

MTC / REPORT / 01
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PLANT TURNAROUND REPORT

(MARCH – APRIL – 2016)

INDIAN FARMERS FERTILISER CO – OPERATIVE LIMITED

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PREFACE

The Annual Plant Turnaround for the year 2016 was taken from 19th March, 2016 to 5th of April, 2016. In addition to routine Preventive maintenance jobs of Static & Rotary equipments, Statutory IBR inspection, maintenance of Electrical & Instrument systems, Civil related jobs, several major Retrofitting and Replacement jobs in plant were carried out during shutdown.

After ensuring availability of all the required material for shutdown and awarding contracts for various shutdown jobs, it was decided to stop Ammonia Plant and Urea Plant on 19th March, 2016. This shutdown report contains Plant wise and section wise details of the jobs carried out. Ammonia plant was re started and regular production was lined up on 5th April, 2016. Similarly Urea plant was restarted and production was also resumed on 5th April, 2016.

Major jobs like Installation of new modified burner of Secondary Reformer, 103-D supplied by M/s. Casale, Replacement of Trays of Autoclave V-1201 was with High Efficiency Trays Supplied by M/s CASALE and preventive maintenance of other rotary equipment was carried out in Ammonia Plant. Heat exchanger 101-CB Tube Bundle was replaced. In Urea plant preventive Maintenance of Hitachi compressor train was carried out. In LP Carbamate condenser (H-1205) IRIS inspection was carried out. In Offsite/Utility plants, IBR inspection of BHEL Boiler (GT-2068) was done.

The Turnaround was carried out smoothly due to meticulous planning of all activities like planning of manpower, material and other resources. Due to exemplary efforts put in by all Personnel at all levels, turnaround jobs could be completed before the scheduled period for Ammonia Plant and Urea Plant.

Safety was one of the major aspects, which was given top most priority during the execution of various jobs. All the jobs were carried out considering all safety aspects and the use of safety equipments was ensured during execution of jobs. Necessary training for safe working in the Plant was given to the Manpower employed by all Contractors and strict vigilance was kept by Fire & Safety section during execution of Critical jobs.

Major jobs carried out during shutdown are as under.

MECHANICAL

✓ AMMONIA

- Ø Under ESP-III scheme, Installation of new modified burner of Secondary Reformer, 103-D supplied by M/s. Casale done.
- Ø Replaced 101-CB Tube bundle assembly which was furmanited to arrest the joint leakage between channel & outer bundle tubesheet occurred during running plant.
- Ø Air Compressor Interstage cooler 130-JC, leakage in 24 nos. tubes was found during hydrotest & these tubes were plugged.
- Ø Air Compressor Interstage cooler 129-JC, leakage in 2 nos. tubes was found during hydrotest & these tubes were plugged.
- Ø Provision of 2oo3 logic made in Steam Drum, 101-F level measurement.

Ø Replaced SP-73 Vent Silencer by new one procured from M/s. Flo-Dyne Controls (India) Pvt. Ltd., Mumbai.

√ **UREA**

- Ø Replacement of Trays of Autoclave V-1201 was with High Efficiency Trays Supplied by M/s CASALE.
- Ø Preventive maintenance of LP Case (K-1801-1), HP case (K-1801-2), drive turbine (Q-1801) & Gear box (M-1801) were carried out
- Ø Preventive Maintenance of lube oil turbine (Q-1814)
- Ø Eddy current testing of tubes of H-1201.
- Ø Air testing and Eddy current testing of HP Condenser H-1202 was carried out.
- Ø IRIS inspection of LP Carbamate condenser (H-1205) tubes & Baffle locking.
- Ø Replacement and modification in CCS-I line at First Floor, second floor & Third Floor.
- Ø Replacement of P-1201 B Pump having SS internals .
- Ø Modification in Off Gas RV Platform and Platform behind the HP Scrubber.
- Ø Replacement of both bearing of Prill tower ID Fan (K-1401/1, K-1401/2 and K-1401/4).
- Ø Replacement of Prill Tower ID Fan Stack cover by Umbrella hood from existing elbow hood.
- Ø IBR inspection of 4 ata steam drum V-1501.
- Ø LP Vessels inspection was carried out and necessary repairs were undertaken as per inspection findings.

√ **OFFSITE & UTILITY**

- Ø Preventive Maintenance of Cooling Water Pumps with turbines, BFW Pumps with turbines and FD Fan (K-5113) train
- Ø IBR inspection / Hydrotest of BHEL Boiler (GT-2068)
- Ø Replacement of existing Solid FRP fan blades with hollow FRP fan blades in NCT (H-4404-1/2/3)
- Ø Replacement of Sintex make partition wall in new cooling tower cell no. NCT 1-2 & NCT 2-3
- Ø Replacement of CS base frame of CWP P-4401A & P-4401D
- Ø Repairing of structural members of cooling towers.
- Ø Refurbishing of Jash make sluice gate of cooling water pump sump.
- Ø Overhauling of all cooling tower distribution valves.
- Ø Insitu refurbishment of discharge gate valve, 1100mm NB x 150# and check valve 1050mm NB x 150# of cooling water pump P-4402.
- Ø Rerubber lining of secondary mixed bed SMB-III.

√ **B&MH**

Following jobs were carried out in B&MH.

- Ø Replaced the Complete length of conveyor belt with new oil & heat resistance Conveyor belt in M 2110. Also provided new SS made discharge chute along with two way feed hopper and SS made flap valve.
- Ø Provided new SS made modified inlet chute in M-2112 Conveyor.
- Ø Shaft of slewing Pinion of New Reclaim Machine M-2116-A was modified as suggested by OEM.
- Ø Two Nos. single piece sprockets were replaced with new modified two piece sprockets in main lower Bucket elevator chain drive assembly in New Reclaim Machine M-2116-A.
- Ø Preventive maintenance of all conveyor gear boxes, weighing machines, packer scales and stitching machines.

INSTRUMENTATION

AMMONIA

- Ø Major focus area of Instrumentation jobs was implementation of EWRs. Field installations, cabling/wiring and software/logic development jobs were carried out for total 09 nos. approved EWRs. These included provision of 2003 low level tripping of steam drum 101-F, provision of Electronic Governor O/P indications on DCS for 04 different pumps drive turbines, DCS indications for MOV local/remote status, DCS indications for motors on/off and ready to start status, provision of PH and conductivity Analyzers with DCS indications for steam drum, provision of metal temperature indication of reformer superheater coil on DCS, provision of LO pressure indications on DCS for 04 nos. rotating machines, configuration of additional interlock inputs for 101-J vent interlock etc.
- Ø Replaced old control valves PICV-16, LICV-15, VS-203 and V7.
- Ø AMC servicing of DCS/PLC/UPSS and UPSS Batteries were carried out with the help of suppliers' service engineers. Preventive maintenance of CH₄, CO₂ NDIR Analyzer, and H₂ Analyzer was done. Preventive maintenance of control valves and calibration of all quality affecting instruments was carried out.

UREA

- Ø Plug of control valve LRCV-1201 for stripper level control was modified inhouse to reduce lateral thrust. Also, continuous condensate flushing arrangement was made in gland area to prevent sticking up of stem/plug in gland area during normal operation. HVD-1 plug/stem was replaced by Safurex plug/stem.
- Ø Control valve TICV-1226, HICV-1204, Magnetic Flowmeter FRCT-1421 and surface condenser Level Troll LT-1821 were replaced by new instruments as capital jobs.
- Ø EWR related Jobs for provision of remote/local status indications of MOVs on DCS, provision of HICV-1204 with higher flow capacity, provision of HICV-1406 in place of existing isolation valve, provision of SOVs for controlling/interlocking of neem oil flow, provision of back-end equipments bypass facility on DCS and provision of BFW pump discharge flow indication on DCS were carried out.
- Ø Servicing & overhauling of the all critical control valves was done. Calibration of all quality affecting instruments was carried out.

✓ **UTILITY AND OFFSITE**

- Ø Ball Valves BTV-2-4A and BTV-2-4B actuators were replaced by new scotch type actuators in Utilities Plant.
- Ø New control valve PICV-6 in steam vent service was provided with necessary interlocking in Utilities Plant as a part of EWR implementation.
- Ø Replaced 4 Ata steam to cooling water turbine control valve FCV-1 by new control valve.
- Ø AMC service of DCS/PLC/UPSS and UPSS Batteries were carried out with the help of supplier's service engineers. Preventive maintenance of control valves was done. Calibration of all quality affecting instruments was carried out.

✓ **BAGGING PLANT**

- ✓ Road Weigh Bridges and weighing machines were overhauled and calibrated.

ELECTRICAL

· **Critical job/ new installation**

- Ø Replacement of Control & relay panel
- Ø Erection & line up of overhead cable rack from 11KV MPSS to 66KV yard with new HT XLPE cables
- Ø Replacement of motor control centre-14 in Urea plant
- Ø Retrofitting of numerical Relays in 11KV substation
- Ø Replacement of Rotork make actuators and installation of new actuators
- Ø Replacement of MCC-13
- Ø Replacement of new variable frequency drives in Urea plant
- Ø Feeder modification & pre-commissioning cable laying for load management system
- Ø Installation of industrial PA system in various plants
- Ø Replacement of MOCB with SF6 circuit breakers in 66KV yard

· **Scheduled preventive maintenance and modification work**

- Ø Servicing of Siemens make 11 KV HT Vacuum circuit breaker (VCB) (
- Ø Servicing of Chhabi make battery charger
- Ø Servicing of Rotork make valve actuators
- Ø Maintenance of transformers
- Ø Overhauling of critical motors
- Ø Maintenance of Motor control center MCCs
- Ø Maintenance of 66 KV switch yard
- Ø Servicing of L&T make LT Air circuit breaker (ACB)
- Ø Servicing of Siemens make LT Air circuit breaker (ACB)
- Ø Provision of local/ remote indications of actuators in plant under EWR scheme

- ∅ Provision of ready to start indication at DCS for motors in plant under EWR scheme
- ∅ Checking of Rope switches in conveyors

CIVIL

√ **AMMONIA PLANT**

- ∅ Refractory repairing jobs in primary reformer, Secondary reformer & Primary waste heat exchanger. The casting of auxiliary boiler side panels was carried out.

√ **UREA PLANT**

- ∅ Anti corrosive treatment of Prill tower.
- ∅ Retrofitting and pocketing of the existing foundations P-1202 A/B in urea plant.

√ **OFFSITES & UTILITY PLANT**

- ∅ Construction of new cable trench in 66 KV yard & fire control room.
- ∅ Retrofitting of the damaged surface of the cooling tower sump basin.
- ∅ The cooling tower basin outside walls are badly damage and prone to seepage. The outside brickwork & plaster was carried out during the shutdown.
- ∅ Construction of foundation for P-4401 & P-4402 in cooling tower basin.

√ **B & MH PLANT**

- ∅ Rehabilitation of conveyor gallery M-2117 (beams, columns & soffit) area of B & MH plant by providing elastomeric lining.

TECHNICAL

- ∅ The annual turnaround, provide opportunity to Technical Department to undertake execution of jobs related to EWRs and various modification schemes which require isolation.
- ∅ Various modification jobs were carried out by Technical Department in Ammonia, Urea and Utility Plants in Annual Turnaround – 2016.
- ∅ All modifications 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 shut down.
- ∅ 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.

PLANT TURNAROUND APRIL - 2016

GENERAL - DETAILS

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

(A) EQUIPMENT UTILIZED :

IFFCO :

135 T Kobelco	01 No
100 T Kobelco	01 No
55 T TIL RT-760 Tyre mounted mobile Crane	01 No
10 T Escort Lift-N-Shift	01 No
14 T Escort Lift-N-Shift	01 No
03 T Forklift	03 Nos.
05 T Forklift	01 No.
909 Tata (Mini Truck)	01 No

(B) MANPOWER UTILIZED :

(I) IFFCO MANPOWER :

1	Mechanical	}	
2	Mechanical Services	}	Existing
3	Electrical	}	strength
4	Instrument	}	
5	Inspection	}	
6	Civil	}	
7	Kandla (Crane Operator)	}	1 Person

(II) HIRED - CONTRACT MANPOWER :

<u>Sr. No.</u>	<u>Category</u>	<u>Man days</u>
1	General Fitter	606
2	Rigger	862
3	S.S. Rigger	1724
4	Fabricator	114
5	Grinder	134
6	Gas Cutter	91
7	IBR Welder	59
8	Non-IBR Welder	76
9	Carpenter	44
10	Mason	44

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
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

SHUT DOWN RELATED CONTRACTS

SR. NO	PLANT	WO NO. & DATE	DESCRIPTION OF JOB	VENDOR'S NAME
1	Mechanical Ammonia	201004161493 24/02/2016	Scaffolding & Blinding / De-blinding jobs during Shut Down-2016	M/S. MAHAVIR ENGG WORKS, Baroda
2	Mechanical Ammonia	201004161544 03/03/2016	Overhauling and Preventive Maintenance of Rotating Equipments	M/S. SAAD Engineering
3	Mechanical Ammonia	201004161545 03/03/2016		M/S.BVL Power
4	Mechanical Ammonia	201004161361 & 04/02/2016	Overhauling of Re-cycle Gas compressor, 117-J	M/S. MALHAN ENTERPRISES PVT. LTD., AHMEDABAD
5	Mechanical Ammonia	201004161607 09/03/2016	Critical Fabrication jobs in Ammonia and Offsite Plant	M/S. A M ERECTORS
6	Mechanical Urea	201004161531 24/02/2016	Replacement of Autoclave (V-1201) Trays	SHREE GANESH ENGG CO
7	Mechanical Urea	201004161612 08/03/2016	Various Critical Fabrication during Annual Shutdown-2016 in Urea Plant	A M ERECTORS
8	Mechanical Urea	201004161158 02/01/2016	Overhauling, Reconditioning and Testing of Valves	Flotec Engg.
9	Mechanical Offsite	201004161302 18-JAN-2016	Servicing/Repairing of Jash make Sluice Gates - (SERVICE)	M/s Jash Engg, Indore
10	Mechanical Offsite	201004161478 29-FEB-16	Supply and installation of Sintex Make PVC Panel in Partition wall of New Cooling Tower (NCT) - (SERVICE)	M/s Abhay Fabricators, Kalol
11	Mechanical Offsite	201004161559 12-MAR-16	Services for In-situ gland re-packing of valves during annual shutdown-2016 (SERVICE)	M/s Flotec , Surat
12	Mechanical Offsite	201004161476 29-FEB-16	Insitu Overhauling/Repairing of Gate Valve / Check Valve	M/s Flotec , Surat
13	Mechanical Offsite	201004161545	Overhauling and Preventive Maintenance of Rotating Equipments in Ammonia , Urea and Utility plants	BVL Power, Hyderabad
14	Mechanical Offsite	201004160733 05/10/2015	Service contract for Replacement of existing Wooden Herringbone type drift eliminators with PVC Honeycomb type drift eliminators in Ammonia CT Cell No.1/2/3	M/s PAHARPUR COOLING TOWERS LIMITED, Vadodara
15	Mechanical Offsite	201004151204 30/01/2015	Specialised services for Repair & Maintenance of "PAHARPUR" make Cooling Towers	M/s PAHARPUR COOLING TOWERS LIMITED, Vadodara

SR. NO	PLANT	WO NO. & DATE	DESCRIPTION OF JOB	VENDOR'S NAME
16	Mechanical B&MH	201004150817 14.11.2014	ARC for providing rubber linings on belt conveyor pulleys	M/s J.K.Rubber Works, Ahmedabad
17	Mechanical B&MH	201004151289 01.04.2015	Splicing and Vulcanizing of conveyor belts	M/s J.K.Rubber Works, Ahmedabad
18	Mechanical B&MH	201004150761, 18.09.2015 Amendment-1	Requirement of skilled Engineer & Technician for Reclaim machine	M/s Elecon Epc Projects Ltd, VV Nagar
19	Mechanical B&MH	201004141314 10.02.2016	Services of skilled engineer of M/s Gabbar Engg.	M/s Gabbar Engineering, Ahmedabad
20	Inspection Ammonia/ Urea	201004150874, 18-11-14	Insitu-Metallography Work	TCR advanced Engg., Vadodara
21	Inspection Ammonia / Urea / Utility	201004160637, 12-09-15	Radiography work	NDT Services, Ahmmedabad
22	Inspection Ammonia / Urea / Utility		NDT Teams for DP Test	S.R. Technical Services, Mumbai
23	Inspection Ammonia / Urea / Utility	201004160956, 03-12-15	NDT Teams for Thickness Measurement	M/s S.R. Technical Services, Mumbai
24	Inspection Ammonia		NDT Team for Ultrasonic Flaw Detection work	M/s S.R. Technical Services, Mumbai
25	Inspection Ammonia	201004160957, 04-12-15	NDT Team for Magnetic Particle Inspection	NDT Services, Ahmmedabad
26	Inspection Ammonia	201004151490, 14-03-15	Helium Leak Testing of 115-C	Gulachi Engrs, Gaziabad
27	Inspection Urea	201004150877, 25-11-14	IRIS Inspection of LPCC (H-1205)	Testex NDT(I) Pvt. Ltd., Mumbai
28	Inspection Urea	201004150853, 14-11-14	ECT of HP Stripper (H-1201) & HP Condenser (H-1202)	Testex NDT(I) Pvt. Ltd., Mumbai
29	Instrument	6555/20100416 1286 dated 12/01/2016	Complete Overhauling of Control Valves	Flotec Technosmart (India) Private Limited, Surat
30	Instrument	6555/20100416 1319 Dated 27/01/2016	Hiring of Skilled Instrument Manpower for Shutdown	A-Z Instruments Services, Vadodara
31	Electrical Ammonia	201004161379 03/02/2016	Servicing of Rotork make valve actuators	M/S Rotork
32	Electrical	201004161250 04/01/2016	Servicing of Chhabi make battery charger	M/S Chhabi
33	Electrical	201004161336 21/01/2016	Services of electrician	M/S A N Electrical
34	Electrical	201004161403 12/02/2016	Servicing of Siemens make LT Air circuit breakers	M/S Pradip
35	Electrical	201004161518 24/02/2016	Servicing of Siemens make 11 KV HT Vacuum circuit breakers	M/S Siemens

SR. NO	PLANT	WO NO. & DATE	DESCRIPTION OF JOB	VENDOR'S NAME
36	Electrical	201004161450 24/02/2016	Replacement of MCC-14	M/S AAY BEE
37	Electrical	201004160859 20/10/2015	Termination of new power and control cable at MPSS panel and at 66 KV switch yard	M/S A N Elect.
38	Electrical	201004161338 20/01/2016	Replacement of MCC-13	M/S A N Electrical
39	Electrical	201004160417 08/07/2015	Removal of Old MOCB's & Installation of New/ABB make SF6 breakers	M/S ABB
40	Electrical	201004161058 18/12/2015	Replacement of CRP panel	M/S Elcon
41	Electrical	201004160959 17/11/2015	Supply & installation of Numerical Protection Relay for 11 KV panel	M/S Elcon
42	Electrical	201004161662	Servicing of L & T make LT Air circuit breakers	M/s. Stabd
43	Electrical	201004161614	Maintenance of 66KV Switch Yard	M/s. Bala services
44	Electrical B&MH	201004161652	Maintenance of transformer	M/s. Unique
45	Planning	201004161472 18/02/2016	Assisting IFFCO during plant turnaround / Breakdown jobs	Ram Bahadur & co. Pali, U.P.
46	Planning	201004161448 18/02/2016	Opening & Boxed up of heat exchangers	General engg works Bharuch, Gujarat
47	Planning	201004161473 24/02/2016	Hydrojetting Cleaning of Heat Exchangers tubes	Hydro jetting services Ahmedabad,Gujarat
48	Planning	201004161475 17/02/2016	Overhauling & Testing of Safety valves/Relief valves/Pilot operated valves	Flotec technosmart (india) private limited Surat
49	Planning	201004141309 13/FEB/2014	Arc for on line leak Sealiing Job.	Dynamic meta sealing engineers Thane India
50	Planning	201004150549 08/09/2014	Arc for Painting Jobs.	B chauhan & co Kalol
51	Planning	201004141171 24/JAN/2014	Arc for Carrying out Various hot & cold Insulation Jobs	Khandelwal Insulations Pvt ltd Mumbai - 400083
52	Planning	201004141170 24/JAN/2014	Arc for Carrying out Various Hot & cold Insulation Jobs	Balaji Insulation India Pvt ltd Thane-west - 400607
53	Planning	201004151074 20/12/2014	Arc For Various Fabrication Work In Plant	Aneesh engineers Kalol
54	Planning	201004151075 20/12/2014	Arc For Various Fabrication Work In Plant	J&J engineers Shertha
55	Planning	201004131192 25/01/2013	Arc for Petty Maint. Jobs.	J&J engineers Shertha

SR. NO	PLANT	WO NO. & DATE	DESCRIPTION OF JOB	VENDOR'S NAME
56	Civil	201004161699	Providing & applying painting of prilling tower in Kalol during annual shutdown.	M/S Dewan Enterprises
57	Civil	201004161672	Rehabilitation of damaged RCC structure in conveyor gallery at B&Mh plant & prill cooling area during annual shutdown	M/S Greensboro Polychem Pvt Ltd.
58	Civil	201004161679	Pre, during & post annual turnaround civil job in IFFCO plant.	M/S Vidya Shankar Upadhyay
59	Technical	201004161534 01-MAR-2016	Structure strengthening & pipe support retrofitting in various Plants.	M/s GENERAL ENGG WORKS
60	Technical	201004161649 17-MAR-2016	Piping and structural Fabrication jobs during Shut Down.	M/s J&J ENGINEERS

MECHANICAL

AMMONIA PLANT
(MECHANICAL)

AIR COMPRESSOR TRAIN (101-J)

101-JT, Air Compressor Drive Turbine

Turbine was decoupled and both end Journal bearings and Thrust bearing were removed for inspection. The bearings were visually inspected & found in good condition. Thrust Bearing Pads active side replaced by new because Thrust bearing RTD was not working. Gauss readings of the bearing pads & shaft journal were measured and found within limits. Journal Bearing clearances were taken and found within the design range. Thrust float with new pads found 0.52mm against design value 0.20 to 0.30mm. Hence, Adjustment of Thrust float carried out by adding shim of 0.20mm (0.10 + 0.10) thick.

101-JLP, Air Compressor

101-JLP 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. Thrust float of 101-JLP rotor was found 0.52mm which was on higher side, adjustment of thrust float carried out by replacing 8.22 mm thick inner side thrust support spacer ring with new 8.42mm thick spacer ring made in w/s. (Size of spacer ring: OD = 194.70 mm, ID = 119.50 mm, Thk. = 8.42 mm in two halves)

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.

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-J TRAIN

COUPLINGS

Description	Position	Design (Inch)	Before (Inch)	After (Inch)
DBSE (With Rotor at extreme ends)				
101 JT-JLP	---	10.500	10.485	10.452
101 JLP-JR	---	8.250	8.285	8.276
101 JR-JHP	---	8.250	8.259	8.253
Distance between Hub Face (With Rotor at extreme ends)				
101 JT-JLP	---	10.557	-	-
101 JLP-JR	---	8.250	-	-
101 JR-JHP	---	8.250	8.259	8.253

PREVENTIVE MAINTENANCE RECORDS: 101 - JT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
JLP End					
Journal Bearing	Mandrel	B	0.007-0.009	0.19	0.19
	Filler / lead wire			-	-
Oil Guard (For Jr.Brg Housing)	L / R	C	0.015-0.021	0.30	0.20
		G	0.058-0.097	0.20	0.30
Oil Guard (For Seal Housing)	-	D	0.077-0.109	-	-
Shaft Diameter	Jr. Brg.	-	4.993	126.80	126.80
Bearing Pinch	Jr. Brg.	-	-	-	-
Governor End					
Journal Bearing	Mandrel	B	0.007-0.009	0.19	0.19
	Filler / lead wire			-	-
Oil Guard (For Brg. Housing)	South	-	-	-	-
	North	C	0.015-0.021	0.15	0.15
Oil Guard (For Thrust Brg.)	South	A	0.002-0.04	-	-
	North	A	0.002-0.004	-	-
Oil Guard (For Seal Housing)	-	D	0.077-0.109	-	-
Axial Thrust.	With Top Housing	-	0.008-0.012	0.35	0.32
	Without Top Housing	-		-	-
Shim thickness. (Thrust adjusting)	North	-	-	0.1	0.3
	South	-	-	-	-

Journal Bearing Pads Thickness				
PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	20.64	20.64	20.67	20.67
No 2	20.62	20.62	20.66	20.66
No 3	20.62	20.62	20.65	20.65
No 4	20.62	20.62	20.66	20.66
No 5	20.62	20.62	20.65	20.65
Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After New Pads	Before	After
No 1	23.14	23.19	Thrust ring	
No 2	23.20	23.26	Top - 12.70 Bottom - 12.70	Top - 12.70 Bottom - 12.70
No 3	22.90	23.16		
No 4	23.24	23.16		
No 5	23.21	23.19		
No 6	23.29	23.16		

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	0.20	0.20
	Filler / lead wire			-	-
Bearing Pinch	Journal Bearing	-----	-----	-	-
Shaft Dia.	Journal Bearing	-----	4.493	-	-
Oil Guard (For Journal Bearing)	L / R	C-1	0.013-0.015	0.15/0.15	0.15/0.15
	South	C-1	0.013-0.015	-	-
Oil Guard (For Outer Housing)	North	A-1	0.021-0.027	-	-
	South	A-1	0.021-0.027	-	-
GEAR BOX END					
Journal Bearing Clearance	Mandrel	D-1	0.005-0.008	0.17	0.17
	Filler / lead wire			-	-
Bearing Pinch	Journal bearing	-----	-----	-	-
Shaft Dia.	Journal bearing	-----	4.493	-	-
Oil Guard (For Journal Bearing)	North	C-1	0.013-0.015	0.25/0.25	0.25/0.25
	South	C-1	0.013-0.015	0.25/0.20	0.25/0.20
Oil Guard (For Thrust bearing)	North	M-1	0.002-0.004	-	-
	South	S-1	0.002-0.04	-	-
Oil Guard (For Outer Housing)	CT side	A1	0.021-0.027	-	-
	SAILO side	A1	0.021-0.027	-	-
Axial Thrust	With Top Housing	-----	0.010 - 0.015	0.52	0.32
	Without Top Housing	-----		-	-
Shim Thickness (Axial Thrust adjusting)	North (inner)	-----	-----	8.22	8.42
	South (outer)	-----	-----	10.28	10.28
Total Float	-----	-----	7.144 - 8.730	-	-

Journal Bearing Pads Thickness

PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	20.13	20.13	20.12	20.12
No 2	20.13	20.13	20.14	20.14
No 3	20.14	20.14	20.14	20.14
No 4	20.14	20.14	20.13	20.13
No 5	20.13	20.13	20.13	20.13

Thrust Bearing Pad Thickness

Pad	ACTIVE		INACTIVE		PAD	ACTIVE		INACTIVE	
	Before	After	Before	After		Before	After	Before	After
No 1	19.81	19.81	19.83	19.83	No 5	19.80	19.80	19.87	19.87
No 2	19.85	19.85	19.84	19.84	No 6	19.82	19.82	19.88	19.88
No 3	19.83	19.83	19.87	19.87	No 7	19.84	19.84	19.83	19.83
No 4	19.83	19.83	19.85	19.85	No 8	19.82	19.82	19.85	19.85

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	0.31 With lead wire	0.27 By rotor lifting
	South	0.008-0.010	0.29 With lead wire	0.27 By rotor lifting
Axial Thrust	-	0.014-0.024	0.31	0.28
Journal Bearing (High Speed driven Pinion)	North	0.009-0.011	0.26 With lead wire	0.26 By rotor lifting
	South	0.009-0.011	0.26 With lead wire	0.22 By rotor lifting
Free float –PINION	-	-	0.80	1.00
Backlash	-	-	0.44	0.40
Shaft Diameter (Low Speed drive Gear)	North Side Bearing.	-	4.492"	4.492"
	South Side Bearing.	-	4.492"	4.492"
Shaft Diameter. (High Speed driven Pinion)	North Side Bearing.	-	3.494"	3.494"
	South Side Bearing.	-	3.494"	3.494"

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	0.19	0.19
	Filler / lead wire			-	-
Bearing Pinch	Journal Bearing	-----	-----	-	-
Shaft Dia.	Journal Bearing	-----	2.996	-	-
Oil Guard (For Journal Bearing)	CT side	B-1	0.013-0.016	0.20	0.20
	SILO side	B-1	0.013-0.016	0.15	0.15
Oil Guard (For Top Housing)	North	D-1	0.015-0.022	-	-
	South	D-1	0.015-0.022	-	-
NON DRIVE END					
Journal Bearing Clearance	Mandrel	D-1	0.015-0.022	0.18	0.18
	Filler / lead wire			-	-
Bearing Pinch	Journal bearing	-----	-----	-	-
Shaft Dia.	Journal bearing	-----	2.996	-	-
Oil Guard (For Journal Bearing)	North	B-1	0.013-0.016	-	-
	South	B-1	0.013-0.016	-	-
Oil Guard (For Thrust bearing)	North	A-1	0.002-0.004	-	-
	South	A-1	0.002-0.04	-	-
Oil Guard (For Top Housing)	North	-----	-----	-----	-----
	South	D-1	0.015-0.022	-	-
Axial Thrust	With Top Housing	-----	0.008 - 0.012	0.32	0.32
	Without Top Housing	-----		-	-
Shim Thickness (Axial Thrust adjusting)	North	-----	-----	0.0	0.0
	South	-----	-----	0.0	0.0
Total Float	-----	-----	2.779 - 3.571	-	-

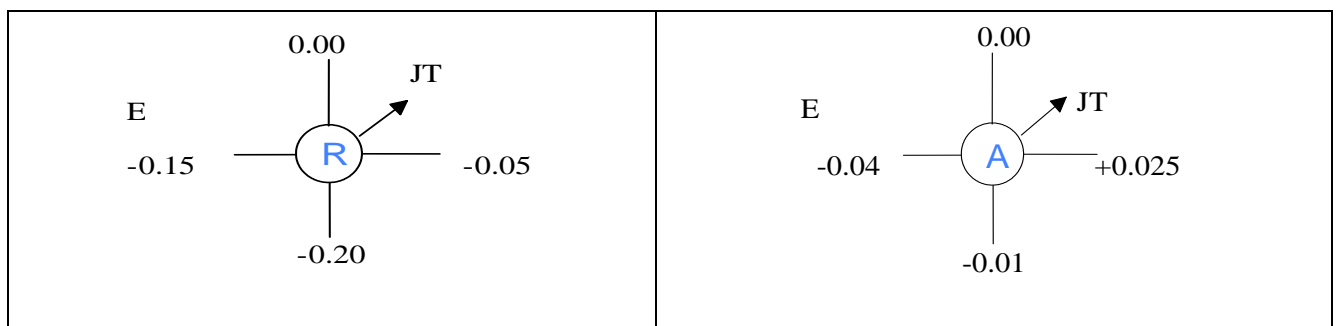
Journal Bearing Pads Thickness				
PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	14.29	14.29	14.26	14.26
No 2	14.26	14.26	14.26	14.26
No 3	14.27	14.27	14.27	14.27
No 4	14.28	14.28	14.26/27	14.26/27
No 5	14.28	14.28	14.25/26	14.25/26

Thrust Bearing Pad Thickness				
Pad	ACTIVE (inner)		INACTIVE (outer)	
	Before	After	Before	After
No 1	12.70	12.70	12.67	12.67
No 2	12.69	12.69	12.66	12.66
No 3	12.67	12.67	12.65	12.65
No 4	12.66	12.66	12.67	12.67
No 5	12.71	12.71	12.66	12.66
No 6	12.69	12.69	12.67	12.67

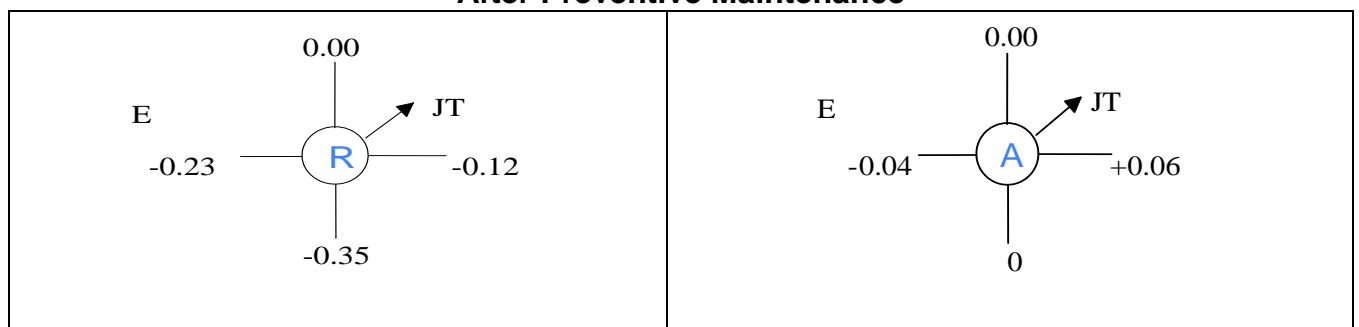
ALIGNMENT READING RECORDS: 101-J TRAIN

101-JT to 101-JLP

Before Preventive Maintenance

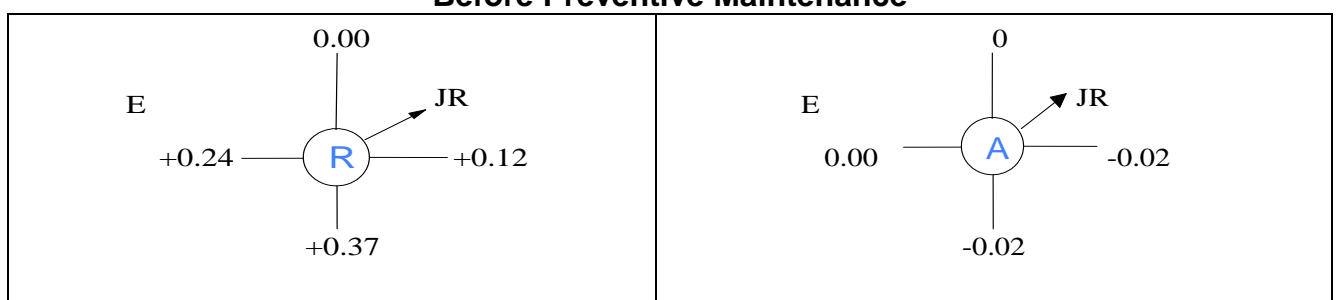


After Preventive Maintenance

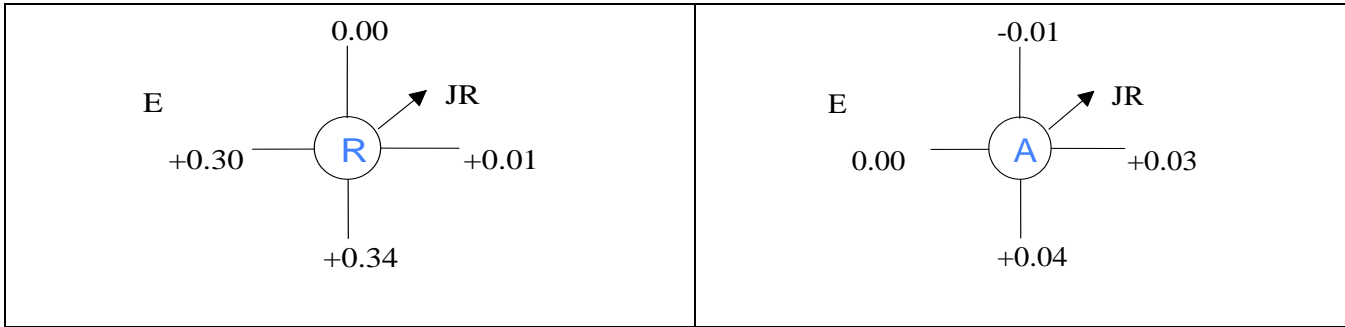


101-JLP to 101-JR

Before Preventive Maintenance

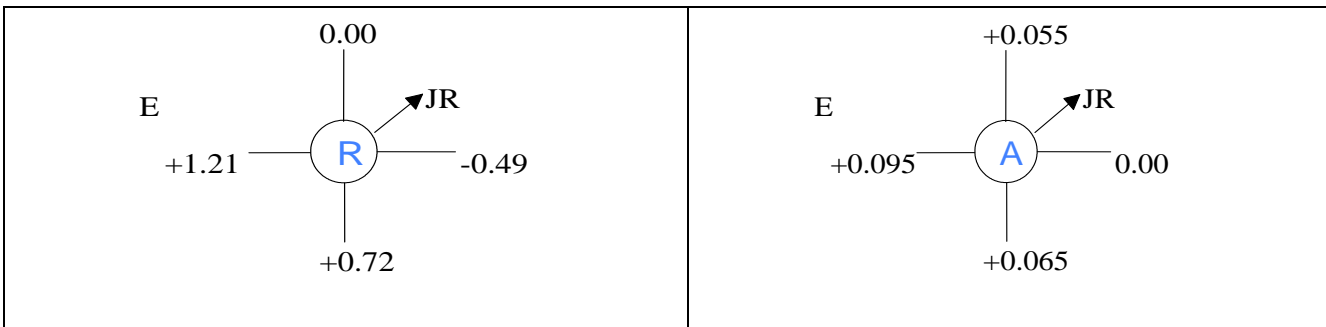


After Preventive Maintenance

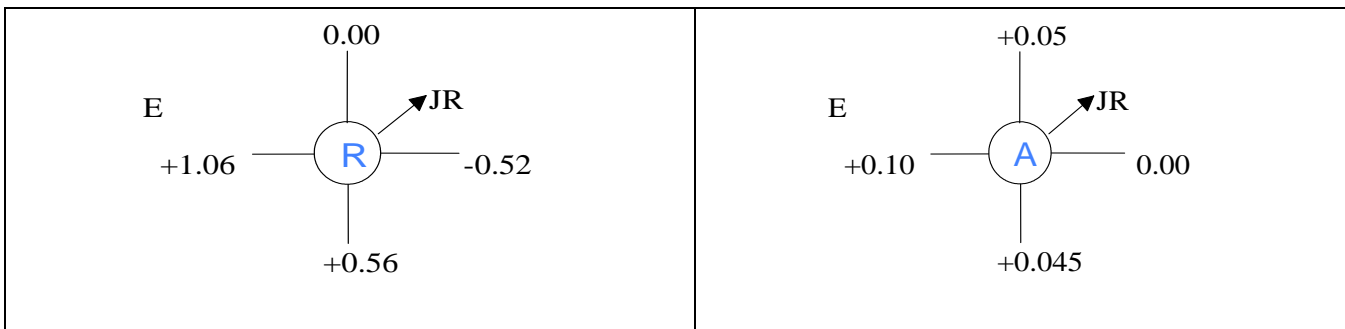


101-JR to 101-JHP

Before Preventive Maintenance



After Preventive Maintenance



SYNTHESIS GAS COMPRESSOR TRAIN, 103-J

103-JBT, Condensing Turbine

The turbine was decoupled. Thrust bearing and both end Journal bearings were visually inspected and found all journal bearing pads damaged. Magnetism level 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 cracks were found. The governor linkages were greased.

Diametral clearance of 103-JBT bearings was 0.11mm against design 0.25 to 0.30 mm with mandrel. Spare bearings was checked and found to have the same clearance. Hence, decided to reduce thickness of pad web by scrapping. Then blue matching with housing was checked (Reduction in South side brg. pad – 0.04mm & north side brg. pad – 0.06mm).

No holes for vibration probes fixture holding were found on 103-JBT north side new brg. shell, so holes were drilled at machine shop.

103-JLP, Synthesis Gas Compressor

The Compressor was decoupled. Thrust bearing and both end Journal bearing were visually inspected and found all journal bearing pads & Thrust brg. (active & inactive) Pads damaged. Also, Thrust collar & Oil control ring found damaged.

Magnetism level check of the removed bearings was carried out. Dye penetration test was performed and the result was found to be OK.

Hole was found offset in new 103-JLP Thrust supporting spacer ring RTD, hence, hole was enlarged in machine shop. Also, 103-JLP South Journal Brg. new Shell RTD holes found offset, holes were enlarged at machine shop.



LP Compressor Thrust End Journal Brg



LP Compressor Thrust Bearing

Drilled 2 nos. hole on new oil control ring of 103-JLP thrust bearing at marked position (Ref fig below) & made hole depth of anti rotation pin 8 mm.



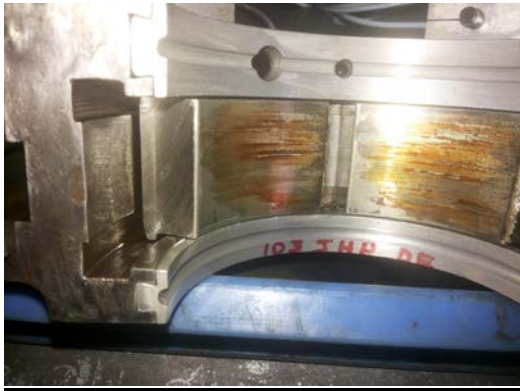
**Oil Control Ring of 103-JLP
Thrust Bearing**



**103-JLP South side
Journal Brg. Pads**

103-JHP, Synthesis Gas Compressor

The compressor was decoupled. Thrust bearing and both end Journal bearing were visually inspected and found all journal bearing pads damaged. Thrust was checked. Magnetism level of the bearings were checked and found within limit. All the removed pads were Dye Penetration tested and found to be OK.



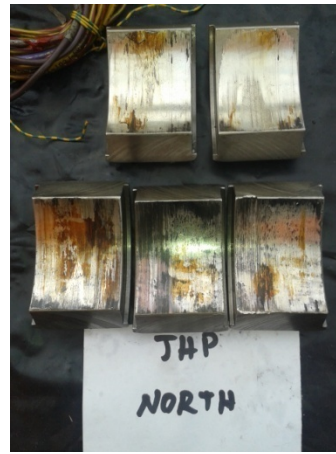
HP Compressor Coupling End Journal Bearing



HP Compressor Thrust Bearing



103-JHP Bottom Half Brg.



103-JHP North side Journal Brg. Pads

103-JAT (Back Pressure Turbine)

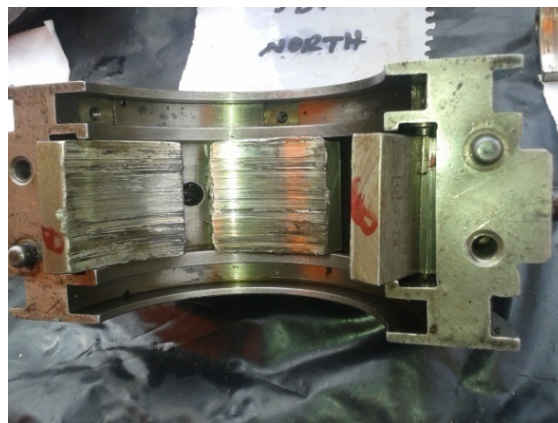
Turbine was decoupled at both ends. Thrust bearing and both end Journal bearing were visually inspected and found both journal bearings damaged.

No holes for vibration probes fixture holding were found on spare journal brg. shells of 103-JBT, so holes were drilled on 2 nos. journal brg. shell (for both ends) at machine shop.

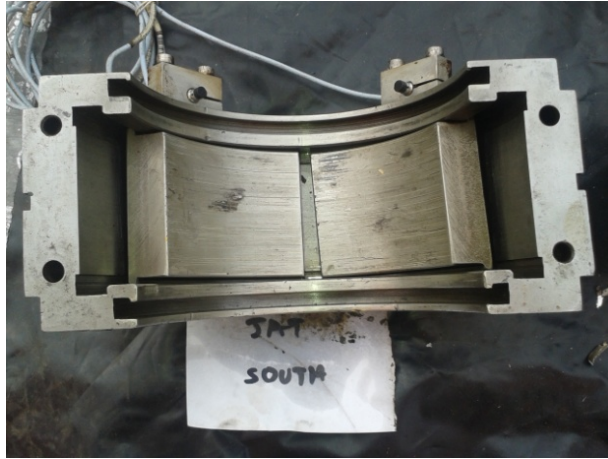
103-JAT north side brg. shell anti rotation pin found at wrong side of spare journal bearing. So, holes were drilled at opposite side & inserted pin.



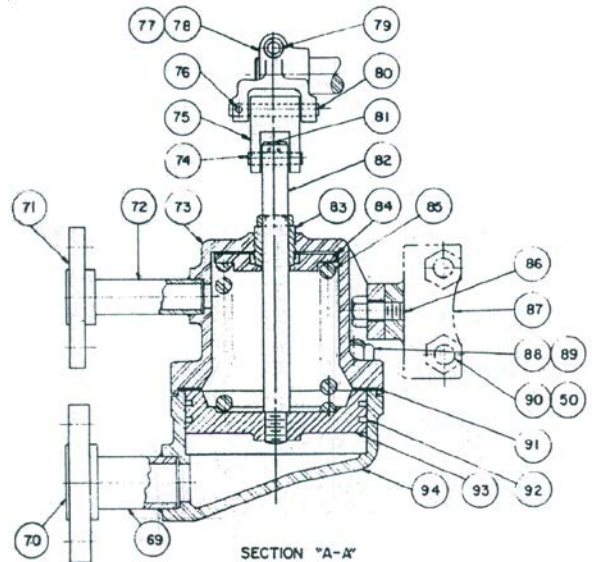
103-JAT North End Top Half Journal Brg.



103-JAT North End Bottom Half J. Brg.



103-JAT South End Top Half Journal Brg.



103-JAT Trip Throttle Valve

103-JAT Trip Throttle Valve oil leak attended. Following parts as per TTV D.NO: S-1028 was replaced:

Part No.	Item Description	Part No.	Item Description
82 & 83	Stem & Adjusting Nut	92	Piston Ring
85	Spring	93	PISTON PSD 3004 FNM
91	Gasket		



Dismantled Components of TTV

PRC-12 Servomotor assembly dismantled to attend the problem of stuck up & sluggish response during operation. Scoring marks were observed on piston ring. Hence it was replaced with new one. Following parts were removed (Ref -Servomotor Assy. Drg. No. F-6654-1). Controller was replaced with refurbished spare by Instrument.

Part No.	Item Description	Qty.
459	PISTON, SYM.:M-1802JP	1
	BEARING, XA-81420, 315515	2
457	THOMSON BRG SYM: 315511 (KA-81420)	1
458	SPRING, SYM.: M-258VA	1
470	BUSHING, SYM: 08 DU-14 (315581)	1



Servomotor Assembly



Piston & Thomson Bearing



Scoring mark on Piston rod

Governing valve lever bearings (2 nos.) were dismantled, cleaned and boxed up after filling new grease. Linkages were also cleaned & greasing done.

Problem of 103-J Lube Oil AOP not developing desired pressure

On 28th July 2015, during normal plant operation, the standby motor driven LO pump (AOP) got started on auto due to sudden tripping of main turbine driven LO pump (MOP), but the AOP did not develop the desired discharge pressure of 12.5 kg/cm² and the Synthesis Compressor turbine tripped after 6 seconds (Accumulator hold up time) on low-low Control oil pressure PSSL-92.

On checking, field operator observed that the AOP was severely vapour locked, which could be normalized after few minutes by opening the discharge vent and minimum flow valve of AOP. The bearing's temperature of complete train was increased and temperatures of 103-JHP/JLP bearings were increased above 190 deg C due to MOP tripping.

After that it was observed that the temperature of 103 JHP and JLP were running higher than normal. *Due to this, incident, the journal bearing of 103 JHP, journal and thrust bearing of JLP, both journal bearings of 103-JAT & both journal bearing of 103-JBT were damaged.*

Following problems were also found during normal running:

- To reduce the bearing temperature, it was tried to increase L.O. pressure by adjusting PCV 303. However it was observed that it was unable to increase the pressure beyond 1.5 kg/cm². Even after increasing the spring compression, it was unable to develop pressure. Also there was no I/V in the pilot valve control oil line tubing, hence, it was not possible to isolate the PCV during normal operation.
- LO filter 3-way valve was passing. Hence it was not possible to isolate the Filter for replacement of cartridge during normal operation.

The probable reasons for AOP not developing Pressure were:

- Air/Oil Vapour trapped in discharge Line of Oil Pump, delaying the pressure built up by motor driven pump, during change over
- NRV elevation above the normal operating level in reservoir
- Combination of above

Following modifications were done during Shutdown for resolving AOP issue:

- #1 above was taken care by providing vent at ½” tapping from AOP discharge line to L.O tank. However there was no improvement.(Done during normal operation)
- For #2 above, the line modification was done as per Isometric drg. RIN52642A_R5 during shutdown. The level of console was increased and kept above the NRV.
- Note: Check valve was replaced from Swing Type to Dual Plate (Wafer Type) check valve & relocated in vertical line instead of horizontal line.
- Since the L.O normal operating level was above the existing transmitter range, Transmitter housing length was also increased by providing spool piece as per Isometric Drg. RIN52642A_R5 Sh 8 of 8.

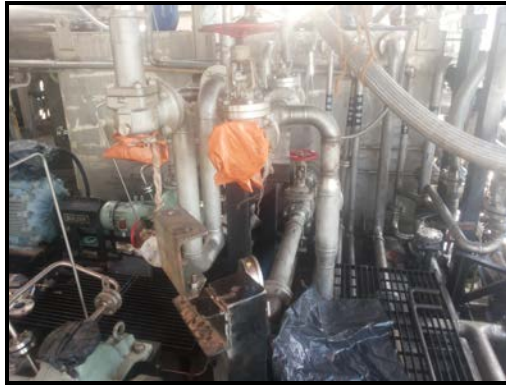
Other Modifications carried out:

- As per IFFCO request, M/s D-R agreed to supply additional accumulator to increase the switch over time to 16 seconds from existing 8 seconds. The provision was made during Shut down as per above Isometric drawing for installation of additional accumulator. The Accumulator was later installed during normal operation.
- 3-way valve was removed and soft goods kit was replaced in presence of representative of M/s Flow-chem and Hydro test was done and found OK. It was observed that the control room side filter gasket was damaged and filter was getting bypassed. Hence gasket was replaced with new gasket cut from rubber sheet.
- After removal of PCV 303, it was observed that valve was having scratches and hence it was getting stuck up. The Pilot operated PCV 303 (size 2”) was replaced with Normal control Valve (Size: 1-1/2”).
- Nitrogen Pressure of LO accumulator was nil. It was filled with Nitrogen at the required charging pressure of 6.30 kg/cm²g.
- Nitrogen Pressure of SO accumulator was nil. The bladder was not holding the pressure as it was punctured. Hence Isolation Valve was provided so that the bladder may be replaced during normal operation. (Spare bladder was not available)

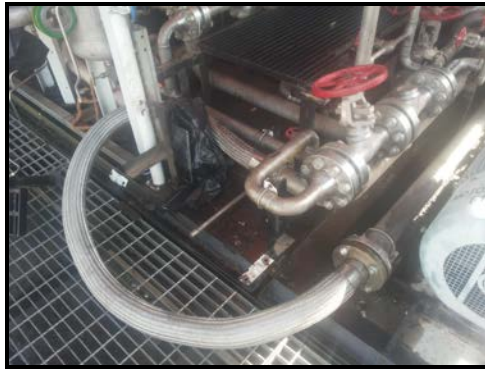
Flushing of LO System

After completing fabrication of piping for modification as per PID, the following piping connections were made to complete the LO circuit for flushing the fabricated lines:

- New fabricated piece was provided at AOP discharge and AOP was run and Valve at MOP discharge closed. (Ref Photo below)



- Filter was by-passed by 3" SS Flexible hose. (Ref Photo below)



- Gate Valve to Seal oil pump suction was closed.
- Governor oil line flange at platform was connected to LO tank through 2" SS flexible hose. (Ref Photo below)



- At LO Outlet line, Old PCV 303 line, new PCV 303 spool piece, New Level Transmitter Spool Piece and New MOP NRV line were connected. (Ref Photo below)



- Then SS flexible hose of 2" and two nos. 1-1/2" were provided and outlet of hose was directed to LO tank after opening cover through mesh. (Ref Photo above)
- At 4" flange for new Accumulator, 3" SS flexible hose provided with 4" flange after welding and oil was returned to LO tank then mesh. (Ref Photo below)



- Old Accumulator was removed from position and SS flex hose was connected outlet to LO tank with mesh. (Ref Photo above)
- Initially, 200 mesh size flat screen mesh was provided at all outlet lines, but it was observed that flat screen was getting torn out. Hence, conical strainer wrapped with screen of 200 mesh size was provided.
- AOP was started with discharge valve throttled.
- Screen checking & replacement frequency was increased gradually from 2-3min then 5min & finally upto 2hrs.
- Delivery pressure was 8 kg/cm²g at discharge of AOP and 2 kg/cm²g at LO outlet line to tank (At Sr No 5 & 6 above) which increased up to 4 kg/cm²g. Then mesh was removed and cleaned. The procedure was repeated until mesh was found clean.
- On 03/04/16 pressure was 9 kg/cm²g at discharge of AOP and 3 kg/cm²g at LO outlet line to tank (At Sr No 5 & 6 above)
- On 03/04/16 LO filter was taken in line and pressure at Sr No 5 & 7 was 1.28 kg/cm²g which increased upto 1.35 kg/cm²g.
- It was observed that filter at Ammonia side was getting bypassed as gasket was damaged. Hence cartridge was removed, changed rubber gasket & fixed back.
- Ammonia Maintenance side filter was ok
- On 04/04/16
 - LO filter (Ammonia Maint. Side) was replaced
 - Circulation was stopped (Control Room side filter in line) at 08.00 AM
 - MOP spool piece provided in its position.
 - Control Valve spool piece as per earlier
 - Accumulator positioned.

Started LO circulation at 11:30 and continued upto 14:30 hrs

- All lines were positioned and taken in line through mesh at LO & CO inlet. Conical strainer with mesh also provided at outlet header. LO circulation continued upto 17:00 hr. The mesh was cleaned and then again circulation was started
- On 05/04/16 09:00 AM, all mesh were removed & pump started

The Fabrication job was done by M/s J & J, Shertha against ARC.

Note:

During start-up, to check the switch over time of AOP, turbine was stopped and AOP started in Auto. It was observed that the required pressure was developed within 4 seconds. However after S/D during normal operation when AOP was started, it was showing erratic behaviour. Hence normal operating level operating level was increased upto NRV top flange.

Also a hole of 3 mm was drilled in NRV flapper so that the problem of vapour entrapment is resolved. (This was done in June, 2016 after shut down. After taking trial it was found OK.)

For checking the AOP on line following procedure was followed:

- Closed AOP discharge valve ,
- Closed min flow line I/V.
- Then AOP was started. .Discharge pressure must develop to 12kg/cm² within 5 seconds
- Then min flow i/v was slowly opened.

PREVENTIVE MAINTENANCE RECORDS: 103-J TRAIN

COUPLING RECORDS

Description	Position	Design (Inch)	Before (Inch)	After (Inch)
DBSE (With Rotor at extreme ends)				
103 JBT – JAT	-	-	-	-
103 JAT – JLP	-	-	17.490	17.490
103 JLP- JHP	-	-	19.170	19.170

PREVENTIVE MAINTENANCE RECORDS: 103 – JBT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
JAT End					
Journal Bearing	Mandrel	A	0.010-0.012	-	-
	By rotor lifting			-	0.27
Oil Guard (For Jr.Brg Housing)	L / R	C	0.008-0.014	0.05/0.05	0.05/0.05
	North	-	-	-	-
Oil Guard (For Seal Housing)	-	D	0.039-0.071	-	-
Shaft Diameter	Jr. Brg.	-	-	-	-
Bearing Pinch	Jr. Brg.	-	-	-	0.01

Governor End					
Journal Bearing	Mandrel	A	0.010-0.012	-	-
	By rotor lifting			-	0.25
Oil Guard (For Brg. Housing)	South	-	-	-	-
	L / R	C	0.008-0.014	0.10/0.05	0.10/0.05
Oil Guard (For Seal Housing)	-	D	0.039-0.071	-	-
Axial Thrust.	With Top Housing	-	0.008-0.012	0.20	0.24
	Without top Housing	-		-	-
Bearing Pinch	Jr. bearing	-	-	-	0.02

Journal Bearing Pads thickness				
PADS	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	DAMAGED	19.03	DAMAGED	19.04
No 2		19.05		19.05
No 3		19.05		19.05
No 4		19.04		19.05
No 5		19.03		19.05
Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	15.88	15.88	Thrust ring Top – 12.72 Bottom – 12.73 Spacer – 4.54	Thrust ring Top – 12.72 Bottom 12.73 Spacer – 4.54
No 2	15.90	15.90		
No 3	15.89	15.89		
No 4	15.87	15.87		
No 5	15.86	15.86		
No 6	15.85	15.85		

PREVENTIVE MAINTENANCE RECORDS: 103 - JAT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
JAT End					
Journal Bearing	Mandrel	N	0.006-0.008	0.16	0.16
	Filler / lead wire			-	-
Oil Guard (For Jr. Brg Housing)	L / R	C	0.015-0.021	0.05/0.25	0.05/0.20
	North	-	-	-	-
Oil Guard (For Seal Housing)	---	D	0.077-0.110	-	-
Bearing Pinch	Jr. Brg.	-	-	-	0.02
JBT End					
Journal Bearing	Mandrel	B	0.010-0.012	-	-
	By rotor lifting			-	0.35
Oil Guard (For Brg. Housing)	South	-	-	-	-
	L / R	C	0.015-0.021	0.10/0.15	0.10/0.10
Oil Guard (For Seal Housing)	-	D	0.077-0.110	-	-

Axial Thrust	With Top Housing	-	0.008-0.012	0.24	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

Journal Bearing Pads Thickness				
PADS	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	DAMAGED	19.05	DAMAGED	20.61
No 2		19.07		20.61
No 3		19.07		20.61
No 4		19.07		20.61
No 5		19.06		20.62

Thrust Bearing Pads Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	25.36	25.36	Thrust ring Top – 15.88 Bottom – 15.87	Thrust ring Top – 15.88 Bottom – 15.87
No 2	25.34	25.34		
No 3	25.38	25.38		
No 4	25.33	25.33		
No 5	25.33	25.33		
No 6	25.36	25.36		

PREVENTIVE MAINTENANCE RECORDS : 103 – JLP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
NON THRUST END					
Journal Bearing Clearance	Mandrel	C1	0.002"-0.004"	-	0.11
	Filler / lead wire			-	-
THRUST END					
Journal Bearing Clearance	Mandrel	C1	0.002"-0.004"	-	0.14
	Filler / lead wire			-	-
Axial Thrust	With Top Housing	-	0.015" -0.022"	0.25	0.40
	Without Top Housing	-		-	-

Journal Bearing Pads thickness				
PADS	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	DAMAGED	18.96	DAMAGED	18.95
No 2		18.96		18.95
No 3		18.96		18.96
No 4		18.96		18.96
No 5		18.96		18.95

Thrust Bearing Pad Thickness				
Pad	ACTIVE - OUTER		INACTIVE - INNER	
	Before	After	Before	After
No 1	DAMAGED	14.26	DAMAGED	14.27
No 2		14.26		14.27
No 3		14.27		14.26
No 4		14.26		14.26
No 5		14.27		14.27
No 6		14.27		14.26
No 7		14.26		14.27
No 8		14.26		14.27

PREVENTIVE MAINTENANCE RECORDS : 103 – JHP

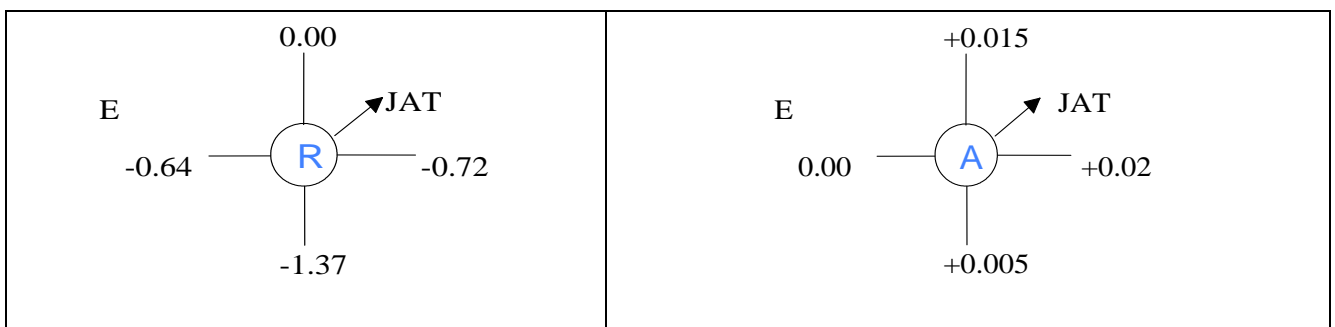
Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
NON THRUST END					
Journal Bearing Clearance	Mandrel	A1	0.0023"-0.0033"	0.16	0.16
	Filler / lead wire			-	-
THRUST END					
Journal Bearing Clearance	Mandrel	A1	0.023"-0.033"	0.17	0.17
	Filler / lead wire			-	-
Axial Thrust	With Top Housing	-	0.015" - 0.022"	0.39	0.41
	Without Top Housing	-		-	-

Journal Bearing Pads thickness				
PADS	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	DAMAGED	18.95	DAMAGED	18.95
No 2		18.95		18.95
No 3		18.95		18.95
No 4		18.95		18.95
No 5		18.95		18.95

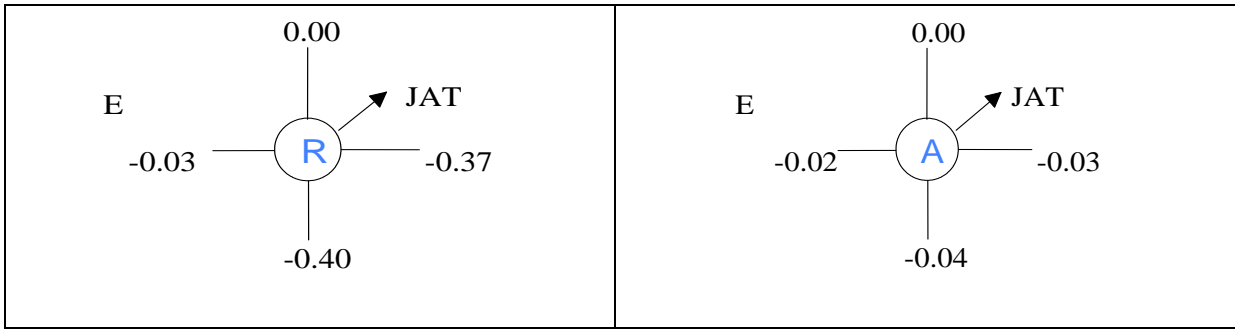
ALIGNMENT READING RECORDS: 103-J TRAIN

103-JBT to 103-JAT

Before Preventive Maintenance

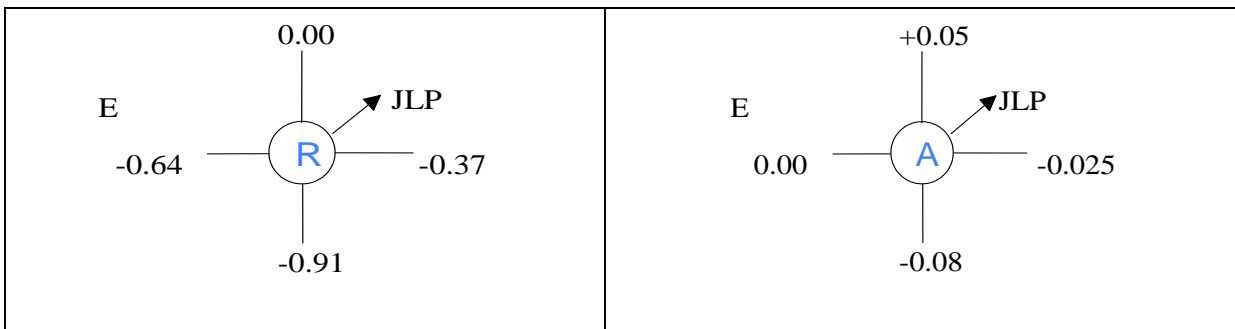


After Preventive Maintenance

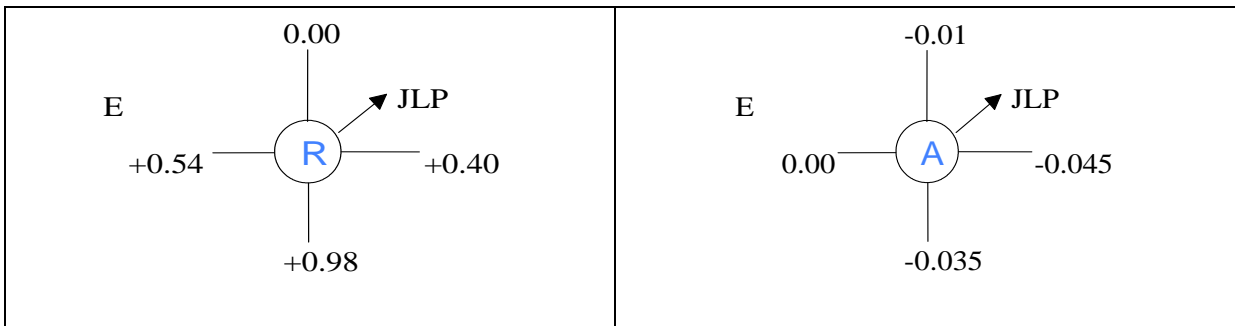


103-JAT to 103-JLP

Before Preventive Maintenance

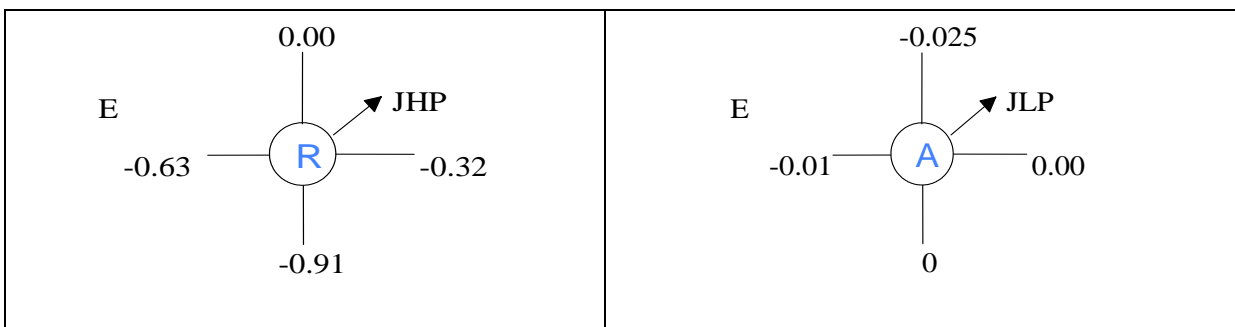


After Preventive Maintenance

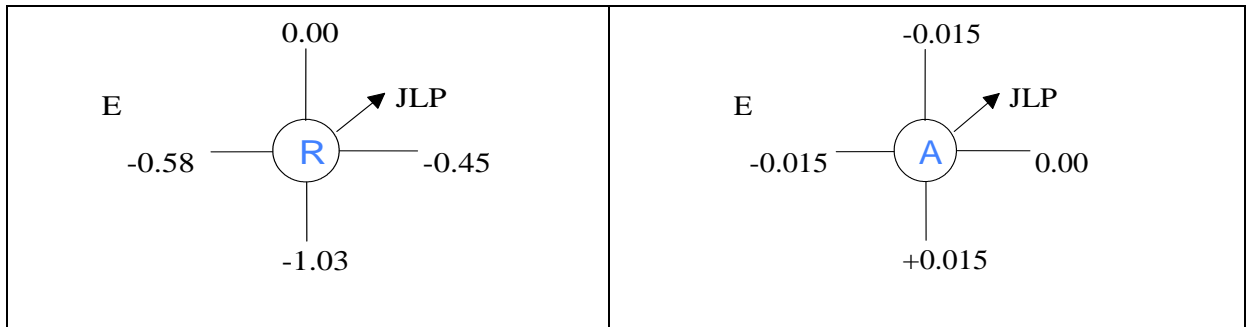


103-JLP to 103-JHP

Before Preventive Maintenance



After Preventive Maintenance



REFRIGERATION COMPRESSOR TRAIN, 105-J

Refrigeration Compressor Drive Turbine, 105-JT

Turbine was decoupled and both ends Journal bearings and Thrust bearings were taken for inspection. 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, gear box end was decoupled. Axial thrust was measured (0.29 mm) and found within limit. Journal Bearings clearances 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 O.K. 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, gear box end was decoupled. Axial thrust was measured (0.40 mm). All couplings were visually inspected. Journal Bearing Clearances checked by Rotor lifting. No damage in flexible elements was observed, all the hubs were found to be in their position intact.

