MTC / REPORT / 01

REPORT NO. 40 / 2023

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KALOL UNIT

PLANT TURNAROUND REPORT

(APRIL – 2023)

INDIAN FARMERS FERTILISER CO.-OP. LIMITED

INDEX

PREFACE

The Annual Plant Turnaround for the year 2023 was taken from **3rd April 2023** to **23rd April 2023.** During Annual Turnaround, shutdown maintenance on critical equipment (Static and Rotary equipments) inspection along with miscellaneous jobs were planned. Major jobs include replacement of CO_2 Stripper Reflux Drum (103-F), Bull gear of scrapper (M-1402), Revamping of New Urea Cooling Tower (H-4404 / 1, 2, 3 - NCT) - Cell No. 3, Installation and commissioning of New Ammonia loading pump (3102 D) and splitting of Conveyor M-2122 in to two Conveyor M-2122-B1 and M-2122-B2.

After ensuring availability of required spares, materials and resources (services for various shutdown jobs) available at site, Ammonia and Urea Plant were stopped on **3rd April 2023**. Ammonia plant and Urea plant were put back into operation on **23rd April 2023 i.e. Total 20 days of shutdown period from production to production.** This shutdown report contains details of the jobs carried out during Annual Turnaround period plant wise and section wise.

The turnaround was completed as per schedule due to meticulous planning of manpower, spares, consumables and other resources. With exemplary collective efforts put by maintenance field team, Engineers, team leaders and guidance of HOD's at all levels, turnaround completed satisfactorily.

Safety was given topmost priority during the execution of jobs. Shutdown jobs were planned and executed considering risk analysis/safety aspects. Effective use of safety equipments were ensured during execution of jobs. Safety induction training was ensured for each person entered in plant premises for working during the shutdown period. Vigilant and Close watch was kept on hired contractual manpower during execution of critical jobs by Fire & Safety section to ensure safe working in the Plant.

A brief detail of Major jobs carried out during shutdown by each sections is as under:

MECHANICAL

❖ AMMONIA PLANT

Kalol Unit Annual Turnaround period was **3rd April 2023** to **23rd April 2023.**

Following Major Jobs were executed during Annual Turnaround:

- Replacement of CO_2 Stripper Reflux Drum, 103-F with upgraded MOC SS 304L.
- Replacement of LO Coolers for 104-JAT & 104-JT with new one. Duplex filter was also installed in 104-JT LO line.
- Safety Valve of Steam drum 101-F (1 no) was replaced with new one.

- Overhauling of ID Fan Drive Turbine, 101-BJT.
- Overhauling of Semi-Lean Pump Drive Turbine, 115-JBT.
- Secondary Waste Heat Boiler, 102-C 1 no. leaky tube was plugged with other 12 nos. tubes observed defective during RFET inspection. Total 13 nos. tubes were plugged.
- Hydro jetting of Air Compressor Inter-stage coolers 129-JC, 130-JC & 131-JC were carried out. During 131-JC hydro test, 1 no. tube was found leak and 8 nos. tubes were badly choked. Total 9 nos. tubes were plugged.
- During hydro test CO_2 Stripper Gas Re-boiler 105-CB, 8 nos. leaky tubes were plugged.

❖ **UREA PLANT**

- Major overhauling of CO_2 compressor drive turbine (Q-1801)
- Minor overhauling of CO_2 compressor LP case (K-1801-1)
- Minor overhauling of CO_2 compressor HP case (K-1801-2)
- Overhauling of Gearbox of CO2 compressor (M-1801)
- Eddy Current Inspection of HP Stripper, H-1201 Tubes, thinning was observed in 68 no. of tubes. The same were plugged.
- Replacement of down comer pipe in Autoclave V-1201.
- Inspection of LP Vessels.
- Preventive maintenance of Prill-tower ID fans K-1401-1/2/3/4.
- Preventive maintenance of Prill-Cooling System inlet air fan (K-1701) and Prill-Cooling System exhaust air fan (K-1702).
- Replacement of Conveyor Belt, M-1403/1, M-1403/2 & M-1702.
- Replacement of Bull Gear of Scrapper, (M-1402-1/2).
- Relief valve overhauling and testing
- Replacement of Circulation system-II water cooler, H-1207.
- Replacement of BEL valves by Douglas Chero make Angle Globe Valves.
- Replacement of HP Vent Valve, HICV-1202.
- Critical Fabrication Jobs.

❖ **OFFSITE & UTILITY PLANT**

- IBR inspection / Hydro test of BHEL Boiler (GT-2068).
- Replacement of leaking Metallic expansion bellow at outlet of BFW coil in APH duct
- Replacement of damaged FD Fan by pass duct.

- Installation of new Low height cylinder volute chamber in K-4401/4 and K-4401/6 ammonia cooling tower.
- Installation of energy efficient M/s. COOLFLO make FRP Fan blade assembly version 2 with Seal Disc Assembly in in K-4401/4 and K-4401/6 ammonia cooling tower.
- Revamping of H-4404/3 NCT-3 cooling tower with Pultruded FRP and upgraded mix (splash fill +film fill) fill media.
- Installation of new Degasser Blower K-4201/A with upgraded M.O.C and capacity in DM Plant.
- Replacement of 24" Faulty Flowmeter in Narmada plant.
- Installation of New CID joint in Clariflocculator drain line.
- Major Overhauling of Condensate Extraction Pump Turbine, Q-4412.
- Preventive Maintenance of Rotary Equipments of Cooling Tower and Boiler Area
- Preventive Maintenance of Jash make sluice gate, discharge valve and NRV of cooling water pump.

❖ **B & MH. PLANT**

- Splitting of Conveyor (800 mm wide) M-2122 in to two Conveyor M-2122-B1 and M-2122-B2. The conveyor structure upgraded with MOC SS 304 material.
- Replacement Conveyor Belt M 2117.
- Conveyor belt M-2121 bend pulley was replaced.
- Preventive maintenance of New reclaim machine (M 2116- A). As the boom was touching floor hence, machine was lifted 18mm.
- Preventive maintenance of all conveyor systems, Vibrating screens and fans.

INSPECTION

❖ **AMMONIA PLANT**

The following major inspection activities were performed in Ammonia Plant.

- Inspection of Primary reformer, catalyst tubes and risers with various NDT Techniques. Details are given at **ANNEXURE - 1 to 6.**
- Visual inspection of equipment.
- Ultrasonic flaw detection on selected weld joints and parent metal of elbows of 108-D, New Synthesis Converter (S50), MP Boiler 107-C & MP Boiler 1123-C loop, 1st Inlet & Outlet Elbows of critical vessels and other critical pipelines was carried out. Details are given at **ANNEXURE - 7.**
- PAUT (Phased Array Ultrasonic Testing) / TOFD **(**Time of Flight Diffraction Technique) on selected weld joints of elbows and pipelines of New MP Boiler-1123-C, New Converter (S-50) & MP Boiler 107-C loop was carried out. Details are given at **ANNEXURE - 8.**

- Thickness measurement of various Equipment and HT & LT Convection coils was carried out. Details are given at **ANNEXURE - 9.**
- Thickness measurement of Partition plate of various Heat Exchangers/ Coolers was carried out. Details are given at **ANNEXURE - 10.**
- Thickness measurement of various pipelines was carried out. Details are given at **ANNEXURE - 11.**
- Measurement of residual magnetism at various parts of rotating equipment and de-magnetization of the same wherever required. Details are given at **ANNEXURE - 12.**
- In-situ Metallography of selected equipment and pipelines was carried out. Detailed summary of observations and microstructure analysis given at **ANNEXURE - 13.**
- Radiography and Ultrasonic Flaw Detection were carried out in the converter loop to assess the condition of weld joints & Elbow parent metal for any deterioration. The details are attached at **ANNEXURE - 14.**
- Inspection of newly fabricated pipelines and fabrication jobs executed by Maintenance and Technical department.
- Qualification tests of welders employed by contractors.
- 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.

❖ **<u>UREA PLANT</u>**

The following major Inspection activities were performed in the Urea plant.

- Internal Inspection of High-pressure vessels viz. Autoclave (V-1201), H.P. Stripper (H-1201).
- Eddy Current Testing of H.P. Stripper (H-1201) tubes carried out by M/s TesTex NDT India Pvt. Limited.
- Inspection of L.P. Carbamate Condenser (H-1205) tubes by Internal Rotating Inspection System (IRIS) technique carried out by M/s Engineering Inspection Services, Mumbai
- Internal Inspection of other vessels.
- Ultrasonic thickness measurement of **HP Lines.** Detailed report is attached at **Annexure-1.**
- Ultrasonic thickness measurement of **SC and ST Lines.** Detailed report is attached at **Annexure-2.**
- Ultrasonic thickness measurement of various **Equipments**. Detailed report is attached at **Annexure-3.**
- Qualification test of welders employed by contractors.

- Residual magnetism measurement and demagnetization, wherever required of Hitachi Compressor (K-1801) Train. Detailed report is attached at **Annexure-4**.
- Radiography of H.P. Line tapping. List is attached at **Annexure-5.**
- Autoclave (V-1201) entire down comer (Overflow line) changed due to severe corrosion.
- The detailed observations and recommendations and 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.

❖ UTILITY PLANT

The following major Inspection activities were performed in the Utility plant.

- Visual Inspection of following in BHEL Boiler (GT 2068)
  - Steam Drum.
  - Mud Drum.
  - Deaerator.
  - Boiler Furnace
  - Air Preheater (APH) (Metallic Expansion Bellow).
  - Flue gas duct at the bank tube zone
- Inspection of 52" NB CW Inter connection line between New Cooling Tower to P-4401 C/D sumps.
- Ultrasonic thickness measurement of various equipments. Detailed report is attached at Annexure-1.
- Ultrasonic thickness measurement of BHEL boiler. Detailed report is attached at Annexure-2.
- Ultrasonic thickness measurement of various Pipelines. Detailed report is attached at Annexure-3.
- Measurement of residual magnetism at various parts of rotating equipment and de-magnetization of the same wherever required. Details are given at Annexure - 4.

The detailed observations of 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.

INSTRUMENTATION

❖ AMMONIA PLANT

- FCS upgradation job: FCS controllers for FCS 101, 102 & 103 were upgraded from AFV10D to AFV 30D. Centum VP software version upgraded from R6.07 to R6.08 in all FCS.

- SCS upgradation job: SCS controllers for SCS 106, 107 & 108 were upgraded from SCS50D to S2SC70D.
- UPS replacement jobs: M/s Fuji make UPSS after completing its useable life and declared obsolete by OEM was replaced with new Vertiv make system with two redundant battery banks and NPS.
- PRCV-18: Very old and obsolete Fisher make control valve was replaced with New Fisher make control valve.
- LT-15 and LT-16: Old and Obsolete leveltrols (with displacer and moving part) were replaced with new M/s Magnetrol make solid state RADAR level measurement.
- FICV-15: Fisher make valve with very old and obsolete actuator was replaced with new actuator Model 585C with latest model positioner 3610JP.

❖ **UREA PLANT**

- Upgrading of Woodward Governor for Hitachi compressor turbine from 505-E to 505-XT.
- FCS0201 controller upgraded from AFV10D to AFV30D. Centum VP software version upgraded from R6.07 to R6.08 in FCS0202 & FCS0203.
- Installation of Split pressure control valves for LS steam according to EWR-U-365: PICV-1130 A & B were installed to replace single control PICV-1130.
- Replacement of field instruments PDT-1212A, PT-1826 & FT-1204 for improved performance.
- Old and obsolete vibration probes & extension cables for probes for Vibration monitoring system for Hitachi compressor were replaced with new ones.
- Old and obsolete control valves were replaced with new control valves with technical specification as per updated process data:
  HICV-1202, PICV-1810, PICV-1481, LICV-1502A & FICV-1351.

❖ **UTILITY AND OFFSITE**

- FCS addition job: New standalone FCS controllers FCS0602 installed for CT plant and Centum VP software version upgraded from R6.07 to R6.08 in all domains.
- NPS System installed in DM UPS system so that if in case one Source falls outside the acceptable limits, the Network Power Switch will transfer the output load to the other "alternate" source.
- PICV-3(4 ata vent): Existing old and obsolete M/s Dresser make control valve was replaced with new M/s Mascot make control valve.
- FI-6200 (Raw water inlet from Jaspur pumping station): The old flow meter (M/s Khrone Marshall make) was showing faulty reading so it was replaced with new flow meter (M/s Khrone Marshall make) with latest model.

- Two new Semi-Automatic Weighing & Bagging Machines - 5 & 6 were commissioned in bagging plant.

ELECTRICAL

- Critical job/ new installation
  - Supply and retrofitting of isolators at 66 KV yard.
  - Retrofitting of Inlet isolation valves 121-J/JA and MOV-13.
  - 11 KV feeder modification job for HP ammonia Pump P-1102D
  - Feeder Modification in MCC-15 for second source arrangement for MCC-14.
  - Replacement of passive harmonic filter In K-1701.
  - CT replacement job at 66 KV Chhatral Line.
  - Electrical jobs related to splitting of conveyor M-2122 old into M-2122B1 and M-2122B2.
  - Upgradation of ACB feeder for K-5301/A from 800 A to 1250 A.
  - Laying and Termination of DC control cables.
  - Installation of Vertiv make static switch at Silo control room.

- Scheduled preventive maintenance and modification work
  - Servicing of Rotork make valve actuators.
  - Preventive Maintenance & Testing of transformers.
  - Overhauling of critical motors
  - Maintenance of Motor control center MCCs
  - Maintenance of 66 KV switch yard
  - Servicing of L&T make LT Air circuit breaker (ACB)
  - Checking & preventive maintenance of Rope switches in conveyors.

CIVIL

❖ AMMONIA PLANT

- 103-F (CO_2 stripper reflux drum) Foundation modification
- Refractory repairing jobs in primary reformer (HT & LT zone), Auxiliary boiler and secondary reformer
- Re – Installation of UPSS Room Door.
- New False Flooring in Ammonia Control Room & UPSS Room.

❖ UREA PLANT

- Anti-corrosive treatment of scrapper floor inside Prill tower.
- Dismantling of CO_2 Sump in Urea Plant.
- Drain Pipe Connection and Concreating Work.

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- **OFFSITES & UTILITY PLANT**
  - Plaster Work of Foundations & Columns.
  - Repairing of Pump Supports above Cooling Tower.
  - Repairing of Lovers in Cooling Tower.
  - Providing and Applying Anticorrosive treatment on Old Painted Surface with Coal tar epoxy / new Surface of RCC wall, Columns & Foundations etc.
  - Refractory Repairing jobs of BHEL Boiler.

- **B & MH PLANT**
  - Epoxy painting of conveyor gallery (beams, columns & soffit) and Loading Floor of B & MH plant.
  - Epoxy screeding on the Loading floor of B & MH Plant.
  - Construction of cutout and anchor fastening for splitting of conveyor belt 2122

TECHNICAL

The annual turnaround, provide opportunity to Technical Department to undertake execution of jobs related to various EWRs and modification schemes.

Lot of EWR jobs have also been carried out during this shutdown.

All modification jobs have also resulted in tangible/ in- tangible benefits.

Jobs have been completed within stipulated time because of meticulous planning, procurement of material at right time and also completion of major prefabrication work well before start of the Shutdown.

As lots of rigging work was involved during execution of above jobs, safety was given top most priority and thus jobs were completed with no unsafe act occurrence.

Jobs were completed successfully due to cooperation from Production, Maintenance and other departments. Senior executives also provide necessary guidance which helped in successful completion of jobs.

JGM (Maintenance)

IFFCO-Kalol

PLANT TURNAROUND APRIL-2023

GENERAL - DETAILS

SR. NO. **CATEGORY** **QUANTITY**

(A) EQUIPMENT UTILIZED

IFFCO

Equipment Name	Capacity	Qty (No)
Kobelco crane	135 T	01
Kobelco crane	100 T	01
Escorts (TRX-2319) Hydra-Lift & Shift	23 T	01
Escorts (F15) Hydra-Lift & Shift	14 T	01
Escorts (8100) Hydra-Lift & Shift	10 T	01
Forklift	05 T	01
Forklift	03 T	02
Truck	08 T	01
Bolero Pick van	1.7 T	01
Boom Lift (Battery operated)	0.227 T	01

(B) MANPOWER UTILIZED

(I) IFFCO MANPOWER

1	Mechanical	Existing strength
2	Mechanical Services	
3	Electrical	
4	Instrument	
5	Inspection	
6	Civil	
7	Technical	

(II) HIRED - CONTRACT MANPOWER

Sr.No.	Category	Man days
1	Rigger	877
2	S.S. Rigger	2183
3	Grinder	158
4	General Fitter	636
5	Fabricator	128
6	HP Welder	16
7	ARC Welder	109
8	Gas Cutter	97
9	Machinist	16
10	Mason	18

THE PLANT TURNAROUNDS AT A GLANCE										
SR. NO.	YEAR	PERIOD FROM PRODUCTION TO PRODUCTION								REASON IF ANY
		AMMONIA PLANT				UREA PLANT				
		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

SR. NO.	YEAR	PERIOD FROM PRODUCTION TO PRODUCTION								REASON IF ANY
		AMMONIA PLANT				UREA PLANT				
		FROM	TO	DOWN TIME		FROM	TO	DOWN TIME		
				DAYS	HRS			DAYS	HRS	
24	2004	20-05-04	09-06-04	20.00	495.17	20-05-04	09-06-04	20.00	480.25	Planned
25	2005	22-05-05	29-06-05	38.75	930..50	22-05-05	24-06-05	33.85	812.50	Planned
26	2006	31-03-06	06-05-06	35.93	862.42	29-03-06	06-05-06	37.06	889.50	Planned
27	2007	14-04-07	08-05-07	23.72	569.25	14-04-07	05-05-07	21.38	513.0	Planned
28	2008	24-03-08	14-04-08	20.26	486.25	24-03-08	14-04-08	20.40	489.50	Planned
29	2009	16-03-09	10-04-09	25.31	607.33	16-03-09	09-04-09	24.63	591.00	Planned
30	2010	21.03.10	05-04-10	15.07	361.50	21-03-10	05-04-10	15.25	366.00	Planned
31	2011	25-03-11	07-04-11	13.25	318.00	25-03-11	07-04-11	13.12	314.92	Planned
32	2012	28-03-12	13-04-12	16.33	392.00	28-03-12	12-04-12	15.34	368.25	Planned
33	2013	29-03-13	10-04-13	11.88	285	29-03-13	10-04-13	11.91	285.92	Planned
34	2014	26-03-14	28-04-14	33.34	800.25	26-03-14	24-04-14	28.75	689.92	Planned
35	2015	01-04-15	13-04-15	11.95	286.83	01-04-15	12-04-15	11.69	280.50	Planned
36	2016	19-03-16	05-04-16	17.36	416.75	19-03-16	05-04-16	16.97	407.25	Planned
37	2017	11-03-17	23-04-17	42.10	1010.33	11-03-17	24-04-17	43.42	1042.16	Planned-ESP III
38	2018	17-09-18	15-10-18	25.79	662.17	17-09-18	15-10-18	27.81	667.50	Planned
39	2019	07-04-19	14-04-19	--	--	--	--	--	--	102-C Tube Failure
40	2019	27-12-19	31-12-19	--	--	--	--	--	--	101-CB Tube Failure
41	2021	--	--	--	--	01-02-21	03-02-21	--	--	H-1201 Ferrules replacement (LP Section Disturbed)
42	2021	29-03-21	19-05-21	51	1246.3	24-03-21	21-05-21	58	1393	Planned
43	2021	25-07-21	01-08-21	07						101-CB-Tube Failure
44	2022					08-03-22	11-03-22	03		H-1201- Ferrules & Tube Sheet Cleaning
45	2022	18-04-22	23-04-22	05						102-C-Tube Failure
46	2022					15-07-22	15-07-22	01		103-J-LPCV Servomotor Replacement
47	**2023**	**03-04-23**	**23-04-23**	**20**	**482**	**03-04-23**	**23-04-23**	**20**	**494.5**	**Planned**

SHUT DOWN RELATED CONTRACTS

Sr. No.	PLANT	WO NO.	DESCRIPTION OF JOB	VENDOR'S NAME
1	MECHANICAL AMMONIA	201004240197 19/05/2023	OVERHAULING AND PREVENTIVE MAINTENANCE OF ROTATING EQUIPMENTS IN AMMONIA PLANT	BVL POWER SYSTEMS PVT LTD, HYDERABAD
2	MECHANICAL AMMONIA	201004240199 19/05/2023	CRITICAL FABRICATION JOBS IN AMMONIA PLANT DURING SHUTDOWN	A M ERECTORS, AHMEDABAD
3	MECHANICAL AMMONIA	201004240196 18/05/2023	REMOVAL AND ERECTION OF CO2 REFLUX DRUM (103-F) AND OTHER NON-CRITICAL FABRICATION JOBS	MECH-TECH ENGINEERS & ERECTORS, KALOL
4	MECHANICAL AMMONIA	201004231440 04/01/2023	OVERHAULING OF RE-CYCLE GAS COMPRESSOR, 117-J	MALHAN ENTERPRISES PVT. LTD., AHMEDABAD
5	MECHANICAL AMMONIA	201004222065	SCAFFOLDING & BLINDING / DE-BLINDING JOBS DURING SHUT DOWN	TMK ENGINEERING, VADODARA
6	MECHANICAL AMMONIA	201004231796	SUPPLY AND APPLICATION OF PUF INSULATION ON AMMONIA PIPING	KRISHNA INSULATION & ENGINEERS PVT. LTD., VADODARA
7	MECHANICAL AMMONIA	201004240224 24/05/2023	SERVICES OF SIEMENS ENGINEER FOR TROUBLESHOOTING OF PROBLEMS OF SIEMENS MAKE TURBINES DURING ATR-2023	SIEMENS LTD., VADODARA
8	MECHANICAL AMMONIA	201004240248 05/06/2023	SERVICES OF HYDAC ENGINEER FOR TROUBLESHOOTING OF PROBLEMS IN HPCOS & BARRING GEAR OF 103-JT DURING ATR-2023	HYDAC (INDIA) PVT. LTD.
9	MECHANICAL AMMONIA	201004240276 03/06/2023	HIRING MOBILE STEAM GENERATION UNIT ON RENT FOR LTS CATALYST HEATING & REDUCTION DURING ATR-2023	AKASH EXPLORATION SERVICES LTD., SHERTHA
10	MECHANICAL AMMONIA	201004231802 18/03/2023	APPLICATION OF STANVAC COATING	ARMATE CORPORATION
11	MECHANICAL AMMONIA	201004240197 19/05/2023	OVERHAULING AND PREVENTIVE MAINTENANCE OF ROTATING EQUIPMENTS IN AMMONIA PLANT	BVL POWER SYSTEMS PVT LTD, HYDERABAD

Sr. No.	PLANT	WO NO.	DESCRIPTION OF JOB	VENDOR'S NAME
12	MECHANICAL UREA	201004230469 12/07/2022	INSITU OVERHAULING / REPAIRING / SERVICING AND TESTING OF BEL MAKE ANGLE VALVES IN UREA PLANT.	FLOTEC TECHNOSMART (INDIA) PRIVATE LIMITED
13	MECHANICAL UREA	201004231882 30/03/2023	SUPPLY & APPLICATION OF ANTI CORROSIVE COATING AT PCS AREA OF UREA PLANT	ARMATE CORPORATION
14	MECHANICAL UREA	201004231761 09/03/2023	REPLACEMENT OF AUTOCLAVE DOWNCOMER PIPE IN NEXT TURNAROUND MAR-APR 2023	SHREE GANESH ENGG CO.
15	MECHANICAL UREA	201004231651 09/03/2023	ROTARY EQUIPMENT'S OVERHAULING IN UREA AND OFFSITE PLANTS.	SAAD TECHNICAL SERVICES
16	MECHANICAL UREA	201004220743 26/07/2021	HYDROJETTING OF HEAT EXCHANGERS TUBES	M/S HYDRO JETTING SERVICES
17	MECHANICAL UREA	201004220429 01/07/2021	RATE CONTRACT FOR OVERHAULING AND TESTING OF RELIEF VALVES	FLOTEC TECHNOSMART (INDIA) PRIVATE LIMITED
18	MECHANICAL UREA	201004231217 24/11/2022	RATE CONTRACT OPENING & BOXED UP OF HEAT	M/S.GENERAL ENGG WORKS
19	MECHANICAL UREA	201004231682 23/02/2023	CRITICAL FABRICATION JOBS	A.M.ERECTORS
20	MECHANICAL OFFSITE	201004202023	SPECIALISED SERVICES FOR REPAIR & MAINTENANCE OF "PAHARPUR" MAKE COOLING TOWERS	M/S PAHARPUR COOLING TOWER LTD, VADODARA
21	MECHANICAL OFFSITE	201004230050	ZINC SPRAYING / GALVANISING ON COOLING WATER PIPE LINES, TANKS AND STRUCTURES.	M/S MYTHRI METALLIZING INDIA, BANGALORE
22	MECHANICAL OFFSITE	201004202071	IN-SITU OVERHAULING / REPAIRING OF VALVES	M/S FLUIDCHEM VALVES INDIA PVT. LTD, THANE
23	MECHANICAL OFFSITE	201004231543	SERVICING/REPAIRING OF JASH MAKE SLUICE GATES/VALVES	M/S. JASH ENGG LTD, INDORE
24	MECHANICAL OFFSITE	201001231409	GLAND RE-PACKING OF VALVES	M/S. FLOTEC TECHNOSMART (INDIA) PRIVATE LIMITED

Sr. No.	PLANT	WO NO.	DESCRIPTION OF JOB	VENDOR'S NAME
25	MECHANICAL OFFSITE	201004231893	SERVICES FOR REPAIRING RECONNECTION OF EXISITING DI / CI PIPE AT CLARIFLOCCULATOR DRAIN LINE IN NARMADA PLAN	MARUTI TRADING PVTLTD, AHMEDABAD
26	MECHANICAL B & MH.	201004230835 20-SEP-22	DESIGN ENGINEERING, MANUFACTURING, TESTING AND SUPPLY OF CONVEYOR M2122B1 & B2 FOR SPLITTING OF CONVEYOR M2122	PRAYAS ENGG, VALLABH VIDYANAGAR.
27	MECHANICAL B & MH.	201004231096 02-NOV-22	ERECTION AND INSTALLATION OF PROPOSED CONVEYORS M2122B1 AND M2122B2	MECH-TECH ENGINEERS & ERECTORS
28	INSPECTION	201004210211	METALLOGRAPHY WORK	M/S. IRC ENGINEERING SERVICES INDIA PVT LTD , NEW DELHI
29	INSPECTION	201004220698	RADIOGRAPHY WORK	M/S. SAHAJANAND TEST LAB, AHMEDABAD
30	INSPECTION	201004231277	RFET OF 102-C	M/S. TESTEX NDT INDIA PVT. LTD., MUMBAI
31	INSPECTION	201004221777	NDT TEAM FOR ULTRASONIC FLAW DETECTION WORK	M/S. INDUSTRIAL X-RAY & ALLIED RADIOGRAPHER S , MUMBAI
32	INSPECTION	201004230819	IRIS INSPECTION OF LPCC (H-1205)	M/S. ENGINEERING INSPECTION SERVICES, MUMBAI
33	INSPECTION	201004231086	ECT OF HP STRIPPER (H-1201)	M/S. TESTEX NDT INDIA PVT. LTD., MUMBAI
34	INSPECTION	201004221712	TOFD/PAUT OF WELDS	M/S. ENGINEERING INSPECTION SERVICES, MUMBAI
35	INSPECTION	201004231451	NDT TEAMS FOR THICKNESS MEASUREMENT & MAGNETIC PARTICLE INSPECTION	M/S. IRC ENGINEERING SERVICES INDIA PVT LTD , NEW DELHI

Sr. No.	PLANT	WO NO.	DESCRIPTION OF JOB	VENDOR'S NAME
36	INSPECTION	201004231354	AUS OF PRIMARY REFORMER TUBES	M/S. PDIL, NOIDA
37	INSPECTION	201004210594	NDT TEAMS FOR D P TESTING	M/S. BALAJI NDT PRIVATE LTD, AHMEDABAD
38	INSTRUMENT AMMONIA	201004190890 28-09-2018	AMC JOBS FOR YOKOGAWA MAKE DCS/ESD/PLC	YOKOGAWA INDIA LTD
39	INSTRUMENT AMMONIA	201004202022 15-04-2020	MAINTENANCE OF CONTROL VALVES	FLOTEC TECHNOSMART (INDIA) PVT LTD
40	INSTRUMENT AMMONIA	201004221120 08-05-2021	RATE CONTRACT FOR PETTY MAINTENANCE JOBS	M R PATEL & CO
41	INSTRUMENT AMMONIA	201004191672 29-03-2019	DCS NODE	YOKOGAWA INDIA LTD
42	INSTRUMENT AMMONIA	201004230431 24-06-2022	UPGRADATION OF DCS AND PLC CONTROLLER	YOKOGAWA INDIA LTD
43	INSTRUMENT AMMONIA	201004221745 09-02-2022	AMC FOR MAINTENANCE OF KOSO MAKE BUTTERFLY VALVES	KOSO INDIA PVT. LTD.
44	INSTRUMENT AMMONIA	201004211517 17-02-2021	MAINTENANCE OF METSO MAKE BALL VALVES	NELES INDIA PVT. LTD.
45	INSTRUMENT AMMONIA	201004230550 02-08-2022	ARC FOR TROUBLESHOOTING OF SIEMENS MAKE TURBINES	SIEMENS LTD.
46	INSTRUMENT AMMONIA	201004222035 15-03-2022	SERVICE RELATED TO 2X60 KVA PARALLEL REDUNDANT UPSS.	KMP COMPREHENSIV E SOLUTIONS LLP
47	INSTRUMENT UREA	201004211043 07-12-2020	AMC FOR AUTOCLAVE/STRIPPER LEVEL MEASUREMENT	BERTHOLD TECHNOLOGIES
48	INSTRUMENT UREA	201004201906 26-03-2020	HIRING OF SKILLED MANPOWER FOR SHUTDOWN	A TO Z INSTRUMENT SERVICES, VADODARA
49	INSTRUMENT OFFSITE	201004211950 24/05/2021	ANNUAL MAINTENANCE CONTRACT FOR UPS SYSTEM	VERTIV ENERGY PVT LTD. AHMEDABAD
50	INSTRUMENT OFFSITE	201004230346 6/8/2022	ANNUAL MAINTENANCE CONTRACT FOR AMCO SAFT MAKE NI-CD UPS BATTERIES	SYN-TECH POWER SYSTEMS, VADODARA

Sr. No.	PLANT	WO NO.	DESCRIPTION OF JOB	VENDOR'S NAME
51	ELECTRICAL	201001221999	SERVICING OF ROTORK MOV	ROTORK CONTROLS (INDIA) PVT LTD CHENNAI
52	ELECTRICAL	201001230827	INSTALLATION OF ROTORK IQ3 ACTUATORS ON INLET ISOLATION VALVE OF 121-J/JA TO IMPLEMENT EWR NO. A530	M/S VINAYAK AGENCY
53	ELECTRICAL	201001221513	OVERHAULING OF MOTORS	M/S NEW NATIONAL ELECTRIC
54	ELECTRICAL	201001221972	PREVENTIVE MAINTENANCE OF TRANSFORMERS	M/S MANPRA ELECTRICAL PRIVATE LIMITED
55	ELECTRICAL	201001211530	PREVENTIVE MAINTENANCE OF ABB MAKE PLC BASED CONVEYOR CONTROL SYSTEM	M/S HI-TECH AUTOMATION
56	ELECTRICAL	201001231351	PREVENTIVE MAINTENANCE OF UNIVERSAL MAKE BATTERY CHARGERS AT MPSS & 66 KV	M/S UNIVERSAL INDUSTRIAL PRODUCTS
57	ELECTRICAL	201001201242	PREVENTIVE MAINTENANCE OF ROCKWELL MAKE LOAD MANAGEMENT SYSTEM	M/S SOFTCON
58	ELECTRICAL	201001230827	REPLACEMENT OF K SERIES ROTORK MOV-14 WITH IQ2 SERIES ROTORK ACTUATOR	M/S VINAYAK AGENCY
59	ELECTRICAL	201001231349	SERVICING OF L&T MAKE ACB	SCHNEIDER ELECTRIC INDIA PVT LTD
60	ELECTRICAL	201001231384	RELEASE ORDER FOR SERVICES OF ELECTRICIAN DURING SHUTDOWN(MARCH 2023) AGAINST CPA	PARIKH ELECTRIC CORPORATION
61	ELECTRICAL	201001210764	REPLACEMENT OF PHF IN MCC 14	SIEMENS LTD. NAVI MUMBAI, MAHARASTRA
62	ELECTRICAL	201001231602	ONLINE CLEANING OF MCC FEEDERS	M J SYSTEM INTEGRATORS
63	ELECTRICAL	201001220996	UPGRADATION OF 11 KV JYOTI MOTOR FEEDER INTO TRANSFORMER FEEDER AS PER DETAIL SPECIFICATION & TERMS AND CONDITIONS ENCLOSED IN ANNEXURE-I AND ATTACHED EXISTING & PROPOSED DRAWING	JYOTI LIMITED, VADODARA

Sr. No.	PLANT	WO NO.	DESCRIPTION OF JOB	VENDOR'S NAME
64	ELECTRICAL	201001230488	RETROFITTING OF BREAKER AND UPGRADATION OF MOTOR FEEDER SUITABLE FOR 1250 A RATING FOR 250 KW SCREW COMPRESOR. MCC 2F-SERVICE	PRADIP POWER TECH AHMEDABAD
65	ELECTRICAL	201001230205	RETROFITTING OF BREAKER AND UPGRADATION OF PANEL SUITABLE FOR 1600A RATING ACB MCC 15-SERVICE	SCHNEIDER ELECTRIC INDIA PVT. LTD. POWAI,MUMBAI
66	ELECTRICAL	201001231290	LAYING OF DC CABLE AND CONTROL CABLES	PARIKH ELECTRIC CORPORATION-AHMEDABAD
67	CIVIL AMMONIA	201004231220 03-DEC-22	SUPPLYING & FIXING OF FALSE FLOORING IN AMMONIA CONTROL ROOM, UREA CONTROL ROOM & VARIOUS OTHER LOCATION IN PLANT	M/S : ANANT BUILDERS (A)
68	CIVIL UREA OFFSITE	201004231153 14-NOV-22	ACID PROOF LINING WORK AT VARIOUS LOCATION IN IFFCO KALOL PLANT.	M/S : RUDRA CONSTRUCTION
69	CIVIL OFFSITE B & MH.	201004231624 25-FEB-23	EPOXY PAINTING OF RCC STRUCTURES AT IFFCO KALOL PLANT.	M/S:GAYATRI CONSTRUCTION
70	CIVIL AMMONIA UREA, OFFSITE B&MH	201004231803 21-MAR-23	MISC. CIVIL WORK DURING ANNUAL SHUTDOWN AT IFFCO KALO PLANT.	M/S:RUDRA CONSTRUCTION
71	TECHNICAL AMMONIA	201004231682	CRITICAL FABRICATION JOBS IN AMMONIA, UREA, UTILITY & OFFSITE PLANTS DURING SHUTDOWN 2023.	M/S A M ERECTORS
72	TECHNICAL AMMONIA UREA OFFSITE	201004220741	ARC FOR FABRICATION & ERECTION OF PIPING, STRUCTURAL AND OTHER MECHANICAL JOBS	M/S J&J ENGINEERS
73	PLANNING	201004220429	RATE CONTRACT FOR OVERHAULING AND TESTING OF RELIEF VALVES	M/S. FLOTEC TECHNOSMART (INDIA) PVT LTD, SURAT
74	PLANNING	201004231217	RATE CONTRACT FOR OPENING & BOXED UP OF HEAT. EXCHANGERS & COOLERS	M/S. GENERAL ENGG WORKS , BHARUCH

Sr. No.	PLANT	WO NO.	DESCRIPTION OF JOB	VENDOR'S NAME
75	PLANNING	201004231457	ASSISTING IFFCO DURING PLANT SHUTDOWN / BREAK DOWN	M/S. GENERAL ENGG WORKS , BHARUCH
76	PLANNING	201004220743	RATE CONTRACT FOR CLEANING OF HEAT EXCHANGERS TUBES	M/S. HYDRO JETTING SERVICES, AHMEDABAD
77	PLANNING	201004211546	RATE CONTRACT FOR FABRICATION WORK	M/S.J & J ENGG.(FABRICATION)-SERTHA
78	PLANNING	201004211548	RATE CONTRACT FOR FABRICATION WORK	M/S.MECH-TECH ENGG.-KALOL
79	PLANNING	201004221398	RATE CONTRACT FOR INSULATION WORK	M/S.BALAJI INSULATIONS-VADODARA
80	PLANNING	201004221884	RATE CONTRACT FOR PETTY MAINT WORK	M/S.GENERAL ENGG WORKS-BHARUCH
81	PLANNING	201004201984	RATE CONTRACT FOR PAINTING WORK	M/S. B CHAUHAN & CO, KALOL
82	PLANNING	201004231813	RATE CONTRACT FOR ONLINE SEALING	M/S.NEW DYNAMIC META SEALING ENGINEERS
83	PLANNING	201004230587	RATE CONTRACT FOR SERVICING & TESTING OF EOT CRANE, HOIST & GEAR OPERATED MONORAIL TROLLEYS	M/S.NEELKANTH ENGINEERING INDUSTRIES-AHMEDABAD

MECHANICAL

AMMONIA PLANT

(MECHANICAL)

ROTATING EQUIPMENT

AIR COMPRESSOR DRIVE TURBINE, 101-J

101-JT Turbine

The Turbine was installed during the SD-2021, So as per OEM recommendation PM was not required.

101-JLP, Air Compressor

Preventive Maintenance of 101-JLP was carried out. 101-JLP was decoupled from both ends. Journal bearings of DE side were removed for inspection, measured the clearances, found on higher side. So, replaced the bearing with new one. NDE side and Thrust bearings were visually inspected and Dye penetration test was carried out. Gauss reading of the bearing pads and base rings were measured and found within limits. Bearing clearances were taken and found within the design range. The DE side inboard oil guard found a crack and replaced it with new one.

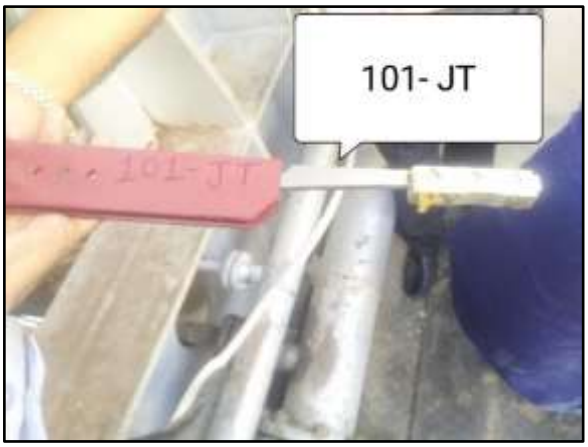
The axial thrust of was found out of the limit. So, provided the shim 0.11mm and adjusted the thrust.

LP compressor front journal bearing pad DP test & gauss test

HP Compressor Front and Rear Journal Bearing pad DP test

HP Compressor Rear thrust Pads (Active/Non-Active) DP test conducted

101-JLP NDE side bearing



Damaged Earthing brush replaced by electrical

PREVENTIVE MAINTENANCE RECORDS: 101-J TRAIN

COUPLINGS DETAILS

Description	Position	Design (MM)	Before (MM)	After (MM)
DBSE (With Rotor at centre)				
101 JT-JLP	---	635.75	635.75	635.75
101 JLP-JR	---	209.55	210.95	211.05
101 JR-JHP	---	209.55	210.34	210.3
Distance between Hub Face (With Rotor at centre)				
101 JT-JLP		590.97	590	590
101 JLP-JR	Spacer length			131.55
101 JR-JHP		226.06	218.76	218.76

PREVENTIVE MAINTENANCE RECORDS: 101-JLP

Description	Position	Dwg. Ref.		Design Clearances (Inch)	Before (mm)	After (mm)
TURBINE END						
Journal Bearing Clearance	Mandrel	D-1		0.005-0.008	0.23	0.20
	Measurement				0.18	0.15
Bearing Pinch	Journal Bearing	------		------	-	-
Shaft Dia.	Journal Bearing	------		4.493	114.12	114.12
Oil Guard (For Journal Bearing)	North	C-1		0.013-0.015	0.10	0.10
	South	C-1		0.013-0.015	0.10	0.10
Oil Guard (For Outer Housing)	North	A-1		0.021-0.027	0.15	0.15
	South	A-1		0.021-0.027	0.15	0.15
GEAR BOX END						
Journal Bearing Clearance	Mandrel	D-1		0.005-0.008	0.22	0.22
	Measurement				0.17	0.17
Bearing Pinch	Journal bearing	------		------	-	-
Shaft Dia.	Journal bearing	------		4.493	114.12	114.12
Oil Guard (For Journal Bearing)	North	C-1		0.013-0.015 (Dia)	0.15	0.15
	South	C-1		0.013-0.015	0.15	0.15
Oil Guard (For Thrust bearing)	North	M-1		0.002-0.004	0.15	0.15
	South	S-1		0.002-0.004	0.15	0.15
Oil Guard (For Outer Housing)	CT side	A1		0.021-0.027	-	-
	Silo side	A1		0.021-0.027	-	-
Axial Thrust	With Top Housing	------		0.010 - 0.015	0.42	0.30
	Without Top Housing	------			-	-
Total Float	------	------		7.144 - 8.730	-	-

Journal Bearing Pads Thickness				
PAD	NORTH SIDE BEARING (NDE)		SOUTH SIDE BEARING (DE)	
	Before	After	Before	After
No 1	19.06	19.06	19.05	19.06
No 2	19.06	19.06	19.03	19.06
No 3	19.05	19.05	19.06	19.06
No 4	19.06	19.06	19.04	19.06
No 5	19.06	19.06	19.03	19.06
Thrust Bearing Pad Thickness				
Pad	ACTIVE (Inner)		INACTIVE (Outer)	
	Before	After	Before	After
No 1	19.82	19.82	19.84	19.84
No 2	19.81	19.81	19.84	19.84
No 3	19.82	19.82	19.83	19.83
No 4	19.83	19.83	19.83	19.83
No 5	19.82	19.82	19.83	19.83
No 6	19.81	19.81	19.84	19.84
No 7	19.83	19.83	19.84	19.84
No 8	19.82	19.82	19.84	19.84

GAUSS RECORDS: 101-JLP			
Description	Position	Before	After
Journal Bearing pads	Thrust End	1.4	1.4
	Non thrust end	1.0	1.0
Journal Bearing base ring	Thrust End	0.6	1.1
	Non thrust end	0.4	0.7
Thrust bearing pads	Active	0.5	0.4
	Inactive	1.1	1.2
Thrust Bearing base ring	Active	0.9	1.3
	Inactive	0.8	1.2
Shaft Journal	Thrust End	1.9	1.1
	Non thrust end	0.4	1.0

101-JR, Gear Box

101-JR was decoupled at both ends. All the bearings were inspected and found in good condition. Both the gear as well as Pinion were inspected and found O.K. Gauss measurement of gear shaft and bearings carried out and found within limit. Bearing clearances were taken and found within the design range.

PREVENTIVE MAINTENANCE RECORDS: 101-JR

Description	Position	Design Clearances (Inch)	Before (mm)	After (mm)
Journal Bearing (Low Speed drive gear)	North	0.008-0.010	0.28	0.28
	South	0.008-0.010	0.30	0.30
Journal Bearing Interference (Low Speed drive gear)	North		0.05	0.05
	South		0.02	0.02
Axial Thrust	-	0.014-0.024	0.35	0.35
Journal Bearing (High Speed driven Pinion)	North	0.009-0.011	0.24	0.24
	South	0.009-0.011	0.26	0.26
Journal Bearing Interference (High Speed driven Pinion)	North		0.04	0.04
	South		0.02	0.02
Free float –PINION	-	-	1.12	1.12
Backlash	-	-	0.45	0.42
Shaft Diameter (Low Speed drive Gear)	North Side Bearing.	-	114.08	114.08
	South Side Bearing.	-	114.08	114.08
Shaft Diameter. (High Speed driven Pinion)	North Side Bearing.	-	88.76	88.76
	South Side Bearing.	-	88.76	88.76

GAUSS RECORDS: 101-JR			
Description	**Position**	**Before (Gauss)**	**After (Gauss)**
Gear Journal Bearing	North	0.5 (T) 0.3 (B)	0.5 (T) 0.3 (B)
	South	0.5 (T) 0.6 (B)	0.5 (T) 0.6 (B)
Pinion Journal Bearing	North	0.2 (T) 0.6 (B)	0.2 (T) 0.6 (B)
	South	0.6 (T) 0.8 (B)	0.6 (T) 0.8 (B)
Thrust bearing	Active	0.6	0.6
	Inactive	0.8	0.8
Shaft Journal Pinion	Thrust End	0.5	0.5
	Non thrust end	0.2	0.2
Shaft Journal Gear	Thrust End	0.4	0.4
	Non thrust end	0.6	0.6

101-JHP, Air Compressor

101-JHP was decoupled from both ends. Journal bearings and Thrust bearings were visually inspected and Dye penetration test was also carried out. Gauss reading of the bearing pads and base rings were measured and found within limits. Bearing clearances were taken and found within the design range.

PREVENTIVE MAINTENANCE RECORDS: 101-JHP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
GEAR BOX END					
Journal Bearing Clearance	Mandrel	C-1	0.004-0.007	0.20	0.20
	Measurement			0.18	0.18
Shaft Dia.	Journal Bearing	------	2.996	76.10	76.10
Oil Guard (For Journal Bearing)	CT side	B-1	0.013-0.016	0.15	0.15
	SILO side	B-1	0.013-0.016	0.15	0.15
Oil Guard (For Top Housing)	North	D-1	0.015-0.022	0.15	0.15
	South	D-1	0.015-0.022	0.15	0.15
NON DRIVE END					
Journal Bearing Clearance	Mandrel	D-1	0.015-0.022	0.19	0.19
	Filler / lead wire			0.18	0.18
Shaft Dia.	Journal bearing	------	2.996	76.10	76.10
Oil Guard (For Journal Bearing)	North	B-1	0.013-0.016	0.15	0.15
	South	B-1	0.013-0.016	0.15	0.15
Oil Guard (For Thrust bearing)	North	A-1	0.002-0.004	0.15	0.15
	South	A-1	0.002-0.04	0.15	0.15
Oil Guard (For Top Housing)	North	------	------	------	------
	South	D-1	0.015-0.022	-	-
Axial Thrust	With Top Housing	------	0.008 - 0.012	0.38	0.38
	Without Top Housing	------		-	-

Journal Bearing Pads Thickness

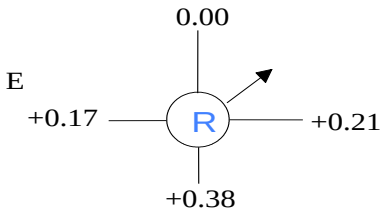
PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	14.26	14.26	14.26	14.26
No 2	14.27	14.27	14.25	14.25
No 3	14.26	14.26	14.25	14.25
No 4	14.25	14.25	14.26	14.26
No 5	14.26	14.26	14.26	14.26

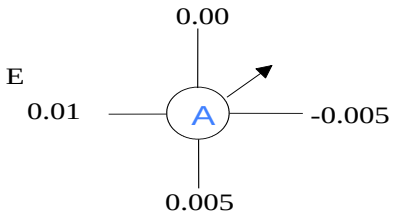
Thrust Bearing Pads Thickness				
	ACTIVE (Inner)		INACTIVE (Outer)	
Pad	Before	After	Before	After
No 1	12.66	12.66	12.66	12.66
No 2	12.67	12.67	12.65	12.65
No 3	12.65	12.65	12.65	12.65
No 4	12.66	12.66	12.67	12.67
No 5	12.66	12.66	12.66	12.66
No 6	12.65	12.65	12.66	12.66

GAUSS RECORDS: 101-JHP			
Description	Position	Before	After
Journal Bearing pads	Thrust End	0.6	0.6
	Non thrust end	0.6	0.6
Journal Bearing base ring	Thrust End	0.6	0.6
	Non thrust end	0.6	0.6
Thrust bearing pads	Active	0.60	0.60
	Inactive	0.40	0.40
Thrust Bearing base ring	Active	0.9	0.9
	Inactive	1.0	1.0
Shaft Journal	Thrust End	0.5	0.5
	Non thrust end	0.9	0.9

ALIGNMENT READING: 101-JT to 101-JLP

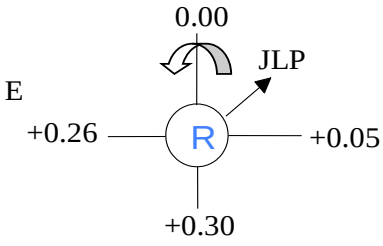
Protocol reading:

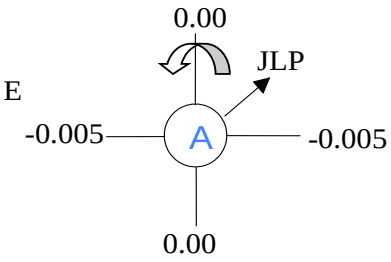




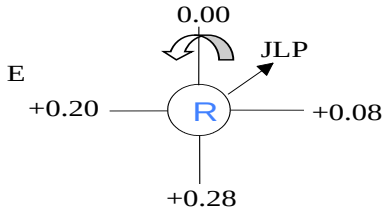
Note – Rotating both Turbine & compressor in Direction of Rotation. (Looking from Turbine end) (Dial gauge on compressor coupling hub)

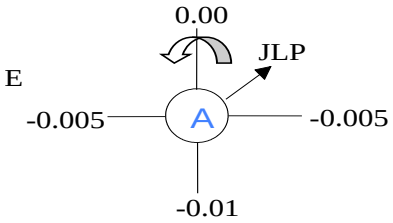
Before Preventive Maintenance





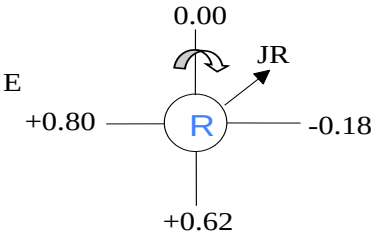
After Preventive Maintenance

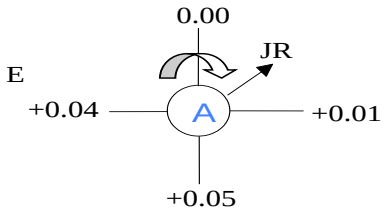




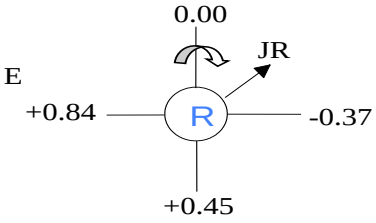
ALIGNMENT READING: 101-JLP to 101-JR

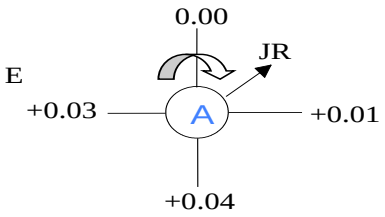
Before Preventive Maintenance





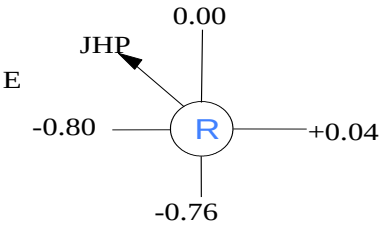
After Preventive Maintenance

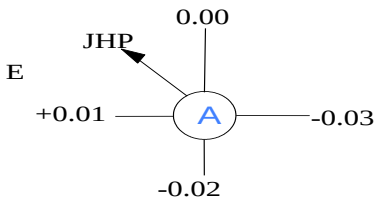




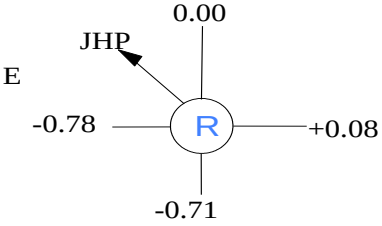
101-JR to 101-JHP

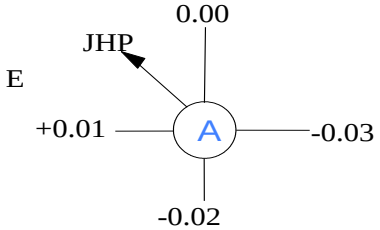
Before Preventive Maintenance





After Preventive Maintenance





SYNTHESIS GAS COMPRESSOR TRAIN, 103-J

103-JT, Synthesis Gas Turbine

The turbine was decoupled and both end Journal bearings and Thrust bearings were removed for inspection. The bearings were visually inspected & DP test of pads carried out. Bearings found in good condition. Journal Bearing clearances were taken and found within the design range.
There was a thread damage found in DE side oil retaining ring, so replaced with new ring.

103-JLP, Synthesis Gas Compressor

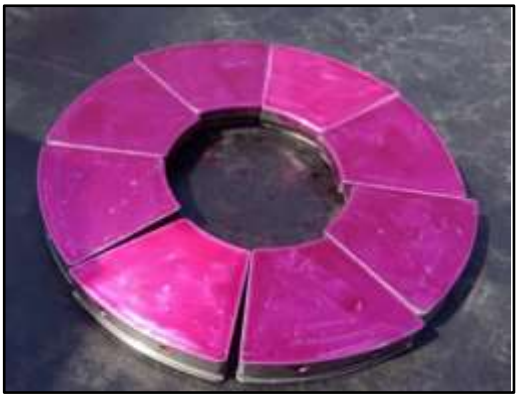
Journal bearings and thrust bearings which were accessible were inspected and found O.K. Gauss readings of both end journal bearings were measured and found within limit.
Dye penetration test was performed on all the pads and found in good condition.

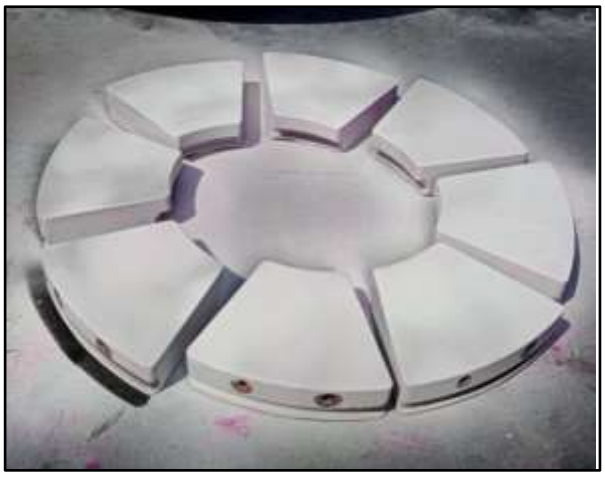
103-JHP, Synthesis Gas Compressor

The compressor was decoupled and thrust bearings and both end Journal bearings which were accessible were inspected and found O.K. Gauss readings of both end journal bearing pad and base ring, shaft journal area, thrust bearing and thrust collar was measured and found within limit. All pads were Dye Penetration tested and no surface cracks were found.


Turbine front journal bearing pads DP test conducted


Turbine Rear Journal bearing Pads DP test conducted




Turbine thrust bearing Pads Active/ Non-Active DP test conducted

Turbine/LP/HP Compressors DE/NDE Bearings clearances checked by Mandrel Method.


HP Compressor Active pads DP test conducted.

PREVENTIVE MAINTENANCE RECORDS: 103-J TRAIN

COUPLING RECORDS

Description	Position	Design (mm)	Before (mm)	After (mm)
DBSE (With Rotor at centre)				
103 JT – JLP	-	748.35	743.82	743.82
103 JLP- JHP	-	-	486.92	486.92
Distance between hub face (With Rotor at centre)				
103 JT-JLP	-		691.96	691.96
103 JLP – JHP			450.00	450.00

PREVENTIVE MAINTENANCE RECORDS: 103 - JT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
JLP End					
Journal Bearing	Mandrel	N	0.006-0.008	0.16	0.16
	measurement			-	-
Oil Guard (For Jr. Brg Housing)	L / R	C	0.015-0.021	0.15/0.15	0.10/0.10
	North	-	-	-	-
Oil Guard (For Seal Housing)	---	D	0.077-0.110	-	-
Bearing Pinch	Jr. Brg.	-	-	0.02	0.02
Governor End					
Journal Bearing	Mandrel	B	0.010-0.012	-	-
	By rotor lifting			0.35	0.35
Oil Guard (For Brg. Housing	South	-	-	-	-
	L / R	C	0.015-0.021	0.10/0.10	0.10/0.10
Oil Guard (For Seal Housing)	-	D	0.077-0.110	-	-
Axial Thrust	With Top Housing	-	0.008-0.012	0.28	0.28
	Without top Housing	-		-	-
Oil Guard (For Thrust Bearing)	North	A	0.002-0.004	-	-
	South	A	0.002-0.004	-	-
Shim thickness (Thrust adjusting)	North	-	-	-	-
	South - Inactive	-	-	6.34	6.34
Bearing Pinch	Jr. bearing	-	-	0.02	0.02

Journal Bearing Pads Thickness				
PADS	**NORTH SIDE BEARING**		**SOUTH SIDE BEARING**	
	Before	**After**	**Before**	**After**
No 1	14.90+ shim	15.00	14.97	15.00
No 2	14.90+shim	15.00	14.95	15.00
No 3	15.00	15.00	14.95	15.00
No 4	15.00	15.00	14.97	15.00
Thrust Bearing Pads Thickness				
Pad	**ACTIVE**		**INACTIVE**	
	Before	**After**	**Before**	**After**
No 1	18.00	18.00	18.00	18.00
No 2	18.00	18.00	18.00	18.00
No 3	18.00	18.00	18.00	18.00
No 4	18.00	18.00	18.00	18.00
No 5	18.00	18.00	18.00	18.00
No 6	18.00	18.00	18.00	18.00
No 7	18.00	18.00	18.00	18.00
No 8	18.00	18.00	18.00	18.00

PREVENTIVE MAINTENANCE RECORDS: 103-JLP

Description	Position	Dwg. Ref.	Design Clearances (Inch) & mm	Before (mm)	After (mm)
NON THRUST END					
Shaft journal Dia				104.78	104.78
Journal Bearing Clearance	Mandrel	C1	0.002”-0.004” (0.05 to 0.10)	0.12	0.12
	Filler / lead wire			-	-
THRUST END					
Journal Bearing Clearance	Mandrel	C1	0.002”-0.004”	-	
	Rotor lift			0.14	0.14
Axial Thrust	With Top Housing	-	0.015” -0.022”	0.43	0.47
	Without Top Housing	-		-	-

Journal Bearing Pads thickness				
PADS	**NORTH SIDE BEARING**		**SOUTH SIDE BEARING**	
	Before	**After**	**Before**	**After**
No 1	-	-	18.96	18.96
No 2			18.96	18.96
No 3			18.96	18.96
No 4			18.96	18.96
No 5			18.96	18.96

PREVENTIVE MAINTENANCE RECORDS: 103-JHP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
NON THRUST END					
Shaft Dia.	Journal bearing	-		104.77	104.77
Journal Bearing Clearance	Mandrel	A1	0.0023”-0.0033”	0.10	0.10
	Measurement			0.11	0.11
THRUST END					
Shaft Dia.	Journal bearing	-		104.77	104.77
Journal Bearing Clearance	Mandrel	A1	0.023”-0.033”	0.11	0.11
	Measurement			0.11	0.11
Axial Thrust	With Top Housing	-	0.015” - 0.022”	0.33	0.32
	Without Top Housing	-		-	-

Journal Bearing Pads thickness				
PADS	**NORTH SIDE BEARING**		**SOUTH SIDE BEARING**	
	Before	**After**	**Before**	**After**
No 1	18.96	18.96	18.96	18.96
No 2	18.96	18.96	18.96	18.96
No 3	18.96	18.96	18.96	18.96
No 4	18.96	18.96	18.96	18.96
No 5	18.96	18.96	18.96	18.96

Gauss			
Description	**Position**	**Before (Gauss)**	**After (Gauss)**
103-JT			
Journal bearing sleeve	Thrust end	0.8	0.8
	Non-Thrust End	1.4	1.4
Thrust bearing pads	Active	1.3	1.3
	Inactive	1.2	1.2
Thrust bearing base ring	Active	1	1
	Inactive	1	1
Shaft journal	Thrust end	1.9	1.9
	Non-Thrust end		
103-JLP			
Journal Bearing Sleeve	Thrust end	-	-
	Non-Thrust end	0.8	0.8
Thrust bearing pads	Active	-	-
	Inactive	-	-
Thrust bearing base ring	Active	-	-
	Inactive	-	-
Shaft journal	Thrust end	-	-
	Non-Thrust end	1.6	1.6
Journal Bearing Base Ring	Non-thrust end	0.9(T) , 0.3(B)	0.9(T) , 0.3(B)
103-JHP			
Journal Bearing Sleeve	Thrust end	0.6	0.6
	Non-Thrust end	0.4	0.4
Thrust bearing pads	Active	0.4	0.4
	Inactive	Not removed thrust collar	Not removed thrust collar
Thrust bearing base ring	Active	0.2	0.2
	Inactive	0.2(T) , 0.3(B)	0.2(T) , 0.3(B)
Shaft journal	Thrust end	-	-
	Non-Thrust end	1.6	1.6
Journal Bearing Base Ring	Thrust end	0.3	0.3
	Non-Thrust end	0.5	0.5

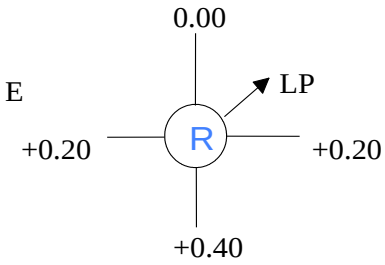
Note:

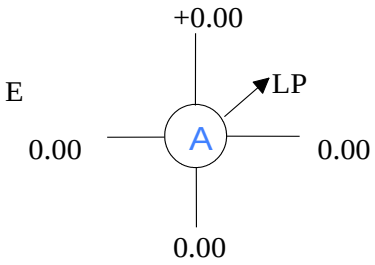
- Pre-stretch b/w 103-JT to JLP measured = 1.6mm (Design =1mm), adjusted by adding 0.38mm shim and maintained at 1.22mm
- Pre-stretch b/w 103-JLP to JHP measured = 1.6mm (Design =2.1mm), adjusted by removed 0.38mm shim and maintained at 1.98mm

ALIGNMENT READING RECORDS: 103-J TRAIN

103-JT to 103-JLP

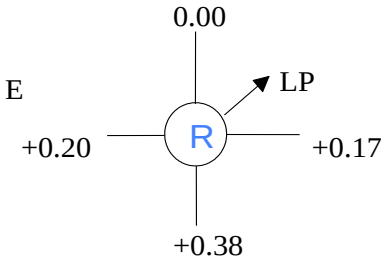
Protocol reading

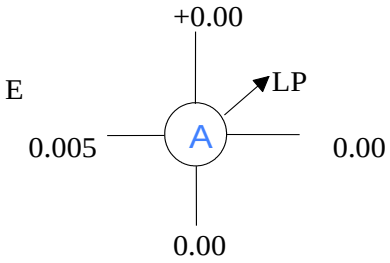




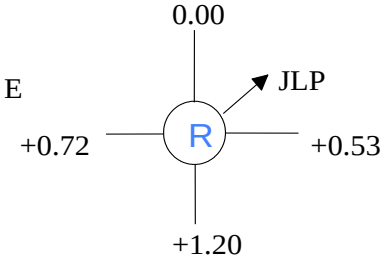
Note: Turbine to be kept 0.2mm above compressor

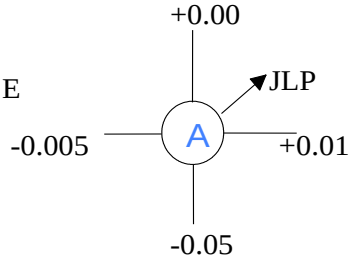
Previous Reading



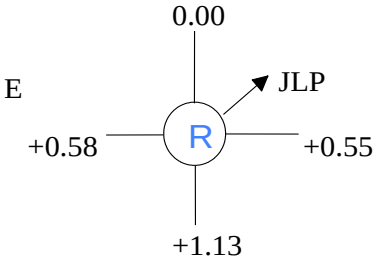


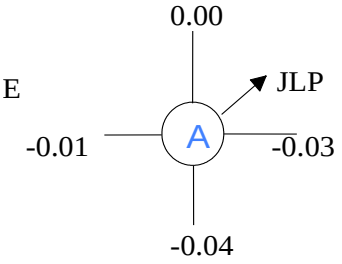
Before Preventive Maintenance





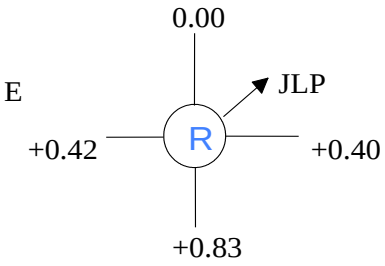
After Preventive Maintenance

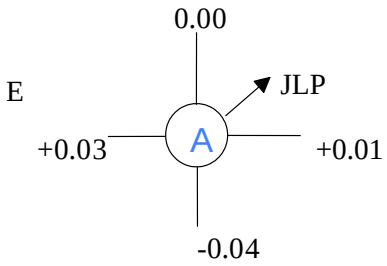




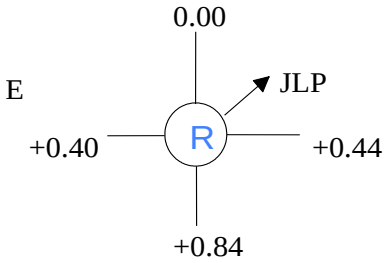
103-JLP to 103-JHP

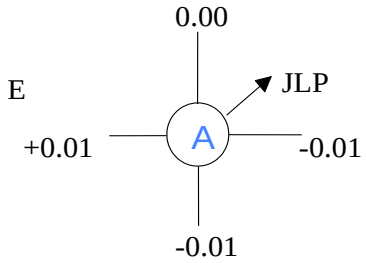
Before Preventive Maintenance





After Preventive Maintenance

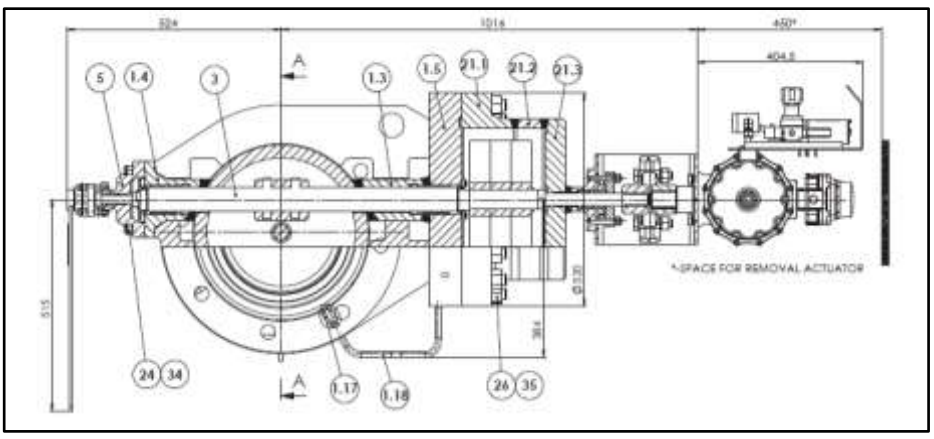




Replacement of QCNRV Damaged Diaphragm of 103-JT

A New Quick Exhaust Valve assembly was installed in QCNRV after modification in connecting thread.

QCNRV was replaced with new spare one with modification in tapping thread



HP Oil System

- All 4 blocks of poppet valves (item code: 2010112590109800) were replaced with new ones.
- Preventive maintenance of COP 8503 and 8504 was carried out. The coupling hub was found ok and the spider was found damaged. Hence, the same was replaced with a new one.
- Preventive maintenance of COP-8501 and 8502 was carried out. The coupling was found ok & spider was found damaged. Hence, the same was replaced with a new one.
- After energizing COP 8504, discharge pressure was checked and found to be OK.
- After energizing COP 8503, discharge pressure was not developed, and at the same time, the COP 8504 motor started rotating even after disconnecting the cable connection.
- As per P & ID, checked all the Oil paths and opened the NRV 8511 of COP 8504 and found some particles got jammed between the seats. Removed the particle, re-assembled and installed it in position.
- Again, re-opened the logic cartridge covers of the safety block, checked the spring position, and boxed up the poppet valve.
- After energizing the safety block, the discharge pressure was 158 kg/cm2.

Logic Catridge Assembly

Poppet assembly removal Tools

NRV 8511 of COP 8504

O-ring particle got stuck in NRV

Dismantled the NRV and removed the particle and assembled.

REFRIGERATION COMPRESSOR TRAIN, 105-J

Refrigeration Compressor Drive Turbine, 105-JT

Turbine & LP side was decoupled, and both ends the element assy. shims found damage, replaced the transmission unit with spare one. The Journal bearings and Thrust bearings were taken for inspection. Thickness of NDE Thrust pad were measured and one pad thickness was reduced to 18.86mm remaining were 19.07mm. Replaced all the NDE thrust pads with spare one (old 101-JT). Gauss readings of the bearing pads were measured and found within limits. The pads were visually inspected as well as dye penetration tested and found OK. Bearing clearances were taken and found within the design range.

Refrigeration Compressor, 105-JLP

105-JLP, the gear box end was decoupled. The couplings were visually inspected. Damage was found in flexible elements & bolts. So, replaced the complete Transmission unit & bolts with new ones. Axial thrust was measured (0.30 mm) and found within the limit. Journal bearing clearances are checked by rotor lifting.

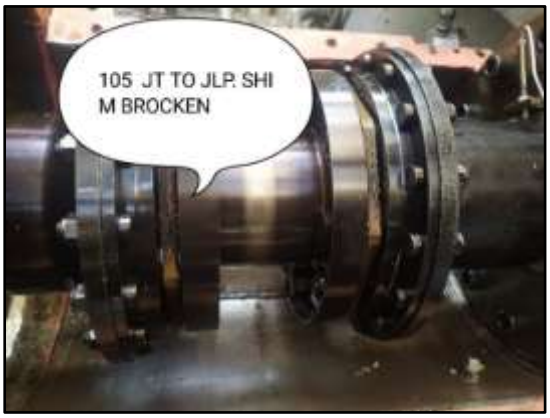
Gear Box, 105-JR

After decoupling, the top cover was removed. All the bearings were inspected and found in good condition. Both the gear as well as Pinion were inspected and found ok. Magnetism level of gear/pinion shaft and their bearings was carried out and found within limit. Bearing clearances were taken and found within the design range.

Refrigeration Compressor Preventive Maintenance, 105-JHP

105-JHP, the gear box end was decoupled. Axial thrust was measured (0.41 mm). All couplings were visually inspected. Journal Bearing clearances are checked by Rotor lifting. No damage in flexible elements was observed, all the hubs were found to be in their original positions intact.HP DE side The oil guard was replaced with a new one due to a crack. A drill and tape were provided on Labyrinth for fixing the probe.

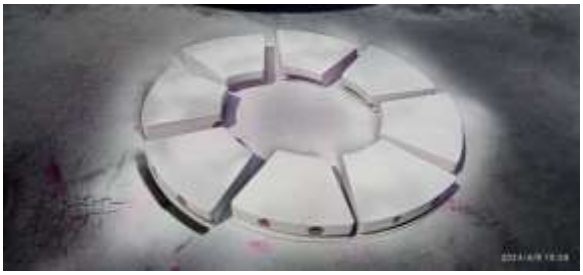
Damage of coupling shim and bolts between LP to GB.



Damage of coupling Shims between Turbine to LP compressor.

Gear wheel & pinion wheel bearing pad DP test

LP Bearing pad DP test



Turbine Active/Non-active thrust pads DP test conducted.

PREVENTIVE MAINTENANCE RECORDS: 105 - JT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
Distance between Hub Face (with Rotor at Centre)					
105-JT-JLP	-		222.4	221.75	221.75
105-JLP-JR	-		242.9	241.60	241.60
105-JR-JHP	-		187.66	188.06	188.06
JLP End					
Journal Bearing	Mandrel		0.007-0.009	0.20	0.20
	Measurement			0.20	0.20
Oil Guard (For Jr. Brg Housing)	South		0.015-0.021	-	-
	North		0.058-0.097	0.15/0.25	0.15/0.25
Oil Guard (For Seal Housing)	-		0.077-0.109	-	-
Shaft Diameter	Jr. Brg.		4.993	126.83	126.83
Bearing Pinch	Jr. Brg.		-	-	-
Governor End					
Journal Bearing	Mandrel		0.007-0.009	0.19	0.19
	Measurement			0.19	0.19
Oil Guard (For Brg. Housing)	South		-	-	-
	North		0.015-0.021	0.15/0.15	0.15/0.15
Oil Guard (For Thrust Brg.)	South		0.002-0.04	0.07	0.07
	North		0.002-0.004	0.07	0.07
Oil Guard (For Seal Housing)	-		0.077-0.109	-	-
Axial Thrust.	With Top Housing		0.008-0.012		
	Without top Housing			0.35	0.35
Total Float	-		0.180	0.32	0.32
Shaft Diameter	Journal bearing		4.993	126.83	126.83
Bearing Pinch	Jr. Bearing		-	-	-

Journal Bearing Pads Thickness				
PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	20.60	20.60	20.62	20.62
No 2	20.60	20.60	20.63	20.63
No 3	20.60	20.60	20.63	20.63
No 4	20.60	20.60	20.62	20.62
No 5	20.60	20.60	20.63	20.63
Thrust Bearing Pads Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	18.85	19.07 (New)	15.92	15.92
No 2	19.08	19.08 (old)	15.92	15.92
No 3	19.06	19.06 (old)	15.92	15.92
No 4	19.07	19.07 (old)	15.92	15.92
No 5	19.06	19.06 (old)	15.92	15.92
No 6	19.05	19.05 (old)	15.92	15.92
			Thickness plate	2.90

PREVENTIVE MAINTENANCE RECORDS: 105-JLP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
GEAR BOX END					
Oil Guard (For Thrust bearing)	North	C	0.002-0.004	0.05	0.07
	South	C	0.002-0.004	0.07	0.07
Oil Guard (For Outer Housing)	North	A	0.020-0.026	0.20	0.20
Axial Thrust	With Top Housing	-	0.011 – 0.015	0.30	0.30
	Without Top Housing	-		-	-
Total Float	-	-	2.38 – 3.96	0.30	0.30

Thrust Bearing Pad Thickness				
PAD	ACTIVE Outer		INACTIVE Inner	
	Before	After	Before	After
No 1	19.75	19.75	19.76	19.76
No 2	19.76	19.76	19.75	19.75
No 3	19.76	19.76	19.76	19.76
No 4	19.75	19.75	19.77	19.77
No 5	19.75	19.75	19.77	19.77
No 6	19.77	19.77	19.76	19.76
No 7	19.76	19.76	19.75	19.75
No 8	19.77	19.77	19.75	19.75

PREVENTIVE MAINTENANCE RECORDS: 105-JR

Description	Position	Design Clearances (Inch)	Before (mm)	After (mm)
Journal Bearing (Low Speed drive gear) With lead wire	North (measurement)	0.014–0.016	0.40	0.40
	South (measurement)	-- do --	0.40	0.40
Axial Thrust	---	0.014-0.024	0.40	0.40
Journal Bearing (High Speed driven Pinion)	North (measurement)	0.013 -	0.40	0.40
	South (measurement)	-- do --	0.39	0.39
Free float – pinion	---	---	1.45	1.45
Backlash	---	---	0.53	0.53
Shaft Diameter (Low Speed drive Gear) 97 gear teeth	North Side Bearing.	---	126.80	126.80
	South Side Bearing.	---	126.80	126.80
Shaft Diameter. (High Speed driven Pinion) 73 gear teeth	North Side Bearing.	---	114.13	114.13
	South Side Bearing.	---	114.13	114.13

PREVENTIVE MAINTENANCE RECORDS: 105-JHP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
GEAR BOX END					
Oil Guard (For Top Housing)	South	A	0.018 - 0.024	-	**0.20/0.15 (new)**
Nut	---	T	0.001 - 0.003	-	-
NON DRIVE END					
Oil Guard (For Thrust bearing)	North	P	0.002 – 0.004	0.05	0.05
	South	P	0.002 – 0.004	0.05	0.05
Oil Guard (For Top Housing)	North	P	0.002 – 0.004	-	-
Axial Thrust	With Top Housing	---	0.009 – 0.013	0.40	0.41
	Without Top Housing	---		-	-
Total Float	------	---	5.55-7.15 mm	-	-

Thrust Bearing Pad Thickness

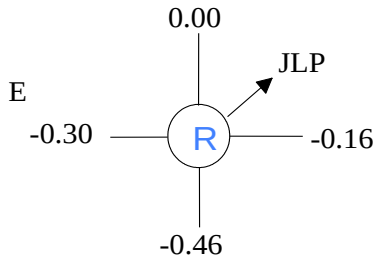
PAD	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	14.22	14.22	14.25	14.25
No 2	14.23	14.23	14.25	14.25
No 3	14.23	14.23	14.25	14.25
No 4	14.24	14.24	14.26	14.26
No 5	14.23	14.23	14.26	14.26
No 6	14.22	14.22	14.25	14.25
No 7	14.23	14.23	14.26	14.26
No 8	14.24	14.24	14.25	14.25

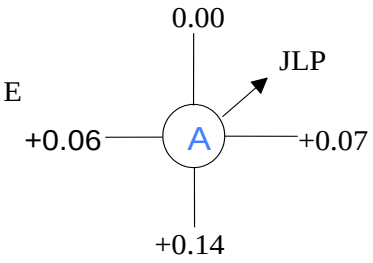
Gauss			
Description	**Position**	**Before (Gauss)**	**After (Gauss)**
105-JT			
Journal bearing Pads	Thrust end	0.4	0.4
	Non-Thrust End	0.5	0.5
Journal bearing Base Ring	Thrust end	0.1(T)/ 0.2(B)	0.1(T)/ 0.2(B)
	Non-Thrust End	0.1(T)/ 0.2(B)	0.1(T)/ 0.2(B)
Thrust bearing Pads	Active	0.3	0.3
	Inactive	0.7	0.7
Thrust bearing base ring	Active	0.5	0.5
	Inactive	0.5	0.5
Shaft journal	Thrust end	0.6	0.6
	Non-Thrust end	0.9	0.9
105-JLP			
Thrust bearing pads	Active	0.4	0.4
	Inactive	0.5	0.5
Thrust bearing base ring	Active	0.3	0.3
	Inactive	0.2	0.2
Shaft journal	Thrust end	0.1	0.1
	Non-Thrust end	-	-
105-JR			
Gear journal bearing	North	0.3(T), 0.4(B)	0.3(T), 0.4(B)
	South	0.5(T), 0.2(B)	0.5(T), 0.2(B)
Pinion journal bearing	North	0.2(T), 0.1(B)	0.2(T), 0.1(B)
	South	0.1(T), 0.2(B)	0.1(T), 0.2(B)
Thrust bearing	Active	0.3(T), 0.6(B)	0.3(T), 0.6(B)
	In-active	0.5(T), 0.8(B)	0.5(T), 0.8(B)
Oil Guard For above	South	-	-
	North	-	-
Shaft Journal	Thrust End	0.3(N), 0.1(S)	0.3(N), 0.1(S)
	Non-Thrust End	0.2(N), 0.6(S)	0.2(N), 0.6(S)
105-JHP			
Thrust bearing pads	Active	0.4	0.4
	Inactive	0.2	0.2
Thrust bearing base ring	Active	0.3	0.3
	Inactive	0.2	0.2
Shaft journal	Thrust end	0.1	0.1
	Non-Thrust end	0.3	0.3

ALIGNMENT READING RECORDS: 105-J TRAIN

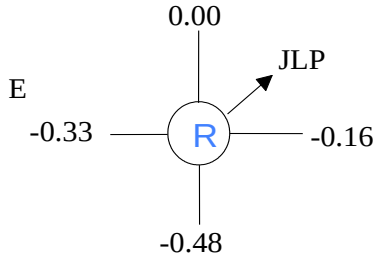
105-JT to 105-JLP

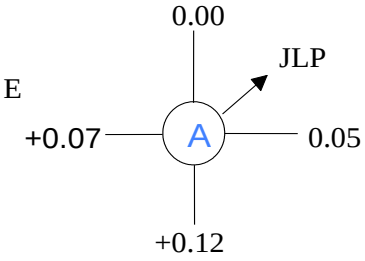
Before Preventive Maintenance





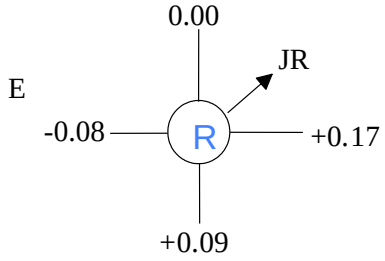
After Preventive Maintenance

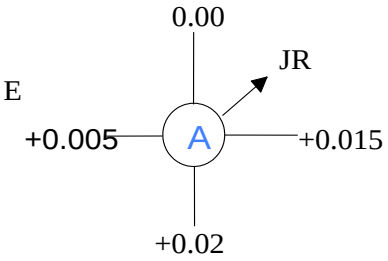




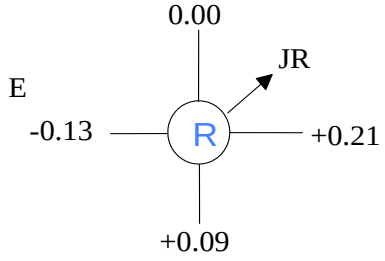
105-JLP to 105-JR

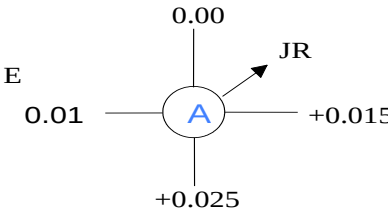
Before Preventive Maintenance





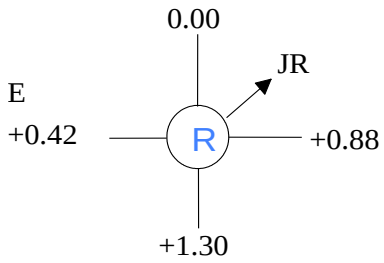
After Preventive Maintenance

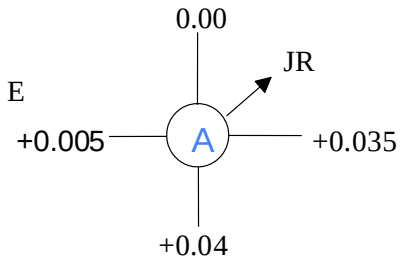




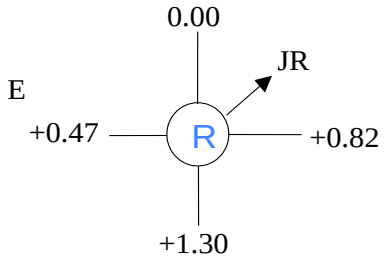
105-JR to 105-JHP

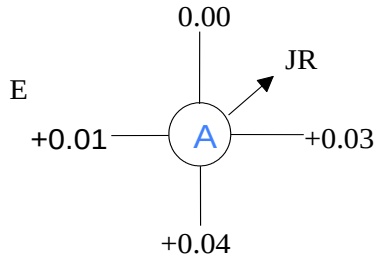
Before Preventive Maintenance





After Preventive Maintenance





INDUCED DRAFT FAN 101-BJ TRAIN

101- BJ Fan

Journal bearings and thrust bearings were inspected and found OK. A Gauss reading was taken and found below the maximum allowable limit. All the bearing pads were Dye Penetration tested, and no cracks were found Bearing clearances were taken and found to be within the design range. Water was circulated in the lines, and no leaks were observed. The final bearing clearance was measured and found to be within the design range.

MAJOR OVERHAULING OF ID FAN DRIVE TURBINE: 101- BJT

The turbine was decoupled. The top casing was removed, and all axial as well as radial clearances were measured. The bearings were removed for inspection. The rotor assembly was taken out, and it was cleaned by shot blasting. Visual inspections of the diaphragm were done. The bearing pads were visually inspected and a DP check carried out, which was found satisfactory. The magnetism level of the bearings and rotor assembly was checked and found to be within an acceptable limit. All labyrinths were also inspected, ID measured, and found to be OK, and the same labyrinths were installed. The thrust bearing was replaced with a new one (6310Z). The rotor was reinstalled, & all axial as well as radial clearances were measured. New carbon rings were installed. Bearing clearances were measured and found to be within limits. The top casing and all other related piping were boxed up.

The PGPL actuator was removed and replaced by spare in position.

The turbine was taken for a slow roll. The speed was increased by 1000 RPM, maintained for 5–10 minutes. Then it was reduced by 500 RPM and maintained for 5–10 min. This procedure ensured proper lapping of the carbon rings. Turbine OST checked and the turbine tripped at 4200 RPM.

101-BJR Gear Box

The top cover of the gear box was removed. The thrust bearings were inspected and found to have high clearance. So replaced the gear wheel thrust bearing with a new one. The remaining bearing dye penetration was inspected, and no defects were observed. A gauss measurement for the bearings was also carried out and found to be within the limit. Gear backlash and bearing clearance were measured and found to be within limits.

All couplings were visually inspected and found to be OK.

101-BJR MOP was replaced with a new pump (make: Tushaco). After start-up, no oil leakage was observed.

Turbine Rotor opened from its position.

Rotor Front & Rear carbon seals replaced with new ones.


Turbine Front & Rear liner bearings DP test conducted


Pinion bearings DP test conducted

Gear wheel bearings DP test conducted


ID Fan Front & Rear bearings DP test conducted

PREVENTIVE MAINTENANCE RECORDS: 101-BJ TRAIN

COUPLINGS RECORDS

Description	Position	Design (mm)	Before (mm)	After (mm)
DBSE (With Rotor at extreme ends)				
101 BJT-GB	---	150	152.10	152.10
101 GB-BJ	---	13	-	-
Distance between Hub Face (With Rotor at extreme ends)				
101 BJT-GB	---	---	148.60	148.60
101 GB- BJ	---	---	-	-
DBSE of GB - MOP coupling		5 to 6 mm	5.5	5.5

Major overhauling Records: 101-BJT

Description	Position	Dwg. Ref	Design Clearances (mm)	Before (mm)	After (mm)
Gear Box End					
Journal Bearing	Mandrel	---	0.18-0.25	-	-
	Filler / lead wire			0.28	0.28
Oil Guard (For Jr. Brg Housing)	CT Side	---	0.25-0.37	0.25 (Urea) 0.25 (Amm)	0.25 (Urea) 0.25 (Amm)
	SILO Side	---	0.25-0.37	0.20 (Urea) 0.20 (Amm)	0.20 (Urea) 0.20 (Amm)
Governor End					
Journal Bearing	Mandrel		0.18-0.25	-	-
	Filler / lead wire			0.23	0.23
Oil Guard (For Brg. Housing	CT Side	---	0.25-0.37	0.20	0.20
	SILO Side	----	0.25-0.37	0.20	0.20
Axial Thrust.	With Top Housing	---		0.40	0.40
	Without top Housing	---			
Nozzle clearance.	---	--		2.35	2.35

PREVENTIVE MAINTENANCE RECORDS: 101-BJR

Description	Position	Design Clearances (mm)	Before (mm)	After (mm)
Journal Bearing (High Speed drive Pinion)	CT Side	0.10-0.14	0.20	0.20
	SILO Side		0.22	0.22
Axial Thrust	Low speed High Speed		0.30 0.25	0.25 0.25
Journal Bearing (Low Speed driven Gear)	CT Side	0.14-0.19	0.25	0.25
	SILO Side	0.20-0.28	0.24	0.24
Backlash	---	0.3-0.50	0.40	0.40
Shaft Diameter (High Speed drive Pinion)	CT Side	---	99.91	99.91
	SILO Side	---	99.88	99.88
Shaft Diameter. (Low Speed driven Gear)	CT Side	---	129.85	129.85
	SILO Side	---	129.85	129.85
Gear Wheel Oil Guard Labyrinth clearance		0.24-0.29	L 0.10	R 0.07
Pinion Oil Guard Labyrinth clearance		0.20-0.24	L 0.07	R 0.10

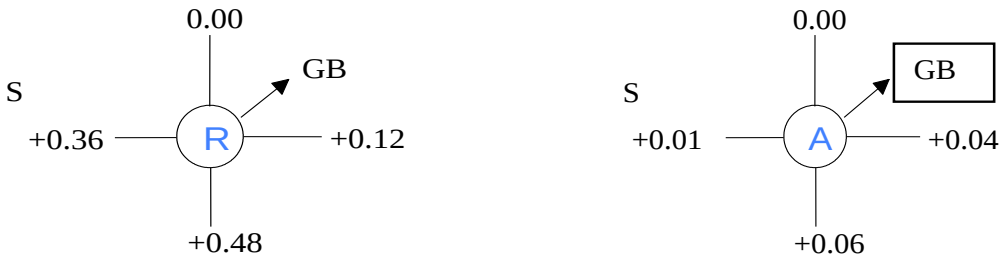
PREVENTIVE MAINTENANCE RECORDS: 101 - BJ

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
Gear Box End					
Journal Bearing	Mandrel	---	0.008" - 0.012"	-	-
	Filler / lead wire			0.40	0.40
Shaft Diameter	Jr. Brg.			177.75	177.75
Free End					
Journal Bearing	Mandrel	---	0.008" - 0.012"	-	-
	Filler / lead wire			0.43	0.43
Axial Thrust.	With Top Housing	---	---	-	-
Shaft diameter	Journal Bearing	-	-	177.82	177.82

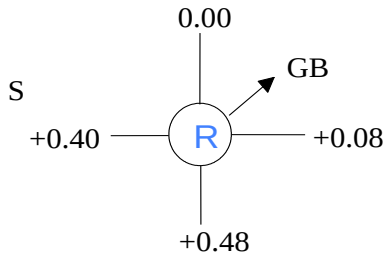
ALIGNMENT READING RECORDS: 101-BJ TRAIN

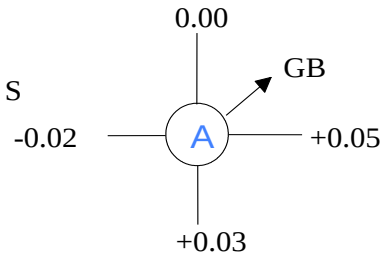
101-BJT to 101-BJR

Before Overhauling Maintenance



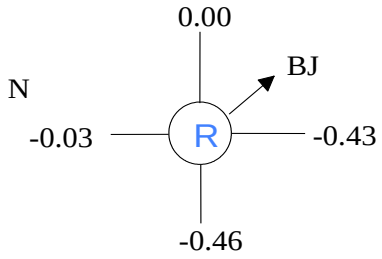
After Overhauling Maintenance

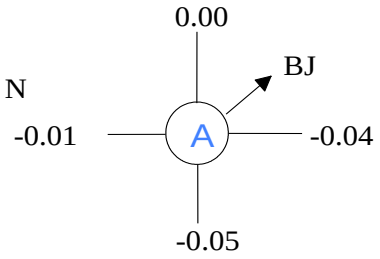




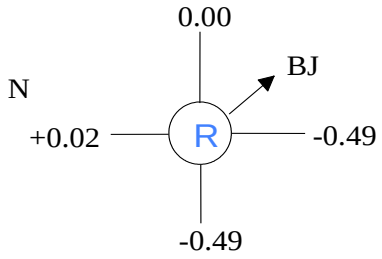
101-BJR to 101-BJ

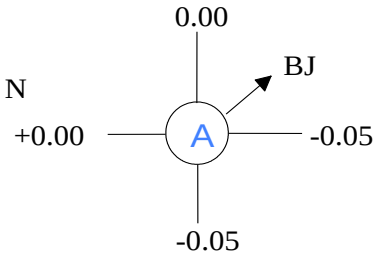
Before Preventive Maintenance





After Preventive Maintenance





SEMILEAN SOLUTION PUMP, 115-JA TRAIN

Preventive Maintenance of complete train was carried out.

