



Tech Bytes

“Knowledge shared is knowledge multiplied”

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Message from Chairman & Managing Director

Knowledge pool is the most valuable resource of any organisation.

An organization reaps the benefit of collective intelligence through sharing of knowledge. At the centre of the excellence, it is always the people with their innovative ideas and creativity coupled with enthusiasm and hard work.

NFL has strong legacy of continuity of thought & action and through that made tremendous leaps in the fields of production, productivity, energy, safety, and environment. To encourage new ideas, NFL has put in place various schemes like suggestion scheme etc. wherein employees suggesting proposals which can improve company's performance in terms of safety, plant performance etc. are rewarded on public functions. This strong tradition of NFL has contributed significantly in progress of the aforesaid areas. Recently, Chairman Reward Scheme was announced which carries a cash award of Rs 25000/- to an individual and up to Rs. 1 lakh to a group of employees (maximum 4 Employees) for the suggestion approved by the Apex Committee.

From time to time, articles on innovative working of NFL employees are getting published in National level magazines like Indian Journal of Fertilizers. Some of these articles in different fields have won accolades as well. Thus efforts made by NFL employees are well recognized by renowned organizations like National Productivity Council, Green Tech, Golden Peacock awards etc.

In order to further improve upon this legacy and considering the current policy regime of tight energy norms, need was felt to formalise knowledge sharing amongst all the units, with a view to replicate the improvement of one Unit in other units thereby maximising the benefits. "**Tech Bytes**" has been conceptualised with this objective in mind.

Any unique idea implemented by any NFL Unit, in any discipline like sustainability, waste reduction, pollution control, energy savings, process optimisation, maintenance practices to reduce repetitive failures, during the quarter is desired to be shared so that other Units can also implement the same.

I am sure this will bring about the intended benefits and also enthuse employees to contribute their ideas.

(Nirlep Singh Rai)
C&MD)



Message from Director (Marketing)

My Dear Colleagues.

In chemical plants like those of NFL, technical staffs are the backbone of any success story. A continuous running plant can bring in profits for any organisation, however tough the environment may be. NFL has strong legacy and over the years have developed operating procedures for maintenance planning, start up and shutdowns, material planning etc.

All NFL Units are implementing schemes or carrying out modifications to improve overall performance. This can be seen by the high capacity utilisation achieved by Units consistently over the years. Advanced instrumentation, systematic replacements can play a big role in improving performance.

An organization's most valuable resource is the knowledge of its people. Knowledge sharing is a key process in translating individual learning into organisational capability. Thus "**Tech Bytes**", a formal platform for knowledge sharing within NFL Units will drive excellence through people involvement, teamwork and efficient methodologies.

I wish you all the best for success of this magazine and hope that the intended benefits perceived through this magazine are sought by the industry as well.

V. N. Datt
Director (Marketing)



Message from Director (Finance)

Dear Friends,

You are all aware that GOI have been tightening energy norms over the last decades. This coupled with under recovery of fixed costs has adversely affected viability of urea operations. Units need to take necessary measures to make urea operations viable through further efficiency improvement, debottlenecking and cost cutting besides new opportunities, utilise surplus/unutilised assets. Steps in this direction can play a pivotal role in bringing about further improvement in energy efficiency.

It has been noted that Units are carrying innovative work in this direction. In order to facilitate knowledge sharing within organisation by allowing employees to put forth their creative technical ideas in “**Tech Bytes**” and having that knowledge be easily accessible can help your organization deliver better results.

I wish you good luck in achieving this objective.

Y. P. Bhole
Director (Finance)

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Vijaipur Unit

Revival/Repair of 11KV, 1300KW, MP1801A Induction motor at Vijaipur-I

Introduction:

In Ammonia Line-I, there are 3 nos. cooling Water pumps. Out of which 1 No. is turbine driven (MP1801B) and two are motor driven (MP1801A & C). During normal operation, motor driven pumps MP 1801A & MP1801C are in operation to meet cooling water process requirement. These pumps are driven by 1300 KW, 11 KV motors. MP1801A motor is having soft starter for starting the motor which comes in line for 10 seconds during motor starting and then gets bypassed to continue power supply through DOL starter (Vacuum Circuit Breaker). This BHEL make, 1300 Kw motor is very old and in service since commissioning of Line I plant. In the month of October 2020 (during ATA), Motor MP1801A (11KV, 1300KW, BHEL Make) tripped during startup on Negative Phase sequence & smoke was observed coming from its body. All Primary Electrical tests (IR Value, Winding resistance & inductance) were found OK.