PREVENTIVE MAINTENANCE RECORDS: 105 - JT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
JLP End					
Journal Bearing	Mandrel		0.007-0.009	0.17	0.17
	Filler / lead wire			-	-
Oil Guard (For Jr. Brg Housing)	South		0.015-0.021	0.20/0.15	0.20/0.15
	North		0.058-0.097	-	-
Oil Guard (For Seal Housing)	-		0.077-0.109	-	-
Shaft Diameter	Jr. Brg.		4.993	-	-
Bearing Pinch	Jr. Brg.		-	0.02	0.02
Governor End					
Journal Bearing	Mandrel		0.007-0.009	0.21	0.21
	Filler / lead wire			-	-

Oil Guard (For Brg. Housing)	South		-	-	-
	North		0.015-0.021	0.20/0.25	0.20/0.25
Oil Guard (For Thrust Brg.)	South		0.002-0.04	-	-
	North		0.002-0.004	-	-
Oil Guard (For Seal Housing)	-		0.077-0.109	-	-
Axial Thrust.	With Top Housing		0.008-0.012	0.24	0.24
	Without top Housing			-	-
Shim thickness. (Thrust adjusting)	North		-	-	-
	South		-	-	-
Nozzle Clearance.	-		0.055-0.065	-	-
Shim thickness. (Nz. Cl. Adjusting)	North		-	-	-
	South - inactive		-	2.90	2.90
Total Float	-		0.180	-	-
Shaft Diameter	Journal bearing		4.993	-	-
Bearing Pinch	Jr. Bearing		-	0.03	0.03
Expansion Key	-		-	-	-
Trip Lever - Plunger	-		0.120-0.130	-	-

Journal Bearing Pads thickness				
PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	20.61	20.61	20.62	20.62
No 2	20.58	20.58	20.62	20.62
No 3	20.62	20.62	20.62	20.62
No 4	20.62	20.62	20.62	20.62
No 5	20.62	20.62	20.62	20.62
Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	19.06	19.06	Thrust ring Top – 15.92 Bottom – 15.92	Thrust ring Top – 15.92 Bottom – 15.92
No 2	19.06	19.06		
No 3	19.08	19.08		
No 4	19.06	19.06		
No 5	19.05	19.05		
No 6	19.07	19.07		

PREVENTIVE MAINTENANCE RECORDS : 105 – JLP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
TURBINE END					
Journal Bearing Clearance	Mandrel	F	0.006-0.008	-	-
	By rotor lifting			0.31	0.31
Bearing Pinch	Journal Bearing	-	-	-	-
Shaft Dia.	Journal Bearing	-	-	-	-

Bushing (For Journal bearing)	North	G	0.005-0.007	-	-
Housing (For Journal bearing)	South	E	0.014-0.017	-	-
Oil Guard (For Outer Housing)	-	T	0.020-0.026	-	-
GEAR BOX END					
Journal Bearing Clearance	Mandrel	F	0.006-0.008	-	-
	By rotor lifting			0.25	0.25
Bearing Pinch	Journal bearing	-	-	-	-
Shaft Dia	Journal bearing	-	-	-	-
Bushing (For Journal bearing)	North	G	0.005-0.007	-	-
Housing (For Journal bearing)	South	E	0.014-0.017	-	-
Oil Guard (For Thrust bearing)	North	C	0.002-0.004	-	-
	South	C	0.002-0.004	-	-
Oil Guard (For Outer Housing)	North	A	0.020-0.026	-	-
Axial Thrust	With Top Housing	-	0.011 – 0.015	0.32	0.29
	Without Top Housing	-		-	-
Shim Thickness (Axial Thrust adjusting)	North - outer	-	-	9.98	9.98
	South - inner	-	-	10.00	10.00
Total Float	-	-	2.38 – 3.96	-	-

Thrust Bearing Pad Thickness				
PAD	ACTIVE Outer		INACTIVE Inner	
	Before	After	Before	After
No 1 & 2	19.80 & 19.78	19.80 & 19.78	19.77 & 19.76	19.77 & 19.76
No 3 & 4	19.76 & 19.76	19.76 & 19.76	19.77 & 19.78	19.77 & 19.78
No 5 & 6	19.78 & 19.77	19.78 & 19.77	19.78 & 19.77	19.78 & 19.77
No 7 & 8	19.77 & 19.78	19.77 & 19.78	19.76 & 19.77	19.76 & 19.77

PREVENTIVE MAINTENANCE RECORDS: 105-JR

Description	Position	Design Clearances (Inch)	Before (mm)	After (mm)
Journal Bearing (Low Speed drive gear) With lead wire	North	0.014 – 0.016	0.42	0.42
	South	-- do --	0.42	0.42
Axial Thrust	---	0.014-0.024	0.40	0.44
Journal Bearing (High Speed driven Pinion)	North	0.013 -	0.33	0.33
	South	-- do --	0.33	0.33
Free float – pinion	---	---	1.50	1.50
Backlash	---	---	-	-

Shaft Diameter (Low Speed drive Gear)	North Side Bearing.	---	-	-
	South Side Bearing.	---	-	-
Shaft Diameter. (High Speed driven Pinion)	North Side Bearing.	---	114.12	114.12
	South Side Bearing.	---	114.12	114.12

PREVENTIVE MAINTENANCE RECORDS : 105 – JHP

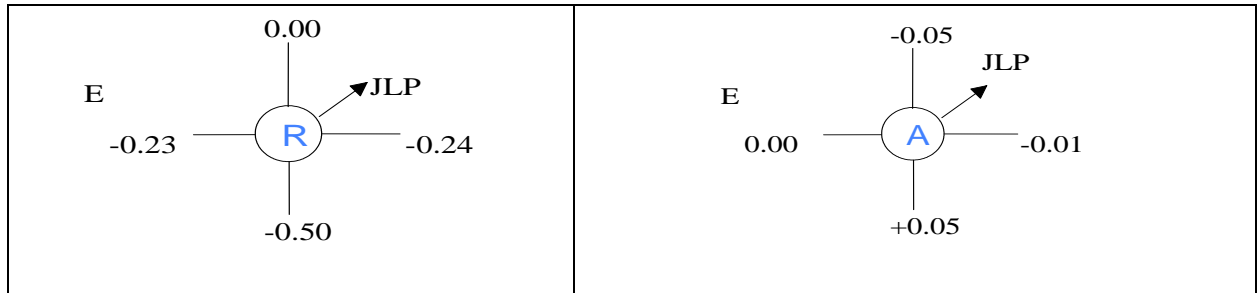
Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
GEAR BOX END					
Journal Bearing Clearance	Mandrel	C	0.004 – 0.007	0.24	0.24
	Filler / lead wire			By rotor lifting	
Bearing Pinch	Journal Bearing	---	---	-	-
Shaft Dia.	Journal Bearing	---	---	-	-
Housing (For Journal Bearing)	South	B	0.014 - 0017	-	-
Bushing (For Journal Bearing)	North	D	0.004 - 0.006	-	-
Oil Guard (For Top Housing)	South	A	0.018 - 0.024	-	-
Nut	---	T	0.001 - 0.003	-	-
NON DRIVE END					
Journal Bearing Clearance	Mandrel	C	0.004 – 0.007	0.24	0.24
	Filler / lead wire			By rotor lifting	
Bearing Pinch	Journal bearing	---	---	-	-
Shaft Dia	Journal bearing	---	---	-	-
Housing (For Journal Bearing)	South	B	0.014 - 0017	-	-
Bushing (For Journal Bearing)	North	D	0.004 - 0.006	-	-
Oil Guard (For Thrust bearing)	North	P	0.002 – 0.004	-	-
	South	P	0.002 – 0.004	-	-
Oil Guard (For Top Housing)	North	P	0.002 – 0.004	-	-
Axial Thrust	With Top Housing	---	0.009 – 0.013	-	-
	Without Top Housing	---		0.40	0.34
Shim Thickness (Axial Thrust adjusting)	North – outer	---	---	9.71	9.71
	South - inner	---	---	9.92	9.92
Total Float	-----	---	5.55 -7.15 mm		

Thrust Bearing Pad Thickness				
PAD	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1 & 2	14.24 & 14.25	14.24 & 14.25	14.30 & 14.30	14.30 & 14.30
No 3 & 4	14.24 & 14.25	14.24 & 14.25	14.31 & 14.31	14.31 & 14.31
No 5 & 6	14.24 & 14.26	14.24 & 14.26	14.31 & 14.28	14.31 & 14.28
No 7 & 8	14.24 & 14.25	14.24 & 14.25	14.29 & 14.30	14.29 & 14.30

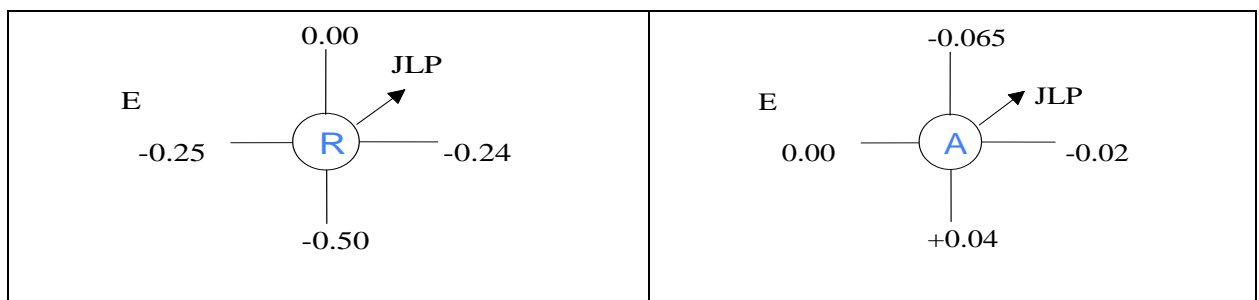
ALIGNMENT READING RECORDS : 105-J TRAIN

105-JT to 105-JLP

Before Preventive Maintenance

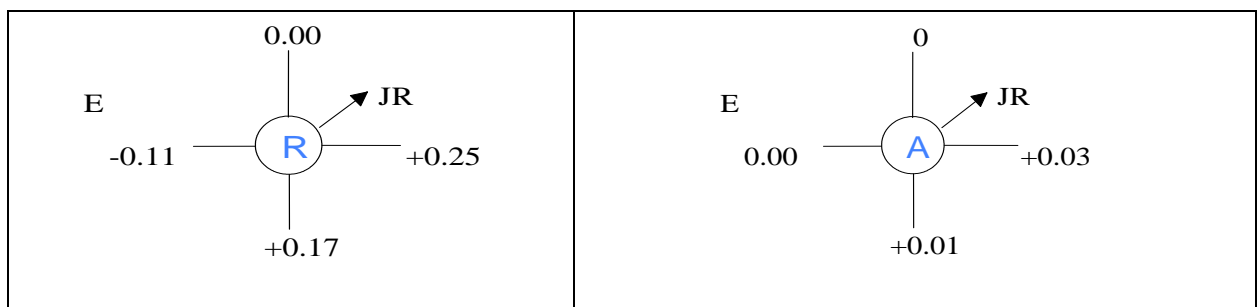


After Preventive Maintenance

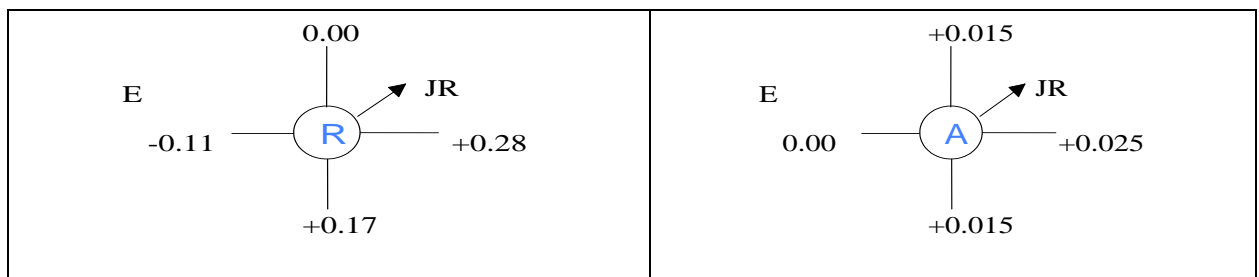


105-JLP to 105-JR

Before Preventive Maintenance

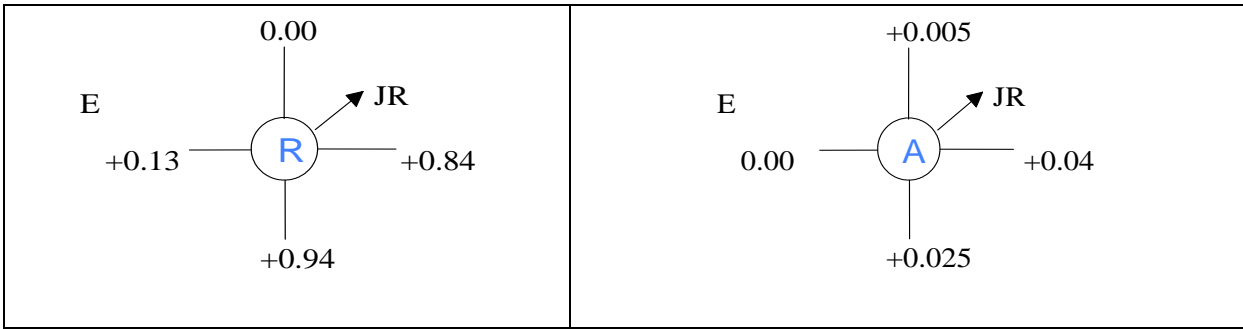


After Preventive Maintenance

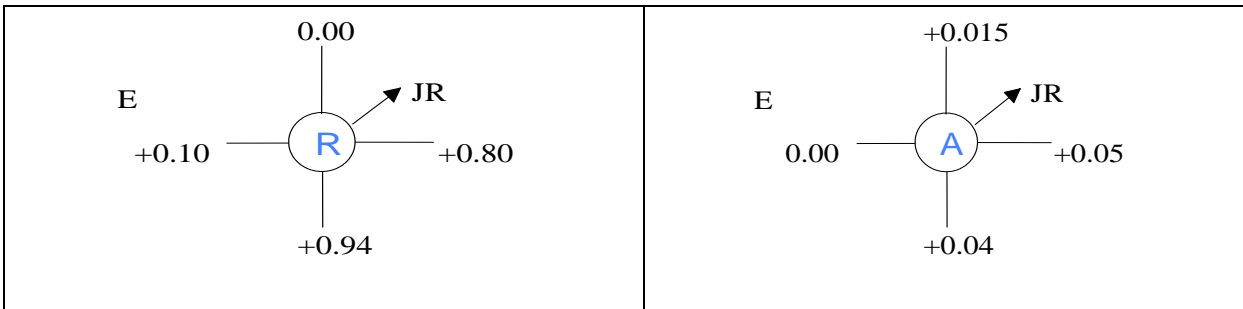


105-JR to 105-JHP

Before Preventive Maintenance



After Preventive Maintenance



INDUCED DRAFT FAN 101-BJ TRAIN

101- BJ Fan

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

101- BJT

101-BJT and Gear box were taken for PM. The turbine was decoupled and both ends bearing housing opened. The thrust bearing and both 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 PGPL actuator drive gear was checked and oil was flushed. Actuator was tested at test bench & was found ok.

101-BJR Gear box

The top cover of GB was removed. The bearings were dye penetration inspected and no defects were observed. Gauss measurement for the bearings was also carried out and found within limit. Gear backlash and bearing clearance was measured and found within limit.

All couplings were visually inspected and found OK.

Installation of New MOP & AOP

During startup after 2015 S/D gear driven MOP was removed & was blinded. The addition pump provided was working as MOP. Due to the non-reliable performance of

Main Oil Pump of 101-BJ LO system, IFFCO asked M/s. KEPL to rectify the issue. After detailed discussion and negotiation KEPL agreed to carry out the remedial activities at free of cost.

Following Remedial measures were taken:

- Existing MOP (Gear Pump) of M/s. DELTA PD was replaced by new Gear Pump of M/s.TUSHACO Make. Additional spacer was provided as pump length was less. Locking was provided for MOP cover bolt to prevent the bolt getting loosened during normal running.
- Existing AOP (Gear Pump) of M/s. Del PD was replaced by new Screw Pump of M/s. TUSHACO Make.
- Modified Suction & Discharge lines of MOP & AOP as per As Built P&ID SL/01/2144/13 231 Sh. 1 of 2 Rev.3 attached below
- During start up of turbine, at a speed of 2600 RPM, discharge pressure of MOP reached 7 kg/cm²g. For controlling the pressure, flexible hose was temporarily provided. Hence, Bypass line with valve was fabricated and provided at MOP discharge (ref As Built P&ID). After provision of bypass line, temporary hose was removed.
- NRV at suction of MOP was replaced with new one. Earlier it was spring type which was replaced with flapper type.

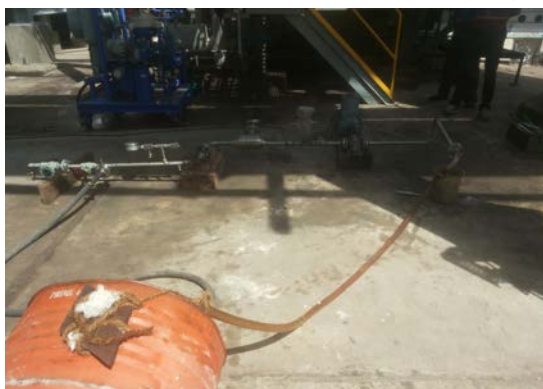
Flushing:

Fabrication job of LO lines was carried out by ARC contractor M/s J&J Engrs. Flushing of LO lines were carried out by using old AOP (Gear Pump) separately outside. Initially, LO circulation with 100 Mesh screen carried out upto 34 hrs. & then with 200 Mesh screen.

Then line was installed in position with 200 mesh at brg. inlet of turbine & oil was circulated till there was no particle.

Other Jobs:

- The additional pump installed earlier which was used as MOP was removed.
- RV's at MOP & AOP check discharge was removed and checked at test bench. Observed that the set pressure was above the required value (Reqd. set pressure 8.5 kg/cm²g). Adjusted RV Set pressure, checked at test bench & then installed.
- AOP discharge pressure was set to 6kg/cm²g by adjusting the spring of pump RV.
- Note – There was leakage through instrument fitting provided at MOP Top during start up. ID Fan was stopped and welding was done.



Flushing arrangement for 101-BJT LO Piping



MOP installed at position

TUSHACO PUMPS PVT. LTD.

GENERAL DIMENSIONAL DRAWING

THREE SCREW PUMP

T3SI-38/42

* ±5 mm UNLESS OTHERWISE SPECIFIED.
* RIGHTS RESERVED FOR MODIFICATION WITHOUT ANY NOTICE.



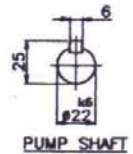
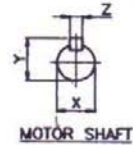
TUSHACO PUMPS

DRN. RAJIV APP.

DRG.NO.:- P781 7112

NOTE :
FROM FRAME SIZE 100 TO 132
USE ADOPTOR FLANGE WITH BRACKET.

LIQUID - GEAR OIL
 VISCOSITY - 68 CST / 46 CST
 FLOW - 43 LPM
 DIS. PRESS. - 6-8 KG/SQ. CM.
 KW/RPM - 2.2 KW / 1500



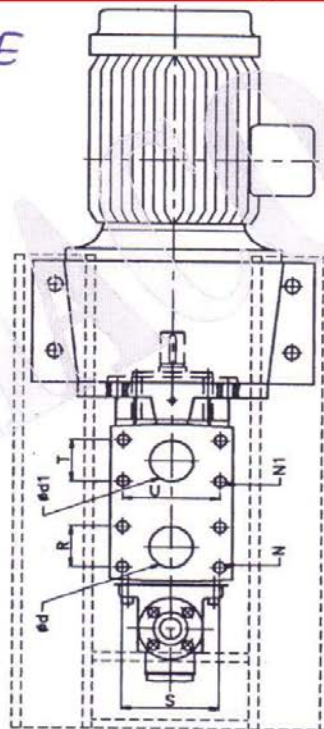
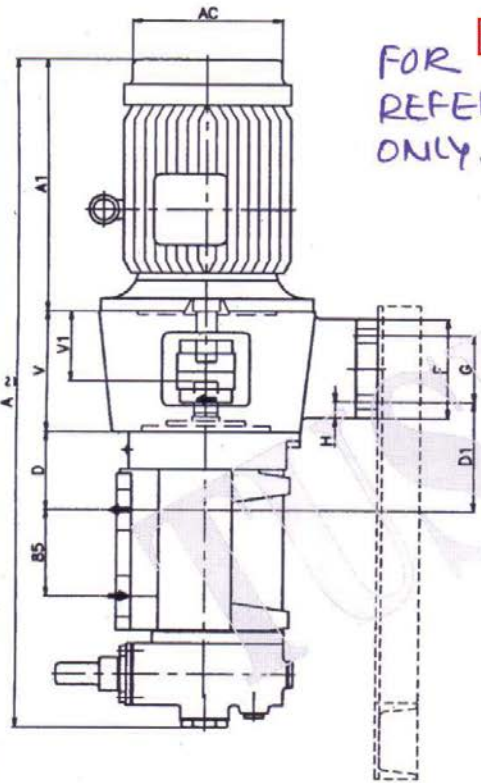
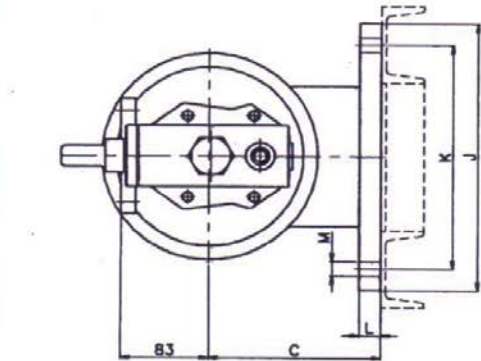
APPROVED For procurement

By Mukund Kulkarni at 11:27 am, Dec 03, 2015

SCOPE OF SUPPLY:- PUMP WITH BRACKET FOR FLANGE MOUNTING, COUPLING, COMPANION FLANGES WITH GASKETS, NUTS & BOLTS.

Scope also includes mounting bracket, motor & coupling

FOR REFERENCE ONLY.



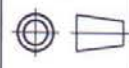
132M	L-110
132S	L-110
112M	L-110
100L	L-110
90L	L-95
90S	L-95
80	L-95
FRAME	COUP.

132M	783	400	260	160	76	106	40.5	40.5	97	65	16	261	220	20	14	11	11	40	90	40	90	146.5	97	38	41	10
132S	745	362	260	160	76	106	40.5	40.5	97	65	16	261	220	20	14	11	11	40	90	40	90	146.5	97	38	41	10
112M	708	325	218	160	76	106	40.5	40.5	97	65	16	261	220	20	14	11	11	40	90	40	90	135	85	28	31	8
100L	683	300	193	160	76	106	40.5	40.5	97	65	16	261	220	20	14	11	11	40	90	40	90	135	85	28	31	8
90L	634	268	176	160	76	106	40.5	40.5	97	65	16	261	220	20	14	11	11	40	90	40	90	118	68	24	27	8
90S	609	243	176	160	76	106	40.5	40.5	97	65	16	261	220	20	14	11	11	40	90	40	90	118	68	24	27	8
80	596	230	156	160	76	106	40.5	40.5	97	65	16	261	220	20	14	11	11	40	90	40	90	118	68	19	21.5	6
FRAME	A	A1	AC	C	D	D1	d	d1	F	G	H	J	K	L	M	N	N1	R	S	T	U	V	V1	X	Y	Z

AOP for 101-BJT & 101-BJR LO System

TUSHACO PUMPS PVT. LTD.

* ±5 mm UNLESS OTHERWISE SPECIFIED.
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DIMENSIONAL DRAWING

EXTERNAL GEAR PUMP

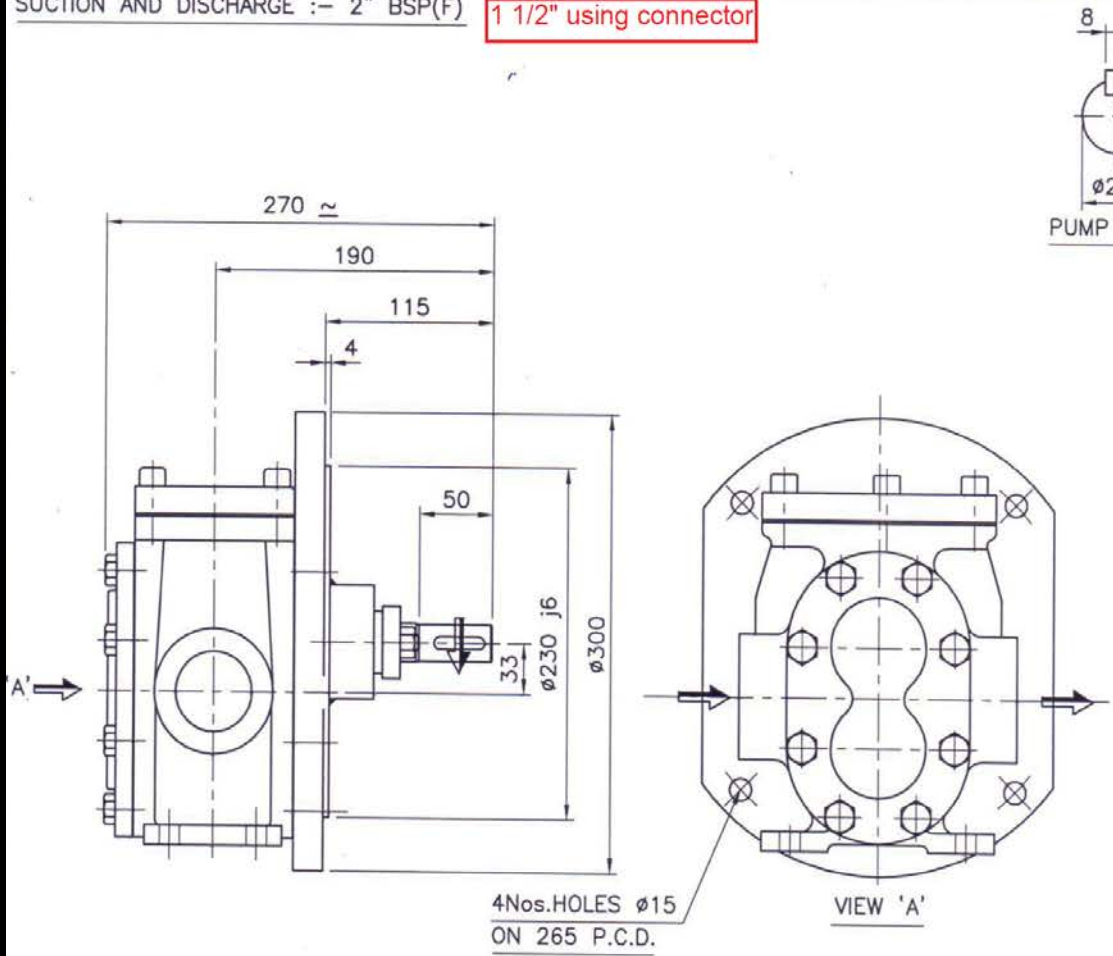
DRN. PNP APP.

R-50-EG-F

CODE:-

DRG.NO.:-
D236 4365

SUCTION AND DISCHARGE :- 2" BSP(F) **1 1/2" using connector**

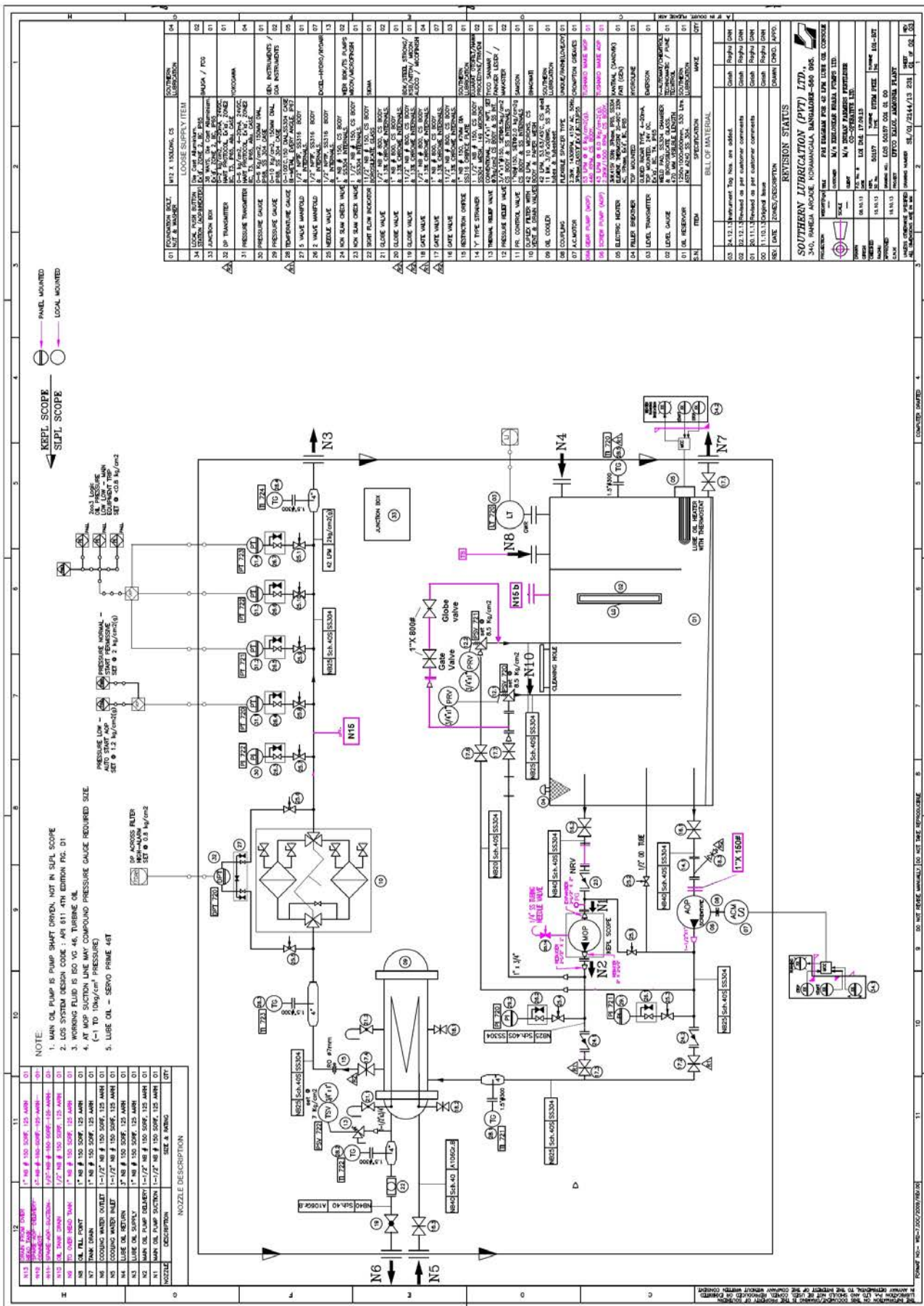


APPROVED for procurement
By Mukund Kulkarni at 11:35 am, Dec 03, 2015

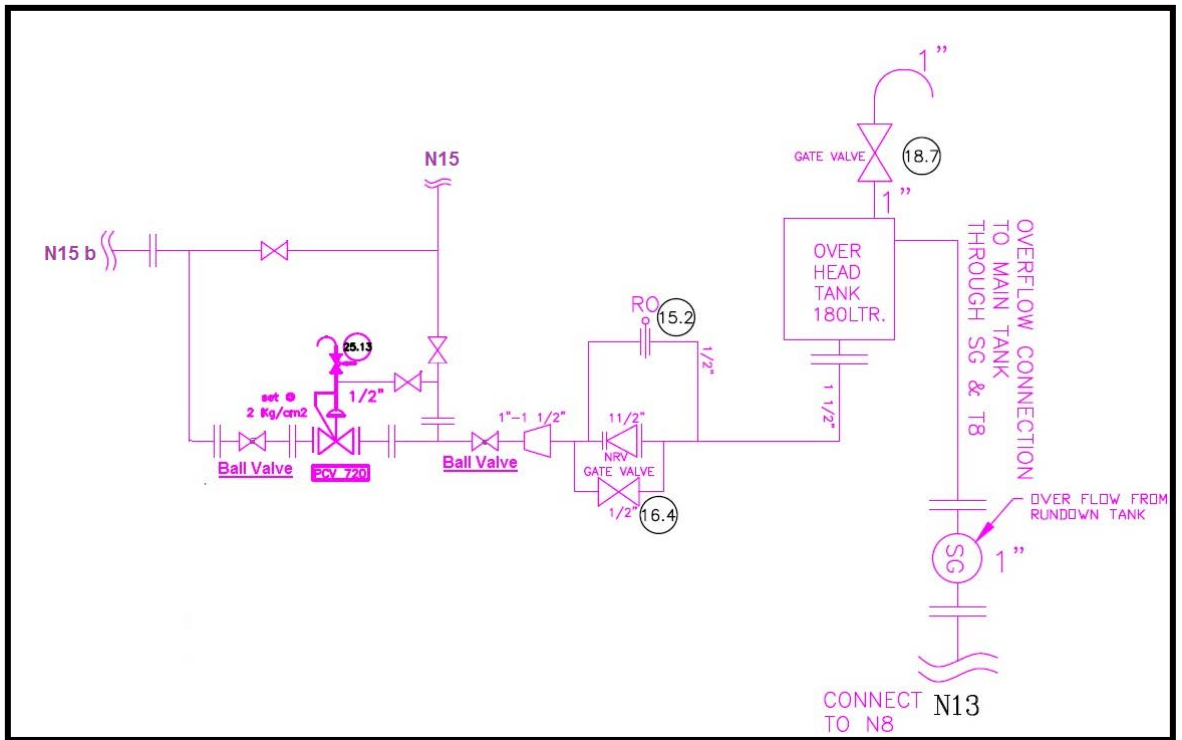
LIQUID - GEAR OIL
 VISCOSITY - 68 CST / 46 CST
 FLOW - 57 LPM @ 440 RPM
 PRESSURE - 6 KG/SQ. CM
 NPSH(R) - 2.3 MTRS
 MKW - 5.5 KW
 SCOPE OF SUPPLY - BARE PUMP WITH 1 1/2" CONNECTOR

PERFORMANCE STD VDMA 24624 GR II CL II

MOP for 101-BJT & 101-BJR LO System



As Built P&ID SL/01/2144/13 231 Sh. 1 of 2 Rev.03 for 101-BJT & 101-BJR LO System



As Built P&ID SL/01/2144/13 231 Sh. 2 of 2 Rev.3 for 101-BJT & 101-BJR LO System

PREVENTIVE MAINTENANCE RECORDS: 101-BJ TRAIN

COUPLINGS

Description	Position	Design (Inch)	Before (mm)	After (mm)
Coupling Float (For Gear Coupling Only)				
101 GB- BJ	---	---	5.62	5.62
DBSE (With Rotor at extreme ends)				
101 BJT-GB	---	---	151.90	151.90
101 GB- BJ	---	---	13.05	13.05
Distance between Hub Face (With Rotor at extreme ends)				
101 BJT-GB	---	---	149.68	149.68
101 GB- BJ	---	---	-	-
DBSE of GB - MOP coupling		5 to 6 mm	-	5.5 mm

PREVENTIVE MAINTENANCE RECORDS: 101-BJT

Description	Position	Dwg. Ref	Design Clearances (mm)	Before (mm)	After (mm)
Gear Box End					
Journal Bearing	Mandrel	---		-	-
	Filler / lead wire			0.29	0.29
Oil Guard (For Jr. Brg Housing)	CT Side	---		0.22 (Urea)	0.22 (Urea)
	SILO Side			0.25 (Amm)	0.25 (Amm)
Bearing Pinch	Jr. Brg.	---	---	0.01	0.01
				0.02	0.02

Governor End					
Journal Bearing	Mandrel	---		-	-
	Filler / lead wire			0.23	0.23
Oil Guard (For Brg. Housing	UREA	---		0.25	0.25
	AMM	----		0.25	0.25
Axial Thrust.	With Top Housing	---		0.40	0.50
	Without top Housing	---		0.45	0.45
Bearing Pinch	Jr. Bearing	---		0.03	0.03
				0.05	0.05

Journal Bearing Liner Thickness				
Liner	CT SIDE BEARING		SILO SIDE BEARING	
	Before	After	Before	After
Top	3.18	3.18	3.18	3.18
Bottom	3.19	3.19	3.18	3.18

PREVENTIVE MAINTENANCE RECORDS: 101-BJR

Description	Position	Design Clearances (mm)	Before (mm)	After (mm)
Journal Bearing (High Speed drive Pinion)	CT Side		0.13	0.13
	SILO Side		0.13	0.13
Axial Thrust	Low speed		0.30	0.25
	High Speed		0.25	0.90
Journal Bearing (Low Speed driven Gear)	CT Side		0.18	0.18
	SILO Side		0.20	0.20
Backlash	---		0.30	0.30
Shaft Diameter (High Speed drive Pinion)	CT Side	---	Not Rec	
	SILO Side	---	-	-
Shaft Diameter. (Low Speed driven Gear)	CT Side	---	Not Rec	
	SILO Side	---	-	-

Gear box Labyrinth clearance	0.1 mm
------------------------------	---------------

Journal Bearing Liner thickness (High Speed drive Pinion)				
Liner	CT SIDE BEARING		SILO SIDE BEARING	
	Before	After	Before	After
Top	27.50	27.50	27.22	27.22
Bottom	25.10	25.10	25.10	25.10

Journal Bearing Liner thickness (Low Speed driven Gear)				
Liner	CT SIDE BEARING		SILO SIDE BEARING	
	Before	After	Before	After
Top	24.72	24.72	24.75	24.75
Bottom	25.10	25.10	25.10	25.10

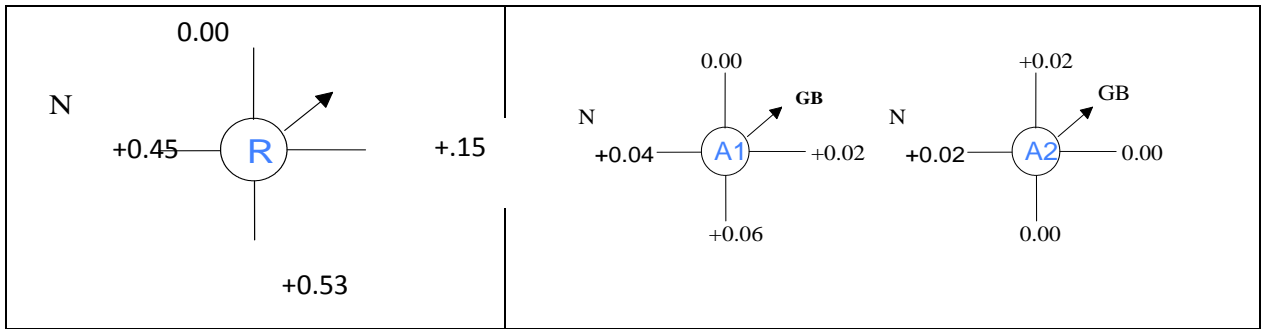
PREVENTIVE MAINTENANCE RECORDS: 101 - BJ

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (Inch)	After (Inch)
Gear Box End					
Journal Bearing	Mandrel	---	0.008" -	-	-
	Filler / lead wire		0.012"	0.37	0.37
Free End					
Journal Bearing	Mandrel	---	0.008" -	-	-
	Filler / lead wire		0.012"	0.29	0.29
Axial Thrust.	With Top Housing	---	---	-	-

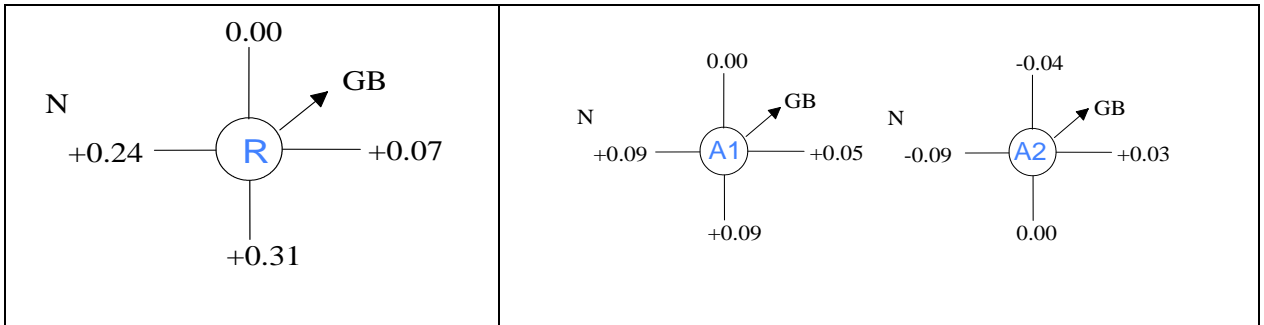
ALIGNMENT READING RECORDS: 101-BJ TRAIN

101-BJT to 101-BJR

Before Preventive Maintenance

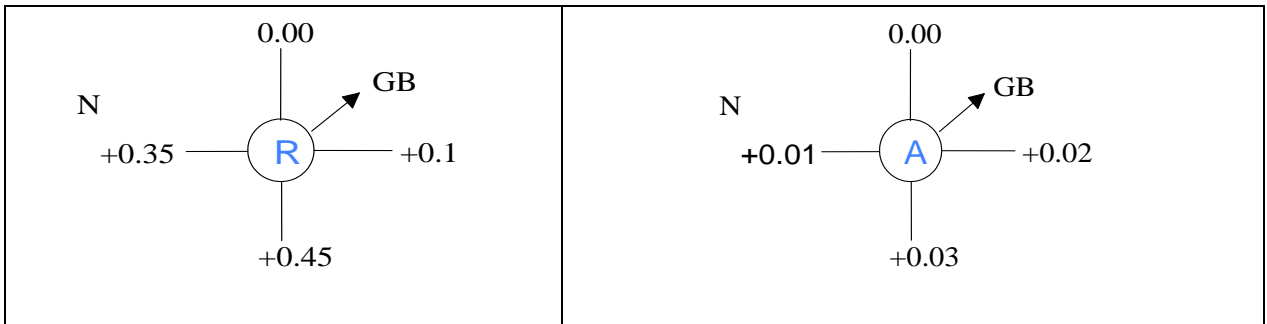


After Preventive Maintenance

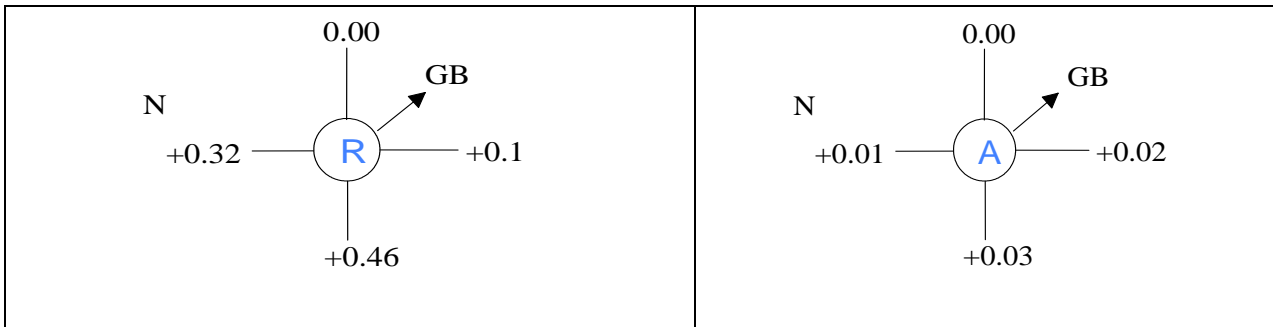


101-BJR to 101-BJ

Before Preventive Maintenance



After Preventive Maintenance



SEMILEAN SOLUTION PUMP, 115-JA TRAIN

Pump, 115-JA

The pump was decoupled and both ends bearing housing opened. The thrust bearing and both 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.

Oil of LO console was removed and filled with new oil.

Drive Turbine, 115- JAT

The turbine was decoupled and both ends bearing housing opened. The thrust bearing and both 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.

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 issued from Stores.

Governing valve spindle was found bent. Hence it was straightened & provided, gland packing was also replaced.

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 to be 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 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.

Clutch

Top cover of clutch was opened and cleaned. Sight glass was also cleaned.

The hydraulic turbine to clutch alignment readings were measured and recorded. Turbine to clutch coupling was done.

PREVENTIVE MAINTENANCE RECORDS 115-JA TRAIN

Coupling Records				
Description		Design Clearances (Inch)	Before (mm)	After (mm)
115-JAT to GB				
DBSE		-	407.20	407.20
115-JAT	Hub Overhang	-	NA	NA
	Hub Override	-	0.30	0.30
115-GB	Hub Overhang	-	0.40	0.40
	Hub Override	-	-	-
115-JA to GB				
DBSE		-	301.05	301.05
115-JAT	Hub Overhang	Lock nut to Hub, lock nut out	0.42	0.42
	Hub Override	Lock nut to shaft, Hub overhung	1.2	1.2
115-GB	Hub Overhang		NA	NA
	Hub Override		0.08	0.08
115-JA to Clutch				
DBSE		-	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)	0.21/0.22	0.21/0.22	
Opp Thrust end bearing	--- do---	0.21	0.21	
Axial Thrust	0.013" – 0.015" (0.35 - 0.40 mm)	0.28	0.27	
Gear box side Oil Gland	Coupling Side	UREA AMM	0.40 mm 0.40 mm	
	Inside Labyrinth	UREA AMM	0.30 mm 0.30 mm	
NDE Side Oil Gland		UREA AMM	0.25 mm 0.35 mm	
Journal Bearing Pads Thickness (Sleeve Bearing)				
SLEEVE	THRUST END BEARING		NON THRUST END BEARING	
	Before (mm)	After (mm)	Before (mm)	After (mm)
TOP	34.91 / 34.88	34.91 / 34.88	34.86 / 34.90	34.86 / 34.90
BOTTOM	34.87	34.87	34.90	34.90
Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	31.76	31.76	31.75	31.75
No 2	31.80	31.80	31.75	31.75
No 3	31.76	31.76	31.75	31.75
No 4	31.77	31.77	31.75	31.75
No 5	31.80	31.80	31.75	31.75
No 6	31.75	31.75	31.75	31.75
No 7	31.78	31.78	31.74	31.74
No 8	31.80	31.80	31.75	31.75

CLEARANCE RECORDS : GEAR BOX, 115- JR

Axial Thrust	HIGH SPEED SHAFT LOW SPEED SHAFT	1.12 mm 2.00 mm	1.12 mm 2.00 mm
High Speed Shaft bearing	Silo Side CT Side	0.23 mm 0.23 mm	0.23 mm 0.23 mm
Low Speed Shaft Bearing	Silo Side CT Side	0.24 mm 0.25 mm	0.24 mm 0.25 mm

Thin Shell Bearing - Thickness				
	Low speed Shaft BEARING		High Speed Shaft BEARING	
	CT Side	Turbine Side	CT side	Turbine Side
TOP	4.05 mm	4.07 mm	3.95 mm	3.93 mm
BOTTOM	4.08 mm	4.05 mm	3.96 mm	3.94 mm

CLEARANCE RECORDS : DRIVE TURBINE, 115- JAT

Axial Thrust		0.010 – 0.012	0.27 mm	0.27 mm
Coupling side bearing		0.0055-0.008	0.27 mm	0.27 mm
Governor side bearing		Inboard Outboard	0.23 mm 0.25 mm	0.23 mm 0.25 mm
Oil Gland Coupling side (inboard)	Radial	0.0100-0.0125 UREA AMM	0.12 mm 0.10 mm	0.12 mm 0.10 mm
	Axial	0.040-0.050	1.90 mm	1.40 mm
Oil Gland Coupling side (outboard)	Radial	0.0100-0.0125 UREA AMM	0.15 mm 0.25 mm	0.15 mm 0.25 mm
	Axial	0.080-0.090	4.00 mm	4.3 mm
Oil Gland Governor side	Radial	0.0100-0.0125 UREA AMM	0.15 mm 0.20 mm	0.15 mm 0.20 mm
	Axial	0.030-0.040	0.90 mm	1.3 mm

Journal Bearing Pads Thickness (Thin Shell Bearing Thickness in mm)

LINER	THRUST END BEARING		NON THRUST END BEARING	
	Before	After	Before	After
TOP	INSIDE 2.92 OUTSIDE 2.90	INSIDE 2.92 OUTSIDE 2.90	INSIDE 2.94 OUTSIDE 2.90	INSIDE 2.94 OUTSIDE 2.90
BOTTOM	INSIDE 2.90 OUTSIDE 2.90	INSIDE 2.90 OUTSIDE 2.90	INSIDE 2.91 OUTSIDE 2.90	INSIDE 2.91 OUTSIDE 2.90

Thrust Bearing Pad Thickness

PAD	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	17.43 mm	17.43 mm	17.44 mm	17.44 mm
No 2	17.44 mm	17.44 mm	17.43 mm	17.43 mm
No 3	17.45 mm	17.45 mm	17.43 mm	17.43 mm
No 4	17.42 mm	17.42 mm	17.43 mm	17.43 mm
No 5	17.42 mm	17.42 mm	17.46 mm	17.46 mm
No 6	17.46 mm	17.46 mm	17.43 mm	17.43 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
Opp Thrust end bearing	0.124 – 0.148	0.19	0.19
Axial Thrust	0.25 – 0.30	0.40	0.28
NDE Labyrinth Clearance	Urea	0.35	0.35
	Amm	0.35	0.35

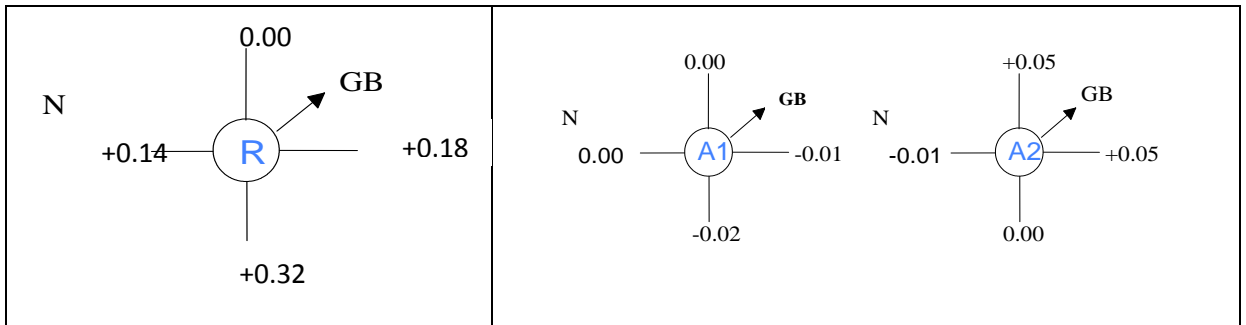
Journal Bearing Pads Thickness				
SLEEVE	THRUST END BEARING		NON THRUST END BEARING	
	Before (mm)	After (mm)	Before (mm)	After (mm)
TOP	22.18 mm	22.18 mm	22.16 mm	22.16 mm
BOTTOM	22.18 mm	22.18 mm	22.17 mm	22.17 mm

Thrust Bearing Pad Thickness				
PAD	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	18.84 mm	18.84 mm	18.84 mm	18.84 mm
No 2	18.85 mm	18.85 mm	18.85 mm	18.85 mm
No 3	18.85 mm	18.85 mm	18.85 mm	18.85 mm
No 4	18.83 mm	18.83 mm	18.86 mm	18.86 mm
No 5	18.84 mm	18.84 mm	18.85 mm	18.85 mm
No 6	18.84 mm	18.84 mm	18.84 mm	18.84 mm

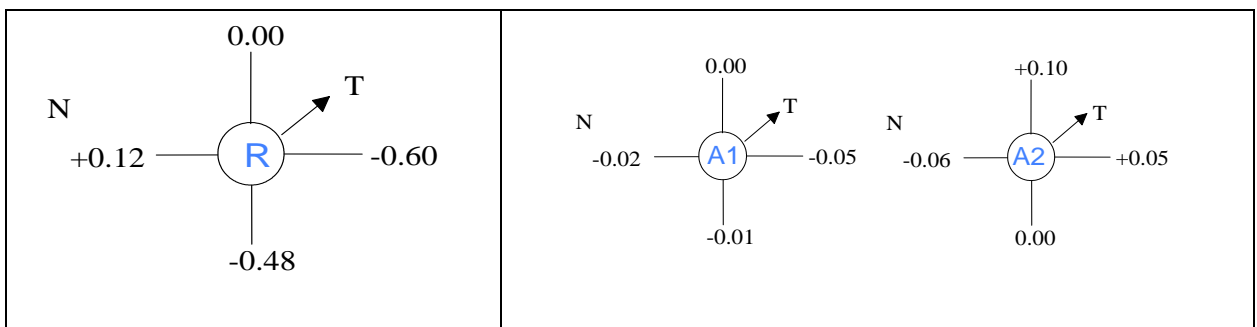
ALIGNMENT READING RECORDS : 115-JA TRAIN

115-JAT to 115-JR

Before Preventive Maintenance

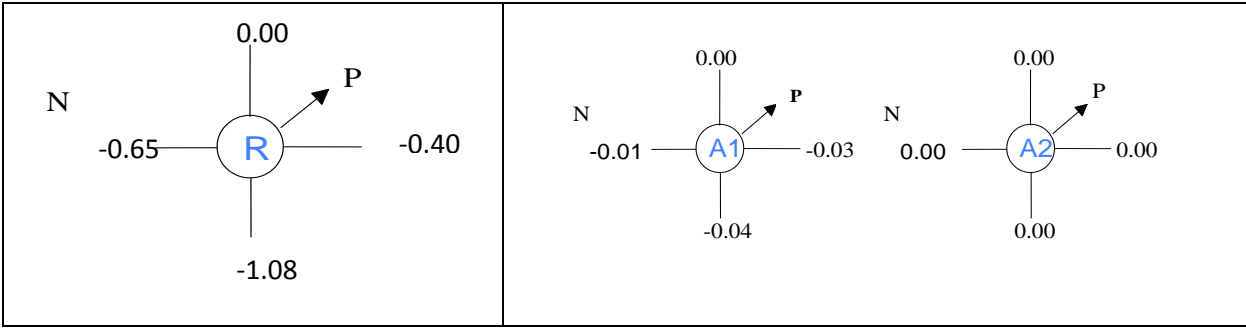


After Preventive Maintenance

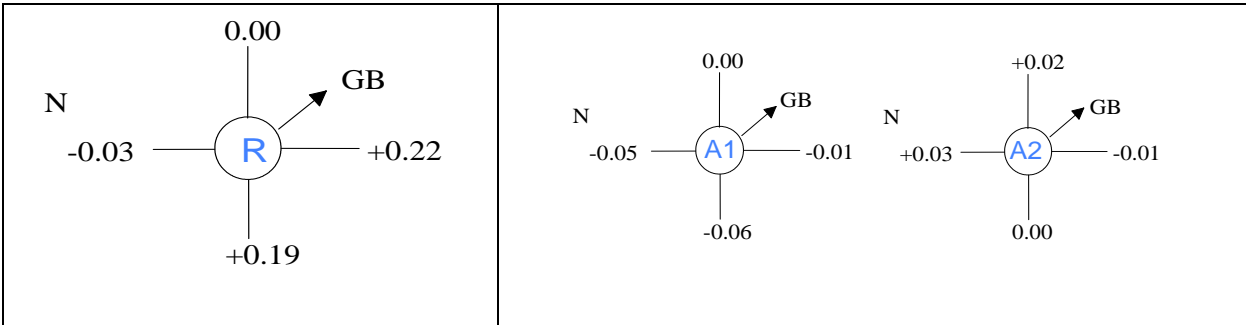


115-JAR to 115-JA

Before Preventive Maintenance

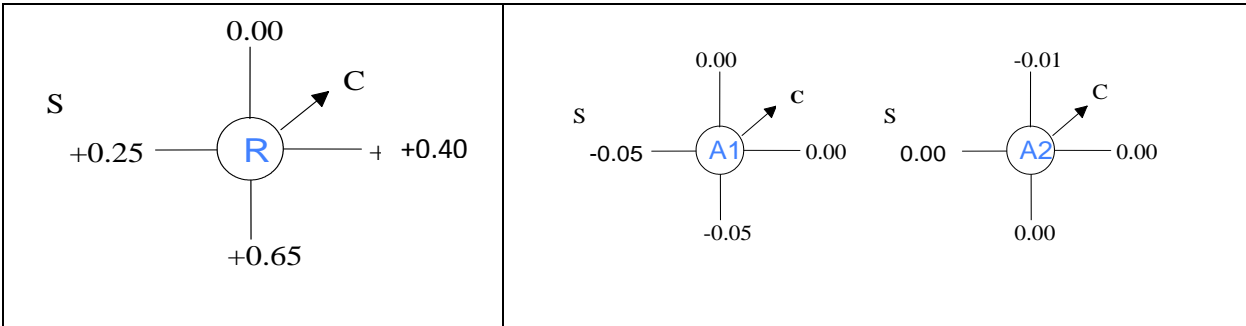


After Preventive Maintenance

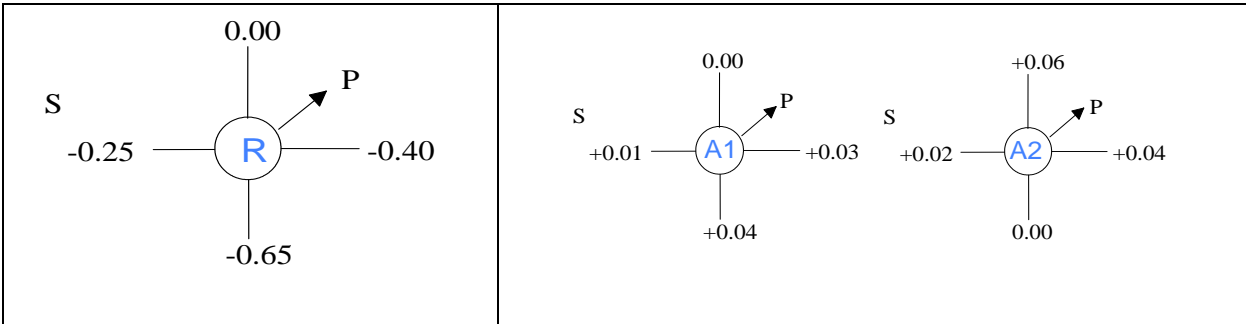


115-JA to Clutch

Before Preventive Maintenance

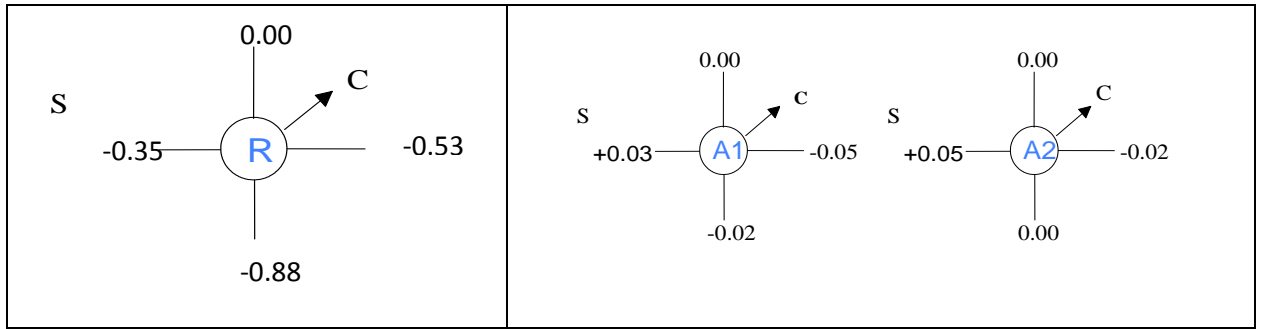


After Preventive Maintenance

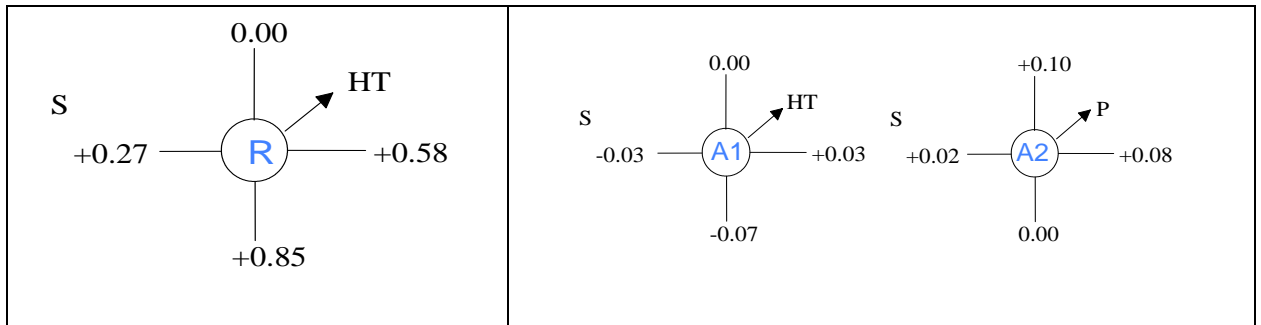


115-HT to Clutch

Before Preventive Maintenance



After Preventive Maintenance



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 carried out and found within desired value. The main oil console and its console along with the filters were cleaned and installed. The seal flushing fluid coolers and strainers were cleaned.

104-JAT Drive Turbine

The turbine was taken for preventive maintenance. Brg housing was having crack welded using electrode 2233.

PREVENTIVE MAINTENANCE RECORDS: 104-JA TRAIN

COUPLINGS

Description	Position	Design (Inch)	Before (mm)	After (mm)
DBSE (With Rotor at extreme ends)	---		127.39	127.39
Distance between Hub Face (With Rotor at extreme ends)	---		129.20	129.20

PREVENTIVE MAINTENANCE RECORDS : 104-JAT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
Coupling End					
Journal Bearing	Mandrel		0.005" – 0.007"	0.19	0.19
	Filler / lead wire			-	-
Oil Guard (For Jr. Brg Housing)	South CT			0.18	0.18
	North Silo			0.18	0.18
Governor End					
Journal Bearing	Mandrel		0.005" – 0.007"	0.19	0.19
	Filler / lead wire			-	-
Oil Guard (For Brg. Housing	South			0.65	0.56
Axial Thrust.	With Top Housing		0.011" – 0.016"	-	-
	Without top Housing			-	-
Spacer thickness. (Thrust adjusting)	North			-	-

Journal Bearing Sleeve Thickness : 104-JAT

PAD	NORTH SIDE BEARING (DE)		SOUTH SIDE BEARING (NDE)	
	Before (mm)	After (mm)	Before	After
Upper	19.70	19.70	-	-
Lower	19.80	19.80	-	-

Thrust Bearing Pad Thickness : 104-JAT

PAD	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	15.89	15.89	15.88	15.88
No 2	15.89	15.89	15.89	15.89
No 3	15.90	15.90	15.89	15.89
No 4	15.89	15.89	15.88	15.88
No 5	15.89	15.89	15.88	15.88
No 6	15.90	15.90	15.89	15.89

PREVENTIVE MAINTENANCE RECORDS : 104-J A

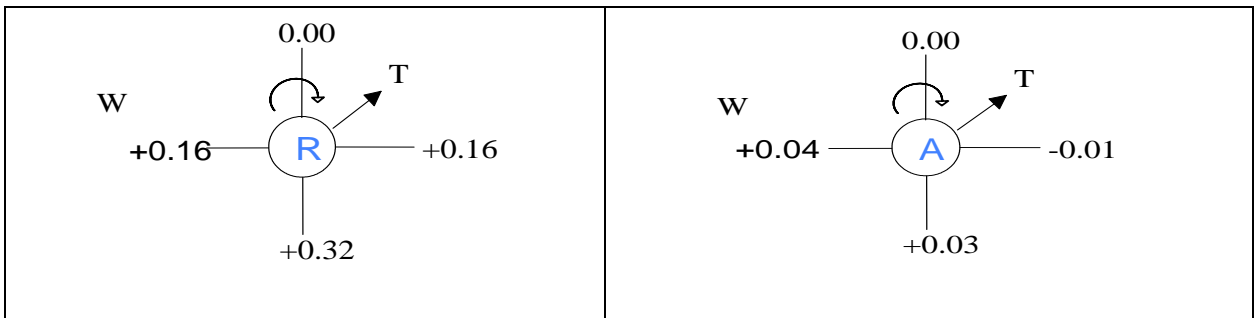
Description	Design Clearance (Inch)	Before PM (mm)	After PM (mm)
Journal bearing (Thrust end bearing)	0.006 - 0.008	0.20	0.20
Journal bearing (Opposite thrust end)	0.006 - 0.008	0.19	0.19
Axial Thrust	0.014	0.35	0.29
DE Labyrinth clearance	COUPLING INSIDE	0.05	0.05
		0.10	0.10
NDE Labyrinth clearance	CT SILO	0.10	0.10
		0.10	0.10
BEARING PINCH	DE	0.03	Interference
	NDE	0.03	Interference

Journal Bearing Sleeve Thickness : 104-JA				
PAD	UREA SIDE BEARING		AMM SIDE BEARING	
	Before	After	Before	After
Upper	11.06 / 17.46		11.09 /17.40	11.09 /17.40
Lower	11.07 / 17.41		11.1/17.38	11.1/17.38

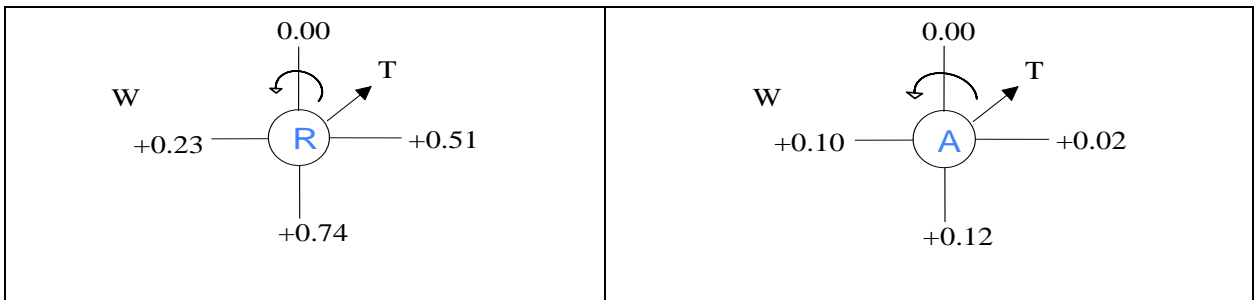
Thrust Bearing Pad Thickness : 104-JA				
PAD	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	25.40	25.40	25.39	25.39
No 2	25.34	25.34	25.39	25.39
No 3	25.35	25.35	25.39	25.39
No 4	25.40	25.40	25.39	25.39
No 5	25.40	25.40	25.39	25.39
No 6	25.39	25.39	25.35	25.35

ALIGNMENT READING RECORDS : 104-JAT to 104-JA

Before Preventive Maintenance



After Preventive Maintenance



a-MDEA PUMP 107-J Train:

107-JT Drive Turbine :

The turbine was decoupled and the coupling was inspected and DBSE were noted. Turbine (107-JT) front, rear bearings and thrust pads were thoroughly polished & dimensionally checked and found to be within limits. DP tests were carried out and found bonding of white metal with base metal damaged in NDE brg. Hence, NDE journal bearing replaced by spare brg. Magnetism level of all bearings was found to be within limit. Clearances were measured and found to be within limit.

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)	---		197.66	197.66
Distance between Hub Face (With Rotor at extreme ends)	---		191.26	191.26

PREVENTIVE MAINTENANCE RECORDS: 107 - JT

Description	Position	Design Clearances (Inch)	Before (mm)	After (mm)
Coupling End				
Journal Bearing	Mandrel	0.005" – 0.007"	-	-
	Filler / lead wire		0.18	0.18
Oil Guard (For Jr. Brg Housing)	South (In Board)	AMM Urea	0.40 0.40	0.40 0.40
	North (Out board)	AMM UREA	0.15 0.15	0.15 0.15
Shaft Diameter	Jr. Brg.		-	-
Bearing Pinch	Jr. Brg.		0.01	Interference
Governor End				
Journal Bearing	Mandrel	0.005" – 0.007"	Brg. replaced	-
	Filler / lead wire			0.19 mm
Oil Guard (For Brg. Housing)	South	AMM.	0.15	0.15
		UREA	0.15	0.15
Axial Thrust	With Top Housing	0.011" – 0.016"	0.45	0.45
	Without top Housing		-	-
Bearing Pinch	Jr. bearing		0.01	Clearance

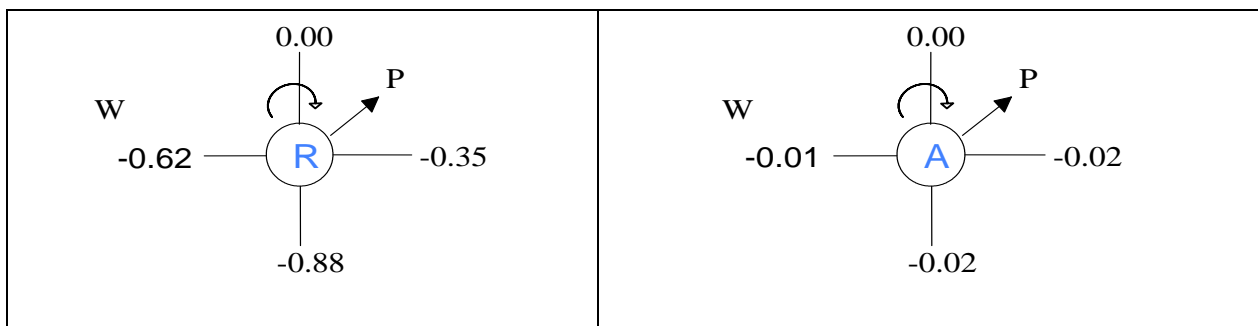
Journal Bearing Sleeve Thickness : 107-JT

PAD	DE BEARING		NDE BEARING	
	Before (mm)	After (mm)	Before (mm)	After (mm)
Upper	23.55	23.55	24.80	24.36
Lower	24.00	24.00	24.85	24.85

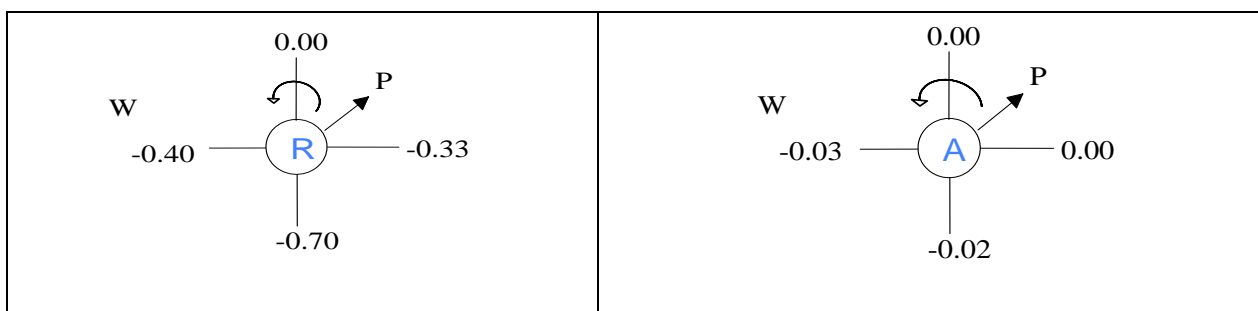
Thrust Bearing Pad Thickness : 107-JT

PAD	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	15.90	15.90	15.90	15.90
No 2	15.90	15.90	15.85	15.85
No 3	15.90	15.90	15.84	15.84

ALIGNMENT READINGS : 107-JT to 107-J (Before PM)



ALIGNMENT READINGS : 107-JT to 107-J (After PM)



RECIPROCATING CO₂-GAS COMPRESSOR TRAIN (117-J)

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 valve assemblies were reconditioned.

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 piston rod assembly of both cylinders was replaced by new one with new gas packing. All the suction and discharge valves were replaced by spare refurbished valves.

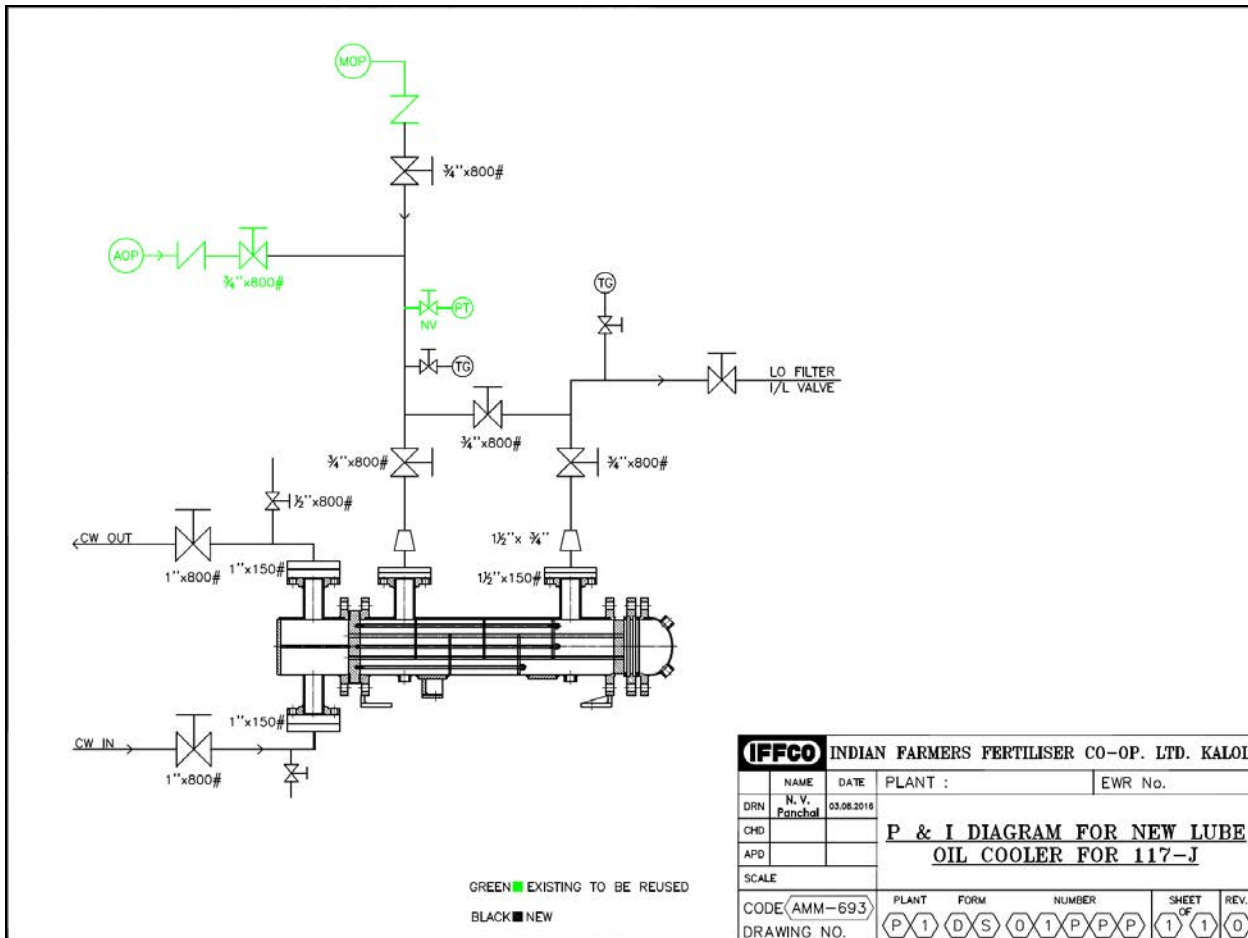
Crank Case Assembly Overhauling

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 and the white metal lining had worn out. These bearings were replaced by new ones. All other components were visually inspected and found OK. All the clearances were measured and found within limit. 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 were replaced by new one.

