TECH BYTES

"knowledge shared is knowledge multiplied"

National Fertilizers Limited, Technical Periodical

(Q-1,2023-24)

(For Internal Circulation)

Contents

Editor-in-chief

A.K. Jain, ED (Tech), CO

Editor

Ritu Goswami, GM (Tech.), CO

Co Editors

Kuldip Singh, DGM (Tech), CO

Pushpraj Choudhary, ENGINEER (Tech), CO

Unit Representatives:

Gurinderjit Kaur, GM (T.S. & Project) - Nangal

Tervinder Singh, DGM (T.S.) - Vijaipur

Sandhya Batra, DGM (T.S) - Bathinda

Seema Chawla, DGM (T.S.) - Panipat

Vijaipur Unit

AVOIDING STOPPAGE OF HRU-3 BY ATTENDING THE FLUE GAS LEAKAGE NEAR BURNER NUMBER #5 & #6 ONLINE IN RUNNING CONDITION OF HRU-3 OF CAPTIVE POWER PLANT

- By Mukesh Khare,CM-Mech.
Anand Kumar Singh, Manager-Mech.
Shailesh Dubay, Manager-Mech.

1. **Month & Year of Implementation : July 2022**

2. **Brief Description**

Introduction:

Vijaipur Unit has three Gas Turbine Generators to cater to the electricity requirement and the exhausts of GTGs are connected with Heat Recovery Units which generate steam.

HRU-3 Heat Recovery Unit (HRUs) runs in cogeneration mode with GTG-3 were commissioned in the year 1997 generates of 100 ata pressure steam. Which thereby is utilized to drive CO_2 Compressors in Urea plants of Vijaipur-II.

Job Challenges:

On 18th July-2022 HRU-3 was running in cogeneration mode with GTG-3 to meet steam requirement of the plant. During field round massive flue gas leakage was observed near burner no. 5 & 6 of HRU-3.

The flue gas leakage was so massive that it required to shutdown HRU-3 to attend the leakage. The flue gas leakage could have been due to fall of refractory material in side furnace, so repair work could have only be done by going inside furnace area. Man, entry inside furnace to attend/repair the refractory inside the furnace can be allowed only after natural cooling of furnace/boiler, which generally takes 36-48 hrs usually. Time required to repair refractory inside furnace is 3-4 days for short term repair. So, a minimum of 5-6 days shutdown was required to attend flue gas leakage.

As 100 ata steam generated by HRU-3 is used to drive CO_2 Compressors in Urea plant, unavailability of 100 ata steam for 5-6 days would have had huge impact on urea production, which thereby had ultimately resulted in financial loss to the company.

Flue gas leakage not only resulted in energy loss but also had affected the instruments installed in its vicinity due to high temperature of flue gas. There was also a possibility of tripping of HRU-3 due to malfunctioning of instruments mounted in the vicinity of leakage due to high temperature of flue gas.

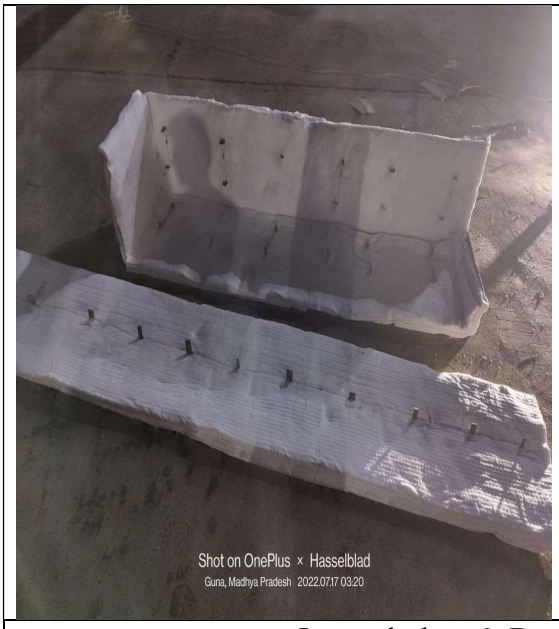
Considering the criticality of the situation CPP Mechanical team came up with an innovative idea of attending the leakage of flue gas online from outside in running condition of HRU-3. As the temperature in the leakage zone was very high, team of CPP Mechanical department took the initiative of attending the leakage by providing plates from outside to arrest the leakage. CPP Mechanical team also ensured safety aspect while executing this job and attended the job by taking all the safety precaution