Observations:

Motor was shifted to Electrical workshop, dismantled & physical observations were:-

1. There were rubbing marks between stator and rotor.
2. In 10 no's stator slots, magnetic Putty had come out of the slots, which had rubbed between stator & rotor.
3. Insulation sleeves on the bolts of NDE side bearing housing were found broken.

Diagnosis & Action taken:

OEM i.e. M/s BHEL was contacted. The party had sought tentative 6 months for complete repair. Due to non-availability of spare motor, sending the faulty motor at party's works would have led to energy loss (due to running of steam turbine) & incurred huge repair cost. So, In-house repair of motor was explored.

To repair the motor in-house, following jobs were carried out:-

- 1) All routine Electrical Tests were carried out & found OK.
- 2) Stator & rotor cleaning done & thin layer of araldite applied on magnetic putty slots (10 nos.).
- 3) 6 nos Bakelite sleeves for bolts of NDE side bearing housing were made in Mechanical Workshop.
- 4) Both sides' bearings replaced & air gap checked.

Motor assembled & solo run trial at reduced voltage taken, found normal. After job completion & all routine tests of Motor /cable/switchgear panel/soft starter, motor installed at site & No load (decoupled) trial was taken, motor tripped on negative phase sequence.

Motor was again taken to workshop and dismantled; some of other slots putty found loosened. Following jobs were carried out:-

- 1) All routine electrical tests of motor, cable & switchboard carried out found OK.
- 2) A thin film of araldite applied on all magnetic putty slots (100%) in stator.
- 3) Glass sleeve insulation removed from cable coming from overhang to terminal box and insulation done with Permacel P-570 tape.
- 4) Rotor Dye Penetration test done at 3-4 locations and was found ok.
- 5) Air gap checked (Top=1.9MM, Bottom=2.0MM).
- 6) Existing 11 KV Current Transformers & surge suppressors were replaced (as minor unbalance observed in secondary circuit).
- 7) Existing electronic Motor protection relay was replaced with P220 numerical relay.

Motor assembled & solo run trial at reduced voltage. Found OK. Thereafter, motor solo run was carried out successfully at site and motor was successfully taken on load & running normal till date.

Conclusion & Recommendations:

The above total exercise was done in-house and well within the time schedule of plant startup. The same has enhanced the reliability of the cooling water system in Ammonia Line-I along with reduction in energy by saving steam.

Nangal Unit

Electrical flash in MRSS of Urea Plant

Introduction:

In Urea Plant, there are two PC-5 carbamate recycle pumps (PC-5N & PC-5R) installed in 3rd stage recovery unit. Out of two pumps, one pump remains in line and the other is kept as standby. On 17.05.2021 evening, leakage was observed from Mechanical seal of PC-5N pump. The pump was changed over to PC-5R so that PC-5N pump could be taken for maintenance on 18.05.2021. The drive motor of PC-5N pump is a 3-phase 55 kW motor which receives electrical energy from Motor Control Center (MCC) installed in the MRSS of Urea plant. On 18.05.2021 the pump PC-5N was taken for maintenance after electrical isolation from its Motor Control Center. During energization of motor from Motor Control Center of the pump, an electrical flash occurred in Switch Fuse Unit (SFU) of MCC. The failed SFU of PC-5N was installed since commissioning of MRSS of Urea plant.

Observations:

The following components were observed to be damaged:

- 1) Switch Fuse Unit of PC-5 N Motor Panel : Incoming contact of all three phases got damaged along with its bakelite cover sheets
- 2) Backside Cover Sheet of MCC panel: 3 holes were observed in backside metal cover sheet of MCC panel due to flash/sparking.