The tube bundle of the inter stage cooler was pulled out and cleaned by hydro jetting. The LP and HP flow dampener were checked and found OK. The lube oil strainers were cleaned and reinstalled.

During summer LO inlet temperature was getting increased above 67 deg C and LO high temperature alarm was appearing in DCS. Hence LO was cooled by providing

water hose above filter. To resolve this new shell & tube Lube oil cooler, manufactured at workshop was installed in LO circuit.



Compressor was taken in line for checking the performance after installing LO cooler. AOP was not developing sufficient pressure initially even after adjustment from RV set screw. Cooler was also bypassed; MOP suction strainer cleaned etc. but no improvement found. After lot of efforts, a pin hole was found on the body of suction strainer from where air get ingressed in the LO circuit resulting in the poor performance of pump. Strainer was removed, repaired by welding & then reinstalled back. After that system get normalized.

CLEARANCE CHART : 117-J TRAIN

Description	Position	Position	Design clearance(mm)	Before (mm)	After (mm)
Piston end clr. (Front /TDC)	LP	Urea side	2		2.30
		Ammonia side	-- do --		2.25
	HP	Urea side	-- do --		2.40
		Ammonia side	-- do --		2.35
Piston end clr. (Intermediate /BDC)	LP	Urea side	1.5		1.60
		Ammonia side	-- do --		1.75
	HP	Urea side	-- do --		1.70
		Ammonia side	-- do --		1.75
Main bearing	I	Urea side to	0.08-0.15 (0.3 MAX)		0.19

Description	Position		Design clearance(mm)	Before (mm)	After (mm)
	II	Ammonia side	-- do --		0.17
	III		-- do --		0.21
	IV		-- do --		0.19
	V		-- do --		0.18
Big end bearing	LP	Urea side	0.07-0.13 (0.3 MAX)		0.16
		Ammonia side	-- do --		0.19
	HP	Urea side	-- do --		0.18
		Ammonia side	-- do --		0.19
Small end bearing	LP	Urea side	0.05-0.10 (0.2 MAX)		-
		Ammonia side	-- do --		-
	HP	Urea side	-- do --		-
		Ammonia side	-- do --		-
Cross head guide	LP	Urea side	0.18-0.26 (0.6 MAX)		0.15
		Ammonia side	-- do --		0.15
	HP	Urea side	-- do --		0.15
		Ammonia side	-- do --		0.15
Side clearance (Crank shaft)	----	Crank shaft	0.45-0.60 (0.9 MAX)		0.65
Side clearance (Connecting rod big end)	LP	Urea side	0.33-0.42 (0.6 MAX)		0.15
		Ammonia side	-- do --		0.20
	HP	Urea side	-- do --		0.20
		Ammonia side	-- do --		0.15

Alignment Reading between Motor & GB:

Vertical:

Offset Value = 0.03mm; Angular Value = 0.00/100mm

Horizontal:

Offset Value = 0.03mm; Angular Value = 0.02/100mm



Crank Case of 117-J

COPPUS TURBINE :

101/105-JLOPT: The lube oil pump drive turbines, was taken for replacement of bearings. The radial bearing i.e. deep groove ball bearing (6308) as well as the thrust bearing i.e. angular contact ball bearing (7312 BECBJ – 2 nos.) were replaced by new one. The cooling water lines were flushed. The bearing oil cooling water jackets were cleaned. The trip valve spindle was made free for smooth start-up of the turbine.

103-JLJAT (103-JLJA LO Pump Drive turbine) : Actuator calibration was checked & found ok

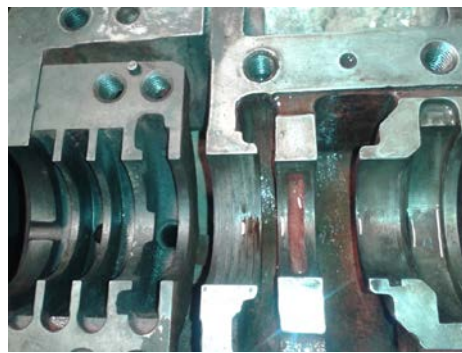
SPLIT STREAM PUMP DRIVE TURBINE, 116-JAT

Turbine was taken for overhauling to correct the bearing & rotor shaft journal contact as the frequency of journal bearing failure increased due to axial misalignment of rotor shaft in the bearing housings. Bearing housing Alignment was checked & Misalignment was rectified by adopting the procedure laid down in Elliott Turbine Maintenance Manual Page No. 4-20 to 4-22.

To correct the misalignment, thickness of spacers located between NDE bearing housing & turbine casing were increased in top two bolts & kept same for bottom two bolts.



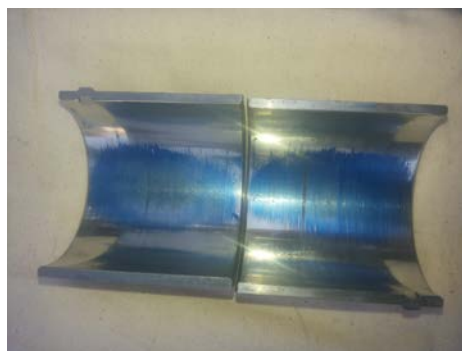
DE Side Bearing Housing Bottom



NDE Side Bearing Housing Bottom



NDE side Bearing Pedestal



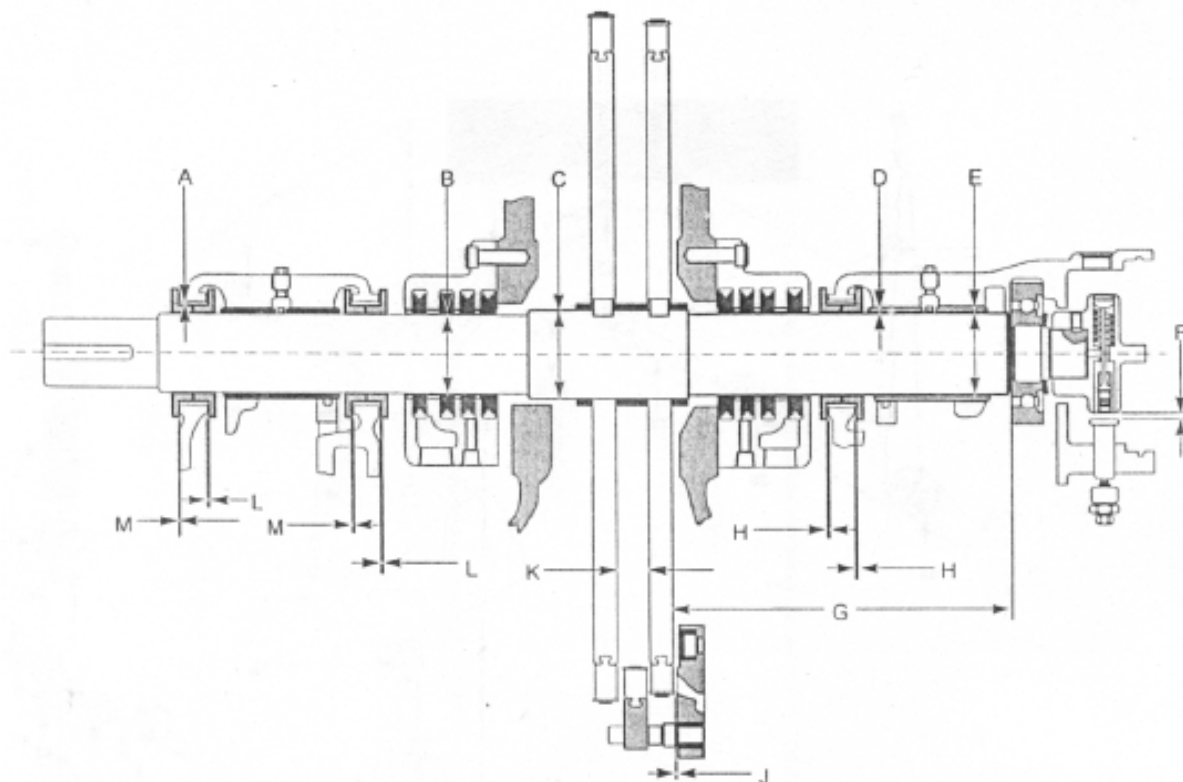
Final Blue of Journal Brg.

	Spacer Thickness	
	Silo side	CT side
Before Alignment	Top bolt: 3.12+0.40mm=3.52mm	Top bolt: 3.12+0.40mm=3.52mm
	Bottom bolt: 3.12+0.40mm=3.52mm	Bottom bolt: 3.12+0.40mm=3.52mm
After Alignment	Top bolt: 3.67mm	Top bolt: 3.62mm
	Bottom bolt: 3.12+0.40mm=3.52mm	Bottom bolt: 3.12+0.40mm=3.52mm

COUPLINGS

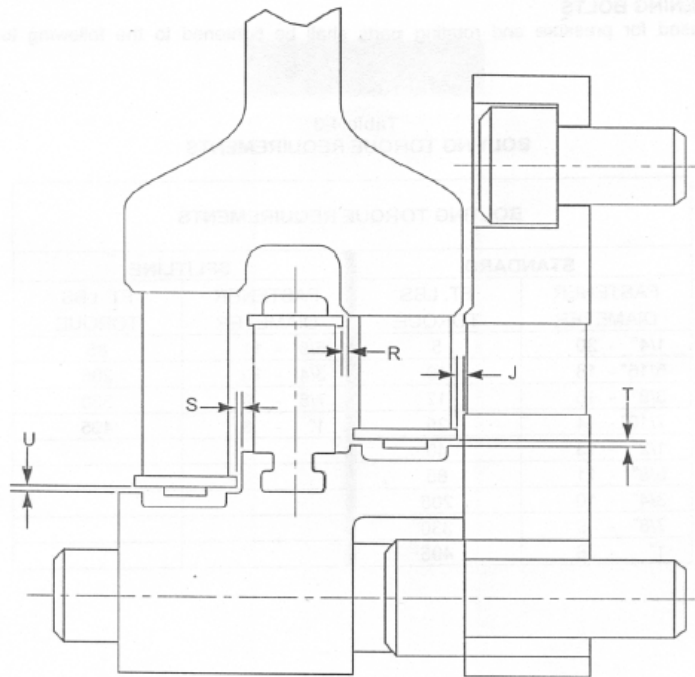
Description	Position	Design (Inch)	Before (mm)	After (mm)
DBSE (With Rotor at extreme ends)	---		182.25	182.25
Distance between Hub Face (With Rotor at extreme ends)	---		179.55	179.50
Axial Float			0.50	0.40

116-JAT CLEARANCE CHART



LOCATION	DESCRIPTION	DESIGN (INCH)	ACTUAL (INCH)
A	Shaft sleeve clearance- radial	0.010-0.0145	1.65/1.65
B	Carbon ring inside diameter NDE -1(Inboard to outboard)		57.45
	Carbon ring inside diameter NDE -2		57.35
	Carbon ring inside diameter NDE -3		57.35
	Carbon ring inside diameter NDE -4		57.32
	Carbon ring inside diameter DE -1 (Inboard to outboard)		57.34
	Carbon ring inside diameter DE -2		57.30
	Carbon ring inside diameter DE -3		57.32
C	Shaft Diameter	2.2500-2.2505	57.15
	DE Journal Bearing clearance - Diametrical	0.006-0.009	0.24/0.26
D	NDE Journal Bearing clearance - Diametrical	0.006-0.009	0.24/0.26
	Journal diameter	1.9320-1.9325	49.05
F	Trip pin – Plunger clearance	0.062	1.65

LOCATION	DESCRIPTION	DESIGN (INCH)	ACTUAL (INCH)
G	Thrust bearing to 1 st wheel - Axial	9.465-9.471	9.471
H	Shaft sleeve clearance- Axial (Bearing end)	0.054-0.064	1.5
	Shaft sleeve clearance- Axial (Carbon ring end)	0.054-0.064	1.2
K	Distance between wheel - Axial	0.930-0.950	NA
L	Shaft sleeve clearance- Axial	0.068-0.098	1.5
M	Shaft sleeve clearance- Axial	0.030-0.040	0.8
L	Shaft sleeve clearance- Axial	0.068-0.098	1.6
M	Shaft sleeve clearance- Axial	0.030-0.040	0.95



LOCATION	DESCRIPTION	DESIGN (INCH)	ACTUAL (INCH)
J	Nozzle clearance - Axial	0.042-0.072	1.30
R	Disc to reversing bucket holder - Axial	0.050-0.090	2.15/2.40
S	Reversing bucket holder to 2 nd row shroud - Axial	0.050-0.090	2.35/2.50
T	Trip seal clearance, 1 st row - Axial	0.050-0.080	-
U	Trip seal clearance , 2 nd row - Radial	0.050-0.080	-

Alignment Reading between Turbine, 116-JAT & Pump, 116-JA:

Before

Vertical:

Offset Value = 0.03mm; Angular Value = 0.05/100mm

Horizontal:

Offset Value = 0.02mm; Angular Value = 0.11/100mm

After

Vertical:

Offset Value = 0.04mm; Angular Value = 0.02/100mm

Horizontal:

Offset Value = 0.09mm; Angular Value = 0.07/100mm

PRIMARY REFORMER, AUXILIARY BOILER & SECONDARY REFORMER JOBS

The Primary Reformer Radiant Zone

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

Row No.	Burner Nos.
1	103, 104, 106, 107
2	213
3	313
5	502
6	607, 614
7	701, 707, 714
8	801
9	902, 907, 909

- The roof insulations were inspected. Damaged/dropped insulation blocks were replaced by new ones and gap was filled.
- Fallen down Z-module of side wall at peephole elevation was replaced. However, side wall insulation at other locations were intact & in satisfactory condition.
- Damaged header insulation were replaced / repaired.
- Scaffolding erected & **dry ice blast cleaning of all reformer tubes were carried out** for the first time by CO2 TECHNOLOGIES, Mumbai vide PO No. 201004161470 dated 24/02/16.
- NDT of reformer tubes were carried out by Inspection section.
- Damaged / broken tunnel slabs were replaced by new ones & damaged wall refractory were repaired.
- All spring hangers locked for inspection & catalyst replacement & unlocked after completion of the job.
- 21 nos. catalyst tubes (i.e. 115, 116, 130, 137, 138, 139, 207, 307, 329, 331, 332, 337, 509, 510, 511, 514, 516, 606, 607, 609, and 629) plugs were opened for replacement of 35% catalyst of top portion & then boxed up.
- All Inlet Manifold end covers were opened & boxed up after job completion.
- All burners air resistor overhauling done.

The Primary Reformer Convection Zone

- Repaired cracked refractory & replaced fallen ones at the ceiling after providing new holding clits against burnt off clits at such locations.
- Insulation of East, West & South wall was found satisfactory.
- The LT and HT end panel walls were opened for external cleaning of the coils.
- **Dry ice blasting** was carried out to clean external scaling of all HT coils & LT coils including BFW coil in the duct for the first time.
- HT & LT panels were boxed up with new gasket after repairing damaged refractory.
- Provision for Metal temperature indication of HT superheat coils at control room panel was made. Holes 2 nos. was drilled on casing plate. Fixed 2 nos. clamps of Incoloy

800H on HT coil fabricated at workshop. Incoloy pipe was welded with clamp for making provision of safe enclosure of RTD wire upto casing wall. Inserted RTD wire through pipe & route it upto nearby JB.



Clamp for HT Superheat Coil Skin Temp.



Clamp Installation on HT Superheat Coil

- Bulged liners around the PRC 23 dampers repaired.
- PRC 23 dampers were not getting closed due to gap between flappers. Hence additional plates were welded to 1st and 2nd flapper to reduce the gap to prevent ingress of excess air. Overhauled the linkage mechanism for free movement of dampers.



PRC-23 Dampers Before Patch Plate Welding



PRC-23 Dampers After Patch Plate Welding

The transfer line end cover was opened for inspection, repaired the crack at the weld joint of cylindrical portion with flange & other cracks on the liners, damaged refractory on seating area of Transfer Line End Plug was repaired and then boxed up.



Transfer Line End Plug



Damaged Refractory on seating area of Transfer Line End Plug

The Secondary Reformer

Installation of new modified burner of 103-D:

Top cover with Air distributor was opened & removed for installing new distributor supplied by M/s. Casale as per Contract dtd 20th May 2015 under ESP-III scheme.

Burner installation was done as per procedure given by M/s. Casale Document No. A00710A-E-FPE-801 and the following drawings:

Burner Drg: A00710A-E-MDH-901-R1, A00710A-E-MMH-801, A00710A-E-MMH-901

Structure Drg.: A00710A-E-FDE-801_00

Plug Gauge: A00710A-E-FDE-802_00

(See attached Sketch A-Old Burner and B & C reproduced from the above drawings)

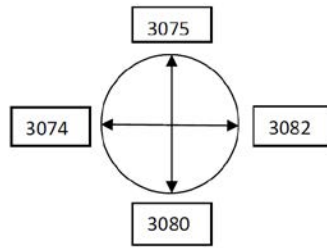
Job was carried out through M/s A M Erector against WO No. 201004161607 dated 09/03/2016. The complete job was done under the supervisor of representative of M/S Casale. Installation was carried out as per the procedure below:

- Disconnected the top cover from piping & shell. Lifted up & removed 103-D Top cover & burner assembly.
- Levelling of the catalyst inside the equipment carried out by production staff. Catalyst was protected by laying tarpaulin over it. Scaffolding was erected for measurement.
- Verified out of roundness of the neck internal liner upto about 200 mm below nozzle (on at least two perpendicular diameters) which was in the range 730 ± 5 mm (As per Drg -745 mm).
- For checking the dimensions a Gauge Plug was made with 2 disks fixed together at 800mm distance, Dia. 745 mm, thk. 2-3mm as per Casale Drg. No. A00710A-E-FDE-802. However, as the minimum dia. Was 730 ± 5 mm was found, hence, an Aluminium disk of 727mm outer diameter with rod at centre was made to check the bulging of liner from top to 200mm below nozzle.
- Liner near transfer line inlet portion was damaged & welding was removed repairing was done in this area. Liner was found bulged at some other locations also however it was minor and was ok.
- A 6mm thick complete circumferential ring of 75mm height & 150mm wide was welded in "L" shape at lower end of neck internal shroud to cover the exposed portion of refractory.
- Measurements were taken to keep the burner tip at the correct elevation, as per drawing.

Height of liner was checked up to the neck portion from top to bottom at four locations. (Dimension "Z" in the Sketch C)

Measured the following dimensions: (Ref sketch C)

Sr. No.	Measured Dimensions	Theoretical as per Drg. (mm)	Actual Measured (mm)
1	Distance from gasket face of top flange to lower end of neck (Z)	3073	3075
2	Total distance from gasket face of top flange to top of levelled catalyst	4873 (From Target Brick)	5310 (From levelled catalyst top as target bricks were not there as it was removed earlier)

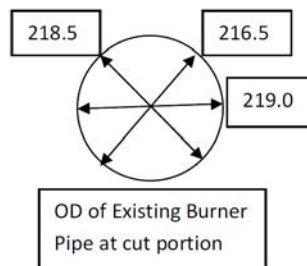


- Marking was done at 420mm on old burner pipe from gasket face of top flange. Burner was taken to the Boring machine at workshop. Burner connecting pipe was cut & Bevel edge was made.
- Final dimension from Bevel edge of pipe to gasket face of top flange = 416mm was made.

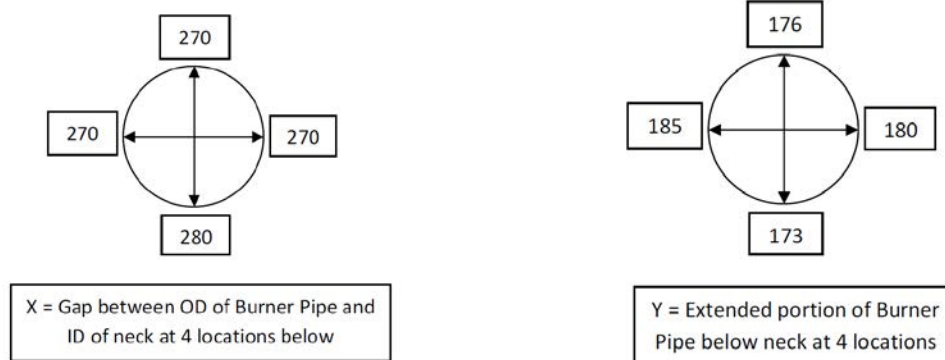
ID of Existing Burner Pipe = 197.20 mm

ID of New Burner Pipe = 197.20 mm to 197.30mm

- OD of existing burner



- The burner was supplied with extra length for keeping the burner at a projection of 373mm from nozzle neck. Burner Pipe was cut at 2845mm from the burner tip. The dimension of burner pipe was 3258mm from the cover gasket face.
- Bevelled the cut end of the pipe (MOC of Pipe: Incoloy 800H).
- Lifted and seated the cover on the supporting frame checking the alignment of the ends of the lower pipe with the burner ends, then tack welded and welded the joint (FW #1), checking the verticality of the burner (after tack weld removed the lower support of the burner and made it free to move).
- Lifted and inserted the new burner inside the supporting frame (Pre-fabricated).
- Trial fitted the assembled grid distribution segments around the central pipe and tightened by hand the fixing bolts to the supporting gussets, then removed them.
- Dye Penetrant check and X-Ray of bevel edges & root weld was carried out.
- Marking was done in the refractory of the reformer neck the 4 axis 0°, 90°, 180°, 270°.
- Then Lifted and positioned the burner at the top of secondary reformer 103-D. The verticality of the burner was checked from inside and following dimensions were noted. (Dimension "X & Y" in the Sketch C)



- After checking the burner verticality, burner was removed, brought down and kept on structure in vertical position.
- Full welding of burner pipe joint (FW #1) was done & Dye Penetrant check and X-Ray of final weld joint were carried out. Cracks found in the Liner of top cover in full Circumference were repaired by welding.
- Damaged Refractory at the face of the flange of 103-D was repaired by civil.
- Introduced the 8 sectors of grid distribution segment and rested them on the gussets of the burner. Adjusted the position of the segments in order to get 750 mm as external diameter. Tightened the nuts.
- Lifted the burner to the top & put it in position. Restrictions were detected between grids and liner during lowering, lifted back the burner and moved the interfering sectors toward the center & reduced external diameter of segments.
- Repeated the step 18 until the gap minimized and made external diameter of segments 726mm to 730mm finally.
- Lifted back the burner, Tack welded the nut to the bolts. (FW #2)
- Completed welding of the fixing pins to the washer and to the distribution grids according to Casale drawing no. A00710A-E-MMH-801. (FW #3)
- Installed and tack welded the inner closure ring to the central pipe only. (FW #4)
- Lifted and installed the cover-burner assembly after having cleaned the gasket seat and replaced the gasket (Spiral Wound Gasket Size: 46-1/2" ID X 48-1/2" OD X 50-3/8"). Then assembly was inserted slowly checking for any fouling.
- Bolted back the cover in the usual way. Connected the feed line. Bottom cover boxed up with new gasket.



Damaged refractory at the top face



Existing 103-D Burner Assembly before Modification



Old Burner Pipe was cut & Bevel edge made on Boring Machine



Circumferential ring in L shape welded on bottom of neck of 103-D



New Burner Pipe was set-up & welded on stand after confirming verticality



Refractory was repaired & setting of distribution grids



Checking restriction between distribution grids and liner

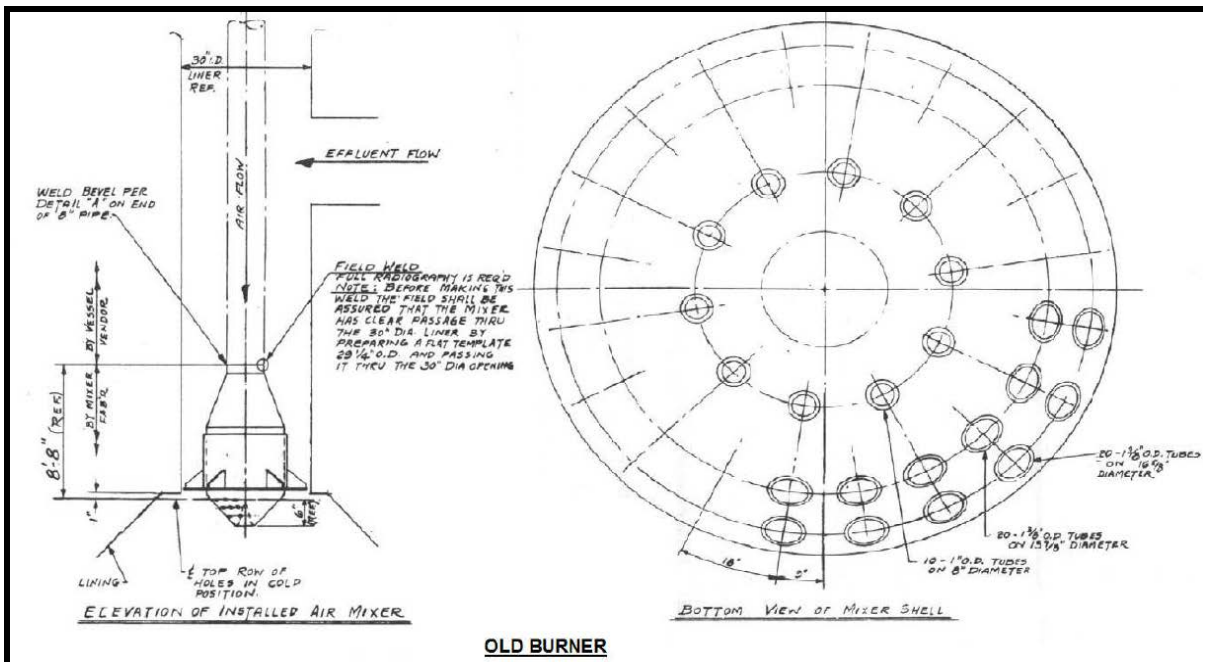




Tack Welding of Nuts to the bolts & fixing pins to the washer

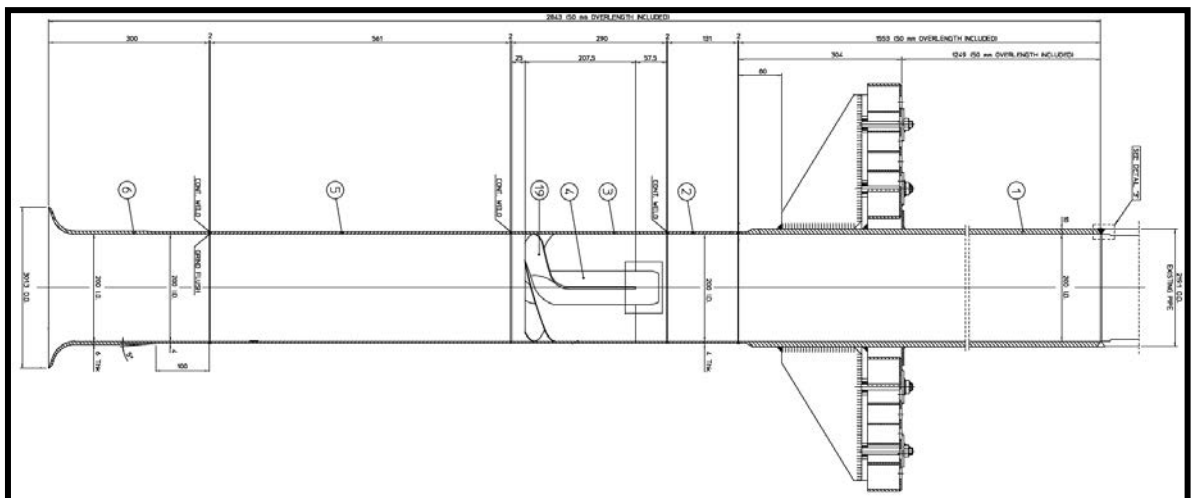


DP check of tack weld

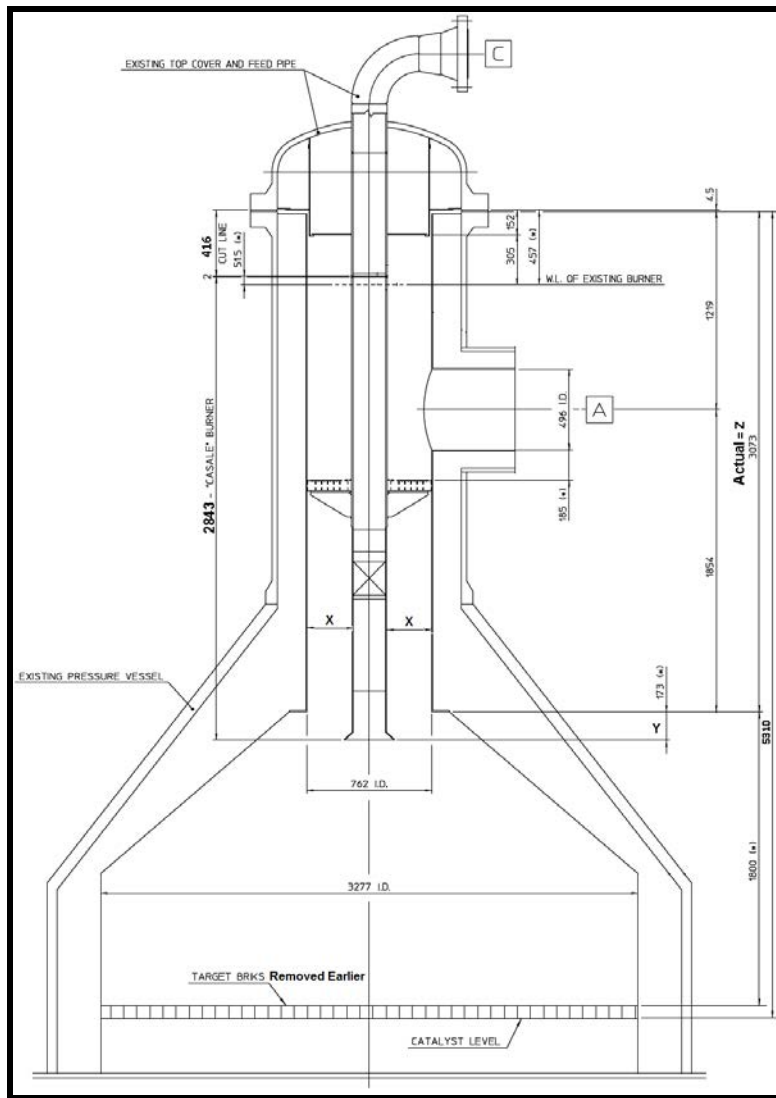


OLD BURNER

Sketch A – OLD BURNER



Sketch B - NEW CASALE BURNER



Sketch C - Checked Dimensions

Bottom cover was opened for inspection. Minor damage of refractory was observed and the same was repaired. Refractory material lying in pipe line towards 101-CA side was removed.

103-D to 101-CA liner Part No #15 with #16 of IFFCO drg. No 01-BS-03044 found removed & lying at bottom of pipe. (Also Ref. Drg No – 405 D2 of M W Kellog). Most of the gas passage of pipe found blocked. Damaged liner piece was cut & removed from position. Liner segment (4Nos.) issued from store (store code: 2010115189935230). It was welded in position.



Damaged 103-D to 101-CA pipe Liner



Repaired 103-D to 101-CA pipe Liner



103-D to 101-CB pipe Liner

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 both sides.
- Manhole was closed by putting bricks and ceramic blanket.
- Cover of BFW coil was removed & dry ice blasting done.

HEAT EXCHANGERS AND COOLER JOBS

101-CB

Gasket between channel & outer bundle tubesheet leaked 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 101-CB Tube bundle Assy. with the spare one available.

The tube bundle assy. was dismantled by detaching downcomer flange joint, top cover to channel flange joint, both riser flange joints & outer tube sheet to shell flange joint one by one. Removed the top cover & fixed the lifting cover by the help of Kobelco crane. Removed the tube bundle from shell by the help of Kobelco crane & lift it to the ground.

Shell inspection was carried out. At 1st Liner Piece from top, Welding of gas outlet nozzle liner with shell liner was found broken at few locations, causing gap of approx. 2 to 5mm on periphery of nozzle. Broken liner was repaired by welding.

Liner and its welding surrounding the gas distributor found broken, eroded and bulged. Broken liner was replaced & repaired by welding. The Gas distributor was found broken and lying at the bottom floor. Cut & removed the damaged distributor & new distributor was fixed at the position.

After completing shell liner repair jobs, tube bundle assy. was inserted into the shell with new joint gasket by the help of Kobelco crane. Removed the lifting cover & placed the top cover with new gasket. Tightened cover to channel & channel to shell flange joint bolts. Inserted new gasket & then tightened downcomer & both riser flange joints bolts.



Damaged Distributor of 101-CB



New Distributor welded on position



101-CB Tube Bundle Installation



Tubesheet of 115-C after Seal Welding

114-C North side channel cover leak

North side channel cover was opened & removed. Channel cover & shell gasket seating area were cleaned properly and boxed up with new gasket.

115-C

Channel cover was opened. Pneumatic test was carried out from shell side at 3.5 kg/cm²g air pressure. Total 28 nos. tube to tubesheet joint leakage locations & one no. tube leak found.

Tube to tubesheet seal welding carried out & one no. leaky tube plugged. Then, Helium Leak detection test carried out and found OK. Welding was done by welder from M/S Patel Airtemp, Ahmedabad.

For pull out of Tube Bundle, Beam was provided in front of 115-C. During removal of tube bundle, RT Crane was used for supporting the bundle.

OTHER EXCHANGERS

EQP TAG		HYDROJETTING		HYDRO TEST PR.	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-JBT	GLAND CONDENSER		✓		
104-J	LUBE OIL COOLER	✓			Cleaning done before shutdown
104-JT	LUBE OIL COOLER	✓			
104-JT	GOV OIL COOLER	✓			
104-JA	LUBE OIL COOLER	✓			
104-JAT	LUBE OIL COOLER	✓			
104-JAT	ACTUATOR OIL COOLER	✓			
105-JT	GLAND CONDENSER	✓			
105-CA		✓		✓	Tube Side: Head Pressure
105-CB		✓		✓	
107-JT	LUBE OIL COOLER	✓			
107-JAT	LUBE OIL COOLER	✓			Cleaning done before shutdown
108-C1A		✓		✓	Shell side : 8.1 Kg/cm2g. Tube side : 8.1 Kg/cm2g.
108-C2A		✓		✓	
109-C1B	REFORMER SIDE	✓	✓	✓	Shell side : 2.5 Kg/cm2g. Tube side : 8.1 Kg/cm2g. Shell side : 7.0 Kg/cm2g.
109-C2B	REFORMER SIDE	✓	✓	✓	
110-CA		✓			
110-CB		✓			

EQP TAG		HYDROJETTING		HYDRO TEST PR.	Remarks
		TUBE SIDE	SHELL SIDE (Tube bundle pull out)		
114-C					North side Channel cover Gasket replaced
115-C			✓	✓	Shell side : 15.8 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	1 st STAGE COOLER	✓			
124-C			✓	✓	Shell side : 26.5 Kg/cm2g
127-CA		✓		✓	Shell side : 27.0 Kg/cm2g
127-CB		✓		✓	Shell side : 27.0 Kg/cm2g
128-C		✓			
129-JC	101-J INTERCOOLER	✓	✓	✓	Shell side : 2.7 Kg/cm2g, 2 nos. tube plugged
130-JC	101-J INTERCOOLER	✓	✓	✓	Shell side : 6.0 Kg/cm2g. 24 nos. tube plugged.
131-JC	101-J INTERCOOLER	✓	✓	✓	Shell side : 15.0 Kg/cm2g.
150-C		✓			
173-C		✓			
HE-2	PGR	✓		✓	Shell side : 25.0 Kg/cm2g.

Air Compressor Interstage Coolers 129-JC, 130-JC & 131-JC

130-JC - During normal operation heat exchanger performance was deteriorated and hence water was sprayed over the shell of 130-JC from outside to improve the heat exchanger performance. Hence 130-JC was taken for the tube pullout.

After removal of bundle holding studs were found broken. It was replaced with new one made in W/s. Hydro test of 130-JC was carried at 6 kg/cm2g. 24 nos. were found leaked. (Total plugged tubes – 28 Nos.)

New Studs were made in workshop to replace the damaged ones & rectangular washers were made to support the studs in enlarged holes.

Stud : 8mm OD X 425mm long – 12 nos. with M8 thread at both ends

8mm OD X 400mm long – 10 nos. with M8 thread at both ends

Washer : 50mm X 25mm X 4mm Thk., 10mm Dia. Hole at centre.

MOC: SS 304

129-JC- Hydrotest of 129-JC was also carried out at 2.7 Kg/cm²g in dummy shell. 2 nos. tubes were found to have leakage. It was plugged.

131-JC- tube bundle of 131-JC was also pulled out. Hydrotest was done in position. 1no tube found to have leakage during hydrotest (hydrotest pr-15kg/cm²g). It was plugged.



Broken studs on 129-JC



2 nos. Tubes Plugged in 129-JC



Total 28 nos. Tube is plugged in 130-JC

VESSEL INSPECTION / REPAIR JOBS:

- 102-EB, CO₂ Stripper: Top Manhole opened & boxed up after inspection, cleaning & tightening of loose U-Clamps of East-North and West-South side distribution header & repairing cracked/detached South-West side distribution header U-clamp support towards east side.
- 102-F & 103-F manhole opened for inspection and then boxed up. No repairing points observed.
- 104-F, Synthesis Gas Compressor Suction Drum: Manhole opened & boxed up after inspection & cleaning. No repairing points observed.
- 105-F, Synthesis Gas Compressor 1st Stage Separator: Manhole opened & boxed up after inspection & cleaning. 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), 111-F (2nd stage), 112-F (3rd stage) Refrigerant Flash Drum: Manhole opened for inspection, cleaning done and then boxed up. No repairing points observed.
- 103-E1, HP Flash Vessel: Top manhole opened for inspection and then boxed up. No repairing points observed.
- 103-E2, LP Flash Vessel: Manhole opened for inspection and then boxed up. No repairing points observed.

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, 02 nos. loose bolts tightened in 6" BFW header. On East side demister pad stiffener plate missing fastener at 04 locations at bottom side of plate was fixed.
- Open inspections as well as hydro test of the following boiler was successfully executed in presence of IBR inspector:

Sr. No.	Tag No.	Identification No.	Hydrotest Pressure (kg/cm ²)
1	101-F	Boiler No. GT-1632	146.0

Bench test of super heater RV, RV 101-B was also executed in pressure of IBR Inspector.

RELIEF VALVES OVERHAULING :

SAFETY RELIEF VALVES OVERHAULING & SERVICING:

The following RVs were overhauled and 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
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	46.00
7	RV-103-J	3 K 4	159.00 (2260PSIG)
8	RV-103-JA	3 J 4	158.90 (2260PSIG)
9	RV-105-D	3 J 4	152.80
10	RV-106-F	1.5" X 2"	157.90
11	RV-102-F	6 R 8	30.50
12	RV-123-CA	3 J 6	122.00
13	RV-123-CB	3 J 6	122.00
14	RV-MS-9	4 P 6	42.20
15	RV-BFW-1	1-1/2 G 2-1/2	92.00
16	RV-112-CA	1-1/2 H 3	10.50

Sr. No.	RV Tag NO	Valve Size	Set Pressure (kg/cm ²) g
17	RV-112-CB	1-1/2 H 3	10.50
18	RV-109-F	6 Q 8	19.00
19	RV-110-F (N)	3 L 4	7.00
20	RV-110-F (S)	3 L 4	7.00
21	RV-111-F	4 P 6	6.30
22	RV-112-F	4 M 6	6.30
23	RV-104-D1	6 Q 8	35.0 (Reset:31.5)
24	RV-104-D2	1-1/2 F 2	34.10
25	RV 101-J	4 M 6	36.90
26	RV-S-7	4 P 6	14.80
27	RV-LS-1	4 N 6	12.20
28	RV-S-26	2-1/2 J 4	14.60
29	RV-170-C (Shell side)	3 K 4	5.30
30	RV-170-C (Tube side)	3/4" X 1"	30.60
31	RV-129-C	1 E 2	8.40
32	RV-101-E	1 D 2	30.50
33	RV-PG-39	4 M 6	5.30
34	PSV-977 (Absorber Inlet)	4 P 6	32.20
35	PSV-976 (Absorber Inlet)	4" X 6"	30.60
36	RV-104-F (Syn. Gas Comp. Suction separator)	1" E 2"	30.5
37	PSV-954	8 T 10	0.7
38	PSV-951	8 T 10	0.7
39	PSV-983	6 Q 8	7.0
40	SV-01 (117-J)	1-1/2" H 3"	5.80
41	SV-02 (117-J)	1.5 G 3	15.8
42	SV-03 (117-J)	1 E 2	30.2
43	PSV-111	15 X 20	57.08
44	PSV-177	15 X 20	57.08
45	RV-104-JAT	8 T 10	0.35
46	RV - 935 (116-JAT Exhaust RV)	3 J 4	6.10
47	RV-105-F (103-J 1 st stage separator)	1 E 2	73.80
48	RV-103-JAT(A)	3 J 4	46.40
49	105-F (103-J 1 st stage separator)	1" X 2"	73.80
50	PSV - 180	0.5" X 0.5"	6.13
51	PSV -167	0.5" X 0.5"	4.00
52	RV-181	3" X 4"	6.13
53	PSV-720 101-BJT AOP RV	3/4" X 1"	8.5
54	PSV-721 101-BJT MOP RV	3/4" X 1"	8.5

The set Pressure of 103-J suction (RV 104-F) was 29.9 Kg/cm² g and leak test was done at 26.9 Kg/cm² g. But as the operating pressure was 27.2 Kg/cm² g, Production Dept informed that the leak pressure is to be increased. Hence, the RV set pressure was increased. Final reading:

Set Pressure– 30.5Kg/cm² g

Leak test at 27.5Kg/cm² g

Note

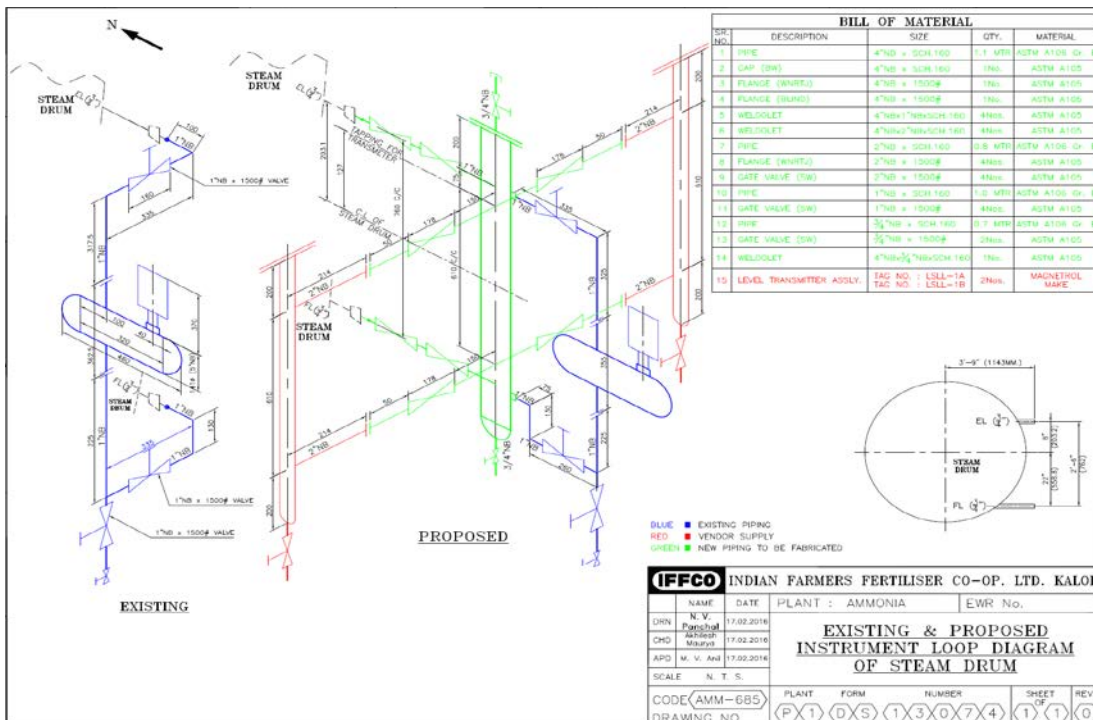
RV 102-F was changed to increased set pressure of 30.5 Kg/cm² g during SD-2015

FABRICATION JOBS

A Fabrication contract i.e. WO No. 201004161607 dated 09/03/2016 was placed on M/s. A.M. Erectors, Ahmedabad to carry out following jobs:

SR. NO.	JOB
CONTRACTOR – A M Erectors	
1	Secondary Reformer, 103-D Burner modification carried out under ESP-III scheme. (See Detail in 103-D section)
2	Fabrication of stand pipe made for installation of 3 nos. level transmitter to make provision of 2oo3 logic in 101-F level measurement. Platform modified.
3	Modification of 104-JT Steam inlet line carried out for making provision of Butterfly Trip Valve installation.

- Fabrication of Stand pipe (MOC: Carbon Steel) and associated piping for installation of new Level Troll on Steam Drum, 101-F. Ref Drg. No. P1-DS-13074 the following jobs were done:
 - Fabrication of standpipe (4"XSch160) as per the Drg. No.P1-DS-13074 Rev.0
 - Dismantled mounted level transmitter,
 - Cut & removed the existing pipe connection with steam drum.
 - Connected pre-fabricated stand-pipe (4") with extended pipes from steam drum & installed 2 nos. new Level Transmitters & 1 no. old.
 - Modification of Platform carried out to accommodate the new installation. Inspection: Butt joints - Root & final DP; 100 % Radiography; Socket joints - Final DP.
 - Obtained all IBR certifications (i.e. Material Identification, Approval of Fabrication job, Approval of Final as built Drawing).



2oo3 Level Transmitter Assembly on Steam Drum, 101-F



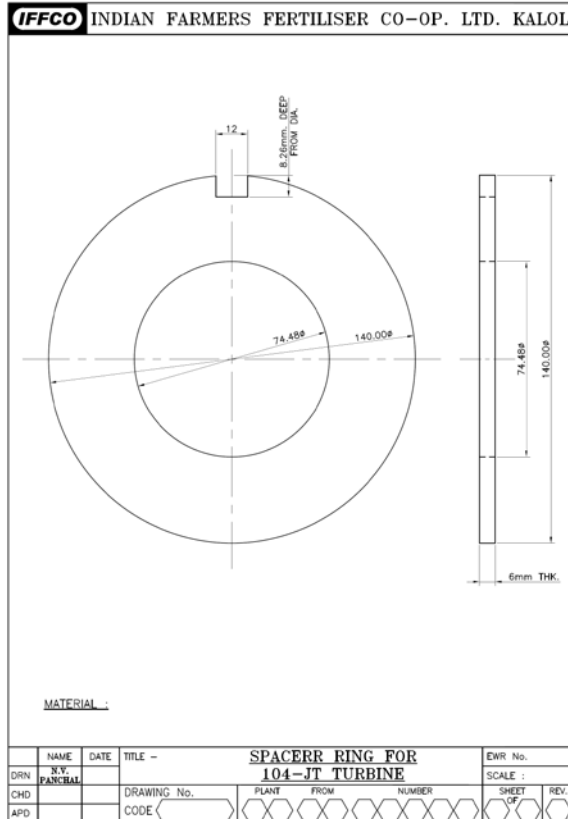
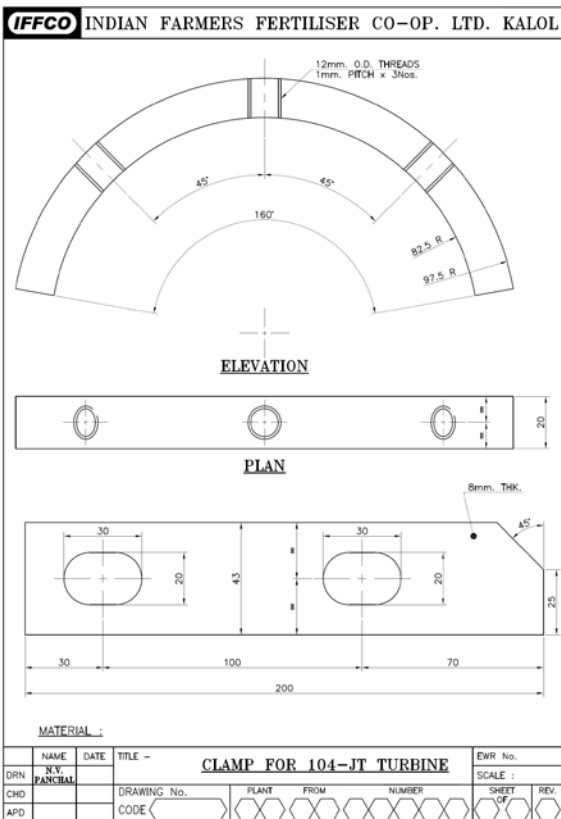
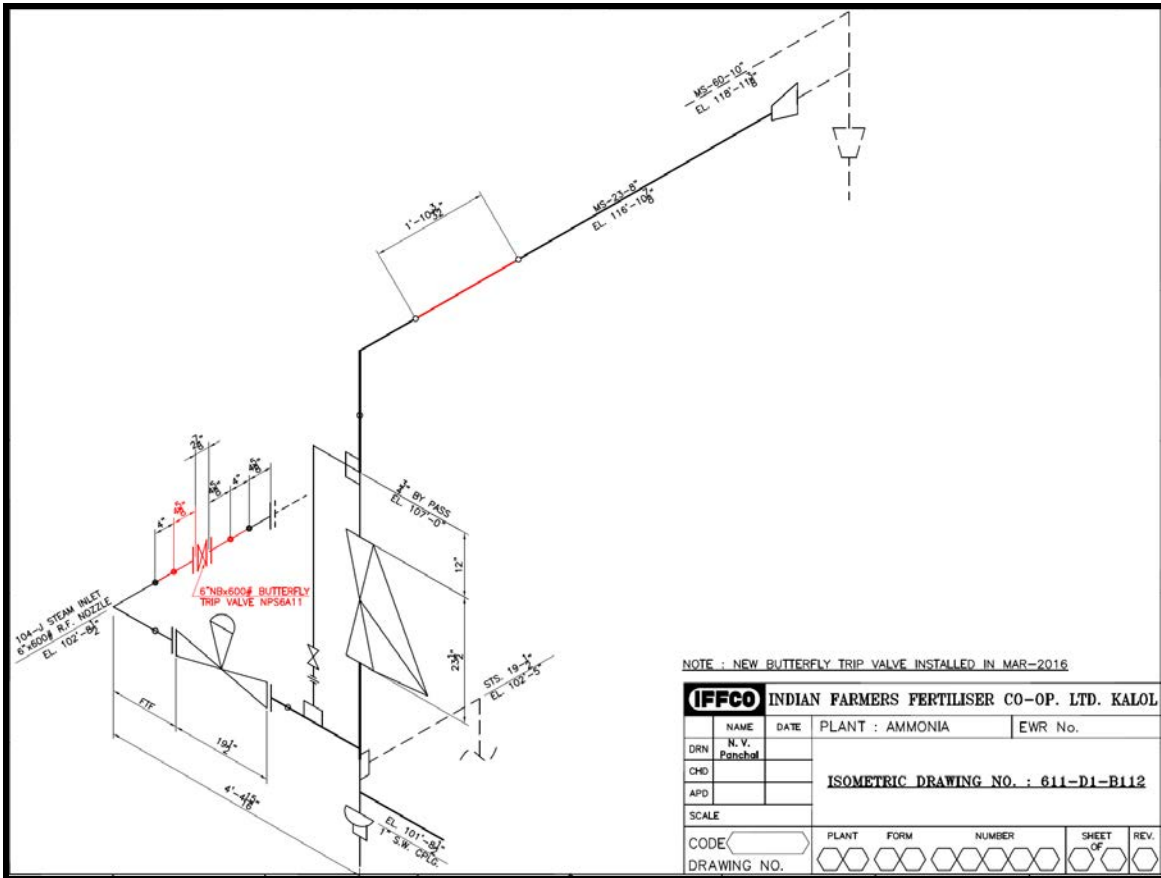
Old Level Transmitter Installation



Assembly of Standpipe & Level Transmitter on Steam Drum

- Modification of 104-JT Steam inlet line (MOC: Carbon Steel) for installation of new Butterfly Trip Valve.
Butterfly top valve was procured from the M/S Emerson, Vadodara against PO No 201004160880 dated 31/10/2015. The following jobs were done:
 - Disconnect steam inlet pipe from turbine.
 - Cut the existing steam inlet pipe (6" X Sch40) of suitable length to accommodate the butterfly trip Valve. As the delivery date of butterfly trip Valve was after shutdown, a ring as per width of butterfly valve was made & then welded the joint. (As per attached modified isometry Drg. No. 611-D1-B112). Inspection: Butt joints - Root & final DP; 100 % Radiography.
 - Steam blowing with target plate carried out.

NOTE: Notched ring & Clamp for fixing of probes was made in workshop as per attached sketch below. Notched ring was installed over the shaft & Clamp was bolted on bearing housing. Butterfly trip valve was installed after shutdown and Tripping was checked by Instrument and found OK.



Following Fabrication jobs were carried out departmentally as well as by ARC Contractor M/s. J&J Engineers:

SR. NO.	JOBS
1	101-BJT steam inlet USV-701 U/S strainer drain valve bonnet leak – ¾" X 800# SW Gate Valve replaced
2	Repaired FRC-2 mixing orifice d/s PI tapping to pipeline root joint by welding.
3	108-D(S-50) Outlet Sample Line Root Valve not operatable due to Wheel free. Tack welded with stem.
4	104-JAT oil console to centrifuge 1/2" line & valve replaced.
5	115-JAT steam inlet line trap passing – Replaced Trap
6	107-JAT steam I/L line D/S trap I/V passing – Replaced ½" X 800# SW Gate Valve
7	Removed redundant old bigger size Amerol pot from two pots in series. Rerouting of lines carried out accordingly.
8	Replaced 103-JBT steam inlet drain line Trap first I/V (bonnet leak) – ¾" X 1500# SW Gate Valve
9	Replaced 105-JT steam inlet line PI tapping I/V (bonnet leak) - ¾" X 800# SW Gate Valve
10	120-J (already removed from site) redundant discharge line R.V. blow off line removed and plugged near 117-C.
11	In PGR Plant, to control the level of B3A tapping for bypass valve with 1" line taken from d/s of DMW inlet control valve LIC-103
12	In PGR, E-2 provision of isolation made by installing new I/V at u/s of LIC-186 for easy maintenance of LIC-186.
13	Replaced 101-F CBD line elbow as pin hole leak was occurred during running plant & repaired temporarily & also I/V replaced as it was passing.
14	Rerouting of Ammonia Dozing pump & Hydrazine Dozing Pump Suction & Discharge lines carried out as both the tanks & pumps were relocated near DM Water Tank.
15	Steam jackets over NG line coming from Gail metering station were cut, cleaned, primer coated & cold insulation wrapped.
16	Installation of new 101-BJT MOP & AOP done & accordingly suction & discharge line modification carried out.
17	Replacement of 107-JAT steam Inlet Isolation Control Valve, V-7 was carried out by Instrument. Accordingly Flanges of 4" X 600# welded after cutting 4" X 400# flanges. Steam blowing done & checked by inserting target plate.
18	One additional gate valve provided in bypass line of FIC-482 – 2" X 1500# SW LTCS Gate Valve. Refer Isometric Drg. No.NH-1302.01 PWHT of 2 nos. weld joint carried out as follows: Rate of Heating: 100 °C/ Hr.; Soaking Temperature: 620 °C; Soaking Time: 2 Hrs.; Rate of Cooling: 100 °C/ Hr.
19	To avoid carryover of water from 109-F to refrigeration loop, Rerouted existing product ammonia line coming from ARU Unit to 109-F. Cut the existing line from 109-F& connected to 121-J common suction line.
20	Removed redundant vapour ammonia line from Dry Ice to 118-C shell outlet.
21	Provision of additional large size drain (2"X800# SW Gate Valve) arrangement made to prevent frequent choking of existing drain line at 178-F (A.G. Separator) near PGR.

22	107-C Platform modification carried out for safe access.
23	Modification of 103-J Lube oil pump (JLJA & JLJB) discharge line, check valve replacement from swing type to Dual plate (wafer type) check valve & relocation in vertical line instead of horizontal line carried out. Provision of extra accumulator in LO line made, 103-J lube oil PCV replaced etc.
24	Corroded bottom portion of Air Compressor Suction filter casing repaired by patch plate welding.
25	Replaced passing PIC-5 snuffing steam second isolation valve of SP-73 along with check valve & piping as piping was found corroded.
26	NG inlet to Arch burner line plug l/v leakage repaired.
27	New LO cooler installed in 117-J Lube oil system.
28	Beams were welded for removal of RV 107-C
29	Provision of online temperature measurement of HT Super heater coil made in Convection zone of Primary Reformer of Ammonia plant.
30	Patch plate welded at corroded bottom portion of Air Compressor, 101-J inlet filter casing.

Replacement of HIC-487 Flange and elbow:

During normal operation leakage was observed at HIC-487 valve d/s flange weld joint. It was temporarily repaired by welding in running plant. Replacement of the pipe piece, 14" X Sch-120 along with the flange 14"X 1500# RTJ, MOC: P-22 carried out (marked in red colour in Drg.).

Before shutdown fabrication of Pipe piece 14" X Sch-120 along with the flange 14"X 1500# RTJ, MOC: P-22 was completed. Weld joint inspection and PWHT was carried out as per the procedure given below Mock test of travel cutter was carried out pre-shutdown to ensure that its operation would not be restricted at position.

After shutdown & cooling of the lines and before cutting the joint, the pipeline hangers reading were noted & then movement of pipeline was restricted by using chain blocks & support clamps.

Adjusted top spring supports in cool condition. 25mm gap was made between pipeline & its bottom support. Line was cut by using travel cutter. Bevel edge prepared by using grinding machine.

Dehydrogenation of old pipe bevel edge carried out as follows:

Rate of Heating: 100 °C/ Hr.; Soaking Temperature: 400 °C; Soaking Time: 24 Hrs.;
Rate of Cooling: 100 °C/ Hr.

Bevel Edge DP test & UT carried out.

Root Gap of 4mm made & then Root welding & hot pass was carried out by 2.5mm dia. filler wire AWS: ER 90SB3. Root weld DP & RT carried out. Interpass temperature 200 °C maintained for fill up & Electrode AWS: E9018 B3 of sizes 2.5mm, 3.15mm & 4.0mm were used for fill-up in succession as the welding progressed. Final Weld DP & RT carried out.

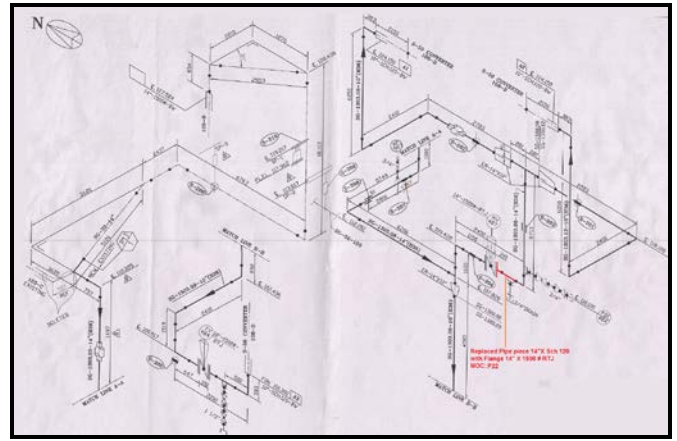
PWHT of weld joint carried out as follows:

Rate of Heating: 190 °C/ Hr.; Soaking Temperature: 740 °C; Soaking Time: 2 Hrs.;
Rate of Cooling: 190 °C/ Hr.

Pipe line Support at the bottom of the pipe was welded with pipe with jack screws for adjustment. All other clamp supports & chain blocks were removed. After plant startup as the line gets heated gap was reduced continuously & become nil finally.



HIC-487 valve d/s flange weld joint leak location



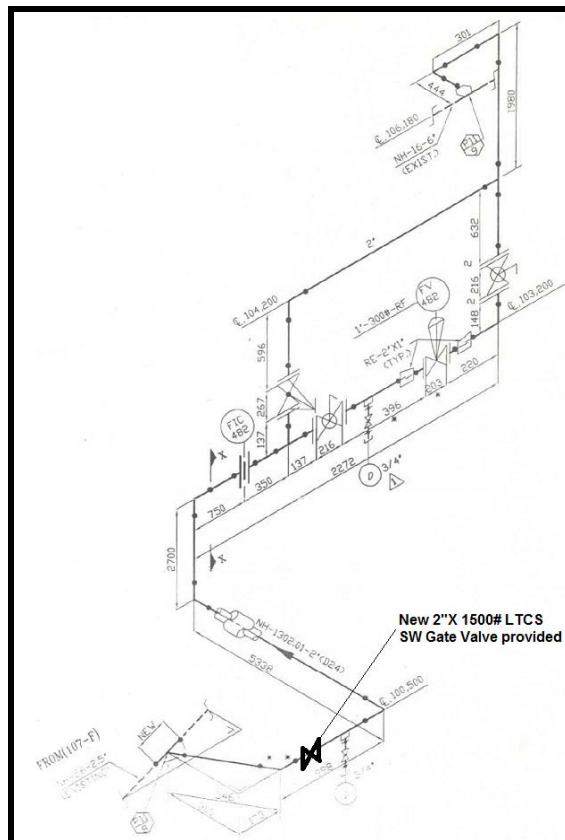
Replaced Pipe Piece & Flange marked in Red colour in Isometry Drg. No. 6332

Ammonia dosing pump:

Old Ammonia dosing pump was replaced with new pump by technical with M/s Shapotool, Mumbai make. Its location was shifted to near DM water tank and hook up was done during normal operation. New SS tank was fabricated from W/S rerouting of piping was done.

Hydrazine pump:

Hydrazine pump and tank was also shifted from front of control room to near DM water tank. Pump levelling & alignment was done. New SS tank was fabricated from W/s. Suction and discharge pipes were rerouted. Fabrication job was done by ARC contractors M/s J&J Engineers.



Provision of additional I/V at u/s of FIC-482 in line from 109-F to 107-F (Isometric Drg. No. NH-1302.01)

VALVE GLAND REPACKING JOBS:

Gland packing of the following valves was replaced by new ones:

- All adjoining valves of 101-F, Aux. Boiler, 112-C & 107-C
- TRC-142 steam valve u/s 2nd i/v gland leak (3 nos. Valve) near PIC 13A
- 101-CA/CB riser & downcomer root I/V
- PIC-15 u/s drain I/V (no margin) near Aux. Boiler West wall
- All valves in ARU
- 101-D inlet I/V

MISCELLANEOUS JOBS

SR. NO.	JOB
1	101-F south side L.G. bottom I/V U/S flange leak (furmanited) - Gasket (1"x 1500#) replaced.
2	FIC-20 orifice flange leak (furmanited) – Gasket replaced.
3	101-BJT TTV drain line flange leak – Gasket replaced.
4	LTS outlet Drain valve u/s flange leak - Gasket (4"x 300#) replaced.
5	FRC 2 Bypass Valve gasket replaced (3" X 600#)
6	FR-501 orifice flange leak (furmanited) - Gasket (3"x 900#) replaced.
7	103-J LO/SO Turbine steam Inlet end flange leak (furmanited) – Flange machined & Gasket (6"X 600#) replaced
8	Vent MIC-107C 1st I/V u/s flange steam leak (furmanited) - Gasket (2" X 600#) replaced
9	181-C steam inlet I/V bonnet leak – Bonnet Gasket replaced
10	MIC-10 u/s & d/s valve flange joint gasket replaced (2" X 150#)
11	101-CA downcomer line chemical dozing blind flange (furmanited) – Gasket replaced
12	101-CA north side riser flange (furmanited) – Gasket replaced
13	Vent to SP-73 I/V flange & RV u/s I/V u/s flange showing explosive – Gasket (Valve Bottom Flange-3" X 600# - 2 nos. Blind Flange - 4" X 600#) replaced.
14	HPFV RV I/V bonnet leak attended
15	N.G. to HPFV I/V at ground floor hard to operate. (Pre.38 kg/cm2g coming from DS outlet) - 2" X 300#,WCB Flanged Gate Valve replaced
16	109-F FIC-482 bypass valve passing – Flanged Globe Valve, 2"X 600# replaced.
17	2004-JT steam inlet valve (Gate Valve, 2"X 600#) replaced.
18	115-JA discharge line drain I/V union leak – Attended thread leak
19	103-J Lube oil filter Change over valve top & bottom overhauled to attend valve passing problem. Valve Seat & other soft seals & packings replaced.
20	115-JA/JB, 115-HT, 116-JA strainer cleaned

NRV's INSPECTION

Inspection of following critical check valves were carried out during Annual Turnaround:

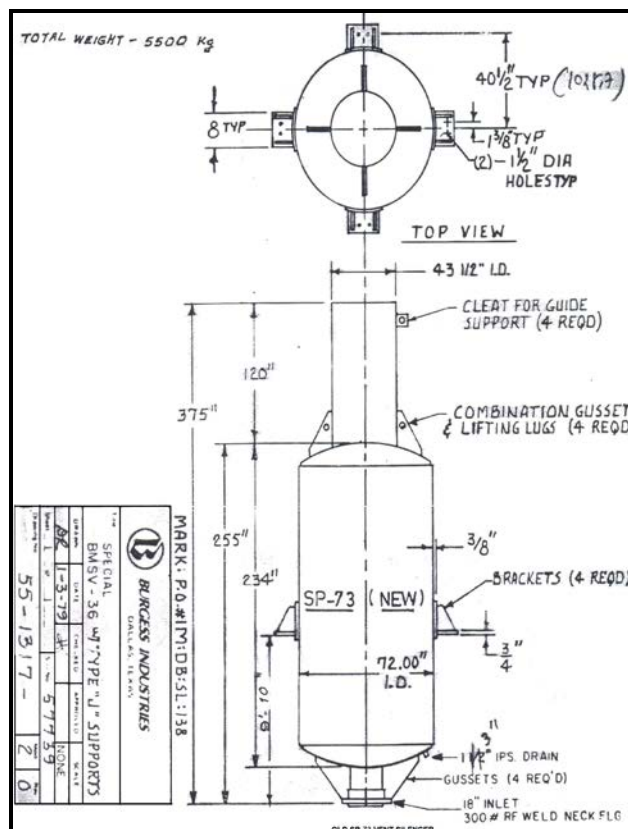
- 103-D air inlet NRV FRC-2 NRV (Steam inlet NRV). Gasket was replaced
- 105-F outlet to 103-J (short loop) HP Case suction
- 103-J final discharge u/s of SP-1.

REPLACEMENT OF SP-73 VENT SILENCER

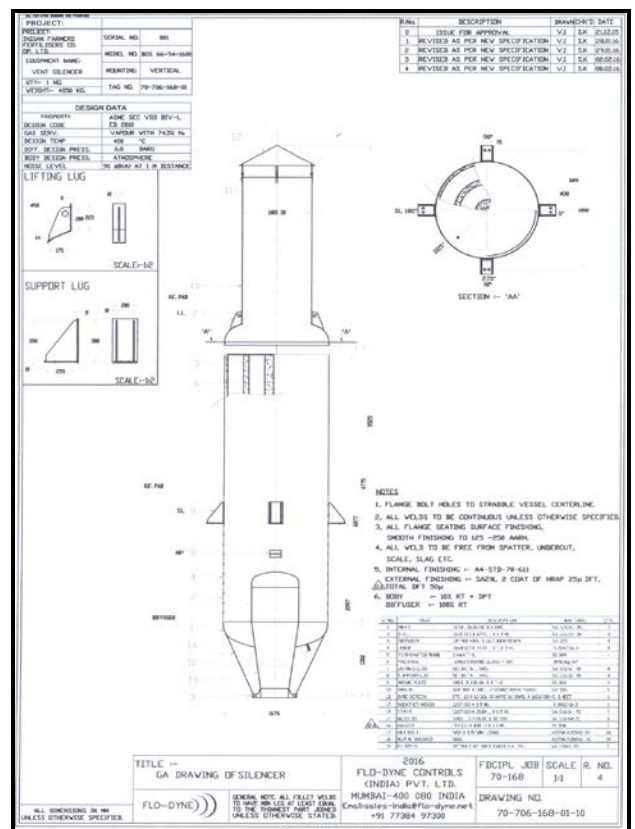
Old Vent silencer, SP-73 (Make: Burgess Industries, Texas, Model: BMSV-36) was brought down in Annual Turnaround 2015 for carrying out Aluminizing of external surface. During Inspection, internals of old Vent silencer, SP-73 was found damaged. Hence, New Vent Silencer, SP-73 was procured from M/s. Flo-Dyne Controls (India) Pvt. Ltd., Mumbai vide PO NO. 201004161033 Dated 09/12/2015 and installed in Annual Turnaround, 2016. The erection job was done by M/S J&J through contract for the opening & box-up of Heat Exchangers. Removal and erection was done using Kobelco crane. Top Canopy at the Silencer outlet was removed before erection as this may restrict the discharge flow.



OLD SP-73 INSTALLED AT SITE



GA DRG. OF OLD SP-73 VENT SILENCER



GA DRG. OF NEW SP-73 VENT SILENCER

Insulation job of NG Feed & Fuel Line

Steam jackets were provided during normal operation over NG fuel line coming from Gail metering station after letdown. It was cut and removed. To prevent corrosion of line decided to provide cold insulation upto exchanger for fuel line and upto desulphuriser for feed line. The insulation was done as given below:

- Application of Bitumen Primer
- 50 mm thk. Mineral wool insulation
- Glass cloth and application of two layers of salicoat
- Aluminium cladding

The job was carried out by M/s Khandelwal Insulation under ARC contract.

UREA PLANT

(MECHANICAL)

ROTATING EQUIPMENT

Hitachi Compressor Train (Q-1801/K-1801):

The following jobs were carried out during the Annual Turnaround 2015.

M/s. BVL Power, H'bad was engaged with our own maintenance group from date 20/03/2014 to 31/03/2016 to complete the job in time.

- Preventive maintenance of steam turbine (Q-1801).
- Preventive maintenance of LP case (K-1801-1).
- Preventive maintenance of HP case (K-1801-2).
- Preventive maintenance of Gear Box (M-1801).
- Calibration of governing system.

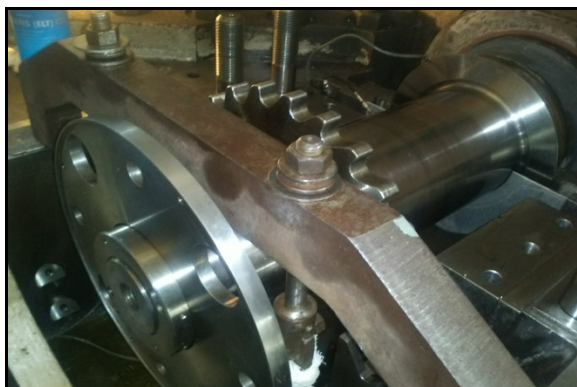
Preventive Maintenance of CO₂ Compressor drive Turbine (Q-1801)

Turbine was taken for preventive maintenance. Following activities were carried out:

- Decoupled the Turbine from LP case.
- Alignment of Turbine and LP case was checked and **found ok**.
- Journal bearing assembly on free end side was opened for inspection. Found clearance values within acceptable limit. (Ref Table-1).



- Journal bearing assembly on LP case side was opened for inspection. Found clearance values within acceptable limit. (Ref Table-1).



- Thrust bearing was opened for inspection. Clearance values were found within acceptable limits.
- Gauss measurement of Journal and thrust bearing pads, base rings, shaft journal, thrust collar were carried out, found within acceptable limit.
- DP testing of pads, thrust collar and journal shaft was done and the same were found acceptable.
- Final alignment readings were taken and corrected as per protocol readings. Details are given in report.



- LP case and Turbine was coupled at the required tightening torque 53.2 kgf.m (521.36 N. m). The Coupling spacer between LP casing & Turbine was assembled.

Table 1-Bearing clearance for Turbine :

Description	Front End Journal bearing	Rear End Journal Bearing
Journal diameter	Ø124.81	Ø159.73
Bearing bore	Ø125.092	Ø160.05
Shell bore	Ø160.00	Ø204.98
Pad thickness	17.454	22.465
Clearance	0.282	0.32
Design Clearance	0.18 to 0.31	0.24 to 0.35

Note: All readings are in mm.

