

No. 1795

W 14

G 4052 mod - SH-564
catalyst tube - weldolet
Item SF-1 - item SF-1

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

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

REVISIONS 1 mod added DATE 31.03.92 43

WELDING PROCESS (ES) GTAW TYPES manual

JOINTS (QW-402)

Groove design Y-groove 70° with gap
Backing without strip or ring, back gas Argon
Other ---

BASE METALS (QW-403)

P No. similar 45* to P No. 45
Thickness range 5 to 19 mm
Other * G-X 40 NiCrNb 3525 (G 4052 mod)

FILLER METALS (QW-404)

	root pass	filler passes	final pass
F No.	NA	NA	NA
A No.	NA	NA	NA
Spec. No. (SFA, SFB)	NA	NA	NA
WPS No. (Class)	NA	NA	NA
Other	manufacturer: Thyssen / UTP type: Thermanit 213 / A21331In		
Size of Electrode	rods 2,4 mm	rods 2,4 + 3,2 mm	rods 2,4 + 3,2 mm

POSITION (QW-405)

Position of Groove 5 G
Welding progression overhead, uphill and flat
Other ---

PREHEAT (QW-406)

Preheat Temp. none
Interpass Temp. max, 200°C
Preheat Maintenance ---
Other ---

POSTWELD HEAT TREATMENT (QW-407)

Temperature none
Time Range ---
Other ---

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

No. 1795

GAS (QW-408)

Shielding Gas(es) Argon

Percent Composition 99.999%
(mixtures)

Flow Rate 8 to 10 liter/min.

Gas Backing Argon

Trailing Shielding Gas Composition 99.999%

Other ---

ELECTRICAL CHARACTERISTICS (QW-409)

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

TECHNIQUE (QW-410)

String or Weave Bead string and weave beads

Orifice or Gas Cup Size GTAW 3/8"

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

Method of Back Gauging ---

Oscillation 3 to 6 mm

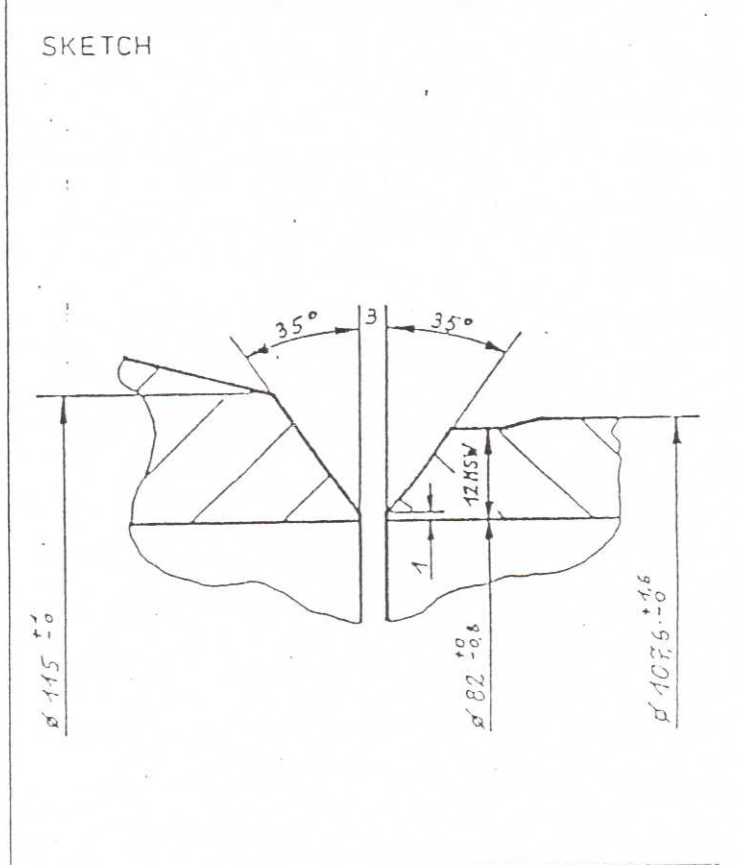
Contact Tube to Work Distance ---

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

Single or Multiple single rods

Electrodes

Other SCHMIDT + CLEMENS GmbH + Co
Edelstahlwerk Kalsruhe
Schweißtechnik
D-5253 Lindlar
15.11.97



(28)



QW-402 Welding Procedure Specification (WPS)

No. 1796

R 15

G 4052 - SB-564
riser tube - weldolet
Item SP-2 - Item SF-2

designation see drawing KA 15320-04-1
KA 15320-06-1
and KA 15320-00-1

WELDING PROCEDURE SPECIFICATION NO. 1796 DATE 13.11.91 SUPPORTING PQR NO(S) P 124

REVISIONS _____ DATE _____

WELDING PROCESS (ES) GTAW TYPES manual

JOINTS (QW-402)

groove design Y-groove 75/30° with gap
backing without strip or plug, back gas Argon
Other ---

BASE METALS (QW-403)

P No. similar 45 to P No. 45
Thickness range 19 to 51 mm
Other ---

FILLER METALS (QW-404)

	root pass	filler passes	final pass
E No.	NA	NA	NA
A No.	NA	NA	NA
Spec. No. (SFA, SFB)	NA	NA	NA
AWS No. (Class)	NA	NA	NA
Other	manufacturer: Thyssen / UTP type: Thermanit 2133 / A2133In		
Size of Electrode	rods 2,4 mm	rods 2,4 + 3,2 mm	rods 2,4 + 3,2 mm

POSITION (QW-405)

Position of Groove 5 G
Welding progression overhead, uphill + flat
Other ---

PREHEAT (QW-406)

Preheat Temp. none
Interpass Temp. max, 200°C
Preheat Maintenance ---
Other ---

Flux Composition ---
Particle Size ---
Electrode Flux Composition ---
Consumable Insert ---
Other ---

POSTWELD HEAT TREATMENT (QW-407)

Temperature none
Time Range ---
Other ---

QW-402 Welding Procedure Specification (WPS) (Cont'd)

No. 1796

GAS (QW-408)

Shielding Gas(es) Argon

Percent Composition 99,999%
(mixtures)

Flow Rate 8 to 10 liter/min.

Gas Backing Argon

Trailing Shielding Gas Composition 99,999%

Other ---

ELECTRICAL CHARACTERISTICS (QW-409)

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

TECHNIQUE (QW-410)

String or Weave Bead string and weave beads

Orifice or Gas Cup Size GTAW 3/8"

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

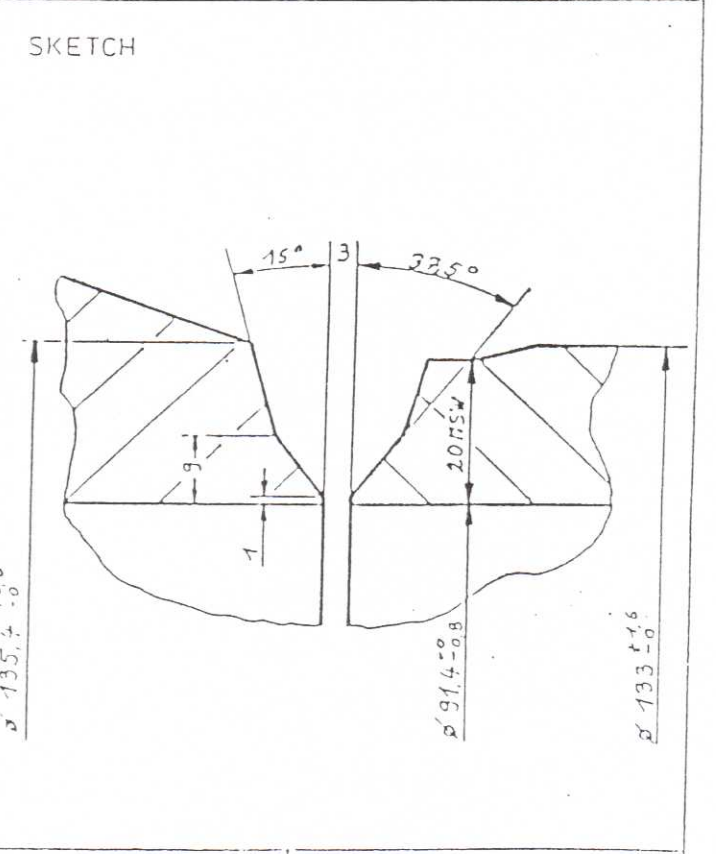
Method of Back Gauging ---

Oscillation 3 to 6 mm

Contact Tube to Work Distance ---

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

Single or Multiple single rods
Electrodes



SCHMIDT + CLEMENS GmbH + Co
Edelstahlwerk Kaiserlautern
Schweißtechnik *L. A. B...*
D-5253 Lindlar 15.11.97



KALOL UNIT
KALOL UNIT

Annexure - C

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INDIAN FARMERS FERTILISER CO OPERATIVE LTD., KALOL UNIT

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

WPS NO.: IFFCO/SD2003/AMM/01NSC

16" NB 42MM thk. Pipe (Group P-4) A335 P11 to 16" JB 34 /30 MM A234 WP11 Elbow

Welding Process : GTAW + SMAW
Type : Manual

1. JOINT DESIGN (QW - 402)

Groove desig : Single 'V' Butt weld
Backing : N.A.
Others : N.A.

2. BASE METALS (QW - 403)

P.No. 4 Group No. 1 to P. No. 4 Group No.1
Specification : ASTM A 335 P 11 TO A 1234 WP11
Thickness Range : 22mm- 44mm
Pipe dia Range : 2-7/8" and above

3. FILLER METALS (QW - 404)

Weld metal analysis : A No. 3
Filler Metal F No. : As per QW -132.1 (SFA 5.5)
AWS Ho. (Class) : Electrode SMA/AWS A 5.5-96 (E 8018 B2 L)
Filler SF A5.28 /AWS A 5.28-96 (ER 80SB2 / ER515)
Size of electrode : 2.4 mm (Filler wire) for root & hot pass
2.5, 3, 15, 4 mm (Electrode) for fill up and capping
Type of electrode flux : Low hydrogen, heavy coated

4. POSITION (QW - 405)

Position of Groove : 6G
Welding Progression : Uphill
Other :

5. PRE-HEAT (QW - 406)

Preheat Temperature min. : 150° C
Interpass Temperature min. : 300° C

6. POST WELD HEAT TREATMENT (QW - 407)

Temperature	:	704 to 760° C
Soaking time	:	01 Hour 40 Minutes
Heating Rate	:	100 ° C / hr. max
Cooling Rate	:	100 ° C / hr. upto 300° C. Then natural cooling under asbestos.

7. GAS (QW - 408)

Shielding gas	:	Argon
Gas consumption	:	99.995 %
Flow rate	:	10 to 12 litres / min
Purging gas	:	Argon
Gas consumption	:	99.995 %
Flow rate	:	6 to 10 litres / min

8. ELECTRICAL CHARACTERISTICS (QW - 409)

Current	:	DC
Polarity	:	Straight for GTAW Reverse for SMAW
Ampere (Range)	:	80 to 130 for GTAW 70 to 190 for SMAW
Other	:	

9. TECHNIQUE (QW - 410)

String or weave bead	:	String and weave
Initial & Interpass cleaning	:	Grinding & brushing
Oscillation	:	N.A.
Method of back gouging	:	N.A.
Contact tube to work distance:	:	N.A.
Single or multiple pass	:	Multiple
Travel Speed (Range)	:	4 to 6 cm/min for GTAW 8 to 12 cm/min for SMAW

10. WELD INSPECTION

Bevel Edge	:	DP Test
Root weld	:	DP Test
Final weld	:	DP Test , 100 % radiography Hardness measurement after PWHT

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT
5300 S. DICKINSON DRIVE
CHICAGO, ILL. 60637
TEL: 773-936-3700

PHYSICS 341

CLASSICAL MECHANICS
LECTURE 1: INTRODUCTION
LECTURE 2: POINT PARTICLES
LECTURE 3: RIGID BODIES
LECTURE 4: OSCILLATIONS

PHYSICS 341

LECTURE 5: SPECIAL RELATIVITY
LECTURE 6: ELECTRODYNAMICS
LECTURE 7: QUANTUM MECHANICS
LECTURE 8: QUANTUM MECHANICS

PHYSICS 341

LECTURE 9: QUANTUM MECHANICS
LECTURE 10: QUANTUM MECHANICS
LECTURE 11: QUANTUM MECHANICS
LECTURE 12: QUANTUM MECHANICS

PHYSICS 341

LECTURE 13: QUANTUM MECHANICS
LECTURE 14: QUANTUM MECHANICS
LECTURE 15: QUANTUM MECHANICS
LECTURE 16: QUANTUM MECHANICS

PRIMARY REFORMER - 101-B :

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Replacement of Low Temperature Steam Superheat Coil in Convection section of Primary Reformer :

A) Introduction :-

Convection zones (High Temp. and Low Temp.) are in the flue gas path in downstream of the Primary Reformer

In Low Temperature (L.T) convection section, following coils are installed for waste heat recovery.

- Steam Superheater coil (Coil - J) at Top
- Boiler Feed Water coil (Coil - K) in Middle
- Boiler Feed Water coil (Coil - L) in Middle
- Feed Preheat coil (Coil-M) in Middle
- Boiler Feed Water coil (Offsites) in Middle
- Boiler Feed Water coil (Offsites) at Bottom

Flue gases flow to L.T zone from H.T.(High Temperature) zone where waste heat is recovered through following coils which are installed in following sequence from top.

- Steam Super heater coil (Coil - H) at Top
- Air Preheat coil (Coil - G) in Middle
- Mixed Feed Preheat coil (Coil - F) at the bottom

In LT section, Offsites BFW Heater coil (Upper Section) was installed in 1986 and is in operation since then. An additional Offsites BFW Heater Coil (Lower Section) was added in October'1993 at the bottom of LT Section for recovering additional heat from the flue gases.

HT Steam Superheat Coil (Coil H) as well as Mixed Feed Preheat Coil (Coil F) in HT section were replaced with modified material and design during October'1993 whereas the rest of other coils in LT and HT section are in operation since 1974.

LT Steam superheat coil is supported on six intermediate supports and one end support. These intermediate supports of the coil are resting on the SS-310 bearing brackets (1" Thk.) which are freely placed on the bearing supports welded to the load bearing "I" beams at the side walls. The guide bars of the bearings brackets can move through the guide groove on the bearing supports during thermal expansion of the coil while it in service.

During inspection of the coils in past years, it was found that most of the intermediate supports of LT Steam superheat coil (Coil - J) were damaged / distorted and the coil was sagged in Middle portion. The intermediate supports were shifted from their respective bearing brackets. Some of the fins on the tubes were also damaged. During thickness measurement in May-June -1997, it was indicated that the thickness of LT coil was reduced to the extent of 14.4% from design thickness.

Hence, it was proposed to replace LT Steam Superheat coil with bigger diameter tubes and superior material for better performance and longer life of the coil. The proposed modifications were also intended to recover more heat from outgoing flue gases. After replacing the coil, the combined heat duty of HT and LT steam superheat coil will increase from 29.1 Gcal / hr. to 31.5 Gcal/hr. Temperature of superheat steam at the exit of HT steam superheat coil will increase by approximately 9 deg C from 425 deg C to 434 deg C. Overall steam savings in Ammonia plant will be approximately 3000 Kg/hr HP steam which is around Rs. 16 Lacs / Annum.

The details of new LT Steam superheat coil is attached as Annexure - A.

The LT steam superheat coil replacement job was awarded to M/s Neo Structo Structures Ltd., Surat who was also engaged for coil fabrication as sub-vendor of L&T, Mumbai.

B) Comparison of Old and New Coil :-

Sr. No.	Parameters	Old LT Coil	New LT Coil	Remarks
1	No. of Rows	4	6	
2	No. of Passes	2	2	
3	No. of Tubes/Row	16	14	
4	Total No of Tubes	64	84	
5	Tube Size	2.5 " N.B, Sch-Xstr	2.5" NB, Sch-Xstr	
6	Tube O.D	2.874"	2.874"	
7	Tube ID	2.323"	2.323"	
8	Tube Thickness	7.01 MM	7.01 MM	
9	Fin Height	0.75"	1"	
10	Thickness of Fins	0.05"	0.05"	
11	Fin Density / inch of Length	5	5	
12	Fin Type	Helicly wound serrated type	Helicly wound serrated type	Welded on tubes by high frequency resistance welding.
13	Overall Tube length		14.389 Mtr.	
14	Finned Tube length		14.288 Mtr.	
15	Size of header		16" NB X 160 Sch	
16	Size of header cap		16" NB X 120 Sch	
17	Material of construction of various parts of LT Coil			
	Bare Pipe	A106	ASTM A 335 Gr. P11	
	Fins	11-13 % Cr Steel	JIS 4035 Gr 409L (11-13% Cr Steel)	
	Intermediate Tube Supports	HK-40	Incolloy - 800 HT	
	End Tube Support	CS	ASTM A 516M Gr.485	
	Weldolets	A 105	ASTM A 182 F Gr. F11 CL 1	
	Header Pipe	A 106	ASTM A 335 Gr. P11	
	Pipe Caps	ASTM A 234 Gr. WPB	ASTM A 234M Gr. WP11 CL1	
	Elbows	ASTM A 234 Gr. WPB	ASTM A 234M Gr. WP11 CL1	
	Pipe Bends	ASTM A 234 Gr. WPB	ASTM A 234M Gr. WP11 CL1	

Prefabrication activities :-

Prefabrication activities for LT coil replacement started on 21.05.2003. The following activities were carried out :-

1. Following materials were issued to the party as free-issue from IFFCO stores -

Sr. No.	Store Code	Item Description	Qty. Issued	Remarks
1	456012002	MS Plate, 6 MM Thk.	745 Kg	or Extension of header box.
2	455102124	Electrode, E-8018 B2L Size - 3.15 MM	1600 Nos.	For fill up of headers Joints (4 Nos)
3	455102623	Filler Wire, ER-80SG Size-2.5 MM	2 Kg.	For root welding of header joints (4 Nos)
4	455102268	Electrode, E-310-16, 3.15 MM	75 Nos.	For welding of distribution baffles.
5	456012004	MS Plate, 10 MM Thk.	300 Kg.	For stiffening of beams welding.
6	456012009	MS Plate, 20 MM Thk.	230 Kg.	For fabrication of lifting lugs.

2. Fabricated Lifting beam for lifting and removal of old LT coil with 600 mm X 210 mm ISMB (9 Mtr. Long) . Two nos. Lifting lugs (20 mm thk plate) were welded on lifting beam and stiffening of beam is done with 6 mm thk plates.
3. Welder's test of 3 welders done on test pieces of 12" NB, Sch.100, A335 Gr. P11 pipe and found acceptable after DP test and 100% radiography of joints. Welding rods used were :-
 - A) Filler wire , ER-80SG (2.5 MM) - For root welding of joints.
 - B) Electrode, E-8018 B2L (3.15 MM) - For fill-up of joints.
4. Fabrication of header box extension done with 6 mm thk. MS plate.
5. 6 Nos. Lifting lugs fabricated with 20 mm thk. MS plate and welded on beams of top of LT convection section roof for lifting of the same.
6. Permission taken from The Chief Inspector of Boilers and Smoke Nuisances, Ahmedabad for replacement of LT steam superheat coil through M/s Neo Structo Construction Ltd., Surat.
7. Fabrication of bearing block (4" X 7") - 16 Nos done at Workshop (Material - SS-310, 25.4 MM Thk.)

Shutdown Activities for Replacement of LT Coil :-

The coil replacement job was awarded to M/s Neo Structo Construction Ltd, Surat vide our W.O No. 12/00707/KLL/12726BK/9913499 dated 11.06.2003 at Lump-sum rate of 37 Lakhs. The contractor had mobilised their manpower for prefabrication activities on 21.05.2003 and whole team of erection on 28.06.2003 which consisted of followings :-

Sr. No.	Activities	Pre-Shutdown	Shutdown
1	Site Incharge	1	1
2	Inspection Supervisor	1	1
3	Site Supervisor	1	2
4	Erection Supervisor	--	1
5	Stores Incharge	1	1
6	Admin Supervisor	1	1
7	Electrician	--	1
8	Structural Welders	2	4
9	IBR Welders	--	3
10	Fitter	2	4
11	Grinder	1	4
12	Gas Cutter	1	4
13	Rigger	10	25
14	Helper	5	12
15	Crane operator	--	1
16	Crane attendant	--	2
17	S R Technician	--	2
Total		26	69

Removal and installation of LT coil was possible only from top. So, the removal of top roof of LT section was necessary. It was also noticed that there might be fouling of hot well side walls while lifting the coil and hence it was necessary to remove the hot well also by gas cutting. But the movable hoist used for catalyst loading in primary reformer was supported through the bottom half of the side wall of hot well and the same was to be used during shutdown for catalyst loading/unloading of primary reformer tubes. So, it was decided to cut the hot well south side wall from the middle after proper supporting the supports of hoist.

M/s Neo structo's original offer was to carry out the job with the help of 205 tons Manitowac 4100 series 11, tyre mounted crane with lattice boom of length 100 ft , capable of lifting maximum 53.8 Tones load @ 45 ft radius. But due to some problems at their end, they were not able to mobilise the planned crane and they came up with Demag TC600 Tyre mounted crane with lattice boom of 48 Mtr length (assembled with 06 segments) which was capable of lifting 46.3 Tones load at 12 Mtr. Radius with full outrigger condition. The total weight of the New LT coil with supported frames for transportation and lifting beam was 47.2 tones (Naked weight of the LT coil was approximately 42 Tones). After removing the supporting frames, the weight of the coil with the same lifting beam was approximately 45 Tones. So, the planned rigging arrangement with new crane was acceptable.

During Annual Plant Turnaround - 2002, it was also observed that the supports of Boiler Feed Water Coil beneath LT Steam Superheat coil in convection section was damaged and the coil was bend in one side (reformer side) while looking from cooling tower side. So, it was also decided to repair the supports of BFW coil after removing the old LT Steam Superheat coil and before installation of the New LT Coil.

Hot spots were observed on wall nos 7 & 8 of the convection section of Primary reformer due to cracks in the castable refractory at many places. So, it was a great opportunity to remove and relining the castable refractory on wall nos 7 & 8. These furnace walls were having very less gap (about 6" to 9") from the walls of the coils in LT convection section, so relining of refractory from inside was not possible. The only way, left out, was to cut the side welded panels of the walls and relining the refractory from outside after wooden shuttering and welding of new side panels. The removal of the welded side panels were also helpful in removing and reinstallation of LT coil.

Ammonia plant was stopped at 0600 Hrs on 28.05.2003 and entry to convection zone was permitted at 1000 Hrs on 29.05.2003. The following activities were performed (in sequence) :-

1. Scaffolding on East side panel of LT convection section erected.
2. Flash drum, condensate line, trap header line and condensate line supports between LT and HT convection section gas cut and removed.
3. Bolted manhole of the convection section opened.
4. All east side bolted panels removed with the help of Hydra and placed on ground. The refractory lining on top two panels were found damaged and it was relined on ground with Insulyte -11 material by M/s ACC.
5. Scaffolding inside convection section erected and existing ceramic fibre insulation on weld joints of LT Convection section roof, hot well duct side walls removed, exposing the weld for gas cutting from top.
6. Top roof of LT convection section was gas cut in one piece from four sides and dropped on ground (with ceramic fire insulation and protection sheet) with the help of HM Crane. (Strengthening of top roof done on ground by welding angle supports with existing beams).

Re-insulation of complete roof done with 5 1/2 " thk. Ceramic fibre insulation and 0.5 mm thk incolloy -800 HT protection sheet on the ground.

7. Scaffolding erected on west panel of LT convection section.
8. Top west side bolted panel (in front of LT coil) removed and dropped on ground with the help of chain block. The same was relined with Insulyte - 11 castable refractory on ground.
9. Top roof of header box of LT convection section gas cut and dropped on ground. Relining done on ground with Insulyte -11 castable refractory.
10. Side plate between inlet and outlet headers of LT coil gas cut and dropped on ground. The same was scrapped as new plate was to be fabricated due to the increased height between inlet and outlet headers.
11. Top MS plate on top of end tube support of LT coil removed and dropped on ground with the help of HM crane. Re-insulation with 5 1/2 " thk. Ceramic fibre insulation done on the ground.
12. Hot well flue gas distributor baffles (bolted on angle supports which were freely supported on side walls of hot well) inside the convection zone unbolted and removed. The supported angles were also removed and dropped on the ground.
13. Hot well gas cut (As per attached sketch) in one piece and dropped on the ground with the help of HM crane and RT-760 crane. The same was placed on ground after welding angle supports at three places on both sides.

Existing insulation on all sides of hot well were inspected and damaged insulation were replaced with 5 1/2" thk new ceramic fibre insulation with 0.5 mm thk incolloy-800 HT protection sheet (Done By M/s Llyod Insulation India Ltd., Mumbai) on ground.

14. Inlet and outlet headers of Existing LT Coil gas cut near to the inside of the header box side plate.
15. Assembly of Demag, TC-600 crane (200 T Capacity, Tyre Mounted and Lattice boom type) done at site (In front of cooling tower and pre-reformer) with the help of RT-760 crane and hydra. The length of boom of the crane was 48 mtrs assembled in 06 boom lengths. Due to bigger boom length, it was very difficult to cross the two pipe racks on the road while crane movement in front of LT Convection section. So, the boom was supported by RT-760 crane in one side and the crane was able to take its position in front of ID Fan duct of Reformer.

16. Demag crane positioned at site and load test done successfully @ 30 Kg load @17 Mtr radius and @48 Mtr boom length as per load chart of the crane & suitable to our requirement. The load test was witnessed by IFFCO Inspection representative.

17. All side panels of Wall no. 8 were gas cut and removed for in-situ relining of refractory on the side wall except the top panels (in front of LT coil) as in-situ replacement of existing ceramic fibre insulation might be done in this area from inside after the removal of existing LT coil. But the chances of fouling of headers of new LT coil with damper box of hot well might arise, so it was decided to first position the headers of the New LT coil from ID fan side and then lower the coil to its position in convection section. So, the top side panel of Wall no. 8 of LT convection section also gas cut in one piece and dropped on ground with the help of Demag, TC-600 crane.

Re-insulation of top panels of wall no. 8 done on ground with 5 1/2 " thk ceramic fibre insulation with 0.5 mm thk incolloy-800HT protection sheet.

18. End tube supports bolts fastened with LT section structure at header box end removed by gas cutting.

19. Old LT coil lifting :- (Rigging arrangement attached as Annexure-)

The tubes of LT coil were supported on six intermediate supports and one end tube supports. The intermediate tube supports and end tube supports were resting on bearing brackets guided between two guide supports welded to the load carrying "I" beams.

A) One number lifting beam were fabricated for the same purpose by using 600 mm X 210 mm ISMB (9 Mtr. Long) with two lifting lugs (20 mm thk plate) at pitch suitable to 1st intermediate support and 4th intermediate support from header end.

B) As the lifting lugs on the intermediate supports of the existing coil were in damaged condition, it was not possible to lift the coil by taking the load on these supports. So, two slings (10 meters lengths each) of 20 Tones capacity each were wrapped on the coil at 1st intermediate support and 4th intermediate support position from the header end (as the wt. Of header end side of the coil was more). These two slings were hooked to the lifting lugs of the lifting beam through D-sackles.

C) Lifting beam was hooked to the crane by using two slings at two lifting points on the lifting beam.

- D) Crane used :- 01 Number Demag, TC-600, tyre mounted lattice boom type crane of capacity 200 T. (Arranged by M/s Neo Structo, Surat).
- E) While lifting the coil, some additional load on the crane due to suspected fouling of intermediate tube supports with guide plates or bearing supports on side walls was felt. Hence the all intermediate supports were inspected and it was found that two intermediate supports were bend in ID fan side and one in HT convection section side. These bend intermediate supports were fouling with the SS-310 bearing support plates. So, fouling bearing support plates (3 Nos) were removed by gauging with cut rods.
- F) LT Steam superheat coil was lifted and slowly taken out on the ground near pre-reformer at 2200 hrs on .06.03
- G) Next day, the removed LT coil was again lifted and placed on the trailer arranged by M/s Neo Structo, Surat. The coil was shifted to the scrap yard inside where it was unloaded with RT-760 crane.
20. Boiler feed water coil beneath LT coil is having six rows. The supports of top three rows and bottom three rows are separate. The whole coil is supported on six intermediate tube supports of HK-40 material and one end tube support of CS material. During last annual turnaround in 2002, it was observed that the top three rows were sagged in primary reformer side while looking from cooling tower side. So, all the intermediate supports were visually inspected and it was found that the first intermediate support from free end and towards primary reformer side, of top three rows of BFW coil was damaged. All other supports were inspected by DPT and found okay.

The top three rows of the BFW coil was lifted from sagged end only with Demag crane and leveling of top face of the coil done. All broken loose pieces of intermediate support removed.

New bearing support plates (ASTM A 240 Type SS-310 S Material) - two numbers of extra length size - 5 ½ " X 8" X 14 MM with guide groove of 3/4" were fabricated and welded at outside of existing bearing support plates of size - 5 1/2" X 4 7/16" X 1/2" . New bearing bracket of size 4" X 7" with guide bar was fabricated of SS-310 S material. DPT of the welding checked and found okay. The BFW coil was lowered and the damaged end of the first intermediate support from free end was made resting on the new bearing bracket which is resting in guide groove of the extended bearing support plates.

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21. DPT of welding joints of all bearing support plates (21 Nos) for LT coil done. Surface cracks were observed in welding of 18 Nos of bearing support plates. Cracks in all welding joints were ground off and full welding done. DPT done and all joints found okay.
 22. 03 Nos New bearing support plates of size 5 1/2" X 4 7/16" X 14 MM Thk. Fabricated of SS-310S material and welded with load carrying "I" beams from where it were removed while removing the old LT Coil. Welding electrode used was E-309. DPT done of all joints and found accepted.
 23. All old bearing brackets (4" X 4") removed and new prefabricated bearing brackets of modified size (4" X 7") with 14 mm thk guide bars positioned in 3/4" wide groove of bearing support plates.
 24. Water leveling of top faces of all bearing brackets checked and found okay.
 25. All Guide plates, for intermediate supports of the coil , welded to the "I" beams of both side wall nos 7 & 8 of convection section were found bend and damaged at some places. So, all guide plates gas cut and removed. "I" beam surface smoothened by grinding and new M.S guide plates of 6 mm thickness stitch welded at same position after maintaining the original gaps between the guide plates. Welding electrode used was overcord E-6013 (3.15 MM).
 26. Grinding of all gas cut edges of top roof of convection section, hot well side plates and top panels of wall no. 08 done.
 27. New modified LT Steam superheat coil reached at IFFCO site from L&T, Hazira works at 23.30 Hrs on 04.06.2003 on 12 axle hydraulic trailer of M/s Nabros Transports, Ahmedabad. Trailer with new LT coil directly Hydrotest cap of outlet header of new LT coil removed by gas cutting. Flushing arrangement made ready by welding of 1/2" nipple to the hole provided in the center of hydrotest cap of inlet header. Fire hose coupled to the nipple and flushing of the coil done with DM water for 4 hrs.
 28. Hydrotest cap of inlet header of new LT coil removed by gas cutting. Smoothening of cut faces of inlet / outlet header done by grinding. Distance between intermediate supports and end tube support checked and found okay. Exact length of inlet and outlet headers (with loose 45 degree bend) of new LT coil measured and the same is marked on old headers for gas cutting.

29. The orientation of lifting lugs (04 nos) on lifting beam of new LT coil changed by 90 degree as the coil was to be lifted by one crane while at L&T, Hazira works, it was lifted with the help of two cranes. All side supports bolted to the top lifting beam (04 on each sides) removed and shifted to ammonia maintenance yard.
30. Identification of the coil done by IBR Inspector on 05.06.2003 and the trailer with the new coil shifted near and parallel to the Demag crane positioned in front of ID fan duct.
31. Old headers of LT coil gas cut as per the actual size of new headers and beveling of edges done by grinding. DPT done of both bevel ends and grinded faces of new headers (at gas cutting portion of hydrotest cap) and found okay.

32. Lifting of new LT Coil :-

LT coil is supported on 06 intermediate supports and one end tube supports. The distance of two intermediate supports i.e pitch is 2362 mm while the distance between end tube support and intermediate tube support is 1384 mm.

- A. The same lifting beam made of ISMB 250X250 MM , used for lifting of coil at L&T, Hazira works was used for lifting of coil.
- B. The lifting beam was hooked up to Demag, TC-600 crane with 04 lifting lugs (made of 20 mm thk MS plate) by means of 04 slings. The position of lifting lugs on the beam was as under:-

Two lifting lugs, one at each side - Between 2nd and 3rd intermediate support from free end.

Two lifting lugs, one at each side - Between 5th and 6th intermediate support from free end.

C. Crane used was 01 Number Demag, TC-600, tyre mounted lattice boom type crane of capacity 200 T. (Arranged by M/s Neo Structo, Surat).

D. The coil was lifted and the intermediate supports were made to slide down slowly through the guide plates on both wall nos 7 & 8 till they were made rested on respective bearing brackets.

E. The alignment of headers on new coil checked with the old headers and found okay.

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33. During fit-up of inlet headers, it was found that the ID of the headers were not matching.

It was decided to grind the ID of inlet and outlet headers of new LT coil and match the ID.

The gap between the inlet header ends of new and existing were not sufficient to undertake the grinding of inlet header ID, hence it was decided to gas cut the existing inlet header from the welding joint of the existing reducer 16" X 12". The reducer was gas cut and both cut ends were ground off for edge preparation. The in-situ grinding of ID of inlet and outlet headers done and ID of both inlet & outlet headers matched.

34. DPT done of bevel edges of reducer ends of inlet header and ground off ID of new coil inlet and outlet headers. Found okay.
35. Fit-up done of both joints of inlet header after obtaining clearance from the production department and found okay. Fit-up done of both joints of outlet header, loose 45 degree bend to new coil header and loose 45 degree bend to existing header. Found okay.
36. Root run and two runs of hot passes of all four fit-up joints done by TIG welding with filler wire ER 80 SG (2.5 MM dia) after preheating at 150 degree as per the WPS procedure which is attached as Annexure - C . DPT done of root runs and found accepted. Radiography done of all four root runs and found accepted.
37. Final fill up of all four root weld joints done with the help of three welders simultaneously maintaining the inter pass temperature of 300 deg. C (Maximum) and preheating at 150 deg C. The welding electrode used was E8018B2L (3.15 MM Dia). DPT and radiography done of all four joints after cooling and found okay.
38. Two removed thermowells from old outlet header were welded on the drilled holes at 90 degree apart on the loose 45 degree bend portion of the new outlet header.
39. Stress relieving of four welded joints of inlet and outlet headers and thermowell welding joints were done as per the following procedure

Loading temperature	:-	300 Deg. C
Heating rate	:-	100 Deg. C per hour.
Soaking temperature	:-	725 Deg C
Soaking time	:-	01 Hour 40 Minutes.
Cooling rate	:-	100 Deg. C per hour.
Unloading temperature	:-	300 Deg. C

40. Removed hot well section (with repaired ceramic fiber inside insulation) lifted with Demag, TC-600 crane and tack welded at position. Cut ends of the side walls were not matching and at some places 3-4 mm gap were observed. So, full welding of side walls done after placing 25 mm wide MS flat (6 mm thk) from outside along full length of joints. Welding at beam portions done after placing suitable size MS pad plates of thickness 20 MM.
41. Removed top roof of LT convection section (with new ceramic fiber insulation from inside) lifted with the help of Demag, TC-600 crane and tack welded at position. Full welding at all four sides done after placing 25 mm wide MS flat of 6 mm thickness from outside to fill up the gap of joints.
42. Angle supports for distribution baffles of hot well positioned and made rested in their respective guide grooves and all distribution baffles were bolted with the support angles.
43. Side plate at top of the end tube support of the LT coil lifted with the help of chain block and bolted with the angles welded to wall nos 7 & 8 of the convection section.
44. Removed top side panel of wall no. 8 (re-insulated with new ceramic fiber insulation, 4 1/2" thk with incolloy - 800 H protection sheet) lifted with Demag, TC-600 crane and welded at position.
45. Repair of ceramic fiber insulation from inside at welded portion of roof , side panel and hot well area done with 4 1/2 thk ceramic fibre and 0.5 mm thk incolloy -800 H top protection sheet.
46. Prefabricated extended portion of header box and relined with insulyte -11 castable refractory welded at position. Both new fabricated and refractory relined side plates between inlet and outlet headers welded at position.
47. Refractory relining of bottom plate between LT and HT section done with 5 1/2 " thk Insulyte - 11. Expansion joints with ceramic fiber done at three places along the length.
48. Scaffolding erected at East side of the LT convection section. All five side panels lifted with the help of hydra and bolted in position with new asbestos sheet as sealing gasket.
49. Removed top west side panels of LT convection section lifted by chain block and bolted in position.
50. Manhole of LT Convection section boxed up with new asbestos sheet gasket.

51. Removed supports of condensate line between LT and HT section erected and condensate line placed on the supports. Removed flash drum shifted with the help of hydra and placed in position with new grouting bolts (4 Nos). Condensate line bolted with the flange on the flash drum and welded to the existing old line at the other end. DPT done of all welding joints and found okay.
52. Hydrotest of the complete boiler system done at 145 Kg/Cm² pressure on 16.06.2003 in presence of IBR inspector and found okay. (LT steam superheat coil was already hydrotested at L&T site at 180 kg/cm² and accepted by IBR inspector, Surat.
53. Complete cleaning of area done and the site was handed over on 16.06.2003.

ANNEXURE**(A) RLA Study of HP Steam System :**

Remnant Life Assessment Study for the HP Steam System of Ammonia was Conducted by M/s.L & T Sargent & Lundy Vadodara. Various tests like DP Test, UT, MPI, Metallography etc. were conducted on various equipments of HP steam system (101-F, 101-CA/CB, 104-C, 102-C, Aux.Boiler, piping etc.) during assesment study.

WASTE HEAT BOILERS GT-1631 & GT-1632**(A) WASTE HEAT BOILER INSPECTION :**

- (1) Boilers were inspected by Boiler Inspector in open test condition on 05.06.2003.

Hydrotest of the following Waste Heat Boilers was carried out on 16-06-2003.

GT-1631 AT 15 Kg / Cm² g Test pressure
GT-1632 AT 145 Kg / Cm² g Test pressure

- (2) Bench Test of follwing Safety valves were done on 16-06-2003. And the readings are as under.

Boiler No.GT-1631

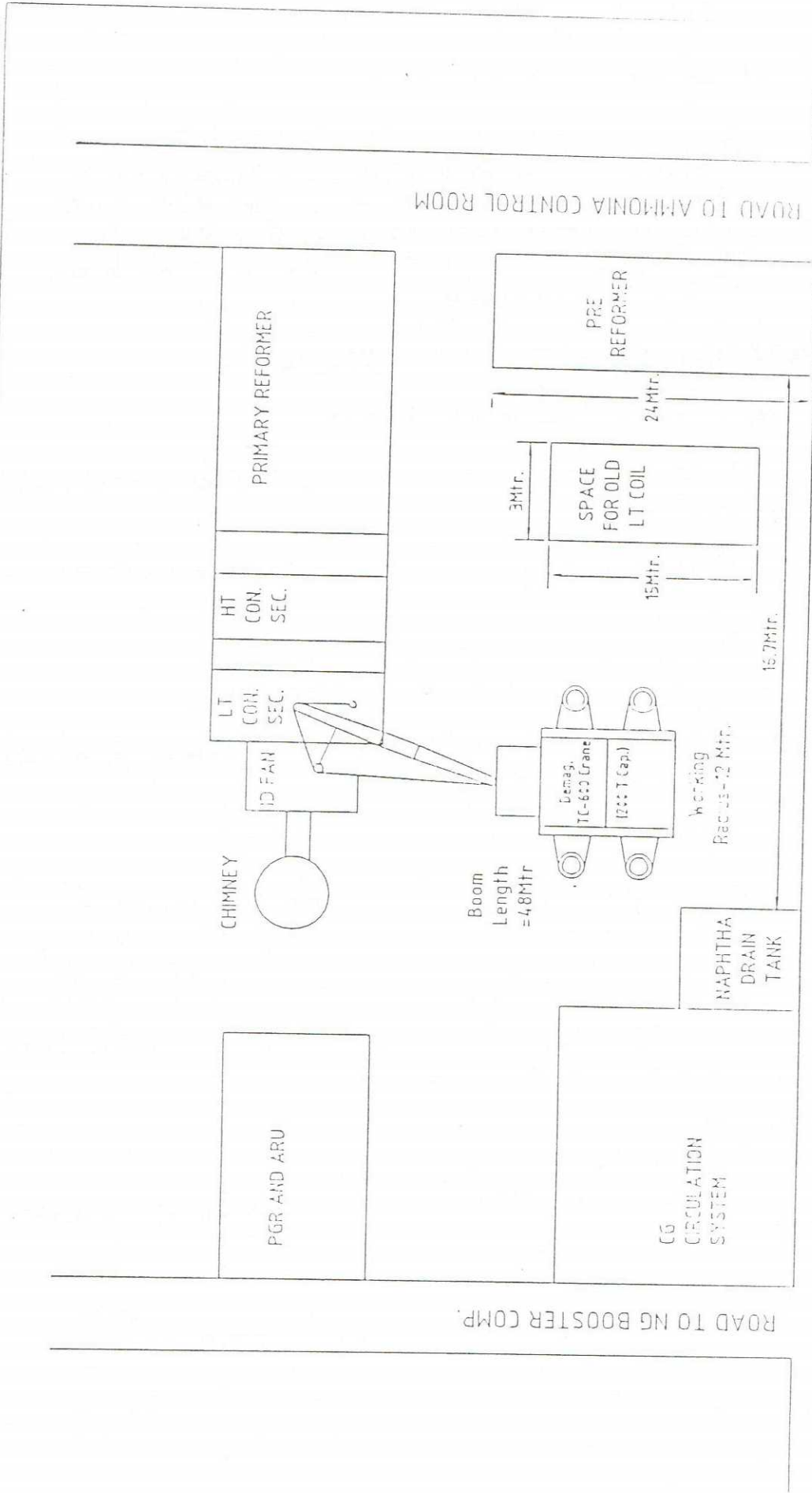
RV No.1 (FRONT)		RV No.2 (REAR)	
Pop. Pressure	Reset Pressure	Pop. Pressure	Reset Pressure
10.5 Kg/Cm ²	9.5 Kg/Cm ²	10 Kg/Cm ²	9.5Kg/Cm ²

- (3) RV Floating of safety valves was carried out on 16-06-2003 and readings are as under:

Boiler No.GT-1632

	RV (North)	RV (Middle)	RV (South)	RV (Super Heater)
Popping Pressure Kg/Cm ²	118 Kg/cm ²	119.3 Kg/cm ²	117 Kg/cm ²	113 Kg/cm ²
Reset Pressure Kg/Cm ²	110.8 Kg/cm ²	117.1 Kg/cm ²	110.8 Kg/cm ²	110.7 Kg/cm ²

ANNEXURE-B



ROAD (8 MTR. WIDE)

Plot Plan for Rigging Arrangement of LT Coil Replacement

80

C.G. OF EQUIPMENT
13810 (FRAME LENGTH)
3000

6750

178

REF.

750

210

405

1300

1300

2100

2600

3000

3500

4000

4500

5000

5500

6000

6500

7000

7500

8000

8500

9000

9500

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133500

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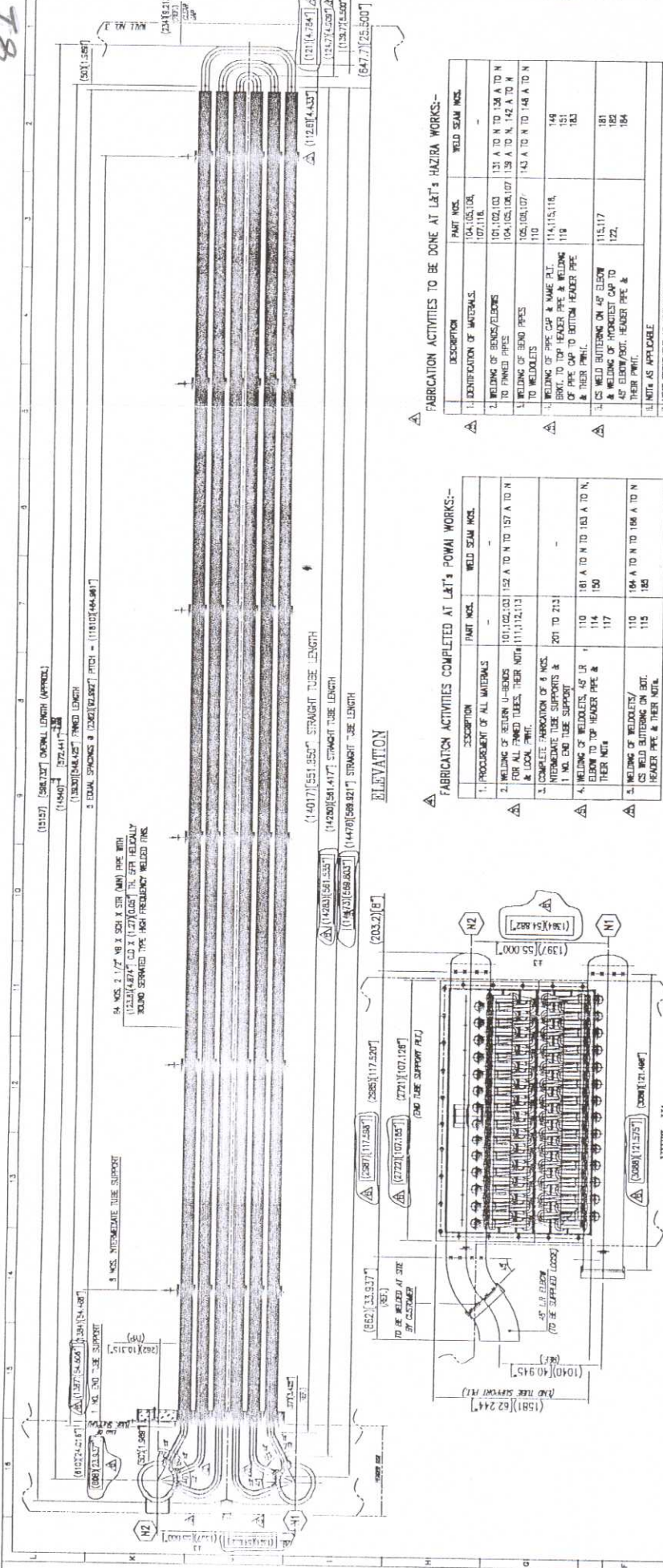
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135000

135500

136000

136500



FABRICATION ACTIVITIES TO BE DONE AT L&T'S HAZIRA WORKS:-

DESCRIPTION	PART NOS.	WELD SEAM NOS.
1. IDENTIFICATION OF MATERIALS.	104,105,106, 107,118.	-
2. WELDING OF BENDS/ELBOWS TO FINNED PIPES.	101,102,103 104,105,106,107,108 A TO N, 143 A TO N	131 A TO N TO 136 A TO N 137 A TO N TO 142 A TO N
3. WELDING OF BEND PIPES TO WELDABLES.	105,106,107	143 A TO N TO 148 A TO N
4. WELDING OF PIPE CAP & NAME PLATE TO TOP HEADER PIPE & WELDING OF PIPE CAP TO BOTTOM HEADER PIPE & THEIR PIPES.	114,115,116, 119	149 151 153
5. CS WELD BUTTERING ON LF ELBOW & WELDING OF HYDROTEST CAP TO 122.	115,117	181 182 184
6. CS WELD BUTTERING ON BOT. HEADER PIPE & THEIR NOIL.	122.	-
7. HEAT TREATMENT AS APPLICABLE.	-	-
8. HYDROTEST	-	-

FABRICATION ACTIVITIES COMPLETED AT L&T'S POWA WORKS:-

DESCRIPTION	PART NOS.	WELD SEAM NOS.
1. PROCEDURE OF ALL MATERIALS	101,102,103	152 A TO N TO 157 A TO N
2. WELDING OF RETURN U-BENDS FOR ALL FINNED TUBES, THEIR NOIL & LOCAL PIPES.	111,112,113	-
3. COMPLETE FABRICATION OF 6 NOS. INTERMEDIATE TUBE SUPPORTS & 1 NO. END TUBE SUPPORT.	201 TO 213	-
4. WELDING OF WELDABLES, AS LR ELBOW TO TOP HEADER PIPE & THEIR NOIL.	110 181 A TO N TO 183 A TO N 114 150	-
5. WELDING OF WELDABLES/HEADER PIPE & THEIR NOIL.	110 184 A TO N TO 186 A TO N 115 185	-

ASME CODE STAMP IS REQUIRED ON THIS EQUIPMENT

ASME

MATERIAL OF CONSTRUCTION FOR MAJOR COMPONENTS:
FOR DETAILS REFER APPLICABLE PART DRAWING

COMPONENT	MATERIAL
FIN PIPE	SA-192M OR FINNED TUBES
HEADER PIPE	SA-192M OR FINNED TUBES
PIPE BENDS/ELBOW/PIPE CAP	SA-192M OR FINNED TUBES
END TUBE SUPPORT	SA-192M OR FINNED TUBES
INTERMEDIATE SUPPORT	SA-192M OR FINNED TUBES
STUD	SA-192M OR FINNED TUBES
HEX NUT	SA-192M OR FINNED TUBES
WASHER	SA-192M OR FINNED TUBES
FLAT PATTERN SHEET	SA-192M OR FINNED TUBES

DATE: 12/07/2007

BY: [Signature]

FOR: [Signature]

L & T NAME PLATE

NOZZLE SCHEDULE

NOZZLE MARK	QTY	PIPE	FACE	TYPE	FACE	SERVICE	PAU	REMARKS
N1	1	18"	180°	3M	OUTLET HEADER	-	-	-
N2	1	18"	180°	3M	INLET HEADER	-	-	-

DATE OF TEST: 12/07/2007

BY: [Signature]

FOR: [Signature]

S-TAMP NAME PLATE

DESIGN DATA

1. DESIGN CODE: ASME SEC. I-2001 EDITION WITH 2002 ADDENDA.

2. DESIGN PRESSURE (kg/cm²) [Pmax] 12.0

3. DESIGN TEMPERATURE (°C) [Tmax] 441

4. MIN. HYDROTEST TEMPERATURE (°C) [Tmin] 100

5. DESIGN TEMPERATURE (°C) [Tmax] 441

6. DESIGN PRESSURE (kg/cm²) [Pmax] 12.0

7. CORROSION ALLOWANCE (mm) 1.0

8. JOINT EFFICIENCY 1.0

9. JOINT EFFICIENCY 1.0

10. FILLING METHOD HYDROTEST

11. FILLING METHOD STEAM

12. NUMBER OF PASSES 20

13. SURFACE AREA (SQ. METERS) (TOTAL) (SQ. FT.) 114.2

14. SURFACE AREA (SQ. METERS) (HEATING AREA) 114.2

15. WEIGHT OF EQUIPMENT (KILograms) (LBS) 1200

16. WEIGHT OF EQUIPMENT (FULL OF WATER) (KILograms) (LBS) 1200

17. WEIGHT OF EQUIPMENT (EMPTY) (KILograms) (LBS) 1200

18. NUMBERS IN INDICATE WELD SEAM NUMBERS.

19. BELONGING TO: [Signature]

20. DATE: 12/07/2007

21. BY: [Signature]

22. FOR: [Signature]



ANNEXURE - A

Details of New Low Temperature Steam Superheat Coil(Coil-J)

A) Overall Process Parameters:

Heat duty	(G Cal/hr)	11.35
Heat Transfer Co-efficient	(KCal/h.m ² ° C)	234.8
LMTD	(° C)	192.7

B) Detail Process Parameters:

Parameter	External (Flue Gas)	Internal (Sat. Steam)
Flow (Kg/hr.)	319,233	271,600
Operating Pressure (Kg/cm ² g)	-	105
Design Pressure (Kg/cm ² g)	-	120
Temp In (° C)	585	314
Temp Out (° C)	466	345
Design Temperature (° C)	-	441
Pressure drop	22 mm WC	0.62 Kg/cm ² g
Fouling factor (h.m ² ° C/KCal)	0.001	0.0002

C) Constructional Details:

No. of Rows	6
No. of passes	2
No. of tubes per row	13
Total no. of Tubes	78
Tube material	ASTM A 335 P-11
OD of tube	2.875 "
ID of tube	2.323 "
Fin height	1.0 "
Fin thickness	0.05 "
Fin density per inch	5
Fin material	11-13 % Chrome Steel
Fin type	Helically wound serrated
Overall tube length	14.389 m
Finned tube length	14.288 m

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HEAT EXCHANGERS AND COOLERS HYDROJET CLEANING :

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

Sr. No.	Equipment	Qty. Nos.	No. Of Tubes	Tube side		Shell side		REMARKS
				Design Hydrotest		Design Hydrotest		
				kg/cm2	kg/cm2	kg/cm2	kg/cm2	
1	109 C1B	2	1,150	30.58	46.00	5.29	8.1	
2	109 C2B	2	1,150	30.58	46.00	5.29	8.1	
3	112-C	1	920	34.01	-	10.5		Machined the gasket area & bolting flange of channel cover at M/S. Chinmay Enterprises,Ahd. To arrest leakage
4	115 C	1	649 U	29.9	-	10.6	15.8	
5	124 C	1	775 U	158	-	17.6	26.5	
6	116 C	1	300 U	66.4	-	10.4	15.8	Machined the channel cover gasket area and bolting flange in our Work shop to arrest leakage
7	129 JC	1	290 U	2.3	-	5.29		
8	131 JC	1	348 U	13.15	-	5.27		

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(II) Following heat exchangers & coolers were opened & boxed up after hydrojetting from tube side. Exchangers were also hydrotested after assembly.