Diagnosis & Action taken:

Diagnosis:

1) **Short Circuit due to foreign component in SF Unit**

The construction of the SF Unit indicates that there is no chance of entry of any foreign particle from outside at the point of flash observed on the incoming conductors. Further, no loose or dismantled component observed in the SF Unit. Hence, short circuit due to foreign component in SF Unit is ruled out.

2) **Short Circuit due to entry of lizard/mammals in SF Unit**

The cabinet of MCC with respect to its sealing indicates that there is no chance of entry of Lizard/mammals inside the cabinet which may cause flash in SF Unit. Further, no remains of any Lizard/mammals were found in SF Unit. Hence, short circuit due to lizard/mammals in SF Unit is ruled out.

3) **Earth Fault in SF Unit**

Flash due to earth fault causes tripping of Earth Fault Relay of the 3-phase circuit. In the present case, no tripping of Earth Fault Relay was observed. Hence, flash due to Earth Fault is ruled out.

4) **Touching of Fuse Box Terminal with incoming charged conductor while insertion of fuses due to pressing**

It was observed that under the OFF condition in SF Unit there is sufficient gap between incoming conductor and fuse terminal conductor. Hence, flash due to touching of Fuse Box Terminal with incoming charged conductor while insertion of fuses due to pressing is ruled out.

5) **Short circuiting through insulating covers provided on SFU incoming conductors**

The damage pattern of incoming conductors of R-Y-B phase indicates that there was flow of excessive current between the incoming R-Y-B conductors of SF Unit and the edges of their insulating covers. The conductivity of the insulating covers may increase either due to ageing effect of insulating material or due to carbon deposits inside the insulating covers due to repeated switching operations. IR value of the insulating covers was checked before cleaning and after cleaning. The IR values were found 0.4 k Ω before cleaning and after cleaning the IR meter was showing open circuit which rules out increase in conductivity of insulating covers due to ageing effect. These observations indicate that the most probable cause of short circuiting of R-Y-B phases through insulating covers of SF Unit incoming conductors is deposition of carbon on the surface of insulating covers. The two screws provided to hold the insulating covers may remain loose in the respective threaded holes as these are normally supposed to be only positioning screws for the insulating covers which may result movement in insulating cover while insertion of fuse and decrease the gap between bottom edge of insulating cover and conductors. This can result in conduction through carbon deposited on insulating covers leading to short circuiting.

Actions taken:

- 1) Complete MCC compartment (Front as well as on rear side), removal of smoke & panel cleaning was done. Damaged SFU (250A) were replaced with new spare SFU.
- 2) As a preventive measure, Power contactor, CT and Overload relay of PC-5N motor module replaced with spare ones.
- 3) Checking of SFU Bakelite shroud was done on 23.05.2021.
- 4) Standard operating procedure (SOP) prepared for energization / de-energization of different types / make of MCC panel and are kept in respective shift offices.

Conclusion & Recommendations:

From the detailed analysis, it was concluded that the most probable cause of present failure/flash is carbon deposited on the insulating covers provided on of SF Units incoming conductors of Switch Fuse Unit (SFU) of PC-5N motor.

Following is recommended to avoid recurrence:

- 1) Arc Flash study of each panel shall be done and accordingly arc flash boundary shall be marked.
- 2) Fixed type MCC installed in the plant shall be replaced with new design draw out type MCC in a phased manner for critical installations where isolation from Switch Fuse Unit is required frequently.
- 3) Conductor covers of all similar Switch Fuse Units (SFUs) shall be cleaned from inside and outside and IR value shall be checked at the available opportunity.
- 4) The conductor covers of SFUs shall also be cleaned periodically (yearly) after removal of covers from the position to avoid any accumulation of dust/carbon inside as well as outside the covers.
- 5) While fixing the conductor covers of SFU, the screws shall be fully tightened to avoid looseness of the covers.