Turbine Thrust Bearing Clearances :

PAD NO.	ACTIVE	PAD NO.	NON ACTIVE
1	19.98	1	20.15
2	19.97	2	20.15
3	19.98	3	20.15
4	19.96	4	20.15
5	19.98	5	20.15
6	19.96	6	20.14
7	19.97	7	20.15
8	19.96	8	20.15

Note: All readings are in mm.

Turbine Rotor Axial Floats :

DESCRIPTION	DESIGN VALUE	ACTUAL VALUE
Turbine Rotor thrust float	0.25 - 0.35	0.24

Preventive Maintenance of CO₂ Compressor LP case (K-1801-1):

LP compressor was taken for preventive maintenance. Following activities were carried out:

- Decoupled the LP case from gearbox and Turbine.
- Alignment of LP case with gear box and turbine was checked and **found ok**.
- Journal bearing assembly on GB side was opened for inspection. Found clearance values within acceptable limits (Ref Table-2).
- Journal bearing assembly on Turbine side was opened for inspection. Found clearance values within acceptable limits (Ref Table-2).
- Thrust bearing assembly was opened for inspection. Clearances value found within acceptable limits.
- Gauss measurement of Journal and thrust bearing pads, base rings, shaft journal, thrust collar were carried out, found within acceptable limits.
- DP testing of thrust pads, thrust collar and shaft journal was done and the same found acceptable.
- Alignment of Turbine - LP Case and LP case – Gear Box was corrected as per protocol values. Details are given in the report.
- LP case with Gear box was coupled at required tightening torque 20 kgf.m (196 Nm) and with turbine was coupled at the required tightening torque 53.2 kgf.m (521.36 N.m). Finally spacers between Turbine - LP case and LP case - Gear box were assembled after alignment correction.

Table 2- Bearing Clearances Data Sheet of K-1801-1 :

Description	Turbine side Journal Bearing	Gear box side Journal Bearing
Journal diameter,	Ø119.98	Ø119.98
Bearing bore,	Ø120.12	Ø120.13
Shell bore,	Ø185.00	Ø185.01
Pad thickness,	32.44	32.44
Clearance,	0.14	0.15
Design Clearance,	0.11 to 0.15	0.11 to 0.15

Note: All readings are in mm.

LP Compressor Thrust Bearing Clearances :

PAD NO.	ACTIVE	PAD NO.	NON ACTIVE
1	19.81	1	19.83
2	19.81	2	19.83
3	19.82	3	19.82
4	19.81	4	19.82
5	19.81	5	19.81
6	19.81	6	19.83
7	19.81	7	19.83
8	19.80	8	19.82
9	19.82	9	19.82
10	19.82	10	19.83
11	19.81	11	19.83
12	19.81	12	19.82

Note: All readings are in mm.

LP Compressor Rotor Axial Float :

DESCRIPTION	DESIGN VALUE	ACTUAL VALUE
Rotor thrust float	0.28 - 0.38	0.37

Preventive Maintenance of CO₂ Compressor HP case (K-1801-2):

HP compressor was taken for preventive maintenance. Following activities were carried out:

- Decoupled the HP case from Gear box
- Alignment readings were checked and **found ok**.
- Journal bearing assembly on Gearbox side was opened for inspection. **Found clearance values within acceptable limit (Clearance values measured are given in Table-3).**
- Journal bearing assembly on free end side was opened for inspection. **Found clearance values within acceptable limit (Clearance values measured are given in Table-3).**



- Thrust bearing was opened for inspection. Clearance values found within acceptable limits.
- Gauss measurement of Journal and thrust bearing pads, base rings, shaft journal, thrust collar were carried out, 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).

Table 3- Bearing Clearance (Diametrical Clearance) Details for HP case :

Description	Gear side – Journal bearing	Rear end – Journal bearing
Journal diameter, mm	Ø79.99	Ø132.00
Bearing bore, mm	Ø80.12	Ø131.87
Shell bore, mm	Ø132.00	Ø132.00
Pad thickness, mm	25.94	25.94
Clearance, mm	0.15	0.13
Design Clearance, mm	0.11 to 0.14	0.11 to 0.14

HP Compressor Thrust Bearing clearance :

PAD NO.	ACTIVE	PAD NO.	NON-ACTIVE
1	22.19	1	22.20
2	22.21	2	22.20
3	22.20	3	22.21
4	22.21	4	22.21
5	22.20	5	22.20
6	22.20	6	22.20

HP COMPRESSOR ROTOR AXIAL FLOAT:

DESCRIPTION	DESIGN VALUE	ACTUAL VALUE
Rotor Axial Float	0.25-0.35	0.33

Preventive Maintenance of GEAR BOX M-1801 :

Gear Box was taken up for major overhauling. Following activities were carried out:

- Decoupled the Gear box from LP case and HP case
- Alignment of Gear box with LP case and HP case was checked and **found ok.**



Low-speed Gear Shaft and Bearings:

- Both Low speed shaft bearings (Elliptical Type) were inspected and clearances values found within acceptable limit. (Clearance values measured are given in Table-4).
- Gauss measurement of pads, journal shaft, thrust collar and bearing was carried out by Inspection section **and found ok.**
- DP checking of thrust bearing pads, thrust collar, journal shaft and bearing was done and found satisfactory.

High-speed Pinion Shaft and Bearings:

- Both Pinion shaft bearings (Offset Halves Type) were opened for inspection **and found ok.**
- Gauss measurement of shaft journal and bearing was carried out by Inspection section and found within acceptable limits.
- DP testing of shaft journal & bearing was done and the same was found acceptable.
- Assembly was done using the same bearings.
- Alignment between LP case – Gear box and Gear box – HP case was corrected as **per protocol readings**. Details are given in this report.
- Gear Box with HP case was coupled at the required tightening torque 9.7 kgf.m (95.06 Nm) and with LP case was coupled at required tightening torque 20 kgf.m (196 Nm)

NOTE:

Both high speed pinion bearing were replaced by new bearing as clearance was found high i.e.0.22 mm.

Both bearing were boxed up and clearance was taken which was 0.16 mm.

It had been checked from previous history report that the clearances were increased to 0.21 against 0.14÷0.184 by M/s HITACHI representative in May 2004 to avoid the bearing failure due to less clearance.

So, both old bearing were installed instead of new one.

Table 4- Bearing clearance for Gear Box :

Description		Design Value (mm)	Clearance
Low speed shaft	Journal bearing clearance on LP side (Front)	0.125 to 0.185	0.15
	Journal bearing clearance on HP side (Rear)	0.125 to 0.185	0.14
	Thrust bearing clearance	0.38 to 0.61	0.46
High speed shaft	Journal bearing clearance on LP side (Front)	0.14 to 0.21	0.22
	Journal bearing clearance on HP side (Rear)	0.14 to 0.21	0.19
Gear backlash		0.383 to 0.608	0.37

Overhauling of Pilot valve of main steam (60 ata), extraction steam (23 ata) and induction steam (4 ata) :

Main Steam (60 ata) Pilot Valve

- Pilot assembly was dismantled.
- All parts were thoroughly cleaned.
- Axial thrust ball bearing was replaced by new one.
- Boxed up the pilot valve assembly.

Extraction Steam (23 ata) Pilot Valve

- Pilot valve assembly was dismantled.
- All parts were thoroughly cleaned.
- Boxed up the pilot valve assembly.

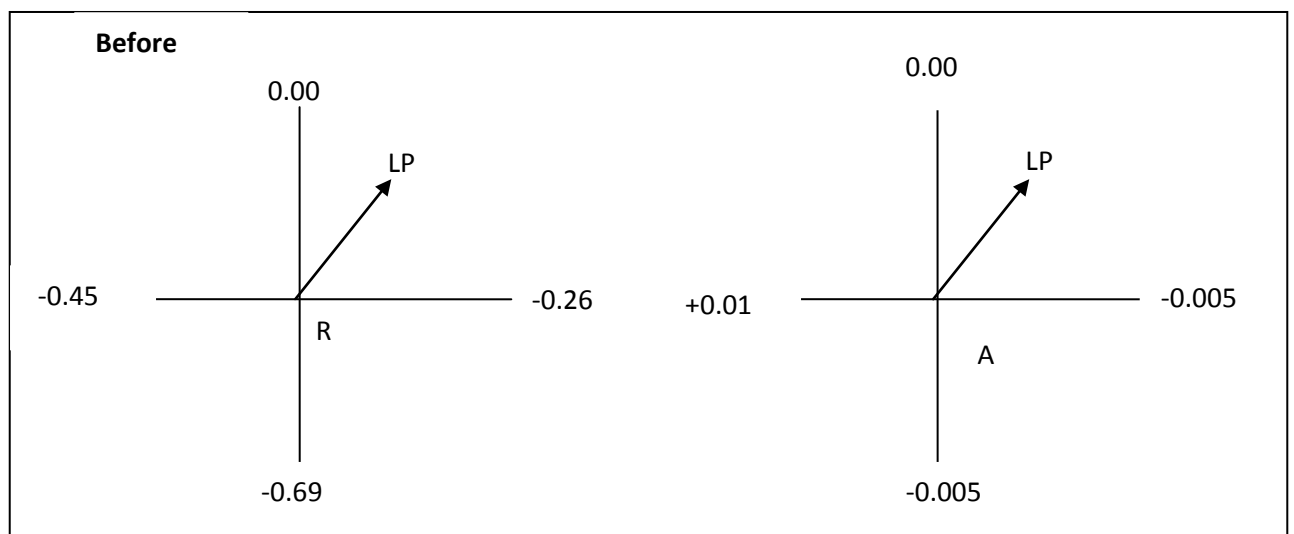
Induction Steam (4 ata) :

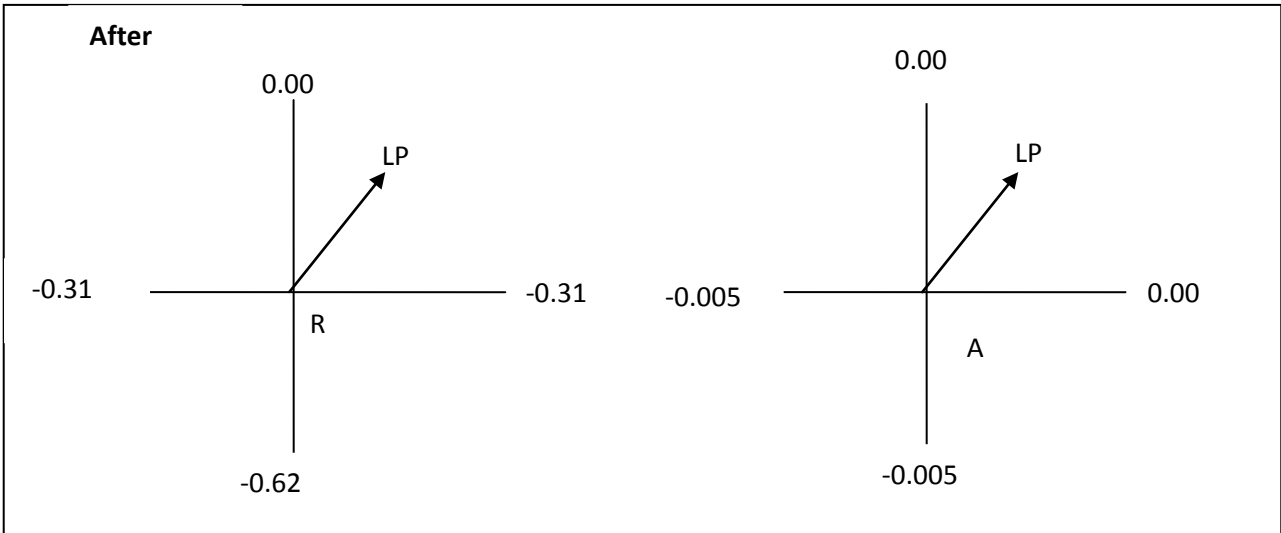
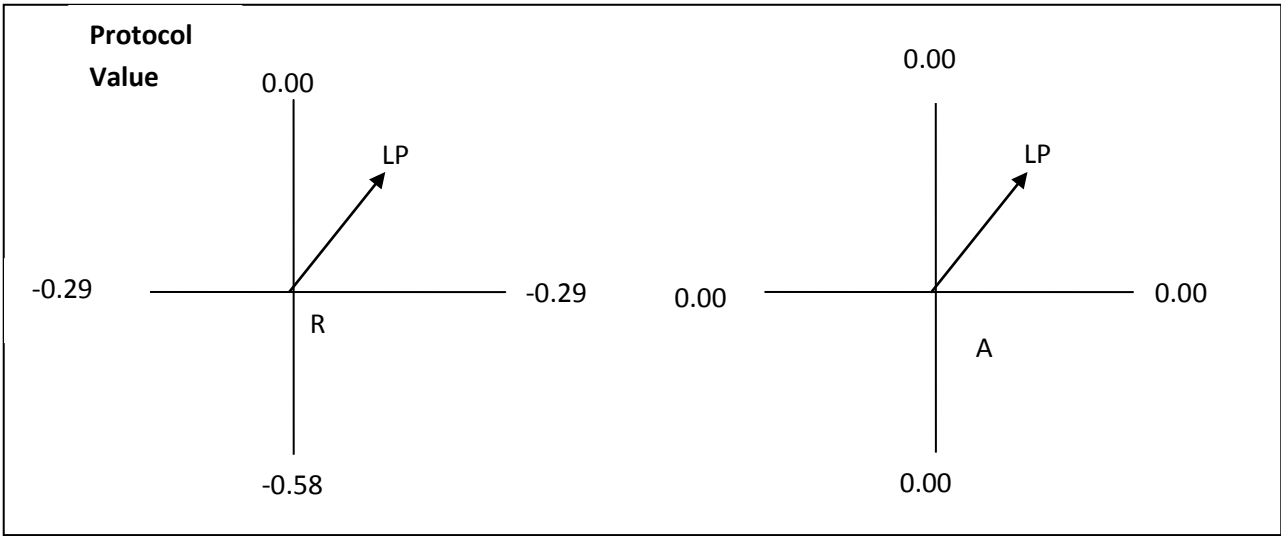
- Servomotor was dismantled.
- Servocylinder seal bush and top and bottom 'o'rings were replaced by new ones.
- Control valve gland packings were replaced by spare ones.
- Pilot valve assembly was dismantled.
- All parts were thoroughly cleaned.
- Boxed up the pilot valve assembly using new sealing set.

BARRING GEAR:

Hydro barring was serviced and top seals were replaced by new ones.

Alignment between Turbine and LP Case :

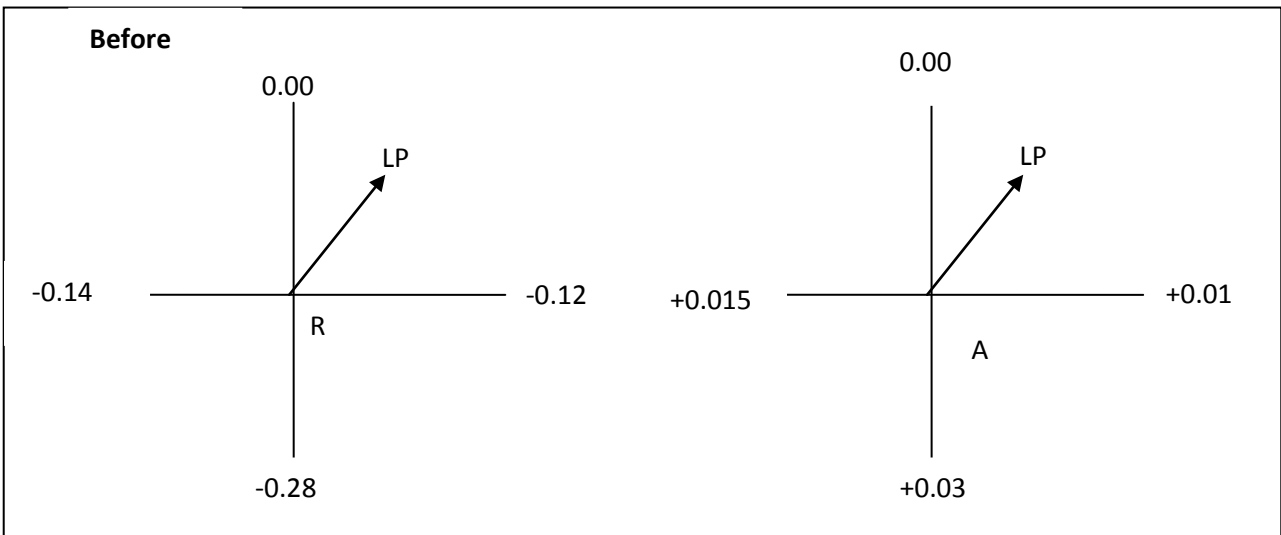


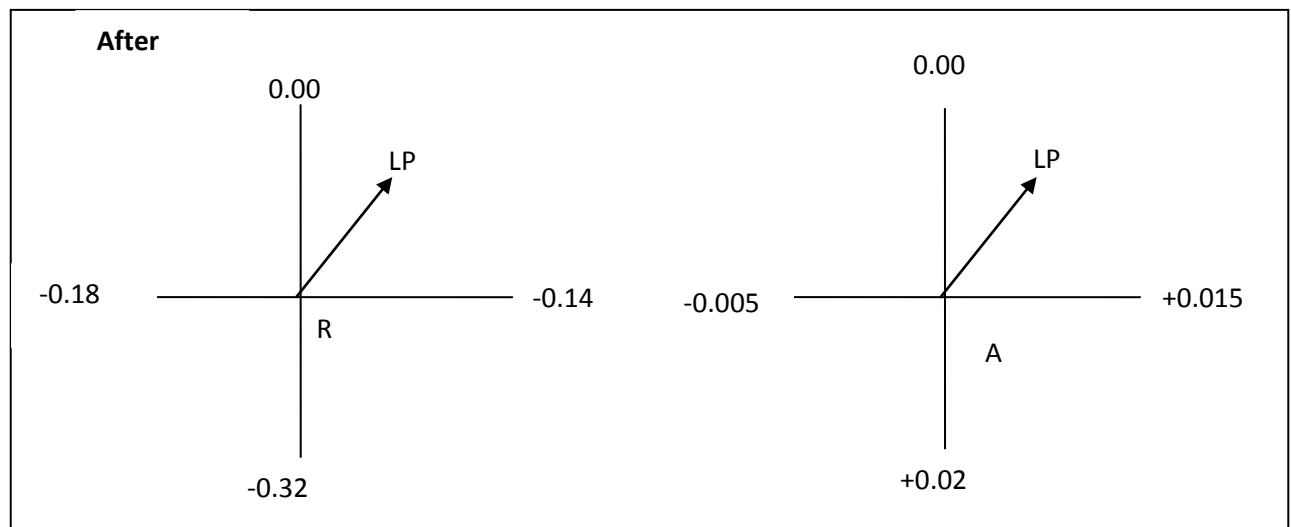
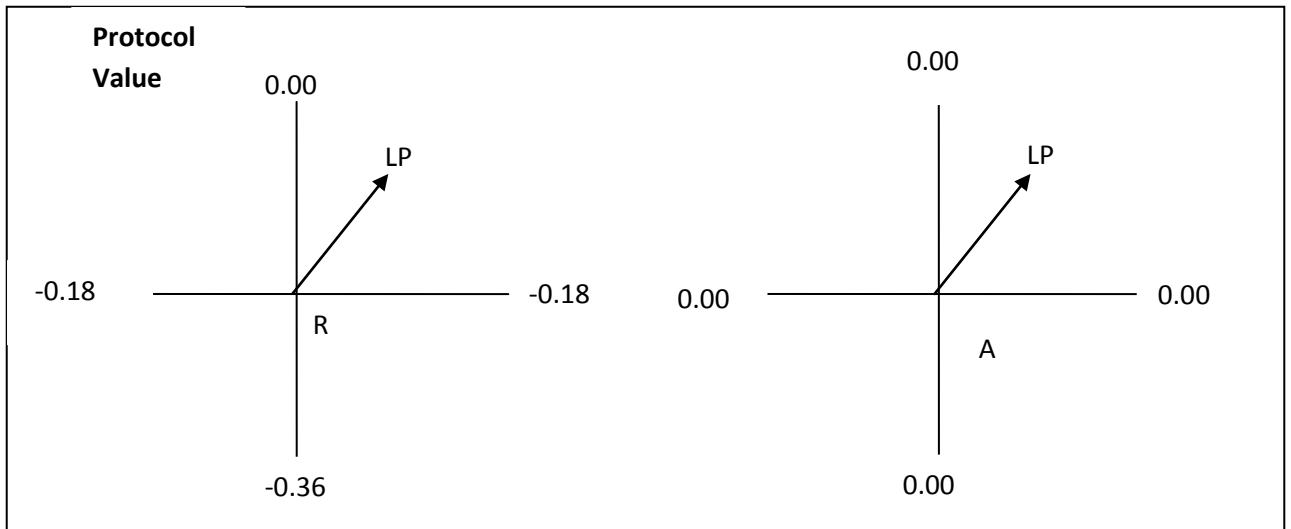


NOTE: 1. Fixture mounted on LP Compressor.

1. Dial reading on Turbine.
2. Looking from Turbine Front Pedestal.
3. All readings are in mm.

Alignment between LP Case and Gear Box

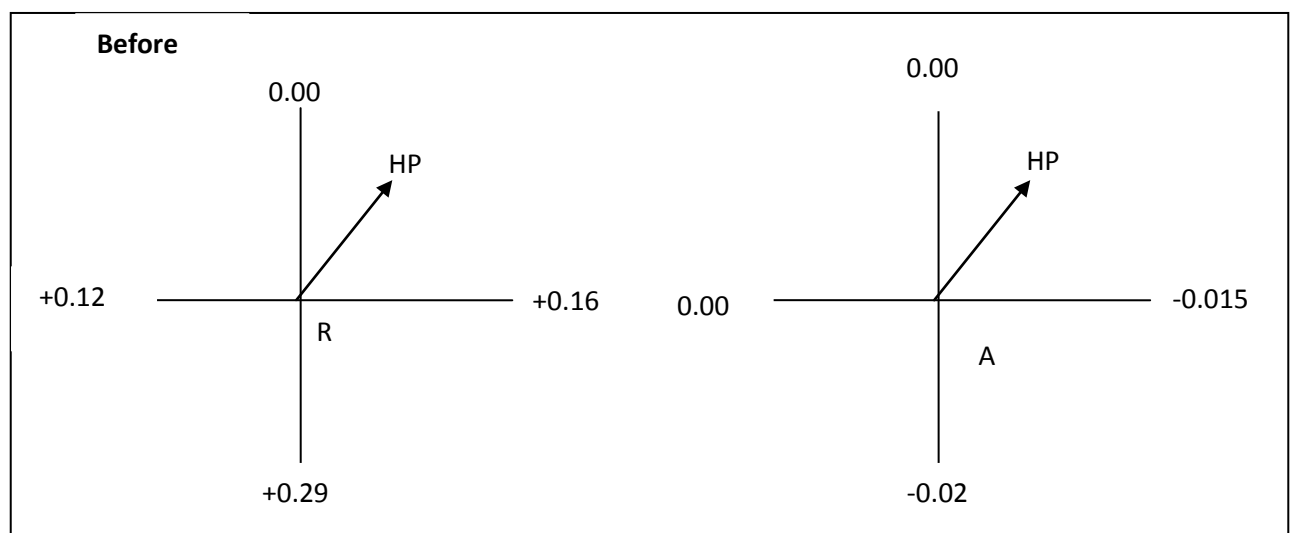


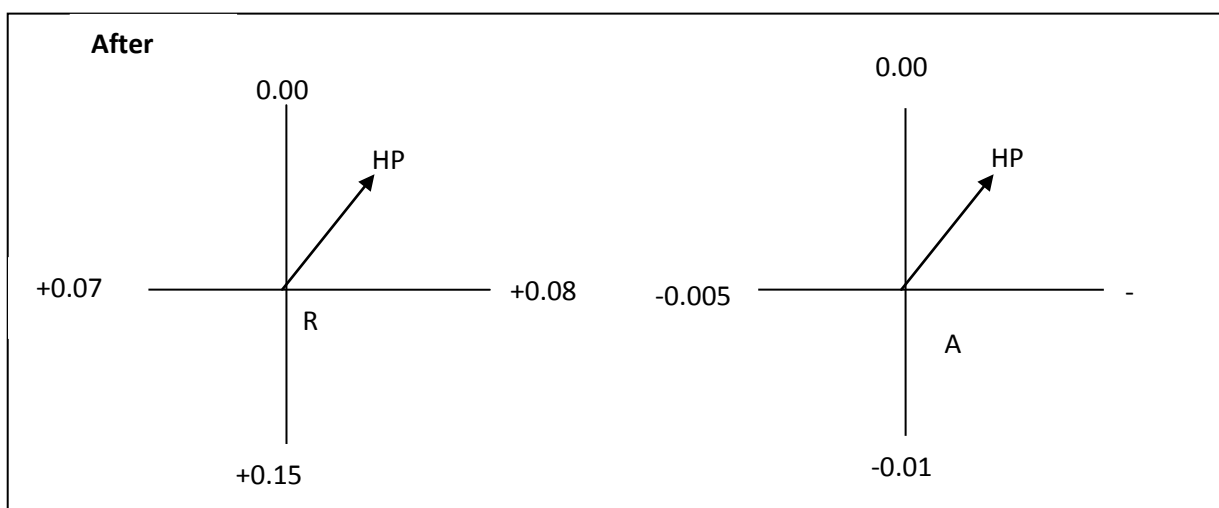
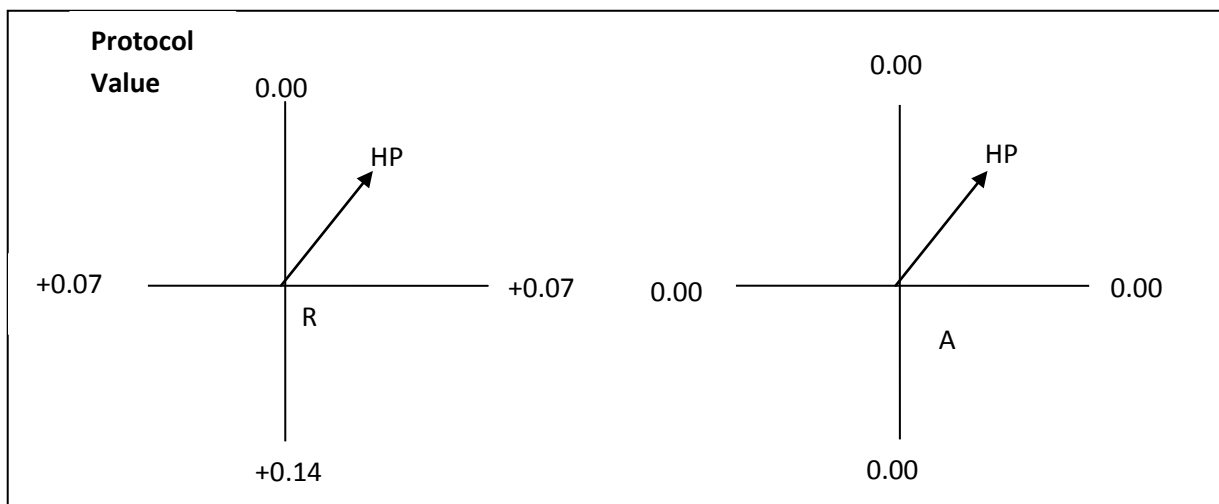


Note :

1. Fixture mounted on Gear Box.
2. Dial reading on LP Compressor.
3. Looking from Turbine Front Pedestal.
4. All readings are in mm.

Alignment between Gear Box and HP Case





NOTE:

1. Fixture mounted on Gear Box.
2. Dial reading on HP Compressor.
3. Looking from Turbine Front Pedestal.

Calibration of control valve lift w.r.t secondary oil pressure:

After assembly of governing system, calibration of control valve lift for 60 ata, 23 ata & 4 ata steam was done with variation of secondary oil pressure respectively in the presence of production and instrument departments.

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)	Milli Ampere MA	Secondary oil pressure	Valve Lift
1	0	1.50	0	1.5	0	4	1.50	0.0
2	10	1.70	5	1.75	1	8	2.15	14.5
3	20	1.95	10	2.00	2	12	2.85	33.0
4	30	2.25	13	2.25	3	16	3.70	46.0
5	40	2.55	17	2.55	5	20	4.55	63.0
6	50	2.85	20.5	2.80	6.5			
7	60	3.15	24.5	3.10	8.5			
8	70	3.50	29	3.45	10.5			
9	80	3.80	33	3.80	13			
10	90	4.15	36.5	4.10	15			
11	100	4.50	41	4.50	30			

Control oil line Accumulator N₂gas pressure was 2.5 kg/cm².

HP VESSEL:

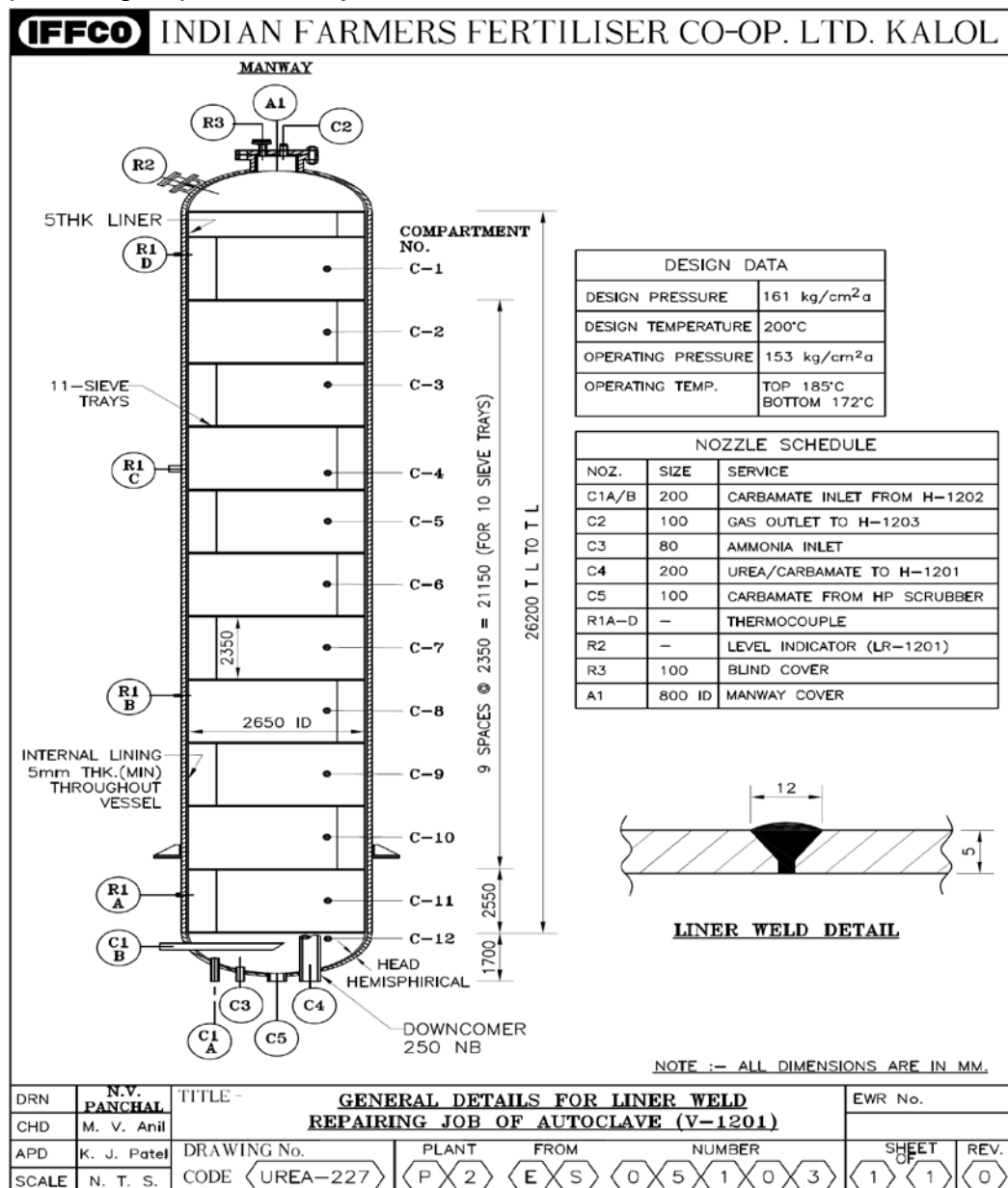
Autoclave V-1201

Repair of Liner weld joints of Autoclave

Liner welds of each compartment of V-1201 were most affected by corrosion. It was decided to repair liner weld one by one during shutdown.

1. During shutdown 2009 liner welds of 1st and 3rd compartment were repaired
2. During shutdown 2010, liner welds of 2nd and 4th compartment were repaired
3. During shutdown 2011, liner welds of 5th compartment were repaired.
4. During shutdown 2012, liner welds of 6th compartment were repaired.
5. During shutdown 2014, liner welds of 7th and 8th compartment were repaired.
6. During shutdown 2015, liner welds of 9th and 10th compartment were repaired.

During shutdown 2016, repairing of liner weld of 11th compartment was carried out. M/s Shree Ganesh Engineering, Ahmedabad was engaged along with our own fabrication and inspection group for above job.



The following repair procedure was followed:

- Weld area was cleaned by SS wire brush.
- Welding joint was ground and flushed. Visible pitting / pores were removed with Grinder and surface was made smooth. It was ensured that grinding was not done deeper than 2 mm below the surface of liner.
- Corroded area of Heat Affected Zone of joints was also grinded and removed.
- DP of grinded portion was carried out. Porosity observed was removed. However if the porosity extends deeper than 2 mm below the surface of liner, it was fused while performing welding.
- Welding was done by TIG using 25-22-2LMn filler wire size -2.4 mm dia with low heat input.
- Inter pass temperature kept below 150 deg. C.
- Minimum three layer of weld was required. At some portions where the width was increased due to removal of corroded portion, an additional layer of welding was applied.
- It was ensured that no area was left ground without welding
- Final DP was carried out.
- Ferrite content was checked. It was found within acceptable limit (Max 0.6 %)
- Finally weld was cleaned and passivated by washing with 10 % HNO₃ and rinsing with DM water.

Autoclave V-1201 Tray Replacement Job :

All the 11 Trays of Autoclave was replaced with high efficiency trays (HET), which were procured by Under ESP III project from M/s Casale. Contract for the fabrication job during the replacement of trays was awarded to M/S Shri Ganesh Engineering Ltd, Ahmedabad @ 12.51 Lacs.

Installation Procedure :

Safety Precautions :

- One/ Two person was positioned (24 x7) at top with register to record entry and exit of each person entering Reactor.
- One safety personal was always be present at top with Portable Oxygen Mask to meet any emergencies.
- Provision of Telephone at the top and Inside the Vessel.
- Availability of Drinking water and Electrolyte powder at top of the vessel.
- Carbon steel material was not permitted inside the reactor
- Stainless steel tools, Non metallic Hammer/ mallets, SS wire brush was used inside Reactor.

Preliminary Jobs

- Plant shut down flushing with condensate and cooling down.
- Provided Blinds in all the vessel nozzles in order to isolate the vessel.
- Remove top cover with bolt tensioner and shift aside the same.
- The existing gasket was left it in position to protect the relevant seating surface.
- Inserted Aluminum ladders in existing trays upto bottom most tray.
- Provided wooden plug on the bottom of the reactor.

Installation work on Tray nr 11

- Dismantled and removed existing tray Nr 11 from top
- Provided scaffolding for Tray No. 11 (about 1200 mm below working level)
- Provided SS Stools (fabricated previously) at even trays (Tray.No.2,4,6,8 & 10)
- Checked and record the Liner thickness.
- Checked the ferrite content.
- The Template provided by M/s CASALE was having marking for '0" degree orientation on Liner considering centerline of Downcomer pipe with Vessel Diameter. (practically, the "0" degree was observed the middle of Two Old Clits welded in Old Trays.
- Then, Clit orientation marking was transferred to Liner.
- The Clit were Tack Welded.
- M/s CASALE had supplied the TSR (Tray Supporting Ring) in Four Segments with Addition length in Segment Number 4. As per drawing, the GAP between Liner and TSR should be 10 mm -0.0 /+2 mm. This need checking of Rings with Match mark of "0" Degree Orientation and grinding of TSR due to Ovality of liner in Vessel etc. { M/s Casale suggested that 10 mm dia round bar should be use for checking and grinding of TSR. Then 8 mm round bar should be used , while tacking of rings on the clits. The reason : as TSR is supplied in FOUR segments, which need to be butt welded, during this welding, the TSR is getting shrinked and then gap between liner and TSR will increase , to more that design}.
- After Grinding, the first , second and third segment of TSR is tack welded with clits by placing 8 mm dia Round Bar and then additional length of TSR is marked and then cut by grinding and welding edge was prepared. Then fourth segment was tack welded.
- After tack welding, butt welding of all four segments was carried out to maximum extent possible with complete Argon purging from both ends.
- Then tacks from clits was cut and Ring was lifted and moved upwards to complete the Butt Welding.
- DP & Ferrite check of Butt welds of Rings.
- Complete weld on Clits with Liner.
- DP & Ferrite check of Welds.
- The TSR was placed on Clits and complete welded was carried out.
- DP & Ferrite Check was performed.
- New trays Inserted and Orientation was matched with slots given in TSR for Bolting.
- Sequence of trays Executed: 11>> 7 & 5>>9 >>3>10& 8& 6>4>1>2 with maximum possibility of execution in multiple trays to the extent possible.

Tray segments installation :

- Tray segments were installed and fixing them by screws, washers and plates following the sequence: A-C-E-B-D-F.
- Bolts were tightened up to torque value 16 Nm
- Tray segments were fitted, and then remove the sectors in order to allow access.
- Washer and bolts were tack weld. This is a special safety measure in new trays to avoid any irregularities in trays at the time of plant disturbance.
- Remove the working platform/ stools

Work completion :

- Final inspection and cleaning by industrial vacuum cleaner starting from the top to the bottom.
 - Remove all protections including the temporary plug.
 - Install and bolt the final sectors of each tray starting from the bottom up to the top. Required torque is 16 Nm.

During removal of ladder and lightening arrangement from the V-1201, all tray segment bolts were tightened. Joint Inspection (Maintenance + production) was carried out and Trays were boxed up. Then after water washing by production from the Top, The Cover was boxed up with new Kempchen make gasket (839 mm OD x 800 mm ID x 4 mm thick) with new 0.5 mm thick Teflon envelop.

- Tightening pressure for top cover.

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

HP Stripper (H-1201) :

Bottom Dome

- Bottom cover was removed using bolt tensioner at 900 kg/cm².
- The bottom cover was lowered onto the wooden sleepers.
- After inspection, the bottom cover was boxed up.
- No repairs /rectifications were required to be carried out.

Top Dome

- Top cover was removed using bolt tensioner at 900 kg/cm².
- The top cover was shifted below the platform using monorail hoist and chain blocks.
- Ferrules were removed from position. Ferrules were thoroughly cleaned by Production department.
- Eddy current testing was carried out by Inspection Department. No repair work was required to be carried out.
- The ferrules were fixed in position with new PTFE gaskets (2600 nos).
- After the bottom cover was boxed up, pressure drop measurement was carried out by production department for each tube and the same was found within limit.
- Exchanger was thoroughly cleaned with compressed air and then with DM water.
- 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.

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

HP Condenser (H-1202) :

- Top flange of off gas lines was opened.
- Bottom flange (H-1202 to V-1201 pipe line) was opened.
- Fasteners of Top cover and bottom cover were loosened using bolt tensioner at 700 kg/cm². Bottom covers were shifted using 2 nos. of 3 ton capacity chain block and top cover was shifted using 1 no. of 5 ton chain block.
- Internals from the top dome were removed.
- After that Eddy current testing of tubes was carried out and found ok.
- Based on visual inspection following repairs were also carried out.
- Weld bead corrosion observed in 2” length at 01 location on dish end to shell liner weld in East direction marked by yellow chalk.
- 01 no. crevice cavity was observed on shell liner longitudinal weld seam in west direction, marked with yellow chalk.
- Pneumatic test of HPCC shell side was carried out at 3 kg/cm².

After inspection, internals were placed on top dome. Top and bottom cover Boxed up with new Kempchen make gasket (839 mm OD x 800 mm ID x 4 mm thick) with 0.5 mm thick Teflon envelop.

- Tightening pressure for top and bottom cover

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

LP Vessel :

Repairing was done in following equipments after manhole opening:

V-1101 (CO2 Knock Out Drum)

New epoxy paint inside of the shell and bottom dish end was done.

V-1503 (9 ATA STEAM DRUM)

U-clamp of the steam inlet header was found loosened, so tightening done.

V-1423 (1st Stage Evaporator Scrubber)

Demister pads were found slightly damaged, loosened & lifted at several locations which are rectified.

V-1206 (Atmospheric vent Scrubber)

Header clamping bolts found loose / nut were found missing which are rectified.

V-1203 (L.P. ABSORBER)

FROM BOTTOM MANHOLE

One no of rasching ring holding tray bolt found shifted from its position and nut of few bolts were found missing which arec rectified.

V-1207 (L.P. SCRUBBER)

Perforated tray observed detached & lying in-between / stuck-up in shell. So, Spares tray was fixed in it.

V-1102 (NH₃ SUCTION FILTER)

Filter was replaced .

Low Pressure Carbamate Condenser, LPCC (H-1205)

IRIS inspection of tubes were carried out after hydrojetting of tubes and found ok.

Finally, hydrotest was carried out at 11 Kg/cm² and and found OK.

Then top dish end and all connected pipe line, other tracing lines and platform which were removed for lifting the tube bundle were fixed/welded and all blinds provided for hydrotest were removed.

2nd stage Evaporator Booster Ejector(P-1423):

Ejector was removed from position with the help of crane as chocking was observed in it.

It was cleaned and boxed up.

VARIOUS FABRICATION JOBS:

Following fabrication jobs were carried out during shutdown:

Replacement of existing corroded CS steam tracing lines

- Various corroded steam tracing lines along with valves and traps were replaced with new CS lines.

Steam Tracing Line details:

Size of Line: ½" & ¾" Sch.40

MOC: ASTM A 106 / A 105

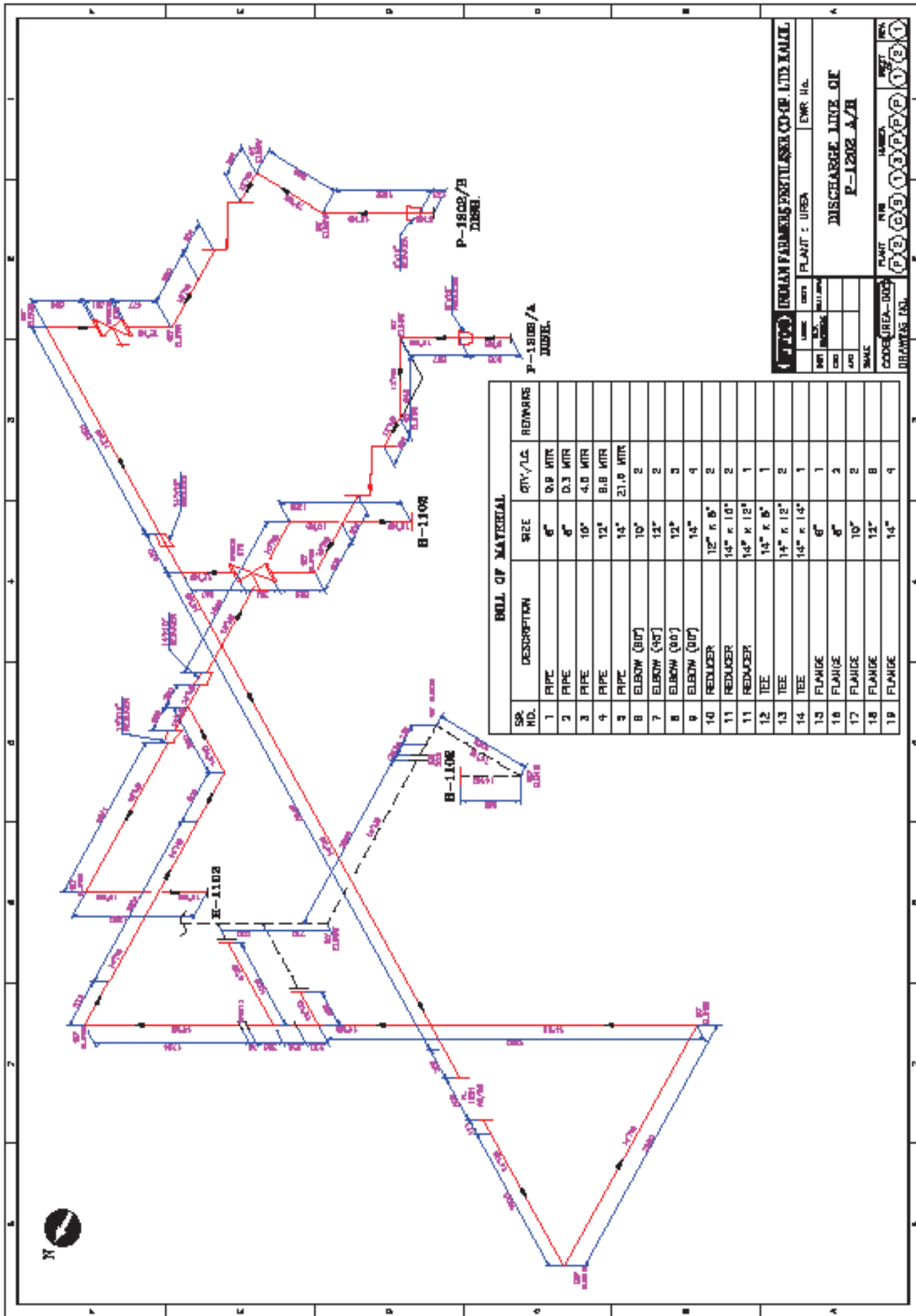
Replacement and modification in CCS-I line at First Floor

Last year, we had completed partial replacement of CCS-1 loop to SS 304. In continuation of that work, it was decided to replace and modify the left out part of CCS-1 loop from first floor to third floor with SS-304 material.

Size of Line: 14" NB, 12" NB, 10" NB and 8" NB, Sch.10

MOC: ASTM A 312 TP 304

Refer: Attached Sketch

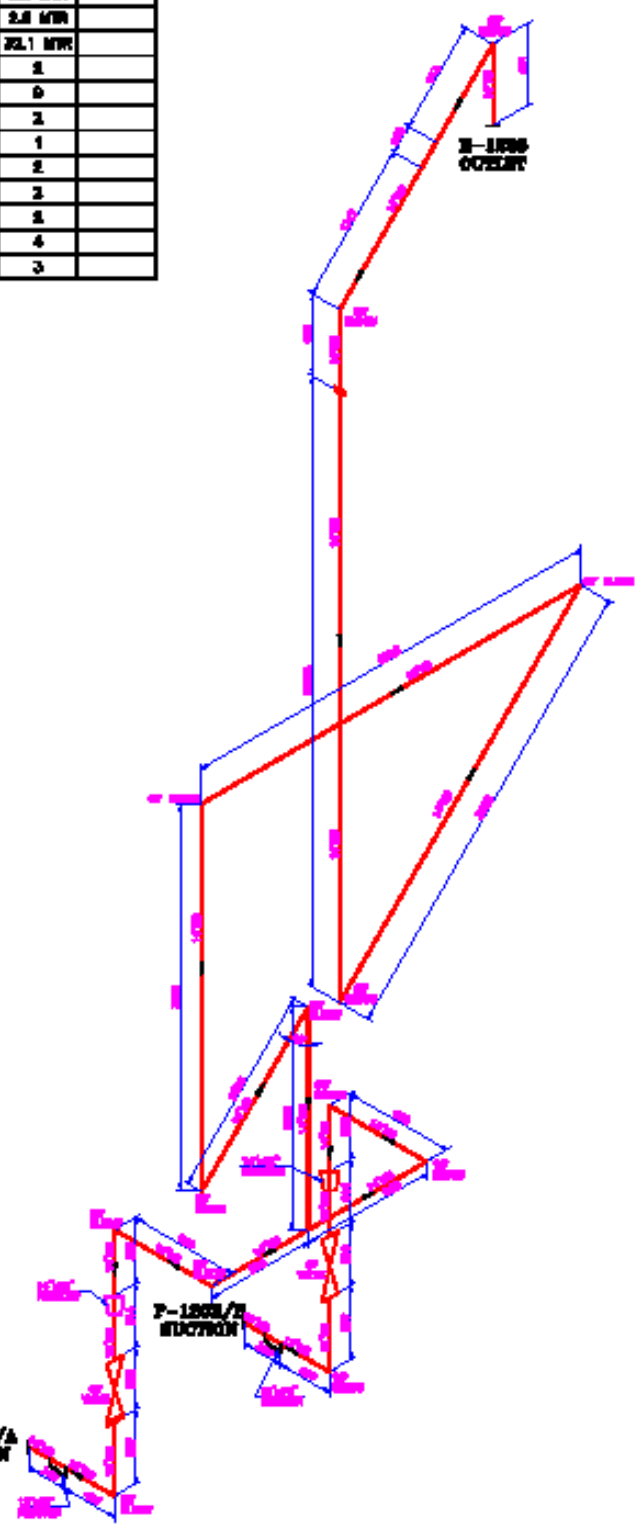


BILL OF MATERIAL

SER. NO.	DESCRIPTION	SIZE	QTY./LC	REMARKS
1	PIPE	6"	0.9 MTR	
2	PIPE	6"	0.3 MTR	
3	PIPE	10"	4.0 MTR	
4	PIPE	12"	8.8 MTR	
5	PIPE	14"	21.9 MTR	
6	ELBOW (90°)	10"	2	
7	ELBOW (90°)	12"	2	
8	ELBOW (90°)	12"	3	
9	ELBOW (90°)	14"	4	
10	REDUCER	12" x 8"	2	
11	REDUCER	14" x 10"	2	
12	TEE	14" x 8"	1	
13	TEE	14" x 12"	2	
14	TEE	14" x 14"	1	
15	FLANGE	6"	1	
16	FLANGE	6"	3	
17	FLANGE	10"	2	
18	FLANGE	12"	8	
19	FLANGE	14"	4	

URBAN FARMERS FERTILISER CO-OP. LTD. KALAJI	
PLANT :	URBAN
ENR. No.	
DISCHARGE LINE OF	
P-1108 A/B	
DATE :	
BY :	
CHKD :	
APP :	
SCALE :	
CODE:URBAN-DIS	PLANT:UR
DRAWING NO.	NO. OF SHEETS
P-1108 A/B	1/1

BILL OF MATERIAL				
SER. NO.	DESCRIPTION	SIZE	QTY./L.S.	REMARKS
3	PIPE	10"	8.3 MTR	
4	PIPE	12"	2.8 MTR	
5	PIPE	14"	22.1 MTR	
7	ELBOW (90°)	12"	2	
8	ELBOW (90°)	14"	6	
9	ELBOW (45°)	14"	2	
14	TEE	14" x 14"	1	
18	REDUCER	10" x 12"	2	
19	REDUCER	12" x 14"	2	
18	FLANGE	10"	2	
19	FLANGE	12"	4	
20	FLANGE	14"	3	



INDIAN FARMERS FERTILISER CO-OP. LTD. RAJAL.

PLANT : URWA

SECTION LINE OF F-1208 A/B

DATE: 1988

DESIGNER: J. J. J.

SCALE: 1:1

NO. OF SHEETS: 1

SHEET NO.: 1

PROJECT NO.: 1

DATE: 1988

DESIGNER: J. J. J.

SCALE: 1:1

NO. OF SHEETS: 1

SHEET NO.: 1



P-1202A/B CCS-1 SUCTION LINE



CCS-1 LINE AT FIRST FLOOR



CCS-1 LINE FROM H-1205/ H-1205-A to P-1202A/B SUCTION

The following activities were carried out;

- Removal of existing CS, CCS-1 line.
- Fabrication and Erection of new SS-304, CCS-1 line at 1st Floor to 3rd Floor in Urea Plant
- Inspection including final weld DP by IFFCO.

Platform behind RV-1201 A/B/C station:

Existing platform at Off gas RV's (RV-1201 A/B/C) was of CS. this RV platform was modified with SS Material.

Replacement of Autoclave (V-1201), Unloading valve at third floor.

Mat. : ASTM A 182 F 316/316L Urea Grade .

K-1401/2/3/4, PT Fan :

PT Fan no. 2 & 4, Duct was replaced by canopy as per production demand.

Recirculation Heater (H-1204) :

6" line was provided at top and bottom dome for chemical cleaning of heat exchanger.

Desorber Reflux Condenser(H- 1352):

4" drain was provided at bottom dome as per production demand.

Prill Cooling System

Inlet Air Fan (K-1701):

- Visual inspection of both bearing was done. Oil flushing of both bearing was done.
- Alignment of both pulleys was done, Belt tension was checked and guard was provided.

Exhaust Air Fan (K-1702):

- Visual inspection of both bearing was done. Oil flushing of both bearing was done.
- Alignment of both pulleys was done, Belt tension was checked and guard was provided.

Conveyor System:

Prill Tower Conveyors (M-1403-1/2/3):

M-1403-1 conveyor:

- All damaged carrying rollers and return rollers were replaced.
- Head pulley and tail pulley bearing was checked and found ok.
- GB teeth were checked, found ok. Oil was flushed.
- Alignment was done between gear box to motor and from gearbox to pulley.

M-1403-2 conveyor:

- Gear Box was replaced by spare one.
- Greasing of chain and sprocket was done.

- Head end pulley was removed as its bearing area of shaft was found damaged. So, it was repaired and boxed up.
- Tail Pulley bearing was checked and its front side bearing was found ok. Rear end bearing block was bent during running of plant. So, it was made straight with the help of jack. Bearing was found ok.
- All damaged carrying rollers and return rollers were replaced.
- Alignment was done between gear box to motor and from gearbox to pulley.

M-1403-3 conveyor:

- All damaged carrying rollers and return rollers were replaced.
- Gear box oil was flushed.
- Coupling bush were checked.
- Alignment was done between gear box to motor and from gearbox to pulley.

Link Conveyor (M-1419):

- All carrying rollers and return rollers were replaced by new HPPE (High Performance Polyethylene) polymer rollers with non metallic composite glass fibre shaft and multi labyrinth sealing system for protecting the bearings from dust ingress.
- Existing belt was replaced with new OHR grade belt.
- Snub pulley and tail pulley were replaced.
- 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.

Prill Cooling System Link Conveyor (M-1421):

- All damaged carrying rollers and return rollers were replaced by new HPPE (High Performance Polyethylene) polymer rollers
- 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.

Dust Conveyor System (M-1702):

- All rollers were replaced by new HPPE polymers rollers.
- 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.

Prill Tower Scraper (M-1402-1/2):

Scraper (M-1402)

Scraper oil was flushed.

Fluid Coupling

- Both Fluid coupling (Hydroflow make) were replaced by spare one.
- Belts were replaced by new one.
- Alignment of motor and coupling was done.

Gear Box of Scraper, M-1402-1/2

- GB foundation bolts were checked and found ok.
- Oil flushed.

Prill Tower ID Fan K-1401-1/2/3/4

K-1401-1/2/3/4

- Both bearing were checked and found ok.
- Greasing of both bearing was done
- Alignment of motor and fan pulley was corrected.

P-1202 A/B CCS-1 Pump :

Old pump was replaced by new Sulzer make pump with SS 316 impeller with new foundation.



M-1402 A/B (PRILL BUCKET)

Bucket assembly was taken for maintenance as its assembly was hard to operate during running of the plant.

PROCEDURE FOR BUCKET ASSEMBLY OPENING :

- Both top chain cover were opened.



- Motor of bucket assembly was removed.
- Bucket assembly unit was hold by chain block during removal of weight.

- Bucket assembly lifting chain was removed.
- Top side sprocket shaft was removed with pedestral bearing.
- Locking spindle of bucket assembly was removed.
- Bucket assembly sliding foundation unit was removed by chain block.



- Same steps were followed to removed other side bucket assembly.
- Main foundation box was opened.
- Assembly was lifted by chain block through bucket room window, platform was made to rest the assembly on it.
- Box bottom journal bearing was opened. (square flange in two pieces)



- Eye bolt at top was fitted to removed the shaft from main box.



- Top bearing were removed from shaft.
- Bearing housing back cover was opened.
- Bearing housing was removed by hydraulic puller after heating.

NOTE :

Top side thrust bearing no. : 51215
Self aligning double row ball bearing no. : NTN 2217
Bearing housing cover oil seal : 10x120x12 mm
Bearing housing oil seal No. : 45x65x10 mm
Shaft pedestral bearing no. : 1207 SKF ENT
Bottom side bearing dimensions :
Shaft dia. : 239.5 mm
Journal Bearing ID :240.9 mm

BEARING ASSEMBLY PROCEDURE:

- Bearing housing cover was fitted with oil seal.
- Bearing 2217 was fitted.
- Earlier, Spacer of width 30.6 mm was fitted, this time, 2.2 mm width spacer was provided as it was loosened.
- Thrust bearing 51215 was fitted.
- Circlip was fitted.
- Bearing housing was fitted after heating.

Vibro priller assembly counter weigh (05 plates) were removed because of removal of redundant motor.

Drain point was provided at top bearing so that bearing will not fail due to lack of lubrication.

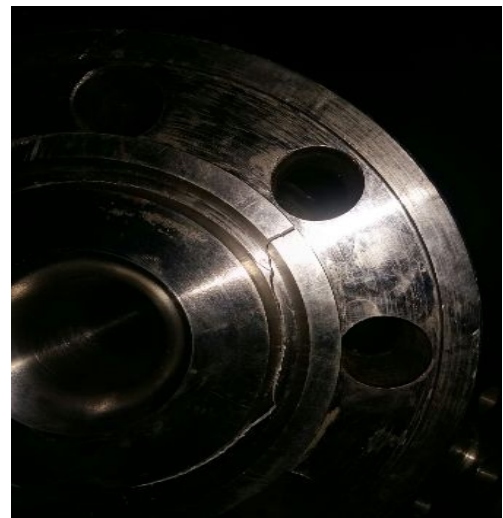
Both bucket assembly were fitted on both sides and handover to production.

Replacement of off Gas line RV-1201 A/B :

There are total 3 relief valve in off gas line RV-1201 A/B/C. It was decided to replace all three relief valves make Tyco Sanmar in annual shutdown for smooth running of plant throughout the year.

We have received Tyco Sanmar make relief valve with new HVD1 nozzle and high capacity spring with a range of 2357 TO 2537 PSIG (05 nos.) and we have also received 01 no. spring and 01 no. HVD1 nozzle separately.

Out of 5 Relief Valve, 1 Relief Valve was taken at RV station, PT Top and installed at position. During installation, HVD1 nozzle was cracked from gasket seating area.



Crack HVD1 Nozzle

In presence and consultation with Tyco Sanmar representative, other relief valve with HVD1 nozzle was installed again, nozzle was cracked.

Later on, It was decided to installed Relief Valve with SS 316L nozzle with new high capacity spring. So, same were reconditioned by M/s Flotec. Also, 03 nos. Relief Valve were repaired and keep it as spare in store.

RELIEF VALVE OVERHAULING AND TESTING

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

Following RV's were removed, overhauled and tested on valve test bench:

Sr. No.	RV No.	Description	Test Medium	Set Pressure Kg/cm² g	Reset Pressure Kg/cm² g
1	RV-1201 A	V-1201 off gas line	Nitrogen	165	150
2	RV-1201 B	V-1201 off gas line	Nitrogen	165	150
3	RV-1201 C	V-1201 off gas line	Nitrogen	165	148
4	RV-1205	P-1201 A discharge	Water	165	148
5	RV-1206	P-1201 B discharge	Water	165	148
6	RV-1208	P-1201 C discharge	Water	170	148
7	RV-1103 A	P-1102 A discharge	Water	150	135
8	RV-1103 B	P-1102 B discharge	Water	150	135
9	RV-1103 C	P-1102 C discharge	Water	150	135
10	RV-1181	K-1801 final discharge	Nitrogen	177	159
11	RV-1903	K-1801 3 rd stage discharge	Nitrogen	111	99.82
12	RV-1901	1 st stage discharge of K-1801.	Nitrogen	8	7.12
13	RV-1902	2 nd stage discharge of K-1801	Nitrogen	28	25.12
14	RV-1513 A	P-1502 A Discharge	Water	200	180
15	RV-1513 B	P-1502 B Discharge	Water	200	180
16	RV-1573	P-1502 Final Discharge	Water	180	162
17	RV-1904	First Stage gas cooler	Water	8	7.3
18	RV-1905	H-1812 Second Stage Gas Cooler	Water	8	7.3
19	RV-1906	H-1812 Third Stage Gas Cooler	Water	8	7.3
20	RV-1907	P-1817 Lube Oil Pump Discharge	Water	5	4.3
21	RV-1910	Lube oil Pump (P-1814) Discharge	Water	6	5.4
22	RV-1916	23 ata exhaust	Water	28	26
23	RV-1917	4 Ata Exhaust	water	5	4.5
24	RV-1911	Surface Condenser C.W.Outlet	Water	8	7.30
25	RV-1912	Surface Condenser C.W.Outlet	Water	8	7.3
26	RV-1913	Surface Condenser Vapour	water	0.2	
27	RV-1914	Surface Condenser Vapour	water	0.2	
28	RV-1915	Turbine Exhaust	Water	0.1	

CLEANING AND HYDROJETTING OF HEAT EXCHANGERS :

- H-1204 (Recirculation Heater)
- H-1207 (Circulation System - li Water Cooler)
- H-1352 (Desorber Reflux Condenser)
- H-1418 (Separator, Pre-Evaporator, Hot Water Part)
- 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-1813
- H-1205
- H-1201
- H-1204

NRV Inspection

Following NRVs in Urea Plant were opened, inspected and boxed up.

- P-1352 A/B suction condensate flushing line NRV.
- P-1408 suction drain condensate flushing NRV.
- T-1401/A to P_1401 A/B suction line sample point condensate flushing line NRV.
- V-1352 to H-1352 gas inlet line condensate flushing line NRV.
- P-1201 A/B/C suction (first floor) condensate flushing line NRV.
- ANR-1202 (N/C ratio meter) condensate line NRV/Strainer (first floor) near three way monoblock valve.
- BFW to P-1304 suction line NRV.
- DM Water to P-1211 A/B suction line NRV.
- Melt return line (HICV-1422)condensate flushing NRV (Prill bucket room)
- P-1501/P1506 discharge to V-1503 (9ata drum)
- P-1501/P1506 discharge line NRV.
- P-1352 A/B discharge to H-1205/H-1205A reflux condensate flushing line.
- ANR-1203 (Carmamate density meter) sample line condensate flushing NRV.
- 9 ata stem injection to D/S line HICV-1208 (Top V-1205)
- 4 ata steam injection to P-1201 A/B/C Suction & discharge RV's NRV.
- 4 ata to 9 ata NRV for H.P.Vessel & H.P.process line steam tracing (Second floor)

- 9 ata to H-1202 steam injection NRV (Third floor)
- 4 ata to V-1202 off gas line NRV.
- 4 ata to PRCV-1201 jacket.
- 9 ata to injection to V-1203/1207 off gas and V-1203 level troll.
- 4 ata injection to HICV 1424 D/S to V-1206.
- 9 ata to injection to PRCV-1202 U/S, D/S & HICV-1208 D/S off gas through orifice.
- 4 ata injection to LIC-1202 level troll.
- 4ata injection to P-1201A/B/C suction/discharge RV.
- 9 ata injection to V-1353 off gas.
- 4 ata to jacket of P-1201 C suction dampner.
- 4 ata to N/C ratio meter RV and jacket of back pressure regulator at LP side.
- 23 ata to injection to LIC-1351 level troll.
- 4 ata injection to H-1421 bottom.
- 4 ata to P-1408 suction/ discharge line jacket.

Process and Steam leak Jobs:

Process Jobs

Sr. No.	JOB DESCRIPTION	TAG NO	REMARKS
	COMPRESSOR :-		
1	H-1813 cooler tube leak.	35	Checked and found ok
2	60 ata steam drain trap not working properly behind H-1303.	34	Trap checked and found ok. By pass valve was passing and replaced
3	Final discharge NRV	36	Internals were replaced
4	H-1815 ejector to be check for not getting vaccum.	33	Condensate flushing nozzle were repaired
5	23 ata extraction NRV to be check.	28	Checked and found ok.
6	23 ata vent I/V to be attended for passing.	29	1-1/2"X 800# SW valve replaced.
8	60 ata trap is passing	31	Replaced
9	H-1815 RV seal pot to be checked,	30	Checked and found ok
	GROUND FLOOR :-		
10	P-1102/B 2nd dish I/V passing	1	4"X 900# Globe Valve replaced
11	P-1102/A 2nd R/C I/V passing.	2	4"X 900# Globe Valve replaced
12	Stripper O/L both gear valve I/V & CO2 to stripper gear valve I/V's lock nut to be replaced	3	
13	P-1201/A suction drain I/V not operatable	4	1-1/2" SW ball valve SS 316 replaced
14	V-1502 LT LP tapping I/V bonnet leak, stripper shell side vent 2nd I/V bonnet leak.	5	Replaced
	FIRST FLOOR :-		
16	P-1201/B 1st dish I/V passing.	14	2" BEL valve replaced
17	P-1201/A suction I/V passing. Not operatable	13	4" X 150# Gate valve NO2 replaced
18	Hot NH3 supply MOV-1102 & its I/V passing (1st floor)	9	Repaired
19	V-1202 LG leak & cover provided to be attended.	15	Gasket replaced

20	4 ata steam I/V gland leak near P-1201/A suc I/V on pillar.	12	Replaced
21	CCS-1 RV at 1st floor (H-1102 O/L line) pinhole leak.	7	Job attended
22	V-1202 steam tracing leak near LG.	16	Line replaced
23	H-1102 NH3 outlet line both RVs are passing	8	Both were repaired
24	N/C ratio meter 1st I/V bonnet leak	11	Valve replaced
	SECOND FLOOR :-		
25	V-1103 suction vessel RV is passing towards P.T	18	Repaired
	THIRD FLOOR & 3-1/2 floor		
26	V-1201 unloading 1st I/V passing.	26	2" BEL valve replaced
27	V-1205 level glass(sight glass) leak.	27	LG replaced
28	PIC-1201 D/S HPF line 1st I/V wheel missing	25	1/2" BEL valve replaced
	FOURTH FLOOR	80	
29	V-1501 (4 ata drum) level glass PT side top I/V wheel free.	44	3/4" 800# SW Globe Valve replaced
	SIXTH FLOOR		
30	HPF CO2 to scrubber both HPF I/V passing at 6th floor.	22	Valve repaired
	PCS/NEEM OIL		
33	P-1701A dis. I/V passing to be attended	21	1-1/2" X150# SS Flange end Ball Valve, repaired

STEAM TRACING LINES & TRAPS REPLACEMENT JOB:

STEAM TRACING LINES & TRAPS REPLACEMENT JOB			
Sr. No.	DESCRIPTION	LOCATION	REMARK
1	V-1201 bottom steam tracing lines along with traps	3 rd Floor	Replaced
2	Near HICV-1425 steam tracing line pin hole leak job	3 rd Floor	Replaced
3	H-1201 shell vent to 9ata drum top vent I/V not operable	3 rd Floor	Replaced
4	V-1205 top 9 ata injection Orifice /trap/tracing	3rd floor	Replaced
5	HIC-1208 D/S steam injection flange leak	3rd floor	Gasket replaced
6	V-1205 bottom Nr. PRC-1202 transmitter steam trap	3rd floor	Replaced

UTILITY & OFFSITE PLANT

(MECHANICAL)

PREVENTIVE MAINTENANCE OF ROTARY EQUIPMENTS

COOLING TOWER AREA

Preventive Maintenance of CW Pump, P-4402:

Following activities were carried out during PM

- Coupling between the pump and motor was decoupled.
- Both the journal bearings were opened, checked & found OK.
- Bearing clearances were measured and recorded.
- During assembly correct positioning of oil splash ring in the bearing housing was ensured.
- Gland cooling water lines was opened, cleaned and boxed up
- After alignment gland was repacked with new 25 MM Sq PTFE gland packings.
- Finally new oil was filled in both bearing housings.
- Free rotation of the pump after coupling was ensured.
- Final Clearance chart is as under:

Sr. No.	Description	Design Value (MM)	Value after PM (MM)
1	Front end journal clearance (by lead wire)	0.20-0.30	0.21-0.23
2	Rear end journal bearing clearance (by lead wire)	0.2-0.30	0.20
3	Front end journal bearing interference	0.02-0.05	0.05
4	Rear end journal bearing interference	0.02-0.05	0.04

- Final alignment between pump and motor was done by laser alignment machine. Readings are as under;

Position	Parallel offset	Angular offset	Correction required	
			Foot-1	Foot-2
Horizontal (H)	0.04	0.00	0.04	0.04
Vertical (V)	0.06	0.00	0.09	0.14
All readings are in mm				

Preventive Maintenance of CW Pump, P-4403 Train

CW Pump P-4403:

Following activities were carried out during PM

- Coupling between the pump and GB was decoupled.
- Both the journal bearings were opened, checked and found ok.
- Bearing clearances were measured and recorded.
- During assembly correct positioning of oil splash ring in the bearing housing was ensured.
- Gland cooling water lines was opened, cleaned and boxed up
- After alignment gland was repacked with new 25 MM Sq PTFE gland packings.
- New oil was filled in both bearing housings.
- Free rotation of the pump after coupling was ensured
- Final Clearance chart is as under

Sr. No.	Description	Design Value (MM)	Value after PM (MM)
1	Front end journal clearance (by lead wire)	0.20-0.30	0.21
2	Rear end journal bearing clearance (by lead wire)	0.20-0.30	0.22
3	Front end journal bearing interference	0.02-0.05	0.04
4	Rear end journal bearing interference	0.02-0.05	0.05

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 and 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 measured & found higher than design value. Bearing condition was found ok, therefore boxed up using same bearing.
- Complete governor removed from position and then again fixed after complete overhauling.
- 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.
- Oil filter cleaned.

- Gland steam leak off port and lines cleaned.
- Final clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value after PM
1	Axial thrust	0.25-0.30	0.35
2	Front end journal bearing clearance (by lead wire)	0.127-0.18	0.22
3	Rear end journal bearing clearance (by lead wire)	0.127-0.18	0.24

Gear Box (GB-4403):

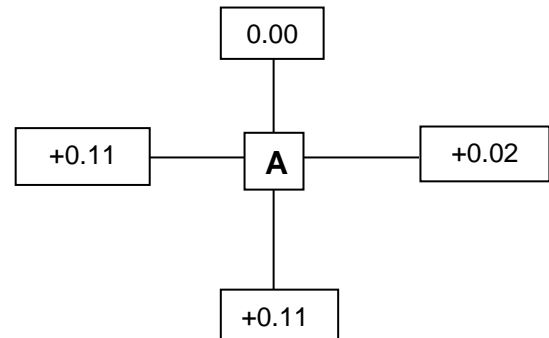
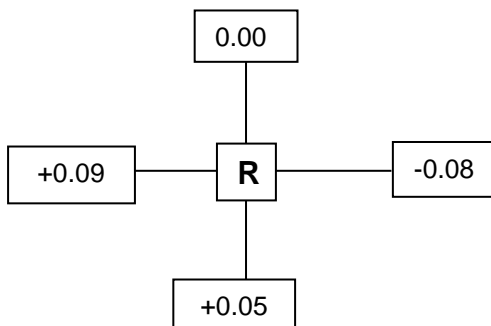
Following activities were carried out:

- 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 and recorded.
- Gear wheel thrust was measured and recorded.
- Pinion wheel float was also measured and recorded.
- All oil lines checked and cleaned.
- Duplex oil filter cleaned.
- Final clearance chart is as under;

Sr. No.	Description	Design Value (MM)	Value after PM (MM)
1	Pinion front bearing clearance	0.15 - 0.20	0.16 - 0.18
2	Pinion rear bearing clearance	0.15 – 0.20	0.18
3	Gear wheel front end bearing clearance	0.20 – 0.30	0.20
4	Gear wheel rear end bearing clearance	0.20 – 0.30	0.22
5	Gear wheel axial thrust	0.50 – 0.60	0.25
6	Gear backlash	0.40 – 0.45	0.40

- Final alignment between turbine to gear box was done by dial gauge. Readings are as under

Turbine to Gear Box



Dial on Gear Box
View from turbine front
All readings are in mm

- Final alignment between gear box and pump was done by laser alignment machine. Readings are as under;

Position	Parallel offset	Angular offset	Correction required	
			Foot-1	Foot-2
Horizontal (H)	-0.49	0.02	-0.36	-0.25
Vertical (V)	2.14	0.18	3.73	4.96
All readings are in mm				

Preventive Maintenance of CW Pump, P-4401/B Train:

CW Pump, P-4401/B:

Following activities were carried out during PM

- Coupling between the pump and GB was decoupled.
- Both the journal bearings were opened, checked and found ok.
- Bearing clearances were measured and recorded.
- During assembly correct positioning of oil splash ring in the bearing housing was ensured.
- Gland cooling water lines was opened, cleaned and boxed up.
- After alignment gland was repacked with new 25 MM Sq PTFE gland packings.
- Finally new oil was filled in both bearing housings.
- Free rotation of the pump after coupling was ensured
- Final Clearance chart is as under

Sr. No.	Description	Design Value (MM)	Value after PM (MM)
1	Axial thrust		
2	Front end journal clearance (by lead wire)	0.20-0.30	0.20 – 0.22
3	Rear end journal bearing clearance (by lead wire)	0.2-0.30	0.22 – 0.23
4	Front end journal bearing interference	0.02-0.05	0.05
5	Rear end journal bearing interference	0.02-0.05	0.05

Turbine, Q-4401/B (Triveni make)

Following activities were carried out during PM

- Coupling between the Turbine and GB was decoupled.
- Both sides of the turbine bearings were opened, cleaned, checked, found OK and boxed up.
- Turbine Bearing Clearances were checked and found higher than design value. Bearing condition was found ok therefore boxed up using same bearing.
- Axial thrust of the Turbine was measured and recorded.