Actions Taken

To attend the leakage one number plate and one number box of Inconel 601 and SA-387 P11 material was fabricated. Both Inconel and P11 material plates were welded together and P-11 plate was used as a lining plate over Inconel plate. High temperature Cerawool insulation layering was done over fabricated plate and box to protect it from direct exposure of heat.

However, to fabricate the plates, dimensions were required to be taken of the damaged portion. But due to high temperature, it was not possible to go near the leakage area to check the dimensions. The approx. dimensions were taken by going to the nearest possible location through crane and jhoola. Some long ½ inch pipes were used to check the dimensions approximately by standing on the jhoola. Even thermal scanning of the area was carried out and from the image, dimensions were interpolated. After having a view of the approximate dimensions of the damaged portion, one number plate and one number box of Inconel 601 and SA-387 P11 material was fabricated with Cerawool insulation.

During fabrication, the plate and box was repeatedly taken near the damaged portion by crane for rectification so that the plate and box were made of perfect dimensions.

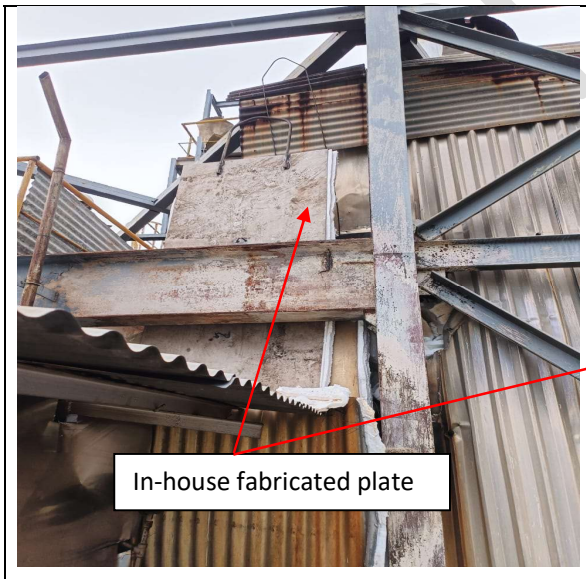


Inconel plate & Box with Cerawool insulation

Following steps were carried out during the job execution:

i. Fabricated plate and box was kept in front of leakage area through crane. After positioning initially, then only persons were able to go near the damaged portion for further checking the dimensions for rectification.

ii. The plate and box were finally made fit as per required dimensions and installed in front of the leakage area.



iii. To support the plate & box and to ensure complete stoppage of flue gas leakage, a Mechanical jack arrangement was also made, which is shown in the snapshot.

iv. This arrangement ensured tightness of the plate with the furnace wall and also avoided

the dislocation of the plate which could have occurred due to flue gas leakage or blowing high winds.

v. After installation of plate and box, high density Pyro-blocks (1425 degree C) were inserted in the remaining cavities around the plate and box to totally seal the area and avoid leakage of flue gas.

vi. Insulation sheet shielding was also provided around the surrounding instruments to protect them from high temperature of flue gas.

3. **Investments**: Negligible (Since the materials were arranged in-house and the work was done at our workshop).