Sr. No.	Equipment	Qty. Nos.	No. Of Tubes	Tube side		Shell side		REMARKS
				Design Hydrotest		Design Hydrotest		
				kg/cm2	kg/cm2	kg/cm2	kg/cm2	
1	105 CA	1	2790	05.27	Static	30.90	46.40	Replaced the damaged expansion bellow at out let
2	105CB	1	2790	05.27	Static	30.90	46.40	One tube plugged
3	108 C1A /C2A	2	1415	05.27	08.1	8.00	--	
4	108 C1B / C2B	2	1415	05.27	08.1	8.00	--	
5	110 CA/CB	2	763	05.60	-	5.27	-	
6	111 CA/CB	2	2790	05.27		5.27	8.10	
7	127 CA/CB	2	3516	05.60	-	21.10	31.50	
8	128 C	1	1200	05.60	-	8.09	-	
9	130 JC	1	264	05.82	-	5.27	-	
10	131-JC	1	690	011.90	-	5.27	-	
11	173 C	1	294	010.60	-	5.27	-	
12	802 C	1	462	07.00	-	18.00	27.00	
12	803 C	1						

(III) Following Lube Oil Coolers were opened for Hydrojetting .

- a) 101-JLC / 1-2 & 3 - Lube oil cooler for 101 - J - 3no.s.However channel cover "O" ring of 101- JLC top towards maintenance side was replaced by new one.
- b) 102-JLC/ 1 & 2 - Lube oil cooler for 102 - J - 2no.s
- c) 103-JLC/ 1 & 2 - Lube oil cooler for 103 - J - 2no.s
- d) 801-JLC/ 1 & 2 - Lube oil cooler for 800 - J - 2no.s

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

- a) 101-BJ Lube oil cooler - 3 no.s
- b) 104-J / JA Lube oil cooler - 5 no.s
- c) 107-J / JA Lube oil cooler - 2 no.s

(V) Following gland condensers, Surface condenser were opened, cleaned by Hydrojetting and boxed up.

a) 101- JCA / JCB Surface Condensor.	- 2 no.s
b) 101-JCA I /A Condenser.	- 2 no.s
c) 101-JCB I /A Condenser.	- 1 no.
d) 101-JT Gland Condensor.	- 1 no.
e) 102-JT Gland Condensor.	- 1 no.
f) 103-JBT Gland Condensor.	- 1 no.
g) 105-JT Gland Condensor.	- 1 no.
h) 852-J Surface Condensor.	- 1 no.
i) 800-JT Gland Condensor.	- 1 no.
j) 851-C I /A Condenser.	- 1 no.

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

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

GLAND RE-PACKING OF VALVES :

This job was carried out by M/S. Dandy Engineering Ahmedabad. In the given valves first old gland packing were removed and then put new gland packing.

Sr. No.	Description of Job	Size	Remarks
1	3.5 Ata steam trap of PRCV-2 u/s isolation valve gland repacked	1/2" x 800 #	Furmenited
2	38 Ata steam to HTS block valve gland leak near FI-54 repacked	3" x 600 #	
3	Steam to Auxillary Boiler burner No.1 isolation valve gland repacked	1-1/2"x800#	
4	38 Ata steam to Pre-Reformer trap near LTS outlet line isolation valve gland repacked.		Line to be shifted
5	101-D bottom drain valve gland repacked	3/4"x800#	Furmenited
6	101-F Eye-hye top isolation valve gland repacked	1 1/2" x 1500 #	
7	11 Ata steam inlet isolation valve gland repacked	4"x150#	
8	TRC-10 sealing steam 1st & 2nd isolation valve gland repacked	1"x800#	
9	MIC-22 & PIC-13A / B block valve gland repacked	6" x 900 #	3 nos.
10	Rich aMDEA line corrosion coupon 1st isolation valve gland repacked	3/4"x800#	
11	38 Ata steam to pre-reformer battery limit valve gland repacked	2" x 600 #	
12	101-JT steam isolation valve gland repacked	6"x400#	
13	Induction steam of 102-JT PI Isolation valve galnd repacked	1/2" x 800 #	Furmenited
14	PIC-13A/B and MIC-22 jump-over HP side drain valve gland repacked		
15	CW Isolation valve 175-C gland repacked	8"x150#	
16	PAHI-316 I/V tapping gland repacked	1/2"x800#	
17	123-J bearing CW isolation valve of inlet and outlet gland repacked	1-1/2"x 800 #	2 nos.
18	101-F outlet isolation valve gland repacked		
19	38 Ata steam header trap near THI-60 main isolation valve gland repacked	1/2"x800#	
20	3.5 Ata steam to 104-E 1st isolation valve gland repacked	6" x 150 #	
21	Steam trap bypass valve near P-111 gland repacked.	1/2" x 800 #	
22	MS-2 800-JT HIC-800 d/s PI isolation valve gland repacked	3/4" x 800 #	
23	HIC-800 bypass valve gland repacked	3/4" x 800 #	
24	800-J lub oil turbine steam inlet isolation valve & its trap isolation valve gland repacked	2" x 150#	
25	102-JT steam inlet line PI isolation valve and inlet line 1-st I/V gland repacked	3/4" x 800 #	
26	102-JT steam inlet line main isolation valve gland repacked	4" x 600#	
27	157-F LG 1st isolation valve gland repacked	3/4" x 800 #	
28	101-JT turbine isolation valve gland repacked		
29	801 JLO turbine TTV leak off valve of governing valve gland repacked	3/4" x 800 #	

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Sr. No.	Description of Job	Size	Remarks
30	102-J SO turbine PI isolation valve gland repacked	3/4" x 800 #	
31	102-J SO pump motor driven discharge line valve gland repacked	3/4" x 800 #	
32	102-J SO turbine exhaust line trap isolation valve gland repacked	1/2" x 800 #	
33	102-J LO filter inlet valve gland repacked	3" x 150 #	
34	102-J LO filter bypass valve gland repacked	1 1/2" x 150#	
35	102-J LO filter PI isolation valve gland repacked	3/4" x 800 #	
36	38 Ata steam trap & bypass valve isolation valve gland repacked	1/2" x 800 #	
37	11 Ata steam trap & bypass valve isolation valve gland repacked	1/2" x 800 #	
38	112-J/JA discharge valve gland repacked	6" x 150 #	
39	103-JAT main isolation valve gland repacked		
40	105-F drum 2nd isolation valve gland repacked	1" x 800 #	
41	LCV-10 isolation valve gland repacked	1" x 800 #	
42	105-F levelroll bottom isolation valve no margin in gland repacked	1" x 800 #	
43	120-C gas inlet drain valve gland repacked	1" x 1500 #	
44	HCV-11 gland repacked		
45	LC-13 isolation valve gland repacked near 106-F	1 1/2" x 1500 #	
46	LC-13 drain valve gland repacked near 106-F	3/4" x 1500 #	
47	113-J discharge isolation valve gland repacked	4" x 150 #	
48	101-E drain valve gland repacked	3" x 600 #	SS
49	117-F filter inlet valve gland repacked	4" x 150#	3 Nos.
50	113-J suction isolation valve gland repacked	4" x 150 #	
51	SP-159 & SP-158 gland repacked	12" x 300 #	2 Nos.
52	FICV-16 isolation valve gland repacked	3" x 600 #	
53	TRC-142 isolation valve gland repacked.	2" x 1500 #	
54	HCV-13 valve gland repacked.		
55	101-B row no. 9 main I/V Gland leakage	1-1/2" x 800#	
56	FT-1017 transmitter TX LP/ HP tapping root isolation valve gland repacked.	3/4" x 800 #	
57	TRC-10 & SP-39 butterfly valve gland repacked.		
58	103-JAT exhaust valve d/s trap 2nd isolation valve gland repacked.	1/2" x 800 #	
59	112-JT exahust valve gland repacked.		
60	FT-54 LP tapping root valve gland repacked.	1/2" x 800 #	
61	FIC-1016 d/s drain valve gland repacked.	3/4" x 800 #	
62	Steam to H-110 decocking line TX HP tapping root valve gland repacked	3/4" x 800 #	
63	101-F blow down 2nd isolation valve gland repacked.	1 1/2" x 1500 #	
64	101-F LRC-1 level-troll both isolation valve gland repacked	1 1/2" x 1500 #	
65	101-F Low level switch top isolation valve and its drain isolation valve gland repacked.	1 1/2" x 1500 #	
66	101-CB down commer PDR-37 tapping isolation valve gland repacked.	1" x 1500 #	
67	101-B Row No.1 atomizing steam header trap isolation valve gland repacked.	3/4" x 800 #	
68	101-B Row No 4 atomizing steam header north side isolation valve gland repacked.	3/4" x 800 #	
69	101-B Row No.7 atomizing steam header north side isolation valve gland repacked.	3/4" x 800 #	

PP

Sr. No.	Description of Job	Size	Remarks
70	V-4 u/s block valve bypass valve gland leakage repacked.	3/4" x800 #	
71	102-JT Seal oil turbine exhaust valve gland repacked.		
72	2004-JT exhaust valve gland repacked.		
73	MS to 11 ata desuperheating station valve gland repacked	1/2" x800#	
74	101-J/105-J T MOP Turbine steam inlet valve gland repacked		
75	104-JT exhaust valve gland repacked	1/2" x800#	
76	104-JAT ejector steam valve (3.5 ata) gland repacked	1/2" x800#	
77	V-5 block valve bypass valve gland repacked.		
78	104-JAT hand nozzle valve gland repacked		
79	PIC-5 Snuffing steam 1st isolation valve gland repacked		
80	PRC-25 Transmitter tap isolation valve gland		
	HS header drain near Aux. Boiler 1-st isolation valve gland repacked		
81	101-JT gland condenser steam inlet valve gland repacked	1/2" x 800#	
82	TRC-142 down steam block valve gland repacked.	2" x 1500 #	
83	101-JT gland condenser ejector steam isolation valve gland repacked.	1/2" x800 #	
84	LS to 800-J header isolation valve gland leak repacked	2" x 800 #	
85	Cold shot u/s common isolation valve gland repacked	2" x 800 #	
86	103-JAT exhaust valve d/s trap 1st & 2nd isolation valve gland repacked.	1/2" x 800 #	2 Nos.
87	101-J LO I/V gland leak near platform		
88	101-J/105-J Lube oil pump discharge PCV u/s I/V Gland repacked		
89	105-JHP Case S.O. Bypass valve gland repacked		
90	105-JT TTV d/s drain valve gland repacked		
91	Steam condensate trap u/s block valve G/L repacked	2"x150#	
92	181-C steam inlet line PI ,I/V gland repacked	3/4"x800#	

FLANGE LEAKAGE:

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Sr. No.	Description of Job	Size
1	800-J lube oil turbine steam inlet thermowell flange leakage and its gasket was replaced by new one.	
2	38 ata steam to HTS bottom orifice flange leakage and its gasket was replaced by new one.	8" x 300 #
3	38 ata steam to Pre-reformer battery limit bypass valve flange leakage and its gasket was replaced by new one.	2" x 600 #
4	103-JAT strainer of steam inlet flange leakage and its gasket was replaced by new one.	
5	FICV-1016 d/s common block valve flange leakage and its gasket was replaced by new one.	
6	PRCV- 25 flange u/s leakage and its gasket was replaced by new one.	
7	MIC-22 flange leakage and its gasket was replaced by new one.	6" x 900 #
8	PRCV-13/A flange d/s and bonnet leak leakage and its gasket was replaced by new one.	6" x 1500 #
9	172-F manhole top cover leakage and its gasket was replaced by new one.	
10	11 Ata steam to desulpheriser 1st isolation valve up stream flange leakage and its gasket was replaced by new one.	
11	11 Ata steam inlet isolation valve up-stream and D/S flange leakage and its gasket was replaced by new one.	
12	112- C LS o/I PIC-21 bypass valve up/ds stream flange leak and its gasket was replaced by new one.	4" x 150 #
14	102-JT LS induction steam ESV d/s of FIC-200 drain flange leak & gasket was replaced.	
15	103-JAT TTV d/s flange leak and its gasket was replaced by new one.	
16	800-JT steam inlet line thermocouple flange leak and its gasket was replaced by new one.	
17	E-110 B tube side condensate line Flange leakage and its' gasket was replaced by new one.	2"x150#
18	SP -71 d/s header flange gasket leakage and its' gasket was replaced by new one.	6"x300#
19	852-C A/B Inter stage ejector cond. 3.5 ata steam 1-st I/V Flange leakage ,Gasket to be replaced	3"x150#
VALVE JOBS		
1	101-D inlet bypass valve passing and it was replaced by new one.	
2	PIC-13 A upstream block valve bonnet leak, gasket was replaced	
3	DM water to cold Ammonia at LC-19 valve thread leakage was attended	
4	102-JT steam inlet valve passing and it was replaced by new one	4x300#
5	107-JAT Steam inlet block valve at u/s of V-7 was dropped for passing and it was lapped after dismantled	
6	MOV SP-5 valve was dropped to check of passing and boxed up after checking.	
7	M/S to LT convection zone bottom snuffing steam valve passing and blind was provided after removing line .	
8	LC-3B U/S Isolation valve passing and dismantled ,lapped and boxed up	

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MISCELLANEOUS JOB :

Sr. No	JOB DESCRIPTION	REMARK
1	PRC-23 greasing was done	
2	800-J AGBC suction strainer was cleaned	
3	800-J NGBC suction strainer was cleaned	
4	800 J oil mist separator to be cleaned	
5	Decocking arrangement for H-110 was made	
6	Cleaning of all burners tips of H-110/H-111 were done	

RELIEF VALVES

Following relief valves were reconditioned and tested

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SR. NO.	RV.NO.	SET.PR. KG/CM ²	RESET PR. KG/CM ²	RV SIZE	DESCRIPTION	REMARK
1	101-F-1	119	116.6	2.5 X 6 (2.545)	Steam Drum RV	Steam tested
2	101-F-2	118	115.6	2.5 X 6 (2.545)	Steam Drum RV	Steam tested
3	101-F-3	117	114.6	2.5 X 6 (2.545)	Steam Drum RV	Steam tested
4	101-B	113	110.5	3 X (3.6) X 6	Super Heater RV	Steam tested
5	5RV-MS-9	42.2		4 P 6	38Kg Steam header	
6	6RV-S-7	14.8		4 P 6	11Kg.Steam heater	
7	RV-LS-1	12.7		4 N 6	3.5 Kg. Steam header	
8	RV-123 -C (South)	122		3 J 6	Convertor outlet BFW Heatexchanger	
9	RV-123-C (North)	124		3 J 6	Convertor outlet BFW Heatexchanger	
10	RV-BFW-1	92		1 1/2 G2 X 1/2	Offsite coil RV	
11	RV-S-26	14.06		2 1/2 J 4	Atamising steam to Aux.boiler	
12	RV-103-JA	660 PSIG		4 P 6	103-JAT exhaust	
13	02 nos.					
14	103-JAT	610 PSIG		3/4 X (110) X 1	103-JAT cover	
15	104-JAT	5.3		6 Q 8		
16	111-C	5.3		1 D 2	3.5Kg.Steam to 111-C	
17	112-C A	10.5		1 1/2 H3	3.5Kg.Steam to 112-C	
18	112-CB	10.5		1 1/2 H3	3.5Kg.Steam to 112-C	
19	101-BJ	5.3		6 Q 8	101-BJT Exhaust	
20	109-F	19		6 Q 8	105-J Discharge	
21	110-F(N&S)	7		3 L 4	Ammoia vapour	
22	111-F	6.3		4 P 6	Ammoia vapour	
23	112-F	6.3		4 M 6	Liquid Ammonia	
24	104-D	35		6 Q 8	HTS Inlet	
25	104-D2	34.1		1 1/2 F2	LTS Inlet	

SR. NO.	RV.NO.	SET.PR. KG/CM ²	RESET PR. KG/CM ²	RV SIZE	DESCRIPTION	REMARK
26	101-D	43.9		3 K 4		
27	102-D	43.9		3 K 4		
28	PSV-2201	6.3		4 M 6	Syn.Gas Tube rupture(141-C)	
29	101-J	36.9		4 M 6	Air	
30	102-F Pilot	29.5		6 X R X 8	PG,Raw gas sep	
31	103-J	2260 PSIG Pilot RV		3 X K X 4		
					PRE-REFORMER RV	
32	PSV-1201	7		1 1/2 H3	F-101 Naphtha gas	
33	PSV-1202	7		1 1/2 F2	F-101 NG	
34	PSV-1203	48		1 E 2	P-110 O/L Naphtha liquid	
35	PSV-1204	48		1 1/2 F2	Recycle H2 from header	
36	PSV-1205	7		3 K 4	B-110,Naphtha liquid & vapour	
37	PSV-1206	48		1 1/2 G2 X 1/2	H-110,Naphtha gas	
38	PSV-1209	42		1 D 2	H2 gas frm header	
39	PSV-1210	48		1 1/2 G2 X 1/2	R-112, Process gas	
40	PSV-1212	7		3 L 4	B-218, Vent gas	
41	PSV-1301	10		1 1/2 H3	Naphtha drain tank	

REPLACEMENT OF MOTOR OPERATED BALL VALVE (SP-1 & SP-70)

Two nos motor operated ball valves in synthesis loop SP-1 at discharge of Syn.gas compressor SP-70 in recycle gas inlet valve of (Cameron make) were replaced by motor operated flanged ball valve with electric Actuator size 12" x 8" x 12" RB Top entry of M/s.Keystone (Tyco) valves control India Pvt.Ltd. Procured vide PO 12/00487/KLL/10153AK/9911294. The valves were procured with companion RTJ type flanges.

Both valves were installed after removal of old RF flange and welded new 12" x 1500 # RTJ flange as per WPS preheat and post heat treatment was done. Fabrication job contract was awarded to M/s.Ganesh Engineering, Baroda.

Following vendor drawing may be referred for future application.

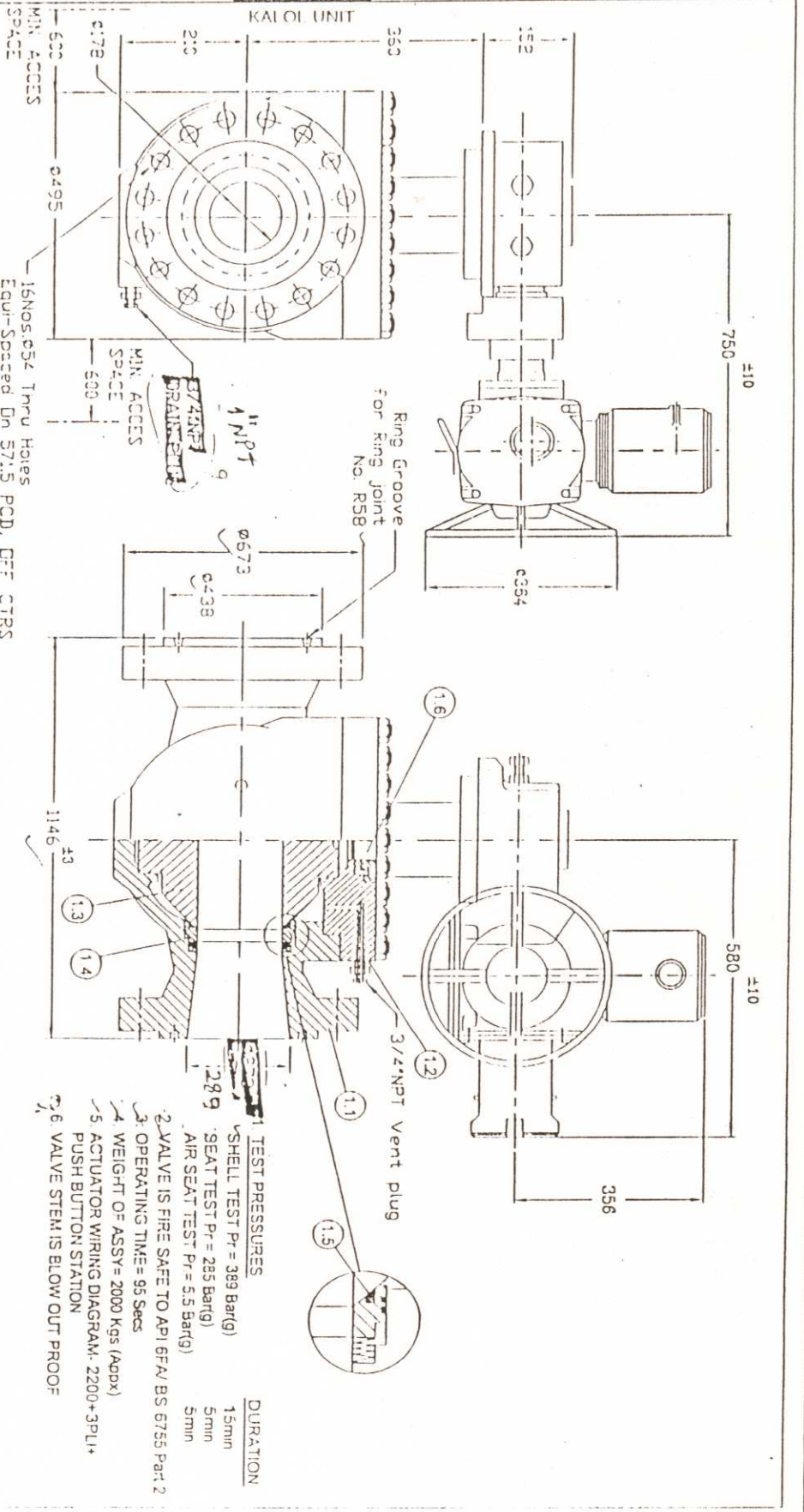
1. Dimensional drawing along with bill of material (Drg.No.ADO-951 Rev.00)
2. 12" x 1500 RTJ weld neck flange Drg.No.ADO-951-01 Rev.0)
3. Rotor make electronic Drg.No.BR-WD-2200
4. Quality assurance plant QAP No.QAP-8003-409 Rev.0.

REPLACEMENT OF LEVEL SWITCH IN STEAM DRUM (101-F)

LSHH 101 & LSSL-101 of 1" x 160 Sch. Existing level controller was removed and installed new imported level switch of M/s.Magnetrol, Belgium make procured by Instrument Maintenance.

Fabrication job was carried out with approval of CIB Gujarat by M/s.Ganesh Engineering Company, Ahmedabad. Following IBR stamped pipe and pipe fittings were used.

Sr. No.	Description of Item	Quantity	Remarks
1	IBR CS Pipe -1" x Sch.160	2 mtr.	Radiography of all butt welds.
2	CS WNRF Flange -1" x 1500#	4 Nos.	
3	CS 90 Socket Elbow- 1"x 6000	4 Nos.	



Sl. No.	PART NAME	MATERIAL	REMARKS
1.0	Ball Valve Assy	IFCO 1500# RTJ	
1.1	BODY & ENDS	ASTM A 216 Gr. KCE	
1.2	CONNECT	ASTM A 106	
1.3	BALL	ASTM A304-ENP / AST 410	
1.4	END	ASTM A304 F08 / AST 410	
1.5	SEAT	PTFE	
1.6	ACTUATOR ASSY	ASTM A304 F08	
1.7	SEAT	PTFE	
1.8	ACTUATOR ASSY	ASTM A304 F08	
1.9	SEAT	PTFE	
1.10	ACTUATOR ASSY	ASTM A304 F08	
1.11	SEAT	PTFE	
1.12	ACTUATOR ASSY	ASTM A304 F08	
1.13	SEAT	PTFE	
1.14	ACTUATOR ASSY	ASTM A304 F08	
1.15	SEAT	PTFE	
1.16	ACTUATOR ASSY	ASTM A304 F08	
1.17	SEAT	PTFE	
1.18	ACTUATOR ASSY	ASTM A304 F08	
1.19	SEAT	PTFE	
1.20	ACTUATOR ASSY	ASTM A304 F08	

[Signature]
 M.P.L.

D. G. INANIDAR
 MANAGER (Mech)
 IFFCO, Kaloil Unit,
 P.O. Keshavnagar,
 Dist. Gandhinagar
 Pin-502 423 Gujrat

VALVE SHAPE IS REPRESENTATIVE ONLY & DIMS AS SPECIFIED ARE TO BE CHECKED
 UNSPECIFIED TOLERANCES
 (2-10) = ±0.1mm
 (101-500) = ±0.1mm
 (501 & ABOVE) = ±0.15mm

TEST STANDARD API 6D

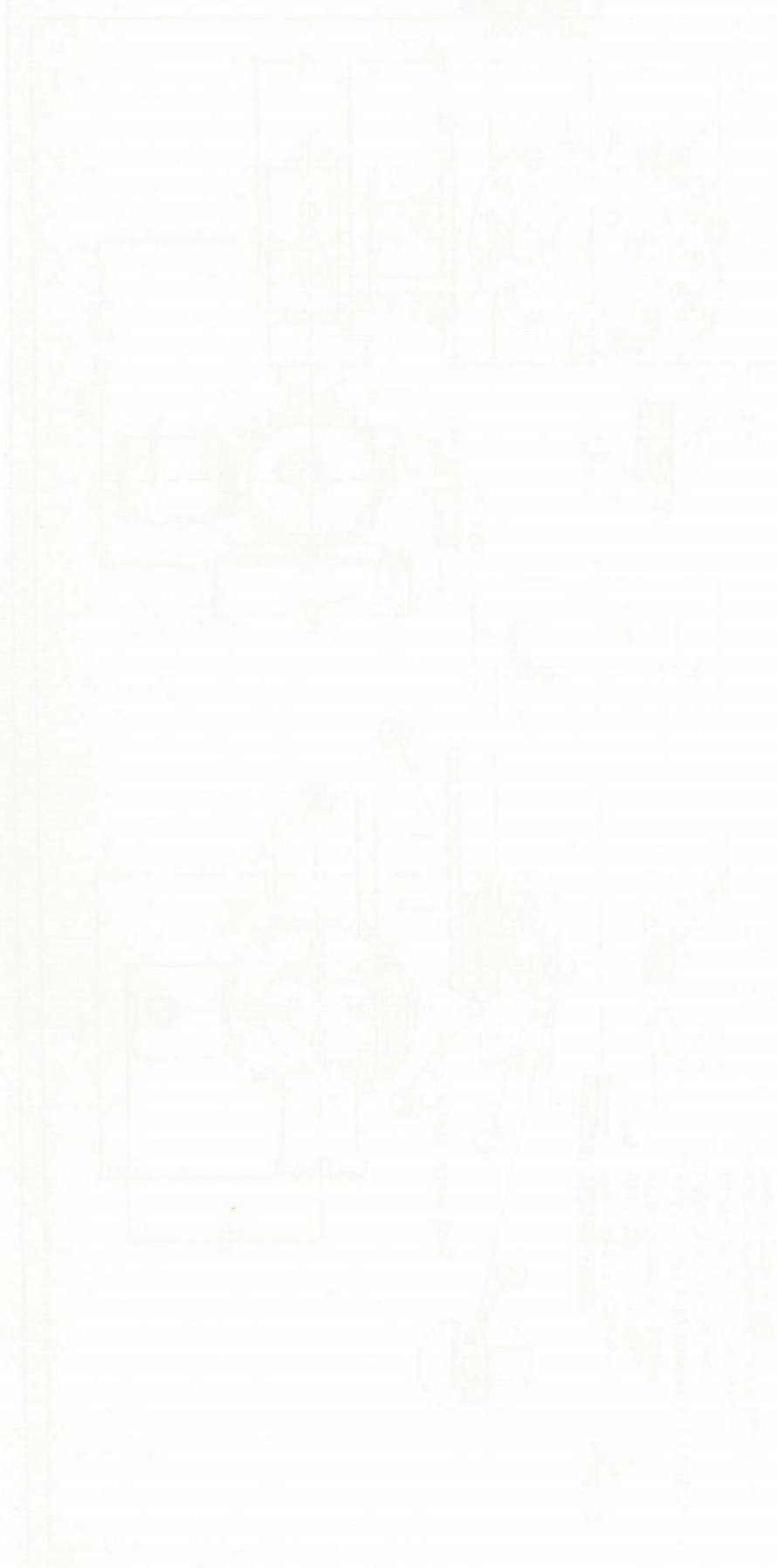
IFFCO - KALOIL

DRILLING STANDARD: ANSI B76.5, 1500# RTJ
 DESIGN STANDARD: API 6D/ANSI B76.34
 TEST STANDARD: API 6D

KEYSTONE INDIA PVT LTD.
 HALOL

12" X 2", 1500# RTJ BALL VALVE
 WITH ELECTRIC ACTUATOR

ADD-951



The following text is a technical specification or description of the assembly shown in the diagram. It is written in a cursive or handwritten style and is oriented vertically on the page. The text is faint and difficult to read, but it appears to contain technical details such as dimensions, material specifications, and assembly instructions.

The text is organized into several paragraphs, with some lines starting with capital letters, possibly indicating different sections or parts of the assembly. The overall appearance is that of a technical drawing or blueprint from a historical or archival source.

VESSELS AND OTHER EQUIPMENT:**1) 103-D, SECONDARY REFORMER:**

Water Jacket was cut in appx. 1 metre x 1 metre area for inspection of the shell cone welds. Visual inspection was done by Inspection department. Secondary Reformer Bottom plug manhole was opened for inspection and found O.K and boxed up after inspection.

2) 104 D HTS and LTS

Top manhole and screen were opened for removal of old catalyst. New catalyst was charged by Production deptt. Internal inspection was done by Inspection Section and manhole boxed up after fixing of top screen and charging Alumna ball.

3) 107 - D ,Transfer Line:

End plug manhole was opened for inspection and same was boxed up with new gasket after clearance from Inspection section.

4) 102-EA CO2 STRIPPER:

Vessel top and bottom man hole was opened for inspection and repair work. The following jobs were carried out given below.

- a) Old "I" beam of 4 mm thk. was bend due to weight of new distributor header and old "I" beam was removed by grind cutting. It was decided to replace new fabricated "I" beam of 10 mm thk and bearing supports of "I" beam was strengthened by providing stiffener and welded new plate.
- b) It was found that 4 nos. "U" clamp of distributor header were broken condition and all six "U" clamp replaced by new one.
- c) Demister pad on top found intact in position.
- d) East side weir plates holding bolts were found missing/sheared at six locations and it was replaced by new one
- e) Welding of deflection plate found cracked in approx. 100 mm length at its South end below the West side liquid distributor and it was repaired by welding.
- f) All trays and fasteners were found O.K..

5) 102-EB, CO2 STRIPPER:

Vessel top and bottom manhole hole was opened for inspection and repair work. The following jobs were work carried out are given below.

- A) Old "I" beam of 4 mm thk. was bend due to weight of new distributor header and old "I" beam was removed by grind cutting. It was decided to replace new fabricated "I" beam of 10 mm thk and bearing supports of "I" beam was strengthened by providing stiffener and welded new plate.
- b) It was found that 4 nos. "U" clamp of distributor header were broken condition and all six "U" clamp were replaced by new one.
- c) Inlet liquid distributor header flange was found loosened condition and hold up at one bolt and line was under tension. Line testation was removed and boxed up with new bolt and gasket.
- d) Demister pad on top found intact in position.
- e) All trays and fasteners were found O.K.

6) 102-F, RAW GAS SEPARATOR

Raw Gas Separator manhole nozzle was opened for inspection. Demister pad at top was found intact in position and boxed up after inspection clearance.

7) 103-F REFLUX DRUM :

Reflux drum manhole nozzle was opened for inspection. Demister pad at top was found intact in position except a gap of 100-150 mm was observed between the central segment gap of demister pad at its North end and same repaired and boxed up after inspection clearance.

8) 104-F SYN. GAS COMPRESSOR SUCTION SEPARATOR :

Syn Gas Compressor suction separator manhole nozzle was opened for inspection. Demister pad at top was found intact in position and boxed up after inspection and Production deptt. clearance.

9) 107-F PRIMARY AMMONIA SEPARATOR :

Primary ammonia separator manhole nozzle was opened for inspection. and boxed up after inspection Production deptt. clearance.

10) 109-F REFRIGERANT RECEIVER :

Refrigerant Receiver manhole nozzle was opened for inspection. Cleaning was done by Production deptt. and boxed up after inspection and Production deptt. clearance .

11) 110-F/111-F/112-F REFRIGERANT FLASH DRUM:

Refrigerant Flash drum manhole nozzle was opened for inspection. Cleaning was done by Production deptt. and boxed up after inspection and Production deptt. clearance .

14) 172-F, AMMONIUM HYDROXIDE TANK:

Ammonium Hydroxide Tank manhole nozzle was opened for inspection. Cleaning was done by Production deptt. and boxed up after inspection and Production deptt. clearance .

16) 800-F, NG Suction knock out drum:

NG Suction knock out drum manhole nozzle was opened for inspection. Demister pad at top was found intact in position and boxed up after inspection and Production deptt. clearance .

17) 801-F, NG discharge knock out drum:

NG discharge knock out drum manhole nozzle was opened for inspection. Demister pad at top was found intact in position and boxed up after inspection and Production deptt. clearance.

FABRICATION JOBS.

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(A) Departmental Jobs

Sr. No	Description of Item	Bill of Quantity	Remarks
1	FI 64 root valve not operable and it was replaced new one.	CS SW Gate valve Size:3/4"x800#	
2	FIC-1017 u/s I/V u/s drain valve bonnet leak and it was replaced new one.	CS SW Gate valve Size:3/4"x800#	
3	LP tapping I/V spindle broken and it was replaced new one.	CS SW Gate VI. Size:3/4"x800#	
4	173-C CW inlet line valve was shifted	Old valve to used	
5	H-111 Inspection cover bolt welded.	Bolt in position	
6	CW outlet sample valve 129-JC not operable and it was replaced new one.	1/2" Gun metal valve	
7	Nozzle for 172-F tank LG in PGR was provided.	Size:3/4"	
8	PIC-181 u/s and d/s drain valve bonnet leak and it was replaced new one.	CS SW Gate valve Size:1/2"x800#	2 nos.
9	150-C trap nipple thread leakage and new nipple welded.	1-1/2" NB	
10	102-JT steam inlet bypass valve of main block valve was passing and it was replaced	CS SW Gate valve Size:1/2"x800#	
11	107-JT (Murray turbine) in gland sealing steam line extra valve provided	CS SW Gate valve Size:1/2"x800#	
12	102-J S.oil turbine ,steam trap both I/V were passing and it was replaced new one.	CS SW Gate valve Size:1/2"x800#	
13	3.5 ata desuperheating station I/V passing and it was replaced new one.	CS SW Gate valve Size:1/2"x800#	
14	FIC-1016 u/s drain valve passing and it was replaced new one.	CS SW Gate valve Size:1/2"x800#	
15	101-B Atomising steam header no.9 drain valve of north side passing and it was replaced new one.	CS Gate valve Size:3/4"x800# SW	
16	FRC-2 u/s steam trap I/V wheel was missing and it was replaced new one.	CS Gate valve Size:3/4"x800# SW	
17	Steam inlet drain valve of 101-JT Bonnet leak and it was replaced new one.	CS Gate valve Size:3/4"x800# SW	
18	38 ata battery limit valve u/s trap isolation bonnet leakage and it was replaced new one.		
19	2004-JAT inlet steam trap was passing and it was replaced new one.	Size: 15 NB	
20	FRC-2 u/s trap passing and it was replaced new one.	TD-3 / 15NB	
21	Trap passing near PRC-18 and it was replaced new one.	TD-3 / 15NB	
22	Trap cold near 101-CA and it was replaced new one.	TD-3 / 15NB	
23	Trap cold near 101-CB and it was replaced new one.	TD-3 / 15NB	
24	Primary Reformer - trap cold	TD-3 / 15NB	

Sr. No	Description of Item	Bill of Quantity	Remarks
25	38 Ata steam header to offsites trap cod	TD-3 / 15NB	
26	Trap near 101-CA at 1st railing is cold	TD-3 / 15NB	
27	102-JT steam inlet trap cold and it was replaced new one.	TD-3 / 15NB	
28	102-JLO turbine steam inlet trap cold and it was replaced new one.	TD-3 / 15NB	
29	102-J SO turbine exhaust trap passing and it was replaced new one.	TD-3 / 15NB	
30	112-JAT trap cold and it was replaced new one.	TD-3 / 15NB	
31	Steam trap near AR-7 piller passing and it was replaced new one.	TD-3 / 15NB	
32	Steam trap near 119-F passing and it was replaced new one.	TD-3 / 15NB	
33	Steam trap near 101-E leaking and it was replaced new one.	TD-3 / 15NB	
34	Steam trap near 103-J was cold and it was replaced new one.	TD-3 / 15NB	
35	PIC-14 u/s trap passing and it was replaced new one.	TD-3 / 15NB	
36	800-J LO turbine steam inlet trap passing and it was replaced new one.	TD-3 / 15NB	
37	800-J Degassing oil tank outlet trap cold and it was replaced new one.	TD-3 / 15NB	
38	CEP 851J turbine steam inlet trap passing and it was replaced new one.	TD-3 / 15NB	
39	Ejector 852 trap passing and it was replaced new one.	TD-3 / 15NB	
40	Steam trap near centrifuge of 102-j passing and it was replaced new one.	TD-3 Size:1/2"x800#	
41	MIC-61 u/s line trap and its' I/V passing and it was replaced new one.	TD-3Size:3/4"x800# SW Type	
42	FIC-9 drain valve wheel missing and and it was replaced new one.	3/4" x 800 #	
43	101-B Atomising steam header drain valve at north side was passing and it was replaced new one.	CS Gate valve Size:3/4"x800# SW	
44	Sample valve in HTS passing and it was replaced new one.	CS Gate valve Size:1/2"x800# SW	
45	101B Atomising steam main header for primary reformer isolation valve passing near super heater coil cooling tower side and it was replaced new one.	CS Gate valve Size:3/4"x800# SW	
46	PIC-14 u/s trap isolation valve passing and it was replaced new one.	CS Gate valve Size:3/4"x800# SW	
47	FT-2 LP tapping 1st isolation valve bonnet leakage and and it was replaced new one..	CS Gate valve Size:1/2"x800# SW	
48	800-J LO pump discharge refrence gas DP switch drain valve passing and and it was replaced new one.	CS Gate valve Size:3/4"x800# SW	
49	MS header drain valve near 113-J piller was passing and it was replaced new one.	CS Gate valve Size:3/4"x800# SW	

Sr. No	Description of Item	Bill of Quantity	Remarks
50	102-JT steam inlet low pressure switch isolation valve bonnet leak and it was replaced new one.	CS Gate valve Size:3/4"x800# SW	
51	MS steam to 800-JT vent valve d/s of HCV-800 was passing and it was replaced new one.	CS Gate valve Size:1 1/2"x800# SW	
52	102-J Seal oil turbine exhaust valve 2nd isolation valve d/s trap isolation valve bush broken and it was replaced new one..	CS Gate valve Size:1/2"x800# SW	
53	102-JT LS induction steam block valve u/s drain valve was passing and it was replaced new one.	CS Gate valve Size:1/2"x800# SW	
54	MS to 102-JT vent valve passing and it was replaced new one.	CS Gate valve Size:1/2"x800# SW	
55	V-4 u/s trap isolation valve passing and it was replaced new one	CS Gate valve Size:1/2"x800#	
56	R.W. Isolation valve sevice station nr.108-J passing & Gland leakage and it was replaced new one.	1-1/2"x150#	
57	172-F bottom drain valve connect to strong effluent pond drain header was done.	CS 1" NB	
58	172-F PT-252 tapping valve was passing and it was replaced new one.		
59	801-JLJT drain valve passing and it was replaced new one.	CS 1"x800#	
60	801-JLJT inlet valve of PCV-860 passing and it was replaced new one.	CS 1"x800#	
61	112-JAT steam inlet vent valve passing	CS 3/4"x800#	
62	MS Header near Vent silencer 2" NB valve to be replaced	CS 2"x1500#	furmenited
63	107-J C/D Pump Suction vent valve to be replaced	CS 1-1/2" x800#	
64	LTS sample line replaced by new	Size: 1/2 NB	Old linewas corroded
65	V-1 u/s I/V bonnet broken and replaced by new one	CS Gate valve3/4"x800#	
66	11 ata steam Line flange replaced		
67	HTS 2" oxidation line valve replaced by new one at third floor.	CS 2"x800#	
68	3.5 ata steam line drain valve Nr. PRCV-2 replaced by new one.	CS Gate valve1/2"x800#	
69	Primary Reformer header no.3 and 6 drain valve were replaced .	Alloy steel , SW Gate valve Size:1"x1500#	
70	PRCV-4 vent valve bonnet leakage & it was replaced by new one.	CS Gate valve Size:2"x800#	
71	Thermowell provided on L.oil line of extra LO cooler of ID Fan	CS Socket Size:3/4,	
72	LC-3B U/S and I/V and its Bypass valve passing was replaced by new one	SS Valve Size:2"x800#	
73	103-JAT exhaust Sentinal RV u/s pin hole leak and it was attended by welding.		

Sr. No	Description of Item	Bill of Quantity	Remarks
74	Atomizing steam header drain valve (Nr. Super-heater vent platform) is passing and same was replaced by new one.	CS SW Gate valve Size:3/4"x800#	
75	103-J Recycle Pilot RV union leak and it was replaced by new one.	CS union Size:3/4"x6000#	
76	104-C tube side drain valve not operable and it was replaced by new one.	CS SW Gate valve Size:3/4"x1500#	
77	Auxiliary boiler br.no.2 steam to Naptha line interconnection union leak and it was replaced by new one	CS Union Size:3/8"	
78	HCV-12 & TRC-10 Sealing steam line NRV was replaced by new one.	CS 1"x800# NRV	
79	103-JAT steam line Exhaust , bypass valve passing and it was replaced by new one.	CS SW Gate valve Size:1/2"x1500#	
80	HCV-12 sealing steam 2-nd I/V was replaced by new one.	3/4"x800#	
81	P-1 Suction line pin hole leakage attended	2" NB SS line	
82	FRC-2 TX H.P. Tapping root valve was replaced by new one	CS SW Gate valve Size:1/2"x1500#	
83	103-JAT exhaust valve d/s trap 1 st I/V was replaced	CS SW Gate valve Size:1/2"x1500#	
84	FT-2 HP tapping root valve passing and it was replaced new one.	CS Gate valve Size:1/2"x1500# SW	
85	38 ata line near 103-J lube oil console drain was shifted at proper place to avoid fouling to head.	CS3/4" NB xSch.80	
86	107-JT steam inlet valve is passing and it was replaced new one.	Size:6x900# Welded	
87	Orientation of suction valve of Hydrazine dozing pump was changed.	Size:1" NB	
88	2004-JT Steam inlet darin valve passing and it was replaced new one.	1/2"x1500#	
89	FR-33 TX LP tapping I-st I/V bonnet leak and it was replaced new one.	1/2"x1500#	
90	E-4 gas outlet line one extra thermowell for local indication was provided	4" NB line	

FABRICATION JOBS BY CONTRACTOR M/S. CHAITHANYA

Sr. No.	Description of Job	Bill Of Material	Remarks
1	101-F Steam Drum to Secondary Reformer damaged Staircase were replaced by new one	Stair case grating	12 nos. staircase were replaced
2	103-D Platform extension between 102-C to 103-D	6 mm plate	
3	R-1 & R-2 second platform plate in loosened condition were tacked welded.		
4	CW connection to 101-JT gland condenser from new CW inlet line of 101-J cooler was provided	1-1/2" NB	To increase cooling water flow.
5	LTS outlet sample line corroded was replaced by new one.	3/4" NB x Sch.80	
6	03-D water jacket was cut for accessing for shell seam welding inspection and rewelded after inspection		Found in good condition
7	131-JC new trap of higher capacity was provided	1" NB inverted bucket type	M/S. Greave make
8	112-F high level vessel trip switch line got corroded and was replaced by new one.	3/4" NB x Sch.80	
9	E-2 Liquid Ammonia inlet oil separator vent and E-2 vapor outlet vent was extended at safe location		Fire & Safety requirement
10	Steam utility point provided at N.G.B.C & N.G. Compressor platform	3/4" NB x Sch.40	Fire & Safety requirement
11	R-110 Services station air line hooked up		
12	101-F services station air line hooked up		
13	R-112 services station air line hooked up		
14	SP-39 & TRC-10 common flange fig.8 lifting arrangement was made.		for easy maintenance.
15	104-JAT gland leak off line was extended and connect with vent header	1/2" NB x 40 Sch.	It was heating to LO console
16	123- C top platform tack welded		It was loosened
17	121-J/JA Pump drain line connection to 119-C was provided to save ammonia from venting		Under energy saving scheme
18	Lifting arrangement of fig-8 HICV-1004 was made.		
19	Jacket water to 103-D & 101-C A/CB block valve position were changed and brought down at ground position.		To easy operation
20	Provision of thermowell in water jacket of 103-D at middle platform was made	Thermowell along with fitting	Instrument requirement
21	123-C RV vent pipe re- orientation at 45 deg. to avoid splashing of hot water during work at RV		
22	38 ata steam trap line was rerouted near Naphtha filter O/L and shifted to 103-D drain pot.		To drain condensate at common drain pot
23	AG connection was provided in to H-110/H-111 Pilot Burner		Prod. requirement.
24	112-C drain valve was non operable & it was replaced by new one.	Size: CS GV 3/4" X800#	

AMMONIA PLANT
SHUT DOWN- 2003

INSPECTION JOBS

103

1. Automatic ultrasonic scanning of all the Catalyst and Riser tubes in Reformer Furnace.
2. Radiography of all the "C" weld of Catalyst and Riser tubes was carried out and defective 25 catalyst tubes and one defective riser tube were replaced.
3. Inspection of 104 D, HTS and LTS from inside after removal of catalyst.
4. Insitu metallography of selected equipment and pipelines.
5. Thickness measurement of equipment and pipelines.
6. Ultrasonic flaw detection on selected weld joints of critical pipelines and equipment.
7. Inspection of newly fabricated pipelines for replacement which mainly include, De-superheater line, various tapping and other miscellaneous pipe lines.
8. Qualification tests of welders employed by contractors.
9. Visual inspection of equipment.

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

(1) PRIMARY REFORMER 101-B :

RADIANT ZONE AND CONVECTION ZONE:

1.1 VISUAL INSPECTION:

Visual inspection of the entire furnace radiant zone, including harp assemblies, refractory and insulation, burner-blocks, etc. was carried out. The detailed report on observations made is enclosed herewith at **Annexure-1.**

The following important observations were made during this shutdown.

- 1.1.1 The Reformer outlet Collector header insulation was found damaged at different locations. The insulation was repaired at these locations after completion of creep measurement job.
- 1.1.2 The Arch burner blocks which were found damaged in visual inspection of the furnace were replaced by Maintenance group.
- 1.1.3 Roof insulation were replaced where ever it was found damaged.

1.2 OTHER NDT ACTIVITIES:

- 1.2.1 Automatic ultrasonic scanning of all the 336 Catalyst tubes and 8 Riser tubes was carried out during Shutdown by PDIL. In all, 13 tubes were detected in 'D' grade category, i.e. more deteriorated tube condition indicating voids, micro and macro fissures in the tube wall. Same 13 nos. of tubes were found in D grade during last turnaround inspection. All riser tubes are found in 'C' grade category. There was no appreciable deterioration in condition of the tubes though some tubes operated with hot bands for long time. The summary of tube conditions is enclosed herewith at **Annexure-2.**
- 1.2.2 Radiography of "C" welds of three tubes 808,809,810 which had shown 1.3 to 2.6% of creep were done. Out of these three tubes, tube no. 809 was observed to have developed crack at the center of the weld. Therefore it was decided to carry out radiography of "C" weld joint of complete 8th row. Radiographs of the 8th row showed cracks in "C" weld of 11 tubes out of 42 tubes. Therefore radiography of "C" welds of all the remaining tubes and Risers was carried out. Details of the observations of radiography results are attached at **Annexure-3.** Defective tubes were replaced. 16 nos. of new tubes available in stores were installed. Balance 9 tubes were replaced after reclaiming defective removed tubes. Total 25 nos. of catalyst tubes and one riser of row no.2 were replaced during this shutdown. Riser of row no.2 was replaced with new riser tube available in stores.

1.2.3 For reclaiming old tubes, following procedure was followed.

- 1) Radiography of "B" and "D" welds were done. After they were found satisfactory, tube was cut from the "C" weld.
- 2) Bevel edge preparation for "C" and "E" weld was done by grinding followed by DP test.
- 3) After the bevel edges were cleared in DP test, same were taken for solution annealing at 1150^o C. in workshop. Rate of heating/cooling 150 ^oC/Hour, Soaking time 2 (Two) hours, followed by air quench.
- 4) After solution annealing "C" weld joint was welded and tested by DP test at root run and final run followed by radiography. Details are attached at **Annexure-4**.

1.2.4 All the "B" welds of removed tubes were checked by Ultrasonic flaw detection and were found satisfactory.

1.2.5 Replaced tubes were checked by DP test at root run and final run, followed by radiography. Radiography of root run was done for initially welded tubes.