- Complete governor removed from position and then again fixed after complete overhauling.
- Fresh oil was filled 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.
- Oil filter cleaned.
- Gland Steam leak off port and lines cleaned.
- Final Clearance chart is as under;

Sr. No.	Description	Design Value (mm)	Value after PM
1	Axial thrust	0.25-0.30	0.30
2	Front end journal bearing clearance (by lead wire)	0.127-0.18	0.22 – 0.24
3	Rear end journal bearing clearance (by lead wire)	0.127-0.18	0.20 – 0.23

Gear Box, GB-4401/B:

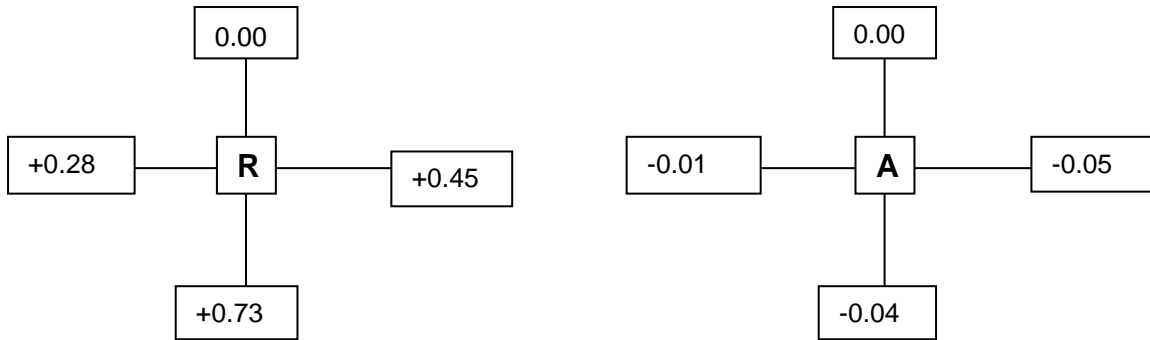
Following activities were carried out during PM;

- 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 was measured and recorded.
- Gear wheel thrust was measured and recorded.
- Pinion wheel float was also measured and recorded.
- All oil lines checked and cleaned.
- Duplex oil filter cleaned.
- Final clearance chart is as under

Sr. No.	Description	Design Value (MM)	Value after PM (MM)
1	Pinion front bearing clearance	0.15 - 0.20	0.18 – 0.20
2	Pinion rear bearing clearance	0.15 – 0.20	0.17- 0.19
3	Gear wheel front end bearing clearance	0.20 – 0.30	0.23 – 0.25
4	Gear wheel rear end bearing clearance	0.20 – 0.30	0.23
5	Gear wheel axial thrust	0.50 – 0.60	0.500
6	Pinion axial thrust	0.40	0.30
7	Gear backlash	0.40 – 0.45	0.45

- Final alignment between turbine and gear box was done by dial gauge. Readings are as under

Turbine to Gear Box



Dial on Gear Box
View from turbine front
All readings are in mm

Preventive Maintenance of CW Pump, P-4401/A Train & Replacement of existing CS base frame of pump with new SS 304 base frame

CW Pump, P-4401/A:

Following activities were carried out;

- Coupling between the pump and GB was decoupled.
- Both the journal bearings were opened, checked & found ok.
- Bearing clearances were measured and recorded.
- Suction & discharge bellow of pump were removed.
- Pump foundation bolts were loosened
- Pump was lifted & shifted to safe location with the help of Kobelco crane and placed on new fabricated SS base frame for marking.



- Old CS base frame was removed after marking reference points at site.
- 4 nos. of 4" dia drilled (425mm length) holes were done at RCC foundation by civil section.
- New SS base frame was placement on its position & fixed it with matching reference points.

- Leveling of base frame was done by providing the shims.
- Grouting of base frame was done along with foundation bolts on position & cured for 4 hrs.
- Pump was placed on new SS base frame.
- Alignment of pump with gear box was checked & corrected
- During assembly correct positioning of oil splash ring in the bearing housing was ensured.
- Gland cooling water lines was opened, cleaned and boxed up
- After alignment gland was repacked with new 25 MM Sq PTFE gland packings.
- Finally new oil was filled in both bearing housings.
- Free rotation of the pump after coupling was ensured
- Final Clearance chart is as under;

Sr. No.	Description	Design Value (MM)	Value after PM (MM)
1	Front end journal clearance (by lead wire)	0.20-0.30	0.22
2	Rear end journal bearing clearance (by lead wire)	0.2-0.30	0.20
3	Front end journal bearing interference	0.02-0.05	0.04/0.05
4	Rear end journal bearing interference	0.02-0.05	0.04

Turbine, Q-4411 (Elliot make):

Following activities were carried out during PM;

- Coupling between the Turbine and GB was decoupled.
- Turbine bearings were opened & cleaned
- Both turbine journal bearing clearances were measured higher than design value. Bearing condition was found ok therefore boxed up using same bearing.
- Axial thrust of turbine was measured and recorded.
- Governor was cleaned, checked and fresh oil is filled in it.
- Governor linkages were also made free.
- 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.
- Gland steam leak off port and line cleaned.
- All oil lines cleaned and flushed.
- Oil sump cleaned.

- Oil cooler tubes cleaned by hydrojetting.
- Oil filter replaced.
- Fresh oil servo Press T-32 filled in oil sump.
- 16 nos. of washer (coupling bolt) were found damaged & replaced the same with new ones.
- 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
1	Axial thrust	0.25-0.30	0.40
2	Front end journal bearing clearance (by lead wire)	0.127-0.18	0.27-0.28
3	Rear end journal bearing clearance (by lead wire)	0.127-0.18	0.26

Gear Box, GB-4411:

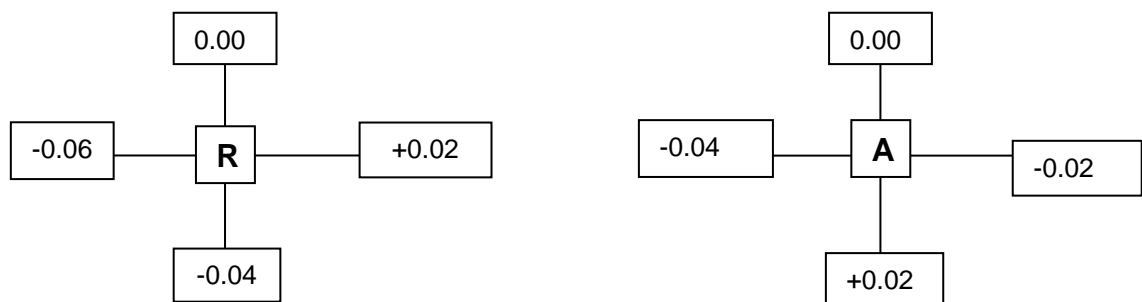
During Preventive maintenance following activities were carried out:

- Gear box top cover removed.
- All the bearing top half's were removed.
- Cleaning of journal on both gear wheel & pinion wheels.
- Cleaning of bearings is carried out.
- Cleaning of bearings covers is carried out.
- Bearing clearances are measured using lead wire and recorded.
- Bearings are assembled back.
- Top covers are assembled back.
- Main Oil Pump drive coupling checked and found ok.
- All oil lines were cleaned and flushed.
- Oil sump was cleaned.
- Oil cooler tubes were cleaning by hydrojetting.
- Duplex Oil Filters were cleaned.
- New Oil filled in oil sump
- Final clearance chart is as under;

Sr. No.	Description	Design Value (MM)	Value after PM (MM)
1	Pinion front bearing clearance	0.15 - 0.20	0.18-0.20
2	Pinion rear bearing clearance	0.15 – 0.20	0.19-0.20
3	Gear wheel front end bearing clearance	0.20 – 0.30	0.25-0.28
4	Gear wheel rear end bearing clearance	0.20 – 0.30	0.28
5	Gear wheel axial thrust	0.50 – 0.60	0.60
6	Pinion axial thrust		
7	Gear backlash	0.40 – 0.45	0.44

- Final alignment between turbine to gear box was done by dial gauge. Readings are as under

Turbine to Gear Box



Dial on Gear Box
View from turbine front
All readings are in mm

- Final alignment between pump and gear box was done by laser alignment machine. Readings are as under;

Position	Parallel offset	Angular offset	Correction required	
			Foot-1	Foot-2
Horizontal (H)	0.00	0.00/100	-0.02	-0.06
Vertical (V)	0.03	0.01/100	0.00	-0.11
All readings are in mm.				

Preventive Maintenance of CW Pump, P-4401/C:

Following activities were carried out during PM

- Coupling between the pump and motor was decoupled.
- Both the journal bearings were opened, checked and found ok.
- Bearing clearances were measured and recorded.
- During assembly correct positioning of oil splash ring in the bearing housing was ensured.
- Gland cooling water lines was opened, cleaned and boxed up
- After alignment gland was repacked with new 25 MM Sq PTFE gland packings.
- Finally new oil was filled in both bearing housings.

- Free rotation of the pump after coupling was ensured.
- Final Clearance chart is as under;

Sr. No.	Description	Design Value (MM)	Value after PM (MM)
1	Front end journal clearance (by lead wire)	0.20-0.30	0.22 – 0.24
2	Rear end journal bearing clearance (by lead wire)	0.20-0.30	0.20 – 0.22
3	Front end journal bearing interference	0.02-0.05	0.04
4	Rear end journal bearing interference	0.02-0.05	0.05

- Final alignment pump between motor and pump was done by laser alignment machine. Readings are as under;

Position	Parallel offset	Angular offset	Correction required	
			Foot-1	Foot-2
Horizontal (H)	-0.06	0.00/100	-0.08	-0.11
Vertical (V)	+0.03	0.01/100	+0.09	0.18
All readings are in mm				

Preventive Maintenance of CW Pump, P-4401/D & Replacement of existing CS base frame with new SS 304 base frame

Following activities were carried out during PM

- Coupling between the pump and GB was decoupled.
- Both the journal bearings were opened, checked & found ok.
- Bearing clearances were measured and recorded.
- Suction & discharge bellow of pump were removed.
- Pump foundation bolts were loosened
- Pump was lifted & shifted to safe location with the help of Kobelco crane and placed on new fabricated SS base frame for marking.
- After alignment gland was repacked with new 25 MM Sq PTFE gland packings.
- Finally new oil was filled in both bearing housings.
- Free rotation of the pump after coupling was ensured
- Old CS base frame was removed after marking reference points at site.
- 4 nos. of 4” dia drilled (425mm length) holes were done at RCC foundation by civil section.
- New SS base frame was placement on its position & fixed it with matching reference points.
- Leveling of base frame was done by providing the shims.
- Grouting of base frame was done along with foundation bolts on position & cured for 4 hrs.

- Pump was placed on new SS base frame.
- Alignment of pump with gear box was checked & corrected
- During assembly correct positioning of oil splash ring in the bearing housing was ensured.
- Gland cooling water lines was opened, cleaned and boxed up
- After alignment gland was repacked with new 25 MM Sq PTFE gland packings.
- Finally new oil was filled in both bearing housings.
- Free rotation of the pump after coupling was ensured
- Final Clearance chart is as under;

Sr. No.	Description	Design Value (MM)	Value after PM (MM)
1	Front end journal clearance (by lead wire)	0.20-0.30	0.21 – 0.24
2	Rear end journal bearing clearance (by lead wire)	0.20-0.30	0.23 – 0.24
3	Front end journal bearing interference	0.02-0.05	0.04
4	Rear end journal bearing interference	0.02-0.05	0.05

- Final alignment pump to motor was done by laser alignment machine. Readings are as under

Position	Parallel offset	Angular offset	Correction required	
			Foot-1	Foot-2
Horizontal (H)	0.06	0.00/100	0.06	0.06
Vertical (V)	0.01	0.01/100	-0.04	-0.13
All readings are in mm				

BOILER AREA

PREVENTIVE MAINTENANCE OF BFW PUMP, P-5111 TRAIN

BFW Pump (P-5111)

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 journal on both sides of the pump was carried out.
- 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.
- Rear side thrust bearing was removed
- Thrust pads were found ok.
- Both the sides bearings and bearing covers were assembled back

- Strainer was removed, cleaned and assembled back.
- Final Clearance chart is as under

Sr. No.	Description	Design/ Recommended Value (MM)	Value after PM (MM)
1	Axial thrust	0.28-0.33	0.16
2	Front journal bearing clearance	0.13-0.18	0.14
3	Rear journal bearing clearance	0.13-0.18	0.15/0.16
4	Front journal bearing interference	0.02-0.05	0.05
5	Rear journal bearing interference	0.02-0.05	0.05

- Thickness of thrust pads were also measured and recorded.

Thrust Pads thickness

Sr. No	Active	Inactive
1	22.16	22.19
2	22.16	22.19
3	22.19	22.22
4	22.19	22.18
5	22.19	22.18
6	22.20	22.19

- Residual Magnetism (Gauss) at bearing journals and bearing were checked.
- All oil lines cleaned and flushed.
- Oil sump cleaned.
- Oil cooler tubes cleaning done.
- Oil Filters cleaned.
- Fresh oil filled in oil sump.

Drive turbine (Q-5111)

Following activities were carried out during PM:

- Decoupled the turbine
- Instruments probes were removed
- Governor top cover and giver or are removed
- Thrust bearing & journal bearings top half's 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;

Sr. No.	Description	Design/ Recommended Value (MM)	Value after PM (MM)	OIL SEAL L/R
1	Axial thrust	-	0.27	
2	Front journal bearing clearance	-	0.14	0.25
3	Rear journal bearing clearance	-	0.15	0.20
4	Front journal bearing interference	-	0.01	
5	Rear journal bearing interference	-	0.05	
6	Mop Gear Backless		0.26	
7	Governor Gear Backless		0.28	

- Final alignment pump to turbine was done by laser alignment machine. Readings are as under ;

Position	Parallel offset	Angular offset	Correction required	
			Foot-1	Foot-2
Horizontal (H)	-0.26	0.07/100	-0.85	-1.23
Vertical (V)	0.09	0.02/100	0.21	0.30
All readings are in mm				

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 journal on both sides of the pump
- Cleaning of bearings and bearing covers was carried out
- DP test was conducted on all the journal bearings & thrust pads and found ok.
- Measured the bearing clearances and found ok.
- Rear side thrust bearing was removed
- Thrust pads were found ok
- Both side bearings and bearing covers were assembled back.
- Strainer was removed, cleaned and assembled back.
- Final Clearance chart is as under;

Sr. No.	Description	Design/ Recommended Value (MM)	Value after PM (MM)
1	Axial thrust	0.28-0.33	0.28
2	Front journal bearing clearance	0.13-0.18	0.16 / 0.18
3	Rear journal bearing clearance	0.13-0.18	0.15 / 0.16
4	Front journal bearing interference	0.02-0.05	0.03
5	Rear journal bearing interference	0.02-0.05	0.03

- Thickness of thrust pads were also measured and recorded.

Thrust Pads thickness

Sr. No	Active	Inactive
1	22.18	22.19
2	22.19	22.19
3	22.18	22.18
4	22.19	22.19
5	22.19	22.19
6	22.19	22.19

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 and MOP 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.
- Measured the bearing clearances and found ok.
- Final Clearance chart is as under;

Sr. No.	Description	Recommended	Value after PM (MM)
1	Pinion, front journal bearing clearance	0.15 – 0.20	0.16/0.17
2	Pinion, rear journal bearing clearance	0.15 – 0.20	0.15/0.16
3	Gear wheel, front journal bearing clearance	0.15 – 0.20	0.16/0.18
4	Gear wheel, rear journal bearing clearance	0.15 – 0.20	0.15/0.17
5	Pinion, front journal bearing interference	-	0.03
6	Pinion, rear journal bearing interference	-	0.05

7	Gear wheel, front journal bearing interference	-	0.03
8	Gear wheel, rear journal bearing interference	-	0.03
9	Gear backlash	-	0.30
10	Input Gear Thrust		0.28

- Final alignment motor to gear box was done by laser alignment machine. Readings are as under;

Position	Parallel offset	Angular offset	Correction required	
			Foot-1	Foot-2
Horizontal (H)	-0.09	0.07/100	-0.45	-1.33
Vertical (V)	0.14	0.10/100	0.66	1.91
All readings are in mm				

PREVENTIVE MAINTENANCE OF FD FAN (K-5113) / DRIVE TURBINE (Q-5113)

Following activities were carried out during PM :

- Decoupled the turbine
- Decoupled Fan from Turbine
- Removed oil lines & Governor
- Gearbox cover was opened and checked the condition of Gears. The same was cleaned; DP test was carried out and assembled back.
- Backlash between gear wheel to pinion was checked.
- Cleaned the Radial bearings.
- Dimensional Inspection, DP test & Gauss measurement of Journal bearings were done. Results were found satisfactory.
- Main oil console was cleaned and recharged with new oil (SERVO PRIME 68).
- MOP was removed from its position & cleaned. Coupling Bush of MOP was replaced.
- Oil cooler was opened and cleaned by Hydro jetting.
- Cleaned Duplex oil filter & replaced O-ring.
- The air dampers were attended for proper working. The Fan inlet air mesh screen was changed.
- Between turbine and fan coupling rubber pads were replaced
- The clutch oil (Servo Trans fluid-A) was replaced.
- The clearances were checked & following are the readings

GEAR BOX CLEARANCE

Description		Clearance	Interference
Pinion	Front bearing	0.15 / 0.16	0.03
	Rear bearing	0.15	0.03
Gear Wheel	Front bearing	0.14 / 0.16	0.02
	Rear bearing	0.16	0.02
Fan	Front bearing	0.12	
	Rear bearing	0.12	
Gear Backless		0.20	
Low Speed Gear Thrust		0.28	

BHEL BOILER JOBS

Bhel Boiler Inspection/Hydrotest:

Boiler was inspected by Boiler Inspector in open condition on 23/03/2016 & Hydro test was carried out at 89.0 kg/cm² pressure on 29/03/2016 and witnessed by Boiler Inspector.

Testing of Boiler RV's

Critical boiler RV's were removed, overhauled and then tested on test bench. RV testing readings are as under:

Description		Set pressure (Kg/cm ² g)	Reset pressure (Kg/cm ² g)	Seat tightness test pressure (Kg/cm ² g)	Remarks
Boiler Drum Front RV Tag no. RV-F-5111-2 Make : Crosby Model : HCL-56-IBR-IFN-SPL Size : 2" x J x 4"	On Valve testing Machine	69.00	-----	62.10	Locking washer thickness 12.70mm, seat diameter 34.29mm
Boiler Drum Rear RV Tag no. RV-F-5111-1 Make : Crosby Model : HCL-56-IBR-IFN-SPL Size : 2.5" x K x 6"	On Valve testing Machine	72.00	-----	64.80	Locking washer thickness 17.20mm, seat diameter 45.72mm
Boiler Super Heater RV Tag no. RV-16126 Size : 1.5" X 3" Model: 1717 WD	On Valve testing Machine	64.60	-----	58.14	Locking washer thickness 12.00mm, seat diameter 28.56mm.
	Online Floating	64.70	62.20	-----	

Description		Set pressure (Kg/cm ² g)	Reset pressure (Kg/cm ² g)	Seat tightness test pressure (Kg/cm ² g)	Remarks
Tag no. RV-Q-5111 Size : 4" x 6" Model : SL-131	On Valve testing Machine	5.00	-----	4.50	
RV-CBD-Tank Size : 1" x 3"	On Valve testing Machine	6.00		5.40	
Tag no. RV5113 Size : 2.5" x 4" Model : 3SL-131	On Valve testing Machine	4.50		4.00	

Boiler Schedule & Timing

Sr. n/o	Description	Date	Time, hrs
1	Urea plant shutdown	19-03-16	17:55
2	40 ata to ammonia plant, supply	19-03-16	02:10
3	40 ata to ammonia plant, back-off	20-03-16	15:00
4	Boiler bottle-up	20-03-16	15:30
5	Boiler force cooling	20-03-16	23:10
6	Boiler natural cooling	21-03-16	23:00
7	Permit for man power entry	22-03-16	23:30
8	IBR open inspection	23-03-16	10:30
9	IBR Hydrotest inspection	29-03-16	11 :30
10	Boiler start-up	03-04-16	08:00
11	40 ata to ammonia plant	03-04-16	16:15
12	SSH RV online testing	04-04-16	15:30
13	40 ata to ammonia plant, back off	05-04-16	08:30
14	60 ata to urea plant	04-04-16	21 :10
15	Feed cut-in by urea plant	05-04-16	11 :15

Steam Drum / Mud Drum:

Manhole covers of both side of steam & mud drum were opened. Inside cleaning was done by using SS wire brush. In steam drum 2 nos. of loosened fasteners were tightened. In mud drum, 1" NB phosphate dosing pipe holding clamp was observed in loose condition and few bolts of blow down line, located at bottom cover plate, observed in loose condition. Both were tightened. Manhole covers of steam & mud drum were boxed up after successful IBR open inspection.

Deaerator:

Bottom two tray segments were found displaced from its position. All tray segments were removed one by one from the top by cutting tack welding. From bottom, each tray segment was placed its position one by one. Total 8 nos. of new larger size tray (Size: 1140mm length x 410mm width x 3mm thickness) and 2 nos. of smaller new size tray (Size: 1140mm length x 224.5mm width x 3mm thickness) were used.

Boiler Furnace:

All furnace manhole covers were opened. SSH top coil (no. 36) existing ceramic fiber blanket was replaced by new one & calcium silicate coating done on it. New insulation was provided at several locations based on as per thermography survey report and also replaced the damaged insulation with new one. Out of four furnace & burner, two broken sight glasses were replaced with new ones. All manhole covers of furnace were boxed up after completion of IBR Hydrotest

Air Pre-Heater (APH)

All manway covers of APH were opened. Air inlet side one deflection plate welding joint was observed in cracked condition. The same was repaired by welding. Epoxy coating was applied on cold flue gas side chamber after thorough cleaning. APH manway covers were boxed-up after completion of IBR Hydrotest

Other Boiler Jobs:

- All five oil coolers were cleaned by hydrojetting
- 4 ata steam header to deaerator drain line welding joint was repaired by grinding / DP / welding
- Corroded deaerator drain line 2" NB, was replaced with new one.
- Alignment of all AOP pumps & P-5117 A/B, P-5118 A/B, P-5119 A/B & P-5120 was done with overhauled motors respectively.
- All 1st & 2nd isolation valves of steam drums were gland repacked.

COOLING TOWER AREA JOBS

Installation of Sintex makes Partition Panel in New Cooling Tower (H-4404-1/2/3).

During shutdown-2014, old wooden damaged partition panels of old ammonia cooling tower cells A1-A2, A2-A3 and A3-A4 were replaced by new sintex make PVC section partition panels. After finding satisfactory performance of new PVC partition panel, during shutdown 2015, existing wooden partition panels of remaining cooling tower cells A4-A5 & A5-A6 were also replaced with the same. In continuation, during shutdown-2016, existing wooden partition panel of new cooling tower **NCT 1-2 & NCT 2-3** were replaced with new PVC partition panel.



Job was awarded to M/s Abhay Fabricators, Kalol against the work order No. 201004161478 dated 29/02/2016

Replacement of Drift eliminator of existing Wooden Herringbone type drift eliminators with PVC Honeycomb type drifts eliminators in Ammonia CT cell No. 1/2/3

WO 201004160733 dated 05/10/2015 was placed on M/S Paharpur Cooling Towers Limited, Vadodara for replacement of existing Wooden Herringbone type drift eliminators with PVC Honeycomb type drift eliminators in Ammonia CT Cell No.1/2/3.



Wooden drift eliminator of ammonia CT cell no. 4/5/6 was already replaced with PVC honeycomb type drift eliminator. Along with preventive maintenance of Ammonia CT fan 2 & 3, replacement job of drift eliminator was carried out in same cell. Remaining job in ammonia CT cell no. 1 was carried out during shutdown.

Following activities were carried

- Prefabrication of PVC Honeycomb type drift eliminator at site
- Prefabrication of wood and ply for PVC Honeycomb type drift eliminator.
- Dismantling of existing Wooden Herringbone type drift eliminators.
- Installation of new PVC Honeycomb type drift eliminators in Ammonia CT Cell No. 1/2/3.

Replacement of existing Solid FRP fan blades with hollow FRP fan blades in New Cooling Tower (H-4404-1/2/3)

In IFFCO Kalol Unit, out of 14 nos. of cooling tower cells, only 3 cells are having solid FRP fan blades, remaining 11 nos. of cooling tower cells are already having hollow FRP fan blades . IFFCO contacted the vendor M/s Coolflo, Mumbai & discussed regarding requirement of new hollow FRP blades having modified aerofoil design to save energy and reliability. Vendor proposed the supply of new hollow FRP fan blades having 3rd generation modified aerofoil design, in the place of existing solid FRP fan blades, with 20% guaranteed energy saving. WO 201004151429 dated 19/03/2015 was placed to supply the three set of modified fan blade assembly from M/s Coolflo Engineers Pvt. Ltd. Mumbai for new cooling tower K-4404/1-3 to save energy. First set of blades were installed in H-44044-2 on 10/12/2015. Performance test of the same was carried out under the supervision of Coolflo’s Engineer.



49% of energy saving was achieved with 14.3% more air flow against the 20% of guaranteed energy saving as per PO. Report for the same is attached below

COOLFLO ENGINEERS PVT. LTD;
MUMBAI - 400 0065.

FAN PERFORMANCE TEST REPORT

CLIENT: *Iffco Limited, Kalol unit, Kesturingar.* TEST DATE: *10/12/2015*

LOCATION: *NCT* FAN MAKE: *Φ1230mm COOLFLO (FRP)* CELL NO.: *H-4404-2*

FAN DIA.: *28' (8.535 mts)* HUB DIA *Φ1230MM* TRAVERSE AREA: *72.97M²*

STACK DIA. *9.72 mts.* BLADE ANGLE: *5°*
(PITCH)

03. AIRFLOW MEASUREMENTS:
(VELOCITY IN M/SEC.)

	STN-I	STN-II	STN-III	STN-IV
R1	<i>4.8</i>	<i>4.2</i>	<i>3.0</i>	<i>3.6</i>
R2	<i>6.1</i>	<i>5.0</i>	<i>5.4</i>	<i>5.5</i>
R3	<i>5.8</i>	<i>5.8</i>	<i>6.5</i>	<i>5.9</i>
R4	<i>6.3</i>	<i>5.2</i>	<i>6.1</i>	<i>5.6</i>
R5	<i>3.0</i>	<i>3.6</i>	<i>4.6</i>	<i>4.6</i>

AVERAGE VELOCITY = $100 \cdot 6 / 20 = 5.03 \text{ M/SEC}$

AIR FLOW = AVG. VEL. X TRAVERSE AREA

= 5.03×72.97

= $367.0 \text{ M}^3 / \text{SEC}$

= $13,21,340.76 \text{ M}^3 / \text{HRS.}$

= $7,77,609.00 \text{ CFM}$

02. POWER MEASUREMENT

	AMP.(I)	AVG. AMP.	VOLTAGE (V)	POWER FACTOR (COS φ)
R	<i>41.4</i>			
Y	<i>38.6</i>	<i>39.64</i>	<i>415.7</i>	<i>0.700</i>
B	<i>39.0</i>			

POWER CONSUMPTION @ MOTOR TERMINALS = $\sqrt{3} VI \text{ COS } \phi / 1000$

= $\sqrt{3} \times 415.7 \times 39.64 \times 0.70 / 1000$

REMARK :

POWER (Cal.) = $19.99 = 20.00 \text{ KW}$

POWER (Inst.) = 20.40 KW

POWER (KWH) = 20.00 KW

Coolflo Engineer Pvt. Ltd.
Mumbai – 400065

**Summary of comparative performance
of existing & Coolflo FRP blade fans**

Client: IFFCO Kalol Unit

Order ref.: 201004151429 & 19/03/2015

Plant / Location: NCT (H-4404-1/2/3)

Fan dia: 28 feet

Date: 10/12/2015

Cell no.: H-4404-2

Stack dia.: 9.72 meter

Blade angle at the TIP is: 5⁰

	Air flow		Power (KW)	Power Saving	Excess air flow
	Cu.M / Sec	CFM			
Existing Fan (Solid FRP fan blades)	321.1	6,80,257	39.41	Base	Base
Coolflo fan (Hollow FRP Blades)	367.0	7,77,609	20.00	49.2%	14.3%

Remarks: Coolflo fan running continuously with normal vibration.

Guaranteed power saving is 20% as per PO.

Achieved power saving is 49% with 14.3 % excess air flow

During shutdown-2016, two set of new FRP hollow fan blades were successfully installed in remaining two cooling tower cells H-4404-1 & H-4404-3 by keeping 5⁰ blade angle. On 13/04/2016, 16.30hrs, following power data of NCT fan motors were taken by electrical section.

Power Data of New Cooling Tower Fan Motors on 13/04/2016, 16.30 Hrs					
New Cooling tower Cell No.	Parameter				
	Active Power (kW)	Voltage (V)	Current (A)	Power Factor	Frequency (Hz)
H-4401-1	21	239	42	0.712	49.9
H-4401-2	19.4	239	40	0.69	49.8
H-4401-3	20.4	239	40	0.707	49.8

In all NCT fan more than 49% of energy saving was achieved with 14.3% more air flow against the 20% of guaranteed energy saving.

Repairing of Cooling Tower

- Committee comprising members from Mech Maint, Inspection, Civil and Utility Production inspected all the cooling towers and recommended the necessary repairs.
- Based on the committee recommendations, Structural members of the cooling towers were checked and replaced the defective members.
- Corroded fasteners were replaced with new SS304 bolts with SS 304 Square washers.
- Leakages attended from end wall & louvers using mastic (STP make Tarplastic Sealant).
- Repaired stair case
- Replaced on cracked Base casting (Towards admin side) of Old Urea Cooling Tower.
- Fill area of all cooling towers were also inspected for any damage on sampling bases by providing outside scaffolding and removing louver sheet to enter in the fill area. All fill area components and structural members found in good condition, however some PVC V-bars are found dislocated and the same was rectified.
- In H-4401-7/8, replaced the cracked fan deck girts & hot water distribution deck girts with new ones. Loosened wooden drift eliminator of both were fixed by providing additional support
- Above Job was carried out through M/s Paharpur cooling tower against the WO no. 201004151204 dated 09/01/2015 for the repairing of cooling towers

Reconditioning of discharge & check valve of Cooling water pump P-4402

Work order 201004161476 dated 29/02/2016 was placed for reconditioning of discharge gate valve (Size: 1100mm NB x 150#) and check valve (Size: 1050mm NB x 150#) of cooling water pump (P-4402) during shutdown.

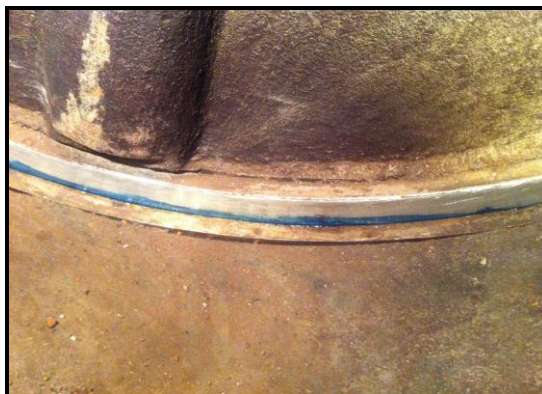
Discharge gate valve (Size: 1100mm NB x 150#):

Actuator of gate valve was removed in presence of electrical section. Bonnet bolts of valve were loosened and removed the bonnet with gate (disc) of valve with help of Kobelco crane. Gate (disc) was dismantled from the bonnet. Both side seating area of gate (disc) were checked and found ok. Cleaning & polishing on both sides

seating area were done. Both side body seating area were checked & found ok. Cleaning & polishing on both sides seating area were done. Bonnet with gate was placed on its position with new gasket. All bonnet bolts were tightened. Gate valve was kept in fully closed position. Contact between the body seta & gate seat was checked from inside the line (opening through the check valve) and found satisfactory. Actuator was placed on it position, checked with valve open / close operation.



Removal of bonnet with gate (disc)



Matching of body seating and gate seating area

- **Check valve (Size: 1050mm NB x 150#):**

Top cover of check valve was removed with help of RT crane after loosening of fasteners. Weight with lever was dismantled from the both side. Flapper disc holding pin was removed from the both side. Flapper disc was removed from its position with help of RT crane. Rubber sheet on body seating area was found in damaged condition and replaced it with new rubber sheet (10mm thick). Flapper (disc) seating area was cleaned & polished. Flapper was placed on it position. Matching of flapper seating area and body seating area was checked & found ok. Top cover was placed on its position and tightened the top cover bolts.

Refurbishing of Jash Make Sluice Gate (1/2/3/4/5/6) of Cooling Water Pump Sump

The job was carried out under the supervision of OEM's Engineer (M/s Jash Engg Ltd., Indore) against the WO no. 6535 /201004161302 & dated 18/01/2016

- (i) **Gate no. 1/2/3/4 (CI Self Contained Spigot Sluice Gate, 2 x 1.4 mtr)**

Following activities were carried out.

- Stem cleaning, oiling & greasing
- Shutler Seat / Frame seat facing cleaning & lubricating by oil.
- Lubricate the shutter groove by oil for free movement
- Gate (full open / full close) , operation found satisfactory.

Gear box of gate no. 1 opened, found bearings are in good condition, gear teeth having minor scoring. In gate no. 3 & 4, bottom wedge blocks (4nos.) were found in damaged condition.



(ii) Gate no. 5/6 (CI Open Channel Gate 2 x 1.4 mtr)

Following activities were carried out.

- Stem cleaning, oiling & greasing
- Shutler Seat / Frame seat facing cleaning & lubricating by oil.
- Lubricate the shutter groove by oil for free movement
- Gate (full open / full close) , operation found satisfactory.

Other Cooling Tower Jobs:

- Hot water distribution valve (butterfly valve, size: 14" x 150#) of NCT cell no 1 (silo side) was replaced with new one. Reconditioning of remaining valves of all 14 nos. of cell was done.
- Heavy pitting observed on 36" cooling water return header (near Q-4411). Welding of 8mm thick patch plate was done on it. A **Stanvac** make corrosion resistance compound was applied on patch plate.



- 10" gate valve at pipe line from ammonia side to offsite CW header was replaced with new one due to passing

DM PLANT

Rerubber Lining of Secondary Mix Base (SMB-III) Unit

Superficial cracks were observed on shell as well as top dish end rubber lining during visual inspection. Hence, it was decided to replace the complete rubber lining with new rubber lining. On 21/01/2016, vessel SMB-III was handed over to maintenance section.

Following activities were carried out to execute the job

- Manhole cover opening / connected flange loosened / Resin unloading
- Lifting of vessel from its position and placing at rollers
- Removal of old rubber lining / scrapping
- Cleaning by shot blasting
- Visual inspection of bare surface & repair , if any
- Primer application
- New rubber lining
- Steaming for curing
- Inspection (Visual / Spark test / Hardness test) & repair , if any
- Nozzle fixing at horizontal position at boiler side area.
- Re-installation of vessel on its position.
- All line, lateral, header & valve are fixed in position.
- Box - up / Resin loading up to side main level.



To check the leakage, resin was filled up to side manhole and the water was filled from the top manhole. Leakage was tested in drain line and no resin was found in drain line. Finally job handed over to production department. The above job was carried out by M/s Unicon Industrial Lining, Vadodara under the ARC 201004160633 dated 18/08/2015.

Other DM Plant Jobs:

- Provision of bypass line with valves for standby strainer in common drain line of SMB-I, II, III & IV. 2 nos. of diaphragm valve (size: 8" x 150#) & 2 nos. of equal tee (size: 8" x Sch 40) were consumed for the same job.



Narmada Plant

Near Narmada main reservoir, a heavy leakage was observed from the push-on joint of 36" DI pipe line (cement mortar lining). Leakage was visual from the middle of two thrust block. Top thrust block around the leaky pipe joint was broken by civil section.



Vertical DI pipe line was flanged joined with MS pipe line. 300mm above the CS pipe line (36" NB) was cut & removed it along with DI pipe line from the push-on joint using hydra. Not gasket found at joint & lead wool was used for sealing. Now joint area was cleaned & new 700mm rubber O-ring was provided on inside groove of joint. Cut DI pipe with flange & CS pipe piece was placed the on it position using hydra. MS structure was fabricated to support the vertical line. 4 nos. of each base plate of MS structure was grouted with HILTI fasteners M16 (total 16 nos.). In pipe joint, lead wool was inserted and araldite compound was applied on it. Further assembly & fabrication was done. After successful testing, handover it to production department.

B & MH PLANT

(MECHANICAL)

PLANT TRANSFER CONVEYOR-M-2110

Following jobs were carried out.

- Replaced complete conveyor belt with new OHR grade, Nirlon make Conveyor belt.
- Provided new SS made discharge chute along with two way feed hopper at head end side.
- Head pulley, Tail Pulley, Bend pulley, Gravity pulley and Snub pulley were inspected and greasing done.
- Provided new rubber lagging on bend pulley.
- Replaced Gravity Pulley with new repaired Gravity pulley.
- Repairing of Tega make Tru- Trac- Trough rollers for arresting sway of conveyor belt.
- Preventive maintenance of Gear Box carried out & coupling done after proper alignment with new rubber bushes.
- Gear box oil was replaced.(Servo system-460)
- Brush pulley was serviced.
- All damaged and noisy carrying rollers, Return rollers, Self alignment carrying roller frames, Self alignment return roller frames and Tracking rollers were replaced.
- New Kaveri make skirt rubber were provided.

TWO WAY FEED HOPPER CHUTE –M 2111

- Replacement of two way discharge flap valve with new SS made flap valve.
- Replacement of bearings.

FRESH UREA SHUTTLE CONVEYOR-M-2112

Following jobs were carried out.

- New Modified SS inlet chute provided at M-2112 conveyor and also provided new kaveri make skirt rubbers.
- Preventive maintenance of Gear Box carried out & Coupling done after proper alignment with new rubber bushes.
- Gear box oil was replaced.(Servo system-460)
- All noisy and damaged carrier, guide and return rollers replaced with new rollers.
- Greasing done in all bearings of head pulley, tail pulley, snub pulley and gravity pulley.
- Tripper Gear box oil replaced and coupled the same with motor with new Rubber bushes after alignment..
- Repaired Tega make tru Track Trough rollers for arresting sway of conveyor belt.
- Rubber lagging provided on tail end Pulley.

RECLAIM CONVEYOR-M-2117

Following jobs were carried out

- Preventive maintenance Gear Box and Coupling done after proper alignment with new rubber bushes.
- Gear box oil was replaced.(Servo Mesh SP-460)
- All noisy and damaged carrying, guide and return rollers were replaced with new rollers.
- Greasing done in all bearings of head pulley, tail pulley, snub pulley and gravity pulley.
- Rubber lagging provided on Bend Pulley.

BAGGING BUILDING FEED CONVEYOR-M-2121

Following jobs were carried out

- Replaced the Head pulley of conveyor belt with repaired one with new bearings and align pulley with Gearbox at both side.
- Preventive maintenance of Gear Box carried out and Coupling done after proper alignment with new rubber bushes.
- Complete skirt board sealing system skirt blocks were replaced with new one.
- Replaced all damaged and noisy Carrying, Return, Impact and guide rollers with new rollers.
- Complete greasing of all pedestal bearings done.
- Replaced bearings of bend pulley.
- Replaced Gearbox oil. .(Servo Mesh SP-460)

BAGGING BUILDING HOPPER CONVEYOR-M-2122

Following jobs were carried out

- Replaced all damaged and noisy Carrying, return and guide rollers with new rollers.
- New Kaveri make skirt rubber were provided.
- Complete greasing in all pedestal bearings done.
- Take up studs were serviced.
- Preventive Maintenance of Gearbox carried out and Coupling done after proper alignment with new rubber bushes.
- Replaced Gearbox oil. .(Servo Mesh SP-460)

BAGGING BUILDING HOPPER CONVEYOR M-2122-A1

Following jobs were carried out

- Preventive maintenance of Gear Box carried out and Coupling done after proper alignment with new rubber bushes.
- Replaced all damaged and noisy Carrying, return and guide rollers with new rollers
- Take up studs were serviced.

BAGGING BUILDING HOPPER CONVEYOR M-2122 A2

Following jobs were carried out

- Preventive maintenance of Gear Box carried out and Coupling done after proper alignment with new rubber bushes.
- Replaced all damaged and noisy Carrying, return and guide rollers with new rollers
- Take up studs were Serviced.
- New lagging provided on snub pulley.
- Repairing of vulcanizing joint.
- Replaced Gearbox oil .(Servo Mesh SP-460

FLAT CONVEYOR BELT M-2142

Following jobs were carried out

- Preventive maintenance of Gear Box carried out and Coupling done after proper alignment with new rubber bushes.
- Replaced all damaged and noisy Carrying and return rollers with reconditioned rollers.

DUST & UREA LUMPS BELT CONVEYOR-M-2137

Following jobs were carried out

- Preventive Maintenance of conveyor belt carried out.
- Complete greasing of all bearings done.
- Preventive Maintenance of Gearbox carried out and Coupling done after proper alignment with new rubber bushes.

BAGGING MACHINE M-2101/1,2,3,4,7,8, 9A,10A,10B

Following preventive maintenance 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.

SLAT CONVEYOR-M-2124 /1,2,3,4,7,8,9,10A,10B

- All gearbox oil was replaced.(Servo system-460)

STITCHING MACHINE-M-2102 /1,2,3,4,7,8,9,10A,10B

- All stitching machines and spare machines were overhauled with M/s gabber engineering.

AIR BLOWER K-2161

- All lines were removed, cleaned and boxed up.

AIR BLOWER K-2704

- All lines were removed, cleaned and boxed up.

CYCLONE SEPARATOR V-2704

- Separator was opened, cleaned and boxed up.

UREA SOLUTION TANK T-2704

- Tank was opened, cleaned and boxed up with new gaskets.

VIBRATING SCREEN M-2136/ A,B,C,D

- All screens were removed, cleaned and boxed up.

RECLAIM MACHINE M-2116 A

Following jobs were done

- Preventive maintenance of Scrapper and Bucket elevator mechanism.
- Replaced damaged slewing Pinion and also modified pinion shaft as suggested by M/s Elecon Engg. Design department.
- New pinion assembly fitted with proper alignment, trial taken for the same and found contact of teeth with slewing ring increased up to 80% which is ok.
- Checking of upper and lower kingpost.
- Inspection of Tie Rod, Tie Rope and Pivot assembly.
- Checking of complete central Greasing mechanism.
- Complete Greasing of reclaim machine
- Checking of Thruster and break shoes
- New hot vulcanizing joint provided in Link Conveyor as old joint was found damaged.
- Two Nos. single piece sprockets were replaced with new modified two piece sprockets in main lower Bucket elevator chain drive assembly.

INSPECTION

AMMONIA PLANT

(INSPECTION)

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 4.**
- Visual inspection of equipment.
- Ultrasonic flaw detection on selected weld joints and parent metal of elbows of New Converter (S-50) loop and other critical pipelines was carried out. Details are given at **Annexure- 5.**
- Thickness measurement of various equipment and HT/LT Convection coils of primary reformer was carried out. Details are given at **Annexure-6.**
- Thickness measurement of various pipelines was carried out. Details are given at **Annexure-7.**
- Measurement of residual magnetism at various parts of rotating equipment and de - magnetization of the same wherever required. Details are given at **Annexure-8.**
- In-situ Metallography of selected equipment and pipelines was carried out. Detailed summary of observations and microstructure analysis given at **Annexure-9.**
- Replacement of pipe spool piece with flange in converter loop line (SG-1303-08-14"). DP test and radiography of these two fabricated joints carried out and found satisfactory. Hardness measurement of these joints was carried out before and after Stress Relieving. Details are mentioned at **Annexure-10.**
- Inspection of newly fabricated pipelines and fabrication jobs carried out departmentally by Maintenance and Technical department.
- NDT's viz. DP, RT and UFD was 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-11.**
- Helium leak detection of 115-C, Methanator Effluent Cooler. Tube sheet lay-out is attached at **Annexure-12.**
- 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.

PRIMARY REFORMER 101-B

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**.
- 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 2**.
- In-situ Metallography carried out on Catalyst tube parent metal, Riser tube parent metal, Catalyst tube to weldolet weld & Riser tube to weldolet weld joint. The detailed report is attached in **Annexure-9**.
- Radiography of all 08 nos. weldolet to riser weld joints was carried out. No significant defect was observed.

CONVECTION ZONE

- Visual inspection of HT convection zone from top and bottom manhole and Auxiliary boiler furnace was carried out. The observations made are as under:

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.
- Refractory at the ceiling in front of 1st & 2nd row tunnel was found fallen hence exposing the holding anchors. Also some patches of refractory found fallen in front of 3rd & 4th row at few locations.



Ceiling Location from where the refractory dropped



Refractory fallen on the floor.

- Half portion of tunnel block was found lying on the floor in 4th row tunnel.



Location at which the tunnel block fallen in 4th row

- Rubbing on the coils observed near anchor supports, however no reduction in thickness was noticed.



Rubbing marks on Coil bottom

- Peeling-off of top layer of casting was observed on first two rows of east side anchor supports of mixed feed coils. This was observed during previous inspections also.



Metal peeled off in anchor supports

- Tunnel thermo well pipes were found slightly bent, scaled and eroded. Same was observed during previous inspection.
- Bottom floor refractories found loosen at some places and flooring found sagged at some location. Same was observed during previous inspection.
- Insulation of East, West and South wall was found satisfactory.
- Mixed Feed coil found sagged in South-West segment compared to North-East Segment.
- Some Brick wall segments were found bent.

HT-LT CONVECTION SECTION FROM TOP MANHOLE

- HT and LT super heater coils were found in satisfactory condition.
- Supports of LT/HT steam super heater coils were found in satisfactory condition.
- Gap observed between Liners in East wall just above the partition wall.
- HT steam super heater top coil tube fins found damaged in 02 nos. tubes. (5th & 9th tube counting from North)
- Crack was observed on Ligament of Mixed Feed coil support at North side.



- Damper condition was satisfactory however liner was found bent and distorted near the damper. Loose Liner Piece was found lying on floor.
- Thermo well near damper was found slightly bent.
- Air pre heater coil was found sagged up to 300 mm downward direction at south side. Same was observed during previous inspection also.



- Loose blackish deposition was observed on bottom most 03 nos. coils of LT convection zone.



Auxiliary Boiler Furnace

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



- Centre partition wall refractory found sagged and some refractory found cracked/damaged.



- Tube supported refractory found loose and damaged adjacent to burner no. 4 from bottom.



- Top roof refractory found damaged and lying on the top tubes.



- Thermo well condition found satisfactory at north side behind tubes.
- North side bottom down comer header refractory found damaged in bottom most area towards west direction.



- Burner side wall refractory found damage in burner no. 5 from bottom.



VESSELS & OTHER EQUIPMENT

101- CB, PRIMARY WASTE HEAT BOILER SHELL

Visual inspection of Primary Waste Heat Boiler Shell liner was carried out after removal of its tube bundle. Observations made are as under:

Ø 1st Liner Piece from top

Thick deposition of dust layer observed on liner surface and hence it could not be thoroughly inspected. However scattered pitting of 1-1.5 mm depth was observed at few locations.



- Welding of gas outlet nozzle liner with shell liner was found broken at few locations, causing gap of approx. 2 to 5mm on periphery of nozzle.



- Thick deposition of dust layer observed at surface of 2nd course, hence surface could not be thoroughly inspected. However Approx. 1-2 mm deep pitting were observed at scattered locations.



- Its longitudinal weld seam was found eroded in its full length below the liner surface. Its circumferential weld was also found eroded at scattered locations



Ø **2nd & 3rd Liner Piece from top**

- Scattered pitting of 1-1.5 mm depth was observed at few locations of the liner area.
- Inward bulging of approx. 5-7 mm was observed at South-West side.

Ø **4th Liner Piece from top**

- Bulging of approx. 5-7 mm was observed just above the gas distributor.



- Liner and its welding surrounding the gas distributor found broken , eroded and bulged.



- Gas distributor bottom half portion was found broken and lying at the bottom floor.



115-C, METHANATOR EFFLUENT COOLER AIR-TEST

- Air test was carried out at 3.5 kg/cm². One no. of tube found leaked and at 27 locations tube/tube sheet seal welding found leaked.
- Tube/tube sheet seal welds were repaired by welding and leaky tube was plugged. These were re-checked by Air test and found satisfactory.

HELIUM LEAK TEST (Carried out by M/s Gulachi Engineers Pvt Ltd.)

- The tube sheet was masked by transparent polythene & Aluminium tape. Both the tube sheets were divided in 06 envelops.



- Helium leak test was carried out at 5.0 kg/cm². First the shell side was pressurized by Nitrogen Cylinder up-to 3 kg/cm² & further up-to 5 kg/cm² by Helium cylinder.



Connections for Nitrogen & Helium cylinders

- Soaking time of 2 hrs. given for Helium transition. Afterwards each envelop was punctured and sniffed by detector.



- Total 03 nos. tubes and 5 nos. T/tube sheet seal welds found leaked. These were attended and finally checked by Air test & found satisfactory.

Observed He Background: 2.6×10^{-6} Stdcc/sec
 Max He Leak rate: 6.6×10^{-2} Stdcc/sec

- Total 04 nos. tubes plugged in this turnaround. Row No./ Tube No. is as under
 Air test: 15/2

Helium Leak test: 3/4, 6/4 & 9/4 (**Tube Sheet lay out attached at Annexure-12**)

- Details of Helium Leak detector used by M/s Gulachi Engineers
 Make: Adixen ASM 310, Germany.
 Sr. No. HLD 1302640

103-D, SECONDARY REFORMER

TOP AIR AND GAS ENTRY:

Visual inspection was carried out from outside and observations are as under:

- Near top flange refractory found damaged creating gap between liner and refractory.



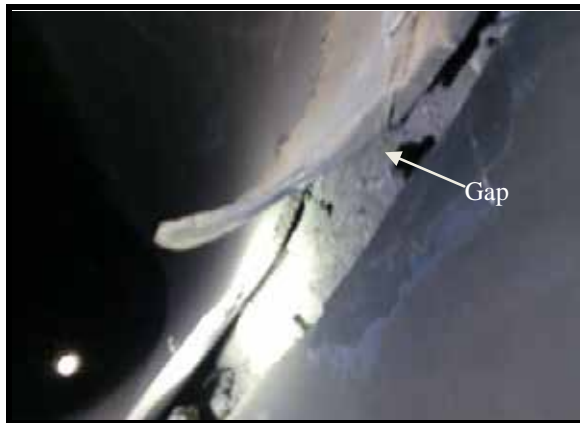
- At scattered locations cracks observed on refractory lining of the shell and cone.
- One segment of shoulder refractory on top of the cone to top-passage junction was found damaged.



- Thermo wells were found intact.
- Approx 1" Gap was observed between shift liners of top shell to transfer line.



- The Patch liner on the junction of transfer line found almost detached creating gap and exposing the refractory.

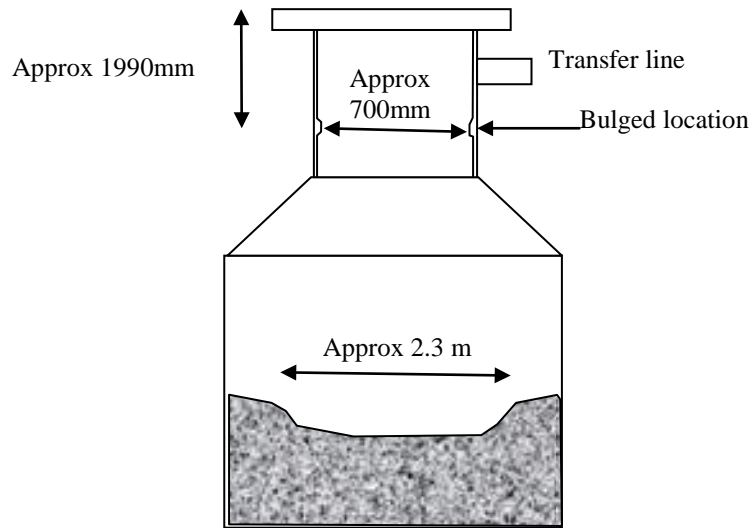


- Inward bulging of approx 1" observed in top shell liner all around the circumference. The ID measured at this location & was found to be approx. 700mm. The location of this bulged location is approx 1990mm from vessel top flange face.



- The catalyst was found uniformly converged throughout the shell. Loose refractory material was found lying on the refractory bed.





BOTTOM DOME

- The refractory around the 101-CA/CB gas inlet nozzles (approx half of the top circumference) was found eroded and loosened.



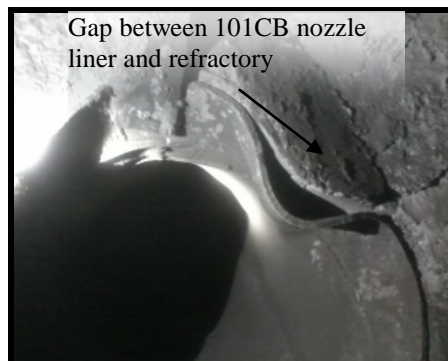
101 CA Nozzle View



101 CB Nozzle View

- Gap was observed between the 101-CA/CB gas inlet nozzle liner and the shell refractory joint. Gap of approx 2" was observed towards the 101-CB nozzle.

The same was observed in previous inspection also.



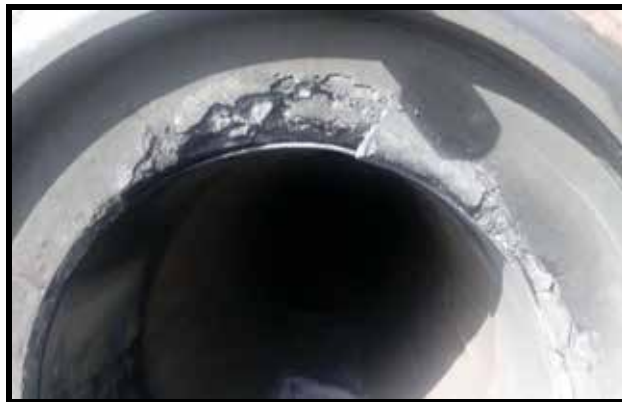
- The liners inside the 101-CB gas inlet nozzle were slightly buckled /distorted. Condition of the thermo-wells was satisfactory. The same was observed in previous inspection also.

- The liner inside the 101-CA gas inlet nozzle was found damaged/detached from its position in approx. 4 ft length creating obstruction in gas flow path. Also the exposed refractory found loosened and damaged at several locations.



107 - D ,TRANSFER LINE (FROM OUTSIDE)

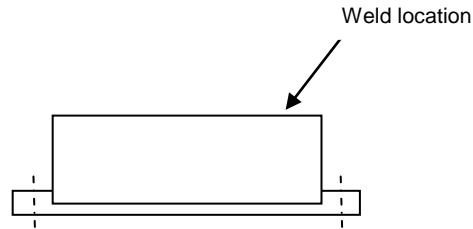
- Minor buckling/distortion of the liner was observed throughout the length of the transfer line.
- Minor damage of the refractory was observed at flange (end plug side) of the transfer line.



- Thermowell was found intact in its position.
- Crack approx of 1" length was observed on End plug weld with its flange.



- Several cracks were observed on top plate of end plug weld with cylindrical portion.



102-EB, CO₂ STRIPPER

FROM TOP MANHOLE

- Demister pads were found slightly shifted in middle portion.
- Demister pad supporting strips and rods were found satisfactory.
- All the bolts of liquid inlet nozzle flange were found in position & intact.
- West side distributor header was found rubbing with the shell plate in S-W direction causing dent in the shell plate. Same was also observed in previous inspections.
- East-North side distributor header found rubbing with U-clamp support plate causing dent/slot of 100 mmX20 mm and 40 mmX10 mm area in cap of header at bottom and west side respectively. (marked with yellow chalk as 1)



- South-West side distribution header U-clamp support found cracked/detached towards east side. (marked with yellow chalk as 2)



- West-South side distributor header found rubbing with U-clamp support causing dent in cap of header. (marked with yellow chalk as 3)



- U-Clamps of East-North and West-South side distribution header were found loose. Need to be tightened. Further with East-North side U-clamp hole found enlarged. Need to be repaired. (marked with yellow chalk as 4)



- 01 no. Stud found stuck up between shell liner and trays below distribution header towards west-south corner. (marked with yellow chalk as 5)



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-South direction.
- Nozzle condition was found satisfactory.
- Thermowell was found intact in its position.
- Thick scaling was observed on shell from inside.
- 02 nos. clip & bolt missing of bottom most sieve tray segment from West towards South side.

103-E2 LP (LP FLASH VESSEL)

FROM TOP MANHOLE

- Demister pad was found intact in its position in satisfactory condition.
- Condition of bubble caps found satisfactory.
- Distributor collectors / drain pipes in West direction one was found satisfactory.
- Debris found lying on the surface of bubble cap resting plate.



- Debris found adhered on the bubble cap resting plate stud.



- All weld joints found satisfactory.

FROM SECOND MANHOLE

- Rectangular riser box and other fittings found intact in position.
- Holding bolts of bottom tray found loose and bent at many locations. 03 nos. bolts are missing from at north side. (Marked with yellow chalk)



- Silver coloration observed at scattered locations. Weld joints observed as if etching has occurred resulting in slightly differing colouration in comparison to adjacent shell surface.
- Bubble cap tray drain line was found satisfactory.

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.
- Liquid distributor header and its 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 found intact in position.
- Liquid collectors and distributor trays segment were found intact in its position.
- Weld joints found in satisfactory condition without any sign of corrosion.

101-F, STEAM DRUM

- 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.
- One of the holes at south end of phosphate dozing line (1" NB) was found enlarged.
- Few bolts and clamps of Demister Pad holding cover plate were found loose. (marked with yellow chalk.)

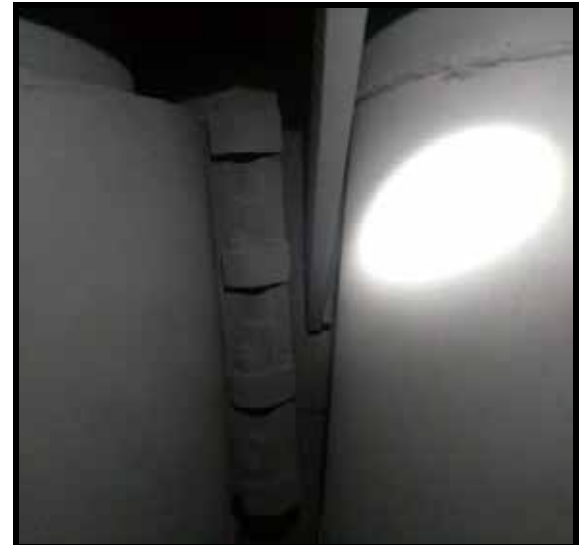


- Grill covering the Down Comers were found bent at few locations.
- 6" BFW header found bent from centre and nut-bolts found loose at north side near elbow.(marked with yellow chalk)
- 1" NB blow off line at bottom of the shell found filled with water.

- 02 nos. Demister Pad holding plate found sheared at the top. (Same were marked with yellow chalk)



- On East side demister pad stiffener plate fastener was found missing at 04 locations at bottom side of plate.



- Down comer no. 2,4,5,6 & 9 counting from south side found filled with water.

103-F, REFLUX DRUM

- Demister pads were found intact in its position.
- Upper layer of Epoxy paint/primer was found peeled off at scattered locations at the dish end and bottom half of the vessel.
- Nozzle condition found satisfactory.

104-F, SYNTHESIS GAS COMPRESSOR SUCTION DRUM

- Grayish black coloration was observed on bottom area, whereas brownish Coloration was observed on remaining surface.
- Thin scales were observed at bottom dish end.

- Bottom vortex breaker was clear and its welds were found intact.
- Condition of demister pad was found satisfactory.
- Blackish coloration was observed inside the inlet hood baffle.
- Condition of the inlet hood baffle was found satisfactory.
- Condition of the nozzle weld joints was satisfactory.
- Condition of weld joints was found satisfactory.

105-F, SYN. GAS COMPRESSOR 1ST STAGE SEPARATOR

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

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 found intact in its position.
- Overall condition of the vessel was found satisfactory.

110-F, FIRST STAGE REFRIGERANT FLASH DRUM

- Brownish black coloration was observed inside the drum.
- Entire internal surface was found oily.
- The demister pads were found intact in position.
- Scattered scales were observed on the surface of the dish ends and shell.
- Overall condition of the vessel was found to be satisfactory.
- Thermowell condition found intact.
- Liquid outlet line weld and vertex plate condition found satisfactory.
- White and yellow colored liquid was found sticky behind liquid inlet line.
- Debris found lying between liquid inlet line and perforated plate.

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, where as one bolt was found missing from middle support of the demister pad towards west direction.
- Dish ends were found covered with scattered scales.
- Condition of all shell weld joints was found satisfactory.
- Thermo well found intact in position.
- 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.
- Oil found accumulated behind the make-up nozzle from 109F.

MISCELLANEOUS JOBS

WELDER QUALIFICATION TESTS

- Performance qualification test of 29 Nos. welders offered by M/s Ram Bahadur (Mech. Planning) (W.O.No- 201004161472) was carried out. 12 nos. of welders were qualified during the test. These welders were allowed to perform S-50 spool

piece replacement job, Technical department related welding jobs & miscellaneous non-critical jobs.

- Performance qualification test of 05 Nos. welders offered by M/s A & M Erectors (W.O. No.201004161607) was carried out. 03 nos. of welders were qualified during the test. These welders were allowed to perform welding for steam drum level troll job, Modification of 104-JT steam inlet line & Installation of new modified burner of 103-D.
- Performance qualification test of total 07 nos. welders (04 Nos. welders for W.O.No.-201004151075 & 03 Nos. welder for W.O.No.-201004161649) offered by M/s J & J Engineering was carried out. Total 07 nos. of welders were qualified during the test. These welders were allowed to perform miscellaneous fabrication jobs in ammonia and urea plant. The removal of "Tee" Joint and providing 12" NB Sch. 100 spool piece (P-11) for isolation of R-111 in NG-9-12".
- Performance qualification test of 07 Nos. welders offered by M/s Shree Ganesh (W.O. No.201004161531) was carried out. 07 nos. of welders were qualified during the test. These welders were allowed to perform V-1201 Trays replacement and Liner Welding joint.

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-5**

ULTRASONIC THICKNESS MEASUREMENT

Ultrasonic thickness measurement was carried out on various pipelines and equipment in the plant. The detailed results of inspection are attached herewith at **Annexure-6** (For equipment) and **Annexure- 7** (For 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-8.** 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-9.**

INSTALLATION OF NEW PIPELINES

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

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:

<u>Burner Row No.</u>	<u>Burner Block No.</u>
1	1,3,4,6,7
2	13,14
3	1,3,7,12,13
4	6
5	2
6	7,10,14
7	1,14
8	1,13
9	2,7,9

BOTTOM HEADER INSULATION

Header insulation was found damaged near following tube nos.:

<u>Header No.</u>	<u>Tube no(s) where insulation found damaged</u>
1	Near tube no. 2,3,4,8 to11, 16 to19,24 to 26, 28 to 30, 37 to40
2	Near tube no. 3 to 15,18,19,25,26,27,31 to 42
3	Near tube no. 14, 23 to26, 30 to 34, 41,42
4	Near tube no. 5,20,21,33, 36 to 40
5	Near tube no. 2 to 14,16,17,32 to 35, 41,42
6	Near tube no.3 to 15,18 to 20, 30 to 42
7	Near tube no. 1 to 15,26,27,29 to 34,38 to 42
8	Near tube no. 15,17 to 21,22 to 42

ROOF INSULATION

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

<u>Row No.</u>	<u>Location</u>
Burner Row No 1	Near Burner no 6, 10
Tube Row No 1	Near Tube No.16, 20
Burner Row No 2	Near Burner No.2,3,13
Tube Row No 2	Near Tube No.1, 10, 11
Burner Row No 3	Near Burner No. 3, 4, 5
Tube Row No 3	Near Tube No.8,9,11,16,19,20,27 ,28 to 32
Burner Row No 4	Near Burner No 7,13,14

Tube Row No 4	Near tube no. 6,7,12,20,21,24,30,34
Burner Row No 5	Around Burner No. 2,3,11
Tube Row No 5	Near tube no. 5,6,37,38
Burner Row No 6	Around Burner No. 2,3,5,13
Tube Row No 6	Near tube no. 19
Burner Row No 7	Around Burner No. 2,3,4,5
Tube Row No 7	Near tube no. 16 to 20
Burner Row No 8	Near burner 1 to 7,11
Tube Row No 8	Near tube no. 1,19,20,21,23,38
Burner Row No 9	Near burner 10,12

REFRACTORY / INSULATION OF WALLS

- **East wall** : Found Satisfactory.
- **West wall** : Found satisfactory.
- **North wall:**
Z-MODULES : Peep hole insulation between tube row no 4 & 5 and 5 &6 found fallen down.
- **South Wall:**
Z-MODULES : Found satisfactory.

Annexure – 2 (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		
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 – 2 (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		
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 – 2(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		
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 – 2(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		
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 – 2(5/5)

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	125.64	125.73		X	
2	125.05	125.03		X	
3	125.51	125.48		X	
4	125.22	125.20		X	
5	125.76	125.73		X	
6	125.57	125.46		X	
7	125.15	125.17		X	
8	125.11	125.17		X	

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

Annexure – 3

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

COLD LOAD READINGS IN MM:

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

TRANSFER LINE SPRING HANGER LOAD READINGS

ROW	1	2	3	4	5	6	7
READINGS	-27	-28	-26	-34	-36	-22	-38

BOTTOM DRAIN READINGS

ROW	1	2	3	4	5	6	7	8
READINGS	100	100	105	95	105	100	100	100

AUXILIARY BOILER SPRING READINGS

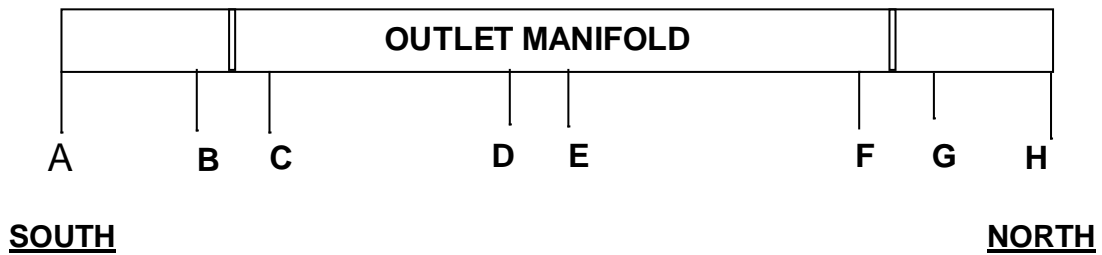
SPRING	S-E	N-E	S-W	N-W
READINGS	60	65	60	60

Annexure – 4

**CLEARANCE OF OUTLET MANIFOLD FROM GROUND FLOOR IN COLD
CONDITION**

<u>Header No.</u>	<u>Location of Measurement</u>					
	B	C	D	E	F	G
1			*200	*190		
2			*215	*200		
3			*190	*165		
4			*140	*160		
5			*170	*140		
6			*170	*120		
7			290	*180		
8			*240	*190		

- NOTE:** (1) All readings are in MM
(2) Readings are taken without insulation.
(3) * Readings are taken with insulation



Annexure – 5

LIST OF PIPELINES FOR ULTRASONIC FLAW DETECTION

SR NO	LINE NO	SIZE (NB)	SCH	FROM	TO	NO. OF WELD JOINTS TESTED	No. of Elbows Tested	No. of T-joints	REMARKS
1	SG-1303-08-14"	14"	120	105-D, SG-33-14	108-D Inlet (Bottom)	12	05	06	No significant defect was observed.
2	SG-1303-09-10"	10"	120	105-D, SG-1303.08-14	108-D Inlet (Bottom)	11	04	-	
3	SG-1303-08-10"	10"	120	SG-1303.08-14" (105-D)	108-D Inlet (Top North)	06	03	-	
4	SG-1303-12-10"	10"	120	SG-1303.08-14" (105-D)	108-D Inlet (Top South)	06	03	-	
5	SG-1303-10-14"	14"	120	108-D	107-C	12	05	-	
6	SG-1303-11-14"	14"	140	107-C	123-C	12	06	-	
7	PG-12A	14"	30	105-CA	PG-26	01	-	-	
8	PG-12B	14"	30	105-CB	PG-26	01	-	-	
9	NG-11-A TO H	6"	120	NG-9	101-B	18	08	-	
10	NG-09-12"	12"	100	101-B	103-D	03	01	-	
11	SG-1303-02-14"	14"	100	121-C	SG-12-14"	16	08	03	
12	SG-1303-03-08"	8"	100	SG-12-14"	137-C	07	02	-	
13	SG-1303-04-8"	8"	100	137-C	SG-51-8"	10	04	-	
14	SG.1303.06-14"	14	100	121-C	124-C	19	07	-	

Annexure – 6

THICKNESS MEASUREMENT SUMMARY OF EQUIPMENT

Sr. No.	Equip. No.	Equipment Description	Shell			Dish End			Channel		
			Nom./Design	Min. Measured	% Red.	Nom./Design	Min. Measured	% Red	Nom./Design	Min. Measured	% Red.
1	103 - C	Primary Shift Effluent Waste Heat Exchanger	55.56	56.80	-	20.63					
2	109 - CB-2	aMDEA Solution Exchanger	12.70	13.60	-	12.70	14.30	-	25.00	24.40	2.40
3	112 - C	Low Temperature Shift Converter Inlet Boiler	12.70	12.70	-	26.99	30.00	-			
4	150 - C	Fuel Preheat Exchanger	8.38	9.70	-	12.70	12.40	2.36	12.70	12.60	0.78
5	151 - C	Fuel Preheat Exchanger	8.38	8.00	4.53	9.52	7.80	18.0	8.38	7.60	9.30
6	171 - C	Condensate Stripper Exchanger	9.52	10.20	-	9.52	9.90	-	9.52		
7	173 - C	Stripped Condensate Cooler	9.50	9.30	2.10					9.50	
8	103 - F	CO2 Stripper Reflux Drum	11.11	11.30	-	11.11					
9	114 - F	aMDEA Storage Tank	4.76	4.39	7.77	4.76					
10	114 - FA	New aMDEA Storage Tank									
11	117 - F	aMDEA Carbon Filter	10.00	8.85	11.5	10.00	9.58	4.2			
12	141-F	New Instrument Air Receiver	NA	10.00		NA	10.00				
13	156 - F	Blow Down Drum	11.11	11.00	0.99		11.90				
14	2001 LF	Hydrazine Mix Tank	NA	2.84		NA	2.84				
15	2002 - LF	Phosphate Mix Tank	NA	2.70		NA	3.70				
16	2006-UF-1	Salt Storage Tank	NA	4.98		NA	7.36 (T.Plate)				
17	2006-UF-2	Salt aMDEA Measuring Tank	NA	8.76		NA	7.96 (T.Plate)				
18	ADU - 04	Instrument Air Drier (Tower A)		7.99			8.06				
19	ADU - 05	Instrument Air Drier (Tower B)		8.10			7.99				
20	2000-SL,AD-A	New Instrument Air Drier		5.07			7.53				
21	2000-SL,AD-B	New Instrument Air Drier		6.20			7.69				

Sr. No.	Equip. No.	Equipment Description	Shell			Dish End			Channel		
			Nom./Design	Min. Measured	% Red.	Nom./Design	Min. Measured	% Red	Nom./Design	Min. Measured	% Red.
22	103-JLC1	Lube & Seal Oil Cooler for 103-J	8.0	7.9	1.25	8.0	7.0	12.5	8.0	8.4	-
23	103-JLC2	Lube & Seal Oil Cooler for 103-J	8.0	8.0		8.0	7.1	11.25	8.0	8.1	-
24	E-4	Regeneration Heater	5.00	4.90	2.00	8.00					

NOTE: All readings are in mm.