Panipat Unit

Fault Diagnosis of 31.5/24 MVA Power Transformer

Introduction:

On-Load Tap Changers (OLTCs), the most complex subassembly in a power transformer, are parts of the voltage regulating system in an electrical power system network. These are connected within the power transformers and are responsible for maintaining the voltage level under variable loading conditions as per the load demand. By changing a tapping on the winding, the OLTC enables the turn's ratio of the transformer to vary and thus the level of output voltage. 132kV/11kV, 31.5/24MVA, GEC Make MT1 Transformer at Panipat Unit, was commissioned along with plant inception since 1987.

Observations:

This paper deals with fault diagnosis of an on-load tap changer (OLTC) of 31.5/24 MVA transformer, at 132/11 kV Captive Power Plant, Panipat & recommended methodologies to be adopted on power transformers.

For assessing residual life of said transformer, using Advanced Electrical Diagnostic Techniques, a comprehensive testing was conducted on 16.02.2021. During Testing, abnormal results in Transformer Insulation resistance (nearly 2Mohms against acceptable limit of 10 Mohms to 100Mohms) & winding tan delta (>5000% against acceptable limit of 0.05% to 5%) were observed against acceptable limits, indicating incipient dielectric fault in HV winding insulation & significant production of by-products due to oil degradation. Also OLTC test results were indicating abnormal non-linear variations in trend of winding resistances. HV winding resistance measurements (OLTC included) were found having abnormal resistance value when compared on three phase basis for 1W-1N and it indicated non-linear trend of winding resistances variation.

Diagnosis & Action taken:

On the basis of above results, complete oil dehydration work on transformer was taken-up for removal of moisture & impurities. Post dehydration the Insulation Resistance of transformer was improved to **100 Mohms**. But there was no improvement in Tangent Delta and Capacitance Measurement of Transformer Winding.

On detailed investigation, it was found that the oil inside On-load tap changer compartments got soiled with impurities & moisture. A major overhauling of OLTC diverter vessel was carried out along with OEM. With removal of soiled oil & rectification of snap switch of OLTC, poor Tangent Delta/ abnormal HV winding resistance measurements were improved to acceptable limits as recommended in IEEE Standard 62: 1995, CIGRE: Paris & CBIP guidelines & transformer was successfully charged.

Conclusion & Recommendations:

Transformers run practically trouble-free if identified maintenance strategy is

followed religiously. An on load tap changer (OLTC) is the most maintenance intensive subassembly on a power transformer, for this purpose a comprehensive maintenance schedule has been formulated for Panipat Unit (Tabulated below). Though this schedule is indicative based on recommendations in “Manual on EHV Substation Equipment Maintenance issued by Central Board of Irrigation & Power” and activities may be conducted at more frequent intervals depending upon the severity of service.

Maintenance Schedule for Power Transformers at Panipat Unit

S No	Maintenance Category	Type of Maintenance Activity	Schedule
1	Condition Monitoring	Comprehensive Oil Analysis as per IS 1866 (BDV,PPM,DGA, Furan), of tank & OLTC	6 Monthly (Pre-monsoon/ Post Monsoon)
2	Condition Monitoring	Degree of Polymerization (based on furan results)	As on requirement for taking decision of rewinding/replace
3	Condition Monitoring	Sweep Frequency Response analysis	After shifting of transformer
4	Condition Monitoring	Tan delta of Bushing/ Winding	2 years
5	Condition Monitoring	Winding resistance measurement of all taps	Along with RLA/ 2years
6	Condition Monitoring	Testing of turret CT	As on requirement
7	Condition Monitoring	Winding ratio measurement of all taps	Along with RLA/ 2years
8	Preventive Maintenance	OLTC Overhauling 1.MRSS-TRFB& C 2. MT1 & 2 3. MRSS TRF A	1. 60,000 to 70,000 operation or 5 years. 2. 70,000 to 100,000 operation or 3 years 3. 30,000 operations
9	Preventive Maintenance	Oil Filtration	2 years/ Based on oil results
10	Preventive Maintenance	Major Inspection & Overhauling	20 years/ based on oil results
11	Preventive Maintenance	OLTC Oil replacement	Yearly/ ATA
12	Preventive Maintenance	Overhauling of Cooling fans	2 years bearing replacement
13	Preventive Maintenance	Electrical Protection Scheme testing	5 years during ATA
14	Preventive Maintenance	Terminal Box, NGR, oil leaks & Marshalling box checking. Scheme testing of Buchholz relay/ MOG/WTI/IR/PI	ATA
15	Condition Monitoring	Checking Bushing oil level, Oil leakage, oil level in conservator/ in OLTC, Manual operation of cooling Fans, Silica Gel condition	Monthly

Bathinda Unit

Optimization of operations of York compressor, Synthesis gas Compressor (AGB 601) and Refrigeration compressor (AGC 601) in Ammonia plant.