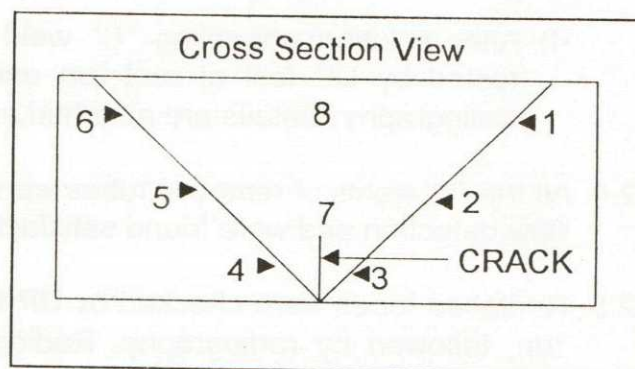
1.2.6 Outlet manifold field weld joints (16 nos.) were radiographed for all the eight rows. No service defects were observed in any joint.

1.2.7 DP test of all the 16 Nos. header field weld joints was carried out. DP test of riser tube to weldolet and weldolet to header weld-joints was carried out for all the risers. Also DP test of weld joints of one catalyst tube in each row of tube to weldolet and weldolet to outlet header joints was carried out. No defects were revealed.

1.2.8 Creep measurement of all the catalyst tubes was carried out using GO-NOGO Gauge at tunnel slab level. No recordable Creep was found in 163 nos. of tubes, creep was upto 0.73 % in 169 nos. of tube, creep range of 0.73 % to 1.3 % was found in 3 nos. of tubes and creep range of 1.3 to 2.5 % was found in one tube. The detailed report is enclosed herewith at **Annexure-5**.

1.2.9 Creep measurement of all the catalyst tubes was carried out using GO-NOGO Gauge at 600 mm above and 600 mm below of "C" weld level. No recordable Creep was found in 120 nos. of tubes, creep was upto 0.73 % in 182 nos. of tube, creep range of 0.73 % to 1.3 % was found in 20 nos. of tubes, creep range of 1.3 to 2.5 % was found in 13 nos. of tubes and tube no. 809 had 2.6 % creep. The detailed report is enclosed herewith at **Annexure-6**.

1.2.10 Surface hardness measurement of 3 defective tubes at weld seam and at HAZ was measured using ultrasonic hardness tester MIC-1 as under.



→ Tube No. ↓ Point No.	140	807	834
1	--	275 TO 285 HV	290 TO 310 HV
2	--	275 TO 285 HV	290 TO 310 HV
3	--	275 TO 285 HV	290 TO 310 HV
4	380 HV	285 TO 295 HV	280 TO 300 HV
5	380 HV	285 TO 295 HV	280 TO 300 HV
6	380 HV	285 TO 295 HV	280 TO 300 HV
7	375 TO 380 HV	285 TO 295 HV	285 TO 305 HV
8	370 TO 380 HV	295 TO 300 HV	265 TO 300 HV

1.2.11 Creep measurement of Riser Tubes was also carried out. The report is attached herewith at **Annexure-7**. Max. Riser O.D. was measured to be 4.9639" which corresponds to 0.48 percent creep. Riser of row no. 2 was replaced during this shutdown.

1.2.12 Creep measurement of outlet headers was carried out. The report is attached herewith at **Annexure-8**. Max. header O.D. was measured to be 5.6244" which corresponds to 0.53 percent creep.

1.2.13 Spring hanger readings of catalyst tubes in cold condition were taken. The report is attached herewith at **Annexure-9**.

1.2.14 West wall header box panel segment of L.T. Convection Zone was opened for thickness measurement on Ammonia BFW Coil tubes. No considerable reduction in thickness was observed.

1.2.15 Insitu metallography of catalyst tubes and riser was done and details are recorded at point no. 4 of miscellaneous jobs.

(2) AUXILIARY BOILER :

(2.1) FURNACE AREA :

2.1.1 The bowing/bending of the tubes was also measured. The bowing of 18 mm to 133 mm observed on tube nos. 44 to 60 on East wall, 12 to 125 mm on tube nos. 45 to 60 on West wall, 30 to 110 mm on tube nos. 1 to 24 of North wall. Deflection readings and the changes in deflection during SD 2002 and SD 2003 are given at Annexure - 10.

2.1.2 Thickness of tubes were measured. Min. thickness observed was 6.2 mm as against design of 7.02 mm.

VESSELS AND OTHER EQUIPMENT:

3.0 103-D, SECONDARY REFORMER :

SECONDARY REFORMER BOTTOM:

Jacket was cut in appx. 1 metre x 1 metre area for inspection of the cone welds. Visual inspection of Secondary Reformer Bottom dome was carried out after removal of plug of bottom manhole. The following observations were made.

3.1 BOTTOM DOME AREA :

3.1.1 Edges of the shroud liner was found buckled slightly outwards.

3.1.2 Top dome refractory brick lining had got slightly damaged just near center portion.

3.1.3 Dome bricks were found intact except their slotted holes were found choked at some places.

3.1.4 The edges of 101 CA nozzle was slightly buckled.

3.1.5 Slight inward buckling of the liner plates was observed at scattered locations at ID of both (101-CA & 101-CB) nozzle.

3.2 TOP CONICAL SECTION :

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The jacket was cut in approx. 1 meter x 1 metre area at the top dome elevation. Ultrasonic Flaw detection of the cone longitudinal seam was carried out in the area where UFD was carried out during last shutdown. No appreciable change was observed in comparison to last year readings. Also hardness measurement was carried out and readings are as under:

Weld: 172 to 186 BHN

Parent metal: 163 to 172 BHN

Haz: 168 to 177 BHN.

Metallography, thickness measurement, UFD and DP test was carried out and no abnormalities were observed.

4.0 104 D HTS and LTS

4.1 HTS :

Visual inspection, Magnetic particle inspection, Dye penetrant testing, Ultrasonic flaw detection and hardness measurement was carried out after removal of catalyst. The following observations were made :

4.1.1 All six supports on one side of oxidation inlet header were found broken at bottom dish end.

4.1.2 Blackish coloration was observed inside the vessel.

4.1.3 MPI (Magnetic particle inspection) was carried out on all circumferential as well as longitudinal weld joints and found to be satisfactory.

4.1.4 DPT (Dye penetrant testing) of all the connected nozzles were carried out. A surface crack of approx. 7 mm length was observed on the weld joint of blinded nozzle near side manhole in South direction. Repairing of the same was carried out.

4.1.5 Hardness was measured on welds, HAZ and parent metal of shell and dished end and was found as mentioned below:

Weld	205 to 232 BHN
HAZ	161 to 172 BHN
Shell/DE	138 to 152 BHN

4.1.5 Ultrasonic flaw detection of all "T" joints was carried out and no abnormality was observed.

4.2 LTS :

Visual inspection, Magnetic particle inspection, Dye penetrant testing, Ultrasonic flaw detection and hardness measurement was carried out after removal of catalyst. The following observations were made :

- 4.2.1 Blackish coloration was observed inside the vessel.
- 4.2.2 MPI (Magnetic particle inspection) was carried out on all circumferential as well as longitudinal weld joints and found to be satisfactory.
- 4.2.3 DPT(Dyepenetrant testing) of all the connected nozzles were carried out and found satisfactory.
- 4.2.4 Hardness was measured on welds, HAZ and parent metal of shell and dished end and was found as mentioned below:

Weld	183 to 196	BHN
HAZ	158 to 170	BHN
Shell/De	143 to 154	BHN

- 4.2.5 Ultrasonic flaw detection of all "T" joints was carried out and no abnormality was observed.

5. 107 - D ,TRANSFER LINE :

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

- 5.1 Minor buckling was observed at scattered locations throughout the length inside the transfer line.
- 5.2 Minor damage of the refractory was observed at flange (entry) of the transfer line.

6. 102-EA, CO2 STRIPPER :

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

- 6.1 Blackish coloration was observed inside the vessel.
- 6.2 Demister pad on top found intact in position.

- 6.3 East side weir plates holding bolts were found missing/sheared at six locations.
- 6.4 Flange joint of inlet liquid distributor found loose and gasket found fly away from the position.
- 6.5 Welding of deflection plate found cracked in approx. 100 mm length at its South end below the West side liquid distributor.
- 6.6 All trays and fasteners were found O.K..
- 6.7 Scaling was observed at scattered locations on shell surface.

Repairs/replacement action was taken up by Mech. Maintenance group and subsequently the vessel was reexamined and found satisfactory.

7. 102-EB, CO2 STRIPPER :

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

- 7.1 Blackish coloration was observed inside the vessel.
- 7.2 Demister pad on top found intact in position.
- 7.3 Flange joint of inlet liquid distributor found loose and gasket found missing from its position.
- 7.4 All trays and fasteners were found O.K..
- 7.5 Scaling was observed at scattered locations on shell surface.
- 7.6 Lot of foreign particles and debris were found laying on the bottom most tray.
- 7.7 Convex bulging of approx. 30-40 mm height was observed on the 105 CB nozzle liner.

Repair / replacement action was taken by mech. maintenance group and inspection was performed subsequently.

8. 102-F, RAW GAS SEPARATOR :

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

- 8.1 Epoxy paint condition was found to be satisfactory.
- 8.2 Manhole nozzle weld was found to be porous at scattered locations.
- 8.3 Demister pad at top was found intact in position.

9. 103-F REFLUX DRUM :

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

- 9.1 A gap of approx. 100-150 mm was observed between the central segment of demister pad at its North end. Rest of the segments were found intact.
- 9.2 Epoxy paint was found peeled off from the few small scattered locations at the bottom half of the vessel.
- 9.3 CO2 inlet nozzle had shown signs of erosion at the bottom portion in approx. 20 mm length on CS face of the nozzle. This face was repaired by welding during SD 2002 turnaround in approx. 40 % circumferential length. The condition of the rest of the repaired area was found satisfactory.
- 9.4 Some debris was found collected on the bottom dish end.

10. 104-F SYN. GAS COMPRESSOR SUCTION SEPARATOR :

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

- 10.1 Coloration of the vessel bottom was observed to be grayish black where as brownish coloration was observed on remaining surface.
- 10.2 Demister pad was found intact in position.
- 10.3 Scattered thin scales observed at bottom dished end.
- 10.4 Overall condition of the vessel was found satisfactory.

11. 107-F PRIMARY AMMONIA SEPARATOR :

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

- 11.1 Colouration of vessel internals was found blackish brown.
- 11.2 Scattered thin scales were observed on the shell and dished end.
- 11.3 Weld joint conditions were satisfactory.
- 11.4 The overall condition of the vessel was found to be satisfactory.

12. 109-F REFRIGERANT RECEIVER :

- 12.1 The shell had assumed grayish black coloration.
- 12.2 The condition of all the weld joints of the shell, dished ends and nozzles was found to be satisfactory.
- 12.3 Thin scales were observed on both the dished ends.
- 12.4 Minor scattered pittings / scales were observed in a width of approx. 250 mm throughout the length of the vessel at its bottom most portion.
- 12.5 Overall condition of the vessel was found to be satisfactory.

13. 110-F, FIRST STAGE REFRIGERANT FLASH DRUM :

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

- 13.1 The shell had assumed brownish black colouration.
- 13.2 Oil layer was found on the surface of shell and sludge was found at the bottom of vessel in complete length.
- 13.3 The Demister pad was found intact in position.
- 13.4 Scattered mill scales were observed on dish ends and shell.
- 13.5 Overall condition of the vessel was found to be satisfactory.

14. 111-F, SECOND STAGE REFRIGERANT FLASH DRUM:

The following observations were made during visual examination.

- 14.1 The shell inside surface had assumed blackish gray coloration.
- 14.2 Thin layer of oil was observed on the complete inside surface and at the West end of vessel debris and oil found accumulated.
- 14.3 The demister pads were found intact in position and in good condition.
- 14.4 Scattered scales were observed on both the dished ends.
- 14.5 Overall condition of the vessel was found to be satisfactory.

15. 112-F, THIRD STAGE REFRIGERANT FLASH DRUM:

The following observations were made during visual examination.

- 15.1 The demister pads were found intact in position.
- 15.2 The coloration of the inside surface of shell was dark blackish.
- 15.3 Oil was found sticking to the vessel shell.
- 15.4 Hard scales were observed in the shell which were more prominent on the dished ends.
- 15.5 Overall condition of the vessel was satisfactory.

16. 172-F, AMMONIUM HYDROXIDE TANK:

The following observations were made during visual examination.

- 16.1 The coloration of the inside surface was blackish gray on top half and brownish colouration was observed on the bottom half of the vessel...
- 16.2 Epoxy paint was peeled off at few locations and underneath layer of red oxide was found exposed.
- 16.3 Weld joint condition was found to be satisfactory.
- 16.4 3" nozzle at East end was not welded from inside.

17. 173-F, 102 J DISCHARGE SEPARATOR:

The following observations were made during visual examination.

- 17.1 The demister pads were found intact in position.
- 17.2 Weld joint and nozzle condition was found to be satisfactory. .
- 17.3 Minor scales were observed at scattered locations on shell surface.

18. 800-F, NG SUCTION KNOCK OUT DRUM: 114

The following observations were made during visual examination.

- 18.1 The demister pads were found intact in position.
- 18.2 Weld joint and nozzle condition was found to be satisfactory. .
- 18.3 The coloration of the inside surface was blackish.
- 18.4 A lot of debris were laying on bottom dish end, required to be cleaned.

19. 801-F, NG DISCHARGE KNOCK OUT DRUM:

The following observations were made during visual examination.

- 19.1 The demister pads were found intact in position.
- 19.2 Weld joint and nozzle condition was found to be satisfactory. .
- 19.3 The coloration of the inside surface was blackish.
- 19.4 A lot of debris were laying on bottom dish end, required to be cleaned.

18. MISCELLANEOUS JOBS :**18.1 WELDER QUALIFICATION TESTS :**

- 18.1.1 Performance qualification test of 13 Nos. welders offered by M/s General Engg. Baroda, and Ram bahadur & Co. was carried out. 10 nos. Non-IBR Welders were qualified during the test. These welders were allowed to perform various miscellaneous non-critical departmental welding jobs in the plant. 3 nos. of welders were qualified out of 5 welders tested, for IBR weld joints.
- 18.1.2 Performance qualification test for one welder was carried out for M/s L & T, for replacement of one defective liner segment of HP Stripper bottom hemi end in Urea plant.
- 18.1.3 Welder qualification test of 4 Nos. welders of M/S. Skywin Engrs., was carried out. 2 welders were qualified. These welders were qualified for performing welding jobs of reformer tubes and other pipeline erection in Ammonia plant.
- 18.1.4 Welder performance qualification test for 3 welders of M/S Neostructo, was carried out for installation of new LT Superheater coil.
- 18.1.5 Welder qualification test of 4 Nos. welders of M/S. Ganesh Engrs., was carried out. 2 welders were qualified. These welders were qualified for performing welding jobs in Ammonia plant.
- 18.1.6 Welder qualification test of 7 Nos. welders of M/S. Albaj Engrs., was carried out. 6 welders were qualified. These welders were utilised for pipeline erection in Urea plant.

18.2 D.P. TEST :

Dye penetrant examination of weld joints of all the pipelines fabricated by contractors/departmentally, supports of new LT Superheater coil, desuperheater new pipeline fabrication/modifications job done by technical and maintenance groups, catalyst tubes and riser tubes at site and for reclamation etc. was carried out after root run welding and after final welding, as per requirement. Any defects observed during the tests were rectified in the presence of inspector followed by DP test for acceptance.

18.3 RADIOGRAPHY:

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In order to ensure immediate radiography work and urgent processing of films, teams were hired on round the clock basis during entire shutdown period. Radiography was performed on the weld joints of the pipe lines fabricated by all contractors as well as departmentally. Also radiography was carried out on "C" welds of all the 336 catalyst tubes and 8 risers, "B" and "D" welds of all 25 catalyst tubes and 1 riser tube (only "D" weld) removed from furnace before reclamation, field weld joints of outlet manifold of primary reformer. Also weld joints of all the pipelines fabricated by contractors/ departmentally was carried out after root run welding and after final welding, as per requirement.

18.4 INSITU METALLOGRAPHY EXAMINATION:

In order to evaluate the condition of certain critical plant equipment and pipelines operating at high temperatures, Insitu metallographic examination was carried out. The details of spots examined on individual equipment are given below. Considerable degradation of the microstructure was observed on the following equipment:

- 1) Mixing Tee (102-C Outlet to HTS) 2) SG-33-14" line from 105 D outlet to 123-C.

It is proposed to replace Mixing Tee based on these findings as has been already recommended. Rest of the items will be monitored during next shutdown to observe the trend of deterioration. Details are as follows

18.4.1 Ammonia plant pipelines :

- i) A - 21 - 10" ; Normal structure
- ii) BF 17 - 3" & MS -12-8" ; Normal structure Hardness - Weld - 172 to 186 BHNHAZ & pipe 168 to 177 BHN
- iii) NG 9-12" mix feed coil Creep void in G 4859 pipe line while P11 (dissimilar weld) pipe & weldment shows normal structure.
- iv) NG - 11 primary reformer inlet All three inlet headers show similar structure Header; Row no 1, 3 & 6 of dissolution of pearlite / bainite, deterioration has started.
- v) PG 2- 18" - 102C outlet Spheroidisation of pearlite is seen, deterioration has started.

- vi) PG 3 – 18" (PG4 to 104 D top) Normal structure on HAZ and weld
Spot taken on down stream of fig 8 Blind
- vii) PG 3-18" – Mixing Tee Abnormalities were detected in the
Structure of pad and the parent material, recommending immediate
replacement .
- viii) PG 6 – 18" (104D TOP to 103C) Normal structure
- ix) SG 32 – 6" (SG 62 A&B to SG 25) Normal structure
- x) SG 33 – 14" (122-C outlet to 123C) Parent material shows micro
void; HAZ region shows type IV crack and
abnormalities were not detected on the
weldment. Hardness measured was as
under
- | | | |
|------|------------|-----|
| Weld | 215 to 226 | BHN |
| HAZ | 145 to 160 | BHN |
| Pipe | 125 to 145 | BHN |
- xi) H -111 (Naphtha super heater outlet Normal structure to R112)

18.4.2 Ammonia plant equipment :

- i) Methanator 106D Shell and weldment shows normal
structure. (East side Bottom end) Dish-
end shows lower volume fraction of
pearlite than the expected in P1material.
- ii) Methanator 106D Shell and weldment shows normal
structure.(West side Bottom end) Dish -
end shows similar structure as that of
east side.
- iii) Methanator 106D Normal structure in shell, weld and top
Dish - end (West side top side)
- iv) Secondary reformer (103D) Normal structure in parent
material, HAZ and weldment.
- v) Reformer outlet header Normal structure in parent
material, fillet weld and HAZ
between tube no 15 & 16
of Row no. 1

- vi) Dissimilar joint of reformer tube Parent material of P11 & G 4852 & weldment of dissimilar Tube no 801; "B" weld joint shows normal acceptable structure spot taken at W/S
- vii) High temperature shift converter Weldment & HAZ shows normal structure(South side bottom weld) Shell and the Dish-end shows minor extent of deterioration.
- viii) High temperature shift converter Shell, weldment and top Dish-end shows normal structure (east side top weld)
- ix) Low temperature shift converter Weldment, HAZ & shell shows normal structure.(south side bottom weld portion) Dish- end shows minor extent of deterioration.
- x) Riser tube Row no 1 Shows some creep void, thickening of secondary & primary Spot taken on the parent carbides, deterioration has started Material below 2nd weld From the bottom at south side
- xi) Reformer tube at "C" weld of Structure shows mainly secondary & primary carbides. Tube No 114 No fissure is seen.
- xii) 114C Methanator Feed exchanger Normal structure at weld, HAZ and the Hardness measured was as under
- | | | |
|---------|------------|-----|
| Weld | 182 to 197 | |
| HAZ | 132 to 146 | BHN |
| Channel | 132 to 146 | BHN |
- xiii) 122C shell Normal structure Hardness measured was as under Weld 245 to 249 BHN

18.4.3 Reformer tubes :

- | | |
|-----------------------------------|--|
| i) Tube no 801 after soln. Ann. | Improved structure in respect of dissolution of secondary and primary carbides in the austenite matrix. |
| ii) Tube No 801 Non- Ann. Portion | Shows heavy precipitation of secondary & primary carbides. In addition some carbides have dissolved in the matrix due to long use at high temperature. |
| iii) Tube soln. Ann from RATMANI | Shows similar structure as like non-annealed tubes and effect of solution annealing treatment is not observed |
| iv) Non – annealed Catalyst tube | No structural difference in annealed and non tube from RATMANI |
| v) Tube no 808, 3m from bottom | Shows lesser extent of carbides thickening and precipitation in the matrix. All the above tubes were examined in the W/S. |
| vi) New & unused Reformer tube | Normal structure containing eutectic carbides in the austenite spot taken on the parent material matrix. Between C & D weld |

18.5 ULTRASONIC FLAW DETECTION OF WELDS :

Weld joints (selected only) of the following pipe lines and equipment were ultrasonically examined for assessing any development of service defects/growth of the acceptable defects. No abnormalities were observed in any of the weld joints inspected. No discontinuity was required to be repaired. The detailed results of inspection and Isometric drawings showing the location of scanned weld joints are enclosed with the **Annexure-11**.

18.6 ULTRASONIC THICKNESS MEASUREMENT :

During the shutdown, ultrasonic thickness measurement was carried out on various pipelines and equipment in the plant. The detailed results of inspection are attached herewith at **Annexure-12** (for equipment) and **Annexure-13** (for pipelines).

18.7 GAUSS MEASUREMENT:

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During this shutdown residual magnetism (gauss) on rotary and stationary parts of various rotary equipment were carried out. Wherever residual magnetism were higher than acceptable limits, same was demagnetised and brought down within acceptable limits. The detailed results of inspection are attached herewith at **Annexure-14**

18.8 INSTALLATION OF NEW PIPELINES:

During this shutdown, various pipelines in Ammonia Plant were installed for different schemes and various tapping were taken by Technical Group. Inspection activities viz. DP Test, Radiography review and repairs etc. were carried out on the weld joints as per fabrication procedures. Radiography work was kept in the scope of Inspection Section to speed up the radiography work and the results.

18.9 OVER SPEED TRIP TEST:

Before startup, during over speed trip test, speed measurement and vibration measurement of BFW pump Turbine104JAT, Air Compressor Drive Turbine 101-JT, Refrigeration compressor drive turbine 105-JT, drive turbine of LO/SO pump of 101 J/105 J , drive turbine of 103-J LOSO pump & drive turbine of aMDEA pump 107JT were carried out.

Annexure-1

VISUAL INSPECTION REPORT OF PRIMARY REFORMER RADIANT ZONE.

1.0 BURNER BLOCKS:

1.1 Burner blocks found badly damaged:

110,112,711,808

2.0 BOTTOM HEADER INSULATION:

<u>Row No.</u>	<u>Location of header insulation damage/ partial layer damage</u>
3	Below tube no 19,20
5	Below tube no. 9,34,36
6	Below tube no. 28,29,30,31,32,33,34
7	Below tube no. 8,9

3.0 ROOF INSULATION:

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

<u>TUBE ROW NO.</u>	<u>LOCATION OF DAMAGE</u>
1	Between tube no. 6 to 20,37 to 42
2	Between tube no. 8 to 12
3	Between tube no. 4 to 5,37 to 38
4	Between tube no. 6,19,20,10,11
5	None
6	Between tube no. (slightly loose) 29 to 32,37,39,41
7	Between tube no. 34
8	Between tube no. 1 to 8,18 to 20, 37 to 42 Near burner block 507,502,812 to 813, 904-906, 910,913,914

4.0 Canister base rings of riser found distorted/damaged of row nos. 2,3,4,8.

5.0 REFRACTORY WALLS:

5.1 NORTH WALL:-

5.1.1 Old repaired crack openings in brick lining in vertical direction is observed to be loosed / peeled off on 3rd panel from bottom between tube row no. 3 & 4

5.2 SOUTH WALL:-

5.2.1 Bricks found displaced/loose around top peephole nos. 4 & 5

5.2.2 Cerafelt may be filled up wherever gap has increased between panel of bricks.

5.2.3 Minor erosion has been observed on the bricks/ceramic fiber blocks at scattered locations which is predicted due to flame impingement.

Annexure -2(1/4)GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

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

Note : (1) N : New tube ; R : Replaced tube
 (2) Tube replacement was done after completion of scanning job.

Annexure -2(2/4)

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GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

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

Note : (1) N : New tube ; R : Replaced tube
(2) Tube replacement was done after completion of scanning job.

Annexure -2(3/4)

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GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

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

Note : (1) N : New tube ; R : Replaced tube
(2) Tube replacement was done after completion of scanning job.

Annexure -2(4/4)

GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

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

AUS OBSERVATION OF INDIVIDUAL RISER TUBE

ROW NO.	RISER NO.	AUS GRADE
1	1	C
2	2	C(Replaced)
3	3	C
4	4	C
5	5	C
6	6	C
7	7	C
8	8	C

Note : (1) N : New tube ; R : Replaced tube
 (2) Tube replacement was done after completion of scanning job.

Annexure-3

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STATUS OF RADIOGRAPHY RESULT OF REFORMER CATALYST TUBES :

Sr. No.	TUBE NO.	OBSERVATION	ACTION
1	104	CRACK IN WELD 'C'	REPLACED
2	107	CRACK IN WELD 'C'	REPLACED
3	109	CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
4	122	CRACK IN WELD 'C'	REPLACED
5	127	CRACK IN WELD 'C'	REPLACED
6	130	CRACK IN WELD 'C'	REPLACED
7	136	CRACK IN WELD 'C'	REPLACED
8	140	CRACK IN WELD 'C'	REPLACED
9	207	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
10	215	CRACK INITIATED IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
11	229	CRACK IN WELD 'C'	REPLACED
12	234	CRACK INITIATED IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
13	238	CRACK IN WELD 'C'	REPLACED
14	310	ROOT OPENING INITIATED AT WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
15	322	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
16	335	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
17	341	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
18	342	CRACK IN WELD 'C'	REPLACED
19	406	CRACK IN WELD 'C'	REPLACED
20	412	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
21	442	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
22	502	CRACK IN WELD 'C'	REPLACED
23	508	CRACK IN WELD 'C'	REPLACED
24	512	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
25	513	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
26	514	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
27	529	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
28	539	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
29	602	CRACK IN WELD 'C'	REPLACED
30	604	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
31	612	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
32	622	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
33	623	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
34	624	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
35	627	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
36	632	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
37	633	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
38	704	CRACK IN WELD 'C'	REPLACED
39	707	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
40	711	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
41	715	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
42	719	MINOR CRACK INITIATED IN WELD 'C'	TO BE CHECKED IN NEXT SHUTDOWN
43	736	CRACK IN WELD 'C'	REPLACED
44	738	CRACK IN WELD 'C'	REPLACED
45	801	CRACK IN WELD 'C'	REPLACED
46	805	INITIATION OF CREEP FISSURES	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
47	806	CRACK IN WELD 'C'	REPLACED
48	807	CRACK IN WELD 'C'	REPLACED
49	808	CRACK IN WELD 'C'	REPLACED
50	809	CREEP FISSURES IN WELD 'C'	REPLACED
51	831	CRACK IN WELD 'C'	REPLACED
52	832	CRACK IN WELD 'C'	REPLACED
53	834	CRACK IN WELD 'C'	REPLACED
54	839	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
55	841	INITIATION OF CRACK IN WELD 'C'	TUBE NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT

STATUS OF RISERS:

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SL. NO.	TUBE NO.	OBSERVATION	ACTION RECOMMENDED
1	RISER-1	CRACK INITIATED IN WELD 'C'	NOT REPLACED. SECOND PRIORITY FOR REPLACEMENT
2	RISER-2	CRACK IN WELD 'C'	REPLACED
3	RISER-5	CRACK INITIATED IN WELD 'C'	NOT REPLACED. SECOND PRIORITY

Annexure-4**STATUS OF RADIOGRAPHY OF B, C AND D WELDS & UFD ON REFORMER TUBES FOR RECLAIMING AFTER REMOVAL FROM HARP FOR REINSTALLATION:**

SL. NO.	TUBE NO (ORIGINAL PLACE)	PLACE AFTER RECLAIM	RADIOGRAPHY OF "B" WELD	RADIOGRAPHY OF "D" WELD	RADIOGRAPHY OF NEW "C" WELD	UFD OF "B" WELD i.e. DISSIMILAR JOINT
0	104	738	O.K..	O.K..	O.K..	O.K.
2	238	602	O.K..	O.K..	O.K..	O.K.
3	809	704	O.K..	O.K..	O.K.	O.K..
4	107	736	O.K..	O.K..	O.K..	O.K..
5	801	136	O.K..	O.K..	O.K..	O.K..
6	808	127	O.K..	O.K..	O.K..	O.K..
7	834	508	O.K..	O.K..	O.K..	O.K..
8	806	140	O.K..	O.K..	O.K..	O.K.
9	832	502	O.K..	O.K..	O.K..	O.K..

Annexure -5(1/4)

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CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL :

TUBE NO	CREEP IN PERCENTAGE				TUBE NO	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
101	X				201			X	
102	X				202	X			
103	X				203	X			
104	X				204	X			
105	X				205	X			
106	X				206	X			
107	X				207	X			
108	X				208	X			
109	X				209	X			
110	X				210	X			
111	X				211	X			
112		X			212	X			
113		X			213		X		
114	X				214		X		
115	X				215	X			
116		X			216	X			
117		X			217	X			
118	X				218		X		
119	X				219	X			
120		X			220	X			
121		X			221		X		
122		X			222		X		
123	X				223		X		
124	X				224		X		
125		X			225	X			
126	X				226		X		
127		X			227	X			
128	X				228	X			
129		X			229	X			
130		X			230		X		
131	X				231	X			
132	X				232	X			
133		X			233	X			
134	X				234	X			
135		X			235	X			
136		X			236		X		
137	X				237	X			
138		X			238		X		
139		X			239		X		
140		X			240	X			
141		X			241	X			
142		X			242	X			
TOTAL	23	19			TOTAL	29	12	1	

Annexure -5(2/4)

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**CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT
SLAB LEVEL:**

TUBE NO	CREEP IN PERCENTAGE				TUBE NO	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
301	X				401		X		
302		X			402	X			
303	X				403		X		
304	X				404	X			
305	X				405	X			
306	X				406		X		
307		X			407	X			
308		X			408	X			
309		X			409	X			
310	X				410	X			
311	X				411		X		
312	X				412		X		
313		X			413	X			
314	X				414	X			
315	X				415	X			
316		X			416		X		
317		X			417	X			
318		X			418	X			
319	X				419	X			
320	X				420		X		
321		X			421	X			
322		X			422	X			
323	X				423	X			
324	X				424	X			
325	X				425	X			
326	X				426		X		
327	X				427	X			
328		X			428	X			
329		X			429	X			
330		X			430	X			
331		X			431	X			
332		X			432	X			
333	X				433	X			
334		X			434	X			
335	X				435	X			
336	X				436	X			
337	X				437	X			
338	X				438	X			
339		X			439	X			
340	X				440	X			
341		X			441	X			
342		X			442	X			
TOTAL	24	18			TOTAL	34	8		

**CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT
SLAB LEVEL:**

TUBE NO	CREEP IN PERCENTAGE				TUBE NO	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
501		X			601		X		
502		X			602		X		
503	X				603		X		
504	X				604		X		
505		X			605		X		
506	X				606		X		
507		X			607		X		
508		X			608		X		
509		X			609		X		
510		X			610	X			
511	X				611		X		
512		X			612		X		
513	X				613		X		
514		X			614		X		
515		X			615	X			
516		X			616		X		
517		X			617		X		
518		X			618		X		
519		X			619	X			
520	X				620		X		
521	X				621	X			
522		X			622		X		
523		X			623		X		
524	X				624		X		
525	X				625	X			
526	X				626	X			
527		X			627	X			
528		X			628		X		
529		X			629		X		
530		X			630		X		
531		X			631	X			
532		X			632		X		
533		X			633		X		
534	X				634		X		
535		X			635		X		
536		X			636		X		
537		X			637		X		
538		X			638		X		
539		X			639		X		
540		X			640		X		
541		X			641		X		
542		X			642	X			
TOTAL	11	31			TOTAL	9	33		

Annexure -5(4/4)

132

CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL:

TUBE NO	CREEP IN PERCENTAGE				TUBE NO	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
701		X			801		X		
702	X				802			X	
703		X			803		X		
704		X			804	X			
705		X			805	X			
706		X			806		X		
707		X			807	X			
708		X			808		X		
709		X			809		X		
710	X				810		X		
711	X				811		X		
712		X			812		X		
713		X			813	X			
714	X				814		X		
715	X				815		X		
716		X			816	X			
717		X			817		X		
718		X			818		X		
719	X				819		X		
720	X				820		X		
721		X			821		X		
722		X			822		X		
723		X			823	X			
724		X			824		X		
725	X				825	X			
726	X				826		X		
727		X			827		X		
728	X				828		X		
729	X				829			X	
730		X			830		X		
731				X	831		X		
732		X			832	X			
733		X			833		X		
734	X				834		X		
735		X			835	X			
736	X				836	X			
737	X				837	X			
738	X				838	X			
739	X				839	X			
740	X				840	X			
741	X				841		X		
742	X				842		X		
TOTAL	19	22		1	TOTAL	14	26	2	

**CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT "C"
WELD LEVEL :
(600 mm ABOVE & BELOW "C" WELD JOINT)**

TUBE NO	CREEP IN PERCENTAGE				TUBE NO	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
101	X				201		X		
102	X				202		X		
103		X			203	X			
104		X			204		X		
105	X				205		X		
106		X			206	X			
107		X			207	X			
108	X				208	X			
109	X				209	X			
110	X				210	X			
111		X			211	X			
112		X			212	X			
113	X				213		X		
114		X			214	X			
115		X			215		X		
116	X				216	X			
117		X			217		X		
118		X			218	X			
119		X			219	X			
120	X				220		X		
121		X			221	X			
122	X				222		X		
123		X			223		X		
124		X			224		X		
125			X		225		X		
126	X				226	X			
127		X			227		X		
128		X			228	X			
129		X			229	X			
130		X			230	X			
131	X				231	X			
132	X				232	X			
133		X			233	X			
134	X				234		X		
135		X			235	X			
136		X			236	X			
137	X				237	X			
138		X			238	X			
139				X	239	X			
140		X			240		X		
141		X			241		X		
142			X		242	X			
TOTAL	15	24	2	1	TOTAL	26	16		

Annexure - 6(2/4)

134

CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT "C"

**WELD LEVEL :
(600 mm ABOVE & BELOW "C" WELD JOINT)**

TUBE NO	CREEP IN PERCENTAGE				TUBE NO	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
301		X			401		X		
302		X			402	X			
303	X				403	X			
304		X			404	X			
305	X				405	X			
306		X			406	X			
307		X			407	X			
308		X			408	X			
309		X			409		X		
310	X				410		X		
311		X			411		X		
312		X			412				X
313		X			413		X		
314		X			414	X			
315				X	415	X			
316		X			416		X		
317	X				417	X			
318		X			418	X			
319		X			419		X		
320	X				420		X		
321		X			421	X			
322			X		422		X		
323	X				423		X		
324		X			424	X			
325		X			425		X		
326		X			426		X		
327		X			427		X		
328	X				428		X		
329		X			429	X			
330		X			430		X		
331		X			431		X		
332	X				432		X		
333	X				433		X		
334		X			434		X		
335		X			435	X			
336		X			436	X			
337		X			437		X		
338	X				438		X		
339			X		439		X		
340		X			440	X			
341			X		441	X			
342				X	442		X		
TOTAL	10	27	3	2	TOTAL	18	23		1

Annexure - 6(3/4)

135

**CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT "C"
WELD LEVEL:
(600 mm ABOVE & BELOW "C" WELD JOINT)**

TUBE NO	CREEP IN PERCENTAGE				TUBE NO	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
501		X			601			X	
502			X		602			X	
503		X			603		X		
504		X			604		X		
505	X				605	X			
506		X			606		X		
507		X			607		X		
508	X				608	X			
509	X				609			X	
510		X			610	X			
511		X			611		X		
512		X			612	X			
513	X				613	X			
514		X			614	X			
515		X			615	X			
516		X			616	X			
517		X			617	X			
518	X				618	X			
519		X			619		X		
520		X			620	X			
521	X				621		X		
522		X			622		X		
523	X				623	X			
524		X			624	X			
525		X			625		X		
526		X			626		X		
527			X		627		X		
528		X			628		X		
529		X			629	X			
530			X		630	X			
531		X			631		X		
532		X			632		X		
533		X			633		X		
534			X		634		X		
535			X		635		X		
536	X				636		X		
537		X			637		X		
538		X			638	X			
539		X			639		X		
540		X			640	X			
541	X				641		X		
542		X			642		X		
TOTAL	9	28	5		TOTAL	17	22	3	

Annexure - 6(4/4)

136

CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT "C"

**WELD LEVEL:
(600 mm ABOVE & BELOW "C" WELD JOINT)**

TUBE NO	CREEP IN PERCENTAGE				TUBE NO	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
701		X			801		X		
702		X			802		X		
703		X			803		X		
704		X			804	X			
705		X			805	X			
706		X			806				X
707	X				807		X		
708		X			808				X
709		X			809				X
710		X			810				X
711		X			811		X		
712		X			812		X		
713		X			813		X		
714		X			814			X	
715		X			815				X
716		X			816		X		
717	X				817		X		
718		X			818		X		
719		X			819	X			
720		X			820				X
721	X				821			X	
722		X			822			X	
723			X		823		X		
724		X			824				X
725		X			825		X		
726		X			826				X
727		X			827		X		
728	X				828		X		
729	X				829		X		
730	X				830			X	
731		X			831				X
732		X			832				X
733	X				833			X	
734	X				834			X	
735	X				835	X			
736	X				836	X			
737	X				837	X			
738	X				838	X			
739	X				839		X		
740	X				840	X			
741	X				841		X		
742	X				842	X			
TOTAL	16	25	1		TOTAL	9	17	6	10

Annexure -7

137

CREEP MEASUREMENT OF RISER TUBES

RISER NO.	OUTSIDE DIAMETER		DESIGN O.D.	CREEP
	E-W	N-S	Max.	%
1	4.9435	4.9419	4.94	0.07
2	4.933	4.9319	4.94	NIL
3	4.9635	4.9638	4.94	0.48
4	4.9419	4.9455	4.94	0.11
5	4.9409	4.9309	4.94	0.02
6	4.9305	4.9339	4.94	NIL
7	4.9443	4.9474	4.94	0.15
8	4.9639	4.9625	4.94	0.48

NOTE : (1) All dimensions are in Inch.

(2) Maximum diameter of 4.9639" was observed which corresponds to 0.48 % creep.

Annexure - 8

138

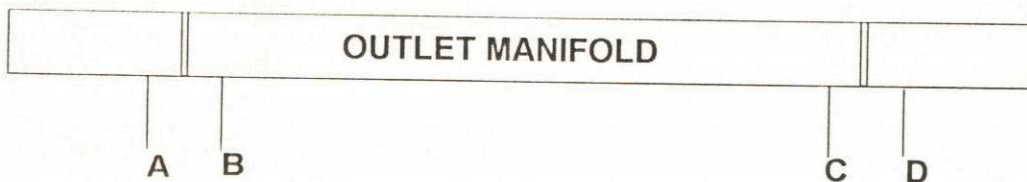
CREEP MEASUREMENT OF OUTLET MANIFOLD

Design Outside Diameter : 5.5945" (Max.)

HEADER NO.	LOCATION OF MEASUREMENT							
	A		B		C		D	
	X-X	Y-Y	X-X	Y-Y	X-X	Y-Y	X-X	Y-Y
1	5.5967	5.5962	5.5969	5.597	5.5947	5.6024	5.6046	5.6138
2	5.5954	5.5944	5.608	5.6062	5.6142	5.5968	5.5927	5.5902
3	5.5866	5.5978	5.5907	5.6023	5.5872	5.5963	5.5882	5.5932
4	5.6046	5.6068	5.5861	5.6042	5.586	5.5913	5.5835	5.5984
5	5.5952	5.6076	5.6124	5.6067	5.5885	5.5949	5.6062	5.5905
6	5.5828	5.6206	5.5955	5.5816	5.6035	5.6032	5.6034	5.6045
7	5.6045	5.6109	5.6079	5.6075	5.6077	5.6244	5.6067	5.6081
8	5.5988	5.5895	5.6001	5.6027	5.5936	5.5896	5.6091	5.615

Note : (1) All dimensions are in Inch.

(2) Maximum diameter of **5.6244"** was observed which corresponds to 0.53 % Creep.



Annexure - 9

1. TUBE SPRING HANGER LOAD READINGS OF PRIMARY REFORMER HARP ASSEMBLY(101-B):

COLD LOAD READINGS IN MM:

R O W	TUBE NOS. (SOUTH TO NORTH)																					
	1	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41		
1	-5	-8	-14	-15	-10	-6	-15	-24	-20	-16	-12	-10	-15	-5	-15	-24	-20	-11	-5	-6	0	7
2	-25	0	-7	-5	-5	-4	-5	-6	0	0	-10	0	0	0	-6	-4	-6	-4	-6	-6	-4	20
3	5	11	10	-5	-12	-8	-5	-8	-12	-15	-10	-8	-10	-8	-6	0	-5	0	6	8	-22	
4	5	6	0	-6	-16	-12	-10	-14	-16	-16	-18	-7	-8	-12	-8	-18	-10	-4	-6	0	2	0
5	*	7	0	0	-10	-15	20	-22	-16	-20	-10	-16	-12	-10	-16	-16	-13	-5	-6	0	0	*
6	*	0	-7	-11	-16	-25	-30	-25	-27	-20	-15	-16	-18	-20	-16	-17	-15	-10	-15	-4	2	*
7	*	3	2	-3	-8	-10	-22	-18	-22	-20	-16	-14	-7	-18	-15	-20	-16	-7	5	2	5	*

Note: * Readings could not be taken as springs were not attached .
 Row no. 8 spring readings could not be taken due to start-up

Annexure - 10

140

AUXILIARY BOILER COIL READINGS

Tube size : 2 1/2" NB x Sch. 80 (OD = 73 MM)

Tube Material : Carbon Steel

EAST SIDE COIL :

SL. NO.	TUBE NO. (FROM SOUTH SIDE)	DEFLECTION IN MM, JUNE-2003	DEFLECTION IN MM, APRIL-2002	DIFFERENC E
1	44	-35	-30	-5
2	45	-32	-35	3
3	46	-25	-22	-3
4	47	30	35	-5
5	48	-52	-50	-2
6	49	-105	-103	-2
7	50	-75	-71	-4
8	51	-95	-92	-3
9	52	-95	-98	3
10	53	-125	-130	5
11	54	-110	-105	-5
12	55	-130	-133	3
13	56	-105	-101	-4
14	57	-120	-119	-1
15	58	-42	-40	-2
16	59	-20	-18	-2
17	60	95 (south)	98(south)	3

WEST SIDE COIL :

SL. NO.	TUBE NO. (FROM SOUTH SIDE)	DEFLECTION IN MM, JUNE-2003	DEFLECTION IN MM, APRIL-2002	DIFFERENC E
1	45	-15	-12	-3
2	46	-32	-30	-2
3	47	-50	-47	-3
4	48	-65	-63	-2
5	49	-80	-85	5
6	50	-70	-68	-2
7	51	-70	-65	-5
8	52	-80	-80	0
9	53	-100	-95	-5
10	54	-98	-100	2
11	55	-130	-125	-5
12	56	-100	-95	-5
13	57	-105	-115	10
14	58	-85	-95	10
15	59	-70	-65	-5
16	60	-55	-60	5

NORTH SIDE COIL :

SL. NO.	TUBE NO. (FROM EAST SIDE)	DEFLECTION IN MM, JUNE-2003	DEFLECTION IN MM, APRIL-2002	DIFFERENCE
1	1	+70	65	5
2	2	+ 100 (W)	105 (W)	-5
3	3	+ 25 (W)	20(W)	5(W)
4	4	- 30, 25 (W)	-25, 20(W)	-5, 5(W)
5	5	-105	-110	5
6	6	-100	-90	-10
7	7	-68	-70	2
8	8	-60	-65	5
9	9	-80	-90	10
10	10	-90	-85	-5
11	11	-100	-110	10
12	12	-105	-100	-5
13	13	-100	-100	0
14	14	-85	-75	-10
15	15	-70	-75	5
16	16	- 70, 65 (E)	-65 , 65(E)	-5 , 0(E)
17	17	- 20, 30 (E)	-25 , 35(E)	5 , -5(E)
18	18	- 45, 30 (E)	-40 , 40(E)	-5 , -10(E)
19	19	-60	-55	-5
20	20	-35	-40	5
21	21	-70	-60	-10
22	22	-46	-50	4
23	23	-32	-30	-2
24	24	- 5, 40 (W)	-10 , 50(W)	5 , -10(W)

NOTE : READINGS ARE TAKEN AT 3750 MM HEIGHT FROM TUNNEL TOP FACE LEVEL (MANHOLE BOTTOM LEVEL)
 - BUCKLED TOWARDS WALL
 + BUCKLED OUTWARD IN FURNACE
 TOTAL TUBES ARE 60 NOS. ON EAST AND WEST SIDE COILS A & B.
 REMAINING TUBES ARE INTACT IN POSITION

Annexure -11

142

UFD OF WELD JOINTS OF FOLLOWING PIPELINES WAS CARRIED OUT:

SR. NO.	LINE NO.	SIZE	SCH.	FROM	TO	NO. OF JOINTS
1	HS-7	10	160/28.58	HS-4	103-J	2
2	HS-9	8	160/23.01	HS-5	HS-12	1
3	MS-19	6	40/7.11	CON. VALVE		}
4	MS-19	6	40/7.11	MS-1	107-JAT	
5	MS-21	6	40/7.11	MS-40	105-J	4
6	MS-25	6	40/7/11	MS-40	101-JT	2
7	MS-34	6	40/7.11	MS-2	S-7	4
8	MS-35	6	40/7.11	MS-11	103-J	4
9	MS-6	6	40/7.11	MS-1	107-JT	4
10	MS-8	8	30/7.00	MS-2	BATT. LIMIT	2
11	NG-8	12	30/8.4	NG-7	101-B	3
12	NG-9	12	100/21.4	101-B	NG-11	4
13	SG-33	14	140/31.75	122-C(105-D)	123-C	5
14	SG-25	8	120/	SG-23	CON.VALVE	4
15	B-WELD OF REFORMER TUBE NOS. :104,107,122,127,130,136,140,229,238,342,406,502,508,602,704,736,738,801,806,807,808,809,831,832,834.	4	12.5			25
16	106-D, METHANATOR NOZZLE 1st WELD AT INLET AND OUTLET LINE.					2
17	104-D NOZZLE 1st WELD AT INLET AND OUTLET LINE. LTS HTS					1 2
				TOTAL		75

Annexure -12

143

THICKNESS MEASUREMENT OF EQUIPMENT DURING S/D-2003

SL. NO.	EQUPT. NUMBER	EQUIPMENT DESCRIPTION	SHELL THICKNESS IN MM			DISH END THICKNESS IN MM			CHANNEL THICKNESS IN MM		
			DGN.	MEASD. MINI.	RED. %AGE	DGN.	MEASD. MINI.	RED. %AGE	DGN.	MEASD. MINI.	RED. %AGE
1	B-110	Condensate Drum for E-110		7.9							
2	B-111	Knock Out Drum For R-110	7.11	6.2	12.8		8.7				
3	B-112	Knock Out Drum For H-111		6.3			9.2				
4	101 - CA	Primary Waste Heat Exchanger	60.33	60.6		22.23					
5	102 - C	Secondary Waste Heat Exchanger	66.67	69.1		NA					
6	103 - C	Primary Shift Effluent Waste Heat Exchanger	55.56	57.4		20.63	27.5			29.9	
7	104 - C	Methanator Feed Heater	17.46	18.1		19.05	24.7			19.4	
8	105 - CA	CO2 Stripper Gas Exchanger	28.57	30.6		26.99	30.7				
9	105 - CB	CO2 Stripper Gas Exchanger	28.57	29.3		26.99	29.6				
10	106 - C	Shift Effluent Feed Water Heater	6.35	6.5		15.08	15.9				
11	108 - CA-1	aMDEA Solution Cooler	12.7	13		12.7	15.8				
12	108 - CA-2	aMDEA Solution Cooler	12.7	13.1		12.7	15.6			13	
13	108 - CB-1	aMDEA Solution Cooler	12.7	12.1		12.7	15.9				
14	108 - CB-2	aMDEA Solution Cooler	12.7	12.7		12.7	15.9			13.1	
15	109 - CA-1	aMDEA Solution Exchanger	12.7			12.7	14.4			25.1	
16	109 - CA-2	aMDEA Solution Exchanger	12.7	14		12.7	14				
17	109 - CB-1	aMDEA Solution Exchanger	12.7			12.7	15.2			23.9	
18	109 - CB-2	aMDEA Solution Exchanger	12.7	13.2		12.7	13.7			23.8	
19	110 - CA	CO2 Stripper Condenser	12.7	15.4					12.7	14.7	
20	110 - CB	CO2 Stripper Condenser	12.7	11.9					12.7	11.9	
21	111 - CA	CO2 Stripper Exchanger	12.7	13.4		12.7	14.1				
22	111 - CB	CO2 Stripper Exchanger	12.7	12.9		12.7	14.1				
23	112 - C	Low Temperature Shift Converter Inlet Boiler	12.7	12.8		26.99	29.1			31.9	
24	114 - C	Methanator Effluent Feed Water Heater	58	59.8		NA	19.9			20.6	
25	115 - C	Methanator Effluent Cooler	12.5	12.2		12.5	14.1				
26	116 - C	Synthesis Gas Compressor Interstage Cooler	11.11	9.4	15.39	11.11	11.4			30	
27	121 - C	NH3 Converter Feed /Converter effluent Exchanger		38.2			81.2				
28	124 - C	Syn. Gas Compr.After Cooler	20	21.8		16	19.7				