THICKNESS MEASUREMENT SUMMARY OF HT/LT COILS.

SR NO	DESCRIPTION	DESIGN THICKNESS	MEASURED THICKNESS	% REDUCTION
1	HT Convection Zone : HT Steam Super Heater Coil (3 rd from bottom)	8.0	7.6	5.0
2	HT Convection Zone : Air-Preheater Coil (2 nd from bottom)	6.55	6.2 22.0	5.35 -
3	HT Convection Zone : Mixed Feed Coil (Bottom most)	8.0	11.5	-
4	LT Convection Zone : BFW Heater Coil (Bottom most)	5.54	4.8	13.35
5	LT Convection Zone : BFW Heater Coil (2 nd from Bottom)	5.54	4.8	13.35
6	LT Convection Zone : BFW Heater Coil (3 rd from Bottom)	3.9	3.9	-
7	LT Convection Zone : Ammonia BFW Coil (4 th from Bottom)	5.54	5.1	7.94
8	LT Convection Zone : LT Steam Super Heater Coil (5 th from Bottom)	7.01	6.3	10.12
9	LT Convection Zone : Additional BFW Heater Coil		6.4	

NOTE: All readings are in mm.

ANNEXURE- 7 (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-2H	1.5	XXS	10.2	CS	101-F	BO-2	7.4	27.45
2	BO-3H	1	160	6.35	CS	102-C	BO-3	5.8	8.66
3	BO-10H	2	XXS	11.07	CS	AUX. BOILER COIL-E	BLOW DOWN BO-10	10.5	5.15
4	BO-12H	2	XXS	11.07	CS	AUX. BOILER COIL-C	BLOW DOWN BO-6	8.3	25.02
5	BO-13	1.5	80	5.1	CS	BO-21-1.5"	BO-13-1.5"	4.2	17.65
6	BO-13	1	80	4.5	CS	BO-13-1.5"	BO-3H-1"	4.1	8.89
7	BO-13BH	2	XXS	11.07	CS	AUX. BOILER COIL-B	BLOW DOWN BO-25	10.4	6.05
8	BO-1304.04	2	40	3.91	CS	107- C	156- F	3.1	20.72
9	BO-14AH	2	XXS	11.07	CS	AUX. BOILER COIL-A	BLOW DOWN BO-26	10.6	4.24
10	BO-21	1.5	80	5.1	CS	BO-2	BO-14	4.8	5.88
11	MDEA-1202.01	18	XS	12.7	CS	101- EA	MDEA-1202.02,(USV470)	7.3	7.82
12	MDEA-1202.02	18	XS	12.7	CS	MDEA-1202.01	115- HT	11.7	7.87
13	MDEA-1202.02	18	40S	12.7	SS	115- HT	103-E1	11.4	10.24
14	MDEA-1202.02	18	XS	12.7	SS	115- HT	103-E1	11.4	10.24
15	MDEA-1203.02	18	10S	4.78	SS	HV-435 (MDEA-1202.03-14")	103-E1/ E2	11.4	10.24
16	MDEA-1204.01	24	10S	6.35	SS	103- E2 HP	LV-416	4.9	-
17	PW-24	4	120	11.13	CS	173-C	CONTROL VALVE	5.7	10.24
18	PW-29	10	60	12.7	CS	171-C	PW-30-14"	12.8	-
19	PW-30	10	60	12.7	CS	171-C(PW-29-10)	PW-31-12, HEADER	10.7	15.75
20	PW-31	12	40	10.31	CS	PW-30	104-E	10.1	2.04

ANNEXURE- 7 (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-31	1.5	80	5.08	CS	A-20	SPEC.BRK	5.0	1.57
2	BF-1H	8	100	15.06	CS	BF-15	101-B	15.4	-
3	BF-3H	3	80	7.62	CS	BF-17	BF-2H	7.5	1.57
4	BF-17	3	80	7.62	CS	114-C	BF-3H	6.5	14.69
5	BF-18	3	80	7.62	CS	BF-22	114-C	6.7	12.07
6	BF-22	8	100	15.06	CS	HEADER	BF-6	14.8	1.7
7	BF-30	2	80	5.5	CS	104-J	BF-31	5.0	9.09
8	BF-31	2	80	5.5	CS	104-JA	101-U	4.8	12.72
9	BF-32	6	40	7.11	CS	101-U	123-J	6.5	8.57
10	BF-34	1	80	4.5	CS	SPEC.BRK	BF-9	4.2	6.66
11	CW-48	6	40	7.11	CS	CW-5	173-C	7.4	-
12	HW-12	10	30	7.8	CS	128-C	HW-41	7.2	7.69
13	HW-34	6	40	7.11	CS	130-JC	HW-15	6.2	12.79
14	aMDEA-25	3	40	5.49	CS	CONT. VALVE	ASSEMBLY	4.8	12.72
15	MS-22	4	40	6.02	CS	MS-2	MS-53	5.3	11.96
16	MS-35	6	40	7.11	CS	MS-11	103-J	6.6	7.1
17	MS-56	2	80	5.54	CS	MS-2	SPEC. BRK.	5.2	6.13
18	MS-60	10	30	7.8	CS	MS-2	HEADER	6.3	19.23
		6	40	7.11	CS	176- F	NG- 30- 24"	6.4	9.98
19	LNG-3	6	40	7.11	CS	PICV-002	101-D & 102-D	6.8	4.36
20	NG-09	12	100	21.4	P-11	101-B	NG-11 A TO H	20.5	4.20
21	NG-11A	6	120	14.3	P-11	NG-9	101-B	13.9	2.79
22	NG-11B	6	120	14.3	P-11	NG-9	101-B	13.6	4.89
23	NG-11C	6	120	14.3	P-11	NG-9	101-B	14.4	-

SR. NO.	LINE NO.	N.B. (in.)	SCH.	NOM. THK. (mm)	MAT.	LINE DESCRIPTION		Minimum Thickness Observed (mm)	% RED.
						FROM	TO		
24	NG-11D	6	120	14.3	P-11	NG-9	101-B	14.1	1.40
25	NG-11E	6	120	14.3	P-11	NG-9	101-B	13.4	6.29
26	NG-11F	6	120	14.3	P-11	NG-9	101-B	13.8	3.49
27	NG-11G	6	120	14.3	P-11	NG-9	101-B	13.4	6.29
28	NG-11H	6	120	14.3	P-11	NG-9	101-B	13.7	4.19
29	NG-64	8	40	8.18	CS	PICV-005	178-F	7.4	9.53
30	NH-29A	6	40	7.11	CS	NH-113	118-C	6.7	5.7
31	NH-29B	6	40	7.11	CS	NH-113	118-C	6.6	7.17
32	NH-79A	6	40	7.11	CS	NH-114	119-C	6.9	2.95
33	NH-79B	6	40	7.11	CS	NH-114	119-C	7.5	-
34	PG-02	18	100	29.36	P11	102-C	PG-4	29.9	-
35	PG-03	18		14.27	P11	PG-4	104-D TOP	13.3	6.8
36	PG-04	24		38.89	P11	MIXING	TEE *	27.6	29.02
37	PG-08	18	STD	9.525	CS	104-C	112-C	7.5	21.25
38	PG-09	2	80	5.54	CS	BY PASS		5.4	2.52
	PG-09	18	STD	9.525	CS	157-F	104-D BOTTOM	8.4	10.71
39	PG-10	18	STD	9.525	CS	104-D Bottom	PG-21	8.4	11.81
	PG-10	2	80	5.5	CS	BY PASS		5.0	9.09
40	PG-15	14	XS	12.7	CS	102-F	101-E	6.6	48.03
41	PG-16	14	20	7.92	CS	101-E	136-C	5.8	26.76
42	PG-17	14	20	7.9	CS	136-C	104-C	7.3	7.59
43	PG-19	14	STD	9.53	CS	PG-8	PG-35	7.5	21.25
44	PG-20	8	20	6.4	CS	PG-9	PG-10	5.1	20.31
45	PG-22	6	40	7.11	CS	PG-15	RV-102F	6.7	5.76
46	PG-24	10	30	7.04	P-11	PG-17	PG-18	6.0	5.51
47	PG-34	6	40	7.11	SS-304	PG-33 A&B	PG-13	7.0	1.54

SR. NO.	LINE NO.	N.B. (in.)	SCH.	NOM. THK. (mm)	MAT.	LINE DESCRIPTION		Minimum Thickness Observed (mm)	% RED.
						FROM	TO		
48	PG-35	20	STD	9.525	CS	112-C	157-F	7.7	19.20
49	PG-36	1.5	40	3.68	CS	PG-21	PG-34	2.9	21.19
50	PW-03	2	160	8.7	CS	SPEC.BRK.		5.5	36.78
		2	40	3.91	CS	PW-12-16"	102-F	2.7	30.9
51	PW-18	4	120	11.13	CS	170-C	LC-3A	11.0	1.16
		4	10S	3.05	SS	170-CA	LC-3A	2.6	14.75
		2	80S	5.54	SS	170-CA	LC-3A	5.4	2.52
52	PW-19	2	10S	2.77	SS	LC-3A	104-E	2.8	-
53	PW-20A	6	80	10.97	CS	PW-20	170 JA	9.6	12.48
54	SC-07	2.5	80	7.01	CS	SC-42	101-JC	4.8	31.52
		1	80	4.55	CS	SC-42	101-JCA	6.1	-
55	SC-08	8	20	6.35	CS	SC-3	101-J	6.0	5.5
56	SC-47	10	40	9.27	CS	101-JC	112-J	6.2	33.15
57	SC-47A	10	40	9.27	CS	101-JC	112-JA	5.9	36.31
58	SG-12	14	100	23.8	CS	103-J	124-C	21.6	9.24
59	SG-39	4	40	6.02	CS	121-C	FG-3	5.3	14.51
60	SG-40	10	100	18.24	CS	CONTR.VALVE	HCV10	16.6	8.99
61	SG-51	8	100	15.06	CS	SG-13	SG-35	14.3	5.04
62	SG-79	1	80	4.5	CS	105F	LC-10	3.8	15.5
63	PIC - 5	12	40	9.53	CS	V-6	V-7(SP-73)	8.4	11.85
		6	40	7.11	CS			7.0	1.5
		2	80	5.54	CS			3.7	32.72
64	PIC-14	6	40	7.11	CS	38 ATA	11 ATA	7.4	-
65	PRC - 1	6	40	7.11	CS	101/102-D I/L	VENT (SP-73)	4.68	34.17
		3	40	5.5				11.4	-
		2	80	5.54				5.59	-

SR. NO.	LINE NO.	N.B. (in.)	SCH.	NOM. THK. (mm)	MAT.	LINE DESCRIPTION		Minimum Thickness Observed (mm)	% RED.
						FROM	TO		
66	PRC-6 U/S (V-29-10")	10	20	6.35	CS	V-27	V-29 (SP-75)	6.3	0.78
67	PRC-6 D/S (V-27-6")	6	80	10.97	CS	V-27	V-29 (SP-75)	5.5	49.86

- **Note:** Part replacement in following pipe lines were carried out based on the thickness measurement report.

SR. NO.	LINE NO.	N.B. (in.)	SCH.	LINE DESCRIPTION		PART REPLACED
				FROM	TO	
1	PIC - 5	2	80	PICV-5-12"	Header	Pipe piece replaced

Annexure-8

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
<u>101-BJT</u>			
Journal Bearing Sleeve	CT Side	T-1.7 B-1.9	
	SILO Side	T-1.3 B-1.8	
Shaft Journal	CT Side	2.3	
	SILO Side	2.5	
<u>101-BJR</u>			
LS Gear Journal Bearing Sleeve	CT Side	T-3.0 B-1.2	T-1.4
	SILO Side	T-0.8 B-0.7	
HS Pinion Shaft Journal	CT Side	2.4	
	SILO Side	1.6	
HS Pinion Journal Bearing Sleeve	CT Side	T-0.6 B-0.9	
	SILO Side	T-1.3 B-0.8	
LS Gear Shaft Journal	CT Side	1.4	
	SILO Side	0.8	
<u>101-BJ</u>			
Journal Bearing Sleeve	CT Side	T-0.6 B-0.8	
	SILO Side	T-0.5 B-0.8	
Shaft Journal	CT Side	1.6	
	SILO Side	0.8	
<u>101-JT</u>			
Journal Bearing Pad	Thrust End	T-1.2 B-0.8	
	Non Thrust End	T-1.2 B-1.0	
Journal Bearing Base ring	Thrust End	T-1.4 B-1.5	
	Non Thrust End	T-0.5 B-0.4	
Thrust Bearing Pads	Active	2.2	
	Inactive	1.5	
Thrust Bearing Base ring	Active	0.5	
	Inactive	0.5	
Shaft Journal	Thrust End	3.8	
	Non Thrust End	2.0	
Thrust Collar	Active	1.5	
	Inactive	2.2	

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
<u>101-JLP</u>			
Journal Bearing Pads	Thrust End	T-0.9 B-1.4	
	Non Thrust End	T-0.8 B-0.5	
Journal Bearing Base ring	Thrust End	T-0.6 B-1.0	
	Non Thrust End	T-0.6 B-1.3	
Shaft Journal	Thrust End	2.4	
	Non Thrust End	1.5	
Thrust Collar	Active	1.3	
	Inactive	1.5	
<u>101-JR</u>			
Gear Journal Bearing (Low Speed)	North side	T-0.4 B-0.6	
	South Side	T-0.5 B-0.6	
Pinion Journal Bearing (High Speed)	North side	T-0.7 B-0.6	
	South Side	T-0.8 B-0.5	
Thrust Bearing (Low Speed)	North	T-1.3 B-0.9	
	South	T-1.0 B-0.6	
Shaft Journal	Thrust End	2.4	
	Non Thrust End	0.5	
<u>101-JHP</u>			
Journal Bearing Pads	Thrust End	T-0.7 B-1.3	
	Non Thrust End	T-1.0 B-0.9	
Journal Bearing Base ring	Thrust End	T-0.7 B-1.3	
	Non Thrust End	T-0.6 B-1.3	
Thrust Bearing Pads	Active	0.4	
	Inactive	0.5	
Thrust Bearing Base ring	Active	4.5	0.7
	Inactive	1.2	
Oil Guard for Above	South	1.0	
	North	1.0	
Shaft Journal	Thrust End	3.6	
	Non Thrust End	1.7	
Thrust Collar	Active	1.3	
	Inactive	1.8	
<u>104-JA</u>			
Journal Bearing Sleeve	Thrust End	T-0.6 B-0.4	
	Non Thrust End	T-0.8 B-0.6	

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
Thrust Bearing Pads	Active	0.4	
	Inactive	0.5	
Thrust Bearing Base Ring	Active	1.3	
	Inactive	0.9	
Shaft Journal	Thrust End	1.6	
	Non Thrust End	1.8	
<u>104-JAT</u>			
Journal Bearing Sleeve	Thrust End	T-0.6 B-0.5	
	Non Thrust End	T-0.6 B-1.2	
Thrust Bearing Pads	Active	0.6	
	Inactive	1.5	
Thrust Bearing Base Ring	Active	4.5	1.0
	Inactive	4.0	1.2
Thrust Collar	Active	1.8	
	In Active	1.1	
Shaft Journal	Thrust End	1.0	
	Non Thrust End	0.6	
<u>107-JAT</u>			
Journal Bearing Sleeve	Thrust End	T-0.8 B-0.9	
	Non Thrust End	T-1.0 B-0.6	
Shaft Journal	Thrust End	0.8	
	Non Thrust End	2.3	
<u>115-JAR (Gear Box)</u>			
HS Pinion Gear Journal Bearing (Turbine side)	Top	1.3	
	Bottom	1.4	
HS Pinion Gear Journal Bearing (Pump side)	Top	0.4	
	Bottom	0.9	
HS Shaft Journal	DE (Turbine Side)	0.8	
	NDE (Pump Side)	2.0	
LS Journal Bearing (Turbine side)	Top	0.5	
	Bottom	0.7	
LS Journal Bearing (Pump side)	Top	1.3	
	Bottom	0.9	
LS Shaft Journal	DE (Turbine Side)	2.5	
	NDE (Pump Side)	0.9	

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
<u>115-JA (Pump)</u>			
Journal Bearing Sleeve	Thrust End	T-0.8 B-0.9	
	Non Thrust End	T-0.6 B-0.6	
Thrust Bearing Pads	Active	1.5	
	In Active	1.7	
Thrust Bearing Base Ring	Active	1.8	
	In Active	1.8	
Thrust Collar	Active	2.0	
	In Active	1.8	
Shaft Journal	Thrust End	0.6	
	Non Thrust End	1.4	
<u>115-JAT (Turbine)</u>			
Journal Bearing Sleeve	Thrust End	T-0.5 B-1.6	
	Non Thrust End	T-0.7 B-1.4	
Thrust Bearing Pads	Active	1.3	
	In Active	0.9	
Thrust Bearing Base Ring	Active	1.5	
	In Active	1.7	
Shaft Journal	Thrust End	2.5	
	Non Thrust End	1.7	
<u>115-HT</u>			
Journal Bearing Sleeve	Thrust End	T-0.8 B-0.9	
	Non Thrust End	T-0.6 B-0.6	
Thrust Bearing Base Ring	Active	1.7	
	In Active	1.9	
Shaft Journal	Thrust End	0.6	
	Non Thrust End	0.6	
<u>103-JAT</u>			
Thrust Bearing Pads	Active	0.5	
	Inactive	1.0	
Thrust Bearing Base ring	Active	1.2	
	Inactive	1.6	

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
Shaft Journal	Thrust End	0.6	
	Non Thrust End	3.5	
Thrust Bearing Collar	Active	1.2	
	Inactive	1.4	
<u>103-JBT</u>			
Thrust Bearing Pads	Active	0.6	
	Inactive	0.3	
Thrust Bearing Base ring	Active	1.7	
	Inactive	1.0	
Shaft Journal	Thrust End	0.4	
	Non Thrust End	1.3	
<u>103-JLP</u>			
Shaft Journal	Thrust End		
	Non Thrust End	0.8	
<u>103-JHP</u>			
Thrust Bearing Pads	Active	0.6	
	Inactive	0.6	
Thrust Collar	Active	1.2	
	Inactive	1.4	
Shaft Journal	Thrust End	2.4	
	Non Thrust End	1.0	
<u>105-JT</u>			
Journal Bearing Pad	Thrust End	T-0.5 B-0.9	
	Non Thrust End	T-0.6 B-0.7	
Journal Bearing Base ring	Thrust End	T-1.0 B-0.8	
	Non Thrust End	T-1.3 B-1.2	
Thrust Bearing Pads	Active	0.8	
	Inactive	0.8	
Thrust Bearing Base ring	Active	1.0	
	Inactive	1.7	
Shaft Journal	Thrust End	1.4	
	Non Thrust End	1.5	

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
Thrust Collar	Active	0.8	
	Inactive	0.8	
<u>105-JLP</u>			
Thrust Bearing Pads	Active	0.7	
	Inactive	0.8	
Thrust Bearing Base ring	Active	0.8	
	Inactive	0.6	
Thrust Collar	Active	1.1	
	Inactive	0.8	
<u>105-JR</u>			
LS Gear Journal Bearing	North side	T-0.5 B-0.6	
	South Side	T-0.7 B-0.5	
HS Pinion Journal Bearing	North side	T-0.8 B-0.5	
	South Side	T-0.8 B-0.7	
Thrust Bearing	North side	T-1.3 B-1.3	
	South Side	T-1.6 B-1.3	
Shaft Journal	Low Speed Gear	N-1.7 S-1.6	
	High Speed Pinion	N-0.8 S-1.2	
<u>105-JHP</u>			
Thrust Bearing Pads	Active	T-0.5 B-0.4	
	Inactive	T-0.5 B-0.4	
Thrust Bearing Base ring	Active	T-1.3 B-0.8	
	Inactive	T-1.5 B-0.8	
Oil Guard For Above	South	1.3	
	North	1.7	
Thrust Collar	Active	1.4	
	Inactive	1.2	

ANNEXURE-9

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
1	Location: 1 (Weld/HAZ) Riser No.-1, Riser to Weldolet Weld Joint	Tube-G- 4852M Weldolet 800HT	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenite. Microstructure at parent metal shows fine & coarse austenitic grain with twins. Second phase carbide precipitation is observed along the grain boundaries. Presence of inter-granular cracks observed at HAZ region.	Inter-granular cracks are observed at HAZ region. Needs attention.
2	Location: 2 (Weld/HAZ) Riser No.-2, Riser to Weldolet Weld Joint	Tube-G- 4852M Weldolet 800HT	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenite. Microstructure at parent metal shows coarse austenitic grain with twins. Second phase carbide precipitation is observed along the grain boundaries. Presence of inter-granular crack filled with oxide scale is observed at HAZ region.	Inter-granular cracks are observed at HAZ region. Needs attention.
3	Location: 3 (Weld/HAZ) Riser No.-3, Riser to Weldolet Weld Joint	Tube-G- 4852M Weldolet 800HT	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenite. Microstructure at parent metal shows fine & coarse austenitic grain with twins. Second phase carbide precipitation is observed along the grain boundaries. Presence of inter-granular cracks observed at HAZ region.	Inter-granular cracks are observed at HAZ region. Needs attention.
4	Location: 4 (Weld/HAZ) Riser No.-4, Riser to Weldolet Weld Joint	Tube-G- 4852M Weldolet 800HT	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenite. Microstructure at parent metal shows fine & coarse austenitic grain with twins. Second phase carbide precipitation is observed along the grain boundaries. Presence of inter-granular cracks observed at HAZ region.	Inter-granular cracks are observed at HAZ region. Needs attention.

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
5	Location: 5 (Weld/HAZ) Riser No.-5, Riser to Weldolet Weld Joint	Tube-G-4852MW eldolet80 0HT	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenite. Microstructure at parent metal shows fine & coarse austenitic grain with twins. Second phase carbide precipitation is observed along the grain boundaries. Presence of inter-granular cracks observed at HAZ region.	Inter-granular cracks are observed at HAZ region. Needs attention.
6	Location: 6 (Weld/HAZ) Riser No.-6, Riser to Weldolet Weld Joint	Tube-G-4852MW eldolet80 0HT	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows coarse austenitic grain with twins. Second phase carbide precipitation is observed along the grain boundaries. Presence of inter-granular cracks observed at HAZ and parent metal region.	Inter-granular cracks are observed at HAZ and parent metal region. Needs attention.
7	Location: 7 (Weld/HAZ) Riser No.-7, Riser to Weldolet Weld Joint	Tube-G-4852M	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenite. Microstructure at parent metal shows coarse austenitic grain with twins. Second phase carbide precipitation is observed along the grain boundaries. Presence of inter-granular cracks observed at HAZ and parent metal region.	Inter-granular cracks are observed at HAZ and parent metal region. Needs attention.
8	Location: 8 (Weld/HAZ) Riser No.-8, Riser to Weldolet Weld Joint	Tube-G-4852M Weldolet 800HT	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows fine & coarse austenitic grain with twins. Second phase carbide precipitation is observed along the grain boundaries.	Microstructure is free from any micro cracks.

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
9	Location: 9 (Weld/HAZ) Row No.-1, Tube NO.35, Tube to Weldolet Weld Joint	Tube-G-4852M Weldolet 800HT	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows fine & coarse austenitic grain with twins. Second phase carbide precipitation is observed along the grain boundaries. Presence of inter-granular cracks observed at HAZ region.	Inter-granular cracks are observed at HAZ region. Needs attention.
10	Location: 10 (Weld/HAZ) Row No.-3, Tube NO.40, Tube to Weldolet Weld Joint	Tube-G-4852M Weldolet 800HT	Microstructure at weld shows ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows fine & coarse-grained austenitic grain with twins. Presence of inter-granular cracks observed at HAZ region.	Inter-granular cracks are observed at HAZ region. Needs attention.
11	Location: 11 (Weld/HAZ) Row No.-6, Tube No.18 Tube to Weldolet Weld Joint	Tube-G-4852M Weldolet 800HT	Microstructure at weld shows ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows fine & coarse-grained austenitic grain with twins. Presence of inter-granular cracks observed at HAZ region.	Inter-granular cracks are observed at HAZ region. Needs attention.
12	Location: 12 (Weld/HAZ) Row No.-7, Tube NO.37, Tube to Weldolet Weld Joint	Tube-G-4852M Weldolet 800HT	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows coarse austenitic grain with twins. Second phase carbide precipitation is observed along the grain and at grain boundary.	Microstructure is free from any micro cracks. Monitor after 1 year of service.
13	Location: 13 (Parent Metal) Riser Tube No.-7	Tube-G-4852M	Microstructure shows dendrite structure of primary carbides along with secondary precipitation including carbides in the austenite matrix. The primary and secondary fine precipitate seems to have coarsened within the matrix.	Microstructure is free from any micro cracks. Monitor after 1 year of service.

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
14	Location: 14 (Weld/HAZ) 102B SG-62B-4" line	P5	Weld microstructure shows dendritic structure of tempered bainite/martensite structure, whereas at HAZ shows fine-grained ferrite and bainite structure. Parent metal microstructure shows fine-grained ferrite & bainite structure. In-situ spheroidization of bainite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
15	Location: 15 (Weld/HAZ) 102B SG-62A-4" line	P5	Weld microstructure shows dendritic structure of tempered bainite/martensite structure, whereas at HAZ shows fine-grained ferrite and bainite structure. Parent metal microstructure shows fine-grained ferrite & bainite structure. In-situ spheroidization of bainite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
16	Location: 16 (Weld/HAZ/PM) SG-1303, 09-10" (H-36) On 108D converter inlet nozzle	P-22	Weld microstructure shows ferrite and carbides in dendrite form, whereas at HAZ microstructure shows fine tempered bainite structure. Parent metal microstructure shows fine-grained ferrite and bainite structure. In-situ spheroidization of bainite is observed.	SEM interpretation is kept below
16.1			Microstructure is free from creep damage at the grain boundaries.	Monitor after 2 years of service.
17	Location: 17 (Weld/HAZ/PM) SG-1303, 09-10" (H-36) On 108D converter Inlet nozzle of Elbow at bottom	P-22	Weld microstructure shows ferrite and carbides in dendrite form, whereas at HAZ microstructure shows fine-grained ferrite & bainite structure. Parent metal microstructure shows fine-grained ferrite and bainite structure. In-situ spheroidization of bainite is observed.	SEM interpretation is kept below
17.1			Microstructure is free from creep damage at the grain boundaries.	Monitor after 2 years of service.
18	Location: 18 (Weld/HAZ/PM) SG-1303, 10-14 (H-36) On 108D converter Outlet nozzle, HAZ of nozzle	P-11	Weld microstructure shows ferrite and carbides in dendrite form, whereas at HAZ microstructure shows tempered bainite & ferrite structure. Parent metal microstructure shows fine-grained ferrite and bainite structure. In-situ spheroidization of bainite is observed.	IIInd stage of creep degradations. Monitor after 2 years of service.

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
19	Location: 19 (Weld/HAZ/PM) SG-1303, 10-14 (H-36) On 108D converter Outlet nozzle of bend at top	P-11	Weld microstructure shows ferrite and carbides in dendrite form, whereas at HAZ microstructure shows shows tempered bainite structure. Parent metal microstructure shows fine tempered bainite structure. In-situ spheroidization of bainite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
20	Location: 20 (Weld/HAZ/PM) SG-1303 11-14 (H-34) On 107C Gas outlet nozzle & HAZ of elbow	P-11	Microstructure at weld shows dendritic structure ferrite and carbides and bainite structure. Microstructure at HAZ shows fine & coarse-grained pearlite/bainite and ferrite structure. Parent metal microstructure shows fine-grained ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
21	Location: 21 (Weld/HAZ/PM) SG-1303 11-14 (H-34) On Gas outlet nozzle & HAZ of nozzle	P-11	Weld microstructure shows ferrite and carbides in dendrite form. Microstructure at HAZ shows fine-grained ferrite and pearlite structure. Parent metal microstructure shows fine-grained ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
22	Location: 22 (Parent Metal) SG-1303 10-14" (H36) On 107C Gas inlet elbow	P-22	Microstructure shows fine-grained ferrite and bainite structure.	No significant degradation observed. Monitor after 2 years of service.
23	Location: 23 (Weld/HAZ/PM) SG-26-6" MICA-16 Upstream Flange weld	CS	Microstructure at weld metal shows ferrite and carbides in dendritic form. Whereas at HAZ microstructure shows fine-grained ferrite and pearlite structure. Parent metal microstructure shows fine-grained non-uniformly distributed ferrite and pearlite structure. Presence of few widmanstatten ferrite is observed.	No significant degradation observed. Monitor after 2 years of service.
24	Location: 24 (Weld/HAZ/PM) SG-27-6" MICA-14 Upstream Flange weld	CS	Microstructure at weld metal shows ferrite and carbides in dendritic form. Whereas at HAZ microstructure shows fine-grained ferrite and pearlite structure. Parent metal microstructure shows fine-grained non-uniformly distributed ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
25	Location: 25 (Weld/HAZ/PM) SG-28-6" MICA 13 Upstream Flange weld	CS	Microstructure at weld metal shows ferrite and carbides in dendritic form. Whereas at HAZ microstructure shows coarse-grained ferrite and pearlite structure. Pearlite is observed at the grain boundary. Parent metal microstructure shows fine-grained non-uniformly distributed ferrite and pearlite structure. Presence of few widmanstatten ferrite is observed.	No significant degradation observed. Monitor after 2 years of service.
26	Location: 26 (Weld/HAZ/PM) SG-32-6" MICA-15 Upstream weld	CS	Microstructure at weld metal shows ferrite and carbides in dendritic form. Whereas at HAZ microstructure shows fine-grained ferrite and pearlite structure. Parent metal microstructure shows fine-grained non-uniformly distributed ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
27	Location: 27 (Parent Metal) On face of 1 st Bend of NG-9-12" (101B-mixed feed coil outlet to NG-11)	P 11	Microstructure shows fine grained ferrite and pearlite structure. In-situ spherodization of pearlite is observed. Possibilities of isolated creep cavities are observed.	Monitor after 1 year of service. Recommended to evaluate under SEM after gold sputtering.
28.	Location: 28 (Weld/HAZ) On weld bet ⁿ . Pipe & Elbow (elbow side) of NG-9-12" (101B-mixed feed coil outlet to NG-11)	P 11	Microstructure at weld shows ferrite and bainite in dendritic form whereas at HAZ shows fine-grained bainite and ferrite structure. Microstructure at parent metal shows fine-grained ferrite and pearlite structure. In-situ spherodization of pearlite is observed. Possibilities of isolated creep cavities are observed.	SEM interpretation is kept below.
28.1			Microstructure shows alloy carbides with isolated creep cavities at the grain boundaries.	Creep cavities are present. IInd stage of creep. Monitor after 1 year of service.
29	Location: 29 (Weld/HAZ/PM) On dissimilar Weld Between pipe piece & Nozzle of Header towards HAZ of P11, NG-9-12" (101B-mixed feed coil outlet to NG-11)	SS 304H to P 11	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix, Microstructure at parent metal shows fine-grained ferrite and pearlite structure. In-situ spherodization of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service.

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
29.1			Microstructure shows alloy carbides with isolated creep cavities at the grain boundaries.	Creep cavities are present. IInd stage of creep. Monitor after 1 year of service.
30	Location: 30 (Weld/PM) On dissimilar Weld Between 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	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix, HAZ & parent metal microstructure shows fine & coarse-grained austenite structure with twins. Second phase precipitates including carbides are observed at the grain boundaries.	IInd stage of creep degradations. Monitor after 1 year of service.
31	Location: 31 (Weld + HAZ) On Weld Bet ⁿ BW-11H-8" outlet Nozzle & 103-C Shell at bottom towards East side	P 11	Microstructure at weld metal shows ferrite and carbides in dendritic form whereas at HAZ microstructure shows fine-grained ferrite and pearlite structure. Parent metal shows fine-grained ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
32	Location: 32 (Weld/HAZ) On weld bet ⁿ . flange & Bend of gas inlet nozzle. PG-6 –18 towards east side of 103-C	P 11	Microstructure at weld metal shows ferrite and carbides in dendritic form. Coarsening of ferrite is observed in the weld region, whereas at HAZ microstructure shows fine & coarse grained ferrite with few pearlite structure. Parent metal shows fine-grained ferrite with few pearlite structure. Pearlite is observed at the grain boundaries. Possibilities of isolated creep cavities are observed.	SEM interpretation is kept below.
32.1			Microstructure is free from creep damage at the grain boundaries.	Monitor after 2 year of service.
33	Location: 33 (Weld/PM) On dissimilar weld between pipe & flange of PG-12A-14", 105 CA to PG-26-18 (106-C)	SS 304 To CS	Weld metal microstructure shows dendritic structure of ferrite pools in austenite matrix. Parent metal microstructure shows fine-grained ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
34	Location: 34 (Weld/PM) On dissimilar weld between pipe & flange of PG-12B-14", 105 CB to PG-26-18 (106-C)	SS 304 To CS	Weld metal microstructure shows dendritic structure of ferrite pools in austenite matrix. Parent metal microstructure shows fine-grained ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
35	Location: 35 (Parent Metal) PIC-13B Drain on Weldolet	CS	Microstructure shows coarse-grained widmanstatten ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
36	Location: 36 (Parent Metal) PIC-13B Drain On Elbow	CS	Microstructure shows coarse-grained widmanstatten ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
37	Location: 37 (Parent Metal) PIC-13B Drain On Tee	CS	Microstructure shows coarse-grained widmanstatten ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
38	Location: 38 (Parent Metal) PIC-13A Drain On Weldolet	CS	Microstructure shows coarse-grained ferrite and pearlite structure. Ferrite is observed at prior austenite grain boundaries. In-situ spheroidization of pearlite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
39	Location: 39 (Parent Metal) PIC-13A Drain On Elbow	CS	Microstructure shows coarse-grained widmanstatten ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
40	Location: 40 (Parent Metal) PIC-13A Drain On Tee	CS	Microstructure shows coarse-grained widmanstatten ferrite and pearlite structure. Ferrite is observed at prior austenite grain boundaries.	No significant degradation observed. Monitor after 2 years of service.
41	Location: 41 (Parent Metal) MIC-22 Drain On Weldolet	CS	Microstructure shows coarse-grained widmanstatten ferrite and pearlite structure. Ferrite is observed at prior austenite grain boundary.	No significant degradation observed. Monitor after 2 years of service.

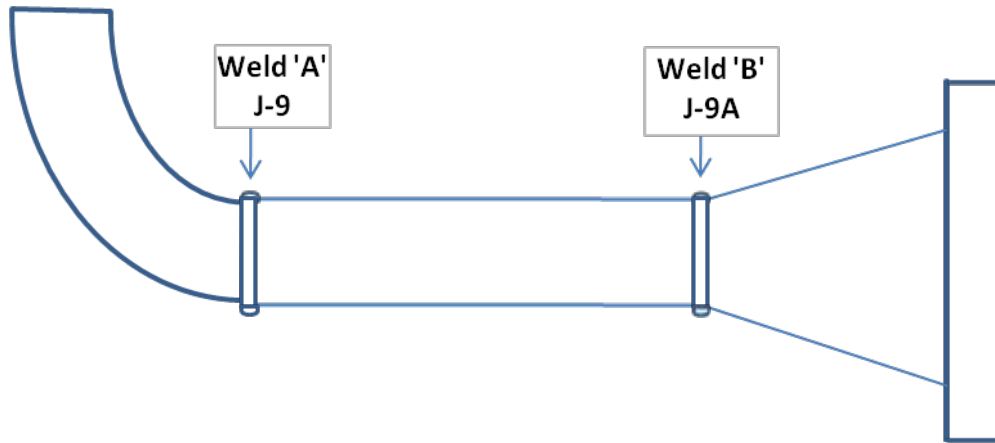
SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
42	Location: 42 (Parent Metal) MIC-22 Drain PI On Elbow	CS	Microstructure shows coarse-grained ferrite and pearlite structure. Ferrite is observed at prior austenite grain boundaries. In-situ spheroidization of pearlite is observed.	Ind stage of creep degradations. Monitor after 1 year of service.
43	Location: 43 (Parent Metal) MIC-22 Drain On Tee	CS	Microstructure shows coarse-grained widmanstatten ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
44	Location: 44 (Weld/HAZ/PM) Row No.-3, Tube NO.7, Tube to Tube Weld Joint top side	Tube-G-4852M	Microstructure at weld shows fine dendrite structure of primary carbides along with secondary precipitation including carbides in the austenite matrix. Whereas HAZ microstructure shows network of primary carbides along with secondary precipitation including carbides in the austenite matrix.	Microstructure is free from any micro cracks. Monitor after 2 years of service.
45	Location: 45 (Weld/HAZ/PM) Row No.-3, Tube NO.29, Tube to Tube Weld Joint top side	Tube-G-4852M	Microstructure at weld shows fine dendrite structure of primary carbides along with secondary precipitation including carbides in the austenite matrix. Whereas HAZ microstructure shows network of primary carbides along with secondary precipitation including carbides in the austenite matrix.	Microstructure is free from any micro cracks. Monitor after 2 years of service.
46	Location: 46 (Weld/HAZ/PM) Row No.-3, Tube NO.30, Tube to Tube Weld Joint top side	Tube-G-4852M	Microstructure at weld shows fine dendrite structure of primary carbides along with secondary precipitation including carbides in the austenite matrix. Whereas HAZ microstructure shows network of primary carbides along with secondary precipitation including carbides in the austenite matrix.	Microstructure is free from any micro cracks. Monitor after 2 years of service.
47	Location: 47 (Weld/HAZ/PM) Row No.-5, Tube NO.11, Tube to Tube Weld Joint top side	Tube-G-4852M	Microstructure at weld shows fine dendrite structure of primary carbides along with secondary precipitation including carbides in the austenite matrix. Whereas HAZ microstructure shows network of primary carbides along with secondary precipitation including carbides in the austenite matrix.	Microstructure is free from any micro cracks. Monitor after 2 years of service.

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
48	Location: 48 (Parent Metal) Aux. Boiler (east side) Tube no.33 from south side	106 Gr.B	Microstructure shows fine-grained banded ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
49	Location: 49 (Parent Metal) Aux. Boiler (west side) Tube no.21 from north side	106 Gr.B	Microstructure shows fine-grained banded ferrite and pearlite structure. In situ spheroidization of pearlite is observed.	IIInd stage of creep degradations. Monitor after 2 year of service.

Note: Location no. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 19, 27, 28, 29, 30, 38, and 42 shall be monitored during next turnaround in detail as recommended by M/S TCR.

ANNEXURE-10

HARDNESS MEASUREMENT OF CONVERTER LOOP SPOOL PIECE



Test	Condition	J9	J9A
DP	Bevel/Root run/Final run	OK	OK
RT	Before SR	OK	OK
	After SR	OK	OK
HARDNESS in BHN Before SR	HAZ of Elbow/Flange	195 to 270	130 to 135
	Weld	180 to 260	245 to 255
	HAZ Pipe	110 to 140	125 to 140
HARDNESS in BHN After SR	HAZ of Elbow/Flange	135 to 170	125 to 135
	Weld	100 to 170	175 to 225
	HAZ Pipe	100 to 130	120 to 135

Annexure - 11

UFD & RT STATUS OF CONVERTER LOOP

JOINT NO.	2013		2014		2015		2016	
	UFD	RT	UFD	RT	UFD	RT	UFD	RT
FROM 108D TO 107C, LINE NO: SG-1303-10-14", SCH-120 (27.79MM NOM THICK.)								
Elbows 1 to 5	NSD	--	NSD	--	NSD	--	NSD	--
J-1	NSD	--	NSD	--	NSD	--	NSD	--
J-2	NSD	--	NSD	--	NSD	--	NSD	--
J-3	NSD	--	NSD	--	NSD	--	NSD	--
J-4	NSD	--	NSD	--	NSD	--	NSD	--
J-5	NSD	--	NSD	--	NSD	--	NSD	--
J-6	NSD	NSD	NSD	--	NSD	--	NSD	NSD
J-7	NSD	NSD	NSD	--	NSD	--	NSD	NSD
J-8	NSD	--	NSD	--	NSD	--	NSD	--
J-9	NSD	--	NSD	--	NSD	--	NSD	--
J-10	NSD	--	NSD	--	NSD	--	NSD	--
J-11	NSD	--	NSD	--	NSD	--	NSD	--
J-12	NSD	--	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	E-2 & E-5 Rest of All NSD	--	NSD	--	NSD	--	NSD	--
J-1	NSD	--	NSD	--	NSD	--	NSD	--
J-2	NSD	--	NSD	--	NSD	--	NSD	--
J-3	--	--	NSD	--	NSD	--	Indication observed	Confirmed by RT and found satisfactory
J-4	--	--	NSD	--	NSD	--	NSD	--
J-5	NSD	--	NSD	--	NSD	--	NSD	--
J-6	NSD	--	NSD	--	NSD	--	NSD	--
J-7	NSD	--	NSD	--	NSD	--	NSD	--
J-8	NSD	--	NSD	--	NSD	--	NSD	--
J-9	--	NSD	NSD	--	NSD	--	NSD	New joint, after SR, NSD
J-9A	--	NSD	NSD	--	NSD	--	NSD	New joint, after SR, NSD
J-9B	--	NSD	NSD	--	NSD	--	NSD	--
J-10	--	--	NSD	--	NSD	--	NSD	--
J-11	NSD	--	NSD	--	NSD	--	NSD	--

JOINT NO.	2013		2014		2015		2016	
	UFD	RT	UFD	RT	UFD	RT	UFD	RT
J-12	NSD	--	NSD	--	NSD	--	NSD	--
J-13	NSD	--	NSD	--	NSD	--	NSD	--
J-14	NSD	--	NSD	--	NSD	--	NSD	--
J-15	NSD	--	NSD	--	NSD	--	NSD	NSD
J-16	NSD	--	NSD	--	NSD	--	NSD	NSD
J-17	NSD	--	NSD	--	NSD	--	NSD	NSD
J-17B	NSD		NSD	--	NSD	--	NSD	NSD
J-17C	NSD	--	NSD	--	NSD	--	NSD	NSD
J-18	NSD	--	NSD	--	NSD	NSD	NSD	NSD
J-19	NSD	--	NSD	--	NSD	--	NSD	--
J-20	NSD	--	NSD	--	NSD	--	NSD	--
J-21	NSD	--	NSD	--	NSD	--	NSD	--
J-22	NSD	--	NSD	--	NSD	--	NSD	--
J-23	NSD	--	NSD	--	NSD	--	NSD	--
J-24	NSD	--	NSD	--	NSD	--	NSD	--
J-25	NSD	--	NSD	--	NSD	--	NSD	--
J-26	NSD	--	NSD	--	NSD	--	NSD	--
J-27	NSD	--	NSD	--	NSD	--	NSD	--
J-28	NSD	--	NSD	--	NSD	--	NSD	--
J-29	NSD	--	NSD	--	NSD	--	NSD	--
J-30	NSD	--	NSD	--	NSD	--	NSD	--
J-T1	NSD	NSD	NSD	--	NSD	--	NSD	--
J-T2	NSD	NSD	NSD	--	NSD	--	NSD	--
J-T3	NSD	NSD	NSD	--	NSD	--	NSD	--
J-T4	NSD	NSD	NSD	--	NSD	--	NSD	--
J-T5	NSD	NSD	NSD	--	NSD	--	NSD	--
J-T6	NSD	NSD	NSD	--	NSD	--	NSD	--
FROM 107D TO 123C, LINE NO: SG-1303-11-14", SCH-140 (31.75MM NOM THICK.)								
Elbows 1 to 6	E-2 & E-3 Rest of All NSD	--	NSD	--	NSD	--	NSD	--
J-1	NSD	--	NSD	--	NSD	--	NSD	--
J-2	NSD	--	NSD	--	NSD	--	NSD	--
J-3	--	--	NSD	--	NSD	--	NSD	--
J-4	--	--	NSD	--	NSD	--	NSD	--
J-5	--	--	NSD	--	NSD	--	NSD	--
J-6	--	--	NSD	--	NSD	--	NSD	--
J-7	NSD	--	NSD	--	NSD	--	NSD	--
J-8	NSD	--	NSD	--	NSD	--	NSD	--
J-9	NSD	NSD	NSD	--	NSD	--	NSD	--
J-10	NSD	NSD	NSD	--	NSD	--	NSD	--

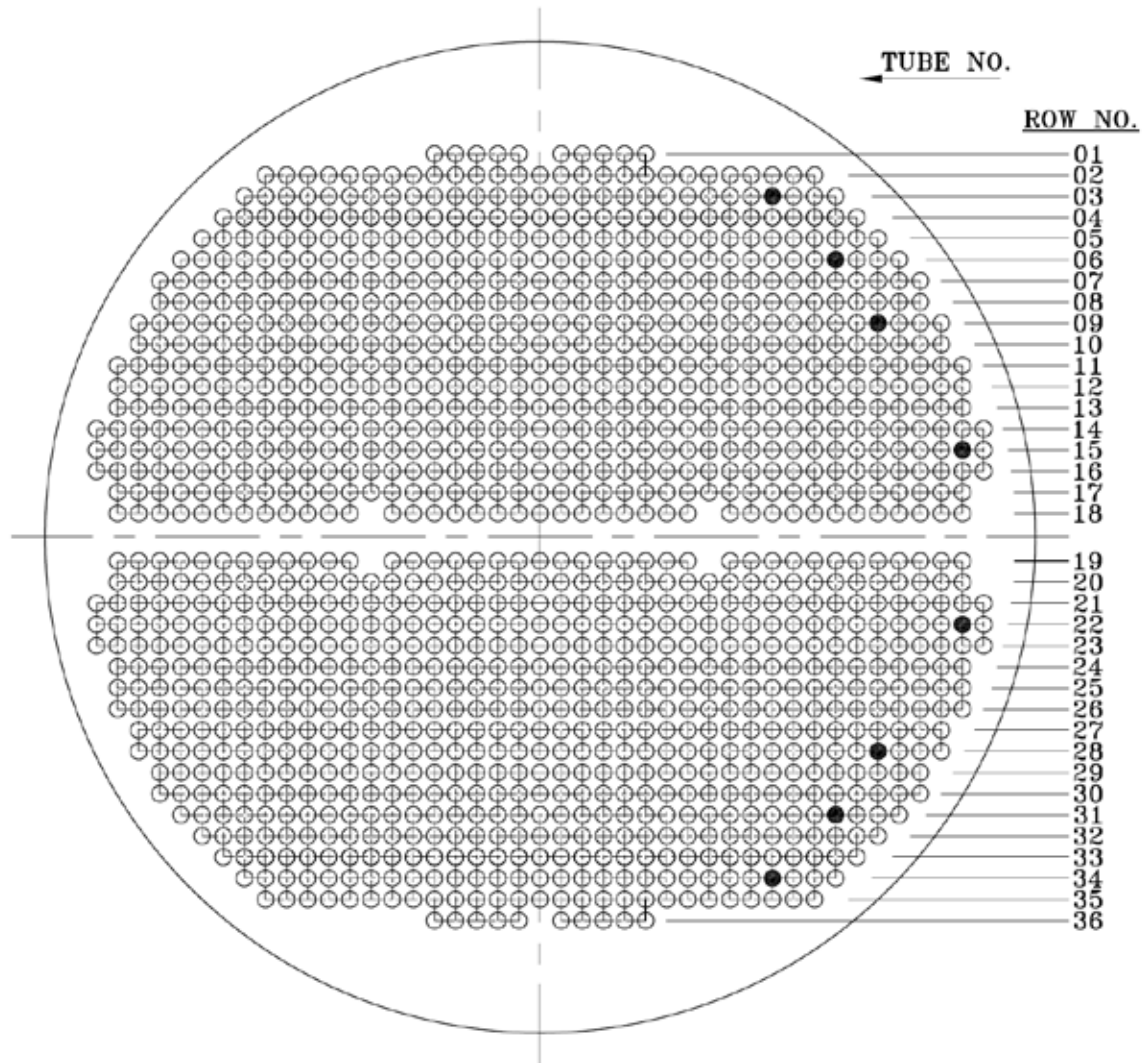
JOINT NO.	2013		2014		2015		2016	
	UFD	RT	UFD	RT	UFD	RT	UFD	RT
J-11	NSD	NSD	NSD	--	NSD	--	NSD	--
J-12	NSD	NSD	NSD	--	NSD	--	NSD	--

NSD: No Significant Defect

Annexure - 12

TUBE SHEET LAY OUT OF 115-C, METHANATOR EFFLUENT COOLER

IFFCO INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL



TUBE PLUGGING DETAIL S/D-2016			
ROW NO.	TUBE NO.	DESCRIPTION	REMARKS
15	2	LEAK IN AIR TEST @ 3.5 Kg/cm ²	S/D-2016
3	4		
6	4	LEAK IN HELIUM TEST	
9	4		

NAME	DATE	TITLE -	EWR No.
DRN	N.V. PANCHAL	05.05.2016	TUBE LAYOUT FOR 115-C
CHD		DRAWING No.	SCALE :
APD		CODE <AMM-000>	SHEET OF 1 1
		PLANT FROM NUMBER	REV. 0
		P 1 E S 0 4 P P P	

UREA PLANT

(INSPECTION)

During Annual Shutdown 2016, 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) & H.P Condenser (H-1202).
- Eddy Current Testing of H.P. Stripper (H-1201) tubes by M/s TesTex NDT India Pvt. Limited.
- Eddy Current Testing of H.P. Carbamate Condenser (H-1202) tubes by M/s TesTex NDT India Pvt. Limited.
- Inspection of L.P. Carbamate Condenser (H-1205) tubes by Internal Rotating Inspection System (IRIS).
- 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**.
- Insitu-Metallography was carried out at selected location on equipment. Summary of observations and microstructure analysis is given at **Annexure-5**.
- 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.

HIGH PRESSURE VESSELS

Following High-pressure equipments were inspected. The observations are listed below:

V-1201 (AUTOCLAVE)

VISUAL INSPECTION

Thorough visual inspection of the liner, its welds and internals was carried out. Observations made in each compartment are mentioned below.

Compartment No.1 (Top Compartment)

- Roughening / corrosion of dome liner was observed along with grayish oxide layer adhered on dome and man way surface.

- In approx. 1-1.5” area just above man way liner’s top C seam high corrosion attack observed all around the circumference.
- Liner segment just below the dome liner was found silver bright in colour throughout the circumference.
- Overall tray corrosion is high in all four segments.
- 1 no. of J bolt found missing just near down comer funnel at north side.
- Previously repaired defects found satisfactory.
- C Seam and L seam welding found satisfactory.

Compartment No.2

- Roughening of tray holding clits and grayish brown oxide layer was observed on bottom side of trays same was observed during previous inspection.
- 01 no. of tray holding clit was found blackish in color and having severe corrosion attack including its welds, same observed in last inspection.
- Due to corrosion / erosion of trays, cavities/gaps were observed between tray and it’s welding with annular shell liner plate.
- Overall tray corrosion is high in first compartment.
- Down comer found dark brown in colour and rough in surface.
- Sharp welding edges formed on down-comer welds due to its erosion.



- Previously repaired defects found satisfactory.
- C Seam and L seam welding found satisfactory.

Compartment No.3

- Bulging of approx. 8mm depth and 2.5” width was observed behind tray skirt in SW to South direction, same was observed during previous inspection.
- 04 nos. of tray holding clits were observed blackish in color and having severe corrosion attack including its welding, same observed in last inspection.
- Due to corrosion / erosion of trays, cavities/gaps were observed between tray and it’s welding with annular plate, high corrosion observed in west side tray.
- Tray bottom surface corrosion is high.

- Insert liner (Size 3.5' long x 4" width approx) observed silver shiny in color.
- Previously repaired defects found satisfactory.
- C Seam and L seam welding found satisfactory.

Compartment No.4

- Approx. 30 mm below C seam depression of approx. 100 mm dia. and 3 mm depth was observed in West side liner. Same was observed during last inspection.
- Convex bulging of liner plate observed just above C 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 seam in approx. 80% of the periphery. Same was observed during last inspection.
- Grayish and brownish oxide layer was observed on the bottom side of trays, prominent on west side.
- 03 nos. of tray holding clits were found black and observed sever corrosion attack including its welding, same observed in last inspection.
- Due to corrosion / erosion of trays, cavities/gaps were observed between tray and it's welding with annular plate.
- Insert liner (Size 3.0' long x 4" width approx) observed silver shiny in color.
- Previously repaired defects found satisfactory.
- C Seam and L seam welding found satisfactory.

Compartment No.5

- Convex bulging of liner plate was observed just above the C seam 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 seam in full periphery. The same was observed during last inspection.
- Previously repaired defects found satisfactory.
- C Seam and L seam welding found satisfactory.

Compartment No.6

- Convex bulging of liner plate was observed above the C seam 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 seam from East to West side L-seam through North side of the shell. The same was also observed during last inspection.
- New welding was done on C seam and L seams by M/s Dowel Erectors in 2012.
- Previously repaired defects found satisfactory.
- C Seam and L seam welding found satisfactory.

Compartment No.7

- Convex bulging of liner plate was observed above the C seam 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, prominent in man way.
- 04 nos. of tray holding clits were found to be blackish in coloration and having severe corrosion attack including its welding, same observed in last inspection.
- New welding was done on C seam and L seam by M/s. Shree Ganesh Engg. in 2014.
- Previously repaired defects found satisfactory.
- C Seam and L seam welding found 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 last inspection also.
- 05 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 its welding found intact.
- New welding was done on both long seams by M/s Shree Ganesh Engg. in 2014.
- C Seam and L seam welding found satisfactory.

Compartment No.9

- 02 nos. of tray holding clit was found blackish in colour near man way and having severe corrosion attack including its welding, same observed in last inspection.
- No noticeable bulging observed in liners.
- Insert liner found silver shiny in color and its welding found intact..
- New welding was done on two no's of C seam and on both L seams of the compartment by M/s Shree Ganesh Engg. In 2015.
- C Seam and L seam welding found satisfactory.

Compartment No.10

- Concave depression of approx 7mm depth at approx 70mm below the C seam in south side of shell in approx. 100 mm dia was observed. Same was observed in last Inspection.
- Concave depression of approx. 9 mm depth just above the C-seam towards the south side of man way and adjacent to L-seam in approx. 100 mm dia. was observed. Same was observed in 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. Same was observed during last inspection.

- 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.
- Pinhole was found in Helium leak detection test of approx 1.0 mm in Dia which was repaired by welding after grinding in S/D 2015.
- Insert liner found silver shiny.
- New welding was done on two no's of C seam and on both L seam of the compartment by M/s Shree Ganesh Engg. In 2015.
- C Seam and L seam welding found satisfactory.

Compartment No.11

- Just below C seam concave depression of approx. 5 to 6 mm depth in approx. 100mm dia. in North-West direction was observed. The same was observed during last inspection also.
- Concave depression of approx. 5mm and 9mm deep in approx. 100mm dia. Was observed just above the C seam in north and west side of the shell respectively. The same was observed during last inspection also.
- On new liner segment convex bulging up to max. 3 mm height having width approx. 10 mm observed just above C 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 seam in old and new liner. The same was observed during last inspection also.
- East and West side both L seams weld roughening observed in past inspection.
- New welding was done on both L seam of the compartment by M/S Shree Ganesh Engg and found satisfactory in DP test.(In S/D 2016).

Compartment No.12 (Bottom Compartment.)

- Down comer nozzle with dish end liner weld joint edges were observed exposed. The same was observed during last inspection also.
- Dark brown coloration on dish end observed.
- Concave depression of approx. 2-3 mm depth and approx. 5mm depth were observed at approx. 200mm above the C seam in 4"dia in east and west direction of the shell respectively. The same was observed during last inspection also.
- All tray holding clits of old Trays were found blackish in color and having corrosion attack including its welding.



- D.P test carried out on all the nozzles welding and found satisfactory.



- 03 nos. petal welding observed rough /porous, marked with yellow chalk which were repaired by M/s Ganesh Engg. and found satisfactory in D.P test.

NOTE

- The existing trays were replaced by Casale H.E. trays in this turn-around .These trays are in 6 segments. Tray Material is 2Re69 (UNS 31050) & installed thickness is 5.0 mm.



- Cleat welding carried out with shell liner and with tray mounting base ring for installation of new trays. D.P. test & ferrite measurement was carried out after welding job.
- The un-assessed location of L seams behind the trays in all the compartments which couldn't be repaired by grinding welding in earlier shutdowns were repaired by grinding & welding in this shutdown before the erection of New H.E. trays.



- Severe etching observed on Down comer in almost all the compartment
- NE-North East, SW-South West, NW-North West, SE- South East, 'L'- Long seam, 'C'- C seam.

THICKNESS MEASUREMENT:

DETAILED THICKNESS REPORT OF AUTOCLAVE (V-1201)							
COMPARTMENT NO.	LOCATION OF MEASUREMENT	NOM. THK. (mm.)	OBSERVED THICKNESS (in mm.)				REMARK
			EAST (1)	WEST (2)	NORTH (3)	SOUTH (4)	
01 (TOP)	Shell Liner New	6.50	7.22	7.21	7.42	7.23	750mm Section Replaced in Yr. 2002 by BC-05.
	Shell Liner Old (Top)	5.00	3.76	4.79	4.87	4.48	Overall Min. liner thick.
	Shell Liner Old (Middle)	5.00	4.07	4.58	4.48	4.20	
	Shell Liner Old (Bottom)	5.00	4.63	4.48	4.65	3.94	
	Dish-End	6.50	6.60	6.57	6.45	6.64	Replaced in Yr. 2002 by BC-05.
	Manway Liner	6.50	6.66	6.87	6.76	6.86	Replaced in Yr. 2002 by BC-05.
02	Shell Liner (Top)	5.00	4.23	4.37	4.62	4.15	
	Shell Liner (Middle)	5.00	3.92	4.32	4.53	4.26	
	Shell Liner (Bottom)	5.00	4.16	4.39	4.42	4.14	
	Down-Comer	9.50	5.87	5.86	5.82	5.90	
03	Shell Liner (Top)	5.00	4.10	4.34	4.07	3.88	
	Shell Liner (Middle)	5.00	4.22	4.44	4.16	3.94	
	Shell Liner (Bottom)	5.00	4.44	4.12	4.12	4.20	

DETAILED THICKNESS REPORT OF AUTOCLAVE (V-1201)

COMPARTMENT NO.	LOCATION OF MEASUREMENT	NOM. THK. (mm.)	OBSERVED THICKNESS (in mm.)				REMARK
			EAST (1)	WEST (2)	NORTH (3)	SOUTH (4)	
	Insert Liner	6.50	6.85	6.82	6.71	6.61	Replaced in Yr. 1997
	Down-Comer (Shiny)	9.50	8.74	9.12	8.36	8.82	
	Down-Comer	9.50	5.06	5.20	5.72	5.73	Overall Minimum Down- Comer thickness
04	Shell Liner (Top)	5.00	4.25	3.87	4.10	4.28	
	Shell Liner (Middle)	5.00	4.23	4.20	4.12	4.54	
	Shell Liner (Bottom)	5.00	4.36	4.33	4.24	4.40	
	Insert Liner	6.50	6.25	6.20	6.25	6.09	Replaced in Yr.1999
	Down-Comer	9.50	6.02	5.92	6.14	6.06	
05	Shell Liner (Top)	5.00	5.23	4.90	4.62	4.67	
	Shell Liner (Middle)	5.00	5.50	4.80	4.54	4.74	
	Shell Liner (Bottom)	5.00	5.65	4.70	4.38	4.83	
	Down-Comer	9.50	6.22	6.28	6.30	6.34	
	Down-Comer (Shiny)	9.50	9.2	9.01	9.14	8.53	
06	Shell Liner (Top)	5.00	4.48	4.56	4.38	4.50	
	Shell Liner (Middle)	5.00	4.23	4.82	4.47	4.71	
	Shell Liner (Bottom)	5.00	4.60	4.69	4.38	4.48	
	Down-Comer	9.50	6.61	6.28	6.25	6.40	
07	Shell Liner (Top)	5.00	4.42	4.69	4.42	4.60	
	Shell Liner (Middle)	5.00	4.52	4.57	4.49	4.65	
	Shell Liner (Bottom)	5.00	4.32	4.62	4.58	4.56	
	Down-Comer	9.50	6.43	6.53	6.62	6.83	
08	Shell Liner (Top)	5.00	4.60	4.52	4.72	4.68	
	Shell Liner (Middle)	5.00	4.64	4.64	4.58	4.58	
	Shell Liner (Bottom)	5.00	4.62	4.50	4.52	4.60	
	Insert Liner	6.50	6.46	6.87	6.58	6.58	Replaced in Yr. 2000
	Down-Comer	9.50	6.73	6.75	6.81	6.70	
09	Shell Liner (Top)	5.00	4.46	4.90	4.62	4.42	
	Shell Liner (Middle)	5.00	4.79	4.73	4.65	4.67	
	Shell Liner	5.00	4.54	4.68	4.54	4.65	

DETAILED THICKNESS REPORT OF AUTOCLAVE (V-1201)							
COMPARTMENT NO.	LOCATION OF MEASUREMENT	NOM. THK. (mm.)	OBSERVED THICKNESS (in mm.)				REMARK
			EAST (1)	WEST (2)	NORTH (3)	SOUTH (4)	
	(Bottom)						
	Insert Liner	6.50	6.28	6.91	6.68	6.53	Replaced in Yr. 2001
	Down-Comer	9.50	7.19	6.68	7.02	7.20	
10	Shell Liner (Top)	5.00	5.40	5.18	5.26	4.93	
	Shell Liner (Middle)	5.00	5.10	5.32	5.37	5.04	
	Shell Liner (Bottom)	5.00	5.02	5.38	5.38	5.03	
	Insert Liner	6.50	7.12	7.20	7.89	7.72	Replaced in Yr. 2002
	Down-Comer	9.50	7.14	7.22	7.19	7.21	
11	Shell Liner (Top)	5.00	4.70	4.72	4.62	4.61	
	Shell Liner (Middle)	5.00	4.46	4.76	4.68	4.74	
	Shell Liner (Bottom)	5.00	4.63	4.72	4.50	4.79	
	Insert Liner	6.50	6.12	6.65	6.49	6.75	Replaced in Yr. 2002
	Down-Comer	9.50	7.75	7.80	7.82	7.73	
12 (BOTTOM)	Shell Liner	5.00	4.74	4.68	4.67	4.70	
	Petal Plate	7.00	6.34	6.28	6.72	6.43	
	Dish-End	7.00	6.83	6.75	6.66	6.49	Replaced in Yr. 1993
	Reducer 10" x 8"	10.00	9.74	9.86	9.69	9.68	Replaced in Yr. 1997
	10" - Pipe	10.00	8.46	8.38	8.26	8.74	
	8" - Pipe (Dist. Piece)	6.00	4.89	5.92	5.37	4.58	Replaced in Yr. 2000
	Nozzle - 8"	6.00	4.52	4.20	4.58	4.27	

Note

- The Complete down-comer was replaced in 1997.
- The measured minimum thickness of Scholler-Blackmen trays in S/D 2015 was 2.99mm against installed thickness of 8.0mm.

H-1201 (HP STRIPPER)

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. No corrosion has been observed.

- The overlay welding on the tube sheet was grey and slightly etched.
- The tube welds were bright and smooth. Thick & hard oxide deposition was observed, more prominent in East - West direction between the tubes on tube sheet area.
- The tubes were found smooth from inside.

BOTTOM CHANNEL

- The condition of sealing face was found satisfactory.
- The overlay welds in the man way were silver and slightly etched.
- Dark brown patches observed at periphery of tube sheet at scattered locations.



- 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 found more etched than the surrounding areas.
- The tube sheet was covered with a thin grey oxide layer. This layer seems to be more hard & bonded on tube-sheet to shell weld joint.
- The tubes from inside were smooth.
- The liquid outlet pipe and the gas inlet pipe were bright, shiny and showed no defects. Their nozzles and welds were in satisfactory condition.
- 01 no. Impingement plate washer of CO2 Inlet line turned black and 2 nos. found missing.

BOTTOM COVER

- The overlay welding was very smooth and shows no defects.
- The vortex strips were silver shiny and good in condition.

THICKNESS MEASUREMENT

The weld overlay thickness was measured with a Fischer Dual Scope MP40 & liner thickness was measured using DMS-2 Ultrasonic thickness meter.

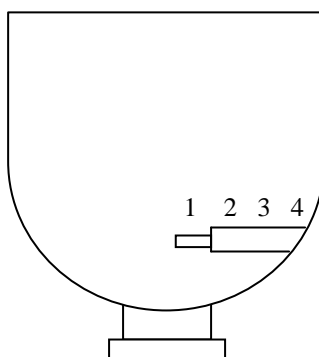
BOTTOM DOME

	Minimum Thickness (mm)	Maximum Thickness (mm)	Design Thickness, mm (Minimum)
Man way (Overlay)	19.13	21.36	8.0
Dome area (Overlay)	12.45	14.21	8.0
Cylindrical area (Liner)	8.12	8.48	8.0
Tube sheet-Overlay weld	13.42 (Machined)	15.25 (Machined)	8.0
Bottom Cover (Overlay)	16.45	17.26	8.0

TOP DOME

	Minimum Thickness (mm)	Maximum Thickness (mm)	Design Thickness, mm (Minimum)
Man way (Overlay)	19.25	22.85	8.00
Dome area (Overlay)	9.50	13.25	8.00
Cylindrical area (Liner)-Gas phase	8.24	9.53	8.00
Cylindrical area (Liner)-Liquid phase	8.12	8.45	8.00
Tube sheet-Overlay weld	13.27 (Machined)	13.85 (Machined)	8.00

RADIOACTIVE SOURCE WELL



Bottom Dish End

POINT NO.	DESIGN THK.	MEASURED THICKNESS (Minimum)
1	7.5	8.64
2	19.0	18.35
3	19.0	18.58
4	19.0	18.45

All measurements are in mm.

FERRITE MEASUREMENT

Ferrite measurement was carried out at random locations on welds and parent metal. No ferrite was found.

EDDY CURRENT TESTING OF TUBES

Eddy current inspection of tubes was carried out by M/s TesTex NDT India Pvt. Ltd. for 2599 tubes from top tube sheet end up to a length of 4.5 meters. 01 tube was plugged before inspection. (Total no of tubes 2600). The Results are as under:

- Wall loss : 0.76 to 0.80 mm observed in 003 tubes
- Wall loss : 0.81 to 0.85 mm observed in 021 tubes
- Wall loss : 0.86 to 0.90 mm observed in 295 tubes
- Wall loss : 0.91 to 0.95 mm observed in 415 tubes
- Wall loss : 0.96 to 1.00 mm observed in 703 tubes
- Wall loss : 1.01 to 1.05 mm observed in 826 tubes
- Wall loss : 1.06 to 1.10 mm observed in 336 tubes

Result and Conclusion: Majority of the wall thinning was observed between 2nd to 5th baffle from top tube-sheet. (Tube sheet layout attached at **Annexure-6**).

H-1202 (H.P. CONDENSER)

TOP CHANNEL HEAD

- The gasket sealing face was found satisfactory.
- The liner and welds in the channel were shiny and slightly rough.
- C Weld seam, patch plate in South direction and long seam welding of shell liner found rough.
- Weld bead corrosion observed in 2" length at 01 location on dish end to shell liner weld in East direction marked by yellow chalk, need to be weld overlaid.
- 01 no. crevice cavity was observed on shell liner longitudinal weld seam in west direction, marked with yellow chalk. Need to be weld deposited.
- The liners above to the gas inlet have scattered bluish grey oxide scale.
- The tray support clips were shiny and slightly etched.
- The tube-to-tube sheet welds were found satisfactory.
- The few tube ends were found slightly damaged, these were also observed in earlier inspections.
- Many tube showed burn-through at ID of tube, these were also observed in earlier inspections.

BOTTOM CHANNEL HEAD

- The sealing face was found satisfactory.
- Man-way, Shell and dish end liner was silvery, shiny in color.

- All liner welds and repairs were bright and smooth.
- The tube to tube sheet welds were bright shiny and smooth.
- Many tubes showed burn-through defects, these were also observed in earlier inspections.
- Roughening of Gas outlet nozzle long seam welding observed, however the repaired locations are smooth & shiny.

BOTTOM CHANNEL COVER

- The sealing face was found satisfactory.
- The liner was shiny and slightly etched.

THICKNESS MEASUREMENT

Weld Overlay and Liner thickness measurement:

The wall thickness of the liner was measured using a Krautkramer DMS-2 thickness meter (accuracy 0.01 mm). The weld overlay thickness has been measured using Dual Scope MP40.

BOTTOM DOME

	Minimum Thickness (mm)	Maximum Thickness (mm)	Design Thickness (mm)
Man way (Liner)	4.27*	5.93	6.0
Dome area (Liner)	6.53	6.97	6.0
Cylindrical area (Liner)	6.28	6.80	6.0
Tube sheet-Overlay weld	9.30	10.7	8.0 (Min)
Bottom Cover (Liner)	19.10	19.83	18.0

*Near vertical seam (Thickness was observed in the same range during previous inspection also)

TOP DOME

	Minimum Thickness mm	Maximum Thickness mm	Design Thickness mm (Minimum)
Man way (Liner)	5.18	6.75	6.0
Dome area (Liner)	6.38	6.58	6.0
Cylindrical area (Liner)	6.23	6.58	6.0
Tube sheet-Overlay weld	7.72	8.96	8.0 (min)

FERRITE MEASUREMENT

- Random Ferrite measurement was carried out on welds and parent metal.
- No Ferrite was found.

EDDY CURRENT TESTING OF TUBES

- Eddy current inspection was carried out by M/s TesTex NDT India Pvt. Ltd. Total tubes in H.P. condenser are 1970 out of which 218 tubes were tested for 12000mm tube length and 1725 tubes tested for 4000mm length. 10 tubes could not be tested due to tray support pads obstructing the probe.
- Total 1941 tubes having wall loss less than 20% observed.
- Till date 19 tubes are plugged.

AIR-BUBBLE TEST FOR LEAK DETECTION

- Air Bubble test was carried out at 3.0 Kg/cm² to detect any leakage from the Tube or Tube to Tube-sheet weld joints.
- No Leakage observed.
- No tube plugged in this turnaround. Total 19 tubes are plugged till date. The tube sheet layout is attached at **Annexure-7.**

H-1205 (LP CARBAMATE CONDENSER)

IRIS INSPECTION OF TUBE BUNDLE

Tubes were inspected by M/s TesTex NDT India Pvt. Ltd, Mumbai by Internal Rotating Inspection System (IRIS). Total No. of U-tubes are 581 Nos. or 1162 tube holes

Result and Conclusion:

% Wall Loss No. of Tubes (Total Inspected 513 Holes.)

0-10	375
11-20	114
21-30	24
31-40	00
41-55	Nil

Note:

- Row No. East to West
- Tube No. North to South

The tube sheet layout is attached at **Annexure-8.**

INSPECTION OF OTHER VESSELS / EQUIPMENT

H-1104 (CO₂ SPRAY COOLER)

- Demister pad condition was found satisfactory.
- Risers holding clamps with Liquid distributor tray were found satisfactory.
- Weld joint condition was found satisfactory.

H-1131-A (LO COOLER OF P-1102-A)

- Condition of tube to tube sheet weld was found satisfactory.
- Thick brownish scales & pitting were observed on the channel area & baffle plate.
 - Through Hole was observed on Baffle plate.



H-1131-B (LO COOLER OF P-1102-B)

- Thin creamy scales were observed inside the tubes.
- Thick brownish scales were observed on the tube sheet, channel area & baffle plate.
- Deep cavities and scales were observed on the tube-sheet area (West Side).