4. **Savings:**

Shutdown of six days was required for attending the flue gas leakage near burner area. Shutdown of HRU-3 results could have in loss of Urea Production due to running of Urea plant on reduced load because of non-availability of sufficient 100 ata steam. It affects the availability of fertilizers to the farmers for which NFL and Central Government are committed. Estmated production loss due to running of Vijaipur-II plants on reduced load during shutdown of HRU-III is around 86 MTPD of Ammonia and 121 MTPD of Urea and excess energy consumption of 0.12 GCal/MT of Urea for the complex. Hence shutdown of HRU-III, would have resulted in less production of 726 MT of Urea and excess energy consumption of 4440 GCal, which is equivalent to Rs. 3.65 Crores. Installation of fabricated box and plate saved 6 days of urea production loss and also allowed Vijaipur to run HRU-3 without any leakage of flue gas till next opportunity for shutdown, which was planned in May-2023.

5. **Other Benefits:**

The shielded insulation sheet around the instruments not only protected it from high temperature of flue gases but also protected it from radiation heat of the boiler.

The above was a innovative solution by CPP Mechanical team to arrest the leakage online, right from taking the dimensions, fabrication of plate and box, providing insulation, installation, provision of Mechanical jack for support and further sealing the remaining cavities to avoid flue gas leakage

Refractory inside the duct plate repaired and duct plate is replaced in May-June-2023 Vijaipur-II shutdown.

****

NANGAL UNIT

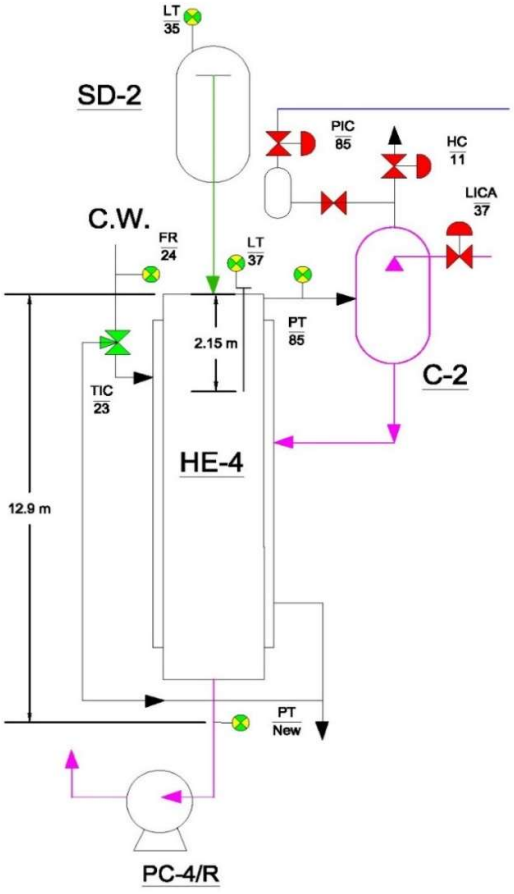
LICA-37 (Carbamate Solution Level Measurement) MODIFICATION JOB

- By Kulpreet Singh Rakra, Manager-Inst.

In HE-4 Exchanger, Level measurement of carbamate solution is done by capacitance probe of 2150 mm length which is installed on the top of the Exchanger. But for some unknown reasons, the probe stopped giving any indications. After inspection, it was found that the probe had got internally short circuit, making it impossible to repair or replace it while the plant was running.

Alternate option was brainstormed. Instrument department proposed to determine the exchanger level by getting a reading of the differential pressure.

Therefore, a new transmitter was installed at the bottom of the HE-4 exchanger as shown in picture. For second stage system pressure reading (vapour pressure) there is already a pressure transmitter PT-85 on top of HE-4 exchanger.



So the reading of both pressure transmitter are computed in another YS-1700 controller as below

Total height is = 12.9 mtrs

Density inside is = 980 kg/m3

Maximum Head pressure = 12.9 x 980

=1.2642 Kg/cm2

= 12642 mm of WC

Scaling of differential pressure between PT-85 and new PT done for the range of 0-100% i.e.

a) 0 mm for 0% and
b) 12642 mm for 100%.