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SL. NO.	EQUPT. NUMBER	EQUIPMENT DESCRIPTION	SHELL THICKNESS IN MM			DISH END THICKNESS IN MM			CHANNEL THICKNESS IN MM		
			DGN.	MEASD. MINI.	RED. %AGE	DGN.	MEASD. MINI.	RED. %AGE	DGN.	MEASD. MINI.	RED. %AGE
29	127 - CA	Refrigerant Condenser	18	17.7					16	15.8	
30	127 - CB	Refrigerant Condenser	18	17.4					NA	16	
31	128 - C	Refrigerant Compressor Inter Cooler	11.7	12						12.2	
32	129 - JC	Air Compressor Interstage Cooler no.1	12.7	12.2							
33	130 - JC	Air Compressor Interstage Cooler no.2	NA	12.6		NA					
34	131 - JC	Air Compressor Interstage Cooler no.3	NA	15.4		NA					
35	136 - C	Synthesis Gas Methanator Feed Exchanger	15.8	15.6		NA	31.2				
36	147 - C	NH3 Vapouriser (by piping)		12.7			12.9				
37	150 - C	Fuel Preheat Exchanger	8.38	9.7		12.7					
38	151 - C	Fuel Preheat Exchanger	8.38	8.2		9.52				8	
39	170 - CA	Condensate Stripper Feed Bottom Exchanger	9.5	9		NA				15.5	
40	170 - CB	Condensate Stripper Feed Bottom Exchanger	9.5	9.1		NA				14.1	
41	171 - C	Condensate Stripper Exchanger	9.52	8.1		9.52	9				
42	172 - C	Condensate Stripper Overhead Condenser		10.4						10.2	
43	173 - C	Stripped Condensate Cooler	9.5	9		NA				8.9	
44	175 - C	aMDEA Solution Cooler No. 2	NA	10		NA					
45	176 - C	Natural Gas Compressor After Cooler	NA	11.8		NA	8.9			19.1	
46	802-C	After Cooler for 800-J	NA	15		NA	11.8			12.1	
47	803-C	By pass Cooler For A.G Compressor	NA	12.7		NA	11.3			13.1	
48	850-C	Gland Steam Condenser		11.3							
49	103 - D	Secondary Reformer	6.35(JK)	6.1(JKT)		34.92	41.3				
50	E-3	Gas Exchanger	5	3.5		5	4.1	16			
51	E-4	Regeneration Heater	5	6		8					
52	E-110 A	Process Feed Stock Preheater		14.5			12.8				
53	E-110 B	Process Feed Stock Preheater		14.4			10.1				
54	E-218	Naphtha Condenser		6.5			10.9				
55	H-111	Naphtha Superheater(Coil)	7.11	7.4			7.4				
56	101 - JLT	Lube oil tank for Air/Ref. Compressor		6.2			6.4(Top)				
57	102 - JLC1	Lube & Seal Oil Cooler for 102-K		8.6			8.2(N) 9.5(S)			8.6(N) 7.2(S)	
58	102 - JLC2	Lube & Seal Oil Cooler for 102-K		8.5			8.8(N) 9.3(S)			8.6(N) 7.2(S)	
59	102 - JLT-1	Lube Oil Tank For Natural Gas Compressor		7.3			8.4(Top)				
60	801-JLT	Main Oil Tank		6			8.2(Top)				
61	K-1	Washing Tower	18	18		NA	18.3				
62	2002 -LF	Phosphate Mix Tank	NA	2.9		NA	3.9				
63	114 - F	aMDEA Storage Tank	4.76	4.3		4.76	4.6				
64	117 - FA	aMDEA Carbon Filter	10	9.8		10	9.3				
65	117 - FB	aMDEA Carbon Filter	10	9.9		10	9.4				

SL. NO.	EQUIP. NUMBER	EQUIPMENT DESCRIPTION	SHELL THICKNESS IN MM			DISH END THICKNESS IN MM			CHANNEL THICKNESS IN MM		
			DGN.	MEAS. MINI.	RED. %AGE	DGN.	MEAS. MINI.	RED. %AGE	DGN.	MEAS. MINI.	RED. %AGE
66	118 - F	Inhibitor Tank 118-F	6	5	16.6	NA	3.9 (CONE)				
67	141-F		N.A	10			10				
68	156 - F	Blow Down Drum	11.11	11			12				
69	157 - F	Process Gas Separator	19.84	21.6		17.46	26.5				
70	158 - FA	Natural Gas Separator	24	23.2		NA	23				
71	158 - FB	Natural Gas Separator Ammonia liquor	24	24		NA	22				
72	172 - F		12	12		NA					
0	173 - F	NG Compressor Suction Knockout Drum	20	19.1		NA	20.7				
74	174 - F	NG Compressor Discharge Separator	NA	15.1		NA	14.5				
75	800-F	Suction Knock Out Drum for 800-J	NA	14.1		NA	14.2				
76	801-F	Discharge Knock Out Drum for 800-J	NA	16		NA	18.1				
77	802-F	Suction Knock Out Drum for A.G. Compressor	NA	10.1		NA	12				
78	2006-UF-1	Salt Storage Tank	NA	4.6		NA	8.2(T)				
79	2006-UF-2	Acid Regeneration Equipment	NA	9.6		NA	8.3(T) 8.0(B)				
80	2000-SL, AD-A	New Instrument Air Drier		5.2			7.5(T) 7.3(B)				
81	2000-SL, AD-B	Lube & Seal Oil Cooler for 102-J		6			7.5(T) 7.5(B)				
82	101-U	Deaerator	9.53	9.4		NA	12.9				
83	2005-U	Condensate Polisher	NA	14.6		NA	23.1				
84	R-1	Drying Vessel	36	36.2		36	36.2				
85	R-2	Drying Vessel	36	36.1		35	36.2				
86	R-112	Pre Reformer		86.9			53.7				

Annexure -13

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THICKNESS MEASUREMENT CARRIED OUT OF AMMONIA PLANT PIPELINES DURING SD2003:

SR NO	LINE NO.	N.B. (INCH)	NOM. THK MM	LINE DESCRIPTION		MIN THK. OBSERVED	% RED.
				FROM	TO		
1	A-25-6	6	7.11	FRCV-3 U/S LINE		6.9	2.95
2	aMDEA-1	12	8.38	101-E	MEA-4A & B	8.4	
3	aMDEA-4A	10	7.8	MEA-1	109C2A	8.1	
4	aMDEA-4B	10	7.8	MEA-1	109C2B	8.3	
5	aMDEA-7	10	9.27	MEA-61	MEA-9A/B	9.2	
6	aMDEA-9A	8	8.18	aMDEA-7	102-EA	4.6	43.77
	aMDEA-9A	6	7.11	aMDEA-7	102-EA	3.4	52.18
7	aMDEA-9B	8	8.18	aMDEA-7	102-EB	6	26.65
	aMDEA 9A	6	7.11	aMDEA-7	102-EB	3.4	52.18
8	aMDEA-10A	12	6.35	102-EA	aMDEA-11	6.6	
9	aMDEA-29A-12"	12	7.92	102-EA/EB REBOLIER(S105CA-CB / 111CA-CB) INLET HEADER		7	11.62
10	aMDEA 33A 16"	16	7.92	102-EA/EB REBOLIER(S105CA-CB / 111CA-CB) INLET HEADER		7	11.62
11	aMDEA-61	14	9.5	MEA-6A/B	MEA-7	7.9	16.84
12	BF-9-2"	2	8.71	104-J/JA MINIMUM FLOW LINES	101-U	8.8	
13	BF-10-2"	2	8.71	104-JA	101-U	8.8	
14	BF-30	2	5.5	104-J THRUST BALANCE LINE TO 101-U		5.2	5.45
15	BF-31	2	5.5	104-JA THRUST BALANCE LINE TO 101-U		5	9.09
16	BF-32	6	7.11	123-J SUCTION LINE		6.9	2.95
17	CO-1A	18	11.13	102EA	CO-17	8.5	23.63
18	CO-2B	18	11.13	102-EB	CO-16	9.6	13.75
19	HS-09	8	23.01	HS-5	HS-12	18.3	20.47
20	HS-7	10	18.3	103-JAT STEAM INLET HS HEADER		17.5	4.37
21	LS-10/ S-8	8	6.35	PICV-17 U/S & D/S LINES			
		6	7.11	PICV 17 U/S & D/S LINES		7.2	
22	LS-18-12"	12	6.35	PICV-20 U/S LINE		6	5.51
23	LS-53	1.5		LS TO 107-JT SEALING STEAM		2	
24	MS-06	6	7.11	MS-1	107-JT	6.8	4.36
25	MS-08	8	7	MS-2	BATT. LIMIT	6.3	10.00
26	MS-09	10	18.24	MS-12	MS-2	19.2	
27	MS-11	16	16.66	103-JAT EXH. VALVE D/S HEADER		19.1	
28	MS-17	2	5.5	2004-JT MS INLET LINE		5.6	
29	MS-19	6	7.11	107-JAT STEAM INLET LINES		6	15.61

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SR. NO.	LINE NO.	N.B (INCH)	NOM.THK. (IN MM.)	LINE DESCRIPTION		MIN.THK. OBSERED	% RED.
				FROM	TO		
30	MS-22	4	6.02	MS-2	MS-53	5.8	3.65
31	MS-23	8	7	104-J STEAM INLET LINES		6.4	8.57
32	MS-24	8	8.18	104-JA STEAM INLET LINES		6.7	18.09
33	MS-34	6	7.11	PICV-14 U/S & D/S LINES		7.2	
		4	6.02	PICV-14 U/S & D/S LINES			
		3	5.49	PICV-14 U/S & D/S LINES		6	
34	MS-35	6	7.11	MS-11	103-J	6	15.61
35	MS-38	6	7.11	V-1 U/S & D/S LINES		6.7	5.77
		4	6.02	V-1 U/S & D/S LINES		5.8	3.65
36	MS-6	6	7.11	107-JT STEAM INLET LINES		6.8	4.36
37	NG-07	8	6.4	SPEC.BRK		6.2	3.13
38	NG-809-12" -10B2	12	6.35	800J GAS INLET VENT HEADER		6.3	
		8	6.35			6.3	
		6	7.11			7	
39	NH-89	6	7.11	121-J	CONTROL VALVE	5.5	22.64
		3	5.49	121-J	CONTROL VALVE	5	8.93
40	NH-89A	6	7.11	121-JA	CONTROL VALVE	6.7	5.77
		3	5.49	121-JA	CONTROL VALVE	5.9	
41	PG	1	4.55	BYPASS LINE	SP5(PG-20-8")	4.1	9.89
42	PG-07	12	8.38	PG-6	103-C	10.7	
43	PG-08	20	9.53	104-C	112-C	9.1	4.46
44	PG-18	12	8.4	106D GAS INLET LINE		12.3	
45	PICV-1101	6	7.11	R-111	NAPHTHA COND.	7.5	
46	PW-02	2	3.91	SPEC.BRK.	PW-12	3.1	20.72
47	PW-03	2	3.91	PW-4	PW-12	2.7	30.95
48	PW-12	16	21.41	PW-2+3	PW-13	12.4	42.08
49	PW-13	6	10.97	PW-12	SEWER	8.5	22.52
		4	3.05			2.6	14.75
50	PW-19	4	3.07	104-E CONDENSATE INLET LINE		2.4	21.82
		2	2.77			2.7	2.53
51	S-11	6	7.11	11 KG STEAM TO LTS		7	1.55
52	S-12	3	5.49	MS + S LINES TO HTS		4.7	14.39
53	SC-04	4	6.02	111-CB	SC-6	4.1	31.89
54	SC-05	4	6.02	111-CA	SC-6	4.4	26.91
55	SC-06	4	6.02	SC-4&5	SC-8	5.1	15.28

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SR. NO.	LINE NO.	N.B. (INCH)	NOM.THK. IN MM.	LINE DESCRIPTION		MIN.THK. OBSERVED	% RED.
				FROM	TO		
56	SC-08	8	6.35	LICV-1007 D/S CONDENSATE LINE TO 101-U	101-U	4.9	22.83
57	SC-47A	10	9.27	101-JC	112-JA	6	35.28
58	SG-01	12	8.4	106-D	114-C	9.1	
59	SG-2	14	7.92	114-C GAS OUTLET LINE		9.8	
60	SG-07	10	12.7	103-J	136-C	12.6	0.79
61	SG-08	10	9.27	136-C	116-C	8.9	3.99
62	SG-12	14	23.8	103-J	124-C	22.7	4.62
63	SG-14	10	15.06	SG-13	117-C	17.5	
64	SG-22	12	25.4	SG-21	105-D	26	
65	SG-23	12	25.4	SG-21	HEADER	24.2	4.72
66	SG-25	8	18.24			17.5	4.06
67	SG-26	6	14.27	MICV-14 D/S LINES TO 105-D		14.1	1.19
68	SG-27	6	14.27	MICV-15 D/S LINES TO 105-D		10.5	26.42
69	SG-28	4	11.13	MICV-16 D/S LINES TO 105-D		10.3	7.46
70	SG-33	14	31.75	105-D GAS OUT TO 123-C & 123-C GAS OUTLET LINE		30.7	3.31
71	SG-34	14	23.8	123-C	121-C	25	
72	SG-36	2.5	7.01	SG-35	125-C	6.2	11.55
73	SG-39-4"	4	6.02	HP PURGE GAS ISOLATION VALVE U/S LINE	101-B	5.8	3.65
74	SG-40	10	18.24	CONTR.VALVE	HCV10	16.3	10.64
75	SG-49	2	8.7	108-F	BD-2,3,6	8	8.05
76	SG-53	3	11.13	SG-22	EVPT. DISC	9.1	18.24
77	SG-76A	4	11.1	SG-25	102-B	10.8	2.70
78	SG-76B	4	11.1	SG-21	102-B	10.8	2.70
79	SG-77-6	6	7.11	PRCV-4 VENT HEADER (SP-75)	PRCV-4	6.6	7.17
80	SG-79	1	4.5	105F	LC-10	3.3	26.67
81	14"-PG-1102.01-G36	14	19.05	R-112 GAS INLET LINE		19.4	
82	14"-PG-1103.01-G36	14	19.05	HICV-1004 D/S TO 101-B INLET LINE	R-112 TO 101-B	18.8	1.31
83	14"-PG-1103.01-G36	14	7.11	PICV-1027 U/S GAS LINE		11.2	
84	8"-NI-1104.01-G36	8	12.7	R-112 IG OUTLET LINE(CG CIRCULATOR LINE)	E-112	12.8	
	8"-NI-1104.01-D24	8	6.35		E-112	5.9	7.09
85	6"-NV-1102.01-F34	6	7.11	R-110 GAS OUTLET LINE		7.2	
86	6"-NV-1103.01-F34	6	7.11	R-111 GAS OUTLET LINE		6.4	9.99
87		2	3.91	K-1 GAS OUTLET & WATER INLET LINE	B3-A	2.8	28.39
		1.5	3.68			2.8	23.91

SR. NO.	LINE NO.	N.B. (INCH)	NOM. THK. IN MM.	LINE DESCRIPTION		MIN. THK. OBSERVED	% RED.
				FROM	TO		
88	AG-803-10-10A2	8	8.18	AGBC DISCH. LINE TO UNDERGROUND & FROM U/G TO PLANT (NEAR COLD BOX)	NG LETDOWN	6.4	21.76
		6	7.11			6.8	4.36
89	NG-809-12-10B2	12	6.35	800JT STEAM INLET VENT HEADER	VENT	6.3	0.79
		8	6.35			6.3	0.79
		6	7.11			7	1.55
90		8	8.18	FICV-202 (102-J LS INLET) U/S HEADER		8.4	
91	12-SM-1102.01 -F24S	12	14.27	MS TO PRE-REFORMER HEADER	PREREFORMER HDR	14	1.89
	6-SM-1102.03 -F24S	6	7.11			6.8	4.36
92		4	6.02	B4,B5 VENT LINES	VENT	6.1	
93		6	7.11	B-218 CONDENSATE INLET & GAS OUTLET LINES	PV-101	6.6	7.17
94	HS-20-50	2	8.71	TRCV-142 (STEAM) D/S LINE		8.3	4.71
95		4	6.02	R1-R2 GAS INLET LINE		5	16.94
96		2		E-6 LS INLET LINE		4.7	
97		2,CS 2,SS		E-6 GAS OUTLET LINE		3.5	
						3	
98	V-6-6"	6	7.11	PICV-5 VENT HEADER & ITS SNUFFING STEAM LINE		8.3	
99		4	6.02	PICV-16 U/S & D/S LINES	101-U	5.9	1.99
100		2		SNUFFING STEAM LINE TO 101-B		5.8	
101	8-AG-164-01-B24	8	6.35	VS-203 (AG VALVE) U/S & D/S LINE	101-B	6.5	
102		1.5		LS FROM E-6 TO 172-F VENT HEADER		4.7	
103		3		PICV-181 U/S		5.2	
		3		PICV-181 D/S	3.5 ATA TO AUX. BLR.	5.4	
104		2		ATOMISING STEAM HEADER	AUX. BLR. BURNER 1,2	4.7	
105	4"SM-160.05-F24S	4	6.02	MS TO ARU,	PV-502	6.1	
106		8	8.18	PICV-17 U/S LINE		7.9	3.42
		8	8.18	PICV-17 D/S LINE		7.2	11.98
107		3		PICV-650 D/S IG HEADER		4.6	
		2		PICV-650 D/S IG HEADER		3.7	

Annexure-14

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GAUSS MEASUREMENT REPORT
101-J AIR COMPRESSOR

1. TURBINE SOUTH BEARING

1.1	Journal Bearing housing	Before Degaussing Reading After Degaussing reading	Max. 21.4 gauss Max. 1.4 gauss
1.2	Journal Bearing shaft	Before Degaussing Reading After Degaussing reading	Max. 10.2 gauss Max. 1.2 gauss
1.3	Journal Bearing Pads	Before Degaussing Reading After Degaussing reading	Max. 5.2 gauss Max. 0.7 gauss
1.4	Journal Bearing Base ring	Before Degaussing Reading After Degaussing reading	Max. 13.7 gauss Max. 0.9 gauss
1.5	Thrust collar	Before Degaussing Reading After Degaussing reading	Max. 13.7 gauss Max. 0.9 gauss
1.6	Thrust Pads		Max. 2.0 gauss

2. TURBINE NORTH BEARING

2.1	Journal Bearing shaft	Before Degaussing Reading After Degaussing reading	Max. 4.4 gauss Max. 0.7 gauss
2.2	Journal Bearing Pad	Before Degaussing Reading After Degaussing reading	Max. 4.5 gauss Max. 0.4 gauss
2.3	Journal Bearing Pads	Before Degaussing Reading After Degaussing reading	Max. 6.0 gauss Max. 0.8 gauss

3. HP CASE SOUTH BEARING

3.1	Journal Bearing housing	Before Degaussing Reading After Degaussing reading	Max. 6.0 gauss Max. 0.7 gauss
3.2	Journal Bearing shaft	Before Degaussing Reading After Degaussing reading	Max. 1.1 gauss

4. HP CASE NORTH BEARING

4.1	Journal Bearing shaft		Max. 2.3 gauss
4.2	Journal Thrust Collar		Max. 0.8 gauss
4.3	Journal Bearing Pads		Max. 0.8 gauss
4.4	Journal Bearing Base ring		Max. 1.8 gauss

5. LP CASE COMP. THRUST END

5.1	Journal Bearing shaft		Max. 2.1 gauss
5.2	Journal Thrust Pads		Max. 2.1 gauss
5.3	Journal Bearing ring	Before Degaussing Reading After Degaussing	Max. 6.6 gauss Max 0.7 gauss
5.4	Thrust collar	Before Degaussing Reading After Degaussing	Max. 7.0 gauss Max 0.8 gauss

6. GEAR BOX

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4.1	Journal Area		Max. 2.0 gauss
4.2	Journal casing		Max. 2.1 gauss

GAUSS MEASUREMENT REPORT 103-J SYN GAS COMPRESSOR

1. JAT THRUST END RADIAL BEARING

1.1	Bearing ring	Before Degaussing Reading After Degaussing reading	Max. 4.2 gauss Max. 0.4 gauss
1.2	Pads	Before Degaussing Reading After Degaussing reading	Max. 3.4 gauss Max. 0.2 gauss

2. JAT OPPOSITE THRUST END RADIAL BEARING

2.1	Bearing ring	Before Degaussing Reading After Degaussing reading	Max. 3.3 gauss Max. 0.4 gauss
2.2	Pads	Before Degaussing Reading After Degaussing reading	Max. 2.3 gauss Max. 0.2 gauss
2.3	Thrust collar	Before Degaussing Reading After Degaussing reading	Max. 3.3 gauss Max. 1.3 gauss
2.4	Journal Bearing shaft	Before Degaussing Reading After Degaussing reading	Max. 2.4 gauss
2.5	Thrust side coupling end	Before Degaussing Reading After Degaussing reading	Max. 7.1 gauss Max. 1.3 gauss
2.6	Thrust side journal area	Before Degaussing Reading After Degaussing reading	Max. 10.1 gauss Max. 0.9 gauss
2.7	Thrust side journal area	Before Degaussing Reading After Degaussing reading	Max. 5.4 gauss Max 0.8 gauss

3. JBT NON DRIVE END (THRUST END) RADIAL BEARING

3.1	Journal Bearing shaft	Before Degaussing Reading After Degaussing reading	Max. 13.2 gauss Max. 1.5 gauss
3.2	Pads		Max. 1.2 gauss

4. JBT OPPOSITE THRUST END RADIAL BEARING

4.1	Bearing ring	Before Degaussing Reading After Degaussing reading	Max. 6.1 gauss Max. 0.7 gauss
4.2	Pads		Max. 1.4 gauss
4.3	Thrust collar		Max. 0.5 gauss
4.4	Journal Bearing shaft		Max. 0.4 gauss
4.5	Thrust side journal shaft area		Max. 2.3 gauss
4.6	Thrust side shaft end	Before Degaussing Reading After Degaussing reading	Max. 9.1 gauss Max. 0.8 gauss

5. HP THRUST END

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5.1	Pads	Before Degaussing Reading After Degaussing reading	Max. 4.9 gauss Max. 0.7 gauss
5.2	Thrust shaft area		Max. 1.1 gauss
5.3	Opposite thrust end shaft area		Max. 1.4 gauss

6. HP JOURNAL BEARING

6.1	Bearing ring		Max. 1.2 gauss
6.2	Pads		Max. 2.9 gauss

7. LP THRUST END

7.1	Thrust shaft area		Max. 0.8 gauss
7.2	Opposite thrust end shaft area		Max. 0.5 gauss

8. LP JOURNAL BEARING (Point No.7)

8.1	Bearing ring		Max. 1.9 gauss
8.2	Pads		Max. 3.5 gauss

GAUSS MEASUREMENT REPORT 105-J REF. GAS COMPRESSOR

1. TURBINE FREE END JOURNAL BEARING

8.1	Bearing ring		Max. 1.1 gauss
8.2	Pads		Max. 1.0 gauss

2. TURBINE COUPLING END JOURNAL BEARING

2.1	Rotor journal portion		Max. 2.3 gauss
2.2	Thrust journal portion	Before Degaussing Reading After Degaussing reading	Max. 4.0 gauss Max. 0.7 gauss
2.3	Thrust collar	Before Degaussing Reading After Degaussing reading	Max. 7.2 gauss Max. 2.0 gauss
2.4	Bearng ring	Before Degaussing Reading After Degaussing reading	Max. 5.1 gauss Max 1.1 gauss
2.5	Pads	Before Degaussing Reading After Degaussing reading	Max. 3.2 gauss Max 0.8 gauss

3. HP CASE COUPLING END JOURNAL BEARING

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3.1	Thrust Bearing shaft	Before Degaussing Reading After Degaussing reading	Max. 17.2 gauss Max. 2.3 gauss
3.2	Thrust Bearing Pad		Max. 2.3 gauss
3.3	Thrust Bearing ring	Before Degaussing Reading After Degaussing reading	Max. 7.1 gauss Max. 0.8 gauss

4. HP CASE FREE END THRUST BEARING

4.1	Thrust Bearing shaft	Before Degaussing Reading After Degaussing reading	Max. 10.1 gauss Max. 1.3 gauss
4.2	Thrust Bearing Pad		Max. 1.7 gauss
4.3	Thrust Bearing Base ring	Before Degaussing Reading After Degaussing reading	Max. 7.2 gauss Max. 0.9 gauss

5. LP CASE FREE END THRUST BEARING

5.1	Thrust Bearing shaft	Before Degaussing Reading After Degaussing reading	Max. 16.2 gauss Max. 1.9 gauss
5.2	Thrust Bearing Pad		Max. 0.8 gauss
5.3	Thrust Bearing Base ring		Max. 2.1 gauss
5.4	Thrust collar		Max. 2.3 gauss

6. GEAR BOX

6.1 All Gauss reading are maximum under 2.9 gauss .

GAUSS MEASUREMENT REPORT 102-J NG COMPRESSOR

1. SOUTH BEARING

1.1	Journal Bearing shaft		Max. 0.8 gauss
1.2	Journal Bearing Pad		Max. 1.1 gauss
1.3	Journal Bearing cage	Before Degaussing Reading After Degaussing reading	Max. 10 to 33 gauss Max. 1.2 gauss
1.4	Thrust collar	Before Degaussing Reading After Degaussing reading	Max. 1.3 gauss Max. 0.9 gauss
1.5	Thrust pads		Max. 0.8 gauss

2. NORTH BEARING

2.1	Journal Bearing shaft		Max. 1.8 gauss
2.2	Journal Bearing Pad		Max. 1.3 gauss
2.3	Journal Bearing cage	Before Degaussing Reading After Degaussing reading	Max. 44 gauss Max. 1.2 gauss

3. TURBINE THRUST END (POINT NO-1)

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3.1	Thrust collar	Before Degaussing Reading After Degaussing reading	Max. 7.9 gauss Max. 0.9 gauss
3.2	Thrust pads		Max. 0.8 gauss

4. TURBINE COUPLING END (POINT NO-2)

4.1	Bearing case	Before Degaussing Reading After Degaussing reading	Max. 36.0 gauss Max. 0.8 gauss
4.2	Thrust Bearing guide	Before Degaussing Reading After Degaussing reading	Max. 8.9 gauss Max. 0.9 gauss

GAUSS MEASUREMENT REPORT 800-J NG BOOSTER COMPRESSOR

1. THRUST END JOURNAL BEARING

1.1	Thrust end journal bearing	Before Degaussing Reading After Degaussing reading	Max.13.0 to 52.0 gauss Max. 0.4 gauss
1.2	Pad	Before Degaussing Reading After Degaussing reading	Max. 5.2 gauss Max. 0.8 gauss
1.3	Thrust Bearing holder	Before Degaussing Reading After Degaussing reading	Max. 5.4 gauss Max. 1.3 gauss
1.4	Pad	Before Degaussing Reading After Degaussing reading	Max. 5.2 gauss Max. 0.8 gauss

2. TURBINE THRUST BEARING

2.1	Journal Bearing area shaft		Max. 1.5 gauss
2.2	Turbine rotor thrust end		Max. 1.7 gauss
2.3	Base-ring	Before Degaussing Reading After Degaussing reading	Max. 3.9 gauss Max. 0.3 gauss
2.4	Pad	Before Degaussing Reading After Degaussing reading	Max. 3.0 gauss Max. 0.3 gauss

3. TURBINE GOVERNOR END THRUST COLLAR :- Max.1.4 gauss

4. TURBINE THRUST END JOURNAL BEARING

4.1	Thrust end journal bearing	Before Degaussing Reading After Degaussing reading	Max.3.2 gauss Max.0.6 gauss
4.2	Pad		Max. 1.2 gauss

5. TURBINE JOURNAL BEARING

5.1	Base-ring	Before Degaussing Reading After Degaussing reading	Max. 3.3 gauss Max. 1.0 gauss
5.2	Pad		Max. 1.2 gauss

6. N.G. COMP. (EAST BEARING)

6.1	Bearing shaft		Max. 0.7 gauss
6.2	Pad	Before Degaussing Reading After Degaussing reading	Max. 5.6 gauss Max. 0.8 gauss
6.3	Bearing cage	Before Degaussing Reading After Degaussing reading	Max. 22.0 gauss Max. 2.0 gauss
6.4	Bearing housing	Before Degaussing Reading After Degaussing reading	Max. 6.8 gauss Max. 0.8 gauss

7. N.G. COMP. (WEST BEARING)

7.1	Bearing shaft		Max. 0.2 gauss
7.2	Pads	Before Degaussing Reading After Degaussing reading	Max. 5.2 gauss Max. 0.8 gauss
7.3	Bearing cage	Before Degaussing Reading After Degaussing reading	Max. 15.2 gauss Max. 1.0 gauss
7.4	Bearing housing	Before Degaussing Reading After Degaussing reading	Max. 0.7 gauss
7.5	Thrust collar		Max. 0.6 gauss

**GAUSS MEASUREMENT REPORT
107-JAB (MDEA PUMP)**

1. TURBINE (WEST BEARING)

1.1	Bearing shaft		Max. 0.8 gauss
1.2	Thrust bearing pads		Max. 0.9 gauss
1.3	Bearing cage		Max. 0.8 gauss
1.4	Bearing housing		Max. 3.4 gauss
1.5	Thrust collar		Max. 1.3 gauss

2. TURBINE (EAST BEARING)

2.1	Bearing shaft		Max. 0.9 gauss
2.3	Bearing cage		Max. 0.7 gauss
2.4	Bearing housing		Max. 1.8 gauss

CIVIL JOBS

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(A) AUXILIARY BOILER :

- (a) Replacement of burner block for burner no-5.
- (b) Repairing of burner block for burner no. 1 and 4.
- (c) Repairing of Header and other refractory work in side auxiliary boiler.

(B) PRIMARY REFORMER :

Replacement of insulation brick along with back up insulation was carried out after removed of old damaged refractory in following area.

- i) North wall one pannel of 2.20 x 1.9 mt, 1.40 x 1.90, 2.8 x 1.90, 1.3 x 1.90 and 2.8 x 1.90.
- ii) On East and West side wall 3 panel of 2.1 x 2.2, 3 panel of 1.4 x 2.2, panel of 0.8 x 2.2, 3 panel of 1.4 x 2.2, 3 panel of 0.8 x 2.2 and one each of 1.4 x 2.2 and 1.95 to 2.10 respectively.

(C) SECONDARY REFORMER :

- (a) Repairing of cracks developed inside the secondary reformer carried out by department.

ELECTRICAL JOBS

1. Preventive maintenance carried out on TR-6 , TR-21, TR-22. The jobs carried out on each transformer are as under :

- A) Inspection of cable end termination in primary and secondary cable boxes, checking and tightening of connections, replacement of gaskets of box cover.
- B) Testing of oil in marshaling boxes on primary and secondary side of transformer TR-6 , cleaning of chamber and replacement of oil .
- C) Reactivating of silica gel of silica gel breather and filling up of oil in breather up to fill up level. Filling up of oil in OTI oil pot and WTI oil pot.
- D) Checking of Buchholz relay, MOG , trip alarm circuit and cleaning of emergency trip boxes.
- E) Turn ratio test, short circuit test, magnetic balancing test, measurement of insulation resistance carried out of each transformer.
- F) Break down voltage test carried out of transformer oil for each transformer.
- G) Attending all the leakage on the transformer by replacement of Gaskets and/or tightening of bolts.
- H) Painting of transformer Tr-6.

2. Preventive maintenance all feeder compartments mounted in MCC-5, MCC-5A/B, 5C, MCC-16 carried out as under :

- A) Cleaning and de-dusting of all the feeder compartment.
- B) Checking of cable terminal heating and repairing of burnt cable terminal.
- C) Checking of terminal tightness of power and control cable.
- D) Checking /Testing of breakers installed in panels.
- E) Replacement of damaged /burnt component/ parts of feeder compartment.
- F) Modification job carried out in MCC-5 on ACBs for manual normalisation of power after resuming the GEB power supply.

3. Overhauling of motors of following equipment carried out :
101 BJT, 104 J, 104JA, 104 JT, Seal oil pump of 102 J, LOP of 102J, P1, P2, 852J, 170J, 170JA, 106 J, 108J, 108JA.
4. Preventive maintenance, cleaning and checking of all motor operated valve and local control panels.
5. Replacement of existing MOV SP1 and SP7 with new MOV of Rotork make.
6. Providing emergency power supply to lube oil pump motor for (Equipment no. 803 JLJ) of NG compressor.

INSTRUMENTATION JOBS

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Control valve : Maintenance jobs :

Following Control Valves were removed from Bonnet and inspected diaphragm and plug/seat and general Overhauling of acuator were carried out.

1. FRCV-3 :

C/v opened from bonnet. Overhauled the actuator and Handjack assembly and the Actuator diaphragm was replaced by new one. Inspected the c/v plug/Seat and lapping carried out for tight shutoff. Provided new gland packing. Then refixed on line & all tubes was connected. Also pneumatic side Quick exhaust, regulator pressure gauge, v/p two gauge & v/p cover was replaced by new one. C/v stroke calibration done and painted the actuator.

2. FRCV-1 :

Actuator diaphragm was inspected found ok. V/p air supply air regulator was replaced by new one. Also provided new gland packings. Also preventive maint. Work was carried out. Finally checked the stroke calibration and painted the c/v actuator.

3. FRCV-2 :

Actuator diaphragm was inspected found ok. Provided new gland packings. Also preventive maint. Work was carried out. Finally checked the stroke calibration and painted the c/v actuator.

4. PRCV-25 :

The valve dropped from line. All parts were disassembled. Machining work on plug, cage & seat were carried out. Also c/v body inside step was found damage, so machining work was done. Provided 1 mm size copper gasket for seat bottom. Quick steel solution put on c/v body step. After c/v assemble work over, hydro test was done upto 50 kg/cm² and found alright. Then c/v was boxed up on line. Finally checked the stroke calibration and painted the c/v actuator.

5. MICV-61 :

The control valve was dropped from bonnet and all the parts of c/v cleaned & overhauled. On plug, cage & c/v gland bush machining work was done. Provided new asbestos sheet gasket for Bottom for cage. Plug and seat lapping Work was done. Then c/v was assembled. Also provided new gland packing. Then c/v was fixed on line. All the tubing work completed. C/v stroke calibration Done. Finally c/v colour painting work was done

6. V-15 :

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The valve was dropped from line as it was reported passing. All parts of c/v cleaned & overhauled. On plug & c/v gland bush machining work was done. Then plug and seat lapping work was done and assembled. Also provided new gland packing then c/v was boxed up on line with all new studs & bolts. Also all copper tubing was replaced by 1/4" s s tubes. Checked the operation of c/v with all the trip logic from control room Finally actuator painting work was done.

7. Aux.Boiler Burner No.1 valves (Steam line) :

C/v was dropped from line and attended actuator bottom side air leakage. C/v made disassembled. All parts of c/v cleaned & overhauled. On plug/seat , cage machining work was done. Also actuator bottom side opened. and found two o -ring damage. It was replaced by new one, then fixed it. Plug and seat lapping work was done, then c/v assemble work was done, also provided c/v gland packing .Then c/v was boxed up on line with new gasket. V/P and air regulator was replaced By new one. C/v stroke calibration done. Finally c/v acture painting Work was done.

8. PICV-1027:

Control valve was dropped from bonnet as reported passing problem. C/v made disassembled. Plug, seat, cage found Damage. So repaired plug and seat issued From store and checked and machining work was done on plug/seat & cage. also provided c/v gland packing and new carbon rings on plug. After c/v Assembly work over it was boxed up on line. C/v stroke calibration done. Finally c/v acture painting Work was done.

9. FICV-1005 :

M/S I L Ltd. company representative came to our site for cv enhancing the CV of the valve from 17 to 24. Replaced the plug/seat with new plug, cage and seat, three new gasket and gland packing graphite ring. Or this, the control valve dropped from bonnet. All parts of c/v cleaned & overhauled. Plug, cage was replaced by new one with new gasket as changing cv. Then c/v assemble work was done. Also provided c/v gland packing new two pieces of graphite ring. After c/v assemble work over, connected all tubes. C/v stroke calibration done. Finally c/v colour painting work was done.

10. MICV-24 to 32 :

All the c/vs were dropped from line and inspected plug/seat and checked diaphragms of all 9 control valves. Replaced the diaphragm of MICV-31 and finally checked the stroke.

11. PICV-28:

The valve was dropped from line and inspected plug / seat and machining was done on plug and fixed back after checking of clearance of plug/seat. Also checked diaphragm found ok .Finally reinstalled and checked the stroke.

12. FRCV- 12:

Control Valve plug seat were inspected. Replaced the new stem in same plug and fine finishing work carried out in plug also Inspected diaphragm found alright. Provided new ss tubing.

13. FRCV-14:

Old control Valve was removed from line and installed new MIL make control vave (the old valve body was CS where as the new one is SS) and provided new SS tubing and finally checked the stroke.

14. TRCV-10 :

Replaced the Diaphragm & provided new gland packings and checked the stroke .

15. V-27(PRC-6) :

C.V. was dropped from line & inspected plug/seat with blue test found all right.

16. LCV-2A : Control valve was dropped from line and replaced the stem as it was bent finally refixed and checked the stroke.

Following C/Vs preventive maintain work was carried out :

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Such as air header & regulator flushed, c/v cleaned, overhauled & gressing done. Hand Jack operation checked, cleaned v/p. Checked & provided c/v gland packing. C/v stroke Calibration done.

FRCV-7	FRCV-8	FICV-10	FICV-11
V4	V5	PRCV-1	PRCV-18
TRCV-12	TRCV-11	FICV-15	MICV-56
MICV-57	FICV-802	FICV-801	PRCV-4
PICV-1101	LICV-185	MICV-13	MICV-14
MICV-15	MICV-16	PRCV-24	MICV-13,14,15,16
LCV-16,18,19		LCV-185	V-150
PRCV-1	PRCV-1a	PICV-181	PRCV-4

32. PICV-13 A / PICV-13 B : Changed gland packing and replaced the copper tubing connections to 1/4" SS tubing. Valve positioner cleaned and stroke hacked.
33. MICV-1 to 9 : all the control valve general cleaning was carried out and finally checked stroke. Replaced the diaphragm of MICV-8 and MICV-9.
34. LCV-13: Replaced the air regulator and Checked the stroke, found OK.
35. MICV-56 : Dropped from the line and overhauled the positioner and general cleaning carried out.
36. FRCV-5: General cleaning, overhauling were carried out and checked the stroke. Also provided new gland packing. Replaced the actuator diaphragm.
37. All the Ball Valve of Naphtha pre reformer general cleaning carried out and checked the operation by operating the respective solenoid valve.

Control Valve : Technical department :

1. PRCV-22 :- checked c/v loop and also c/v stroke calibration checked.
2. TICV-28 :- checked c/v loop and adjusted c/v stroke calibration. Also Solenoid trip system checked .& found alright.
3. MICV-4401:- c/v stroke calibration checked it was found alright.
4. LCV-2 : c/v stroke calibration checked it was found alright.

3. Governor positioner MIC-23 cleaning/checking was done and its stroke checking was performed.
4. Extension cable connector of probe no. 7V was found damaged. The same was replaced and gap voltage was checked and found ok.
5. Replaced damaged extension cable of probe 10A.
6. Lube / Seal oil tank LT removed and fixed at new location to facilitate the mech.Maint. Of new provided cooler. Also, provided new impulse line, air tubing and cable tray for the same.

Ammonia Refrigeration Compressor (105J):

1. Removed all radial , axial and key-phasor probes alongwith relevant junction boxes, speed pick-ups, Temp. gauges , pressure gauges and THIs to facilitate mechanical jobs. After completion of jobs the same were fixed back after cleaning / functional checking of RTDs and gap voltage adjustments for radial and axial probes.
2. Governor positioner PRC-9 cylinder, fittings and tubings were checked. Its stroke checking and lock-out relay functional checking was also performed.
3. Replaced damaged extension cable connector of probe 1V.

FIELD INSTRUMENTS JOBS :

1. TI-504 T/C and T/W replaced with new one.
2. TI-0063 and TI-0064 removed for facilitating mechanical jobs and fixed back after completion of jobs.
3. FT 64 transmitter manifold replaced with new manifold.
4. FT-51 : removed parallel FT-51a Tx and new impulse line for FT-51 was provided.
5. 129 JC , 130 JC , 131 JC cooling water inlet/outlet THIs removed for facilitating mechanical jobs and same were fixed back after completion of jobs.
6. Annunciator-D : old annunciator was removed from its location and old switches connections, pipings etc. Were disconnected. New annunciator D alongwith its purge panel was installed. Power supply connections, common alarm cable connections from individual switches to ANN-D and cable glanding were done. Alarm function checking for all 19 switches was performed from field.

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7. LI-134/PI-114 old impulse lines were removed and new 3/8" ss impulse lines were provided.
 8. PIC-178 old 440R controller alongwith its relevant air tubings was removed.
 9. FI-115, LT-134, TV-183, LIC-185 old copper tubing from instrument to JB was removed.
 10. PR-79 transmitter, air regulator, impulse line, and air supply/output copper tubing were removed.
 11. MIC-11, LC-16, LC-18, LC-19, FRC-5, FR-95, Fr-40, PR-8, PI-84, PI-81, Pr-62, Pr-36, PR-79 relevant copper tubings removed.
 12. In reformer area TI-0066, TI-0068, TI-0043, TIAH-0085 and O2 analyser alongwith calibration panel also D.G points-2,3,7,8,17 tubig were removed and refixed after copmletion of mech. work. Relaced all the thermocouples above t/c and t/c head.
 13. Naptha pre-reformerwere (H-110, H-111) : All the ignitors/gas gun were cleaned and functionaly checked.
 14. Eye-Hye : Provided new wires lugs new terminations done and cheked the electrodes.
 15. Ignitors and solenoids valves of start-up heater were checked and functionally checked.
 16. FI-98, FI-181 old pneumatic transmitters were removed alongwith impulse pipes, air supply and output tubings and regulator. New electronic transmitters were installed and related cabling/Impulse tubing DCS soft work was carried out.
 17. LIC-1 leveltrol transmitter flapper/nozzle cleaned and relay was checked. Relay to nozzle tube was cleaned and functional checking of transmitter was performed. Also flushed the trol in startup.
 18. FI-53 Jacket water flow indication provided near FI-51 TX so related fabrication and tubing work was carried out. As per MWO from production from P/P.

19. Following new Magnetrol make level switches were installed and after new wiring in switches performance of the switches was checked by filling water.

LSHH -116
LAH -101

LSHH -118
LAL -101 (101-F)

LSHH-120(110-F,111-F, 112-F)
LSHH -111 (105-F)

20. Cv value enhancement (from 17 to 24) job was carried out for FV-1005
21. FI-651B Crack gas flow rotameter was removed from line, cleaned it and checked the performance off-line. The same was found ok. Rotameter was fixed back in line. The rotameter FI-651B was not showing any flow when other parallel rotameter FI-651A was also in line.
22. For PSHH - 81 2 nos. Additional switches were installed for provision of 2 out of 3 trip logic in PLC.

For that related impulse tubing ,cabling and wiring.
23. Provided new junction box for thermocouples near desulphuriser.
24. Provided sample tubings from LTS and HTS vessels to laboratory building to facilitate catalyst reduction analysis.
25. Instrument air headers flushing was carried out in different areas.
26. General cleaning and checking of all the level trolls of 104F,105F,106F,107F 108F were carried out.
27. Provided Pressure gauges on HP pump and steam drum ,102C, Pressure transmitter flushing and zero checking and other related work with Boiler inspection were carried out.
28. Provided Pressure gauges and PVC tubings work done to facilitate reformer catalyst tube DP measurement system with production people.
29. Provided new I/P convertor for LIC-1a and FRC-5a new control loop and related cabling and air regulator provision and tubing work completed.
30. Trip circuit of the all compressors were checked with production people and adjusted switches as per requirement and design trip value.
31. Removed the impulse tubing of FT-16 and FT-17 and refixed after Mech. Work over.

- 32. Provided one Loop current monitor(YBL) parallel with FT-115 in PGR to facilitate production people for the operation of HCV-109 c/v.
- 33. In H-111 (Naptha prereformer) TASH -1045 and TI -1029 modification job was carried out so related JB mounting and cabling ,wiring work done.
- 34. PRC-23 : Replaced power cylinder with new one . related modification for mounting was carried out.
- 35. Attended all the Plant start up activities
- 36. Following ISO related quality affecting transmitters, Analyzer and temperature point (total 31 instrument) was calibrated :

PT-7	PT-8	PT10	PT-28	PT-150	TI-0026
PT-4	PT-80	PT-62	PT-9	PT-36	
FT-1	FT-2	FT-3	FT-100	TI-104E	
FT-1006	FT-1005	PT-846	TI -0117	TI-0007	
TI-0039	TI-0036	TIC-1025	PT-501	PT503	
PT-5	PT-27	AR-1	TI-0011	PT-1027	

Annual Maintenance of UPSS, DCS and PLC :

UPSS :

- 1. The preventive maintenance of UPSS was carried by M/s IL, Jaipur against the AMC. General cleaning, servicing and configuration of parameter checking were done.
- 2. UPSS to AVR Auto changeover was checked, found OK. Battery performance were checked by switching off input supply. Conditions of the battery were checked by voltage reading before and after discharging of batteries and found in good condition.

YBL DCS :

- 1. The preventive maintenance of DCS was carried by M/s YBL as per the AMC. All EFCD, EOPS, EFMS and Engineering stations circuit PCB cards were removed from cabinet/panel and cleaned. Overhauled the fans, cleaned the filter, panels and cabinets.
- 2. All the jobs related with AMC were attended. Checked the reduendancy for CPUs, MAC2 cards, power supplies and HF buses.

HIMA PLC :

1. The preventive maintenance of HIMA PLC was carried out. Cleaning of cards, filters, fans, cabinets etc. was carried out for all the four PLC stations. A new F-6214 analog cards defined.

GE-Fanuc PLC :

1. The preventive maintenance of GE-FANUC PLC was carried out. PLC was completely tested for redundancy at CPU and bus level from A to B change over and vice versa.

CONTROL ROOM JOBS :

1. PDSL-61,64 alarm switches (105-J LP, HP case seal oil) were configured with PDSL-62,65.
2. Provided average readings of reformer tubes north and south area temperatures. Also, assigned the same to graphic page .gr0027.
3. Defined USV-1108,1109,1110 and 1122 for open/close indication in PLC event sequence recorder and in operator station.
4. Wrong indication of ZLH-1004 in DCS was corrected by redefining the same.
5. Provided acknowledge button in trip block IS-102 in PLC to facilitate acknowledgement of alarms.
6. MICV-22 was configured in DCS and its new logic was developed and implemented. The trip signal has taken from PLC IS-103 trip block.
7. LI-103D : secondary reformer jacket water level indication was provided in DCS.
8. Provisions of I/P and air supply were made for separate controlling of 104J and 107J i. e. Standby BFW pumps and MDEA pumps.
9. LIC-1a and FRC-5a new controllers were defined in DCS for above 104J and 107J.
10. PLC logic for PSHH-81A and PSHH-81B was added and provision for 2 out of 3 signals from three different switches was made.

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11. TI 1029 indications were provided in DCS as well as PLC and TAH-1045 indication was provided only in DCS. Also, TAH-1045 was removed from PLC.
 12. DCS shift report formats were modified with addition of new instrument tags as per requirement of production department.
 13. Generated new I-16 block in the PLC and it was hooked up with TICV-28.
 14. MIC-61 new logic was developed and implemented in DCS.
 15. Complete logic for sequential operation of air dryer was developed and implemented in DCS and its functional checking was carried out. Now the air dryer is fully controlled from DCS.
 16. Eye - Hye Lamp indication bulbs were replaced by dual LED (red/green) indication. Fixed new junction box for 110v a.c. relays. Also fixed 'OMRON' power supply nearby new j.b. to feed 24 v dc to relay contact.
 17. SP-1 and SP-70 (New installed) wiring modified for open/close indication in PLC operator console.
 18. Replaced the front indicator assembly of Bentley make bearing temperature monitor for 800J.
 19. Painting work of all the DCS/PLC consoles was carried out..
 20. Provided new Hensel make 110V AC power distribution box for field instruments 110V AC power. Removed old P.D.Boxes and all the power cables were terminated in new box.

TECHNICAL DEPARTMENT JOBS

1. Cooling tower pump speed indication/control modifications jobs were completed and new instrument tags SI-4401 and HIC-4401 were developed and implemented in DCS.
2. Instrument tags for desuperheater in primary reformer PIC-22, TIC-28, FI-28 were newly configured in DCS. Also temperature indicators TI-0095 and TI-0096 were configured in DCS.

CAPITAL JOBS CARRIED OUT IN ANNUAL TURNAROUND :

1. FICV-14 new masoneilan make control valve was installed in place of 25 years old control valve.
2. FI-98,FI-181 new Fuji make smart transmitters were installed in place of old pneumatic transmitters.
3. New Analog card was defined in HIMA PLC(F-6214)
4. New Annunciator-D for compressor house was installed and commissioned.
5. PSHH-81A and PSHH-81B new two nos. of additional switches were mounted for 2 out of 3 logic.

PREVENTIVE MAINTENANCE JOBS AS PER ISO 9001: 2000 :-

1. The preventive maintenance of UPSS was carried by M/s I/L, Jaipur. The general cleaning, servicing and configuration and parameter checking were done as per AMC. The trip setting noted down using the hand held configurator. Battery back up test carried out. Redundancy test for the UPS1 and 2 checked.
2. The preventive maintenance of DCS was carried by M/s YBL as per the AMC. All EFCD, EOPS, EFMS and Engineering station cards were removed from cabinet / panel and cleaned. Overhauled the fans, cleaned the filter, panels and cabinets. Checked the redundancy for CPUs, MAC2 cards, power supply and HF buses. Engineering station and EOPS healthiness checked through software.
3. The preventive maintenance of HIMA PLC were carried out by M/s Chemtrol Ltd.as per the AMC. Removed all cards from all the four PLC station and put back after cleaning of cards, filters, fans, cabinet and physical inspection. Checked the redundancy for CPU, input and output cards, power supply cards and HIMA buses.
4. The preventive maintenance of GE-FANUC PLC were carried out. PLC was completely tested for redundancy at CPU and bus levels and the changeover from A to B and vice versa were checked.

TECHNICAL DEPARTMENT JOBS:

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(A) MECHANICAL JOBS :

1) Installation of Desuperheater (SP-71) with Control Valves, Accessories & Instrumentation ::

Desuperheater has been installed in NG-8 line (Steam & NG Mixed Feed Line) to reduce the mixed feed coil outlet temperature.

Desuperheater was supplied by M/s SPX Valves & Controls, USA. Body Material of desuperheater is ASTM A-312 TP 304H. To install Desuperheater, existing Mixed Feed line (NG-8) connected to Mixed Feed Coil was dismantled (Size : 300 mm NB, Approx. Length : 14 mtr., Mat : A 53 Gr.B) & Line was rerouted to get required straight length upstream & downstream of Desuperheater as per Drg. No. 01-DL-13454, Sheet 1 of 1. Approx. 20 mtr CS (Mat : A 106 Gr.B , Size : 300 mm NB x Sch-40) & 19 mtr SS (Mat : A 312 TP 304H, Size : 300 mm NB x Sch-40S) piping was done.

For Desuperheater , BFW line as per Drg No. 01-DI-13472, sheet 1 of 1 (Mat: A 106 Gr.B, Size : 25 mm NB x Sch-160 & A 312 TP304, Size : 40 mm NB x Sch-40S) was fabricated & erected . In BFW line, Pressure reducing control valve PIC- 22 (Size : 25 mm NB x 1500 #), Flow Indicator FI-28 (25 mm NB x 300 #) & TICV-28 (20 mm NB x 300 #) are provided.

The installation job of Desuperheating System was carried out by M/s Skywin Erectors, Ahmedabad.

2) Fabrication & Erection of 12" NB Vent Gas Line from Condensate Stripper (104-E) to ID Fan Stack :

Aprox. 28 mtr. 250 mm NB x Sch-20 (Mat : A 53 Gr.B) pipe line from 104-E to 172 - C was dismantled . Vent line as per Drg. No. 01-CL-13473, Sheet 1 of 1, Rev-P was fabricated & erected (Approx. Length : 48 mtr, Size : 300 mm NB x Sch-20, Mat : A 106 Gr.B). This scheme will enable to 104 -E vent to ID Fan Stack.

The job was carried out by M/s Skywin Erectors, Ahmedabad.

3) Fabrication & Erection of New Line from R-112 Inlet to downstream of PICV -1027 in Pre-reformer area :

A 150 mm NB tapping from 14"-PG-1102.01-G36 (Line connected to R-112) was taken & the same was connected to 12"-PV-1107.01-B24 (Flare Line to Stack) . Material of this line upto Spectacle blind is P22 & the line at the down stream of Spectacle blind is of CS (A106 Gr.B). Line Size - 150 mm NB x Sch - 80, Material - A 335 P22, & A106 Gr.B. as per Drg. No. -01-DL-13460, Sheet 1 of 1. The job was carried out by M/s Skywin Erectors, Ahmedabad.