PM of Pump, 115-JA

The pump was decoupled and both ends bearing housing opened. The DE side bearing clearance were measured and found in higher side. Replaced the bearing with new one. The thrust bearing and NDE ends radial bearings clearance were measured and found within limit. The bearing pads were visually inspected and DP inspected and found OK. The gauss measurement was taken and found within acceptable limit. The suction strainer was cleaned.

PM Overhauling of Drive Turbine, 115- JAT

The Turbine was decoupled and both ends bearing housing opened. The DE side bearing clearance were measured and found in higher side. Replaced the bearing with a new one. The thrust bearing and NDE ends radial bearings clearance were measured and found within the limit. The bearing pads were visually inspected, and DP checked and found OK. The gauss measurement was taken and found within acceptable limit.

The actuator filter was cleaned, and the actuator was flushed with oil SERVO ULTRA 40.

The condition of TB woods coupling sleeve was not good and hence replaced with new one.

Gear Box, 115-JAR

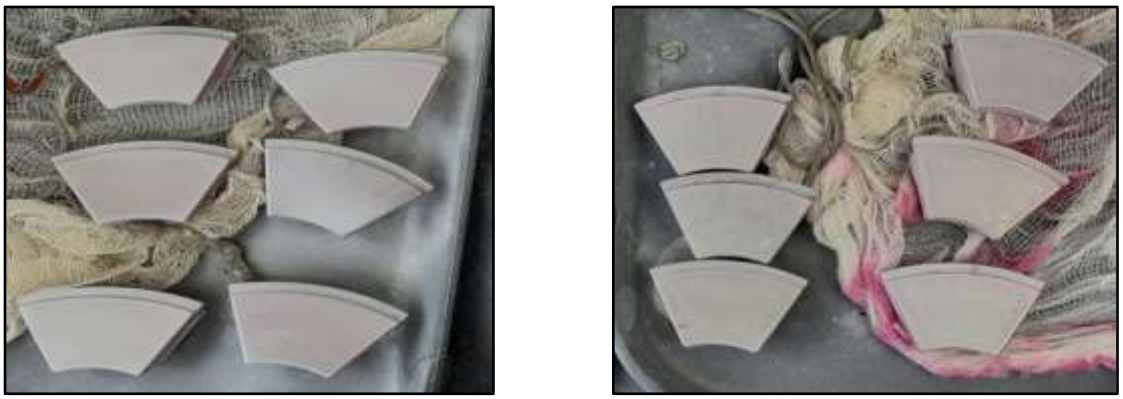
Gear Box was opened, and all the bearings were inspected and found O.K. Both the gear as well as Pinion were inspected and found O.K. Gauss measurement of gear shaft and bearings carried out and found within limit. Bearing clearances and backlash were measured and found within the design range. The main oil pump drive coupling was inspected and found in good condition. The oil piping's were cleaned with air.

Hydraulic Turbine, 115-HT

The hydraulic turbine was decoupled. The thrust bearing and both end radial bearings clearance were measured and found within limit. The bearing pads were visually inspected, and DP checked and found OK. The gauss measurement was taken and found within acceptable limit.

Clutch

The top cover of clutch was opened and cleaned. The sight glass was also cleaned. The hydraulic turbine to clutch alignment readings were measured and recorded. Turbine to clutch coupling was done.



Turbine thrust pads Active/Non-active DP tests conducted

Turbine Front & Rear bearings DP test conducted

Gear wheel bearings DP test conducted

Pinion bearings DP test conducted.

Pump Front bearings DP test conducted.

Pump Rear bearings DP test conducted

PREVENTIVE MAINTENANCE RECORDS 115-JA TRAIN

Coupling Records				
Description		**Design Clearances (mm)**	**Before (mm)**	**After (mm)**
115-JAT to GB				
DBSE		-	398.82	398.82
115-JA to GB				
DBSE		300	298.15	298.15
115-JA to Clutch				
DBSE		360	311.45	311.45
115-JA	Hub Overhang	-	NA	NA
	Hub Override	-	0.2	0.2
115-Clutch	Hub Overhang	-	NA	NA
	Hub Override	-	0.06	0.06

CLEARANCE RECORDS: SEMILEAN SOLUTION PUMP, 115-JA

Description	**Design Clearances**	**Before (mm)**	**After (mm)**
Thrust end bearing	0.005”-0.0098” (0.217-0.249mm)	0.26	0.26/0.18
Opp Thrust end bearing	--- do---	0.32	0.32/ 0.19
Axial Thrust	0.013” – 0.015” (0.35 - 0.40 mm)	0.28	0.28/0.35

Journal Bearing Pads Thickness (Sleeve Bearing)				
SLEEVE	**THRUST END BEARING**		**NON THRUST END BEARING**	
	Before (mm)	**After (mm)**	**Before (mm)**	**After (mm)**
TOP	34.85	34.85	34.84	34.84
BOTTOM	34.85	34.85	34.85	34.85

Thrust Bearing Pad Thickness				
Pad	**ACTIVE**		**INACTIVE**	
	Before (mm)	**After (mm)**	**Before (mm)**	**After (mm)**
No 1	31.77	31.77	31.76	31.76
No 2	31.77	31.77	31.76	31.76
No 3	31.77	31.77	31.77	31.77
No 4	31.77	31.77	31.75	31.75
No 5	31.77	31.77	31.77	31.77
No 6	31.77	31.77	31.76	31.76
No 7	31.77	31.77	31.76	31.76
No 8	31.77	31.77	31.75	31.75

CLEARANCE RECORDS: GEAR BOX, 115- JR

Axial Thrust	HIGH SPEED SHAFT LOW SPEED SHAFT	1.15 mm 2.00 mm	1.15 mm 2.00 mm
High Speed Shaft bearing	Silo Side CT Side	0.33 mm 0.34 mm	0.33 mm 0.34 mm
Low Speed Shaft Bearing	Silo Side CT Side	0.29 mm 0.29 mm	0.29 mm 0.29 mm
Black lash		0.69	0.69

CLEARANCE RECORDS: DRIVE TURBINE, 115- JAT

Description		**Design clearance**	**Before (mm)**	**After (mm)**
Axial Thrust		0.010 – 0.012	0.28	0.26
Coupling side bearing		0.0055-0.008	0.36(old)	0.32(New)
Governor side bearing		Inboard Outboard		0.26
Oil Gland Coupling side (inboard)	Radial	0.0100-0.0125	0.15	0.15
	Axial	0.040-0.050		
Oil Gland Coupling side (outboard)	Radial	0.0100-0.0125	0.10/0.10	0.10/0.10
	Axial	0.080-0.090		
Oil Gland Governor side	Radial	0.0100-0.0125	0.10 / 0.20	0.10/ 0.10
	Axial	0.030-0.040		

Thrust Bearing Pad Thickness				
PAD	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	17.46 mm	17.47 mm	17.46 mm	17.43 mm
No 2	17.44 mm	17.47 mm	17.46 mm	17.44 mm
No 3	17.44 mm	17.47 mm	17.43 mm	17.43 mm
No 4	17.44 mm	17.47 mm	17.46 mm	17.43 mm
No 5	17.46 mm	17.47 mm	17.46 mm	17.46 mm
No 6	17.44 mm	17.47 mm	17.44 mm	17.46 mm

SEMILEAN SOLUTION PUMP 115-HT

CLEARANCE RECORDS			
Description	Design Clearances (mm)	Before (mm)	After (mm)
Thrust end bearing	0.124 – 0.148	0.16	0.16/0.20
Opp Thrust end bearing	0.124 – 0.148	0.20	0.20/0.19
Axial Thrust	0.25 – 0.30	0.40	0.40/0.32

Thrust Bearing Pad Thickness				
PAD	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	19.82	19.82	19.88	19.88
No 2	19.86	19.86	19.87	19.87
No 3	19.88	19.88	19.88	19.88
No 4	19.86	19.86	19.88	19.88
No 5	19.86	19.86	19.86	19.86
No 6	19.85	19.85	19.88	19.88

ALIGNMENT READING RECORDS: 115-JA TRAIN

115-JAT to 115-JR

After Preventive Maintenance:

Vertical:Offset Value = -0.16mm; Angular Value = 0.00/100mm

Horizontal:Offset Value = 0.14mm; Angular Value = 0.02/100mm

115-JR to 115-JA

After Preventive Maintenance:

Vertical:Offset Value = -0.20mm; Angular Value = 0.03/100mm

Horizontal:Offset Value = -0.16mm; Angular Value = 0.02/100mm

115-JA to Clutch

After Preventive Maintenance:

Vertical:Offset Value = 0.02mm; Angular Value = 0.06/100mm

Horizontal:Offset Value = -0.10mm; Angular Value = 0.01/100mm

115-HT to Clutch

After Preventive Maintenance:

Vertical:Offset Value = 0.08mm; Angular Value = 0.04/100mm

Horizontal:Offset Value = 0.01mm; Angular Value = 0.03/100mm

SEMILEAN SOLUTION PUMP, 115-JB TRAIN

Overhauling of turbine and Preventive Maintenance of GB & Pump was carried out.

Pump, 115-JB

The pump was decoupled, and both ends of the bearing housing were opened. The thrust bearing and both end radial bearing clearances were measured and found to be within limits. The bearing pads were visually inspected, DP checked, and found to be OK. The gauss was checked and found to be within an acceptable limit. The suction strainer was cleaned.

The Lube Oil filter was replaced with a new one.

LP-Pump Front & Rear bearings DP test conducted

LP-Pump thrust pads Active/Non-active DP test done.


Pinion bearings DP test conducted


Gear wheel bearings DP test conducted

Drive Turbine, 115- JBT

The turbine was decoupled, and the exhaust line was removed. The top casing was removed, and all axial as well as radial clearances were measured. The bearings were removed for inspection. The rotor assembly was taken out, and it was observed that the rotor blades of the last stage were eroded and filled with mud, cleaning done by shot blasting. The 2, 3, and 4 diaphragms were taken out for cleaning. The 6th diaphragm, which was jammed in both the top and bottom casings, was found to be eroded. Pittings were observed on the diaphragm, and DP checked and found to be okay. The bearing pads were visually inspected and DP check carried out, and both side bearings were replaced with new ones. Inter-stage labyrinths no. 2, 3, and 4 were also taken out, and new labyrinths were installed. While removing the inter-stage labyrinths, some of them were broken as they had been stuck in the diaphragm. The new rotor was installed, and all axial as well as radial clearances were measured. New carbon rings were installed. Bearing clearances were measured and found to be within limits. The steam inlet pipe, exhaust pipe, and all other related piping were boxed up.

The TG13 E actuator was removed, tested, and replaced by a new one as there was a problem of hunting. The coupling sleeve was also replaced with a new one.

The turbine was kept in a decoupled position.

Note: The removed diaphragm was cleaned by shot blasting and offered for reverse engineering to M/s. Triveni Engineering PVT against the order number.

After opening the top casing

Bottom Last stage Diaphragm

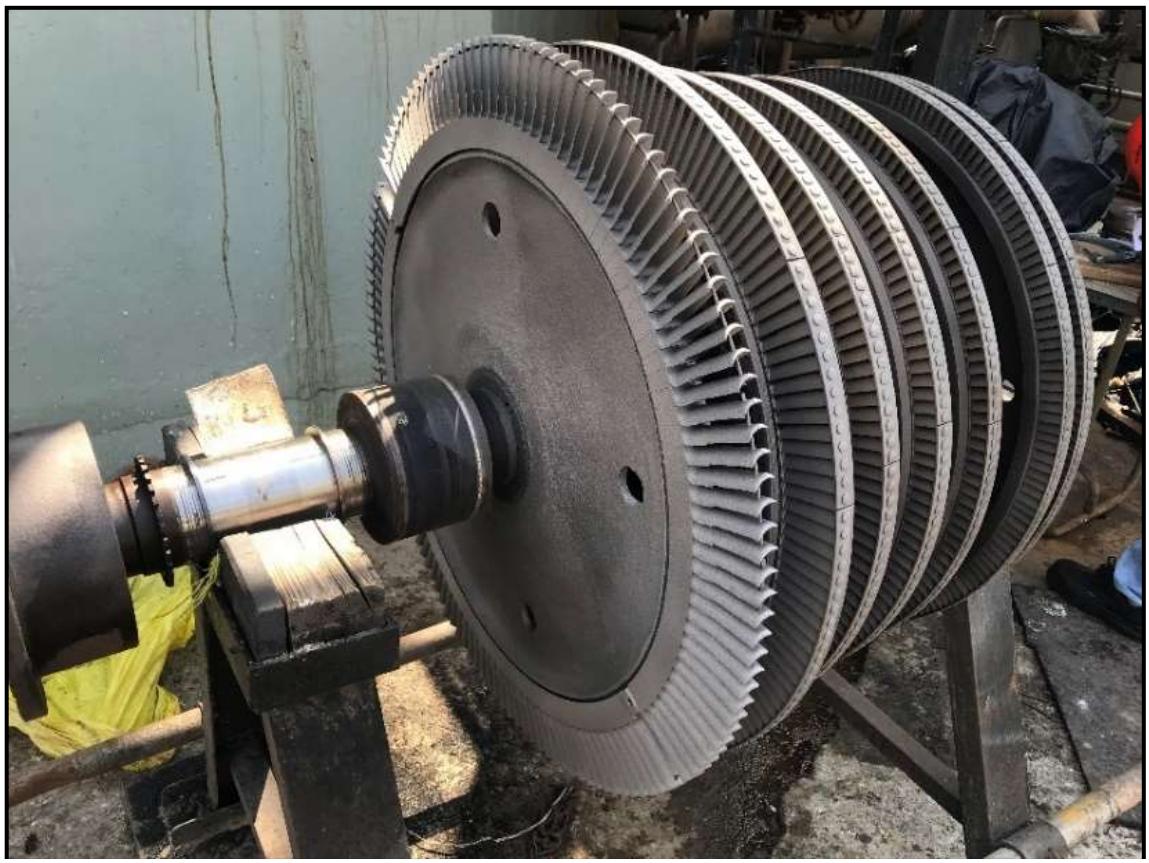
Bottom casing

Last stage Diaphragm

Removed Rotor

Bearing housing

Pittings observed in stage



Gear Box, 115-JBR

Gear Box was opened and all the bearings were inspected and found O.K. Both the gear as well as Pinion were inspected and found O.K. Gauss measurement of gear shaft and bearings carried out and found within limit. Bearing clearances and backlash were measured and found within the design range. The main oil pump drive coupling was inspected and found in good condition.

PREVENTIVE MAINTENANCE RECORDS 115-JB TRAIN

Coupling Records		
Description	**Before (mm)**	**After (mm)**
DBSE of 115-JBT to 115-JBR	396.32	396.32
DBSE of 115-JB to 115-JBR	302.05	302.05

CLEARANCE RECORDS : SEMILEAN SOLUTION PUMP, 115-JB

Description	**Design Clearances**	**Before (mm)**	**After (mm)**
Thrust end bearing	0.005”-0.0098” (0.217-0.249mm)	0.18	0.18
Opp Thrust end bearing	--- do---	0.18	0.18
Axial Thrust	0.013” – 0.015” (0.35 - 0.40 mm)	0.43	0.43

Thrust Bearing Pad Thickness				
Pad	**ACTIVE**		**INACTIVE**	
	Before (mm)	**After (mm)**	**Before (mm)**	**After (mm)**
No 1	31.74	31.73	31.74	31.73
No 2	31.74	31.74	31.74	31.74
No 3	31.74	31.74	31.74	31.73
No 4	31.74	31.74	31.74	31.74
No 5	31.74	31.74	31.72	31.74
No 6	31.73	31.73	31.73	31.74
No 7	31.73	31.73	31.74	31.73
No 8	31.74	31.74	31.74	31.73

Description	Position	Gauss
115-JB		
Journal Bearing Pads	Thrust End	-
	Non Thrust End	T- 0.6, B-0.3

CLEARANCE RECORDS: GEAR BOX, 115- JBR

Description		Before (mm)	After (mm)
High Speed Shaft bearing	Front Side Rear Side	0.27 0.29	0.27 0.29
Low Speed Shaft Bearing	Front Side Rear Side	0.18 0.29	0.18 0.29
GB Backlash		0.48	0.43

Description	Position	Gauss
115-JBR		
Gear Journal Bearing	North	T-0.2, B-0.4
	South	T-0.1, B-0.7
Pinion Journal Bearing	North	T-0.4, B- 0.6
	South	T-0.5, B-0.4

CLEARANCE RECORDS: DRIVE TURBINE, 115-JBT

Description			Before (mm)	After (mm)
Axial Thrust		0.010 – 0.012	0.10	0.30
Coupling side bearing		0.0055-0.008	0.33	0.26
Governor side bearing		Inboard Outboard	0.33	0.26
Oil Gland Coupling side (inboard)	Radial	0.0100-0.0125	L-0.25 /R-0.20	L-0.25 /R-0.20
	Axial	0.040-0.050	L-0.90/ R-1.00	L-0.90/ R-1.00
Oil Gland Coupling side (outboard)	Radial	0.0100-0.0125	0.10	0.10
	Axial	0.080-0.090	2.65	2.65
Oil Gland Governor side	Radial	0.0100-0.0125	0.10	0.10
	Axial	0.030-0.040	1.20	1.20

Thrust Bearing Pad Thickness				
PAD	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	17. 45	17. 45	17.45	17.45
No 2	17.45	17.45	17.46	17.46
No 3	17.46	17.46	17.45	17.45
No 4	17.45	17.45	17.45	17.45
No 5	17.45	17.45	17.46	17.46
No 6	17.44	17.44	17.45	17.45

Gauss for 115-JBT

Description	Position	Gauss
105-JBT		
Journal Bearing Pads	Thrust End	T-0.8, B-1.2
	Non Thrust End	0.7
Thrust Bearing Pads	Active	0.9
	Inactive	0.7
Shaft journal	Thrust End	0.9
	Non Thrust End	1.8

COLD CLEARANCE TOLERANCES					
Sr. No.	DESCRIPTION	DESIGN		ACTUAL (mm)	
		MIN	MAX		
1	DIAMETRAL SHAFT SLEEVE SEALS	.0100	0.0125		
2	RADIAL DIAPHRAGM SEAL stage 2	.0148	0.0165	0.25	0.30
3	RADIAL DIAPHRAGM SEAL stage 3	.0148	0.0165	0.25	0.30
4	RADIAL DIAPHRAGM SEAL stage 4	.0148	0.0165	0.25	0.25
5	RADIAL DIAPHRAGM SEAL stage 5	.0148	0.0165	0.20	0.25
6	RADIAL DIAPHRAGM SEAL stage 6	.0148	0.0165	0.25	0.25
7	CARBON RING DIAMETRAL	.0070	0.0085	STM. END	EXT. END
8	JOURNAL BEARING DIAMETRAL	.0035	.0080	STM. END	EXT. END
				-	-
9	TRIP PIN/ PLUNGER	.0620	.0650	-	-

Sr. No.	DESCRIPTION	DESIGN		ACTUAL (mm)	
		MIN	MAX		
10	AXIAL BEARING HOUSING SEAL, STEAM END	.0300	.0400	-	-
11	AXIAL BEARING HOUSING SEAL, EXHAUST END INBOARD	.0400	.0500	-	-
12	AXIAL BEARING HOUSING SEAL, EXHAUST END OUTBOARD	.0800	.0900	-	-
13	NOZZLE RING, AXIAL	.0500	.0720	2.00	2.22
14	BUCKET HOLDER, AXIAL (INLET)	.0500	.0900	2.80	2.65
15	BUCKET HOLDER, AXIAL (OUTLET)	.0700	.1050	2.70	2.85
16	RADIAL, DISK (ROW 6)	.0580	.0680	-	-
17	DIAPHRAGM, AXIAL (ROW 6)	.0840	.1140	-	-
18	DIAPHRAGM, AXIAL (ROW 2)	.0520	.0820	1.45	1.5
19	DIAPHRAGM, AXIAL (ROW 3)	.0520	.0820	1.45	1.3
20	DIAPHRAGM, AXIAL (ROW 4)	.0520	.0820	1.30	1.55
21	DIAPHRAGM, AXIAL (ROW 5)	.0520	.0820	1.50	1.55
22	MAGNETIC IMPULSE SPEED PICK – UP AIR GAP	.0200	.0250	-	-
23	END THRUST	0.010	0.012	0.30	

ALIGNMENT READING RECORDS : 115-JB TRAIN

115-JBT to 115-JBR

After Preventive Maintenance:

Vertical:Offset Value = -0.10mm; Angular Value = 0.03/100mm

Horizontal:Offset Value = -0.05 mm; Angular Value = 0.01/100mm

115-JBR to 115-JB

After Preventive Maintenance:

Vertical:Offset Value = 0.25mm; Angular Value = 0.00/100mm

Horizontal:Offset Value = -0.33mm; Angular Value = 0.01/100mm

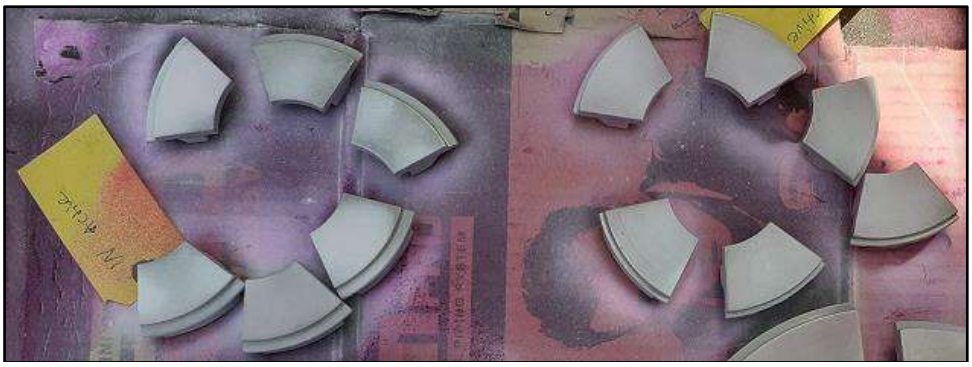
BOILER FEED WATER PUMP, TRAIN 104-JA

104-JA Boiler Feed Water Pump

Both ends journal bearing sleeves were visually inspected and dye penetration tested and found OK. The bearing clearance were measured and found within design range. Magnetism level of the bearings was checked and found within desired value. The main oil console and its filters elements were cleaned and installed. The seal flushing fluid coolers and strainers were cleaned. The NDE Bearing housing gasket was replaced with new one.

104-JAT Drive Turbine

The turbine was taken for preventive maintenance.



Turbine thrust pads DP test conducted

Pump thrust pads DP test conducted

Pump DE/NDE bearings DP test conducted

Description	Before (MM)	After (MM)
DBSS (With Rotor at extreme ends)	126.95	126.92
Distance between Hub Face (With Rotor at extreme ends)	130.00	130.00

Preventive maintenance record of 104-JAT

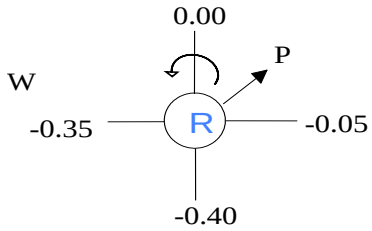
Description	Position	Design (Inch)	Before (MM)	After (MM)
Coupling End				
Journal Bearing	Mandrel	0.005”-0.007”		
	Filler / lead wire		0.15	0.15
Oil Guard (For Jr. Brg Housing)	South		0.10	0.10
	North		0.10	0.10
Shaft Diameter	Jr. Brg		69.7	69.7
Governor end				
Journal Bearing	Mandrel	0.005”-0.007”		
	Filler / lead wire		0.20	0.21
Oil Guard (For Brg. Housing)	South		(L)0.15/ 0.12(R)	(L)0.15/ 0.12(R)
Axial Thrust	With Top Housing	0.011”-0.016”	0.42	0.42
	Without top Housing			
Spacer thickness. (Thrust adjusting)	North		0.30	0.10
Total Float	---		0.41	0.41

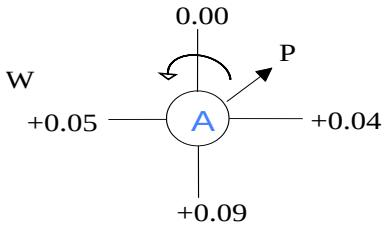
Thrust Bearing Pad Thickness : 104-JAT				
Pad	**ACTIVE**		**INACTIVE**	
	Before	**After**	**Before**	**After**
No 1	15.90	15.90	15.40	15.92
No 2	15.89	15.89	15.41	15.92
No 3	15.89	15.89	15.40	15.91
No 4	15.90	15.90	15.42	15.91
No 5	15.89	15.89	15.42	15.92
No 6	15.91	15.91	15.41	15.92

CLEARANCE CHART : 104-JA			
Description	**Design Clearance (Inch)**	**Before PM (MM)**	**After PM (MM)**
104 JA			
Journal bearing (Thrust end bearing)	0.006 - 0.008	0.16	0.16
Journal bearing (Opposite thrust end)	0.006 - 0.008	0.15	0.15
Axial Thrust	0.014	0.45	0.45

Thrust Bearing Pad Thickness : 104-JA				
PAD	**ACTIVE**		**INACTIVE**	
	Before	**After**	**Before**	**After**
No 1	25.37	25.37	25.38	25.38
No 2	25.36	25.36	25.37	25.37
No 3	25.37	25.37	25.37	25.37
No 4	25.36	25.36	25.38	25.38
No 5	25.37	25.37	25.37	25.37
No 6	25.37	25.37	25.37	25.37

ALIGNMENT READING RECORDS : 104-JAT to 104-JA

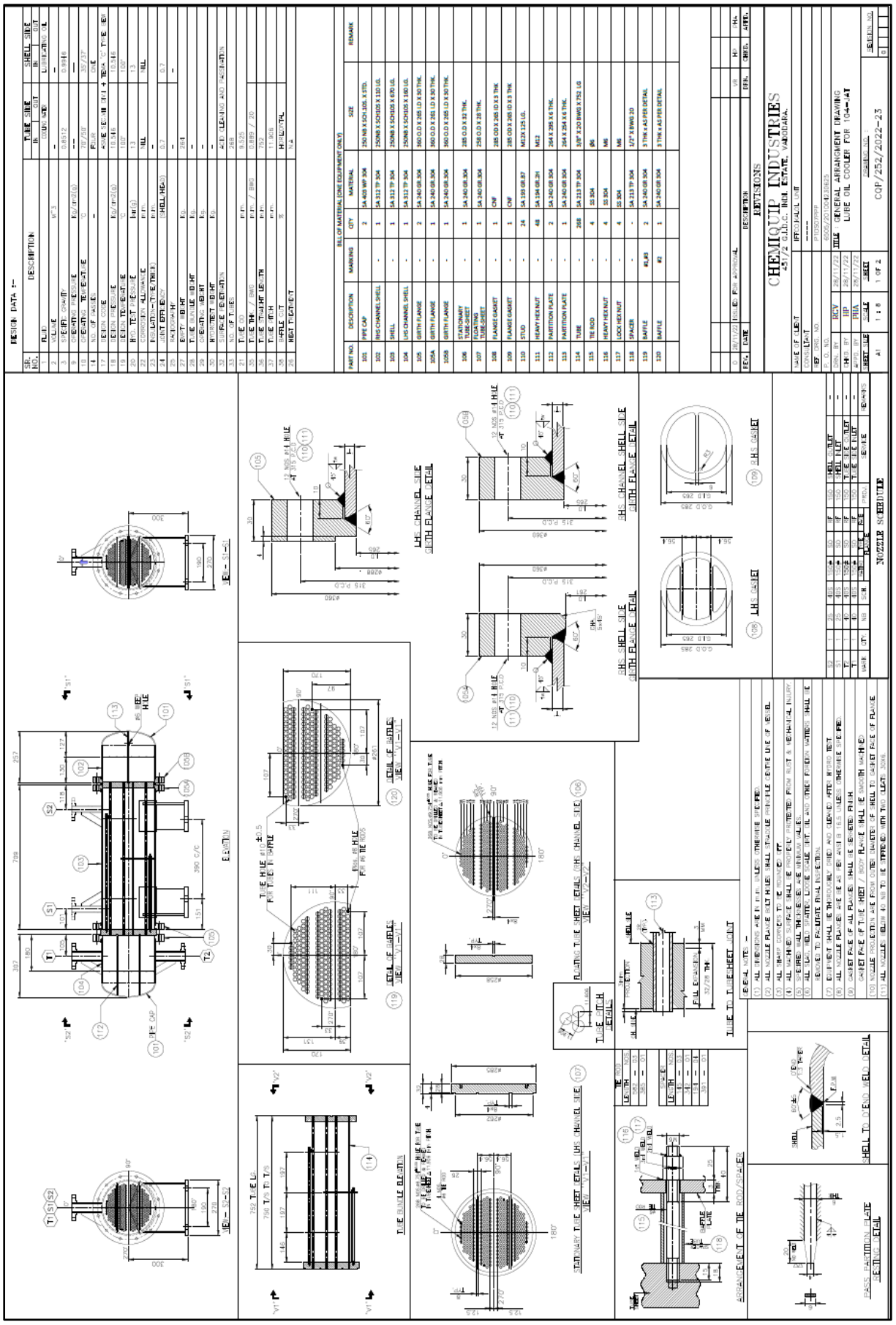




104-JAT Turbine Side Lube Oil Cooler

A new lube oil cooler was procured against the purchase order no. 201004230625, Dtd 09-Aug 2022 from M/s. CHEMIQUIP Industries, Vadodara. Installed in position with modifications to the inlet and outlet lines of the lube oil pipeline. A Complete lube oil was replaced with a new one.

New lube oil Cooler of 104-JAT



GA drawing of 104-JAT lube Oil Cooler

New AOP with motor was installed on the lube oil tank with inlet and outlet lube line modification. Pump was procured from M/s. FABSMITH INDIA PRIVATE LIMITED, Chennai. against the order no 201004220318, Dtd : 02-Jun-2021.

New AOP with motor of tuthill make was installed

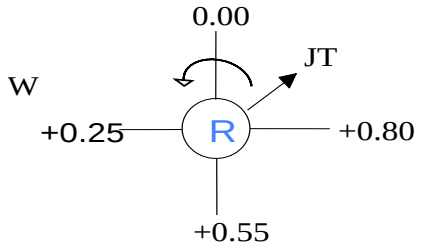
PREVENTIVE MAINTENANCE OF 104-JT (ELLIOT)

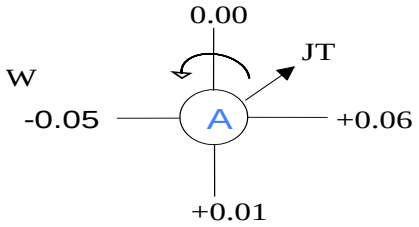
Preventive maintenance of turbine was carried out, Both ends journal bearing sleeves were visually inspected, dye penetration checked and found OK. The bearing clearance was measured and found within design range. Magnetism level of the bearings were checked and found within desired value.

Description	Position	Dwg. Ref	Design Clearances (mm)	Before (Inch)	After (mm)
Coupling side					
Journal Bearing	Filler / lead wire		0.007”-0.010”	0.30	0.30
Oil Guard Inboard (Radial)	South		0.015”- 0.0195”	0.15/0.10	0.15/0.10
	North		0.015”- 0.0195”	-	-
Oil Guard out board (Radial)	South		0.015”- 0.0195”	0.15/ 0.10	0.15/ 0.10
	North		0.015”- 0.0195”	-	-
Governor End					
Journal Bearing	Filler / lead wire		0.007-0.010”	0.32	0.32
Oil Guard In	South	---	0.015”- 0.0195”	0.10/0.10	0.10/0.10

Description	Position	Dwg. Ref	Design Clearances (mm)	Before (Inch)	After (mm)
Board (Radial)	North		0.015”- 0.0195”	0.10/0.15	0.10/0.15
Axial Thrust.	With Top Housing	---	-	0.37	0.37
	Without top Housing	---		-	-
GAUSS					
LOCATION			**BEFORE (Gauss)**	**AFTER (Gauss)**	
Journal bearing Governor end	Top half		1.0	1.0	
	Bottom half		0.6	0.6	
	Shaft		1.2	1.2	

ALIGNMENT READING RECORDS : 104-JT to 104-J





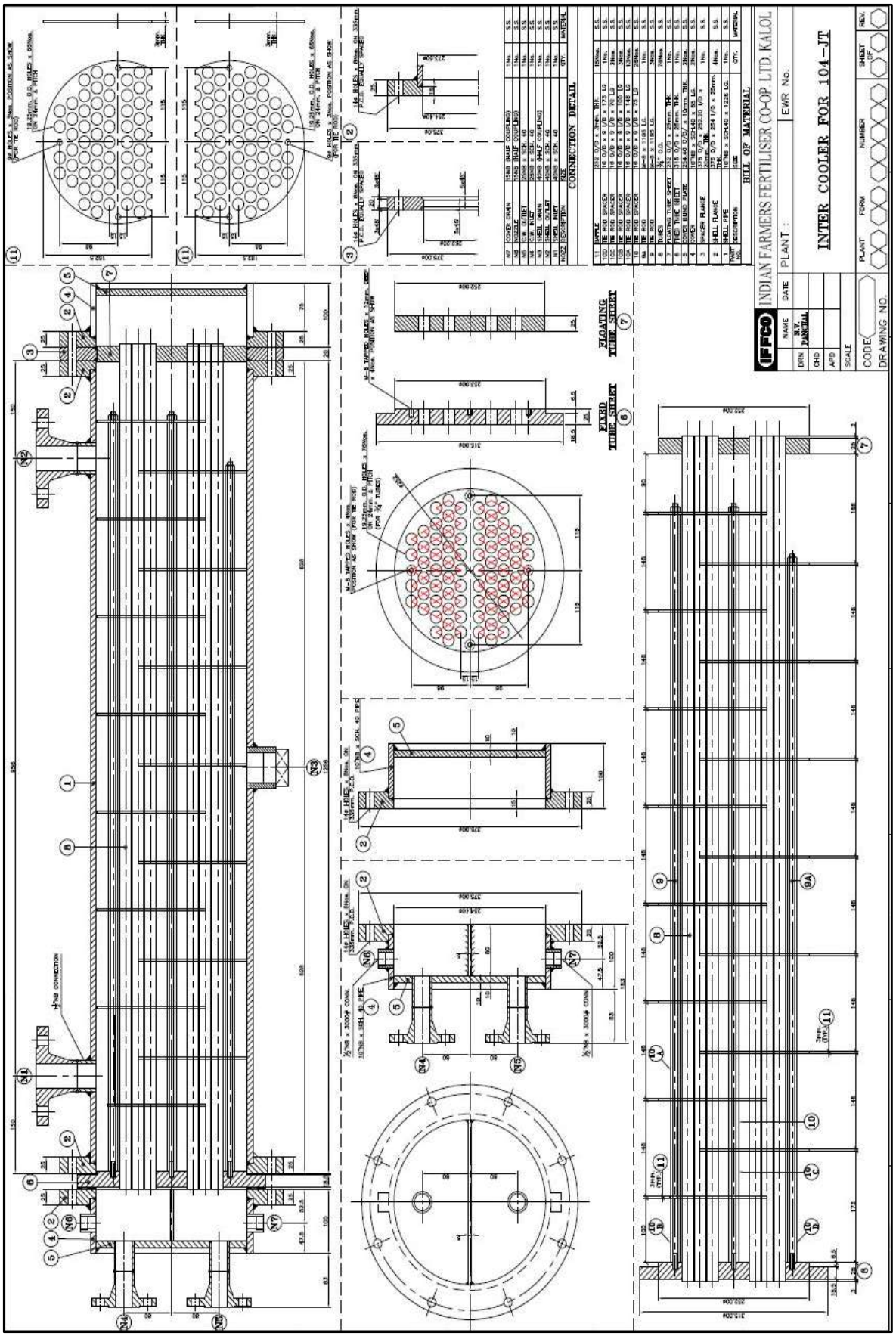
Installation of In-house Designed Lube oil cooler

During last SD, the lube oil cooler was found with complete chocking with mud and the damage In tubes. So decided to replace the cooler with upgraded MOC ss 304 of tube and shell and increase in surface area & in tube size. The installation of upgraded oil cooler was carried out by modifying in Cooling water inlet and outlet lines as per site.

A new Duplex Filter assembly procured from **M/s. Bhagwati filter** of 20 microns was also installed on cooler outlet line.

After fabrication a lube oil circulation was carried out by providing mesh in lube oil circulation line and carried out until the no particles were found and Flow was measured at the bearing housing inlets of the turbine and found ok.

Complete oil was replaced of oil console and its existing filters element were cleaned and installed.



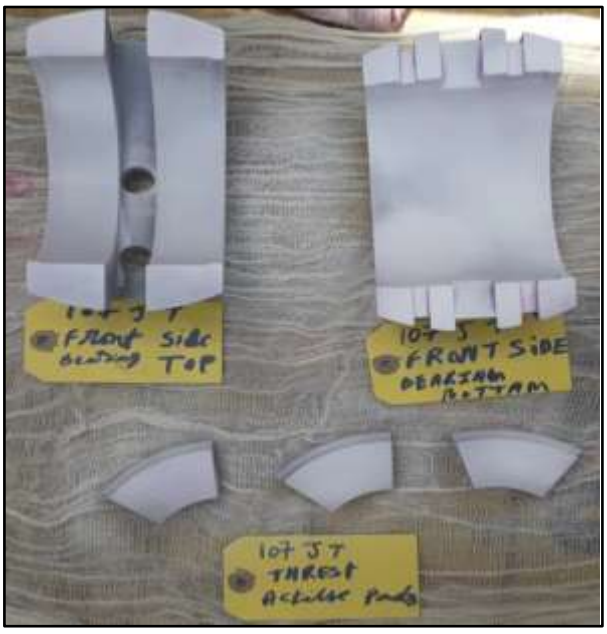
In-house fabricated Lube Oil cooler of 104-JT

Lube oil Cooler with new Duplex Filter assembly installed in cooler outlet line

PM of aMDEA PUMP 107-J Train

107-JT Drive Turbine

The turbine was decoupled, coupling was inspected and DBSE was noted. Turbine (107-JT) front & rear bearings and thrust pads were thoroughly polished and dimensionally checked and found to be within limits. DP tests were carried out and found to be okay. The magnetism level of all bearings was found to be within limits. Clearances were measured and found to be within the limit.



Turbine Front bearings, Active side thrust pads DP test done.

Turbine Rear bearings, Non-active side thrust pads DP test done

107-J aMDEA Pump

Both ends bearing housing oil flushed. Alignment between Turbine & Pump was done and final coupling of the turbine to pump done.

COUPLINGS

Description	Position	Design (Inch)	Before (mm)	After (mm)
DBSE (With Rotor at extreme ends)	---		182.62	182.62
Distance between Hub Face (With Rotor at extreme ends)	---		178.49	178.49

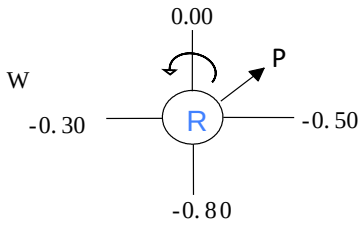
PREVENTIVE MAINTENANCE RECORDS: 107 - JT

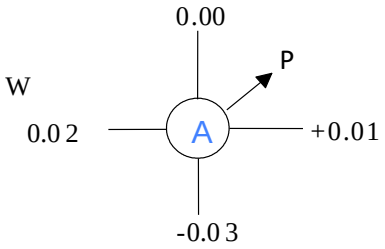
Description	Design Clearance (Inch)	Before PM (MM)	After PM (MM)
Journal Bearing Thrust end	0.004” - 0.006”	0.15	0.15
Oil Guard Thrust end - Inboard	0.011” – 0.017”	0.20 / 0.15	0.20 / 0.15
Journal Bearing Opposite Thrust end	0.004” - 0.006”	0.16	0.16
Oil Guard Thrust end - Outboard	0.011” – 0.017”	0.10 / 0.10	0.10 / 0.10
Oil Guard Opposite thrust end - Inboard	0.011” – 0.017”	0.15 / 0.15	0.15 / 0.15
Axial Thrust	0.007 – 0.013	0.40	0.40
Turbine active side spacer thickness		19.50	19.50

Thrust Bearing Pad Thickness : 107-JT				
PAD	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	15.84	15.84	15.88	15.88
No 2	15.87	15.87	15.87	15.87
No 3	15.87	15.87	15.86	15.86

GAUSS			
LOCATION		BEFORE (Gauss)	AFTER (Gauss)
Journal bearing Governor end	Top half	0.3	0.3
	Bottom half	0.1	0.1
	Shaft	0.7	0.7
Journal bearing Coupling end	Top half	0.5	0.5
	Bottom half	0.3	0.3
	Shaft	0.6	0.6
Thrust bearing	Collar	0.8	0.8
	Pad	0.2	0.2

ALIGNMENT READINGS : 107-JT to 107-J





RECIPROCATING CO_2 GAS COMPRESSOR TRAIN (117-J)

Compressor was taken for major Overhauling.

LP Cylinders Overhauling

The end clearance at TDC and BDC were measured and opened the head of both cylinders to remove the piston assembly. The cylinder liners were inspected and found OK. The piston assembly of both the cylinders was replaced. Spare refurbished gas packings were reinstalled on both the cylinders. All the suction and discharge valves were replaced by spare refurbished valves.

HP Cylinders Overhauling

The end clearance at TDC and BDC were measured and opened the head of both cylinders to remove the piston assembly. The cylinder liners were inspected and found OK. The piston rod assembly of both cylinders was replaced by new one with new dry gas packings were reinstalled on both the cylinders. All the suction and discharge valves were replaced by spare refurbished valves.

Crank Case Assembly Overhauling

- The crank case cover was opened for the inspection of the bearings and other internals.
- Clearances of all the big end bearings were found on higher side. These 5 set bearings were replaced by new ones.
- Big End bearings and Gudgeon Pin of all 4 nos. connecting rods were replaced by new one
- All the clearances were measured and recorded.
- All critical nuts were tightened at respective design torque.
- The AOP was run and oil flow inside the crank case was checked and found OK.
- The oil scrapper rings (4 nos.) were replaced by new one.
- Tyre coupling was checked and found ok.

Miscellaneous jobs

- The tube bundle of the inter stage cooler was pulled out and cleaned done.
- Replaced the O-rings of Floating Head of Inter stage cooler.
- Dish end of HP flow dampener was replaced with SS304.

- The LP and HP flow dampener were checked and found OK.
- The lube oil strainers were cleaned and reinstalled.

CLEARANCE CHART: 117-J TRAIN

Description	Position		Design clearance(mm)	Before (mm)	After (mm)
Piston end clr. (Front /TDC)	LP	Urea side	2	2.10	2.60
		Ammonia side	-- do --	2.70	2.70
	HP	Urea side	-- do --	2.40	2.70
		Ammonia side	-- do --	3.00	2.60
Piston end clr. (Intermediate /BDC)	LP	Urea side	1.5	1.60	1.50
		Ammonia side	-- do --	1.80	1.60
	HP	Urea side	-- do --	1.60	1.60
		Ammonia side	-- do --	1.90	1.60
Main bearing	I	Urea side to Ammonia side	0.08-0.15 (0.3 MAX)	0.22	0.20
	II		-- do --	0.23	0.20
	III		-- do --	0.23	0.20
	IV		-- do --	0.23	0.20
	V		-- do --	0.22	0.20
Big end bearing	LP	Urea side	0.07-0.13 (0.3 MAX)	0.23	0.22
		Ammonia side	-- do --	0.22	0.22
	HP	Urea side	-- do --	0.22	0.21
		Ammonia side	-- do --	0.22	0.22
Small end bearing	LP	Urea side	0.05-0.10 (0.2 MAX)	0.07	0.07
		Ammonia side	-- do --	0.07	0.07
	HP	Urea side	-- do --	0.06	0.06
		Ammonia side	-- do --	0.06	0.06

Description	Position		Design clearance(mm)	Before (mm)	After (mm)
Cross head guide	LP	Urea side	0.18-0.26 (0.6 MAX)	0.15	0.25
		Ammonia side	-- do --	0.15	0.25
	HP	Urea side	-- do --	0.15	0.25
		Ammonia side	-- do --	0.15	025
Side clearance (Crank shaft)	----	Crank shaft	0.45-0.60 (0.9 MAX)	0.80	0.60
Side clearance (Connecting rod big end)	LP	Urea side	0.33-0.42 (0.6 MAX)	0.20	0.30
		Ammonia side	-- do --	0.20	0.30
	HP	Urea side	-- do --	0.25	0.30
		Ammonia side	-- do --	0.25	0.30

Alignment Reading between Motor & GB:

Vertical:Offset Value = 0.09mm; Angular Value = 0.02/100mm

Horizontal:Offset Value = 0.01mm; Angular Value = 0.01/100mm

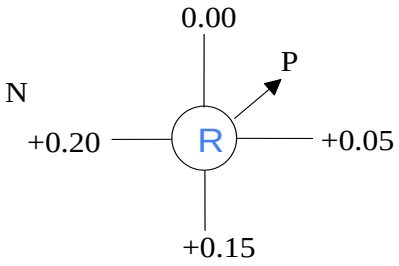
Drive Turbine of Lube Oil/ Seal Oil Pump for 101-J & 105-J Train, 101-JLJT

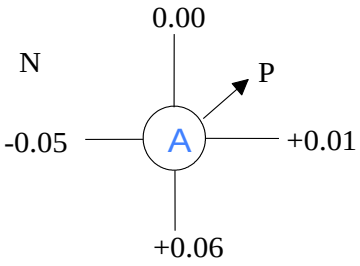
- Preventive Maintenance of Turbine was carried out.
- DE & NDE Bearing Housing's top cover was opened for bearing inspection.
- Both the bearings were checked and found ok.
- Turbine trip pin assembly found damaged, so replaced the trip pin assembly by removed one from spare rotor assembly.
- Actuator to turbine coupling was inspected and found ok.
- Speed sensor ring found loose.
- Axial thrust was found to be 0.28 mm
- Mesh of Strainer of LO pump was found ok.
- All bearings Oil were flushed.
- Actuator was replaced with new one as the drive shaft was having play.

Turbine Trip pin broken

Complete trip assembly replaced

Final Alignment Reading





DBSE= 140.10 mm

Drive Turbine of Seal Oil Pump for 103-J (103-JLJCT)

- The Turbine was taken for Preventive Maintenance.
- DE & NDE Bearing Housing's top cover was opened for bearing inspection.
- Both the bearings were checked and found ok
- Recorded the governing valve travel as 19.10 mm (open: 63.50mm and close: 44.40mm)
- Actuator coupling was replaced with new one.
- Actuator tested and found ok.

Decoupling, Alignment and Coupling Job

- Following motors were replaced by energy efficient motors:

  101-BJT AOP & 104-J AOP.

- Following motors were taken for overhauling by electrical section:

  116-JB, 104-JT AOP, 104-JAT AOP, 101-BJT AOP, PC-2A, PC-2B, 121-J, 121-JA, 107-JAT AOP, 115-JAT AOP, 115-JBT AOP, 113-J, 103-JLJD, 103-JLJB, 117-J, 117-J AOP, RCOP-8501, RCOP-8502, COP-8503, COP-8504, 2004-J, 2001-LJ & 2001-LJA

PRIMARY REFORMER, AUXILIARY BOILER & SECONDARY REFORMER JOBS

Primary Reformer, 101-B

Radiant Zone

Burner blocks were inspected and fifteen damaged burner blocks were replaced by Unifrax make, Model: Moldafrax BBM 15 burner blocks.

Row No.	Burner Nos.
1	114
2	201, 202, 205, 206
3	301, 310, 312
4	Nil
5	501
6	601, 608
7	Nil
8	803, 809
9	906, 914

- The roof insulations were inspected. Damaged / dropped insulation blocks were replaced by new ones and gap was filled.
- All Side wall insulations were found intact & in satisfactory condition.
- Damaged header insulations were replaced / repaired.
- Scaffolding erected & dry ice blast cleaning of all reformer tubes were carried out.
- NDT of reformer tubes were carried out by Inspection section.
- Damaged / broken tunnel slabs were replaced by new ones.
- All spring hangers locked for inspection & unlocked after completion of the job.
- All burners air resistor overhauling done.
- Arch burners damaged clamping studs and ferrules of gas inlet lines were replaced by new ones.

Arch burners damaged studs cut

Arch burners new studs welded

- The transfer line, 107-D end cover was opened for inspection, damaged refractory on seating area of Transfer Line End Plug was repaired and then boxed up.

Auxiliary Boiler

- All Manholes were opened.
- Scaffolding was erected for dry-ice blast cleaning of tubes & repairing of damaged refractory of walls.
- Repairing of damaged wall refractory & dry-ice blast cleaning of tubes carried out.
- Scaffolding was removed from inside.
- Manhole was closed by putting bricks and ceramic blanket.

Secondary Reformer, 103-D

Top cover with Air Mixer Nozzle & Bottom cover were opened for inspection and catalyst screening. After removal of bottom cover, piping arrangement connected with CG Circulator line for catalyst cooling.

Air Mixer Nozzle

Severely eroded circumferential weld of central pipe with top cover liner was repaired by welding. Weld fill-up done on crevice observed at few locations on both sides of long seam of old pipe. Weld fill-up done on eroded weld of old pipe. (Below perforated trays)

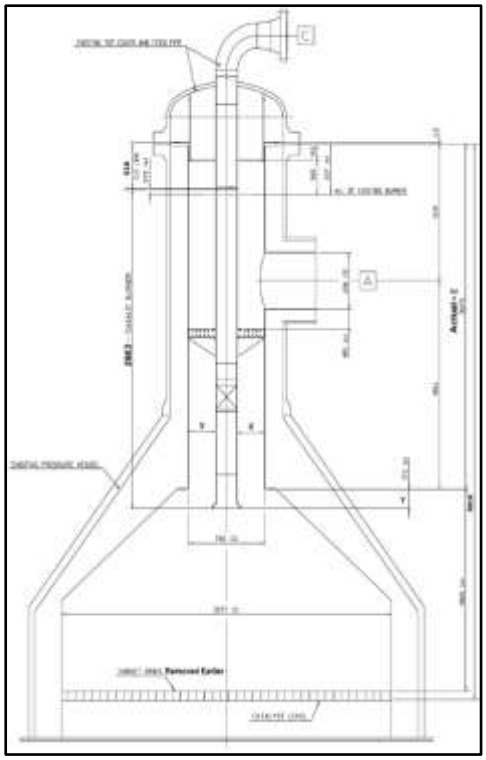
Burner Tip was found cracked / damaged, it was referred to M/s. Casale and they recommended to replace the burner tip at next available opportunity.

Condition of the perforated plate found satisfactory. However, found slightly damaged at few locations during removing.

All stitch weld condition found satisfactory.

Repaired damaged Liner joint of 103-D top shell to transfer line. Damaged top flange refractory was repaired by civil section before box-up.

Damaged refractory in bottom portion was repaired by civil section as per the observation in inspection report.



103-D Top Cover assembly with Shell

Top Cover with Air Mixer Nozzle

Damaged Liner

Weld Repaired Liner

Extended portion grinded off

Weld fillup done on eroded welding

Top Flange Refractory repaired

Box-up of Top cover with new gasket

Bottom Dome Refractory

Catalyst Replacement of LTS, 104-D1

- 104-D1, LT Shift Converter: Manholes were opened. Screens were removed for catalyst replacement. After removing all catalyst from the vessel, internal inspection of the vessel was carried out.
- Thermowell pipe found bent and its assembly found loose at end. It was repaired.
- After filling bottom Alumina balls, Bottom floating screen was provided.
- Then Catalyst loading was done.
- Then Raschig ring was provided above catalyst.
- Then top Floating screen and grating was provided
- Old bottom Floating ring mesh (Mesh size 3 X 3) and Top floating ring mesh (Mesh size 2 X 2 X 0.063" Ø & Mesh size 6 X 6 X 0.054" Ø) were reused.
- Manhole boxed up.
- LTS Catalyst was replaced after 5 years (earlier replaced on 2018)
- 2 nos. Portable boilers were hired for heating & reduction of catalyst by M/s. Aakash Exploration Services, Shertha. CPA No. 201004231962 dated 04/04/2023.

Unloading of Catalyst

Bottom mesh

HEAT EXCHANGERS AND COOLER JOBS

Primary Waste Heat Exchanger, 101-CB

Leakage was occurred from top cover to channel flange joint during running. To avoid the plant shutdown, furmaniting was done & the leakage was arrested. To avoid any future occurrence of leak through furmanited joint, it was decided to replace the gasket of top cover to channel flange joint.

Studs were stucked in the holes due to furmanited material. Each & every stud was unbolted by using chain blocks and removed by hammering & heating through gas torch.

Four nos. jack plates were welded on both the flanges and jacking done by 50 ton hydraulic jacks to make gap between flanges. After removing all studs and making gap between flanges, the cover was lifted by the help of Kobelco crane & shifted it to the ground.

Top cover & channel flanges face and bolt holes were thoroughly cleaned and then Gasket was replaced by new one.

Top cover was lifted from ground & placed on position by using Kobelco crane. All studs of top cover to channel flange joint and downcomer line flange joint were inserted. Tightened all studs of top cover to channel flange joint first as per the normal stud tightening sequence by using hydraulic torque wrench and then the downcomer line flange joint studs.

All Top cover & channel flange studs were tightened by RSL-30 torque wrench at 1st round 1000 PSI, 2nd round 2000PSI, 3rd round at 3000PSI, 4th round at 4000PSI & final check round at 4000PSI.

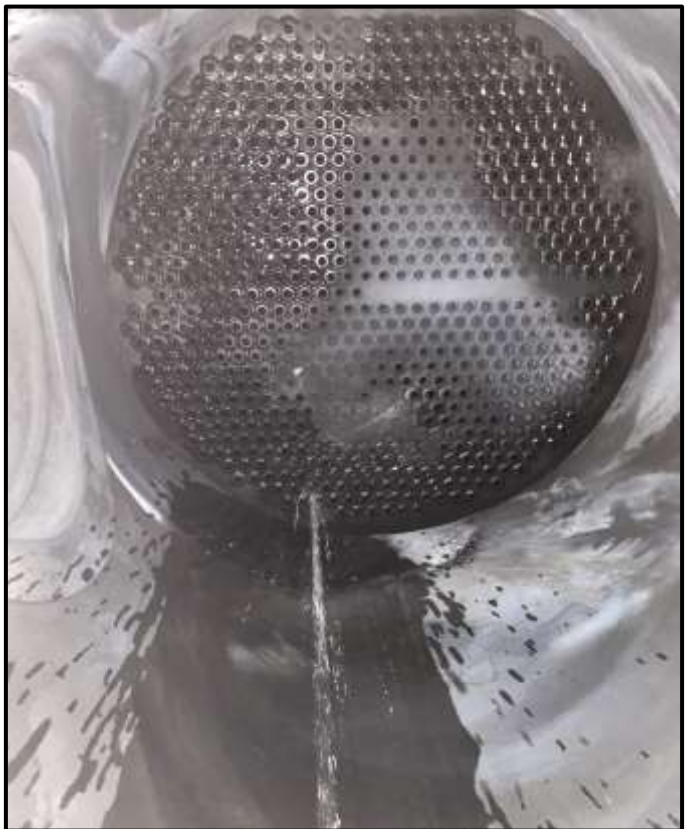
Primary Waste Heat Exchanger, 101-CA

Top cover & channel flange joint started leaking during hydrotest. To arrest the leakage, studs were tightened by RSL-30 torque wrench at 1st round 4000 PSI, 2nd round 5000PSI, 3rd round at 5500PSI, 4th round at 6000PSI & final check round at 6000PSI

Secondary Waste Heat Exchanger, 102-C

After completion of blinding and obtaining clearance from production top and bottom cover bolts were opened, both covers were removed, and top cover was brought down to ground floor by KOBELCO Crane**.**

Water fill-up was carried out on shell side for identifying the leaky tubes. Leakage from one tube i.e. #30/13 was observed from full bore at bottom side of the tube sheet.

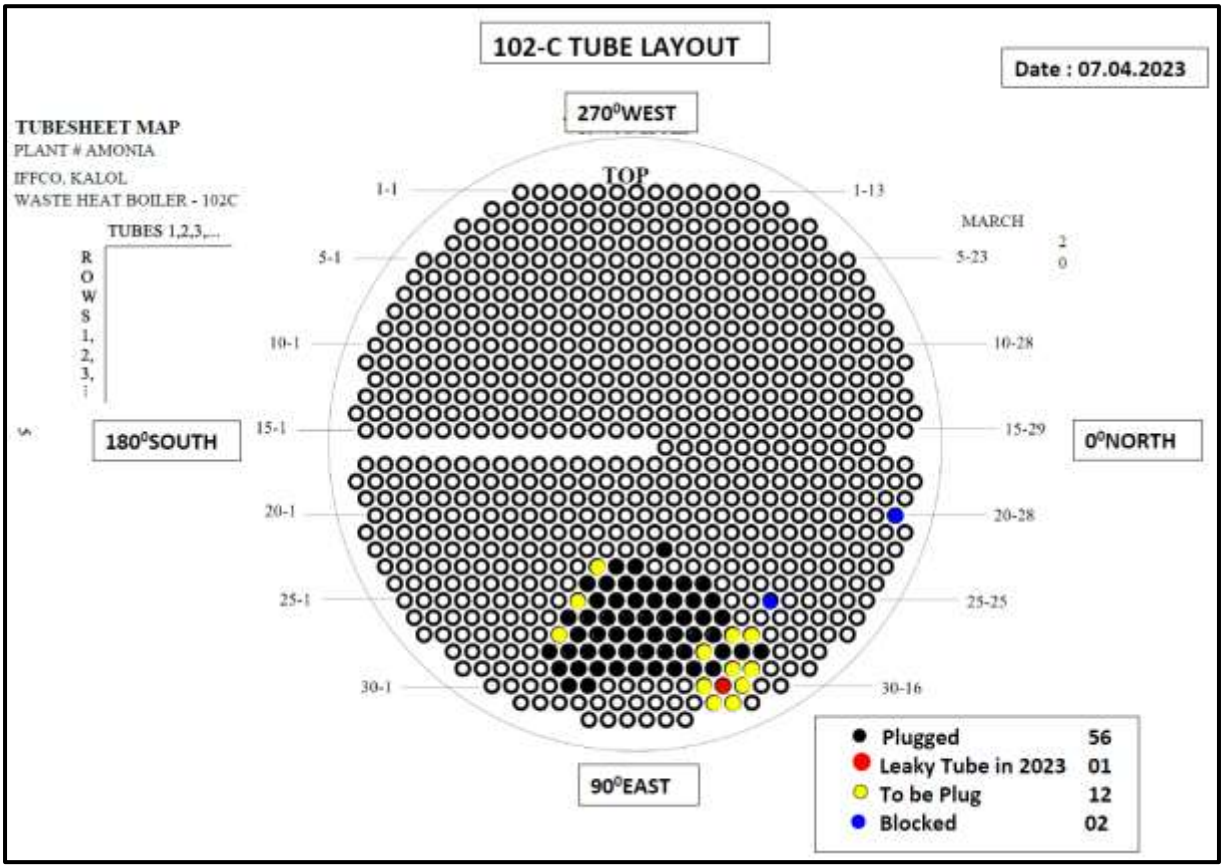


Leaky Tube #30/13

Water drained from the 102-C shell after marking the leaky tube. Hydrojetting of tubes carried out and after that RFET was carried out by M/s. Testex NDT India Ltd. and observations were as under:

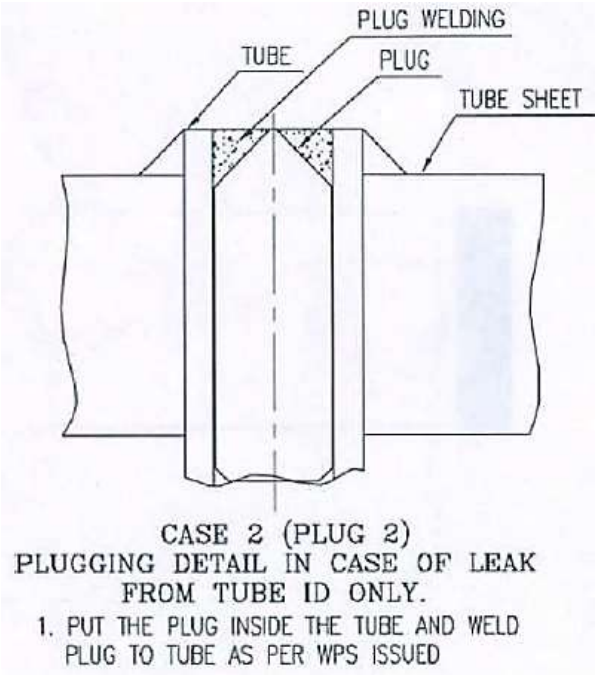
% Wall loss	No. of Tubes
<20 %	691
21-30 %, 31-40 %	00
41-50 %, >50 %	00
Blocked Tubes	02
Total Tubes Inspected	693
Plugged Tubes	57
Not Inspected Tubes	00
Total Tubes in 102-C	750

It was decided to plug 13 nos. tubes (1 no. leaked tube in red color and 12 nos. tubes in yellow color) as marked in the tubesheet map below:

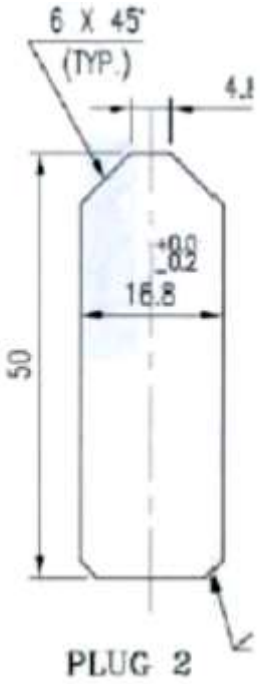


Tube plugging of 13 nos. leaky tubes were carried out and the tube plugging procedure adapted was same as per L&T followed in the year 2019.

Plug of MOC P11 was inserted inside the tubes and held firmly in position as per L&T Case 2 Set up procedure (Dia of plug-16.8mm, ID of tube – 17 mm. Clearance of 0.1 mm).



Plug Set up



Plug Dimensions

Plug Welding was carried out as per WPS. Preheating of 150 deg. C (Min.) was done. Post weld heating of 300-350 degree Celsius for 3 hrs. minimum was carried out manually by heating torch.

Hydrotest was carried out from shell side after tube plugging at a pressure of 146 Kg/Cm2g. No leakage was observed from tubes.

Boxed up top and bottom cover and tightened bolts with RSL-14 Torque wrench 1st round 1000 psi, 2nd round 1500 psi, 3rd round 2000 psi & 4th round at 2200 psi (Top cover & Bottom cover).

Bottom cover studs tightened at 2500 psi after plant start-up due to leakage.

103-C

Leakage was occurred from HE tubesheet to inlet channel flange joint during running. To avoid the plant shutdown, furmaniting was done & the leakage was arrested. To avoid any future occurrence of leak through furmanited joint, it was decided to normalize the joint by replacing gasket.

Blinds were fixed and purging done, unbolted the channel to tubesheet flange joint and inlet piping to channel flange joint. Support was cut to make gap between flanges.

All gasket seating area was cleaned properly and inspected, then boxed up with new gasket.

Tightened bolts with RSL-14 Torque wrench 1st round 500 psi, 2nd round 1000 psi & 3rd round 1800 psi.

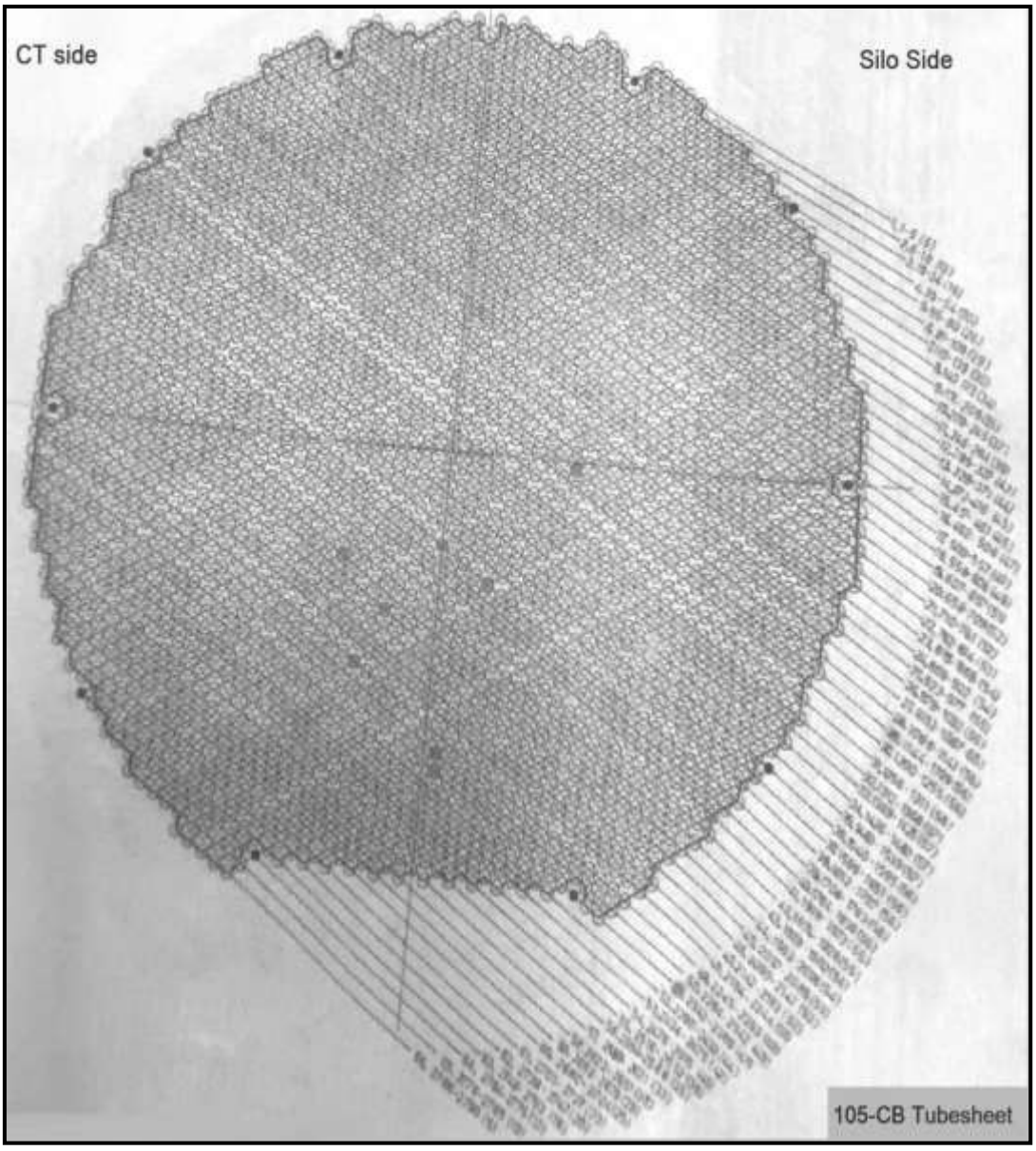
Studs tightened at 2400 PSI after shutdown due to occurrence of leakage after plant startup.

OTHER HEAT EXCHANGERS AND COOLERS

EQUIPMENT TAG		HYDROJETTING		HYDRO TEST	Remarks
		TUBE SIDE	SHELL SIDE (Tube bundle pull out)		
101-JCA		✓			
101-JCA	I/A COOLER	✓			
101-JCB		✓			
101-JCB	I/A COOLER	✓			
101-BJT	LUBE OIL COOLER	✓			
101-JLC1	LUBE OIL COOLER	✓			
101-JLC2	LUBE OIL COOLER	✓			
101-JT	GLAND CONDENSER	✓			
103-JLC1	LUBE OIL COOLER	✓			
103-JLC2	LUBE OIL COOLER	✓			
103-JT	GLAND CONDENSER	✓			
103-JT HPOC-1	HP OIL COOLER	✓			
103-JT HPOC-2	HP OIL COOLER	✓			
104-J	LUBE OIL COOLER	✓			
104-JT	GOV OIL COOLER	✓			
104-JA	LUBE OIL COOLER	✓			
104-JAT	ACTUATOR OIL COOLER	✓			
105-JT	GLAND CONDENSER	✓			
105-CA		✓		✓	Shell Side: 28 Kg/cm2g, Tube Side: Water Head Pressure
105-CB		✓		✓	**8 nos. tubes plugged.** Shell Side: 28 Kg/cm2g, Tube Side: Water Head Pressure
107-JT	LUBE OIL COOLER	✓			
107-JAT	LUBE OIL COOLER	✓			
108-C1A		✓		✓	Shell side : 8.0 Kg/cm2g. Tube side : 6.0 Kg/cm2g.
108-C2A		✓		✓	

EQUIPMENT TAG		HYDROJETTING		HYDRO TEST	Remarks
		TUBE SIDE	SHELL SIDE (Tube bundle pull out)		
109-C1A	SILO SIDE	✓	✓	✓	Shell side : 8.0 Kg/cm2g. Tube side : 6.0 Kg/cm2g. Shell side : 8.0 Kg/cm2g.
109-C2A	SILO SIDE	✓	✓	✓	
109-C1B	REFORMER SIDE	✓	✓	✓	
109-C2B	REFORMER SIDE	✓	✓	✓	
110-CA		✓			
110-CB		✓			
115-C		✓		✓	Shell side : 40.0 Kg/cm2g.
115-JALC1	LUBE OIL COOLER	✓			
115-JALC2	LUBE OIL COOLER	✓			
115-JBLC1	LUBE OIL COOLER	✓			
115-JBLC2	LUBE OIL COOLER	✓			
116-C		✓	✓	✓	Shell side : 8.0 Kg/cm2g
117-J	INTERCOOLER	✓	✓		
117-J	1st STAGE COOLER	✓			
117-J	LO COOLER	✓			
124-C			✓	✓	Shell side : 8.0 Kg/cm2g
127-CA		✓		✓	Shell side : 27.0 Kg/cm2g
127-CB		✓		✓	Shell side : 27.0 Kg/cm2g
128-C		✓		✓	Shell side : 12.3 Kg/cm2g
129-JC	101-J INTERCOOLER	✓	✓	✓	With Dummy Shell 6.0 Kg/cm2g
130-JC	101-J INTERCOOLER	✓	✓	✓	With Dummy Shell 6.0 Kg/cm2g
131-JC	101-J INTERCOOLER	✓	✓	✓	9 nos. tubes plugged (1 no. leaky & 8 nos. choked) Shell side : 13.0 Kg/cm2g.
137-C		✓			
173-C		✓			
HE-2	PGR	✓			
HE-4		✓			
	MP EJECTOR COOLER	✓			

9 nos. tubes plugged (1 no. leaky & 8 nos. badly choked) in 131-JC



8 nos. leaky tubes plugged in 105-CB (Tube #51/14, #50/16, #49/24, #45/25, #44/30, #39/22, #39/26, #29/21. Rows marked from silo side

CO2 STRIPPER REFLUX DRUM, 103-F

Leakage was occurred from shell during normal running of plant. Thickness was checked, found more than 5 mm. Then, it was tried to arrest the leakage by patch welding but another hole occurred as grinding was carried out for color removal. Stanvac compound was also used to arrest the leakage after inserting wooden pieces, but after some time again leakage started from underneath the patched area by compound. Half circumference patch with box having drain valves was made of 3 mm thk. SS 304 sheet and height same as the height between two cicumferential seams & welded on Circ. Seam joint to control the leakage.

Since the shell material of existing vessel (MOC: CS) deteriorated, hence it was decided to replace the vessel with new one of upgraded material SS 304L.

Manufacturing & Supply of CO2 Stripper Reflux Drum, 103-F with upgraded MOC: SS304L was carried out by M/s. V. J. Industries, Ahmedabad against PO No. 201004230894 dtd. 15/09/2022 & Demisting Pad Assy. was supplied by M/s. Evergreen Technologies Pvt. Ltd., Valsad against PO No. 201004231532 dtd. 28/01/2023.

Removal of old vessel & Erection of new vessel was carried out by M/s. Mech. Tech. Engineers & Erectors, Kalol against WO No. 201004231529 dtd. 09/02/2023.

Pre-Shutdown Activities

- Fabricated Proper supports for Gas Inlet Line (24”), Gas Outline (30”), Gas Vent Line (16”) and condensate outlet line (4”) at pre-specified locations.
- Water level Marking done for Critical Nozzles.
- Welding of Jack Plates carried out at bottom skirt of Vessel for ease of lifting.

Inside view of new 103-F from top nozzle

New Demister Pads

Shutdown Activities

- Blinds fixed and purged the vessel.
- Supporting done and Cutting of Gas Inlet Line (24”), Gas Outline Line (30”), Vent Line (16”) and Condensate Outlet line (4”) at suitable locations carried out.
- Lifting Lugs welded at top dish end for the lifting of existing vessel.
- Removal of all attachment & fittings.
- Dismantled and removed all ladders and platforms.

Pipe Supports erected & cut the lines

- Fixing of New Demisting pads carried out departmentally in horizontal position before lifting.
- Lifted existing 103-F with the help of 135 T Kobelco crane and kept at suitable location.
- Cleaning and dressing of Base plate and foundation studs carried out.
- Chipping of RCC foundation carried out by civil section.

Demister Pads installed

Foundation after removal of 103-F

- Placed New Vessel on existing foundation. Levelling, alignment and tightening of foundation bolts done.
- Welded pads for fixing of vessel outlet line support and ladders & platforms.

- Fixed ladders, platforms and other attachments.
- Fabrication, Welding and connecting the gas inlet line, gas vent line, gas outlet line and condensate outlet line carried out as per isometric.
- Root DP, final DP of all piping weld joint carried out.
- Blowing of vessel was carried out by air @ 0.5 kg/cm2g.
- Removed all blinds and handed over to production.

VESSEL INSPECTION / REPAIR JOBS

- 101-EA, CO2 Absorber: All 6 nos. Manholes opened & boxed up after inspection, cleaning and repairs marked. At Top Manhole, refixed demister pad which was found lifted from its position on north side. At 2nd MH from top, 1 no. loose clamp of bubble tray bottom and main inlet header loose clamp bolts tightened. At 4th MH from top, repaired by weld fill-up & patch plate welding on corrosion cavities and holes which were observed on South most liquid distributor collector plate, located just below the liquid distributor. Removed loose piece of debris found between gas rising holding plate towards North.
- 102-EB, CO2 Stripper: Top & Bottom Manholes opened & boxed up after inspection, cleaning & repairs marked. At top manhole, repaired by welding the cracks observed in: a) South-West side shell and liner plate tack welding, b) distributor header and support weld at North-West side. Tightened the loose distributor header U clamp nut at North-West side and North-East side.
- 103-E1, HP Flash Vessel: Top manhole opened for inspection and then boxed up. No repairing points observed.
- 103-E2, LP Flash Vessel: All 3 nos. Manholes opened & boxed up after inspection & cleaning. No repairing points observed.
- 105-E, Dehydrator: All manholes opened & boxed up after inspection & cleaning. No repairing points observed.
- 1104-E, Process Condensate Stripper: All manholes opened & boxed up after inspection & cleaning. No repairing points observed.
- 102-F, Raw Gas Separator: Manhole opened for inspection and then boxed up. Putty re-applied on the circumferential weld joint of manhole nozzle with shell from inside which was found detached approx. in top half of the circumference
- 104-F, Synthesis Gas Compressor Suction Drum: Manhole opened & boxed up after inspection & cleaning. Top demister pad refixed properly which was found lifted and shifted from its position.
- 105-F, Synthesis Gas Compressor 1st Stage Separator: Manhole opened & boxed up after inspection & cleaning. No repairing points observed.
- 106-F, Ammonia Separator: Manhole opened for inspection and then boxed up. No repairing points observed.
- 107-F, Primary Ammonia Separator: Manhole opened for inspection and then boxed up. No repairing points observed.

- 109-F, Refrigerant Receiver: Manhole opened for inspection, cleaning done and then boxed up. No repairing points observed.
- 110-F, 1st Stage & 112-F, 3rd Stage Refrigerant Flash Drum: Manhole opened for inspection, cleaning done. Refixed detached top plate (approx. size of 400 mm x400 mm) of 117-C return standpipe by replacing new bolts in place of sheared one and then boxed up.
- 111-F, 2nd stage Refrigerant Flash Drum**:** Manhole opened for inspection, cleaning done and then boxed up. No repairing points observed.


Coating peeled off at many location inside DM Water Tank


Surface prepared by grinding

DM Water Tank inside view after coating

- 155-F, Knockout Drum: Manhole opened for inspection, cleaning done and then boxed up. No repairing points observed.
- 101-U, Deaerator: Manholes opened for inspection, cleaning done, refixed detached packing tray segments and then boxed up.
- Cold Box: Dumpout blind was opened & removed perlite from cold box. Then bottom Manhole cover was opened for inspection as during normal running, leakage from Cold Box Annular space was coming outside from bottom of Cold box wall at E-2 Side. Checked but no leakage found, hence boxed up manhole cover & dumpout blind.
- DM Water Tank: All manhole covers opened for inspection. Resins were found at the bottom, resins removed & cleaning done. Stanvac compound coating was found peeled off at many locations. Coating was applied at 0.5 mtr. Height from bottom and 0.5 mtr. Width at bottom plate.

  M/s. Armate Corporation, Ahmedabad has supplied the stanvac compound against PO No. 201004231802 dated 18/03/2023 and its application was also in their scope.

  Application procedure followed was:

  - Cleaning with Grinder & Emery paper.
  - **Chemcoint RL -500 PF.** Applied 1 coat.
  - **Stangard 1311 Corrokote.** Applied 1 Coat.

In addition to above coating was applied on bottom portion of B3A vessel & complete K-1 vessel of PGR

Bottom portion of B3A Vessel in PGR before Coating

Bottom portion of B3A Vessel in PGR after Coating

K-1 Vessel in PGR Before coating

K-1 Vessel in PGR After Coating

OPEN INSPECTION & HYDROTEST OF BOILERS

- 101-F, Steam Drum: Side Manholes opened, tightened loose bolts and clamps of Demister Pad holding cover plate & provided new against missing one, 1no. loose bolts tightened & 2 nos. bolts new provided against missing one in 6" BFW header. Refixed properly 6" BFW header which was found removed from clamp at center and found bent towards south side. 02 nos. Demister Pad holding plate bolts new provided against sheared one which was found sheared and tightened 01 no. loose bolt found at the top. Refixed bottom demister pad which was found removed from its position and lying at the bottom. Provided new cap nuts against missing ones. All new stiffener plates welded for 1st bottom demister pad from North as all were found missing. Re-welded all Stiffener plate of the 2nd bottom demister pad from North which was found detached from weld.

  01 no. Safety Valve (RV-101-F3) replaced by new one.

- Open inspections of all boilers was carried out on 10/04/2023 and hydrotest witness of the following boilers were successfully executed in presence of IBR inspector on 13/04/2023:

Sr. No.	Tag No.	Identification No.	Hydrotest Pressure (kg/cm^2)
1	101-F	Boiler No. GT-1632	146.00
2	107-C	Boiler No. GT-5217	67.50
3	1123-C	Boiler No. GT-9410	67.50

RELIEF VALVES OVERHAULING:

The following RVs were overhauled, serviced and tested on test bench:

Sr. No.	RV Tag NO	Valve Size	Set Pressure (kg/cm^2) g
1	RV-101-F 1	2.5” X 6” (2.545)	118.80
2	RV-101-F 2	2.5” X 6” (2.545)	117.00
3	RV-101-F 3	2.5” X 6” (2.545)	115.30 (New Installed)
4	RV-101-B	3” X M(3.6) X 6”	111.10 (Online Floating) 111.80 (at test bench)
5	PSV-986 (107-C)	4 L 6	45.00
6	PSV-987 (107-C)	4 L 6	46.30
7	PSV-3006-A (1123-C)	2 J2 4	43.00
8	PSV-3006-B (1123-C)	2 J2 4	45.00
9	RV-103-J	3 K 4	158.93
10	RV-103-JA	3 J 4	159.00
11	RV-105-DA	3 K 4	153.00
12	RV-106-F	1.5” X 2”	157.94
13	RV-102-F	6 R 8	30.50
14	RV-123-CA	3 J 6	122.00
15	RV-123-CB	3 J 6	122.00
16	RV-MS-9	4 P 6	42.00
17	RV-101-L (aMDEA Filter)	1.5 G 3	30.94
18	RV-104-JT	6 Q 8	5.27
19	RV-2004-JT	1.5” X 3”	5.20
20	RV-109-F	6 Q 8	19.00
21	RV-110-F (N)	3 L 4	7.00
22	RV-110-F (S)	3 L 4	7.00
23	RV-111-F	4 P 6	6.30
24	RV-112-F	4 M 6	6.30
25	RV-104-D2	1-1/2 F 2	34.10
26	RV 101-J	4 M 6	36.90
27	RV-S-7	4 P 6	14.80
28	RV-LS-1	4 N 6	7.50
29	RV-115-JA-01 (115-JA AOP Discharge)	1 E 2	11.00
30	RV-115-JA-02 (115-JA MOP Discharge)	1 E 2	11.00
31	RV-115-JB-01 (115-JB AOP Discharge)	1 D 2	11.00

Sr. No.	RV Tag NO	Valve Size	Set Pressure (kg/cm^2) g
32	RV-115-JB-02 (115-JB MOP Discharge)	1 E 2	11.00
33	RV-170-C (Shell side)	3 K 4	5.70
34	RV-101-E	1 D 2	30.60
35	PSV-977 (Absorber Inlet)	4 P 6	32.20
36	PSV-976 (Absorber Inlet)	4" X 6"	30.60
37	RV-104-F (Syn. Gas Comp. Suction separator)	1" E 2"	30.0
38	SV-01 (117-J)	1-1/2" H 3"	5.80
39	SV-02 (117-J)	1.5 G 3	15.8
40	SV-03 (117-J)	1 E 2	30.2
41	PSV-177	15 X 20	57.08
42	RV-104-JAT	8 T 10	0.35
43	RV - 935 (116-JAT Exhaust RV)	3 J 4	6.10
44	RV-105-F (103-J 1st stage separator)	1 E 2	73.80
45	RV-181	3" X 4"	6.13
46	PSV-720 101-BJT AOP RV	¾" X 1"	8.5
47	PSV-721 101-BJT MOP RV	¾" X 1"	8.5
48	PSV-301 (103-J Lube Oil Pump)	1.5 G 3	13.00
49	PSV-302 (103-J Lube Oil Pump)	1.5 G 3	13.00
50	PSV-303 (103-J Seal Oil Pump)	1.5 D 2	92.50
51	PSV-304 (103-J Seal Oil Pump)	1.5 D 2	92.50
52	RV-103-JAT-A (103-JT Exhaust)	4 P 6	660 PSI
53	RV-103-JAT-B (103-JT Cover Sentinel RV)	4 P 6	46.40
54	RV-84 (103-JLJAT Exhaust RV)	1.5 G 3	5.27
55	RV-85 (103-JLJCT Exhaust RV)	1.5 G 3	5.27
56	RV-101-JT (Sentinel RV)	1.5 H 3	1.96
57	PSV-3026 (173-C)	2 J 3	5.00
58	RV-156-F	3 K 4	5.27

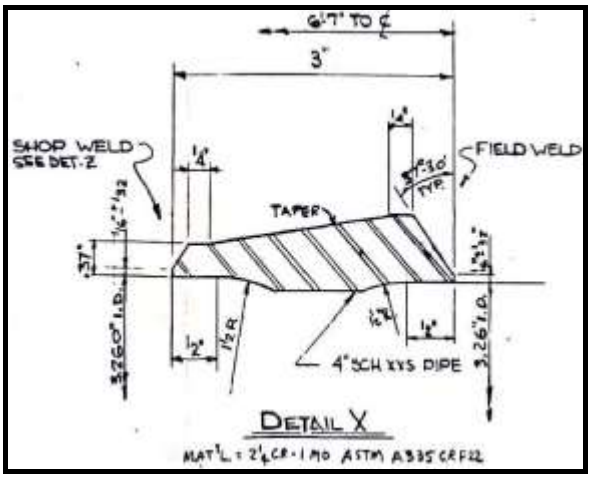
Sr. No.	RV Tag NO	Valve Size	Set Pressure (kg/cm^2) g
59	PSV-401 (101-J LO Pump Discharge)	3 J 4	14.00
60	PSV-402 (101-J LO Pump Discharge)	3 J 4	14.00
61	PSV-105	3" X 3"	-300 MMWC
62	SRV-8301	1.5 G 3	11.37
63	RV-MS-9A	6" X 8"	43.50

FABRICATION JOBS

A Fabrication contract i.e. WO No. 201004231682 dated 23/02/2023 was placed on M/s. A.M. Erectors, Ahmedabad to carry out following jobs:

SR. NO.	JOBS
CONTRACTOR – A M Erectors	
1	Replacement of reducers having corrosion of Startup Heater(102-B) outlet line.
2	Replacement of existing LTS bypass valve with mating flange (Size: 18" X 300#) by new one (Size: 18" X 600#)
3	Re-routing of existing Mixed Feed gas inlet line to Feed Preheat coil in Reformer (Size: 12" X Sch. 40) as per isometry drawing.

- Replacement of reducers having corrosion of Startup Heater(102-B) outlet line. MOC: P22
  - Spool pieces – 2 nos. machined as per drawing from 4" Sch. XXS pipe of P-22 material and made ready before shutdown for replacement.

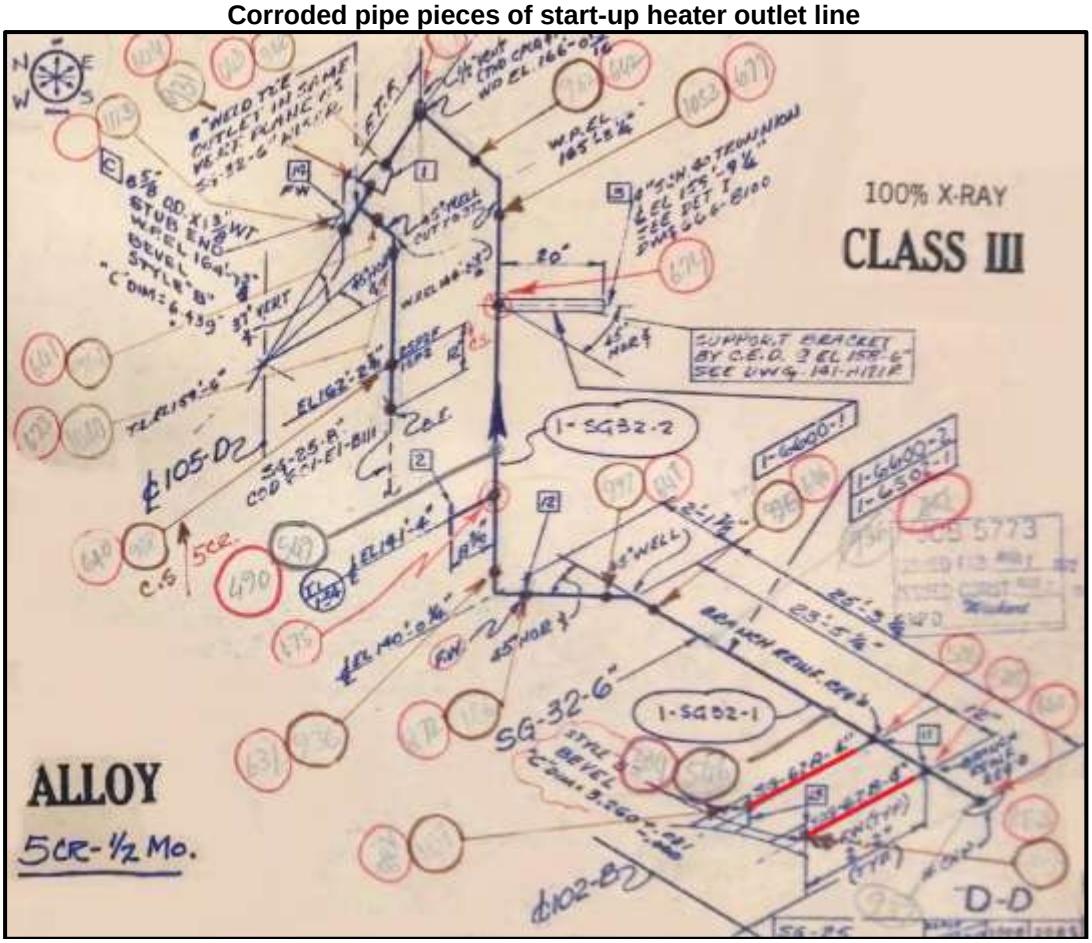


Drawing of Reducer

Piece made from 4" X Sch. XXS P22 pipe

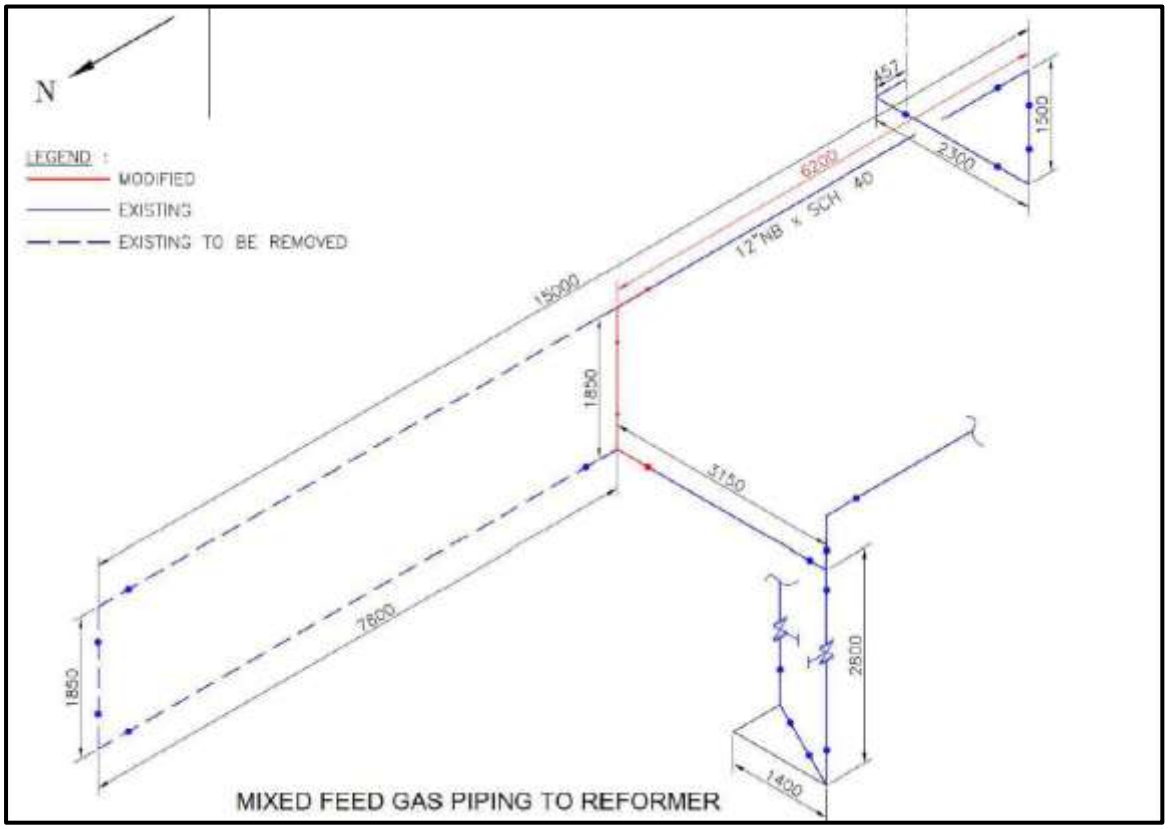
- Cut & removed existing piping (4” X Sch XXS) after marking. (Marked in red color in the isometry)
- Edges prepared; Fit-up & root welding of joints done.
- Root DP & radiography done.
- Final Welding carried out.
- PWHT of all joints carried out as per following: Loading Temp. : 200 ^{O}C, Heating Rate: 100 ^{O}C/Hr., Soaking Temp.& Time : 735 ^{O}C +/- 15 for 2 Hrs., Cooling Rate : 100 ^{O}C/Hr. After that cooling under insulation.
- Inspection: Butt joints - Root & final DP, 100% Radiography before & after PWHT

Corroded pipe pieces of start-up heater outlet line



- Replacement of existing LTS bypass valve with mating flange (Size: 18” X 300#) by new one (Size: 18” X 600#) MOC: Carbon Steel
  - Dismantled & removed existing valve (Size: 18” X 300#) by the help of crane and shifted it to yard.
  - Cut & removed existing 2 nos. flanges of Size: 18” X 300# alongwith spool piece to accommodate valve.
  - Weld edge preparation done, DP checked, Fit-up & welding of spool piece (Butt Joint) & new 2 nos. SORF flanges of Size: 18” X 600# (SW Joint) done.
  - Fixed new Gate valve, Size: 18” X 600# by the help of crane.
  - DP checked after final welding and radiography of butt joint done.
  - Modified existing platform to accommodate the new installation.