As Level in HE-4 was maintained at the Probe length i.e. within top 2.15m of vessel and to enable appropriate signals to level controller, following re-Scaling was done for probe length of 2.15 m and dead zone of 0.15m from top i.e.

a) For 0% of capacitance based LT-37, effective pressure head i.e. 12.9m-2.15m=10.75m (10535 mm of WC) which is equivalent to 83.33% of differential pressure head measured by PT-85 & new PT.

b) For 100% of capacitance based LT-37, effective pressure head i.e. 12.9m-0.15m=12.75m (12495mm of WC) which is equivalent to 98.83 % of differential pressure head measured by PT-85 & new PT.

Hence, one additional electronic controller configured with following ranges:

Electronic Controller Display	Measured differential Pressure (New PT- PT 85) value fed to electronic controller	Equivalent reading of LT-37 capacitance Type
0%	83.33% (10535 mm of WC)	0%
100%	98.83 % (12495mm of WC)	100%

So one additional electronic Controller (YS1700) mounted behind the panel and rescaling range configured from 83.4 % to 98.94 % matching with the existing probe length. Afterwards the output of YS 1700 connected with existing LICA-37 Controller as the input of capacitance probe LT-37. Response and behavior of LT-37 was on the mark and working alright in Auto Mode.

****

PANIPAT UNIT

DIVERSION OF OIL MIST VENT OF GAS TURBINE TO DISTANT LOCATION

- By Manish, DM-Mech.

INTRODUCTION:

GTG at Panipat was installed to cater the power requirement of the unit. It is a twin shaft machine where gas generator comprising of 11 stages of Axial compressor and 2 stages of turbine are installed on one shaft and 2 stages of power turbine are installed on second shaft. Complete assembly is supported on 4 bearings and located by 2 thrust bearings.

An AC-driven oil system ventilation fan maintains a sub-atmospheric pressure in the bearing casings during start-up and cooling down in order to prevent oil leakage through the shaft sealing. During normal operation the ejector will maintain a sub-atmospheric pressure in the bearing casings. The ejector is designed for 100% capacity and is driven by air from bearing no.2. From the tank the oil mist passes through a filter extracting the oil from the air. The oil is returned to the tank and the air outlet is connected to atmosphere. Flame arrestor is provided in oil mist exhaust line to prevent ignition of oil mist.

OBSERVATION:

The oil mist exhaust line is in immediate vicinity of the air intake housing. There is high possibility of ingress of oil mist fumes through intake filters and also at downstream of filters via flange joints, in case the sealing is damaged. During air intake chamber inspection in Mar-'22 some traces of oil were found at downstream of static filters. At that time, all flange joints of Air Intake system were sealed with M-seal putty as a precaution.