4) 12 " Tapping for Ammonia Vapour Line :

Tapping was taken for Ammonia vapour line from Refrigeration Compressor (105-J) suction Line. The tapping shall be connected to 300 mm NB Ammonia Vapour Line from Ammo. Storage area in future.

Size: 300 mm NB X Sch - 40, Material : A106 Gr.B.

The job was carried out by M/s Skywin Erectors, Ahmedabad

5) Two Nos. Tapping for I.G. Circulator (From 6" & 4" Header):

One tapping of 150 mm NB was taken from Line No. 4"-NL-1107.01-F24 for IG circulation. Tapping was taken providing 100 mm NB x Sch-80 Tee, 150x100 mm NB reducer , 150 mm NB x 600 # gate valve & spectacle blind at valve end.

Size: 100 mm NB X Sch 80, Material: A106 Gr.B.

Second tapping of 150 mm NB was taken from Line No. 6"-PV-1110.01-B24 for IG circulation. One BW gate valve (150 mm Nb x 300#) was also provided in header for isolation

Size: 150 mm NB X Sch 40, Material: A106 Gr.B

The job was carried out by M/s Skywin Erectors, Ahmedabad.

6) Three Nos. 6" NB Tapping for LP Boiler (112-C) operation at Higher Pressure :

Tappings were taken from LS-25-200 (line from 112-C to LP steam header) with isolation valve & from S-7-150 (11 ata header) shifting existing gate valve as isolation vale to the header.

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Size: 150 mm NBXSch40 , 200 mm NBXSch40, Gate valve : 200 mm NB x 300 # 150 mm NB x 300# & Globe valve 150 mm NB x 300 #

The job was carried out by M/s Skywin Erectors, Ahmedabad.

7) To provide 0.5" Globe valve (bypass of existing control valve MICV -61) :

A 15 mm NB bypass line with globe valve (Body Mat: A-105, 1500 #) was provided to existing control valve MICV- 61). The size of MICV - 80 mm NB x 600#.

The job was carried out by M/s Skywin Erectors, Ahmedabad.

8) From new flare stack following tapping taken for bio-fertiliser plant:

- i) 25 NB Tapping from 4 ata steam header .
- ii) 20 NB tapping taken from instrument air header.

(B) INSTRUMENTATION JOBS :

- 1) Flowmeter in AG Line in Flare Stack Area is installed & commissioned.
- 2) Flowmeter in Tail Gas Line in Prereformer area is installed & commissioned.
- 3) Existing LCV-2 Control Valve is replaced with Newly Procured Lo-dB Control Valve.
- 4) Control Valve for Level Control of 182-F in NG gas Compressor Area is installed.
- 5) Various instruments jobs connected with new desuperheater station of Ammonia plant are completed. Installation of Pressure transmitter PT-22, Pressure control valve PICV- 22 was completed.

For temperature control, thermowells along with duplex thermocouples, control valve TICV-28 including their cabling for interconnection with DCS & PLC was completed. Flow meter (Vortex Type) FI-28 was installed & remote indication was given in DCS in Ammonia Control room.

MECHANICAL JOBS**CO₂ CENTRIFUGAL COMPRESSOR (HITACHI) TRAIN
(K-1801 HP/LP CASE AND Q-1801 :)****(A) PREVENTIVE MAINTENANCE OF HITACHI
COMPRESSOR K-1801 L.P.CASE :**

- Coupling guards were removed
- Decoupled from Gear Box and Turbine after match marking.
- Alignment readings were taken and noted.
- Both Journal bearings of LP compressor were opened.
- After cleaning & polishing the bearings, DP check of journal bearing pads were carried out and found ok.
- Reassembled bearings for checking the bearing clearances with lead wire.
- Journal Bearing clearances were measured and recorded.
- Gauss measurement was done by Inspection and found within limit.
- Both Journal bearings were boxed up.
- Removed thrust bearing , cleaned , checked and found in good condition.
- DP check of thrust pads were carried out and found ok.
- Thickness of thrust pads were checked and found ok.
- Final alignment readings were taken and recorded

FINAL CLEARANCE READINGS OF LP COMPRESSOR :

Sr No	Description	Design value (mm)	Actual Value BPM(mm)	Actual Value APM(mm)
1	Axial Float	0.28 -0.38	0.28	0.28
2	DE Bearing Clearance	0.11-0.15	0.15	0.15
3	NDE Bearing Clearance	0.11-0.15	0.15	0.15

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**(B) PREVENTIVE MAINTENANCE OF HITACHI COMPRESSOR
K-1801: HP CASE :**

- Coupling guard was removed
- Decoupled from Gear Box after match marking.
- Alignment readings were taken and noted.
- Journal bearings on coupling end and free end were opened.
- Thrust bearing was removed on free end and cleaned , polished and re-assembled.
- DP check of thrust pads were carried out and found ok.
- The journal bearings were cleaned, polished , re-assembled back. Bearing clearances checked with lead wire. Gauss measurement was done by Inspection and reading recorded and same was found ok.
- Thickness of thrust pads were checked and found ok.
- Final alignment readings were taken and recorded

FINAL CLEARANCE READINGS OF HP COMPRESSOR

Sr No	Description	Design Value (mm)	Actual Value BPM(mm)	Actual Value APM(mm)
1	Axial Float	0.25 ~ 0.35	0.30	0.31
2	Gear Box End Bearing Clearance	0.11 ~ 0.14	0.14	0.14
3	Free End Bearing Clearance	0.11 ~ 0.14	0.14	0.14

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

- Coupling end bearing top cover removed after opening instrument lines.
- Free end bearing top cover removed . Due care was taken to remove all the oil lines, instrument lines, side plates etc.
- Turbine float was measured and recorded. **Turbine float : 0.18mm**

- Free end bearing was opened and cleaned, polished and the dimensions are recorded.
- - Pad Thickness : **17.47mm/14.48mm**
 - Journal dia is measured and found : **124.80mm**
 - Bearing housing ID : **159.99mm**
 - Clearance was found to be : **0.24mm**
- Thrust bearing was removed and cleaned, polished and re-assembled since the float was as per the requirement.
- Free end bearing cover boxed up after cleaning.
- Turbine coupling end bearing was removed, cleaned, polished and reassembled .

Bearing dimensions are recorded as follows.

Bearing Pad Thickness : **22.48mm**
 Journal dia is measured and found : **159.71mm/159.72mm**
 Bearing housing ID : **204.99mm/205.00mm**
 Clearance was found to be : **0.32mm**

- Oil leakage was reported at turbine free end. Guard clearance was found higher, so it was replaced by new guard of lower clearance made in W/S.
- Turbine free end and coupling end top covers boxed up by applying Hylomer compound to the split face.
- Alignment readings were taken for LP to Turbine

FINAL READINGS OF TURBINE :

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

(D) MAJOR OVERHAULING OF GEAR BOX M-1801 :

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Since last one year, the Temperature of high speed pinion bearing of gear unit was remaining higher than permissible value of 80 ° C. Once, it even went upto 126 ° C causing shutdown of the unit. The problem was resolved by opening the machine and scrapping of the bearing for removal of oil residues. Expert opinion of M/S Hitachi, Japan was sought for solving this problem. Accordingly, M/s Hitachi deputed their service engineer and the problem was attended as detailed in the enclosed service report.

Observations : High speed Pinion Shaft and Bearings :

- Pinion shaft bearings were not in good condition.
- Blackish color was found on the white metal of both the bottom halves.
- White metal of top halves of the bearings had flowed with deep scoring marks.
- Old bearings were replaced with new and bearing clerics were kept at higher side of design value.
- After reassembling pinion shaft and gear shaft ,gear contact and backlash were checked and found ok.
- Bearing clearances were recorded

Observations : Low speed Gear Shaft and Bearings :

- Both bearings were found in good condition.
- Bearing clearances were measured and recorded. Found within design limit.
- After re-assembling pinion shaft and gear shaft ,gear contact and backlash were checked and found ok.

BEARING CLEARANCE DATA OF GEAR ASSEMBLY

Sr. No	Description	Design Value (mm)	Measured Initial value (mm)	Adequate Value (mm)	Actual value (AOH)
1	Gear Shaft - L.P. Side	0.125 -0.147	0.1250	0.125-0.169	0.147
2	Gear Shaft - H.P. Side	0.125 -0.147	0.1250	0.125-0.169	0.14
3	Pinion Shaft - L.P. Side	0.140 - 0.162	0.16	0.140-0.180	0.18
4	Pinion shaft - H.P. Side	0.140 - 0.162	0.15	0.140-0.180	0.18

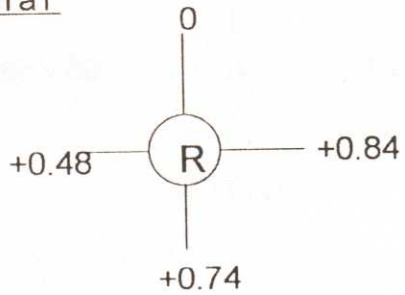
ALIGNMENT DATA FOR HITACHI COMPRESSOR TRAIN :

LP Compressor to Turbine :

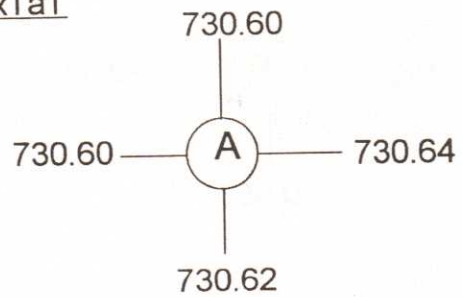
Before Overhauling

Dial on Turbine Coupling
1 Div = 0.01mm

Radial



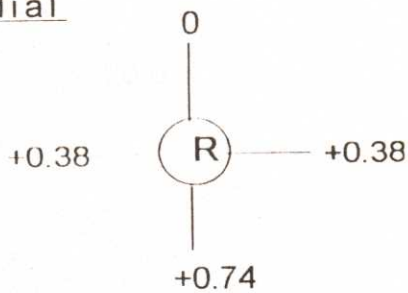
Axial



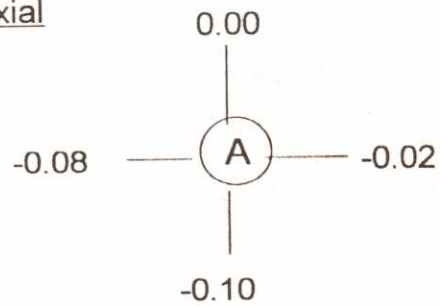
After Overhauling

Dial on Turbine Coupling
1 Div = 0.01mm

Radial



Axial



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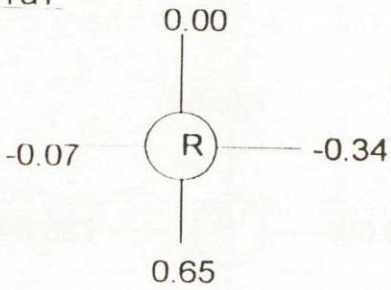
Gear Box to LP Compressor :

Before Overhauling

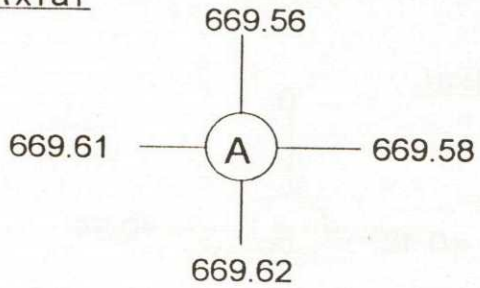
Dial on LP Compressor Coupling

1 Div = 0.01mm.

Radial

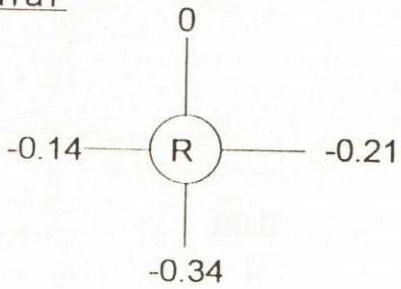


Axial

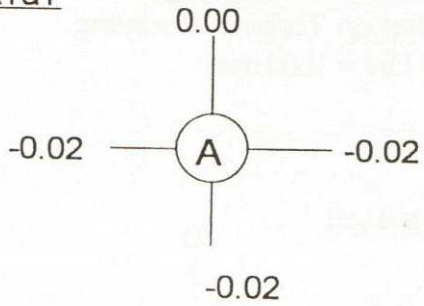


After Overhauling

Radial



Axial

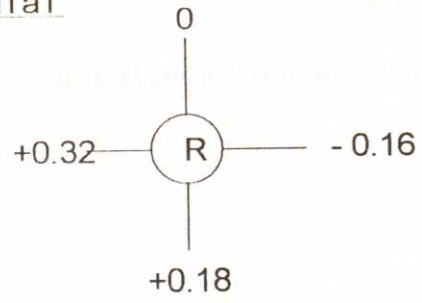


Gear Box to HP Compressor

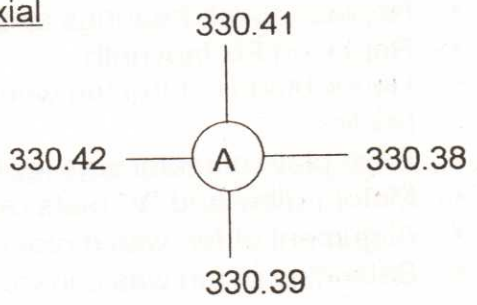
Before Overhauling

Dial on HP Compressor Coupling
1 Div = 0.01mm.

Radial

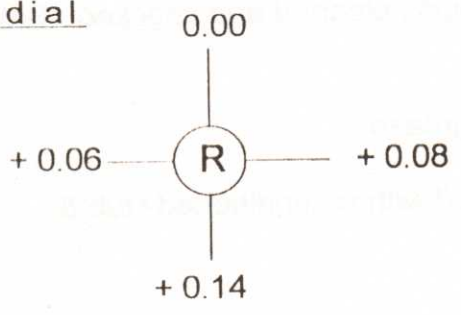


Axial

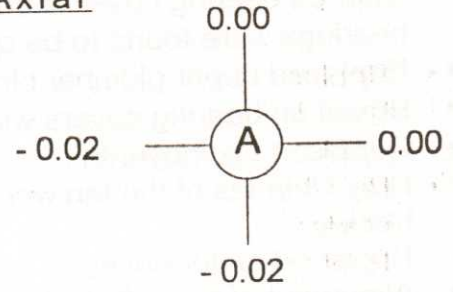


After Overhauling

Radial



Axial



PRILL TOWER I D FANS (K- 1401/ 1,2,3 & 4) :

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A. PRILL TOWER ID FAN (K-1401 /1)

Following jobs were carried out.

- Opened side cover and inspection cover.
- Replaced both bearings and upper plumber block..
- Replaced Fix labyrinth .
- Hub & blades of the fan were replaced with reconditioned Hub & blades.
- Base plate of motor was replaced.
- Motor pulley and 'V' belts replaced.
- Alignment of fan with motor checked .
- Balancing of fan was carried out.

B. PRILL TOWER ID FAN (K-1401 /2)

Following jobs were carried out.

- Opened side cover and inspection cover.
- Opened bearing cover of both bearings , cleaned and checked . Both bearings were found to be ok.
- Replaced upper plumber block..
- Boxed up bearing covers with fresh grease.
- Replaced Fix labyrinth .
- Hub & blades of the fan were replaced with reconditioned Hub & blades.
- Replaced motor pulley.
- Alignment of fan with motor checked .
- Balancing of fan was carried out.

C. PRILL TOWER ID FAN (K-1401 /3)

Following jobs were carried out.

- Opened side cover and inspection cover.
- Opened bearing cover of both bearings , cleaned and checked . Both bearings were found to be ok.
- Position of both bearings were shifted about 20 mm towards hub side for proper alignment.
- Boxed up bearing covers with fresh grease.
- Replaced Fix labyrinth .
- Hub & blades of the fan were replaced with reconditioned Hub & blades.
- Replaced motor pulley.
- Alignment of fan with motor checked .
- Balancing of fan was carried out.

D. PRILL TOWER ID FAN (K-1401 /4)

Following jobs were carried out.

- Opened side cover and inspection cover.
- Replaced both bearings and upper plumber block..
- Replaced motor pulley and 'V' belt.
- Alignment of fan with motor checked .
- Balancing of fan was carried out.

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

A. Inlet Air Fan (K-1701)

Following preventive maintenance jobs were carried out.

- Bearing of Inlet air fans (K-1701) opened, Cleaned and checked. Bearings were found in good condition and hence boxed up.
- Fresh lube oil charged.
- Fan pulley (810 mm OD) of K-1701 was replaced by new pulley of 875 mm OD as an energy conservation measure.
- Rotor and casing of fan were cleaned.
- Damper gate was made operable.
- Alignment of fan belt checked and corrected.
- Painting of external surfaces of casing carried out.

B Exhaust Air Fan (K-1702)

Following preventive maintenance jobs were carried out.

- Bearing of K-1702 opened, Cleaned and checked, Bearings were found in good condition and hence boxed up.
- Lube oil of bearings flushed.
- Casing of fan was cleaned and painted .
- Damper gate was made operable.
- Aligned fan with motor.

Complete inlet air duct of PCS was replaced with new duct made out of SS304 material. Fabrication and erection of the inlet air duct were carried out through M/s. Engineers & Consultant , Ghaziabad against WO. NO 13/00491/9912448. The old inlet air duct was made of MS and was severely corroded .

SCRAPPER (M-1402) :

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Following preventive maintenance jobs were carried out.

- Fluid Couplings of scrapper arm was checked and found ok .
- Coupling oil flushed.
- Replaced V- belt of M-1402/1.
- Alignment checked and rectified.
- Damaged plates on top portion of scrapper arm were replaced by new 5 mm thk MS plate. Gear Box checked and found ok.
- Scrapper arm thoroughly cleaned and epoxy painted.
- New aluminium sheet provided over scrapper arm.

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

Following preventive maintenance jobs were carried out.

- Bucket change over mechanism was cleaned thoroughly.
- Shaft and bearings were removed, cleaned & checked. Both bearings were found to be OK.
- Bearings were boxed up with fresh grease.
- Pulley of the mechanism checked and found OK.
- Belts were replaced.
- Greasing of chain done.

HYDROJET CLEANING OF HEAT EXCHANGERS :

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

1. Main L.O. Coolers of Hitachi Compressor Train (H-1814 A/B).
2. Main L.O. Coolers of P.B. Compressor Train (H-1113 A/B).
3. Lube oil cooler (H-1123)
4. Flash tank condensor (H-1421)
5. 1 st evaporator (H-1422) with DM Water.
6. I st evaporator Condenser (H-1423).
7. II nd evaporator I st Condenser (H-1425).
8. II nd evaporator II nd Condenser (H-1426).
9. Final Condenser (H-1420).
10. Recirculation Heater (H-1204) with DM Water.
11. L.O. Coolers of P-1102 A/B/C.
12. L.O. Coolers of P-1201 A/B.
13. Pre evaporator Condenser (H-1419).
14. First inter stage coller (H-1811)
15. Desorber feed heat exchanger (H-1301 A/B/C)
16. Hydrolyser Preheater (H-1351 A/B/C)
17. Reflux condenser (H-1352)
18. CCS II Cooler (H-1207).

STEAM LEAK JOBS :

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Following steam leak jobs were attended.

Sr. No	Jobs Descriptions	Repair done.	Spares consumed.
COMPRESSOR :-			
1.	Q-1101-1 : 60 ATA BOTH I/V ARE PASSING.	Valve Seats were lapped , blue checked and found ok.	-
2.	60 ATA STEAM HEADER (BATTERY LIMIT) BOTH DRAIN I / V ARE PASSING (NEAR SUPPORT PILLAR).	Rerouted drain line with new isolation valve.	1. Gate valve 2"X1500# - 1 No. 2. Pipe,CS, 2"XSch. 80- 0.75 M.
GROUND FLOOR.			
3.	V-1502 L/G IS LEAKING.	Dismantled Level Glass , cleaned and boxed up with new gasket.	1. Non asbestos gasket for LG - 24 Nos.
4	4 ATA. STEAM HEADER DRAIN LINE ROOT I/V G/L.	Replaced drain isolation valve.	1 .Gate valve 1/2" X 800 # - 1 no.
IST FLOOR :-			
5.	RECTIFYING COLUMN BOTTOM STEAM TRACING COIL PIN HOLE LEAK.	Repaired by welding.	-
6.	STEAM CONDENSATE TRAP HEADER AND IT'S I/V (NEAR HICV-1201 PLATFORM)REPLACEMENT	Replaced Condensate trap header.	1. CS Socket, 1/2"X 3000# - 9 Nos. 2. Pipe 2" X Sch. 40- 0.75 M.
7.	23 ATA STEAM TO H-1201 INLET FLANGE LEAK	Replaced flange gasket.	1. Gasket , 12" X 300# - 1 No.
IIND FLOOR :-			
8.	9 ATA STEAM JACKET TO CCS II CONDENSATE TRAP LINE IS TO BE CONNECTED TO TRAP HEADER.	Condensate trap line connected to trap header with 1 no. new isolation valve.	1 .Gate valve 3/4" X 800# - 1No.
9.	4 ATA STEAM TO V-1301 MAIN FLANGE LEAK.	Replaced flange Gasket.	1 . Gasket, 10" X 150# - 1No.
10	CONDENSATE FLUSHING OF P-1352 A/B DISCHARGE TO H-1205A MAIN I/V G/L. LEAK.	Replaced gland packing.	-

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Sr. No	Jobs Descriptions	Repair done.	Spares consumed.
IIIRD FLOOR :-			
11.	H-1422 STEAM TRACING COIL LEAK.	Repaired by welding.	
12.	H-1202 LIQ. O/L LINE TRACING TRAP LEAK.	Replaced trap along with isolation valve.	1. Steam trap, BPT (15mm)- 1No. 2. Gate vlv. 1/2" X 800# - 2 Nos.
13.	NH3 TO V-1201 STEAM TRACING TRAP U/S PIN HOLE LEAK & TRAP IS TO BE RELOCATED.	Complete tracing line was replaced along with trap and isolation valve.	1. Pipe , 1/2"XSch. 40 - 3 M. 2. Steam Trap , BPT-21 - 1 No. 3. Gate vlv. 1/2" X 800# - 1 No.
14.	CONDENSATE TO H-1422 I/V BUSH IS BROKEN TO BE REPLACED.	Replaced valve.	1. Gate vlv. 1/2" X 800# - 1 No.
15.	4 ATA STEAM TO V-1202 OFF GAS LINE SECOND I/V IS PASSING & NRV TOP COVER IS LEAKING.	Opened cover of NRV. Lapped valve seat. Replaced gasket of top cover and boxed up.	1. Top cover gasket - 1 no.
IVTH FLOOR :- (FIC-1204 FLOOR) :-			
16.	STEAM TRACING LINE PIN HOLE LEAK ON CARBAMATE TO H-1202 (NEAR HPF FIRST I/V). STEAM LINE IS CORREDED. TO BE REPLACED.	Repaired by welding.	-
17.	STEAM TRACING TRAP BONNET LEAK TO H-1203 (NEAR FICV-1204)	Replaced steam trap.	1. Steam Trap , BPT-21 - 1 No
18.	23 ATA. STEAM TRACING I/V OF H-1201 OFF GAS G/L(ON H-1202 TOP)	Replaced gland packing of 3 nos. valve and replaced one no. isolation valve with new valve.	1. Gate vlv. 3/4" X 800# - 1 No.
H-1203 BOTTOM FLOOR :-			
19.	CCS II GLAND PACKING LEAK.	Replaced gland packing.	-
20.	H-1203 VESSEL TRACING PIN HOLE LEAK (MIDDLE PORTION OF VESSEL NEAR LIFTING LUGS.)	Repaired by welding.	-

PT TOP FLOOR :-			
Sr. No.	Jobs Descriptions	Repair done.	Spares consumed.
21.	H-1203 OFF GAS TRACING TRAP LEAKAGE. (MIDDLE TRAP)	Replaced gasket of middle trap.	Trap gasket - 1 no.
22.	STEAM INJECTION TO V-1203 OFF GAS LINE 1ST & 2ND I/V G/L (U/S OF NRV) JUST NEAR VESSEL TOP COVER.	Both isolation valves replaced.	1. Gate vlv. 1/2" X 800#- 2 Nos.
23.	V-1203 VENT I/V F/L AT V-1203 TOP COVER (JUST NEAR JOB NO. 21).	Replaced flange gaskets of valve.	1. Gasket ,3/4"X 300# - 2 Nos.
24.	4 ATA TO RV-1201A/B/C MIDDLE I/V G/L.	Replaced gland packing.	-
25.	4 ATA I/V G/L (2 NOS.) OPPOSITE TO HICV-1202 U/S I/V.	Replaced gland packing	-
26.	4 ATA I/V G/L (OLD 9 ATA) OPPOSITE TO RV-1201A.	Replaced gland packing	-
HYDROLISER :-			
27.	TO ATTEND G/L OF BOTH I/V OF CONDENSATE TAPPING (NEAR V-1353) TO P-1352 A/B SUCTION.	Replaced both isolation valves.	1. Gate valve 1/2" X 800#- 2 Nos.

VALVE REPAIR / INSPECTION / TESTING / REPLACEMENT :

1. The following isolation valves were dismantled, Checked and Overhauled.
 - i) CO₂ to H-1201 1st. Isolation valve : Valve seat was machined and lapped. Replaced spindle with seal ring and nut . Boxed up valve with new bonnet gasket.
 - ii) CO₂ to H-1201 2nd Isolation valve (MOV) : Replaced complete valve by modified valve removed from final discharge line of GHH compressor. Earlier, this valve was gear operated. It was reconditioned and modified to motor operated service by replacing it's bush and connecting plate.
 - iii) Discharge valve of Carbamate Pump (P-1201 A/B/C) : Valve seat was repaired by welding and machining. Replaced bonnet assembly. Boxed up with new bonnet gasket. - Size : 3" X 1500 # Qty : 6 nos.
 - iv) Recycle valve of Carbamate Pump (P-1201 A/B/C) : Valve seat was repaired by welding and machining. Replaced bonnet assembly. Boxed up with new bonnet gasket. Size : 2" X 1500 # Qty : 3 nos.

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- v) Drain valve of Carbamate Pump (P-1201 A/B/C) : Valve seat was repaired by welding and machining. Replaced bonnet assembly. Boxed up with new bonnet gasket. Size : 1" X 1500 # , Qnty : 6 nos.
 - vi) Bleeder valve of Carbamate Pump (P-1201 A/B/C) : Valve seat was repaired by welding and machining. Replaced bonnet assembly. Boxed up with new bonnet gasket. Size : 1/2" X 1500 # , Qnty : 3 nos.
 - vii) Suction valve of Carbamate Pump (P-1201 A/B) : Replaced both valves by new SS316L, 4" X 150# gate valves.
 - viii) Recycle valve of P-1102 A : Replaced 1st. recycle valve by repaired 4" x 900 # globe valve.
 - ix) Discharge valve of P-1102 B : Replaced 2nd. Isolation valve by repaired 4" x 900 # globe valve.
 - x) Autoclave to Seal Isolation valve : Replaced bonnet with gasket.
 - xi) Autoclave unloading valve : Replaced bonnet with gasket.
 - xii) Autoclave overflow line drain valve : Replaced bonnet with gasket.
 - xiii) HPF to NH₃ to V-1201 line : Replaced HPF to NH₃ line 1st. Isolation valve (1" x 1500 #) and replaced bonnet with gasket of 2nd. Isolation valve.
 - xiv) Co₂ to HP Scrubber : Replaced 1st isolation valve by a new 1" x 1500 # BEL valve.
 - xv) HPF to Co₂ to HP Scrubber line : Replaced 1st isolation valve by a new 1" x 1500 # BEL valve.
 - xvi) 4th stage suction root valve of Hitachi compressor : Replaced valve by a new SS304 , 3/4" X 1500 # Gate valve.
 - xvii) Isolation valves of Co₂ to Dry Ice plant : Both isolation valves were replaced by new CS , 1" X 1500 # globe valves.
 - xviii) Discharge isolation valve of P-1502 : Replaced valve by new SS 304 , 1" X 1500 # , globe valve.
 - xix) FR-1201 : Both isolation valve were replaced with new CS , 1/2" X 1500# gate valve.
 - xx) HPF to PRCV-1201 : Replaced bonnet with gasket of 1st isolation valve.

xxi) PRCV-1504 : Replaced valve by new CS , 12" X 300 # , BW , gate valve.

xxii) PICV-1502 By-pass valve : Replaced valve by new CS, 4" X 300# , BW , gate valve.

xxiii) CW Isolation valves of PB compressor: Replaced both CW inlet & outlet line isolation valves by new 24" X 150# , Butterfly valves. This was required to isolate flow of cooling water to PB compressor as an energy conservation measure.

RELIEF VALVE OVERHAULING AND TESTING :

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

Sr. No.	Tag No.	Equipment No and Name	Required Test Press		Actual Test Press		Remarks
			SET PR. (kg/cm ²)g	RESET PR. (kg/cm ²)g	TEST PR. (kg/cm ²)g	RESET PR. (kg/cm ²)g	
1	RV-1203	P-1201 A Suction RV	8.5	7.5	8.5	7.65	OK
2	RV-1204	P-1201 B Suction RV	8.5	7.5	8.5	7.65	OK
3	PSV-1201	P-1201 C Suction RV	8.5	7.5	8.5	7.6	OK
4	RV-1102/1	V-1103 Ammonia Suction Vessel	31	28	31	28	OK
5	RV-1102/2	V-1103 Ammonia Suction Vessel	31	28	31	28	OK
6	RV-1108/1	Liquid NH ₃ line from NH ₃ storage tank	31	28	31	28	OK
7	RV-1108/2	Liquid NH ₃ line from NH ₃ storage tank	31	28	31	28	OK
8	RV-1351	V-1351	24	21.5	24	21.6	OK
9	RV-1221	P-1204 Disch. To H-1203 (CCS-II)	13	11.5	13	11.5	OK
10		Ammonia pre-heater	10	9	10	9	OK
11	RV-1503	23 ata steam drum(V-1502)	25	22.5	25	22.5	OK
12	RV-1504	9 ata steam drum (V-1503)	12	11	12	11	OK
13	RV-1916	23 ata. Exhaust.	28	25.2	28	25.2	OK
14	RV-1129A	4 ata. Steam header.	6	5.4	6	5.4	OK
15	RV-1129B	4 ata. Steam header.	6	5.4	6	5.4	OK
16	RV-1130	23 ata steam Header	26	23.4	26	23.4	OK
17	RV-1201A	V-1201 off gas line.	165	158	165	158	OK
18	RV-1201B	V-1201 off gas line.	165	158	165	158	OK
19	RV-1107	Liquid Ammonia line (hot) before Ammonia filter.	31	28	31	28	OK
20	RV-1110/A	Liquid Ammonia line from Amm. Storage to H-1102.	31	28	31	28	OK

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Sr. No.	Tag No.	Equipment No and Name	Required Test Press		Actual Test Press		Remarks
			SET PR. (kg/cm ²)g	RESET PR. (kg/cm ²)g	TEST PR. (kg/cm ²)g	RESET PR. (kg/cm ²)g	
21	RV-1110/B	Liquid Ammonia line from Amm. Storage to H-1102.	31	28	31	28	OK
22	RV-1917	4 ata Exhaust.	5	4.5	5	4.5	OK
23	RV-1209	V-1203 Vapor inlet.	10	9	10	9	OK
24	RV-1301	II nd Desorber (V-1301)	6	5.4	6	5.4	OK
25	RV-1202 /A	V-1202 to H-1205 line	6	5.4	6	5.4	OK
26	RV-1202 /B	V-1202 to H-1205 line	6	5.4	6	5.4	OK
27	RV-1202 /C	V-1202 to H-1205 line	6	5.4	6	5.4	OK
28	RV-1205	P-1201 A Discharge RV	165	158	165	158	OK
29	RV-1206	P-1201 B Discharge RV	165	158	165	158	OK
30	PSV- -----	P-1201 C Discharge RV	171	158	171	158	OK
31	RV-1504	V-1503 9 ata. steam header	12	11	12	11	OK
32	PSV- -----	2nd suction of Hitachi Compressor	7	6.7	7	6.3	OK
33	PSV- -----	3rd Suction of Hitachi Compressor	27	25.1	27	24.3	OK
34	PSV- -----	4th. Suction of Hitachi Compressor	111	99.8	111	98.9	OK
35	PSV- -----	Final disch. of Hitachi Compressor.	177	159	177	170	OK
36	RV-1253	Co ₂ to Dry Ice Plant.	45	40.8	45	40.8	OK

INSPECTION OF CHECK VALVES (NRV'S) :

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

- **Co₂ to H-1201** : Replaced plug & guide . Repaired valve seat by machining and lapping. Boxed up NRV with new gasket.
- **NH₃ to H-1202** : Checked plug & guide of valve and found to be OK. Valve seat was repaired by machining and lapping. Boxed up NRV with new gasket.
- **NH₃ to V-1201** : Plug & seat of valve were repaired by machining and lapping. Boxed up NRV with new gasket.
- **Carbamate to H-1202** : Plug & seat of valve were repaired by machining and lapping. Boxed up NRV with new gasket.
- **Carbamate to H-1203** : Repaired seat by welding , machining & lapping. Cleaned guide and plug. Boxed up valve with new gasket.
- **4 ata steam to V-1352** : Plug , seat & guide of valve were repaired by machining and lapping. Boxed up valve with new gasket.
- **23 ata steam to V-1351**: Plug , seat & guide of valve were cleaned and lapped. Boxed up valve with new gasket.
- **Final discharge NRV of Hitachi Compressor** : Replaced damaged center stud with nut. Repaired seat by welding machining and lapping.
- **P-1202 A discharge** : Flapper cleat hole was found oval and the same was repaired by welding & drilling. Valve seat was lapped . Replaced flapper pin and boxed up with new gasket.
- **P-1202 B discharge** : Flapper cleat hole was found oval and the same was repaired by welding & drilling. Valve seat was lapped . Replaced flapper pin & spindle of the valve. NRV was boxed up with new gasket.

CLEANING /SERVICING OF LEVEL GAUGES:

Gauge glass of following vessels were replaced / cleaned

- a) 4 ata steam drum (V-1501)
- b) 23 ata steam drum (V-1502)
- c) 9 ata steam drum (V-1503)
- d) Rectifying column (V-1202)
- e) L.P Condenser Separator (V-1205)
- f) Ist Desorber (V-1352)

HIGH PRESSURE VESSEL JOBS :

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(A) AUTOCLAVE (V-1201) :

Top cover of Autoclave was opened for inspection and to carry out maintenance job. Lighting and ladder arrangement were made inside the vessel and then it was handed over to inspection section.

1) Findings of Inspection section :

1) Compartment No.1 (Top Compartment) :

Minor oxide layer observed on upper portion of dished end petal plates. One porous spot on liner marked for repair. Overall condition of the liner of top dished end as well as cylindrical shell and man-way nozzle was satisfactory.

2) Compartment No.2 :

Overlay weld above the liner at top end of the man-way nozzle is very rough due to corrosion attack.

3) Compartment No.3 :

Insert liner plate had shown almost no corrosion attack. Just above the circumferential weld, liner was found bulged outward (concave) by amount of approx. less than 5 mm in circumferential length of approx. one mtr. and width of 6" at the north-east side. DP test on the bulged liner was carried out, no service defects were observed. Cluster of dent marks observed on the north side just above tray no 3 on an area of 10"x 10" approx. Thickness of 3.9 to 4.1 observed at location just above circumferential seam near 3rd support cleat from man-way towards south.

4) Compartment No.4 :

Insert liner plate which was replaced during shutdown-2001 had shown almost no corrosion attack. Just above the circumferential weld, liner was found bulged outward by an amount of approx. less than 5 mm in circumferential length of approx. two mtr. and width of 6" at the west side. Approx. 30 cm below circumferential weld seam a concave bulging of approx. 100mm dia and 3 mm depth was observed at west side.

5) Compartment No.5 :

Convex bulging of liner plate was observed just above the circumferential weld joint by approx. 4 to 7 mm height in approx. 60 % of the circumferential length from north to south direction. DP test on the bulged liner was carried out , no service defects were observed. Concave depression of max. 4.5 mm was observed approx. 500 mm below cirseam on southeast side on 70 % circumferential length.

6) Compartment No.6:

Convex bulging of liner plate was observed above the circumferential weld joint by approx. 7 to 10 mm height in approx. 50 % circumference at the west side. Location starts 460 mm from east side longitudinal seam towards south-west at a length 4710 mm . Concave depression having a depth of less than 5 mm was observed at approx. one meter below circumferential weld in an area of approx. 750 x 100 mm at the east side of shell liner. DP test on the bulged liner was carried out , no service defects were observed. **Since there was no further bulging of the liner as compared to last year , replacement of the same was not carried out.**

7) Compartment No.7 :

Convex bulging of liner plate was observed above the circumferential weld joint by approx. less than 5 mm height in approx. 2 mtr. circumference at the West side.

8) Compartment No.8 :

Convex bulging of liner plate was observed at approx. 30 cm above the 8 th tray having a height of less than 4 mm in approx. 2.5 mtr circumference length and 150 mm width at the East side.

9) Compartment No.9 , 10, 11 & 12 : Found satisfactory.**II.) REPAIR JOBS INSIDE AUTOCLAVE****Compartment no 1.**

One Porous spot on liner in east side was repaired by grinding and welding by using 25-22-2 L Mn filler wire . DP check of repaired weld was carried out and found OK.

Compartment no 2.

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One no undercut on S-W long seam was repaired by grinding and welding by using 25-22-2 L Mn filler wire . DP check of repaired weld was carried out and found OK.

Compartment no4.

1 no undercut on West long-seam and 2 nos. undercut on East cir-seam were repaired by grinding and welding by using 25-22-2 L Mn filler wire . DP check of repaired weld were carried out and found OK.

Compartment no5.

1 no undercut on S-E long-seam and 1 no. undercut on North long-seam were repaired by grinding and welding by using 25-22-2 L Mn filler wire . DP check of repaired welds were carried out and found OK.

Compartment no 6.

1 no undercut East long-seam was repaired by grinding and welding by using 25-22-2 L Mn filler wire . DP check of repaired weld was carried out and found OK.

Compartment no 8 .

1 no Corrosion cavity (cleat mark - in north side just above insert liner) was filled up by welding using 25-22-2 L Mn filler wire . DP check of repaired weld was carried out and found OK.

Compartment no 9 .

3 nos Corrosion cavity (cleat mark - in north side just above insert liner) and 1 no undercut in N-E longseam were repaired by welding using 25-22-2 L Mn filler wire. DP check of repaired welds were carried out and found to be OK.

Compartment no 10.

3 nos Corrosion cavity (cleat mark - in north side just above insert liner) were repaired by welding using 25-22-2 L Mn filler wire . DP check of repaired welds were carried out and found OK.

Compartment no 11 .

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1 no undercut on North longseam and a cavity on liner were repaired by welding using 25-22-2 L Mn filler wire . DP check of repaired welds were carried out and found to be OK.

Apart from the above , the following repair jobs were also carried out :-

I. Replaced liner of R-3 nozzle. - Due to reduction in thickness from 5 to 1.9 mm

II. Replaced nozzle sleeve of off gas outlet nozzle. - Due to reduction in thickness from 5 mm to 2.8 mm.

Liner / nozzle sleeve replacement activities.

1. Opened blind cover of R- 3 nozzle. Cut off gas pipe line from weld joint with nozzle sleeve by grinding.
2. Removed liner of R-3 nozzle / nozzle sleeve of C2 nozzle by grinding the welding seam between liner / sleeve and buffer layer of man way cover without any damage to overlay weld deposit and CS portion of man way cover.
3. Removed old weld material from buffer layer.
4. Beveling of buffer layer were done .
5. DPT of beveled face were carried out as per standard inspection procedure.
6. Pressurized argon at 0.2 kg/cm² from nearby weep hole to ensure clear air passage.
7. New liner and sleeve were fabricated from 4" X Sch 160 , SS 316L pipe as per required dimension .
8. DP Check and ferrite check of new fabricated liner and sleeve were carried out.
9. New Liner and sleeve were put in position and tack welded with buffer layer by TIG welding.
10. Root run completed by TIG welding using filler wire 25-22-2 LMn.
11. DP Check and ferrite measurement of root run was carried out.
12. Remaining weld pass completed by TIG welding using filler wire 25-22-2 LMn. Inter pass temperature was maintained below 150 deg. C.
13. DP test and ferrite measurement of final run were carried out.
14. Air and soap solution test of new weld joints were carried out.
15. New weld joints were cleaned property and passivated by washing with 10% HNO₃ and rinsed with plenty of DM Water.

Removed ladder and light from the vessel and manhole cover boxed-up with new gasket .

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

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Top and bottom covers of HP Stripper (H-1201) were opened. Hold down plate and ferrules were removed. Stripper was handed over to inspection section for inspection. Delta P measurement and repairing of ferrules were done as a simultaneous activities. After completion of inspection the ferrules were fixed in position with new sleeve gasket. Precaution was taken to prevent entry of any foreign particles inside the stripper. Delta P measured by production department.

Replacement of defective liner segment of bottom compartment of H.P.Stripper H-1201 with 11 mm thk. plate and repairing of CO₂ inlet line flange were carried out through M/s. L&T, Mumbai. Lapping of gasket seating area of top & bottom man way and it's covers were carried out

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

Top and bottom cover of HPCC were opened and handed over to Inspection section for inspection. Visual inspection and thickness measurement were carried out. The condition of HPCC was found satisfactory. Top and bottom covers boxed up with new gaskets.

LOW PRESSURE VESSEL JOBS :

(A) CO₂ SPRAY COOLER (H-1104) :

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

- Demister pad was found OK.
- Bottom trays found intact in position.
- Pin hole in shell was repaired by welding a CS patch plate of size 12" X12" X 6 mm thick.
- SS liner of 3 mm thick was provided from inside in CS seal channel.
- Epoxy paint coating were peeled off. Repainting of cooler was done.
- Manhole cover of the cooler was boxed up with new gasket.

(B) CO₂ KNOCKOUT DRUM (V-1101) :

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

- Overall condition of Co₂ knockout drum found satisfactory.
- Epoxy paint coating peeled off at some location.
- Epoxy paint was applied inside the Knockout drum.

Manhole cover boxed up with new gasket.

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

Cover of Ammonia suction filter was opened for inspection. Visual inspection was carried out from inside. The observations were as below.

- Oily surface was observed inside the vessel.
- Small foreign particles were observed inside the bottom dish end nozzle.
- Overall condition of Ammonia suction filter was found satisfactory.

Oily surface of the vessel was cleaned properly, removed foreign particles from inside and vessel was boxed up with new gasket.

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

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

(E) RECTIFYING COLUMN (V-1202) :

Top cover, Manhole cover and handhole of the rectifying column were opened. Ranche rings were removed from the column and cleaned properly. About 70 % of the ranche rings were found crushed. Visual inspection of rectifying column was carried out. Conditions of bottom nozzle weld joint was found satisfactory. Hydrojet cleaning was carried out to remove metallic scales from shell and dish end. The damaged Spray breaker grid was repaired and extra supports were provided to its holding bracket. Ranche rings (new) were put back in position. Top cover, Manhole cover and handhole covers were boxed up with new gasket.

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

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Top cover and Manhole cover of L.P. Absorber were opened for inspection. Rasching rings were removed . Visual inspection was carried out. Support gratings at top end was found distorted and the same was straighten..

Center nozzle of bottom dish end was found intact in position.
Top cover and manhole cover were boxed up with new gasket.

(G) L.P.CARBAMATE SEPARATE (V-1205) :

Cracks were found in parent material at heating coil support areas of the old vessel during inspection in shutdown April -2002. These cracks were repaired by weld repair followed by patch plates at 42 places. It was suspected that the cracks may be due to aging effect as Vessel was 27 year old. Hence it was decided to replace the vessel by new one.

New L.P.Carbamate Separator was procured against P.O. No.13 / 00427/ KLL / 11672PB 9911480 from M/S. Anup Engineering Co.Ahmedabad. Removal of old vessel, Installation of new vessel and piping works were carried out by M/S. J&J Engineering work, the ARC contractor during Annual turnaround-2003.

Ref. Drawing : 1) Assembly and Detail drawing (Drg.No. S-757/2002/1)

2) Detail of Level Glass-R1(Drg. No. S-757/2002/2)

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

Manhole cover was opened for inspection. Visual inspection was carried out and following observation were made.

- Demister pad was intact.
- All fasteners were intact.
- The overall condition of the vessel was satisfactory.

Manhole cover was boxed up with new gasket.

(I) AMMONIA SCRUBBER (V-1207) :

Top cover, top and bottom handhole covers were opened. Ranche rings were removed and vessel was handed over for inspection. One no new nut was provided in place of missing nut of top grill . Ranche ring put back in position. Top cover and hand hole covers were boxed up with new gasket.

(J) FIRST DESORBER (V-1352) :

Top and bottom manhole covers of 1st desorber were opened for inspection. Visual inspection was carried out. Condition of 1st desorber found to be ok. Top and bottom manhole covers were boxed up with new gaskets.

(K) II DESORBER (V-1301) :

Top and bottom manhole covers were opened for inspection. Visual inspection was carried out. Condition of II nd desorber was found satisfactory. All clamps and fasteners were found intact in position. Top and bottom manhole covers were boxed up with new gaskets.

(L) HYDROLYSER (V-1351) :

Top and bottom manhole covers of hydrolyser were opened. Visual inspection was carried out. All clamps and fasteners were found intact in position. Overall Condition of vessel was found satisfactory. Top and bottom manhole covers were boxed up with new gaskets.

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

Manhole cover of I st evaporator scrubber was opened for inspection. Visual inspection was carried out. Condition of damister pad was found satisfactory. All fasteners were intact in position . Manhole cover was boxed up with new gaskets.

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

Manhole cover of 4 ata steam drum were opened for inspection. Vessel was cleaned properly . Visual inspection was carried out. All loose bolts of baffle plates were tightened . New bolts & nuts were provided in place of missing bolts of baffle plates . Damister pads found intact in position. Manhole covers were boxed up with new gaskets.

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

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

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

Manhole cover was opened for inspection. Vessel was cleaned properly. Visual inspection was carried out. Complete internal surface of the vessel was cleaned properly. Broken support welding of BFW inlet line was repaired by grinding and welding. Overall Condition of 9 ata steam saturator was found satisfactory. Manhole cover was boxed up with new gaskets.

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

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

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

Manhole cover of urea solution tanks were opened for inspection. Visual inspection was carried out. Bulging of bottom plate of tank T-1401 was observed at several locations in upward direction. Overall condition of the tanks were found satisfactory. Manhole cover boxed up with new gasket.

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

Manhole cover of ammonia water tanks were opened for inspection. Visual inspection was carried out. Bottom plate of tank T-1301 found bulged at scattered location, the same was observed in past also. Overall condition of the tanks were found satisfactory. Manhole covers were boxed up with new gasket.

(T) FIRST STAGE SEPARATOR (V-1811)

Manhole cover of separator was opened for inspection. Visual inspection was carried out. Weld joints were found in satisfactory condition. Demister pad was intact in position. Overall condition of the shell was satisfactory. Manhole cover was boxed up with new gasket.

(U) SECOND STAGE SEPARATOR (V-1812)

Manhole cover of separator was opened for inspection. Visual inspection was carried out. Weld joints were found in satisfactory condition . Demister pad was intact in position . Overall condition of the shell was satisfactory .Manhole cover was boxed up with new gasket.

(V) THIRD STAGE SEPARATOR (V-1813)

Manhole cover of separator was opened for inspection. Visual inspection was carried out. Weld joints were found in satisfactory condition . Demister pad was intact in position . Overall condition of the shell was satisfactory .Manhole cover was boxed up with new gasket.

(W) PRE-EVAPORATOR SEPARATOR (V-1418/ H-1418):

Manhole cover of separator was opened for inspection. Visual inspection was carried out. minor scaling was observed inside the tube. Condition of weld joints were found satisfactory. Overall condition was found to be satisfactory. Manhole cover was boxed up with new gasket.

(X) CONDENSATE TANK (T-1401)

Manhole cover of condensate tank was opened for inspection. Visual inspection and thickness measurement were carried out from inside. Condition of weld joints and all internal nozzles were found satisfactory. Overall condition was found satisfactory. Manhole cover was boxed up with new gasket.

FABRICATION JOBS :

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(1) Following lines / Fittings were replaced :

Sr. No.	Line. No. / Location.	Job Carried out.	NDT Carried out	Material consumed.
1	CO ₂ Discharge line to HP stripper (GA-1112-6")	Replaced line segment from I/V to flange joint along with MOV and it's associated fittings.	<ul style="list-style-type: none"> •100% DPT of root and final weld. •100% radiography of all butt joints 	<ul style="list-style-type: none"> • CS pipe 6"x 120sch . - 3 mtr. • CS elbow 6"x120sch x 90° - 1 no. • WNRF Flange 6" X 1500# - 1 no. • Sockolet 6" x 1.5" x 6000# - 2 nos. • Sockolet 6" x 1" x 6000# - 2 nos. • MOV(Reconditioned) - 1 no.
2	Autoclave Off gas line to HP Scrubber (PR-1208-4")	<ul style="list-style-type: none"> • Replaced line from V-1201 top to flange joint along with flanges . • Orientation of thermowell was rotated by 90°. 	<ul style="list-style-type: none"> •100% DPT of root and final weld. •100% radiography of butt joint 	<ul style="list-style-type: none"> • SS316 L pipe, 4"x sch160 - 3.0 mtr. • Elbow , SS316L ,4"x sch160 x 90° . - 1 no. • WNRF Flange, SS316L , 4" X 1500# - 2 Nos. • Sockolet ,SS316L, 4" x 1.5 " - 1 no.
3	Line from H-1301 to V-1352 (PW-1351-4")	Replaced both elbows along with spool piece.	<ul style="list-style-type: none"> •100% DPT of root and final weld 	<ul style="list-style-type: none"> • SS304 Elbow , 4" x sch 10 - 2 nos. • SS304 Pipe, 4" x sch10 - 300 mm.
4	TR-1210- Stripper liquid outlet line.	Replaced sockolet along with thermowell pipe.	<ul style="list-style-type: none"> •100% radiography of 1.5" to flange joint. •100% DPT. 	<ul style="list-style-type: none"> • Sockolet ,SS316L, 6" x 1.5 " - 1 no. • SS316 L pipe, 1.5"x sch80 - 200 mm.
5	PB compr. final discharge line. (GA-1112-6")	Replaced reducer of final discharge line of PB compressor.	<ul style="list-style-type: none"> •100% DPT of root and final weld. •100% radiography of final weld. 	<ul style="list-style-type: none"> • CS reducer 6" X 4" (Sch.120 x sch.80)- 1no.
6	P-1102C discharge line (MA-1604-3" F2)	Replaced 2nd. elbow of P-1102 -C discharge line from pump side.	<ul style="list-style-type: none"> •100% DPT of root and final weld. •100% 	<ul style="list-style-type: none"> • CS Elbow , 3" x sch. 80 x 90 deg. - 1 no.
7	Line from V-1102 to V-1103 (MA-1104-6")	Replaced reducer of inlet line to ammonia vapor eliminator.	<ul style="list-style-type: none"> •100% DPT of root and final weld. 	<ul style="list-style-type: none"> • CS reducer 6" x 3" x sch40. - 1no.
8	Condensate line from V-1204 to T-1501. (SC-1407)	Replaced 2 nos elbow 1 no. each at ground floor near V-1502 and first floor near T-1501 top.	<ul style="list-style-type: none"> •100% DPT of root and final weld. 	<ul style="list-style-type: none"> • CS Elbow , 4" x sch. 40 x 90 deg. - 2 nos.
9	U/S flange of Antisurge control valve of Hitachi Compressor.	Replaced flange.	<ul style="list-style-type: none"> •100% DPT of root and final weld. •100% radiography of final weld. 	<ul style="list-style-type: none"> • WNRF Flange 4" X 1500# - 1 no.