- Re-routing of existing Mixed Feed gas inlet line to Feed Preheat coil in Reformer (Size: 12” X Sch. 40) as per isometry drawing MOC: Carbon Steel
  - Cut & remove existing piping.
  - Modification of piping carried out as per isometry drawing.
  - Inspection: Butt joints - Root & final DP, 100 % Radiography
  - Modification of existing pipe support carried out to accommodate the new installation.
  - Removed BFW quench line for Mixed feed coil and plugged the tapping.

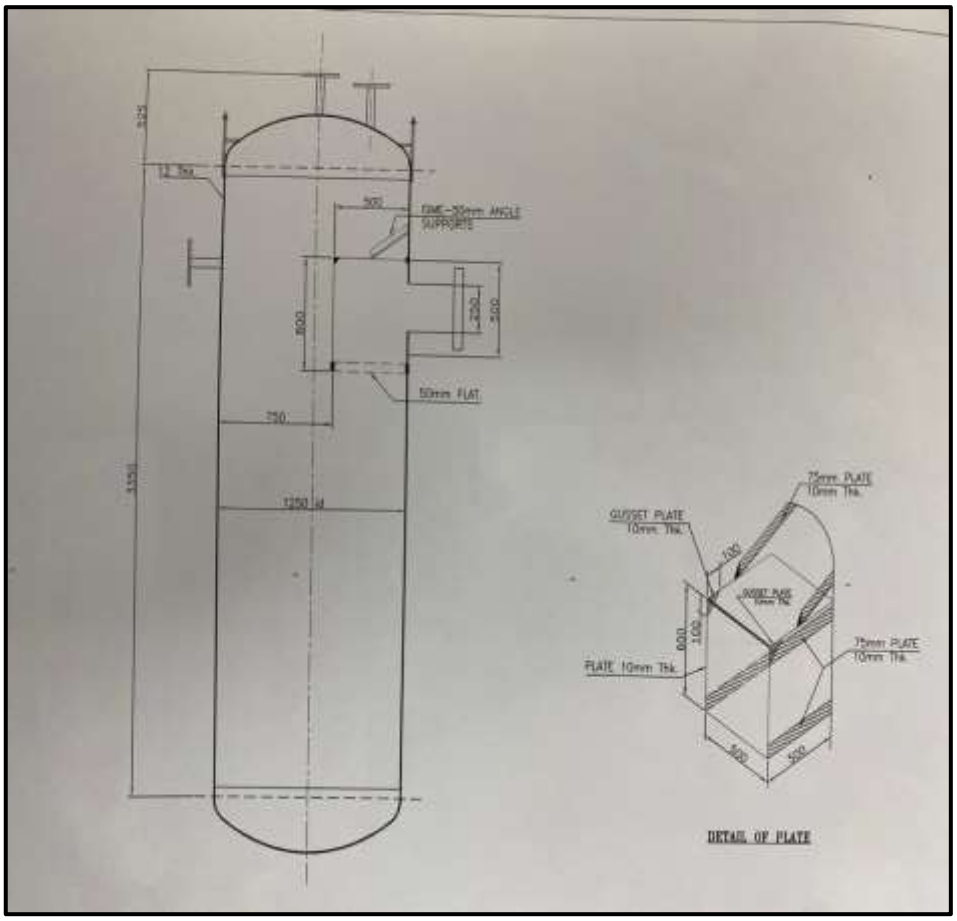


MIXED FEED GAS PIPING TO REFORMER

Following Fabrication jobs were carried out departmentally as well as by Contractors:

SR. NO.	JOBS
1	104-JAT LO Cooler replaced by new one and modified LO & CW inlet & Outlet line as per requirement.
2	104-JT LO Cooler replaced by new one, provided new Duplex filter in shell outlet line and modified LO & CW inlet & Outlet line as per requirement.
3	Hood/Deflector provided at the inlet nozzle of 179-F (Fuel NG to Utility line Separator) for better distribution of gas. Spool piece at PIC-29 d/s of 6" X 4" size fabricated & replaced.
4	110-CA/CB inlet line old patch removed, welded the leaky point and new full circumference patch fabricated & welded.
5	127-CA/CB CW strainer common back flushing line modified and separated.
6	Tapping of 3" size taken from 38 Kg/cm2g steam header for Nano-Urea plant. (Weldolet: 8" X 3" X Sch. 80, Pipe spool piece: 3" X Sch. 80, Gate Valve: 3" X 1500#, WNRF Flange & Blind Flange: 3" X 1500#)
7	103-C gas inlet drain valve passing – ¾" X 1500# F22 SW Gate Valve replaced
8	Drain valve near SP-4 valve (1" X 1500#, A-105 SW Gate Valve) replaced.
9	103-J discharge pilot RV impulse line union leak & its I/V is passing – Union joint was cut & replaced by flanged joint & passing isolation valve replaced (3/4" X 1500#)
10	103-J SO & LO MOP turbine steam inlet common header vent valve (3/4" X 800#) bonnet leak – Valve replaced.
11	107-F to 111-F, FT-19 HP tapping root isolation valve wheel is free – Valve replaced
12	115-JAT steam inlet TTV trap & isolation valves are passing – TD-55 Trap & ¾" X 800# I/V replaced
13	HDS coil steam blowing arrangement - Temporary line made ready from PIC-14 d/s I/V to NG coil inlet I/V d/s
14	107-JT steam inlet line support shifted from its position – Refixed properly & tack weded.
15	PIC-502 u/s trap I/V wheel free – Valve (1/2" X 800) replaced as spindle found broken.
16	107-C blowdown sample line pin hole leakage – ¾" pipe approx. 6 Mtr. replaced
17	Snuffing steam to silencer I/V passing – Additional 2" X 800# Gate valve provided.
18	ID Fan Steam Inlet TTV drain trap & its bypass I/V passing – Replaced gate valve & steam traps (3/4" X 800#)
19	Cryogenic type drain valve of B-2 drain coming out of cold box replaced.

SR. NO.	JOBS
20	aMDEA pump delivery line to 114-F I/V replaced 2” X 800# WCB Gate Valve
21	Phosphate dozing line at 101-F floor started leaking during hydrotest – 1” X Sch. 80 Pipe piece with coupling welded.
22	104-JT exhaust line vent valve (3/4” X 800#) replaced.
23	DM Water I/V (3/4” X 800#) replaced with new one.
24	Level troll LT-15 of LIC-15 of 1.5” size with union joint at 109-F Refrigeration Receiver removed and modified the process line with 1.5” X 150# (SS316) flanged end connection type for installation of new measurement chamber of GWR type Level transmitter.
25	Level troll LT-16 of LIC-16 of 1.5” size with union joint at 110-F Ammonia Flash Drum removed and modified the process line with 1.5” X 150# (SS316) flanged end connection type for installation of new measurement chamber of GWR type Level transmitter.
26	For installation of new vortex flow meter in ammonia plant battery limit in instrument airline, modified the line with provision of two no. of 2” X 150# flanged end connection type and suitable spool piece provided for installation of new flow meter



179-F

VALVE GLAND REPACKING JOBS

Gland packing of the following valves were replaced:

- All adjoining valves of 101-F (32 nos. valves), 107-C (31 nos. valves).
- 101-F CBD valve (1 no. valve).
- 101-F IBD valve (1 no. valve).
- Blowdown valves near Aux boiler (Valves - 8 nos.)
- PT-12 root isolation valve (¾" X 800#) (furmanited) – Packing replaced.
- Gail Area (16 nos. valves)
- 156-F area (5 nos. valves), LTS area (2 nos.)

IN-SITU OVERHAULING / RECONDITIONING OF VALVES

In-situ Overhauling / Reconditioning of Valves carried out by M/s. Fluidchem Valves India Pvt. Ltd., Thane against CPA No. 201004202071 dtd. 22/04/2020.

- PICV-11A upstream & downstream isolation valves - 2 nos.
- LICV-13 downstream plug valve (2" X 1500#) – 1 No.
- 101-JT heating line MOV (2" X 800#) – 1 No.
- 101-F LI-GWR (Radar) LP Tapping I/V (2" X 1500#) – 1 No.
- VS-203 upstream I/V (Plug valve) – 1 No.
- GAIL Area – 6 nos. valve

PROCESS JOBS

SR. NO.	JOB DESCRIPTION
1	155-F (LT Guard Inlet Separator) LT-401 HP tapping chocked - Attended
2	107-C south side LG LP tapping isolation valve downstream union leak.
3	107-C south side LG LP tapping isolation valve is passing.
4	116-JAT steam inlet first isolation valve bonnet leak (Furmanited) – Valve (2 inch X 600# Gate Valve) replaced.
5	127-CA CW flushing isolation valve (Butterfly Valve, 12 inch X 150#) not getting closed – Butterfly Valve replaced
6	105-E to 107-F isolation valve is hard to operate - Attended
7	The operation of Gear arrangement of HCV-11 was checked after removing the Gear Box. The Hex Nut stop was adjusted and operation was made OK
8	CV-8104 (103JT casing drain valve) valve wheel fixed.
9	101-JCA/JCB MP ejector steam inlet THI flange leak - Gasket replaced
10	Plug Valve (4"X300#, WCB) in Purge gas line from 106-E/107-F & 109-F to 151-C replaced.

SR. NO.	JOB DESCRIPTION
11	Bag filters of Air Compressor, 101-J replaced.
12	101-J Roll-o-matic filter mechanism overhauling done and rolls replaced.
13	115-JA/JB, 116-JA strainer cleaned, 115-HT strainer replaced by new one.
14	Bladder and seal kit of 103-J Seal Oil Accumulator replaced
15	121-J discharge I/V is passing – Gate Valve (6” X 300#) replaced
16	103-D Air inlet line NRV bonnet leak - Gasket replaced
17	1101-D vent line first isolation valve passing – Gate Valve (4” X 150#) replaced
18	1101-D vent line second isolation valve bonnet leaking – Valve replaced by new Gate Valve 4” X 300#
19	104-JAT ARV/NRV replaced.
20	CW line valve replaced (8” X 150#)
21	MP Ejector system TI flange gasket replaced from sheet gasket to SW gasket (4”X150#, 6”X150#, 1-1/2”X150#)

COLD INSULATION JOBS

CPA No. 201004231798 dated 21/03/2023 was awarded to M/s. Krishna Insulations & Engineers Pvt. Ltd., Vadodara for carrying out various cold PUF insulation jobs in Ammonia Plant during SD-2023.

Major Jobs carried out are:

- E-2 Exchanger in PGR and related piping
- 118-J/JA/JB suction & discharge lines
- 106-F & 107-F piping
- 111-F to E-2 pipeline
- 118-C & 119-C piping

UREA PLANT
(MECHANICAL)

ROTATING EQUIPMENT

MAJOR OVERHAULING OF CO_2 COMPRESSOR DRIVE TURBINE (Q-1801)

TECHNICAL DATA

MAKE	:	M/S SIEMENS GERMNY
TYPE	:	ENK 32/45/8/20-7
M/C NO	:	Q-1801
MAXIMUM OUT PUT	:	7679 KW
DESIGN RATING	:	9690 KW
SPEED	:	7875 RPM
INLET STEAM PRESSURE	:	60 ATA
INLET STEAM TEMPERATURE	:	395 DEGREE CEN
EXHAUST STEAM PRESSURE	:	0.12 ATA
EXTRACTION STEAM PRESSURE	:	23 ATA
INDUCTION STEAM	:	4.91 ATA

The last major overhauling of Siemens Turbine (Q-1801) was carried out during Shutdown -2017. During plant running, sealing steam consumption was increased and it was decided to execute overhauling of turbine in SD-2023.

Activities performed are as under:

The turbine stopped at 02.30 AM on 03-04-2023 and the barring gear was started. Barring gear and lube oil circulation was stopped at 11.30 AM. At the same time Insulation removal started from top of the casing. Temperature was 250 °C at 60 ata main steam inlet pressure gauge and casing expansion reduced to 3.9 mm.

Disassembly of Turbine

Disassembly started when the turbine cooled down to normal condition and casing expansion was reduced to 1.0mm. Following activities were carried out for disassembly of Turbine.

- For decoupling the turbine with LP compressor, coupling guard with bellow was removed, and then coupling spacer was removed with the help of jack bolts.
- After removing the barring gear pipeline and instrument probe, the top cover of rear bearing was lifted.
- Emergency trip gear gap measured after keeping OST pin perpendicular to the face of lever. It was 0.92 mm.

- The earthing brush was removed by the electrical department. Then the top cover of the front bearing pedestal was removed.
- Rotor axial thrust was measured, and it was 0.20 mm.
- 60ata steam servo cylinder with pilot valve removed.
- Alignment fixture was fixed with turbine coupling half and dial indicator was kept at LP case coupling half. Alignment reading between Turbine and LP Compressor was measured and recorded.
- Steam pipelines (23ata steam inlet and outlet at the top of casing & 4ata induction steam line) connected to casing were removed.
- Both 60ata Emergency stop valves were removed
- 23ata servo cylinder and pilot valve were removed.
- 4ata emergency stop valve & servo cylinder and pilot valve were removed.
- The turbine front end journal bearing clearance was measured and found to be 0.26 mm.
- The turbine rear end journal bearing clearance was measured and found to be 0.35 mm.
- At the front bearing pedestal, oil guard clearance was measured. (Ref 12+)

Front oil guard	Left – 0.50mm,	Right – 0.50mm
Rear oil guard	Left – 0.50mm,	Right – 0.50 mm.
Aluminum oil guard	Left – 0.45mm,	Right – 0.45mm

OIL GLAND CLEARANCES

FRONT OIL GLAND

	Left	Right	Bottom
Radial clearance C	0.10	0.05	0.05
Axial Clearance	2.40	2.45	-

REAR OIL GLAND

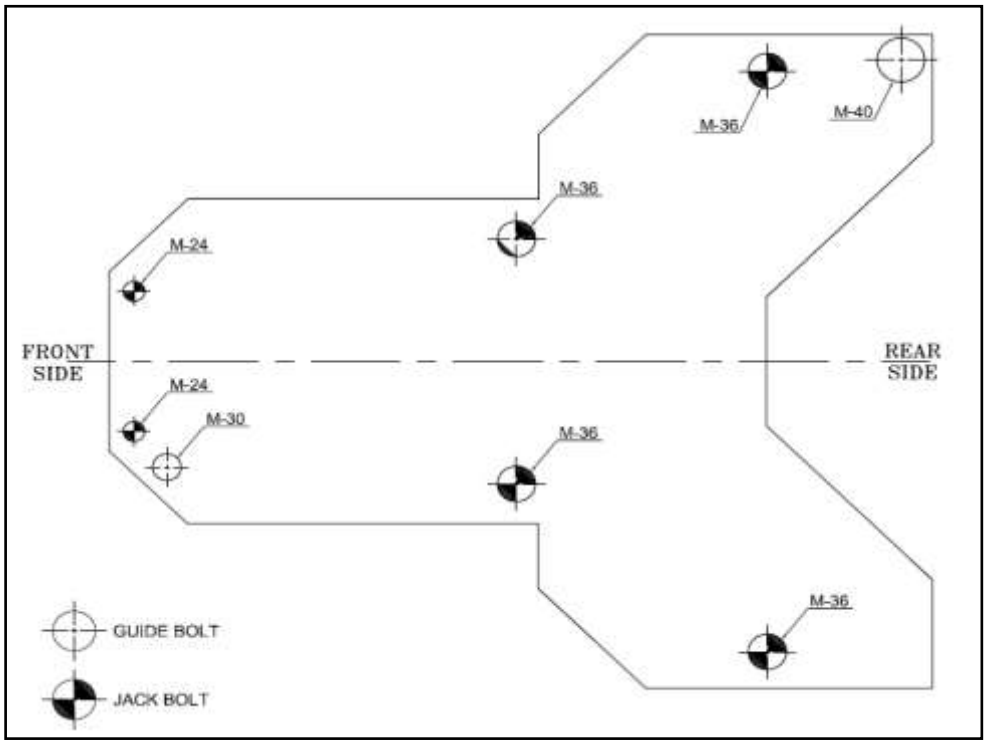
	Left	Right	Bottom
Radial clearance C	0.10	0.05	0.05
Axial Clearance	2.40	2.45	-

- Oil Seal clearances at rear side were measured. (Ref 12+)

Rear (radial)	Left – 0.10mm,	Right – 0.25mm as
Rear (axial)	Left - 4.50mm,	Right – 4.46mm
Aluminum oil guard	Left - 0.50mm,	Right – 0.45mm

- The total float of rotor was measured after removal of active and non-active side thrust pads. It was 3.95 mm.

- All casing bolts were removed. (Spanner Size - 50mm/ 55mm/ 60mm/ 65mm/ 75mm).
- For lifting the top casing, 2 nos. of guide bolts and 6 nos. of jack bolts were provided at front and rear side as shown in figure below:



- 2 nos. of 5-ton chain block at front side of casing and 2 nos. of 3-ton slings at rear side were provided.
- The top casing was lifted by 100mm by jack bolt, and then lifted by Overhead crane (as shown in picture. The top casing was shifted to the ground and placed at Wooden Planks.

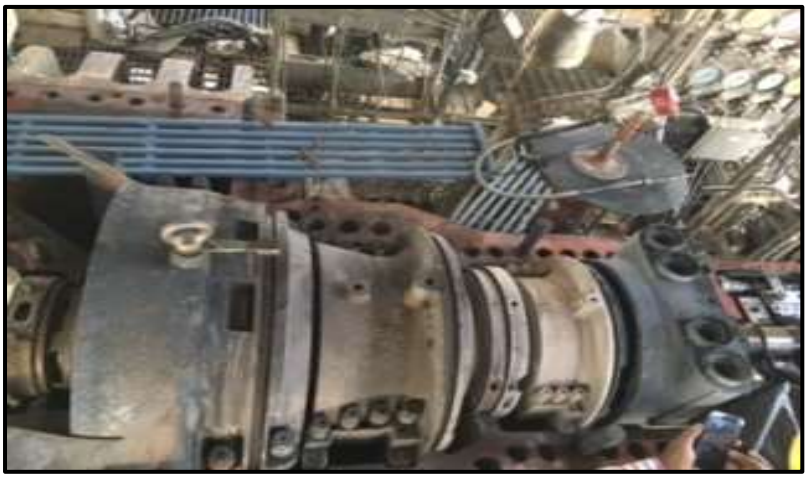
Removal of Top casing of turbine

Lifting of Top casing

Shifting of Top casing cover

Top cover placed over slippers

- After removal of top casing, bottom casing was kept on jack bolts provided at bottom.
- Tack welding on bolts between top and bottom halves of guide blade carriers (3 Nos.), steam chamber and inner gland were grind and removed by barring cutter.
- Top half of all guide blade carriers lifted one by one from HP to LP side then top half of inner gland and steam chambers were lifted.



View of turbine After removal of Top casing cover

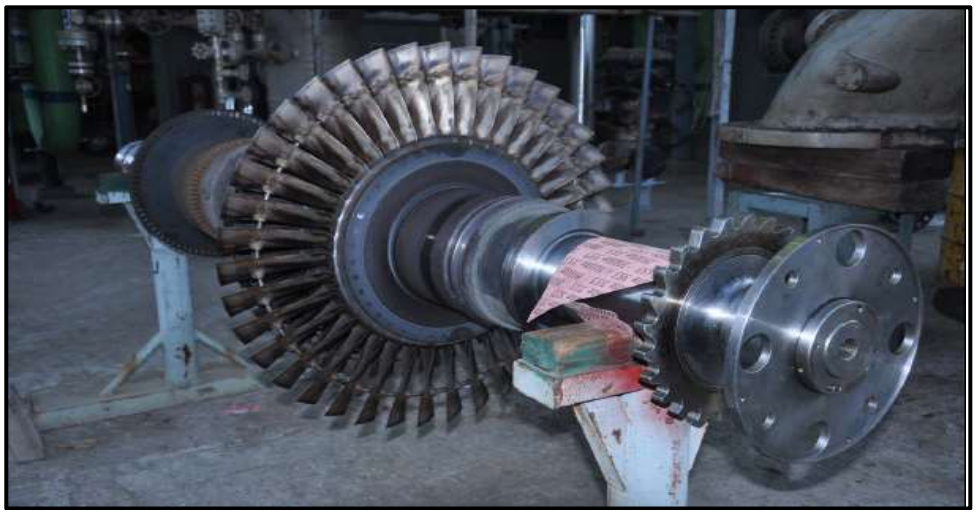
Removal of diaphragm assembly

Diaphragm assembly lifted

- Axial labyrinth clearances were measured and recorded.
- Front and rear steam gland removed.
- For lifting the rotor**,** level of same was maintained by 2 nos. of bolt provided in special rigging arrangement. The rotor was lifted using 2 nos. of 3 ton web sling and shifted to ground and placed on stand as shown in Figure.

Lifting of Rotor under progress

Rotor shifting to stand



Rotor positioned for inspection.

- Run out of rotor was checked at eight point which are as:

Sr. No.	Location	Run-Out Value
1	Thrust Collar	0.01
2	Front Journal	0.00
3	Front oil gland	0.01
4	Front steam gland	0.02
5	IP gland	0.03
6	Rear steam gland	0.03
7	Rear oil gland	0.01
8	Rear journal bearing	0.00

- Gap between casing and guide blade carriers are measured with help of filler gauge as shown in figure below and recorded in table given below.

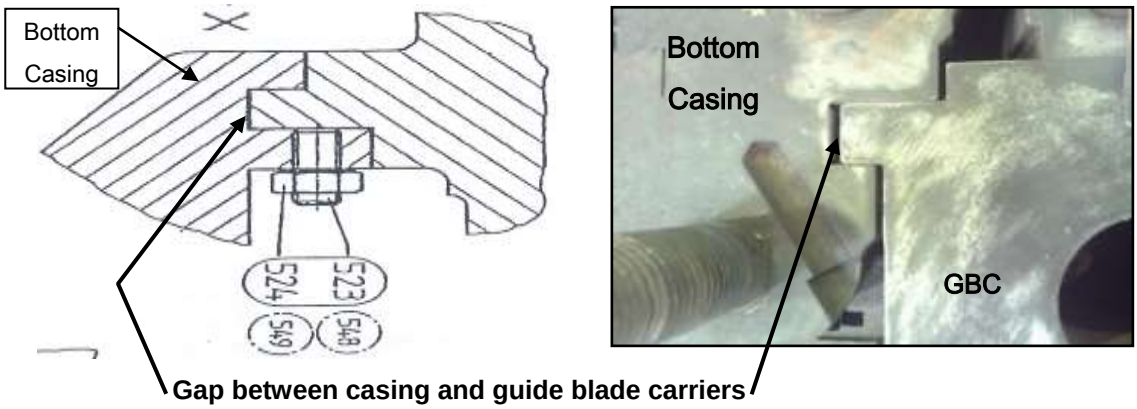
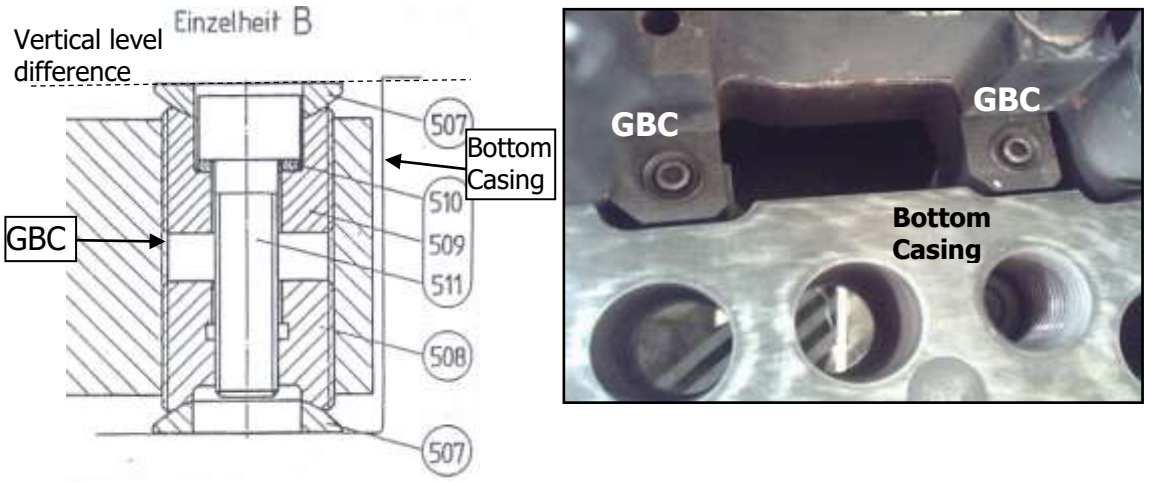


Table : Gap between casing and guide blade cariiers

Sr. No.	Description	Left side	Right side
1	Nozzle	2.05 mm	1.55 mm
2	1st guide blade carrier	1.40 mm	1.65 mm
3	2nd guide blade carrier	2.35 mm	1.65 mm
4	3rd guide blade carrier	2.30 mm	1.95 mm

- The vertical level difference between casing and guide blade carrier (gap between spherical washer level and casing facing level as shown in figure was measured and recorded.



GBC and bottom casing

- Removed bottom halves of all three Guide blade carrier, steam chamber and inner gland one by one front side to rear side.
- Scaling was observed on fin area of rotor specially at area of 23 ata extraction steam.

Scaling observed in above picture

- Rotor, guide blade carriers, steam chamber (Nozzle block) and inner gland were cleaned by grit blasting at Auto yard.

Cleaning of rotor and diaphragm assembly.

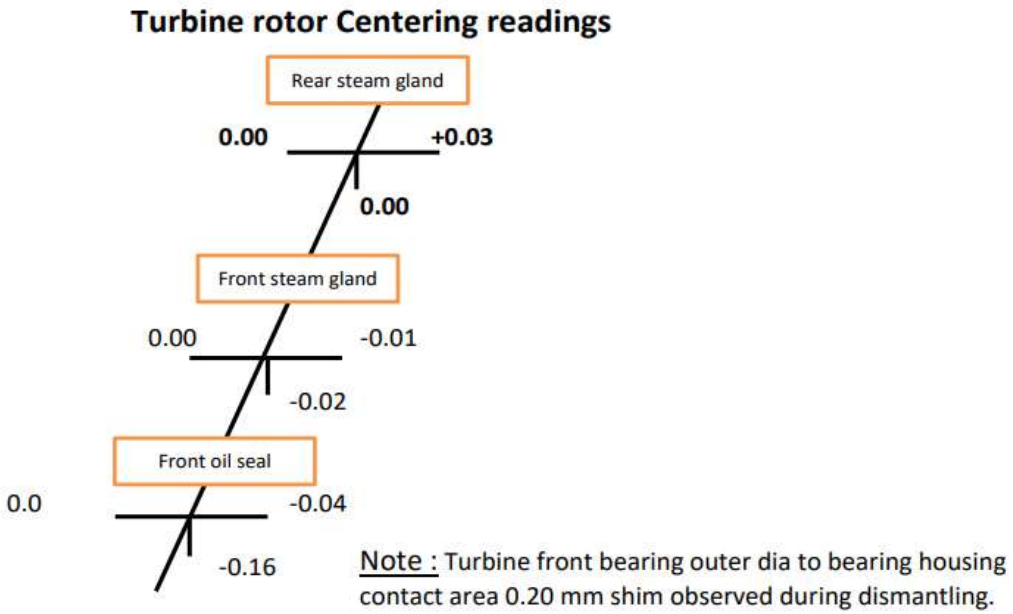
- DP test of rotor, all guide blade carriers, steam chamber and inner gland were done which were found ok.

Assembly of Turbine

Following activities were carried out for assembly of Turbine.

- Bottom half of both side journal bearing were assembled. Bottom half of thrust bearing was placed.
- Kept the bottom spherical washer at both sides of the bottom casing. Placed the bottom half of GBC on bottom casing ensuring that washer is not displaced from position
- Assembly of bottom halves of GBC was done from LP to HP section.
- Then bottom half of nozzle block and inner gland was placed.
- Rotor was lifted from the stand after checking level with help of spirit level using leveling bolts in rigging arrangement. Placed the rotor on bottom casing.
- For centering the rotor following activities were carried out.
  - All 6 nos. of locking bolts were loosened

- Bottom half of thrust bearing assembly was done.
- Dial was kept at bearing pedestal shims (POS 38), as shown in figure-8 and bottom casing was kept at 0.10 mm below from bearing pedestal with shims using jack bolt.
- One dial gauge was placed at rotor free end with dial on front bearing pedestal bottom, second dial gauge at bearing oil seal area, of front pedestal and third dial gauge was kept on rear bearing pedestal.



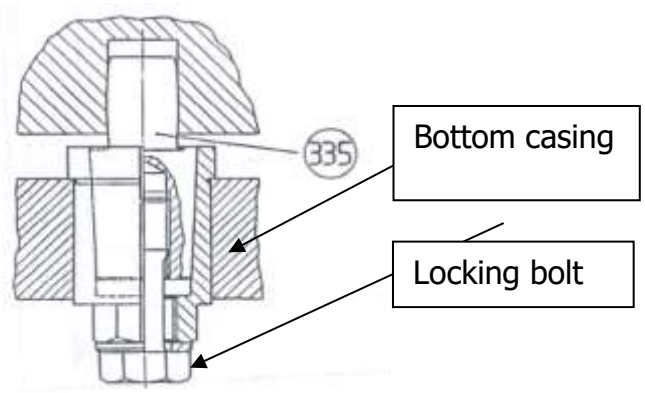
FINAL CENTERING READINGS

- Following activities were carried out for centering of bottom of GBC-1 (Guide Blade Carrier-1) w.r.to rotor in a horizontal plane:
  - Labyrinth clearances were 0.30 mm at left side and 0.70 mm at right side.
  - Lifted the Guide Blade carrier and removed the guide pin**.** The guide pin are positioned in slots as shown in figure below

Guide Pin

  - For shifting the bottom of GBC towards left, tack welding was done at right side of guide pin. On the slot at left side, metal was removed by grinding by same amount.
  - Pin was placed at slot and guide blade carrier no.1was placed at position and clearance was found ok.

- Similar procedure adopted for shifting GBC-2.
  - After placing rotor, clearance was checked and found ok. ()



Locking bolt arrangement.

- Now vertical alignment of all Guide blade carriers was required to be corrected. Following activities were carried out for GBC-III.
  - Dial gauge base was placed on top face of bottom casing and dial point was placed on top of bottom half of GBC-III bottom on both sides.
  - Lifting and lowering of GBC-III was done by bottom calotte.
  - By loosening the bottom calotte (POS 508), GBC-III was lowered
  - When we loose the calotte, GBC-III was lowering, at the time of contacting with casing, sound came, so we stopped and checked the reading.
  - Accordingly, GBC was set to optimum reading.

0.50

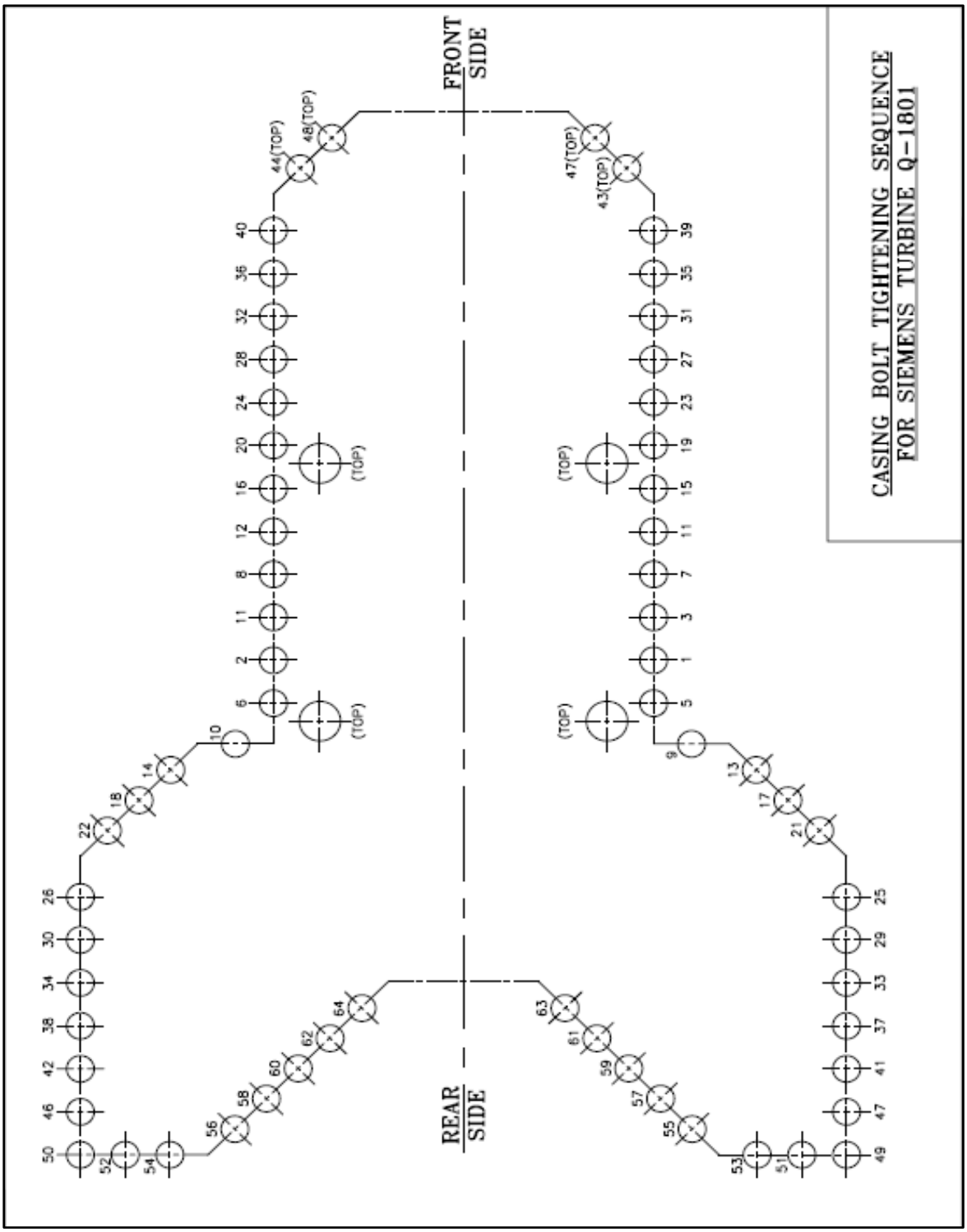
0.50

Total float is 1 mm

  - Then top calotte was placed and tightened.
  - Then socket head screw and ring was tightened and spherical washer was placed on it.
  - The position of spherical washer w.r.to bottom case plane was checked. By adjusting top calotte level of spherical washer was made 0.15mm below bottom casing.
  - Then locked the both calotte by socket head screw with ring.
- The same procedure was adopted for GBC-II & I.

0.55	0.75
0.50	0.65
GBC-II	GBC-I
Total float is 1.05 mm	Total float is 1.4 mm

- Top half of all guide blade carrier, steam chamber and inner gland were placed. All bolts were tightened. Tack welding of bolt done with guide blade carrier body by TIG welding using 2.5 mm dia filler wire - ER 70 S2.
- Top casing was lifted after checking the level with the help of measuring scale. Birkosit was applied on both face of casing. Top casing was placed on bottom casing using 6 nos. of guide bolts.
- Tightening of bolt was done sequentially as per shown in figure.



Tightening sequence

- Both 60 ata inlet flange was tightened using new gasket.
- Placed the lift bar. 60 ata emergency stop valve (ESV) were assembled.
- 23 ata servo cylinders with pilot valve was assembled on the position.
- All steam piping flange (4 ata induction line, 23 ata extraction line top and bottom) to casing were tightened
- 4 ata servo cylinder with pilot valve was assembled
- All locking washer of top casing were loosened.
- Alignment between turbine and LP was checked and corrected.
- Instrument probe was provided in front and rear bearing assembly.
- Axial thrust of rotor was checked and calibrated it with instrument's reading. Placed the rotor in center position.
- Box-up the front and rear vent line of turbine.
- Front end pedestal top cover of turbine was placed and boxed up.
- Earthing brush was provided.
- Top cover of rear end pedestal bearing was placed.
- AOP started, no leakage observed.
- Motor drive Lube oil pump was started.
- 60 ata, 23 ata and 4 ata governing valve lift was checked w.r.t secondary oil pressure, found as per protocol value shown in Table.

Governing valve lift w.r.t secondary oil pressure – Protocol value

Sr. No	WW-505 DCS out-put in %	60 ata		23 ata		4 ata		
		Secondary oil pressure	Valve Lift (Div)	Secondary oil pressure	Valve Lift (Div)	Current in mA	Secondary oil Pressure	Valve Lift (Div)
1	0	1.5	0	1.5	0	4	1.5	0
2	10	1.75	3.5	1.7	2.5	8	2.15	7
3	20	2	9.5	1.95	2.5	12	2.88	28
4	30	2.2	13	2.2	3.5	16	3.7	41
5	40	2.65	17	2.5	5.5	20	4.6	55
6	50	2.9	20.5	2.8	7			
7	60	3.3	24.5	3.05	9			
8	70	3.6	29	3.4	11.5			
9	80	4.0	34	3.75	13.5			
10	90	4.3	38	4.1	16			
11	95	4.5	40	4.2	18.5			
12	100	4.7	42	4.45	32			

- Placed the dial indicator on the top casing – front side.

- Before the start-up of turbine, turbine was run by barring gear for heating the turbine.
- Barring was started by production and it was observed that barring was stopped after some time. This problem was observed again and again and it was discussed by production, instrument and mechanical.
- Barring was checked by mechanical and it was found ok.
- Instrument had checked the proxy and it was reset and all wiring were replaced.
- Heating of turbine started by the 60 ata main bypass valve, valve regulated slowly. Barring started and Heating was done for 2 hrs.
- Instrument speed indictor shown 2000 rpm during barring. Same was recalibrated by instrument department.
- After 4 hrs. Turbine was kept at slow roll at 2000 rpm. Casing expansion was 0.60 mm when 60 ata main steam temperature was 280 C.
- At the time of startup of turbine, it was observed that start up oil was not generated in the system.
- There were some problem in getting signal from DCS, control room. After hours of discussion and testing between mechanical, production and instruments deptt. It worked and startup oil was generated.
- Turbine speed increased up to 4600 rpm for by passing the critical speed range. Hold it at 4600 rpm for 5 minute.
- Increased speed up to minimum governor speed 6375 rpm and hold for 30 minute. 60 ata main steam temperature was 280 C,
- Turbine speed increased to max. Governor speed 7875 rpm and over speed lock was bypassed by control room.
- Speed increased and OST done at 8620 rpm. (Design valve : 8663 rpm +/- 1%)
- Oil line leakage from the 60 ata was attended.
- Removed the rear bearing pedestal top cover.
- Coupled the turbine with LP case and placed the top cover of rear end pedestal cover.
- Turbine handed over to production department.
- Bearing temperature and vibration were within acceptable limit.
- Consumed spares are shown in table below.

Overhauling of Accessories

60ata Control valve

- Dismantled the 60ata stem chest valve and taken to ground with the help of EOT Crane.
- Both side Emergency stop valve were dismantled.
- It was observed that silica was deposited on both side strainers.

- Both side strainers were cleaned.
- In 60 ata and 23 ata control valve, stem gland packing were replaced with new one. measured the packing length for both control valve, it was 42.00 mm.
- Consumed spares are shown in table- 6

60 ata servo cylinder and Pilot valve

- 60ata servo cylinder and Pilot valve were opened.
- Both were cleaned properly.
- Complete sealing set of servo cylinder were replaced by new one.

23ata servo cylinder and Pilot valve

- 23 ata servo cylinder and Pilot valve were opened and cleaned.

4 ata servo cylinder and Pilot valve

- 4 ata servo cylinder and Pilot valve were opened and cleaned.

Re-Nitrogen Filling in Oil Accumlator

Accumulator Details

- The Balloon was checked and found approx 3.0 Kg pressure in Balloon.
- Gas filling Kit is available for filling of Nitrogen to oil accumulator.
- As per name plate details available on the body of Accumulator, nitrogen pressure may be kept between 6.0 kg to 9.0 kg. It was kept as 7.0 kg.

Consumed Spares

Sr. No.	ITEM CODE	DESCRIPTION	QTY
1	2010122023326420	GLAND PACKING, FLOJET MAKE, (POS-503/504), SIZE : 19.95MM ID X 32MM OD X 6MM THICK ,OF 60 ATA CONTROL VALVE (POS-0038), DRG. NO.: 0-0006-0802-04 FOR Q-1801, SIEMENS TURBINE	10
2	2010122023326410	GLAND PACKING, FLOJET MAKE, (POS-503/504), SIZE : 19.95MM ID X 32MM OD X 4MM THICK ,OF 60 ATA CONTROL VALVE (POS-0038), DRG. NO.: 0-0006-0802-04 FOR Q-1801, SIEMENS TURBINE	15
3	2010122029424770	GASKET DN 150 PN 160 POS-28,OF GASKETS FOR STEAM PIPING(POS-0601) FOR Q-1801, SIEMENS TURBINE	02
4	2010122029424740	GASKET DN 80 PN 40 POS-25,OF GASKETS FOR STEAM PIPING(POS-0601) FOR Q-1801, SIEMENS TURBINE	02
5	0000993790600000	MAINT. CHEMICALS / SEALANT / ADHESIVE COMPOUND BIRKOSITE COMPOUND STAG "B" 1 KG PACK	2
6	2010122023539510	O-RING, SACH-NR. : 5-6748-3210-25, POS 37, SIZE-210X4, OF INDUCTION STEAM STOP VALVE (POS-0035), DRG NO : 0-0006-2302-05, FOR Q-1801, SIEMENS TURBINE	1
7	2010122024647810	SEALING SET,POS-101,OF 60 ATA SERVO CYLINDER (POS-0046), DRG. NO.: 0-0006-1900-07 FOR Q-1801, SIEMENS TURBINE (Turbo make)	1
8	2010122024740400	PILOT VALVE,POS-15,OF 60 ATA PILOT VALVE (POS-0047), DRG. NO.: 0-0006-1910-07 FOR Q-1801, SIEMENS TURBINE	1
9	2010122024702600	THRUST BALL BEARING,POS - 20,OF 60 ATA PILOT VALVE (POS0047), DRG. NO.: 0-0006-1910-07 FOR Q-1801, SIEMENS TURBINE	2
10	2010122025907310	SEALING BUSHING, SACH-NR : 5- 6568-2061-00,POS-100,OF EXTRACTION (23 ATA) & INDUCTION (4 ATA) SERVO CYLINDER (POS-0050 & 0059), DRG. NO.: 0-0006-1900-08 FOR Q-1801, SIEMENS TURBINE	1
11	2010122020439900	TILTING PAD BEARING SEGMENTS, SACH-NR.: 5-6685-4003-77 OF COUPLING END (BACK) JOURNAL BEARING ASSY (POS-0004), DRG NO: 0-006-0240-25 FOR Q-1801, SIEMENS TURBINE	1 Set
12	2010122010356811	Gearbox Thrust bearing pads replaced.	1 Set

DATA SHEET OF TURBINE, Q-1801

TURBINE BEARING CLEARANCES

Front journal bearing : ACTUAL VALUE

SR. NO.	PAD THICKNESS	DESCRIPTION	DESIGN VALUE	Actual Value
1	17.46	Bearing shell bore		159.99
2	17.46	Journal Bearing Bore (A)		125.06
3	17.45	Journal Dia. (B)		124.80
4	17.46	Clearance (A-B)	0.18 TO 0.31	0.22
5	17.48	Interference		0.03

Rear journal bearing

SR. NO.	PAD THICKNESS	DESCRIPTION	DESIGN VALUE	Actual Value
1.	22.46	Bearing shell bore		204.98
2.	22.47	Journal Bearing Bore (A)		160.05
3.	22.47	Journal Dia. (B)		159.73
4.	22.46	Clearance (A-B)	0.24 TO 0.35	0.31
5.	22.42	Interference		0.04

Note: Old bearing replaced because the clearance was 0.36mm.

THRUST PADS THICKNESS

SR. NO.	THICKNESS (mm)	
	ACTIVE (t)	NON – ACTIVE (t)
1	19.98	20.10
2	19.96	20.09
3	19.98	20.08
4	19.97	20.07
5	19.97	20.08
6	19.95	20.10
7	19.96	20.07
8	19.96	20.09

THRUST FLOATS

ACTUAL VALUES

- Rotor free float +ve : 2.10
- Rotor free float -ve : 1.85
- Total free float : 3.95
- Thrust float with all internals : 0.34
- Housing movement : 0.14
- **(Design value : 0.25 to 0.35)**

FINAL STEAM GLAND CLEARANCES BETWEEN ROTOR FINS AND GLAND FINS

Turbine internals fins radial clearances		
Component	**Left**	**Right**
Front steam gland	0.45	0.45
BP Gland 1	0.45/0.55	0.40
BP Gland 2	0.40/0.60	0.40/0.60
A Wheel	1.70	1.70
Intermediate gland	0.55/0.65	0.55/0.65
Rear steam gland	0.45	0.50

GBC Thermal gaps		
Component	**Left**	**Right**
Nozzle Block	2.05	1.95
GBC 1	1.45	1.60
GBC 2	2.10	1.90
GBC 3	2.3	2.45

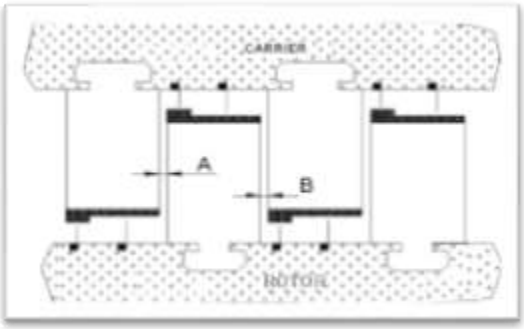
GBC bottom half PP levels		
Component	**Left**	**Right**
Nozzle Block	-0.11	-0.07
GBC 1	+0.42	+0.16
GBC 2	+0.10	+0.35
GBC 3	+0.58	+0.20

NOTE

PP : Parting Plate

GBC: Guide blade carrier

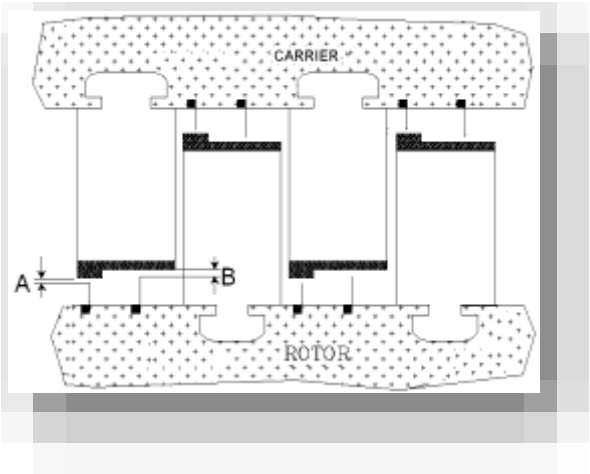
AXIAL CLEARANCES



Stationary blades to Rotor fins radial clearances				
Stage	**Left**	**Right**	**Top**	**Bottom**
1	0.60	0.60	0.65	0.65
2	0.60	0.60	0.65	0.65
3	0.60	0.60	0.65	0.65
4	0.60	0.60	0.65	0.65
5	0.60	0.60	0.65	0.65
6	0.60	0.60	0.65	0.65
7	0.55	0.55	0.55	0.55
8	0.55	0.55	0.55	0.55
9	0.55	0.55	0.55	0.55
10	0.55	0.55	0.55	0.55
11	0.55	0.55	0.55	0.55
12	0.55	0.55	0.55	0.55
13	0.55	0.55	0.55	0.55
14	0.55	0.55	0.55	0.55
15	0.55	0.55	0.55	0.55
16	0.55	0.55	0.55	0.55
17	0.55	0.55	0.55	0.55
18	0.55	0.55	0.55	0.55
19	0.70	0.70	0.75	0.75
20	0.70	0.70	0.75	0.75
21	0.70	0.70	0.75	0.75
22	0.70	0.70	0.75	0.75
23	0.70	0.70	0.75	0.75

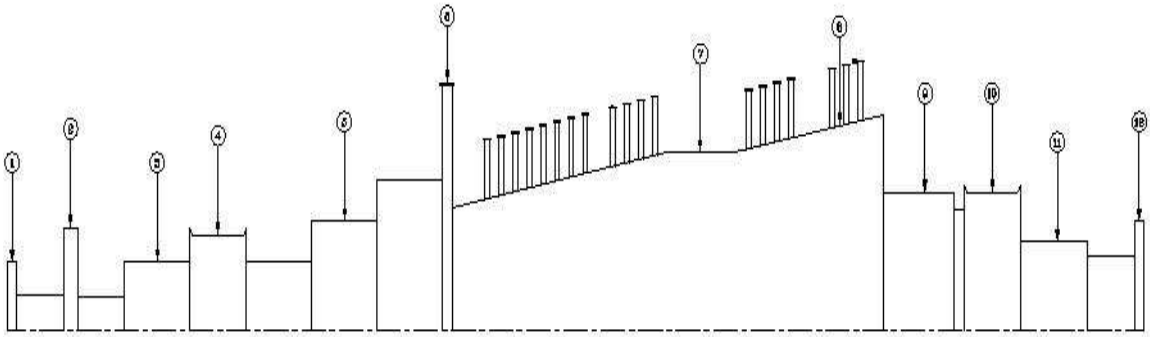
RADIAL CLEARANCE

(Rotor Fins to Carrier Blade and carrier fins to rotor body)



Moving blades (Rotor) to stationary fins radial clearances				
Stage	**Left**	**Right**	**Top**	**Bottom**
1	0.60	0.60	0.605	0.65
2	0.60	0.60	0.65	0.65
3	0.60	0.60	0.65	0.65
4	0.60	0.60	0.65	0.65
5	0.60	0.60	0.65	0.65
6	0.60	0.60	0.65	0.65
7	0.55	0.55	0.60	0.60
8	0.55	0.55	0.60	0.60
9	0.55	0.55	0.60	0.60
10	0.55	0.55	0.60	0.60
11	0.60	0.55	0.60	0.60
12	0.55	0.55	0.60	0.60
13	0.55	0.60	0.60	0.60
14	0.55	0.55	0.60	0.60
15	0.55	0.55	0.60	0.60
16	0.55	0.60	0.60	0.60
17	0.55	0.55	0.60	0.60
18	0.55	0.55	0.60	0.60
19	0.70	0.70	0.75	0.75
20	0.70	0.70	0.75	0.70
21	0.70	0.70	0.75	0.75
22	0.70	0.70	0.75	0.70
23	0.70	0.70	0.75	0.75

ROTOR RUN OUTS



Sr. No.	Location	Run-Out Value
1	THRUST COLLAR	0.01
2	FRONT Journal	0.00
3	Front oil gland	0.02
4	Front steam gland	0.03
5	IP gland	0.05
6	Rear steam gland	0.03
7	Rear oil gland	0.02
8	Rear journal bearing	0.00

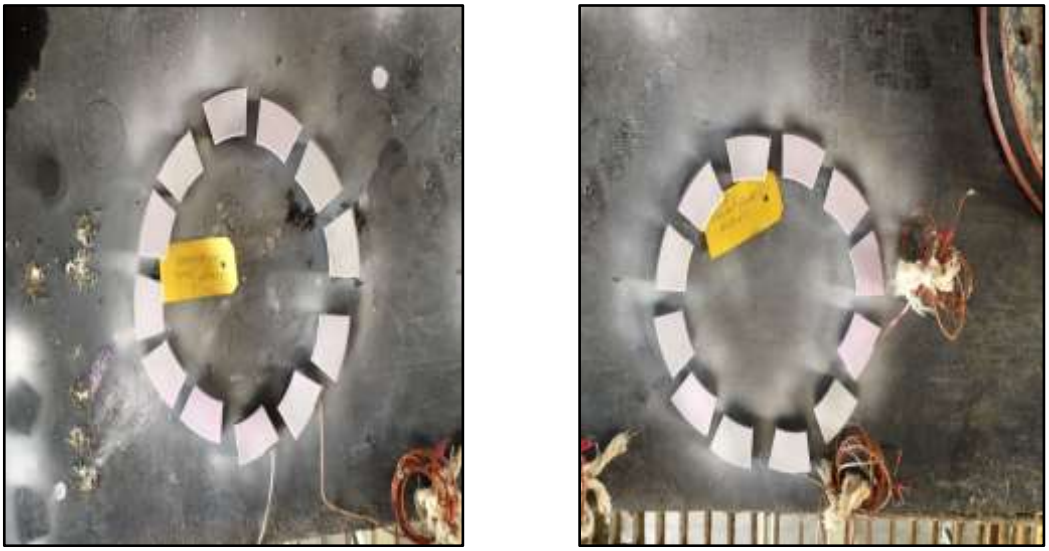
MINOR OVERHAULING OF CO_2 COMPRESSOR LP CASE (K-1801-1)

TECHNICAL DATA

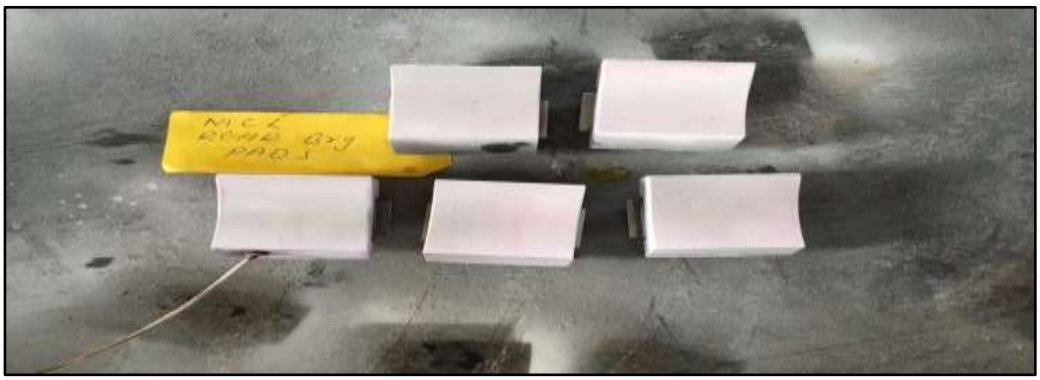
MAKE	: M/S HITACHI LTD .TOKYO, JAPAN
SERIAL NO	: K-1801-1 /K-1801-2
TYPE	: 2MCH607+2BC306A
MANUFACTURING YEAR	: 1997
NORMAL CAPACITY	: 64680 KG/HR WET
SUCTION PRESSURE	: 0.99 G/CM2
DELIVERY PRESSURE	: 165.25 KG/CM2 A
POWER	: 41039
NORMAL SPEED	: 7500/14826 RPM
MAX CONTINOUS SPEED	: 7875/15567 RPM
FIRST CRITICAL SPEED	: 3200/8200
CASING DESIGN PRESSURE	: 31/191 KG/CM2 A
CASING DESIGN TEMPERATURE	: 250 DEG CEN

LP compressor was taken up for minor overhauling. Following activities were carried out:

- Decoupled the LP case from Gear box.
- Alignment of LP case and gear box was checked and noted.
- Journal bearing pads on GB side were opened for inspection.
- Journal bearing pads on Turbine side were opened for inspection.
- Thrust bearing was opened for inspection. Clearances value found within acceptable limits.
- Gauss measurement of pads, Thrust collar, journal shaft & bearing housing were carried out by Inspection section and found within acceptable limit.
- DP testing of thrust pads, thrust collar and shaft journal was done and the same found acceptable.



Thrust bearing Pads DP test



Tilting pad of Journal Bearing after DP test.

- Alignment between LP Case & Gear box was corrected as per OEM reference values.
- LP case and Gear box was coupled at required tightening torque 20 kgf.m (196 Nm)**.** Finally spacers between LP case & gearbox were assembled after alignment correction.

Bearing Clearances Data Sheet of K-1801-1

Bearing Description	Design value (mm)	After PM (mm)
Journal bearing clearance on Turbine side	0.11 ~ 0.15	0.12
Journal bearing clearance on Gear Box side	0.11 ~ 0.15	0.13
Axial Thrust	0.28 ~ 0.38	0.32

MINOR OVERHAULING OF CO_2 COMPRESSOR HP CASE (K-1801-2)

TECHNICAL DATA

MAKE	:	M/S HITACHI LTD .TOKYO, JAPAN
SERIAL NO	:	K-1801-1 /K-1801-2
TYPE	:	2MCH607+2BC306A
MANUFACTURING YEAR	:	1997
NORMAL CAPACITY	:	64680 KG/HR WET
SUCTION PRESSURE	:	0.99 G/CM2
DELIVERY PRESSURE	:	165.25 KG/CM2 A
POWER	:	41039
NORMAL SPEED	:	7500/14826 RPM
MAX CONTINOUS SPEED	:	7875/15567 RPM
FIRST CRITICAL SPEED	:	3200/8200
CASING DESIGN PRESSURE	:	31/191 KG/CM2 A
CASING DESIGN TEMPERATURE	:	250 DEG CEN

HP compressor was taken up for minor overhauling. Following activities were carried out.

- Decoupled the HP case from Gear box
- Alignment readings were checked and found disturbed.
- Journal bearing pads on Gear box side were opened for inspection.
- Journal bearing pads on free end side were opened for inspection.
- Thrust bearing was opened for inspection. Thickness of the thrust pads was checked and clearances values found within acceptable limits.
- Gauss measurement of pads, Thrust collar, journal shaft & bearing housing were carried out by Inspection section and found within acceptable limit.
- DP testing of thrust pads, thrust collar and shaft journal was done and the same found acceptable.
- Alignment between HP-Gearbox was corrected as per OEM reference values. Details are given in this report.
- HP case and Gear Box was coupled at the required tightening torque 9.7 kgf.m (95.06 Nm).

Bearing Clearance Details for HP case

Description	Design Value (mm)	After PM (mm)
Journal bearing clearance on Free end	0.11 to 0.14	0.12
Journal bearing clearance on Gear Box side	0.11 to 0.14	0.14
Thrust bearing clearance	0.25 to 0.35	0.28

Overhauling of Gear Box

TECHNICAL DATA:

MANUFACTURER	:	M/S HITACHI JAPAN
TYPE	:	HCD025
RATED POWER	:	3900 KW
INPUT	:	7500 RPM
RATIO	:	1.9768
OUTPUT	:	14826 RPM
LUBRICATION oil	:	VG46
INLET OIL TEMPERATURE	:	45˚C+
INLET PRESSURE	:	2.0 kg/cm G
OIL QTY	:	220 LTR/MIN

GEAR BOX PREVENTIVE MAINTENANCE ACTIVITIES

- Both LP & HP side couplings were decoupled.
- Gear Box top cover was opened.
- All the bearing top halves were removed and also high-speed shaft & Low speed shaft were removed by lifting through chain block.

Complete Gearbox assembly before boxing up

- All the Pinion & Gear wheel journal bearings were thoroughly cleaned, and DP test was conducted found ok. Clearances were checked & the journal bearing of high-speed shaft were out of design range, so replaced.

- Gear wheel thrust bearings pads were thoroughly cleaned and DP test was conducted found ok. Clearances were checked & clearance was found out of design range, so the same were replaced.

- The backlash between Pinion & Gear wheel was checked and found to ok.

- Alignment between Gear Box & HP Compressor was checked and corrected as per protocol values.

JOURNAL BEARING CLEARANCES

Description	**Position**	**Design clearance, mm**	**Actual Clearance, mm**	
			Before OH	**After OH**
Journal Bearing **(Low speed)**	Front	0.125/0.185	0.25	0.25
	Rear	0.125/0.185	0.25	0.25
LSS side Axial Thrust clearances	----	0.38-0.610	0.78	0.41
Journal Bearing **(High speed)**	Front	0.15/0.21	0.21	0.21
	Rear	0.15/0.21	0.21	0.21
GW Backlash	----	0.383-0.608	0.28	0.28

Pinion Gear bearing journal diameter : Ø84.85

Gear wheel bearing journal diameter : Ø99.88 mm

THRUST BEARING PADS THICKNESS

PAD NO.	ACTIVE, mm	PAD NO.	Non-ACTIVE, mm
1-1	12.78	2-1	12.75
1-2	12.78	2-2	12.76
1-3	12.77	2-3	12.76
1-4	12.77	2-4	12.78
1-5	12.76	2-5	12.76
1-6	12.78	2-6	12.74

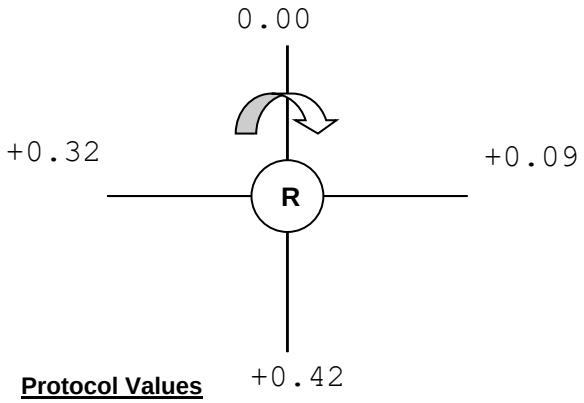
ANNEXURE-I

ALIGNMENT READINGS: TURBINE TO LP COMPRESSOR:

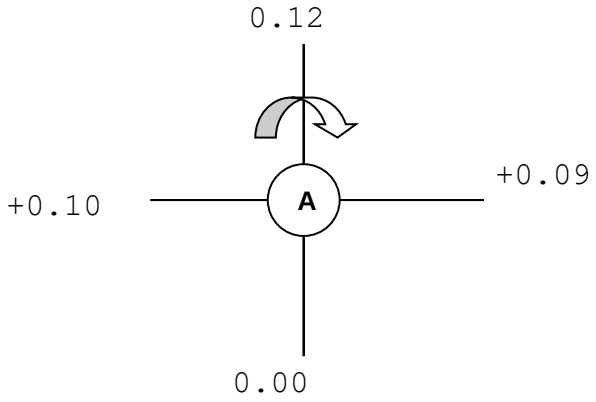
- View from LP compressor side.
- Dial put on Turbine.
- Axial readings (Before PM) were taken with an inside micrometer.
- All Readings are in mm.

Before PM

RADIAL

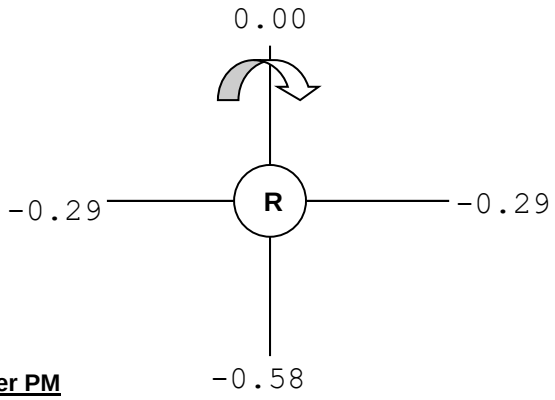


AXIAL

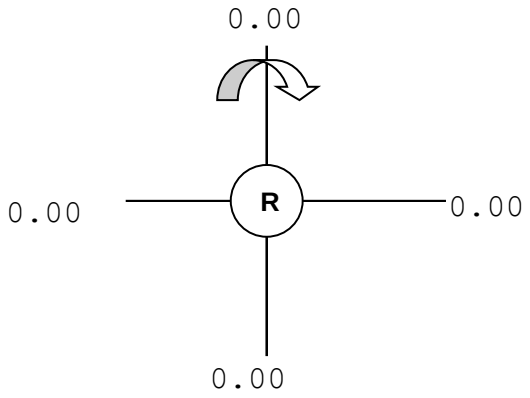


Protocol Values

RADIAL

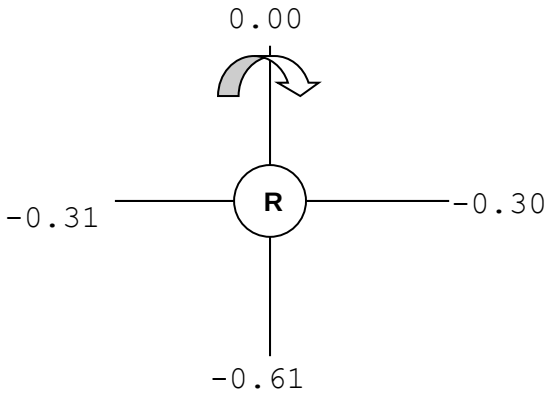


AXIAL

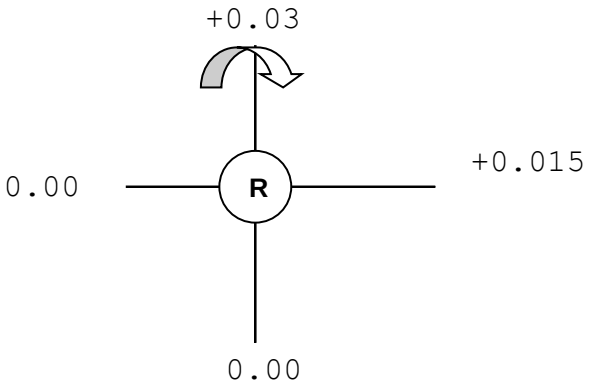


After PM

RADIAL



AXIAL

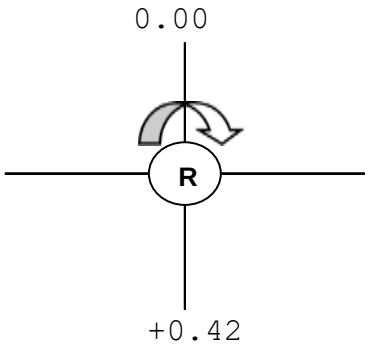


ALIGNMENT READINGS: GEAR BOX TO LP COMPRESSOR:

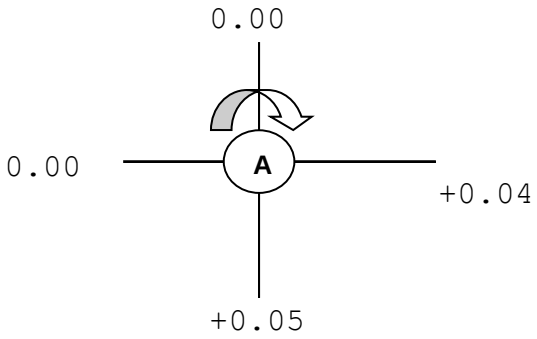
- View from Turbine Front side
- Dial put on LP Compressor Rotor.
- Axial readings (Before PM) were taken with an inside micrometer.
- All Readings are in mm.

Before PM

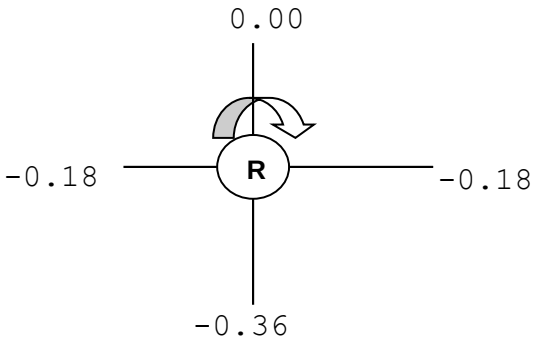
RADIAL



AXIAL



RADIAL



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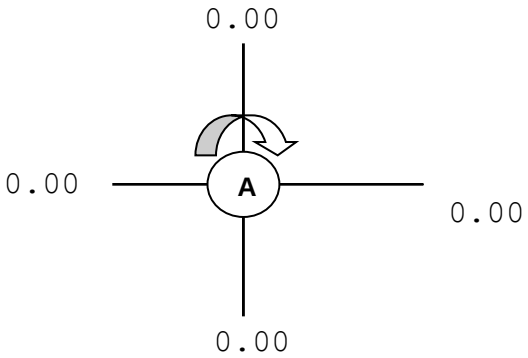

Protocol Value

After PM

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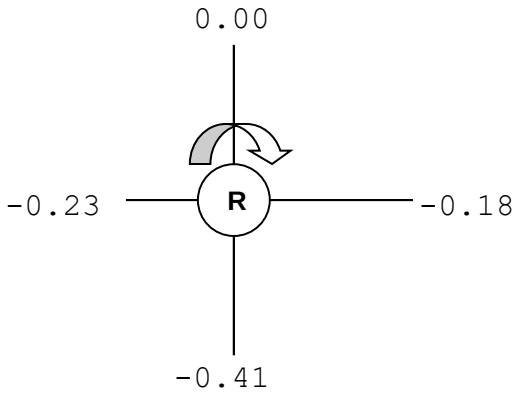

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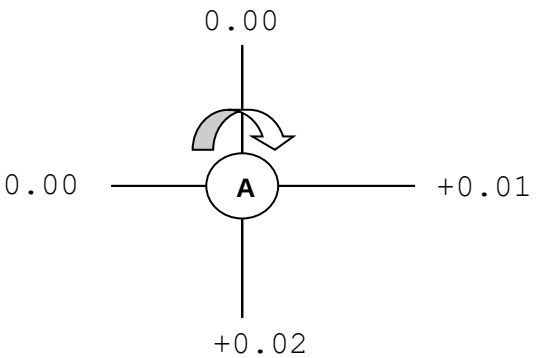
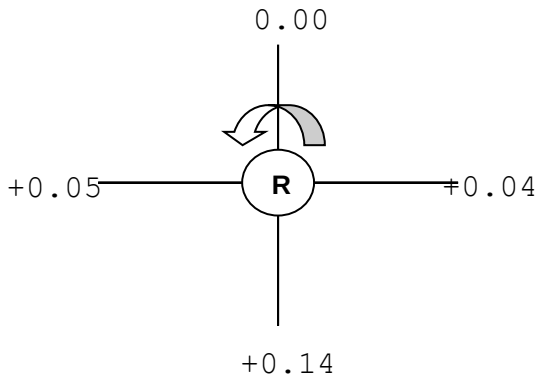


ALIGNMENT READINGS: GEAR BOX TO HP COMPRESSOR

- View from Turbine Front side
- Dial put on HP Compressor Rotor.
- Axial readings (Before PM) were taken with an inside micrometer.
- All Readings are in mm.

Before PM

RADIAL



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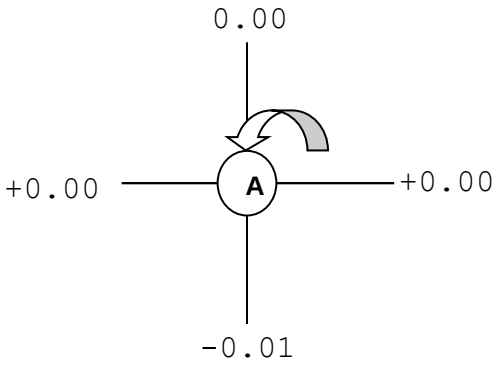

Protocol Value

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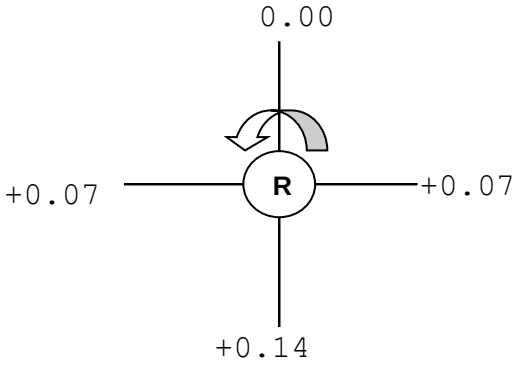

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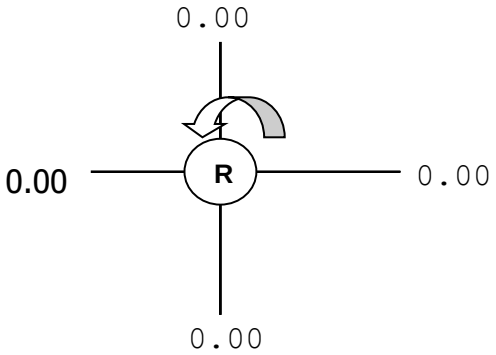
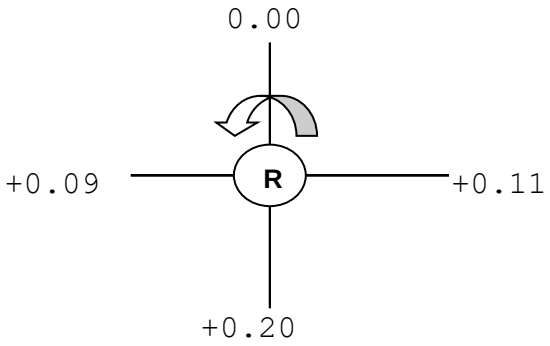


After PM

RADIAL



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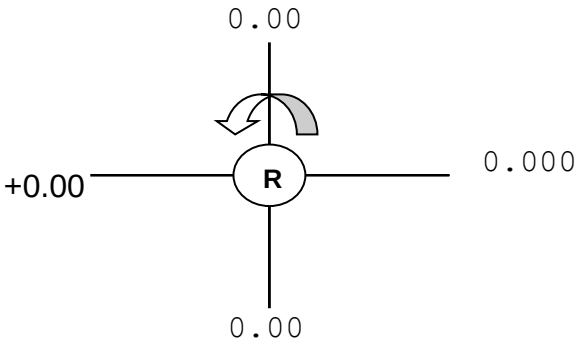


HP Stripper (H-1201)

The bottom cover was removed using bolt tensioner at 900 kg/cm2. The bottom cover was lowered onto the Hillman roller (Used Nr.:4) with ISMC150 as a guide.

The top cover was removed using bolt tensioner at 900 kg/cm^2 and the top cover was shifted below the platform using monorail hoist and chain blocks. Ferrules were removed from position. The same was cleaned and delta pressure was checked by the Production department.

Bottom manhole cover removed and placed on Hillman roller

The ferrules were replaced in Feb 2021 planned shutdown and were good to be in good condition.

Eddy current testing was carried out by the Inspection Department. The thickness of a few ferrules was found to be below MRT value. After Eddy current testing 68 tubes were found to be below MRT value of 1.72mm. Hence these tubes were decided to be plugged. The procedure for the same was provided by Casale and the same was followed.

Appendix 2

Heat exchanger tube plugging procedure for High Pressure Equipment in Stamicarbon Urea Plants

Introduction

The way of plugging differs from top and bottom tubesheet.
In any case is it our advice:

- To use cylindrical and flexible plugs.
- To plug always the top and bottom end of the referring tube.
- A positive leak should be made in the affected heat exchanger tube to allow leak detection in case of a leaking plug.

When to plug a tube:

- Leaking tube.
- Insufficient tube wall thickness.
- Seal tube to tubesheet weld defect.
- Tube end selectively attacked.
- No tube protrusion.
- Serious burn through defect.

Plugging procedure

To plug in top tubesheet

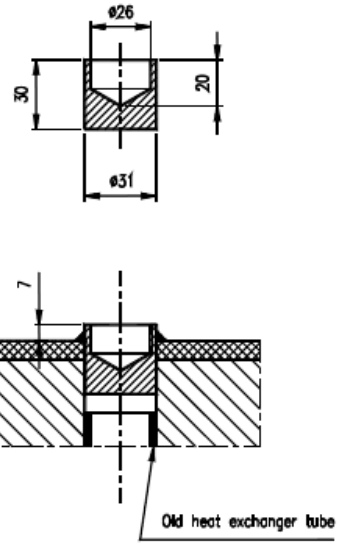
- Always plug in tube hole.
- Machine the tube end down 5 mm deeper than the bottom of the plug to install. This is required to create a positive leak in the affected tube.
- Clean the tube hole by reaming or by grinding over the length of the plug.
- Machine the plugs, material quality equal to material of heat exchanger tube as per enclosure 1 and 3.
- Clean and degrease the plug and tube hole.
- Insert the plug.
- Protect the surrounding tube ends very careful with help of the old PTFE bushing. This is extremely important at the top tube ends of a H.P. Stripper.
- Weld the plug in two layers, GTAW (material quality filler wire equal to material of heat exchanger tube; rod diameter 1.2 mm to 2.0 mm); start / stop points staggered to each other.
- After each layer of welding perform a penetrant test, an air soap test and a ferrite check.

To plug in bottom tubesheet.

- Always plug in tube end.
- Machine the tube end down until 50% of the tube to tubesheet weld metal is removed.
- Clean the tube inside by reaming or by grinding at the location where the plug will be positioned.
- Determine the inner tube diameter D.
- Machine the plugs, material quality equal to material of heat exchanger tube as per enclosure 2 and 4.
- Clean and degrease the plug and the inner tube hole.
- Insert the plug.
- Protect the surrounding tube ends very careful.
- Weld the plug in two layers, GTAW (material quality filler wire equal to material of heat exchanger tube; rod diameter 1.2 mm to 2.0 mm); start / stop points staggered to each other.
- After each layer of welding perform a penetrant test, an air soap test and a ferrite check.

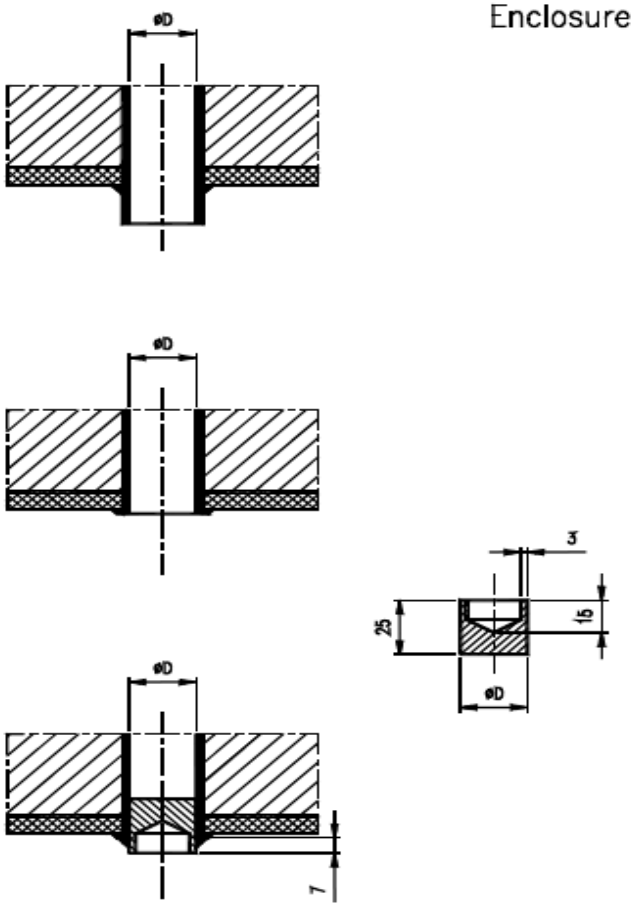
General remarks regarding the execution of the plugging

In order to be sure that the execution of the plugging is correctly welded we strongly advice to perform a welding and welders qualification. For that reason we advice to simulate in a workshop the conditions as present in the HP equipment.
To simulate position, tube protrusion, including the limitations as a result of the presence of the surrounding tube ends.
Examine this plug by macro examination of two cross sections, perpendicular.

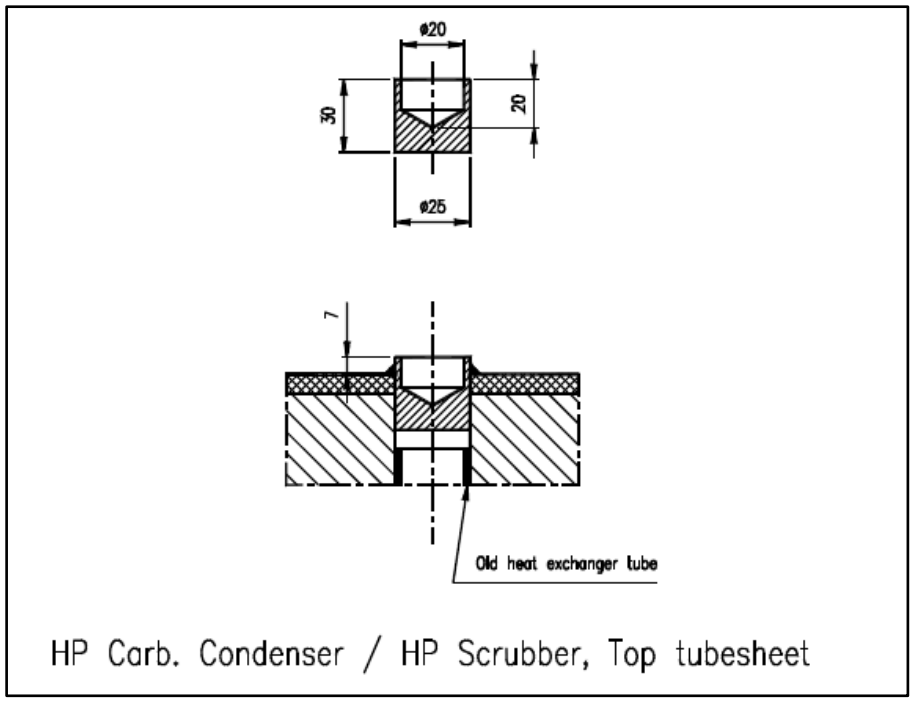


H.P. Heat Exchanger (Stripper), Top tubesheet

Enclosure 2.

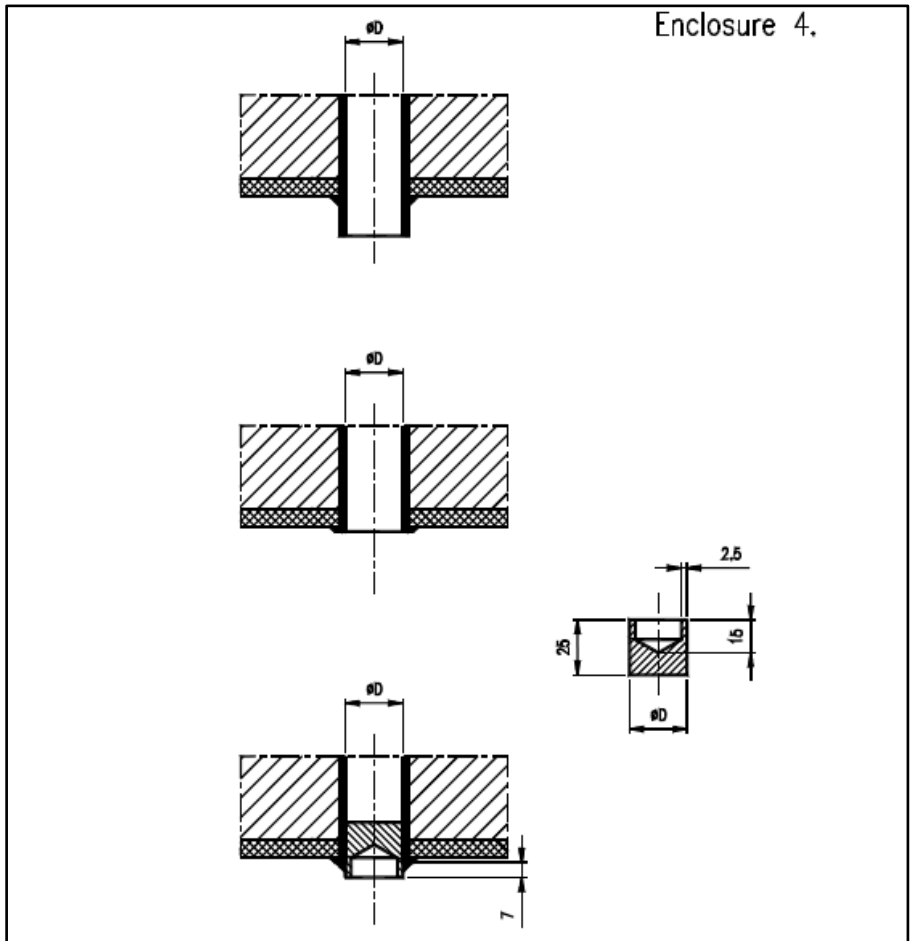


H.P. Heat Exchanger (Stripper), Bottom tubesheet



HP Carb. Condenser / HP Scrubber, Top tubesheet

Enclosure 4.



HP Carb. Condenser / HP Scrubber, Bottom tubesheet

Protruded end of tube grinded

Bottom tube sheet side tube plug

Top side tube sheet tube plug

Post inspection cleaning done by production. All deposits on tube sheet were removed by stainless steel wire brush. The ferrules were fixed in position with new PTFE gaskets.

After the bottom cover was boxed up, pressure drop measurement was carried out by the production department for each tube and the same was found within limit. The exchanger was thoroughly cleaned with compressed air and then with DM water.

The top and bottom cover were boxed up with new “Kempchen” gasket (839 mm OD x 800 mm ID x 4 mm thick) with new 0.5 mm thick Teflon envelope. Tightening pressure for top and bottom cover is as follows:

1st tightening round	300 kg/cm2
2nd tightening round	600 kg/cm2
3rd tightening round	900 kg/cm2
Final tightening round /checking round	900 kg/cm2

Autoclave V-1201

The autoclave was opened for checking leakage of liners. The top cover was removed after unbolting using hydraulic bolt tensioner with oil pressure maintained slightly above 700 bar. All the 11 Trays of Autoclave were opened for inspection and visual as well as helium leak test was carried out. The downcomer line was planned to be replaced and services of M/s Shree Ganesh were taken vide WO No. 201004231761 for replacement of the same.

The pipe was procured from M/s KEY-TECH ENGINEERING COMPANY, Mumbai. The size of pipe procured was 10”X8mm thk i.e., OD of 273mm, MOC: 2RE69(UNS31050), welded pipe.

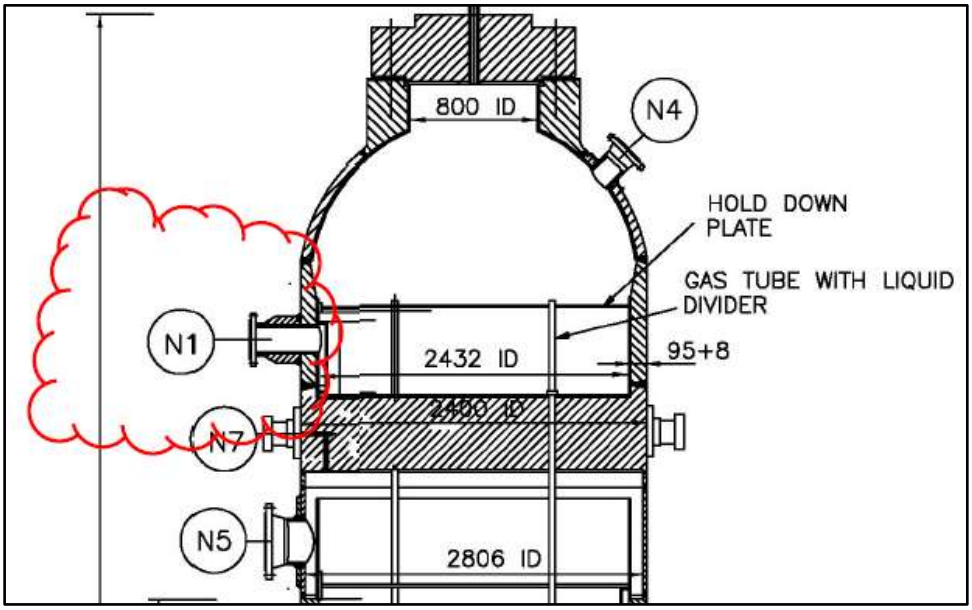
The old pipe was removed by grinding and lifted using a crane. New pipes in prefabricated conditions were already kept reducing the number of joints inside vessel.

Top manhole removed

Downcomer line condition

Post welding the downcomer line was filled with DM water to check for any leakage. No leakage was observed hence the condition of welding was found satisfactory.