H-1131-C (LO COOLER OF P-1102-C)

- Thin creamy scales were observed inside few the tubes.
- Tube sheet condition was found satisfactory.

H-1204 (RECIRCULATION HEATER)

- Hard blackish scaling prominent at bottom side observed inside the tubes.
- Brownish scaling was observed on both top and bottom tube sheet.
- Tube to tube sheet welding found satisfactory.

H-1207 (CIRCULATION SYSTEM -II COOLER)

- Pitting and whitish scaling was observed on the tube sheet area.
- Channel cover was found pitted / corroded from inside.
- Scaling was observed on the inside surface of all tubes.
- Epoxy primer may be applied inside channel cover.

H-1231-A (LO COOLER OF P-1201- A)

- Condition of tube to tube sheet weld was found satisfactory.
- Thin creamy scales were observed inside almost all the tubes.
- Overall condition of the coolers was found satisfactory.

H-1231-B (LO COOLER OF P-1201- B)

- Thin creamy scales were observed inside almost all the tubes.
- Condition of tube to tube sheet weld was found satisfactory.

H-1352 (REFLUX CONDENSER)

TOP TUBE SHEET

- Tube to tube sheet welding found satisfactory.
- Minor scaling was observed on the inside surface of all the tubes and on tube-sheet Area.

BOTTOM TUBE SHEET

- Tube to tube sheet welding was found satisfactory on CW inlet side.
- Thick scaling was found on the CW outlet side tube sheet.
- On cooling water outlet side, minor scaling was observed inside the tubes and outlet line Elbow.
- Epoxy primer paint inside the channel area may be applied
- Thermo wells were found intact in position.

H-1419 (PRE-EVAPORATOR CONDENSER)

TOP TUBESHEET

- Tube to tube sheet weld found satisfactory.
- Minor whitish scaling was observed inside the tubes.
- Brownish coloration was observed on the tube sheet at few locations.
- Overall condition of heat exchanger found satisfactory.

H-1420 - TOP (FINAL CONDENSER)

- Tube to tube sheet welding found satisfactory.
- Inside surface of the tubes found satisfactory.

H-1421 (FLASH TANK CONDENSER)

- Tube to tube sheet welding was found satisfactory.
- Minor scaling observed inside most of the tubes.
- All the tubes were found filled with water.

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.
- Condition of impingement cone found satisfactory.
- Impingement cone to support bolts were observed bent, However they were tack Welded and found satisfactory.
- Top distributor outlet vanes found clear and intact.
- Condensate flushing nozzles (08 nos.) were found in satisfactory condition.
- At bottom dish end water and urea lumps were observed.

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.
- All the tubes were found filled with water.

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 and tubes found clear from I.D.
- C sparger and its supports found bent in downward direction at many locations.



- Off gas line was removed due to polymer depositions.

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.
- Thick brownish scales were observed on the tube sheet.
- Minor scales were observed inside few tubes.
- Tubes were found filled with water.

H-1814-A & H-1814-B, L.O. COOLER OF HITACHI COMPRESSOR

- Condition of tubes and tube sheet was found satisfactory.
- Thin scaling was observed inside the tubes.

H-1811, 1st INTER STAGE COOLER OF HITACHI COMPRESSOR

- Condition of tubes and tube sheet was found satisfactory.
- Thin scattered scaling observed on tubes.
- Scaling and rust observed on baffle plates.
- Near the baffle location scales/rust observed on OD of the tubes.



H-1812, 2nd INTER STAGE COOLER OF HITACHI COMPRESSOR

- Condition of tubes and tube sheet was found satisfactory.
- Thin scattered scaling observed on tubes.
- Baffle tie rods were slightly bent.

H-1813, 3rd INTER STAGE COOLER OF HITACHI COMPRESSOR

- Condition of tubes and tube sheet was found satisfactory.
- Heavy erosion / corrosion observed on baffles.
- Old tie rods are replaced by SS material.
- Thin milky scales were observed on tubes.

H-1815 (SURFACE CONDENSER)

NORTH SIDE HALF (EAST SIDE CHANNEL)

TOP HALF

- Tube sheet was found in satisfactory condition.
- Epoxy coating was found intact.
- Thermo well was found intact.
- Minor scaling was observed at ID of few tubes.
- Loose scale with water found lying at bottom.

BOTTOM HALF

- Tube sheet was found in satisfactory condition.
- Epoxy coating was found peeled off at few locations and initiation of rusting/corrosion observed at such locations.



- Minor scaling was observed at ID of few tubes.
- Loose scale with water found lying at bottom.

NORTH SIDE HALF (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 scattered location.
- Loose scale with water found lying at bottom.

BOTTOM HALF

- Tube sheet was found in satisfactory condition.
- Thermo well was found intact.
- Paint found peeled off at scattered locations.

SOUTH SIDE HALF (EAST SIDE CHANNEL)

TOP HALF

- Tube sheet was found in satisfactory condition.
- Minor scaling was observed at ID of few tubes.
- Thermo well was found intact.
- Debris were observed at bottom surface.

BOTTOM HALF

- Tube sheet was found in satisfactory condition.
- Minor scaling was observed at ID of few tubes.
- Minor damage of epoxy coating was observed.

SOUTH SIDE HALF (WEST SIDE CHANNEL)

TOP HALF

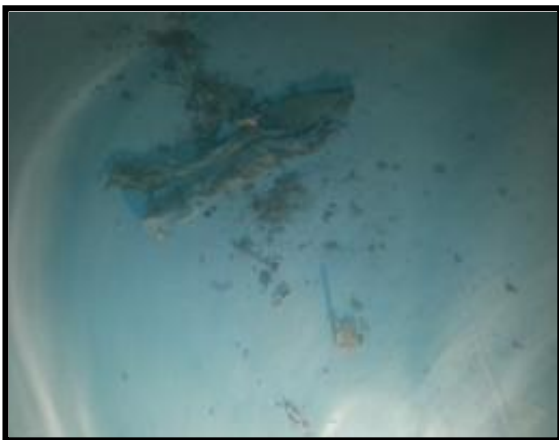
- Tube sheet was found in satisfactory condition.
- Minor scaling was observed inside the tubes.

BOTTOM HALF

- Tube sheet was found in satisfactory condition.
- Thermo well was found intact.
- Minor damage of epoxy coating was observed.

NEW AIR RECEIVER

- Metal pieces, Pieces of welding rods and Debris found lying at the bottom which were removed and cleaned.



- Minor damage of epoxy paint observed at scattered location.
- Weld joints condition found satisfactory.
- Nozzles condition found satisfactory.
- Overall condition 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-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-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 centre and downward at entire Circumference as observed in the past also.
- Stiffener provided on top roof plate was found intact in position.

T-1401-A , NEW UREA SOLUTION TANK

- Brownish gray coloration observed inside of the shell.
- Thermo-well condition found satisfactory.
- Nozzles and weld joint condition satisfactory.
- Thermo-well condition found satisfactory.
- Overall condition found satisfactory

T-1501 (CONDENSATE TANK).

- Reddish brown coloration was observed inside the tank.
- Weld joint condition found satisfactory.
- Supports of 6” condensate inlet found intact.
- Overall condition of the tank found satisfactory.

V-1101 (CO2 KNOCK OUT DRUM)



- Epoxy paint was found peeled off from few locations in bottom dish end and shell also.
- Demister pads were found satisfactory.

V-1102 (NH₃ SUCTION FILTER)

- Colour of filter was observed brownish from inside.
- Filter support ring and strips were found intact.
- Condition of the weld joint was found satisfactory.
- Condition of SS filter was found satisfactory.
- Oil was found at the bottom of the filter.

V-1103 (NH₃ SUCTION VESSEL)

- Vessel from inside was found blackish.
- The condition of longitudinal and C weld joints was satisfactory.
- Oily layer was found on the bottom dish end, shell and man way.
- Level troll nozzles found intact.
- Overall condition was found satisfactory.

V-1202 (RECTIFYING COLUMN)

FROM TOP MANHOLE

- Grey hard scales were observed on entire shell portion.
- Tray holding cleats holes observed elongated.
- Tray support / Mesh Grid support strips found satisfactory and they were covered with grayish hard scales.

FROM BOTTOM MANHOLE

- Coloration of top cone was brownish with white solution like layer observed.
- Condition of the nozzles found satisfactory
- Overall condition of vessel is satisfactory.

V-1203 (L.P. ABSORBER)

FROM BOTTOM MANHOLE

- Shell observed silver shiny in colour.
- One no of rasching ring holding tray bolt found shifted from its position and nut of few bolts were found missing.



FROM TOP END

- Shell observed brownish in colour.
- Perforated support grid just below top hand hole was found intact in position.

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, However header clamping bolts found loose / nut missing at west end.



- Overall condition was found satisfactory.

V-1207 (L.P. SCRUBBER)

From Top Cover

- Shell portion observed brownish black from inside.
- Grating condition was satisfactory. Condition of the top cover was found satisfactory.

Middle Manhole/ Flange

- Perforated tray observed detached & lying in-between / stuck-up in shell.



Bottom Hand hole

- Nozzle found filled with Paul rings.



V-1301 (SECOND DESORBER)

BOTTOM COMPARTMENT

- Shell observed blackish in color from inside.
- Nozzle condition was found satisfactory.
- Thermo well was found intact.
- Overall condition was found satisfactory.

V-1351 (HYDROLYSER)

TOP COMPARTMENT

- Brownish black coloration was observed on Top dish end and shell.
- Trays also observed brownish black in color.
- Fasteners of top sieve tray were found intact in position.

BOTTOM COMPARTMENT

- Grayish black coloration was observed from inside.
- Condition of the perforated trays found satisfactory.
- Tray clamps & steam inlet pipe found satisfactory.
- Flange and clamp fasteners of Steam inlet pipe were found loose / missing.

V-1352 (FIRST DESORBER)

FROM BOTTOM MANHOLE

- Brownish coloration was observed inside the vessel.
- Thin minor scaling was observed on the shell surface.
- Condition of the perforated trays found satisfactory.
- Weld joint condition was found satisfactory.

FROM TOP MANHOLE

- Brownish coloration was observed inside the vessel.
- All fasteners were found intact
- Weld joint condition was found satisfactory.
- Manhole gasket seating face observed eroded / corroded at several locations.



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 covered with grayish.
- Tube to tube sheet weld observed in satisfactory condition.

- Tubes found satisfactory.
- Impingement cone was found in intact condition.
- Lumps of urea found accumulated on the bottom of the dish end.

V-1423 (1st STAGE EVAPORATOR SCRUBBER)

- Reddish coloration was observed inside the vessel.
- Demister pads were found slightly damaged - loosened & lifted at several locations.

V-1501 (4 ATA STEAM DRUM)

- Dish ends were found Grayish with Reddish brown coloration at scattered locations.
- Distribution sparger was found intact in position.
- Demister pads were found intact in position and condition of the same was found satisfactory.
- Condition of all the weld joints was found satisfactory.
- Minor pitting was observed on bottom of the shell.
- Hard scaling was observed on both the dished ends.

V-1502 (23 ATA STEAM DRUM):

- Brownish 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.

V-1503 (9 ATA STEAM DRUM)

- Grayish black coloration was observed inside the vessel.
- U-clamp of the steam inlet header was found loose.
- I.D. of 1" bottom nozzle for Level controller in East direction at center portion of the shell was found having pitting/cavities up to 1.5mm depth. This was observed in previous inspections also.
- Overall condition of the vessel was found satisfactory.

V-1811 (1ST STAGE SEPARATOR)

- Demister pads were found intact in position.
- Vortex breaker was found intact in position.
- Condition of the weld joints was found satisfactory.
- All Nozzles found clear from inside.
- 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.
- Demister drain pipe was found intact in position.
- All 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) seems to be detached from its weld joint and lying freely inside the vessel (in vertical condition). This was observed during previous inspections also.
- Vessel from inside was found grayish in colour.

MISCELLANEOUS JOBS

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 of all the coupling bolts of Hitachi compressor train carried out and found satisfactory.

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.

VARIOUS MODIFICATION / REPLACEMENT JOBS

- During this shutdown, various modifications/replacement jobs were carried out by Technical and By Urea Mechanical Group. Inspection activities viz. DP Test, Radiography review and repairs etc. were carried out on the weld joints as per the fabrication procedure
- Performance qualification test of 07 Nos. welders offered by M/s Shree Ganesh Engineering was carried out. All welders were qualified during the test. These welders were allowed to perform welding in V-1201 Liner Weld joint repair ,New Tray Installation,
- From A.M Erectors 03 out of 05 welders were qualified. These welders were allowed to perform welding in Steam Condensate Line Job, Ammonia line Valve replacement, H-1205 Elbow replacement and Steam Tracing line in Urea plant And CCS loop Pipeline Job

ANNEXURE-1

PIPELINE THICKNESS MEASUREMENT SUMMARY OF HP LINES

SR. NO.	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION FROM TO		MIN. THK. OBSERVED	%AGE RED.
1	CO-F10-2119-PP25	8	160	23.01	K-1801,III	H-1813	22.03	4.25
1A	CO-F10-2119-PP25	1.5	160	7.14	K-1801,III	H-1813	7.01	1.82
1B	CO-F10-2119-PP25	0.75	160	5.54	K-1801,III	H-1813	5.02	5.38
2	CO-F10-2124	8	160	23.01	K-1801,DIS.	GA-1112	22.16	3.69
2A	CO-F10-2124	0.75	160	5.54	K-1801,DIS.	GA-1112	5.01	9.56
3	CO-E10-2139-PP25	4	80	8.56	CO-F10-2140-4" (TV-1808)	CO-E10-2122-6"	6.91	19.27
4	CO-F10-2140	4	160	13.49	K-1801,III	V-1813	12.10	10.30
4A	CO-F10-2140	0.75	160	5.54	CO-F10-2140-PP25	DRAIN	5.21	5.95
5	CO-E10-2122	6	80	10.97	H-1813	V-1813	9.62	22.30
6 *	GA-1112	6	F2	14.27	K-1101-2 (GA-1602-8"-F10)	GA-1201	6.89	* 51.71
6A	GA-1112	1.5	X1	5.08	FROM GA-1112	TO BYPASS	3.78	25.59
6B	GA-1112	1	F2	6.35			6.48	----
7	GA-1201	6	X4	13.33	GA-1112	H-1201	14.29	----
7A	GA-1201 TI-1207	1.5	X4	5.08	GA-1112	H-1201	4.86	4.33
8	GA-1202	1	F2	6.35	GA-1112-6"	Control-Valve (GA-1203)	4.14	34.80
9	GA-1203	1	X1	4.55	GA-1202	H-1203	3.73	18.02
9A	GA-1203 DRAIN	0.5	X1	3.73	GA-1202	H-1203	3.55	4.82
10	GA-1204	1	X1	4.55	H-1203	PR-1231	3.90	14.28
10A	GA-1204 DRAIN	0.5	X1	3.73	H-1203	PR-1231	2.95	20.91
11	GA-1602	8	F2	22.83	K-1801	GA-1112	21.28	6.78
11A	GA-1602	4	160	13.49	K-1801	GA-1112	12.04	10.74
11B	GA-1602	0.75	160	5.54	K-1801	GA-1112	5.37	3.06
11C	GA-1602	0.5	80	3.73	K-1801	GA-1112	3.58	4.02
12	GA-1603	4	F2	11.13	GA-1602	GA-1604	10.02	9.97

SR. NO.	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION FROM TO		MIN. THK. OBSERVED	%AGE RED.
13	GA-1606	1	B3	3.38	GA-1607-0.75"	GA-1350-1"	2.91	13.90
14	GA-1607	0.75	X3	2.87	K-1801	GA-1606-1"	2.03	29.62
15	MA-1106-B	4	E2	8.56	MA-1605-6"	MA-1203-4"	6.60	22.89
15A	MA-1106-B	1	E2	4.55	MA-1605-6"	MA-1203-4"	5.52	----
15B	MA-1106-B	0.75	E2	3.91	MA-1605-6"	MA-1203-4"	4.15	----
15C	MA-1106-B	1.5	E2	3.68	MA-1605-6"	MA-1203-4"	3.79	----
16	MA-1106-A	4	E2	8.56	P-1102-A	MA-1605-6"	7.30	14.71
16A	MA-1106-A	0.5	E2	3.73	P-1102-A	MA-1605-6"	4.01	----
17	MA-1123	4	E2	8.56	P-1102/B	MA-1605	6.24	27.10
17A	MA-1123	0.75	E2	3.91	P-1102/B	MA-1605	3.78	3.32
18	MA-1201	3	E2	7.62	MA-1605-6"	MA-1202-3"	6.69	12.20
18A	MA-1201	1.5	E2	5.08	MA-1605-6"	MA-1202-3"	3.31	34.84
19	MA-1202	3	X4	7.62	MA-1201	V-1201	6.31	17.19
19A	MA-1202	2	X4	5.54	MA-1201	V-1201	5.39	2.70
20	MA-1203	4	X4	9.14	MA-1106-6"	PR-1230	9.07	0.76
21	MA-1603	6	C2	7.11	MA-1122-6"	P-1102 /C	6.00	16.61
21A	MA-1603	1	C2	4.55	MA-1122-6"	P-1102 /C	4.06	10.76
21B	MA-1603	0.75	C2	3.91	MA-1122-6"	P-1102 /C	2.94	24.80
22	MA-1603	4	C2	6.02	MA-1122-6"	P-1102 /C	5.30	11.96
23	MA-1604	3	E2	7.62	P-1102 /C Discharge	MA-1604-4"	5.72	24.93
23A	MA-1604	4	E2	8.56	MA-1604-3"	MA-1604-4"	7.27	4.59
23B	MA-1604	1.5	E2	5.08	P-1102 /C Discharge	RV-1103-C	5.46	----
23C	MA-1604	0.75	E2	3.91	P-1102 /C Discharge	RV-1103-C	4.37	3.95
24	MA-1604	4	E2	8.56	MA-1604-3"	MA-1605-6"	7.00	18.22

SR. NO.	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION FROM TO		MIN. THK. OBSERVED	%AGE RED.
24A	MA-1604	2	E2	5.54	MA-1604-3"	MA-1605-6"	5.06	8.66
24B	MA-1604	0.75	E2	3.91	MA-1604-3"	MA-1605-6"	3.11	20.46
25	MA-1605	6	E2	14.27	MA-1106	MA-1203	12.59	11.77
25A	MA-1605	0.75	E2	3.91	MA-1106	MA-1203	3.24	17.13
26	MA-1605	4	E2	8.56	MA-1106	MA-1203	8.08	5.60
27	MA-1607	4	C2	6.02	MA-1605	MA-1116	5.39	10.48
27A	MA-1607 DRAIN	0.75	C2	3.91	MA-1605	MA-1116	2.96	24.29
28	MA-1609	4	C2	6.02	MA-1603-6"	MA-1604-3"	4.80	20.26
29	PR-1201	8	X1	19.58	V-1201	H-1201	14.98	23.49
30	PR-1202	10	X1	24.33	H-1201	H-1202	20.00	17.79
31	PR-1203	8	X1	19.58	H-1202	V-1201 (Vapour Line)	17.00	13.17
32	PR-1204	8	X1	19.58	H-1202	V-1201 (Liquid Line)	16.58	15.32
32A	PR-1204 (TR-1202)	1.5	X1	5.08	H-1202	V-1201 (Liquid line)	4.02	20.86
33	PR-1205	6	X1	15.24	PR-1205-8"	V-1202	10.45	31.43
33A	PR-1205	1.5	X1	5.08	PR-1205-8"	V-1202	4.30	15.35
33B	PR-1205	0.75	X1	3.91	PR-1205-8"	V-1202	3.32	15.08
34	PR-1205	8	X1	19.58	H-1201 Bottom	V-1202	16.47	15.88
34A	PR-1205	6	X1	15.24	H-1201 Bottom	V-1202	11.36	15.45
34B	PR-1205 (TR-1210)	1.5	X1	5.08	H-1201 Bottom	V-1202	4.79	5.70
35	PR-1206	4	X1	10.40	PR-1210-10"	H-1203	12.22	----
36	PR-1208	4	X1	10.40	V-1201 Top	PR-1206-4"	11.10	----
36A	PR-1208 (TR-1206)	1.5	X1	5.08	V-1201 Top	PR-1206-4"	6.39	----
37	PR-1211	1.5	X1	5.08	PR-1208-4"	PR-1212-4"	4.16	18.11
38	PR-1212	4	X1	10.40	H-1203	V-1201 Bottom	8.73	16.05
39	PR-1213	2	X4	5.54	PR-1201	PR-1205-6"	4.06	26.71

SR. NO.	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION FROM TO		MIN. THK. OBSERVED	%AGE RED.
40	PR-1224	3	X4	7.62	P-1201B	PR-1638-4"	6.29	17.45
41	PR-1225	3	X4	7.62	P-1201A/B, PR1638-4"	H-1203	6.64	12.86
42	PR-1226	2	X4	5.54	PR-1224	H-1205	4.26	23.10
43	PR-1230	6	X1	15.24	MA-1203-4"	H-1202	12.91	15.28
43A	PR-1230 (TR-1205)	1.5	X1	5.08	MA-1203-4"	H-1203	4.25	16.33
44	PR-1231	3	X1	7.62	H-1203	PRCV-1201	6.86	9.97
45	PR-1232 (JACKET)	6	-	-	PRCV-1201 (RV-1209)	ATMOS	3.09	----
46	PR-1234	4	X4	10.41	PRC-1201 (H-1203)	V-1203	10.32	0.86
47	PR-1234	3	X4	7.62	P-1201A	PR-1638-4"	5.92	22.30
48	PR-1637	3	X4	7.62	P-1201C	PR-1638-4"	6.67	12.46
49	PR-1638	4	X4A	9.14	P-1201A/B/C	PR-1230-6"	12.04	----
49A	PR-1638	1.5	X4A	5.08	P-1201A/B/C	PR-1230-6"	5.69	----
50	PR-1666	2	X4A	5.54	PR-1637	PR-1226	4.14	25.27

***GA-1112-6'' –F2 one straight length pipe replaced (Approx length 4.0 Mtr)**

ANNEXURE-2
PIPELINE THICKNESS MEASUREMENT SUMMARY
(SC, ST LINES)

Sr. No	LINE NO.	NB (inch)	SCH	NOM. THK. (MM)	LINE DESCRIPTION		Min. Thk. Observed	%Age red.
					FROM	TO		
<u>SC-LINES</u>								
1	SC-1209	10		9.27	H-1207	H-1203	8.2	11.54
2	SC-1211	10	B4	9.27	H-1203	P-1204	6.3	32.04
3	SC-1212	10	B4	9.27	SC-1210	SC-1209	8.1	12.62
4	SC-1212	4	B4	6.02	SC-1210	SC-1209	5.7	5.316
5	SC-1213	6	C1	7.11	H-1201	V-1502	6.1	14.21
6	SC-1213	4	B4	6.02	LCV-1501	V-1503		-
7	SC-1239 III FROM NE	16	B4	9.53	H-1202	V-1501	8	16.05
8	SC-1407	3	B4	5.49	H-1422	T-1501	3.9	28.96
9	SC-1407	8	B4	8.18	H-1422	T-1501	7.3	10.76
10	SC-1409	4	B4	6.02	H-1424	T-1501	4.11	31.73
11	SC-1502	3	B4	5.45	P-1501/6	V-1501	4.8	11.93
12	SC-1504	4	B4	6.02	V-1503	V-1501	5.4	10.3
12A	SC-1504	6"	B4	7.11	V-1503	V-1501	5.8	18.42
13	SC-1506	4	B4	6.02	T-1501	P-1505	4.5	25.25
14	SC-1507	3	B4	5.48	P-1505 A/B RETURN LINE	T-1501	4.9	10.58
14A	SC-1507	3	10S	3.05	P-1505 A/B RETURN LINE	T-1501	2.4	21.31
15	SC-1509	3	B4	5.48	SC-1507	B/L	5.4	1.46
16	SC-1510	2	B4	5.5	P-1502	PCV-1501	5.3	3.636
16A	SC-1510	1.5	B4	5.08	P-1502	PCV-1501	4.6	9.449
17	SC-1511	1.5	B4	3.68	PICV-1221	T-1501	3.2	13.04
18	SC-1513	4	B4	6.02	LCV-1501	V-1503	5.9	1.993
19	SC-1514	4	B4	6.02	T-1501	SEAL POT	5.6	6.977
19A	SC-1514	3	B4	5.49	T-1501	SEAL POT	4.6	16.21

Sr. No	LINE NO.	NB (inch)	SCH	NOM. THK. (MM)	LINE DESCRIPTION		Min. Thk. Observed	%Age red.
					FROM	TO		
20	SC-1530	3	B4	5.49	HEADER	SC-1407	4.5	18.03
21	SC-1601	10	C2	9.27	SC-1211	H-1418	7.9	14.78
22	SC-1602	2	10S	2.77	SC-1603	PR-1616	2.8	----
23	SC-1605	1.5	B4	5.08	H-1418A	SC-1407	4.5	11.42
24	SC-1607	1	B4	4.55	SC-1226	PR-1636	3.4	25.27
<u>ST-LINES</u>								
1	ST-1124	6	E3	10.97	ST-1104	PICV-1128	9.3	15.22
2	ST-1125	10	B4	9.27	ST-1116	PICV-1129	8.2	11.54
3	ST-1129	10	B4	9.27	PICV-1128	ST-1116	8.33	10.14
4	ST-1206	8	B4	8.2	ST-1506	H-1204	8.2	----
5	ST-1206	10	B4	9.27	ST-1506	H-1204	7.9	14.78
6	ST-1302	6	B4	7.11	ST-1504	V-1301	6.2	12.8
7	ST-1352	3	B4	5.5	23 ATA HEADER	HYDROLYSER	4.6	16.36
7A	ST-1352	3	10S	3.05	23 ATA HEADER	HYDROLYSER	3	1.639
8	ST-1402	3	B4	5.48	ST-1415	P-1421	5.4	1.46
9	ST-1409	4	B4	6.02	V-1503	H-1424	5.3	11.96
9A	ST-1409	6	B4	6.02	V-1503	H-1424	7.8	----
9B	ST-1409	8	B4	6.02	V-1503	H-1424	9.1	---
10	ST-1410	2	B4	3.91	ST-1506	H-1424	3.6	7.928
11	ST-1411	8	B4	8.18	ST-1415	P-1423	7.31	10.64
12	ST-1412	6	B4	7.11	ST-1415	P-1424	6.17	13.22
13	ST-1415	10	B4	9.27	ST-1506	HEADER	8.6	7.228
14	ST-1502	4	B4	6.02	ST-1116	V-1503	5.1	15.28
15	ST-1502	3	B4	7.62	ST-1502	V-1503	5.1	33.07
16	ST-1502	2	B4	5.54	ST-1502	V-1503	4.3	22.38
17	ST-1504	2	B4	3.91	V-1503	ST-1302	3.8	2.813
18	ST-1504 Extra Line	2	B4	3.91	V-1503	ST-1302	3.5	10.49
19	ST-1506	14	B4	9.525	V-1501	ST-1106	8.9	6.562

Sr. No	LINE NO.	NB (inch)	SCH	NOM. THK. (MM)	LINE DESCRIPTION		Min. Thk. Observed	%Age red.
					FROM	TO		
20	ST-1506	18	B4	9.525	V-1501	ST-1106	9	5.512
21	ST-1508	2	B4	3.9	ST-1506	PCV-1502	4.1	----
22	ST-1508	4	B4	6.02	ST-1506	PCV-1502	5.1	15.28
23	ST-1603	8	B4	8.18	ST-1506B4	H1418/A	7.4	9.535
24	ST-1614	4	B4	6.02	ST-1409	H-1424	5.3	11.96

ANNEXURE-3

UREA PLANT VESSEL THICKNESS MEASUREMENT SUMMARY

Sl. 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-1205/A	ADDITIONAL L.P. CARBAMATE CONDENSER	12.0	10.67	11.08	10.0	10.13	----			
2	H-1301/A	ADDITIONAL DESORBER HEAT EXCHANGER	8.0	8.1	----						
3	H-1301/B	ADDITIONAL DESORBER HEAT EXCHANGER SHELL & TUBE TYPE	12.0	12.13	----				5.0		
4	H-1351/A	HYDROLYSER FEED PREHEATER	12.0	12.6	----	12.0	11.6	3.3			
5	H-1351/B	HYDROLYSER FEED PREHEATER	12.0	11.3	5.83	12.0	12.0	----			
6	H 1351/C	HYDROLYSER FEED PREHEATER	12.0	12.71	----	12.0	11.48	4.3	12.0	12.06	---
7	H-1352	REFLUX CONDENSER	8.0	8.36	----	12.0	12.88	----	14.0	13.94	0.42
8	H-1427	CIRCULATION COOLER FOR V-1423	8.0	8.2	----	10.0	10.11	----			
9	T-1301	LEAN AMMONICAL WATER TANK	6.0	6.09	----	Roof 5.00	Roof - 4.90				
10	T-1301 A	STRONG AMMONICAL WATER TANK	6.0	5.38	10.3	5.0 (T)					
11	T-1401	UREA SOLUTION TANK	6.0	6	----			----			
12	T-1401 A	UREA SOLUTION TANK	6.0	5.2	13.3			----			
13	T-1701A	UREA DUST DISSOLVING TANK	6.0	6.0	----			----			
14	T-1701B	UREA DUST	5.0	5.38	----			----			

		DISSOLVING TANK									
15	V-1102	AMMONIA FILTER	11.0	11.0	----	11.0	10.92	0.7			
16	V-1103	AMMONIA SUCTION VESSEL	21.0	20.77	1.09	21.0	22.18	----			
17	V-1200	LEAN CARBAMATE SEPARATOR	5.0	5.38	----	6.0	6.4	----			
18	V-1203	LOW PRESSURE ABSORBER	6.0	8.10	----	8.0	8.2	----			
19	V-1206	ATMOSPHERIC VENT SCRUBBER	5.0	5.4	----	8	5.37	32.9			
20	V-1207	AMMONIA SCRUBBER	5.0 / 8.0	5.38 / 7.59	-- / 5.12			----			
21	V-1351	HYDROLYSER	28.0	29.52	----	28.0	----	----			
23	V-1425	2ND STAGE EVAPORATOR CONDENSER POT	8.0	8.92	----	10	10.32	----			
24	V-1423	1ST STAGE EVAPORATOR SCRUBBER	8.0	8.0	----	10.0	9.87	1.3			

AN

NEXURE-4

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

K-1801 (HITACHI COMPRESSOR)

DESCRIPTION	POSITION	BEFORE (Gauss-max.)	AFTER (Gauss max.)
<u>TURBINE (FREE ENDSIDE)</u>			
Journal Bearing Pads	Governor side	0.9	Within limits
Journal Bearing Base Ring	Governor side	Top-0.5 Bottom-0.6	"
Shaft Journal	Governor side	0.9	"
Thrust Collar	Governor side	1.6	"
Thrust Bearing	Governor side	0.8	"
Thrust Base Ring	Governor side	0.9	"
Thrust Bearing Pads	Governor side	0.6	"

DESCRIPTION	POSITION	BEFORE (Gauss- max.)	AFTER (Gauss max.)
Collar	Active	1.6	“
	Inactive	1.8	“
<u>TURBINE (NORTH END)</u>			
Journal Bearing Pads	Top Half	0.6	“
	Bottom half	0.8	“
Shaft Journal		0.6	“
Journal Bearing Base Ring	Top Half	0.8	“
	Bottom half	1.6	“
	Inactive	0.6	“
<u>L.P. CASE (TURBINE END)</u>			
Shaft Journal		1.2	“
Journal Bearing Pads		Top– 0.6 Bottom–0.4	“
Journal Bearing Base Ring	Top	0.7	“
	Bottom	0.9	
Shaft Journal		0.9	
<u>L.P. CASE (G.B. END)</u>			
Shaft Journal		1.2	“
Journal Bearing Pads		0.5 Max	“
Thrust Bearing Pads	Active	0.9	“
	Non active	0.8	
Thrust Collar		1.0	“
Thrust Shaft		1.2	“
<u>GEAR BOX</u>			
L.S. Shaft Journal Bearing L.P. Side	Top half	1.3	“
	Bottom half	0.4	
L.S. Shaft Journal Bearing	Top half	0.9	“

DESCRIPTION	POSITION	BEFORE (Gauss- max.)	AFTER (Gauss max.)
H.P. Side	Bottom half	0.6	
H.S. Shaft Journal Bearing L.P. Side	Top half	0.9	“
	Bottom half	0.6	
H.S. Shaft Journal Bearing H.P. Side	Top half	0.9	“
	Bottom half	0.5	
Thrust Base Ring	Inboard side Active	Top-0.4 Bottom-0.6	“
	Outboard side Non Active	Top- 0.8 Bottom-0.9	
Thrust Pads	Inboard side	0.6	“
	Outboard side	0.9	
Thrust Collar		0.9	“
High Speed Shaft Journal	L.P.Side	0.9	“
	H.P Side	0.5	
Low Speed Shaft Journal	L.P.Side	1.2	
	H.P Side	0.8	
<u>H.P. CASE (FREE END SIDE)</u>			
Shaft Journal		0.6	“
Journal Bearing Pads		Top- 0.6 Bottom-0.6	
Journal Bearing Base Ring	Top	0.5	“
	Bottom	0.3	
Thrust Base Ring	Inboard side Active	Top-0.8 Bottom-0.6	
	Outboard side Non Active	Top-0.6 Bottom-0.4	
Thrust Pads	Inboard Active	0.5	
	Outboard Non Active	0.7	
Thrust Collar		1.3	“

DESCRIPTION	POSITION	BEFORE (Gauss- max.)	AFTER (Gauss max.)
<u>H.P. CASE (G.B.SIDE)</u>			
Shaft Journal		1.2	“
Journal Bearing Pads		Top– 0.9 Bottom–1.0	
Journal Bearing Base Ring	Top	0.8	“
	Bottom	0.9	“
Thrust Pads	Inboard	0.8	
	Outboard	0.7	
Thrust Collar		1.2	“
Thrust Collar Journal		0.9	“

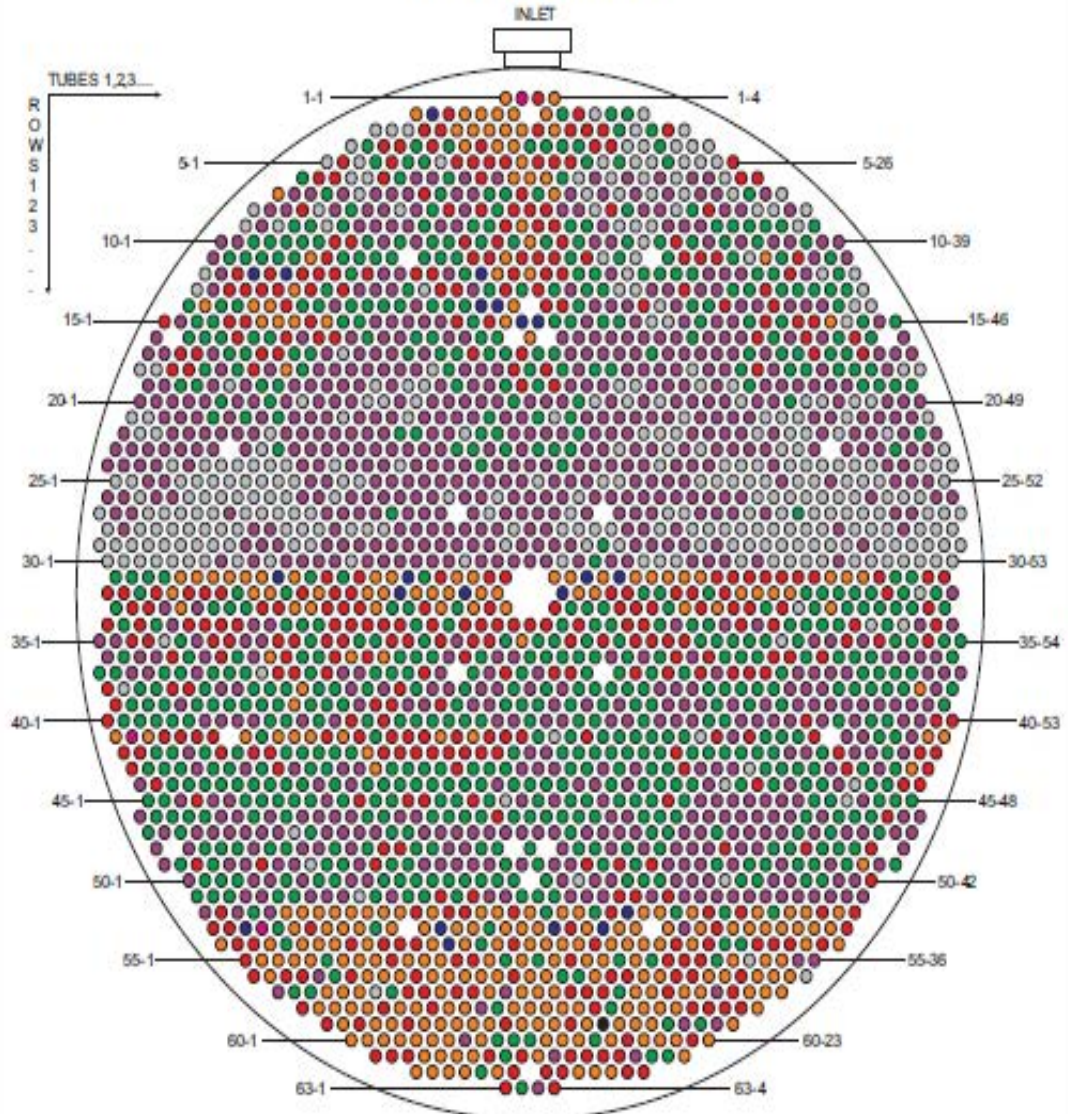
ANNEXURE-5

METALLOGRAPHIC EXAMINATION LIST UREA PLANT-S/D-2015

SR · NO ·	LOCATION	MO C	MICROSTRUCTURE OBSERVATION	REMARK
1	H1202, H.P.Condenser Stub end Gas outlet bottom side	SS	Presence of weld spot is observed at PM region. Weld metal microstructure shows dendritic structure of ferrite pools in austenite matrix. Microstructure at parent metal shows coarse- austenitic grain structure with twins	Presence of weld spot is observed at PM region. No significant degradation observed. Monitor after 1 year of service

ANNEXURE- 6
TUBE SHEET LAY OUT OF H-1201 (VIEWED FROM TOP)

Viewed from Top Side



Denotes: Wall Loss

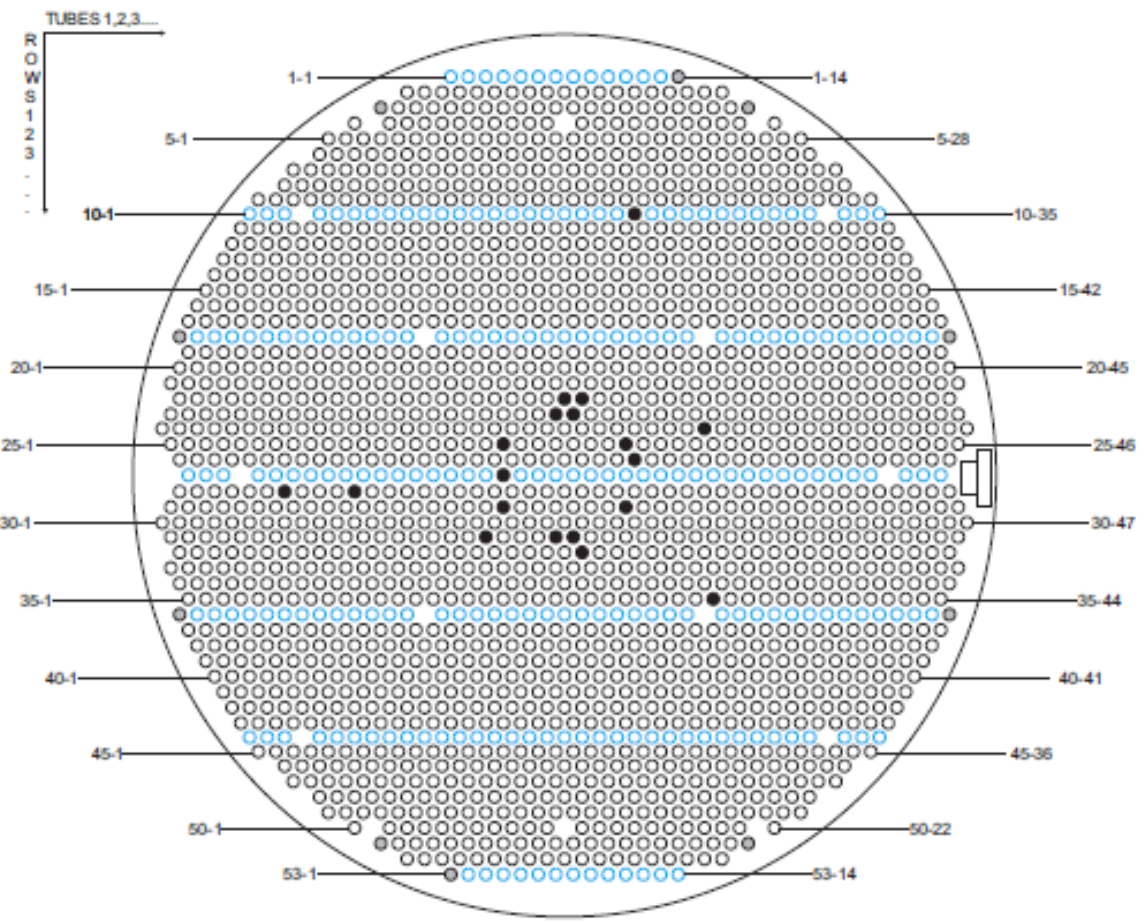
- 0.3mm to 0.68mm ● 0.69mm to 0.75mm ● 0.76mm to 0.80mm ● 0.81mm to 0.85mm ● 0.86 mm to 0.90mm
- 0.91mm to 0.95mm ● 0.96mm to 1.0mm ● 1.01mm to 1.05mm ● 1.06mm to 1.1mm ● 1.11mm to 1.15mm
- Plugged

ANNEXURE- 7

TUBE SHEET LAY OUT OF H-1202 (VIEWED FROM TOP)



Viewed From Top Side



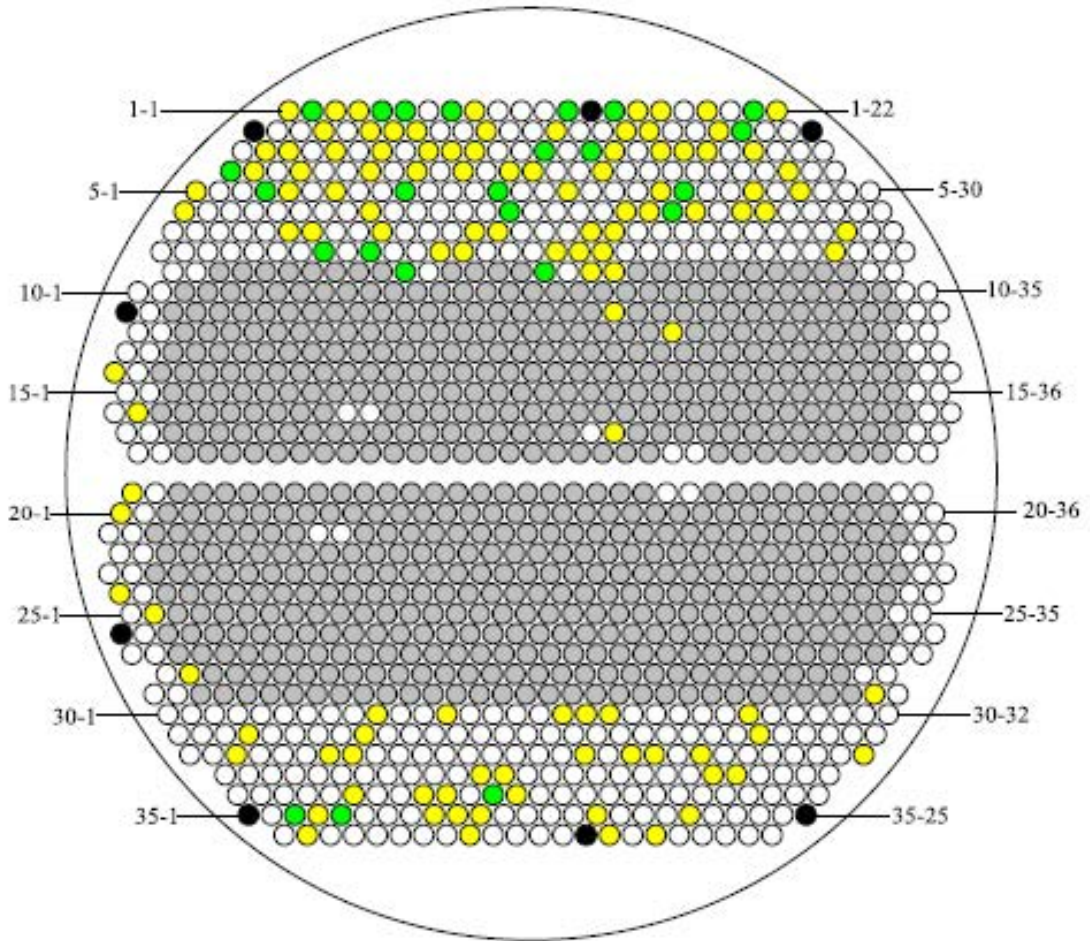
Tube Sheet Drawing

Denotes:

- | | | | | | |
|--|----------------------|--|-----------------------|--|------------------|
| | < 20% Wall Loss | | 31% to 40 % Wall Loss | | > 50 % Wall Loss |
| | 21% to 30% Wall Loss | | 41% to 50 % Wall Loss | | |

ANNEXURE- 8
TUBE SHEET LAY OUT OF H-1205 (VIEWED FROM TOP)

EAST SIDE



Legend (% Wall Loss)			
○ 0-10 (375 Tubes, 32%)	● 31-40 (0 Tubes, 0%)	● 51-54 (0 Tubes, 0%)	● Plug (8 Tubes, 1%)
● 11-20 (114 Tubes, 10%)	● 41-45 (0 Tubes, 0%)	● 55 (0 Tubes, 0%)	⊗ Not Tested (0 Tubes, 0%)
● 21-30 (24 Tubes, 2%)	● 46-50 (0 Tubes, 0%)	● >56 (0 Tubes, 0%)	● Uninterpretable (641 Tubes, 55%)

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UTILITY PLANT

(INSPECTION)

The following inspection activities were performed in Utility Plant during Annual Shut-down 2016.

- Inspection of Deaerator.
- Inspection of Boiler Drums.
- Inspection of Mud Drum
- Inspection of 52" NB CW Inter connection line of P-4405 and P-4401 C/D sump.
- Gauss measurement.
- Thickness measurement of lines.

The detailed observations 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.

BHEL BOILER (GT-2068)

Visual inspection and ultrasonic thickness measurement of Steam Drum and Mud Drum was carried out.

STEAM DRUM:

- The internal surface of the drum observed brownish black in colour.
- All the weld joints found satisfactory.
- 2 no of fasteners of bottom plate were found missing.
- 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 stub ends were free from any defect.
- Few Phosphate dosing pipe (located at top 1"NB) holding "U" clamps found loose.
- Few bolts of Blow down line (located at bottom) cover plate found loose.
- Overall condition of the mud drum found satisfactory.
- Minimum thickness of 81.52 mm and 55.74 mm was observed on shell and dished end respectively against the nominal thickness of 78.0 mm and 54.00 mm.

DEAERATOR:

Inspection of the Deaerator Head and the Storage Shell carried out and observations are as under

Deaerator Head:

- Bottom two tray segments were found displaced from its position
- Brownish coloration was observed inside the shell and dish end.

Deaerator Storage Shell :

- Brownish coloration was observed inside the shell and dish end.
- Condition of the weld joint was found satisfactory.
- Minor rusting observed at both dish ends.

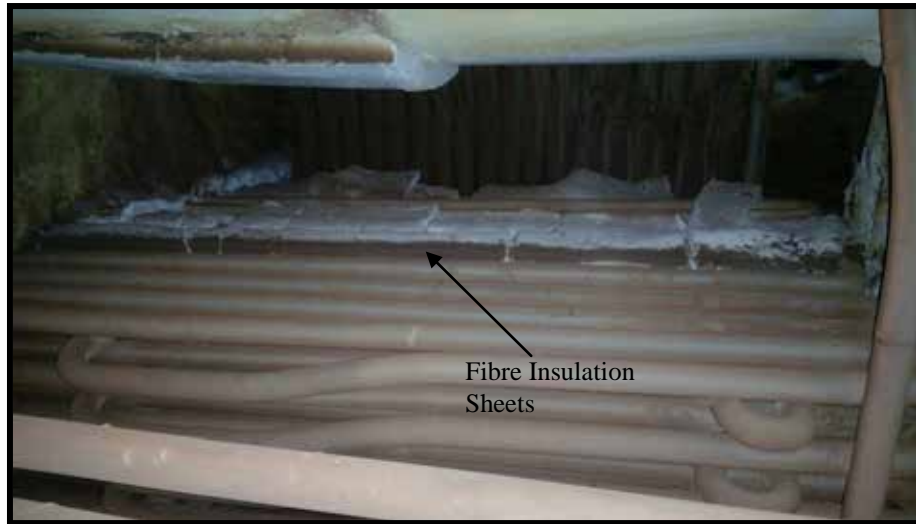
BHEL BOILER FURNACE

From South Wall Access Door

- Refractory found damaged just above the access door.



- Minor rust and scaling was observed on South wall, Front panel, Rear panel, Cut corner tubes and baffle wall tubes.
- Floor refractory was found damaged & loosened at some locations.
- Condition of thermo-wells found satisfactory.
- Condition of refractory around the burners was found satisfactory.
- Minor scaling was observed on Primary Super heater tubes.
- Insulation fiber modules placed on top of the Secondary superheater coil was found displaced from its location.



From North Wall Access Door

- Refractory found damaged on roof just above the access door.
- Minor rust and scaling was observed on boiler bank tubes.
- Condition of Secondary super heater coils was found satisfactory.
- Refractory matter was found slightly detached from baffle wall.



Following were also Visually Inspected as per the available access & No any abnormalities observed.

- Attemperator Header (De-Super heater header)
- Primary & Final (Secondary) Super heater Headers
- Main Steam Piping (Main steam pipe line up to Main steam stop valve).

AIR PREHEATER (APH)

From Air Entry side (North side) Manhole

- Air Inlet duct was found in satisfactory condition.

- Condition of painting/coating was found satisfactory.
- Air Inlet flow diverter plate tack welding found broken from bottom.

From East side Manhole

- Air Inlet duct was found in satisfactory condition, however the surface of old duct was found with Rust and scales & lot of loose debris was found lying at the bottom of the duct.
- Thermowell was found intact in its position.
- Condition of SS plates was found satisfactory.

From Flue Gas Exit side (South side) Manhole

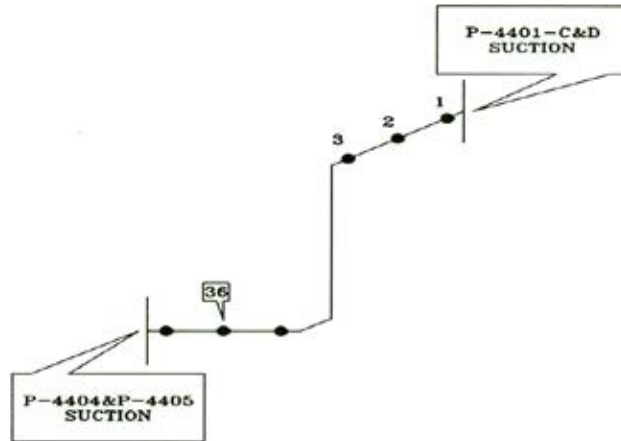
- Painting/ coating of middle compartment roof area was found peeled off.



- Minor Peeling off was observed in top compartment also.
- At rest of the location the Painting/ coating quality is satisfactory.

52"NB COOLING WATER INTER CONNECTION LINE OF P-4405 TO P4401C/D:

- Epoxy paint was found peeled off at many locations however primer was found intact on these locations.
- Blisters on Epoxy paint also observed at many locations.
- All circumferential and long seam welds found satisfactory.
- Crack was found on the previously applied putty at the location no.36 (counting from P-4401 C/D Suction) which was repaired.



MISCELLANEOUS JOBS:

All coupling bolts of P-5111 and P-5112 were D/.P tested and found satisfactory.

GAUSS MEASUREMENT:

Measurement of residual magnetism (Gauss) on rotary and stationary parts of BFW pump (P-5111) and its drive turbine bearings was carried out. Wherever residual magnetism was higher than acceptable limits, same was demagnetized and brought down within acceptable limits.

GAUSS MEASUREMENT OF EQUIPMENT

BFW Turbine (Q-5111)		
Journal Bearing Coupling Side	Top	0.6
	Bottom	0.7
Journal + Thrust Bearing Governor Side	Top	0.6
	Bottom	0.8
	Thrust Face	0.9
Shaft Journal	Thrust End	1.2
	Non Thrust End	1.1
BFW Pump (P-5111)		
Journal Bearing Free End	Top	1.0
	Bottom	1.1
Journal Bearing Coupling side	Top	0.4
	Bottom	0.5
Thrust Bearing Pads	Active	0.9

	Inactive	0.8
Thrust Collar		1.2
Shaft Journal	Thrust End	1.0
	Non Thrust End	0.6

THICKNESS MEASUREMENT OF LINES

Thickness measurement of BHEL boiler vent/drain line was carried out. Results are summarized as mentioned below.

SR. NO.	LINE DESCRIPTION	SIZE	DESIGN THICKNESS(MM)	MINIMUM THICKNESS(MM)
1	Air vent feed line	1"	4.55	2.8
2	Steam drum vent line	1"	4.55	3.1
3	Attemperator vent line	1"	4.55	3.4
4	SSH Vent Line	1"	4.55	3.7
5	PSH Vent line	1"	4.55	3.3
6	BF drain line	1"	4.55	3.1

INSTRUMENTATION

AMMONIA PLANT

(Instrumentation)

Control Valve Maintenance jobs:

FRCV- 1: Actuator diaphragm was checked & found in damaged condition, so it was replaced with new one. General cleaning of air filter regulator was carried out. Gland packings were replaced with new one. Finally control valve stroke was checked & found ok.

FRCV-2: Control valve was opened from bonnet for complete overhauling. Actuator diaphragm was checked & found ok. Plug & seat inspection was carried out & found plug in damaged condition, so it was replaced with repaired one. New gland packings had been provided. General cleaning of Positioner, air filter regulator was carried out. Finally control valve was re-assembled; stroke was checked & found ok.

FRCV-3: Control valve was opened from bonnet, trim & seat parts were checked. All parts of valve were cleaned and overhauled. Actuator diaphragm was inspected & found in good condition. Valve Positioner pilot relay & cam were replaced with new one. New gland packings had been provided. Finally stroke was checked & found ok.

VS-203: Old control valve was replaced with new one. SOV power cable wiring connection & air supply tubing work were carried out. Finally control valve action was checked and found ok.



FICV-485: Control valve was open from bonnet for complete overhauling purpose. All parts of valve were inspected & found plug in damaged condition, so it was replaced with new one. Air filter regulator was replaced with new one. After complete overhauling of control valve, box-up job done. Finally valve operation was checked & found ok.

LCV-490: Control valve was opened from bonnet for inspection. Cleaning of trim & seat parts were carried out. Control valve had been checked for tight shutoff. Actuator diaphragm was inspected & found ok. Complete Overhauling of control valve was

carried out. New gland packings & bottom gasket had been provided. Finally stroke was checked & found ok.

PICV-16 & LICV-15: Old control valves had been replaced with new control valve. Related signal cable connection & air supply tubing work was carried out. Finally control valves stroke were checked and found ok.



LICV-15



PICV-16

FRCV-18: Control valve was removed from line for complete overhauling purpose. Plug & seat parts were inspected & found ok. Actuator diaphragm was checked & found in damaged condition, so it was replaced with new one. Valve Positioner relay was replaced with new one. General cleaning of control valve was done. New gland packings were provided. Finally control valve stroke was checked & found ok.

FICV-14: Control valve was opened from bonnet for complete overhauling purpose. Plug & seat parts were inspected & found ok. General cleaning of all parts of valve was done. New gland packings were provided. Finally control valve stroke was checked & found ok.

PICV-13A: Control valve removed from bonnet for complete overhauling purpose. Plug and seat were inspected & found plug slightly damaged. Plug machining work was carried out and lapping of plug & seat was done. Also found one stud broken so new stud was made by mechanical workshop. Finally valve was reassembled & stroke was checked, found ok.

PICV-13A & 13B: Valves I/P splitting job was carried out. New I/P was installed for PICV-13B, related cable laying, dressing & termination work at junction box & cabinet end were done. New air tubing was provided for both the valve & new logic for splitting of both valves was made in DCS. Stroke was checked for both the valves & found ok.

V-7: Old control valve was replaced with new control valve. Signal cable, SOV Power cable connection & air supply tubing work were carried out. Finally control valve stroke was checked and found ok.



PICV-11A: Control valve was opened from bonnet for complete overhauling. Plug & seat were inspected & found plug in damaged condition, so it was replaced with new one. General cleaning of all parts of valve was done. New gland packings were provided. Finally control valve stroke was checked & found ok.

FICV-482: Control valve was opened from bonnet for complete overhauling purpose. Actuator diaphragm was checked & found in damaged condition, so it was replaced with new one. All parts of valves were checked & found ok. General cleaning of air filter regulator was carried out. Gland packings were replaced with new one. Finally control valve stroke was checked & found ok.

LCV-12: Control valve was opened from bonnet for plug seat inspection. Plug was inspected & found ok. Plug seat lapping work was performed. Actuator diaphragm was checked, found ok. Air filter regulator & gland packings were replaced with new one. Valve Box-up job completed and Hydro-test was performed, found no leakage. Finally stroke was checked & found ok.

PICV-137: Control valve was opened from bonnet for complete overhauling purpose. Actuator diaphragm was checked & found in damaged condition, so it was replaced with new one. Plug seat were inspected & found in good condition. General cleaning & checking of air regulator & valve Positioner was done. Valve gasket was replaced with new one. Finally stroke was checked & found ok.

V-3: Quick exhaust Valve had air leakage problem, so it was replaced with new one. General cleaning of all parts of control valve was done. New gland packings were provided. Finally stroke was checked & found ok.

LCV-19: Control valve was opened from bonnet for complete overhauling purpose. Actuator diaphragm, plug & seat were checked & found ok. Air filter regulator & gland packings were replaced with new one. Finally stroke was checked & found ok.

TRCV-406: Control valve general overhauling was carried out. Air regulator, Volume booster & air lock relay were replaced with new one. Finally stroke was checked & found ok.

MICV-7: Control valve I/P was found faulty, so it was replaced with new one. Valve general cleaning & calibration work was performed & found ok.

TRCV-10: Actuator diaphragm was checked & found ok. General cleaning of air filter regulator was carried out. Gland packings were replaced with new one. Finally control valve stroke was checked & found ok.

V-4: Valve was dropped from line for complete overhauling. General cleaning & checking of valve's all parts were carried out. SOV power cable connection & air

tubing re-routing work was done. Finally valve was taken in line, stroke checked & found ok.

Following valves Air filter regulator were replaced with new one:

1.	PICV-501	5.	LICV-503
2.	PICV-502	6.	LICV-134B
3.	FICV-505	7.	TICV-507
4.	LICV-501		

General Maintenance & stroke checking of control valves :

Following control valves general maintenance/cleaning/ greasing were carried out. New gland packings were provided wherever required. Valve Positioner was cleaned and air header & regulators were flushed. Stroke checking was carried out:

1.	PRCV-1	8.	MICV-11	15.	LICV-18
2.	PICV-002	9.	MICV-16	16.	LCV-25
3.	PICV-5	10.	MICV-17	17.	LICV-27
4.	PRCV-18	11.	FICV-11	18.	TRCV-11
5.	PICV-44	12.	FICV-100B	19.	TRCV-12
6.	MICV 1 to 9	13.	LICV-13		
7.	MICV 1A to 9A	14.	LICV-16		

COMPRESSOR HOUSE JOBS:

Air Compressor (101J):

Removed 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 after cleaning & functional checking. Gap voltage adjustments for radial and axial probes were carried out.

HIC-101J: Old pneumatic governor actuator was replaced with ITT Conoflow make new one. Calibration of I/P Converter was carried out. New pressure gauge was provided for I/P converter & air supply regulator. Finally governor actuator stroke was checked & found ok.



TRIP-101J: Mechanical trip feedback limit switch was overhauled and checked its operation, found ok.

VS-101J: Trip Solenoid valve was overhauled. Coil of trip solenoid valve was checked & found in good condition. Finally its operation was checked & found ok.

101J/105J MOP: Electronic governor actuator output signal cable & MPUs were removed to facilitate mechanical maintenance Jobs. After completion of jobs same were re-fixed.

101J (Trip logic): Checked the setting for alarm and trip logic.

ZSH-18: Control valve Open/Close feedback limit switch was overhauled and checked its operation, found ok.

Ammonia Refrigeration Compressor (105J):

Removed 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 proximitors were cleaned. After completion of M/M jobs the instruments and probes/pick-ups were re-fixed 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 pressure gauges were provided for I/P Converter, air supply Regulator & Positioner. Calibration of I/P converter was carried out. Finally governor actuator was re-fixed and stroke checking was performed, 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 & found in good condition. Finally its operation was checked & found ok.

105J (Trip logic): Checked the setting for alarm and trip logic.

Synthesis Gas Compressor (103J):

Removed 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 proximitors were cleaned. After completion of M/M jobs the instruments and probes/pick-ups were re-fixed after cleaning & functional checking. Gap voltage adjustments for radial and axial probes were carried out.

PRCV-12 (103-JAT) & MIC-23 (103-JBT): General cleaning and overhauling of pneumatic governor actuator were carried out. New lip seal of Piston/Cylinder was provided. New pressure gauges were provided for I/P Converter, air supply regulator & Positioner. Calibration of I/P converter was carried out. Finally governor actuator was re-fixed and stroke checking was performed.

103-J all vibration probes linearity was checked with standard TK3 instrument. On observation of linearity graph, probes 1V/1H, 6V/6H & 8V/8H were found non-linear. All these probes were replaced with new one.

VS-103J & VS-103: Trip Solenoid valve were overhauled. Coil of trip solenoid valve were checked & found in good condition. Finally its operation were checked & found ok.

103J (Trip logic): Checked the setting for alarm and trip logic.

Field Instrument jobs:

115-JAT: Removed & reinstalled different instruments (RTD, MPU, SV etc.) at 115-JAT to facilitate Mechanical Maintenance jobs. Checked both MPUs of electronic Governor. One RTD of 115-JA was replaced with new one as old one found in damaged condition.

101-BJT: Removed different instruments (RTD, MPU, SV etc.) at 101-BJT to facilitate Mechanical Maintenance jobs. Checked all MPUs of electronic governor. After completion of job all instruments were re-fixed.

104-JA: Removed different instruments (RTD, MPU, SV etc.) at 104-JA to facilitate Mechanical Maintenance jobs. Checked both MPUs of electronic Governor for 104-JA. After completion of job all instruments were re-fixed.

107-JA: Removed different instruments (RTD, MPU, SV etc.) at 107-JA to facilitate Mechanical Maintenance jobs. All speed probes were cleaned & checked. After completion of job all instruments were re-fixed.

LI-301: 103-J lube oil console tank modification was done by M/M; old Radar type level measurement was replaced with new one, related re-programming & signal cable connection work was done.

FT-35: Transmitter was relocated; related tubing & signal cable re-routing work was done.

PAL-67: 104-JA BFW running pump low lube oil pressure AOP auto start logic was made. New pressure transmitter was installed, related cable laying, dressing, ferruling work done at cabinet & junction box end.

VS-4: 104-J SOV was re-located, related power cable shifting & re-tubing work was done.

Low range pressure gauges were provided at different locations in plant as per requirement of production department for purging & maintenance purpose.

Following PDR'S Impulse line was removed as per requirement of M/M, Provided new impulse line.

1.	PDR-26	3.	PDR-27	5.	PDR-36
2.	PDR-34	4.	PDR-35	6.	PDR-37

Level-State (101-F): All electrodes were cleaned by flushing the chamber & connections were tightened.

Draft point Manometer tubing was removed & re-fixed to facilitate Mechanical Maintenance jobs.

TI-217: Thermowell was replaced with new one as old one was found broken. New air header was provided for the following critical control valves/equipments:

1.	MICV-13	6.	LICV-23	11.	USV-400
2.	MICV-14	7.	TICV-16	12.	USV-934
3.	MICV-15	8.	USV-2004	13.	USV-936
4.	MICV-16	9.	VS-5	14.	Cold Shut Valve
5.	LICV-17	10.	TTV-104JA		

Boiler Inspection: Provided standard 10" dial size pressure gauges on steam drum 101-F, 112-C and 107-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.

All Metal temperature thermocouples (MTI-105, MTI-106, MTI-107 & MTI-108) were removed & re-fixed to facilitate mechanical maintenance.

JB-WGCR1: Old junction box was replaced with new one, related cable ferruling, lugging & termination work was done.

USV-933: Control valve had sluggish behavior problem. Pneumatic slider valve was replaced with new one as old one had air leakage problem.

104-J: New pressure transmitter was installed for low lube oil pressure trip of BFW stand-by pump. Related fabrication work for transmitter mounting, cable laying, dressing, ferruling & termination work at junction box and cabinet end was done. 104-J 2003 over-speed trip logic was made in PLC; related wiring work was done in field & cabinet side. Single pair signal cables were laid from 104-J to junction box end. One small junction box was mounted at the base of 104-J for speed probes termination. F/I convertors were installed in PLC marshalling cabinet & same were programmed, related wiring work was done at both marshalling cabinet & junction box end.

PRC-23: Cylinder & damper mechanism was over-hauled. Damper Positioner had been checked & found ok.

JBS-22: Junction boxes T.B. were replaced with new one as old one found in damaged condition.

110-V AC floating power supply from UPSS to Power Distribution Board & 24V DC supply in cabinet SCS0107 was checked & found ok.

Steam Drum (101F): Following instruments of steam drum were checked:

- Level monitoring system- Level State.
- Level transmitter.
- Pressure transmitter.
- Level switches.

General cleaning & Calibration were carried out of ISO & CDM related instruments.

Following ISO related Quality/Safety affecting instruments were calibrated:

1.	PT-7	7.	TRC-12	13.	TI -0117	19.	PT-36	25.	PT-80
2.	PT-150	8.	PT-501	14.	TI-0039	20.	FT-100	26.	FT-1
3.	PT-62	9.	PT-8	15.	PT-503	21.	TRC-10		
4.	FT-2	10.	PT-5	16.	PT-10	22.	TI-0036		
5.	AR-1	11.	PT-9	17.	PT-4	23.	TI-104E		
6.	PIC-1A	12.	FT-3	18.	PT-28	24.	TI-0011		

Following CDM related instruments were calibrated:

1.	PI-82	4.	PI-676	7.	TI-0043
2.	FR-6	5.	AR-5	8.	TI-0065
3.	FI-65	6.	TI-0023		

Annual Maintenance Jobs for DCS/ESD, UPSS & Gas Analyzers:

YIL DCS:

- DCS shutdown maintenance activities were carried out as per AMC procedure. The following activities were carried out in Ammonia plant :

- Before starting preventive maintenance activities, tuning parameters of all control stations were saved on Engineering station. Project back up was taken.
- Checking of System healthiness was carried out from System detail display and same was 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.
- FCS0101Node 3 Slot 5 & 6 RTD Card connecting RTD cables were removed as per requirement.
- New Graphic pages GR0500 & GR0501 were made for Motor On/Off & Ready to start & MOV Local/Remote related EWR.
- Pre-reformer related all DCS tags were removed from IOM & Control drawing as per requirement.
- MIS Machine had network connectivity issue, after inspection CISCO make firewall which was connected between L2 switch & MIS machine, found faulty. Firewall was replaced with new one & same was re-programmed. IP address also changed from 192.168.138.230 to 192.168.138.231, now working ok.
- Data was collected for all HIS & FCS in Project backup for reference.
- All Operator stations & engineering station Anti-virus had been updated.
- Control room dust level & temperature had been observed & found within limit.
- Cooling fan for HIS 0162 was replaced with new one.

Prosafe - RS ESDS

- 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.
- Latest Back up was taken on DVD media.

- New logic was developed for steam drum 2003 low level trip; Tags LSL1A & LSL1B were made in PLC station. Logic was implemented in I-47 Block. Finally logic was tested & found ok.
- New logic was developed for 104-J BFW standby pump 2003 over-speed trip; Tags SAHH104JA, SAHH104JB & SAHH104JC were made in PLC station. Logic was implemented in I-39A Block. Finally logic was tested & found ok.
- New tags MOV-101JT close command on tripping of 101-J with close feedback & MOV-105JT close command on tripping of 105-J with close feedback were made in PLC station & also provided in relevant logic page. Finally it was tested & found ok.
- New logic for opening of 101-JT vent on high temperature of 101-CA/CB and low NG to Air ratio was made in PLC station. Tags TSHH-0085 & TSHH-0089 were made in PLC station & also provided in relevant logic page. Finally logic was tested & found ok.

FUJI UPSS:

- Servicing of UPSS was carried out. Air filters of all the cabinets were cleaned and exhaust/cooling fans were checked. Voltage on all the test points was measured. Both UPSS Power supply had been switched off & total load was taken on battery bank for one hour & forty minutes. Before load transfer voltage was 232 VDC at 52 A & after load transfer voltage was 204 VDC at 52 A. Also load had been transferred on AVR & found satisfactory result. After one hour, power for both UPSS was switched on & found ok. Battery cleaning, cell voltage measurement & electrolyte level checking were done.
- Electrolyte was poured into the cells wherever required. Alarm & trip setting for UPSS were checked & found ok. Software database was checked by UPS Loader & the same was found ok. Tightening of all control cables & sockets were done.

On line Gas Analyzer:

- Preventive maintenance of CH₄ analyzer (AR-1) & CO₂ analyzer (AR-2) were carried out. Analyzer span & zero gas response were checked & found satisfactory result. Cleaned sample path by flushing it with air jet. Cleaned sample conditioning system. Checked the communication between analyzer & electronic system & found ok.
- Manual Calibration of both the analyzers was performed & found ok.

CAPITAL JOBS CARRIED OUT IN ANNUAL TURNAROUND:

PICV-16 & LICV-15: Old control valves were replaced with new control valves. Related signal cable & air supply tubing work were carried out. Finally control valves stroke were checked and found ok.

Steam Drum Low level trip 2003 Logic: Two Radar type level measurement transmitters were installed at steam drum for providing 2003 logic for steam drum low level trip system.

HIC-101J: Old pneumatic governor actuator was replaced with ITT Conoflow make new one.

VS-203 & V-7: Old control valves were replaced with new one. SOV power cable wiring connection & air supply tubing work were carried out. Finally control valve action was checked and found ok.

EWR / SUGGESTION SCHEME / RECOMMENDATION COMMITTEE AND TECHNICAL DEPT. RELATED JOBS:

Steam Drum Low Level trip 2oo3 Logic: As per EWR A-304 two Radar type level measurement transmitters were installed at steam drum for providing 2oo3 logic for steam drum low level trip system. Stand pipe was made by mechanical maintenance. Radars were installed on stand pipe; cable laying, dressing, ferruling & termination work were done at junction box & PLC cabinet end. One trip amplifier was installed in PLC cabinet for Digital tag LSSL1B & programming of trip amplifier was done. Other tag LSSL1A was taken as analog tag & directly terminated at analog isolator in PLC cabinet. Logic was made by YIL Person in I-47 Block. Finally logic was tested & found ok.



DCS Indication of Governor Actuator output Valve position: As per EWR A-323 governor actuator output valve position were provided for 116-JA, 103-JSO, 103-JLO & 101-BJT. Related cable laying, dressing, ferruling & termination work were done at Peak-150 & cabinet end. Tags were defined in IOM & relevant graphic pages in DCS. All tags were tested & found ok.

DCS Indication of MOV Local/Remote: As per EWR A-319 ammonia plant MOV Local/Remote indication were provided for the list of tags provide as per EWR. New junction box was installed in old MCC-5 behind marshalling room. Multi-pair cable was laid between junction box & DCS digital marshalling cabinet, related cable laying, ferruling & termination work was done at both cabinet & junction box end. All tags were defined in IOM & new graphic page was made in DCS. Finally tags were tested & found ok.