PRILL TOWER CONVEYOR SYSTEM (M-1403) :**Following jobs were carried out.**

- Replaced conveyor belt .
- Replaced damaged carrying idler . - 50 nos.
- Replaced damaged return rollers - 5 nos.
- Replaced corroded portion of Deck plate.
- Replaced head end pulley with 1 no. new Pillow block bearing (75mm.)
- Replaced damaged skirt rubber block.

Gear box (PCS side)

- Opened top cover of gear box , cleaned internals , checked and found ok.
- Replaced both oil seals of pinion shaft.
- Replaced coupling bush.
- Boxed up gear box with fresh oil.
- Alignment of motor to gearbox and gearbox to pulley were checked/rectified.

Gear box (Control room side)

- Opened top cover of gear box , cleaned internals , checked and found ok.
- Replaced coupling bush.
- Boxed up gear box with fresh oil.
- Checked chain & sprocket and found ok.
- Alignment of motor to gearbox and gearbox to pulley were checked/rectified.

LINK CONVEYOR SYSTEM (M-1419) :**Following jobs were carried out.**

- Replaced conveyor belt . (15.750 Mtr.)
- Replaced damaged carrying idler .
- Replaced damaged troughing rollers.
- Replaced damaged return rollers.
- Replaced corroded portion of Deck plate.
- Replaced Tail end pulley with new Pillow block bearings.

Gear box

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- Opened top cover of gear box , cleaned internals , checked and found ok.
- Replaced coupling bush.
- Boxed up gear box with fresh oil.
- Checked chain & sprocket and found ok.
- Alignment of motor to gearbox and gearbox to pulley were checked/rectified.

NEW LINK CONVEYOR SYSTEM (M-1421) :

Following jobs were carried out.

- Belt joints were checked and found ok.
- Replaced damaged toughing rollers .
- Replaced damaged return rollers.
- Checked bearings of Head end & Tail end pulley and found to be ok. Greasing of bearings were done.

Gear box

- Opened top cover of gear box , cleaned internals , checked and found to be ok.
- Replaced both oil seals of pinion shaft.
- Replaced coupling bush.
- Boxed up gear box with fresh oil.
- Checked chain & sprocket and found to be ok. Loose chain was tightened.
- Alignment of motor to gearbox and gearbox to pulley were checked/rectified.

Dust Belt Conveyor (M-1703) :

Following jobs were carried out.

- Belt joints were checked and found ok.
- Replaced damaged return rollers.
- Greasing of bearings were done.
- Replaced corroded deck plate.

Gear box

- Opened top cover of gear box , cleaned internals , checked and found to be ok.
- Replaced both oil seals of pinion shaft.
- Replaced coupling bush.
- Boxed up gear box with fresh oil.
- Alignment of motor to gearbox and gearbox to pulley were checked/rectified.

INSPECTION JOBS

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During this Shutdown, the following major Inspection activities were performed.

1. Replacement of defective liner segment of bottom compartment of H.P.Stripper H-1201 with 11 mm thk. plate by M/S L & T. Various inspection activities were carried out as per the check plan attached at **annexure A**.
2. Internal inspection and ultrasonic thickness measurement of other vessels in the Plant.
3. Ultrasonic thickness measurement of various pipelines including HP lines in the Plant.
4. Dye penetrant examination and radiography of weld joints lines fabricated, erected and offered by Technical Department.
5. Dye penetrant examination and radiography (wherever required) of weld joints.
 - a) Replacement of Nozzle liner of blind nozzle of Autoclave top cover, as minimum thickness observed was 1.9 mm.
 - b) Replacement of Nozzle liner of Autoclave top gas outlet line as minimum thickness observed was 2.8 mm.
 - c) Replacement of one elbow in line no. MA-1604-3"-E2 as thickness reduction was 32%.
 - d) All PI,PT,Vent,Drain,RVS tapping welding joints of Main CO2 line from Hitachi compressor to HP Stripper were checked by DPT and repairing was carried out wherever required.
 - e) Condensate flushing line from Hitachi compressor to HP ammonia pump.
 - f) Outlet line of V-1401 (One no. Elbow- 3" sch 40)
 - g) Discharge line of Ammonia pump P 1102 C (MA-1604-3"- 1 elbow)
 - h) Replacement of Reducer of 6"X4" at PB compressor final discharge line. Photograph showing the reducer is attached at **Annexure- B**

- 6) Thickness measurement and DP test of following thermocouples. IR-1210, II-1209, TR-1202 .
- 7) Insitu Metallography of equipment and piping was carried out, no major abnormalities were reported. Detailed report is attached at Annexure-C
- 8) Residual magnetism measurement of Hitachi compressor rotor and various parts was carried out and wherever required the same were demagnetised . Detailed report is attached at Annexure-D

HIGH PRESSURE VESSELS :

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

1. AUTOCLAVE (V-1201) :

1.1 VISUAL INSPECTION :

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

1.1.1 TOP COVER :

- a) Replacement of Nozzle liner of blind nozzle of Autoclave top cover, as minimum thickness observed was 1.9 mm.
- b) Replacement of Nozzle liner of Autoclave top outlet line as minimum thickness observed was 2.8 mm.

1.1.2 Compartment No.1 (Top Compartment) :

Minor oxide layer observed on upper portion of dished end petal plates. One no porous spot on liner marked for repair. Overall condition of the liner of top dished end as well as cylindrical shell and manway nozzle was satisfactory. Overlay weld above the liner at top end of the manway nozzle is very rough due to corrosion attack.

1.1.3 Compartment No.2 :

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One no. undercut marked for repair. Otherwise Found satisfactory.

1.1.4 Compartment No.3 :

- (a) Insert liner plate had shown almost no corrosion attack. Just above the circumferential weld , liner was found bulged outward (concave) by amount of approx. less than 5 mm in circumferential length of approx. one mtr. and width of 6" at the north-east side. DP test on the bulged liner was carried out , no service defects were observed. Undercuts at three locations were observed which were marked for repair.
- (b) Cluster of dent marks observed on the north side just above tray no 3 on an area of 10"x 10" approx.
- (c) Thickness of 3.9 to 4.1 observed at location just above circumferential seam near 3rd support cleat from manway towards south.

1.1.5 Compartment No.4 :

Insert liner plate which was replaced during shutdown-2001 had shown almost no corrosion attack .Just above the circumferential weld , liner was found bulged outward by amount of approx. less than 5 mm in circumferential length of approx. two mtr. and width of 6" at the west side. Approx. 30 cm below circumferential weld seam a concave bulging of approx.100mm dia and 3 mm depth was observed at west side, same was observed in the previous year also. Undercuts were observed at two locations which were marked for repairs.

1.1.6 Compartment No.5 :

Convex bulging of liner plate was observed just above the circumferential weld joint by approx. 4 to 7 mm height in approx. 60 % of the circumferential length from north to south direction. DP test on the bulged liner was carried out , no service defects were observed. Concave depression of max. 4.5 mm was observed approx. 500 mm below cirseam on southeast side on 70 % circumferential length. One no. undercut observed at one location which was marked for repair.

1.1.7 Compartment No.6:

Convex bulging of liner plate was observed above the circumferential weld joint by approx. 7 to 10 mm height in approx. 50 % circumference at the west side. Location starts 460 mm from east side longitudinal seam towards south-west at a length 4710 mm . Concave depression having a depth of less than 5 mm was observed at approx. One meter below circumferential weld in an area of approx. 750 x 100 mm at the east side of shell liner. DP test on the bulged liner was carried out , no service defects were observed. One no. corrosion cavity at clit mark observed which was marked for repair. Since there was no further bulging of the liner as compared to last year , replacement of the same was not carried out.

1.1.8 Compartment No.7 :

Convex bulging of liner plate was observed above the circumferential weld joint by approx. less than 5 mm height in approx. 2 mtr. circumference at the West side.

1.1.9 Compartment No.8 :

Convex bulging of liner plate was observed at approx. 30 cm above the 8 th tray having a height of less than 4 mm in approx. 2.5 mtr circumferential length and 150 mm width at the East side. 3 nos.. of corrosion cavity at clit mark and one no. undercut were marked for repair.

1.1.10 Compartment No.9 :

3 nos.. of corrosion cavity at clit mark and one no. undercut were marked for repair. Otherwise found satisfactory.

1.1.11 Compartment No.10 :

Insert liner plate which was replaced during S/D 2002 showed no sign of corrosion attack. Three nos. of corrosion cavity at clit mark marked for repair.

1.1.12 Compartment No.11 :

Replacement of bulged liner which was carried out during S/D-2002 shows no sign of corrosion attack. Just below circumferential seam concave depression of liner in approx. 6" dia. area and about 8 mm max. depth was observed at three locations. One no. undercut and one corrosion cavity marked for repair.

1.1.13 Compartment No.12 (Bottom Compartment.) :

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Weld joints of all nozzles as well as patch plates of bottom dished end liner DP tested. No service defects indications observed.

1.1.14 At some locations, tray bolts and tray support bolts were found loose. Intimated Maint. Urea for corrective action.

1.1.15 Total 18 nos. defects were repaired, DP tested and final passivation with DM water was done..

1.2 THICKNESS MEASUREMENT :

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

1.2.1 MAIN LINER THICKNESS :

DESCRIPTION	Min.Thk. (mm)	Max.Thk (mm)	Remarks
Man way	6.7	6.8	Replaced with 2 RE69 in April-02, with 6.5 mm thick liner plate.
Dome area	6.5	6.7	Replaced with 2 RE69 in April-02, with 6.5 mm thick liner plate.
Compartment 1 (new liner)	6.6	6.7	Replaced with 2 RE69 in April-02, with 6.5 mm thick liner plate.
Compartment 1 (Old liner)	4.2	5.0	Installed thickness 5 mm.
Compartment 2	4.2	5.0	Installed thickness 5 mm.
Compartment 3	3.9	4.8	Installed thickness 5 mm.
Compartment 4	4.4	4.8	Installed thickness 5 mm.
Compartment 5	4.9	5.4	Installed thickness 5 mm.
Compartment 6	4.7	5.2	Installed thickness 5 mm.
Compartment 7	4.5	5.0	Installed thickness 5 mm.
Compartment 8	4.7	5.2	Installed thickness 5 mm.
Compartment 9	4.7	5.1	Installed thickness 5 mm.
Compartment 10	4.6	5.5	Installed thickness 5 mm.
Compartment 11 old liner	4.8	5.8	Installed thickness 5 mm.
Compartment 11 new(Partial)	6.6	6.7	Replaced with 2 RE69 in April-02,
Compartment 12 Shell liner	4.6	4.8	Installed thickness 5 mm
Compartment 12 Dome liner	6.4	6.8	Fabricated from 7 mm thick 2RE69 plate.

1.2.2 INSERT LINER :

Min. thickness of 6.5mm, 6.5mm, 6.9mm ,6.8 mm and 6.6 was observed for compartment no. 3,4,8,9 & 10 respectively.

1.2.3 DOWN COMER AND TRAYS :

Compartment no.	Downcomer thickness(mm)		Tray thickness(mm) (Design thickness)	
	Design thk	Min.	Design thk	Min.
1	10.0	10.4	8.0	6.9
2	10.0	9.4	8.0	7.2
3	10.0	9.4	8.0	7.1
4	10.0	9.5	8.0	7.4
5	10.0	9.5	8.0	7.3
6	10.0	9.8	8.0	7.5
7	10.0	9.8	8.0	7.5
8	10.0	10	8.0	7.6
9	10.0	9.7	8.0	7.9
10	10.0	9.8	8.0	8.1
11	10.0	10	8.0	8.5
12	10.0	10.4	-	-

2. HP STRIPPER (H-1201) :

2.1 BOTTOM DOME :

Defective liner plate of 740 mm x 750 mm was cut and new liner petal plate of 11 mm thickness (Since 8 mm thick plate was not available with L&T) was put to replace the old defective plate in which 2 nos. cracks were repaired in August-2002. After cutting the old liner, thickness of barrier layer was measured and found to be in the range of 1.5 mm to 5 mm and ferrite content found to be in the range of 0.2 to 14 %. Depth measurement of grinded groove from buffer layer face was also carried out which was found in the range of 0.18 to 5.04 mm. The over ground portion was repaired by preheating & weld filling followed by DP test & ferrite measurement. Ferrite measurement and DPT of root run as well as final run was carried out.

2.2 TOP CHANNEL :

The following inspection activities were performed.

- (a) Visual Inspection (b) Thickness measurement

The observations on above inspections are as under:

2.2.1 VISUAL INSPECTION :

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Tube to tubesheet seal welds found to be in satisfactory condition and were found covered with thin oxide layer. No other significant observation made.

2.2.2 Overlay weld and Liner thickness measurement of top dome:

Description	Minimum Thickness, mm	Maximum Thickness, mm
Man way (Overlay)	19.27	23.55
Dome area (Overlay)	13.23	14.2
Cylindrical area (Liner)	8.1	8.2
Tube sheet-Overlay weld	13.7	19

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

The following inspection activities were performed.

- a. Visual Inspection
- b. Thickness measurement

The observations on above inspections are as under. :

3.1 VISUAL INSPECTION :

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

3.1.2 Top Channel : The J-bolts showed some crevice corrosion on the screw thread. The sealing face was satisfactory. The overlay weld of tube sheet had shown some minor pitting. Tube to tube sheet welds were smooth.

3.1.3 Bottom Channel : The sealing face was satisfactory. Weld joints of Gas inlet nozzle, which was repaired during shutdown-2001 due to heavy corrosion of one of the two weld seams was found satisfactory. Tube to tube sheet weld and tube sheet overlay weld was found smooth.

3.2 Overlay weld and Liner thickness measurement :

3.2.1 Top Section :

DESCRIPTION	Minimum Thickness, mm	Maximum Thickness, mm
Cover (Liner)	19.7	20
Man way (Liner)	6.4	7.1
Dome area (Liner)	6.7	7
Cylindrical area (Liner)	6.4	7
Tube sheet-Overlay weld	10.58	13.38

3.2.2 Bottom Section :

DESCRIPTION	Minimum Thickness, mm	Maximum Thickness, mm
Cover (Liner)	19.8	20.1
Man way (Liner)	4.4	7.5
Dome area (Liner)	6.5	7
Cylindrical area (Liner)	6.4	6.9
Tube sheet-Overlay weld	11.19	28.36

4.0 INSPECTION OF OTHER VESSELS :

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

- a) Tube and Tubesheet observed in satisfactory condition.
- b) Epoxy coating had been peeled off from the inside surface of channel cover of both south and north end resulting in corrosion attack at scattered locations.

4.2 H-1123 (Crank case cooler of K-1101/2) :

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

4.3 H-1204 (Recirculation Heater):

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- a) Tubesheet to tube seal welding found intact and free from corrosion.
- b) Top and bottom channel covers were found in satisfactory condition with brownish colouration.
- c) Orifice plugs inserted on bottom tubes found intact in position. Heavy deposits inside the tubes were cleared by extensive hydrojetting.
- d) Shell external surface has got minor corrosion scales at bottom end.
- e) Brownish deposits/colouration was observed on the tube inside surface

4.4 H-1207 (Circulation System-II Cooler):

- a) Heavy corrosion/pittings were observed on the tubesheet area
- b) Water was found coming from tube O.D. Sealing of tube to tubesheet hole was recommended to be inspected by hydraulic test .

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

- (a) Tube to tubesheet seal welding was found satisfactory for H-1301 A/B where as pinholes were observed on tube seal welding of H-1301 C.

4.6 H-1351 A/B/C (Hydrolyser feed preheater) :

- (a) Tube to tubesheet seal welding was found satisfactory.
- (b) Minor damages of few tube ends were observed.

4.7 H-1352 (Reflux Condenser) :

- a) Tube to tube sheet welding was found satisfactory.
- b) Minor pitting were observed on both inlet and outlet cooling water lines.
- c) Minor scaling were observed on the inside surface of the tubes looking from the top end.
- d) Overall condition was found satisfactory.

4.8 H-1419 (Pre-evaporator Condenser) :

Checked tubesheet area and tubes seal welding. No abnormalities observed.

4.9 H-1421 (Flash Tank Condenser):

- a) Tube to tube sheet welding was found satisfactory.
- b) Minor scales was observed inside the few tubes.
- c) Overall condition was satisfactory.

4.10 H-1422 (1st Stage Evaporator) :

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

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

4.11 H-1423 (First Stage Evaporator Condenser):

- a) Tube to tube sheet welding was found satisfactory.
- b) Minor scales were observed inside the few tubes.
- c) Overall condition was satisfactory.

4.12 H-1424 (2 nd Stage Evaporator) :

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

- a) Coloration of the shell and dished end was bright shiny.
- b) Tube to tubesheet weld joints were found satisfactory.
- c) All other weld joints were found satisfactory.
- d) At scattered locations of bottom dished end, urea lumps alongwith water were found accumulated.
- e) Impingment cone was found intact in position.

4.13 H-1425 (Second Evaporator First Condenser) :

- a) Tube to tube sheet welding was found satisfactory.
- b) Minor scales was observed inside the few tubes.
- c) Overall condition was satisfactory.

4.14 H-1426 (Second Evaporator Second Condenser) :

- a) Tube to tube sheet welding was found satisfactory.
- b) Minor scales was observed inside the few tubes.
- c) Overall condition was satisfactory.

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

- a) Tubes and tube sheet were found satisfactory.
- b) Holes at the centre of partition plates on east end were found choked.
- c) Epoxy coating had got peeled off at various scattered locations on channel cover inside surface at both east and west cover. The same was marked for repainting.

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

- a) Tubes and tube sheet were found satisfactory.
- b) Holes at the centre of partition plates on east end were found choked
- c) Epoxy coating had got peeled off at various scattered locations on channel cover inside surface at both east and west cover the same was marked for repair.

4.17 H-1815 (Surface Condenser for Hitachi Compressor) :**4.17.1 North side partition (East side cover)**

- a) Scaling was observed at the inside surface of the tubes.
- b) Tubes and tubesheet surface condition was found satisfactory.
- c) Corrosion scales were observed on the bottom end west corner. This was marked for proper cleaning and application of epoxy paint.

4.17.2 North side partition (west side cover) :-

- a) Scaling was observed at the inside surface of the tubes.
- b) Tubes and tubesheet surface condition found satisfactory.
- c) Epoxy coating found in satisfactory condition except at one location. Where minor peeling off the paint was noticed.

4.18 T-1301 (Ammonia Water Tank) :

- a) Brownish coloration on bottom plate and bottom half of shell and silver bright colouration on top half of shell was observed.
- b) Bottom plate was found bulged up-side at different locations. Same has been observed in past.
- c) Overall condition of the tank was found satisfactory.

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

- a) Brown coloration on bottom plate and bottom half of shell and silver bright coloration on top half of shell was observed.
- b) The overall condition of the tank was found satisfactory.

4.20 T-1401 (Urea Solution Tank) :

- a) Bottom plate is having bulging upward as has been observed in the past.
- b) Weld joints condition was found satisfactory.
- c) Dark brown coloration was observed .
- d) Stiffner provided on top roof plate was found intact in position.
- e) New manhole was provided D.P. test was carried out for all the weld joints.

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

- a) Brownish gray coloration was there on bottom half of the vessel and top half was observed having bright silver coloration.
- b) Overall condition of the tank was satisfactory.

4.22 T-1501 (CONDENSATE TANK) :

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

- a) The internals (shell and dished ends) had assumed brownish colouration.
- b) Condition of all internal nozzles was satisfactory.
- c) Weld joints condition found satisfactory.
- d) Overall condition of the tank was found satisfactory.
- e) Thickness measurement was carried out. Refer Annexure-E

4.23 V-1101 (CO₂ KNOCK OUT DRUM) :

- a) Epoxy paint was found peeled off from many locations particularly at the surface of inlet nozzle.
- b) Small blisters of epoxy paint were observed at scattered locations.
- c) Demister pads were found intact in position but were partially covered with peeled off epoxy paint.

4.24 V-1102 (NH₃ SUCTION FILTER) :

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

- a) Oily surface was observed inside the vessel.
- b) Small foreign particles were observed inside the bottom dish end nozzle.
- c) Overall condition of the equipment was found satisfactory.

4.25 V-1103 (NH3 SUCTION VESSEL) :

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

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

4.26 V-1202 (RECTIFYING COLUMN) :**4.26.1 Top Compartment :**

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

4.26.2 From Bottom manhole :

- a) Coloration of top cone was silver with black patches where as brownish coloration was found on bottom dished end.
- b) Condition of bottom nozzle weld joint was found satisfactory.
- c) Metallic scales up to 2.5 mm thickness were observed at the scatted locations on shell and dish end. Thickness was measured below these locations after removal of scales was found satisfactory.

4.27 V-1203 (L. P. ABSORBER) :**4.27.1 From Top End**

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

4.27.2 From Bottom End:

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- a) Coloration of shell was observed grayish black.
- b) Weld joints condition found satisfactory.
- d) Centre nozzle of bottom dish end found intact in position.
- e) Packing supporting grid was found intact in position.

4.28 V-1206 (ATMOSPHERIC VENT SCRUBBER) :

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

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

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

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

- a) Coloration of shell top portion was observed blackish grey.
- b) Corrosion attack was observed on the second circumferential weld seam from top.
- c) One no nut of top grill was found missing.
- d) Irregular shaped cavity was observed on the bottom supporting grill of pall rings bed.

4.30 V-1301 (2ND DESORBER) :

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

4.30.1 Bottom Compartment :

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

4.30.2 Top Compartment :

- a) Shell coloration was found brownish.
- b) All fasteners were intact in position.
- c) All the trays were found satisfactory
- d) Top nozzle was found satisfactory

4.31 V-1351 (HYDROLYSER) :

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

4.31.1 Top Compartment :

- a) Top dish end and shell of top section has assumed brownish black coloration.
- b) Trays had brownish coloration.
- c) Fasteners were found intact in position.
- d) Condition of top tray was found satisfactory.

4.31.2 Bottom Compartment :

- a) Brownish coloration was observed.
- b) Fasteners were found intact in position
- c) Oil layer was observed all around.

4.32 V-1352 (FIRST DESORBER) :

Visual inspection was carried out from top and bottom manhole.

4.32.1 Top Manhole :

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- a) Shell and dish end had brownish coloration.
- b) All fasteners were found intact.
- c) Weld joint condition was found satisfactory.

4.32.2 Bottom Manhole :

- a) Shell and dish end had brownish coloration.
- b) All fasteners were found intact.
- c) Overall condition was satisfactory.

4.33 V-1418 (Pre Evaporator Separator) :

- a) Minor scaling was observed inside the tubes.
- b) Weld joints condition was found satisfactory.
- c) Condition of the cone was found satisfactory.
- d) All internal nozzles were found satisfactory.
- e) Overall condition was satisfactory.

4.34 V-1421 (FLASH DRUM SCRUBBER) :

- a) Shell inside was found brownish in colour.
- b) Demister pads condition was found satisfactory.
- c) Weld joint condition was found satisfactory.
- d) Previously repaired welding was found satisfactory.

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

Visual inspection was carried out from top manhole.

- a) Dark brown coloration was observed.
- b) Demister pads condition was found satisfactory.
- c) All fasteners were found intact.
- d) Overall condition of the vessel was satisfactory.

4.36 V-1501 (4 ATA STEAM DRUM) :

- a) Coloration of shell was blackish brown in general.
- b) Demister pads were found intact and in good condition.
- c) Minor pittings and hard scales were observed on both side of dished end.
- d) All fasteners were intact in position.
- e) Weld joint condition was satisfactory.

4.37 V-1502 (23 ATA STEAM DRUM) :

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

4.38 V-1503 (9 ATA STEAM DRUM) :

- a) Colouration of Shell and dished end was observed grayish black for the bottom half where as brownish gray for top half.
- b) Complete internal surface of vessel was found covered with fine dust particles.
- c) Scattered scales were observed on both the dished ends.
- d) BFW inlet line supports welding was found cracked, which was marked for repair.

4.39 V-1811 (Ist STAGE SEPARATOR):

- a) Weld joints were found in satisfactory condition.
- b) Demister pads found intact in position.
- c) Coloration of shell had assumed shiny.
- d) Overall condition of the vessel found satisfactory.

4.40 V-1812 (Iind STAGE SEPARATOR):

- a) Weld joints were found in satisfactory condition.
- b) Demister pads found intact in position.
- c) Coloration of shell was silver.
- d) Overall condition of the vessel found satisfactory.

4.41 V-1813 (IIIrd STAGE SEPARATOR):

- a) Weld joints were found in satisfactory condition.
- b) Demister pads found intact in position.
- c) Overall condition of the vessel found satisfactory.

THICKNESS MEASUREMENT OF EQUIPMENT :

Thickness measurement of selected heat exchangers and vessels was also carried out. The details are summarised at the **Annexure - E**

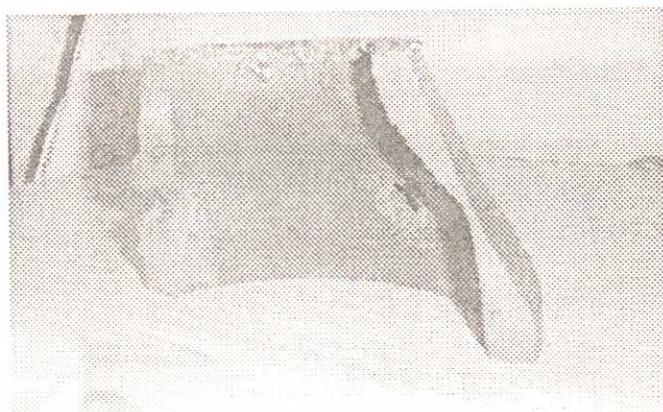
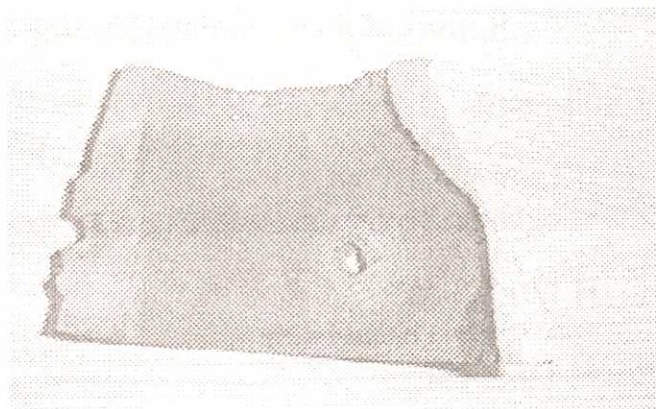
PIPE LINES THICKNESS MEASUREMENT :

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

Annexure-A**QUALITY CHECK PLAN FOR LINER REPLACEMENT OF
BOTTOM CHANNEL OF H.P. STRIPPER**

Sr. No	Description of Items	Channel		Remarks
		L & T	IFFCO	
1	Grinding and removal of existing lining plates without damage to carbon steel surface			
2	Visual inspection			
3	Confirmation of weep holes on liner removed area for their clear passage of air.			
4	Buffer layer thickness checking with dualscope to be carried out. If required, build-up the same.			
5	Fabricate the new liner plate as per required dimension in the drawing			
6	DPT of weld edge preparation for the long seam & cir seams of the plate			
7	DPT of buffer layer preparation for the long seam & cir seams.			
8	Ferrite check of the buffer layer			
9	Install new liner in position & tack weld have required gap & dimensional requirements.			
10	Thorough cleaning after fit-up by using SS wire brushes to be ensured.			
11	Complete the root run by using TIG with low heat input..			
12	Ensure proper argon back purging of root pass welding.			
13	Visual & DPT check after root pass.			
14	Ensure ferrite check after root within the limits.			
15	Air and soap solution test at 0.2 Kg/cm ²			
16	Ensure final/cover passes cleaned with SS wire brushes.			
17	Visual & DP check after final welding.			
18	Ferrite check after final welding.			
19	Rectification of repairs / defects if any.			
20	Ensure cleaning & passivation of the new welds as per			
21	Ammonia leak test as per procedure.			

ANNEXURE- B



Photographs showing the thickness reduction of 6"X4" reducer of PB compressor final discharge line.

Report of Insitu Metallography**Equipment**

- | | |
|--|------------------|
| i) V 1202 Shell
spot taken on east side 1 1/2 floor | Normal structure |
| ii) H 1205 Shell
spot taken on east side
at 1 1/2 floor | Normal structure |
| iii) H 1352 Shell
spot taken on north side
at Hydrolyser floor | Normal structure |

Pipelines

- | | |
|---|------------------|
| i) PR1230- 6"(MA1203 to H1202)
spot taken at the D/S of TR 1203
(on lift 4 th floor) | Normal structure |
| ii) PR1206- 6"x 6(V1202 toV1406)
spot taken on parent material at the
U/S of LICV 1201 (at lift 3 rd floor) | Normal structure |
| iii) PR1216-16"x6 (V1202 to H1205)
Spot taken on parent material at the
North side on 1 1/2 floor near H1205 | Normal structure |
| iv) PR 1219-8"x3 (H1205 to V1205)
spot taken on parent material at
north side (at lift 3 rd floor) | Normal structure |
| v) PR 1220-8"x3 (V1205 to H1205)
spot taken on parent material at
east side (at lift 3 rd floor (balancing line)) | Normal structure |
| vi) PR 1231 -3" (H1203 to PRCV1201)
spot taken on parent material at
U/S of PRCV 1201 at PT Top | Normal structure |
| vii) PR1607 -18"x6 (H1205 inlet gas line
from V1202)
spot taken on parent material at
north side (at lift 3 rd floor) | Normal structure |

- viii) PR1203 6" x1 (H1202 gas outlet to V1201)spot taken on parent material on south side (at lift 3rd floor) Normal structure
- ix) PR1201 8" x1(H1202 liquid outlet to V1201) spot taken on parent material on west side (at lift 3rd floor) Normal structure
- x) PR1201 8" x1(V1201 liquid outlet to H1201) spot taken on parent material (at lift 3rd floor) Normal structure
- xi) PR1202 10"x1(Stripper off gas line to H1202) spot taken on parent material on south side (at lift 3rd floor) Normal structure
- xii) PR1208 4"x1 (V1201 off gas to H1203)Normal structure spot taken on parent material at west side (on lift 5th floor) (opposite scrubber bottom)

GAUSS MEASUREMENT REPORT

(1) K-1801 CO₂ COMPRESSOR

1. TURBINE SOUTH BEARING

Journal Bearing Pads :- Before Degaussing Reading :- Max. 4.7 gauss
After Degaussing reading :- Max.1.2 gauss

Journal Bearing Base ring :- Before Degaussing Reading :- Max.14.8 Gauss
After Degaussing reading :- Max.0.7gauss

Shaft Journal :- Max. 0.4 gauss

Thrust Bearing Case :- Max. 1.8 gauss

Thrust Bearing Base ring :- Max. 2.7 gauss

Thrust Collar :- Max. 1.5 gauss

Thrust Pads :- Max. 1.4 gauss

2. TURBINE NORTH BEARING

Shaft Journal :- Max. 0.4 gauss

Journal Bearing Base ring :- Max. 1.9 gauss

Journal Bearing Pads :- Before Degaussing Reading :- Max.13.0 gauss
After Degaussing reading :- Max.0.4 gauss

3. HP CASE SOUTH BEARING

Shaft Journal :- Max. 0.9 gauss

Bearing Pads :- Max. 0.8 gauss

Bearing Base ring :- Before Degaussing Reading :- Max.12.9 gauss
After Degaussing reading :- Max.1.2 gauss

4. HP CASE NORTH BEARING :

Shaft Journal :- Max. 1.3 gauss

Journal Bearing Base ring :- Before Degaussing Reading :- Max.7.0 gauss
After Degaussing reading :- Max.0.9 gauss

Journal Bearing Pads :- Max.0.4 gauss

Thrust Collar :- Max. 1.4 gauss

Thrust Pads :- Max. 1.4 gauss

5. LP CASE SOUTH BEARING

Shaft Journal :- Max. 0.9 gauss

Journal Bearing Pads :- Max.2.0 gauss

Journal Bearing Base ring :- Before Degaussing Reading :- Max.14.2 gauss
After Degaussing reading :- Max.1.0 gauss

6. LP CASE NORTH BEARING

Shaft Journal :- Max. 1.8 gauss

Journal Bearing Pads :- Max.1.2 gauss

Thrust Collar :- Max. 0.5 gauss

Thrust Pads :- Max.0.3 gauss

Journal Bearing Base ring :- Before Degaussing Reading :- Max.16.0 gauss
After Degaussing reading :- Max.1.2 gauss

Annexure-E

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SL. NO.	EQUIP. No.	EQUIPMENT DESCRIPTION	SHELL THICKNESS IN MM			DISH END THICKNESS IN MM			CHANNEL THICKNESS IN MM		
			DGN.	MEAS. MIN.	REDU-CTION	DGN.	MEAS. MIN.	REDU-CTION	DGN.	MEAS. MIN.	REDU-CTION
1 ✓	H-1204	RECIRCULATION HEATER	11	11.0	-	9 (T) 9 (B)	10.0 (T) 10.0 (B)	-	-	-	-
2 ✓	H-1207	CIRCULATION SYSTEM-II COOLER	10	10.2		13(N) 10(S)	13.4 (N) 8.0 (S)	20%(S)	8.0	7.7	-
3 ✓	H-1421	FLASH TANK CONDENSER	8	7.6	7.5	11(T) 7(B)	12.1 (T) 8.6(B)	-	-		-
4 ✓	H-1423	1ST STAGE EVAPORATOR CONDENSER	8	11.1		10	12.1 (T) 10.5 (B)	-	-	-	-
5 ✓	H-1425	2ND STAGE EVAPORATOR 1ST CONDENSER	12	13	-	-	18.4(T) 18.5 (B)	-	15.0	15.4	-
6 ✓	H-1426	2ND STAGE EVAPORATOR IIND CONDENSER	7	7.3	-	9	12.4 (T) 8.3(B)		-	-	-
7 ✓	H-1811	1ST STAGE GAS COOLER OF K-1801	12	13.2	-	12	12.0 (S) 12.1 (N)		-	12.3	-
8 ✓	H-1812	2ND STAGE GAS COOLER OF K-1801	10	11.4	-	12	11.5		-	22.1	-
9 ✓	H-1813	3RD STAGE GAS COOLER OF K-1801	10	10.1	-	10	10 (S) 20.5(N)		-	32.1(N) 10.1(S)	-
10 ✓	T-1501	STEAM CONDENSATE TANK	10	10.1		10 (E) 10(W)	12.6(E) 12.7(W)		-	-	-
11 ✓	T-1701/A	UREA DUST DISSOLVING TANK	N.A.	6	-	-	-		-	-	-
12 ✓	T-1701/B	UREA DUST DISSOLVING TANK	N.A.	6	-	-	-		-	-	-
13 ✓	T-1814	MAIN LUBE OIL TANK FOR K-1801	N.A.	5.8 (Vertical Plates)			8.6(Top/ Roof)				
14 ✓	V-1101	CO2 KNOCKOUT DRUM	10	9.0	-	13	12.1				-

SL. NO.	EQUIPT NO	EQUIPMENT DESCRIPTION	SHELL THICKNESS IN MM			DISH END THICKNESS IN MM			CHANNEL THICKNESS IN MM		
			DGN.	MEAS. MIN.	REDU-CTION	DGN.	MEAS. MIN.	REDU-CTION %	DGN.	MEAS. MIN.	REDU-CTION
15 ✓	V-1102	AMMONIA FILTER	11.0	11.0	-	11.0	11.1	-	-	-	-
16 ✓	V-1103	AMMONIA SUCTION VESSEL	21	20.7	-	23	22.0(T) 22.2(B)	-	-	-	-
17 ✗	V-1111	INTER COOLER SEPARATOR FOR K-1101/1	5.0	5.3	-	6.0	7.8(T) 8.0(B)	-	-	-	-
18 ✗	V-1112	AFTER COOLER SEPARATOR FOR K-1101/1	10	10.2	-	10	10.5(T) 9.2(B)	8.0(B)	-	-	-
19 ✗	V-1121	1ST STAGE SEPARATOR FOR K-1101/2	N.A.	7.7	-	N.A.	8.1(B) 8.5(T)	-	-	-	-
20 ✗	V-1122	2ND STAGE SEPARATOR FOR K-1101/2	N.A.	16.0	-	N.A.	20 (B) 20.1(T)	-	-	-	-
21 ✓	V-1206	ATMOSPHERIC VENT SCRUBBER	5	5	-	8	7.0(T) 7.6(B)	12.5(T) 5.0(B)	-	-	-
22 ✓	V-1406	FLASH TANK SEPARATOR	8	8.5	-	10.0	10.4	-	-	-	-
23 ✓	V-1409 A	UREA SOLUTION FILTER	6	6.4	-	-	5.5	-	-	-	-
24 ✓	V-1409 B	UREA SOLUTION FILTER	6	6.4	-	-	5.4	-	-	-	-
25 ✓	V-1418	PRE-EVAPORATOR	12	12	-	12	10.5	12.5	-	-	-
26 ✓	V-1421	FLASH TANK SCRUBBER	5	5.3	-	6	5.8 (T) 5.9 (B)	3.0 (T) 3.0 (B)	-	-	-
27 ✓	V-1423	1ST STAGE EVAPORATOR	8	7.9	-	10	8.7 (T) 10.0 (B)	13.0 (T)	-	-	-
28 ✓	V-1811	1ST STAGE SEPARATOR	6	6	-	6	5.9 (T) 5.9 (B)	-	-	-	-
29 ✓	V-1812	2ND STAGE SEPARATOR	10	10.0	-	12	11.9 (T) 11.6 (B)	-	-	-	-
30 ✓	V-1813	3RD STAGE SEPARATOR	30	27.8	7.3	30	26.3 (B) 26.9 (T)	12.3(B) 10.3(T)	-	-	-

Annexure-F

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PIPELINE THICKNESS OF UREA PLANT MEASURED DURING SD-2003 :								DATE: 24-7-2003	
SR NO	LINE NO.	N.B. (in.)	SCH.	NOMINAL THK. IN MM	LINE DESCRIPTION		MIN. THK. OBSERVED mm	%GE RED	REMARKS Readings are in mm
					FROM	TO			
0	CO-A3-2102	26	-	6.01	GA-1601	K-1801,I SUC.	5.80	3.49	
2	CO-B22-2109	8	20	6.35	CO-B22-2115	COHA2-2109	6.00	5.51	
3	CO-B22-2114	8	20	6.35	V-1812	K-1801,III SUC	5.90	7.09	Min.rdg.is 5.7 in Jan-00
4	CO-B22-2115	6	10	3.40	V-1812	K-1801,III SUC	3.20	5.88	
5	CO-B22-2135	8	20	6.35	H-1812	V-1812	6.00	5.51	Min.rdg.is 5.7 in Apr-99
6	CO-E10-2122	6	80	10.97	H-1813	V-1813	10.00	8.84	Min.rdg.is 9.3 in Apr-99
7	CO-E10-2123	6	80	10.97	V-1813	K-1801,IV SUC.	10.00	8.84	Min.rdg.is 9.6 in Apr-99
8	CO-E10-2139-PP25	4	80	8.56	CO-F10-2140-PP25	CO-E10-2112	7.10	17.06	
9	CO-F10-2119-PP25	8	160	23.01	K-1801,III	H-1813	22.70	1.35	Min.rdg.is 22.2 in Apr-9
10	CO-F10-2140-PP25	4	160	13.49	CO-F10-2119-PP25	CO-E10-2139-PP25	13.00	3.63	
11	CO-HA2-2109	10	10	9.27	CO-B22-2109	K-1801	8.50	8.31	
12	GA-1102	30	B3	6.35	H-1104	V-1101	5.80	8.66	
13	GA-1103	30	B3	6.35	V-1101	K-1101-1	5.80	8.66	
14	GA-1104	10	B3	4.20	K-1101-1	K-1101-2	3.40	19.05	
15	GA-1112	6	F2	14.20	K-1101-2	GA-1201	9.00	36.62	Reducer rep. in SD/03
16	GA-1201	6	X4	13.33	GA-1112	H-1201	14.20	-	
17	GA-1202	1	F2	4.55	GA-1112-6"	CHECK VALVE(GA-1203)	3.30	27.50	
18	GA-1602	8	F2	23.01	K-1801	H-1201	22.30	3.09	
19	GA-1602	6	F2	18.26	K-1801	GA-1602-8"	17.60	3.61	
20	MA-1103	4	C2	6.02	B/L	MA-1102	5.20	13.62	
21	MA-1104	3	C2	5.49	V-1102	V-1103	4.10	25.32	1Elbow rep.in S/D-03
22	MA-1104	6	C2	7.11	V-1102	V-1103	5.90	17.02	
23	MA-1106	4	E2	8.55	MA-1203	MA-1605	7.20	15.79	
24	MA-1108	1	B2	3.38	RV-1108	MA-1108-3"	3.30	2.37	
25	MA-1110	1	B2	3.38	RV-1107	MA-1108	3.10	8.28	
26	MA-1113	1	B2	3.38	RV-1110	MA-1108	3.00	11.24	
27	MA-1114	1	B2	3.38	RV-1106	MA-1113	4.10	-	
28	MA-1118	1	B2	3.38	MA-1106	T-1301	3.60	-	
29	MA-1119	1	B2	3.38	FS-1101	MA-1110	4.10	-	
30	MA-1201	3		7.62	MA-1605-6"	MA-1202-3"	7.30	4.20	
31	MA-1202	3	X4	7.62	MA-1201	V-1201	7.60	0.26	
32	MA-1203	4	X4	9.14	MA-1106	PR-1230	6.60	27.79	
33	MA-1603	6	C2	7.11	MA-1122-6"	P-1102/C SUC.	6.10	14.21	
34	MA-1603	4	C2	6.02	MA-1122-6"	P-1102/C SUC.	4.80	20.27	
35	MA-1604	3		7.62	P-1102 /C DIS.	MA-1604-4"	5.20	31.76	1 elbows replaced
36	MA-1604	4		8.56	MA-1604-3"	MA-1605-6"	7.10	17.06	Min.rdg.is Apr-02
37	MA-1605	6		14.27	MA-1106	MA-1203	13.90	2.59	
38	MA-1607	4		6.02	MA-1605	MA-1116	5.40	10.30	
39	MA-1609	4		6.02	MA-1603-6"	MA-1604-3"	5.10	15.28	
40	PR-1201	8		19.58	V-1201	H-1201	16.70	14.71	Min.rdg.is 15.1 of March-01
41	PR-1202	10		24.33	HP-STRIPPER H-1201	HP-CONDENSER	19.40	20.26	
42	PR-1203	8		19.58	HP-CONDENSER H-1203	V-1201 (VAPOR LINE)	17.70	9.60	Min.rdg.is 16.6 of Apr-02
43	PR-1204	8		19.58	HP-CONDENSER	V-1201 (LIQUID LINE)	17.80	9.09	Min.rdg.is 16.7 of Apr-02
44	PR-1205	8		19.50	STRIPPER BOTTOM	PR-1205-6"	19.40	0.51	Minor pittings,Min.rdg.is 17.1 of Apr-02
45	PR-1205	6		15.20	PR-1205-8"	RECTIFYING COLUMN	12.50	17.76	Min.rdg.is 11.9 of Apr-02

SR NO	LINE NO.	N.B. (in.)	SCH.	NOMINAL THK. IN MM	LINE DESCRIPTION		MIN. THK OBSERVED mm	% GE RED	REMARKS Readings are in mm
					FROM	TO			
46	PR-1207	14	X10	4.19	LICV-1201	V-1408	5.20		
47	PR-1208	4		10.40	AUTOCLAVE TOP	SCRUBBER	8.00	23.08	Minor pittings, Min.rdg.is 7.7 IN Apr-02
48	PR-1211	1.5		5.08	PR-1208-4"	PR-1212-4"	4.50	11.42	Min.rdg.is 4.2 of Apr-02
49	PR-1212	4		10.40	SCRUBBER	AUTOCLAVE BOTTOM	9.70	6.73	Min.rdg.is 8.4 of April-98
50	PR-1215	16	X6	4.78	H-1204	V-1202	5.20		Min.rdg.is 5.0 of May-97
51	PR-1216	16	X6	4.78	V-1202	H-1205	4.70	1.67	
52	PR-1219	8	X3	3.75	H-1205	V-1205	3.50	6.67	Min.rdg.is 3.3 of May-97
53	PR-1223	4		3.06	LP SEPARATOR	P-1201 A/B SUCTION	2.50	18.30	Min.rdg is 2.2 of Apr-98
54	PR-1224	3		7.62	P-1201B	PR-1638-4"	7.50	1.57	Replaced in june-03
55	PR-1230	6		15.24	MA-1203-4"	H-1202	14.20	6.82	Min.rdg.is 14 of Apr-02
56	PR-1231	3		8.13	H-1203	PRCV-1201	6.30	22.51	Jacket Pipe Min.Thk. 3.4 mm
57	PR-1234	3		7.62	P-1201A	PR-1638-4"	6.50	14.70	Replaced in june-03
58	PR-1234	4	X7	8.56	V-1203	PRCV-1201	10.80		
59	PR-1206	12	X10	4.57	V-1202	PR-1206-6"	4.30	5.91	
60	PR-1206	6	X10	3.40	PR-1206-12"	LICV-1201	3.60		
61	PR-1308	10	X3	4.19	RV-1301	PR-1309	4.00	4.53	
62	PR-1356	3	X7	3.05	V-1351	V-1352	2.30	24.59	
63	PR-1362	4		3.05	V-1351 LIQ.	H-1351/A	2.30	24.59	
64	PR-1363	4		3.05	LICV-1351 D/S	V-1301	3.20		
65	PR-1367	3	X6	3.05	V-1353	P-1352A/B	2.30	24.59	
66	PR-1401	8	X10	3.76	V-1406	T-1404	3.50	6.91	
67	PR-1403	8	X3	3.76	T-1401	P-1401/A	3.20	14.89	
68	PR-1403	6	X3	3.40	T-1401	P-1401/A	2.80	17.65	
69	PR-1403	4	X3	3.05	T-1401	P-1401/A	3.80		
70	PR-1405	6	X10	3.40	H-1422	H-1424	3.20	5.88	
71	PR-1406	4	X3	3.05	V-1409	H-1422	3.20		
72	PR-1408	8	X10	3.05	P-1408	M-1401	3.20		
73	PR-1637	3		7.62	P-1201C	PR-1638-4"	10.20		Min.rdg.is 6.7 of Apr-02
74	PR-1638	4		10.40	P-1201A/B/C	PR-1230-6"	11.70		
75	PW-1101	3	B3	3.05	V-1101	SEAL POT	2.30	24.59	
76	PW-1103	8	10S	3.76	B/L(DM PLANT)	H-1104	3.80		Partly Replaced in April-99, & Partly in June 2003
77	PW-1104	10	B6	4.19	H-1104	P-1106	3.80	9.31	
78	PW-1105	8	B6	3.76	P-1106	B/L	3.60	4.26	
79	PW-1501	2	B1	4.50	B/L	T-1501	4.00	11.11	Min.rdg.is 2.4 of may-97
80	SC-1216	4	B4	6.02	V-1204	SC-1407	2.20	63.46	2 Elbows rep.in S/D-03
81	SC-1216	2	B4	3.91	V-1204	SC-1216-4"	4.50		
82	SC-1233 I FROM N	12	B4	9.53	V-1501	H-1202	9.40	1.31	Min. rdg. Is 9.3 of Jun-96
83	SC-1234 II FROM N	12	B4	9.53	V-1501	H-1202	9.90		Min. rdg. Is 9.3 of Jun-96
84	SC-1235 III FROM N	12	B4	9.53	V-1501	H-1202	9.50	0.26	
85	SC-1236 IV FROM N	12	B4	9.53	V-1501	H-1202	9.40	1.31	Min. rdg. is 9.3 of Apr-98
86	SC-1237 I FROM NE	16	B4	9.53	H-1202	V-1501	9.00	5.51	
87	SC-1238 II FROM NE	16	B4	9.53	H-1202	V-1501	10.70		
88	SC-1240 IV FROM NE	16	B4	9.53	H-1202	V-1501	10.10		Min. rdg. Is 9.5 of Apr-98

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SR NO	LINE NO.	N.B. (in.)	SCH.	NOMINAL THK. IN MM	LINE DESCRIPTION		MIN. THK OBSERVED mm	% GE RED	REMARKS Readings are in mm
					FROM	TO			
89	SC-1241 I FROM NW	16	B4	9.53	H-1202	V-1501	9.00	5.51	Min. rdg. is 8.8 of Apr-98
90	SC-1242 II FROM NW	16	B4	9.53	H-1202	V-1501	8.90	6.56	Min. rdg. is 8.4 of Apr-98
91	SC-1244 IV FROM NW	16	B4	9.53	H-1202	V-1501	9.90		
92	SC-1502	3	B4	5.45	P-1501/6	V-1501	4.80	11.93	
93	SC-1504	4	B4	7.11	V-1503	V-1501	6.00	15.81	Replaced in Oct. 99 with S.S.Min.4.8 in Apr-02

CIVIL JOBS

1. Repairing of scrapper floor by filling the joints of existing tiles and vastas by epoxy system.
2. Providing and laying IP net painting on outside surface of bucket room
3. Epoxy painting of RCC structure of Prill bucket room, Lift cabin room, Stair case at Prill tower top level inside scrapper floor of prill tower etc.
4. Dismantling of floor and making new foundation for prill cooling system duct line.
5. Painting of conveyor gantry from prill tower to silo.

ELECTRICAL JOB

1. Preventive maintenance carried out on TR-7A, TR-7B, TR-17, TR18, TR-19, TR-20. The jobs carried out on each transformer are as under:
 - A) Inspection of cable end termination in primary and secondary cable boxes, checking and tightening of connections, replacement of gaskets of box cover.
 - B) Overhauling of transformer Tr-17 by cleaning of core with hot oil, attending all the leakage with replacement of Gaskets and tightening of bolts, replacement of oil, etc.
 - C) Checking the condition of oil in marshaling boxes of HT and LT side marshalling box of Tr-7A, Tr-7B, cleaning of chamber, filling of oil up to fillup level.
 - D) Reactivating of silica gel of silica gel breather and filling up of oil in breather up to fill up level of above transformer. Filling up of oil in OTI oil pot and WTI oil pot. Replacement of silica gel breather of TR-17.
 - E) Checking of Buchholz relay, MOG, trip alarm circuit and cleaning of emergency trip boxes. Replacement of damaged buchholz realys of Tr-7B.
 - F) Turn ratio test, short circuit test, magnetic balancing test, measurment of insulation resistance carried out of each transformer.
 - G) Break down voltage test carried out of transformer oil for each transformer.
 - H) Attending all the leakage on the transformer by replacement of Gaskets and / or tightening of bolts.
 - I) Heavy leakage on radiators of transformer TR-7B, which was attended by brazing and applying metal reapinging putty on it.
 - K) Painting of transformers Tr- 7A, 7B and tr-17.