Post repair, all trays were installed back. All bolts were reused, except a few new ones at locations where bolts were removed by grinding. Before boxing up of vessel the downcomer line along with line up to stripper was flushed. Later blowing arrangement with plant air was done by removal of HICV-1201 over N1 nozzle of H-1201 as shown below to ensure no slag was left inside the lines.



HICV-1201 removed from Nozzle N1 for blowing.

Later after proper blowing of the downcomer line, the top cover was boxed up and studs tightened by hydraulic tensioner.

Tightening pressure for top cover.

1st tightening round	300 kg/cm2
2nd tightening round	500 kg/cm2
3rd tightening round	700 kg/cm2
Final tightening round /checking round	700 kg/cm2

LP Vessel

V-1501

The vessel was opened, and internal inspection was done, and repair was done as per inspection report.

One no. bolt was found missing from feed water inlet line flange and few bolts were found missing from saturation box. The same were replaced and tack welded at its position.

Boiler open inspection was done in presence of boiler inspector on 10/04/2023 and hydro test was done on 13/04/2023 at 11.10 kg/cm^2.

Relief valves were tested in the presence of a boiler inspector and same was found satisfactory. The boiler was found ok and boxed-up. After boxing up all blinds were removed from its circuit.

The other LP vessels which were opened for inspection and repair done as per inspection report are as under:

- V-1503
- V-1423
- V-1203
- V-1207
- V-1351
- V-1811
- V-1202: The bed limiter was found damaged and the same was repaired during shutdown.
- V-1424: Dummy skirt condition was checked and found ok. A few bolts were found missing from the sparger clamp and they were replaced.
- V-1502
- V-1301
- V-1351: All trays were removed and found satisfactory.
- V-1352: Trays up to level 7 were removed and found ok. Hence the remaining trays were not opened, and vessel was boxed up.

V-1424 DUMMY 2RE69 SKIRT

V-1202 NOZZLE ON STAND

PRILL TOWER ID FAN K-1401-1 / 2 / 3 / 4

- For fan No 4 top and bottom bearing housing were replaced by new one. The support structure for the bottom bearing was also replaced.
- All fans have top bearings as fixed type and bottom bearing as expansion type.
- Greasing of all bearing was done.
- Belts of fan NO 1, 2, 3 & 4 were replaced by new ones.
- The alignment of motor and fan pulley was corrected.

PRILL COOLING SYSTEM INLET AIR FAN (K-1701)

- The bearing condition was checked, and pulley side bearing was replaced.
- The free end side bearing was found ok.
- Oil flushing of both bearings done.
- The motor was placed in position and alignment was done with fan.
- All belts were replaced by new ones.

PRILL COOLING SYSTEM EXHAUST AIR FAN (K-1702)

- The bearing condition was checked and found ok.
- Oil flushing of both bearings done.
- The motor was placed in position and alignment was done with fan.
- All belts were replaced by new one.

CONVEYOR SYSTEM

M-1403-1

- The belt was replaced by a new one.
- 850 mm HR grade belt was used.
- The bearings of head & tail pulley were replaced.
- Head pulley and Tail pulley was replaced during shutdown.
- Alignment & coupling was done between gear box to motor.
- Damaged carrying rollers and return rollers were replaced.
- All skirt blocks were replaced by new ones, as the skirt blocks towards wall side are difficult to be replaced during normal operation.

M-1403-2

- The belt was replaced by a new one.
- 850 mm HR grade belt was used.
- The greasing of bearings of tail pulley was done.

- Damaged carrying rollers and return rollers were replaced.
- The gear box oil was flushed.
- Alignment & coupling was done between gear box-motor-pulley.
- Skirt rubber for chute was replaced during shutdown with fabric inserted rubber.

M-1403-3

- The gear box oil was flushed.
- Coupling bush were checked.
- Alignment was done between gear box to motor and from gearbox to pulley.

M-1419

- Damaged carrying rollers and return rollers were replaced.
- The gear box oil was flushed.
- Greasing of chain and sprocket was done.
- Greasing of tail & head pulley bearings was carried out.
- Alignment was done between gear box to motor and from gearbox to pulley.
- Skirt block was replaced by new one.

M-1421

- Damaged carrying rollers and return rollers were replaced.
- The gear box oil was flushed.
- Greasing of chain and sprocket was done.
- Alignment was done between gear box to motor and from gearbox to pulley.
- Skirt block was replaced by new one.

M-1702

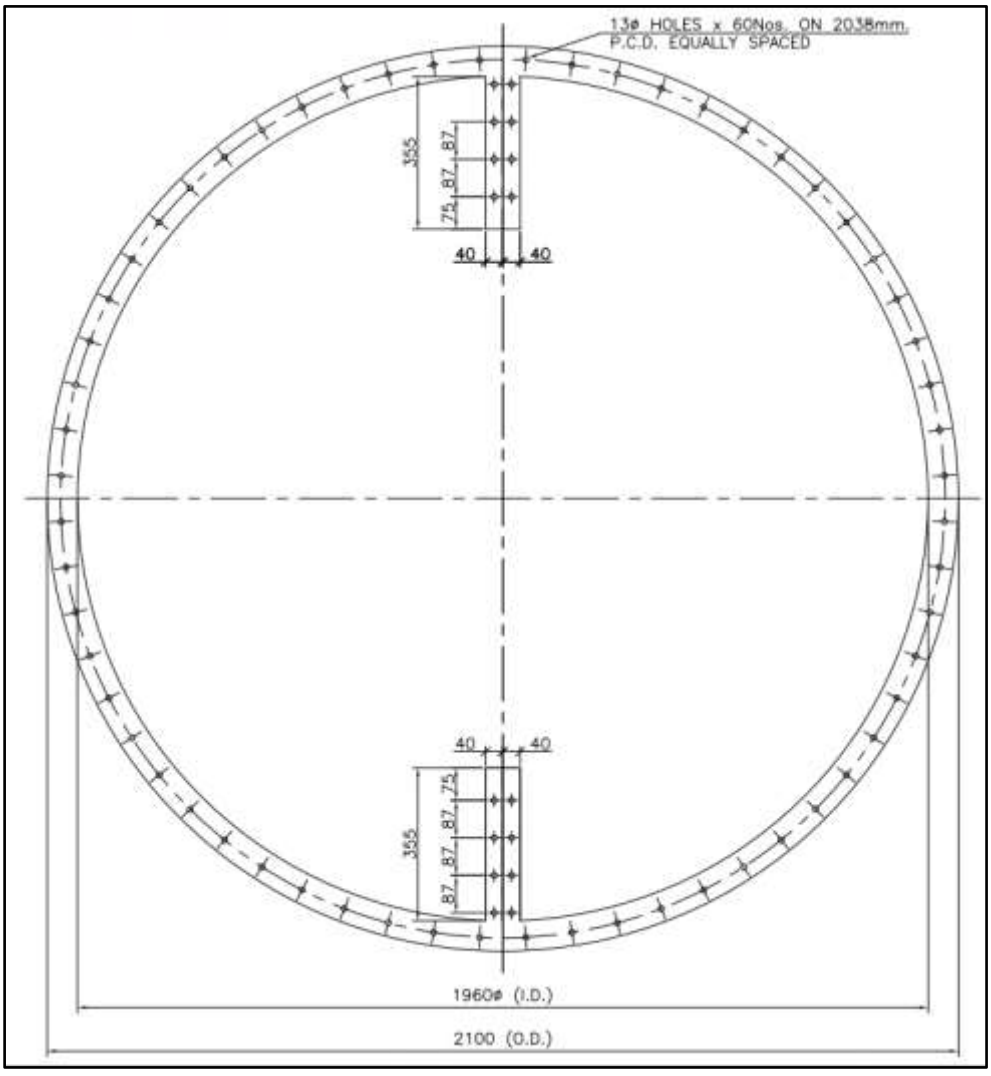
- Belt was replaced and new joint was prepared.
- Damaged carrying rollers and return rollers were replaced.
- The gear box oil was flushed.
- Greasing of chain and sprocket was done.
- Alignment was done between gear box to motor and from gearbox to pulley.

SCRAPER (M-1402-1/2)

Dismantling of Scrapper

- Removed Aluminum sheet above scraper.
- Shifted lifting rack inside Prill tower and installed the same.
- Using rack, lifting beam, 2 nos. Monorail (3 T Capacity) and 2 nos. Chain blocks

- (5 T) were erected above scraper.
- Measured and noted down the gap between floor and bottom of scrapper **(Design value: 200mm)**.
- Measured and noted down the gap between scraper end and wall **(Design value: 50 mm)**.
- Measured and noted down clearance between scraper blades and floor **(Design value: 15-20 mm)**.
- Marked the position of scraper before dismantling. Scraper arms were to be assembled at the same position.
- Opened the bolts of both side scraper arms and kept the scraperarms crosswise by lifting arrangement.
- Removed the ring clamp (in 2 pieces) by opening bolt.
- Removed the Neoprene band, checked the fitting position & measured theheight.
- Opened bolt and nut of split ring.
- Removed the reamed bolt – 4 Nos. of flange and marked the position.



- The surface above split cover was covered with araldite. Araldite was removed to access the counter sunk bolts of split cover.
- Opened the counter sunk bolts (M 12 X 25 mm lg) from split cover (split coveris in two half)
- Split cover was removed after lifting split ring (#76) by pin.
- Split ring was removed.
- Opened top bolt between scraper and Gear wheel (M-24 x 70 mm long -40Nos.)
- Lifted scrapper & shifted sideways using monorail.
- Measured and noted down clearance between gear wheel and bottom plate
- Skew bearing and pinion were replaced as they were damaged.
- Seating surface of gear wheel was cleaned.

Derrick arrangement for removal of scrapper arm.

Assembly of Scrapper Arm

- Scrapper arms were assembled at the same position at which they were dismantled.
- Hylomer was applied on seating surface of gear wheel.
- Bolts were fastened after applying Loctite. While fastening the bolts scraper
- arm was turned to check the smooth running of the arm.
- Installed the split ring.

Scrapper arm lifted from position.

- Installed split cover with packing on horizontal face and hylomer between vertical flanges.
- Bolts and countersunk bolts were provided and tightened.
- Split ring was lowered, and bolts were fastened.
- Neoprene band was provided, and its end was joined by cold Rubbercompound and ring-clamp was fitted.
- Scraper end parts were installed, and bottom and side gap were measured
- Checked scraper blades clearance between scraper blades and floor and found ok.
- Connected air supply to labyrinth

After removal of scrapper arm, condition of slewing bearing.

RELIEF VALVE OVERHAULING AND TESTING

Overhauling and testing of RV's were carried out through M/s Flotec Techno smart (India) Private Limited, Surat. Testing of RVs was done on test bench at Urea mechanical works.

Following RVs were removed, overhauled, and tested on valve test bench:

Sr. No.	RV No.	Equipment Details	Set Press. (Kg/cm2 g)	Remarks
1	RV-1201 A	V-1201 off gas line	165	
2	RV-1201 B	V-1201 off gas line	165	
3	RV-1201 C	V-1201 off gas line	165	
4	RV-1205	P-1201 A discharge	165	
5	RV-1206	P-1201 B discharge	165	
6	RV-1208	P-1201 C discharge	165	
7	RV-1103 A	P-1102 A discharge	180	
8	RV-1103 B	P-1102 B discharge	180	
9	RV-1103 C	P-1102 C discharge	180	
10	RV-1181	K-1801 final discharge	177	
11	RV-1903	K-1801 IIIrd stage discharge	111	
12	RV-1202A	V-1202 off gas line LP System	6	
13	RV-1202B	V-1202 off gas line LP System	6	
14	RV-1202C	V-1202 off gas line LP System	6	
15	RV-1203	P-1201 A Suction line	8.5	
16	PSV-1201A	P-1201 A Suction line	8.5	
17	PSV-1201B	P-1201 B Suction line	8.5	
18	PSV-1201C	P-1201 C Suction line	8.5	
19	RV-1101A	Liquid ammonia line from H-1102 to V-1102	31	
20	RV-1101B	Liquid ammonia line from H-1102 to V-1102	31	
21	RV-1102 A	Ammonia suc. Vessel (V-1103)	31	
22	RV-1102 B	Ammonia suc. Vessel (V-1103)	31	.
23	RV-1108 A	Cold ammonia line from Amm storage tank to H1102	31	
24	RV-1108 B	Cold ammonia line from Amm storage tank to H1102	31	
25	RV-1106 A	Liquid amm, line from amm. Plant to amm. filter.	31	
26	RV-1106 B	Liquid amm, line from amm. Plant to amm. filter.	31	

Sr. No.	RV No.	Equipment Details	Set Press. (Kg/cm2 g)	Remarks
27	RV-1107 A	Liquid ammonia line (hot) before ammonia filter	31	
28	RV-1107 B	Liquid ammonia line (hot) before ammonia filter	31	
29	RV-1110 A	Liquid ammonia line from atm. Amm. storage tank to H-1102	31	
30	RV-1110 B	Liquid ammonia line from atm. Amm. storage tank to H-1102	31	
31	RV-1901	Ist stage discharge of K-1801.	7	
32	RV-1902	IInd stage discharge of K-1801	27	
33	RV-1503	23 ata Steam	25	
34	RV-1504	9 ata Steam Drum	12	
35	RV-1501 A	4 ata Steam Drum	7.5	
36	RV-1501 B	4 ata Steam Drum	7.5	
37	RV-1506	4 ata Steam Main	6	
38	RV-1209	V-1203 Vessel	10	
39	RV-1351	RV of V-1351	24	
40	RV-1352	RV of V-1352	6	
41	RV-1301	RV of V-1301	6	
42	RV-1184 (CCS-I)	H-1102 outlet NH3 outlet	6	
43	RV-1221 (CCS-II)	P-1204 disch. To H-1203	16.5	
44	RV-1913	Ejector system of Q-1801	0.2	
45	RV-1914	Ejector system of Q-1801	0.2	
46	RV-1916	23 ata Steam extraction	28	
47	RV-1917	4 ata Steam exhaust	4	
48	RV-1351 A	RV of P-1351 A	10	
49	RV-1351 B	RV of P-1351 B	10	
50	RV-1130	24 ata steam header	26	
51	RV-1904	H-1811 First stage gas cooler	7	
52	RV-1905	H-1812 Second stage gas cooler	7	
53	RV-1906	H-1813 Third stage gas cooler	7	
54	RV-1224	C.W from utilities	6	

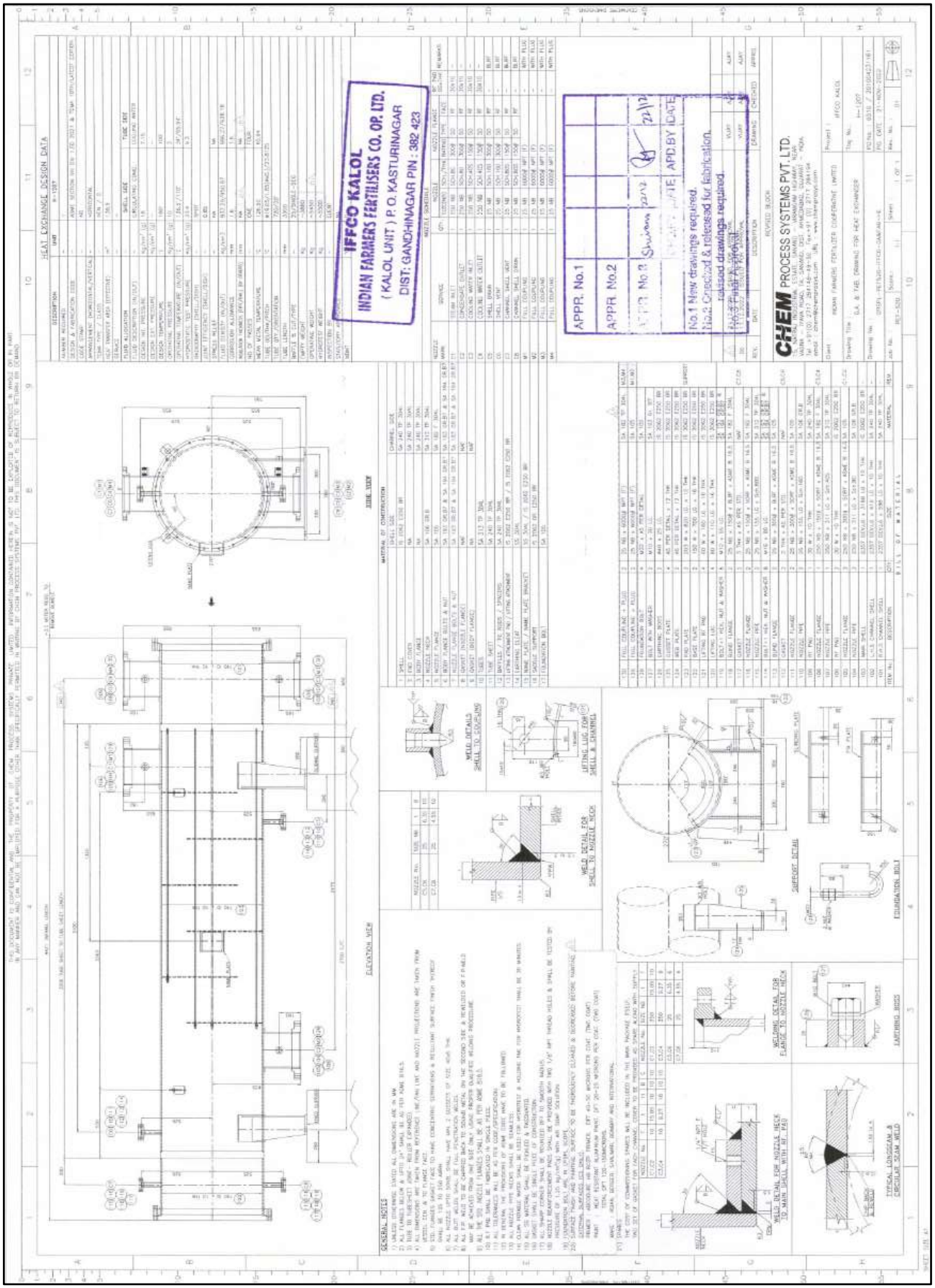
HEAT EXCHANGER JOBS

H-1207

New heat exchanger was procured form M/s Chem process, Ahmedabad via PO No. 201004231161 dated 21-Nov-2022 as old heat exchanger tubes were plugged more than 30%. Hence, same was replaced during shutdown internally. Modification of the existing lines for the new heat exchanger was done by M/s A. M. Erectors.

Lifting of new heat exchanger

Old heat exchanger being removed.



New Heat Exchanger General arrangement drawing

H-1813

As routine the heat exchanger channels & connected piping were removed. The shell along with tube bundle was lifted to ground level & tube bundle pulled out. The tube bundle was cleaned by hydro jetting & reinstalled inside the shell. Test rings were installed and the tubes hydro tested at design test pressure & no leak was observed.

Opening, Hydrojetting & Boxup of Heat Exchangers

The following heat exchangers were opened for hydro jetting. The same was carried out and boxed up with new gaskets.

- H-1204 (Recirculation Heater)
- H-1207 (Circulation System - ii Water Cooler)
- H-1352 (Desorber Reflux Condenser)
- H-1419 (Pre-Evaporator Heat Exchanger)
- H-1424 (Second Stage Evaporator / Condenser)
- H-1425 (Second Stage Evaporator / First Condenser)
- H-1426 (Second Stage Evaporator / Second Condenser)
- H-1814 A/B (Lube Oil Cooler Hitachi Compressor Train)
- H-1815 (Surface Condenser For Hitachi Compressor Turbine)
- Lo Coolers Of P-1102 A/B/C
- Lo Coolers Of P-1201 A/B
- H-1811 - Tube Bundle Removal
- H-1420 (Final Condenser)
- H-1421 (Flash Tank Condenser)
- H-1422 (First Stage Evaporator / Separator)
- H-1423 (First Stage Evaporator / Condenser)
- H-1204 (Recirculation heater)
- H-1427(Circulation cooler for V-1423)
- H-1208 (Ammonia water cooler)
- H-1209
- H-1812
- H-1813

BEL Make Angle Valves Overhauling

During shutdown all BEL make angle valves were taken for maintenance and M/s Flotech Technosmart Pvt Ltd was given the job as per CPA Nr. 201004230469 dtd 12/07/2022.

All BEL make valves were repaired as per list. The repaired bonnet assembly of valves was placed in position and blue match was done to ascertain that the sealing was complete. Then the bonnet assembly was placed in position with the new gasket.

Motor Alignment jobs

Following motors were removed from position and later aligned in position:

- P-1131 A/B/C
- P-1231 A/B
- P-1814
- P-1817
- P-1815 A/B
- M-1403/1
- M-1403/2
- M-1403/3
- M-1402/1
- M-1402/2
- P-1506
- M-1419
- M-1421
- K-1401/1,2,3&4

Critical Fabrication Jobs

BEL Valve Replacement

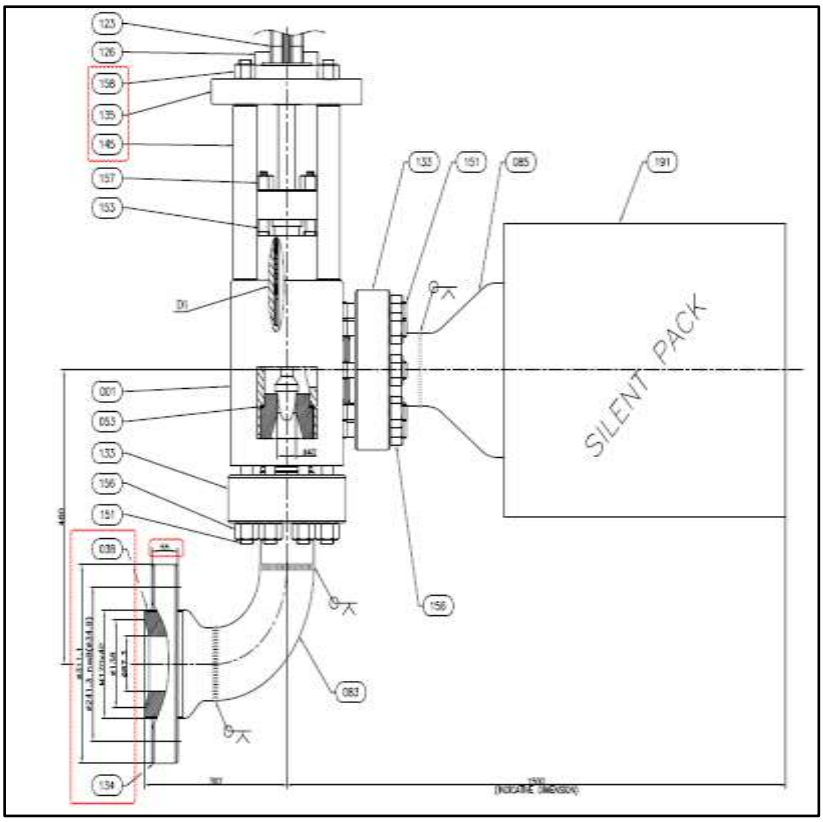
Following BEL make Angle Globe Valves were replaced by Douglas Chero make Angle Globe valves:

- P-1201 A/B second discharge I/V
- HP carbamate pump common recycle I/V
- Stripper sample point I/V
- Autoclave unloading I/V
- Autoclave to HPF line I/V
- HP carbamate pump, P-1201A/B recycle valves.
- HPF to Scrubber bottom I/V.

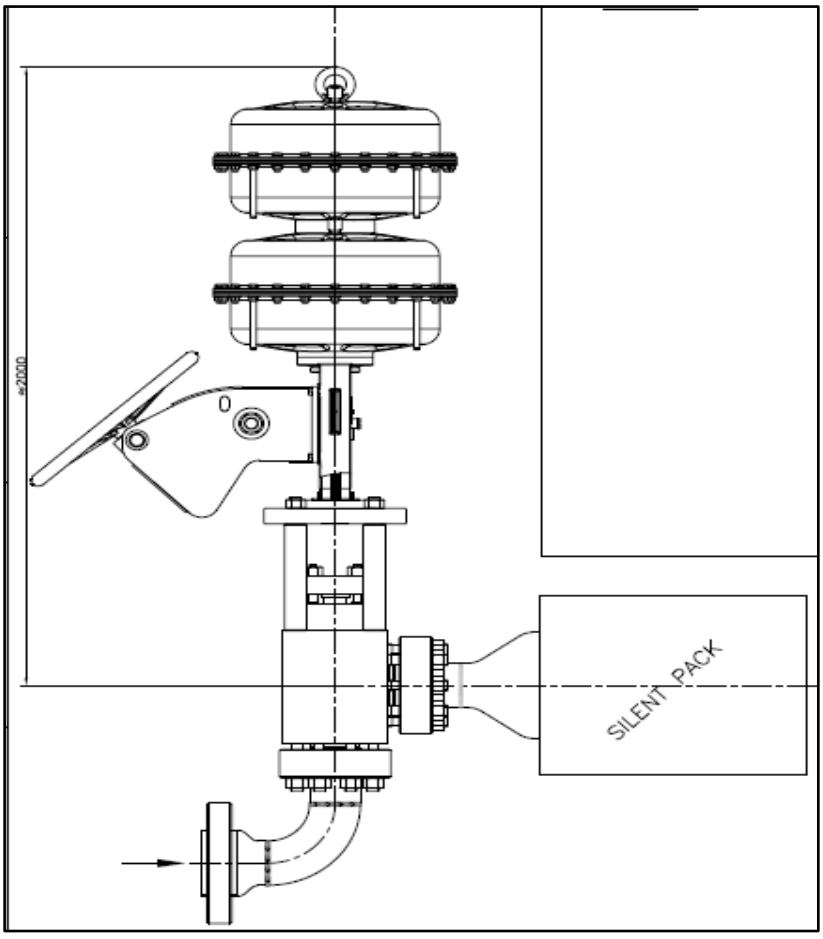
HP Vent Valve, HICV-1202

HICV-1202 Angle Control Valve (Flow to Close) was replaced by New Control Valve (Flow to Open) due to non availability of spares of old control valve. Valve was procured from M/s Keytech Engineering Company, Mumbai by instrumentation Department.

Required supports were welded for installation of control valve with Silencer.



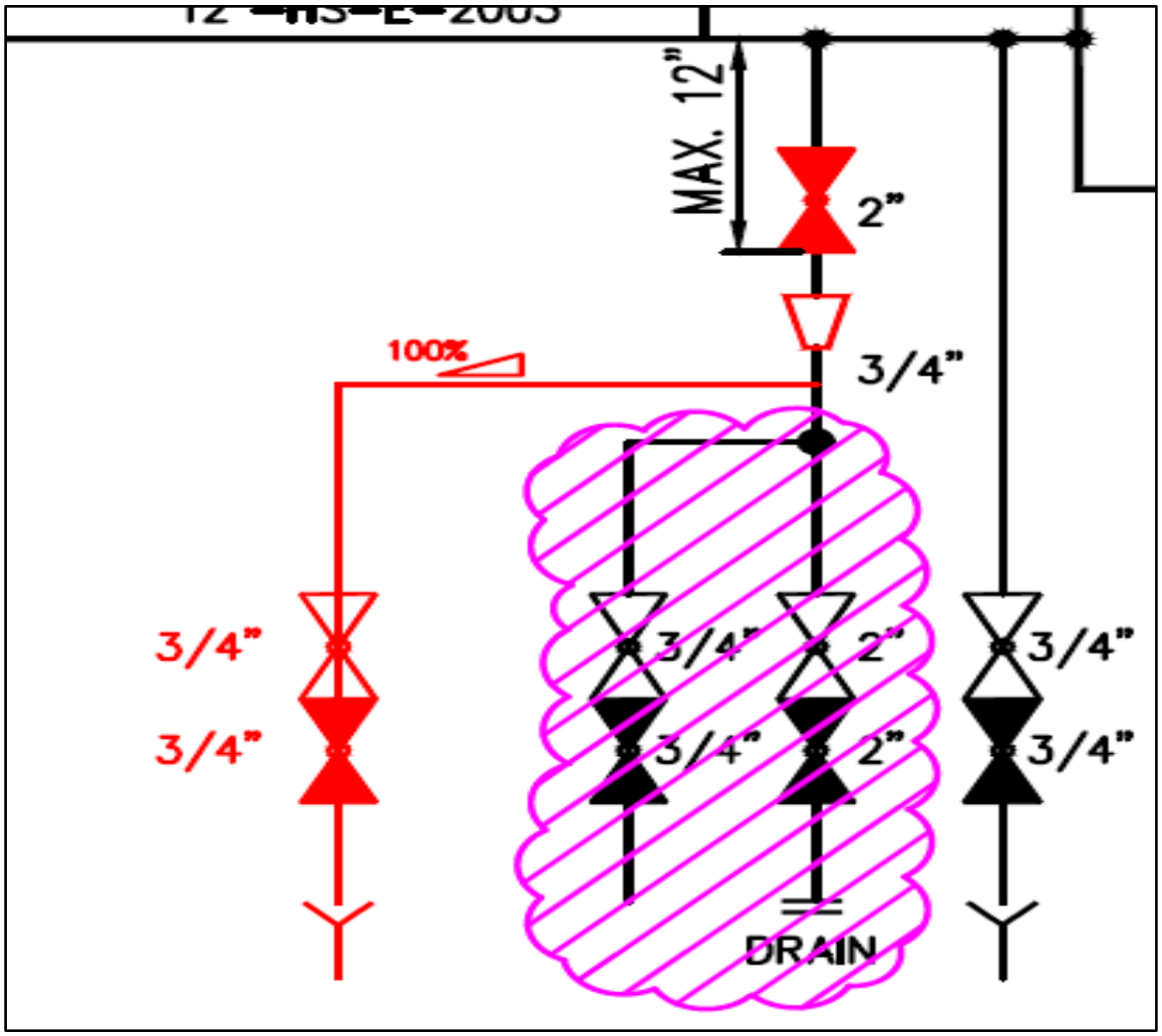
HICV-1202 GA drawing.



HICV-1202 Orientation Details.

60 ata drain line replacement job

During plant normal operation a leakage was observed from Q-1801 main steam inlet line drain. This drain was used during commissioning for steam washing of steam turbine and was later blinded. Over period of time this lines thickness got reduced and the same started leaking. The line was replaced along with tapping for removal of excess condensate was provided. The P&ID for the same can be found below for reference:



P&ID of newly fabricated drain line.

OFFSITE & UTILITY PLANT

(MECHANICAL)

ROTATING EQUIPMENT

Preventive Maintenance of BFW Pump, P-5111 (Turbine Driven) BFW Pump (P-5111)

Following activities were carried out during PM

- Oil pipe lines were disconnected.
- Both the end covers of the pump were removed
- Bearings were removed on both the sides
- Cleaning of bearings and bearing covers were carried out
- DP test was conducted on all the journal bearings & thrust pads and found ok.
- Checked the bearing clearance and found ok.
- Rear side thrust bearing was removed
- Thrust pads were found ok.
- Both the sides bearings and bearing covers were assembled back
- Suction Strainer was removed, cleaned and assembled back
- Alignment readings checked and recorded.
- Bearing clearance checked and recorded in clearance chart

Clearance Chart

Sr. No.	Description	Design / Recommended Value (mm)	Value Before PM (mm)	Value After PM (mm)
1	Thrust Bearing Axial Clearance	0.28-0.33	0.25	0.25
2	Coupling End Journal Bearing Top Clearance	0.12-0.18	0.19- 0.21	0.18-0.22
3	Coupling End Journal Bearing Top Interference	0.02-0.05	0.03	0.03
4	Free End Journal Bearing Top Clearance	0.12-0.18	0.19-0.22	0.19-0.22
5	Free End Journal Bearing Interference	0.02-0.05	0.05	0.05

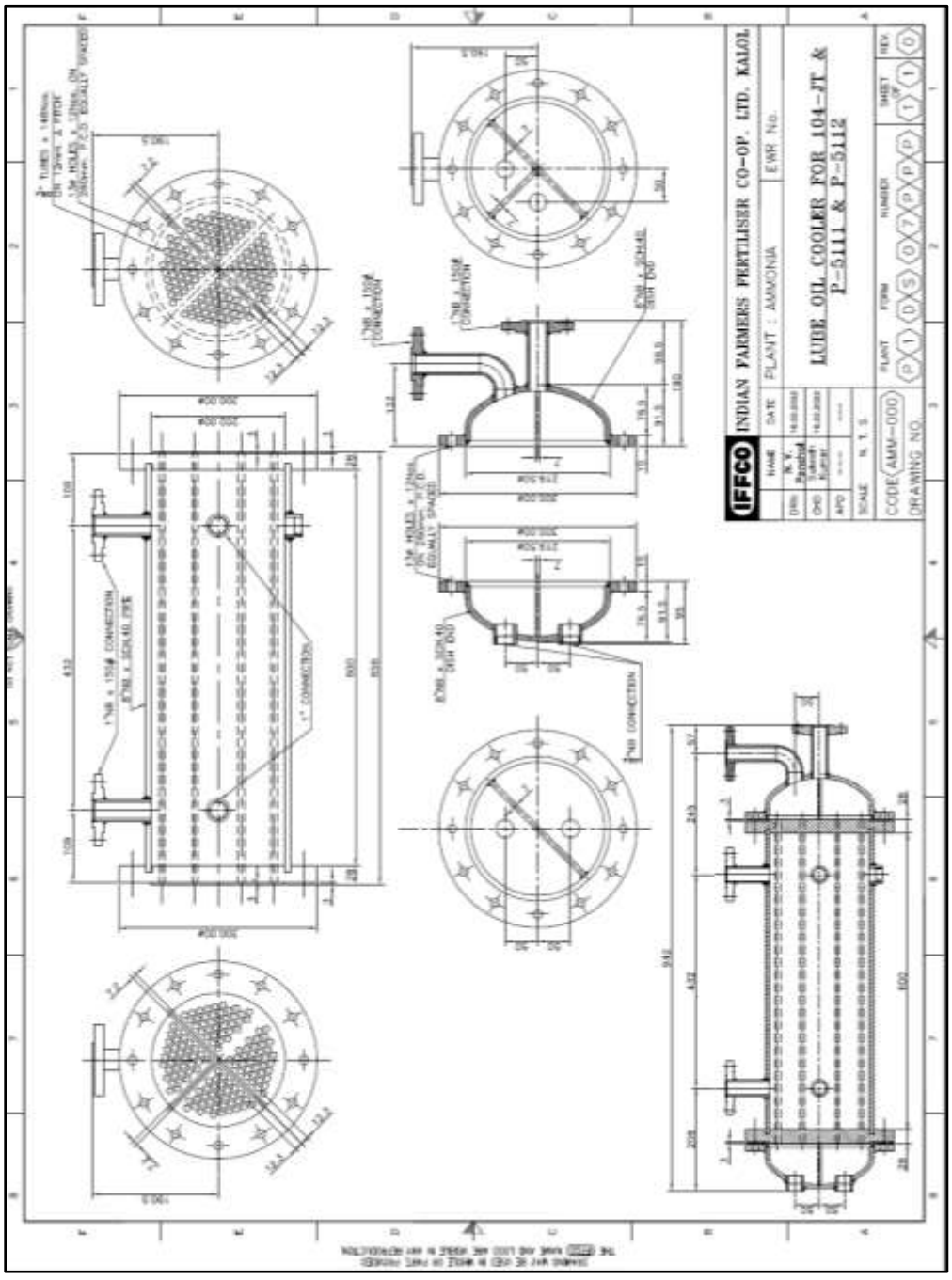
- Residual Magnetism (Gauss) Checked and recorded: Yes
- Run Out of Thrust Collar checked: Yes
- All Oil Lines Cleaned and flushed: Yes
- Oil Deflector Correctly positioned: Yes

Alignment readings (P-5111 to Q-5111)

Position	Vertical		Horizontal	
	Before	After	Before	After
P		-0.13 mm		-0.07 mm
A		0.04 mm		0.05 mm
F-1		-0.04 mm		0.09 mm
F-2		0.25 mm		0.53 mm

Lube Oil Cooler

- Lube oil cooler replaced. New cooler having higher heat load capacity was purchased by M/s. CHEMIQUIP INDUSTRIES, Vadodara vide PO No. 201004230625. Drawing is attached below.



Preventive Maintenance of BFW Turbine, Q-5111

Following activities were carried out during PM:

- Decoupled the turbine.
- Instruments probes were removed.
- Governor top cover and lever were removed.
- Thrust bearing & journal bearings top halves were removed.
- Cleaning of rotor shaft was carried out.
- Governing components were removed and found ok.
- Measured the all bearing clearances and found ok.
- Final Clearance chart is as under.

Clearance Chart

Sr. No.	Description	Design / Recommended Value (mm)	Value Before PM (mm)	Value After PM (mm)
1	Front End Journal Bearing Clearance	0.12-0.17	0.19-0.21	0.19-0.21
2	Rear End Journal Bearing Clearance	0.12-0.17	0.14-0.16	0.15-0.16
3	Axial Thrust	0.2-0.4	0.28	0.27
4	Front End bearing oil labyrinth clearance	0.2-0.4	0.20-0.30	0.20-0.30
5	Rear End bearing oil labyrinth clearance	0.2-0.4	0.20-0.25	0.20-0.25

Preventive Maintenance of BFW Pump, P-5112 (Motor Driven) BFW Pump, P-5112

Following activities were carried out during PM:

- All the oil pipe lines were disconnected.
- Both the end covers of the pump were removed.
- Bearings were removed on both the sides.
- Cleaning of bearings and bearing covers was carried out
- DP test was conducted on all the journal bearings & thrust pads and found ok.
- Checked the bearing clearance and found ok.
- Thrust pads were found ok
- Both the sides bearings and bearing covers were assembled back.
- Strainer was removed, cleaned and assembled back

Clearance Chart

Sr. No.	Description	Design / Recommned. Value (mm)	Value Before PM (mm)	Value After PM (mm)
1	Thrust Bearing Axial Clearance	0.28-0.33	0.25	0.25
2	Coupling End Journal Bearing Top Clearance	0.13-0.18	0.19-0.22	0.17-0.18
3	Coupling End Journal Bearing Top Interference	0.02-0.05	0.07	0.07
4	Free End Journal Bearing Top Clearance	0.13-0.18	0.18-0.22	0.18-0.20
5	Free End Journal Bearing Interference	0.02-0.05	0.04	0.05

- Residual Magnetism (Gauss) checked and recorded: Yes
- Run Out of Thrust Collar checked: Yes
- Thrust collar run out is: 0.02 mm
- All Oil Lines Cleaned and Flushed: Yes
- Oil Deflector Correctly Positioned: Yes

Gear Box for BFW Pump, GB-5112

Following activities were carried out during PM:

- All the oil pipe lines are disconnected and oil drained from Gear Box.
- Gear Box end covers removed.
- Gear Box top cover opened and removed.
- Condition of Gear and pinion checked and found OK.
- Bearings of Gear and pinion removed, cleaned, checked and found OK.
- DP test was conducted on all the journal bearings.
- Checked the bearing clearance and found ok
- Residual Magnetism (Gauss) checked and recorded.
- All oil lines cleaned and flushed.
- Oil sump cleaned.
- Oil cooler tubes cleaning done
- New Oil filled in oil sump.
- AOP Coupling spider replaced.
- Final alignment motor to gear box was done by laser alignment machine

Clearance Chart

Sr. No.	Description	Recommend (mm)	Value before PM (mm)	Value after PM (mm)
1	Pinion Wheel Motor End Journal Bearing Clearance	0.15 – 0.20	0.18	0.20
2	Pinion Wheel Pump End Journal Bearing Clearance	0.15 – 0.20	0.17	0.20
3	Gear Wheel Motor End Journal Bearing Clearance	0.15 – 0.20	0.20	0.19
4	Gear Wheel Pump End Journal Bearing Clearance	0.15 – 0.20	0.22	0.19
5	Gear Wheel Axial thrust	0.30	0.38	0.37
6	Gear Backlash	0.20	0.25	0.25

Alignment reading (GB to Motor):

Position	Vertical		Horizontal	
	Before	After	Before	After
P		0.03 mm		0.02 mm
A		0.01 mm		-0.08 mm
F-1		0.03		-0.08
F-2		0.07		-0.10

Alignment reading (Pump to GB):

Position	Vertical		Horizontal	
	Before	After	Before	After
P		0.0 mm		0.00 mm
A		-0.01 mm		0.03 mm
F-1		-0.04		0.10
F-2		-0.08		0.10

Preventive Maintenance of FD Fan (K-5113) Drive Turbine (Q-5113)

- Coupling guard opened between gearbox and fan.
- Coupling decoupled and toothed rubber pads removed for any wear/damage.
- Toothed rubber pads were found damaged and replaced.
- Governor mounting flange bolts opened and remove the governor removed and kept it on stand on safe working place.
- Trip valve assembly removed
- Top housing of gear box lifted carefully and placed in inverted position at safe working place.
- Condition of teeth of pinion & gear checked
- Gear and pinion shaft journal and journal cum thrust bearing top halves removed
- Cleaned and checked the condition of top bearing half for any wear/damage.
- Gear and pinion shaft journal bearing clearances checked and recorded

- Gear and pinion wheel bottom journal and journal cum thrust bearings removed one by one.
- Condition of bottom bearings checked for any damage/wear.
- Cleaned and checked the condition of gear drive arrangements for governor drive.
- Checked and recorded the gauss measurement reading of bearing journal area, bearing halves, thrust collars, thrust bearing surface.
- Bottom and top gear box housing cleaned thoroughly
- Cleaned and installed the bearings and the final bearing clearances recorded
- Backlash between gear and pinion wheels checked and recorded
- Cleaned and applied the sealant on the parting plane of gear box housing and placed the gear box top housing on position.
- Tightened the top gear box casing uniformly.
- Gear wheel end covers fixed
- Installed main oil pump with new gasket.
- Installed the governor after cleaning.
- Opened and cleaned the steam strainer.
- Oil leakage from Servomotor/regulating piston valve was there. Oil Seal, spindle with cone and carbon packing replaced.
- Trip valve assembly installed
- Sump cover opened and the oil drained
- After draining the oil sump cleaned.
- Opened and cleaned the oil pump suction strainer.
- Oil cooler opened and its tubes cleaned by hydro jetting.
- Cleaned the duplex oil filters.
- Final alignment between turbine gear box to fan done
- Coupled the turbine gear box and fan
- New oil in oil sump fill.

Clearance Chart

Sr. No.	Description	Design/Recomm. Value (mm)	Value after PM (mm)
1	Pinion Wheel Turbine End Journal Bearing Clearance	0.10-0.15	0.10
2	Pinion Wheel Fan End Journal Bearing Clearance	0.08-0.13	0.12
3	Gear Wheel Turbine End Journal Bearing Clearance	0.08-0.136	0.16
4	Gear Wheel Fan End Journal Bearing Clearance	0.08-0.136	0.18
5	Pinion wheel Axial Thrust	0.18-0.25	0.18
6	Gear Wheel Axial thrust	0.18-0.25	0.23
7	Backlash between Gear and Pinion	-	0.30

- Backlash between gear and pinion checked: Yes
- Main Oil Pump drive coupling bushes checked/replaced: Yes
- Regulating valve checked/overhauled/replaced: Yes
- Trip valve checked/overhauled: Yes
- All oil lines cleaned and flushed: Yes
- Oil sump cleaned: Yes.
- Oil cooler tubes hydro jetting done: Yes
- Duplex Oil Filters cleaned/Replaced: Yes
- New Oil filled in oil sump: Yes
- Final alignment checked and recorded: Yes
- Residual Magnetism (Gauss) checked and recorded: Yes

Alignment reading (GB to Fan):

Position	Vertical		Horizontal	
	Before	After	Before	After
P		-0.12 mm		-0.01 mm
A		0.06 mm		0.07 mm
F-1		0.64		-0.08
F-2		1.48		-1.94

Alignment reading (Fan to Clutch):

Position	Vertical		Horizontal	
	Before	After	Before	After
P	0.00	0.00 mm	0.01	0.01 mm
A	0.01	0.01 mm	0.01	0.01 mm
F-1		0.01		0.02
F-2		0.03		0.04

During start up following problem was observed:

- Abnormal sound from clutch observed and oil seal came out in running.
- Clutch Bearing and oil seal replaced and trial run taken.
- Initially AOP was lined up and discharge pressure was 8.0 Kg/Cm^2.
- Then control oil pressure at governor output to servomotor was observed at 8.0 Kg/CM^2.

- Then turbine was slowly speed up to 990 RPM (speed of the turbine i.e at Gear box output speed) and this control oil pressure at governor output was continuously reducing and stabled at 3.4 Kg/CM^2.
- After that speed of the turbine was increased up to 1025 RPM by governing it through pneumatic pressure from DCS.
- Later speed was further reduced by varying the air impulse pressure to governor to 1000 RPM and at that speed the turbine was stable and suddenly after 15 minutes, control oil pressure at governor output was boosted to 16 Kg/CM^2 and speed of the turbine was abruptly increased to 1400 RPM and at that time turbine was suddenly stopped.
- After that Trip and Regulating Servomotor was replaced and after engagement of Trip, pressure of control oil pressure at governor output was showing at 8.0 Kg/CM^2. When the turbine was put on slow roll and this control oil pressure at governor output was going down up to 6.0 Kg/CM^2 and then suddenly this oil pressure increased to 10.5 Kg/CM^2 without any speed change in the turbine.
- Later again turbine trials were taken but when the Trip was latched, control oil pressure at governor output was reached to 8.0 Kg/CM^2 but keep on increasing with the turbine speed.
- In the normal running operation of the turbine, control oil pressure at governor output was maintained at 3.0 to 3.5 KG/Cm^2 and turbine speed was controlled by altering air impulse pressure to Governor.
- Gear box opened to checked condition of governor coupling shaft. After inspection throughout the locking pin of governor was found damaged. Then locking pin was replaced.
- Trial run taken and found ok.

Governor locking pin was damaged and replaced

Testing of Governor and servomotor was conducted at governor test bench in Mechanical Ammonia. Oil supply of 8 kg/cm^2 g pressure was given to servomotor and governor connections were done as per site. Pressure gauge at output of Governor to servomotor and at inlet of servomotor provided. Air impulse were given accordingly. At 2000 RPM governor has taken control and by varying impulse air pressure servomotor stroking was checked.

Spares consumed

Sr. No	Item Code	Item description	Qty
01	2010142130426701	SPEED GOVERNOR WITH PNEUMATIC UNIT FIG-400 FOR Q-5113 KKK AF4Gs TURBINE. (REPAIRED)	01
02	2010142130617100	REGULATING CYLINDER POS-430.19 FOR REGULATING & EMERGENCY VALVE FIG.	01
03	2010142130146500	RUBBER TOOTHED RING FOR COUPLING 15 OF Q-5113 KKK AF4Gs TURBINE	04
04	2010142130607300	REGULATING BUSH POS-430.39 FOR REGULATING & EMERGENCY VALVE FIG. 430	01
05	2010142130607310	STOP BUSH POS-430.41 FOR REGULATING & EMERGENCY VALVE FIG. 430 OF Q-5113 KKK AF4Gs TURBINE	01
06	2010142130624700	RADIAL SEALING RING, DIMENSION: DIA 20 X 30 X 7, ITEM NO. 430.61, ARTICLE NO.	01
07	2010142130624720	GASKET GASKET, SIZE:175/131 X 25, DRG. NO. 4950 430 00 08, ITEM NO. 430.44 ,	01
08	2010142130624730	GASKET GASKET, SIZE:125/76 X 25, DRG. NO. 4950 430 00 08, ITEM NO. 430.47 ,	01
09	2010142130645200	PISTON RING POS-430.26 FOR REGULATING & EMERGENCY VALVE FIG. 430 OF Q- 5113 KKK AF4Gs TURBINE	01
10	2010142130648400	RADIAL GASKET RING POS-430.23	01
11	2010142130651910	VALVE SPINDLE W/CONE CAP SCREW DU 11 FOR REGULATING & EMERGENCY	01
12	2010142130660500	VALVE OVERFLOW 4950-520-009 FIG. 520 FOR REGULATING & EMERGENCY VALVE	01
13	2010142130660521	VALVE REGULATING & EMEGENCY VALVE COMPLETE	01
14	2010142130665600	GLAND(STEAM) PACKING & GASKET POS.-430-13 & 430.11FOR REGULATING & EMERGENCY VALVE FIG. 430 OF Q-5113 KKK AF4Gs TURBINE. (1NO=4PCS)	01
15	0000996010521000	SINGLE ROW DEEP GROVE BALL BEARING SERIES 16021	01
16	2010112211247810	OIL SEAL	01

BHEL BOILER JOBS, GT-2068

BHEL Boiler inspection / Hydrotest

Boiler (GT-2068) was inspected by Boiler Inspector in open condition on **19/04/2023** & Hydro test was carried out at 89.0 kg/cm2 pressure on **22/04/2023** and witnessed by Boiler Inspector.

(This certificate must be hung up in the boiler house)

No.: CA032022-20230035799

FORM VI

GUJARAT BOILER INSPECTION DEPARTMENT

CERTIFICATE FOR USE OF A BOILER

(regulation 389)

Registry No. of Boiler : GT-2068 — **Type of Boiler** :Water Tube - Process Boiler

Boiler Rating :4,422.00 m² — **Place & Year of Manufacture** :Trichy -1980

Maximum Continuous Evaporation : 80,000.00 **kg/hr**

Name of Owner : IFFCO LTD.

Situation of Boiler : IFFCO Kalol Unit, Po Kasturinagar- Gandhinagar

Repairs : 1996-one tube plugged 2000-RLA study carried out boiler side wall down corner, Bank tube raw Y 66 nos. tubes renewed, bank tubes nos.2 plugged. 2001- 3 nos spool pieces replace. 2002 3 nos. spool piece of SH replaced. 2005- 14 Nos. W.W(burner tubes) changed. Re. RLA carried out by TWB Ltd.2008-one PSH Coil plugged,New control valve in feed line installed. 2009-P.S.H & S.S.H.U/L & C/L header & coils renewed. 2010- Spools for RLA are replaced. 2011- Soot blower removed by plugging caps in piping. 2012- PHE coil 01 segment change & 2 nos Drum + 01 super heater safety valve replaced with new one (Flanged end). 2013- 02 Nos water level gauge tapping plugged.. 1993 & 2014 New feed water coil installed.

Remarks : 2014 & 2018 Re RLA carried out & six year action plan to be follow 2022. Boiler Exemption under Reg 376(ff)

Hydraulically tested on 13-04-2023 to 89.00 kg/cm²(g)

I hereby certify that the above described boiler is permitted by **Shri A N Chudasama /Assistant Director of Boilers** under the provisions of Section 7/8 of the Boilers Act, No. V (Amended 2007) of 1923, to be worked at a Maximum Pressure of **70.60** kg/cm²(g) for the period from **14/04/2023** to **13/04/2024**.

The loading of the **34.29 mm Dia & 45.72 mm Dia SPSL** safety valve is not to exceed **70.60** kg/cm²(g) Cws **CWS-RV-F-5111-1= 17.2 mm, RV-F-5111-2= 12.7 mm and SHSV-RV-F5111-3= 12.0 mm thick**.

I hereby further certify that the main steam pipe was tested hydraulically to a pressure of -- kg/cm² last on

Fees Rs.**23,000.00** paid on - **28/03/2023** V.No. - **2138842**

Signature valid

(Shri A N Chudasama)
Assistant Director of Boilers
Gandhinagar

Counter Signed
Director of Boilers
Gujarat State,
Ahmedabad

see reverse for "conditions"

Boiler Furnace

All furnace manholes were opened. Thickness measurement of Boiler tubes was done. New insulation was provided at several locations and also replaced the damaged insulation with new one. New ceramic blanket insulation was replaced at super heater top tube. Broken sight glasses were replaced with new ones. Furnace refractory inspection was done and damaged refractory was replaced. Repairing of Furnace manhole was done. All manhole covers of furnace were boxed up after completion of IBR Hydro test.

Refractory inside boiler furnace

Ceramic insulation

Deaerator

- Pinhole was found at deaerator down comer 6” line and was repaired.
- 5th number Tray segment was found displaced from its original location and repaired

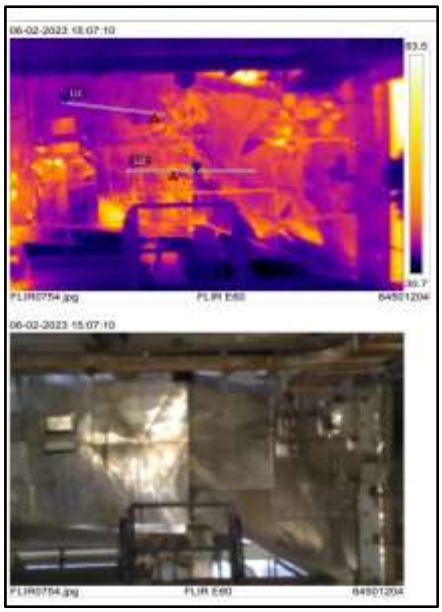
Pinhole at deaerator downcomer line

5th number Tray segment

Air Pre-Heater (APH)

All manway covers of APH were opened. APH manway covers were boxed-up after completion of IBR Hydro test.

High temperature was recorded in BFW Coil outlet/ Flue gas inlet duct before shutdown. After opening insulation bellow was found damaged and not repairable, requires replacement. APH duct leakage was from bellow. The damaged bellow was sent to party works M/s. Technoflex (PO No. 201004240038) and new bellow was fabricated and installed.



Damaged Bellow

New Bellow for FD Fan Turbine duct

Steam drum/ Mud drum

- Manhole covers of both side of steam & mud drum were opened. Inside cleaning was done by using SS wire brush. Manhole covers of steam & mud drum were boxed up after successful IBR open inspection.
- Steam drum valves gland re-packing was done by M/s. FLOTEC TECHNOSMART as per the list.

Seal ring replacement

- BHEL make MOV-12- 6” x 250# valve seal ring was replaced.
- 30% isolation valve of BFW inlet bypass 6”, 250# seal ring was replaced.

Fabrication Jobs in Boiler Area

- Plant air tapping provision was provided near boiler furnace, gate valves 2” x 800# was installed.
- Q-5111 lube oil cooler cooling water drain line was provided.
- Two isolation valves size 3” was provided at cooling water inlet and outlet line of P-5111 pump.
- Q-5113 FD fan turbine 4 ATA line drain valve replaced.
- FD Fan bypass duct was replaced and patch work was done on damaged area.
- BFW pump P-5111 Lube oil cooler is replaced.
- PIC-6 silencer drain line (1" CS) was replaced.
- 1” boiler vent line replaced as per inspection thickness report.

Replacement of damaged part of duct and Lube oil cooler of P-5111 is replaced

Cooling water drain line extension work

Vent lines repairing

Overhauling & Testing of Safety Valves

Critical boiler RV's were removed, overhauled and then tested on test bench.

RV testing readings are as under:

RV tag	Location	RV details	Set Pr. (Kg/Cm2 g)	Seat tightness test Pr. (Kg/Cm2 g)
RV-F-5111-1	Steam Drum, Rear BHEL Boiler	Size : 2-1/2" X 6.0" Make : Dresser Rand Model : HCL-56-IBR-IFN-SPL Sr. No. 201120150	71.0	69.80
RV-F-5111-2	Steam Drum, Front, BHEL Boiler	Size : 2.0" X 3.0" Make : Dresser Rand Model : HCL-56-IBR-IFN-SPL Sr. No. 201120159	69.0	66.80
RV-F-5111-3	Super Heater, BHEL Boiler	Size : 1-1/2" X 3.0" Make : Dresser, BHEL Size : 1.5" X 3" Model: 1717 WD	64.68	61.37 (Reset pressure during online floating)
RV-Q-5111	BFW Pump Turbine Exhaust	Size : 4" X 6" Make : Crosby Model: SL-131 Sr. No. 12263	5.0	4.5
RV-Q-5113,	FD Fan Turbine Exhaust	Size : 3" X 4" Make : Crosby	4.6	4.1
RV- CBD Tank	CBD Tank, BHEL Boiler	Size : 1" X 2" Make : Crosby	6.0	5.4
RV-V-5111	Deaerator	Size : 6" x 8" Make : BHEL	4.1	3.6
RV-40 ata	RV Tag : RV-40 ata For : 40 Ata Header	Size : 4" x 6" Make : Crosby	44.0	41.00

COOLING TOWER AREA

Preventive Maintenance of Rotary Equipment Cooling Tower Area

Preventive Maintenance of CW Pump- P-4401/A, P-4402, P-4405

Following activities were carried out during O/H for P-4401/A:

- Coupling between the pump and motor was decoupled.
- Pump casing was opened and impeller and wear ring condition was found ok.

- Clearance of wear ring was recorded 0.8-1 mm.
- Both the journal bearings were opened and checked.
- DE side journal bearing was worn out and replaced
- Bearing clearances were checked & recorded.
- New oil was filled in both bearing housings.
- Free rotation of the pump after coupling was ensured.
- Final Clearance chart is as under:

CLEARANCE CHART

Sr. No.	Description	Design/ Recommend. Value (mm)	Value Before Pm (mm)	Value After Pm (mm)
1	Coupling End Journal Bearing Top Clearance	0.05-0.08	0.20	0.17
2	Coupling End Journal Bearing Side Clearance	0.10-0.15	0.10	0.10
3	Coupling End Journal Bearing Interference	0.02-0.05	0.04	0.03
4	Free End Journal Bearing Top Clearance	0.05-0.08	0.30	0.18
5	Free End Journal Bearing Side Clearance	0.10-0.15	0.15	0.15
6	Free End Journal Bearing Interference	0.02-0.05	0.05	0.03

Spares consumed

Sr. No.	Item code	Item description	Qty
01	2010133410133200	BUSH BEARING WHITE METAL LINED DRG.NO. 03-DS-06002 SHEET 1OF1	01

Following activities were carried out during PM for P-4402:

- Coupling between the pump and motor was decoupled.
- Both the journal bearings were opened, checked & found OK.
- Bearing clearances were checked & recorded.
- New oil was filled in both bearing housings.
- Free rotation of the pump after coupling was ensured.
- Final Clearance chart is as under:

CLEARANCE CHART

Sr No	Description	Design / Recommend. Value (mm)	Value Before Pm (mm)	Value After Pm (mm)
1	Coupling End Journal Bearing Top Clearance	0.05-0.08	0.25	0.17
2	Coupling End Journal Bearing Side Clarence	0.10-0.15	0.10	0.10
3	Coupling End Journal Bearing Interference	0.02-0.05	0.04	0.03
4	Free End Journal Bearing Top Clearance	0.05-0.08	0.18	0.18
5	Free End Journal Bearing Interference	0.02-0.05	0.03	0.03
6	Total Float	0.30-0.50	0.35	0.35

Following activities were carried out during PM for P-4405

- Coupling shims were found broken and replaced
- Coupling between the pump and motor was decoupled.
- Both the journal bearings were opened, checked & found OK.
- Bearing clearances were checked & recorded.

CLEARANCE CHART

Sr. No.	Description	Design/ Recommend. Value (mm)	Value Before Pm (mm)	Value After Pm (mm)
1	Coupling End Journal Bearing Top Clearance	0.05-0.08	0.25	0.17
2	Coupling End Journal Bearing Side Clarence	0.10-0.15	0.10	0.10
3	Coupling End Journal Bearing Interference	0.02-0.05	0.04	0.03
4	Free End Journal Bearing Top Clearance	0.05-0.08	0.18	0.18
5	Free End Journal Bearing Interference	0.02-0.05	0.03	0.03
6	Total Float	0.30-0.50	0.32	0.32

Cooling Water Pump GB-4401 B & GB 4403

During Preventive maintenance following activities were carried out:

- Gear top cover was opened. GB internals were checked and found OK.
- Bearings of gear box was opened, cleaned, checked and found ok.
- Bearing clearances of gear box were measured. Bearing condition was found ok, therefore boxed up using same bearing.
- Gear wheel thrust was measured & recorded.
- Pinion wheel float was also measured.
- All oil lines checked and cleaned.
- Duplex oil filter was replaced.
- Final clearance chart is as under

Clearance Chart

Sr. No.	Description	Recommended (mm)	Value Before Pm(mm) GB-4401 B	Value After Pm (mm) GB 4403
1	Pinion Wheel Turbine End Journal Bearing Clearance	0.15-0.20	0.22	0.23
2	Pinion Wheel Pump End Journal Bearing Clearance	0.15-0.20	0.22	0.24
3	Gear Wheel Turbine End Journal Bearing Clearance	0.20-0.25	0.26	0.15
4	Gear Wheel Pump End Journal Bearing Clearance	0.20-0.25	0.28	0.20
5	Pinion wheel axial thrust	0.40	0.42	0.40
6	Gear wheel axial thrust	0.50-0.60	0.30	0.30

Turbine, Q-4403 (Triveni make)

Following activities were carried out during PM:

- Coupling between the Turbine and G.B. was decoupled.
- Both sides of the turbine journal bearings were opened & cleaned.
- Bearing clearances of both sides were measured & found higher than design value.
- Bearing condition was found ok, therefore boxed up using same bearing.
- Axial thrust of the turbine was recorded.
- Fresh oil was charged in the governor
- Oil console was properly cleaned and charged with fresh oil.
- All connected oil pipe lines were also cleaned.

- Oil cooler was opened, cleaned and boxed up.
- Oil strainer was cleaned & replaced the oil filter.
- Gland steam leak off port and lines cleaned.

Clearance Chart

Sr. No.	Description	Design/ Recommended Value(mm)	Value Before Pm (mm)	Value After Pm (mm)
1	Front End Journal Bearing Clearance	0.20-0.25	0.15	0.20
2	Rear End Journal Bearing Clearance	0.20-0.25	0.15	0.20
3	Axial Thrust	0.25-0.30	0.40	0.40

- Gland steam leak off port cleaned: Yes
- Residual Magnetism (Gauss) Checked and Recorded: Yes
- Run Out of Thrust Collar Checked and Recorded: Yes

  Thrust Collar Run out: 0.02 mm

Preventive maintenance of Cooling water pump drive Turbine (Q-4411- Elliot make)

Following activities were carried out during PM.

- Coupling between the Turbine and GB was decoupled.
- Turbine bearings were opened and inspected
- Both turbine journal bearings were found damaged. DE and NDE side Bearings were replaced. Thrust was recorded higher and turbine thrust bearing at DE side was replaced.
- Governor linkages were cleaned.
- Oil console was drained, cleaned and fresh oil charged (SERVO PRESS T-32).
- Main oil pump & Auxiliary oil pump suction strainers were cleaned & boxed up.
- The surface condenser was opened. Hydro jetting was carried out & then boxed up.
- All oil lines cleaned and flushed.
- Oil sump cleaned.
- Oil cooler tubes cleaned by hydro jetting.
- Oil filter replaced.
- Fresh oil servo Press T-32 filled in oil sump.

- One coupling bolt of the coupling between turbine to Gear box was found damaged which was replaced from the spare coupling bolt.
- Final Alignment readings from Turbine to Gear Box was checked with laser alignment tool and alignment report is attached below:
- Final clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value after PM (mm)
1	Axial thrust	0.25-0.30	0.30
2	Front end journal bearing clearance (by lead wire)	0.127-0.18	0.15
3	Rear end journal bearing clearance (by lead wire)	0.127-0.18	0.15

- Residual Magnetism (Gauss) Checked and Recorded: Yes
- Run Out of Thrust Collar Checked and Recorded: Yes
  Thrust Collar Run out: 0 mm

Overhauling of GB-4411

Following activities were carried out during overhauling;

- Gear top cover was opened. GB internals were found damaged.
- Gear wheel and pinion was replaced with new one.
- DE and NDE Bearings of pinion found damaged, and replaced with spare.
- Checked and recorded DE and NDE bearing clearances and interference
- New gear wheel installed and recorded gear wheel DE and NDE bearing clearances.

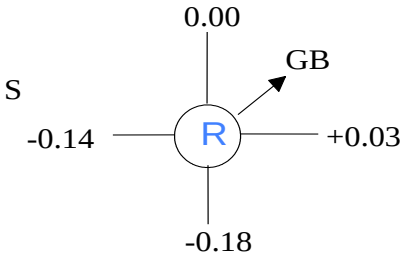
New gear wheel for Q-4411

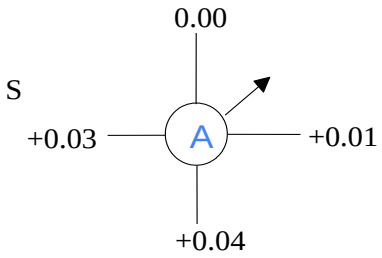
- Top cover was placed on its position.
- Final Clearance chart is as under:

Sr. No.	Description	Design / Recomm. Value (mm)	Value after PM (mm)
1	Pinion Front Journal Bearing Clearance	0.15 – 0.20	0.26
2	Pinion Rear Journal Bearing Clearance	0.15 – 0.20	0.26
3	Gear Wheel Front Journal Bearing Clearance	0.20 – 0.30	0.38
4	Gear Wheel Rear Journal Bearing Clearance	0.20 – 0.30	0.45
5	Back lash between pinion and gearwheel	0.40 – 0.45	0.47
6	Gear wheel axial thrust	0.50 – 0.60	0.51

- Alignment reading between turbine to gear box

  Turbine to Gear Box



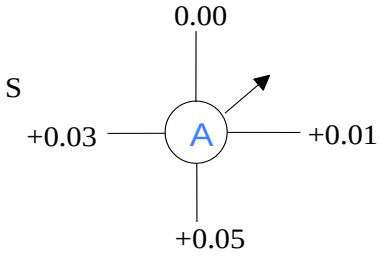


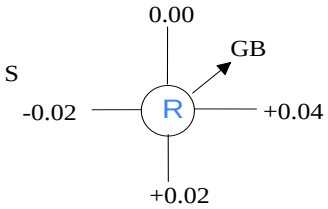
  Dial on Gear Box

  View from turbine front

  All readings are in mm

- Alignment reading between gear box to pump



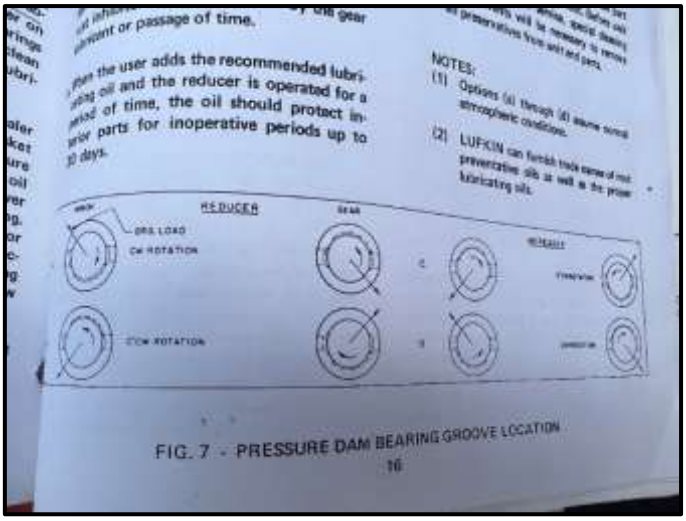


Pressure DAM orientation

During preventive maintenance we have observed that gear and pinion tooth found broken and gear box input shaft both bearings (severe damage), turbine rear bearing also found damaged (less damaged than gear box).

The turbine is CCW rotation and gear box output is driving pump with CW rotation viewing from turbine governor front.

We have confusion that which type bearing installation is to be referred to fix bearing, as existing found bearing arrangement was as per CW configuration for pinion and gear. From which end direction to be viewed (Turbine governor end or Pump end) to decide installation of pressure dam part of bearing.



M/s. Lufkin has confirmed that the orientation of the bearings has to be for a reducer with CW rotation (top left on the extract of the manual).

For pressure dam orientation Gearbox rotation to be viewed from pump end i.e Pinion rotation is CW.

Spares consumed

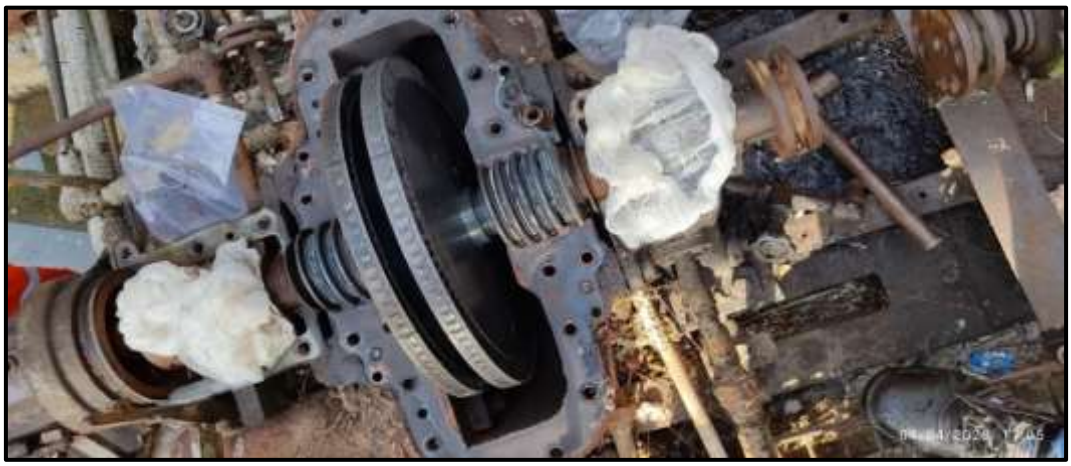
Sr. No.	Item code	Item description	Qty
01	2010132110256800	THRUST BEARING, PT. NO. 1562G-609 OF TURBINE ASSEMBLY, DRG. NO. WC-	01
02	2010132113003420	BEARING, PT.NO BM 114906, FOR HS PINION SHAFT OF LUFKIN GEAR REDUCER,	02
03	2010132113024900	GEAR L.S, PT. NO. 174636 FOR GEAR REDUCER, DRG. NO N1800C-12994A FOR Q-4411	01
04	2010132113040800	PINION H.S, CM 174630 FOR GEAR REDUCER, DRG. NO N1800C-12994A FOR Q-4411	01
05	2010132110233200	BEARING LINER, PT NO 603360-23 OF TURBINE ASSEMBLY, DRG. NO. WC-402164	02
06	2010132110233210	BEARING LINER, PT NO 667521-1 OF TURBINE ASSEMBLY, DRG. NO. WC-402164	02

07	2010132110233220	BEARING LINER, PT NO 667521-2 OF TURBINE ASSEMBLY, DRG. NO. WC-402164	02
08	2010132110339800	PACKING RING PART NO. P725Z050, STEAM CHEST ASSEMBLY DRG NO W-651122	01
09	2010132111722500	FILTER ELEMENT FOR DUPLEX OIL FILTER, MODEL NO. P10P FOR AUXILIARY OIL	01

Overhauling of condensate extraction pump drive steam turbine, Q-4412

Following activities were carried out for complete overhauling of turbine;

- Coupling between the Turbine and pump was decoupled.
- Governor was removed from the position.
- Removed all the bolts of the turbine casing and lifted the casing from the position.
- Top half of the bearing housings- both sides were also removed.
- Lifted the turbine rotor from the position.
- All carbon seals were removed. The carbon rings were found damaged and replaced.



Turbine Rotor

- Placed the rotor on support. DP test of rotor done and found ok.
- Top casing was positioned and tightened.
- Thrust of the Turbine was measured and recorded.
- Turbine oil seal clearance were also measured and recorded.
- Governor linkages were also made free.
- OST of turbine was done at 3430rpm.

- Final readings are as under:

Sr. No.	Description	Design Value(mm)	Value before PM (mm)
1	Front end journal bearing clearance (new)	0.15 - 0.23	0.23
2	Coupling end journal bearing clearance (new)	0.15- 0.23	0.23
3	Axial Thrust	-	0.42

- **Carbon Seal Ring:**

Sr. No.	ID (mm)
1	57.34
2	57.33
3	57.33
4	57.33

Sr. No.	ID (mm)
5	57.34
6	57.33
7	57.33
8	57.33

- **Oil Gland Clearances**

Description		Left (mm)	Right (mm)	Bottom (mm)
Front Oil Gland	Radial Clearance	0.15	0.15	0.05
	Axial Clearance	1.30	1.35	1.20
Rear Oil Gland 1	Radial clearance C	0.15	0.12	0.05
	Axial Clearance	1.45	1.20	1.40
Rear Oil Gland 1	Radial clearance C	0.15	0.15	0.06
	Axial Clearance	1.00	1.80	1.00

- **Axial Clearances**

Sr. No.	Description	Active side (mm)		Non active side (mm)	
		left	right	left	right
1	A-Wheel 1	2.95	2.90	1.20	1.20
2	Stage 1	open	open	2.15	2.10

- **Rotor Run-out**

Sr. No.	Location	Value(mm)
1	Front Journal	0.005
3	Rear journal	0.005
4	Coupling hub	0.04

SPARES CONSUMED

Sr. No.	Item code	Item description	Qty
01	2010132120135200	BEARING LINER (UPPER), PART NO. 668012-7, ITEM NO. 16 OF FIG NO. 4-8 FOR Q-4412	02
02	2010132120135210	2010132120135210 BEARING LINER (LOWER), PART NO. 668012-8, ITEM NO. 15 OF FIG NO. 4-8 FOR Q-4412	02
03	2010132120139800	2010132120139800 PACKING RING, PT. NO. 634159-63, FOR TURBINE ASSEMBLY OF Q-4412 ELLIOT	08

Hydrojet cleaning of surface condenser

- Hydro jet cleaning of surface condenser of Cooling water pump drive turbine Q-4411.
- Replacement of sacrificial Anode in Surface Condenser.

Cooling Tower Area Fabrication Jobs

- **Pillar No. 51**
  - Main Isolation 3/4" gate valve in 4 ATA line is replaced.
  - By pass gate valve 3/4" in 4 ATA line is replaced.
- **Pillar no. 47**
  - Main isolation gate valve 3/4" is replaced in 40 ATA line.
  - By pass valve 40 ATA 3/4" gate valve is replaced.
- **Q-4401/B**
  - Casing drain line of 40 ATA, 1/2" gate valve is replaced.
- **Q-4403**
  - Casing drain 2nd in 40 ATA line gate valve 1/2” is replaced.
  - 4 ATA isolation valve gland is replaced.

- **Q-4412**
  - 4 ATA line main isolation valve downstream gland is replaced (in main discharge line).
  - 4 ATA drain line gate valve 3/4" is replaced.
- **Q-4411**
  - Governor valve/TTV spindle gland is replaced.
  - 40 ATA main steam line condensate drain 1st isolation valve 3/4" is replaced.
- **Pillar No. 31**
  - 40 ATA Main line isolation valve gland is replaced.
- **Pillar No. 25**
  - 40 ATA Main line isolation valve 3/4" is replaced

Gate valves replaced

8" x 150# WCB gate valve

- **Pillar No 21**
  - 40 ATA 2nd isolation valve gland is replaced.
  - By-pass drain line Gate valve is replaced-3/4".
- **Pillar No. 17:**
  - 40 ATA by pass line 3/4" gate valve is replaced.
- **Pillar No. 15:**
  - 4 ATA line 1/2" Steam trap is replaced.
  - Pillar No. 12:
  - 40 ATA main line isolation valve 3/4" is replaced.
  - Steam Trap-3/4" is replaced.

- **Pillar No. 11:**
  - 40 ATA line main isolation valve 3/4" is replaced.
  - Steam Trap isolation valve is replaced.
  - 4 ATA by pass line gate valve-3/4" is replaced.
  - 4 ATA line main isolation valve - 3/4" is replaced.

- **Pillar No. 8:**
  - 40 ATA line main isolation gate valve 3/4" is replaced.
  - 40 ATA Steam Trap is replaced.
  - By pass G.V 3/4" is replaced.
- 8" x 150# WCB ASTM 216 Gate valve (1216) replacement at 4 ATA control valve upstream.
- Ammonia cell 1-6 cooling tower basin outlet line drain valve near P-4401/B is replaced.
- Old urea cooling tower basin drain line replacement work.

Old urea basin drain line replacement

Basin drain line valve replacement

<u>Cooling Tower Cylinder, Fan Blade and Hub assembly replacement (K-4401/6 and K-4401/4)</u>

- Motor is electrically de-energised and stub received
- Both side distribution valves closed
- Inspection cover opened and wooden planks placed inside the cylinder/cell (fan deck area).
- Both side motor and GB decoupled after removing the clamps and drive shaft
- Both side couplings with hub and yoke removed
- Coupling bush condition checked and found ok
- Both side oil hose opened, oil drained and collected

- Blades removed. Blades condition found satisfactory. Blades cleaned, painted and shifted at ground
- GB with the help of hub assembly removal arrangement and hydraulic jack removed at position and new hub assembly (Supplied by M/s. Coolflo) fitted in the existing GB
- Hub bolts checked, omega grease applied and tightened again.
- Oil level indicator and oil hose cleaned
- New Low Height Fan cylinder volute chamber 13 feet 9 inch purchased from M/s. Paharpur were installed.
- New energy efficient FRP version 2 blades with seal disk and hub blade assembly were installed.
- GB oil changed (Servo sytem-150). (Approx. 70 ltr oil) filled.
- Blades (6 nos) tightened to 160 N-m torque and tip clearance maintained
- Blade angle maintained 7 degree and Blade tracking measured

Cooling Tower Cylinder, Fan Blade and Hub assembly replacement

- Torque tube, Drive shaft, I- beam for both motor and GB side checked for any corrosion. All found ok.
- Cylinder fixing bolts checked. Found ok

Insitu overhauling / repairing / servicing and testing of NRV and Gate valves

Insitu overhauling and testing of NRV and Gate valves of P-4401A, P-4402 and P-4401C/D was performed by Ms. Fluidchem valves. Cleaning / greasing of all internals, lubricating of spindle and boxing up the gate valves and NRV was performed.

NRV and Gate valves repairing

Jash make Sluice gates/valves in CT Area O/H

Cast Iron Spigot self-contained Type Sluice Gates (2X1.4 mtr- 4 No.s)

The complete servicing/repairing of 04 Nos. of Jash Make Self Contained type CI sluice gate, Size 2000 mm W X 1400 mm H in the Cooling Water Sump open channel.

- All gates stem cleaning, lubrication and greasing done
- overhauling, cleaning and greasing of all gates gear box assembly
- Shutter and frame and wedges seat facing cleaning and lubrication
- Cleaning and lubrication on frame grooves for smooth shutter operation
- Operated the gate open and close operation manually, found satisfactory.

Cast Iron open channel Gate-Rotork Actuator Operated (2x1.4mtr-1no)

- Gate stem have cleaned, lubricated and greased.
- Frame seat facing have cleaned and lubricated.
- Frame grooves have properly cleaned and lubricated for smooth shutter operation.
- Operated the gate open & closed by actuator, Checked & found satisfactory operation.

Jash make Sluice Gates preventive maintenance

Cast Iron open channel Gates -Manual Operated (2x1.4mtr-2nos)

- Both gates stem was cleaned, lubricated and greased
- Both gates frame seat facing have cleaned and lubricated.
- Frame grooves have properly cleaned and lubricated for smooth shutter operation.

Zinc Spraying/Galvanising On Cooling Water Pipe Line And Structures

Zinc Spraying/Galvanising was carried out on cooling water pipe lines and structures by M/s Mythri Metallizing. The Pipeline surfaces is cleaned with Shot/Grit/Copper Slag blasting for removal of hard scale, rust, dust, mild scale, welding flux, stratified rust, slag, loose paint, blisters, flakes. Spray Galvanizing was done after the through surface cleaning / preparation by Shot/Grit/Copper Slag Blasting, with deposition of Zinc.


Zinc coating on cooling water pipelines

Old Ammonia Cooling tower admin side risers replacement job

12” risers of cooling water (H-4401-5,6,7 and 8) east side were leaking. The same were replaced.


Replacement of risers

Cladding of SS 304 plate on CW Header riser pipes

CW return header between Ammonia cell 8 and 1 cladding/sleeving done with SS-304 plate. Sleeving done on total 5 no.s of header using:

Plate: SS 304, 3000MM (LENGTH) X 2000MM (WIDTH) X 2 MM (THICK).

This job involves:

- Removing the wrapping coating with gas cutting up to approx. 1 mtr depth.
- Cutting of SS-304 patch plate in required quantity and sizes to suit the profile of the pipe.

- Welding of patch plates upto 1 mtr depth on CW headers.
- DP test was performed.
- Wrapping coating of exposed CS pipe surface of CW header done.


SS-304 plate cladding work with subsequent wrapping coating

SS 304 Patch work was done on leaking CW return header between Ammonia CT 1 and 8. Details of CW Header Sizes:

- 36” NB Sch. STD, MOC: CS
- 24” NB Sch. STD, MOC: CS

CT Structure and Partition wall repairing work

- M/s. Paharpur has done inspection of all cooling towers and found partition wall (Panels) in between Ammonia Cooling Tower cell 5 and 6 was dislocated. Also timber at some places in Ammonia CT between cell 4 and 6 found in bad conditions.
- Damaged timber is replaced with new timber as per inspection
- PVC partition panels were re-assembled between Ammonia CT cell 5 & 6.

Damaged timber replacement work

Partition wall rearrangement work

Cooling Tower (N.C.T) Revamping work

IFFCO-Kalol is operating a total of 14 nos. of cooling tower cells of M/s Paharpur make to cater the total requirement of cooling water in Ammonia, Urea & Offsite plans. In order to enhance the safety of and reliability of these cooling tower cells, it was planned to carry out the revamping of cooling tower cells in phased manner. Cooling tower cell H 4404/3 was revamped by M/s. Paharpur cooling tower Ltd.

Following activities were carried out.

Dismantling of existing wooden cooling tower

- Shut down of Cooling Tower
- Motor cable disconnection
- Electrical cable with tray removal
- Removal & lowering of fan blades
- Decoupling, removal & lowering of drive shaft
- Removal & lowering of fan cylinder from cooling tower top
- Removal & lowering of gear box with hub assembly and motor from cooling tower top
- Removal & lowering of torque tube & I-beam support from cooling tower top
- Removal & lowering of hot water distribution valve from cooling tower top
- Removal of hot water distribution cover, nozzle and splash box
- Removal of FRP wall, partition wall, deck cover and louvers, drift eliminator.
- Removal of wooden structure from top to basin.
- Cleaning and checking of RCC cold water basin.

Erection & Commissioning of new FRP cooling tower

- Levelling & fixing of base casting along with anchor bolt.
- Erection of bottom columns
- Erection of all bottom diagonals
- Erection of final columns
- Erection of balance diagonals
- Erection of louver columns
- Mounting of fan deck & hot water deck
- Erection of end wall casing of cell 3 & partition wall
- Fixing of louvers with louvers bar with diagonal
- Mounting of splash fill from top to bottom
- Mounting of film type fill from bottom to top and drift eliminator
- Lifting & installation all 'I' Beam and torque tube at top of fan deck
- SS torque tubes & SS I-beam (gear box side) were installed in both cells.
- Levelling of I-Beam and torque tube
- Lifting & installation of gear box with hub assembly
- Lifting & installation of drive shaft assembly and motor
- Shaft level checking of motor and gear Box
- Lifting, installation & fixing of fan blade
- Lifting & erection of fan cylinder at top of fan deck

- Fan cylinder alignment and tightening of fan cylinder fasteners
- Alignment between gear Box - drive shaft and drive shaft - motor
- Lifting & installation of hot water distribution valve
- Fixing of new FRP splash box
- Nozzle fitting
- Fixing of distribution deck covering
- Fixing of cable tray bellow Fan Deck Level
- Fixing of earthing strip & lightning arrester
- Final checking & any rectification work if required
- Cooling water charge and trial run of fan
- Vibration checked and power consumption check
- Job Finish




Erection and commissioning of cell No. 3 of NCT

IG PLANT AREA

- Gate Valve ASTM A 216 GRADE WCB 6" NB x 150# HP airline inlet to bagging air receiver (V-5303) is replaced
- Old Bagging Air Receiver (V-5303) Loose Instrument Air Line (Redundant) Near New IR Compressor is removed and isolation valve is provided.
- Old reciprocating compressors redundant cooling water lines were removed.

6” X 150# Gate valve replaced

Redundant Cooling water lines removal

DM PLANT AREA

Installation of new Degasser blower

Due to ageing effect old blower was replaced with new upgraded M.O.C SS 304 blower.

Two no. of degasser blower purchased from M/s. AEROTHERM PRODUCTS vide PO No. 201004221578. One blower K-4201/A is commissioned at site.

Old Degasser blower

New Degasser blower

NARMADA PLANT AREA

Flowmeter installation in raw water pipeline

Replacement of 24” Faulty Flowmeter FI- 6200 in NARMADA WTP.

Flowmeter replacement

Repairing reconnection of existing DI/CI pipe at Clariflocculator drain line in Narmada plant

10" x 150# mud discharge Clariflocculator drain line spigot joint was leaking in Narmada plant. Leaking Spigot Joint is replaced with new CID joint.