Introduction:

It was envisaged that the load on AGB 601 will increase in post AFCP scenario due to presence of Methane and Argon in circulating Synthesis Gas (which used to be free of methane and Argon due to Nitrogen washing) and will result in higher circulation flow.

Observations:

It is worthwhile to mention that for AFCP the chillers E 432 and E 433 inert stage Chillers of Synthesis compressor (AGB 601) to cool Synthesis compressor inter stage gas were installed. In addition to these chillers E 315 Chiller to cool Product CO₂ gas was also installed.

To take care of the additional Ammonia vapour load another Ammonia Refrigeration compressor (York Compressor) driven by HT motor of 1400 KWH was installed to provide cooling for three nos. of Chillers (E 432 and E 433 inert stage Chillers of Synthesis compressor (AGB 601) to cool Synthesis compressor inter stage gas and E 315 Chiller to cool Product CO₂ gas.

Diagnosis & Action taken:

Before GTG/HRSG commissioning Power Energy from Steam Turbo Generators (STG) used to be around 4.5 Gcal/MWH as STG are less efficient than Gas Turbo Generators (GTG) with Co-Generation mode. In a scenario when GTG/HRSG was not available, it was prudent to keep maximum load on Steam Drives of AGB 601 and AGC 601 and to keep minimum load on Motor Drive for efficient/economical operation. Keeping this in view, the Ammonia vapour load of E 315 (CO₂ Chiller) was shifted to AGC 601 (refrigeration compressor) and E 432 & E 433 were taken out of service (isolated). In case of outage of E 432 and E 433, the additional load was taken care by steam drive of AGB 601.

Hence Motor driven York compressor was stopped and load of York compressor was shifted to steam driven AGB 601 and AGC 601 compressors as explained above.

After Commissioning of GTG/HRSG, Power Energy from gas turbo generators remains around 1.5 Gcal/MWH. Therefore in present scenario, it is found to keep minimum load on Steam Drives of AGB 601 and AGC 601 and to keep maximum load on Motor Drive is efficient operation.

Therefore, it was prudent to take motor driven York compressor in line to reduce the load on steam drive of AGB 601 and AGC 601.

Conclusions & Recommendations:

By taking the York compressor in line, Around 60 MT/day (100 ata) steam saving was achieved in steam driven compressors (AGB 601 & AGC 601) with the increase of only 20 MWH power per day. Therefore, net saving of around 0.025 Gcal/MT Urea was achieved by optimization of operation of York compressor, AGB 601 and AGC 601, which is equivalent to 2.5 Crore per year.

Bathinda Unit

2003 TRIP PROVISION ON TRIP LEVER OF UGA-102 A/B PUMPS.

Introduction:

In Urea plant the Recycle Carbamate Solution from High Pressure Absorber Cooler (U EA-401) is pumped to Urea Reactor by one of the Recycle Solution Feed Pumps UGA-102 A/B through EMV-103. As safety measure, on tripping of Carbamate Pump UGA-102 A/B, EMV-103 gets closed and vice-versa. As the result the logic circuit operates due to drop of limit switch installed on trip lever of main steam stop valve. On tripping of UGA-102 A/B, the manually engaged lever of the main steam trip valve gets disengaged through the operation of trip solenoid valve and pneumatically operated power cylinder. As the lever operates during tripping of UGA-102 A/B, the feedback limit switch (Single voting) connected with the lever further gives the close command to the EMV-103 through logic circuit.