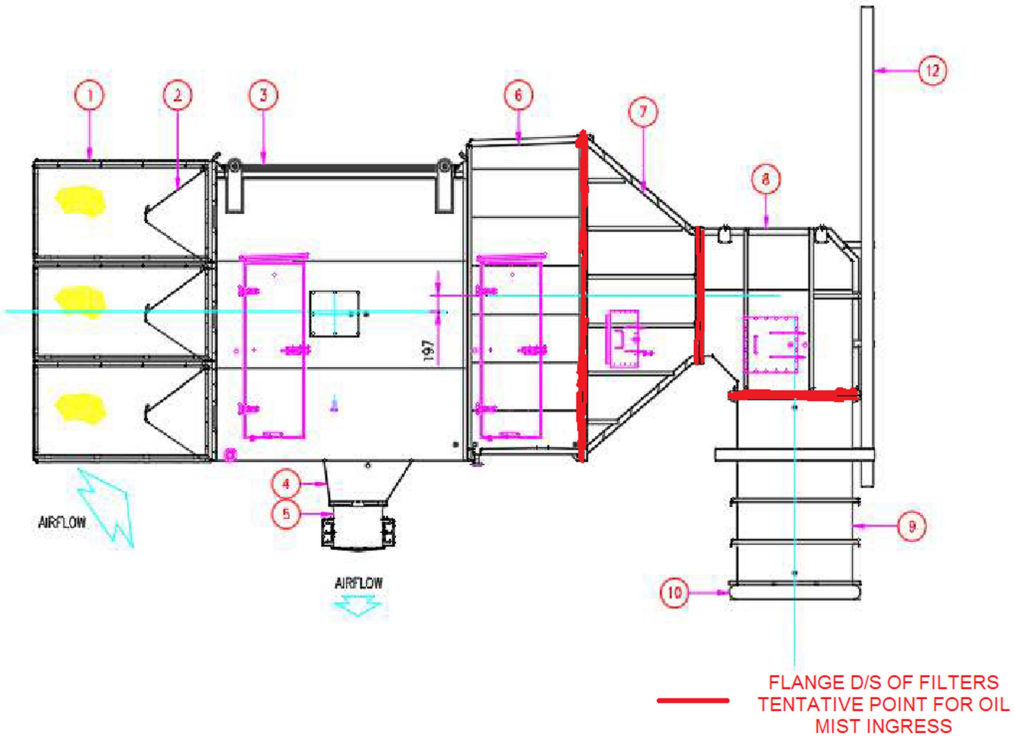
Oily dark substance was also observed at clean side of static filters and in inlet plenum at Bhatinda Unit.

Ingress of this oily substance in presence of dust particles forms a sticky compound which have tendency to stick to the Gas Generator rotor & stator blades. Deposition of material would result into fouling and ultimately the surging of compressor.

DIAGNOSIS & ACTION TAKEN:

Since the oil mist exhaust line is in the immediate vicinity of air intake housing, it might be the source of oily substance found inside the housing. So it became necessary to re-route the oil mist exhaust far from the air intake housing.

Any modification of existing oil mist exhaust piping was not possible during plant operation and also might had an impact on tank sub-atmospheric state/parameter.



GENERAL ARRANGEMENT OF AIR INTAKE SYSTEM

OIL MIST FUMES DIVERSION ARRANGEMENT

So a 24” pipe was used to enclose the exhaust portion and a 12” pipe was attached sideway. At the end of 12” pipe a flameproof exhaust fan was installed to suck oil mist exhaust and carry

over the fumes at far location. Following precautions were taken while installation of modified system.

1) Oil Mist vent was only closed around the circumference. Top and bottom were left open so that in case exhaust fan ceases to operate, the existing system at local may work as it is.
2) No part was welded/clamped with the existing vent. Separate structure was fabricated and new system was supported on it.
3) Exhaust fan used was explosion proof with IP66 protection.

In addition to above, all the joints of Air intake housing were also sealed with RTB.

CONCLUSION & RECOMMENDATIONS:

Installation of diversion pipe along with exhaust fan ensured the venting off the oil mist fumes far away from the air intake housing. The arrangement would definitely help in eliminating the chances of oil ingress from the oil mist exhaust.

****

Bathinda Unit

Unbalancing Of Current in One Phase during Paralleling Of Both NFL , Bathinda 132 KV Feeders

- By Hariom Gupta, SM-Elect.

Introduction

National Fertilizers Ltd. is getting power through two no's of 132 KV feeders from Guru Nanak Dev Thermal Power Station, Bathinda. From 09.01.2023 onwards, owing to the maintenance of Gas Turbine Generator, Power @ 17.5 MW is being taken from PSPCL to meet the total power requirement of the plant. Generally one feeder remains in line and power is being taken through incomer 2.

Observation:

On 14.01.2023 during the round in NFL 132 KV switchyard, a hot spot was observed in the B phase at PSPCL Incomer 2 having a temperature of 112 degrees. To attend this hotspot, PSPCL Incomer 1 was taken in line and kept parallel to PSPCL incomer 2 for some time to check the reliability of PSPCL Incomer 1. But it was observed that the blue phase current at PSPCL Incomer 1 was zero when checked on the corresponding ampere meter. The current of this B-phase automatically shifted to PSPCL Incomer 2.