Old CI/DI spigot joint

New CID spigot joint

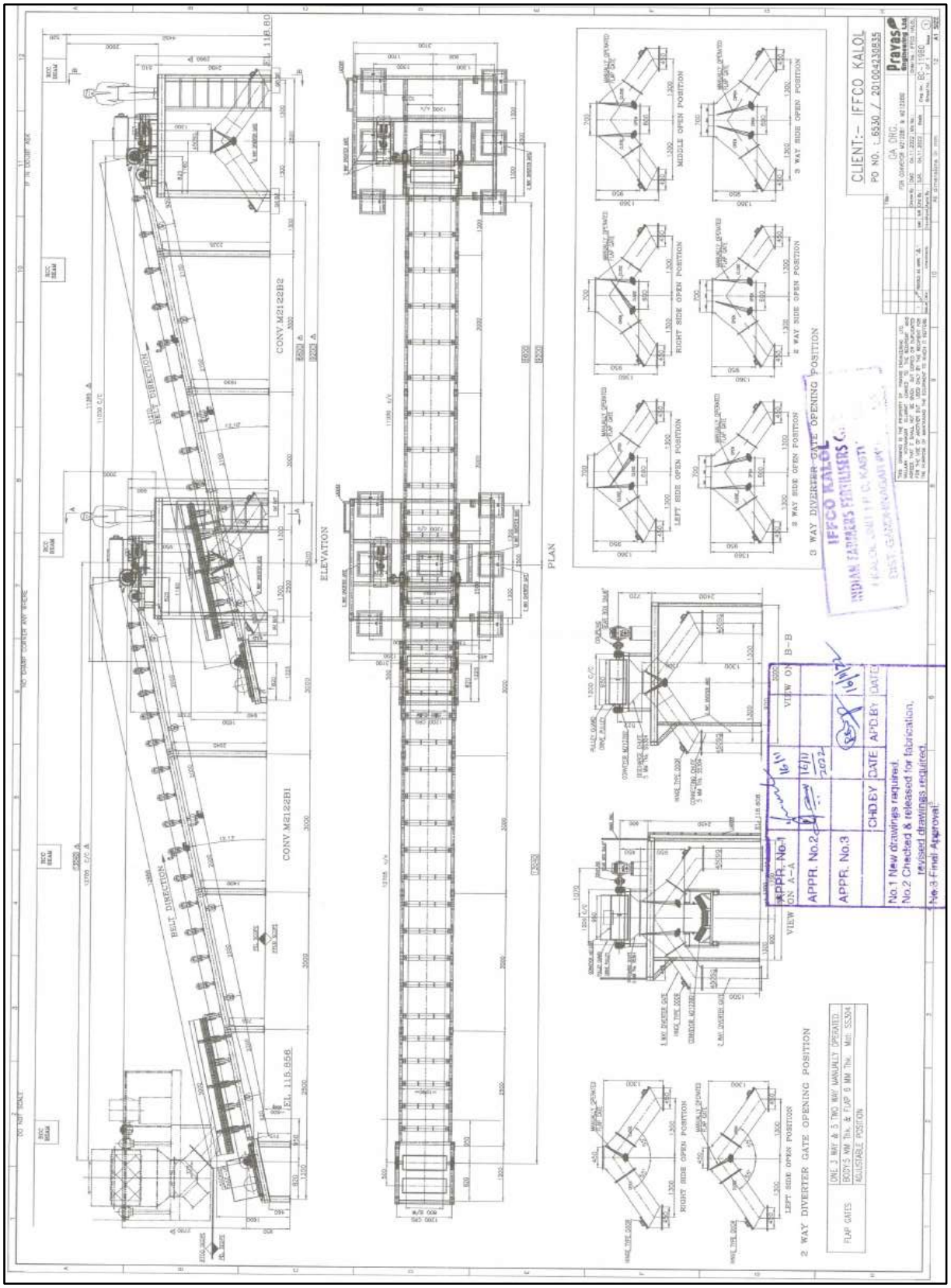
B & MH PLANT
(MECHANICAL)

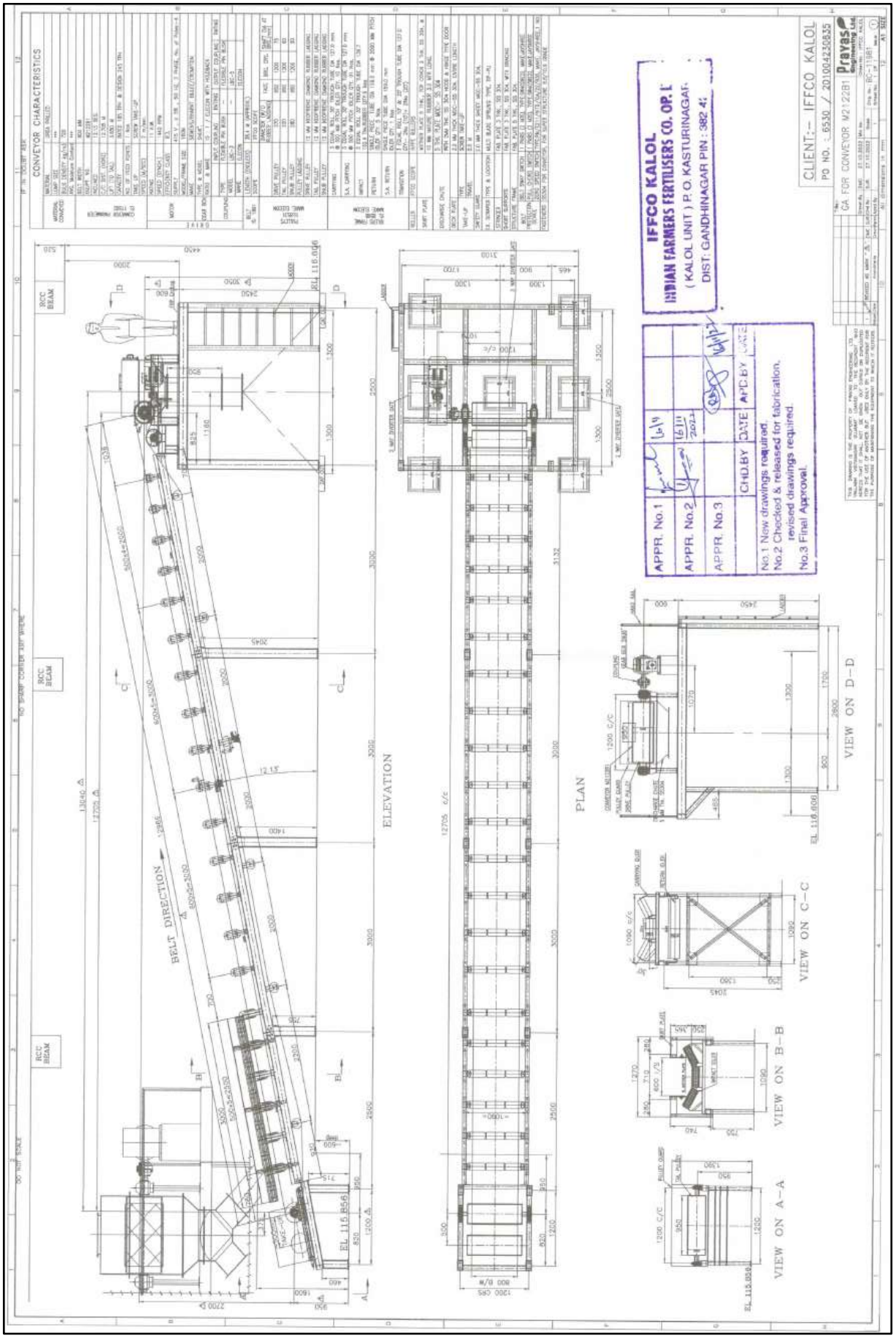
BAGGING BUILDING HOPPER CONVEYOR M-2122

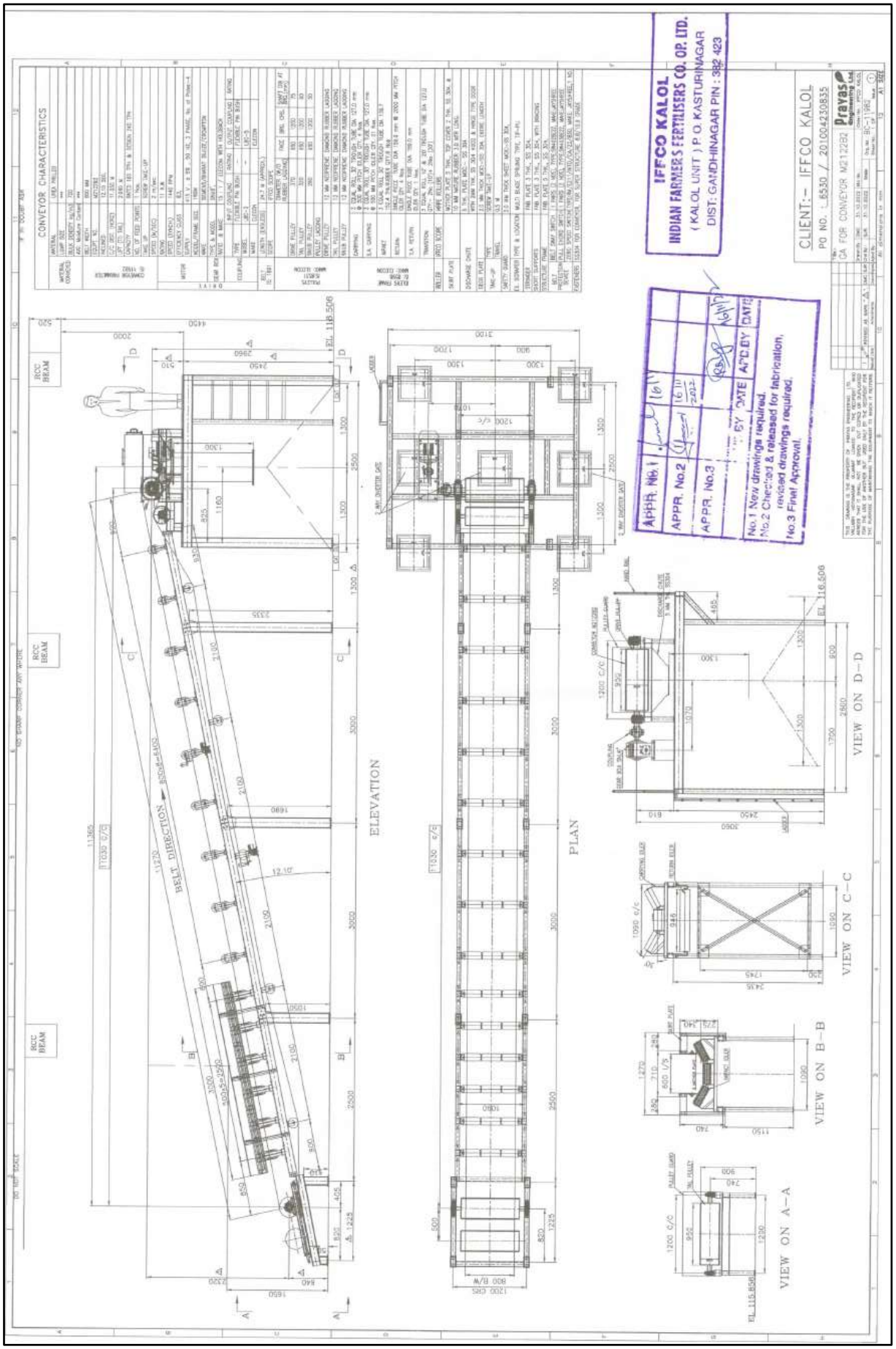
Following jobs were carried out

- Conveyor M2122 was splitted into M2122-B1and M2122-B2 with upgraded MOC (SS 304) for facilitating us to feed the hopper no. 5 & 6. Against our PO no. 201004230835, described as Design engineering, Manufacturing, Testing, Supply and supervision for Dismantling / Erection / Commissioning of Conveying System consisting of two belt conveyors with enlisted details:

Vendor	:	M/S Prayas Engg,Vallbh Vidyanagar
WO No-	:	201004230835
Conveyor tag Number	:	M-2122
Product handled	:	Neem Coated Urea
Bulk density of Material	:	720 Kg/M3
Design Capacity	:	245 Ton Per Hour
Belt Width	:	800 mm
Belt Speed	:	2 M/sec
Take-up	:	Screw Take-up
Structural MOC	:	SS304
Discharge Chute	:	5 MM THK. (M.O.C.: S.S. 304)
Nut, Bolt, Fasteners & Hardware	:	SS 304
Safety devices	:	Rope switch +zero speed + sway Switch


CLIENT:- IFFCO KALOL
PO NO. L-6530 / 2010042835
IFFCO KALOL
INDIAN FARMERS FERTILISERS C.
ELEVATION
PLAN
CONV.M2122B2
CONV.M2122B1
BELT DIRECTION
3 WAY DIVERTER GATE OPENING POSITION
2 WAY DIVERTER GATE OPENING POSITION
MIDDLE OPEN POSITION
RIGHT SIDE OPEN POSITION
LEFT SIDE OPEN POSITION
VIEW ON A-A
B-B
APPR. No.1
APPR. No.2
APPR. No.3
CHDBY
DATE
APD.BY
No.1 New drawings required.
No.2 Checked & released for fabrication.
Revised drawings required.
No.3 Final Approval.


CONVEYOR CHARACTERISTICS
CLIENT:- IFFCO KALOL
PO NO. : 6530 / 20100420835
IFFCO KALOL
INDIAN FARMERS FERTILISERS CO. OP. L
(KALOL UNIT) P. O. KASTURINAGAR-
DIST: GANDHINAGAR PIN : 382 42
APPR. No.1
APPR. No.2
APPR. No.3
No.1 New drawings required.
No.2 Checked & released for fabrication,
revised drawings required.
No.3 Final Approval.
ELEVATION
PLAN
VIEW ON D-D
VIEW ON C-C
VIEW ON B-B
VIEW ON A-A
BELT DIRECTION
RCC BEAM
DO NOT SCALE


IFFCO KALOL
INDIAN FARMERS FERTILISERS CO. OP. LTD.
(KALOL UNIT) P O. KASTURINAGAR
DIST: GANDHINAGAR PIN : 382 423
CLIENT:- IFFCO KALOL
PO NO. : 8530 / 2010042308 35
CA FOR CONVEYOR M212282
Prayas Engineering Ltd
APPR. No.1
APPR. No.2
APPR. No.3
No.1 New drawings required.
No.2 Checked & released for fabrication, revised drawings required.
No.3 Final Approval.
CONVEYOR CHARACTERISTICS
ELEVATION
PLAN
VIEW ON D-D
VIEW ON C-C
VIEW ON B-B
VIEW ON A-A
BELT DIRECTION
RCC BEAM

- Dismantling of existing conveyor system M2122, erection and Installation of two conveyors system M2122B1 and M2122B2 under supervision of Ms. Prayas Engineering Ltd. (PEL)/IFFCO for engaging additional hoppers 5&6.

  Vendor : M/S Mech-Tech Engineers & erectors.

  WO No : 201004231096

M-2122 B1

M-2122 B2

Dismantling of M-2122

<u>Replacement of M-2117 Conveyor belt, return roller, carrying rollers.</u>

Tag No – M-2117 Reclaim conveyor

Length of conveyor: 465 mtrs.Approx.

Specification of Belt

- Make - Forech India pvt ltd
- Belt width: 800mm x NN 630/4 HD x 3mm Top & 1.5mm Bottom,
- Grade Oil & Heat Resistance (OR-HR),
- Cut Edges & Open Ends, Carcass Thickness: 5.85mm min.

Replaced conveyor belt return roller, carrying rollers

- Shift the belt drum stand at erection site / point tail end of M-2117
- Shift the belt drum on the stand and make sure it rotates freely during erection, if required a flange of required size may be tack/ spot welded.
- Lift the gravity take up pulley with the help of 02-ton chain block and slings.
- Cut the belt from the return side (towards head pulley side) near the tail pulley and clamp the end of belt to drag the belt and fasten the other end with new belt
- With the help fork lift tie one end of belt with the clamp and drag the belt.
- Keep pulling and cutting the belt as per requirement at site.
- Proceed for first vulcanizing joint.
- After first vulcanizing joint, again pull the belt next day.
- Once the complete belt is positioned, clamp both ends.
- Clamp the belt from one side and for tensioning arrange a 3-ton chain block to pull the conveyor up to desire length and tension for hand over to hot vulcanization and confirm that both joint overlaps are aligned to each other.
- After completion of vulcanizing check for the quality and alignment of joint.
- Release the belt gradually by gravity take up.
- Replaced damaged carrying, guide & return rollers
- Replacement of oil from gear box.

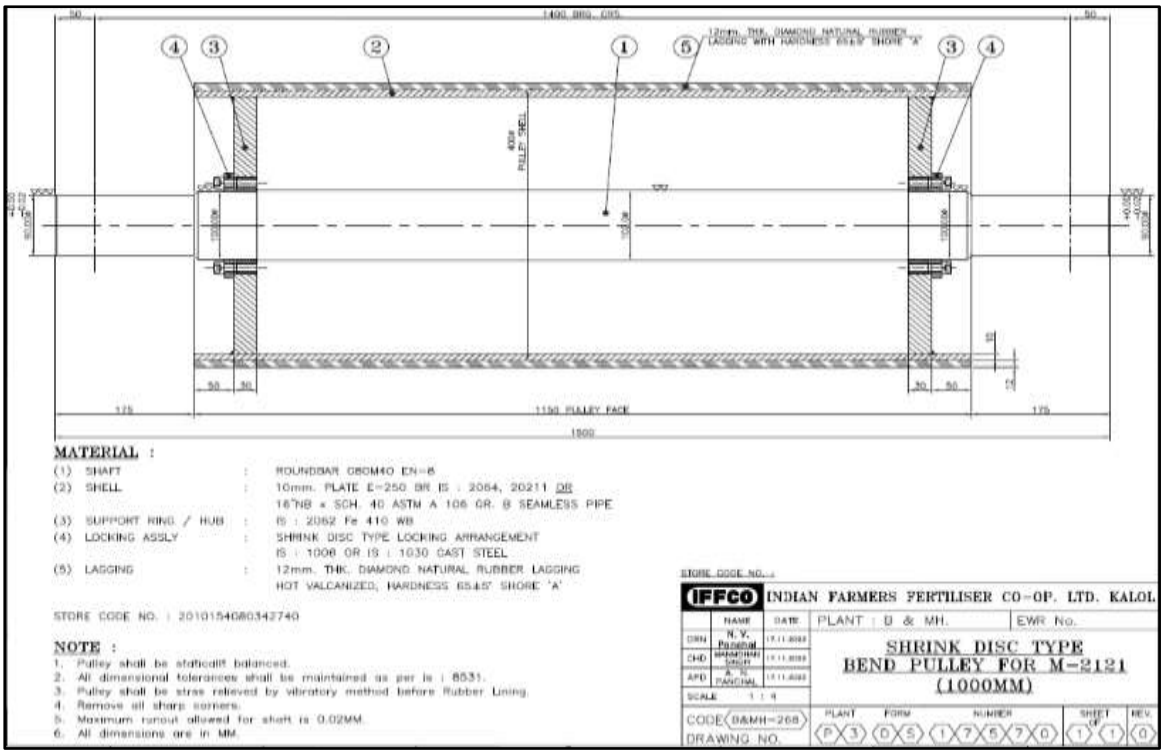
Replacement of bend pulley for conveyor belt M-2121

Tag no- M-2121 bagging building feed conveyor

Bend pulley size: 1500 mm x 400 mm x 1150 mm x 90 mm

Reason for replacement: 2 no’s bend pulley rubber lagging was damaged.

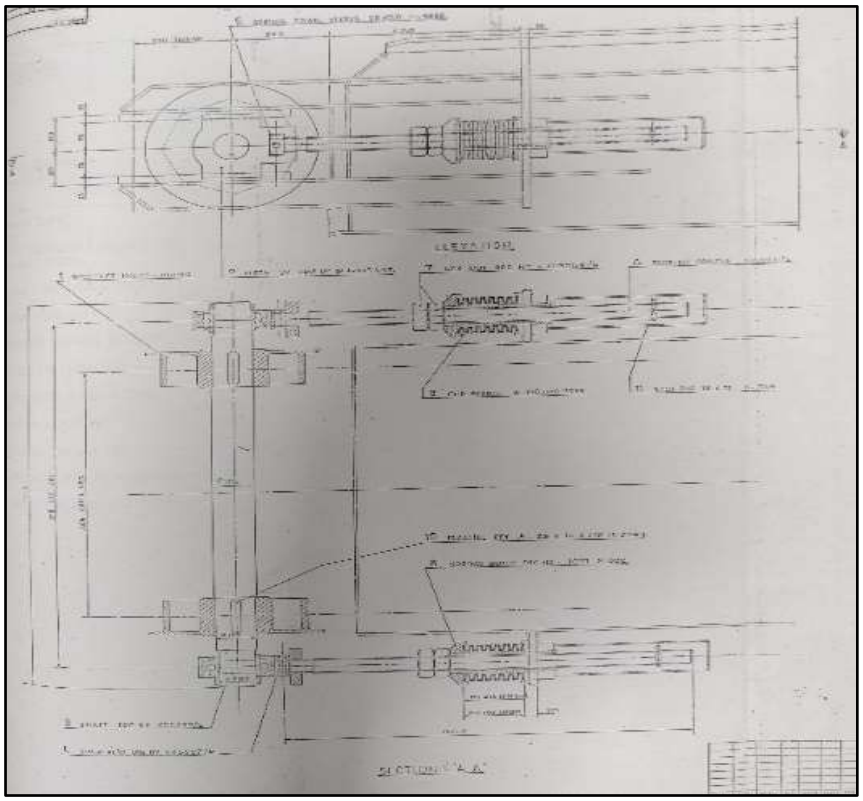
- Clamp the Belt from top / bottom sides. (As per requirement)
- Lift the gravity take up pulley with the help of 2-ton chain block and slings.
- Removed damaged pulley from position by 2-ton chain block and sling.
- Old pulley shifted from site and new pulley shifted at position.
- New pulley positioned and bearing block bolts tightened.
- Clamps opened.
- Release the gravity take up pulley after both pulleys replaced.



New reclaim Machine HM-470,(M-2116-A)

Following jobs were carried out

- Bucket elevator was checked for any crack, deformation or damage,
- 2 no's Bucket replaced due to damaged.
- Scrapper take up assy replaced. (Shaft dia is under size)



- Bucket elevator DE and NDE Bearing opened and greasing done.
- Elevator side plate support channel damaged it was repaired.
- Link chain and pin checked necessary replacement was done.
- Link chain circlip and washer was checked. necessary replacement was done.
- Scrapper DE and NDE Bearing opened and greasing done.

Slewing gear box was replaced due to its output shaft oil seal damaged.

- Bevel helical reduction gear
- Type & size : VK 5 S/424
- Ratio : 1000:1
- Rotation : Reversible
- Make : Elecon
- Cleaning of slewing Ring gear tooth and greasing in all 22 points of slewing ring bearing manually.
- King post guide roller were replaced as per requirement.
- Link conveyor belt found elongated; replacement done.
- Modification done of elevator discharge chute. (Fabricated reducer type discharge)
- All gear boxes input and output coupling decoupled and motor to gear box alignment checked.
- Greasing of slewing bearing and rollers done manually and completed.
- Wire rope condition checked, found ok.
- Overhauling of all drive's motors like slewing, link conveyor, scrapper and elevator were done by electrical department.
- Alignment done for all motor to gear boxes.
- Replacement of oil from all gear boxes, thruster and fluid coupling in machine and completed.

Link conveyor belt

- Belt length : 22 mtr
- Width : 1000 mm
- Top covert thickness : 3.0 mm
- Bottom cover thickness : 2.0 mm
- Carcase thickness : 3.75 mm
- Link conveyor belt replacement job work done.
- Link conveyor belt alignment completed by adjusting return rollers and checked found ok

- Checking of all operation like scrapper, elevator, travel, slewing and luffing working found normally.
- Load trial taken and handling 100-ton material and working of reclaim machine found normally.

  Scrapper boom lower limit was increased by adding shim to the lower carriage and lifting complete assembly by 18 mm.
- 4 no's bearing housing foundation bolts were loosen done Travel Bogie was raised by 4 no's of hydraulic jack 100-ton chain block were placed on travel bogie structure on each corner.

- 18 mm shim inserted between bearing housing foundation and travel bogie structure
- Released the 100-ton hydraulic jacks placed at each corner (4 corner)
- Scrapper boom lower limit was checked and adjusted by the limit switch.

Old reclaim machine HM-122,(M-2116)

Following jobs were carried out

- Checking of luffing mechanism and wire rope condition found normal.
- Preventive maintenance of gear box and drive unit of scraper and bucket elevator.
- Lubrication / greasing and overhauling of reclaim machine.

Plant transfer Conveyor M-2110

Following jobs were carried out

- Head pulley, Tail pulley, Gravity pulley and Snub pulley were inspected and greasing done.
- Bend pulley (Tail end side) both brgs replaced by plumber block 513, brg 22213 EK, sleeve H 213.

- Motor overhauled by electrical section.
- Preventive maintenance of gear box carried out & coupling done after proper alignment with new rubber bushes of input and output coupling.
- Replacement of oil (servo system-460) from gear box.
- Idler and return roller cleaned and replaced metallic to HPPE.
- All pulleys brg checked and cleaned.
- Motor and gear box coupling FBC replaced by LBC
- Discharge chute modified.

Two-way feed hoper chute M-2111

Following jobs were carried out

- Servicing of two-way discharge flap valve.
- Servicing of all bearing with cleaning and greasing.

Fresh urea shuttle conveyor M-2112

Following jobs were carried out

- Preventive maintenance of gear box carried out & coupling done after proper alignment.
- Replacement of oil (servo system-460) from gear box.
- All noisy carrying, guide and return rollers do the cleaned and damaged roller replaced with spare HPPE roller.
- Head pulley, Tail pulley, Bend pulley, Gravity pulley and Snub pulley were inspected and greasing done.
- Tripper gear box oil replaced and coupled the same with motor with new rubber bushes after alignment.
- Tripper output chain guard opened and boxed up work done after checking of chain cleaning and condition.
- Gear box input and output coupling all bushes are replaced.

Reclaim Conveyor M-2117

Following jobs were carried out

- Preventive maintenance of gear box carried out & coupling done after proper alignment.
- Replacement of oil (servo system-460) from gear box.
- All noisy carrying, guide and return rollers do the cleaned and damaged roller replaced with spare HPPE roller.
- Head pulley, Tail pulley, Bend pulley, Gravity pulley and Snub pulley were inspected and greasing done.

Bagging building feed conveyor M-2121

Following jobs were carried out

- Head pulley, Tail pulley, Gravity pulley and Snub pulley were inspected and greasing done.
- Brush pulley opened and repositioning after serviced.
- Preventive maintenance of both gear box carried out & coupling done after proper alignment.
- Oil replaced of gear box (servo system-460).
- Damaged roller replaced of carrying, return & guide.

Bagging building hopper conveyor M-2122 A1& A2

Following jobs were carried out

- Oil replaced of gear box (servo system-460).
- Damaged roller replaced of carrying, return & guide.
- Preventive maintenance of both gear box carried out & coupling done after proper alignment.
- Head pulley, Tail pulley, Snub pulley were inspected and greasing done.
- Take up studs were serviced.
- Oil seal replaced of gear box output shaft.

Dust & Urea lumps belt conveyor M-2137

Following jobs were carried out

- Preventive maintenance of both gear box carried out & coupling done after proper alignment.
- Oil replaced of gear box (servo system-460).
- Preventive maintenance of conveyor belt carried out.

Bagging machine (packer scale) M-2101-1/2/3/4/5/7/8/9A,9B,10A,10B

Following jobs were carried out

- Overhauling of gate assembly.
- Overhauling of bucket assembly.
- Overhauling of sack grip assembly.
- Servicing of all cylinders.
- Alignment of stabilizer plate.
- Calibration of packer scales.

Bagging stitching Slat Conveyor M-2124 / 1, 2, 3, 4, 7, 8, 9, 9A, 9B, 10A, 10B

- All stitching machines and spare machines were overhauled.
- Al stitching machine belt checked found some damaged that was replaced.
- All gear boxes oil replaced.
- All chain checked found some damaged that was replaced.
- All slates sprockets, fasteners etc. checked found some damaged that was replaced.

Air blower K-2161 & K-2704

- Air lines were opened. Checking and inspect, cleaned and boxed up.
- Job done of Bearing cleaned and clearance checked.

84" Vibro screen M-2136 / A, B, C, D

- All screen were opened and check wire mesh condition, cleaned and boxed up with new rubber gasket.
- All clamps' bolts serviced and damaged bolts replaced with new bolts.
- Electrical motor replaced of vibrating screen 'C'.

All portable conveyor overhauling job

- All idler and return rollers were checked and roller cleaned work completed.
- Take up studs were serviced.
- Head and tail pulley were checked and bearing cleaned and greasing work completed.

INSPECTION

AMMONIA PLANT
(INSPECTION)

101-B, PRIMARY REFORMER

RADIANT ZONE

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.**

OTHER NDT ACTIVITIES

- Automatic Ultrasonic Scanning of all the 336 Catalyst tubes and 8 Riser tubes was carried out during Shutdown by PDIL. All 326 Catalyst tubes are placed in C grade. And amongst 8 risers, 01 risers are placed in B grade & 07 risers are placed in C grade. Details are attached at **ANNEXURE - 2.**
- DP test of all riser tube to weldolet weld-joints was carried out. No service defects were revealed.
- DP test of random catalyst tube to weldolet weld-joints was carried out. No service defects were revealed.
- Creep measurement of all the catalyst tubes was carried out using GO-NOGO Gauge at tunnel slab level. Creep was found in the range of 0 - 0.17 % for 335 nos. In 01 no. of tube creep observed in the range of 0.17 to 0.70 %. Creep measurement of the riser tubes at tunnel slab level was also carried out using digital micrometer. Creep in all Riser tubes was observed in the range 0.33 – 1.10 %. The report is attached at **ANNEXURE - 3.**
- Creep measurement of all outlet manifold of primary reformer was carried out using digital micrometer. The report is attached at **ANNEXURE - 4.**
- Cold Load readings of Primary Reformer Catalyst Tube spring hanger Harp Assembly, Transfer Line Spring Hanger, Bottom Drain readings and Auxiliary Boiler Spring Readings are measured. The report is attached at **ANNEXURE - 5.**
- Clearance of Outlet Manifold from Ground floor in Cold condition was measured. And the report is attached at **ANNEXURE – 6.**
- In-situ Metallography carried out on Catalyst tube to weldolet weld & Riser tube to weldolet weld joint. The detailed report is attached in **ANNEXURE - 13.**
- Radiography of all 08 nos. weldolet to riser weld joints was carried out. No significant defect was observed.

VISUAL INSPECTION REPORT

101-B, H.T. CONVECTION SECTION

FROM BOTTOM MANHOLE

- Scaling was observed on all the tubes of Mixed Feed Coil.
- Bottom most part of Insulation covering plate was found burnt off at most of the locations. This was observed in previous inspection also.
- Rubbing on the coils observed near anchor supports. (Also observed in previous inspection)

- Peeling off of top layer of casting was observed on first two rows of east side anchor supports of mixed feed coils. (Also observed in previous inspection)

- Bottom floor refractory found loosens at some places and flooring found sagged at some location. Same was observed during previous inspection.
- 1st, 2nd and 3rd (counting from West) support resting plate found bent / twisted.

- Tunnel thermo well pipes were found slightly bent, scaled and eroded. Same was observed during previous inspection.

- Sealing refractory found fallen between tunnel slab wall and refractory near tunnel no. 2 & 4.
- Minor refractory found damaged at scattered locations.
- Insulation of East, West and South wall was found satisfactory.
- Mixed Feed coil found sagged in South-West segment compared to North-East Segment. (Same was observed in previous inspection)
- Some Brick wall segments were found bent.
- 01 no. Rod having approx. size of 15 mm dia. and 900 mm (3 ft) length found lying at bottom floor near West wall.

- Refractory of 1st center pillar found fallen.
- Few burnt metallic parts found lying on bottom floor.

- Few refractory bricks & insulations found lying on bottom floor near East wall.

- Tunnel slab found cracked / damaged as follows.

Tunnel Row No.	No. of Slabs
1.	1
2.	1
3.	5
4.	1
5.	1
6.	5
7.	6
8.	2
9.	3

101-B, L.T. CONVECTION SECTION

- Few fins of the LT Steam Super Heater Coil found bent.

- Support of the tubes found satisfactory.

- Insulation covering sheet wire found laying on tube fins.

- Insulation covering sheet found laying near West side wall.

- Insulation covering sheet found loosed at East side wall.

- Top roof insulation covering sheet found satisfactory, however its wire found loose at 05 locations.

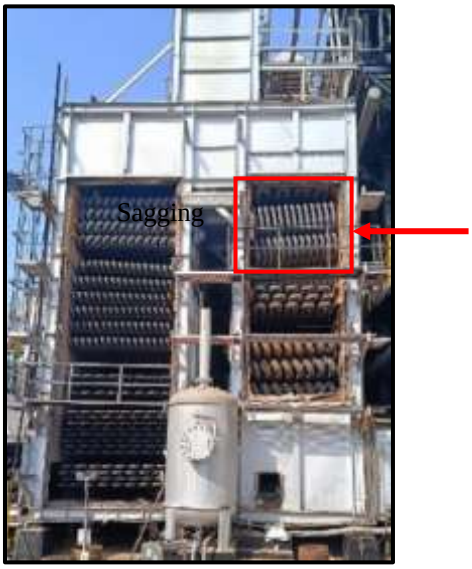
- Cracks was observed on partition wall between HT & LT section.

- 5th no. (Counting from West) hollow plate of flue gas path found sagged compared to other plates.

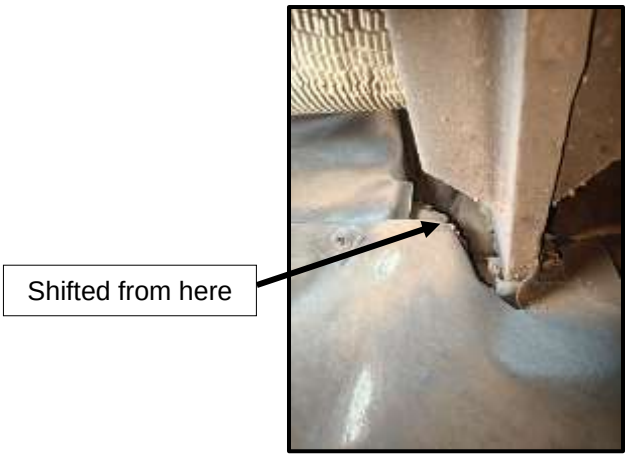
101-B, H.T. CONVECTION SECTION

FROM EAST SIDE

- HT Steam Super Heater Coil was observed sagged from South side.



- 1st Support counting from East found shifted from its resting plate.



- Also Support and Support Resting plate found damaged at its corner.

- Insulation covering sheet found sheared as a result of support shifting.

- 1st Super Heat Cap Hollow Pipe counting from East found cracked.

- 2nd Super Heat Cap Hollow Pipe counting from East found bent.

- Bolt, Stud and Debris found inside the Super Heat Cap Hollow Pipe.

CONVECTION SECTION (PRC-123)

FROM TOP MANHOLE

- HT Coil (finned tubes) were observed in good condition.

- LT coils found sagged (1 to 2") between 2nd and 3rd support.

- Refractory found in good condition
- Thermowells were found intact.
- Tube supports were found in good condition.
- Minor refractory found damaged in East side. Insulation sheet was also found bent.
- Side wall and top roof Insulation covering sheet found satisfactory.


- Central distributor duct plate found in good condition.
- PRC-23 blades found open and in good condition.


VESSELS & OTHER EQUIPMENT

AUXILIARY BOILER FURNACE

- Thin hard brownish scales were observed on the tubes.
- Metallic draft tubes were found burnt off inside the furnace.
- Refractory around 05 no. burners was found intact.


- Top header refractory was found having cracks at few locations.
- Top layer of bottom side wall refractory found loose in both East&West side.
- Center partition wall refractory found intact but burned at one location


- North side bottom down comer header refractory found damaged in bottom most area towards East and West direction.
- Refractory just above the access door was found loosened.


- Condition of the tubes was found satisfactory.
- Burner holes found satisfactory.
- Top header refractory was found having cracks at few locations.
- Side wall refractory found loose in East-West side.


- Thermo well condition found satisfactory at north side behind tubes.

FROM OVERHEAD MAN HOLE

- Flue gas distribution shield found severely damaged need immediate repair work.


- Entire Furnace liner also found badly bulged and need to be repaired.


- Bottom floor refractory bricks were found slightly loose.

102-C, WASTE HEAT BOILER

- Brownish Black coloration was observed.
- Thermowell was found intact in position at top nozzle.

- The tubes were found brownish black in color.
- Tube to tube sheet welding found satisfactory.
- Water accumulated in top nozzle.

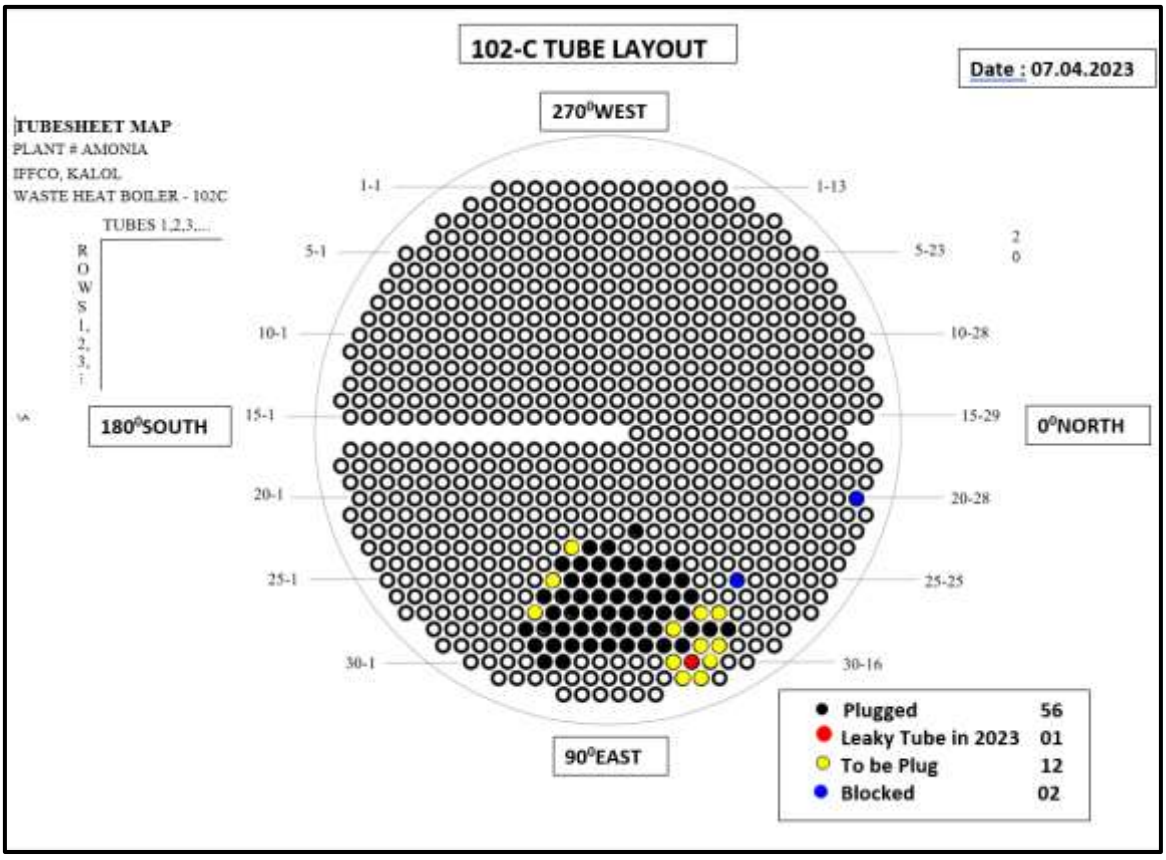
- Water fill test was carried out and 01 no. of tubes were found leaked.

Row no.	Tube no.
30	13

- Boroscopic inspection of leaky tube & its surrounded tube was carried out and found satisfactory.
- RFET was carried out and observations are as under.

Date of Inspection	April 6, 2023
<20% Wall Loss	691
21-30% Wall Loss	00
31-40% Wall Loss	00
41-50% Wall Loss	00
>50% Wall Loss	00
Blocked Tubes	02
Total Tubes Inspected	693
Plugged Tubes	57
Not Inspected Tubes	00
Total Tubes in Unit	**750**

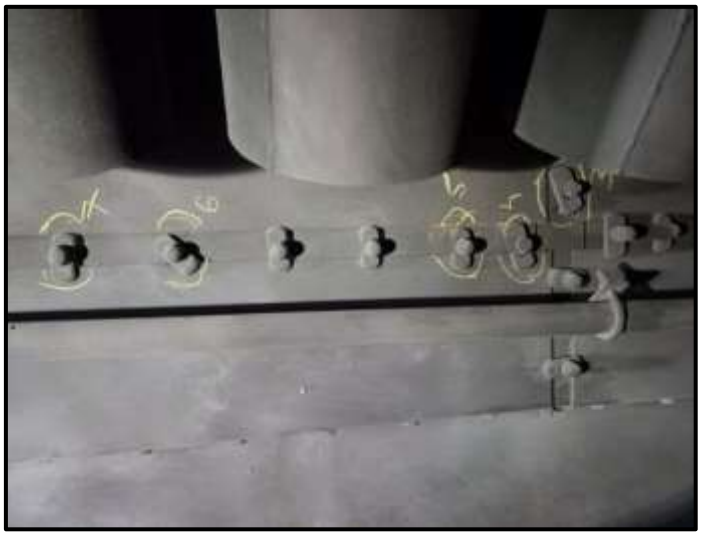
- **TUBE LAYOUT**



- Leaky tubes and surrounding 11 tubes (Total 12 tubes) were plugged.
- DP test of 12 nos. plugged tube was carried out and found satisfactory.

STEAM DRUM (101-F)

- Grayish black coloration was observed inside the drum.
- All Cyclone Separators were found intact in position.
- Demister pads were found intact in position.
- Minor pitting of approx. 0.5 to 1.0 mm depth was observed at scattered locations. (Same was observed at previous inspection).
- One of the holes at south end of phosphate dozing line (1" NB) was found enlarged.
- Grill covering the Down Comers were found bent at few locations. (Same was observed at previous inspection).
- Few bolts and clamps of Demister Pad holding cover plate were found loose. (Same were marked with yellow chalk & need to be attend)

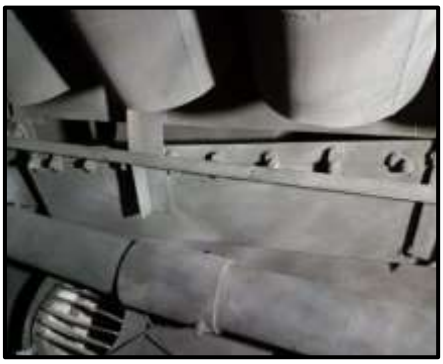


- 1" NB blow off line chocked by mud at bottom of the shell. (Need to be clean)
- 02 nos. bolts found missing and 01 no. bolt found loose of 6" BFW header flange at East side. (Need to attend)

- 6” BFW header found removed from clamp at center and also found bent towards south side. (Need to attend)

- 02 nos. Demister Pad holding plate bolts found sheared and 01 no. bolt found loose at the top. (Same was observed at previous inspection). (Need to attend)
- Bottom demister pad found removed from its position and laying at the bottom. (Need to attend)

  Also, it’s all cap nut found missing and few of that laying behind the removed demister pad.



- All Stiffener plate of the 1st bottom demister pad from North found missing. (Need to attend)
- All Stiffener plate of the 2nd bottom demister pad from North found detached from weld. (Need to attend)
- Phosphate scale was observed at grill covering plate of downcomers and 6” BFW heater at few locations. (Need to be clean)

- Bottom surface of seal bar observed shiny at scattered locations.

- Erosion of the weld was observed in top demister plate holding stiffener at several locations.
- Down comer no. 2,5,6 & 9 counting from south side found filled with water.

START-UP HEATER (102-B)

- Condition of weld joints was found satisfactory.
- Coils were observed with thin scaling/rusting on the surface.

- Dust and dust lumps deposited on the outer surface of the coil.

- Minor pitting observed on the coil surface.
- Bottom floor refractory was found damaged around the burner.

- Some of the burner block bricks were found damaged.
- Cracks were observed in wall refractory bricks at few locations.

- Cracks were observed in cone area refractory at few locations and also found fallen from scattered locations.

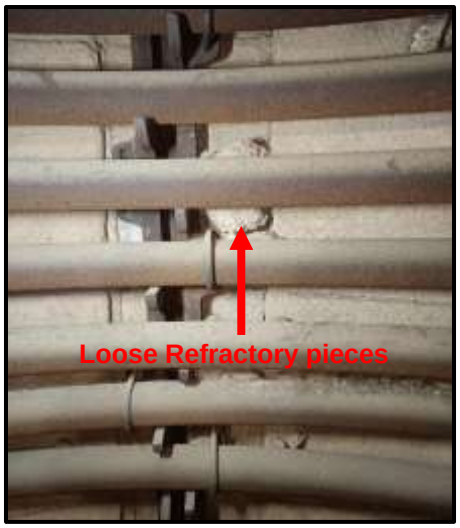
- Erosion of shell wall refractory was observed at few locations.

- Few supports were found loosed.

- Thermowell condition found satisfactory.
- Corner of 01 no. burner fan blade was found damaged, however burner fan condition found satisfactory.

- Thermowell condition found satisfactory.
- Condition of air flow flapper was found satisfactory.
- 01 no. coil was found bent at top side. (Connected with Line no. SG-62 A)
  - DP Test was carried out on top turn of both coils weld joints and No Significant Defect was observed.
  - Ultrasonic thickness measurement was carried out at top turn of both coils and found satisfactory.

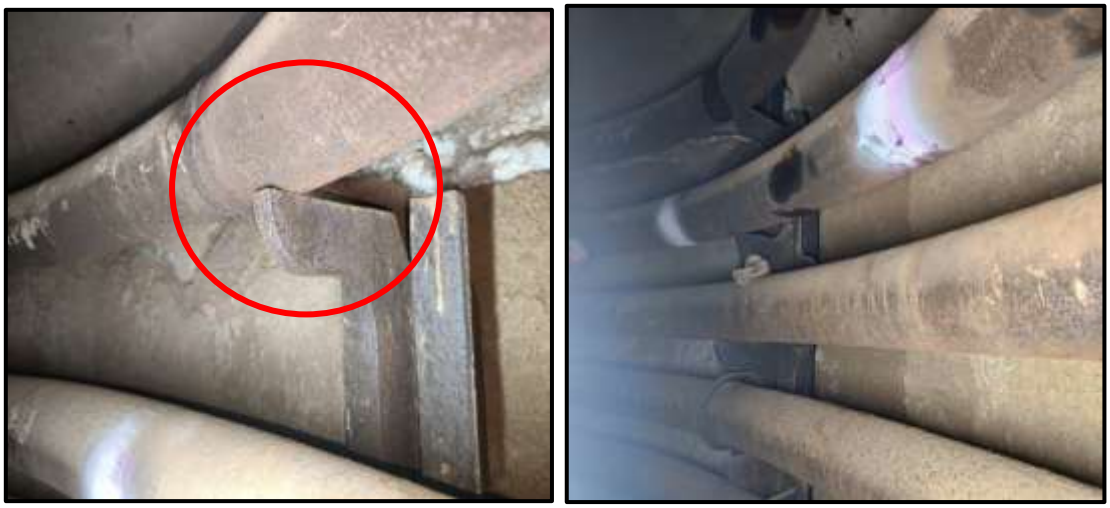
- Loose refractory material was found entrapped between the coils at few locations.



- Thickness measurement was carried out & found satisfactory.
- DP Test was carried out at random joints of the coil and No Significant Defect was observed.
- Metallography was carried out at 1st joint of both coils.

- Refractory found fell down and shell surface was exposed and corroded. (Need to be attend)

- Both coils found shifted towards inner side of the shell and rested only at the edge of clamp.

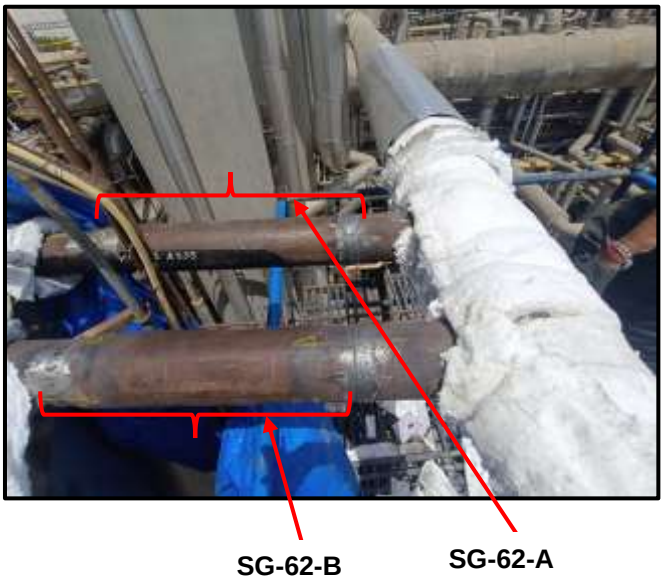


- Insulation was found missing in coils covering cap at top end of the coils.

- Erosion / Corrosion was observed in covering cap of coil connected to SG-62 A Line. Also, one side of the covering cap found touched to coil surface. (Need to attend)

- Erosion of shell wall refractory at top side was observed at few locations.
- Refractory behind clamp at West side found fell down.

- 4” Outlet headers (SG_62-A & B) of both 02 nos. coils were replaced. DP Test, Radiography and Hardness measurement (Before and After SR) was carried out and found satisfactory.

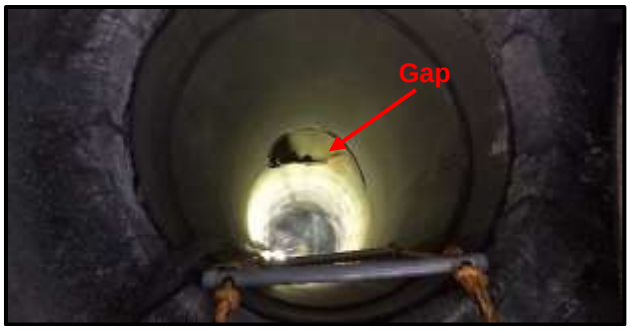


103-D, SECONDARY REFORMER (FROM TOP)

- Near top flange refractory found damaged.

- At scattered locations cracks observed on refractory lining of the shell and cone.
- Thermowell was found intact.

- Approx.1” Gap was observed between shift liners of top shell to transfer line.



- Inward bulging of approx. 1” observed in top shell liner all around the circumference. The ID measured at this location & was found to be approx. 700mm. The location of this bulged location is approx. 1990mm from vessel top flange face.

- Refractory found loose in cone portion of the shell at North and East side.

- Refractory found loose in straight portion of the shell at West side.

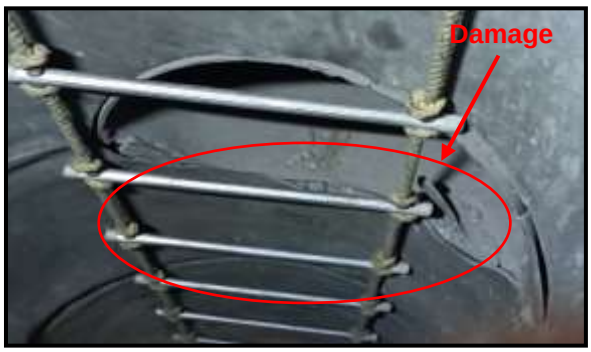
- Gap observed between cone refractory and bottom peripheral liner.

103-D, SECONDARY REFORMER (FROM TOP)

Visual inspection was carried out after removal of aluminia balls catalyst from the vessel.

- Top flange refractory was damaged.

- Liner joint of top shell to transfer line was damaged.

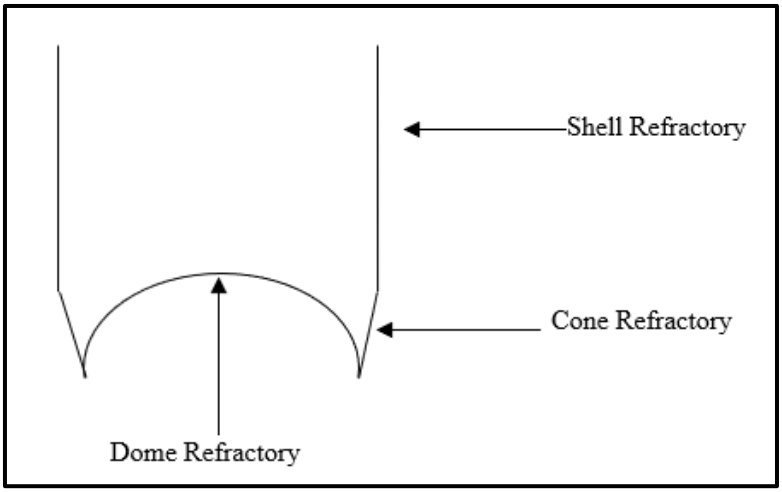


- Scattered cracks were observed in entire shell and cone refractory.

- Dent/Abrasion marks of alumina balls observed with white coloration in prominently in shell refractory and slightly in cone refractory.

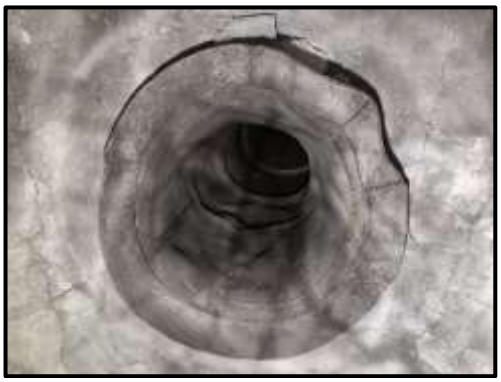
- Alumina balls found stuck up between gaps of dome refractory.

- Condition of Thermowells found satisfactory.
- 1st layer of the shell refractory found peeled off at few locations.



103-D, SECONDARY REFORMER (FROM BOTTOM DOME)

- The refractory around the 101-CA/CB gas inlet nozzles was found loosen and fell down and need to be repaired, liners of both nozzles found badly bulged.



101 CA Nozzle View

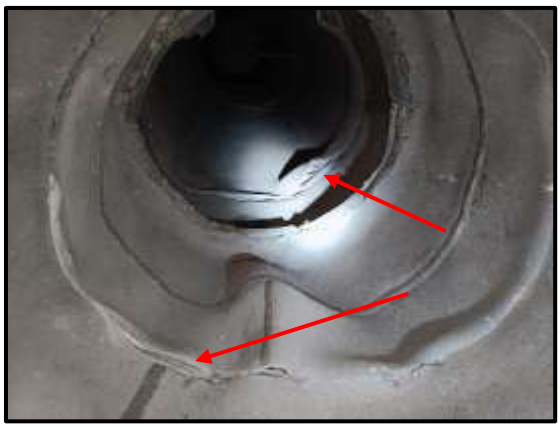
101 CB Nozzle View

- Gap was observed between the 101-CA/CB gas inlet nozzle liner and the shell refractory joint. Gap of approx 3" was observed towards the 101-CB nozzle.

- 101-CA Gas Inlet Nozzle liner was badly buckled /distorted. Also welding of liner found eroded and cracked at ¾ portion of the welding at previously repaired location.

- Condition of the thermo well was found badly eroded in 101-CA Gas Inlet Nozzle.

- 101-CB Gas Inlet Nozzle liner was badly buckled /distorted. Also welding of liner found cracked at mostly in bottom area.



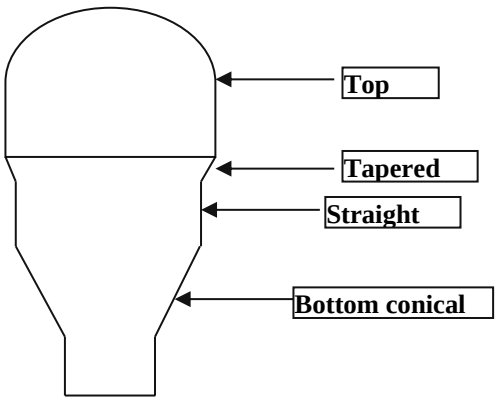
- Condition of the thermo well was found satisfactory in 101-CB Gas Inlet Nozzle.

- Top Brick dome refractory found loose, broken and fallen down at few locations.

- Bottom conical refractory found cracked and loosen at many locations.

- In straight circumferential joint, refractory found cracked and fallen down at few locations.
- Alumina balls found exposed/trapped in gas path passage in top brick dome.

- Refractory around the manway found cracked and damaged at few locations.



AIR MIXTURE NOZZLE OF 103-D

- Severe erosion was observed in circumferential weld of central pipe with top cover liner.

- Crevice observed at few locations on both sides of long seam of old pipe.
- Erosion was observed in top roof refractory.

- Erosion was observed weld of old pipe. (Below perforated trays)

- Bottom funnel area found cracked / damaged.

Old Image of SD-2017 **Image of 08.04.2023**

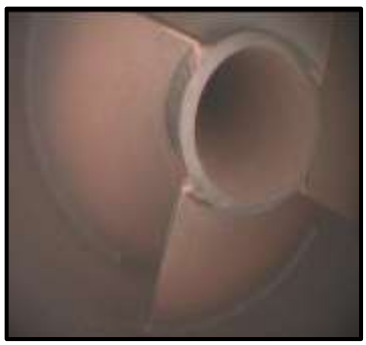
- Condition of the perforated plate found satisfactory. However, found slightly damaged at few locations during removing.


- All stitch weld condition found satisfactory.

BOROSCOPIC INSPECTION REPORT

- Reddish Coloration was observed in ID of Nozzle.
- Blade assembly was found satisfactory.

- Weld condition of blade found satisfactory.




- Weld condition of air mixture pipe found satisfactory.

- Bottom funnel area found Burnt, Cracked and damaged.

107-D, TRANSFER LINE: (FROM OUTSIDE)

- Bulging was observed at several locations.

- Black scales were observed inside transfer line.
- Thermowell condition found satisfactory.
- Minor damage of the refractory was observed at flange (end plug side) of the transfer line. Also End plug seating area found eroded/damaged at Top and North side. (Same was observed in previous inspection)

- Scattered cracks were observed on refractory.

- Gap was observed between transfer line and End plug seat in entire periphery.

- Gap was observed between liner and riser.

<u>107-C (M.P. BOILER)</u>

FROM TOP MANHOLE (FROM OUTSIDE)

- Grayish black coloration was observed inside the boiler.
- All internals were found intact in position.
- Overall condition of the vessel was found satisfactory.

<u>1123-C NEW SYN LOOP BOILER</u>

- Condition of the weld joints were found satisfactory.
- Rust/ scaling observed on the weld & Dished End.
- Rust / scaling observed on the tube baffles and some of the tubes.

- Rust / scales observed lying on the shell bottom.
- South side top demister half was found upward lifted.
- Whitish scaling was observed on PO_4 inlet header.

101-U, DEAERATOR TOP HEAD

- Reddish coloration was observed inside the shell.
- Water found accumulated at bottom of the dish end.
- Resin found accumulated at bottom of the dish end.
- 02 bolt found missing of the tray enclosure manhole.
- Tray segments were found displaced from its position.
- Few tray supports were lying on bottom dish end. A metallic plate found lying on BDE.

Tray Segment laying on bottom DE

A metallic plate found lying on BDE.

Tray Segments found dislocated from its position

- Two no. distributor header found intact in position.

DEAERATOR STORAGE TANK

- Reddish coloration was observed inside the shell.
- All internals were found in good condition.
- Thermowell found intact.
- Overall condition of the storage tank found satisfactory.

101- EA (CO_2 ABSORBER)

(MANHOLE NO. COUNTING FROM TOP OF THE VESSEL)

FROM MANHOLE- 1

- Brownish black coloration was observed on the shell.
- Bubble cap condition found satisfactory with all nuts intact.

- Top demister pad condition found lifted on north side.

FROM MANHOLE- 2

- Brownish black coloration was observed on the shell.
- Black coloration observed on the Inlet distributor header.
- Bubble cap bottom tray condition found satisfactory. 01 no. clamp found loose.
- Loose oily debris particles found adhered on the shell surface.
- Rectangular gas riser condition found satisfactory.
- Main inlet header clamp was found loose.

FROM MANHOLE- 3

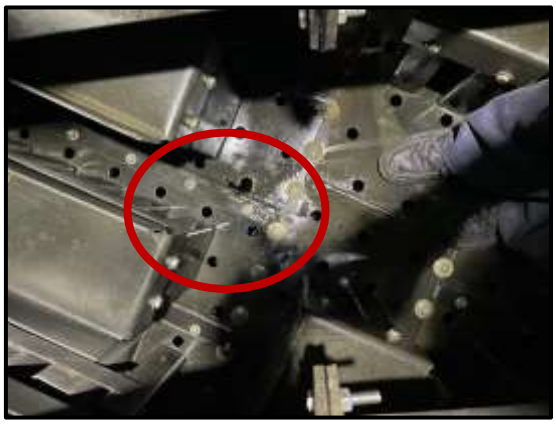
- Brownish grey coloration was observed on the shell as well as on all the gas risers.
- Sample collectors were found intact in its position.

- Condition of the gas risers was found satisfactory.


FROM MANHOLE- 4


- Corrosion cavities and holes were observed on South most liquid distributor collector plate, located just below the liquid distributor. (Visible just from M/H, (Same was observed in previous inspection)

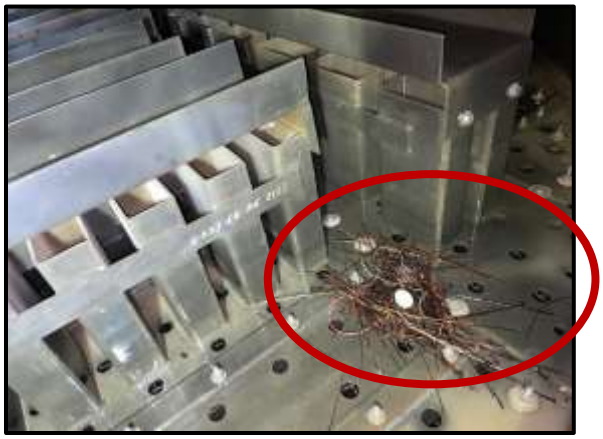


- Loose piece of debris found between gas rising holding plate towards North.

FROM MANHOLE- 5

- Excessive gap as compared to others was observed in several rasching ring holder. (Between two half of holder, (Same was observed in previous inspection).
- Grey coloration was observed on the shell.
- Bird nest and eggs found near M/H to be cleaned before box Up.



FROM MANHOLE- 6 (INSPECTED FROM OUTSIDE)

- Condition of gas distributor was found satisfactory.
- Grey coloration was observed on the shell.

- Paul ring inside. Outlet pipe found intact.

102-EB, CO2 STRIPPER

FROM TOP MANHOLE

- Demister pad supporting strips were observed slightly downward bent (mostly in center portion).
- Demister pad was found slightly removed and also gap was observed in center rib joint compare the other rib joints. (Need to attend)

- All the bolts of liquid inlet nozzle flange were found in position & intact.
- Rubbing marks was observed behind the distributor header cap at S-W direction.

- Crack was observed in South-West side shell and liner plate tack welding.

- Distributer header was observed to be shifted approx. 20mm towards south-west direction this has led perforated plate over header to foul with shell wall.
- Distributor header clamp found loose at North-West side. And its 01 no. nut found missing and same was found laying on the floor.

- Weld erosion observed in bottom stiffening plate of header support plate.
- Distributor header clamp found loose at North-East side. And its nut found missing.

- Crack was observed in distributor header and support weld at North-West side. (Marked with yellow chalk)

- Also, severe dent was observed in header cap at North-West side.

- Debris of weld spatters was observed at South-West corner on the floor.

FROM BOTTOM MANHOLE

- Blackish coloration was observed on the top half and brownish coloration observed on the bottom dish end from inside.
- White coloration was observed at the East-West direction.
- Nozzle condition was found satisfactory.
- Thermowell was found intact in its position.
- Thick scaling was observed on shell as well as on man-hole passage from inside.

- Vortex breaker was found intact.
- Rail marks of the liquid was observed coming from behind the liner plate.

- Water was accumulated at bottom of the dish end.

1104-E (PROCESS CONDENSATE STRIPPER)

FROM TOP MANHOLE

- Grayish Coloration was observed on the shell & Man-way.
- Mist eliminator was found intact in its position.
- Brownish flow marks were observed coming from the supports of the Mist eliminator.
- Grayish dust was found adhered on the top plate and internals.

FROM BOTTOM MANHOLE

- Grayish Coloration was observed on the shell & Man-way.
- Bottom most tray was found intact in its position.
- 6” SS Internal Pipe (Steam Inlet) was found intact.
- Vortex breaker in the bottom was found in satisfactory condition. Flow marks observed on east side of shell.

102-F RAW GAS SEPARATOR

- Epoxy paint condition was found satisfactory.
- Demister pads were found lifted from its position in East Side.

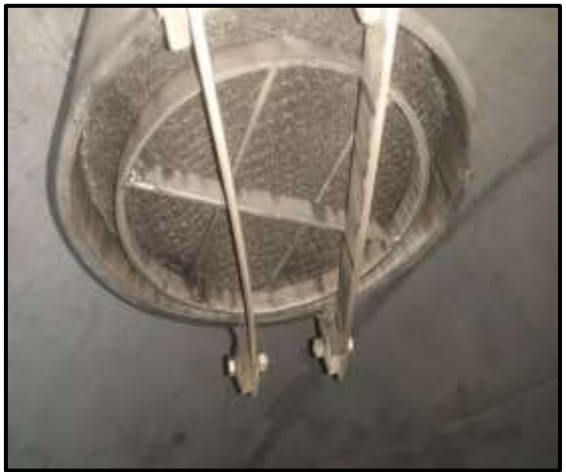
- Putty applied on the circumferential weld joint of manhole nozzle with shell from inside was found detached approx in top half of the circumference.
- Condition of Gas inlet nozzle located at East side was found satisfactory.
- On Dished end soft blackish scales were observed, however the paint behind it was found intact.

103-E1, HP FLASH VESSEL

FROM TOP MANHOLE

- Silver gray coloration was observed at top dish end and shell coarse.
- Demister pipe found intact in position with pad.
- Liquid distributor header and its 03 nos. distributor pipes found intact in position, color of the same was observed silver gray with black patches at scattered location and liquid flow marks.
- Distributor pipe holding supports 02 nos. C-channel found intact in position. Distributor trays segment was found intact in its position.
- Hard scale and dust deposit was observed the outer surface of distributor header, pipes, gas riser and supports.
- Weld joints found in satisfactory condition without any sign of corrosion.



FROM BOTTOM MANHOLE:

- Paul rings inside the bottom dished.
- HP outlet header found intact and in good condition.
- Brownish color on Paul rings observed.

- Top bed demister found intact as seen from bottom manhole.

103-E2 LP (LP FLASH VESSEL)

FROM TOP MANHOLE COMPARTMENT

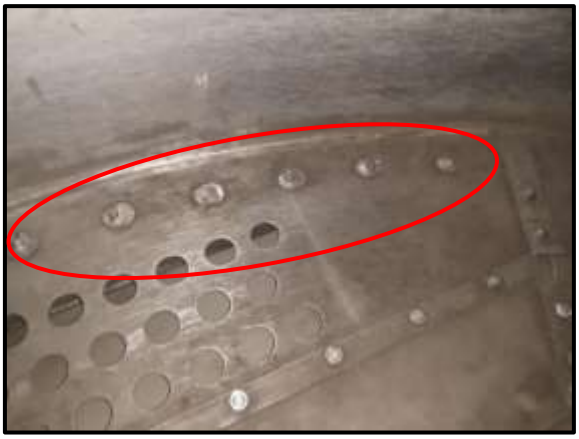
- Demister pad was found intact in its position in satisfactory condition.
- Condition of bubble caps found satisfactory.
- Distributor collectors / drain pipes in West direction was found satisfactory.
- All weld joints found satisfactory.

FROM SECOND MANHOLE COMPARTMENT

- Rectangular riser box and other fittings found intact in position.
- Holding bolts of flash feed gallery were bent at many locations.
- Silver coloration observed at scattered locations. Weld joints observed as if etching has occurred resulting in slightly differing colour in comparison to adjacent shell surface.
- Bubble cap tray found intact in position. 02 nos. drain line were found intact however 01 no. its clamp nut found loose. 01 no. drain pot found eroded.
- 02 nos. plates having approx. size of 10”x36” found lying on the rectangular riser box. Which were taken out.

- 02 nos. tangential inlet nozzle found in good condition.





BOTTOM MANHOLE COMPARTMENT (FROM OUTSIDE)

- Vortex plate of the header found intact in position.
- Silver coloration observed at scattered locations.
- aMDEA liquid found accumulated on the bottom floor of the vessel.

104-D, LTS (LOW TEMPERATURE SECTION)

- Grayish black and Brownish coloration was observed inside the vessel in top and bottom half respectively.
- Depression / Cavity observed in parent metal of the shell at 02 location at South side.
- Hard scattered scales and pitting were observed on the surface of entire vessel.
- Manway welding found satisfactory.
- All welding of the vessel found satisfactory.
- 01 no. Stiffening rod of the inlet distributor found detached at top buffel segment at N-W side.
- Welding of the previous repair patch of the inlet distributor bottom plate found satisfactory.
- Catalyst found laying on manway of side M/H at West side.
- 1” nozzle at North side found chocked.
- Debris found adhered on dump out nozzle.
- Catalyst found adhered in ID of 6” nozzle at North side.
- Thermowell pipe found bent and removed from its resting assembly.
- Bottom screen found intact.
- Catalyst found laying at bottom and around the screen plate.
- Fastener of screen clamps found satisfactory.
- Catalyst impression observed in entire periphery of bottom dish end.
- Magnetic Particle test was carried out on all Circumferential and Longitudinal weld joints from inside and found satisfactory.

- Hardness measurement was carried out and observed in the range of 140 to 185 BHN.
- Ultrasonic Flaw Detection was carried out in length of 12” x 12” of all T-joints and approx. 6” area of parent metal. No significant defect was observed.
- Ultrasonic thickness measurement was carried out and found satisfactory.
- Metallography was carried out at selected locations and found satisfactory.

104-F, SYNTHESIS GAS COMPRESSOR SUCTION DRUM

- Grayish black coloration was observed on bottom dome, whereas brownish Coloration was observed on shell.
- Blackish coloration was observed inside the inlet hood baffle.
- Thin scales were observed on bottom dish end.
- Weld discontinuity was observed in inlet hood baffle east side weld joint.

- Bottom vortex breaker was clear and its welds were found intact.
- Top demister pad found upward lifted from center and slightly shifted towards south side. Also center portion of the demister pad observed shiny.

- Condition of all the nozzle weld joints was found satisfactory.

105-F (SYN. GAS COMPRESSOR 1ST STAGE SEPARATOR)

- The coloration of vessel was brownish black from inside.
- Scattered minor pitting were observed throughout the shell surface, the same was observed in past also.
- Entire internal surface was found oily.
- Demister pad was found intact in its position.

- The Overall condition of the vessel was found satisfactory.
- Oil was found accumulated at the bottom dished end of the vessel, need to be cleaned.
- Vortex breaker was found intact.

106-F, AMMONIA SEPARATOR

Visual inspection of the separator was carried out from OUTSIDE.

The following observations were made.

- Demister pad was found intact with its fasteners.
- Inlet distributor supports were in satisfactory condition.
- Brownish black colouration was observed inside the vessel.
- Overall condition of the vessel seems to-be satisfactory.

107-F, PRIMARY AMMONIA SEPARATOR

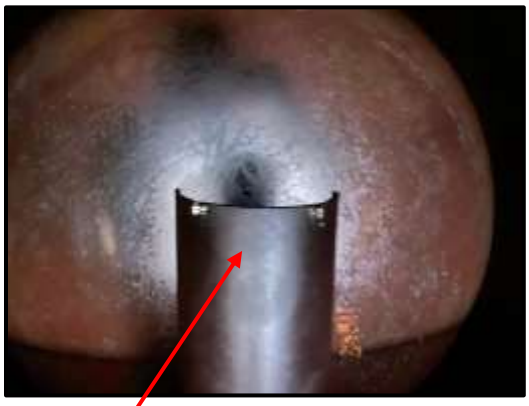
- Blackish brown coloration was found inside the vessel.
- Scattered thin scales were observed on the shell and dished end.
- Internal surface was found oily.
- The condition of all the weld joints of the shell, dished ends and nozzles was found satisfactory.
- Scattered pitting was observed on entire shell surface, more prominent on bottom portion.
- Condition of target plate was found satisfactory.
- Hard scaling observed at manhole man way and same were found peeled off at scattered locations.
- Thermo well was found intact in position.
- Overall condition was found satisfactory.

109-F, REFRIGERANT RECEIVER

- The shell had assumed Grayish black coloration in upper half. Bottom half of the shell was having brownish coloration.
- The condition of all the weld joints of the shell, dished ends and nozzles was found to be satisfactory.
- Thin scales were observed on both the dished ends.
- Minor scattered pitting / scales were observed in a width of approx. 250mm throughout the length of vessel at its bottom most portions. The same was observed in past also.
- Entire bottom surface was found oily.
- Thermo-well was found intact in its position.
- Overall condition of the vessel was found satisfactory**.**

110-F, FIRST STAGE REFRIGERANT FLASH DRUM

- Brownish black coloration observed inside the drum.
- Entire internal surface found oily.
- The demister pads were found intact.
- Scattered scales were observed on the surface of the dish ends and shell.
- Thermowell found intact.
- Top plate bolts of 117-C return standpipe found sheared and plate (approx. size of 400 mm x 400 mm) was detached and lying near manhole.
- Vortex breaker condition found satisfactory.
- Overall condition of the vessel was found to be satisfactory.



Standpipe cover plate detached from here and laying on bottom of the shell

111-F, SECOND STAGE REFRIGERANT FLASH DRUM

- Blackish gray coloration was observed inside the shell surface.
- Entire internal surface was found oily.
- The demister pads were found intact in position.
- Dish ends were found covered with scattered scales.
- Condition of all shell weld joints was found satisfactory.

- Thermo well found intact in position.
- Vortex plate condition found satisfactory.
- Oil found accumulated behind the make-up nozzle from 109F.

112-F, THIRD STAGE REFRIGERANT FLASH DRUM:

- The demister pads were found intact in position.
- The coloration of the inside surface of shell was brownish black.
- Surface of the entire vessel was found oily.
- Scattered hard scales were observed on the shell
- On East dish end thick scales with oily surface were observed.
- Condition of all the nozzles was found satisfactory.
- Condition of all the weld joints was found satisfactory.
- Overall condition of the vessel was found satisfactory.
- Thermowell condition found intact.
- Top plate bolts of 117-C return standpipe found sheared and plate is dislocated from its position.

Standpipe cover plate detached from here and dislocated.

155-F (KNOCK-OUT DRUM)

FROM MANHOLE

- Grayish Coloration was observed on the shell &Man-way.
- Demister was found intact in its position.
- Vortex breaker in the bottom was found in satisfactory condition.
- Overall condition of vessel was found satisfactory.

157-F (PROCESS GAS SEPARATOR)

Videoscopic inspection was carried out form the hand holes and observations are as under.

- Rasching rings were accumulated at bottom of the separator**.**

- Weld joint condition found satisfactory**.**
- Brownish Black coloration was observed at inside surface**.**

2002 - F (DM WATER STORAGE TANK):

- Blisters were observed on whole bottom plate area. Rusting were observed on blister broken area on bottom plate.

- Blisters were also observed on shell wall plate**.**


- Top roof angle supports with fasteners were found intact from inside**.**

- Paint was also found damaged at few locations on shell wall from outside**.**

- Top roof from outside found O.K**.**

105-E, DEHYDRATOR

FROM BOTTOM MANHOLE

- Bubble cap holding plate found satisfactory.
- Bubble cap surface found oily.
- Distribution header flange bolt was found intact in position.
- Loose scaling was observed in side surface of the gas inlet distribution header.
- Brownish coloration observed inside the shell.

- Vortex breaker was found intact in position.
- Overall condition was found satisfactory.

FROM TOP MANHOLE

- Bubble cap holding plate found satisfactory. All bubble caps were found intact with its fasteners.

- Demister pads found intact in position, however at 03 location demister pad found upward lifted at North & West Side. Same was reported in previous shut down.

  - Debris was found lying on the bubble cap plate.
  - Oily surface found on bubble cap.
  - Brownish coloration observed inside the shell.
  - Overall condition was found satisfactory.

<u>WELDER QUALIFICATION TESTS</u>

- Performance qualification test was carried out of 05 Nos. welders offered by M/s A M ERECTORS, Ahmedabad (Mech. Planning) (W.O. No- 201004231682). All 03 nos. of welders were qualified during the test. These welders were allowed to perform for fabrication & erection of piping, structural and other related mechanical jobs during Shutdown 2023.

- Performance qualification test was carried out of 04 Nos. welders offered by M/s J & J Engg., (W.O. No. 201004211546 / 201004220741). 02 nos. of welders were qualified during the test. These welders were allowed to perform for fabrication & erection of piping, structural and other related mechanical jobs during Shutdown 2023.

- Performance qualification test was carried out of 14 Nos. welders offered by M/s GENERAL ENGINEERING COMPANY LTD. (W.O. No. - 201004231457). 12 nos. of welders were qualified during the test. These welders were allowed to perform for fabrication & erection of piping, structural and other related mechanical jobs during Shutdown 2023.
- Performance qualification test was carried out of 02 Nos. welders offered by M/s SHREE GANESH ENGG. (W.O. No. 201004231761). All 02 nos. of welders were qualified during the test. These welders were allowed to perform various fabrication jobs for Urea Plant Autoclave Downcomer replacement job in Urea plant during Shutdown 2023.
- Performance qualification test was carried out of 04 Nos. welders offered by M/s MECH-TECH ENGG. (W.O. No. 201004231529). 02 nos. of welders were qualified during the test. These welders were allowed to perform various fabrication jobs for replacement in 103-F in Ammonia Plant and miscellaneous fabrication jobs during Shutdown 2023.
- Performance qualification test was carried out of 04 Nos. welders offered by M/s TEVOREN TECNOLOGIES LLP. (W.O. 221004230623). 01 nos. of welders were qualified during the test. These welders were allowed to perform for fabrication & erection of piping, structural and other related mechanical jobs during Shutdown 2023

D.P. TEST

Dye Penetrant examination of weld joints of all the pipelines fabricated by contractors/departmentally, new pipeline fabrication / repairing / modifications job done by technical and maintenance groups 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.

RADIOGRAPHY

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 / repaired by all contractors as well as departmentally as per the requirement.

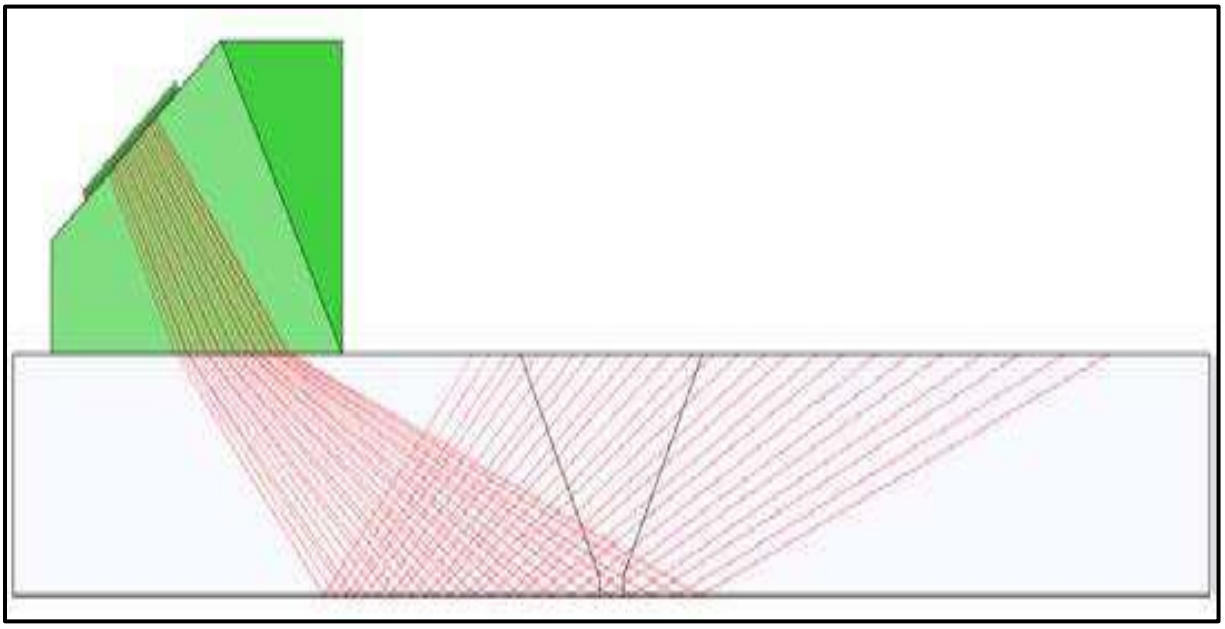
ULTRASONIC FLAW DETECTION OF WELDS

Weld joints (selected only) of the critical 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.

The detailed list of pipeline inspected is mentioned at **ANNEXURE - 7**

PHASED ARRAY ULTRASONIC TESTING (PAUT)

Phased array ultrasonic testing is an advanced method of Pulsed echo Ultrasonic testing that has wide application and more advantage than conventional ultrasonic testing. The term PHASED refers to the timing and the term ARRAY refers to the multiple elements. PAUT is based on the principle of Constructive and destructive wave physics. Phased array ultrasonic systems utilize multi-element probes, which are individually excited under computer control. Ultrasonic beams can be constructed, steered at different angles & focused at required depths by computer controlled excitation at different time delay of different elements of PA probe. Software controls the characteristics of the ultrasonic beam.



The advance software of PAUT Instrument provides the data in terms of different views that greatly helps to determine characteristics of the defect. Below are the advantages of Phased Array Ultrasonic Testing.

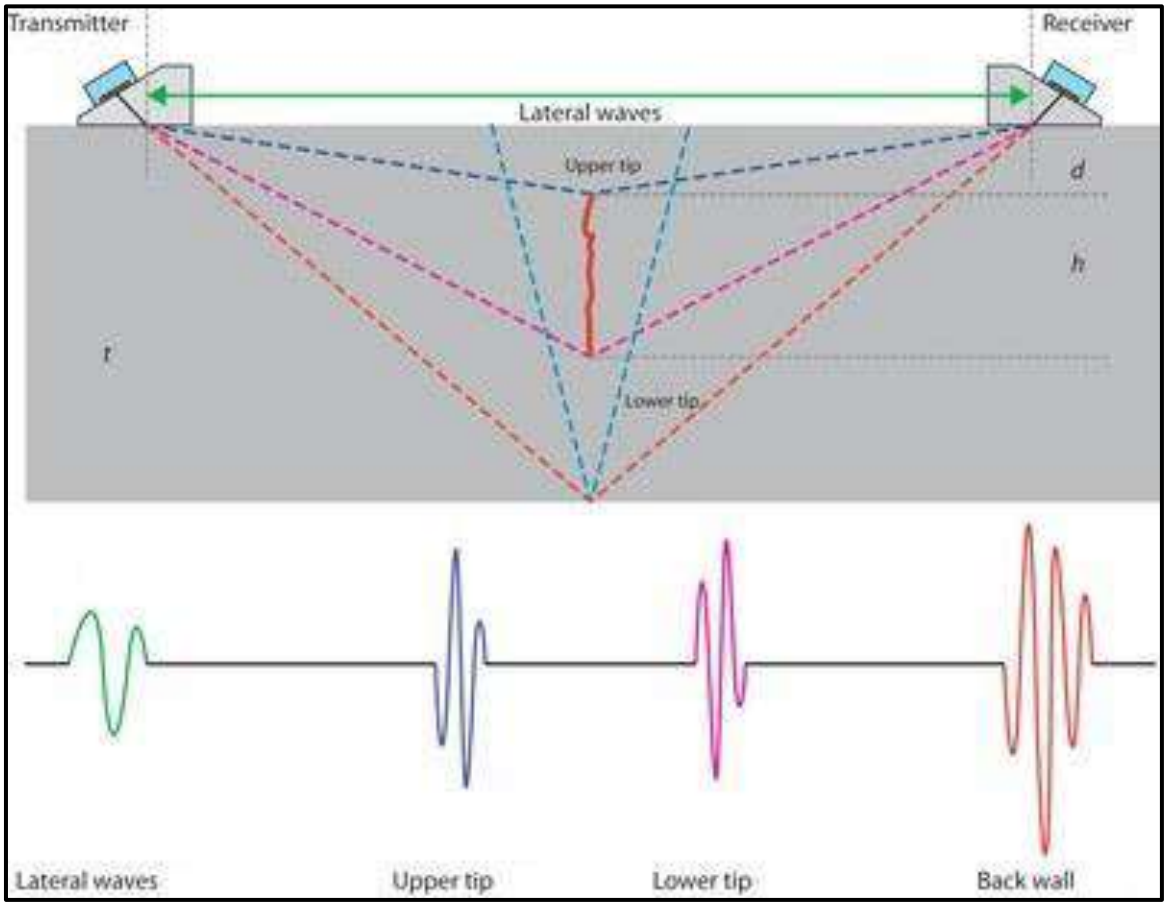
- High probability of defect detection than conventional UT
- Beam Focusing
- Beam Steering

- Better Visualization of flaw
- Higher sensitivity than Conventional UT
- Permanent data storage

TIME OF FLIGHT DIFFRACTION TECHNIQUE (TOFD)

Time of flight diffraction testing (TOFD) is an advanced method for testing of welds.

Unlike Conventional Ultrasonic testing which is based on pulse echo, TOFD uses the time of flight of a diffracted ultrasonic pulse to determine the position & size of the reflection. As shown in image below, In a TOFD system a pair of ultrasonic probes sits on opposite sides of a weld. One of the probe acts as transmitter emits an ultrasonic pulse that is picked up by the probe on the other side, the receiver. In undamaged part of the job, the signals picked up by the receiver probe are from two waves: One that travels along the surface – Lateral Wave and one that reflects off the back wall. When a crack is present, there is a diffraction of the ultrasonic wave from the tip of the crack. Using the measured time of flight of the diffracted signal, the depth of the crack can calculated.



Weld joints (selected only) of the critical 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.

The detailed list of pipeline inspected is mentioned at **ANNEXURE – 8.**

ULTRASONIC THICKNESS MEASUREMENT

Ultrasonic thickness measurement was carried out on various pipelines, equipment, Tubes / Coils & Partition plates of the coolers in the plant. The detailed results of inspection are attached herewith at **ANNEXURE – 9 (1/2)** for equipment, **ANNEXURE-9 (2/2)** for HT/LT Coils, **ANNEXURE – 10** for Partitional plate of coolers and **ANNEXURE – 11 (1/2)** for 02 phase pipelines and **ANNEXURE – 11 (2/2) f**or Other pipelines.

GAUSS MEASUREMENT, D.P TEST OF BEARINGS & COUPLING BOLTS OF HIGH SPEED TURBO MACHINARIES

Measurements of residual magnetism (gauss) on rotary and stationary parts of rotary equipment were carried out. Wherever residual magnetism was higher than acceptable limits, same was demagnetized and brought down within acceptable limits. The detailed results of inspection are attached herewith at **ANNEXURE - 12.**

D.P. Test was carried out on all bearings to check condition of liner and its bonding and all coupling bolts of High Speed rotary equipment.

INSITU METALLOGRAPHY EXAMINATION

In order to evaluate the condition of certain critical plant equipment and pipelines operating at more than 300 deg. C temperatures, parent metal, HAZ welds , weld joints of dissimilar material, In situ metallographic examination was carried out. List of the lines/equipment checked along with observations and remarks are mentioned at **ANNEXURE - 13.**

INSTALLATION OF NEW PIPELINES

Various pipelines in Ammonia Plant were installed under different schemes and various tapping were taken by Technical Department. Inspection activities viz. DP Test, Radiography review and repairs etc. were carried out on the weld joints as per fabrication procedures.

ANNEXURE - 1

VISUAL INSPECTION REPORT

PRIMARY REFORMER RADIANT ZONE

Visual inspection of the entire furnace Radiant zone including refractory, insulation, burner-blocks, etc. was carried out. The detailed report on observations made are as under:

BURNER BLOCKS: Following burner blocks were found damaged:

BURNER ROW NO.	BURNER BLOCK NO.	BURNER ROW NO.	BURNER BLOCK NO.
1	14	6	8
2	1 & 2	8	3 & 9
3	1, 10 & 12	9	6 & 14
5	1		

BOTTOM HEADER INSULATION

Header insulation was found damaged near following tube nos.:

Header No.	Tube no(s) where insulation found damaged
1	Near tube no. 15 to 20, 27, 28, 33 to 37
2	Near tube no. 1, 2, 3, 14 to 18, 24 to 28, 36 to 40
3	Near tube no. 1, 14, 15, 19 to 22, 26 to 32, 38 to 41
4	Near tube no. 14 to 17, 20 to 27, 42
5	Near tube no. 5 to 18, 26 to 32, 34, 35, 40 to 42
6	Near tube no. 1 to 20, 23, 25 to 32, 36 to 42
7	Near tube no. 3 to 6, 14, 15, 23 to 42
8	Near tube no. 1 to 18, 21, 22 to 35

ROOF INSULATION

Roof insulation was found damaged/ dropped/gap has been observed at following locations:

Row No.	Location
Tube Row No 2	Near Tube No. 38 to 42
Tube Row No 3	Near Tube No. 19 to 20
Tube Row No 4	Near Tube No. 20, 21, 33
Burner Row No 5	Near Burner no. 1, 3, 5, 11, 12
Burner Row No 6	Near Burner no. 1, 3
Tube Row No 6	Near Tube No. 21, 22, 30, 38, 40
Burner Row No 8	Near tube no. 8, 11, 13
Burner Row No 9	Near tube no. 10

REFRACTORY / INSULATION OF WALLS:

East Wall	:	Gap observed between East wall :and tunnel slab	South Wall	:	Found Satisfactory
West Wall	:	Found Satisfactory	Tunnel Slab	:	Found Satisfacory
North Wall	:	Found Satisfactory			

ANNEXURE - 2 (1/3)

GRADATION OF TUBES BY AUS CARRIED OUT BY M/s 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	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	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	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
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	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	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

ANNEXURE - 2 (2/3)

GRADATION OF TUBES BY AUS CARRIED OUT BY M/s 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	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	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	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
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	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	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	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

ANNEXURE – 2 (3/3)

GRADATION OF RISER TUBES BY AUS CARRIED OUT BY PDIL

ROW NO.	RISER NO.	AUS GRADE
1	1	C
2	2	B
3	3	C
4	4	C
5	5	C
6	6	C
7	7	C
8	8	C

ANNEXURE – 3 (1/5)

TUBE NOS 101 TO 242

CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL:

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
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		

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
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	42	0	0	Total	42	0	0

ANNEXURE – 3 (2/5)

TUBE NOS 301 TO 442

CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
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		

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
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	42	0	0	Total	42	0	0

ANNEXURE – 3 (3/5)

TUBE NOS 501 TO 642

CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL:

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
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		

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
538	X			638	X		
539		X		639	X		
540	X			640	X		
541	X			641	X		
542	X			642	X		
Total	41	01	0	Total	42	0	0

ANNEXURE – 3 (4/5)

TUBE NOS 701 TO 842

CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
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		

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
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	42	0	0	Total	42	0	0

ANNEXURE – 3 (5/5)

RISERS

CREEP MEASUREMENT OF PRIMARY REFORMER RISER TUBES AT SLAB LEVEL:

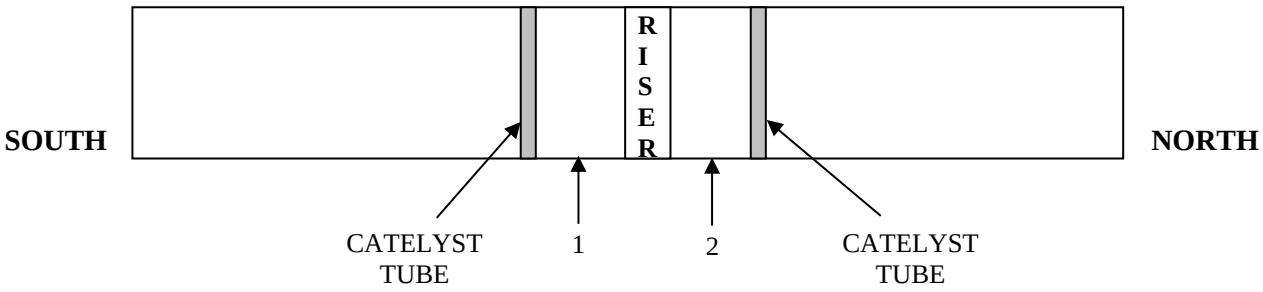
Riser No.	N- S	E- W	Creep in Percentage		
			0 – 0.33	0.33 – 1.10	1.10 – 1.44
1	125.59	125.74		X	
2	125.08	125.10		X	
3	125.66	125.74		X	
4	125.43	125.50		X	
5	125.64	125.86		X	
6	125.55	125.57		X	
7	125.24	125.33		X	
8	125.15	125.21		X	

* Design O.D. of Riser = 124.44^{+1}_{-0}

ANNEXURE- 4

CREEP MEASUREMENT OF OUTLET MANIFOLD OF PRIMARY REFORMER

ROW NO	1		Creep in Percentage	2		Creep in Percentage
	XX	YY		XX	YY	
1	142.40	141.96	0.623	142.34	142.18	0.679
2	142.53	142.16	0.740	141.85	142.22	0.520
3	142.86	142.54	0.991	142.21	142.35	0.694
4	142.22	142.61	0.789	141.86	142.16	0.502
5	142.18	142.33	0.676	142.14	142.44	0.701
6	142.17	142.41	0.701	142.51	142.25	0.764
7	142.22	142.35	0.697	142.41	142.09	0.672
8	142.16	142.32	0.665	142.56	142.45	0.853



+0.8
- 0.0

* Design O.D. of Riser = 141.3

ANNEXURE – 5

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

COLD LOAD READINGS IN MM.

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

TRANSFER LINE SPRING HANGER LOAD READINGS

ROW	1	2	3	4	5	6	7
READINGS	**-34**	**-30**	**-20**	**-19**	**-27**	**-10**	**-14**

BOTTOM DRAIN READINGS

ROW	1	2	3	4	5	6	7	8
READINGS	**95**	**90**	**95**	**90**	**98**	**95**	**90**	**90**

AUXILIARY BOILER SPRING READINGS

SPRING	S-E	N-E	S-W	N-W
READINGS	**55**	**55**	**55**	**55**

Note : 02 nos. spring of 107-D, Transfer Line were replaced during SD-2021

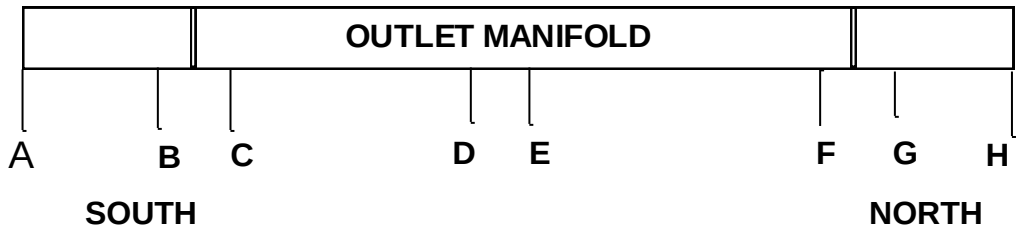
ANNEXURE – 6

CLEARANCE OF OUTLET MANIFOLD FROM GROUND FLOOR IN COLD CONDITION

HEADER NO.	LOCATION OF MEASUREMENT					
	B	C	D	E	F	G
1			330	320		
2			315	313		
3			310	300		
4			330	337		
5			295	290		
6			305	308		
7			309	313		
8			305	305		

NOTE: (1) All readings are in MM

(2) Readings are taken without insulation.