2. Preventive maintenance of all feeder compartments mounted in MCC-6, MCC-14, MCC-15 carried out as under :
 - A) Cleaning and dedusting of all the feeder compartment.
 - B) Checking of cable terminal heating and repairing of burnt cable terminal.
 - C) Checking of terminal tightness of power and control cable.
 - D) Checking /Testing of breakers installed in panels.
 - E) Installation of 'MotPro' relay for motor No. K-1701 & K-1702 in panel.
 - F) Modification job carried out in panel for prill bucket motors for further easy maintenance.
 - G) Replacement of damaged /burnt component/ parts of feeder compartment.
3. Overhauling of following motors :

M1403/2, P-1817, MP-1814D, M1401/A, M1401/B, K-1401/3, K-1401/4, P1408, M1421, M1419, P1131/C, P1231A, P1231B, P1231C, P1402/1, P1402/2
4. Replacement of aged motors of equipment P1402/1, P 1402/2 with new motors.
5. Preventive maintenance, cleaning and checking of all motor-operated valves and local control panels.
6. Modification job carried out for installation of position indicator on MOV (Equipment No. 1203).

INSTRUMENTATION JOBS

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HITACHI (CO2) COMPRESSOR

1. All vibration probes extension cables and Proximeter were removed to facilitate Mech. Maintenance, checked and installed back.
2. All RTDs and thermocouples were removed to facilitate Mech. Maintenance, checked and installed back. TE-1814 RTD new lug soldered.
3. Provided support to Mech. Maint. For compressor related job
4. Followings Trip and Alarm Switches were cleaned, checked and calibrated :-

PSLL - 1801A/B/C , PSLL - 1818A/B/C , PSLL - 1844 , PSL - 1838A/B/C , PSL-1813 , PSHH-1839A/B/C , LAHH-1804 , LAHH-1806 , LAHH-1808 & LAH-1802

5. Local Control Panel and TLC Box were cleaned, all wiring connection were tightened.
6. Followings transmitters were cleaned and calibrated :-
LICT-1805, LICT-1807, LICT-1821, LICT-1803, PI-1802, PI-1809, LT-1809, PT-1836
7. PSLL-1844 wiring modified. Now power is given from PLC cabinet.
8. Speed probes SE-1801, SE-1802 and SE-1803 were checked.
9. Key phasors probes KE-1801, KE-1802 and KE-1803 were checked.
10. All junction boxes were cleaned, terminal tightened and terminal details were noted.
11. Proximator of XE-1806B replaced with new one.
12. All I/H converters calibrated.

CONTROL / MARSHALLING ROOM :

1. DCS, ACDB, PDB, Vibration cabinet, PLC Panel were cleaned, all terminals were tightened.
2. MINILEC annunciator hooter was repaired for ring back annunciation and installed back.
3. 110 VAC power for LRC-1201, LH-1201 and LR-1201A (Master & Slave) evaluation units were given from ACDB Panel's MCB-9, 9A, 9B and 9C.
4. LRC-1201 and LH-1201 detectors were removed to facilitate Mech. Maintenance. Mounting of LRC-1201 was taken 100 mm down to lower the temperature high oblem.
5. New Radio Active Level Measurement System for Autoclave (LR-1201A) was installed and kept under observation parallel to LR-1201.
6. Temperature high alarm THLRC-1201 , THLH-1201 , THLR-1201M and THLR-1201S were provided for detector LRC-1201, LH-1201, LR-1201A (Master and Slave).
7. Radiac Relay unit for LR-1201 was calibrated. One spare unit was also calibrated.
8. Annual preventive maintenance of DCS was carried out by Yokogawa representatives, like cleaning of Cards, Software backup of FCS and all ICS, functionality checking of FCS and all ICS by diagnostic software.
9. Batteries of all ICS and FCS replaced with new ones.
10. Battery Voltage of both CPU of OMRON PLC was checked and found O.K.
11. All ICS consoles were painted
12. Multipair cable from Vibration Retransmission output to DCS was replaced.
13. P-1814 Pump On/ OFF indication was given on DCS Alarm Annunciator
14. Fuse terminals for 230V AC supply to cabinet fans were replaced with Phoenix terminals.
15. MTL -ICC-312 signal multiplier provided to provide LRCV-1201 ouput signal for electronic and pneumatic positioners separately.

OTHER PLANT JOBS :

1. Following ISO Quality affecting instruments/ transmitter were calibrated:
PT-5303, PT-4405, PT-1121, PT-1145, PT-1201, PT-1202, PT-1422,
PT-1421, PT-1105, PT-1802, SI-1401A, SI-1401B, FT-1201
2. All Plant J. B.s terminal details were noted for the preparation of as
built drawings.
3. LI-1201 was removed and installed back to facilitate mechanical job.
4. 8 nos. HP Thermowell removed and hydrotested. One no. Thermowell
failed which was replaced with new one.
5. Fuse Terminal Strips were provided in all terminals of PJB-1.
6. Preventive maintenance was carried out on cooling water flow turbine
flow meter
7. Panel of GHH compressor was removed.
8. SMART Valve positioner was provided on LRCV-1201.
9. PICV-1810 I/P position was shifted on suitable location for
maintenance ease
10. EWR related jobs were done. FICT-1352 magnetic flow meter removed
and installed for FICT-1435. LIC-1401 changed as LI-1401.
11. All Vacuum transmitter were calibrated. FRC-1201 transmitter
overhauled and calibrated.
12. Following alarm and trip switches were calibrated- PAHH-1194,
PAH-1193, PHCO-1363A&B, PLCO-1102A, PLCO-1201A,
PLCO-1201B, PALL-1195, PLCO-1102B, PSL-1101, LSL-1357
13. Coordinated with Production-Urea/ Maintenance/Technical sections for
miscellaneous plant jobs.
14. 23 ata steam drum leveltrol replaced by SMART leveltrol transmitter.
15. LRCT-1421 replaced with SMART transmitter.
16. GHH compressor panel removed.
17. Painting of instrument supports carried out.

18. I/P converters of 5 critical loops replaced with Rosemount I/P.
19. Calibration of LICT-1235 carried out.
20. MOV-1203 position indication provided in DCS.
21. The radio active sources of LR-1201 & LRC-1201 removed to facilitate mechanical job and reinstalled after completion of mechanical job.
22. Flushing of Instrument air headers carried out.
23. Polythene sheet covering provided to field instruments to provide monsoon protection
24. Cleaning of terminals all electrical and Thermocouple junction boxes carried out.

WEEP HOLE CHECKING OF HP VESSELS :

1. Provided arrangement for carrying out Ammonia Leak Test in Stripper and Autoclave in coordination with Production and technical Deptt.
2. Coordinated with production urea for passing inst. Air/ clearing weepholes

CONTROL VALVES :

1. Complete overhauling of the following control valves were carried out :-
 TICV-1101, TICV-1421, FICV-1352, PICV-1502A, LICV-1353,
 LICV-1420, FICV-1204, FRCV-1421, FICV-1303, PICV-4801,
 FICV-1351, HICV-1581, PICV-1481, TRCV-1201, TRCV-1202,
 HICV-1221B, FICV-1302, HICV-1222B, HICV-1221A, HICV-1222A,
 HICV-1208, LICV-1422, LICV-1301, LICV-1502A, HICV-1204,
 PRCV-1501, PICV-1221, , LICV-1351.
2. HICV-1801 and PICV-1810 were removed from line and their plug & seat were replaced. Body reversal are done in these two valves to check plug & seat damage due to coming of foreign material between plug & seat.
3. HICV-1202 - Diaphragm changed and overhauled.

4. LRCV-1201 - Diaphragm changed with new one, Actuator O Ring replaced, Plug & seat replaced with repaired one. Calibration carried out with Smart positioner, spare smart positioner and pneumatic positioner.
5. HICV - 1201 - Body repaired by inserting & welding of gland sleeve , Diaphragm changed with new one, Plug & Seat replaced with new Ferralium set.
6. PICV-1129 - Plug repaired, Guide Bush changed and overhauled.
7. PICV -1181 - New seat & plug , Graphite spacer ring , grafoil seal ring are provided and overhauled.
8. LICV-1352 - New positioner and regulator provided and overhauled.
9. LICV-1235 - Diaphragm and positioner changed and overhauled
10. LICV-1502A - New guide provided, Plug & Seat repaired and overhauled.
11. PICV-1221 - Plug & Seat replaced, and overhauled.
12. FRCV-1201 Additional gland packing provided and calibrated.
13. N/C Ratiometer monoblock valve was overhauled.
14. Passing problem of following control valves were attended by complete overhauling : PICV-1130, PRCV-1504.
15. LICV-1353 replaced with old HICV-1204 as per technical scheme.
16. Prill Divert three-way valve replaced with spare one.
17. HICV-1424 control valve was changed with new one.
18. Painting and stroke-checking of Control valves carried out.

TECHNICAL DEPARTMENT JOBS

MECHANICAL JOBS :

1) Replacement of Liner in H P Stripper :

- i. Parting line on old (damaged) liner on edges of weld towards & within the liner plate area was marked.
- ii. Liner on all 4 sides parted & separated.
- iii. Thickness check & ferrite check was carried out on buttering layer.
- iv. Weld Edge Preparation (WEP) on the left over weld of existing adjacent liners on two vertical sides and also on existing overlay on top & bottom were prepared.
- v. D.P. Test was cleared.
- vi. Seal weld on parting line & adjacent liners was done
- vii. Air leak test on existing adjacent liner which is seal welded was done.
- viii. Dimensions were transferred on new liner plate & cutting was done. WEP was made and 1:3 taper to take care of extra thickness (New liner is 10 mm thick instead of existing 8 mm thick).
- ix. New liner fit-up was done.
- x. Seal weld was completed.
- xi. Air leak test , DP test & ferrite check was completed.
- xii. Welding was completed.
- xiii. Ferrite check & DP test was cleared.
- xiv. at last Ammonia Leak Test was done & was found O.K.

2) Re-routing of carbamate Pump discharge lines (EWR No.U-204, 29-10-2001):

Discharge lines of P-1201 A/B/C pumps were in very congested manner, which is causing operational and mechanical maintenance jobs very inconvenient and unsafe.

The same were removed from first floor & rerouted alongwith recirculation line, flushing line (1" x Sch.80) as per drawing no. 02-DL-13434 SH.20F3 and 3 of 3. For rerouting the lines new platform fabricated as per drawing No.02-CA-12253 SH 1 Of1. Some of the pipe fittings has been upgraded from ASTM A312 TP316L to 316LN during rerouting. The job has been carried by M/s Aneesh Engineers.

1) Replacement of line (PR-1256-150-X3) from Urea Plant to Hydrolyser Plant :

The above line has been replaced and material is upgraded from A312 TP 304 to 304L. The layout and size of the pipe line kept same. The job has been carried by M/s Aneesh engineer Pvt. Limited. Approximately length : 40 mtr.

2) Replacement of line PW-1103-6" from DM Plant to H-1204, CO2 spray cooler :

The above line has been replaced and material has been upgraded from CS with rubber lined to ASTM A312 TP304 to increase reliability. The job has been carried by M/s Aneesh Engineer. Approximately length : 70 mtr.

3) Installation of prill bucket heating system : (EWR No.U-205) :

A steam control No.HICV-1401 valve to prill bucket inlet melt line has been provided. 25 NB 4 ata steam header was replaced by 40 NB . 25 NB steam injection through HICV-1401 & NRV to melt line d/s of three may control valve HICV-1421. The layout of steam line is as per Drawing No.02-DL-13435 Sh. 1 of 1. The job has been carried by M/s Skywin erection.

4) Replacement of condensate line (EWR No.U-206 dated 14-06-2002)

Following CS pipelines from P-1505 discharge header were replaced with SS 304 material.

- i. Condensate lines provided for 1st and 2nd evaporated dome PRCV-1202.
- ii. Pre evaporator liquid inlet line
- iii. V-1409 A/B (Urea sol. Filters)
- iv. Urea melt return line
- v. P-1401 A/B suction from old F-1401
- vi. P-1201 A/B/C suction line
- vii. T-1701 A/B (dust dissolving tank)
- viii. P-1201 A/B/C suction isolation valve main upstream line and u/s of LT-1201 flushing.

1) Provision of side manhole on old urea sol. tank. (EWR No.U-210 dated 10-10-2002):

Side manhole of 24" dia on T-1401/A has been provided. Material of manhole is SA 240 Gr. 304L. Job has been carried by M/s Skywin Erectors.

2) Closing of top manhole of ammonia water tank (T-1301) (EWR No.U-212 dated 10-10-2002) :

40/80 NB ammonia water line from PGR / Utility plant and 80 mm NB lean carbamate vessel drain line coming in T-1301 has been rerouted & hook -up with C-3 nozzle. HP Ammonia pump P 1102/C plunger packing condensate return line (25 mm NB) will be removed & hooked up with ammonia pump A&B condensate flushing new line by maintenance.

3) Provision of hot CO2 to first desorber (Scheme TM/02/1307 dated 18-02-2003) :

20 NB S.S. CO2 tapping with valve taken from Hitachi CO2 compressor IInd stage discharge upstream of second stage inter cooler (H-1812) & connected to existing 20NB S.S. CO2 line to desorber / reflux condenser. By using CO2 from IInd stage discharge at higher temperature will save steam in desorber.

- 1) 6" NB bypass line (with Globe Valve) installed to HICV-1221/B Control Valve.

(B) INSTRUMENTATION JOBS :

- 1) Prill bucket heating system instruments installation & commissioning of the loop is completed.

1) Theory of government - government structure (1-10/11/1991)

1-10/11/1991

The theory of government structure is based on the separation of powers into three branches: the executive, the legislative, and the judicial. This structure is designed to prevent any one branch from becoming too powerful and to ensure a system of checks and balances. The executive branch is responsible for enforcing the laws, the legislative branch for making the laws, and the judicial branch for interpreting the laws. This system is a key feature of a democratic government.

2) Structure of the state - how does it work? (10-11/1991)

10-11/1991

The structure of the state is defined by its political organization. It includes the central government, regional governments, and local authorities. The central government is responsible for national defense, foreign relations, and major economic policies. Regional governments handle issues like education and health, while local authorities manage local services like waste collection and housing. This multi-level structure allows for more effective governance and responsiveness to local needs.

3) The role of the state - what does it do? (11-12/1991)

11-12/1991

4) The role of the state - what does it do? (12-1/1992)

The role of the state is to provide public goods, maintain law and order, and regulate the economy. It also has a responsibility to protect the rights of its citizens and to promote social justice. The state acts as a referee in the market, ensuring fair competition and protecting consumers. Additionally, it provides social safety nets for those in need, such as unemployment benefits and public housing.

MECHANICAL JOBS

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COOLING WATER PUMP (P-4401/A) :

PREVENTIVE MAINTENANCE OF PUMP :

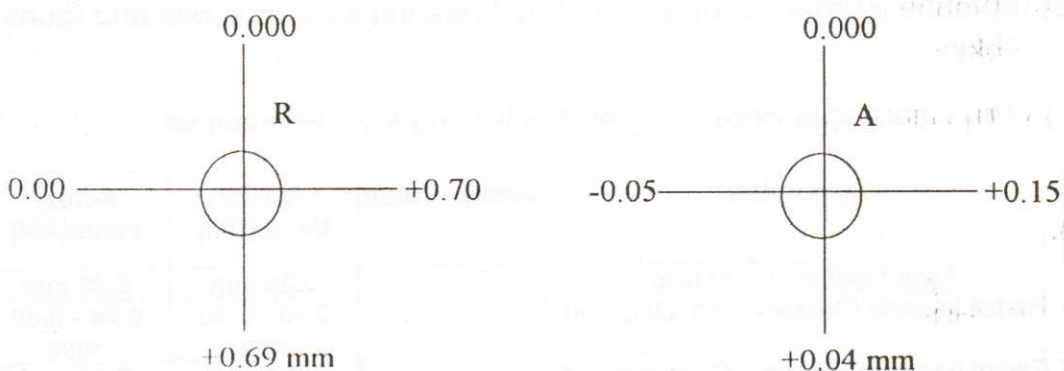
- a) Coupling between the pump and the gear box was decoupled after recording the necessary match marks.
- b) Both the journal Bearings were checked and found okay.
- c) The clearances were checked & following are the readings:

Sr. No.	Description	Design Value	Actual Value(BM)	Actual Value (AM)
1	Total Float of the pump	10 mm	8 mm	8 mm
2	Coupling Flot	-	5.4 mm	5.4 mm
3	Radial bearing Clearance coupling end	0.20 mm	0.21mm	0.21 mm
3	Radial bearing Clearance free end	0.20 mm	0.20 mm	0.20 mm
4	Axial Thrust	-	0.9 mm	0.75mm

- d) Pump with gear box of Elliot Turbine alignment was checked

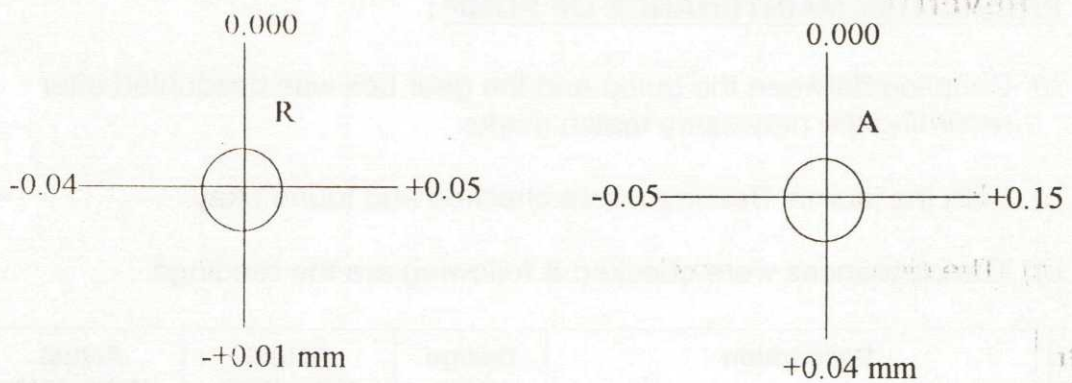
Following are the readings :

Dial on gear box Coupling



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Alignment was corrected,
Following are the readings:
Dial on gear box coupling



- (e) Total Axial Float of the pump measured is 8 MM.
- (f) Cleaning the coupling of pump with gear box & greasing done.
- (g) New Gland packing (25 mm) both side repacked.

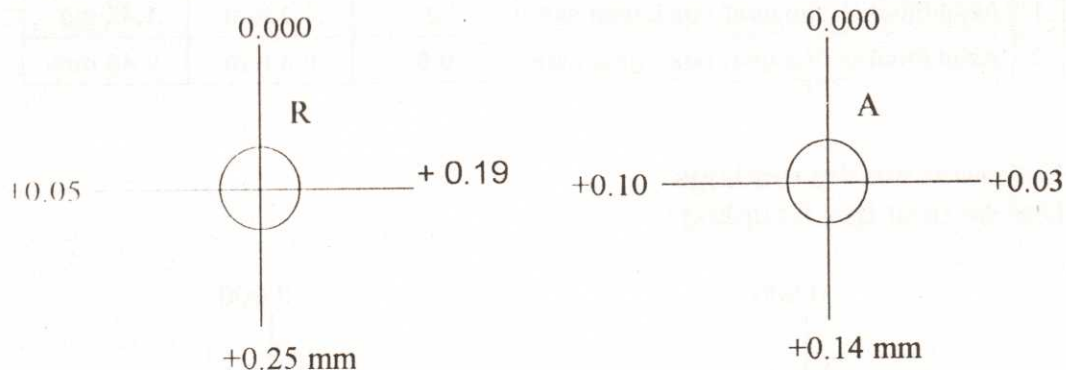
COOLING WATER PUMP ELLIOT TURBINE (Q-4401/A) :
PREVENTIVE MAINTENANCE :

- a) Coupling between the turbine and the gear box was decoupled after recording the necessary match marks.
- b) Both the journal Bearings and thrust bearing were checked and found okay.
- c) The clearances were checked & following are the readings:

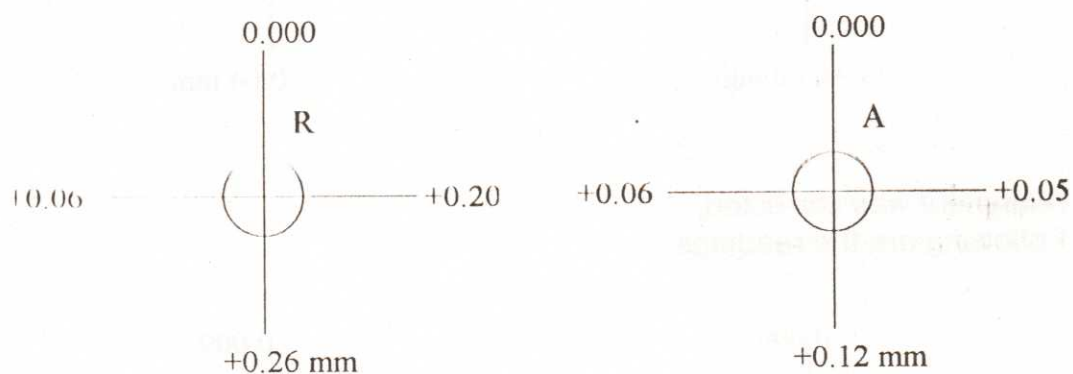
Sr. No.	Description	Design Value	Actual Value(BM)	Actual Value(AM)
1	Axial Float on the turbine		0.25 mm	0.25 mm
2	Radial bearing Clearance coupling end		0.29 - 0.30 mm	0.29 - 0.30 mm
3	Radial bearing Clearance Governor end		0.31 mm	0.31 mm

- d) Governor assembly was removed, cleaned, inspected and boxed up.
- e) Governor oil flushed and fresh oil (Servo 32 No.) charged.
- f) Oil console was drained, cleaned and fresh oil charged.
- g) Additional packing assembled in steam control valve.
- h) Main oil pump and Auxiliary oil pump suction strainer were cleaned & boxed up.
- i) Gear box to Turbine alignment was checked.

Following are the readings:



Alignment was corrected, Following are the readings:



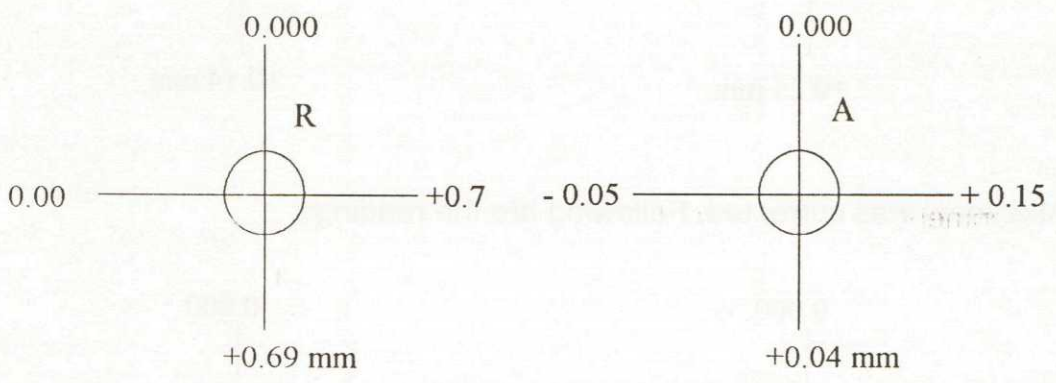
Elliot Turbine Gear Box :

- (a) Top & side covers of gear box were removed.
- (b) Bearing top halves were removed.
- (c) Bearing halves were cleaned & polished using green rouge.
- (d) Gears were checked and found okay.
- (e) Gear box and gears were cleaned & fresh oil charged.
- (f) Bearings were boxed up after taking clearances .
- (g) Axial Float was measured and following are the readings
- (i) Pump to gear box of Elliot Turbine alignment was checked

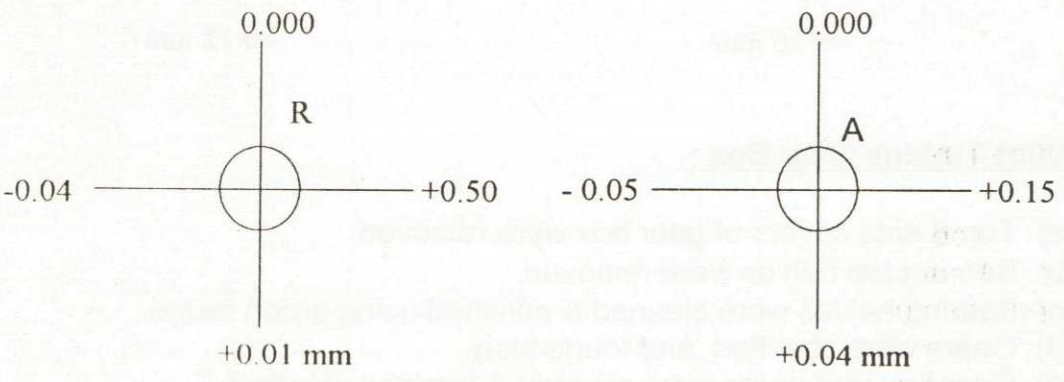
247

Sr	Description	Design Value	Actual Value (BM)	Actual Value (AM)
1	Axial Float on the gear box pinion side	2	1.3 mm	1.45 mm
2	Axial Float on the gear box - gear side	0.5	0.4 mm	0.48 mm

Following are the readings :
Dial on gear box Coupling :



Alignment was corrected,
Following are the readings:



COOLING WATER PUMP (P-4401/B) :

PREVENTIVE MAINTENANCE :

(a) Both the journal bearings were checked & found okay
Clearance were checked & the readings are as follows.
Free end side : 0.18 mm
Coupling side : 0.18 mm

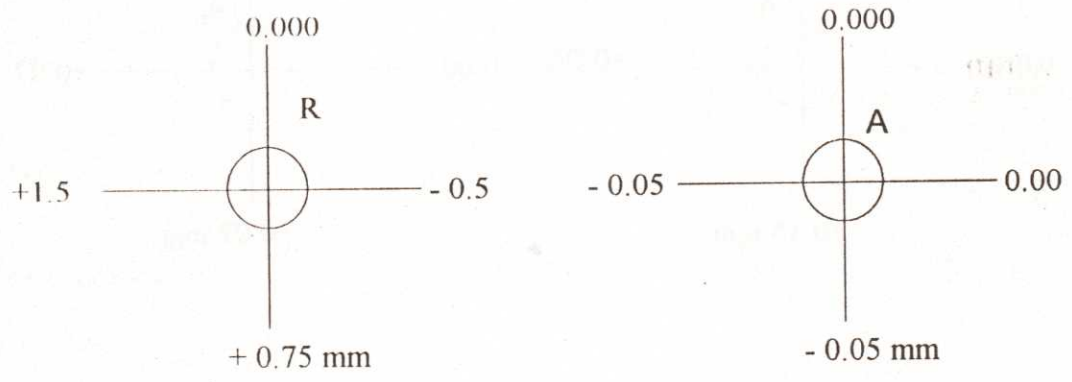
(b) Decoupled the turbine coupling , cleaned & greasing done.

(c) Pump & Turbine Gearbox alignment was checked.

(d) New Gland packing (25 mm) both side repacked.

(e) N.R.V. Gland packing replaced.

Alignment was checked, Following are the readings:



COOLING WATER PUMP (P-4402) :

OVERHAULING OF UREA COOLING WATER PUMP :

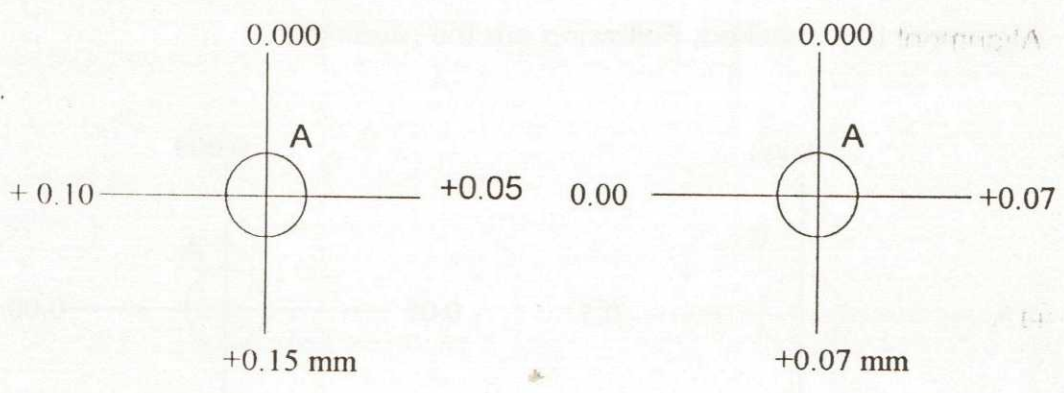
(a) Coupling between the pump and motor was decoupled.

(b) Top casing of the pump was removed, impeller vens found eroded hence decided to replace with new rotor assembly.(store code : 333300035)

(c) Both the journal bearings were checked & found okay.

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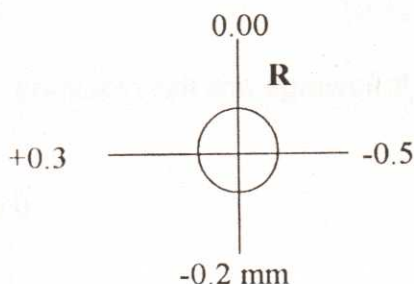
- (d) The clearances were checked & following are the readings.
Free end side : 0.18 mm Coupling side : 0.19 mm
- (e) Free end side new dowel pin is provided on the top bearing half.
- (f) Motor was decoupled , coupling checked, new grease filled.
- (g) Gland packing (25 mm) both sides repacked.
- (f) N.R.V. Gland packing is done.
- (g) Pump with Motor alignment was checked and following are the readings:



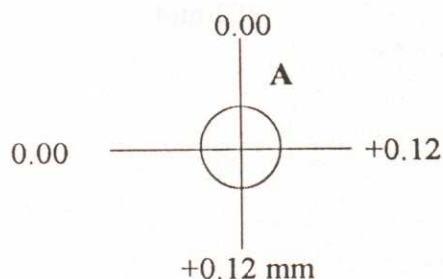
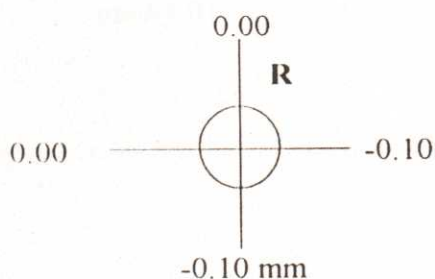
COOLING WATER PUMP (P-4403) :**PREVENTIVE MAINTENANCE :**

- (a) Both the journal bearings were checked & found okay.
- (b) The clearances were checked & following are the readings.
Free end side : 0.21 mm
Coupling side : 0.19 mm
- (c) Decoupled the turbine gearbox coupling , cleaned & greasing done.
- (d) Gland packing (25 mm) both sides repacked.
- (e) N.R.V. Gland packing repacked.
- (h) Alignment was checked & followings are the readings.

Dial indicator fixed on Gearbox shaft :

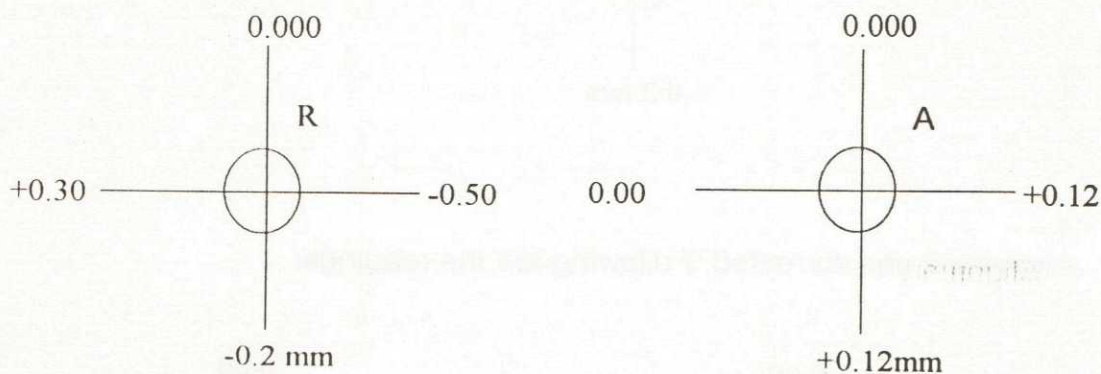


Alignment was corrected, Following are the readings:

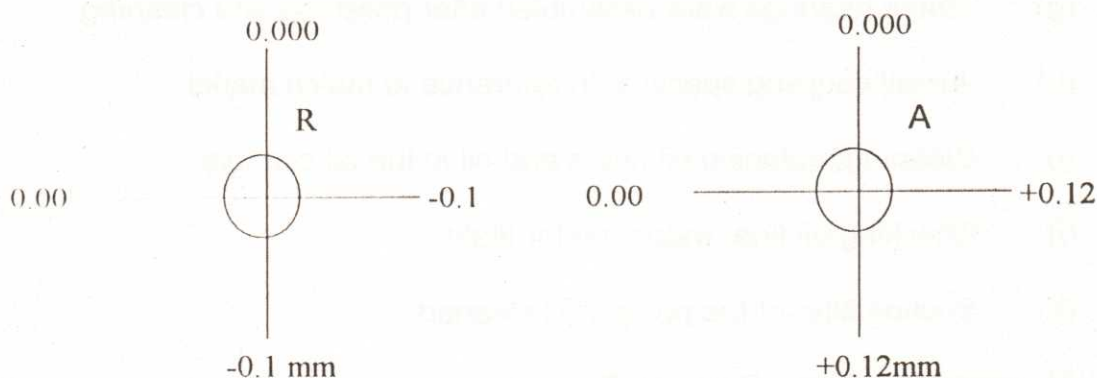


COOLING WATER PUMP (P-4401/C) :**PREVENTIVE MAINTENANCE :**

- (a) Both the journal Bearings were checked & found okay.
- (b) The clearances were checked & following are the readings.
Free end side : 0.20 mm
Coupling side : 0.22 mm
- (c) Both the bearing housing were flushed with oil & fresh oil servo prime 68 charged in the both bearing housing.
- (d) Decoupled the pump coupling , cleaned & greasing done.
- (e) Gland packing (25 mm) both sides repacked.
- (f) N.R.V. Gland packing repacked.
- (g) Alignment was checked & followings are the readings



(g) Alignment was checked & followings are the readings :



COOLING WATER PUMP (P-4401 / D) :

PREVENTIVE MAINTENANCE :

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

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

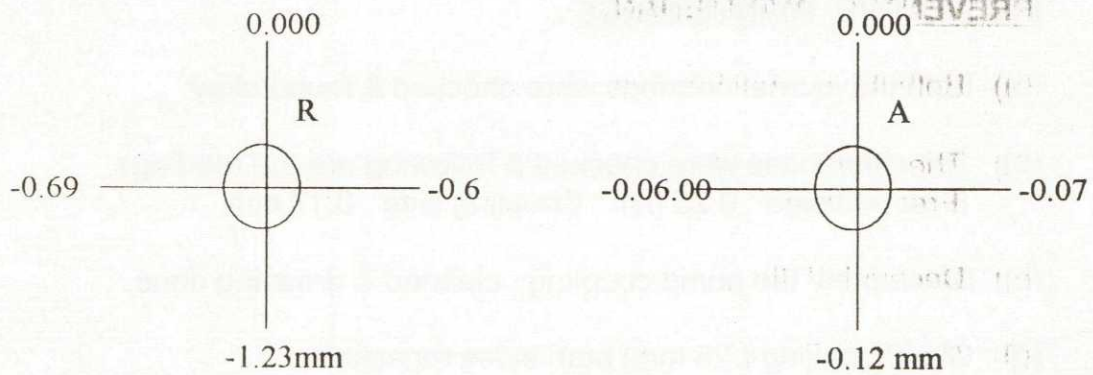
PREVENTIVE MAINTENANCE :

P/M Jobs on this equipment was carried out as per the details

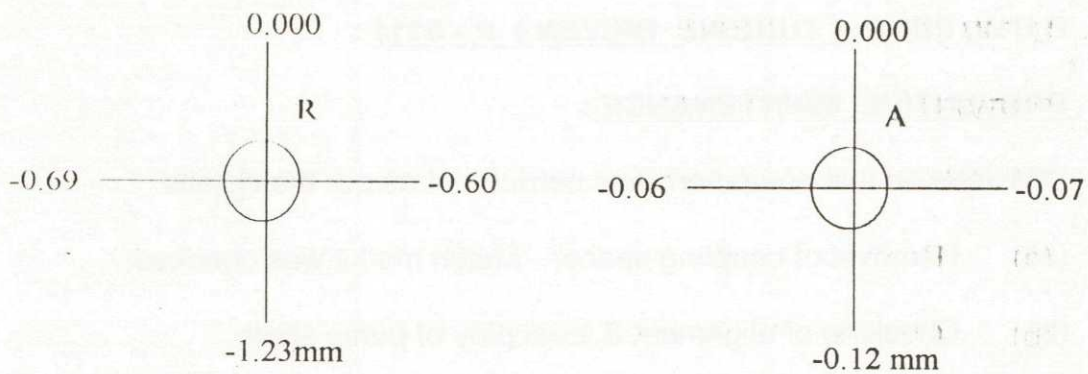
- (a) Removal of coupling spacer - Match marks was checked.
- (b) Checking of alignment & axial play of pump shaft.
- (c) Removal of DE & NDE bearings top halves.
- (d) Cleaning of radial & Thrust bearings.
- (e) Checking radial clearances of bearings using lead wire.

- (f) Alignment readings and bearings clearances were checked.
- (g) Same bearings were assembled after polishing and cleaning.
- (h) Install coupling spacer with reference to match marks.
- (i) Cleaning/replacing oil filters and oil in the oil console.
- (j) Checking oil line, water line for leaks.
- (k) Suction filter of the pump was cleaned.

Alignment Readings: Pump To Turbine-
 (Before Preventive maintenance)
 Dial on Pump Coupling :



After Preventive maintenance



Clearance Details :

Sr. No.	Description	Design Value	Actual Value(BM)	Actual Value(AM)
1	Axial Thrust	0.28 - 0.33	0.19 mm	0.19 mm
2	Radial bearing Clearance coupling end	0.13 - 0.18	0.16 - 0.18 mm	0.16 - 0.18 mm
3	Radial bearing Clearance free end	0.13 - 0.18	0.13 - 0.15 mm	0.13 - 0.15 mm

Float of Coupling : 8.20 mm

B F W PUMP TURBINE (SHIN NIPPON) Q-5111 :**PREVENTIVE MAINTENANCE OF TURBINE :****JOBS CARRIED OUT:**

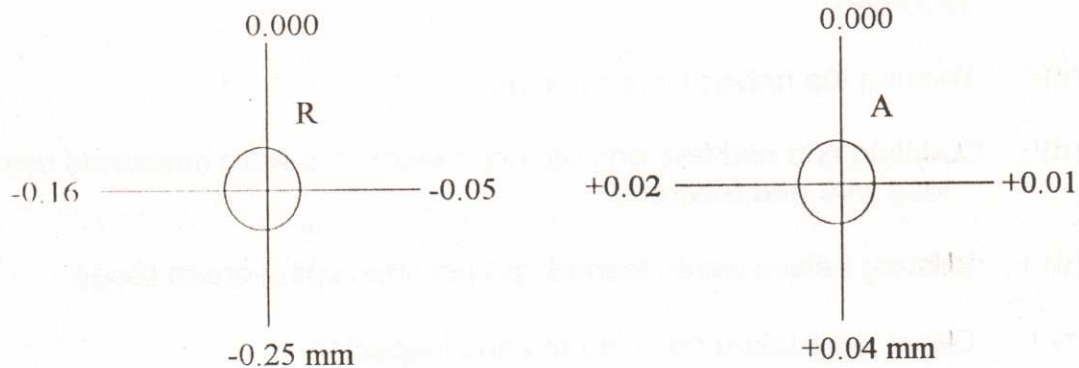
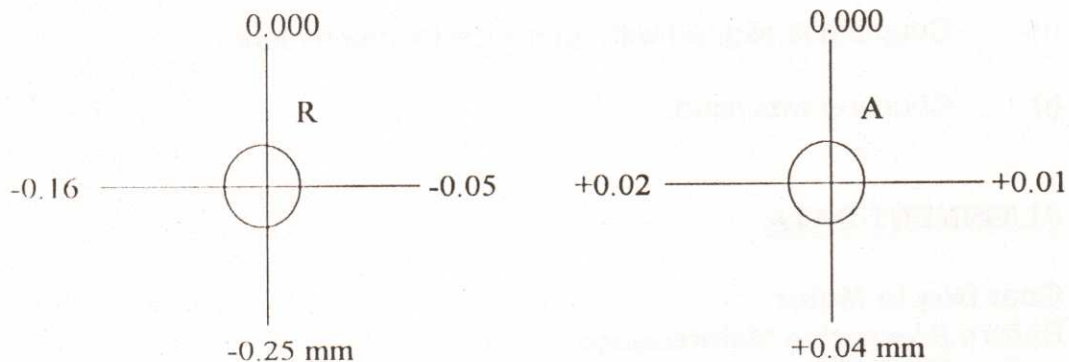
- (a) Couplings between the Pump to Turbine was decoupled after recording the necessary match marks.
- (b) Initial alignment readings and axial float were measured and recorded.
- (c) Bearing top halves were removed .
- (d) Coupling end and free end bearing clearances were measured using lead wire and recorded.
- (e) Bearing pads were cleaned and polished using green rouge.
- (f) Governor assembly was removed.
- (g) Bottom halves of the bearings were assembled, clearance checked and recorded.
- (h) Coupling is aligned with reference to match mark.
- (i) Oil filter was removed, cleaned and re installed.
- (j) Oil cooler was opened and cleaned.
- (k) Oil in the console was drained, cleaned and boxed up.
- (l) Governor was cleaned, lubricated and refited with fresh oil charged.

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

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

- (a) Couplings between the Pump to Gear Box was decoupled after recording the necessary match marks.
- (b) Initial alignment readings and axial float were measured and recorded.
- (c) Bearing top halves were removed .
- (d) Coupling end and free end bearing clearances were measured using lead wire and recorded.
- (e) Bearing halves were cleaned and polished using green rouge.
- (f) Thrust collar and the bearings assembled, clearance checked and recorded.
- (g) Coupling is aligned with reference to match mark.
- (h) Oil filter was removed, cleaned and re installed.
- (i) Oil cooler was opened and cleaned.
- (j) Suction filter of the pump was cleaned.

ALIGNMENT DATA :**Pump to Gear Box****Before Preventive Maintenance : Dial on gear box :****After Preventive maintenance****CLEARANCE DETAILS:****All the values are in mm**

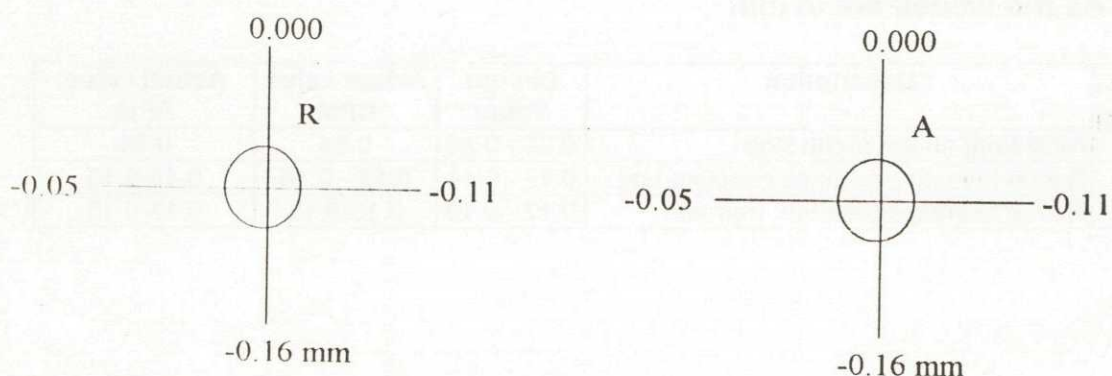
Sr. No.	Description	Design Value	Actual value BPM	Actual value APM
1	Axial float on the pump side	0.28 - 0.33	0.34	0.34
2	Radial bearing clearance coupling end	0.12 - 0.18	0.15 - 0.16	0.15-0.16
3	Radial bearing clearance free end	0.12 - 0.18	0.13-0.15	0.13-0.15

PREVENTIVE MAINTENANCE OF GEAR BOX:**JOBS CARRIED OUT:**

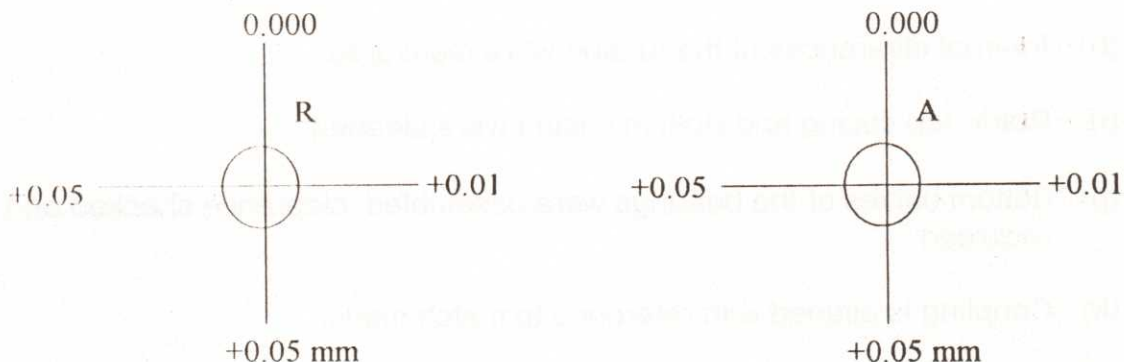
- (a) Couplings between the Gear Box and Motor was decoupled after recording the necessary match marks.
- (b) Initial alignment readings and axial float were measured and recorded.
- (c) Bearing top halves were removed .
- (d) Coupling end and free end bearing clearances were measured using lead wire and recorded.
- (e) Bearing halves were cleaned and polished using green rouge.
- (f) Gears were taken out, cleaned and inspected.
- (g) Gears were re installed. Backlash was checked and noted
- (h) Bearings were assembled, clearance checked and recorded and boxed up..
- (i) Coupling is aligned with reference to match mark.
- (j) Coupling was fixed.

ALIGNMENT DATA :

Gear Box to Motor
Before Preventive Maintenance:
 Dial on Motor:



After Preventive Maintenance : Dial on Motor :



CLEARANCE DETAILS : (All the values are in mm)

Sr. No.	Description	Actual value APM
1	Pinion Axial float	1.28
2	Bull gear axial float	0.23
3	Backlash	0.040-0.42mm
4	Pinion bearing clearance	
	Coupling end	0.18 - 0.19 mm
	Free end	0.18 - 0.19 mm
5	Bull gear bearing clearance	
	Coupling end	0.18 - 0.19 mm
	Free end	0.13-0.14 mm
6	Coupling float motor to GB	4.6 mm

F. D. FAN TURBINE Q-5113 :

OVERHAULING OF F.D. FAN TURBINE:

Overhauling of the equipment was carried out as per the details given below :

- (a) Couplings between the Fan to Turbine was decoupled after recording the necessary match marks.
- (b) Initial alignment readings and axial float were measured and recorded.
- (c) Bearing top halves were removed .
- (d) Coupling end and free end bearing clearances were measured using lead wire and recorded.

- (e) Bearing halves were cleaned and polished using green rouge.
- (f) Outer cover of the turbine casing is removed.
- (g) Top casing of the turbine is dismantled.
- (h) Internal clearances of the turbine were measured.
- (i) Rotor, top casing and Bottom casing were cleaned
- (j) Bottom halves of the bearings were assembled, clearance checked and recorded.
- (k) Coupling is aligned with reference to match mark.
- (l) Oil filter was removed, cleaned and re installed.
- (m) Oil cooler was opened and cleaned.
- (n) Oil in the console was drained, cleaned and boxed up.

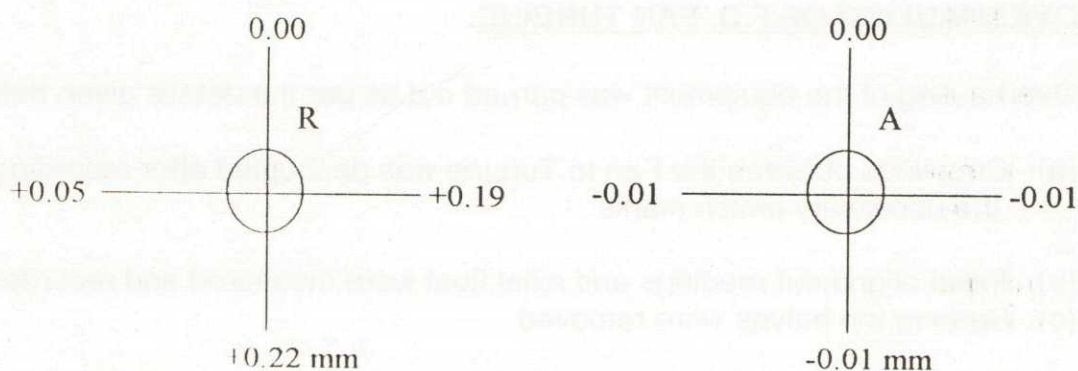
Note : (a) High Speed Pinion was found damaged. (one teeth of pinion was found broken about 2" Long from wheel side) Hence replaced with new. (store code : 335401014)

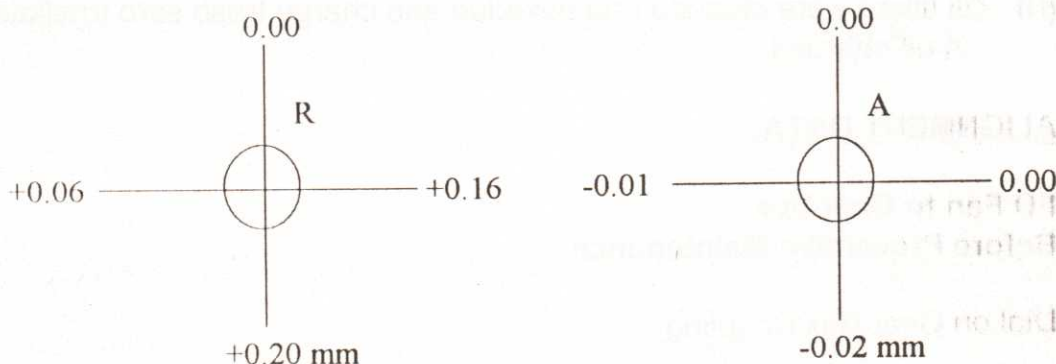
(b) Carbon seals set, consists of 05 nos of rings, were replaced. (store code : 335402007)

ALIGNMENT DATA:

Gear box to Turbine

Before Preventive Maintenance:



After Preventive Maintenance:**CLEARANCE DETAILS: (All the values are in mm)**

Sr. No.	Description	Design Value	Actual value BOH	Actual value AOH
1	Axial float of the Turbine		0.26 mm	0.26 mm
2	Radial bearing clearance of low speed shaft of the gear box coupling end.	0.3	0.12 - 0.12	0.12 - 0.11
3	Radial bearing clearance of low speed shaft of the gear box free end.	0.2	0.1 - 0.11	0.1 - 0.11
4	Radial bearing clearance of high speed shaft of the gear box turbine wheel side.	0.3	0.11 - 0.13	0.11 - 0.13
5	Radial bearing clearance of high speed shaft of the gear box turbine free end.	0.2	0.10 - 0.13	0.12 - 0.13
6	Inlet nozzle to moving blade clearance		1.6	1.6
7	Reversing Nozzle segment to moving blade clearance - Top segment		1.7	1.7
8	Reversing nozzle segment to moving blade clearance - Bottom segment		1.8	1.8

PREVENTIVE MAINTENANCE OF THE FD FAN K5113**JOBS CARRIED OUT:**

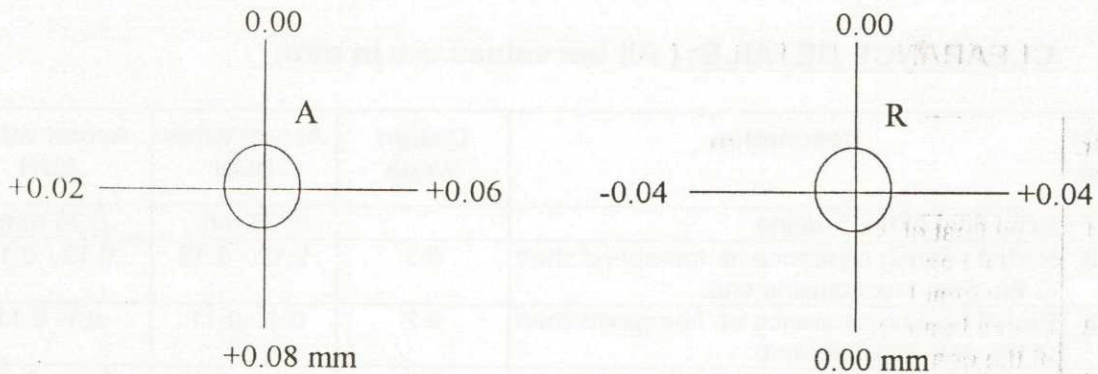
- (a) Couplings between the fan to Turbine was decoupled after recording the necessary match marks.
- (b) Initial alignment readings and axial float were measured and recorded.
- (c) Bearing clearances were measured using lead wire and recorded.
- (d) Coupling is aligned with reference to match mark.
- (e) Bearing housing oil removed, cleaned, oil filled up to the required level.
- (f) Cooling Water lines removed, cleaned, fixed.