Missing current on one phase may have caused the tripping of PSPCL feeders on earth fault due to current unbalance which further could have resulted in power failure (total blackout) in the NFL factory leading to the tripping of plant. Therefore PSPCL Incomer 1 was immediately isolated.

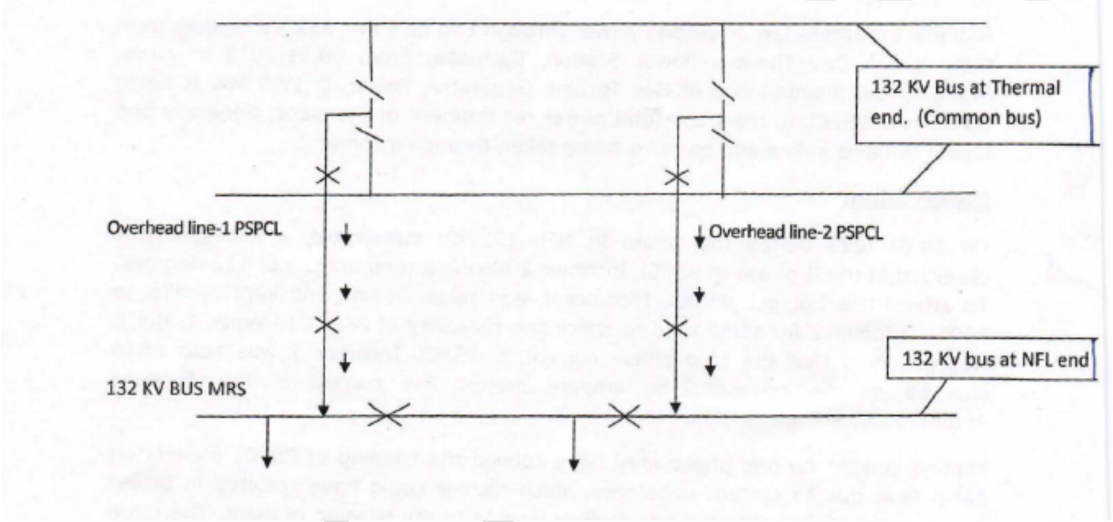
In ATA-2023 when plant load was minimum, feeder changeover from 2 to 1 was carried out; during that time also same phenomena occurred and became normal after one feeder was isolated.

Diagnosis & Action taken:

1. The healthiness of the 132 KV line of PSPCL Incomer 1 was checked by PSPCL staff and found ok.
2. Testing and maintenance of circuit breakers, CTs, and isolators of PSPCL Incomer 1 were carried out and found ok.
3. On further study following phenomena may occur due to following reasons:
   When both PSPCL feeders are taken in line in parallel, 132 KV bus at the Thermal end and NFL end become in parallel, and as per current law:
   a. Current splits between the branches:-
      The current along the branch with the smallest resistance will be larger than the branch with higher resistance. The total current in the circuit must remain constant.

b. If the line impedance in one branch is decreased the current will increase along with that branch. In order to compensate for that current increase, the current in the other branch must decrease so that the total current will remain constant.

As the length of feeders from PSPCL thermal end is approximately 2.5 KM and each line has nos. of isolators, towers etc. Hence it seems that both lines may have different impedance. In view of this, above said phenomena at point no. 3 may occur. If we run both feeders independently (i.e. one feeder at a time), this problem does not occur. The circuit diagram is as given below:



Conclusion & Recommendation

If we run both PSPCL feeders in parallel to increase the system reliability, the situation of current imbalance occurs this further may cause tripping of the plant on current imbalance. To avoid such a situation both feeders should not be run in parallel. In the emergency, if changeover of the feeder is required paralleling can be done only for short duration .

****