ANNEXURE – 7

LIST OF PIPELINES FOR ULTRASONIC FLAW DETECTION

Sr. No.	Line No.	Size (NB)	Sch.	From	To	No. of weld joint tested	No. of Elbows Tested	No. of T-Joints	Remarks
1	SG.1303.02-14”	14	100	121-C	SG-12-14”	12	06	03	
2	SG.1303.04-8”	8	100	137-C	SG-51-8	10	-	-	
3	SG.1303.06-14”	14	100	121-C	124-C	11	04	-	
4	SG.1303.08-10”	10	120	SG-1303.08-14	108-D Inlet (Top North)	02	01	-	
5	SG.1303.12-10”	10	120	SG-1303.08-14	108-D Inlet (Top South)	04	02	-	
6	SG-0044-14”	14	140	SG-1303.08-14	1123-C INLET	01	-	-	

Sr. No.	Line No.	Size (NB)	Sch.	From	To	No. of weld joint tested	No. of Elbows Tested	No. of T-Joints	Remarks
7	NG-09-12”	12	100	Mixed Feed Outlet	101-B Inlet Header	04	01		
8	NG-11A TO H	6	120	NG-09	101-B	24	8	-	
19	PG-06-16” & 18”	16”/ 18”	20	104-D O/L	103-C	02	01		
10	PG-07-12”	12”	30	104-D O/L	103-C	02	01		
11	SG-01	12	30	106-D (Bottom 1st & 2nd Elbow)	1114-C	04	02	-	
12	104-D (LTS)			1st Outlet Elbow		02	01		
13	104-D (LTS)			All T-joints from inside		04	-	-	

ANNEXURE – 8

LIST OF PIPELINES FOR PAUT (PHASED ARRAY ULTRASONIC TESTING)

Sr. No.	Line No.	Size (NB)	Sch.	From	To	No. of weld joint tested	No. of Elbows Tested	No. of T-Joints	Remarks
1	SG.1303.08-14”	14	120	105-D	SG-0044-14”	04	-	-	
				SG-0045-14"	SG-1303-12-10” & 08-10”				
2	SG.1303.09-10”	10	120	105-D, SG-1303.08-14	108-D Inlet (Bottom)	08	-	-	
3	SG.1303.10-14”	14	120	108-D	107-C	11	-	-	
4	SG.1303.11-14”	14	140	107-C	123-C	01	-	-	
5	SG-0044-14”	14	140	SG-1303.08-14	1123-C INLET	06	-	-	
6	SG-0045-14”	14	140	1123-C OUTLET	SG-1303.08-14	10	-	-	
7	SG-0047-10”	10	140	SG-0044-14”	SG-0045-14”	05	-	-	

ANNEXURE – 9 (1/2)

THICKNESS MEASUREMENT SUMMARY OF EQUIPMENT

Sr. No.	Equip. No.	Equipment Description	Shell			Dish End			Channel		
			Nom./ Design	Min. Meas.	% Red.	Nom./ Design	Min. Meas.	% Red	Nom./ Design	Min. Meas.	% Red.
1	102 - B	Start up Heater (Tubes)	8.89	9.90	-						
2	101 - CA	Primary Waste Heat Exchanger	T & B Course - 44.45 Middle- 23.81	6.8 (Jacket)	-	22.22	-	-	6.70		
3	101 - CB	Primary Waste Heat Exchanger	T & B Course - 44.45 Middle- 23.81	6.9 (Jacket)	-	22.22	-	-	6.70		
4	102 - C	Secondary Waste Heat Exchanger	66.68	60.10	9.86	NA	-	-			
5	105 - CA	CO2 Stripper Gas Exchanger	28.58	29.10	-	26.99	29.90	-			
6	105 - CB	CO2 Stripper Gas Exchanger	28.58	30.00	-	26.99	29.90	-			
7	106 - C	Shift Effluent Feed Water Heater	6.35	6.70	-	15.08	18.00	-		19.40	
8	108 - CA-1	aMDEA Solution Cooler	12.70	12.70	-	12.70	16.00	-	12.70	12.90	
9	108 - CA-2	aMDEA Solution Cooler	12.70	12.20	3.94	12.70	15.80	-	12.70	12.30	3.15
10	109 - CA-1	aMDEA Solution Exchanger	12.70	13.10	-	12.70	17.00	-	25.00	24.80	0.80
11	109 - CA-2	aMDEA Solution Exchanger	12.70	12.10	4.72	12.70	12.20	3.94	25.00	24.00	4.00
12	109 - CB-1	aMDEA Solution Exchanger	12.70	12.90	-	12.70	16.00	-	25.00	25.20	

Sr. No.	Equip. No.	Equipment Description	Shell			Dish End			Channel		
			Nom./ Design	Min. Meas.	% Red.	Nom./ Design	Min. Meas.	% Red	Nom./ Design	Min. Meas.	% Red.
13	110 - CA	CO2 Stripper Condenser	12.70	16.00	-					16.30	
14	110 - CB	CO2 Stripper Condenser	12.70	16.00	-					16.30	
15	115 - C	Methanator Effuent Cooler		19.30	-		68.00	-		19.80	
16	116 - C	Synthesis Gas Compressor Interstage Cooler	11.11	10.30	7.29	11.11	12.30	-	30.72	33.50	
17	121 - C	NH3 Converter Feed/ Converter effluent Exchanger		38.30	-					81.30	
18	122 - C	NH3 Converter Interchanger	7.90	6.20	21.52	16.00	71.20	-	7.90		
19	123 - C	NH3 Converter Feedwater Exchanger	82.55	-	-	44.00	47.90	-			
20	124 - C	Synthesis Gas Compressor After Cooler	20.00	22.19	-	16.00	19.08	-	88.90		
21	127 - CB	Refrigerant Condenser	18.00	17.87	0.72				16.00	14.23	11.06
22	128 - C	Refrigerant Compressor Inter Cooler	12.00	11.64	3.00				12.00	11.10	7.50
23	130 - JC	Air Compressor Interstage Cooler no.2	NA	12.70	-	NA	8.20	-			
24	131 - JC	Air Compressor Interstage Cooler no.3	15.80	15.39	2.59	NA	9.27	-			
25	136 - C	Synthesis Gas Methanator Feed Exchanger	15.80	15.90	-	NA	32.50	-		15.80	

Sr. No.	Equip. No.	Equipment Description	Shell			Dish End			Channel		
			Nom./ Design	Min. Meas.	% Red.	Nom./ Design	Min. Meas.	% Red	Nom./ Design	Min. Meas.	% Red.
26	101 - JCA	Surface Condenser	NA	12.10	-					11.40	
27	101 - JCB	Surface Condenser	NA	12.30	-					11.50	
28	101 - JLC1 (TOP)	Lube & Seal Oil Cooler for 101-J & 105-J	8.00	8.20	-	6.00	8.10	-	8.00	8.10	
29	101 - JLC2 (BOTTOM)	Lube & Seal Oil Cooler for 101-J & 105-J	8.00	8.00	-	6.00	8.20	-	8.00	8.00	
30	101J/105J	Lube oil Console	NA	3.20	-						
31	105-JT	Gland Condenser		7.50	-						
32	103 - D	Secondary Reformer	57.15		-	28.58		-	6.35 (Jkt)	6.80(Jkt)-T	
33	104 - D2 (BOTTOM)	LTS	60.32	63.00	-	58.74	72.20	-			
34	106 - D	Methanator	44.50		-	48.40	48.80	-			
35	107 - D	Transfer Line	3.2(Liner)	4.9 (Jacket)	-						
36	101-EA	New CO2 Absorber	M1,2,3; 33 mm thk M4;50 thk M5,6; 46 thk	50.0		Top; 32 thk Bottom; 46 thk.					
37	102 - EB	CO2 Stripper (Tray1to11) Tray 11 to bottom	9.53 15.9	10.30 16	-	11.9(T) 15.9(B)	14.4 (T)	-			
38	103-E1HP	HP FLASH Vessel		20.90	-						
39	103-E2LP	L.P. Flash Vessel		15.30	-						
40	105-E	Ammonia Wash Unit		49.90	-		50.00	-			
41	101 - F	Stream Drum	106.40	109.28	-	106.40	105.16	1.17			
42	102 - F	Raw Gas Separator	34.93	37.10	-	33.33	36.70	-			

Sr. No.	Equip. No.	Equipment Description	Shell			Dish End			Channel		
			Nom./ Design	Min. Meas.	% Red.	Nom./ Design	Min. Meas.	% Red	Nom./ Design	Min. Meas.	% Red.
43	104 - F	Synthesis Gas Compressor Suction Drum	24.60	25.40	-	23.82	25.90	-			
44	109 - F	Refrigerant Receiver	21.40	21.60	-	18.20	20.40	-			
45	141-F	New Instrument Air Receiver	NA	10.00	-	NA	11.00	-			
46	142-F	New Instrument Air Receiver	NA	13.20	-	NA	13.00	-			
47	172 - F	Ammonia liquor Tank	12.00	12.00	-		12.00	-			
48	178-F	Fuel Seperator	NA	10.10	-		10.00	-			
49	2002-F	De mineralized Water Storage Tank	4.8		-	4.8 (Roof)	4.9	-			
50	103 - JLT	Lube Oil Tank for Synthesis Gas Compressor		7.90	-						
51	101 - U	Deaerator	9.53	9.60	-	NA	9.70	-			
52	2000-SL,AD-A	New Instrument Air Drier		8.10	-		8.10	-			
53	2000-SL,AD-B	New Instrument Air Drier		8.00	-		8.00	-			
54	2005-U	Condensate Polisher	NA	13.27		NA	20.68				
55	2007-U	Resin Trap	NA	8.03	-	NA	9.03	-			
56	2008-U		NA	16.15	-	NA	19.60	-			
57	E-1	Cryogenic Exchanger (Cold Box)	NA	3.00	-	NA					
58	E-2	Feed gas Cooler		9.00	-		18.70	-			
59	K-1	Washing Tower	18.00	20.20	-		18.20	-			
60	R-2	Drying Vessel	36.00	36.31	-	36.00	36.32	-			

NOTE: All readings are in mm.

ANNEXURE – 9 (2/2)

THICKNESS MEASUREMENT SUMMARY OF HT/LT COILS

Sr. No.	Description	Design Thickness	Measured Thickness	% Reduction
Thickness Measured From East Side				
1	HT Convection Zone : HT Steam Super Heater Coil (3rd from Bottom)	8.0	8.0	-
2	HT Convection Zone : New SS Air-Preheater Coil (2nd from Bottom)	6.1	9.1	-
3	HT Convection Zone : Mixed Feed Coil (Bottom most)	8.0	12.2	-
4	LT Convection Zone : BFW Heater Coil (Bottom most)	5.54	4.8	13.35
5	LT Convection Zone : BFW Heater Coil (2nd from Bottom)	5.54	4.8	13.35
6	LT Convection Zone : BFW Heater Coil (3rd from Bottom)	3.9	4.8	-
7	LT Convection Zone : Ammonia BFW Coil (4th from Bottom)	5.54	5.8	-
8	LT Convection Zone : LT Steam Super Heater Coil (5th from Bottom)	7.01	9.1	-
9	Additional BFW Coil	-	7.4	-

NOTE : All readings are in mm.

ANNEXURE- 10

AMMONIA PLANT COOLERS PARTITION PLATE INSPECTION ATR-2023

Sr. No.	Cooler	Min. Thickness Observed (mm)
1	115-JA LO Cooler (North Side)	Top - 8.0, Bottom - 8.3
2	115-JA Lo Cooler (South Side)	Top - 9.0, Bottom - 9.4
3	115-JB LO Cooler (North Side)	Top - 8.1, Bottom - 8.3
4	115-JB Lo Cooler (South Side)	Top - 9.4, Bottom - 9.0
5	103-JA LO Cooler (East Side)	11.0
6	103-JB LO Cooler (East Side)	11.1
7	105-JT Gland condenser (West side)	14.1
8	128-C (Internal)	12.0
9	129-JC (West side)	13.8
10	130-JC (Internal)	4.9
11	130-JC (West side)	13.8
12	131-JC (Internal)	5.8
13	131-JC (South)	13.1
14	101-JT Gland condenser (East Side)	7.9
15	101-JT Gland condenser (West Side)	8.0
16	101-JCA (East Side)	Top - 18.0, Bottom - 17.6
17	101-JCB (East Side)	Top - 18.7, Bottom - 17.0
18	101-JCA/JCB LP Ejector	Top - 6.4, Bottom - 6.1
19	103-JT R COP Cooler South-Top)	9.3
20	103-JT R COP Cooler (South-Bottom)	9.2
21	101-J/ 105-J LO cooler 2 Nos.	14.5
22	103-JA	10.1
23	103-JB	10.2
24	109-C1A	15.0
25	109-C2A	13
26	109-C1B	14.4
27	109-C2B	13

ANNEXURE- 11 (1/2)

THICKNESS MEASUREMENT OF TWO PHASE FLOW PIPELINES

SR. NO.	LINE NO.	N.B. (in.)	SCH.	NOM. THK. (mm)	MAT.	LINE DESCRIPTION		Min. Thickness Observed (mm)	% RED.
						FROM	TO		
1	BO-3H	1	160	6.35	CS	102-C	BO-13-1" (SP-7)	4.4	30.71
2	BO-06	1	80	4.5	CS	BO-12H	BO-11-1.5"	4.1	8.89
3	BO-6H	1	160	6.35	CS	103-C	BO-4-1" (SP-7)	5.1	19.69
4	BO-07	1	80	4.5	CS	BO-11-1.5"	BO-14-2"	4.2	6.67
5	BO-9	1	80	4.5	CS	BO-11H	BO-11	4.1	8.89
6	BO-10	1	80	4.5	CS	BO-10H	BO-11	4.1	8.89
7	BO-10H	2	XXS	11.07	CS	AUX.BOILER COIL-E	BLOW DOWN BO-10	11.5	-
8	BO-12H	2	XXS	11.07	CS	AUX.BOILER COIL-C	BLOW DOWN BO-6	10.2	7.86
9	BO-13	1	80	4.5/5.1	CS	BO-21-1.5"	BO-3H-1"	4.5	-
10		1.5	80	4.5/5.1	CS	BO-21-1.5"	BO-3H-1"	4.4	13.39
11	BO-13AH	2	160	9.53	CS	AUX.BOILER COIL-B	BLOW DOWN BO-8	9.8	-
12	aMDEA-24A	3	40	5.5	CS	108-J	aMDEA-25-3"	4.2	23.64
13	aMDEA-24B	3	40	5.5	CS	108-JA	aMDEA-25-3"	4.4	20.00
14	aMDEA-25	3	40	5.5	CS	aMDEA-24A,B-3"	aMDEA-26B-2.5"	5	9.09

ANNEXURE- 11 (2/2)

THICKNESS MEASUREMENT OF OTHER PIPELINES

SR. NO.	LINE NO.	N.B. (in.)	SCH.	NOM. THK. (mm)	MAT.	LINE DESCRIPTION		Minimum Thickness Observed (mm)	% RED.
						FROM	TO		
1	A-20	10	20	6.35	C.S.	101 J	101 B	5.9	7.09
2	A-21	10	60	12.7	P-11	101 B	103 D	13.8	-
3	A-31	1.5	80	5.08	CS	A-20	SPEC.BRK	3.9	23.23
4	A-32	6	40	7.11	CS	101-J LP DISCH.	CV	5.9	17.02
5	BF-04	6	80	10.97	CS	104-JA	BF-22	10	8.84
6	BF-1304-1	3	160	11.13	CS	142-CA/CB	107-C	11	1.17
7	BO-11	1.5	80	5.1	CS	JCT BO-G789	BO-14	5.1	0.00
8	BO-14	3	40	5.49	CS	HEADER	156-F	5.2	5.28
9	BW-0116	3	160	11.13	CS	1123-C		10.1	9.25
10	HG-02(A-41)	3	40	5.49	CS	PGR, Cold Box Top		6.0	-
11	HS-10	6	100	13	P-11	HS-5	PIC-13 A	13.0	0.00
12	HS-11	6	120	14.27	P-11	HS-9	PIC-13 B	13.9	2.59
13	HS-12	6	100	13	P-11	HS-9	MICA-22	13	0.00

SR. NO.	LINE NO.	N.B. (in.)	SCH.	NOM. THK. (mm)	MAT.	LINE DESCRIPTION		Minimum Thickness Observed (mm)	% RED.
						FROM	TO		
14	HS-20-50	2	160	8.71		TRCV-142 STEAM D/S LINE		8.2	5.86
15	HW-25	10	30	6.35	CS	124-C	HW-5	5.8	8.66
16		4	40	6.02	CS	124-C	HW-6	5.3	11.96
17	HW-48	6	40	7.11	CS	173-C	HW-5	7.7	
18		8	40	8.18	CS	173-C	HW-5	6.5	20.54
19	aMDEA-13A	12	20	6.35	CS	109C2A	aMDEA-60	5.9	7.09
20	aMDEA-13B	12	20	6.35	CS	109C2B	aMDEA-60	5.7	10.24
21	aMDEA-14	14	20	7.92	CS	aMDEA-16	aMDEA-15A & B	7	11.62
22	aMDEA-15B	12	20	6.35	CS	aMDEA-14	108C1B	6.8	-
23	aMDEA-16B	12	20	6.35	CS	108C2B	aMDEA-62	6.1	3.94
24	aMDEA-17	16	20	7.92	CS	aMDEA-62	aMDEA-41	7.3	7.83
25	aMDEA-19C	8	30	8.38	CS	107-JC	aMDEA-21	8.1	3.34
26	aMDEA-19D	8	30	7.04	CS	107-JD	aMDEA-21	7.8	-
27	aMDEA-20	12	30	8.38	CS	aMDEA-21	101-E	8.1	3.34
28	aMDEA-21	12	30	8.38	CS	aMDEA-19C+D	aMDEA-20	9.1	-
29	aMDEA-22	4	40	6.02	CS	103-F	MEA-23A,B	6.0	0.33
30	aMDEA-23A	4	40	6.02	CS	aMDEA-22	108-J	6.0	0.33
31	aMDEA-23B	4	40	6.02	CS	aMDEA-22	108-JA	6.0	0.33
32	aMDEA-27B	18	20	7.92	CS	102-EB	aMDEA-33B	8.6	-
33	aMDEA-42	16	20	7.92	CS	aMDEA-17	MEA-18C+D	7.7	2.78
34	aMDEA-60	14	20	7.92	CS	HEADER	aMDEA-14	7.1	10.35
35	aMDEA-62	16	20	7.92	CS	HEADER	aMDEA-17	7	11.62
36	MS-11	16	60	16.66		103-J	MS-3	20.3	-
37	MS-16	2	80	5.54	CS	MS-40	112-JAT	4.6	16.97
38	MS-17	2	80	5.5	CS	MS-2	2004-JA	5.9	-
39	MS-19	6	40	7.11	CS	MS-1	107-JAT	7.7	-
40	MS-19	4	40	6.02	CS	CONTROL VALVE		6.0	0.33
41	MS-23	8	30	7	CS	MS-60	104-J	8.3	-
42		6	40	7.11	CS			6.9	2.95
43	MS-24	6	40	7.11	CS			8.2	-
44	MS-1304-03	2	40	3.91	CS	107-C Middle Course	107-C Top Header	4.3	-
45		1	80	4.55	CS	107-C Middle Course	107-C Top Header	4.1	9.89
46	NG-22	8	40	8.18	CS	176- F	NG- 30- 24"	7.3	10.76
47	NG-23	6	40	7.11	CS	NG-30	NG-26	6.9	2.95
48	NG-26	8	40	8.18	CS	NG-23	BURNER	7.1	13.20
49		3	40	5.49	CS	NG-23-8"	BURNER	5.2	5.28
50	NG-28	2.5	40	5.2	CS	NG-27	102-B	5	3.85

SR. NO.	LINE NO.	N.B. (in.)	SCH.	NOM. THK. (mm)	MAT.	LINE DESCRIPTION		Minimum Thickness Observed (mm)	% RED.
						FROM	TO		
51	NH-09	6	40	7.11	CS	NH-8	NH-114	6.9	2.95
52	NH-13	2	80	5.5	CS	109-F	126-C	6.1	-
53	NH-17	6	40	7.11	CS	109-F	NH-15	6.9	2.95
54	NH-20	18	20	7.92	CS	105-J	NH-106 A&B	7.3	7.83
55	NH-29A	6	40	7.11	CS	NH-113	118-C	6.2	12.80
56	NH-29B	6	40	7.11	CS	NH-113	118-C	6.8	4.36
57	NH-79A	6	40	7.11	CS	NH-114	119-C	6.5	8.58
58	NH-79B	6	40	7.11	CS	NH-114	119-C	6.2	12.80
59	NH-89	6	40	7.11	CS	121-J	CONTROL VALVE	7	1.55
60	NH-89	3		5.49		121-J	CONTROL VALVE	5.6	-
61	NH-106A	14	20	7.9	CS	NH-20	128-C	8.4	-
62	NH-106B	14	20	7.9	CS	NH-20	128-C	8.5	-
63	NH-113	3	40	5.49	CS	HEADER	118-C	4.9	10.75
64	NH-114	8	20	6.35	CS	HEADER	119-C	5.9	7.09
65	NH-117A	6	40	7.11	CS	NH-116	GATE	5.7	19.83
66		4	40	6.02				5.3	11.96
67	NH-117B	4	40	6.02				5.4	10.30
68	NH-117C	4	40	6.02				5.6	6.98
69	NH-118A	3	40	5.5	CS	118-J	NH-119	4.9	10.91
70	NH-118B	3	40	5.5	CS	118-JA	NH-119	4.7	14.55
71	NH-118C	3	40	5.5	CS	118-JB	NH-119	5.2	5.45
72	NH-119	3	40	5.5	CS	118-A&B	CONTROL VALVE	5	9.09
73	NH-119	4	40	6.02	CS	SWAGE	B.L.	9.9	-
74	PG-06	18	20	7.93	P11	104-D TOP	103-C	14.9	-
75	PG-07	12	30	8.38	P11	PG-6	103-C	9.3	-
76	PG-12A	14	30	9.525	SS-304	105-CA	PG-26	8.1	14.96
77	PG-15	14	XS	12.7	CS	102-F	101-E	8.3	34.65
78	PG-16	14	20	7.92	CS	101-E	136-C	6.3	20.45
79	PG-18	12	30	8.4	P-11	104-C	106-D	12.1	-
80	PW-01	6	80	10.97	CS	102-F	PW-4	11	-
81	PW-02	2	40/S	3.91	SS	SPEC.BRK.	PW-12	3.3	15.60
82	RG-02 (A-21)	8	40	8.18	CS	Tail Gas	E1	7.9	3.42
83	SC-07	2.5	80	7.01	CS	SC-42	101-JC	4.9	30.10
		1.5	80	5.08	CS			5.3	-
		1	80	4.55	CS			5.6	-
84	SC-17	3	80	7.62	CS	156-F	SEWER	6.9	9.45
85	SC-41A	6	40	7.11	CS	112-J	SC-12	6.3	11.39
86	SC-41B	6	40	7.11	CS	112JA	SC-41A	7	1.55
87	SC-42	6	40	7.11	CS	SC-41A	CV	6.3	11.39

SR. NO.	LINE NO.	N.B. (in.)	SCH.	NOM. THK. (mm)	MAT.	LINE DESCRIPTION		Minimum Thickness Observed (mm)	% RED.
						FROM	TO		
88	SC-47	10	40	9.27	CS	101-JC	112-J	6.4	30.96
89	SC-47A	10	40	9.27	CS	101-JC	112-JA	6.1	34.20
90	SC-51	2	80	5.5	CS	150-C	STS-51	5.1	7.27
91	SC-52	2	80	5.5	CS	STS-51	SC-72	5.3	3.64
92	SG-01	12	30	8.4	P-11	106-D	114-C	9.3	-
93	SG-05	14	20	7.92	CS	115-C	104-F	8	-
94	SG-08	10	40	9.27	CS	136-C	116-C	9.2	0.76
95	SG-09	10	40	9.27	CS	116-C	129-C	9.9	-
96	SG-22	12	120	25.4	CS	SG-21	105-D	24.9	1.97
97	SG-23	12	120	25.4	CS	SG-21	HEADER	25.8	-
98	SG-29	6	120	14.27	CS	SEWDGE		13.3	6.80
99	SG-29	4	120	11.13	CS	SG-21	HEADER	10.3	7.46
100	SG-32	6	7/8"	22.22	P-5	SG-62 A & B	SG-25	22.93	-
101	SG-51	8	100	15.06	CS	CONTR.VALVE	FICA-15	13.8	8.37
102	SG-62A	4	xx	17.11	P5	102-B	SG-32	12.6	26.36
103	SG-62B	4	xx	17.11	P5	103-B	SG-32	13.92	18.64
104	SG-76A	4	120	11.1	CS	SG-25	102-B	10.9	1.80
105	SG-76B	4	120	11.1	CS	SG-21	102-B	10.9	1.80
106	SG-78	8	20	6.35	CS	PIC-A	V-36	5.9	7.09
107	SG-1303- 08	14	120	27.79	P 22	105- D	SG- 33	28.7	-
108	SG-1303- 08	10	120	21.44	P 22	SG- 1303. 08	108- D INLET (Top North)	21.6	-
109	SG-1303- 09	10	120	21.44	P 22	105- D	SG-1303- 08, 14"	22.1	-
110	SG-1303- 10	14	120	27.79	P 22	108- D	107- C	26.0	6.44
111	SG-1303- 11	14	140	31.75	P 11	107- C	123- C	30.9	2.68
112	SG-1303- 12	10	120	21.44	P 22	SG-1303- 08, 14"	108- D INLET (Top South)	21.7	-
113	SG-0044	14	140	31.75	P22	1123-C GAS INLET		30.7	3.31
114	SG-0045	14	140	31.75	P22	1123-C GAS OUTLET		30.1	5.20
115	SG-0047	10	140	25.4	P22	SG-0044	SG-0045	24.9	1.97
116	FIC - 7	6	40	7.11	CS	103-JLP DISCH.	103-JLP SUCT.	8.7	-
117	PIC - 5	12	40	9.53	CS	V-6	V-7(SP-73)	12.6	-
118	PIC-16	6	40	7.11				6.9	2.95
		3	40	5.5				5.2	5.45
119	PRC - 1	6	40	7.11	CS	101/102-D INLET	VENT (SP-73)	7.1	0.14
		3	40	5.5				5.4	1.82
		2	80	5.54				7.1	-

ANNEXURE-12

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
101-BJR			
101-BJ			
Journal Bearing Sleeve	CT Side	T-0.3 B-0.5	
	SILO Side	T-0.6 B-0.5	
Shaft Journal	CT Side	0.8	
	SILO Side	0.6	
101-JR			
Gear Journal Bearing (Low Speed)	North	T-0.5 B-0.3	
	South	T-0.5 B-0.6	
Pinion Journal Bearing (High Speed)	North	T-0.2 B-0.6	
	South	T-0.6 B-0.8	
Thrust Bearing (Low Speed)	Active	0.6	
	Inactive	0.8	
Shaft Journal (Low Speed)	North (Thrust End)	0.4	
	South (Non Thrust End)	0.6	
Shaft Journal (High Speed)	North	0.2	
	South	0.5	
101-JLP			
Journal Bearing Pads	Thrust End	1.4	
	Non Thrust End	1.0	
Journal Bearing Base ring	Thrust End	0.6	
	Non Thrust End	0.4	
Thrust Bearing Pads	Active	0.5	
	Inactive	1.1	
Thrust Bearing Base ring	Active	0.9	
	Inactive	0.8	
Shaft Journal	Thrust End	1.9	
	Non Thrust End	0.4	
101-JHP			
Journal Bearing Pads	Thrust End	0.6	
	Non Thrust End	0.6	
	Thrust End	0.6	

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
Journal Bearing Base ring	Non Thrust End	0.6	
Thrust Bearing Pads	Active	0.6	
	Inactive	0.4	
Thrust Bearing Base ring	Active	0.9	
	Inactive	1.0	
Shaft Journal	Thrust End	0.5	
	Non Thrust End	0.9	
101-JLJT MOP			
Journal Bearing Pads	Thrust End	0.1	
	Non Thrust End	0.2	
Thrust Bearing Pads	Active	0.1	
	Inactive	0.3	
Shaft Journal	Thrust End	1.1	
	Non Thrust End	0.9	
107-JAT			
Journal Bearing Sleeve	Thrust End	T-0.3 B-0.1	
	Non Thrust End	T-0.5 B-0.3	
Shaft Journal	Thrust End	0.7	
	Non Thrust End	0.6	
Thrust Bearing Pads	Active	0.8	
	In Active	0.2	
103-JT			
Journal Bearing Sleeve	Thrust End	0.8	
	Non Thrust End	1.4	
Thrust Bearing Pads	Active	1.3	
	In Active	1.2	
Thrust Bearing Base ring	Active	1.0	
	In Active	1.0	
Shaft Journal	Thrust End	1.9	
	Non Thrust End	1.1	
103-JLP			
Journal Bearing Sleeve	Thrust End	0.7	
	Non Thrust End	0.8	
	Thrust End	0.5	

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
Journal Bearing Base ring	Non Thrust End	T-0.9 B-0.3	
Shaft Journal	Thrust End	1.1	
	Non Thrust End	1.6	
103-JHP			
Journal Bearing Sleeve	Thrust End	0.6	
	Non Thrust End	0.4	
Journal Bearing Pads	Active	0.4	
	In Active	-	
Thrust Bearing Base Ring	Active	0.2	
	In Active	0.2	
Shaft Journal	Thrust End	1.6	
	Non Thrust End	1.4	
Journal Bearing Base ring	Thrust End	0.3	
	Non Thrust End	0.5	
104-JAT			
Journal Bearing Sleeve	Thrust End	T-0.3 B-0.5	
	Non Thrust End		
Thrust Bearing Pads	Active	0.6	
	Inactive	0.6	
Shaft Journal	Thrust End	1.0	
	Non Thrust End	2.0	
104-JA			
Journal Bearing Sleeve	Thrust End	T-0.5 B-0.9	
	Non Thrust End	T-0.5 B-0.6	
Shaft Journal	Thrust End	0.7	
	Non Thrust End	2.8	
105-JR			
Gear Journal Bearing	North	T-0.3 B-0.4	
	South	T-0.5 B-0.2	
Pinion Journal Bearing	North	T-0.2 B-0.1	
	South	T-0.1 B-0.2	
Thrust Bearing	Active	T-0.3 B-0.6	
	In Active	T-0.5 B-0.8	
Shaft Journal (Low Speed)	North	0.3	
	South	0.1	

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
Shaft Journal (High Speed)	North	0.2	
	South	0.6	
105-JT			
Journal Bearing Pad	Thrust End	0.4	
	Non Thrust End	0.5	
Journal Bearing Base ring	Thrust End	T-0.1 B-0.2	
	Non Thrust End	T-0.1 B-0.2	
Thrust Bearing Pads	Active	0.3	
	Inactive	0.7	
Thrust Bearing Base ring	Active	0.5	
	Inactive	0.5	
Shaft Journal	Thrust End	0.6	
	Non Thrust End	0.9	
105-JLP			
Thrust Bearing Pads	Active	0.4	
	Inactive	0.5	
Thrust Bearing Base ring	Active	0.3	
	Inactive	0.2	
Shaft Journal	Thrust End	0.1	
	Non Thrust End	-	
105-JHP			
Thrust Bearing Pads	Active	0.4	
	Inactive	0.2	
Thrust Bearing Base ring	Active	0.3	
	Inactive	0.2	
Shaft Journal	Thrust End	0.1	
	Non Thrust End	0.3	
115-JAT			
Journal Bearing Liner	Thrust End	T-0.4 B-1.1	
	Non Thrust End	T-0.5 B-0.9	
Shaft Journal	Thrust End	1.5	
	Non Thrust End	1.6	

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
115-JR			
Gear Journal Bearing	Front (West)	T-0.2 B-0.4	
	Rear (East)	T-0.1 B-0.7	
Pinion Journal Bearing	Front (West)	T-0.4 B-0.6	
	Rear (East)	T-0.5 B-0.4	
Gear Shaft Journal	Thrust End	0.5	
	Non Thrust End	0.4	
Pinion Shaft Journal	Front (West)	0.1	
	Rear (East)	1.2	

ANNEXURE-13

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
1	(Parent Metal) On parent metal of 1st elbow of NG-9-12” (101B-Mixed feed coil outlet to NG-11)	P-11	WELD	• Microstructure reveals, polygonal ferrite and lamellar pearlite grains. Pearlite grains decomposition observed. • Alert: Need Monitoring In next SD opportunity, this spot and new adjacent replica spots to be developed, to check, verify if any further deterioration is progressive. • Microstructure is free from any, micro cracks.
2	Weld On Weld Betn pipe & Elbow (Elbow side) ofNG-9-12” (101B-Mixed feed coil outlet to NG-11)	P-11	WELD	• Microstructure reveals grain boundary ferrite with some side plate ferrite and acicular ferrite. • Microstructure is normal for Weld. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
3	(Weld + HAZ) On Dissimilar Weld Betⁿ Pipe Piece & Nozzle of Header towards HAZ of P-11, NG-9-12" (101B-Mixed Feed Coil Outlet to NG-11)	P-11	HAZ	**Parent Metal** • Microstructure revealed polygonal ferrite and lamellar pearlite grains. No carbide precipitation is observed. • Microstructure is normal. No metallurgical degradation observed. • Microstructure is free from any, micro cracks. **Weld** • Microstructure revealed dendritic structure of ferrite pools in austenite matrix. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			WELD	• Microstructure revealed s dendritic structure of ferrite pools in austenite matrix. • Microstructure is normal for Weld. No incipient crack / fissure noted.
4	(Weld + HAZ) On Dissimilar weld bet" pipe piece & nozzle of header towards HAZ of SS304, NG-9-12" (101B-Mixed feed coil outlet to NG-11)	P-11 TO SS-304	HAZ	**Parent Metal** • Microstructure reveals, austenite grains, with twins. Microstructure is normal. No metallurgical degradation observed. Microstructure is free from any, micro cracks. **Weld** • Microstructure revealed dendritic structure of ferrite pools in austenite matrix. • Microstructure is normal for Weld. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
			WELD	• Microstructure revealed s dendritic structure of ferrite pools in austenite matrix. • Microstructure is normal for Weld. No incipient crack / fissure noted.
5	(Weld + HAZ) Weld bet" flange & elbow of gas inlet nozzle, PG-6-18" towards east side of 103C	P-11	WELD	• Microstructure reveals grain boundary ferrite with some side plate ferrite and pearlite. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			HAZ	• Microstructure reveals, Fine recrystallized grains on left side with ferrite and pearlite grains of parent metal on right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
6	SG-1303-08-14" (H-36) On 108-D Converter Inlet 'Reducer' (Weld + HAZ of Reducer)	P-22	HAZ	• Microstructure reveals, Fine recrystallized grains on top side with ferrite and bainite grains of parent metal on bottom side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
		P-22	WELD	• Microstructure reveals, primary ferrite (PF) and FS ferrite with second phase (bainite). • Microstructure is normal for Weld. No incipient crack / fissure noted
7	SG-1303-08-14" (H-36) on 108-D Converter inlet, Reducer, (Weld + HAZ of Pipe)	P-22	HAZ	• Microstructure reveals, Fine recrystallized grains on right side with ferrite and bainite grains of parent metal on left side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
			WELD	• Microstructure reveals grain boundary ferrite with some side plate ferrite and bainite. • Microstructure is normal for Weld. No incipient crack / fissure noted.
8	SG-0047-10", ON 1123-C, Converter inlet 'Tee' (Weld + HAZ of pipe)	P-22	WELD	• Microstructure reveals Grain boundary ferrite, and intergranular ferrite, with ferrite-MAC (bainite) structure. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			HAZ	• Microstructure reveals, Fine recrystallized grains on right side with ferrite and bainite grains of parent metal on left side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
9	(Weld + HAZ of Nozzle) SG-1303-10-14" (H-36) On 108-D Converter Outlet Nozzle	P-22	WELD	• Microstructure reveals Grain boundary ferrite, and intergranular ferrite, with ferrite-MAC (bainite) structure. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			HAZ	• Microstructure reveals, Fine recrystallized grains on right side with ferrite and bainite grains of parent metal on left side. Grains are coarser. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
10	(Weld + HAZ of Pipe) SG-1303-10-14" (H-36) On 108-D Converter Outlet Nozzle & Elbow at Top	P-22	WELD	• Microstructure reveals Grain boundary ferrite, and intergranular ferrite, with ferrite-MAC (bainite) structure. • Microstructure is normal for Weld. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
			HAZ	• Microstructure reveals, Fine recrystallized grains on left side with ferrite and bainite grains of parent metal on right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
11	(Parent Metal) SG-1303-10-14” (H-36) On 108-D Converter Outlet to 107-C Gas Inlet Elbow-01	P-22	Parent Metal	• Microstructure reveals ferrite and bainite grains. • Microstructure is normal. No metallurgical degradation observed. • Microstructure is free from any, micro cracks.
12	(Parent Metal) SG-1303-10-14” (H-36) On 108-D Converter Outlet to 107-C Gas Inlet Elbow-04	P-22	Parent Metal	• Microstructure reveals, polygonal ferrite and bainite grains. • Microstructure is normal. No metallurgical degradation observed. • Microstructure is free from any, micro cracks.
13	(Parent Metal) SG-1303-10-14” (H-36) On 108-D Outlet to 107-C Gas Inlet elbow-5	P-22	Parent Metal	• Microstructure reveals polygonal blocky ferrite and bainite grains. • Grain sizes is very coarser. • Microstructure is normal. No metallurgical degradation observed. • Microstructure is free from any, micro cracks.
14	Weld + HAZ of Elbow) SG-1303-11-14” (H-34) On 107-C Gas Outlet Nozzle & HAZ of Elbow	P-11	HAZ	• Microstructure reveals, Fine recrystallized grains on right side with ferrite and pearlite grains of parent metal on left side. • Grains are coarser. • Microstructure is normal for HAZ. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
			WELD	• Microstructure reveals grain boundary ferrite with some side plate ferrite and pearlite. • Microstructure is normal for Weld. No incipient crack / fissure noted.
15	Weld + HAZ of Nozzle) SG-1303-11-14” (H-34) On 107-C Gas Outlet Nozzle & HAZ of Nozzle	P-11	HAZ	• Microstructure reveals, Fine recrystallized grains on right side with ferrite and pearlite grains of parent metal on left side. • Grains are coarser. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
			WELD	• Microstructure reveals, primary ferrite (PF) and FS ferrite with second phase (bainite). • Microstructure is normal for Weld. • No incipient crack / fissure noted.
16	(Weld + HAZ) Riser No.-01, Riser to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800 HT	WELD	• Microstructure revealed s dendritic structure, and primary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix with some precipitate and twinning, on left side • The cast dendritic structure of filler metal is at right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
17	(Weld + HAZ) Riser No.-02, Riser to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800 HT	WELD	• Microstructure revealed s dendritic structure of ferrite pools in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix with some precipitate, on left side. • The cast dendritic structure of filler metal is at right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
18	(Weld + HAZ) Riser No.-03, Riser to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800 HT	WELD	• Microstructure revealed s dendritic structure, and primary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix with some precipitate, on right side • The cast dendritic structure of filler metal is at left side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
19	(Weld + HAZ) Riser No.-04, Riser to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800 HT	WELD	• Microstructure revealed s dendritic structure with primary & secondary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
			HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix, on right side. • The cast dendritic structure of filler metal is at left side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
20	(Weld + HAZ) Riser No.-05, Riser to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800 HT	WELD	• Microstructure revealed s dendritic structure with primary & secondary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix, on left side. • The cast dendritic structure of filler metal is at right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
21	(Weld + HAZ) Riser No.-06, Riser to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800	WELD	• Microstructure revealed s dendritic structure and primary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
		HT	HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix, having carbides and precipitates on grain boundaries on right side. • The cast dendritic structure of filler metal is at left side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
22	(Weld + HAZ) Riser No.-07, Riser to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800 HT	WELD	• Microstructure revealed s dendritic structure and primary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix, having carbides and precipitates on grains on left side. • The cast dendritic structure of filler metal is at right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
23	(Weld + HAZ) Riser No.-08, Riser to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800	WELD	• Microstructure revealed s dendritic structure and primary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
		HT	HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix, with precipitated carbides on grain boundaries on left side. • The cast dendritic structure of filler metal is at right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
24	(Weld + HAZ) Row No.-01, Tube no.35, Tube to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800 HT	WELD	• Microstructure revealed s dendritic, structure with primary & secondary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix, with precipitated carbides on grain boundaries on left side. • The cast dendritic structure of filler metal is at right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
25	(Weld + HAZ) Row No.-03, Tube no.40, Tube to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800 HT	WELD	• Microstructure revealed s dendritic, structure with primary & secondary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
			HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix, with precipitated carbides on grain boundaries on right side. • The cast dendritic structure of filler metal is at left side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
26	(Weld + HAZ) Row No.-06, Tube no.18, Tube to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800 HT	WELD	• Microstructure revealed s dendritic, structure with primary & secondary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.
			HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix, with precipitated carbides on grain boundaries on right side. • The cast-fibrous dendritic structure of filler metal is at right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
27	(Weld + HAZ) Row No.-07, Tube no.37, Tube to Weldolet Weld Joint	Tube : G-4852 M Weldolet 800 HT	WELD	• Microstructure revealed s dendritic, structure with primary & secondary carbides in austenite matrix, with nickel solid solutions. • Microstructure is normal for Weld. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
			HAZ	• Microstructure reveals, wrought parent metal having solid solution austenite matrix, with precipitated carbides on grain boundaries on right side. • The cast dendritic structure of filler metal is at left side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
28	(Parent Metal) Riser No.-07	Tube : G-4852 M	Parent Metal	• Microstructure revealed, solid - solution matrix. • Primary and Secondary carbides observed in austenite matrix. • Microstructure is normal. No metallurgical degradation observed. • Microstructure is free from any, micro cracks.
29	106 D, Bottom Dish End to shell joint at East side	CS	HAZ	• Microstructure reveals, Fine recrystallized grains on left side with ferrite and pearlite grains of parent metal on right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
			Parent Metal	• Microstructure reveals polygonal blocky ferrite and lamellar pearlite grains. • Microstructure is normal. No metallurgical degradation observed. • Microstructure is free from any, micro cracks.
			DE WELD	• Microstructure reveals grain boundary ferrite with some side plate ferrite and acicular ferrite. • Microstructure is normal for Weld. No incipient crack / fissure noted.

SR. NO.	LOCATION	MOC	Location	MICROSTRUCTURE OBSERVATION
30	102 B COIL FROM SG-76-B (1st Weld Joint)	P22	Parent Metal	• Microstructure reveals polygonal ferrite and lamellar pearlite grains. • Microstructure is normal. No metallurgical degradation observed. • Microstructure is free from any, micro cracks.
			HAZ	• Microstructure reveals, Fine recrystallized grains on left side with ferrite and pearlite grains of parent metal on right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
			WELD	• Microstructure reveals grain boundary ferrite with some side plate ferrite and acicular ferrite. • Microstructure is normal for Weld. No incipient crack / fissure noted.
31	102 B Coil From SG -76-A (1st Weld Joint)	P22	Parent Metal	• Microstructure reveals polygonal blocky ferrite and lamellar pearlite grains. • Microstructure is normal. No metallurgical degradation observed. • Microstructure is free from any, micro cracks.
			HAZ	• Microstructure reveals, Fine recrystallized grains on left side with ferrite and pearlite grains of parent metal on right side. • Microstructure is normal for HAZ. No incipient crack / fissure noted.
			WELD	• Microstructure reveals grain boundary ferrite with some side plate ferrite and acicular ferrite. • Microstructure is normal for Weld. No incipient crack / fissure noted.

ANNEXURE - 14

UFD & RT STATUS OF CONVERTER LOOP

JOINT NO.	2017		2018		2021		2023	
	UFD	**RT**	**UFD**	**RT**	**UFD/ PAUT**	**RT**	**UFD/ PAUT**	**RT**
FROM 108D TO 107C, LINE NO: SG-1303-10-14", SCH-120 (27.79MM NOM THICK.)								
Elbows 1 to 5	Indication observed in E4 Elbow	Confirmed by RT and found satisfactory	NSD	--	--	--	--	--
J-1	NSD	--	NSD	--	NSD	--	--	--
J-2	NSD	--	NSD	--	NSD	--	--	--
J-3	NSD	--	NSD	--	--	--	--	--
J-4	NSD	--	NSD	--	--	--	--	--
J-5	NSD	--	NSD	--	--	--	--	--
J-6	NSD	--	NSD	--	NSD	--	--	--
J-7	NSD	--	NSD	--	NSD	--	--	--
J-8	NSD	--	NSD	--	--	--	--	NSD
J-9	NSD	--	NSD	--	--	--	--	NSD
J-10	NSD	--	NSD	--	NSD	--	--	--
J-11	NSD	--	NSD	--	NSD	--	--	--
J-12	NSD	--	NSD	--	NSD	--	--	--
FROM 105D TO 108D, LINE NO: SG-1303-8-10" SCH-120 (21.44MM NOM THICK.), **SG-1303-8-14"** SCH 120 (27.79MM NOM THICK.), **SG-1303-9-10"** SCH-120 (21.44MM NOM THICK.) & **SG-1303-12-10**" SCH-120 (21.44 MM NOM THICK.)								
Elbows 1 to 15	NSD	E-2 Elbow replaced	PAUT of elbow 2,4,5,6 & 7 , NSD	--	--	--	--	--
J-1	--	--		--	--	--	--	--
J-2	NSD	--		--	--	--	--	--
J-3	NSD	New joint of elbow replaced	NSD	--	--	NSD	--	--
J-4	NSD	New joint of elbow replaced	NSD	--	--	--	--	--
J-5	NSD	--	--	--	--	--	--	--
J-6	NSD	--	--	--	--	--	--	--
J-7	NSD	--	--	--	--	--	--	--
J-8	NSD	--	NSD	--	--	--	--	--

JOINT NO.	2017		2018		2021		2023	
	UFD	RT	UFD	RT	UFD/ PAUT	RT	UFD/ PAUT	RT
J-9	NSD	--	NSD	--	--		--	--
J-9A	NSD	--	NSD	--	--	NSD	--	--
J-9B	--	--	--	--	--	NSD	--	--
J-10	NSD	--	NSD	--	--		--	--
J-11	NSD	--	NSD	--	--	NSD	--	--
J-12	NSD	--	NSD	--	--	NSD	--	--
J-13	NSD	--	NSD	--	--	NSD	--	--
J-14	NSD	--	NSD	--	--	NSD	--	--
J-15	NSD	--	NSD	--	--	NSD	--	--
J-16	NSD	--	NSD	--	--	NSD	--	--
J-17	NSD	--	NSD	--	--	NSD	--	--
J-17B	NSD	--	NSD	--	--	NSD	--	--
J-17C	NSD	--	NSD	--	--	NSD	--	--
J-18	NSD	--	NSD	--	--	NSD	--	--
J-19	NSD	--	--	--	--	--	--	--
J-20	NSD	--	--	--	--	--	--	--
J-21	NSD	--	--	--	--	--	--	--
J-22	NSD	--	--	--	--	--	--	--
J-23	NSD	--	--	--	--	--	--	--
J-24	NSD	--	--	--	--	--	--	--
J-25	NSD	--	--	--	--	--	--	--
J-26	NSD	--	--	--	--	--	--	--
J-27	NSD	--	--	--	--	--	--	--
J-28	NSD	--	--	--	--	--	--	--
J-29	NSD	--	--	--	--	--	--	--
J-30	NSD	--	--	--	--	--	--	--
J-T1	NSD	New joint of Tee replaced	--	--	--	NSD	--	--
J-T2	NSD	New joint of Tee replaced	--	--	--	NSD	--	--
J-T3	NSD	New joint of Tee replaced	--	--	--	--	--	--
J-T4	NSD	--	--	--	--	--	--	--
J-T5	NSD	--	--	--	--	--	--	--
J-T6	NSD	--	--	--	--	--	--	--
FROM : 107-C TO 123-C, LINE NO: SG-1303-11-14", SCH-140 (31.75MM NOM THICK.)								
Elbows	NSD	--	NSD	--	--	--	--	--

JOINT NO.	2017		2018		2021		2023	
	UFD	RT	UFD	RT	UFD/ PAUT	RT	UFD/ PAUT	RT
1 to 6								
J-1	NSD	--	--	--	NSD	--	--	--
J-2	NSD	--	NSD	--	--	--	--	--
J-3	NSD	--	NSD	--	NSD	--	--	--
J-4	NSD	--	--	--	NSD	--	--	--
J-5	NSD	--	NSD	--	--	--	--	--
J-6	NSD	--	NSD	--	--	--	--	--
J-7	NSD	--	NSD	--	--	--	--	--
J-8	NSD	--	--	--	--	--	--	--
J-9	NSD	--	NSD	--	NSD	--	--	--
J-10	NSD	--	NSD	--	NSD	--	--	--
J-11	NSD	--	NSD	--	NSD	--	--	--
J-12	NSD	--	--	--	NSD	--	--	--
FROM : 105-D TO 1123-C, LINE NO: SG-0044-H-36-14", SCH-140 (31.75MM NOM THICK.)								
Elbows 1 to 5	--	--	--	--	--	--	--	--
J-1	--	NSD	--	--	--	--	--	--
J-2	--	NSD	--	--	--	NSD	--	--
J-3	--	NSD	--	--	--	--	--	--
J-4	--	NSD	NSD	--	--	--	--	--
J-5	--	NSD	NSD	--	--	--	--	--
J-6	--	NSD	NSD	--	--	--	--	--
J-7	--	NSD	NSD	--	--	--	--	--
J-8	--	NSD	NSD	--	--	--	--	--
J-9	--	NSD	NSD	--	--	--	--	--
J-10	--	NSD	NSD	--	--	NSD	--	--
J-11	--	NSD	NSD	--	--	NSD	--	--
J-12	--	NSD	NSD	--	--	NSD	--	--
J-13	--	NSD	NSD	--	--	NSD	--	--
J-14	--	NSD	NSD	--	--	NSD	--	--
J-15	--	NSD	NSD	--	--	NSD	--	--
J-16	--	NSD	NSD	--	--	NSD	--	--
J-17	--	NSD	NSD	--	--	NSD	--	--
J-17A	--	NSD	NSD	--	--	NSD	--	--
J-18	--	NSD	NSD	--	--	NSD	--	--
J-18A	--	NSD	NSD	--	--	NSD	--	--
FROM : 1123-C TO 108-D,								

JOINT NO.	2017		2018		2021		2023	
	UFD	RT	UFD	RT	UFD/ PAUT	RT	UFD/ PAUT	RT
LINE NO: SG-0045-H-36-14", SCH-140 (31.75MM NOM THICK.)								
Elbows 1 to 4	--	--	NSD	--	--	--	--	--
J-1	--	NSD	NSD	--	--	NSD	--	--
J-2	--	NSD	NSD	--	--	NSD	--	--
J-3	--	NSD	NSD	--	--	NSD	--	--
J-4	--	NSD	NSD	--	--	NSD	--	--
J-5	--	NSD	NSD	--	--	--	--	--
J-6	--	NSD	NSD	--	--	--	--	--
J-7	--	NSD	NSD	--	--	--	--	--
J-8	--	NSD	NSD	--	--	--	--	--
TJ-1	--	NSD	NSD	--	--	--	--	--
TJ-2	--	NSD	NSD	--	--	--	--	--
TJ-3A	--	NSD	NSD	--	--	--	--	--
TJ-4	--	NSD	--	--	--	--	--	--
TJ-5	--	NSD	--	--	--	--	--	--
T1	--	NSD	NSD	--	--	--	--	--
T2	--	NSD	--	--	--	--	--	--
FROM : SG-0044 TO SG-0045, **LINE NO: SG-0047-H-36-10**", SCH-140 (25.4 MM NOM THICK.)								
Elbows 1 to 4	--	--	--	--	--	--	--	--
J-1	--	NSD	--	--	--	NSD	--	--
J-2	--	NSD	--	--	--	NSD	--	--
J-3	--	NSD	NSD	--	--	--	--	--
J-4	--	NSD	NSD	--	--	NSD	--	--
J-5	--	NSD	NSD	--	--	--	--	--
J-6	--	NSD	NSD	--	--	NSD	--	--
J-7	--	NSD	NSD	--	--	NSD	--	--
J-8	--	NSD	NSD	--	--	NSD	--	--
J-9	--	NSD	NSD	--	--	--	--	--
J-10	--	NSD	NSD	--	--	--	--	--

NSD: NO SIGNIFICANT DEFECT

UREA PLANT
(INSPECTION)

HIGH PRESSURE VESSELS

Following High-pressure equipment were inspected. The observations are listed below:

AUTOCLAVE (V-1201)

VISUAL INSPECTION

Thorough visual inspection of the liner, its welds, trays, Downcomer and internals were carried out. Total 10 nos of defects like pinholes, weld opening, crevices observed which were repaired by grinding and welding. All repaired defects found satisfactory in DP test.

As a major activity entire downcomer pipe was replaced with new pipe of 10''NB x 8.00 mm thk , 2Re69 MOC except top funnel and bottom 10'' x 8'' NB reducer.

Observations made on each compartments are mentioned below.

Compartment No.1 (Top Compartment)

- High roughening /corrosion of man way liner including its cladding, weld and on parent metal observed. Man way liner "L" seam weld observed more rough/ porous with compare to its ''C'' Seam weld. Same was observed in past inspection also.



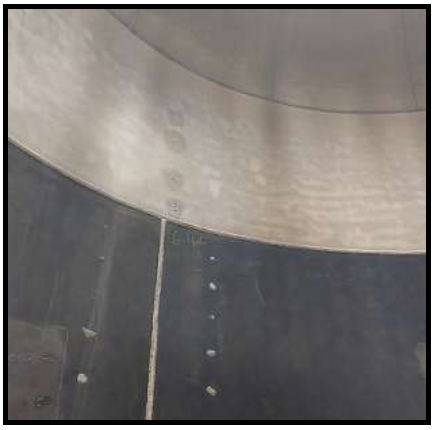
- Parent metal of man way liner observed rough / corroded / eroded at several scattered locations.


- Man way to dome liner weld observed rough.

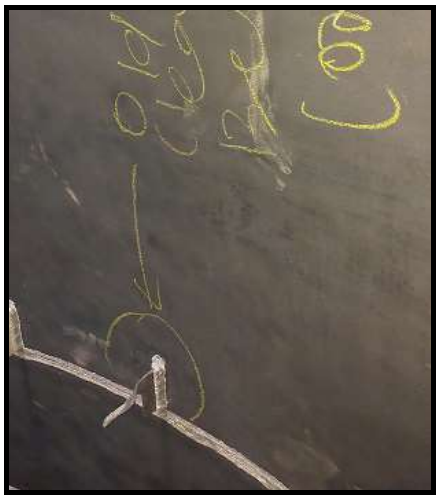
- Petal welding and parent metal observed rough / porous. Same was observed in past inspection also.


- Black paste like deposition observed on dome area in west direction.

- Liner plate piece just below dome liner was found silver bright in colour throughout in circumference and below that liner plate observed brownish in colour.



- Bulging of 5 to 8 mm height and 75mm width observed 500 mm above tray level in South –West location. The same was observed in past.
- “C” Seam and “L” seam of liner welding found satisfactory.
- 01 nos. of old tray holding clits (total-14) was found bend, black in colour and having sever corrosion attack including its welding, same observed in last inspection.



- Down-comer cone (Funnel) observed silver shiny in colour and rough in surface. Downcomer pipe was replaced with new pipe of 2Re69 MOC.

Compartment No.2

- All new cleats (Total-14 No's) and its welding observed satisfactory.
- Previously repaired defects found satisfactory.
- "C" Seam and "L" seam of liner welding found satisfactory.

Compartment No.3

- Bulging of approx. 8mm depth and 2.5" width was observed in SW to South direction just above "C" seam near insert liner, same was observed during previous inspection.
- 03 nos. of tray holding clits were observed blackish in color and having severe corrosion attack including its welding, same observed in last inspection
- Circumferentially provided Insert liner (Size 3.5Ft long x 4 Inch width approx) observed silver shiny in color.
- Previously repaired defects found satisfactory.
- "C" Seam and "L" seam of liner welding found satisfactory.

Compartment No.4

- Approx. 30 mm below circumferential weld depression of approx. 100 mm dia. and 3 mm depth was observed at west side liner. Same was observed during last inspection.

- Convex bulging of liner plate observed just above circumferential weld by approx. 4 mm height in complete circumference. Same was observed during last inspection.
- Concave depression of approx 2-5 mm depth observed at approx. 200mm below the C-weld seam in approx. 80% of the periphery. Same was observed during last inspection.
- 03 nos. of tray holding cleats (11 Old + 09 New=20) were found black and observed sever corrosion attack including its welding, same observed in last inspection.
- Circumferentially provided Insert liner (Size 3.0 Ft long x 4 Inch width approx) observed silver shiny in color.
- "C" Seam and "L" seam of liner welding found satisfactory.

Compartment No.5

- Convex bulging of liner plate was observed just above the circumferential weld joint by approx. 3 to 9 mm height in almost all the periphery. The same was observed during last inspection.
- Concave depression of approx. 2-6 mm was observed at approx. 500 mm below the C-weld seam in full periphery. The same was observed during last inspection.
- "C" Seam and "L" seam welding found satisfactory.
- **On "C" seam weld Pinhole of approx. 0.3 to 0.5mm and 3 to 4 mm depth observed, Marked as D5-1 for repair.** Repair was carried out by welding and found satisfactory in DP test.

Compartment No.6

- Convex bulging of liner plate was observed above the circumferential weld joint by approx. 3 to 10 mm height, which starts from north-west to south-east direction in approx. Length of 4500 mm. The same was also observed during last inspection.
- Concave depression of approx. 5 mm depth was observed at approx. One meter below C-weld seam from East to West side L-seam through North side of the shell. The same was also observed during last inspection.
- Previously repaired defects found satisfactory.
- "C" Seam and "L" seam welding found satisfactory.
- 12 old cleats having minor corrosion whereas 11new cleats and its welding observed satisfactory.
- Shell liner observed brownish black in colour.
- **On "L" seam weld at two different locations Pinholes of approx. 0.3 to 0.5mm and 3 to 4 mm depth were observed, Marked as D6-1 and D6-2 for repair.** Repair was carried out by welding and found satisfactory in DP test.

Compartment No.7

- Convex bulging of liner plate was observed above the circumferential weld joint by approx. 2-6 mm height at few locations. The same was observed during last inspection also.
- Concave bulging 1200mm below C seam and max. 5 mm. depth in approx. 60% periphery.
- 04 nos. of tray holding clits were found to be blackish in coloration and having severe corrosion attack including it's welding, same observed in last inspection.
- "C" Seam and "L" seam welding found satisfactory.
- Previously repaired defects were observed satisfactory.
- Tray orientation was in NW – SE direction.

- 11 old cleats having minor corrosion whereas 10 new cleats and its welding observed satisfactory.

Compartment No.8

- Concave bulging at the elevation of approx. 300 mm above tray and 3 to 6mm. deep was observed in complete circumference. The same was observed during previous inspection also.
- 04 nos. of tray holding clits were found blackish in colour and having corrosion attack including its welding, same observed in last inspection.
- Insert liner found silver shiny in color and Shell liner observed brownish black in colour.

- "C" Seam and "L" seam welding found satisfactory.
- 04 old cleats (out of 10) having minor corrosion whereas 10 new cleats and its welding observed satisfactory.
- Tray orientation was in NE – SW direction.
- **On "C" seam weld of insert liner at two different locations Pinholes of approx. 0.3 to 0.5mm and 3 to 4 mm depth were observed, Marked as D8-1**

and D8-2 for repair. Repair was carried out by welding and found satisfactory in DP test.



Compartment No.9

- 02 no. of tray holding cleats were found blackish in colour and having corrosion attack including its welding, same observed in last inspection.
- No noticeable bulging observed in liners.
- Insert liner found silver shiny, Shell liner observed brownish black in colour.
- "C" Seam and "L" seam of liner welding found satisfactory.
- 10 New and 11 Old cleats and its welding observed satisfactory.
- Trays orientation is in NW-SE direction.

Compartment No.10

- Concave depression of approx 7mm depth at approx 70mm below the C-weld seam in south side of shell in approx. 100 mm dia was observed. Same as last Inspection.
- Concave depression of approx. 9 mm depth just above the C-weld seam towards the south side and adjacent to L-seam in approx. 100 mm dia. was observed. Same as last Inspection.

- Vertical bulging of approx. 2-3 mm height 25mm wide was observed from the C-weld seam to the bottom of the compartment in north side of the shell. The same was observed during last inspection also.
- Concave depression of about 5mm depth at approx 70mm below C seam in west side just adjacent to L seam was observed in 100 mm area. The same was observed during last inspection also.
- Insert liner found silver shiny.
- "C" Seam and "L" seam of liner welding found satisfactory.
- Shell liner observed brownish in colour
- Previously repaired defects were observed satisfactory.
- 10 New and 11 Old cleats and its welding observed satisfactory.
- Down comer was observed brown in colour with corrosion in its welding.

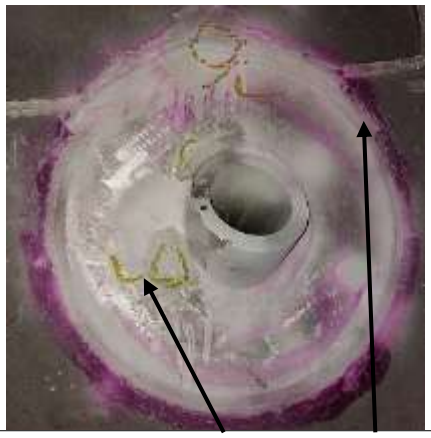
Compartment No.11

- Just below circumferential weld concave depression of approx. 10 to 12 mm depth in approx. 100mm dia. in North-West direction was observed. The same was observed during last inspection also.
- On insert liner segment convex bulging up to max. 5 to 8 mm height having width approx. 20-25 mm observed just above circumferential stitch welds (approx. 125 mm long). Same was observed during last Inspection also.
- Concave depression of about 5-6 mm was observed just above and below of C-weld seam in old and new liner. The same was observed during last inspection also.
- Insert liner and shell liner ''L'' and "C'' seam welding observed satisfactory.
- Insert liner observed silver shiny and shell liner observed dark brow in colour.
- Shell liner observed brownish black in colour.

- 11 New and 11 Old cleats and its welding observed satisfactory.

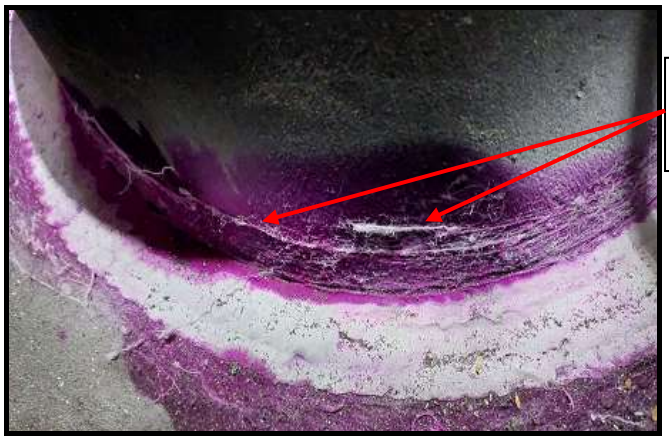
Compartment No.12 (Bottom Compartment.)

- Down comer nozzle with dish end liner found satisfactory
- Reducer of 10''x8'' observed silver shiny in colour.
- Dark brown coloration on dish end observed.
- Concave depression of approx. 2-3 mm depth and approx. 5mm width were observed at approx. 200mm above the C-weld seam in 4"dia in east and west direction of the shell respectively. The same was observed during last inspection also.
- All old tray holding cleats (15 no's) were found blackish in color and having corrosion attack, however all new cleats (14 no's) and It's welding observed satisfactory.
- Tray orientation is in North –South direction.
- Two no's of long seams observed satisfactory. (North – South Direction)
- Petal welds condition observed satisfactory. (Total 12 Seams)
- All nozzles welding D.P test carried out and and few of them are observed with defects which were repaired by welding and found satisfactory in re dp test.



Two no's of indications observed in DP test. Repaired by grinding and welding.

One no's of indication observed in DP test. Repaired by grinding and welding.

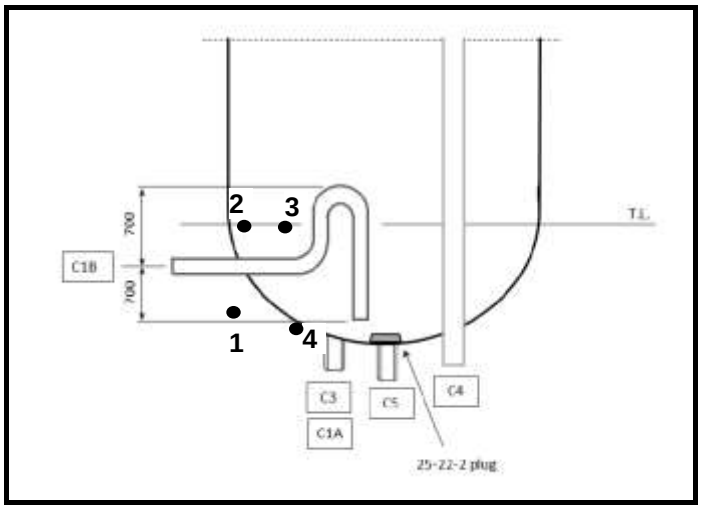


Weld opening /crevices observed at many locations hence complete circumferential weld run provided.

One no's of indication observed in DP test. Repaired by grinding and welding.

- C1B nozzle (8''NB Goose neck) found satisfactory in its position.

- Thickness measurement on C1B nozzle (8''NB Goose neck) carried out and readings are mentioned below.



Meas. Location	Nom.Thk 8''NBX10S	North	So	st	West	Remarks
1	3.76	3.35	3.42	3.50	--	Elbow (Outer)
2	3.76	3.40	3.37	3.22	--	Elbow (Outer)
3	3.76	3.44	3.46	3.28	--	Elbow (Outer)
4	3.76	3.98	3.99	4.02	4.01	Pipe

NOTE:

- Severe etching observed on Downcomer and on its welding in almost all the compartment
- NE-North East, SW-South West, NW-North West, SE- South East, 'L'- Long seam, 'C'- Circumferential seam.
- NW - SE orientation of trays- Tray No-01 from North side.
- NE - SW orientation of trays- Tray No-01 from East side.
- Helium leak detection test was carried out by M/S Gulachi Engineers and pinhole observed in 10th compartment lower "C" seam of Insert liner in 2015.

- Helium leak detection test was carried out by M/S Gulachi Engineers and pinhole/crack observed in 5th compartment at bottom of cleat welding in south direction near “C” seam in 2018.

- All compartments new Trays installed by M/S Ganesh Engg. & Co. in 2016 and designed by Casale. These trays are in 6 segments .
  - In all compartments all tray segments were observed silver shiny in colour in SD-2018.
- Entire downcomer pipe (10’’NB x 8.00 mm thk) was replaced with new pipe of 2Re69 MOC except top funnel and bottom 10’’ x 8’’ NB reducer by M/S Shree Ganesh Engg. & Co.in SD-2023.
  - In all compartments downcomer pipe observed silver shiny in colour.

THICKNESS MEASUREMENT

DETAILED THICKNESS REPORT OF AUTOCLAVE (V-1201)							
COMPARTMENT NO.	LOCATION OF MEASURMENT	NOM. THK. (mm.)	OBSERVED THICKNESS (in mm.)				REMARK
			EAST (1)	WEST (2)	NORTH (3)	SOUTH (4)	
01 TOP COMPARTMENT	Manway Liner	6.5	6.52	6.32	6.68	6.56	Replaced in Yr. 2002 by BC-05.
	Dish End (Top Dome)	6.5	6.60	6.42	6.98	6.20	Replaced in Yr. 2002 by BC-05.
	Shell Liner (New)	6.5	6.25	6.42	6.60	6.22	750mm Section Replaced in Yr. 2002 by BC-05.
	Shell Liner Old (Top)	5.0	3.90	3.52	3.78	3.55	
	Shell Liner (Middle)	5.0	4.00	3.50	4.03	3.54	
	Shell Liner (Bottom)	5.0	4.04	3.53	3.99	3.50	
	Tray Segment -1	5.0	5.50	5.00	5.42	5.49	
	Tray Segment -2	5.0	5.93	5.57	5.28	5.40	
	Tray Segment -3	5.0	5.30	5.34	5.26	5.20	
	Tray Segment -4	5.0	5.34	5.38	5.28	5.38	
	Tray Segment -5	5.0	5.39	5.42	5.44	5.40	
	Tray Segment -6	5.0	5.40	5.27	5.28	5.27	
	Down Comer	8.0	7.96	7.99	8.02	8.10	
02	Shell Liner (Top)	5.0	3.35	3.92	3.90	3.33	
	Shell Liner (Middle)	5.0	3.43	3.95	4.04	3.42	
	Shell Liner	5.0	3.25	4.04	4.02	3.25	

DETAILED THICKNESS REPORT OF AUTOCLAVE (V-1201)							
COMPARTMENT NO.	**LOCATION OF MEASURMENT**	**NOM. THK. (mm.)**	**OBSERVED THICKNESS (in mm.)**				**REMARK**
			EAST (1)	**WEST (2)**	**NORTH (3)**	**SOUTH (4)**	
	(Bottom)						
	Tray Segment-1	5.0	5.33	5.15	5.49	5.25	
	Tray Segment-2	5.0	5.20	5.12	5.40	5.47	
	Tray Segment-3	5.0	5.10	5.17	5.20	5.37	
	Tray Segment-4	5.0	5.16	5.33	5.16	5.33	
	Tray Segment-5	5.0	5.47	5.24	5.22	5.30	
	Tray Segment-6	5.0	5.22	5.40	5.46	5.46	
	Down-Comer	8.0	7.95	8.03	7.94	7.86	
03	Insert Liner	6.5	5.40	5.67	5.62	5.78	Replaced in Yr. 1997
	Shell Liner (Top)	5.0	3.27	3.78	3.70	3.16	Overall Min. liner thickness SD-2023
	Shell Liner (Middle)	5.0	3.45	3.75	3.66	3.55	
	Shell Liner (Bottom)	5.0	3.42	3.52	3.50	3.43	
	Tray Segment-1	5.0	5.30	5.35	5.51	5.36	
	Tray Segment-2	5.0	5.30	5.31	5.24	5.26	
	Tray Segment-3	5.0	5.33	5.34	5.48	5.46	
	Tray Segment-4	5.0	5.31	5.32	5.51	5.41	
	Tray Segment-5	5.0	5.41	5.40	5.36	5.51	
	Tray Segment-6	5.0	5.51	5.40	5.41	5.48	
	Down-Comer	**8.00**	7.61	7.76	7.72	7.83	
04	Insert Liner	6.5	6.20	6.18	6.22	6.13	Replaced in Yr.1999
	Shell Liner (Top)	5.0	3.50	3.43	3.42	3.95	
	Shell Liner (Middle)	5.0	3.86	3.68	3.65	3.65	
	Shell Liner (Bottom)	5.0	3.68	3.94	3.60	3.75	
	Tray Segment-1	5.0	5.26	5.39	5.30	5.33	
	Tray Segment-2	5.0	5.26	5.39	5.30	5.33	
	Tray Segment-3	5.0	5.32	5.49	5.46	5.48	
	Tray Segment-4	5.0	5.51	5.49	5.43	5.38	
	Tray Segment-5	5.0	5.48	5.27	5.30	5.44	
	Tray Segment-6	5.0	5.43	5.51	5.55	5.57	
	Down-Comer	10.0	7.66	7.71	7.51	7.71	
05	Shell Liner (Top)	5.0	3.86	4.26	3.88	4.60	
	Shell Liner	5.0	4.27	4.34	4.04	4.80	

DETAILED THICKNESS REPORT OF AUTOCLAVE (V-1201)							
COMPARTMENT NO.	**LOCATION OF MEASURMENT**	**NOM. THK. (mm.)**	**OBSERVED THICKNESS (in mm.)**				**REMARK**
			EAST (1)	**WEST (2)**	**NORTH (3)**	**SOUTH (4)**	
	(Middle)						
	Shell Liner (Bottom)	5.0	4.36	4.24	4.40	4.34	
	Tray Segment-1	5.0	5.37	5.30	5.31	5.30	
	Tray Segment-2	5.0	5.24	5.36	5.39	5.36	
	Tray Segment-3	5.0	5.45	5.35	5.36	5.34	
	Tray Segment-4	5.0	5.57	5.36	5.40	5.38	
	Tray Segment-5	5.0	5.26	5.26	5.22	5.28	
	Tray Segment-6	5.0	5.46	5.36	5.40	5.44	
	Down-Comer	8.0	8.10	8.05	8.25	8.03	
06	Shell Liner (Top)	5.0	3.80	4.28	3.99	3.98	
	Shell Liner (Middle)	5.0	3.89	4.13	3.98	4.40	
	Shell Liner (Bottom)	5.0	3.78	4.11	3.93	4.04	
	Tray Segment-1	5.0	5.48	5.51	5.46	5.42	
	Tray Segment-2	5.0	5.43	5.41	5.46	5.41	
	Tray Segment-3	5.0	5.39	5.38	5.40	5.45	
	Tray Segment-4	5.0	5.57	5.49	5.36	5.41	
	Tray Segment-5	5.0	5.39	5.48	5.37	5.38	
	Tray Segment-6	5.0	5.37	5.43	5.44	5.48	
	Down-Comer	10.0	8.05	8.06	8.05	8.00	
07	Shell Liner (Top)	5.0	3.96	4.26	4.16	4.20	
	Shell Liner (Middle)	5.0	4.05	4.30	4.08	4.36	
	Shell Liner (Bottom)	5.0	3.92	4.46	4.06	4.54	
	Tray Segment-1	5.0	5.45	5.55	5.47	5.50	
	Tray Segment-2	5.0	5.36	5.51	5.44	5.38	
	Tray Segment-3	5.0	5.32	5.32	5.33	5.43	
	Tray Segment-4	5.0	5.43	5.40	5.32	5.31	
	Tray Segment-5	5.0	5.56	5.61	5.60	5.62	
	Tray Segment-6	5.0	5.18	5.17	5.15	5.13	
	Down-Comer	8.0	8.08	8.24	8.12	8.26	
08	Insert Liner	6.5	6.48	6.86	6.72	6.72	Replaced in Yr. 2000
	Shell Liner (Top)	5.0	4.48	4.32	4.22	4.42	
	Shell Liner (Middle)	5.0	4.72	4.57	4.38	4.54	
	Shell Liner (Bottom)	5.0	4.47	4.39	4.23	4.39	
	Tray Segment-1	5.0	5.83	5.69	5.64	5.65	
	Tray Segment-2	5.0	5.60	5.62	5.63	5.61	

DETAILED THICKNESS REPORT OF AUTOCLAVE (V-1201)							
COMPARTMENT NO.	**LOCATION OF MEASURMENT**	**NOM. THK. (mm.)**	**OBSERVED THICKNESS (in mm.)**				**REMARK**
			EAST (1)	**WEST (2)**	**NORTH (3)**	**SOUTH (4)**	
	Tray Segment-3	5.0	5.55	5.54	5.53	5.55	
	Tray Segment-4	5.0	5.52	5.57	5.59	5.54	
	Tray Segment-5	5.0	5.56	5.61	5.60	5.62	
	Tray Segment-6	5.0	5.65	5.67	5.66	5.64	
	Down-Comer	8.0	8.13	8.06	8.09	8.10	
09	Insert Liner	6.5	6.89	6.66	6.54	6.68	Replaced in Yr. 2001
	Shell Liner (Top)	5.0	4.38	4.63	4.46	4.49	
	Shell Liner (Middle)	5.0	4.53	4.59	4.57	4.36	
	Shell Liner (Bottom)	5.0	4.56	4.47	4.44	4.61	
	Tray Segment-1	5.0	5.26	5.35	5.33	5.34	
	Tray Segment-2	5.0	5.33	5.24	5.18	5.23	
	Tray Segment-3	5.0	5.39	5.38	5.32	5.30	
	Tray Segment-4	5.0	5.46	5.48	5.46	5.47	
	Tray Segment-5	5.0	5.42	5.55	5.44	5.55	
	Tray Segment-6	5.0	5.48	5.64	5.42	5.44	
	Down-Comer	8.0	8.12	8.13	8.11	8.13	
10	Insert Liner	6.5	6.51	6.54	6.43	6.81	Replaced in Yr. 2002
	Shell Liner (Top)	5.0	4.63	4.94	5.11	5.91	
	Shell Liner (Middle)	5.0	4.90	5.38	5.22	5.88	
	Shell Liner (Bottom)	5.0	4.76	5.26	5.20	5.96	
	Tray Segment-1	5.0	5.6	5.51	5.52	5.41	
	Tray Segment-2	5.0	5.48	5.49	5.46	5.62	
	Tray Segment-3	5.0	5.62	5.57	5.60	5.52	
	Tray Segment-4	5.0	5.46	5.52	5.51	5.60	
	Tray Segment-5	5.0	5.50	5.42	5.48	5.51	
	Tray Segment-6	5.0	5.41	5.60	5.51	5.47	
	Down-Comer	**8.00**	8.30	8.40	8.41	8.29	
11	Insert Liner	6.5	6.65	6.65	6.48	6.60	Replaced in Yr. 2002
	Shell Liner (Top)	5.0	4.30	4.43	4.30	4.48	
	Shell Liner (Middle)	5.0	4.57	4.49	4.40	4.42	
	Shell Liner (Bottom)	5.0	4.57	4.48	4.50	4.52	
	Tray Segment-1	5.0	5.40	5.42	5.44	5.46	
	Tray Segment-2	5.0	5.47	5.38	5.36	5.42	
	Tray Segment-3	5.0	5.50	5.52	5.42	5.38	

DETAILED THICKNESS REPORT OF AUTOCLAVE (V-1201)							
COMPARTMENT NO.	**LOCATION OF MEASURMENT**	**NOM. THK. (mm.)**	**OBSERVED THICKNESS (in mm.)**				**REMARK**
			EAST (1)	**WEST (2)**	**NORTH (3)**	**SOUTH (4)**	
	Tray Segment-4	5.0	5.50	5.51	5.48	5.42	
	Tray Segment-5	5.0	5.47	5.49	5.44	5.50	
	Tray Segment-6	5.0	5.60	5.67	5.60	5.62	
	Down-Comer	**8.00**	8.02	8.12	8.09	8.14	
12 BOTTOM COMPARTMENT	Shell Liner	5.0	4.55	4.63	4.57	4.60	
	Petal Plate	7.0	6.09	5.63	6.02	6.03	
	Bottom Dome	7.0	5.98	6.17	6.21	6.18	Replaced in Yr. 1993
	Reducer 10" X 8"	10.0	9.32	9.30	9.25	9.30	Replaced in Yr. 1997
	Down-Comer	8.0	8.10	8.03	8.16	8.00	
	Nozzle-8"	6.0	6.17	6.24	6.13	6.39	As per visual insp report through holes were observed and min measured thickness was 2.1 mm near leakage/hole and same was replaced with new piece by M/S ISGEC, Dahej in S/D-2021.

Note

Tray and Downcomer Replacement History

- The Complete down-comer was replaced in 1997.
- 1997 H.E. Trays installed by L&T and Supplied by Scholler & Blackman, Germany.
- 2016 New Trays installed by M/s Shri Ganesh Engg. & Co and Designed & Supplied by Casale Urea in all Compartments. These trays are in 6 segments. Tray Material is UNS-S31050 (25 Cr-22Ni-2Mo Alloy).
- Complete downcomer pipe of 10"NB x 8.00 mm thickness (except top funnel and bottom 10''x8''NB reducer), was replaced with new of MOC-2RE69 by M/S Ganesh Engg. & Co in S/D-2023

HP STRIPPER (H-1201)

VISUAL INSPECTION

TOP CHANNEL

- The condition of sealing face was satisfactory.
- A thin blue grey oxide layer covered the overlay welding and liner in the gas phase (man way, dome and part of cylinder), except for the areas between the strip beads.


- The liner and liquid inlet box in the liquid phase were grey and slightly etched.

- Silver shiny surface observed at bottom portion of shell liner. Its height in mm from top tube sheet measured at different directions are as per under photographs.




- Blackish deposition observed in North and North-West direction on the shell.


- The overlay welding on the tube sheet was grey and slightly etched.

- The tube welds were bright and smooth and brownish in colour from inside. Tube stub ends observed etched / rough in many tubed.

- Thick & hard oxide deposition of 3-5 mm thick approx. was observed, more prominent in center of tube sheet and East direction on tube sheet area.

- Minor pittings were observed in ID of tubes 5 to 6mm from stub end edge in many tubes.
- Reddish coloration observed at one location in ID of gas outlet nozzle.

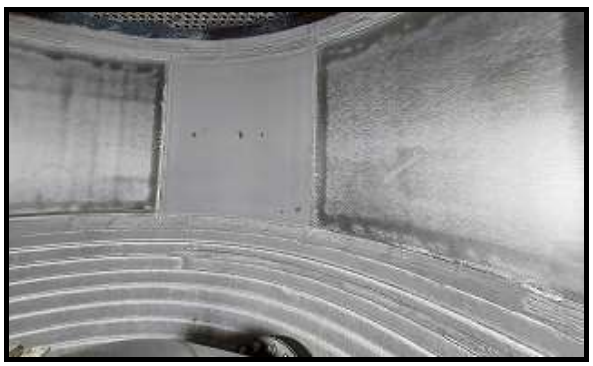
BOTTOM CHANNEL

- The condition of sealing face observed slightly etched.

- The overlay welds in the man way observed silver and slightly etched.

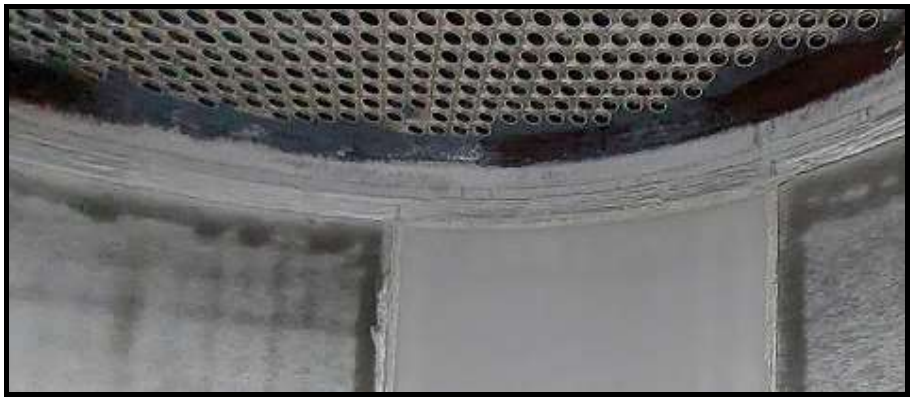
- The overlay welds in the hemi-head were silver and etched. Many patches of approx. 2”x2” size on the hemi-head overlay welds were observed which were more etched than the surrounding areas in North and East direction, same was observed in previous inspection also.

- Cylindrical liner observed silver shiny in colour, however one liner plate observed little rough and dull in shine.



- The tube sheet was covered with a thin grey oxide layer. This layer seams to be more hard & bonded on tube-sheet to shell weld joint.

- Dark brown patches were observed at periphery of tube sheet same was observed in previous inspection also.



- The tubes from inside were smooth.
- Minor pittings were observed in ID of tubes 5 to 8 mm from stub end edge in many tubes.
- The liquid outlet pipe and the gas inlet pipe were observed bright and shiny. Its condition found satisfactory.
- Reddish coloration observed in dish end near radioactive source well.

- Blackish coloration observed at one corner of CO2 gas inlet nozzle distribution plate.

BOTTOM COVER

- The overlay welding was smooth and shows no defects.
- The vortex strips were silver shiny and good in condition.

FERRITE MEASUREMENT

Ferrite measurement was carried out at random locations on welds and parent metal from top and bottom dome. No ferrite was found.

THICKNESS MEASUREMENT

The weld overlay thickness is measured with a Fischer Dual Scope MP40 & liner thickness was measured using DMS-2 Ultrasonic thickness meter.

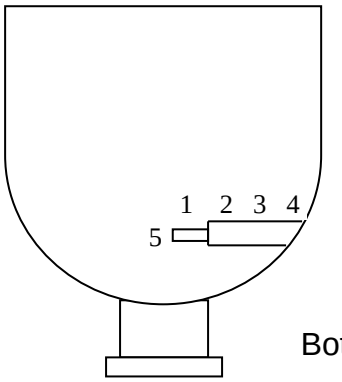
TOP DOME

	Minimum Thickness (mm)	Maximum Thickness (mm)	Design Thickness, mm (Minimum)
Man way (Overlay)	21.92	23.19	8.00
Dome area (Overlay)	11.84	13.90	8.00
Cylindrical area (Liner)-Gas phase	7.75	8.77	8.00
Cylindrical area (Liner)-Liquid phase	7.46	8.25	8.00

BOTTOM DOME

	Minimum Thickness (mm)	Maximum Thickness (mm)	Design Thickness, mm (Minimum)
Man way (Overlay)	21.20	23.76	8.0
Dome area (Overlay)	13.28	14.07	8.0
Cylindrical area (Liner)	8.29	8.33	8.0
Bottom Cover (Overlay)	16.14	17.31	8.0

RADIOACTIVE SOURCE WELL



Bottom Dish End

POINT NO.	DESIGN THK.	MEASURED THICKNESS (Minimum)
1	7.5	8.83
2	19.0	19.80
3	19.0	19.73
4	19.0	19.63
5	7.5	10.70

All measurements are in mm.

EDDY CURRENT TESTING OF TUBES

Eddy current inspection of tubes was carried out by M/TesTex NDT India Pvt. Ltd. for 2581 tubes from top tube sheet end up to a length of 4.5 meters. 19 tubes were plugged before inspection. (Total no of tubes 2600)

RESULT AND CONCLUSION:

- Majority of the wall thinning was observed between 2nd to 5th baffle from top tube-sheet.
- 11 nos of tubes were observed having maximum wall loss of 1.80mm (Remaining Wall Thickness 1.50mm) (Cumulative since March-2002).
- 57 nos of tubes were observed having maximum wall loss of 1.70mm (Remaining Wall Thickness 1.60mm).

- Rest of the tubes were observed having maximum wall loss in the range of 1.10 mm to 1.60 mm (Remaining wall thickness range of 1.70 to 2.20 mm.)
- Total 68 tubes (57+11) were plugged having remaining thickness ranging from 1.50 to 1.60 mm. in SD-2023
- (Tube sheet layout attached at Annexure-6).
- All 68 tubes each from top and bottom tube sheet were plugged by welding. DP test carried out and found satisfactory.
- Total 87 tubes plugged till SD-2023.

- After that pneumatic test was carried out at 0.48 to 0.40 Kg/Cm2 and found satisfactory.

H-1205 (LP CARBAMATE CONDENSER)

TOP TUBE SHEET OF H-1205, LP CARBAMATE CONDENSER

- Tube to tube sheet welding found satisfactory.
- Minor scaling observed in ID of the tubes.
- All tubes were found filled with water.

IRIS INSPECTION OF TUBES

- Tube Dimensions in mm: 25.4 OD x 2.1 thick x 6000 long (vertical: ‘U’ TUBES)
- Grade: SS 316L
- Total Nos. Of Tubes: 1162 (581 'U' tubes)

Tubes were inspected by M/S Engineering Inspection Services, Mumbai by Internal Rotating Inspection System (IRIS). Total No. of inspected U-tubes are 576 Nos. (1152 tube holes).

Observations of IRIS are as under:

Sr No	% Wall Loss	No. of Tubes (Total Inspected 1154 Holes.)		
		2018	2021	2023
1	0-10	733	1044	974
2	11-20	310	090	160
3	21-30	084	000	0
4	31-40	012	016	16
5	41-50	003	002	002
6	51-60	000	000	000
7	Not Interpreted	012	- - -	- - -

- Localized Baffle Fretting between 90° to 180° degree circumferences was recorded in most of the defective tubes near to bend area.
- Minimum remaining wall thickness observed during the IRIS are 1.16 mm and 1.13 mm respectively in East half Row # 4 Tube # 13 and West half Row # 1 Tube # 02. Thickness reduction observed in the range of 45 to 50 % and same two tubes were plugged in SD-2023.
- Remaining wall thickness observed during inspection of all tubes are given in Tube Test Summary and color-coded format is given in Tube Sheet Map Layout.

Note:

- Row No. Inlet-East to West / Outlet-West to East.
- Tube No. Inlet- North to South / Outlet- North to South
- The tube sheet layout is attached at Annexure-7.

INSPECTION OF OTHER VESSELS / EQUIPMENT

H-1131-A (LO COOLER OF P-1102-A)

- Condition of tube to tube sheet weld was found satisfactory.
- Thin scaling observed inside the tubes.
- Rusting/corrosion observed on the channel area & baffle plate.

H-1131-B (LO COOLER OF P-1102-B)

- Condition of tube to tube sheet weld was found satisfactory.
- Thin scaling observed inside the tubes.
- Rusting/corrosion observed on the channel area & baffle plate.

H-1231-A (LO COOLER OF P-1201- A)

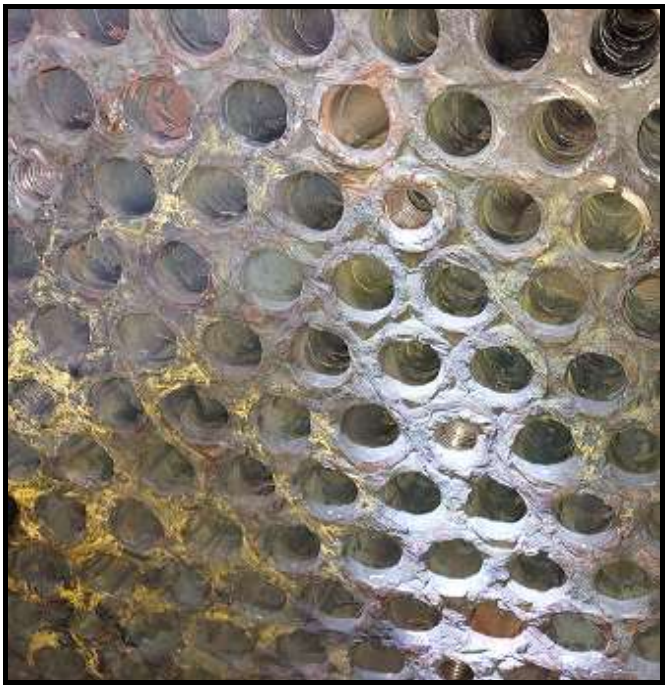
- Condition of tube to tube sheet weld was found satisfactory.
- Thin scaling observed inside the tubes.
- Minor rusting/corrosion observed on the channel area & baffle plate.

H-1231-B (LO COOLER OF P-1201- B)

- Condition of tube to tube sheet weld was found satisfactory.
- Thin scaling observed inside the tubes.
- Minor rusting/corrosion observed on the channel area & baffle plate.

H-1204 (RECIRCULATION HEATER)

- Hard blackish scale observed inside the tubes from bottom tube sheet.



- Minor brownish scaling was observed inside the tubes from top tube sheet.
- Tube to tube sheet welding found satisfactory.
- Visual inspection carried out after hydro jetting.

H-1208 (PROCESS WATER COOLER)

- Tube to tube sheet welding was found satisfactory.
- Minor thin white scales observed inside the tubes.

H-1352 (REFUX CONDENSER)

- After re-hydro jetting tube to tube sheet weld joints from top & bottom found satisfactory.
- Tubes found cleaned viewed from top and bottom side.