Observations:

Some times during the tripping of UGA-102 A/B, Trip lever of main steam stop valve operate however the limit switch malfunction. Single limit switch is not a reliable instrument to use in critical trip logic and may result in non-operation other logic sequences which are not safe for plant.

Diagnosis & Action taken:

In order to have the reliable system, Modification has been done from single voting to 2003 voting. Feedback limit switch (Single voting logic) connected with the main trip lever of main steam stop valve is replaced with the three limit switches (2003 Voting logic). 2003 voting system will also rule out the false tripping command generated if any. This modification was carried out in short break down on both UGA 102 A/B, simulated from field to control room and taken in line.

Conclusion & Recommendations:

2003 trip logic circuit is more reliable for safety of plant and machine. Also, better to avoid false tripping on malfunction of single limit switch.

Corporate Office

Tour Report of Kribhco Fertilizers Limited (KFL)

Introduction:

A team comprising of members from Vijaipur and CO visited KFL. The complex comprising Ammonia, Urea and off site facilities was commissioned in the year 1995. The Ammonia plant is based on M/s HTAS and Urea plant is on M/s SAIPEM technology. The complex is having configuration utilizing features from NFL's Vijaipur Line-I and Line-II plants. The single line plants operate on power generated from GTG (16.5 MWh; One + One standby) without any Grid back up.

Major Differences between Vijaipur- I and KFL:

The KFL plants have following major design differences w.r.t. Vijaipur -I:

- The CO₂ compressor is driven by 100 ata steam instead of 40 ata steam.
- The Process air compressor has a design flow of 71000 Nm³/hr in comparison to VP Line-I flow of 59240 Nm³/hr.
- CO₂ slip from GV section is designed for 400 ppm as against 1200 ppm in Vijaipur-I.
- Semi lean and lean pumps are motor driven as against condensing steam turbine drive.
- Ammonia-I, Vijaipur has CDR (additional power of 1MWh) while KFL has no CDR.
- KFL has Low Pressure condensate stripper while NFL is changing to MP stripping.
- KFL has membrane based PGR while Vijaipur-I has cryogenic PGR
- NFL already have VAM in PAC and an additional PAC to augment air flow to match requirement for 1750 MTPD of ammonia.

Modifications carried at KFL :

In addition KFL have carried out following modifications from time to time:

- Recently S-200 Ammonia converter basket was replaced with S-300 basket in the same pressure shell and S-50 converter added in series. Also Synthesis Compressor turbine replaced with high efficiency turbine.
- NG fuel used for Primary reformer is pre-heated to 180⁰C by taking a tapping downstream of NG preheater coil in reformer WHS.
- KFL study for energy saving was carried out by HTAS for 1950 MTPD. Accordingly to reduce pressure drop in the system, Process airline size increased from 12" to 16" and process gas line exit GV absorber to synthesis gas compressor inlet changed from 16" to 20" (Replacement carried out in 3 phases). Also Process Air preheater

coil inlet manifold changed from 8 to 16 points to reduce pressure drop.

- BFW preheater E1211A/B position changed from series to parallel to address issue of frequent leakages in the exchangers.
- Super cup trays (17 no's) installed in one urea reactor and in the other reactor, number of trays augmented from 10 to 15 numbers with increased number of holes.
- HITLIN insulation is used for high pressure steam lines and high temperature lines

Presently, after the annual turnaround in April-May,2021, Ammonia plant operates on 1905 MTPD of Ammonia and Urea plant operates on 3050 MTPD urea. The Specific Energy consumption of the plant is 5.197 Gcal/MT Urea on daily basis. Prior to shutdown KFL was operating at 1800 TPD and an energy about 5.48 Gcal/MT urea.

Conclusion:

- KFL informed that in 2011, a study was carried out by M/s HTAS to augment ammonia production from 1520 MTPD to 1950 MTPD, based upon which they have carried modifications indicated in 1.0 above in a phased manner. NFL carried out similar study for 1750 MTPD of Ammonia.
- The pressure drop of front end at KFL is 8 kg/cm²g which is similar to that at Vijaipur I
- Cooling water range is 8-9⁰C that is almost similar to being achieved at Vijaipur I.
- The ammonia conversion across converter is also similar to Vijaipur I

The main contributor of less Specific Energy consumption at KFL is higher Ammonia Plant load (1900 TPD plus) and CO₂ Compressor turbine operation with 100 ata steam. In order to achieve similar energy, NFL shall have to get an additional study done from Process licensor to remove bottlenecks like process air compressor, pipeline size etc.

