

Paper on "Fine tuning of sugar, co-gen and distillery complex for improvement in performance, result, crushing, bagasse saving, efficiency, power export and reduce stoppages with modifications, alteration and changes"

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Background -

In the sugar complex there is vast scope for improvement in the performance and results by reducing stoppages, down time by very careful, perfect overhauling and maintenance during off-season and proper preventive maintenance during crushing season. Also there is vital scope for improvement in crushing, bagasse saving, efficiency, power export with some changes, alterations, modifications in off-season by studying and finding out proper, perfect solution and remedy on the faced problems and losses and frequent breakdowns at particular stations.

After joining Shree Pandurang SSK Ltd, Shreepur during last 03 off-seasons we have done following work and achieved the goal in different fields.

- Reduction in 95% stoppages.
- Increase in average crushing rate by 500MT.
- Increase in bagasse saving by 6000MT per season for making self dependant to run further Co-gen and Distillery during off-season for 50days.
- Saving of 400KW power with some interchanges of pumps and motors.
- Saving of 6.0 lac litre of water per day.
- To reduce overall leakages in plant for improvement in cleanliness, housekeeping as a hygienic and appearance like pharmaceutical industry.

Mill Section :-

- Provided 1" angles on cane carrier at specific distance to avoid slippage & Accommodate higher crushing rate of 6500 MT on 1980mm cane carrier width.
- To improve preparation & reduce power / load on Leveller and ultimately on Fiberiser 44 fix knife type leveller was replaced with swing type leveller (80 knives).
- Designed prepared cane equalizer from scrap material & fitted in between leveller & fiberiser to improve overall performance of mill, boiling house, boiler and co-gen.
- Provided Nuts to TRPF teeth to increase feedability & crushing rate.
- Mill alignment and roller lift corrected as per standard norms to reduce wear and tear of mill components.
- Increased all feed roller meschart grooving depth & width to improve juice drainages & ultimate to increase crushing rate & results of milling station.
- Stopped rotary screen washing water dropping and mixing in rake carrier before first mill, collected it & taken on fourth mill thus reduced unwanted imbibitions water quantity & ultimately more steam requirement.
- Stopped practice to use cold & hot water in mill juice tray to avoid juice tray jamming by bagasse and careless and safe side working of gala majdoor, resulting in maximum use of water for imbibition before last mill, resulting in improved milling performance.
- Stopped practice to apply cold water for mill bearing cooling to save water & keep clean environment.
- At once we removed only feed roller of last 33" x 66" size without mill house crane & without stopping crushing operation for repair of journal and replacement of bearing and refitted it at its position without stopping mill .
- Fine tuning and resetting of ACFC done to achieve uniform cane feeding and performance.

Boiler Section -

For increasing average steam generating capacity, efficiency of boiler & reducing down time & fluctuations, to improve bagasse saving & ultimately power export following steps are taken by studying & observing existing performance & parameters.

- For better heat transfer and proper circulation of flue gas to cover maximum heating surface all type of baffling, bricks and walls were checked for any type leakages and short circuit of the flue gasses and corrected the same.
- All types of cold air leakages through doors & brick work were arrested.
- All types of heat loss due to radiation, conduction were arrested by full proof insulation lagging & aluminum cladding.
- Old & outdated steam traps were replaced with thermodynamic steam traps to reduce steam loss due to condensation.
- Steam leakages were reduced by replacement of all 800 class IBR valves by 1500 class IBR valves
- All soot blowers under repair & not in operation were replaced, modified, changed position.
- We replaced previous fire side chemical with technically proven Thermax B fire side chemical for proper combustion of bagasse and avoid super heater jamming for prolonging cleaning period.
- Short circuit & Cold air leakages near goose nose & side walls of WIL co-gen Boiler were arrested by new refractory & aluminum cladding. This helped to arrest cold air entry & improved bagasse burning & efficiency of boiler remarkably resulting in bagasse saving.
- Travelling grate operation of same boiler were changed from continuous to periodical to avoid unburned heat loss through ash conveyor belt.
- For increasing boiler efficiency hot air temp of FD air was increased by reducing thickness of air heater tube from 3.25mm to 2.64mm with carbon steel for better heat transfer.
- Stopped SA & pneumatic spreader fan inlet cold air, instead of that hot air given by heating it from F.D. hot air duct.
- Sitson Boiler ID fan was replaced with higher capacity fan to improve steam generating capacity.
- Changed bio-gas connection from WIL Boiler to sitson boiler & provided hot air to inlet of blower fan & observed increased boiler efficiency with bagasse saving & reduced fluctuations in steam generation.
- Stopped frequent tripping of bagasse feeder by increasing its torque by replacement of suitable chain-sprockets & avoiding loose connection.
- To provide continuous & uninterrupted bagasse supply to sitson boiler we provided bypass bagasse sliding gate. This helped to reduce frequent pressure & load drop of boiler.
- For sitson boiler flue gas was short circuited behind bottom mud drum flue gas duct due to fabrication fault during erection is arrested with closed MS plates which increased efficiency of boiler and ultimately bagasse saving.