H-1419 (PRE-EVAPORATOR CONDENSER)

- Tube to tube sheet weld found satisfactory.
- Whitish scaling was observed inside the tubes.
- Re hydro jetting may be carried out.

H-1420 - TOP (FINAL CONDENSER)

- Tube to tube sheet welding found satisfactory.
- After hydrojetting tubes observed satisfactory from ID.

H-1422 (FIRST STAGE EVAPORATOR)

- The shell and Dish ends observed grayish black in color.

- Colour of tube sheet observed blackish.
- Tubes to tube sheet weld joints were found satisfactory. Brownish scaling observed inside many tubes.

- Condition of impingement cone found satisfactory.

- Impingement cone to support bolts were observed bent, however they were tack welded and found satisfactory.

- Condensate flushing nozzles was found in satisfactory.
- Urea deposition observed in slots.

- At bottom dish end water and Urea accumulation observed.

- Overall condition of vessel is satisfactory.

H-1423 (FIRST STAGE EVAPORATOR CONDENSER)

- Tube to tube sheet welding was found satisfactory.
- Brownish scaling was observed on the tube to tube sheet weld joints.
- Minor scales were observed inside few tubes.
- Tube sheet was found brownish in coloration.
- Hydro jetting of tubes was under progress.
- Overall condition of the exchanger was found satisfactory.

H-1424 (2ND STAGE EVAPORATOR)

- Shiny silver surface observed inside the vessel.

- Impingement cone corner was found bent in downward directions at few locations, this was also observed in earlier inspection.

- Tube to tube sheet welding found satisfactory, urea solution layer observed on scattered locations on the tube sheet. Scaling observed from the I.D in many tubes.

- Circumferential sparger and its supports found bent in downward direction at many locations. Sparger clamps observed broken at many locations.



- Melt pump suction line observed satisfactory.

- Vapor outlet line observed clear.

- H-1425 (Second Evaporator First Condenser):
- Tube to tube sheet welding was found satisfactory.
- Whitish scale was observed inside the tubes.
- Overall condition of heat exchanger was found satisfactory.

H-1426 (SECOND EVAPORATOR SECOND CONDENSER)

- Tube to tube sheet welding was found satisfactory.
- Thin brownish scales were observed on the tube sheet.
- Tubes were found filled with water.

H-1811, 1st INTER STAGE COOLER OF HITACHI COMPRESSOR

- Condition of tubes and tube sheet was found satisfactory.
- Thin scattered scaling observed on tubes.
- Cleaning from tube I.D Observed satisfactory.
- Corrosion observed on baffles and tie rods.
- Parting plate thickness found satisfactory (12.15 mm.)

H-1812, 2nd INTER STAGE COOLER OF HITACHI COMPRESSOR

- Condition of tubes and tube sheet was found satisfactory.
- Cleaning from tube I.D Observed satisfactory.
- Thin scattered scaling observed on tubes OD.
- Corrosion observed on baffles and tie rods.
- Inspection carried out after tube bundle removal from shell.

H-1813, 3rd INTER STAGE COOLER OF HITACHI COMPRESSOR

- Condition of tubes and tube sheet was found satisfactory.
- Cleaning from tube I.D Observed satisfactory.
- Corrosion observed on baffles and tie rods.
- Thin scattered scaling observed on tubes OD.
- Parting plate thickness found satisfactory (10.50 mm.)

H-1814-A and H-1814-B, L.O. COOLERS OF HITACHI COMPRESSOR

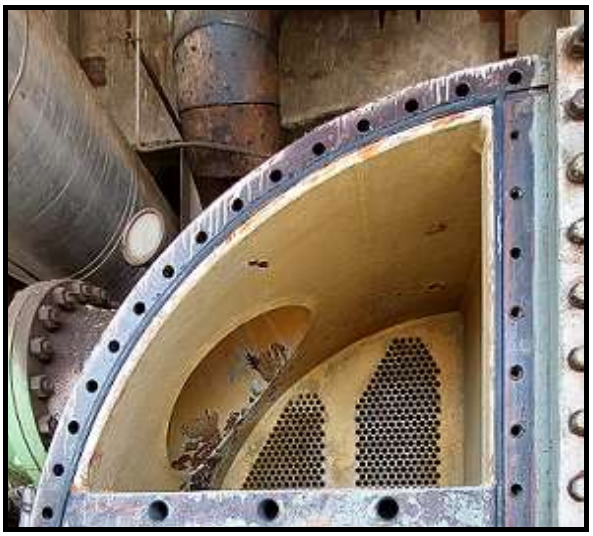
- Condition of tubes and tube sheet was found satisfactory.
- Thin white scaling observed inside the tubes.
- Few tubes observed partially filled with water.
- Epoxy layer was found peeled off at several locations on channel cover & partition plates, repainting may be carried out.

H-1815 (SURFACE CONDENSER)

SOUTH SIDE HALF (EAST SIDE CHANNEL)

TOP HALF

- Tube sheet and tubes observed satisfactory in condition.
- Scale layer observed on entire half.



- Thermowell observed covered with white colour scales.
- Few tubes observed partially filled with water.
- Parting plate thickness found satisfactory (18.10 mm.)
- White dry scaling was observed inside the tubes, re-hydro jetting suggested and found satisfactory after that.

BOTTOM HALF

- Tube sheet and tubes observed satisfactory in condition.
- Epoxy coating layer was found peeled off at several locations.

- Few tubes observed partially filled with water.
- White dry scaling was observed inside the tubes, re-hydro jetting suggested and found satisfactory after that.

SOUTH SIDE HALF (WEST SIDE CHANNEL)

TOP HALF

- Tube sheet and tubes observed satisfactory in condition.
- Scale layer observed on entire half.

- Thick layer of scale observed accumulated on the baffle plate.
- White dry scaling was observed inside the tubes, re-hydro jetting suggested and found satisfactory after that.

BOTTOM HALF

- Tube sheet and tubes observed satisfactory in condition.
- Epoxy coating layer was found peeled off at several locations.
- White dry scaling was observed inside the tubes, re-hydro jetting suggested and found satisfactory after that.

NORTH SIDE HALF

(EAST SIDE CHANNEL)

TOP HALF

- Tube sheet was found in satisfactory condition.
- Epoxy coating layer was found peeled off and cracked at several locations.
- Thermo well was found intact.
- Minor scaling was observed inside few tubes.

BOTTOM HALF

- Tube sheet was found in satisfactory condition.
- Epoxy coating was found peeled off at few locations.
- Minor scaling was observed inside few tubes.
- One tube found leaky in water fill test and same was plugged.

(WEST SIDE CHANNEL)

TOP HALF

- Tube sheet was found in satisfactory condition.
- Minor scaling was observed inside the tubes.
- Epoxy coating was found peeled off at partition plate to tube sheet corner.

BOTTOM HALF

- Tube sheet was found in satisfactory condition.
- Thermo well was found intact.
- Debris found accumulated at bottom corner.

T-1301 (AMMONIA Water TANK)

- Bottom plate and bottom half of shell observed brownish in colour.
- Silver bright colour observed on top half of shell.
- Bottom plate was found bulged upwards at various locations, same was observed in past inspection also.
- Weld joints and nozzle condition was found satisfactory.
- Thermowell condition was found satisfactory.
- Internal surface of the shell was found oily.
- Condition of the roof was found satisfactory

T-1301-A, NEW AMMONIA WATER TANK

- Bottom plate and bottom half of shell observed brownish in colour.
- Top dome observed silver shiny in colour.
- All the weld joints and nozzle condition was found satisfactory.
- Thermo-well found intact.
- Overall condition was satisfactory.

T-1340 (AMMONIA WATER TANK)

- Bottom plate and bottom half of shell observed silver shiny in colour.
- Silver bright colour observed on entire shell and roof.
- Bottom plate was found bulged upwards at various locations (Near M/H).
- Weld joints and nozzle condition was found satisfactory.
- Thermowell condition was found satisfactory.
- Condition of the roof was found satisfactory.
- Stiffener provided to the pipes found intact in position.

T-1401 UREA SOLUTION TANK

- Brownish coloration observed inside of the shell.
- Thermo-well condition found satisfactory.
- Nozzles and weld joints condition found satisfactory.
- Bottom plate having upward bulging at center and downward at entire
- Circumference as observed in the past also.
- Stiffener provided on top roof plate was found intact in position.
- Overall condition was satisfactory.

T-1401-A, NEW UREA SOLUTION TANK

- Brownish coloration observed inside of the shell.
- Thermo-well condition found satisfactory.
- Nozzles and weld joint condition satisfactory.
- Overall condition found satisfactory.

T-1501 (CONDENSATE TANK).

- Inside surface of tank observed reddish brown in colour.

- Weld joints condition found satisfactory.
- Supports of 6”NB and 8’’NB condensate inlet found satisfactory.
- 2’’NB DM water makeup line sparger observed satisfactory.
- Water with resins observed accumulated at the floor.

- Level indicator nozzle observed filled with resins.

- Overall condition of the tank found satisfactory.

NEW INSTRUMENT AIR RECEIVER

- Bottom dish end observed satisfactory.
- Epoxy paint observed satisfactory on shell.
- Weld joints condition found satisfactory.
- Nozzles condition found satisfactory.
- Overall condition found satisfactory.

V-1101 (CO_2 KNOCK OUT DRUM)

- Epoxy paint was found peeled off from many locations in bottom dish end and on shell.

- Co2 inlet line observed satisfactory.

- Demister pads found intact in its position, however one bolt of its holding tray observed loose.

- Rusting / corrosion observed in bottom dish water outlet / drain line.

- All visible weld seams found satisfactory.
- End cap welding found satisfactory.

V-1202 (RECTIFYING COLUMN)

FROM TOP MANHOLE

- Grey hard scales were observed on entire shell portion; however, it was peeled off at some locations.
- Tray holding cleats holes observed elongated.
- Mesh found damaged at 01 location.
- Tray support / Mesh Grid support strips found satisfactory and they were covered with grayish hard scales.

V-1203 (L.P. ABSORBER)

FROM TOP END

- Shell observed brownish in colour.
- Perforated support grid was found intact in position.
- All internals were taken outside.

FROM BOTTOM MANHOLE

- Shell observed silver shiny in colour.
- Weld joints condition found satisfactory.
- Vortex Breaker was found intact.

- Perforated support grid was found distorted as viewed from top & bottom side.

V-1205 (L.P. CARBAMATE SEPARATOR)

FROM TOP MANHOLE

- Brownish black coloration observed at top dish end and rest of the area observed silver gray coloration inside the vessel.
- Condition of all nozzles found satisfactory.
- Overall condition was found satisfactory.

V-1206 (ATMOSPHERIC VENT SCRUBBER)

- Demister pads were found intact and satisfactory in position.

- Shell observed brownish red in color from inside.
- All bolts of liquid inlet flange found satisfactory.
- Liquid distributor condition found satisfactory.

- Overall condition was found satisfactory.

V-1207 (L.P. SCRUBBER)

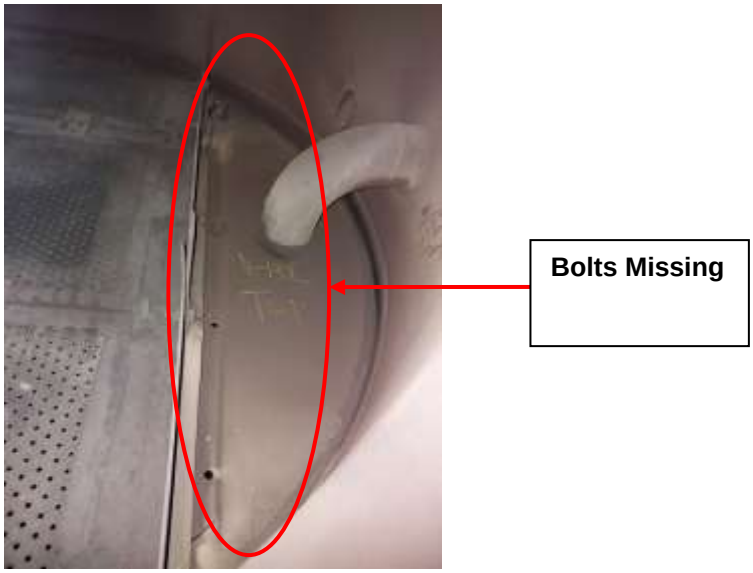
- Inspection carried from top & bottom end.
- Shell portion observed brownish black from inside
- Grating condition was satisfactory.
- Condition of the top cover was found satisfactory.
- Thermowell was found intact.

V-1301 (2ND Desorber)

TOP COMPARTMENT

- Shell Internal surface found rusty / brownish in colour.
- Nozzle found satisfactory.

- Perforated tray might be observed shifted / bolts in missing condition.



- Fasteners and clamp of trays observed in satisfactory condition.

BOTTOM COMPARTMENT

- Shell observed brownish in colour from inside.
- Nozzle condition was found satisfactory.
- Thermo well was found intact.
- Tray condition observed satisfactory.
- Weld joint condition was found satisfactory.

<u>V-1351 (HYDROLYSER)</u>

FROM TOP M/H.

- Vessel was offered for visual inspection after dismantling middle segment of trays till 10th compartment.
- Brownish coloration was observed on Top dish end and shell.

- Trays also observed reddish in color with minor oily sludge at periphery.

- Fasteners of sieve tray were found intact in position for other than dismantled segments.
- Accumulated sludge / debris observed in ¾'' nozzles near M/H (Top) in east side.

- Tray segments condition found satisfactory till 10th compartment.

- All visible weld seams observed satisfactory.

FROM BOTTOM M/H

- Thermowell condition found satisfactory.
- Steam inlet line flange and clamping bolt missing / loose.

- Reddish coloration was observed from inside.
- Middle tray condition found satisfactory.

V-1352 (FIRST DESORBER)

FROM TOP MANHOLE

- Brownish coloration was observed inside the vessel.
- All fasteners were found intact.
- Weld joint condition was found satisfactory.
- 1st tray middle tray segment was removed.
- 2nd tray middle segment was removed.
- Condition of 1st, 2nd and 3rd segment was found satisfactory.

V-1352 (FIRST DESORBER)

FROM TOP MANHOLE

- Brownish coloration was observed inside the vessel.
- All fasteners were found intact
- Weld joint condition was found satisfactory.
- 1st tray middle tray segment was removed.

FROM BOTTOM MANHOLE

- Brownish coloration was observed inside the vessel.
- Weld joint condition was found satisfactory.
- Condition of the vortex breaker was found satisfactory.
- Overall condition of the vessel was found satisfactory.

V-1503 (9 ATA STEAM DRUM)

- Grayish black coloration was observed inside the vessel.
- U-clamp of the steam inlet header was found satisfactory.
- Dish and shell weld joints condition observed satisfactory.
- Overall condition of the vessel was found satisfactory.

V-1418 (PRE EVAPORATOR SEPARATOR)

- Top half observed silver and bottom half observed brownish in colour.
- Condition of the cone and weld joints was found satisfactory.
- Entire surface of the tube sheet was grayish in color.
- Tube to tube sheet weld observed in satisfactory condition.
- Tubes found satisfactory.
- Impingement cone was found in intact condition.

V-1423 (1st STAGE EVAPORATOR SCRUBBER)

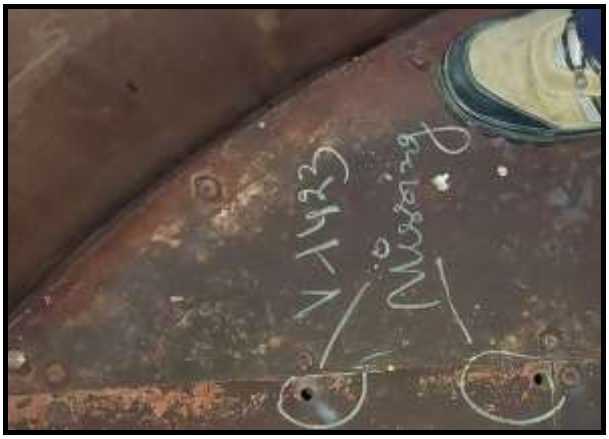
- Reddish Brown coloration was observed inside the vessel.
- Demister pads were found slightly damaged / loosened & lifted at several locations most prominent in South-East direction.

V-1423 (1st STAGE EVAPORATOR SCRUBBER)

- Reddish Brown coloration was observed inside the vessel.
- Demister pads condition observed satisfactory.

- Top perforated trays observed satisfactory.

- 02 no of bolts found missing at bottom plate below M/H.



V-1501 (4 ATA STEAM DRUM)

- Grayish coloration observed on Shell.
- Hard grayish scaling observed on both dished ends.
- Distribution sparger was found intact in position.
- Demister pads were found intact in its position.
- Condition of all the weld joints found satisfactory.
- Water observed accumulated on shell floor.
- Few bolts of Steam inlet saturation box cover were found missing and few bolts observed loose in N-W side saturation box.

- One bolt found missing in Feed water inlet line flange (South side end).

V-1502 (23 ATA STEAM DRUM)

- Grayish black coloration observed inside the vessel.
- Minor scaling observed at both dished ends.
- Weld joints condition found satisfactory.
- Distributor Pipe, Nozzles and Thermo Well condition found satisfactory.
- Overall condition found satisfactory.
- All visible weld seams found in satisfactory condition.
- Water logging found in bottom of shell. To be cleaned.

V-1811 (1ST STAGE SEPARATOR)

- Demister pads were found intact in position.
- Vessel from inside was found silver grayish in colour.
- Vortex breaker was found intact in position.
- Condition of the weld joints was found satisfactory.
- Nozzles found clear from inside.
- M/H flange seal run welding observed satisfactory.
- Overall condition of the vessel was found satisfactory.

V-1812 (2ND STAGE SEPARATOR)

- Demister pads were found intact in position.
- Vortex breaker was found intact in position.
- Condition of the weld joints was found satisfactory.
- Vessel from inside was found silver grayish in colour.
- Demister drain pipe was found intact in position.
- Nozzles found clear from inside.
- Overall condition of the vessel was found satisfactory.

V-1813 (3RD STAGE SEPARATOR) : Thru Hand Hole

- Demister drain pipe (1" NB) observed may be detached from its weld joint and moving freely inside the vessel (in vertical condition). This was observed during previous inspections also.
- Vessel from inside was found silver grayish in colour.
- Inspection carried out from bottom hand hole.
- Overall condition of the vessel was found satisfactory.

MISCELLANEOUS JOBS

Various activities performed for piping fabrication and equipment erection jobs during annual shut down by various agencies of Mechanical and Technical Department etc.

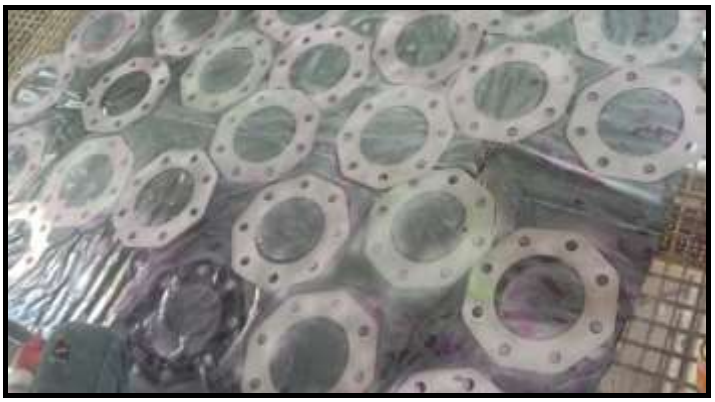
Viz. Root weld / Final weld DP, Random Ferrite Measurement, PMI for Urea grade pipelines, Final weld visual, Review of Radiographs etc.

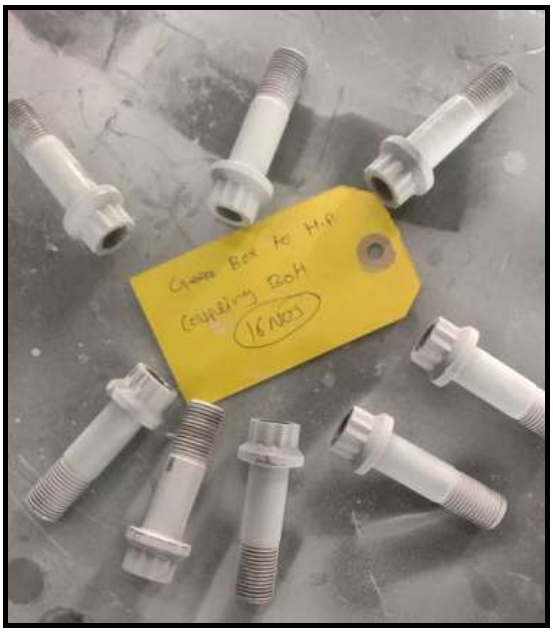
D.P. TEST

Dye Penetrant examination of weld joints of all the pipelines fabricated by contractors/departmentally, new pipeline fabrication / repairing / modifications job done by technical and maintenance groups 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.

D.P. Test was carried out on all bearings to check condition of liner and its bonding of of Co_2 Compressor.

DP Test carried out on all coupling bolts and thick coupling shim discs of Co_2 Compressor.





GAUSS MEASUREMENT OF BEARINGS & COUPLING BOLTS OF K-1801, CO_2 COMPRESSOR

Measurement of residual magnetism (Gauss) on rotary and stationary parts of rotary equipment was carried out. Wherever residual magnetism was found higher than acceptable limits, same was demagnetized and brought down within acceptable limits. The detailed results of inspection are attached herewith at **Annexure-4.**

RADIOGRAPHY

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 / repaired by all contractor's jobs as well as departmentally executed jobs as per the requirement.

ANNEXURE-1

PIPELINE THICKNESS MEASUREMENT SUMMARY OF H.P. LINES

SR. NO.	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION FROM	TO	MIN. THK. OBSERVED	%AGE RED.
1	CO-F10-2119	8	160	23.04	K-1801,III	H-1813	21.55	6.47
		4	160	13.49			12.98	3.78
		1.5	160	7.14			6.67	6.58
		0.75	160	5.54			5.09	8.12
2	CO-F10-2124	8	160	23.04	K-1801 DIS	GA-1112-6"	22.01	4.47
		4	160	13.49			11.84	12.23
		3	160	11.13			11.43	-2.70
		0.75	160	5.54			5.00	9.75
3	CO-F10-2139	4	80	8.56	4"-CO-F10-2140 (TV-1808)	CO-E10-2122-6"	6.98	18.46
4	CO-F10-2140	4	160	13.49	CO-F10-2119-8”PP25	CO-F10-2139-4” (TV-1808)	12.00	11.05
		0.75	160	5.54			4.88	11.91
5	CO-E10-2122	6	80	10.97	H-1813	V-1813	9.34	14.86
6	GA-1112	6	F2	14.27	GA-1602-8" (K-1101-2)	GA-1201-6"	11.28	20.95
		1.5	X1	5.08			4.00	21.26
		1	F2	6.35			6.01	5.35
7	GA-1201	8	X4	19.58	GA-1112-6"	H-1201 BOTTOM	17.10	12.67
		6	X4	15.24			13.38	12.20
		1.5	X4	5.08			5.14	---
8	GA-1202	1	F2	6.35	GA-1112-6"	GA-1203-1" (C.V.)	5.02	20.94
		0.75	F2	5.54			5.08	8.30
9	GA-1203	1	X1	4.55	GA-1202-1"	H-1203	3.18	30.11
		0.5	X1	3.73			3.46	7.24
10	GA-1204	1	X1	4.55	H-1203 (GA-1202-1")	PR-1231-X1-3"	3.41	25.05
		0.5	X1	3.73			2.79	25.20
11	GA-1602	8	F2	22.83	K-1801	GA-1112-6' (H-1201)	21.50	5.83
		4	F2	11.13			11.70	---
		0.75	F2	5.54			5.10	7.94
		0.5	F2	4.75			3.67	22.74
12	GA-1603	4	F2	11.13	GA-1602-8"-F2	GA-1604-16" (PIC-1810)	9.52	14.47
13	GA-1606	1	B3	3.38	GA-1607-0.75" (K-1801)	GA-1350-1"	2.77	18.05

SR. NO.	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION FROM	TO	MIN. THK. OBSERVED	%AGE RED.
14	GA-1607	0.75	B3	2.87	K-1801	GA-1606-1"	2.33	18.82
15	MA-0002	4	E2/N	8.56	P-1102-A	6"-MA-0009-77A-V	11.00	---
		1.5	E2/N	5.08			4.52	11.02
		0.75	E2/N	3.91			5.19	---
		0.5	E2/N	3.73			3.06	17.96
16	MA-0003	4	E2/N	8.56	P-1102-B	6"-MA-0009-77A-V	11.85	---
		1.5	E2/N	5.08			4.60	9.45
		0.75	E2/N	3.91			5.10	---
		0.5	E2/N	3.73			3.75	---
17	MA-0006	4	E2/N	8.56	P-1102-C	6"-MA-0009-77A-V	7.19	16.00
		3	E2/N	7.62			10.39	---
		1.5	E2/N	5.08			5.18	---
		0.75	E2/N	3.91			5.16	---
18	MA-0007	4	E2/N	8.56	2"-MA-0102/0104-77A-V	V-1103	6.47	24.42
		0.75	E2/N	3.91			5.02	-28.39
19	MA-0009	6	E2/N	14.27	4"-MA-0002-77A-V	H-1250	13.35	6.45
		1.5	E2/N	5.08			7.89	---
		1	E2/N	4.55			6.20	---
		0.5	E2/N	3.73			3.90	---
20	MA-0015	6	E2/N	14.27	H-1250	4"-PR-0016-99A-T	15.17	---
		4	E2/N	8.56			11.96	---
		1.5	E2/N	5.08			7.62	---
		0.75	E2/N	3.91			6.09	---
		0.5	E2/N	3.73			4.35	---
21	MA-0102	2	E2/N	5.54	4"-MA-0007-77A-V	4"-MA-0002-77A-V	8.08	---
		0.75	E2/N	3.91			5.08	---
22	MA-0103	2	E2/N	5.54	4"-MA-0007-77A-V	4"-MA-0003-77A-V	8.52	---
		0.5	E2/N	3.73			5.14	---
23	MA-0104	2	E2/N	5.54	4"-MA-0007-77A-V	4"-MA-0006-77A-V	6.43	---
		0.75	E2/N	3.91			3.69	5.63
24	MA-0107	6	E2/N	14.27	6"-MA-0009-77A-N	6"-MA-0015-77A-V	16.28	---
25	MA-1201	3	E2	7.62	6"-MA-0015-77A-V	V-1201	6.51	14.57
		1.5	E2	5.08			3.52	30.71
		0.75	E2	3.91			7.19	---

SR. NO.	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION FROM	TO	MIN. THK. OBSERVED	%AGE RED.
26	PR-0019	10	X1/N	24.33	H-1202 (C1B/C1C)	V-1250	---	---
		8	X1/N	19.58			23.99	---
		0.75	X1/N	3.91			6.87	---
27	PR-0021	4	X4	10.41	8"-PR-0020-99A-T	PR-1638-4"-X4A	10.94	---
28	PR-1201	8	X1	19.58	V-1201	HP-STRIPPER (H-1201)	14.23	27.32
29	PR-0020	8	X1/N	19.58	P-1250	H-1202 (C2)	21.48	---
		1.5	X1/N	5.08			4.52	11.02
30	PR-0026	12	X1/N	28.80	H-1201 (N4)	H-1202	32.58	---
		10	X1/N	24.33			7.32	69.91
31	PR-1205	6	X1	15.24	PR-1205-8"	V-1202	10.00	34.38
		1.5	X1	5.08			4.09	19.49
		1	X1	4.55			2.10	53.85
		0.75	X1	3.91			4.04	---
32	PR-1205	8	X1	19.58	HP-STRIPPER (H-1201)	PR-1205-6" (V-1202)	16.36	16.45
		6	X1	15.24			11.01	27.76
		1.5	X1	5.08			4.30	15.35
33	PR-1208	4	X1	10.41	V-1201 TOP	PR-1206-4"	10.35	0.58
		3	X1	8.12			10.38	---
		1.5	X1	5.08			6.39	---
34	PR-1213	2	X4	5.54	PR-1201-8"	PR-1205-6"	3.88	29.96
		0.5	X4	3.73			2.85	23.59
35	PR-1224	3	X4	7.62	P-1201-B	PR-1638-4"	7.29	4.33
36	PR-0027	8	X1/N	19.58	12"-0026-99A-T	V-1201 (C1B)	20.25	---
37	PR-1234	3	X4	7.62	P-1201-A	PR-1638-4"	6.84	10.24
38	PR-1637	3	X4A	9.14	P-1201-C	PR-1638-4"	9.56	---
39	PR-1638	4	X4A	9.14	P-1201-ABC	PR-1230-6"	11.05	---
		1.5	X4A	5.08			5.08	0.00

ANNEXURE-2

PIPELINE THICKNESS MEASUREMENT SUMMARY

(STEAM CONDENSATE & STEAM LINES)

Sr. No	LINE NO.	NB (inch)	SCH	NOM. THK. (MM)	LINE DESCRIPTION		Min. Thk. Observed	%Aged
					FROM	TO		
SC-LINES								
1	SC-1101 (CW-1118)	14	B4	9.53	H-1102	H-1206	5.00	47.51
2	SC-1101 (CW-1118)	10	10S	4.78	H-1102	H-1206	3.80	9.31
3	SC-1211	10	B4	9.27	H-1203	P-1204	7.60	18.02
4	SC-1213	6	C1	7.11	H-1201	V-1502	5.60	21.24
5	SC-1216	4	B4	6.02	V-1204	SC-1407	4.50	25.25
6	SC-1216	2	B4	3.91	V-1204	SC-1216-4"	5.40	--
7	SC-1228	10	B4	9.27	P-1202	H-1102	8.80	5.07
8	SC-1228	12	B4	9.53	P-1202	H-1102	7.10	25.50
9	SC-1228	14	B4	9.53	P-1202	H-1102	7.90	17.10
10	SC-1407	3	B4	5.49	H-1422	T-1501	3.80	30.78
11	SC-1407	8	B4	8.18	H-1422	T-1501	5.60	31.54
12	SC-1409	4	B4	6.02	H-1424	T-1501	5.30	11.96
13	SC-1409	2	B4	3.91	H-1424	T-1501	4.10	--
14	SC-1409	1.5	B4	5.08	H-1424	T-1501	5.30	--
15	SC-1501	4	B4	6.02	T-1501	P-1501/6	5.40	10.30

Sr. No	LINE NO.	NB (inch)	SCH	NOM. THK. (MM)	LINE DESCRIPTION		Min. Thk. Observed	%Aged.
					FROM	TO		
16	SC-1502	3	B4	5.49	P-1501/6	V-1501	5.40	1.64
17	SC-1502	1.5	B4	3.68	P-1501/6	V-1501	3.18	13.59
18	SC-1503	1	B4	4.56	SC-1502	V-1503	3.50	23.25
19	SC-1504	4	B4	6.02	V-1503	V-1501	5.00	16.94
20	SC-1504	6	B4	7.11	V-1503	V-1501	8.60	---
21	SC-1505	2	B4	3.91	SC-1504	T-1501	4.00	---
22	SC-1505	6	B4	7.11	SC-1504	T-1501	5.20	26.86
23	SC-1510	2	B4	3.91	P-1502	PCV-1501	5.40	---
24	SC-1510	1.5	B4	5.08	P-1502	PCV-1501	4.20	17.32
25	SC-1511	1.5	B4	5.08	PCV-1501	T-1501	3.80	25.20
26	SC-1512	4	C1	6.02	SC-1213	LCV-1501	5.60	6.98
27	SC-1513	4	B4	6.02	LCV-1501	V-1503	3.30	45.18
28	SC-1514	4	B4	6.02	T-1501	SEAL POT	5.40	10.30
29	SC-1514	3	B4	5.49	T-1501	SEAL POT	4.50	18.03
30	SC-1605	1.5	B4	5.08	H-1418A	SC-1407	4.90	3.54
31	SC-1606	10	C2	9.27	H-1418	SC-1211	8.80	5.07
32	SC-1607	1	B4	4.55	SC-1226	PR-1636	3.40	25.27

Sr. No	LINE NO.	NB (inch)	SCH	NOM. THK. (MM)	LINE DESCRIPTION		Min. Thk. Observed	%Aged.
					FROM	TO		
C.W LINES								
33	CW-0037	14	SCH20	7.92	CW-1118-14"	H-1250	9.10	---
34	CW-0038	12	SCH20	6.35	CW-1119-12"	H-1250	8.00	---
35	CW-0047	12	SCH20	6.35	CW-1119-12"	H-1250	6.20	2.36
ST-LINES								
36	ST-1123	14	B4	9.525	PICV-1129	ST-1106	8.60	9.71
37	ST-1124	6	E3	10.97	ST-1104	PICV-1128	9.80	10.67
38	ST-1125	10	B4	9.27	ST-1116	PICV-1129	7.90	14.78
39	ST-1205	12	C1	9.52	V-1502	H-1201	5.80	39.08
40	ST-1206	10	B4	9.27	ST-1506	H-1204	7.60	18.02
41	ST-1206	8	B4	8.18	ST-1506	H-1204	8.00	2.20
42	ST-1352	3	B4	5.5	23 ATA HEADER	HYDROLYSER	5.10	7.27
43	ST-1402	3	B4	5.49	ST-1415	P-1421	4.90	10.75
44	ST-1409	8	B4	7.11	ST-1504	H-1424	7.00	1.55
45	ST-1502	8	C1	8.2	ST-1116	PICV-1502A	7.60	7.32
46	ST-1502	4	B4	6.02	ST-1116	PICV-1502A	5.20	13.62
47	ST-1504	2	B4	3.91	V-1503	ST-1302	3.90	0.26

Sr. No	LINE NO.	NB (inch)	SCH	NOM. THK. (MM)	LINE DESCRIPTION		Min. Thk. Observed	%Aged.
					FROM	TO		
48	ST-1507	6	B4	7.11	ST-1506	ST-1302	6.10	14.21
49	ST-1507	4	B4	6.02	ST-1506	ST-1302	3.60	40.20
50	ST-1508	2	B4	3.9	ST-1506	PCV-1502	3.80	2.56
51	ST-1508	3	B4	5.49	ST-1506	PCV-1502	5.30	3.46
52	ST-1509	10	B4	9.27	T-1501	H-1502	8.70	6.15
53	ST-1510	10	B4	9.27	T-1501	H-1502	8.30	10.46
54	ST-1603	8	B4	8.18	ST-1506B4	H1418/A	7.60	7.09
55	ST-1606-12 (Drain Points)	0.5	E3	3.73	60 ATA HEADER	HITACHI BL	3.90	--
56	ST-1606-12 (Drain Points)	0.75	E3	3.91	60 ATA HEADER	HITACHI BL	3.70	5.37
57	ST-1606-12 (Drain Points)	1.5	E3	5.08	60 ATA HEADER	HITACHI BL	4.80	5.51
58	ST-1606-12 (Drain Points)	2	E3	5.54	60 ATA HEADER	HITACHI BL	5.2	6.14

ANNEXURE-3

UREA PLANT VESSEL THICKNESS MEASUREMENT SUMMARY

Sr. No	Equip. No.	Equip. Description	Shell			Dish End			Channel		
			Nom / Desig	Min./ Meas	% Red.	Nom. / Desig.	Min. Meas.	% Red	Nom. / Desig	Min./ Meas	% Red
1	H-1351/A	HYDROLYSER FEED PREHEATER	12.0	12.3	----	12.0	10.9	9.17			
2	H-1351/B	HYDROLYSER FEED PREHEATER	12.00	12.00	0.00	12.00	11.10	7.50			
3	H-1351/C	HYDROLYSER FEED PREHEATER	12.00	11.10	7.50	12.00	11.20	6.67			
4	H-1352	REFLUX CONDENSER	8.00	7.90	1.25	12.00	11.80	1.67	14.00	12.20	12.8
5	H-1418	PRE-EVAPORATOR	12.00	12.00	---	10.00	9.50	5.00			
6	H-1424	2ND STAGE EVOPARATOR SEPARATOE	14.00	14.40	---	10.00	11.00	---			
7	T-1301	LEAN AMMONICAL WATER TANK	6.00	6.20	---	---	---	---			
8	T-1301 A	STRONG AMMONICAL WATER TANK	6.00	5.40	10.00	---	---	---			
9	T-1401	UREA SOLUTION TANK	6.00	5.90	1.67	---	---	---			
10	T-1401 A	UREA SOLUTION TANK	6.00	5.40	10.00			---			
11	T-1814	MAIN LO TANK FOR HITACHI COMPRESSOR	6.00	5.70	5.00	---	---	---	---	---	---
12	T-1701A	UREA DUST DISSOLVING TANK	6.00	6.20	---	---	---	---			
13	T-1701B	UREA DUST DISSOLVING TANK	6.00	6.00	0.00	---	---	---			
14	V-1102	AMMONIA FILTER	11.00	11.00	0.00	11.00	10.80	1.82			
15	V-1103	AMMONIA SUCTION VESSEL	21.00	20.80	0.95	21.00	22.00	---			
16	V-1203	LOW PRESSURE ABSORBER	6.00	6.00	0.00	14.00	13.40	4.29			
17	V-1207	AMMONIA SCRUBBER	5.00	5.70	---	8.00	8.90	---			
18	V-1418	PRE-EVAPORATOR	12.00	10.30	14.17	10.00	10.50	---			
19	V-1423	1ST STAGE EVAPORATOR SCRUBBER	8.00	8.50	---	10.00	10.10	---			
20	V-1424	2ND STAGE EVOPARATOR SEPARATOE	12.00	11.70	2.50	---	---	---			
21	V-1503	9 ATA STEAM DRUM	13.00	12.90	0.77	13.00	14.20	---			

ANNEXURE-4

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

K-1801 (HITACHI COMPRESSOR)

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
TURBINE (GOV END)			
Journal Bearing Pads		0.3	Within limits
Thrust Bearing Pads	Active	0.8	Within limits
	Inactive	0.6	
TURBINE (NORTH END)			
Journal Bearing Pads	Top Half	0.5	---
	Bottom half	0.5	---
L.P. CASE (TURBINE END)			
Journal Bearing Pads	Top	0.8	---
	Bottom	0.6	
Shaft		0.9	
L.P. CASE (G.B. END)			
Journal Bearing Pads		0.4	---
Thrust Bearing Pads	Active	0.3	Within limits
	Non active	0.2	
Shaft		0.7	
GEAR BOX			
L.S. Shaft Journal Bearing L.P. Case Side	Top half	0.4	---
	Bottom half	0.2	
L.S. Shaft Journal Bearing H.P. Case Side	Top half	0.6	---
	Bottom half	0.4	
L.S. Speed Pinion Shaft		1.0	
H.S. Shaft Journal Bearing L.P. Case Side	Top half	0.2	---
	Bottom half	0.4	
H.S. Shaft Journal Bearing H.P. Case Side	Top half	0.5	---
	Bottom half	0.2	
H.S. Speed Pinion Shaft		0.8	
Thrust Bering Pads L.S. Shaft H.P. Case Side	Active (6 no's)	0.4	---
	Non Active (6 no's)	0.5	
H.P. CASE (FREE END SIDE)			
Journal Bearing Pads (Free End Side)	Top	0.4	---
	Bottom	0.6	
Thrust Pads (Free End Side) (Free End Side)	Active	0.6	---
	Non Active	0.8	
H.P. CASE (G.B.SIDE)			
Journal Bearing Pads	Top	0.4	---
	Bottom	0.3	

ANNEXURE- 5

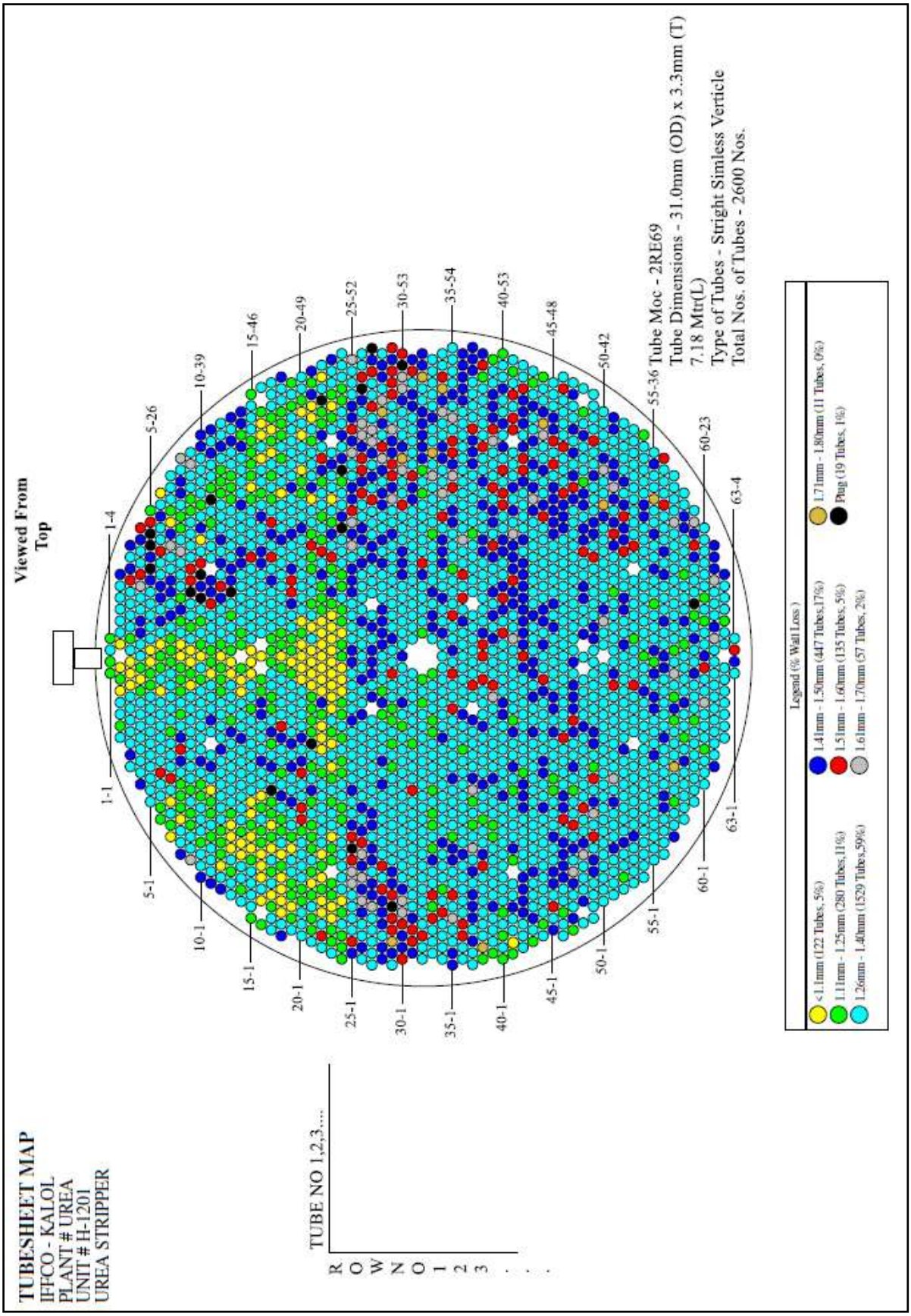
RADIOGRAPHIC EXAMINATION OF HP LINE/HPF FITTINGS

Sr No.	Fitting Identification-No.	Line where Installed	Location		Size (OD)	Nom. Thick. (mm)	RT Result
1	TR-1206	V-1201 Offgas line	5th	Above V-1201	1.5" Sch.80	5.08	Satisfactory
2	TR-1210	H-1201 O/L Line	GF	Near Stripper Bottom	1.5" Sch.80	5.08	Satisfactory
3	2"-MA TO AMM PLANT	BET P1102A/ 1102B	G.F	--	2"	5.54	Satisfactory
4	10"-PR-0019-99A-T HPCC Liquid O/L to V-1201	HPF Drain	3rd	Nr Autoclave Bottom	1" Sch 80	4.55	Satisfactory
5	Sample Point Nr Pillar	Nr Old Position of P-1102-C	G.F	J1 & J2	1" Sch-80	4.55	Satisfactory
6	P-1102-A Disc RV Flange Joint 01 No. Butt Joint	--	G.F	--	1.5" Sch.80	5.08	Satisfactory
7	P-1102-B Disc RV Flange Joint 01 No. Butt Joint	--	G.F	--	1.5" Sch.80	5.08	Satisfactory
8	P-1102-C Disc RV Flange Joint 01 No. Butt Joint	--	G.F	--	1.5" Sch.80	5.08	Satisfactory
9	V-1201 Unloading Line	Liquid Outlet from V-1201	GF	Near P-1102-C NE side	2" Sch.80	5.54	Satisfactory
10	HPF to FICV-1204	Carb. Pump Discharge to H-1203	3.5th	South/West corner of floor	1" Sch.80	4.55	Satisfactory
11	HPF to PRCV-1201	H-1203 Off gas to V-1203	6th	East side from PRCV-1201	1" Sch.80	4.55	Satisfactory
12	HPF to HICV-1202	V-1201 Off gas to H-1203	6th	North side from HICV 1202	1" Sch.80	4.55	Satisfactory
13	HPF Amm. To V-1201	--	3rd	---	1" Sch 80	4.55	Satisfactory
14	HPF H-1203 bottom	--	5th	---	2" Sch 80	5.54	RT Repair. After found Satisfactory
15	V-1201 Unloading Line	V-1201 (Bottom)	3rd	---	2" Sch.80	5.54	Satisfactory (After BEL V/V Replacement)

Note: After repair, weld Joints Were Rechecked by Radiography and found satisfactory.

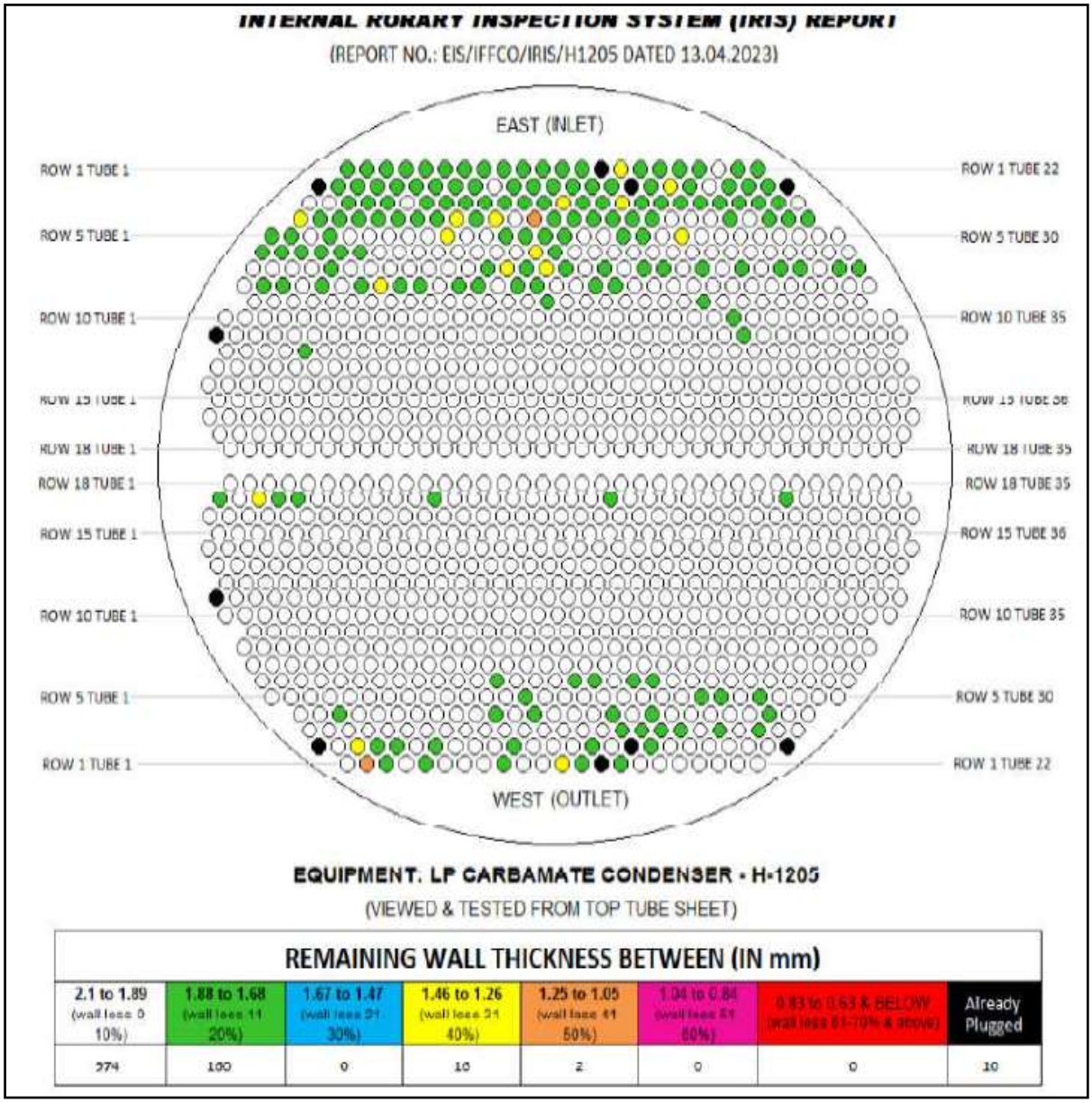
ANNEXURE- 6

TUBE SHEET LAY OUT OF H-1201 (VIEWED FROM TOP)



ANNEXURE- 7

TUBE SHEET LAY OUT OF H-1205 (VIEWED FROM TOP)



REMAINING WALL THICKNESS BETWEEN (IN mm)							
2.1 to 1.89 (wall loss 0 10%)	1.88 to 1.68 (wall loss 11 20%)	1.67 to 1.47 (wall loss 21 30%)	1.46 to 1.26 (wall loss 31 40%)	1.25 to 1.05 (wall loss 41 50%)	1.04 to 0.84 (wall loss 51 60%)	0.83 to 0.63 & BELOW (wall loss 61-70% & above)	Already Plugged
274	100	0	10	2	0	0	10

OFFSITE & UTILITY PLANT

(INSPECTION)

BHEL BOILER (GT-2068)

VISUAL INSPECTION

STEAM DRUM

- The internal surface of the drum observed brownish black in colour.
- All the weld joints found satisfactory.
- Minor rusting observed at both dish-end.
- Whitish scaling was observed in some tube inside area.
- The tube ends were free from any defect.
- Overall condition of the steam drum found satisfactory.

MUD DRUM

- The internal surface of the drum observed brownish black in colour.
- The condition of the weld joints found satisfactory.
- The tube ends were free from any defect.
- Whitish scaling was observed in some tube inside area.
- Phosphate dozing pipe (Located at top 1''NB) holding ''U" clamps found satisfactory.
- Overall condition of the mud drum found satisfactory.

DEAERATOR

Visual inspection of the Deaerator Tray section and the Storage vessel section carried out and observations are as under.

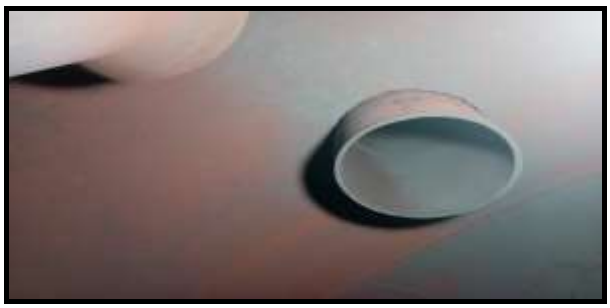
DEAERATOR TRAY SECTION

- Brownish coloration was observed inside the shell and dome area.
- 5th number Tray segment was found displaced from its original location as shown in below figure.

- Rest other tray segments and angle supports were found intact in position.
- Overall condition of tray section observed satisfactory.

DEAERATOR STORAGE VESSEL

- Brownish coloration observed inside the vessel at shell and dish-end surface.
- Evaporator nozzle located at west side was found with incomplete weld from inside as shown in below figure.



- Conditions of the approachable weld joints were found visually satisfactory.
- A pinhole was observed in the downcomer line located at North-East side as shown in below figure.

- Minor rusting observed at both dish ends.
- Resins were found near DM water line as shown in below figure.

- Central pipe at bottom was found intact with all the supports, U-clamps and its fasteners.
- Overall condition of vessel observed satisfactory.

BHEL BOILER FURNACE

FROM SOUTH WALL ACCESS DOOR

- Previously repaired east side refractory near to inspection glass refractory found in damage condition.

- Gap observed between manhole metal sheet and refractory.

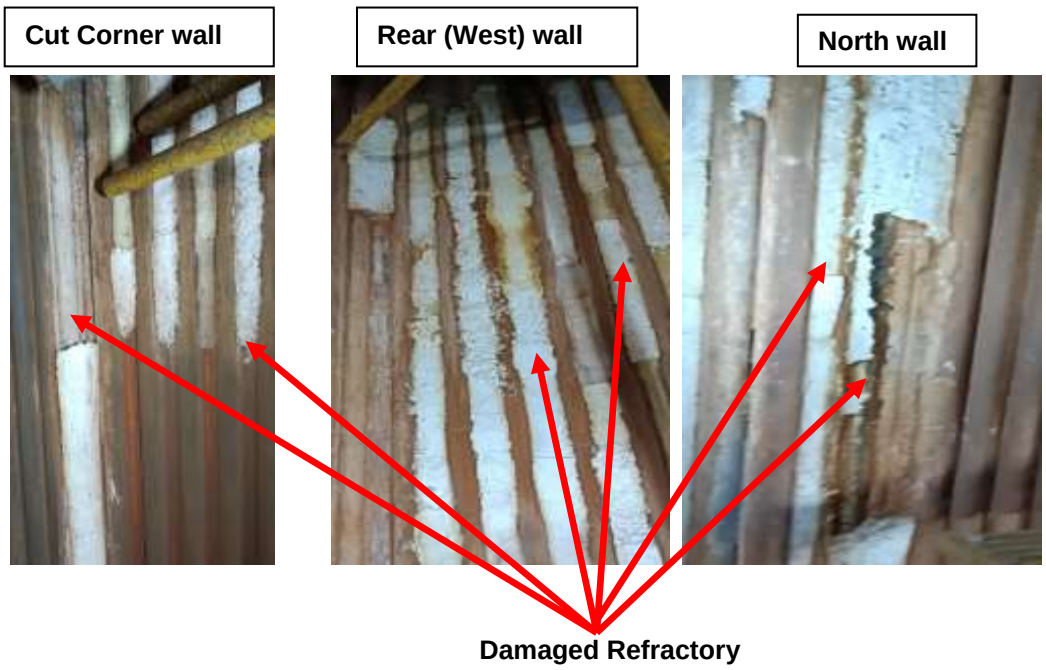
- Minor rust and scaling observed on South wall, Front panel, Rear panel, Cut corner tubes and baffle wall tubes.
- Floor refractory was lifted upwards approx 6'' at centre of furnace floor.
- Condition of thermo-wells in cut-corner wall found satisfactory
- Refractory around the bottom burner was found damaged also carbon deposition observed on all nozzles bottom burners.

Damaged Refractory

- Condition of refractory around the top burner was found satisfactory but carbon deposition observed.
- Below bottom burner repaired refractory found satisfactory.

- Minor scaling was observed on Primary Super heater tubes.
- Primary super heater coil found dislocated.

- Previously repaired refractory was found damaged condition at scattered location.



- Insulation fiber blankets placed on top of the Secondary superheater coil was found damage condition due to refractory fall down on it.

- Refractory found damaged and loosened above secondary super heater coil.

- Refractory found damaged and loosened near primary super heater coil west wall.

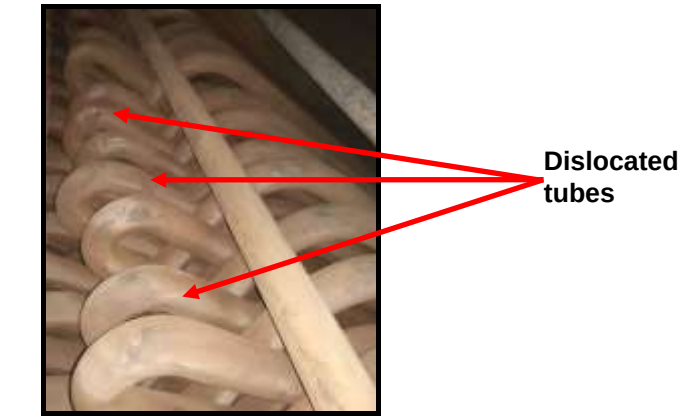
FROM NORTH WALL ACCESS DOOR

- Baffle wall tube refractory found damaged near secondary super heater.

- Bulging was observed at baffle wall.

- Minor rust and scaling was observed on boiler bank tubes.
- Secondary super heater coil found dislocated.

- Refractory was damaged condition at corner of wall.



AIR PREHEATER (APH)

AIR PREHEATER (APH) METALLIC EXPANSION BELLOW

WEST SIDE

- Bellow found ruptured at location of appx.1.5 feet from top.

- Rust and white scales observed.
- Over all gasket condition found satisfactory.

TOP SIDE

- Gasket was found leakage

- Fasteners were found in loose condition.

- Minor rust was observed.

EAST SIDE

- Minor rust and white scales observed.

AIR PREHEATER (APH) NON METALLIC EXPANSION BELLOW

- No leakage observed
- Over all condition found satisfactory.

LOCATION : FLUE GAS DUCT AT THE BANK TUBE ZONE

- Erosion over the plate was observed inside the flue gas duct near bank tube zone as shown in below figure.

ANNEXURE - 1

OFFSITE PLANT EQUIPMENT THICKNESS MEASUREMENT SUMMARY

Ultrasonic Thickness measurement of following equipment was carried out. Observations are summarized as mentioned below.

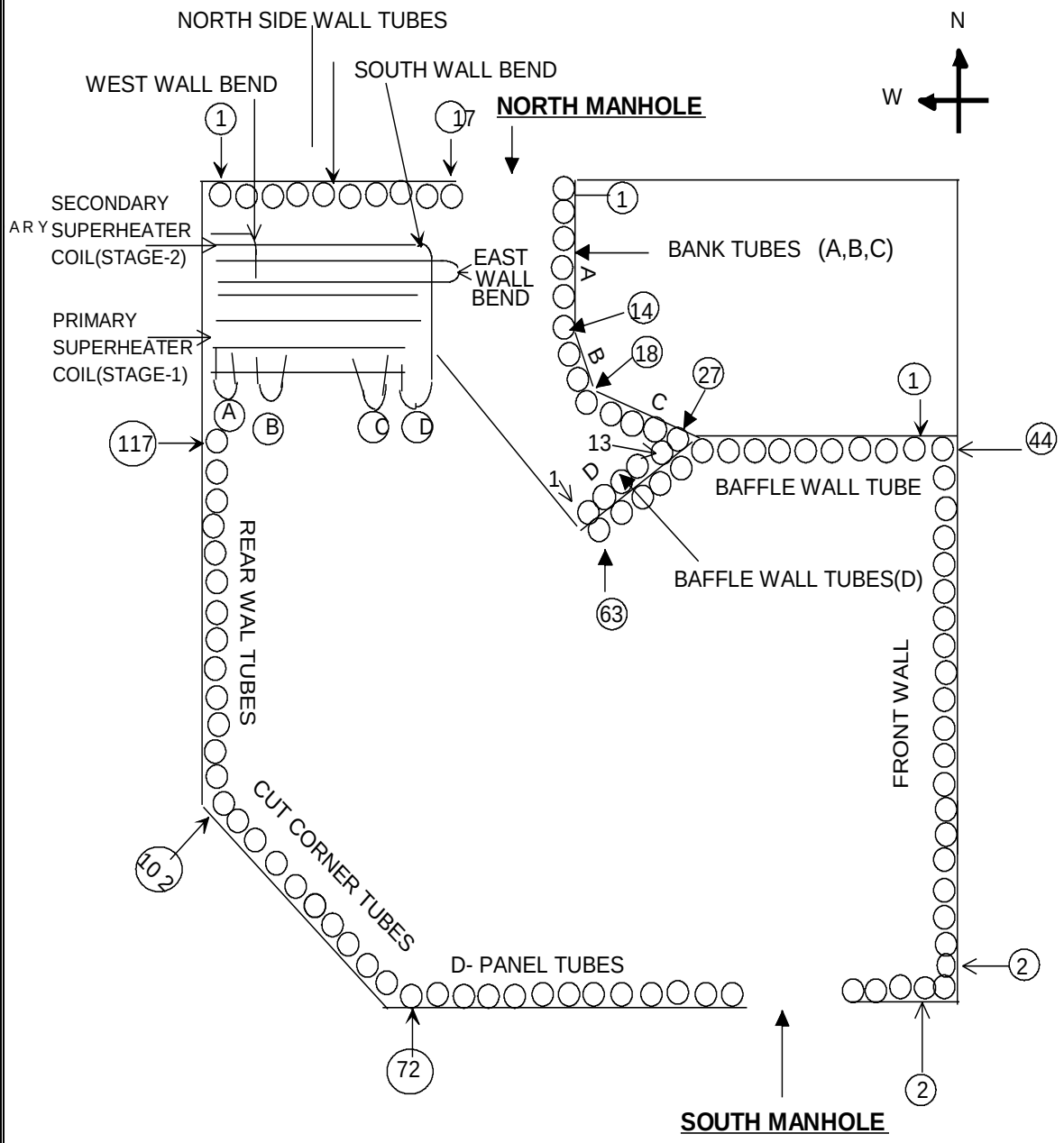
Sr. No.	Equipment Description	Design Thick.(mm)	Minimum Thick. (mm)
1	Anion-3	8	7.95
2	Anion-5	8	8.46
3	Cation-1	8	8.18
4	Cation-2	8	8.37
5	Cation-3	8	8.06
6	Cation-4	8	7.96
7	SBA-1	8	6.07
8	SBA-2	8	6.85
9	SBA-3	8	6.24
10	SBA-4	8	8.14
11	SMB-1	8	6.18
12	SMB-2	8	6.53
13	SMB-3	8	6.30
14	SMB-4	8	8.25

ANNEXURE - 2

BHEL BOILER THICKNESS MEASUREMENT SUMMARY

Ultrasonic Thickness measurement of following BHEL boiler was carried out. Observations are summarized as mentioned below.

Sr. No.	Equipment Description	Design Thick.(mm)	Minimum Thick. (mm)
1	D. Panel Tubes	4.5	4.61
2	CUT CORNER TUBES	4.5	4.86
3	REAR WALL TUBES	4.5	4.89
4	FRONT WALL TUBES	4.5	4.63
5	BANK TUBES (A) WALL	3.6	3.30
6	BANK TUBES (B) WALL	3.6	3.31
7	BANK TUBES (C) WALL	3.6	3.33
8	NORTH SIDE WALL TUBES	4.5	4.60
9	BAFFLE WALL TUBES	4.5	4.78
10	PRIMARY SUPERHEATER COIL (STAGE-1) (BEND OF (A) COLUMN)	7.1	6.41
11	PRIMARY SUPERHEATER COIL (STAGE-1) (BEND OF (B) COLUMN)	7.1	6.52
12	PRIMARY SUPERHEATER COIL (STAGE-1) (BEND OF (C) COLUMN)	7.1	5.85
13	PRIMARY SUPERHEATER COIL (STAGE-1) (BEND OF (D) COLUMN)	7.1	6.61
14	PRIMARY SUPERHEATER COIL (STAGE-2) (EAST WALL BEND)	5.6	4.84
15	PRIMARY SUPERHEATER COIL (STAGE-2) (SOUTH WALL BEND)	5.6	5.11
16	PRIMARY SUPERHEATER COIL (STAGE-2) (WEST WALL BEND)	5.6	4.51
17	BANK TUBES (EAST BOTTOM MANHOLE)	3.6	3.20
18	Mud Drum	78.0	80.92
19	Steam Drum	97.0	99.92



BHEL BOILER FURNACE LAYOUT
(GT-2068)

ANNEXURE - 3

PIPE LINE THICKNESS MEASUREMENT SUMMARY

Ultrasonic Thickness measurement of following pipe line was carried out. Observations are summarized as mentioned below.

Sr. No.	Equipment Description	Design Thick.(mm)	Minimum Thick. (mm)
1	AIR VENT FEED LINE-1” (BFW)	4.55	2.98
2	DRUM VENT LINE-1” (BFW)	4.55	1.75
3	ATTEMPERATOR VENT LINE-1” (BFW)	4.55	2.35
4	SECONDARY SUPER HEATER VENT LINE-1” (BFW)	4.55	1.79
5	PRIMARY SUPER HEATER VENT LINE-1” (BFW)	4.55	2.53
6	Deaerator Down comer Line-6''	7.11	4.01

ANNEXURE - 4

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

Component	Location	Initial Gauss*
BFW Turbine (Q-5111)		
Journal Bearing Coupling Side (DE)	Top	1.5
	Bottom	1.2
	Shaft	0.7
Thrust Bearing Pads	Collar (Top)	1.6
	Collar (Bottom)	**1.6**
	Shaft (Top)	**1.7**
	Shaft (Bottom)	**1.3**
BFW Pump (P-5111)		
Journal Bearing Coupling Side (DE)	Top	1.3
	Bottom	1.4
	Shaft	0.6
Thrust Bearing Pads	Collar (Top)	1.20

Component	Location	Initial Gauss*
	Collar (Bottom)	**1.30**
	Shaft (Top)	**1.60**
	Shaft (Bottom)	**6.5 (After De Gauss 2.20)**
BFW Pump (P-5112) Gear Box		
Journal Bearing Coupling Side (DE)	Top	1.3
	Bottom	1.5
	Shaft	0.6
Thrust Bearing Pads	Collar (Top)	1.4
	Collar (Bottom)	**1.6**
	Shaft (Top)	**1.2**
	Shaft (Bottom)	**1.1**
BFW Pump (P-5112)		
Journal Bearing Coupling Side (DE)	Top	1.2
	Bottom	1.6
	Shaft	0.5
Journal Bearing Free End (NDE)	Top	1.0
	Bottom	1.1
	Shaft	0.9
Thrust Bearing Pads	Collar (Top)	1.3
	Collar (Bottom)	**1.4**
	Shaft (Top)	**1.2**
	Shaft (Bottom)	**1.1**
F.D Fan (Q-5113) Gear Box		
Thrust Bearing Pads (DE)	Gear wheel	0.3
	Pinion wheel	**1.0**
Thrust Bearing Pads (NDE)	Gear wheel	**0.6**
	Pinion wheel	**1.2**
C.W Pump (Q-4403) turbine		
Thrust Bearing Pads	Collar	1.0
	Shaft	**1.2**

Component	Location	Initial Gauss*
C.W Pump (P-4404-E)		
Thrust Bearing Pads	Collar	0.9
	Shaft	**1.0**
C.W Pump (P-4405-A)		
Thrust Bearing Pads	Collar	0.9
	Shaft	**1.0**
C.W Pump (Q-4401) turbine		
Journal Bearing Coupling Side (DE)	Top	1.3
	Bottom	1.4
	Shaft	1.2
Journal Bearing Free End (NDE)	Top	0.8
	Bottom	0.9
	Shaft	0.8
Thrust Bearing Pads	Collar	0.9
	Shaft	**0.8**
C.W Pump (Q-4401-B**) turbine**		
Thrust Bearing Pads	Collar	1.0
	Shaft	**0.8**
C.W Pump (P-4401-B)		
Thrust Bearing Pads	Collar	0.7
	Shaft	**0.8**

INSTRUMENTATION

AMMONIA PLANT

(INSTRUMENT)

CONTROL VALVE MAINTENANCE JOBS

FRCV-5A : Control valve was dropped from line for complete overhauling purpose. Plug, seat and body were inspected & found minor scratches on seating area hence reconditioning of trim parts and body was done by machining and lapping. Control valve was boxed up with reconditioned trim parts and new gasket sets. Actuator diaphragm was checked and found ok. Lined up the control valve with necessary tubing. Control valves operation and stroke were checked, found ok.

USV-930 : Metso Neles make ball valve was checked and general maintenance jobs were done. Actuator coupling box was opened, cleaned and greasing done over coupling mechanism. Control valve operation was checked and found ok.

USV-932 : Metso Neles make ball vave was checked and and general maintenance jobs were done. Actuator was decoupled from control valve for overhauling purpose. Actuator was dismantled, cleaned all internals and overhauled. Box up the actuator with with new soft part and sealing kit. Fixed back the actuator on ball type control valve. Control valve operation was checked and found ok.

PRCV-18 : Very old and obsolete Fisher make control valve was replaced with New Fisher make control valve. Necessary tubings were modified. Finally control valve operation and stroke was checked, found ok.

FRCV-2: Control valve was checked for operation and general maintenance jobs were done. For gland leakage issue opened control valve from bonnet, replaced all gland packings with new gland packing set then boxed up the control valve. Actuator diaphragm was checked and found ok. Finally control valve operation and stroke were checked & found ok.

FICV-15: Fisher make valve with very old and obsolete actuator with typical top mounted positioner model 476U was giving problems from few years. Hence it was replaced with new actuator Model 585C with latest model positioner 3610JP. Mounted new actuator on angle valve body and coupled the actuator stem with valve plug. New Actuator was lined up with necessary tubing. Finally control valve operation and stroke were checked & found ok. Two no. of branch cables were laid from JBC-47 to control valve location and connected at position feeedback switch mounted on actuator. Control valve Open ZSH-15 & Control valve CLOSE ZSL-15 position feedback indications were lined up in DCS by installing P&F make isolator KCD2-SR-Ex2 in marshalling cabinet and wired it with inputs of OPEN and CLOSE feedback and necessary engineering configuration.

MICV-107C: Control valve was opened from bonnet for trim inspection purpose. Plug and seat were inspected & found minor scratches on seating area hence reconditioning of trim parts done by machining and lapping. All parts of valve were cleaned, overhauled and boxed up control valve. Control valves operation and stroke were checked, found ok.

MICV-1123C: Control valve was opened from bonnet due to passing issue. Plug, seat and body were inspected & found minor scratches on seating area hence reconditioning of trim parts was done by machining and lapping. Control valve boxed up with reconditioned trim parts and new gasket set. Actuator diaphragm was checked and found ok. Control valves operation and stroke were checked, found ok

PICV-16: Control valve was dropped from line for line modification job and provision of input and output isolation valves in line. Control valve was opened from bonnet for inspection of trim part. Its plug stem was found in broken condition. Complete cleaning and overhauling was done and boxup control valve with new plug, seat ring and body gasket set. Finally control valve operation and stroke was checked &found ok.

PICV-3016: Control valve was opened from bonnet for trim inspection. Plug & seat were inspected & minor damage was found. After cleaning and overhauling, control valve was boxed up with new plug, seat ring, gland packing ad gasket sets. Actuator diaphragm was checked and found ok. Finally control valve operation and stroke was checked & found ok.

FICV-481/1: Control valve was dropped from line for complete overhauling. Foreign material was found in trim part, control valve body and main line. To remove the foreign material flushed and clean the line, also cleand trim part and valve body. Plug & seat were inspected & found in good condition. Box up the control valve with same plug and seat after proper cleaning. Finally control valve operation and stroke was checked & found ok.

FICV-481/2: Control valve was opened from line for complete overhauling. Foreign material found in trim part, control valve body and main line. To remove the foreign material flushed and clean the line, also cleand trim part and valve body. Plug & seat were inspected & minor damage was found. Control valve body box up with new plug, and seat ring and seat gasket. Finally control valve operation and stroke was checked & found ok.

LICV-480/2: Control valve general maintenance was done and checked operation after stem was taken down for tight shutoff. Actuator diaphragm was checked and found ok. Control valve operation and stroke were checked & found ok.

TV-12A: Control valve was found stuck up during operation since installation. So the butterfly type normally open control valve was closed by handjack and was dropped from line for inspection. The baffle or vane of control valve was found stuck in body and not operated by actuator. Piston cylinder type actuator was dismantled from valve body and its operation was checked seperately, it was found ok. So solve the stuck of butterfly vane dismentaled vane from shaft after removeing all four lock pins and removed shaft from body of butterfly valve. Necessory maching and polishing was done over shaft and bush to recondition for proper smooth operation. Butterfly type control valve body was assembled with new seat ring and locked the vane on shaft with new lock pins.Actuator was mounted over the butterfly valve and control valve operation and stroke was checked & found ok. Finnaly control valve was installed back in line and further checked the operation, found ok.

LICV-43: Control valve was opened from bonnet for complete overhauling purpose. Cleaned and overhaul the complete body with trim parts. Actuator was open to inspect the diaphragm, found ok, so boxed up thr valve after servicing. Line up the control valve with necessary tubing and checked control valves operation and stroke, found ok.

PICV-14: Control valve was opened from bonnet for trim inspection. Plug & seat were inspected & minor damage was found. Control valve body box up after general servicing, with new cage, plug, seat ringwith new seal ring set and gasket set. Control valve body boxed up after general servicing. Actuator diaphragm was checked and found ok. Finally control valve operation and stroke was checked & found ok.

CV-8102: Control valve was opened from bonnet for complete overhauling. Welded metal found at cage edge. Plug & seat were inspected & minor damage was found. Welded metal removed and Control valve body box up with new seat and body gasket set. Finally control valve operation and stroke was checked & found ok.

FRCV-5 : Control valve general maintenance was done and checked operation. Actuator for control valve was replaced with new actuator. New actuator was lined up with necessary tubing. Finally control valve operation and stroke were checked & found ok.

PICV-24: Control valve general maintenance was done and checked operation. Actuator was opened for diaphragm inspection, it was found damaged. So the actuator was boxed up with new diaphragm and leakage checked. Finally control valve operation and stroke were checked & found ok.

FICV-9: Control valve general maintenance was done and checked its valve positioner. Its pneumatic valve positioner model FISHER 3580 was replaced with new model FISHER 3582 valve postioner with necessary mounting arrangement modification and tuned positoner for proper valve operation. Control valve was opened from actuator for diaphragm inspection. Actuator diaphragm was found in good condition. Control valve operation and stroke were checked & found ok.

FICV-10: Control valve general maintenance and valve postioner overhauling was done and checked operation. Actuator was opened for diaphragm inspection, it was found in good condition. Actuator was box up with same diaphragm and leakage checked. Finally control valve operation and stroke were checked & found ok.

FICV-11: Control valve general maintenance and valve postioner overhauling was done and checked operation. Actuator was opened for diaphragm inspection, it was found in good condition. Actuator was box up with same diaphragm and leakage checked. Finally control valve operation and stroke were checked & found ok.

PCV-402: Control valve general maintenance and valve postioner overhauling was done. Actuator was opened for diaphragm inspection. Actuator diaphragm was found in good condition. Actuator was box up with same diaphragm and leakage checked. Finally control valve operation and stroke were checked & found ok.

MICV-13: Control valve general maintenance and valve postioner overhauling was done. Actuator was opened for diaphragm inspection, it was foundin good condition. Actuator was box up with same diaphragm and leakage checked. Finally control valve operation and stroke were checked & found ok.

MICV-14: Control valve general maintenance and valve postioner overhauling was done. Actuator was opened for diaphragm inspection, it was found damaged, so the actuator was box up with new diaphragm and leakage checked. Finally control valve operation and stroke were checked & found ok.

MICV-15: Control valve general maintenance and valve postioner overhauling was done. Actuator was opened for diaphragm inspection, it was found damaged, so the

actuator was box up with new diaphragm and leakage checked. Finally control valve operation and stroke were checked & found ok.

MICV-16: Control valve general maintenance and valve postioner overhauling was done. Actuator was opened for diaphragm inspection, it was found damaged, so the actuator was box up with new diaphragm and leakage checked. Finally control valve operation and stroke were checked & found ok.

USV-935: Metso Neles make ball valve and its actuator were checked and general maintenance was carried out. Passing was observed from its solenoid valve so it was replaced with new one. Control valve operation was checked and found ok.

PICV-29 : As per EWR A-571**,** IL make globe type control valve was opened from bonnet to resolve high noise level. Its VSC trim part (Cage, Plug & seat ring) were replaced with low noise VSN trim (cage, plug and sea ring). Control valve body was boxed up after general servicing. Finally control valve operation and stroke was checked & found ok. Control valve was taken in line and observed the sound level, found significantly less sound than previous condition and now the noise is within allowable range.

PIC-23: Auxilary boiler outlet flue gas duct damper actuator power cylinder was replaced with spare (ready to use) power cylinder and overhauled it positioner and checked damper operation.

General Maintenance & stroke checking of control valves

Following control valves general cleaning/ greasing were carried out. New gland packing had been provided wherever required. Valve positioner was cleaned and air header & regulators were flushed. Stroke checking was carried out:

1	FRCV-1	5	PRCV-3	9	LICV-44	13	PICV-137	17	TV-11A
2	FRCV-3	6	FICV-07	10	PICV-8	14	USV-933	18	TV-11B
3	PRCV-1	7	FICV-08	11	PICV-006A	15	USV-434	19	HICV-3046A
4	PRCV-2	8	PRCV-04	12	PICV-006B	16	USV-470	20	HICV-3046B

COMPRESSOR HOUSE JOBS

Air Compressor (101-J)

101-J Compressor related all radial, axial and key-phasor probes along with relevant junction boxes, speed pick-ups, bearing pad temperature thermocouple & RTD, pressure gauges and local THI were removed to facilitate Mechanical Maintenance jobs. All Junction boxes of proximitor were cleaned. After completion of mechanical maintenance jobs all instruments and probes/pick-ups were fixed back after cleaning & functional checking. Gap voltage adjustments for radial and axial probes were carried out.

101J-3H & 3V : Probe, extension cable and conduit of LP case radial vibration were replaced with new ones.

101J-4H : Probe of LP case radial vibration was replaced with new one.

101J-9A & 9B : Probes of HP case axial vibration were replaced with new ones**.**

101J-AK & AV: Probes of gearbox keyphasor & radial vibration were replaced with new ones.

101J-CA & CB : Extension cable and conduit of gearbox axial vibration were replaced with new ones.

101J (Trip logic): Checked the setting for alarm and trip logic.

Ammonia Refrigeration Compressor (105-J)

105J related all radial, axial and key-phasor probes along with relevant junction boxes, speed pick-ups, bearing pad temperature thermocouple & RTD, pressure gauges and local THI to facilitate Mechanical Maintenance jobs. All Junction boxes of proximitor were cleaned. After completion of M/M jobs the instruments and probes/pick-ups were re-fixed back after cleaning & functional checking. Gap voltage adjustments for radial and axial probes were carried out.

PRC-9: General cleaning and overhauling of pneumatic governor actuator was carried out. New lip seal of Piston/Cylinder was provided. New I/P, air Regulator provided for I/P and positioner air supply. Calibration of I/P converter was carried out. Ready to install I/P provided in field for emergency replacement. Finally governor actuator was fixed back and stroke checking was performed, found ok.

105J-EA &105J-EB: Probes for LP case axial vibration were replaced with new probes.

TR-15-15: Bearing temperature sensor was checked and found ok.

TRIP-105J: Mechanical trip feedback limit switch was overhauled and its operation was checked.

VS-105J: Trip Solenoid valve was overhauled. Coil of trip solenoid valve was checked and replaced with new one. Finally its operation was checked & found ok.

105J (Trip logic): Checked the setting for alarm and trip logic.

Synthesis Gas Compressor (103-J)

103-J Compressor related all radial, axial and key-phasor probes along with relevant junction boxes, speed pick-ups, bearing pad temperature thermocouple & RTD, pressure gauges and local THI were removed to facilitate mechanical maintenance jobs. All Junction boxes of proximitors were cleaned. After completion of M/M jobs all instruments and probes/pick-ups were re-fixed back after cleaning & functional checking. Gap voltage adjustments for radial and axial probes were carried out.

103J-9A & 9B: Extension cable and conduit of HP case axial vibration were replaced with new ones.

TI-103-11: 103J HP case thrust bearing temp thermocouple was checked and replaced with new one.

TI-103-6: 103J LP case general radial bearing temp thermocouple was checked and replaced with new one.

TI-103-7: 103J LP case thrust bearing temp thermocouple was checked and replaced with new one.

103-J LO/SO system: Pressure switches were checked and calibrated and then checked the setting for alarm and trip logic.

103-J turbine Valve Stroking: All three steam inlet valve HPCV 8101,HPCV 8102 & HPCV-8103 and Extraction Valve LPCV 8104 stroke were checked from TCC panel. Configuration of output controller WEST Module for all three HPCV and a LPCV were checked and taken back up of them.

Safety Block & QC NRV Solenoid valves: Three Solenoid valves mounted on safety block and two Solenoid valves mounted at actuator of QC NRV were checked for operation and found ok**.**

103-J turbine steam ESV: Feedback limit switch and SOV wire connections were removed to facilitate mechanical maintenance jobs & same were re-fixed after completion of job.

Field & Control room Instrument jobs

101-BJT: Removed different instruments (RTD, MPU, SV etc.) for 101-BJT to facilitate Mechanical Maintenance jobs. Checked all MPUs of electronic governor. After completion of job all instruments were fixed back. Feedback element/ proximity sensor of TTV were checked and replaced with new one as old one was faulty. Leakage from tubing of Turbine sealing steam line was attended by providing new SS tubing.

104-JT & 104-JAT: Removed different instruments (RTD, MPU, SV etc.) for 104-JA to facilitate Mechanical Maintenance jobs. Re-routing of instrument SS tubing was done. Checked both MPUs of electronic Governor for 104-JA. After completion of job all instruments were re-fixed back.

115JAT &115-JBT: Removed & reinstalled different instruments (RTD, MPU, SV etc.) to facilitate Mechanical Maintenance jobs. Checked both MPUs of electronic Governor. After completion of job all instruments were fixed back at their location. One MPU of 115-JA was replaced with new one as old one was found in damaged condition.

LT-15 and LT-16: Old and Obsolete leveltrols(with displacer and moving part) were replaced with new M/s Magnetrol make solid state RADAR level measurement to provide more accurate and reliable reading and low maintenace type level sensor. Necessary line modification was done with the help of Mech. Maintenance. Old signal cable was connected with level transmitter and lined up with necessary configuration using HART communicator.

LT-15 at 109-F

LT-16 at 110-F

FI-5301A: New Vortex flow meter was installed to measure HP air flow. Necessary line modification was done with the help of Mech. Maintenance. New branch cable laid from transmitter location to JB and line up in DCS with necessary wiring in marshalling cabinet. Flow transmitter was line up with necessary configuration using HART communicator.

FI-5301A HP air Flowmeter

Low range pressure gauges were provided at different locations in plant as per requirement of production department for purging & maintenance purpose.

As per requirement of production and maintenance impulse line of following transmitter were disconnected from transmitter and reconnected after completion of activity.

FSL-84, FSL-84A, PT-2004, PDI-484, FT-19,PT-19

109-CA/CB: Thermocouples & local PI were removed from its location to facilitate M/M, after completion of job all instruments were re-fixed back in its location.

Boiler Inspection: Provided standard 10" dial size pressure gauges on steam drum 101-F, 107-C & 1123-C. Pressure transmitter flushing and zero checking and other jobs related with Boiler inspection were carried out. After completion of inspection pressure gauges were reverted to original.

103-D: Removed temperature sensors mounted over 103-D top for clearance to Mechanical Maintenance work. All Metal temperature thermocouples (MTI-101, MTI-102, MTI-105, MTI-106, MTI-107 & MTI-108) were checked and some of found faulty and some having cable problem.. The branch cable of all these thermocuple were found hard and brital so replaced all such cable with new cabletherocouple cable. Also replaced four no. of faulty thermocuple with new one. Refixed all these thermocoupl after completion of mechanical maintenance work.

TI-0085 : 103-D to 101-CA inlet line Temp. indication was functionally ok but as per 103-D internals Inspection report of Inspection section, the thermowell is bent and badly corroded. So old 30” long, bend and damage thermowell was removed from mounting by jacking and pulling with chain block. After recondtioning the tapping and path of thermowell, new thermowell with new K type duplex temperature element were instlled at location and and line up in DCS by connecting its signal cable.

103-J LO/SO Turbine: Removed different instruments (RTD, MPU, SV etc.) to facilitate Mechanical maintenance jobs. Re-routing of instrument SS tubing was done. Checked both MPUs of electronic Governor. After completion of mechanical jobs, all instruments were fixed back.

JBT-3: Internal TB and wiring condition of few cables are very bad, so few possible temperatures input in nearby new JB, JBT-16, JBT-17 and JBT-18.

JBT-31A: New JB installed near primary reformer named as JBT-31A. few thermocouples input, TI-0069, TI-0066, TI-0067, TI-0085 and TI-0089 were rerouted through this new JB.

Pre-reformer Nonuse old cables: Old non used cables of Pre reformer were removed from four cable trays located at front side bottom of primary reformer and up to near 103-D structure.

Cable laying: Cable laying jobs were done as per following

- Two number of single pair signal cables were laid from marshalling room to the JBC-47 for limit switch installation to indicate FICV-15 open/close.

- 12 pair signal cable laid from new marshalling room to the UPSS room.
- New multi-pair J type thermocouple cable laid from 105-D top to JBT-12.
- New signal cable was installed for FR-650 to filed JB.

103-F: All instruments (Pressure transmitter, Pressure switch and Leveltrol) were removed & re-fixed to facilitate mechanical maintenance to replace 103-F vessel.

Catalyst replacement job : Sample tubings were provided from LTS/HTS and LT guard to the lab for sampling purpose during catalyst replacement job.

FT-982: Flow transmitter FT-982 was relocated to the new place for better visibility of reading. Necessary tubing work done and line up the transmitter.

Fuse Replacement : All Critical tags fuse checked and replaced if required. Fuse rating eg: 1A , 500mA , 2A etc.

AR-5: Auxiliary boiler outlet duct oxygen analyser insersion type sensor assembly was removed for safety of detector/sensor cell. Same was installed after startup of Auxiliary Boiler.

Recorder for Critical Parameter Monitoring: For monitoring of critical parameter of different area like Desulphurizer, HTS & LTS convertor, Methanator, 105-D and 108D convertor during non availability of DCS due to non availability of UPS power because of UPSS replacement acitivity, a Yokogawa make stand alone Hybrid recorder with online display was line up with domestic 220VAC power. Necessary tags input wiring and configuration of recorder was done for monitoring and recording arounf 24 No. important temperature reading. Other variable like pressure and level can monitor on local praqssure gauge and level gauge of respective vessel or area. Few temperature m,onitorin were also done using local temperaure gauge available in field.

Steam Drum (101F): Following instruments of steam drum were checked:

- Level monitoring system- Level State.
- Level transmitter.
- Pressure transmitter.
- Level switches.

Following ISO related Quality/Safety affecting instruments were calibrated:

1	PT-7	7	PT-62	13	FT-3	19	TI -0117
2	PT-8	8	PT-80	14	FT-100	20	PT-501
3	PT-10	9	PT-9	15	PIC-1A	21	PT-503
4	PT-150	10	PT-36	16	TRC-10	22	AR-1
5	PT-4	11	FT-1	17	TI -0036	23	
6	PT-5	12	FT-2	18	TI -0039	24	

AUX console/ Mosaic Panel: All faulty and damaged lamp indicators , push buttons and selector switches were replaced with new one as per following details:

1	KS-306A	Selector switch of SP-5	**6**	MT-I-103G	MANUAL TRIP Push Button
2	3CS-SP151	Selector switch of SP-5	**7**	MT-I-308	115-HT TRIP Push Button
3	3CS-SP4/5	Selector switch Emergency	**8**	MT-I-307	116-JBM TRIP Push Button
4	KS-306A	Selector switch STANDBY 116JA/JB	**9**	117-TRIP	117-J TRIP push button
5	IN-FSL-115	Selector switch DMW to K15	**10**	IS-308	MANUAL TRIP Push Button

Annual Maintenance Jobs for DCS/ESD, UPSS & Gas Analyzers

YIL DCS

The following activities were carried out in Ammonia plant.

Following jobs were executed for FCS Controlling Node Upgradation job for FCS101, FCS102 and FCS103

- Before starting upgradation activities, tuning parameters of all control stations were saved on Engineering station.
- Project back up was taken.
- Collected the FCS performance data.
- FCS <101>, <102> & <103> were upgraded from AFV10D to AFV30D. IO modules were removed from FCS node & Old FCS was removed. Then new FCS was installed & all IO modules were installed back.
- For FCS <104>, both CPU cards, Model: CP461 were changed with CPU cards CP471.
- CENTUM VP software version was upgraded from R6.07 to R6.08.
- FCS fan Unit and fan failure with temperature detector unit were installed for each of the FCS.

Remote Node Removal Job

- To decrease load of existing FCS <102> & <103>, remote nodes of existing FCS were removed and shifted to the new FCS0104.
- Two Number of Old remote node were removed from their cabinet and their I/O cards(AAT145).
- First node N1 belongs to FCS102 and Second Node N2 belongs to FCS103. Both node I/O cards were incorporated in the single node N2 of FCS104.
- DCS side engineering work done in FCS104 to install I/O card.
- After completion of above jobs, all the tags which were shifted from one FCS to other were checked properly.
- Remote nodes were deleted from FCS0102 and 0103.

UPSS Related DCS Job

- 20 number of Digital tags defined for each UPS-1 and UPS-2.
- New graphic designed according to the vertiv UPSS workflow.
- Modbus Communication established between UPSS and DCS using ALR121 card**.**

MOV SP6 and SP7: DCS side enginnering done for new MOV SP6 and SP7 motor operated actuator installed by Electrical section at hot ammonia pump 121-J and 121-JA suction line gate vavle.

DCS side enginnering work done for rerouted temperature tags. TI-0061, TI-0062, TI-0063 , TI-0085 and TI-0089.

DCS side engineering done for new vortex flowmeter (i.e FI-5301A) installed to measure HP air flow from ammonia plant to IG plant.

Primary Reformer area new JB, JBT-31A multipair cable were taken in line after termination in DCS marshalling panel.

DCS shutdown/ preventive maintenance activities were carried out as per the AMC procedure.

- Checking of System healthiness was carried out from System detail display and found Normal.
- AC/DC voltages and Battery voltages were measured wherever applicable for all Stations and were found within limit.
- The system was dismantled as per plant clearance and operating conditions like dust, moisture and temperature were checked. All parameters were checked and found within limit. Interior of system cabinets, Engineering station and HIS consoles were cleaned thoroughly. PCBs were inspected and inspection of data bus and connectors were done. No abnormality was observed.
- Printers were cleaned & overhauled, wherever applicable. CPU back-up battery voltage and grounding were checked and same were found within specified limit in all stations.

- Function of each component of the DCS was checked. YOKOGAWA diagnostic software was run on FCS, the results of the test Program indicated the healthiness of the system.
- Redundancy checks were performed on V net / IP Bus, CPU, Power Supply cards and AAB841 cards wherever applicable. As per redundancy feature, control transfer took place to the stand by one properly.
- HIS to HIS communication was checked by pinging and found normal. After cleaning functionality of all HIS were checked and found ok.
- Daily reports were modified & new tags were taken in report and also three numbers of new reports were made as per requirement of Production people.
- Data was collected for all HIS & FCS in Project backup for reference.
- Control room dust level & temperature had been observed & found within limit.
- Wiring termination checked in all marshalling cabinet and tighen them.
- Fuse of all power supply tB for isolators and field TB of DI and DO in all Marshalling cabinets were checked and checked fuse of all critical DI and DO with new one.