- (g) Clutch between motor and FD Fan opened inspected and found in good condition.
- (h) Oil filters were cleaned and boxed up and charge fresh sero trnsfluid - A oil charged.

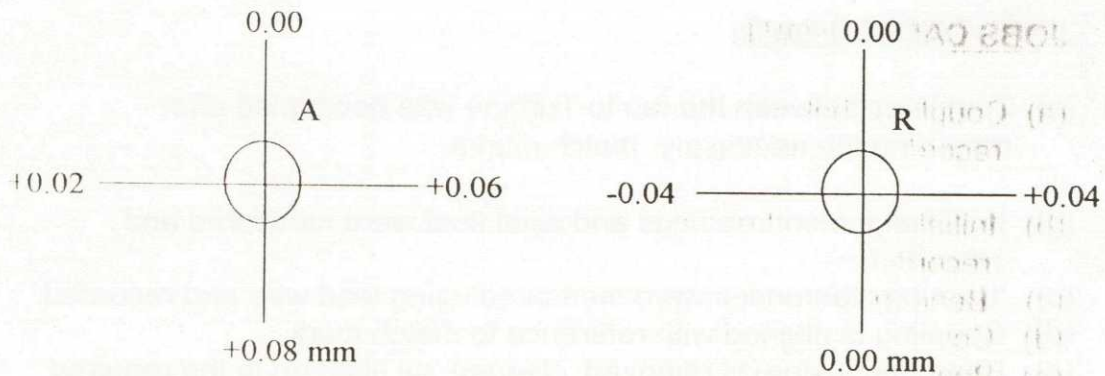
ALIGNMENT DATA:

**FD Fan to Gear box
Before Preventive Maintenance:**

Dial on Gear Box Coupling :



**After Preventive Maintenance:
Dial on Gear Box Coupling:**



CLEARANCE DETAILS : (All the values are in mm)

Sr. No	Description	Design Value	Actual value BPM	Actual value APM
1	Float on Fan shaft	4.1	4.1	4.2
2	Float on Gear box shaft		3.2	3.2
3	Gear coupling gap between FD fan and GB		6.1	6.1
4	Gap between motor and gear box		5.44	5.5

STEAM LEAK JOBS :

- (1) All Steam leak jobs attended as per the Shutdown job list.
- (2) All the steam leak jobs as per the list were attended for cooling water pump turbines.

BHEL BOILER JOBS (F-5111) :

(A) BHEL BOILER INSPECTION :

- (1) Boiler was inspected by Boiler Inspector in open test condition on 05.06.2003. Hydrotest at 90 Kg/cm² pressure was done and witnessed by Boiler Inspector on 12.06.2003.
- (2) All the three safety relief valves were overhauled & tested on 21.06.2003 and their readings were as follows.

Description	Popping Pressure Kg/cm ² g	Reset Pressure Kg/cm ² g
Drum Rear R.V.	72.50	69.30
Drum Front R.V.	69.00	65.60
Super Heater R.V.	64.40	61.50

- (3) F.D.Fan turbine Exhaust 4 ata Header R.V. , 14 ata Automisation line R.V. And 40 ata Soot Blower Header R.V. Dearator R.V. BFW turbine exhaust R.V. And LSHS supply pump turbine exhaust R.V. Were overhauled and tested on test bench.
- (4) Steam drum connected all first and second isolation valves gland packing were repacked.

(C) BHEL BOILER FURNACE AREA JOBS:

- 1) Gas burner nozzles (top and bottom) were inspected and found o.k.
- 2) All inspection window glasses were cleaned and replaced where ever found broken.
- 3) Flue gas leakage observed from front side, side man hole cover flange joint of the mud drum. Hence man hole cover asbestos gasket was replaced with asbestos gland packing rope for proper sealing of the flange joint.
- 4) Damper of burner made free and greasing done.
- 5) All dampers were checked and made free by greasing for smooth operation.

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

- 1) Both the LRB's LRB-1 & LRB 2 were overhauled.
- 2) Nozzle of Lance tube of LRB no. 1 was found damaged hence lance tube with feed pipe assembly were replaced.(code : 335810130 lance tube, 335810010 : feed pipe)
- 3) All the four RB'S were overhauled and boxed up.

RE -GENERATIVE AIR PRE-HEATER H-5111 :

PREVENTIVE MAINTENANCE :

- 1) General condition of Cold End baskets was found ok.
- 2) General condition of Hot End Baskets was found o.k.
- 3) Cold End Radial one Seal was replaced with new one, as the old seal was corroded.
- 4) Radial seal clearances of Hot End side & cold end side adjusted.
- 5) Both End Rotor Bearings (Spherical self aligning, withdrawal sleeve 22330 CCK / C3 / W 33) housing were open for inspection. The condition of bearings were found o.k. Boxed-up and fresh oil charged.
- 6) Bearings Clearances were checked and this is the readings :
 Clearance hot end bearing : 0.025"
 Clearance cold end bearing : 0.020"

- 7) Steam nozzle for swivel type soot blower of RAH unit was cleaned.
- 8) RAH drive Air Clutch Motor Assembly was overhauled.
- 9) RAH Gear Box opened for internal inspection and found okay.

FABRICATION JOBS :

- 1) Degasser Tower in D.M. Plant replaced with new Degasser Tower fabricated at M/S Patels Airtemp (India) Ltd. Ahmedabad and rubberlined at M/S Shri Ram Rubtech Pvt. Ltd. Baroda.
- 2) Raw water pump P-4101-A suction valve replaced with new one.
- 3) P-4404 (Kirloskar make) pump discharge valve 30" BDK make butterfly valve replaced.
- 4) As per steam leak job list, defective steam traps and passing isolation valves were replaced.

PAINTING JOBS CARRIED OUT ON :

- (1) All The Cooling Tower Fans ,
- (2) Cooling water return header on the top of cooling tower (ammonia old urea and new urea).

OTHER JOBS :

P- 4401 C and D pump 900 mm discharge valves were In situ repaired by M/S EFCO, Hyderabad.

INSPECTION JOBS

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1.0 BIHEL BOILER (GT-2068):

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

1.1 STEAM DRUM :

- 1.1.1 The internal surface of the drum had assumed blackish colouration.
- 1.1.2 All the weld joints were found in good condition and free from any corrosion attack.
- 1.1.3 All the internal fittings were found intact.
- 1.1.4 The stub ends of the tubes were found free from defects.
- 1.1.5 Overall condition of the steam drum was found to be satisfactory.

Ultrasonic thickness measurement was carried out. Min. thickness was observed to be 99.7 mm against nominal specified thickness of 97 mm in cylindrical shell area and 78.3 mm on dished end against nominal specified thickness of 77 mm. Detailed report is attached at Annexure - 1

1.2 MUD DRUM :

- 1.2.1 The shell had assumed blackish colouration.
- 1.2.2 The condition of the weld joints was found satisfactory.
- 1.2.3 The tube stub ends were free from any defect.
- 1.2.4 In general, the overall condition of the mud drum was found satisfactory.

Ultrasonic thickness measurement was carried out. Min. thickness was observed to be 82.0 mm in cylindrical shell area against nominal specified thickness of 78 mm and 55.3 mm on dished end against nominal specified thickness of 57 mm / 54 mm min. Detailed report is attached at Annexure - 2

1.3 DEAERATOR :

Inspection of the deaerator head and the storage shell was carried out. Observations are as under

1.3.1 In vertical head, on South side, one spring loaded valve was found in open condition.

1.3.2 Bottom most tray was found lifted upward from North side ,However trays were not loose.

1.4 FURNACE TUBES :

In general, the condition of the furnace tubes and superheater tubes exposed to flue gases was satisfactory. The thickness measurement of Stage-I & Stage-II Primary and Secondary Superheater tubes, Bank tubes, Sidewall tubes, Baffle wall tubes, D-Panel tubes, Cut corner tubes, Rear wall tubes and Front wall tubes was carried out . The detailed report indicating the thickness of individual type of the tubes is mentioned below:

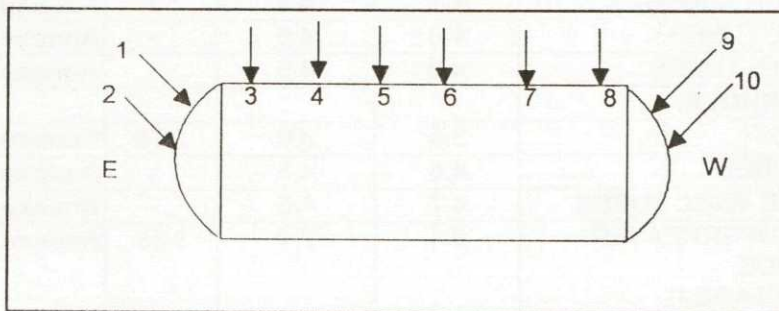
SL. NO.	DESCRIPTION	MIN. THK. (MM)	DESIGN THK.(MM)	% RED.	REFER ANNEXURE
1	SOUTH MANHOLE:				
(A)	BAFFLE WALL TUBES	4.9	4.5	-	Annexure - 3,7
(B)	D-PANNEL TUBES	4.8	4.5	-	Annexure - 3,7
(C)	CUT CORNER TUBES	4.7	4.5	-	Annexure - 3,7
(D)	REAR WALL TUBES	4.8	4.5	-	Annexure - 3,7
(E)	FRONT WALL TUBES	4.8	4.5	-	Annexure - 3,7
2	NORTH MANHOLE:				
(A)	BANK TUBES	3.5	3.6	2.78	Annexure - 4,7
(B)	BAFFLE TUBES	4.8	4.5	-	Annexure - 4,7
(C)	NORTH SIDE WALL TUBES	4.7	4.5	-	Annexure - 4,7
3	PRIMARY SUPERHEATER TUBES INSIDE FURNACE(STAGE-I)	6.4	7.1	9.86	Annexure - 5,7
4	SECONDARY SUPERHEATER TUBES INSIDE FURNACE (STAGE-II)	4.9	5.6	12.5	Annexure - 6,7

ANNEXURE -1

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THICKNESS MEASUREMENT REPORT OF STEAM DRUM

<u>SHELL</u>				
POINT NO.	TOP	BOTTOM	NORTH	SOUTH
3	100.9	100.4	102.1	100.8
4	-	-	100.9	101.5
5	-	-	100.9	100.3
6	-	-	101.6	100.2
7	101	100.8	100.3	101.4
8	100.9	101	99.7	100.6
<u>DISH END:</u>				
POINT NO.	TOP	BOTTOM	NORTH	SOUTH
1(E)	78.3	79.6	79.7	79.7
2(E)	82	82.8	82.2	82.5
9(W)	82.1	80.4	82.2	80.2
10(W)	79	79.4	79.6	79.8

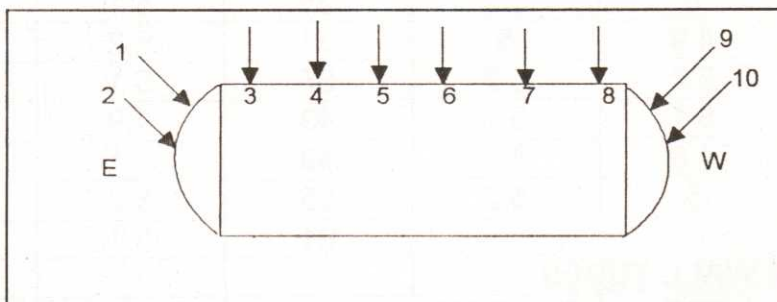


ANNEXURE -2

268

THICKNESS MEASUREMENT REPORT OF MUD DRUM

<u>SHELL :</u>				
POINT NO.	TOP	BOTTOM	NORTH	SOUTH
3	82.3	82.2	82	82.3
4	82.4	82.6	82.1	82.2
5	82.7	82.6	82.1	82.1
6	82.2	82.5	82.6	82.5
7	82.3	82.5	82.7	82.6
<u>DISH END:</u>				
POINT NO.	TOP	BOTTOM	NORTH	SOUTH
1(E)	58.9	58.3	58.4	58.1
2(E)	56	57.2	55.3	58.7
8(W)	56.2	56.4	58.2	56.5
9(W)	57.9	58.2	57	58.7



ANNEXURE -3

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THICKNESS MEASUREMENT REPORT OF D-PANEL TUBES ,CUT CORNER TUBES, REAR WALL TUBES, FRONT WALL TUBES AND BAFFLE WALL TUBES :

D-PANEL TUBES			FRONT WALL TUBES:		
TUBE NO.	TOP	BOTTOM	SL. NO.	TOP	BOTTOM
2	5.1	5.1	2	4.8	5
8	5.1	4.9	8	5	4.9
14	5	5	14	5	4.9
20	4.9	5	20	5	4.9
26	4.9	5	26	5	4.9
32	5.1	5.1	32	4.9	4.9
38	5.1	5.1	38	5	5
44	5	4.9	44	5	4.9
50	4.8	4.9			
56	5	5	BAFFLE WALL TUBES:		
62	5.1	5.1	SL. NO.	TOP	BOTTOM
68	5	5	1	5	5
			7	4.9	4.9
			13	4.9	4.9
CUT CORNER TUBES:			19	5.1	5.1
TUBE NO.	TOP	BOTTOM	25	5.1	5
70	5	5.2	31	5.2	5.2
80	4.9	5	37	5.1	5
86	5.2	5.2	43	4.9	4.9
82	5.1	5.1	49	5.1	5.2
98	4.8	4.7	55	5.2	5.1
104	5	5.2	61	5.1	5.1
REAR WALL TUBES:					
TUBE NO.	TOP	BOTTOM			
110	4.8	4.8			
116	5.1	5			

ANNEXURE -4**THICKNESS MEASUREMENT REPORT OF BANK TUBES, BAFFLE WALL TUBES AND SIDE WALL TUBES :**

<u>BANK TUBES "A" WALL</u>		
TUBE NO.	TOP	BOTTOM
1	3.6	3.5
6	3.6	3.6
11	3.5	3.5
<u>BANK TUBES "B" WALL</u>		
TUBE NO.	TOP	BOTTOM
14	3.5	3.6
16	3.5	3.6
<u>BANK TUBES "C" WALL</u>		
TUBE NO.	TOP	BOTTOM
19	3.5	3.5
24	3.6	3.5
29	3.5	3.5
<u>BAFFLE ("D") WALL TUBES:</u>		
TUBE NO.	TOP	BOTTOM
2	4.8	4.9
8	4.8	4.9
13	4.9	4.9
<u>SIDE WALL TUBES:</u>		
TUBE NO.	TOP	BOTTOM
2	4.9	5
8	4.9	4.9
0	4.8	4.8
20	4.7	4.9

ANNEXURE -5

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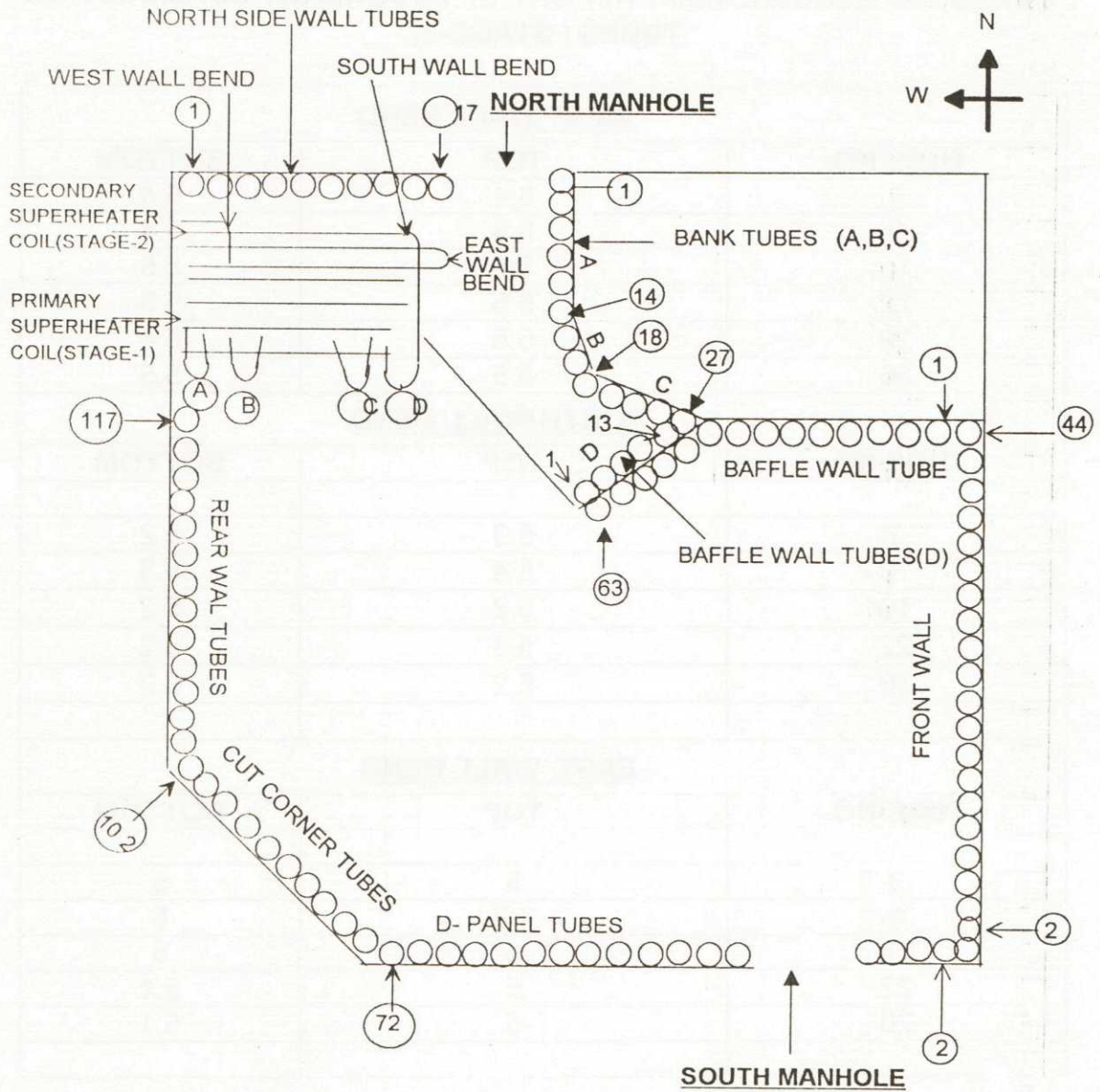
THICKNESS MEASUREMENT REPORT OF PRIMARY SUPERHEATER TUBES
(STAGE-1):

BEND-A		
TUBE NO.	TOP	BOTTOM
0	6.6	6.7
7	6.5	6.6
15	6.6	6.5
21	6.5	6.6
27	6.6	6.7
34	6.6	6.8
40	6.9	6.7
BEND-B		
TUBE NO.	TOP	BOTTOM
3	6.9	7
9	7	6.9
10	6.8	6.9
22	7	6.7
28	6.9	6.8
34	6.8	7
40	6.9	7.1
BEND -C:		
TUBE NO.	TOP	BOTTOM
1	6.6	6.4
7	6.4	6.7
13	6.7	6.5
19	6.6	6.5
25	6.4	6.7
31	6.5	6.6
37	6.6	6.7
BEND-D		
TUBE NO.	TOP	BOTTOM
2	6.4	6.5
8	6.5	6.7
15	6.6	6.5
21	6.6	6.5
27	6.7	6.8
33	6.7	6.5
39	6.5	6.4

ANNEXURE -6**THICKNESS MEASUREMENT REPORT OF SECONDARY SUPERHEATER
TUBES (STAGE-2):**

<u>WEST WALL BEND</u>		
TUBE NO.	TOP	BOTTOM
0	5.4	5.4
9	5.5	5.4
15	5.4	5.5
22	5.6	5.5
29	5.5	5.4
36	5.5	5.5
<u>SOUTH WALL BEND</u>		
TUBE NO.	TOP	BOTTOM
2	5.3	5.2
10	5.4	5.3
16	5.2	5.2
22	5.3	5.2
30	5.2	5.2
<u>EAST WALL BEND</u>		
TUBE NO.	TOP	BOTTOM
3	5	5
9	4.9	5
15	5	5
22	5	5.1
28	5	5.1

ANNEXURE -7



**BHEL BOILER FURNACE LAYOUT
(GT-2068)**

CIVIL JOBS**(A) WATER TREATMENT PLANT :**

- 1) Repairing of acid proof brick linings in strong effluent tank no. A & B.
- 2) Replacement of acid proof brick lining of top of wall weak effluent sump.
- 3) Repairing of supports for pipeline in Water treatment plant & floor of H₂SO₄ tank near cooling tower sump side.
- 4) Repairing of floor by bitumastic lining in the acid unloading area surrounding of equipment of DM plant.
- 5) Maintenance of strong and weak effluent channel and repairing of strong as well as weak effluent chambers in water treatment plant upto effluent tank.
6. FRV lining work for strong effluent channel and open channel near lagoon phase B area.

(B) BOILER HOUSE :

- 1) Repairing of casting refractory for burners side, floor and superheated zone inside BHEL boiler.

ELECTRICAL JOB

1. Preventive maintenance carried out on TR-1B, TR-2A, TR-2B, TR-3A, TR-3B, TR-4A, TR-4B, TR-8, TR-10, TR-11, TR-12 & TR-13 The jobs carried out on each transformer are as under :
 - A) Inspection of cable end termination in primary and secondary cable boxes, checking and tightening of connections, replacement of gaskets of box cover.
 - B) Overhauling of transformer Tr-12 and TR-14 by cleaning of core with hot oil, attending all the leakage with replacement of Gaskets, tightening of bolts, replacement of oil, etc.
 - C) Checking the condition of oil in marshaling boxes of HT and LT side marshalling box of Tr-2A, Tr-2B, Tr-3A, Tr-3B, Tr-4A, Tr-4B, Tr-8 cleaning of chamber, filling of oil up to fill up level.
 - D) Reactivating of silica gel of silica gel breather and filling up of oil in breather up to fill up level of above transformer. Filling up of oil in OTI oil pot Replacement of damaged silica gel breather of Tr-12 with new one. Replacement of damaged OTI of TR-1B, Tr-12, Tr14 and Tr-13 with new one.
 - E) Checking of Buchholz relay, MOG , trip alarm circuit and cleaning of emergency trip boxes. Replacement of damaged buchholz realys of Tr-12, Tr-8, Tr-2A, Tr-4A with new one. View glass of oil gauge of Tr-11, Tr-2A, TR-13 were replaced. Damaged MOG of Tr-3B was replaced with new gauge.
 - F) Turn ratio test, short circuit test, magnetic balancing test, measurement of insulation resistance carried out of each transformer.
 - G) Break down voltage test of transformer oil carried out of each transformer.
 - H) Attending all the leakage on the transformer by replacement of Gaskets and/or tighteneing of bolts.
 - I) Painting of transformers Tr- 3A, Tr-3B, Tr-8, Tr-12 and Tr-14.
 - J) Preventive maintenance of OLTC of transformer Tr-1B and attending all the leakages.

2. Preventive maintenance all feeder compartments mounted in MCC-1, MCC-2A, MCC-2B/2E, MCC-3, MCC-8 and MCC-11 carried out as under:
 - A) Cleaning and de-dusting of all the feeder compartment.
 - B) Checking of cable terminal heating of power and control cables and repairing of burnt/damaged terminals.
 - C) Checking of terminal tightness of power and control cable.
 - D) Checking /Testing of air circuit breakers installed in panels.
 - E) Providing new connection for making available emergency power to N/E feeder of MCC-3 by laying and termination of 3 ½ c x 70 mm.sq. AYFY PVC cable from new extension feeder No. 2R4 to existing feeder No. 11 sec.B. Now emergency power will be available from N/E emergency feeder of MCC15 after power failure. Old cable, provided for this purpose, were disconnected at both ends.
 - F) Modification job carried out in MCC -2A. Auto change over scheme is introduced to changeover from emergency power breaker to normal power breaker as DG set OFF.
 - G) Replacement of damaged /burnt component/ parts of feeder compartment.
3. Overhauling of motors of following equipment :

P 4405A, P4412, P4406, BFW shut off main valve, BFW shut off bypass valve, H5111, P5111A, P5111B, P5112A, P-5112/B, P-5115/A, P-5115/B and P-4402
4. Preventive maintenance of 11 KV VCB panels by carrying out following jobs :
 - A) De-dusting, cleaning of all feeder compartments
 - B) Checking terminals of all power and control cables.
 - C) Checking for closing and tripping operation of all the VCBs.
 - D) Upgrading the DC main fuse for Jyoti make 11 KV panels by replacement of 16 Amp fuse base with 125 Amp. rated fuse base.
 - E) AC power supply for 'Enercon' meters of 'Jyoti' panel from normal supply feeder to Emergency supply feeder of MCC-16.

5. Preventive maintenance of 2.2 MW AMF set and battery pannels.
6. Preventive maintenance carried out in 66 KV switchyard by carrying out following jobs
 - A) Cleaning of insulators of all the CT & PT units, bus bar support, lightning arrester, breakers , etc.
 - B) Checking alignment and lubricating of all isolators at 66 KV switchyard for Proper opening and closing.
 - C) All the MOCB (52-B, 52 F, 52G and 52L) were cleaned and overhauled. Breakers mechanism operation were checked and leakage was attended.
 - D) Insulation resistance of all the CT units were measured.
7. Installation, commissioning and testing of new 'BHEL' make MOCB for 52-A breaker and removing of old BOCB.

INSTRUMENTATION JOBS

BHEL BOILER PLANT

CONTROL ROOM PANEL INSTRUMENTS :

- (1) Following Receiver / Recorders were cleaned, checked and calibration was carried out.
- (2) General cleaning, Cleaning of Orifices, Flapper Nozzle, seal checking was carried out)
- (3) PR1 / PR2, PRC5, PR15, PRC 22, PIC5151, FR2/FRC1, FR3/FR4, TRC4, LRC2, LRC3, LRC 4, FRC11/PR15, FRC22, FRC21/FR 22.
- (4) Following Set point Tx. were cleaned and checked calibration was carried out.
- (5) FR3/FR4, TRC4, LRC3, FRC1, LRC2, PRC5, FRC11, FRC21, FRC22, PIC5151, PIC 22.
- (6) (Gas pressure controller)
- (7) Following Controllers were cleaned and checked/carried out the Synchronization.
(Cleaning of Orifices, Flapper Nozzle)
- (8) TRC4, LRC3, FRC1, LRC2, PRC5, PIC 22, FRC11, FRC21, PIC 5151.
- (9) Following Receiver switch set value were checked.
- (10) PSL2, PSL 7, LAL 3, LAH4, PSL 8, FSL 5111, PSL 6, FSL 2, FSL 11, FSL 2, PSL 4, PSL 41, TIA6, LSL-1, LSL-2, LSL-3, PAL-4, PSL-11, PSH-12, PSL-28,, PSL-29, PSL-22 ,PSL-223.
- (11) Following Temp. Indicator / Recorder were cleaned and checked.
- (12) TIA 6, TIA 7, TIA 14, TR 13.
- (13) Air regulators behind Control Panel were cleaned , overhauled.
- (14) Following Square Root Extractor 's relay, flapper - Nozzle were cleaned.
- (15) FSQ 1, 2, 3, 4, 11, 21, 22,

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- (16) All wiring terminals of BMS Panel & Main Control Panel were cleaned and tighten.
- (17) Steam Drum: EYE - HYE Electrodes were checked. damaged terminal wire lugs were replaced by new ones.
- (18) Cleaned the Old O2 Analyzer (J.N.Marshall make) Sampling system (sample pipe & filter)
- (19) New In-Situ Zirconia Oxygen analyzer was installed and commissioned. Calibration was checked with std. O2 Cylinder. The performance of analyzer was found O.K.
- (20) Field Controllers: Cleaning and synchronization of the following field controllers was carried out : DPC-1, PIC-21, PIC-50, LRC-4, LRC-3, PIC-2. PIC 1, PIC-2, LRC-3 (Blow Down Tank level controller), Soot Blower steam pressure controller, Oil Header Pressure controller.
- (21) Removed the TRC-5 Pneumatic Controller as Electronic controllers (TRC 5) was working satisfactory since last year.
- (22) Painted the Boiler Control panel and BMS panels.

UPSS. SYSTEM :

- (1) Checked the performance of batteries for M/s I.L. make UPS System by taking 30 minutes load on batteries. and found satisfactory.

FIELD JOBS :

- (1) Following Flow transmitters and air regulators were cleaned and checked /carried out the calibration of Tx / Receiver gauge.

FT -1, FT-2 (Pneumatic & Electronic Both), FT- 3, FT-11, FT-13,
DPT-1, DPT-14, DPT-12.

- (2) Installed the FT-11 smart type electronic flow transmitters in parallel with existing pneumatic TX.

Note : Glycol was filled in impulse line of FT-21,PSL-21,PSL-23, PAL-25,PT-(oil header press.) LT- (Day tank level tx). Day Tank local level indicator float was replaced.

- (3) Following Pressure transmitters and air regulators were cleaned, checked, calibration carried out (calibration of Tx / Receiver gauge)

PT-1, PT-2, PT- 4 &4a, PT- 5&5a, PT-6, PT-7, PT-21, PT-22, PT-41, PT-50, DPI-1, DPT-12.

- (4) Following Level Transmitter and regulators were cleaned and checked the calibration of Tx Receiver gauge LT 1, LRC 2, LRC 4, LT-3 (Blow Down Level Tx), LT-5 (LT5 : Location of Tx. shifted at parallel to bottom of oil tank)

- (5) Following pressure&level switch were cleaned and checked/Calibrated the set value.Day Tank High/Low Level , Dearator Extra low level, low level, High level, Drum level Extra low level (LSLL 1),LAL 2, LAH 3, LAH 4,PAL 5114, PLCI 5112, PLCO 5111, PAL5115, PLCI 5114, PLCO 5113, PAL 5114, PLCI 5113, PLCI - 5112, PSH 12, PAH 11,PSL 2, PSL 7,PAL 4,PSL 6, PSL 8,FSL 2,FSL 11,PSL 41,PSL 24, PSL 25, PSL 26, PSL 27(LSL-1 (Drum Level Extra low)

- (6) Limit Switches :

- a) Cleaned limit switches of Burner no 1 & 2 main gun engagement
- b) All BTV's limit switches(BTV 1-1, 1-2,1-3,BTV 2-1,2-2,2-3)were cleaned and checked it's operation. Found OK.
- c) HOHTV, IGTV, CCV21,CCV22 limit switches were cleaned and checked it's operation
- d) All Manual Main Gun Oil / Atomizing Valve limit switch were cleaned and checked operation. Found OK.
- e) All Fuel Air Damper's limit switch were cleaned and checked it's operation.
- f) Following Drum Pressure gauges were calibrated for production requirement for Boiler hydro testing PI-2, PI-3, PI-4, PI-5, LI-1 (Receiver Gauge)

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(7) CONTROL VALVES :

Following control valves & it's positioner were cleaned and checked the stroke.

- a) PCV-2, LCV-4, PCV-1, TCV-1, Oil Header Pr. C/V, PRV-2, Dearator overflow C/V.
- b) 4 ata Vent valve (Seat lapping in Dearrator Over Flow valve carried out for passing problem.)
- c) BTV 1-1, BTV 1-2, BTV 1-3, BTV 2-1, 2-2, 2-3, HORV, HOHTV, GHTV, IGTV
(Checked Diaphragm of all BTV valves. Replaced diaphragm in BTV1-2, BTV)
- d) PICV-50: New control valve M/s MIL make with positioner is installed and provide necessary tubing and fittings.
- e) FCV 1 (100 %BFW) : Replaced the Trim set with new one for reduce the noise. All gaskets of seat, body were replace with new. Overhauled and checked the stroke.
- f) CCV-21 : Replaced the Plug stem with new one as old one was found damaged. Overhauled the valve and positioner and checked the stroke.

(8) DAMPERS :

Following dampers overhauling and checked its operation.
(Checked/overhauled limit switches, solenoids, air regulators etc.)

- (a) Fuel Air Damper , (b)F.D. fan inlet damper and its valve positioner.
- (c) F.D. fan outlet damper. (d)Air heater inlet damper. (e) Air heater outlet damper.

(9) IGNITORS :

- * Both Burner's ignitor gun & spark plug cleaned and checked. Found OK.
- * Ignitor gas solenoid valve overhauled and checked. Found OK
(During Boiler start up , both burner's ignitor gun & spark plug were not working due to accumulation of water particles in gas. Replaced with new ignitor gun with spark plug in burner No. 2. and Replaced repaired ignitor gun with spark plug in burner No.1 .Both burner ignitor gun is OK now.)

- * Both gas & Oil flame scanners were cleaned and checked operation found OK.
- (10) All furnace draft point /impulse lines were flushed with 7.0 kg/cm² air.
- (11) Following solenoid valves were cleaned and checked operation.
 - * BFW Turbine governor oil trip.
 - * FD Fan turbine governor oil trip.
- (12) Furnace Temp T/C with thermow ell was found burnt. Replaced with new one.
- (13) Removed and Reinstalled following instruments as per mech. requirement.
 - Pressure switches of BFW pump(Motor/Turbine driven) , tacho generator, THI & PI.
- (14) Attended plant start up jobs.
 - * New Ignitor provided in Burner No.1 & 2.
 - * PT-4 Steam Pr.(60 kg/cm²) Tx. impulse line leakage
 - * Oil Burner No.1&2 "ON" indication did not come, attended it.(by adjusted of limit switch.)

D.M. W. Plant

- (1) Control Valves.
 - Following control valve's overhauling/cleaned positioner, checked the stroke.And carried out painting of Anion I, II, III, IV, V.
- (2) Cleaned and tightened all wiring terminals behind the Control panel.
- (3) Following controller YBL.MakeUS-1000&Rockwin make flow totalizes installed in control panel..
 - (a) Anion flow totaliser and cation flow totaliser & flow controller.
 - (b) R.W. tank inlet, R.W. To D.M.P, C.T. make-up, R.W. To C.T, D.M Water F.T. S.P.C. inlet F.T.
- (4) Painted the D.M. Plant Control panel
- (5) Relocate level transmitter of NH₄OH tank & calibrated in 0 to 2.5 mtr.
- (6) Painted 15 nos. control valves.

NH3 STORAGE :

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

Control valve:- Following control valve's positioner, air regulator, stroke checking and painted. LIC-3051, LIC-3058, LIC-3055, LIC-3053, LIC-3064, PIC-3065, EMV 3001, ESDV, PCV 3008 and New Tank Flare Stack panel

- (2) PIC 3103 Local Controller were cleaned and synchronized.
- (3) K-3101 NH3 Compressor Full / Half Load Pressure switch were setting value checked.
- (4) All control valves & it's local controller related 3 LSHS Tank A ,B and C were overhauled and checked the operation.
- (5) All electrical JB , RTD JB were cleaned and tightened all wiring terminals.
- (6) All SLPC indicators / controllers 40 / recorders , Hybrid Recorders were cleaned and checked the Back up Battery.
- (7) Cleaned, checked and tightened all terminals inside old panel, new panel, PLC panel.
- (8) Main control panel in the cotrol room was painted.

COOLING TOWER :

- (1) Following Flow/Pressure/Level Tx. were cleaned / overhauled and calibrated Raw Water Inlet Flow Tx.(Annubar - 24 " line cleaned the flow element), C.T. Basin. level Tx, Q-4401A/B Steam Flow To Turbine Tx(FT 1090). Q-4403 Stea Flow to Turb Raw Water Tank to C.T.Flow Tx., FT 1091 Condensate flow, Surface cond . Lvl Tx.
- (2) Following Pressure/ Level Switch were cleaned and checked the set value. Surface cond. High-Low, High-High level switch.
- (3) Q-4403-B Turbine:- New speed pickup unit (Becon make) was installed to indicate speed in Ammonia control room & boiler control room.
- (4) Checked and tightened all wiring terminals of control panel.
- (5) Q-4411 Turbine. North and south side radial vib probes , speed pickup unit was removed and installed as per mech. Requirement.

(6) M-4403 Motor winding temperature indication signal cable were replaced by new cables.

(7) Q-4403 B Turbine :- MICV 4403 B Control valve was installed and required control wiring and tubing was carried out by working with General Engineering Section.

I.G. Plant : Attended all running jobs.

Weigh Bridge (Main Gate) :

(1) Following jobs have been carried out .
(Service engineer From M/s Ashbee Systems Pvt. Ltd. came to attend the job)

- * Cleaned the digital indicator/Computer .
- * Cleaned the weigh bridge inside as well as outside
- * Checked the alignment & Overhauled of load cell mounting assembly. It was found O.K.

TECHNICAL DEPARTMENT JOBS

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MECHANICAL JOBS :

- 1) Auto startup of motor driven LSHS SUPPLY PUMP IN BHEL boiler (EWR-SG-59)

Individual check valve with drain has been provided in the discharge line of all three fuel oil charge pumps.

- 2) Vent Silencer in 4 ata steam line installed in BHEL Boiler area.

(B) INSTRUMENTATION JOBS :

- 1) Ultrasonic level indicator on sulphuric acid tank is installed in cooling tower area & its commissioning with its indicator & there interconnections are completed.
- 2) Steam tracing of newly installed check valves oil day tank area in boiler area completed.

MECHANICAL JOBS

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RECLAIM MACHINE M-2116 :

Following jobs were carried out during plant turnaround-2003.

- 1 Replacement of bucket elevator structure. Overhauling of top and bottom bucket shaft assembly. Overhauling of complete bucket chain assembly and replacement of buckets.
- 2 Centering of king-post with respect to pivot centre within 70 mm.
- 3 Over hauling of Link conveyor belt conveyor. Carried out cleaning and over hauling of carrier rollers & return rollers. Also rectified skirt sealing system.
- 4 Replacement of Link conveyor gear box.
- 5 Lower pivot assembly replaced by new one with new mounting plates. New pivot mounting structure fixed in position.
- 6 Scrapper shaft of Gear-train replaced with new bearings and brg. Housings (Inner and outer).
- 7 New platform provided on the top of bucket elevator.
- 8 Both chain sprockets of top bucket elevator shaft replaced.
- 9 Bucket elevator chain inspected and damaged pins, circlips and chain-links etc. replaced.
- 10 Thruster oil replaced and brake shoes checked.
- 11 Fluid coupling oil replaced.
- 12 Coupling bushes of main gear - box FC-16 coupling replaced.
- 13 Removal and refixing of operator's cabin. Roof of cabin provided with white sintex pvc section along with aluminium frame and ceiling for heat insulation.
- 14 Swing gear box coupling bushes replaced.
- 15 Hub and lantern pinion assembly dismantled and assembled after checking the gap and condition of shear pins.
- 16 Carrying Roller base frame assembly replaced.

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- 17 All swing rack pins replaced with new pins & greasing done.
- 18 Replacement of wire rope for hoisting mechanism. Cardium compound provided on wire rope.
- 19 Pedestal bearings of both rear and front axle checked and greasing done.
- 20 Limit switch set for maximum up and down movement of scrapper arm.
- 21 Complete greasing of all greasing points and bearings of reclaim machine carried out.
- 22 Bracket rollers inside bunker of reclaim machine replaced.
- 23 4 No. of sheave pulley of hoisting mechanism replaced.
- 24 Complete cleaning and painting of Reclaim machine.
- 25 Trial & Testing.

PREVENTIVE MAINTENANCE OF PACKER SCALES :

Following preventive maintenance jobs were carried out in all packer Scales i.e. Packer scale No. 1,2,3,4,7 and 8.

- 1 Replacement of damaged doors.
- 2 Over hauling of coarse and fine feed gate assembly.
- 3 Over hauling of bottom flapper assembly.
- 4 Servicing of all cylinders.
- 5 Over hauling of sack grip assembly.
- 6 alignment of stabiliser plate.
- 7 Overhauling of bucket assembly.
- 8 Calibration of packer scales.

PLANT TRANSFER CONVEYOR M-2110 :

Following jobs were carried out.

- 1 Replacement of Gear Box of M-2110 conveyor along with oil-seals, coupling bolts, coupling rubber bushes and oil. Coupling done after proper alignment.
- 2 M--2111 diverter Flapper valve attended for proper sealing and easy operation. Greasing of bearings carried out.
- 3 Head pulley brush roller serviced.
- 4 All damaged return rollers removed, serviced for free rotation and refixed after replacement of rubber disks and sleeves.
- 5 All damaged and noisy carrier rollers and guide rollers replaced.
- 6 All pedestal bearings of snub pulley, head pulley, tail pulley and gravity pulley checked and greasing done.
- 7 Complete cleaning and painting of structure done.
- 8 Damaged belt portion of the conveyor replaced with 15 Mtrs. of new 800 mm wide conveyor belt and vulcanising of new joins carried out.
- 9 Provided two Nos of HOSCH make Tracker rollers on return side to prevent sway of conveyor belt.

FRESH UREA SHUTTLE CONVEYOR M - 2112 :

Following jobs were carried out

- 1 Gear box overhauled and aligned with motor and conveyor. Replaced oil seals and coupling bushes.
- 2 All noisy and damaged carrier, guide and return rollers replaced with new rollers.
- 3 Greasing done in all brgs. of head pulley, tail pulley, snub pulley and gravity pulley.
- 4 Complete cleaning and painting of conveyor structure done.
- 5 Provided two Nos of HOSCH make tracker rollers on return side to prevent belt sway.

6 Gear box of Tripper of M-2112 conveyor over hauled and realigned with motor. Checked it's drive chain.

RECLAIM CONVEYOR M-2117 :

Following jobs were carried out

- 1 Over hauling of gearbox and replacement of oil seals, oil, coupling bolts and bushes. Coupling done after proper alignment.
- 2 All damaged return rollers, carrier rollers and impact rollers replaced with new rollers.
- 3 Complete greasing of all bearings of head pulley, tail pulley, snub pulley and gravity pulley.
- 4 Damaged deck plate of conveyor replaced.

BAGGING FEED CONVEYOR M-2121 :

Following jobs were carried out

- 1 Gear box attended for proper cleaning, alignment and coupling. Gear box oil replaced.
- 2 Diverter flapper valve of M-2121 conveyor attended for free and easy operation. Air cylinders overhauled.
- 3 Head pulley scrapper rubber (12 mm thk.) replaced and serviced for free operation.
- 4 Complete skirt board sealing system repaired and replaced damaged skirt blocks.
- 5 Return rollers and carrier rollers removed and replaced with new rollers.
- 6 One No extra Self aligning belt tracking roller provided to prevent off-centre of the belt.
- 7 Damaged portion of Conveyor belt replaced with approx. 25 meters of new conveyor belt.
- 8 Complete greasing of all pedestal bearings done.
- 9 Complete cleaning and painting of structure done.

BAGGING HOPPER FEED CONVEYOR M - 2122 :

Following jobs were carried out

- 1 Gear box of M-2122 belt conveyor attended for replacement of coupling bolts, bushes, oil-seals and oil. Complete cleaning and painting of gear box done. Coupling done after proper alignment.
- 2 Diverter plate of 3 and 4 hopper overhauled.
- 3 Skirt rubber with inner rubber sheet replaced.
- 4 Gear box of tripper of M-2122 conveyor overhauled.
- 5 All damaged return rollers and carrier rollers replaced by new rollers.
- 6 Conveyor belt repaired.
- 7 Complete greasing in all bearings done.
- 8 Complete cleaning and painting of conveyor structure done.

BELT CONVEYOR M - 2122 A/B :

Following jobs were carried out

- 1 Both gear boxes overhauled.
- 2 All damaged return rollers replaced with new rollers.
- 3 Skirt rubber replaced.
- 4 Repaired damaged conveyor.
- 5 Cleaning and painting of complete structure.

DUST CONVEYOR :

Following jobs were carried out

- 1 Replacement of oil, oil-seals, coupling bolts and bushes.
- 2 All damaged return rollers overhauled.
- 3 All carrier rollers attended for free operation.
- 4 New skirt rubber with inner rubber sheet provided.
- 5 Complete greasing of all bearings done.

SLAT CONVEYOR M-2124 (1 - 6) :

Following jobs were carried out on all six slat conveyors
All six slat conveyors attended for :

- (1) Replacement of wooden slats . In slat conveyor No.2 all wooden slats replaced with HDPE slats.
- (2) Gear box servicing.
- (3) MPG and MHT-60 bearing servicing and greasing.
- (4) Conveyor adjusting mechanism servicing.
- (5) Cleaning and painting of all slat conveyors.

PAY LOADER CONVEYOR M-2113

Following jobs were carried out.

- 1 Overhauling of carrying and return rollers.
- 2 Replacement of gearbox oil, coupling bushes and checking of alignment.
- 3 Replacement of complete deck plate.

CIVIL JOBS

Following jobs were carried out during plant turnaround-2003.

1. Repairing of Walk way for conveyor belt inside the Silo by epoxy monolithic plaster.
2. Epoxy painting of Transfer tower and conveyor gantry from silo to B& MH.
3. Repairing of Hopper floor / packer scale floor with the use of epoxy monolithic plaster.
4. Epoxy painting of RCC columns, ceiling, slab, beams, and other RCC structure in Bagging plant .
5. IP Net painting for the external surface of conveyor gantry from silo to B&MH plant and screen house.
6. Alluminium frame work and glass fixing for reclaim machine in silo.

ELECTRICAL JOBS

1. Preventive maintenance carried out on TR-5A and TR-5B. The jobs carried out on each transformer are as under :
 - A) Inspection of cable end termination in primary and secondary cable boxes, checking and tightening of connections, replacement of gaskets of box cover.
 - B) Testing of oil of HT and LT marshaling boxes, cleaning of chambers and filling of oil up to fill up level.
 - C) Reactivating of silica gel of silica gel breather and filling up of oil in breather up to fill up level of above transformers. Filling up of oil in OTI oil pot.
 - D) Checking of Buchholz relay, MOG, trip alarm circuit and cleaning of emergency trip boxes. Buchholz relay of transformer TR-5B was replaced with new one. Damaged MOG of Tr-5A and Tr-5B were replaced.
 - E) Turn ratio test, short circuit test, magnetic balancing test, measurement of insulation resistance carried out of each transformer.
 - F) Break down voltage test carried out of transformer oil for each transformer.
 - G) Attending all the leakage on the transformer by replacement of Gaskets and/or tightening of bolts.
2. Preventive maintenance all feeder compartments mounted in MCC-4, MCC-4A, MCC-9 carried out as under :
 - A) Cleaning and de-dusting of all the feeder compartment.
 - B) Checking of cable terminal heating and repairing of burnt cable terminal.
 - C) Checking of terminal tightness of power and control cable.
 - D) Checking /Testing of breakers installed in panels.
 - E) Replacement of incoming breaker of MCC-9 with new one.

- F) Hook up of MCC-4A with new MCC-4A meeting meeting power supply in emergency.
 - G) Replacement of damaged /burnt component/ parts of feeder compartment.
 - H) Modification job carried out by Replacing existing 250 Amp rated fuse bases with 400 Amp. Rated fuse base in MCC panel for reclaim machine..
- 3 Overhauling of motors of following equipment carried out :
M-2110, M-2112, M-2117, M-2121, M-2122, M-2123, M2116/1, M2116/2, M2116/3, M2216/5, dust conveyor motor in silo.
 4. Cleaning and maintenance of reclaim control panels.
 5. Preventive maintenance of rope switches of entire conveyor system for proper operation.

INSTRUMENTATION JOBS

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BAGGING PLANT :

(1) PACKER SCALES NO. P/S 1,2,3,4,7,8 :

- (1) Checked all relays operation, fuses, Cleaned RIC Card & terminals, cleaned Data Pond and checked it's operation found OK .
- (2) Calibration was carried out of all 6 Nos. P/S. Found OK.
- (3) Installed & Commissioned the new control panel of Packer Scales No.3. In all respect (Main/local panel operation, weight variation within range) P/s No. 3 is found OK
- (4) Our person facilitated/worked with Mechanical Maintenance people for following jobs carried out for better accuracy in the weighment.
 - (a) Replaced new "I" bolt bearing, Bottom flapper bearing, Sack-Grip assembly bearing in all 6 Nos. P/S.
 - (b) Replaced new stabilizer mounting and done alignment of stabilizer in all 6 Nos. P/S.

(2) Computpak Panels :

- (a) All PCB's inside the computpak panels were removed and cleaned
- (b) Calibrated the Both UBM 9A, UBM 9B .

(3) Auto Bag Placers :

- (a) Cleaned/checked the all sensors of both auto bag placers.
- (b) Cleaned the local panels, PLC Panels.
- (c) Tighten the all wiring terminals of local panels, PLC Panels for both auto bag placers.

(4) WEIGHING SCALES :

- (a) Cleaned the weighing scales , Digital Indicators
- (b) Cleaned the PCB of digital indicator.
- (c) Calibrated the all weighing scales.

(5) BELT WEIGHER SYSTEM :

- (a) Cleaned/Overhauled the whole systems.
- (b) Checked the healthiness of load cell, tachometer, digital indicator.
- (c) Checked the load cell performance by actually putting weights and checking milli volts, the performance was found satisfactory.
- (d) Cleaned/Overhauled the tachometer assembly.

(6) Dust Extraction System :

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

(7) (a) All Oil Lubricators inside solenoid boxes were overhauled and checked.

- (b) Painted Bagging operator panel & Computpak (JRSL) Panels.

TECHNICAL DEPARTMENT JOBS

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INSTRUMENTATION JOBS :

- 1) Bagging plant HDP tank Urea Recovery scheme level TX, Level Switches, Level Controller installation with their cabling work completed.