It was also noted that Vijaipur-II has inbuilt low energy schemes like 100 ata turbine drive for CO₂ compressor, GT driven PAC, no fired steam super heater, MP stripper etc. Further the plant has capacity to produce 1900 TPD Ammonia. However, due to leakage in BFW preheater (E-3210 A/B/C), make up gas cooler (E-3312), steam super heater coils, Damaged refractory & Lining of Primary Reformer, Leakages of Strippers large amount of energy is getting wasted.

Thus by replacing defective equipments, PR refractory, attending to the leakages and by regular and timely replacement of leaky equipments, implementation of ESP-II, the specific energy consumption of Vijaipur II can be substantially brought down.

Corporate Office

GTG-HRSG Projects at Bathinda , Panipat & Nangal Unit

Introduction:

To meet the latest energy norms of energy under NUP-2015 (New Urea Policy) at Bathinda, Panipat & Nangal units, NFL has installed & commissioned GTG-HRSG (Gas-Turbo Generator cum Heat Recovery Steam Generator) at Bathinda and Nangal whereas same is expected to be commissioned soon at Panipat unit subject to mobilisation of foreign experts. These projects have been executed by M/s Thermax Pvt Ltd, Pune on LSTK basis at total project cost of Rs 675 Crore. In these projects gas turbine has been supplied by M/s Siemens Sweden of model No SGT-700 of 32 MW ISO rating. However, the GTGs have been designed for power generation of 20 MW at ambient site temperature of 46 °C. The HRSG has been supplied by M/s Thermax.

Gas Turbine:

M/s Siemens Sweden make SGT-700 gas turbine is high efficiency machine used for power generation with high exhaust heat rate and thus is also excellent for cogeneration mode in NFL for steam generation. The SGT-700 make is of well-proven design with twin-shaft engine for flexible operation with excellent efficiency at even part load conditions. Further gas turbine is best-in-class in terms of fuel flexibility and hence capable of taking care of variation in NG composition. It employs 11-stage axial-flow transonic compressor incorporating the latest aerodynamics, with variable guide vanes for robust operability and optimized performance over a wide range of operating conditions. It features a third-generation Dry Low Emissions (DLE) combustion system with NO_x emissions level < 15 vppm and CO level < 20 vppm.

Heat Recovery Steam Generator (HRSG):

HRSG supplied by M/s Thermax are designed for generation of 70 MTPH high pressure (100 ata) superheated steam along with 8 MTPH of LP steam (7.5 ata) generation at Bathinda & Panipat. At Nangal, HRSG has been designed for generation of 100 MTPH high pressure (91 ata) superheated steam along with provision of superheating of 45 MTPH of steam from saturated condition to superheated condition. The HRSG are designed for supplemental firing to enhance the steam generation to meet the plant load. Operation of HRSG independent of the Gas Turbine, using only the duct Burners has also been provided at all the three units. For this purpose combustion air fan is provided to burn the fuel & to run the HRSG in fresh air firing mode. Steam generation in fresh air firing mode is 70 TPH (MCR) for Bathinda and Panipat & 100 MTPH for Nangal unit. In addition, the HRSG has been designed for maximum heat recovery from flue gases with exhaust temperature of 145 °C at all the three units. To meet the

above design flue gas temperature of 145 °C, Thermax has provided heating arrangement of DM water and Natural Gas.

Energy Reduction Post commissioning:

Post commissioning of GTG-HRSG at Bathinda, daily energy consumption of Urea has been come down to 6.15 Gcal/MT of Urea whereas at Nangal same has been reduced to 6.22 Gcal/MT of Urea. Further owing to commissioning of machines at these units, plant tripping has been saved number of times due to power fluctuation in Grid or due to Grid failure.

Tech Bytes