Co-gen & Electrical -

Changes/Alterations/Modifications done to reduce electrical down time & Co-gen tripping modified scheme.

In Mill Section:-

Problem: *Frequent tripping of cane leveller motors & overloading of fiberizer also resulting in stoppages, frequent cane carrier control and hampering crushing rate.*

Remedy: Old 187 kW leveller motor replaced by new as 300 kW (Total 2 Nos.) with starter ARS (Automatic Rotor Starter with slip Regulator) Also fix type leveller replaced by

swing type leveller.

At 10 MW Co-gen Power house : -

Problem: *Frequent tripping of turbines & Co-gen export*

Remedy: Faulty and duplicate current transformer (CT) was main cause and were replaced with new of Pragati make in 11 kv HT Panel at 11 kv Gen. Feeder, Export Feeder, Bus Coupler Feeder, Mill Transformer Feeder No.1&2, Fiberizer, Distillery, Trash Cutter 2.5 MVA & 4.15 MVA Transformer Feeder

Problem: *When 10 MW Export trip, Generator breaker was also tripping & Total System dark out.*

Remedy: In Generator & Export side relay Co-ordination done with related software and new programmable relay setting done.

Problem: *Due to Generator earth fault problem Generator was always tripping.*

Remedy: Separate Earth Pit provided for Generator Neutral Earthing and Generator body earthing providing Neutral Earth pit 3 Nos and Body Earth Pit 4 Nos.

At 9 MW Co-gen Power house -

Problem: *When Export trip Generator Breaker also trip and total 9MW Co-Gen plant Dark-out.*

Remedy: 1. New relay (Numerical relay) replaced for 9 MW, 11 kv Generator. (7 SJ Siemens Make) with new hard wiring and new setting.

2. In export side old electromagnetic type relays were replaced with new numerical relay (Alstom make) with new relay setting.

Problem: *When total system Dark-out due to grid problem turbine also trip due to COP (control oil pump) supply failure*

Remedy: 3 Phase UPS system provided which results in turbine always running when total system Dark-out and hence time saved for turbine start-up from initial stage .

Problem: *When Co-gen ACW (Auxiliary Cooling water pump) Trip then total 9 MW Co-gen trip due to Safety interlocking*

Remedy: Another supply arrangement provided only for ACW pump. hence time saved for turbine boiler tripping avoided

Problem: Due to Generator earth fault problem Generator was always tripping.

Remedy: Separate Earth Pit provided for Generator Neutral Earthing and Generator body earthing providing Neutral Earth pit 3 Nos and Body Earth Pit 4 Nos.

Problem: *For 3 MW Power house Breaker & Jaw heating Problem.*

Remedy: In 3 MW, 440 V Generator set LT Breaker replaced with new C-power, 4000 Amp, L&T make. Breaker (2 Nos).