Prosafe-RS ESDS

SCS Controlling Node Upgradation job for SCS106, SCS107 and SCS108

- Before starting upgradation activities, tuning parameters of all control stations were saved on Engineering station.
- Project back up was taken.
- Collected the FCS performance data.
- SCS Controlling node updated from SCS50D with CPU module SCP451 to S2SC70D with CPU module SCP471.
- Prosafe-RS software version was upgraded to R4.06.
- SCS fan Unit and fan failure with temperature detector unit installed for each of the SCS.
- Wiring termination checked in all marshalling cabinet and tighen them.
- Fuse of all power supply TB for isolators and field TB of DI and DO in all Marshalling cabinets were checked and checked fuse of all critical DI and DO with new one.

Prosafe-RS ESD shutdown/ preventive maintenance activities were carried out as per the AMC procedure.

Cleaning of filters, fans, cabinets were carried out for all the three SCS.

Redundancy of all the CPU, Power Supply cards, V net / IP Buses and IO cards were checked and found ok.

Few old and nonused cables were removed from Marshalling cabinet No. C273 and C274.

Latest Back up was taken on DVD media.

New soft tag of Manual trip input assigned in trip logic IS-47 for Manual trip of Plant.

TCP for 101-JT

For air compressor turbine, after reaching Minimum Governor Speed , the speed gets reduced to around 980-1000 rpm instead of holding at minimum governor speed (i.e. 6310 rpm) if immediately remote speed set-point is not increased. It was necessary to change the setting, due to a very narrow gap of only 5 rpm between third idle speed setpoint of 6305 rpm and Minimum govenor speed of 6310RPM.

To overcome this problem , Woodword Governor Minimum Governor Speed setting was changed from 6310 RPM to 6350 RPM with necessary consent of OEM (Siemens) and approval of authority in presence of M/s Sicagen person.

After this change in setting, machine was found running stably at Minimum Governor speed of 6350RPM without any problems. Also changed related our parameter like rated speed and Analog input 03 for 4Ma, it is for remote speed input.

Woodword make governor controller 505D and 2003 OSPS (Over speed Protection System) Protech GII were also checked for configuration, wiring and proper functioning.

TCC for 103-JT: Siemens PLC S7-400 were checked, also checked all module of PLC, 2003 trip system functioning and wiring connection and tighten all terminals. Also checked Braun make 2oo3 Overspeed trip system functioning.

UPSS(Uninterrupted Power Supply System) Replacement:

- Fuji Make, Model:CVCF500, 2x60 KVA UPS system with 3-pahse input and 1-phase 110V AC output, installed and in service since from 1997 has completed its useable life and declared obsolete by OEM needed to be replaced as their is no technical support availabe from the OEM.
- Fuji UPSS system was replaced with Vertiv make, Model: Liebert FP60Z 2x60KVA UPS system with 3-pahse input and 1-phase 110V AC output having IGBT based design and uses patented digital Vector Control technology for signal and controlling of entire system.
- **NPS:** Vertiv make NPS Model: Libert NPS-1 FL2 is a network power switch which has two source and one output. NPS facilitate bumpless transfer of load from Source-1(Vertiv FP60Z UPSS) to Source-2 (Emerson Hipulse UPSS) system with in less than in 3 ms.
- **New UPSS Battery Bank:** New UPSS Battery Bank consist of two redundant battery bank each having HBL make 175 No. Battery Model: PKPH 155P with backup capacity of 30 min each with total backup of 30min.x2= 60min.

Vertiv UPS Model: Liebert FP60Z with SCVS and NPS

- Existing Fuji make UPS load was first transferred on Bypass AVR by tripping one by one both Invertor after isolating battery bank. Also make the maintenance bypass ON then after transfer of load switch OFF 3-phase AC input of UPS-1, UPS-2 and Bypass. Removed old panel of UPS-1 and UPS-2 Battery braker, system control cabinet and system monitoring cabinet. All interpanel interconnection, Input and output power connection cables were disconnected and removed all pane out from UPSS room. Likewise discoonect wiring from battery bank and also discconect all 175 battery interconnection and taken out all batteries and battery racks from battery room.
- Assemble new battery racks for both battery bank, filled all 175x2No. new battery with electrolyte and placed on their rack and intercoonected with intercoonecting link to form battery bank.
- After cleaning and reconditioning of base frame structure with necessary dimensional modification as per requirement of new cabinet of new UPSS system, installed new panel of UPS-1, UPS-2, SCVS and NPS on the base frame structure. Done necessary signal cable interconnection and Input and output power cable and battery link connection for both redundent battery bank though their invidual breaker.
- Power ON the UPS-1and UPS-2 and after performing necessory functional and redundency test put both battery bank for charging through them for one overnight period.
- During battery charging and after full charge, battery test for each battery of both battery bank were done. Top up electrolyte level in each battery of both battery bank as per requirement. Both battery bank drain test were done individually using two water load arrangement for around four hour and after draing both battery bank were put in boost charging and charged 100%.
- Power down the DCS, ESD PLC and other instrumentation system and transffered input of old ACDB from output Bypass of FUJI UPS to Output of new Vertive UPS-1 and UPS-2.
- Power OFF the input of FUJI BYPASS system and removed its transformer and AVR cabinet after disconnection of all interconnection, input and output power connection. Line up the input power cable to input of new SCVS and power ON it and done necessary test of SCVS and load transfer test from UPS-1/UPS-2 to Bypass SCVS and Bypass SCVS to UPS-1/UPS-2.

- Battery back up test of UPSS system was done bay switching OFF Input of both UPS, UPS-1 and UPS-2 tested at available online load of approx. 20% for 30min.
- Line-up NPS(Network power switch) by connecting Vertiv FP60Z output to Source-1 and another UPSS system available, Emerson Hipulse output to Source-2 and configured same with priority of Source-1. Necessary load transfer test were done.
- New ACDB was installed in UPSS room after required modification of base frame. Power down the DCS, ESD PLC and other instrumentation system and transffered input new ACDB from output of NPS and all out going power cable of old ACDB to new ACDB. Then power ON NPS output and input of ACDB,.line up line up all outgoing power of DCS, ESD PLC and other instrumentation system through new ACDB one by one.

Mass Spectrometer

All primary sample system and secondary sample conditioning system were cleaned and checked. Calibration and necessary tuning were carried out for measurement components of each stream.

EWR / SUGGESTION SCHEME / RECOMMENDATION COMMITTEE AND TECHNICAL DEPT. RELATED JOBS:

PICV-29: As per approved EWR A-571 to review fuel NG to utility line separator for low dB noise. Its VSC trim part (Cage, Plug & seat ring) were replaced with low noise VSN trim, (cage, plug and sea ring). Control valve body box up after general servicing. Finally control valve operation and stroke was checked & found ok. Control valve was taken in line and observed the sound level, found ssignificantly less than previous condition and now the noise is within allowable range.

PICV-29

MOV Installation: As per approved EWR A-530 for installation of motorized actuator on the inlet isolation valve of 121J and 121JA suction line, Electrical section has installed Rotork make MOV actuator at 121J and 121JA suction line isolation valves. To line up both these MOV-SP6 and MOV-SP7 operation and status monitoring in DCS necessary engineering configuration in DCS and wiring for status input signal and output command signal were done in MOV interfacing JB and in marshalling

cabinet C113. Both MOV operation and OPEN and CLOSE feedback were checked on DCS, found Ok.

FT-982: Flow transmitter FT-982 was relocated to the new place for better visibility of transmitter reading.This will facilitate the production team for better work the Necessary tubing work done and line up the transmitter.

CONTINUAL IMPROVEMENT

FCS upgradation job: FCS controllers for FCS 101, 102 & 103 were upgraded from AFV10D with CPU cards CP451 to AFV 30D with CPU cards CP471.

SCS upgradation job: SCS controllers for SCS 106, 107 & 108 were upgraded from SCS50D with CPU module SCP451 to S2SC70D with CPU module SCP471.

UPS replacement jobs: Fuji UPSS system was replaced with new Vertiv make system with two redundant battery banks and NPS.

PRCV-18 : Very old and obsolete Fisher make control valve was replaced with New Fisher make control valve.

LT-15 and LT-16: Old and Obsolete leveltrols(with displacer and moving part) were replaced with new M/s Magnetrol make solid state RADAR level measurement.

FICV-15: Fisher make valve with very old and obsolete actuator was replaced with new actuator Model 585C with latest model positioner 3610JP.

UREA PLANT

(INSTRUMENT)

CONTROL VALVES

HICV-1201: Valve was opened from the bonnet and done compete overhauling. Cleaned and checked its body and trim parts. Boxed up the valve with new bottom guide bush, gland packing set. Pneumatic positioner and position transmitter were replaced. Actuator was mounted back. All pneumatic & Electrical connections were done. Carried out stroke checking and calibration of positioner & position transmitter.

LRCV-1201: Valve was dropped from the line. Cleaned and checked its body and trim parts. Its plug and seat were replaced with new plug and seat and boxed up the valve with new bottom guide bush, gland packing set and bonnet and seat seal rings set. Control valve was installed back in line. All pneumatic & Electrical connections were done. Carried out stroke checking and calibration of positioner & position transmitter.

PRCV-1201: Valve actuator was removed & replaced with new actuator. New positioner was mounted. Positioner linking & all pneumatic connections were done. Positioner calibration was carried out & stroke was checked.

HICV-1421: Valve was dropped from the line and replaced by spare overhauled valve with new teflon seat. New Valve operation SOV was provided. Actuator seal ring & Bonnet seal kit was also replaced. Control valve installed back in line. All pneumatic & Electrical connections were done. Carried out control valve operation checking.

FICV-1281 : Valve was dropped from the line & overhauling was carried out. Hydro test was carried out. Control valve was installed in line. All pneumatic connections were done and carried out valve positioner calibration and stroke checking.

FICV-1202: Valve was dropped from the line & overhauling was carried out. Hydro test was done. Control valve was installed in line. All pneumatic connections were done and carried out valve positioner calibration and stroke checking.

HICV-1206: Valve was dropped from the line & overhauling was carried out. Hydro test was done. Control valve was installed in line. All pneumatic connections were done and carried out valve positioner calibration and stroke checking.

HICV-1207: Valve was dropped from the line & overhauling was carried out. Hydro test was done. Control valve was installed in line. All pneumatic &connections were done and carried out valve positioner calibration and stroke checking.

HICV-1422: Valve was dropped from the line & overhauling was carried out. Hydro test was done. Control valve was installed in line. All pneumatic connections were done and carried out valve positioner calibration and stroke checking.

PICV-1202: Valve was dropped from the line. Boxed up the valve with new bonnet gaskets and gland packing. Hydro test was done. Control valve was installed in line after hydro testing and carried out valve operation and stroke checking.

MICV-1101C: Control valve was dropped from the line for mechanical modification. Replaced its gaskets. Valve was mounted back in new orientation after line modification. Accordingly, I/P converter stand was relocated & new tubing work was done. All other pneumatic & Electrical connections were done. Valve positioner calibration & stroke checking was completed.

LICV-1352: Valve was dropped from the line. It's trim set & gland packing were replaced. Entire body seal kit including body & bonnet gaskets were replaced. Internal cleaning was carried out. Hydro test was carried out. Control valve was installed in line. All pneumatic connections were done and carried out valve positioner calibration and stroke checking.

PICV-1129: Valve was opened from the bonnet. Plug & Cage-guide-seat was inspected & some damage was observed. So these were replaced. Seal ring around the plug was replaced. Booster & Positioner were also replace. Valve was mounted back on body. All pneumatic & Electrical connections were done. Positioner calibration was carried out. Stroke checking was completed.

HICV-1221A: Valve was dropped from line. Overhauling was carried out. Seat was replaced due to problem of passing. Valve was mounted back in line. All pneumatic connections were done. Positioner calibration was done & stroke checking was completed.

HICV-1221B: Valve was dropped from line due to mechanical line modification. Overhauling was carried out. Valve was mounted back in line. All pneumatic connections were done. Positioner calibration was done & stroke checking was completed.

HICV-1405: Valve was dropped from line. Its overhauling was carried out. Stroke checking was done. Some problem was observed, so positioner was replaced & its calibration was carried out. All pneumatic connections were done. Valve was mounted back in line.

HICV-1202: Old Control valve was dropped from line & was brought down. After mechanical line modification, new Control valve & silencer were lifted to the platform & installation was carried out. New tubing work for positioner & booster air supply was done. I/P signal to positoner tubing was extended. Tubing was done for drain points in Silencer upstream & downstream upto drain funnel. Control valve stroke checking was carried out & positioner calibration was done. Then it was taken in line.

PICV-1810: Old Control valve was dropped from line. New Control valve was lifted to the platform & installation was carried out. All pneumatic connections were done. Control valve stroke checking was carried out & positioner calibration was done. Then it was taken in line.

PICV-1481: Old Control valve was dropped from line. New Control valve was lifted to the platform & installation was carried out. New tubing was done for positioner input & supply. Control valve stroke checking was carried out & positioner calibration was done. Then it was taken in line.

FICV-1351: Old Control valve was dropped from line. New Control valve was lifted to the location & installation was carried out after mechanical line modification. Tubing work was done for positioner supply. All electrical & pneumatic connections were done. Control valve stroke checking was carried out & positioner calibration was done. Then it was taken in line.

LICV-1502A: Old Control valve was dropped from line. New Control valve was lifted to the 4-ata steam drum platform & installation was carried out. All electrical & pneumatic connections were done. Control valve stroke checking was carried out & positioner calibration was done. Split control was done from DCS. Then it was taken in line.

General checking & stroke checking of following control valves were carried out:

HICV-1385, FICV-1203, LICV-1282 , HICV-1221B, TICV-1226, HICV-1211, HICV-1204, HICV-1210, HICV-1424, , HICV-1405, PICV-1502A, PICV-1502B, PICV-1131, LICV-1501, LICV-1502B, PICV-1450, PICV-1422, HICV-1423, HICV-1425, HICV-1418.

COMPRESSOR HOUSE JOBS

Woodward Governor upgradation to 505-XT: All wiring terminals were disconnected from Old governor 505-E & the governor was removed from the panel. New governor 505-XT was installed with retrofit kit for connecting terminals. Overspeed test & mock-up testw as carried out through new governor.

Old

New

Local Indicators: All local temperature and pressure gauges were removed to facilitate mechanical jobs. All were checked and fixed back after the completion of the jobs. Faulty temperature and pressure gauges were replaced with new one.

Bearing temperature: All bearing RTDs in turbine, HP case, LP case & gear box were removed to facilitate mechanical jobs. All were checked and reconditioned RTD termination with new lugs and soldered the wiring terminal wherever found necessary and then re-fixed on completion of mechanical maintenance jobs.

Following damaged RTDs were replaced with new ones:

TI-1821

TI-1832 (damaged twice during mechanical bearing cover installation)

Vibration probes: All vibration probes for radial, axial and key-phasor points in turbine, HP case, LP case and gear box were removed to facilitate mechanical jobs. Physical condition of probe tips and end connector of all vibration probes were checked. Also checked extension cable and proximitor for all vibration probes. After completion of mech. maintenance jobs, all probes were re-fixed with proper gap voltage adjustments.

Damaged vibration probes were replaced with new ones for following probes:
XE-1803B, XE-1804B

Damaged extension cables were replaced with new ones for following probes:
XE-1810A, XE-1810B, XE-1809B, ZE-1803A, ZE-1803B

Pressure Switches: Following pressure switches for oil & steam alarm and trip function were cleaned, checked and calibrated.

PSLL-1801C, PSLL-1838C, PSHH-1839C, PSHH-1843C, PSL-1816, PSL-1812, PSL-1813, PSLL-1844

Level Switches: Following low level and high level switches of separators & surface condenser were cleaned, checked and calibrated.

LSHH-1804, LSHH-1806, LSHH-1808, LSL-1824, LSHH-1822 & LSH-1823

Limit switches: All limit switches for 60-ata steam control valve, Extraction Control valve, admission steam valve and barring were removed to facilitate mechanical job and re-fixed after completion of the job. Position switches were adjusted as per trip settings provided by Urea-production.

Speed Sensors: All the 3 speed sensors for Woodward governor's turbine speed measurement were removed to facilitate mechanical jobs and re-fixed after the completion of the jobs.

All the field Junction Boxes, Local Control Panel and turbine local control box were

cleaned, all wiring connections terminals were tightened. Also checked all MCB fuse terminals and fuses replaced as per necessity.

Mock up test carried out for Woodward governor for CO2 Compressor for HP and LP Valves stroke checking. Also checked the stroking for 4ata admission steam valve from DCS.

General cleaning & stroke checking and air filter regulators were cleaned and checked for following control valves:

HICV-1801, HICV-1802, HICV-1803, LICV-1803, LICV-1805
LICV-1807, LICV-1821A/B, PICV-1979A/B & TICV-1808

PT-1826: New vacuum Pressure transmitter was provided. New tubing via different route was done for to improve measurement of Vacuum pressure.

PICV-1979B: Valve was opened from bonnet. Bonnet was dismantled & Gland packing replacement was done to solve gland leak problem. Valve was assembled. & all pneumatic connections were carried out. After that, stroke was checked & calibrated.

FIELD JOBS

HP Stripper's and Autoclave's pressurised as well as empty count readings for LRC-1201 & LR-1201 detectors were taken and recorded.

Radioactive source of LR-1201 was removed from its mounting for Autoclave to facilitate mechanical maintenance jobs. After completion of mechanical maintenance jobs radioactive source was installed back.

Radioactive source and scintillation counter of nucleonic level gauge of HP Stripper (LRC-1201) were removed to facilitate mechanical maintenance jobs and installed back after completion of mechanical maintenance jobs.

Following HP Thermowell were removed and hydro tested.

TR-1205, TR-1206, TR-1207,TR-1210,
TI-1209, TI-1222
Inspection of following magnetic flow meters was done:

FICT-1203, FICT-1435, FRCT-1421, FICT-1352 & FIT-1353

Following extended pad type transmitters were checked and calibrated:

LICT-1201, LICT-1202, LIC-1421,
LT-1353, LICT-1282 and LRCT-1421

New Mass Flowmeter FS-1101B was installed parallel to existing mass flowmeter FS-1101A after mechanical line modification work. Transmitter mounting & cable laying work was completed & instrument was taken in line.

Following quality affecting instruments declared in ISO were calibrated:

PT-5303, PT-4405, PT-1121, PT-1145, PT-1802, PT-1105,
PT-1201, PT-1202, PT-1421, PT-1422, SI-1401AR, SI- 1401B,
FR-1201, PICT-1202

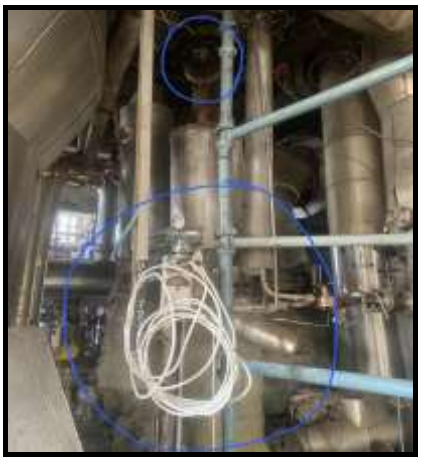
Two no. of 10 inch dial pressure gauges were checked and calibrated and mounted at HPF pump discharge and at 4 ata steam drum for hydro test purpose.

Cleaned the I to P convertor panel at prill bucket room and general checking of the I to P converters and their associated tubing for leakage etc were carried out.

The instrument air headers at all floors and in Hitachi compressor area were flushed for any foreign particles accumulation.

Weep holes related tubings were removed from HPCC to facilitate mechanical maintenance jobs. Also all weep holes for HP scrubber were checked and attended and cleared the choking.

PDT-1212A: Extended diaphragm dual capillary type Differential Pressure sensor & Transmitter PDT-1212A of ABB make was replaced with new one from Yokogawa. Old seal & flanges was removed from LP & HP tappings along with oil capillary & transmitter. New seal was inserted in tapping flange. Mounting flanges were tighetened. Oil capillary were guided to transmitter mounting location. New transmitter was mounted & cable gland & termination work was completed.



LICT-1501: 23-ata steam drum level: Old leveltrol was removed & GWR type level instrument was installed. Transmitter was mounted on platform & branch cable gland & termination work was done. Response of the radar was checked & instrument was taken in line.

FI-1204: Magnetic flowmeter: Old instrument was removed from line & new instrument was installed. Cable termination was done & transmitter was taken in line.

FT-1206: Due to reading getting stuck up, Transmitter impulse tubing was modified & Transmitter was relocated. Cable re-routing was carried out & termination was done. Then Instrument was taken in line.

H-1207 Thermocouple & thermowell were removed for mechanical work & refixed after mechanical work.

K-1701 PCS fan-1 TI was removed for mechanical work & refixed after mechanical work.

Neem Oil tank instruments were shifted to new day tank. Old valve was removed & general cleaning was done & stroke checking was done.

Pressure gauges and temperature gauges were replaced at different locations as required.

New JB was installed near carbamate pump area & related tray work done.

VAM PLC panel was cleaned, checked fuse and all wiring terminals.

Removal of old cables and non used tubing in different plant areas.

DCS RELATED CONTROL/ MARSHALLING ROOM JOBS

Annual shutdown preventive maintenance activities were carried out for complete CentumVP DCS System with FCS0201, FCS0202, FCS0203 all six marshalling cabinets, Operator station HIS0259 to HIS0263, SOE station HIS0258 and Engineering station EWS0264. Following activities were carried out as per AMC procedure in Urea plant.

- Before starting preventive maintenance activities / AMC jobs, tuning parameters of all control stations were saved on EWS0264 and project back up was taken.
- DCS System & Panel earth resistance were checked, found within limits
- Checking of system healthiness was carried out from system details display and found normal.
- AC and DC voltages and battery voltages were measured wherever applicable for all stations and were found within limits.
- The system was dismantled; cleaned and operating conditions like dust, moisture and temperature were checked. All parameters were checked and found within limits.
- Interior of system cabinets, ENGS and HIS consoles were cleaned thoroughly. PCBs were inspected and inspection of data bus and connectors were done. No abnormality was observed.
- Printers were cleaned/overhauled, wherever applicable. CPU back-up battery voltages and grounding were checked and the same were found within specified limits in all stations.
- Function of each component of the DCS was checked. YOKOGAWA diagnostic software was run on FCS, the results of the test program indicated the healthiness of the system.
- Redundancy checks were performed on V net / IP Bus, CPUs, Power supplies and cards wherever applicable. As per redundancy feature, control transfer took place to the stand by one properly.
- HIS to HIS communication was checked by pinging and found normal. After cleaning functionality of all HIS were checked and found working ok.
- Wiring terminals of all cabinet was checked and tightened, also checked fuses in all fuse TB and changed the fuses of critical trip related IO terminals.
- Data was collected for all HIS & FCS in Project backup for reference. Latest project backup was taken on DVD media.

FCS0201 was upgraded from AFV10D to AFV30D. IO modules were removed from FCS node & Old FCS was removed. Then new FCS was installed & all IO modules were installed back. All LC64 & ST16 blocks were checked for proper operation.

CENTUM VP software version was upgraded in FCS0202, FCS0203 from R6.07 to R6.08.

Hitachi compressor First out logic was corrected to identify first trip input as earlier all inputs used to show as First out in case of compressor trip.

MOV-1801: Valve operation in stop command was pulsating & not continuous. So, logic was modified to make it continuous as per safe practice for electrical machinery.

HIS <0263> was formatted due to hang & trend cut issue. OS was reinstalled, CENTUM Software & Antivirus were installed. Operation from this HIS was chcked in front of production staff.

EWR-365: PICV-1130 Split control loop was defined in DCS. Related IOM & graphics modification was carried out.

CAPITAL JOBS

Existing old and obsolete control valves **PICV-1810, HICV-1202, PICV-1481 & FICV-1351** were replaced with Fisher, Keytech & Mascot make control valves respectively and KSB MIL make valve respectively procured with technical specification as per updated process data.

New Mass flowmeter FS-1101B was installed in parallel to existing mass flowmeter FS-1101A.

EWR JOBS & OTHER TECHNICAL RELATED JOBS

EWR U-365: To provide split pressure control valve for LS steam PICV-1130 A & B: Old Control valve PICV-1130 was dropped from line. After mechanical line modification, new Control valve PICV-1130A was lifted to the location & installation was carried out. All electrical & pneumatic connections were done. Control valve stroke checking was carried out & positioner calibration was done. Then it was taken in line. After mechanical line modification, New Control valve **PICV-1130B** was lifted to the location & installation was carried out. New branch cable was laid. All electrical & pneumatic connections were done. Control valve stroke checking was carried out & positioner calibration was done. Then it was taken in line.

EWR U-394: New flowmeter in Seal flushing line fo carbamate pump P-1201A & B: New Rotameter installation were completed with GE scetion.

CONTINUOUS IMPROVEMENT

Following old and obsolete control valves were replaced with new control valve with technical specification as per updated process data:

PICV-1481, PICV-1810 & FICV-1351, HICV-1202

Following new flowmeters were provided

FS-1101B & FI-1204

Old and obsolete proximeters for vibration probes were replaced with new ones.

DCS controller for FCS0201 was upgraded from AFV10D to AFV30D.

OFFSITE & UTILITY PLANT

(INSTRUMENT)

CONTROL VALVES

HICV-5154(C.T): Valve was opened from the bonnet and done compete overhauling. Cleaned and checked its body and trim parts. Boxed up the valve and Complete overhauling of the actuator was also done. After verification, valves were installed back in line and checked its operation and stroke.

SWV-2(AMMONIA STORAGE): Valve was opened from the bonnet and done compete overhauling. Cleaned and checked its body and trim parts. Boxed up the valve and Complete overhauling of the actuator was also done. After verification, valves were installed back in line and checked its operation and stroke.

FCV-2(S.G): Complete overhauling of the actuator was done with replacement of diaphragm and Provided new gland packing. After complete verification, valves operation and stroke checked.

TCV-1(S.G): Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

FCV-1(S.G): Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

PCV-50(S.G): Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

LCV-4(S.G) : Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

HICV-5153(C.T) : Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

MICV-4401B(C.T) : Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

HICV-4201(C.T) : Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

FCV-3101(AMMONIA STORAGE): Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

PV-3101/1(AMMONIA STORAGE): Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

PV-3101/2(AMMONIA STORAGE) : Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

PV-3101/3(AMMONIA STORAGE) : Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

PV-3101/4(AMMONIA STORAGE) : Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

PV-3101/5(AMMONIA STORAGE) : Complete overhauling of the actuator was done. Provided new gland packing. After complete verification, valves operation and stroke checked.

Following Boiler NG Gas Burner trip valves preventive maintenance was carried out. Actuator parts, pneumatic accessories and operation were checked, and necessary action was taken.

Sr. No.	Tag	Description	Area	Problem	Job done
1	BTV1-4A & BTV1-4B	NG Gas burner trip valve	Boiler	valve operation sluggish	Both BTV SOV replaced.
2	BTV2-4A & BTV2-4B	NG Gas burner trip valve	Boiler	valve operation sluggish	SOV overhauling performed.
3	GHTV and GHVV	NG Gas Header trip & Vent valve	Boiler	Preventive overhauling	General overhauling performed.
4	IGTV and IGVV	NG Gas Ignitor trip & Vent valve	Boiler	Preventive overhauling	General overhauling performed.

Following BTV Limit Switches operation were checked & found ok:

1.	IGTV	2.	GHTV	3.	GBTV-1
4.	GBTV-2	5.	FCV-22	6.	SGHTV
7.	SGBTV-1	8.	SGBTV-2	9.	SGFCV-41

Following Boiler Syn gas Burner trip valves preventive maintenance was carried out. Actuator parts, pneumatic accessories and operation were checked, and necessary action was taken.

Sr. No.	Tag	Description	Area	Problem	Job done
1	SGBTV-43 & 44	Syn Gas burner trip valve	Boiler	Preventive overhauling	Quick exhaust was overhauled
2	SGBTV-46 & 47	Syn Gas burner trip valve	Boiler	Preventive overhauling	Quick exhaust was overhauled
3	SGBTVV-45 & 48	Syn Gas burner Vent valve	Boiler	Preventive overhauling	Quick exhaust was overhauled
4	SGHTV-41	Syn gas header trip valve	Boiler	valve operation sluggish	SOV replaced, and Quick exhaust was overhauled.

General cleaning & stroke checking and air filter regulators were cleaned and checked and preventive maintenance was carried out for following control valves.

Sr. No.	Tag	Description	Area
1	FCV-1	100% BFW flow C/V	Boiler
2	FCV-2	30% BFW C/V	Boiler
3	LCV-3	Blowdown valve	Boiler
4	PICV-25	NG pressure C/V	Boiler
5	TICV-25	Flue gas temp (After Header)	Boiler
6	PIC-50	4-ata steam to De- aerator	Boiler
7	PIC-6	60-ata steam vent valve	Boiler
8	TCV-4	Spray water control valve	Boiler
9	LCV-4	De-aerator level control valve	Boiler
10	FRC-22	Main Gas Flow control	Boiler
11	SV-5307	Plant air SOV	IG
12	PIC-5501	New IG VAP Pr.	IG
13	FIC-5502	New I.G Crack gas Flow	IG
14	LIC-5401	Old I.G Amm. Vap Level	IG
15	PIC-5401	Old I.G Amm. Vap Pressure	IG
16	FIC-5402	Old I.G Comb. Chamber Gas Flow	IG
17	PIC-5501	Crack Gas Pressure control	IG
18	LIC-5501	New IG Vap Level	IG
19	PIC-5503	New I.G Surge drum. pr.	IG
20	PIC-5403	Old I.G Surge drum. pr.	IG
21	PIC-5504	New I.G Receiver Pr.	IG
22	PIC-5404	Old I.G Receiver pr.	IG
25	LlCV-01	Surface Condenser Recirculation	CT
26	LlCV-02	Surface Condensate export	CT
27	LlCV-4401	CT Basin Level	CT
28	PIH-4401	Amm. NaOH pH	CT
29	PIH-4402	Urea NaOH pH	CT
30	PIH-4403	Amm H2SO4 pH	CT
31	PIH-4404	Urea H2SO4 pH	CT
32	PHICV-4502	Combine Effluent pH control	ETP
33	FIC-4502	Combine Eff. Flow to Gard Pond	ETP
34	FIC-2201	Anion 1 outlet flow control	DM
35	FIC-2204	Anion 4 outlet flow control	DM

36	FCV-2201	Anion 1 outlet flow control	DM
37	FCV-2202	Anion 2 outlet flow control	DM
38	FCV-2203	Anion 3 outlet flow control	DM
39	FCV-2205	Anion 5 outlet flow control	DM
40	LCV-2905	DM Water Buffer tank Level control	DM
41	LCV-2311	Degras sure Lvl	DM
42	PCV-3064A	Condenser Pressure control	Ammonia Storage
43	PCV-3064B	H3001A VAP to V300A Pr.	Ammonia Storage
44	LCV-3055A	Receiver Level control	Ammonia Storage
45	LCV-3055B	V3004A ammonia Receiver Lvl.	Ammonia Storage
46	PCV-3501	T3501 VAP TO FLARE PR	Ammonia Storage
47	PCV-3504	T3501 VAP TO PLNT PR	Ammonia Storage
48	PIC3008	T3001 VAP TO FLARE PR	Ammonia Storage
49	PIC-3009	T3001 VAP TO PLANT PR	Ammonia Storage
50	PCV-3065A/B	V3003A I.G gas Sep. Lvl	Ammonia Storage
51	PCV-3055A/B	Receiver Pressure control	Ammonia Storage
52	LCV-3051A/B	Saturator Inlet Level control	Ammonia Storage
53	LCV-3058A/B	Inter stage cooler Level control	Ammonia Storage
54	LCV-3065B	Gas Separator Level control	Ammonia Storage
55	LCV-3053A/B	V3003A I.G gas Sep Levl	Ammonia Storage
56	PICV-6209	DM Water HDR Pr. Control	Narmada

FIELD JOBS

BOILER

O_2 Analyzer: Flue Gas O2 analyzer sensor was removed and cleaned. A visual inspection was carried out. General maintenance of O2 analyser was carried out and installed back.

Igniter: Burner 1 & 2 both Igniter guns were taken out for inspection. Clean leads with cleaning solvent. Connectors were inspected for damaged threads, corrosion, cracked insulators, and bent or broken connector pins. Continuity of ignition leads, and operation of igniter were checked.

Flame Scanner: All four flame scanners were removed from the line and general cleaning was done. Visual Inspection was carried out and installed back in line.

Pressure gauges PI-14, PI-15 and PI-16 of furnace draft were removed from line and checked. Clean the line with air and install back.

Electrodes of Steam drum level indicator were checked. Cleaned all and installed back. Terminal tightening was done.

All pressure gauges (PI-2, PI-3, PI-4, and PI-5) were calibrated for boiler inspection.

PSH-11 was not responsive during calibration procedure. So replaced it with new calibrated Pressure switch.

TI-13 New set of thermocouples and thermowell was installed for TI-13 and TI-13A.

HIC-11: FD Fan Inlet damper positioner preventive maintenance and calibration performed. Damper Stroke checked.

PC-2 & PC-3: FD Fan air damper SOV replaced, and operation checked. PC-2 SOV cable also replaced.

FD Fan Turbine (Q-5111) jobs

Turbine Speed pick-up probes, local temperature & pressure gauges were removed & reinstalled to facilitate mechanical maintenance.

FD Fan Turbine Start-up activities

- HIC-3- FD fan turbine speed control loop output to governor operation checked, I/P zero adjusted as per requirement.
- New Spare Yokogawa I/P configure for HIC-3 control loop.
- Operation checked for both Installed Turbine Trip SOV and Spare SOV (issued from store).
- Facilitate Mechanical Maintenance for testing Governor and oil Servo on test Bench by providing necessary tubing work, fabrication of BSP pipe fittings and other important activities.
- RPM meter of Governor Test Bench was not working same was attended.

Fig – Governor/actuator Test Bench

FD Fan Turbine Trip Timer: Originally FD Fan Turbine trips after 30 sec delay timer, if Stop PB Pressed. It is now changed to 10 sec.

BFW Pump (Turbine/Motor driven)

Speed pick-up probes, local temperature & pressure gauges were removed & reinstalled to facilitate mechanical maintenance.

PSL1: FD fan L.O pressure switch calibration performed.

The following pressure gauges (PI) were replaced.

Boiler -P-5111 and P-5112 PI replaced.

All air headers were flushed at various points.

Following Critical field switches set value were checked & found ok.

1.	PSH-11	2.	PSL-24	3.	PSL-25
4.	PSN-26	5.	PSH-26	6.	LSLL-1
7.	PSL-27	8.	PSL-8	9.	PSL-30
10.	LLCI-5111	11.	LAHH-5111	12.	PSN-42
13.	PSL-42	14.	PSH-42	15.	LLCO-5111

Following Critical transmitters were calibrated.

1.	FT-1	2.	FT-2	3.	FT-3
4.	FT-4	5.	FT-11	6.	FT-22A
7.	FT-22B	8.	FT-42	9.	PT-1
10.	PT-3	11.	PT-4	12.	PT-5
13.	PT-6	14.	PT-7	15.	PT-15
16.	PT-22	17.	PT-42	18.	LT-1
19.	LT-2	20.	PI-18	21.	DPT-12
22.	DPT-14				

Following ISO related Quality/Safety affecting instruments were calibrated

1.	PI -2	2.	PI -3	3.	PI -4
4.	PI -5	5.	PT-3A	6.	TRC-5
7.	LI -2A	8.	PSH-11	9.	PSH-12(PT-14)
10.	LSLL-1	11.	LT-2A	12.	LT-4

FIELD JOBS COOLING TOWER

Chlorination system : All chlorine tonner isolated, rubber hoses disconnected as per shutdown SOP.

Q-4411: In Elliott Turbine all radial vibration probes- 1A/1B,2A/2B,3A/3B,4A/4B, Trip SOV, speed pick-up probes, local temperature & pressure gauges were removed & re-installed to facilitate mechanical maintenance.

Woodward Governor power off/on and PGPL actuator feedback, output and speed connecting cables disconnected/ connected to facilitate mechanical maintenance.

P-4403 & P-4401E : Speed Proxy switches and six no. of temperature gauges were removed & re-installed to facilitate mechanical maintenance.

Q-4402 & Q-4403: Turbine side speed pick-up probes, local temperature & pressure gauges were removed & reinstalled to facilitate mechanical maintenance.

Following Level switches of surface condenser were cleaned & calibrated:

1.	LS LSHH-1	2	LS LSH-2
3	LS LSL-3	4	PS PSH-1

Following ISO related Quality/Safety affecting instruments were checked:

1.	PI - 4401	2.	PI - 4405
3.	AR - 4401	4.	AR - 4402

Following Critical transmitters were calibrated:

1.	PT-1	2.	FT-1090
3.	FT-1091	4.	LT-01

MOV-4401B: MOV Open Indication fault, checked and helped E/M to resolve the issue.

FI-1815- Old faulty insertion type turbine flow meter removed from line.

Chlorine detector: Zero calibration and general cleaning were carried out. All other parts were inspected & found in healthy condition.

FIELD JOBS I.G. PLANT

ANR-5401 (Old IG), Hydrogen Analyser was flushed and checked. General maintenance and visual inspection were carried out. Calibration was done with zero & span (5%). Anayser was taken inline after maintenance and calibration.

ANR-5402 (Old IG), Oxygen Analyser flushed and checked. General maintenance and visual inspection were carried out. Calibration was done with zero & span.

But Analyser was not responsive due to cell ageing factor So replaced it with new electrolytic cell after that sensor Zero and Span calibration performed, and Analyser was taken inline after maintenance and calibration.

ANR-5501 (New IG), Hydrogen Analyser was flushed and checked. General maintenance and visual inspection were carried out. Calibration was done with zero & span (5%). Anayser was taken inline after maintenance and calibration.

ANR-5502 (New IG), Oxygen Analyser flushed and checked. General maintenance and visual inspection were carried out. Calibration was done with zero & span. Analyser was taken inline after maintenance and calibration.

SV-5502 (Gaso IG-Dryer 4-way valve) : Operation checked and general maintenance were done.

FIELD JOBS DM PLANT

SMB-3 Diaphragm Valves Maintenance

V1, V2, V12, V3, V4, V6, V11, V15, V8, V7, V17 valves operation checked, and general maintenance performed.

SMB-2 Diaphragm Valves Maintenance

V1, V2, V12, V3, V4, V6, V11, V15, V8, V7, V17 valves operation checked, and general maintenance performed.

SMB-5 V17 Valve: Valve hand wheel was replaced.

CI-2102 & CI- 2303

Flushing and sensor cleaning was performed. Instrument was taken in line after maintenance work.

Following Critical transmitters were cleaned, checked, and Totalizer Reset action was performed.

1.	FT-2003	2.	FT-2906	3.	FT-2005
4.	FT-2001	5.	FT-2008	6.	FT-2101
7.	FT-2102	8.	FT-2103	9.	FT-2104
10.	FT-2105	11.	FT-2201	12.	FT-2202
13.	FT-2203	14.	FT-2204	15.	FT-2205

FIELD JOBS E.T. and D.G PLANT

Cleaning and general maintenance for instruments related to new and old DG set was carried out.

AI4500 : Cleaning of sampling system and calibration of Ammonia analyzer were carried out.

PHI-4502 & PHI-4502A: Combined effluent pH meter was cleaned & calibrated.

FIELD JOBS AMMONIA STORAGE AREA

Following Critical field switches were calibrated & found ok.

1.	PSL-3053A	2.	PSH-3063B	3.	PALL-3004
4.	PSH-3063A	5.	FSL-3050A	6.	PSHH-3007
7.	PAL-3057B	8.	FSL-3050B		

All control valves, field instruments & JB were checked, cleaned and general services were done.

FIELD JOBS NARMADA OFFTAKE POINT AREA

Cleaning, checking and general maintenance of field transmitters, Solenoid valves & alum tank related control valves.

Weigh Bridge

- Ashbee make 50MT Weigh Bridge pit cleaning and general maintenance performed.
- Mettler & Toledo make 50MT Weigh Bridge pit cleaning and general maintenance performed.

DCS RELATED CONTROL/ MARSHALLING ROOM JOBS

Annual shutdown preventive maintenance activities were carried out for complete Centum-VP DCS and ESD System-Stardom, FCS0301, FCS0302, FCS0401, FCS0601, FCS0602, FCS0701, FCS0801, FCS0802, FCS0901 related to Boiler, DM, IG/CT & Ammonia Storage, Narmada WTP, ETP & DG Set and Fire & Safety plants respectively and for related marshalling cabinets, Operator station, and Engineering station EWS.

Following activities were carried out as per AMC procedure.

- Before starting preventive maintenance activities / AMC jobs, tuning parameters of all control stations were saved on engineering station and project back up was taken.
- Offline download
- DCS System & Panel earth resistance were checked, found within limits.
- Checking of system healthiness was carried out from system details display and found normal.
- AC and DC voltages and battery voltages were measured wherever applicable for all stations and were found within limits.
- The system was dismantled, cleaned and operating conditions like dust, moisture and temperature were checked. All parameters were checked and found within limits.
- Interior of system cabinets, ENGS and HIS consoles were cleaned thoroughly. PCBs were inspected and inspection of data bus and connectors were done. No abnormality was observed.
- Printers were cleaned/overhauled, wherever applicable. CPU back-up battery voltages and grounding were checked and the same were found within specified limits in all stations.
- Function of each component of the DCS was checked. YOKOGAWA diagnostic software was run on FCS, the results of the test program indicated the healthiness of the system.

- Redundancy checks were performed on V net / IP Bus, CPUs, Power supplies and cards wherever applicable. As per redundancy feature, control transfer took place to the standby one properly.
- HIS to HIS communication was checked by pinging and found normal. After cleaning functionality of all HIS were checked and found working ok.
- Wiring terminals of all cabinet was checked and tightened, also checked fuses in all fuse TB and changed the fuses of critical trip related IO terminals.
- Data was collected for all HIS & FCS in Project backup for reference. Latest project backup was taken on DVD media.
- 2 no. of batteries were replaced for FCS <901> CPU (CP 461) with new ones.
- Marshalling Cabinet fans were replaced wherever found faulty.
- All MCB termination in all DCS Power distribution cabinet & marshalling cabinets were checked for loose connection.
- DM Plant ACDB panel termination was also checked.
- All critical I/O related fuses were checked.
- HIS <0360> was having slowness and hanging issues in operations. HIS complete formatting, Windows O.S & Centum software re-installation performed. Long term data updated, and system taken back in line.
- Software was run on FCS; the results of the test Program indicated the healthiness of the system.
- Redundancy checks were performed on AAB841 card wherever applicable. As per redundancy feature, control transfer took place to the stand-By module properly.

Stardom PLC system for BMS

- All BMS logic and Loop were checked with actual operation of all BTV, GHTV,IGTV and their open/close limit switches.

Duplicate DCS Tags with other Domains.

Duplicate Tags PSL-1, LY-2, LSLL-1, LI-2A, FRC-1, PIC-3 redefined.

Domain -9 F & S

DCS FCS CPU was replaced originally from CP471 to CP461 (swapped with Domain-1 - FCS104) and new CPU battery installed with expiry date Aug 2026.

SD-AMC JOBS- UPSS SYSTEM & Battery Bank

EMERSON make 2 X 60 KVA UPS System (Located at DM Plant)

AMC jobs for 'EMERSON' make 2 x 60 KVA UPSS was carried out by M/s Vertiv representative. Physical inspection, testing and cleaning of all cabinets, logic boards for UPS- 1 and UPS-2, step down transformer, bypass, and AC servo stabilizer etc. of 60KVA redundant UPS system were done one by one. SCVS – Servo Mechanism carbon bush maintenance performed. Load change over from UPS-1 to UPS-2 and vice versa as well as on bypass were checked and found normal. Load was also

transferred on Battery bank during their Source MCC shutdown and battery was work properly up to around 45 minutes.

UPSS Battery Bank

Preventive Maintenance of HBL make UPSS Battery Bank was carried out in shutdown. Cleaning of all Inter-cell connectors, vent caps & applied petroleum jelly on all Battery terminals work for all 302 Nos. of batteries was carried out M/s Syntech power representatives. Electrolyte level in each battery was checked & electrolyte/DM water was filled whenever required. Finally the total load of UPSS was transferred to Battery bank and checked its performance, found ok. & was sustained for around 45 minutes. Also, Checked the Battery voltage during charging & discharging, found satisfactory.

DB make 2 X 10 KVA UPS System (Located at DM Plant)

AMC jobs for 'DB power' make 2 x 10 KVA UPSS was carried out by M/s Vertiv representative. Physical inspection, testing and cleaning of all cabinets, logic boards for UPS- 1 and UPS-2, step down transformer, bypass, and AC servo stabilizer etc. of 10KVA redundant UPS system were done one by one. Load change over from UPS-1 to UPS-2 and vice versa as well as on bypass were checked and found normal. Load was also transferred on Battery bank during their Source MCC shutdown and battery was work properly up to around 45 minutes.

UPSS Battery Bank

Preventive Maintenance of Exide make SMF UPSS Battery Bank was carried out in shutdown. Cleaning & greasing work of all 20Nos. of batteries was carried out. Finally, the total load of UPSS was transferred to Battery bank and checked its performance, found ok. & was sustained for around 30 minutes. Also, Checked the Battery voltage during charging & discharging, found satisfactory.

EMERSON make 2 X 10 KVA AMMONIA STORAGE

AMC jobs for 'EMERSON' make 2 x 10 KVA UPSS was carried out by M/s Vertiv representative. Physical inspection, testing and cleaning of all cabinets, logic boards for UPS- 1 and UPS-2, step down transformer, bypass, and AC servo stabilizer etc. of 10KVA redundant UPS system were done one by one. Load change over from UPS-1 to UPS-2 and vice versa as well as on bypass were checked and found normal. Load was also transferred on Battery bank during their Source MCC shutdown and battery was work properly up to around 45 minutes.

UPSS Battery Bank

Preventive Maintenance of AMCO shaft make UPSS Battery Bank was carried out in shutdown. Cleaning of all Inter-cell connectors, vent caps & applied petroleum jelly on all Battery terminals work for all 287 Nos. of batteries was carried out by M/s Syntech power representatives. One battery cell was found damaged, so removed it from the bank. Electrolyte level in each battery was checked & electrolyte/DM water was filled whenever required. Finally, the total load of UPSS was transferred to Battery bank and checked its performance, found ok. & was sustained for around 45

minutes. Also, Checked the Battery voltage during charging & discharging, found satisfactory.

CAPITAL JOBS

PICV-3: Existing old and obsolete DRESSER make control valve was replaced with new MASCOT make control valves procured with technical specification as per updated process data.

Description - 4 ata vent

Location- 4 ata vent pipeline

Type – Globe type, Linear characteristics

Size - 4” inch

Make - MASCOT

FI-6200: The old flow meter was showing faulty reading. During its calibration it was found that one of its flow element coils was opened, so the meter cannot be repaired in installed condition and action was taken to for its replacement to latest model.

Description – Raw water inlet from Jaspur pumping station

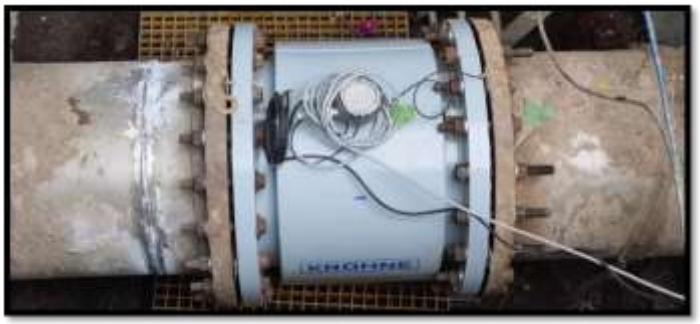
Location- Narmada WTP Plant

Principle – Electromagnetic type Flow meter

Size - 24” inch

Make - Krohne Marshall

FI-6200 Transmitter / Flow indicator



Flow element was installed 2.5 meters below ground level in a 24” pipeline carrying raw water from Jaspur plant to Narmada WTP plant.

Required Welding, cutting and mounting work performed with the help of M/M.

After installation, flow Transmitter configuration, cable termination work performed.

Flow meter Zero calibration work was performed, and value was comparable with FI-6100 located at Jaspur Pumping station.

NPS System

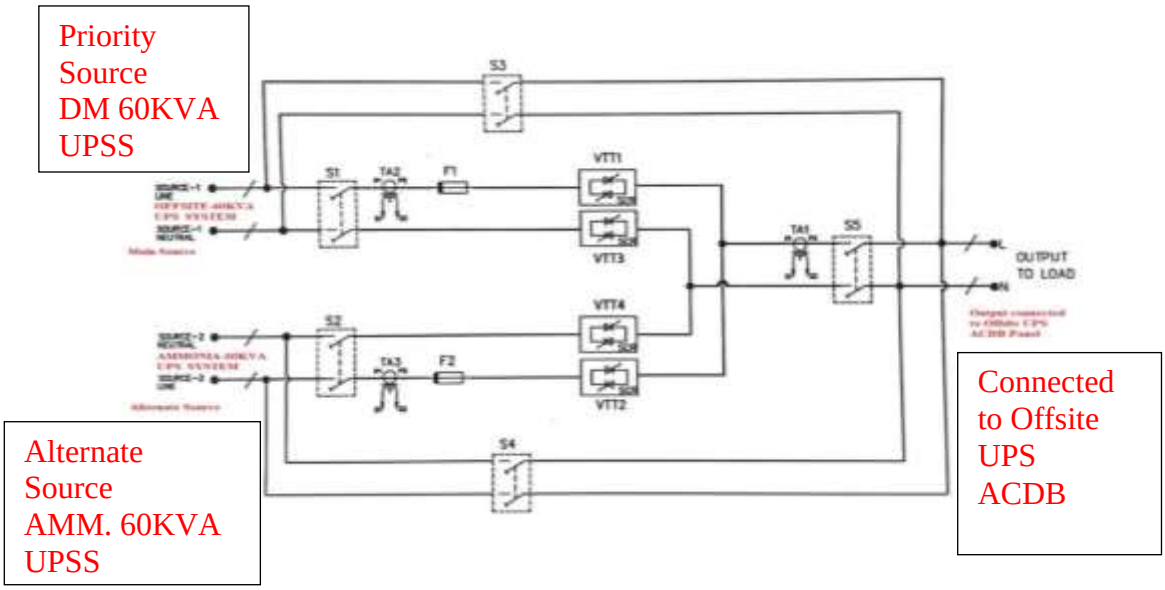
The Liebert Network Power Switch-I is an intelligent static transfer switch designed to provide fast automatic transfer between two independent AC power sources (one is DM UPSS power source, and another is Ammonia UPSS power source) to all Offsite, Urea plants and critical equipment.

One of the two AC power sources is designated as the "priority" source (for this NPS priority source is DM UPSS) to which the Liebert Network Power Switch-I will connect the load as long as the input source is within acceptable voltage & frequency limits.

NPS - Network Power Switch (Static Switch)

If the priority Source falls outside the acceptable limits, the Liebert Network Power Switch-I will transfer the output load to the other "alternate" input (for this NPS alternate source is Ammonia UPSS). It will remain on this source as long as the alternate Source is within acceptable voltage and frequency limits.

When the priority Source comes under the acceptable limits, the Liebert Network Power Switch-I will transfer the output load back to the other "priority" source input. Further, in case of overload, Liebert Network Power Switch-I gives alarm. Under short circuit conditions the load is protected by a fast-acting fuse & by electronic circuitry.



New Addition of Standalone FCS0602 for CT plant to DCS system

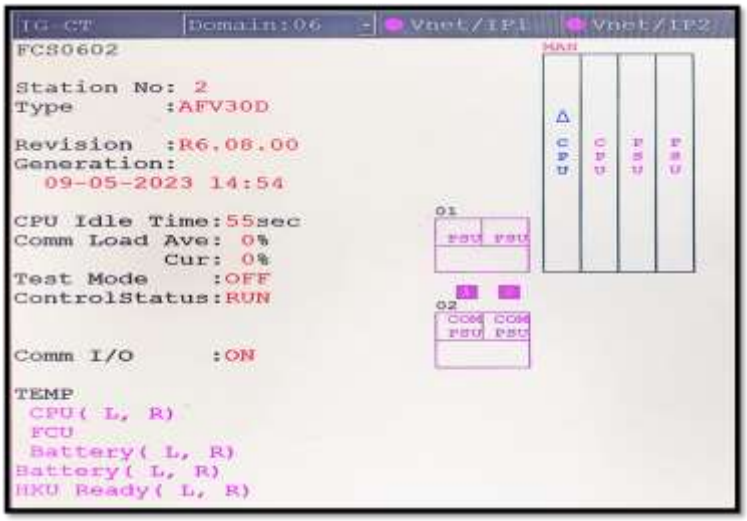
Fig – NPS Diagram

For providing standalone controller to CT plant, new FCS0602 was installed with necessary parts like ethernet switches, dedicated power supply etc. This arrangement will provide independent control for CT plant, if in case OFC communication with IG plant break, CT plant will work independently.

For successfully completion of this activity following changes were made in existing system

- New FCS node AFV30D was installed in panel 602 in place of node-5 ANB10D.
- All node-5 cards are mounted back to FCS node, and with these activities' node-5 will convert to node-1 of CT plant.
- Removed node ANB10D from panel 602, installed in panel 601 in place of node-4 ANB11D. All node -4 cards are mounted back in ANB10D node, and with these activities' node-4 will convert to node-2 of CT plant. Remote node ANB11D has now been removed from CT plant and kept as spare for another project.

Fig – FCS panel 602



System View FCS0602

- For establishing FCS-HIS communication two no. of ethernet switches (For Bus-1 and Bus-2) were also installed and these switches are connected to IG plant Bus-1 and Bus-2 ethernet switches via OFC cables. Alternately Cat-6 cable for bus-1

and bus-2 connected with IG plant kept as a spare, if in case OFC communication break, communication will be rebuilt with spare bus-1 & bus-2 CAT-6 cables.

- ESB bus 1 & 2 terminator cards installed in IG plant node-3 and CT plant node-2.
- PDBF-1 & PDBF-2 power supply distribution board installed in CT plant to power-up node-1 & node-2. Also, completed its related cable termination work completed.
- FCS cooling system and FFDU unit was also installed.

EWR JOBS & OTHER TECHNICAL RELATED JOBS

EWR-SG-81

Boiler CBD tank flow meter:

Differential Pressure- orifice type Flow meter installed for the measurement of blow down flow to CBD tank. DCS programming and Necessary installation work performed.

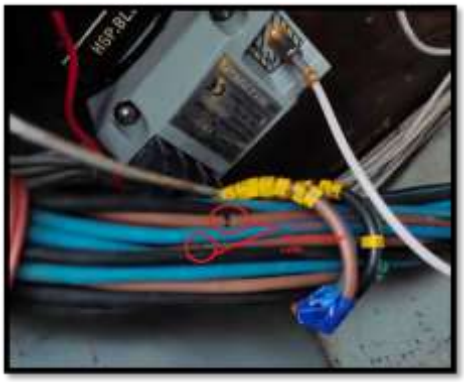
Fig – Orifice and isolation valves

Fig – DPT transmitter

CONTINUOUS IMPROVEMENT

Vibration Cable replacement

During the maintenance activities of vibration system of Q-4411 elliott turbine, multi-triad vibration cable was found damaged at many locations, crakes were observed on each core. This issue occurs due to cable aging factor. For rectification, Immediate action was taken and a new 6Tx1.0 mm2 multi-triad cable laid from control room to vibration proximitor JB.



Proximitor JB

New Elco board installation

Fig – New Elco Board

To accommodate new FD Fan turbine analog inputs of related new instrumentation two additional analog cards (AI-141) with elco board were installed in Domain -3 boiler DCS analog marshalling cabinet MCA01(rear). Necessary Prefab cable laying and Fuse TBs installation and cable termination work completed. Elco card 24 VDC Power supply connection were provided from DC bus bar.

PI-M5112

Description – M-5112 Gear Box lube oil pressure.

Alarm – Pr. <1.50 kg/cm2

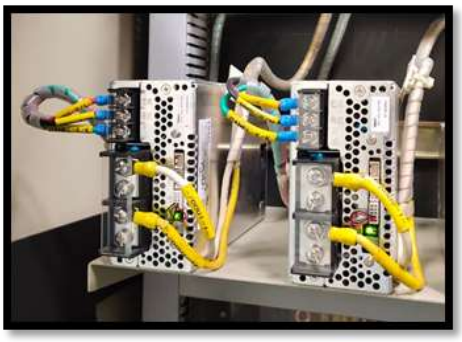
AOP Start CMD- Pr.<1.25 kg/cm2

Old digital Pressure switch was out of calibration range. So, replaced with pressure transmitter with advantage that it will provide real time lube oil pressure value on DCS for better operation reliability.

Pressure Transmitter

Cosel Power Supply 24VDC,27A

Domain -3 SG plant, PDB panel, Both JW600-24VDC, 27A power supply live and redundant replaced with new cosel make power supply because of its end of useful life.



Redundant Power Supply

B & MH. PLANT

(INSTRUMENT)

CAPITAL JOBS

During this turn around the B & MH control room was equipped with two new Semi-automatic Weighing & Bagging Machines. This entire job was coordinated by our section. With this opportunity, several modifications were taken up and completed successfully.

In IFFCO- Kalol, Weighing & Bagging machines/bag filling machines are cumulatively termed as Packer Scales (P/S).

In the empty space between Weighing machines panels 4 & 7 at control room, two new Weighing machines control panels 5 & 6 with panel width 550mm and same height installed so that sequential order maintained, and corresponding bagging machines were installed in the predefined location in the field. These two new weighing machine & bagging machines have the following specifications.

- OEM– Prayas Eng. Ltd.
- Type- Semi Automatic Simplex Machine.
- Working Philosophy – Gravitational Feed.
- Material – Neem coated Urea Prills /Granules.
- Capacity – 750 bags/hr.
- (Design)
- Control on Feed actions-
  - Coarse feed
  - Fine feed
  - After flow

Weighng Machine 5 & 6

- Both weighing machines equipped with the latest B & L make, microprocessor-based controller **Data Pond-3F** with many advantages over the old controller.
- Both Bagging machines are equipped with 4 load cells each having capacity of 50kg at all four corner of weighing receptacle/bucket.

Controller Display

- New bagging M/c installed with new bucket arrangement having no stabilization plate system.
- New bagging M/c installed with modified feed gates arrangement with adjustable fine feed opening on inner gate (coarse feed cut-off gate) and modified outer gate (fine feed cut-off gate) stroke arrangement to cut-off fine feed more rapidly.

  Following Installation and commissioning activities related to both machines performed.

  - Cable and cable tray laying, termination work.
  - All field JB's mounting work.
  - Required S.S tubing and PVC work for both machines.
  - Load cell mounting and alignment work.
- Both bagging machines hand lever arrangement (located on
  - sack grip) modified as per other machines.
  - Hopper level Switches provided for Low- and High-level indication.
  - M & T make weighing scales of capacity 150kg provided.
  - Both machines Stamping are done as per Guidelines of Dept. of Legal Metrology (Govt. of Gujarat).

Bagging Machine Side view

CONTINUOUS IMPROVEMENT

During this turnaround the new Conveyor Belt system 2122-B1 & B2 installed for material filling in bagging machines hoppers 1 to 8. Therefore, the following modification was performed related to hopper switches.

- First, all hopper level switch and related connected cables were removed to facilitate mechanical maintenance for commissioning of new belt system.
- After installation of the new belt system, cable tray support fabrication and welding work and cable tray laying work completed.
- Cable laying work for different level switches completed.
- New 8" Nozzles for hopper Level switches mounting completed which include following work.

- 8-inch Dia and 135 mm height nozzles fabricated in workshop.
- Slots were made on hoppers top covering S.S grill and S.S plates.
- Nozzles welding work over grill and 100mm x 100mm J.B mounting work.
- Level switch mounting and cable termination work in J.B.
- These JBs used to provide safety for level switches and prevent urea dust ingression in connection T. B's

Nozzle and JB for level switch

Field jobs in the B & MH plant

Following activities were carried out for the Packer scale number 1, 2, 3, 4, 7, 8, 9A, 9B, 10 A &10B and Mettler-Toledo make weighing scales:

- Cleaning and tightening of terminals in local panel, load cell junction box and proximity Switch junction box of all the packer scales were carried out. Provided lugs in solenoid box wherever were required.
- Diverter solenoid, relay & limit switch were cleaned and checked its function.
- Checked wiring terminals in the main panel, local panel, Solenoid boxes, and load cell box.
- Cleaned and checked CSC-25, relay board, fuses, and all proxy sensors.
- Checked functioning and calibration of all Packer Scales.
- All the solenoid valves were overhauled.
- Maintenance & calibration of new reclaim Belt Weigher System was done.
- Maintenance & calibration of M-2117 Belt weighing System was done.
- Dust Extraction panel was cleaned.
- Cleaned all field instruments Control valve, Transmitter, local float indicator related to DES. Local float indicator S.S rope replaced, and pully lubrication performed.
- Control valve stroke checking for Dust Extraction System Area.
- Maintenance and functionality checking of level switches in Hopper for P/S–1, 2, 3, 4, 7,8,9A/B and P/S –10 A/B.
- Checking of level transmitter after removal from tank in Dust Extraction System Area.
- Checking and maintenance of a Level transmitter and level switches for Fiber Tank in P/S floor.
- Cleaning of all the Mettler-Toledo make weigh scale's platform was done.
- All the 10 machines were tested for desired sequential operations before putting into practical bagging.

ELECTRICAL

AMMONIA PLANT

(ELECTRICAL)

Modification and New Installations

Installation, testing & commissioning of new actuators

Hand operated inlet isolation valves of 121-J/JA have been replaced with Third generation (IQ3 series) Rotork make motor operated valve. The MOV's were installed & commissioned successfully during ATA-23. The same was also tested for operation & indications from Local and remote as per process requirement. New tag no. assigned to inlet isolation MOV's are SP-6 and SP-7.

Actuator type- IQ25F14A, Speed 24 RPM, Wiring diagram: 101B0010-3

The picture of the new installed actuators is as below -

Scheduled Preventive Maintenance :

Preventive maintenance of transformer: Most of the equipment of ammonia plant is getting electric power from MCC-5, and 16. TR-6 and TR-21 & 22 feeding power to these MCC.

Common activity carried out during transformer maintenance is as under

- Isolation of transformer from both side (LT & HT)
- Dismantling of HV & LV terminal box.

- Visual inspection about any leakage of oil from any part and any heated terminal.
- Measurement of earthing resistance, IR value, PI value and oil BDV.
- Testing of Buchholz relay about its function of tripping and alarm.
- Condition of silica gel was checked. Accordingly discharged silica gel was replaced
- Tightening of loose parts.

Preventive maintenance of MCC: Preventive maintenance carried out on all the feeder compartments in MCC-5, MCC-16 and the job details are as under.

Common activity carried out during MCC maintenance:

- Isolation of MCC from power source.
- General cleaning of all feeders.
- Tightness checking of all power and control cable connection.
- Checking & cleaning of contactors.
- Checking of operation of breaker in test position.
- Checking continuity and IR valve of bus bar.
- Lamp test.
- Normalization of MCC.

Overhauling of critical motors: Overhauling of following motors was carried out in Ammonia plant.

Equipment Name		**Description**
P-2001 L J A	:	HYDRAZENE INJ.PUMP
P-2002 L J A	:	HYDRAZENE INLECTION PUMP
P-116 JB	:	SPLIT STREAM PUMP
104 J	:	AOP FOR B.F.W.PUMP MOTOR
104 JA	:	AOP FOR B.F.W.PUMP MOTOR
104 JT	:	AOP FOR B.F.W PUMP(TURBINE)
104 JTA	:	AOP FOR B.F.W PUMP (TURBINE)
101 BJT	:	AOP FOR I.D.FAN MOTOR
PC 2A	:	LQD AMM.PUMP MOTOR
PC-2B	:	LQD AMM.PUMP MOTOR
P-121 J	:	HOT AMM.PRODUCT PUMP
P-121 JA	:	HOT AMM.PRODUCT PUMP
P-107 JTA	:	AOP FOR MEA PUMP(TURBINE) MOTOR
115 JA	:	LOP FOR SEMI LEAN PUMP(STAND BY)
115 JB	:	LOP FOR SEMI LEAN PUMP

113 J	:	MEA PUMP MOTOR
P-103J SO MOTOR	:	SEAL OIL MOTOR
117 J	:	Recycle gas Compressor
AOP 117 J	:	AOP FOR CG COMP.
8501	:	RCOP Pump-1
8502	:	RCOP Pump-2
8503	:	COP Pump-1
8504	:	COP Pump-2

Preventive maintenance of actuators carried out for the following MOVs and tested with their interlocks

SP1, SP-3, SP-4, SP-5, SP70, SP151, SP152, SP 154, SP 158,101,105,8101, LTS guard & SP 159.

Testing and Servicing of L&T make Air Circuit breakers were carried out.

UREA PLANT

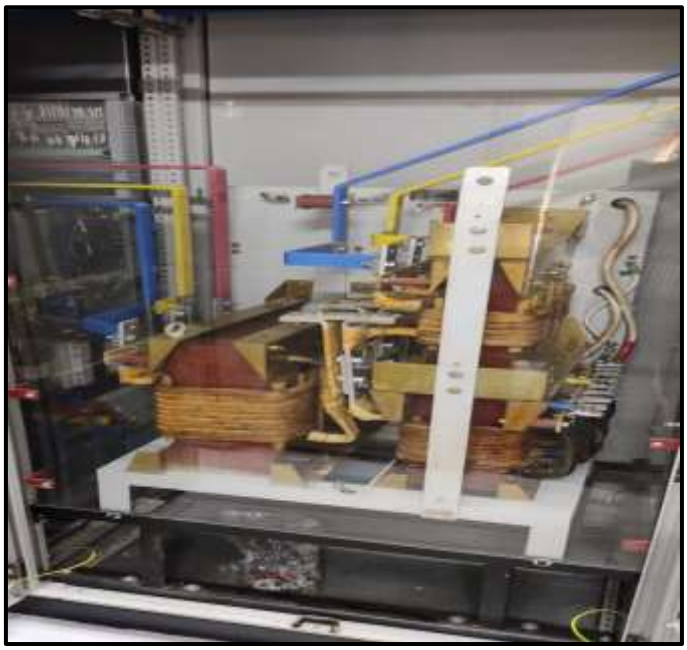
(ELECTRICAL)

Modification and New Installations

Installation, testing & commissioning of Passive harmonic filter in K-1701

Passive harmonic filter replaced in VFD panel of K-1701 and successfully trial have been taken of K-1701 in VFD mode as well as in DOL mode.

Some of the images of PHF replacement are added below for reference.



Feeder Modification in MCC-15 for second source arrangement for MCC-14

800 A ACB feeder has been upgraded to 1600 A feeder in MCC-15 to feed MCC-14 in case of outage/failure of Single transformer (TR-17) of MCC-14. Image are added below for reference:

Scheduled Preventive Maintenance

Preventive maintenance of transformer: Most of the equipment of urea plant is getting electric power from MCC-14, & 15. TR- 17, 18, 19 & 20 feeding power to theses MCC.

Common activity carried out during transformer maintenance is as under:

- Isolation of transformer from both side (LT & HT)
- Dismantling of HV & LV terminal box.
- Visual inspection about any leakage of oil from any part and any heated terminal.
- Measurement of earthing resistance, IR value, PI value and oil BDV.
- Testing of Buchholz relay about its function of tripping and alarm.
- Condition of silica gel was checked. Accordingly discharged silica gel was replaced
- Tightening of loose parts.
- Cleaning and washing.

Preventive maintenance of MCC: Preventive maintenance of the all feeder compartment in, MCC 14, and MCC 15 were carried out and the job details are as under:

Common activity carried out during MCC maintenance**:**

- Isolation of MCC from power source.
- General cleaning of all feeders.
- Tightness checking of all power and control cable connection.
- Checking & cleaning of contactors.
- Checking of operation of breaker in test position.
- Checking continuity and IR valve of bus bar.
- Lamp test.
- Normalization of MCC.

Overhauling of critical motors: Overhauling of following motor was carried out in urea plant.

Equipment Name		**Description**
M-1403/1	:	3 part conveyor
M-1402/1	:	Scrapper motor
M-1402/2	:	Scrapper motor
P-1131A	:	AOP for P-1102A
P-1131B	:	AOP for P-1102B
P-1815/B	:	Condensate pump
P-1814	:	Main LOP for CO2 comp.

Equipment Name		Description
P-1817	:	LOP hitachi
K-1401/3	:	PT fan
	:	Cool Urea Conveyor
P-1408	:	Melt pump
K-1401/1	:	PT fan
K-1401/2	:	PT fan
K-1401/4	:	PT fan
P-1401/A	:	Prill Bucket Motor
P-1815/A	:	Condensate pump
P-1231/A	:	AOP for P-1201
P-1231/B	:	AOP for P-1202

Preventive maintenance of actuator of following MOV's was carried out:

MOV 1101, 1102, 1201, 1202, 1203, 1842, 1800 & 1811

Testing and Servicing of L&T make Air Circuit breakers were carried.

OFFSITE & UTILITY PLANT
(ELECTRICAL)

Modification and New Installations

Installation, testing & commissioning of new actuator.

K series Actuator in MOV-13 has been replaced with Rotork make second generation (IQ2 series) actuator in Steam Generation plant. The MOV is installed & commissioned successfully during ATA-23. The same is also tested for operation & indications from Local as well as DCS as per process requirement.

Upgradation of ACB feeder for K-5301A

Upgradation of ACB feeder from 800 A to 1250A has been carried out to cater the load of 250 KW screw compressor**.** Images are added for reference:

Scheduled Preventive Maintenance

Preventive maintenance of transformer: Preventive maintenance of transformer TR-2A, 2B, 3A, 3B, 7, 8, 11, 12, 13, 14, 16 , 23 & TR-25 were carried out. Detail is given as below**:**

Common activity carried out during transformer maintenance is as under:

- Isolation of transformer from both side (LT & HT)
- Dismantling of HV & LV terminal box.
- Visual inspection about any leakage of oil from any part and any heated terminal.

- Measurement of earthing resistance, IR value, PI value and oil BDV.
- Testing of Buchholz relay about its function of tripping and alarm.
- Condition of silica gel was checked. Accordingly discharged silica gel was replaced
- Tightening of loose parts.
- Cleaning and washing.

Preventive maintenance of MCC: Preventive maintenance of the all-feeder compartment in MCC 1, MCC 2B & 2E, MCC-2, MCC-2F, MCC-11 and MCC 13 were carried out and the job details are as under:

Common activity carried out during MCC maintenance**:**

- Isolation of MCC from power source.
- General cleaning of all feeders.
- Tightness checking of all power and control cable connection.
- Checking & cleaning of contactors.
- Checking of operation of breaker in test position.
- Checking continuity and IR valve of bus bar.
- Lamp test.
- Normalization of MCC.

Overhauling of critical motors: Overhauling of following motors was carried out in utility

Equipment Name		**Description**
P-4412/B	**:**	LOP of Q-4401 A
P-4413/B	**:**	LOP of Q-4401 B
P-4414/B	**:**	LOP of Q-4403
P-5111A	**:**	A O P FOR PUMP P-5111
P-5112 A	**:**	AOP for PUMP 5112
P-5112 B	**:**	AOP for Motor 5112
P-5111 B	**:**	A O P FOR PUMP Q -5111
P-5120	**:**	condensate Pump
P-5113	**:**	AOP of E-5113
P-4411 A	**:**	Condensate pump C.T area

Servicing of following Rotork make actuators installed in utility plant was carried out.

MOV-10, MOV-11, MOV-12, MOV-14,MOV-15, P-4403(700), P-4403(900), P-4401/A, P-4401/B, P-4401/C, P-4401/D, P-4402

Testing and Servicing of L&T make Air Circuit breakers were carried out**.**

Modification and New Installations in Offsite Plant

11 KV feeder modification job has been carried out to cater the load of new upcoming HP Ammonia pump P-1102D. The new VCB has been retrofitted and CT's have been replaced to take load of 2500 KVA 11/3.3 KV transformer. Images are added below for reference.

- All old and aged DC control cables replaced by new DC cables to avoid tripping of feeders.
- Three no. old isolators (89-7 ,89-9 and 89-10) have been replaced with 800 A ABB make motorized isolators at 66 KV yard. images are added below for reference:

- Maintenance of CRP panel have been carried out at 66 KV yard.
- CT replacement have been carried out in Chhatral line from 100/1 to 150/1 to cater the enhance demand of 13.5 MVA. Total 3 CT's have been replaced under the supervision of GETCO/UGVCL. Images are added below for reference:

Scheduled Preventive Maintenance

Preventive maintenance of transformer

Preventive maintenance of transformers TR-1A, 15, 4A and TR-4B was carried out. As per detail given below:

Common activity carried out during transformer maintenance is as under:

- Isolation of transformer from both side (LT & HT)
- Dismantling of HV & LV terminal box.
- Visual inspection about any leakage of oil from any part and any heated terminal.
- Measurement of earthing resistance, IR value, PI value and oil BDV.

- Testing of Buchholz relay about its function of tripping and alarm.
- Condition of silica gel was checked. Accordingly discharged silica gel was replaced
- Tightening of loose parts.
- Cleaning and washing.

Preventive maintenance of MCC: Preventive maintenance of all the feeder compartment of in MCC-DG set, MCC-3, MCC-10& 10A and MCC-Jaspur was carried out and the job detail is as under**:**

Common activity carried out during MCC maintenance

- Isolation of MCC from power source.
- General cleaning of all feeders.
- Tightness checking of all power and control cable connection.
- Checking & cleaning of contactors.
- Checking of operation of breaker in test position.
- Checking continuity and IR valve of bus bar.
- Lamp test.
- Normalization of MCC.

Preventive maintenance of actuators carried out for the following MOVs and tested with their interlocks (If any)

6001,6002,6003,6004,6201,6202,6203,6204,6205,6206,6207,6208, 6101 , 6102, 6103

Preventive maintenance jobs were carried out in 66 KV switch Yard:

Common activity carried out during maintenance:

- All insulators of isolator, breaker and CTs and PTs are cleaned.
- Cleaned the contacts and oiling &greasing done in all isolators in yard.
- Operation of all isolator is checked & found OK.
- I R Value of all CT's and PT's are noted & found OK.
- Contact resistance of all isolator are noted.

<u>Special activity carried out during total power</u>

- During total power shutdown in spite of routine maintenance following special maintenance are carried those are usually not available for maintenance during normal running hours and even in shutdown also.
- Checking & maintenance of bus coupler & Incomer feeders in MCC-1, 2, 2F, 6, 4, 15, 16 are done without feeding Emergency (DG) power to those MCC for early 3 Hrs.

- Checking & maintenance of all incomers & bus couplers in 11KV MPSS by load sharing & load management.
- Checking & maintenance of bus bars in 11KV MPSS & all MCCs incomers & bus couplers by load sharing & load management.

Preventive maintenance and servicing of 11KV MPSS, DCDB, and Capacitor bank in installed at 11 KV MPSS were carried out.

- Cleaning of all incoming & bus coupler feeder of Siemens &Jyoti panels.
- Checking & cleaning of bus bars & HT cables was carried out.
- Cleaning of Jyoti breaker contacts.
- Checking of operation of breakers with all interlocks.
- Tightness checking of all control connection.
- Checking of continuity & IR value of bus by lamp test.
- Visually Inspected checked & cleaned DCDB feeders.
- Checking & cleaning of all the 4 capacitor banks done.
- Checked oil level of all capacitor banks & top-up done.

B & MH. PLANT
(ELECTRICAL)

New Installation and Modifications

- All electrical jobs have been carried out for splitting of conveyor M-2122 Old into M-2122B1 and M-2122 B2. New Local control stations, wiring of safety switches have been carried out. After completion of Job, successful trial of both conveyors have been taken from Local and PLC mode.
- New Vertiv make static switch has been installed to increase the reliability of PLC panel in case of UPS cable fault.

Schedule maintenance

Preventive maintenance of Transformer: Preventive maintenance of transformer Tr-5A & TR-5B was carried out.

Common activity carried out during transformer maintenance is as under:

- Isolation of transformer from both side (LT & HT)
- Dismantling of HV & LV terminal box.
- Visual inspection about any leakage of oil from any part and any heated terminal.
- Measurement of earthing resistance, IR value, PI value and oil BDV.
- Testing of Buchholz relay about its function of tripping and alarm.
- Condition of silica gel was checked. Accordingly discharged silica gel was replaced
- Tightening of loose parts.
- Cleaning and washing.

Preventive maintenance of MCC

Preventive maintenance of all the feeder compartment in MCC 4 and 4A (Old & New) was carried out.

Common activity carried out during MCC maintenance**:**

- Isolation of MCC from power source.
- General cleaning of all feeders.
- Tightness checking of all power and control cable connection.
- Checking & cleaning of contactors.
- Checking of operation of breaker in test position.
- Checking continuity and IR valve of bus bar.
- Lamp test.
- Normalization of MCC.

Checking and preventive maintenance of Pull Chord switches have been carried out in all conveyors of bagging plant.

Overhauling of critical motors: Following motors were overhauled in B & MH plant:

Equipment Name		Description
M-2136/C	:	Vibro screen C Motor
P-2704/B	:	Dust solution pump
K-2704/3	:	Dust blower B&MH
M-2122	:	Conveyor
M-2122 A1	:	Conveyor
M-2122 A2	:	Conveyor
M-2112	:	Conveyor
M-2121(New)	:	Conveyor
M-2110	:	Conveyor
M-2117	:	Conveyor
Link Conveyor	:	Reclaimer link conveyor
Slewing	:	Reclaimer slewing
Luffing	:	Reclaimer Luffing

Non plant

Schedule maintenance

Preventive maintenance of transformer

Preventive maintenance of TR-10A, 10B, T/S-1 and T/S-2 was carried out as per detail given below:

Common activity carried out during transformer maintenance is as under:

- Isolation of transformer from both side (LT & HT)
- Dismantling of HV & LV terminal box.
- Visual inspection about any leakage of oil from any part and any heated terminal.
- Measurement of earthing resistance, IR value, PI value and oil BDV.
- Testing of Buchholz relay about its function of tripping and alarm.
- Condition of silica gel was checked. Accordingly discharged silica gel was replaced
- Tightening of loose parts.
- Cleaning and washing.

Preventive maintenance of MCC

Preventive maintenance of all the feeder compartment fire MCC and MCC-7 were carried out.

Common activity carried out during MCC maintenance**:**

- Isolation of MCC from power source.
- General cleaning of all feeders.
- Tightness checking of all power and control cable connection.
- Checking & cleaning of contactors.
- Checking of operation of breaker in test position.
- Checking continuity and IR valve of bus bar.
- Lamp test.
- Normalization of MCC.

CIVIL

AMMONIA PLANT

(CIVIL)

103-F (CO2 stripper reflux drum) Foundation modification

The foundation modification work to install the 103-F (CO2 stripper reflux drum) was carried out in Ammonia Plant.

Refractory repairing jobs in primary reformer (HT & LT zone), Auxillary boiler and secondary reformer

The refractory repairing in primary reformer & auxiliary boiler was carried out. The 20 no. of tunnel blocks in primary reformer were replaced. The casting of auxiliary boiler side panels was carried out by civil section using the refractory material ''Insulyte-11''.

Re-Installation of UPSS Room Door:

Removed the Door to Change the Panel in the UPSS Room in the Ammonia Plant and After Changing the Panel, Installed a New Door.

New False Flooring in Ammonia Control Room and UPSS Room:

The Damaged False Flooring was replaced in Ammonia Control Room and UPSS Room.

UREA PLANT

(CIVIL)

Anti-corrosive treatment of scrapper floor in prill tower

Anti-corrosive treatment of prill tower inside Scrapper Floor was done by M/S Gayatri Construction. The epoxy coating of scrapper floor and refixing of acid proof brick lining was also done.

The inside surface of prilling tower was badly corroded, so epoxy painting was necessary for life of prill tower.

Dismantling of CO2 Sump in Urea Plant:

The CO2 sump was abundant, so dismantling of the same was done in urea plant.

Drain Pipe Connection and Concreting Work:

There was a Drain Line leakage in the Urea Plant. Due to this waste water is seeping inside the nearby Cable channel. New line was provided to avoid the further seepage.

OFFSITE & UTILITY PLANT

(CIVIL)

Plaster Work of Foundations & Columns

Removed Loose Plaster and re-plastering work of foundations, Columns and Cooling Tower Sump Walls.





Repairing of Pump Supports above Cooling Tower

It was observed that various structural Supports were damaged above Cooling Tower. So, Repairing of Damaged Supports by using 19 mm water proof plywood.

Repairing of Louvers in Cooling Tower

The Lovers of Cooling Tower were Damaged which were repaired.



Providing and Applying Anticorrosive Treatment with Coal tar epoxy (Epilux-5) on RCC wall, Columns & Foundations etc of cooling tower sump

It was observed that Cooling Tower Sump inside wall were surface is badly corroded.

So, Anti-corrosive treatment of Cooling Tower Sump inside wall was done by M/S Gayatri Construction.

The application of coal tar epoxy (Epilux-5) was done on damaged footing, supports and cooling tower sump area.

Refractory Repairing Job of BHEL Boiler

The refractory repairing in BHEL boiler was carried out. The boiler inside wall was damaged carried out by civil section using the refractory material ‘’whytheat & Insulyte-11’’

The inside boiler floor and side walls refractory was also damaged. Repairing of same was done using refractory material Insulyte-11.






B & MH PLANT
(CIVIL)

Epoxy painting of conveyor gallery (beams, columns & soffit) and Loading Floor of B & MH plant

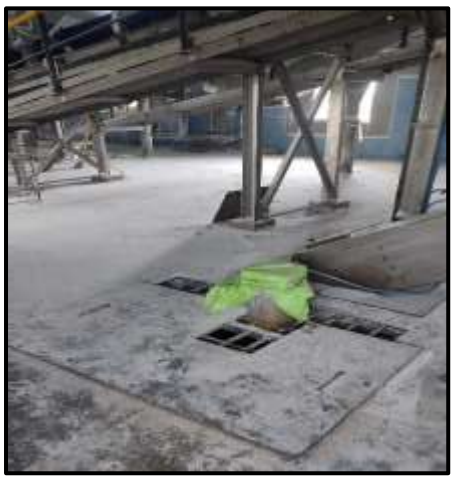
The condition of the concrete structure in conveyor gallery & Loading Floor is deteriorated. To rehabilitate the concrete condition, epoxy painting was carried out in B&MH plant. M/S. Gayatri Construction Co. did the epoxy painting job.

Epoxy screeding in silo

The condition of Loading floor is deteriorated due to urea penetration. 5 mm thick epoxy screeding was done in urea silo as rehabilitation measure of Loading floor. The job was carried out by M/S. Gayatri Construction Co.

Construction of cutout and anchor fastening for splitting of conveyor belt 2122

Two cutouts were made and anchor fastening was done for splitting of conveyor 2122 in B&Mh plant.



TECHNICAL

AMMONIA PLANT
(TECHNICAL)

Installation of PSV (Set Pressure :42.36Kg/ Cm2g) in MP steam header at back End. (Size : 6" x 8" ,600#) (Ref: EWR no. A528)

Previously, only one relief valve (RV-MS-9) with isolation valve was installed on MP steam header (MS-1-8"). It was observed that MP steam header safety was at risk, when this relief valve is isolated for maintenance purpose. Therefore, to ensure the safety of MP steam header, additional PSV is installed towards the back end of Ammonia Plant by undertaking required line modifications with IBR approval.

Job was carried out by M/s A.M. Erectors Engineers.

New PSV

Provision of isolation valves at upstream & downstream of PICV-16 (3.5 Kg/cm2 steam to deaerator) (Ref. EWR no. A574)

PICV-16 controls the pressure of 3.5 KG/cm2 steam to Deaerator (101-V). this PICV 16 was not provided with any U/s and D/s isolation valves, making maintenance of the CV difficult without interrupting the normal flow of LP steam to 101-U.

Therefore, isolation valves are provided at upstream & downstream of PICV-16, by undertaking required line modifications with IBR approval.

Job was carried out by M/s A.M. Erectors Engineers.

PICV 16

Installation of additional lube oil cooler for 101BJT (ID fan turbine) (Ref. EWR no. A573).

Previously, it was observed that existing LO cooler of 101BJT was insufficient and unable to maintain lube oil temperature within operating range, specially during summer season.

Therefore, additional lube oil cooler is provided for 101-BJT in parallel to existing cooler, with complete isolation for oil & CW side, to ensure lube oil temperature is kept within the operating range.

Job was carried out by M/s J&J Engineers.

Additional lube oil cooler

Provision to use Ammonia Plant LP steam in C-2 (ARU unit)

4.5% Ammonia solution from PGR is fed to the Ammonia distillation column (C-1). The ammonia from bottom of C-1 is sent to stream stripper C-2. In C-1 MP steam is used to provide the heat for evaporation of ammonia. MP steam from Ammonia plant steam header is supplied to C-1. Provision has been made to let down Ammonia Plant MP Steam to LP steam in FIC-505 and supply to C-2. There is no provision to use Ammonia plant LP steam directly in C-2.

Therefore, provision was made for supply of LP steam from Ammonia Plant LP steam header to C-2.

Job was carried out by M/s J&J Engineers.

Provision of 1-1/2" NRV at upstream of MICV-12 (Ref: EWR A 565)

1.5” inch NRV is provided at upstream of MICV-12 to avoid ingress of any steam / condensate from vent header to synloop.

Job was carried out by M/s A.M. Erectors Engineers.

Provision of 1.5” Bypass line with isolation valve at the level control valve of 1104-E (LIC-3018)

Provision of 1.5” Bypass line with isolation valve (Globe) at the level control valve of 1104-E (LIC-3018) was made to address the problem of high vibration in 3” LIC-3018 Bypass line.

1.5" bypass line

UREA PLANT
(TECHNICAL)

Installation of two Split pressure control valve instead of single vent control valve (PICV - 1130) (Ref: EWR U 365).

PICV-1130 (20") control valve was provided to vent 4 ata steam to atmosphere via silencer, to maintain 4 ata steam header pressure in case of any abnormal condition. The problem of frequent passing of PICV-1130 was observed and was also difficult to maintain.

Accordingly, suitable line modifications were carried out to provide new 8" PICV-1130 A & B for split range operation. PICV -1130A will operate from 0 to 50% range and PICV-1130B will operate 50 to 100% range

Job was carried out by M/s J&J Engineers.

Split pressure control valves

Provision of additional Ammonia Mass flow meter in parallel to existing meter.

Previously only one Ammonia Mass flow meter (FS-1102A) was in line in Ammonia stream and Urea Production was calculated based on this Mass flow meter readings, which sometimes, got erratic and showed wrong valve.

Accordingly, suitable line modifications were carried out in ammonia stream to install additional mass flow meter in parallel of existing one, to improve the reliability of the system.

Job was carried out by M/s J&J Engineers.

Additional mass flow meter

<u>Provision of oil filter (5 to 10 micron) in Ammonia stream for oil removal at HP Ammonia pump suction (Ref: EWR U 397).</u>

Liquid ammonia from Ammonia Plant of from ammonia storage tanks, after preheating is filtered for suspended impurities in ammonia filter (V-1102). It was observed that liquid ammonia, used as feed stock contains about 3-5 ppm oil, coming from oil seals of upstream compressors, which caused operational bottle necks in HP section.

In view of the above, suitable piping modifications ware carried out to provide new oil removal filter with double isolation valves, in parallel to existing filter in liquid ammonia stream, to avoid any operational bottlenecks in HP section.

Job was carried out by M/s J&J Engineers.

New oil filter

4" isolation valves at upstream and downstream of LICV-1352 (provided at outlet line of hydrolyser feed preheaters) with piping modification (Ref: EWR U 379).

LICV-1352 is provided at outlet line of Hydrolyser feed preheater (H-1351 A/B/C). Initially, no isolation valves were provided for LICV-1352, making it difficult to isolate for maintenance purpose.

Therefore, suitable line modifications were carried out to provide isolation valves at upstream & downstream of LICV-1352.

Job was carried out by M/s J&J Engineers.

LICV 1352

Fabrication & installation of new underground ammonical water tank (T-1303) and associated Piping jobs (Ref: EWR U 399).

Underground ammonical water tank (T-1302), capacity – 9.8 m3 was installed to collect ammonical water from closed draining system, and collected water can be recycled to Process water tank (T-1301) for further processing in Hydrolyser stripper system. This tank was located at the site of proposed new centrifugal pump, therefore, a new tank with bigger capacity – 13.6 m3 was constructed and installed at different location, along with associated pump and piping.

Job was carried out by M/s J&J Engineers.

New underground ammonical water tank

Provision of flow meter in seal flushing fluid line of HP Carbamate Pump (P-1201A/B) (Ref: EWR U 394).

Provision of NRV in 8" effluent line from hydrolyser system to 30" CW return header (Ref: EWR U 392).

Effluent generated in Hydrolyser system can be sent to either CW return header or to strong effluent, based on conductivity. It was observed that during start-up, there was a backward flow in system and CW reached to second desorber (V-1301) and lean ammonical water tank (T-1301) due to pressure in CW return header.

Therefore, to avoid backflow of cooling water, an NRV is provided in 8” line of effluent from hydrolyser system to CW return header.

Job was carried out by M/s J&J Engineers.

- Provision of flow indicator for condensate going to ACF (Ref: EWR WT 115).

  New orifice type flowmeter is provided in 3” steam condensate line, to monitor the condensate used for heating / regeneration of ACF units in DM Plant.

  Job was carried out by M/s J&J Engineers.

- Provision of NRV (along with 2” bypass with isolation valve) in instrument air receiver inlet line of Utility boiler. (Ref: EWR SG 79).

  In Utility Boiler, instrument air is received in instrument air receiver (V-5304).

  A new 4” NRV with 2” bypass, is installed in the inlet line of V-5304, to avoid back flow of air from V-5304 to instrument air main header during dip in header pressure.

  Job was carried out by M/s J&J Engineers.

- Provision of trap for moisture removal from instrument air receiver (V-5304), (Ref: EWR SG 80).

  Presently water collected in the Instrument air receiver (V-5304) is periodically drained manually which sometime cause carryover of water along with instrument air to downstream equipment’s and pipe lines.

  Therefore, to replace manual draining facility, a float type moisture trap with upstream isolation valve is installed in instrument air receiver for instantaneous draining of water.

  Job was carried out by M/s J&J Engineers.

- To provide flow transmitter in CBD line in BHEL boiler (Ref: EWR SG 81).

  New Flow transmitter is installed in CBD line for flow measurement & monitoring the quantity of condensate flow for fine control CBD of steam drum.
  Job was carried out by M/s J&J Engineers.