MOV at 38 Kg/cm² Steam Inlet to 101-JT & 105-JT: As per EWR A-301 MOV at 38 Kg/cm² steam inlet to 101-JT & 105-JT were provided by Electrical maintenance. Spare pair was identified in multi-pair signal cable in junction box present inside old MCC-5 behind marshalling room. Cable dressing, ferruling & termination work done at junction box & PLC cabinet end. Logic page was made by YIL person. Finally MOV operation was tested & found ok.

DCS Indication of Motor On/Off & Ready to Start: As per EWR A-336 ammonia plant Motor On/Off & Ready to start indication were provided for the list of tags present in EWR. New junction box was installed in electrical MCC-5, Multi-pair cable was laid between junction box & DCS digital marshalling cabinet, related cable laying, ferruling &

termination work was done at both cabinet & junction box end. All tags were defined in IOM & new graphic page was made in DCS. Finally tags were tested & found ok.

Conductivity & pH Meter in Steam Drum CBD Line: As per EWR A-322 conductivity & pH meters were installed in steam drum CBD line. Mounting support was welded at relevant position & both conductivity & pH meters were installed on it. Single pair cable had been laid between junction box & meter. Cable dressing, ferruling & termination work was done at both junction box & cabinet end. Tubing work was done from sample point to both meters. Tags AR-101FC & AR-101FP were made in DCS & defined in relevant graphic page. Finally both meters were taken in line & found ok.



Lube Oil pressure indication of Rotary Machine: As per EWR A-309 lube oil pressure indication for rotary machine 115-JA, 115-JB, 107-JA & 104-J were provided in DCS. Transmitters were installed in relevant position; single pair signal cable was laid between junction box & transmitter. Cable dressing, ferruling, termination were done at both junction box & cabinet end. Tags PI-115JALO, PI-115JBLO, PI-107JLO & PI-104JALO were defined in IOM & relevant graphic pages. Finally tags were taken in line & found ok.

Metal Skin Temperature Indication of Super Heater Coil of Reformer: As per EWR A-321 metal skin temperature indication of super heater coil of reformer was provided. K type duplex thermocouple was installed inside the reformer tube. Related thermocouple single pair cable was laid between junction box & thermocouple head, cable dressing, ferruling & termination work was done between temperature cabinet C-101F & junction box. Tag TI-103-E was defined in IOM & related graphic page of DCS. Finally tag was taken in line & found ok.



Interlock logic for opening of 101-J vent on high temp. of 101-CA/101-CB and low NG to air ratio was developed in PLC and same was implemented as per EWR A-330.

CONTINUAL IMPROVEMENT:

VS-203: Old control valve was replaced with new one. SOV power cable wiring connection & air supply tubing work were carried out. Finally control valve action was checked and found ok.

Steam Drum Low level trip 2oo3 Logic: Two Radar type level measurement transmitters were installed at steam drum for providing 2oo3 logic for steam drum low level trip system.

Metal Skin Temperature Indication of Super Heater Coil of Reformer: Metal skin temperature indication of super heater coil of reformer was provided. K type duplex thermocouple was installed inside the reformer tube.

Conductivity & pH Meter in Steam Drum CBD Line: conductivity & pH meters were installed in steam drum CBD line.

HIC-101J: Old pneumatic governor actuator was replaced with ITT Conoflow make new one. Related new air tubing work was carried out. Governor actuator stroke was checked & found ok.

UREA PLANT

(Instrumentation)

CONTROL VALVES:

HICV-1421: Valve was dropped from the line and replaced by spare valve which was already overhauled, boxed up with new Teflon seat and checked for operation. Also replaced its SOV, HCO-1423 with new one. After mounting the proximity switches for ON and OFF position sensing, checked valve operation.

HICV-1201: Valve was opened from the bonnet and overhauled the trim parts. All other parts were cleaned & overhauled. Boxed up the valve with new bottom guide bush, gland packing set and seal rings set for bonnet. Mounted the actuator on valve body and replaced the position transmitter with new one of Eckardt make then carried out control valve stroke checking and calibration of position transmitter.

LRCV-1201: Valve was opened from the bonnet then cleaned and checked its body and trim part, seat was found ok but plug was found with erosion over stem length. Replaced its plug of MOC: HVD1 with modified plug of MOC: Safurex. Also modified its bonnet for continuous flushing in stuffing box of valve. Boxed up the valve with new bottom guide bush, gland packing set and seal rings set for bonnet. Installed the actuator on valve body with Valve Positioner and Positioner transmitter. Replaced the volume booster with new one then carried out control valve stroke checking and calibration of position transmitter. Also connected tubing related to continuous flushing arrangement provided in valve.



**LRCV-1201 Plugs Old and New
Modified to reduce side thrust**



**LRCV-1201 Bonnet modification
for continuous flushing path**

LICV-1201: Valve was opened from the bonnet then cleaned and checked its trim part. The plug was found with erosion on seating area so it was replaced with spare one. Cleaned and overhauled the internals and trim parts then boxed up valve with new gland packings and bonnet gaskets. Actuator was opened, cleaned and overhauled. Actuator was boxed up with new O rings. Finally the valve was assembled and stroke checking was carried out.

PICV-1130: The control valve was opened from the bonnet. Replaced the plug and seat with spare ones. The valve was boxed up with new gland packing set, seat and bonnet

gaskets and piston seal ring. Actuator was checked and installed on valve body with new volume boosters. Control valve operation and stroke checking were carried out.

PICV-1128: The control valve was opened from the bonnet. Replaced the plug and seat with new one. Overhauled the cage. Boxed up the valve with new seat and bonnet gaskets and provided new gland packing set. Finally the valve was assembled and operation and stroke checking were carried out.

PICV-1181: Valve was opened from the bonnet. Machining was done over its trim parts. Cage was cleaned and overhauled. All other parts were cleaned & overhauled. Provided new plug and body seal rings, seat and bonnet gaskets, plug spacer ring and gland packing. Actuator was opened and its internals were cleaned and overhauled. Replaced the actuator O ring and seal ring with new one. Boxed up the actuator. Replaced the volume booster and air pressure regulator with new one. Finally the valve was assembled then carried out valve operation checking and stroke checking.

FRCV-1421: Valve was dropped from the line. Replaced its plug and seat by new modified one for reduced Cv. All internal parts were cleaned & overhauled then box up valve with new bonnet gasket and gland packing. Actuator was checked and replaced the valve Positioner with spare one. Finally the valve was assembled and fixed back in line and carried out valve operation checking as well as stroke checking.

PICV-1810: Control valve was opened from the bonnet. Machining and lapping was done on plug & seat and overhauled the internals of trim parts. Replaced the inner and outer seal rings with new one. Provided new seat and bonnet gaskets. Its actuator was opened then cleaned and overhauled its internals. Replaced the actuator stem O ring, top and bottom cover plate O rings and piston O ring with new ones. Finally the valve was assembled then carried out valve operation checking and stroke checking.

HICV-1801 : Control valve was opened from the bonnet. Machining and lapping was done on plug & seat and overhauled the internals of trim parts. Replaced the inner and outer seal rings with new one. Provided new seat and bonnet gaskets. Finally the valve was assembled then carried out valve operation checking and stroke checking

LRCV-1501: Valve was opened from the bonnet. Overhauled the trim parts, provided new seat and bonnet gaskets and gland packing. Replaced its damaged actuator with new one. Valve was installed back in the line and its stroke and operation were checked.

HICV-1207: Valve was dropped from the line. Replaced its actuator with new one. Also replaced the Positioner with spare one. Provided new flange gaskets and gland packing. All parts were cleaned & overhauled. Hydro test was carried out and valve was installed back in the line. Finally control valve operation and valve stroke were checked.

PICV-1202: Valve was dropped from the line. Lapping was done on plug and seat. Provided new flange gaskets & gland packing. All parts were cleaned & overhauled. Finally control valve was box up and checked valve operation and valve stroke.

FICV-1281: Valve was dropped from the line. Overhauled the trim parts, provided new gland packing and flange gaskets. Boxed up the control valve & installed back in line and checked control valve operation and valve stroke.

LICV-1235: Valve was dropped from the line. Cleaned and overhauled its trim parts, provided new gland packing and flange gaskets. Valve was installed back in line and checked its stroke and operation.

HICV-1206: Valve was opened from bonnet. All parts of valve were cleaned and overhauled. Boxed up the valve with new gland packing set. Finally control valve operation and valve stroke were checked.

LICV-1352: Valve was dropped from the line. General cleaning & overhauling of its trim parts and internals was done. Provided new gasket and gland packing. Valve was installed back in line and checked its stroke and operation.

HICV-1422: Valve was dropped from the line. Machining was done on plug and overhauled the trim parts. Hydro test was carried out and valve was installed back in the line with new gland packing and flange gaskets. Also provided new air pressure regulator and checked control valve operation and valve stroke.

TICV-1353: Butterfly type valve was dropped from the line. Provided new actuator O ring and completely overhauled the actuator. Cleaned and overhauled the valve internals. Replaced the Positioner with spare one. Valve was installed back in the line and stroke was checked.

PRCV-1201 & HICV-1202: General checking of control valve, actuator and valve Positioner was done. Valve Positioner was overhauled and stroke checking was carried out.

FICV-1351, TRCV-1421, and TRCV-1422: Gland packings of all control valves were replaced with new one. General cleaning, checking & overhauling work were done. Air filter regulators were cleaned & overhauled. Finally stroke was checked & found ok.

HICV-1221A & HICV-1423: Control valve Positioner /Electro-pneumatic Positioner were replaced by new one as old one found faulty. General cleaning & checking of control valve was done. Air filter regulator was overhauled. Finally stroke was checked & found ok.

Following control valves I/P Convertor was replaced with new one:

1.	PRCV-1481	4.	TRCV-1201
2.	FICV-1204	5.	HICV-1204
3.	LICV-1425		

General Maintenance & Stroke checking of following valves was carried out :

1.	PICV-1128	6.	TRCV-1202
2.	PICV-1221A	7.	LICV-1805
3.	FICV-1302	8.	LICV-1807
4.	FICV-1385	9.	HICV-1221A
5.	TICV-1201	10.	HICV-1422B

COMPRESSOR HOUSE JOBS:

All local temperature and pressure gauges were removed to facilitate mechanical jobs. Same were checked and fixed back after the completion of the jobs. Faulty temperature and pressure gauges were replaced with new one.

All bearing RTDs in turbine, HP case, LP case & gear box were removed to facilitate mechanical jobs. Same were checked and re-fixed after the completion of the jobs.

All vibration probes for radial, axial and key-phasor points in turbine, HP & 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 proximator for all vibration probes. After completion Mech. Maintenance jobs, all

probes were re-fixed with proper gap voltage adjustments. Housing/head type junction box for the axial vibration probes XE-1808A and XE-1808B were replaced with new.

Following pressure switches for Alarm and Trip function were cleaned, checked and calibrated:

1.	PSLL-1801C	6.	PSLL-1838C
2.	PSL-1812	7.	PSHH-1839C
3.	PSL-1813	8.	PSHH-1843C
4.	PSL-1816	9.	PSLL-1844
5.	PSLL-1818C		

Following low level and high level switches of separators & surface condenser cleaned, checked and calibrated:

1.	LSHH-1804	4.	LSHH-1822
2.	LSHH-1806	5.	LSL- 1823
3.	LSHH-1808	6.	LSL-1824

LICT-1803, LICT-1805 & LICT-1807: level-trolls for separators & surface condenser were cleaned, checked and calibrated.

All the limit switches for admission steam valves and barring were removed to facilitate mechanical jobs. Same were checked and re-fixed after the completion of the jobs.

All the 3 MPUs for Woodward governor's turbine speed measurement were removed to facilitate mechanical jobs. All were checked 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 were tightened.

New blocks were provided as per suggestion for modification of square blocks to round shape for HP steam, LP steam and admission steam valves' limit switches.

Mock up test carried out for Woodward governor for CO2 Compressor for HP and LP Valves stroke checking. Also checked the stroking for admission steam valve. Calibration of all three I to H converter (HP valve, LP valve and admission steam valve) were also checked.

Spare VOITH make I to H converters were checked and calibrated

General cleaning & stroke checking and air filter regulators were cleaned and checked for following control valves:

1.	HICV-1801	5.	PICV-1979B	9.	LICV-1821A
2.	HICV-1802	6.	LICV-1803	10.	LICV-1821B
3.	HICV-1803	7.	LICV-1805		
4.	PICV-1979A	8.	LICV-1807		

FIELD INSTRUMENT JOBS:

- HP Stripper's and Autoclave's pressurized as well as empty count readings for LRC-1201 & LR-1201 detectors were taken and recorded.
- Radioactive source of LR-1201 were removed from its mounting at Autoclave to facilitate mechanical maintenance jobs. After completion of mechanical maintenance jobs radioactive source was installed back.
- Empty counts reading were taken and calibrated radic relay unit and its spare unit for LR-1201 (Autoclave level).

- Radioactive source and Scintillation Counter of Nucleonic Level Gauge at HP Stripper (LRC-1201) were removed facilitate mechanical maintenance jobs and installed back after completion of mechanical maintenance jobs.
- Berthold level measurement system for Autoclave (LR-1201) and HP stripper (LRC-1201 & LH-1201) were checked and calibrated by Berthold service engineer. Also checked set of spares for same and updated its configuration. Backup battery cell in all online level Monitor units and spare units were replaced with new.
- N/C ratio meter mono block valve was dropped from the line and installed back in line after overhauling, lapping of stem and hydro testing it at 150 kg/cm². Also checked the NRV and hydro tested at 150 kg/cm². Its relief valve was checked and hydro tested at 40 kg/cm² and fixed back in line.

Following HP Thermo-wells were removed and hydro tested:

1.	TR-1205	3.	TR-1209
2.	TR-1207	4.	TR-1210

- Mass Flow-meter FS-1101 was removed from line and sent to EQDC for calibration. After receiving duly calibrated the same was mounted back in line.

Inspection of following magnetic flow meters was done:

1.	FIC-1203	4.	FIT-1353
2.	FI-1204	5.	FICT-1435
3.	FICT-1352		

Following extended pad type transmitters were checked and calibrated:

1.	LICT-1201	5.	LRCT-1421
2.	LICT-1202	6.	LI-1701A
3.	LICT-1282	7.	LI-1701B
4.	LICT-1353		

LICT-1421 & LRCT-1481: extended pad type transmitters for Urea solution tanks (T-1401 & T-1401A) were replaced by new one after checking and calibration.

Following quality affecting instruments declared in ISO were calibrated:

1.	PT-1105	8.	PICT-1202
2.	PT-1121	9.	PT-4405
3.	PT-1145	10.	PT-5303
4.	PT-1201	11.	PT-1802
5.	PT-1202	12.	SI-1401A
6.	PT-1421	13.	SI-1401B
7.	PT-1422	14.	FR-1201

LICT-1203, LICT-1235 & LRCT-1501: All level-trolls were calibrated.

- New power Junction box (PJB-06) at PT top was installed for provision of 110V AC UPSS power for vibro priller control unit.
- New modbus cable was connected in Vibro priller junction box and in system cabinet <200> (in card ALR-121) for communication with DCS.
- Old and damaged TBs were replaced by new one and terminations were tightened for PT top Junction box.
- Reconditioned the damaged thread of weep holes tappings in HP Autoclave and

changed old and damaged fittings by new.

- Two no. of pressure gauges were checked and calibrated for boiler hydro test purpose.
- Instrument Items like proximity speed sensor and pressure switch in Vibro-Priller bucket & proximity type speed sensor of Simco bucket were removed to facilitate mechanical maintenance jobs and were fixed back after the completion of jobs.
- To line up the motor/pump running indication in DCS a new multi-pair power cable was connected in new MCC-14 feeder marshalling cabinet No. 1 from instrument interfacing Junction box inside MCC-14.
- As per EWR-264 (Interlock bye pass logic), multi-pair power cable was terminated in MCC 14 marshalling cabinet as well as in Digital marshalling cabinet <111>.
- As per EWR-271 (Flow indication, FI-1506), instrument signal cable was laid from transmitter side to Junction box AJB-03.
- A Stripper ferrule testing hook up/set up with pressure gauge, rotameter and digital pressure indication was provided for differential pressure measurement of HP stripper ferrules.
- 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.
- Provided arrangement of air pressure regulators and pressure gauges for HPCC shell side as per production requirement and was removed after completion of the jobs.
- PVC tube was provided as per production requirement for delta P measurement for HP Stripper and removed after the completion of jobs.
- Painting and earth cable connection on all Prill Tower top control valves were done.
- The instrument air header at all floors was flushed for any foreign particles accumulation.
- Thermo-well TR-1210, TI-1433 and TI-1422 were removed and fixed back for vessel draining.
- 3 way valve was replaced with new one for control valve PICV-1502A.

New tubing was provided for following flow transmitters:

1.	FIC-1202	5.	PICV-1130
2.	FR-1502	6.	HICV-1204
3.	TICV-1226	7.	HICV-1406
4.	TICV-1353	8.	HICV-1421

DCS RELATED CONTROL/ MARSHALLING ROOM JOBS:

- DCS System & Panel earth resistance was checked, found within limits.
- Vibration monitoring system cabinet was cleaned, checked and tight all wiring terminals.
- In the DCS System, complete system was “powered down” and dismantled. All the hardware of FCS0201, FCS0501 and HIS0260 to HIS0263 and Engineering station were cleaned and installed back. All the System, marshalling and vibration cabinets were cleaned. The system was “powered on” and taken online. After power ON, system functioning was found ok.
- Measured control room temperature and dust level, both were found within limits.

- AC/ DC and battery voltages were measured, wherever applicable, for all the stations and found within limits.
- Checked System healthiness. Checked CPU, PSU and communication cards redundancy and found working fine. Checked overall system functionality and found working normal.
- All operator stations and Engineering station were upgraded with anti-virus McAfee AV updates.
- Application Project backup was taken for DCS in DVDs (two set). One Set of the backup retained with us and one set of the backup is kept by M/S YIL for their future reference.
- Node interface unit (NIU) and nest, AMN32 were replaced for Node 8 for FCS<501> to solve the communication error problem.
- Three no. of faulty node power supply modules, PW-401 for FCS<501> were replaced by new ones.
- New power cables were laid from MCC-14 to Urea inst. Marshalling cab.<113> for shifting of feeders from MCC-6 to MCC-14. Old cable terminations for the various motors and pumps were removed and new cable connections were provided.
- New signal cable was laid from MCC-14 to Marshalling cab.<201> for current indications of M-1402-1, M-1402-2 & M-1403-1 in DCS.
- New power cable was laid from MCC-14 to Urea inst. Marshalling cab. <111> and terminated for Interlock trip bypass logic as per EWR-271.
- New tags HICV-1406, PIC-1979, SOV-1901A and SOV-1901B were defined and generated in DCS and suitable soft keys for operation were provided in Graphics.

CAPITAL JOBS CARRIED OUT IN ANNUAL TURNAROUND:

TICV-1226: Old Existing control valve TICV-1226 was replaced with the new valve.



Control valve TICV-1226



Magnetic flow meter FRCT-1421

Existing magnetic flow-meter FRCT-1421 was replaced with the new magnetic flow-meter with HART Compatibility.

Level-troll for surface condenser LICV-1821 was replaced with new one having HART Compatibility

EWR / SUGGESTION SCHEME / RECOMMENDATION COMMITTEE AND TECHNICAL DEPT. RELATED JOBS:

EWR-U258: Replacement of CO2 battery limit isolation valve with MOV-180 & EWR U-262 MOV-1811 on 60 ata steam line.

For operation and indication (open/close) of new MOV-1800 & MOV-1811, continuity was checked from Auxiliary console <95> to MOV JB (field side). Operations of the MOVs were checked by operating from Auxiliary panel in control room.

EWR-U263: Provision of SOVs for controlling of Neem oil flow:

Two no. of solenoid operated valves were provided in neem oil line supply system, one in supply line and another in recirculation line for auto diverting neem oil supply as recirculation to neem oil tank on diverting of Prilling. For automatic operation of these valves with prill divert trip logic, necessary configuration updated in DCS and generated two DO with time delay action through Timer TM-1901 and TM-1901A with Tag SOV-1901A and SOV-1901B. Lined up both valves in DCS with necessary cable laid from valve to field JB in Neem oil tank area. Normally when prilling in line the Neem oil supply valve remain open and recirculation valve close but on prill divert means urea solution is diverted to urea solution tank the Neem oil supply valve closed and recirculation valve opened.

EWR-U264: Backend equipments interlock bypass:

New multi pair power cable was laid and terminated from MCC 14 feeder to Digital Marshalling cab. <111> for bypass provision. Soft bypass tags as listed below for equipment as per the list in request were provided in DCS and their operation and functionality was checked from DCS.

**ILB-M1402, ILB-M1403-1, ILB-M1403-2, ILB-1403-3,
ILB-M1419, ILB-M142, ILB-K1701& ILB-K1702**

EWR-U265: To provide higher capacity control valve (HICV-1204) on cooling water bypass line of CCS-II cooler (H-1207):

New control valve HICV-1204 of higher capacity was installed after line modifications on cooling water bypass line of CCS-II cooler (H-1207) and its operation and stroke was checked.



Control valve HICV-1406



Control valve HICV-1204

EWR-U275: To provide control valve (HICV-1406) in place of existing manual isolation valve to bypass Pre-evaporator (H/V-1418):

New control valve HICV-1406 was installed in place of existing manual isolation valve to bypass Pre-evaporator (H/V-1418) and its operation and stroke was checked.

EWR-U269 : Remote/ local Status Indication of MOVs in DCS:

Remote / local indications tags were defined in DCS for all the MOVs in the plant area. Configured alarm actuation at Remote to Local switch over for all MOV and A new Graphics for Status monitoring of MOV Remote/Local condition provided in DCS.

EWR-U271 : Flow indication for discharge of BFW Pumps (P-1501 /P-1506):

New DP Transmitter was installed on mounting stand in pump P-1501 /P1506 area and connected it with its flow element orifice FE-1506 with necessary impulse line tubing and isolation valves. To line up the flow indication in DCS a signal cable was laid from transmitter FT-1506 to Junction box AJB-03 and create a new tag FI-1506 in DCS and provided same in related DCS graphics for monitoring. The DPT was configured and calibrate for required range and lineup. The flow transmitter was lineup after configuration and checking calibration.

EWR-U276 : To control CCS-I temperature on Auto Mode:

As per EWR approval and for operation flexibility, Manual operated block HIC-1222 for manual operation of control valve HICV-1222 A and HICV-1222B was converted to auto control as TIC-1222 by necessary change in DCS configuration. The temperature input for Controller TIC-1222 is signal of TE-1202 same as that of TRC-1202. Necessary DCS graphics were also updated for this change.

CONTINUOUS IMPROVEMENT:

- Old and obsolete control valve TICV-1226 was replaced with the new valve manufactured and supplied by M/s Mascot Valves.
- Old and obsolete Level-troll for surface condenser LICT-1821 was replaced with new FISHER make Level-troll with Model No.: 249B DLC3010 HART compatible.
- The square shaped target block for proximity sensor of Hitachi compressor(CO2 Compressor) for HP, LP and Admission steam valve OPEN and CLOSE position feedback to DCS trip logic/ interlock were changed with new round shape block as per suggestion for safety of proximity sensor and reliable ensured operation of trip logic.
- It is to overcome damage of 2 out 3 logic three proximity sensor on each above mentioned valve. The square shaped target block having different dimension for side face and for diagonal and rotary movement of it may damage the proximity sensors mounted in close proximity, where as there is no any chance of damage of proximity sensor mounted with round shaped target block having only single dimension and it is the radius of block. The installations with square and round shaped blocks are shown below:

Before Change:



Proximity switches installed with Square shaped Target block

After Change:



Proximity switches installed with Round shaped Target block

- This square shaped to round shaped target block modification were done for following tags of HP, LP and Admission steam Proximity switches.
- HP Steam control valve Hi position: ZSH-1849, ZSH-1850, ZSH-1851
- LP Steam control valve Hi position: ZSH-1854, ZSH-1855, ZSH-1856
- Admission Steam control valve Hi position: ZSH-1857, ZSH-1858, ZSH-1859

OFFSITES & UTILITY PLANT

(Instrumentation)

Control Valve Maintenance jobs:

FCV-1: Cooling Tower (40-ata steam to Q-4412 Turbine) old control valve replaced with new Control valve along with related accessories i.e. SOV, limit switches etc. Air supply tubing was also replaced. Control valve stroke was checked and found ok.



BTV-2-4A & BTV-2-4B: Actuators of both the BTV valves were replaced with new Scotch type actuator. Reconnected limit switch & SOV cables with new actuator. Checked operation of both the valves from control room.



PICV-5305: IG Plant (HP Air pressure control) Control valve removed from line for complete overhauling. Actuator diaphragm was checked, found ok. Replaced Plug & seat, body & bonnet gasket, gland packing etc. with new one. Lapping of plug & seat was done. I/P converter had been replaced with new one. General cleaning of air filter regulator was carried out. Control valve was re-assembled; stroke was checked. Found ok.

PICV-6: New 60-ata steam vent valve installed by GE was taken in line. Power & signal cables were connected to SOV, Positioner and limit switches. SS tubing for air supply to Positioner & volume booster was done. Valve's operational logic related wiring inside Marshalling cabinet was done. Control valve stroke was checked and found ok. New Graphics page was prepared in DCS for operation of valve.



LCV-4 and TICV-5114: Air supply tubing was separated for both the control valves. In control valve LCV-4 gland leakage was observed, so gland packing was replaced with new one. Air filter regulator was checked & found in good condition. General checking & cleaning of all parts of control valve was done. Finally stroke was checked & found ok.

FCV-2204: Control valve was overhauled & checked its all parts. After inspection it observed that gland follower stud was broken, so it was replaced with new one. Air filter regulator was checked & found in good condition. All parts of control valve were checked & found in healthy condition. Finally control valve stroke was checked & found ok.

Following control valve's preventive maintenance was carried out. General cleaning and control valve stroke checking:

S.No.	Tag	Description	Area
1.	FRC-22	Main Gas Flow control	Boiler
2.	PICV-25	RLNG Pressure control	Boiler
3.	TCV-1	De-super heater Temperature control	Boiler
4.	LCV-3	CBD Tank Level control	Boiler
5.	PCV-42	Syn. Gas Pressure control	Boiler
6.	FCV-42	Syn. Gas Flow control	Boiler
7.	PIC-3	4 ata Steam vent	Boiler
8.	PIC-50	Dearator Pressure control	Boiler
9.	LCV-4	Dearator Level control	Boiler
10.	FCV-1	Boiler Feed Water Control Valve	Boiler
11.	HICV-5153	40 ata Steam to Ammonia plant	Cooling Tower
12.	HICV-5154	4 ata steam Inlet	Cooling Tower

13.	HICV-4401B	Steam to Q-4402 Turbine	Cooling Tower
14.	FICV-4502	Combine Effluent Flow control	ETP
15.	PHICV-4502	Combine Effluent pH control	ETP
16.	FCV-2201	Anion 1 outlet flow control	DM
17.	FCV-2202	Anion 2 outlet flow control	DM
18.	FCV-2203	Anion 3 outlet flow control	DM
19.	FCV-2204	Anion 4 outlet flow control	DM
20.	FCV-2205	Anion 5 outlet flow control	DM
21.	LCV-2905	DM Water Buffer tank Level control	DM
22.	PCV-3008	T-3301 Tank Pressure Control	Ammonia Storage
23.	PIC-3009	NH ₃ Vapor to Stack Pressure control	Ammonia Storage
24.	PCV-3055A/B	Receiver Pressure control	Ammonia Storage
25.	PCV-3064A/B	Condenser Pressure control	Ammonia Storage
26.	LCV-3051A/B	Saturator Inlet Level control	Ammonia Storage
27.	LCV-3055A/B	Receiver Level control	Ammonia Storage
28.	LCV-3058A/B	Inter stage cooler Level control	Ammonia Storage
29.	LCV-3065A/B	Gas Separator Level control	Ammonia Storage

FIELD JOBS BOILER:

Q-5113 & P-5111: F.D. Fan turbine & BFW pump related field instruments (Switches, probe, Temperature & pressure gauges etc.) were removed to facilitate mechanical maintenance job and re-fixed back.

APH inlet Damper (PC-3) CLOSE indication limit switch (ZSH-PC3) was replaced with new one, also replaced ZSL-PC3 micro switch. SS tubing for air supply was done.

F.D. Fan outlet Damper SOV was replaced with new one.

TI-13 & TI-13A Boiler furnace temperature Thermocouples were replaced with new one.

TRC-5 & TIA-6 (Final Steam temp.) replaced both the T/C with new one.

O₂ Analyzer: Flue Gas O₂ Analyzer sensor was removed from location for complete overhauling. Sensor & sintered filter was checked & cleaned properly. Sensor was re-fixed.

Igniter: Burner # 1 & 2 Igniter gun was taken out for inspection. General cleaning & overhauling was done. Igniter was checked for its spark strength & it was found strong enough for flame establishment. Igniter was re-fixed back in its location.

Flame Scanner: All the four flame scanners general cleaning & checking was done. One flame scanner of burner #2 was replaced with new one. Also aligned the Scanner so that maximum Flame Counts had been achieved.

Replaced SOV of GHTV with new one as old one was found passing.

Furnace draft points were checked & cleaned properly.

Steam drum level indicator electrodes were checked, cleaned and tighten all terminals.

All pressure gauges related to Boiler Drum & steam press. (PI-2, PI-3, PI-4 and PI-5) were calibrated as per requirement for boiler inspection.

Operation of all Syn. Gas BTV was checked & found ok.

Following Critical field switches set value were checked & found ok:

1.	PSH-11	2.	PSH-12	3.	PSL-24
4.	PSL-25	5.	PSN-26	6.	PSH-26
7.	PSL-27	8.	PSL-30	9.	LSLL-1
10.	PAL-Q-5112	11.	PLCI-Q-5112	12.	PLCO-Q-5111
13.	PLCI-P-5113	14.	PLCO-P-5112	15.	PAL-M-5113
16.	PLCO-P-5113	17.	LLCO-5111	18.	LLCI-5111
19.	LAHH-5111	20.	DPAH-5111	21.	PSL-42
22.	PSH-42				

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-3A	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.	LT-4	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 -1	8.	PSH-11	9.	PSH-12
10.	LSLL-1	11.	LT-1	12.	LT-4

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-42

FIELD JOBS COOLING TOWER:

Q-4411: Elliott Turbine all radial vibration probes, Trip SOV, speed pick-up probes; local temperature & pressure gauges were removed & reinstalled to facilitate mechanical maintenance. Replaced the Speed Sensor during plant start up

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.	LSHH-1	2.	LSAH-2	3.	LSAL-3
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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

Cleaning of control panel & tightening of all terminals in marshalling panel was carried out.

Instrument air supply header supplying air to Q-4411(Elliott turbine) & Surface condenser related instruments was disconnected from Ammonia plant air header and it was connected with existing old air supply header coming from IG plant / Compressor area.

FIELD JOBS I.G. PLANT:

Hydrogen Analyzer: AMC work was carried out for ABB Make Hydrogen Analyzer: Checked Analyzer by passing span gas of 5% H₂ It was found alright.

Following ISO related Quality/Safety affecting instruments were checked:

1.	PI - 5301	2.	PI - 5302
3.	PI - 5401		

FIELD JOBS : DM PLANT :

SMB-2, V-3 valve's air diaphragm was replaced.

Following Critical Transmitters were cleaned & checked:

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 : EFFLUENT TREATMENT PLANT :

AI-4500: Cleaning of sampling system & calibration of Ammonia Analyzer was carried out by service engr. from M/S DNP.

pHI-4502: Combined effluent pH meter was cleaned & calibrated.

Damaged OFC cable from ETP to DG set was replaced with a new one.

FIELD JOBS : AMMONIA STORAGE AREA :**Following Critical field switches were calibrated & found ok:**

1.	PSL-3053A	2.	PSL-3052B	3.	PALL-3004
4.	PAL-3055A	5.	PAL-3006	6.	PSHH-3007
7.	PSH-3063A	8.	PSH-3063B	9.	PAL-3067A
10.	PAL-3057B	11.	FSL-3050A	12.	FSL-3050B

Following Critical Transmitters were calibrated:

1.	PIC-3008	2.	PT-3103	3.	PIC-3103
4.	LT-3103	5.	LT-3001		

B & MH PLANT

(Instrumentation)

ASHBEE MAKE WEIGH BRIDGE :

- ASHBEE make Weigh Bridge maintenance was carried out by service engineer from M/S ASHBEE Systems. All the six load cells were cleaned, aligned and re fixed. Calibration of Weigh Bridge was done. Cleaning of Weigh Bridge pit was also carried out.

POWER BUILD MAKE AUTOMATIC BAGGING MACHINE:

- Following activities were carried out for the Packer scale number 1, 2, 3, 4, 7, 8, 9A, 9B, 10 A &10B.
- Carried out cleaning and tightening of terminals in local, load cell junction box and proximity switch junction box of all the packer scales. Provided lugs in solenoid box where ever required.
- Replaced a base block of solenoid valve with new one for the inner gate of P/S-4. Diverter 1 & 2: Cleaned solenoid, relay & limit switch and checked its function. Replaced old corroded JB of DIV-1 SOV with new SS JB fabricated in Mech. W/S.
- Checked wiring terminals in the main panel, local panel, Solenoid boxes, and load cell box.
- Flushed exhaust tubes of solenoids valves in all the packer scales.
- Cleaned and checked CSC-25 relay board, fuses, and all sensors.
- Checked functioning and calibration of all Packer Scales.
- All the solenoid valves were overhauled.
- Cleaned Hopper level switches LVL HH-9 and LVL HH-10. Also verified its functionality in Hopper for P/S-9A/B and P/S -10 A/B.

DUST EXTRACTION SYSTEM :

- Calibrated 5 nos. of pressure gauges of Urea dust extraction system & fixed it back. Cleaned the Dust Extraction plant control panel.
- Cleaned air filter regulator, I/P convertor and valve Positioner of 2 control valves i.e. LCV-371 and DCV-601 of Urea dust extraction system. Checked both the control valves stroke.
- Old pneumatic level transmitter of Urea dust dissolving tank T-2163 was replaced with new Electronic level transmitter. Signal & power supply arrangement for the same was done.

SILO : RECLAIM M/C BELT WEIGHER SYSTEM :

- Servicing and calibration of both the old & new Reclaim m/c Belt Weigher system was carried out by Service engr. from EMTICI. Cleaned & checked wiring terminals in the Belt Conveyor Logic panels and its related JB.

METTLER WEIGHING SCALES :

- Cleaning and calibration of all the METTLER Make weigh scales were done.

Annual Maintenance Jobs for DCS & PLC:

- DCS shutdown maintenance activities were carried out as per the AMC procedure.
- Following activities were carried out in Boiler, DM, IG/CT & Ammonia Storage area, Narmada, ETP & DG Set.
- Before starting preventive maintenance activities / AMC jobs, tuning parameters of all control stations were saved on Engineering station. Project back up was taken.
- 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 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, 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 voltage & grounding were checked and the 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 system.
- Redundancy checks were performed on V net / IP Bus, CPU, PS 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 working ok.
- Data was collected for all HIS & FCS in Project backup for reference. All Operator stations & engineering station Anti-virus had been updated.
- Control room dust level & temperature had been observed & found within limit.
- Marshalling Cabinet fans were replaced with new one (5 numbers in DM & 1 numbers in Narmada).
- New Logic was implemented for PICV-6 (60 ata steam vent when urea Hitachi compressor trip) in boiler plant DCS.
- New graphics page was generated for operation of PCV-6 (60-ata steam vent valve) and modification was also done in existing PRG01 graphics page.
- CPU battery was replaced with new one in IG plant and Ammonia Storage.
- ALR 121 card in Boiler is replaced with spare one from Cooling Tower Replaced CPU Backup battery for IG/CT and Ammonia Storage DCS.
- New indicator provided in boiler PDB cabinet.

DCS System for Fire & Safety: Installed the HIS and System/Marshaling Panel in F&S control Room. New Junction box was installed. Field cables were laid and terminated in JB and Marshalling cabinet. Interconnection cabling done between AUX panels and marshalling cabinet. Earth cable was provided for DCS System. UPS cable from UPS ACDB (installed in DM Plant) was laid and terminated. Powered on the DCS System. Application Project downloaded in FCS. DCS System make ready for the commissioning activities.

Annual Maintenance Jobs for UPSS SYSTEM:

EMERSON make 2 X 60 KVA

- AMC jobs for 'EMERSON' make 2 x 60 KVA UPSS and AMCO battery bank by M/S EMERSON NETWORK POWER and M/s SANTECH Power System respectively was carried out.
- Performance of UPS was checked with draining of battery for about 45 Minutes.
- Redundancy Functionality of UPS checked. Load Taken on AVR for 15 minutes.
- Two nos. of AMCO battery cell were by-passed as they were found unhealthy.
- Checked the Battery voltage/performance during charging & discharging & found ok.

DB make 2 X 5 KVA UPSS JASPUR OFF-TAKE POINT :

- AMC Jobs for 2 X 5 KVA DB Make UPS was carried out.
- Redundancy/functionality test carried out & found ok.
- Checked tightness of all power cables, control cables, PCB Mounting & found ok.

DB make 2 X 10 KVA UPSS NARMADA WTP :

- AMC Jobs for 2 X 10 KVA DB Make UPSS was carried out.
- Redundancy/functionality test carried out & found ok.
- Checked tightness of all power cables, control cables, PCB Mounting & found ok.
- Cleaning of both UPSS one by one was done with blower.

EMERSON make 2 X 10 KVA AMMONIA STORAGE :

- AMC jobs for 'EMERSON' make 2 x 10 KVA UPS and AMCO battery bank was carried out by Service Engineer.
- Redundancy/functionality test carried out & found ok.
- Checked tightness of all power cables, control cables, PCB Mounting & found ok.
- Cleaning of both UPSS one by one was done with blower.

CAPITAL JOBS CARRIED OUT IN ANNUAL TURNAROUND

BTV-2-4A & BTV-2-4B: Boiler plant Burner-2 both the trip valve's actuator was replaced with new scotch type actuator. Related tubing & cable connection was carried out. Finally action was checked from control room DCS and found ok.

FCV-1: Cooling Tower (40-ata steam to Q-4412 turbine) old control valve was replaced with new Control valve along with related accessories i.e. SOV, limit switches. Air supply tubing was also replaced. Control valve stroke was checked and found ok.

PCV-6: In Boiler, new 60-ata steam vent valve PCV-6 was taken in service. Signal & power cables were connected to Positioner, limit switches & SOV. Air supply tubing was carried out. Operational logic related wiring job done in Marshalling cabinet. Control valve stroke was checked and found ok. New graphic page was provided for operation of valve through DCS.

EWR/SUGGESTION SCHEME / RECOMMENDATION COMMITTEE JOBS:

PCV-6: In Boiler, new 60-ata steam vent valve PCV-6 taken in line. Electrical connections to SOV, Positioner and limit switches were provided. Operational logic related wiring job done in marshalling room. Air supply tubing work was carried out. Finally control valve stroke was checked and found ok. New graphics page provided for operation.

CONTINUAL IMPROVEMENT:

FCV-1: Cooling Tower (40-ata steam to Q-4412 Turbine) old control valve replaced with new Control valve along with related accessories i.e. SOV, limit switches. Air supply tubing was also replaced. Finally control valve stroke was checked and found ok.

BTV-2-4A & BTV-2-4B: Rotary Actuators of both the BTV valves were replaced with new Scotch type actuator. Reconnected limit switch & SOV cables with new actuator. Checked operation of both the valves from control room.

ELECTRICAL

AMMONIA PLANT

(ELECTRICAL)

Modification and New Installations

- Installation, testing & commissioning of new actuators 101J &105J train.
- Installation, testing & commissioning of new PA system at various locations.

New installation:

Installation, testing & commissioning of new actuators 101J &105J train

The existing manual operated valves are replaced with Rotork make IQ2 series latest motor operated actuators in 101J & 105J train in ammonia plant . The MOVs are installed & commissioned successfully during ATA-15. The same is also tested for operation & indications from Local as well as DCS as per process requirement.

The picture of the new installed actuators are attached below-



Installation, testing & commissioning of new PA system at various locations

The old , non-operative Philips make public address system is replaced with the new updated latest Neumann make public address system at various locations & control room.



Scheduled Preventive Maintenance

- **Preventive maintenance of transformer:** Most of the equipment of ammonia plant is getting electric power from MCC-5, 5A, 5B and 16. TR-6 and TR-21 & 22 feeding power to these MCC.

Startup heater is also part of ammonia plant and same is getting power from TR-start up.

Common activity carried out during transformer maintenance is as under:

- Ø Isolation of transformer from both side (LT & HT)
- Ø Dismantling of HV & LV terminal box.
- Ø Visual inspection about any leakage of oil from any part and any heated terminal.
- Ø Measurement of earthing resistance, IR value, PI value and oil BDV.
- Ø Testing of Buchholz relay about its function of tripping and alarm.
- Ø Condition of silica gel was checked. Accordingly discharged silica gel was replaced
- Ø Tightening of loose parts.

- **Preventive maintenance of MCC:** Preventive maintenance carried out on all the feeder compartments in MCC-5, MCC-5A, MCC-5B & 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 value 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
117JM AOP	AOP for 117JM
104JA	AOP for 104J
104J	AOP for 104J
104JT	AOP for 104J
104JTA	AOP for 104J
101BJT	AOP for 101BJ
101BJ	AOP for 101BJ
115JB	AOP for 115J
170J	Scrapped condensate pump
170JA	Scrapped condensate pump
2001LJA	Hydrazine solution pump
117J	Recycle gas compressor motor

- **Preventive maintenance of actuators carried out for the following MOVs and tested with their interlocks:**
SP1, SP3, SP4, SP5, SP70, SP151, SP152, SP 154, SP 156 and SP 158 & SP 159.
- **Testing and Servicing of L&T and Siemens make Air Circuit breakers were carried out.**

UREA PLANT

(ELECTRICAL)

Modification and New Installations

Installation, testing & commissioning of new actuators.

The existing manual operated valves are replaced with Rotork make IQ2 series latest motor operated actuators in MOV1811&MOV1110 train in Urea plant. The MOVs are installed & commissioned successfully during ATA-15. The same is also tested for operation & indications from Local as well as DCS as per process requirement.

Similarly MOV 1202, MOV1203 & MOV1842 are replaced with Rotork make IQ2 series latest motor operated actuators successfully. The same is also tested for operation & indications from Local as well as DCS as per process requirement.





· **Installation, testing & commissioning of new PA system at various locations.**

The old, non-operative Philips make public address system is replaced with the new updated latest Neumann make public address system at various locations & control room for better communication.





- **Replacement of motor control center, MCC-14**

Extension of RCC trench for MCC installation with base frame at same location was done.

New MCC -14 is installed at new location with interconnection of bus bars, Busducts & sections.

All the loads from old MCC-14 are shifted to MCC-14 new. Necessary cable laying & jointing was done for shifting of motors/loads at suitable locations.

The MCC was charged by taking that power in line. The changeover scheme was also tested for both normal two incomer auto changeover and emergency power changeover during power failure.

All the numerical relays for incomers & motors are tested & calibrated for its successful operation.

Every motor loads are tested for their DOR & operation from DCS as well as LCS.

All other loads are tested for their functionality and lighting circuits are also tested.

Desired loads are also interfaced with instrument JB for indication, operation & interlocks in DCS for smooth functioning.

Replacement of new variable frequency drives in Urea plant

All the variable frequency drives installed in P-1102A, B&C and P-1201A,B &C pumps are successfully replaced with new Siemens make SimonixG120 drives with latest features.

Scheduled Preventive Maintenance

- **Preventive maintenance of transformer:** Most of the equipment of urea plant is getting electric power from MCC-6, 14, & 15. TR-7A, 7B, 17, 18 & 20 feeding power to these MCC.

Common activity carried out during transformer maintenance is as under:

- Ø Isolation of transformer from both side (LT & HT)
- Ø Dismantling of HV & LV terminal box.
- Ø Visual inspection about any leakage of oil from any part and any heated terminal.
- Ø Measurement of earthing resistance, IR value, PI value and oil BDV.
- Ø Testing of Buchholz relay about its function of tripping and alarm.
- Ø Condition of silica gel was checked. Accordingly discharged silica gel was replaced
- Ø Tightening of loose parts.
- Ø Cleaning and washing.

- **Preventive maintenance of MCC:** Preventive maintenance of the all feeder compartment in MCC 6, MCC 14, and MCC 15 were carried out and the job details are as under:

Common activity carried out during MCC maintenance:

- Ø Isolation of MCC from power source.
- Ø General cleaning of all feeders.
- Ø Tightness checking of all power and control cable connection.
- Ø Checking & cleaning of contactors.
- Ø Checking of operation of breaker in test position.
- Ø Checking continuity and IR value of bus bar.

Ø Lamp test.

Ø Normalization of MCC.

- **Overhauling of critical motors:** Overhauling of following motor was carried out in urea plant.

M-1403/1	3 part conveyor
M-1403/3	3 part conveyor
M-1402/2	Scrapper motor
M-1401/B	Prill bucket
M-1403/1	3 part conveyor
P-1815/B	Condensate pump
M-1401/A	Vibro pillar
P-1817	LOP hitachi
M-1419	Link Conveyor
M-1421	Cool urea Conveyor
P-1408	Melt pump
K-1401/1	PT fan
K-1401/2	PT fan
K-1401/4	PT fan
P-1501	BFW pump motor
P-1815/A	Condensate pump
M-1402/1	Scrapper Motor
P-1202/A	CCS-I motor

- **Preventive maintenance of actuator of following MOV's was carried out:**
MOV 1101, 1102, 1201, 1202, 1203, 1501 & 1801
- **Testing and Servicing of L&T and Siemens make Air Circuit breakers were carried.**

OFFSITE & UTILITY PLANT

(ELECTRICAL)

Scheduled Preventive Maintenance

Preventive maintenance of transformer: Preventive maintenance of transformer TR-2A, 2B, 3A, 3B, 8, 11, 12, 13, 14, 16 and 23 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-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 value of bus bar.
- Lamp test.
- Normalization of MCC.

Overhauling of critical motors:Overhauling of following motors was carried out in utility

P-4412	LOP of Q-4401 A
P-4405	LOP of Q-4401 B
P-4403	LOP of Q-4403
P-5119	Ammonia Dosing Pump
P-5111A	A O P FOR PUMP P-5111
P-5112 A	AOP for PUMP 5112
P-5112 B	AOP for Motor 5112
P-5117	Hydrayzne dosing pump

P-5118 A	Phosphate dosing pump
P-5118 B	Phosphate dosing pump
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
P-4405/A	Cooling water pump motor

Servicing of following Rotork make actuators installed in utility plant was carried out.

FL2 (MAIN), FL2 (BYPASS), S2 (MAIN), S2 (BYPASS), S5, S6, 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 & Siemens make Air Circuit breakers were carried out.

Replacement of motor control center, MCC-13

Extension of RCC trench for MCC installation with base frame at same location was done.

New MCC -13 is installed at new location with interconnection of bus bars, Busducts & sections.

All the loads from old MCC-13 are shifted to MCC-13 new. Necessary cable laying & jointing was done for shifting of motors/loads at suitable locations.

The MCC was charged by taking that power in line. The changeover scheme was also tested for both normal two incomer auto changeover and emergency power changeover during power failure.

All the numerical relays for incomers & motors are tested & calibrated for its successful operation.

Every motor loads are tested for their DOR & operation from DCS as well as LCS.

All other loads are tested for their functionality and lighting circuits are also tested.

Desired loads are also interfaced with instrument JB for indication, operation & interlocks in DCS for smooth functioning.

Offsite Plant

Scheduled Preventive Maintenance

Preventive maintenance of transformer: Preventive maintenance of transformers Tr-1A, 1B, 15, 4A and TR-4B was carried out. As per detail given below:

Common activity carried out during transformer maintenance is as under:

- Ø Isolation of transformer from both side (LT & HT)
- Ø Dismantling of HV & LV terminal box.
- Ø Visual inspection about any leakage of oil from any part and any heated terminal.
- Ø Measurement of earthing resistance, IR value, PI value and oil BDV.
- Ø Testing of Buchholz relay about its function of tripping and alarm.

- Ø Condition of silica gel was checked. Accordingly discharged silica gel was replaced
- Ø Tightening of loose parts.
- Ø 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 value 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 /Servicing of 11 KV Siemens Breakers were carried at MPSS and 66KV yard as per detail given below:

Common activity carried out during maintenance:

Visual inspection of breakers for any abnormality.

- Ø Thorough cleaning of breakers was carried out
- Ø Checked power & control circuit connections in the breaker for tightness.
- Ø RE 300-relays are replaced in defective feeders.
- Ø Gear box operation, tripping mechanism, spring charging limit switch Operation , Circlips ,Mechanical interlocks were checked
- Ø Mechanism was tested and lubricated.
- Ø Insulation resistance of each breaker was measured
- Ø Closing & Tripping time of all the Breakers was measured.
- Ø Closing coil & Tripping coil resistance was measured.
- Ø Contact resistance of each breaker was measured
- Ø Adjustment of breaker damper roller gap wherever required.
- Ø Adjustment of breaker rack out/in key position for smooth operation wherever required.

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

Specific activity carried out during maintenance:

- Ø Two clamps of "B" Phase Tie isolator found corroded. Opened the clamps and cleaned & fitted the clamps with new nut bolts.
- Ø All phase connection of Chhatral side GEB PT to isolator (89.4) found corroded. All Connections (lug) opened and cleaning done. After cleaning reconnection of isolators to PT done.
- Ø Main isolator of chhatral line was not closing properly. Alignment done of the isolator done and operation tested & found OK.
- Ø CT Contact of 52 B breaker found corroded. Open the contacts from terminal and cleaned. After cleaning reconnect the same.

Special activity carried out during total power

- Ø 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.
- Ø 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.
- Ø Checking & maintenance of all incomers & bus couplers in 11KV MPSS by load sharing & load management.
- Ø Checking & maintenance of bus bars in 11KV MPSS & all MCCs incomers & bus couplers by load sharing & load management.
- Servicing of Chhabi make Battery charger in 11 KV MPSS.
- 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.
- Replacement of control & relay Panel:
 - Ø All the existing cables were removed with noting down of ferrules and proper tagging on cable.
 - Ø Old panel was removed.
 - Ø New panel was installed on same location with the modification in existing cable trench.
 - Ø All the removed cables were reconnected as per scheme.
 - Ø Change over scheme of both of the lines was successfully tested.
- Replacement of MOCB with SF6 circuit breakers.
- Erection & line up of overhead cable rack from 11KV MPSS to 66Kv yard with new HT XLPE cable.
 - New cable rack was prepared for laying of new cables from 66KV switch yard to MPSS.
 - HT cable laid up from 66KV yard to MPSS.
 - Termination at both of the end was carried out.
 - MPSS panel charged via new cables.\
- Retrofitting of numerical relay in 11 KV Substation:
 - Ø Electromagnetic relays for protection of 11 KV feeders are replaced with new advanced numerical relay.
 - Ø Modification of wiring as per scheme for new relay.
 - Ø Feeder was checked for their functionality and found ok as per scheme finalized.

B & MH PLANT

(ELECTRICAL)

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 value of bus bar.
- Lamp test.
- Normalization of MCC.

Overhauling of critical motors: Following motors were overhauled in B & MH plant:

P-2704/A	Dust solution pump
P-2704/B	Dust solution pump
K-2161	Dust blower B&MH
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
M-2137	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 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 value of bus bar.
- Lamp test.
- Normalization of MCC.

CIVIL

AMMONIA PLANT

(CIVIL)

Refractory repairing jobs in primary reformer (HT & LT zone), Auxillary boiler

The refractory repairing in primary reformer & auxillary boiler was carried out. The 15 no. of hollow blocks in primary reformer were replaced. The casting of auxillary boiler side panels was carried out by civil section using the refractory material "Insulyte-11".



Primary Reformer



Side panel of Auxillary boiler



UREA PLANT

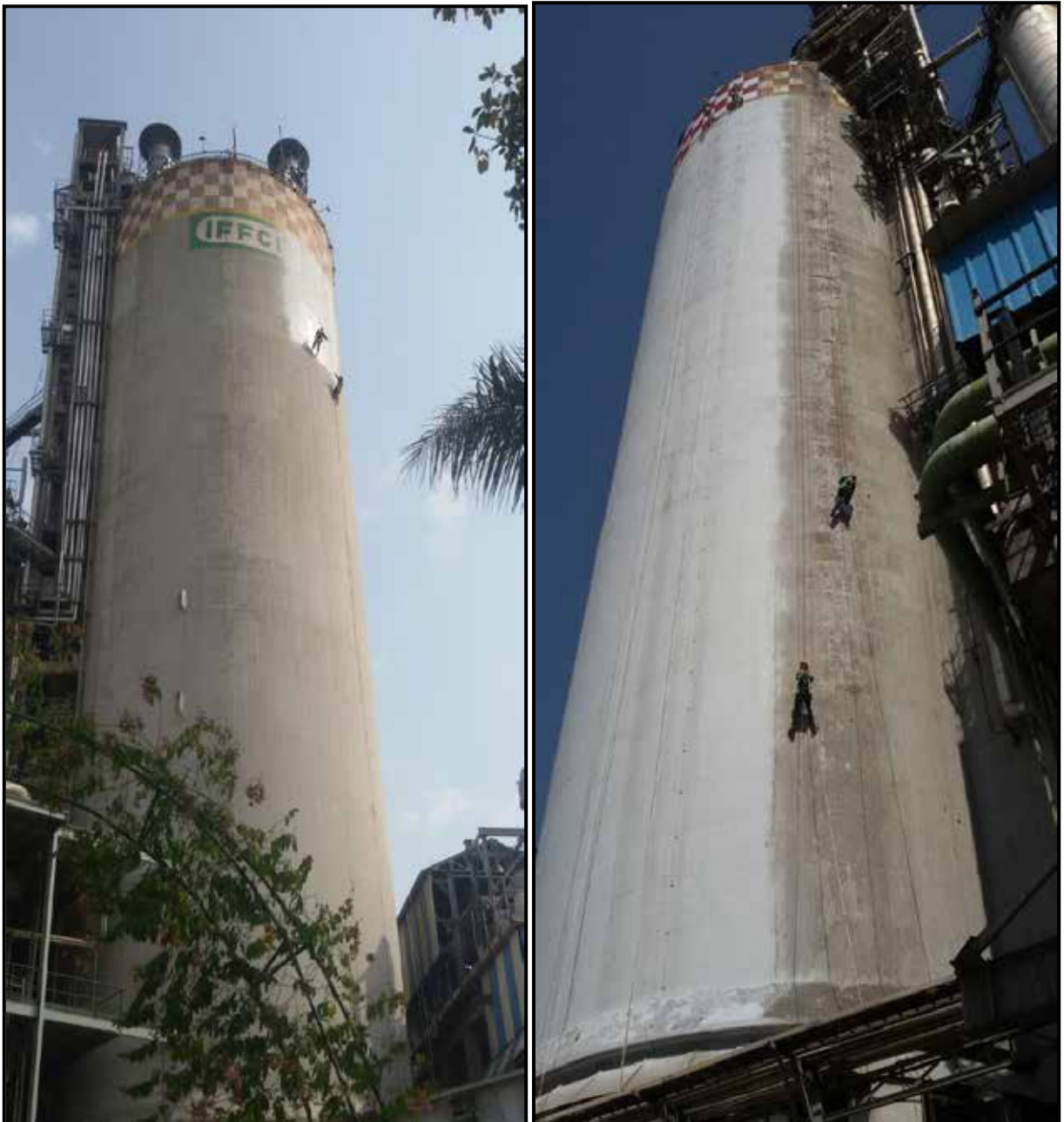
(CIVIL)

Anti corrosive treatment of prill tower:

Anti corrosive treatment of prill tower was done by M/S Deewan Enterprises, Bareilly. The total height of the prill tower is 72 meters and diameter of the prill tower is 18 meter.

Top 8 meter chequered block & bottom 8 meter was painted using Epoxy painting and remaining portion was painted using apex paint. The lift walls, columns, beams and conveyor gallery M-2117 & M-2121 were also painted using epoxy paint and apex paint.

The party purchase special working arrangement for painting as per the directives of fire & safety department. The painting was done using high pressure pump.





Retrofitting and pocketing of the existing foundations P-1202 A/B in urea plant

The new pump P-1202A/B is to be installed in urea plant. The foundation of old foundation was retrofit and new pockets were made by using the Hilti core cutter. The size of the old foundation was modified using dowel bars and new steel reinforcement was also provided to accomodate new modified pump.



Newly constructed foundations P1202 A/B

OFFSITE & UTILITY PLANT

(CIVIL)

Construction of new cable trench in 66 KV yard & fire control room

New cable trench was constructed in 66 KV yard to accommodate new panel & cable trench in fire control room was made for installation of new DCS system.



Retrofitting of the damaged surface of the cooling tower sump basin.

The outside wall of the cooling tower sump is badly damaged. There may be leakage during charging of the water in the sump. The damaged part of the sump was demolished and new plaster was done.



Construction of foundation for P-4401 & P-4402 in cooling tower basin

There was a problem of vibrations in the existing foundation of pump in the cooling tower basin. It was decided to replace the MS base frame with new SS base frame. The foundation retrofitting was done and new base frame was grouted to accommodate P-4401 and P-4402.

B & MH PLANT

(CIVIL)

Rehabilitation of conveyor gallery M-2117 (beams, columns & soffit) area of B & MH plant by providing elastomeric lining

The condition of the concrete structure in silo & conveyor gallery area is deteriorated. To rehabilitate the concrete condition, It was decided to provide the chemical treatment offered by M/S Greensboro polychem Pvt. Ltd. Accordingly the job was carried out which included removal of existing plaster, cleaning of the surface, application of Polydee-RC (Rust convertor), application of bond coat, providing polymer modified mortar (PMM), proper curing of the PMM & application of 1 mm thick elastomeric layer. The supply of material and job execution was carried out by m/s Greensboro Polychem Pvt. Ltd.



TECHNICAL

AMMONIA PLANT

(TECHNICAL)

Jobs carried out by Technical Department during Annual Turnaround March / April-2016 are as under:

Following jobs have been carried out in Ammonia Plant :

Tappings for ESP-III (Ref. : TM/02/1200dt. 30/01/2016)

Tapings as under have been taken in Ammonia plant for Energy saving project :

8" NB By pass of Feed pre-heater (150-C)

8" isolation valve provided on inlet / outlet nozzles of 150-C and 8" bypass line provided with 8" NB globe valve.



2" NB tapping for LP purge gas of Synthesis Loop.

2" tapping with isolation valve for LP purge gas to Flash Gas tower taken from Line NH-120-2"



Isolation of Naphtha Pre-Reformer unit with Ammonia plant

The process gas (Reformed naphtha & process steam) line 14"-PG-160.01-G36 of Naphtha Pre-Reformer unit was connected with mixed feed coil exit process line (NG-9-12"-15P2) WITH 14"X12" reducer. This tapping removed and spool Pipe welded has been provided.

2"NB Tapping for water supply to flash gas tower from ARU

2" NB tapping with isolation valve taken from treated water supply line 3"-EL-102.01-D24 in ARU Unit.



2" NB Tapping for Ammonia water from Flash gas tower to ARU Unit

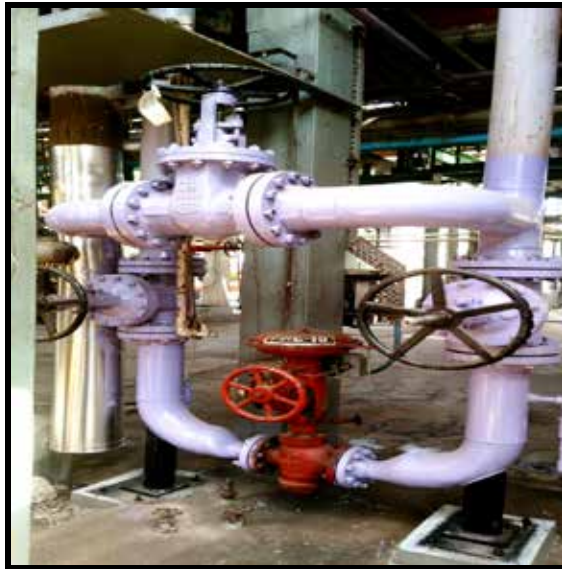
2"NB tapping taken with isolation valve from ammonia water inlet line 3"-AW-113.01-D24 to feed pre-heaters (HE 1A/B/C/D)



Bypass arrangement of FRCV-18 (Hot ammonia control valve) and Battery limit isolation valve. (Ref. EWR No. A325Dated 03/07/2015)

6" NB Bypass of MOC A106Gr. B has been provided for FRCV-18 with upstream & downstream isolation valve. Also, Battery limit isolation valve provided near DM water tank on the same line going to Urea plant.

This will provide operation flexibility and isolation at Ammonia battery limit. The job was carried out by M/s J&J



Bypass arrangement of LICV-19 (Cold Ammonia Flow control valve) and Battery limit isolation valve. (Ref. EWR No. A-326 Dated 03/07/2015)

3" NB Bypass of MOC A106Gr. B has been provided for LICV-19 with upstream & downstream isolation valves. Also, Battery limit isolation valve provided near DM water tank on the same line going to Ammonia storage tank.

New orifice (FR-35) having following details has also been provided in cold ammonia line to storage tank.

Tag No.	: FR-35
Flow	: Liquid Ammonia
Design Flow	: 63 T/Hr.
Density	: 667 Kg/ M ³
Line Size	: 77.92 mm
Differential pressure	: 240mm of water
Orifice Details	: 2.591"

This will provide operation flexibility and isolation at Ammonia battery limit. The job was carried out by M/s J&J



Tapings for New ACF (2008-U) and re-routing of CW lines.

6" NB toppings have been taken for New ACF for condensate polishing. Also the existing cooling water lines above operator cabin re-routed to facilitate ACF Erection and operator cabin near BFW pump (104-JA) removed.

Increase of line size of DM water to B3A of E3 In PGR. (Ref. EWR No. A327 dated 23/09/2015 and TM/02/1200 dated 15/03/2016)

DM water line size to PGR unit has been increased from 1" to 1.5". The job was carried out by M/s J&J with available in stock material.

By this modification it will be helpful to maintain level in B3A of E3 in PGR plant.

Connection of E-2 drain line to strong Effluent.(Ref. EWR A-334 dated 20/01/2016 and TM/02/1200 dated 15/03/2016)

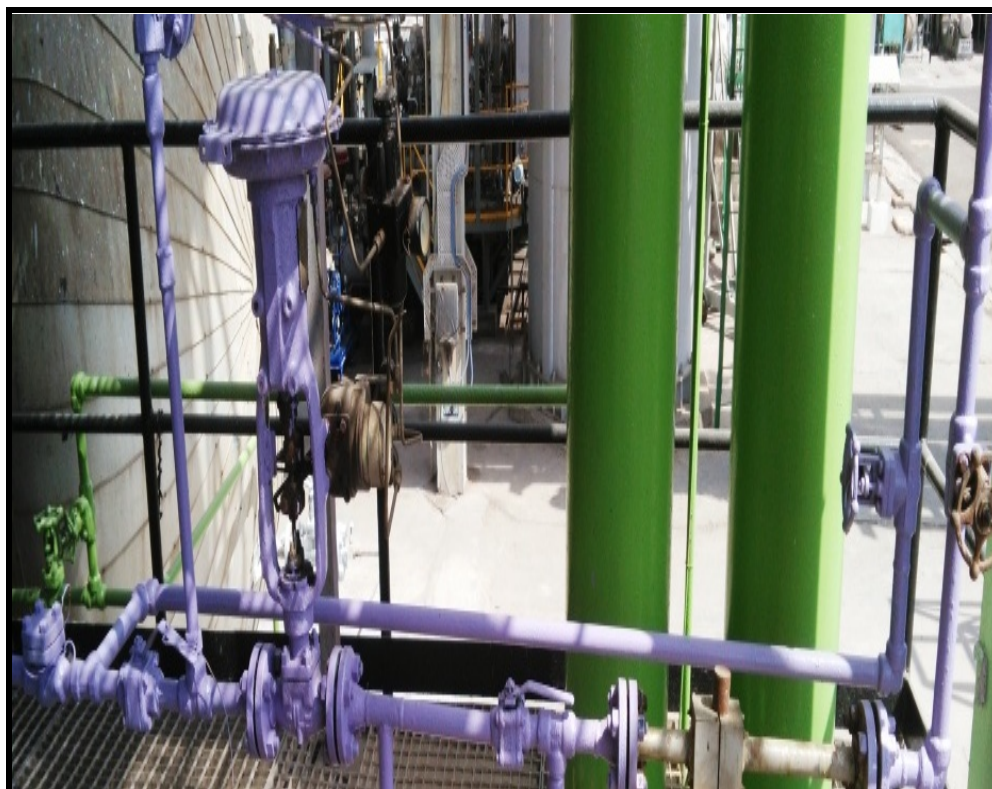
Above EWR was raised to provide E2 Ammonia drain lines connection to strong effluent. The job was carried out by M/s J&J from available in stock material.

This avoided E2 ammonia drained to open area at GAIL premises.

Provision of LCV-502 by-pass line in ARU. (Ref. EWR A-332 dated 20/01/2016 and TM/02/1200 dated 15/03/2016)

In existing system bypass line was there which exclude LCV-502.

Accordingly 1" by-pass line to LCV-502 with isolation valve has been provide. This will increase operation flexibility of the system.



Removal of AG line from Gail station to fuel separator inlet. (Ref. TM/02/1200, Dated 18/05/2015, EWR NO. Dated 13/03/2015)

Redundant Associated Gas (AG) line from upstream of fuel gas separator (178-F) at Ammonia plant battery limit has been removed. Due to lower pressure from GAIL supply of Associated Gas (AG) has been stopped.

**Removal of redundant Separators and Piping for Energy Saving Project (ESP),
Ref. Process scheme TM/02/1200 Dated 18/03/2016**

Following redundant Separators and Piping have been removed :-

- Separator (177-F) for 104-E vapour to stack removed and boot drain line connected to drain pot near 104-E.
- MP Steam header (S-11-6") which was provided to supply the MP steam to HTS and LTS at inlet and at bottom has been removed and inlet MP steam connection has been re-routed to provide more space near the 104-C and 106-D
- Atomising steam header of 11-ata and 4-atanear and around PICV-15 has been removed. Also, atomisation 4-ata steam header of Arch burners at Primary reformer furnace has been removed.
- Naphtha fuel supply header and naphtha distribution headers at top of Primary reformer furnace top arch burners have been removed.
- Separator (101-BF) on fuel supply line (NG-22-6") TO Auxiliary boiler gas burners has been removed and PAH-69/ PAL-69 tapping will be taken from pipeline NG-22-6" as per P&ID 63-D1-1

UREA PLANT

(TECHNICAL)

Following jobs have been carried out in Urea Plant :

Arrangement for chemical cleaning of Recirculation heater (H-1204) tubes. (Ref. EWR No. U-272 Dt. 16/05/2015 and TM/02/1331 dated 07/03/2016)

Following arrangements have been made for chemical cleaning :

- 6" SS304L inlet/ outlet nozzles on recirculation heater top/ bottom channel cover provided with 1" SS vent/ drain isolation valve.
- 6" CS/ SS Pipings for supply and return connection provided from existing chemical cleaning system of plate heat exchangers.
- Isolation valve with blinds and 1" NB drain and vents have been provided.
- With implementation of above, the performance of Recirculation heater (H-1204) will be improved and thereby reduced the load on LP system and Hydrolyser section.



Higher capacity control valve (HICV-1204) on cooling water bypass line of CCS-II cooler (H-1207) to control CCS-II temperature. (Ref. EWR No. U-265 dated 22/11/2014 and T/02/1331 dated 27/02/2015)

- In existing system H-1207 cooling water outlet bypass control valve size is not sufficient to maintain CCS-II temp during start up and shutdown. 2" Globe type control valve (Redundant LCV-1123B) having Cv-50, Class 300# RF was installed in April, 2009 in place of isolation valve on 3" bypass line of cooling water outlet from H-1207 to avoid hammering .
- During plant turn around, 2"NB Globe type control valve (HICV-1204) on 3" cooling water bypass line (H-1207 CW outlet) has been replaced by 6" NB line

with 6" Globe type control valve procured vide P.O. No. 201004160544dated 28/07/2015.



- It will be helped for maintaining the CCS-II temperature from DCS timely during plant start-ups & shutdowns and hammering in cooling water lines will be avoided by monitoring and controlling the CW outlet temperature.

Installation of orifice flow meter (FI-1506) on 3" discharge line of BFW pumps (P-1501/ P-1506) . (Ref. EWR No. U-271,dated 17/04/2015)

- It is done to provide the flow indication at the discharge of BFW Pumps (P-1501 / P-1506) . Accordingly orifice flange assembly provided with following details :

Tag No.	: FI-1506
Flow	: Steam Condensate
Design Flow	: 19 m3/h
Condensate temperature	: 95 deg C
Condensate pressure	: 11.7 kg/cm2a
Specific Gravity	: 0.962
Line Size	: 77.92 mm
Differential pressure	: 2000 mm WC
Orifice Details	: 40.84 mm

- By implementing above modification , operational reliability and process safety will increased.

Extension of Hot and Cold ammonia vent line to vent stack. (Ref. EWR No. U-274 dated 19/07/2015 and TM/ 02/1331 dated 20/07/2015)

- In existing system both hot and cold ammonia supply line in Urea plant battery limit were open to atmosphere, hence it was very difficult and unsafe to depressurize the system.
- Therefore 1" hot ammonia vent and 1" cold ammonia vent connected to 1-1/2" common line and this 1-1/2" common line has been connected to 20" vent

header at 3.25 Floor. Also, 1" vent with isolation valve for each vent provided at existing location



- With implementation of above modification, operational safety, working environment and operational flexibility will be increased in Urea plant.

Installation of control valve HICV -1901A & HICV-1901B on Neem oil pump Bypass & Discharge line.(Ref. EWR No. U-263dated 28/06/2014 and TM/02/1331 dated 27/02/2015)

- In existing system there is no control system to control flow of Neem oil to the nozzles as per prilling load. It is being controlled by throttling neem oil pump recycle I/V manually.

Following modification have been carried out to overcome above problem :-

- A solenoid operated control valve (HICV-1901A) provided with by-pass line on 25mm NB oil recycle line.
- A solenoid operated control valve (HICV-1901B) provided on Neem oil pump (P-1901 A/B) discharge line.
- Trip logic provided to open HICV-1901A and to close HICV-1901B on auto with delay timer, when urea solution is diverted to urea solution tank.
- Additional isolation valve provided on Neem oil recycle line (25mm NB) to transfer neem oil from pump discharge to either of the neem oil tank.
- With implementation of above EWR, optimization of neem oil consumption and improve the operational flexibility of neem coating system will increased.



Installation of DCS operated control valve (HICV-1406) to bypass H/V-1418. (Ref. EWR No. U-275 dated 07/05/2015 and TM/02/1331 dated 26/08/2015)

- The butterfly type control valve (HICV-1406) provided in place of existing isolation valve on line PR-1401-8"-X10, to bypass pre-evaporator during plant start up/ process upset/ any emergency.
- With implementation of above, it will improve the operational flexibility and reliability of system



New instrument air receiver for Urea Plant :

- New Instrument receiver taken in service with instrument header. Necessary piping modification has been carried out by M/s J&J . Instrument air receiver has been checked from inside for cleanness before taken in line.



UTILITY PLANT

(TECHNICAL)

Following jobs have been carried out in Utility Plant :

Installation of control valve in 60 ATA Vent line. (Ref. EWR No. SG-63)

PICV-6 has been installed in 60 ata vent line upstream of silencer. This will facilitate about 40 t/h steam venting during plant start up and shutdown.

Details of PICV-6 are as under :-

Size	: 150 NB
End Connection	: Flanged , RTJ ,Octagonal groove
MOC	: SA217Gr. WC6
MAKE	: Forbes Marshall
Type	: Globe, single seated
Leakage class	: Class V
Calculated Cv	: 164



Vent line from drain from fuel gas header in BHEL boiler area. (Ref. EWR NO. SG 64dated 16.09.2015)

The existing ¾” drain line on fuel gas line extended and connected to vent header in BHEL boiler area with isolation valve.

This will help in removing inerts from gas to safe height and avoid unsafe working conditions.



BAR CHART