Sugar and Co-gen Instrumentation

- Fine tuning of Auto Feed Control System with multi set point to Equipment load are given and accordingly loop output fed to Cane carrier and First mill rake carrier.
- Improved PLC based Condition Monitoring system provided for Zero mill Planetary gearbox.
- Mill Auto Imbibition controlled by sensing second and third mill load and output fed to Pneumatic Control.
- Individual Mill Speed automation: According to bagasse height in Donnelly Chute and by sensing load on the mill motor, its speed varies automatically & thereby kept constant load on individual mill. Due to this system milling efficiency improved.
- It is observed frequent tripping of export and further this lead to Dark-out of Co-gen plant; this problem resolved by making fine tuning in Woodward Governor and correct calibration of HP Governing Valve.
- Single entry S.S. condensers for pans were in operation in the factory with no automation for vacuum control. at that time vacuum 26" of mercury a 'A' pan and 27" of mercury for B & C pans could never be obtained. As a result, viscosity of process fluid remained high and the desired exhaustion at pan station could not be achieved. In order to overcome this problem Condenser automation system installed

and this condenser automation system ensued the following benefits to the factory.

- Vacuum could be maintained at the desired level throughout the pan strike.
- Hourly requirement of injection water could be brought down from 2400 m³ to 1800 m³.
- Power consumption at the condensing and cooling system could be brought down to 10.67 KWH/T/Hr.
- We provided automation at various sections like Mill, Boiler, PRDS station and Boiling House to get proper and efficient work done without manual intervention. Safety Interlock will help to avoid the accidents. Also the system works very efficiently with low power consumption that further leads to get better efficiency.

Boiling House : -

1. To arrest huge stoppages and frequent maintenance of all three sugar hoppers-
We succeeded to reduce 99% maintenance and stoppages of hopper.
 - a. We balanced the eccentricity in the driving shaft for minimizing jerks and vibrations.
 - b. We used stainless steel 2mm strip alternatively in between two wooden strips to avoid un-balance and jerks and reduce 98% breakage of wooden strips
 - c. For the Rory removing screen on the second hopper, the excess over hanging weight and load was reduced by taking Rory screen back towards middle tray, resulting in no breaking of connecting rod hence forth.
 - d. proper sheet of connecting rod near middle tray fitting brackets were taken by sander paper and good alignment and stopper check nuts provided resulting in smooth operation and lower maintenance .
2. For Sugar dust collector we made following modifications.
 - a. Proper sizing and cross section area of branch line of the suction pipes were studied and corrected.
 - b. Provided new additional 18 suction points at grader & other places which were necessary.
 - c. Increased the capacity of blower as per no. of points and maintaining proper vacuum at all branch pipes.
 - d. Proper & modified water spraying arrangement with pipe and nozzles was provided in ventury & wet scrubber to arrest all sugar dust particles in the sprayed water.
 - e. Proper complete closing & making air leak proof all the points attached to grader, elevator, silo, Sugar weighing machine & hopper by air proof cloths and rubbers
 - f. Thus we found increase in sugar dust collection bags to 12 quintals per day in place of previous 03 quintals.

Electricity/Power saving in sugar plant & allied unit

- We studied the requirement of pump capacity and actual installed pump capacity & re-location, changing the position, avoiding unnecessary running of stand by pump we saved around 250 kW to 300 kW power.
- For lifting the water from reservoir and service water tank we stopped 75 HP pump as 70% overflow was taken out & instead of that fitted only 25 HP water pump thus saving of 50 HP power was achieved at both stations.
- For distillery the water lifting from main reservoir was carried out by 75 Hp Pump there also 70% over flow was taken back. Here as we given sugar plant saved water to distillery by cooling it & processing it in CPU. this saved water was taken to distillery without pump by gravity. And only 5 HP pump was used for taking make up water for distillery from main reservoir. Thus saving of 70 HP power was achieved.
- After studying the service water pump running in factory (75Hp + 60HP + 20HP) we

make changes & connections as per study & only 75HP pump was sufficient to lift the water from service tank to over head cold water tank & stopped two pumps of 60HP & 20HP. Thus saving of 80HP was achieved.

- At some crystallizer instead of regular gear box we fitted planetary gear box for power saving and saved around 80HP.
- At mill and boiling house station we replaced the regular motors with AC VFD motors at some places to achieve power saving around 70HP.

Water saving & Consumption reduction Steps

We have saved around 6 to 8 lac litres of water per day by

- Proper recirculation of water.
- Avoiding wastage of water through leakages.
- Excess hot water condensate in sugar was cooled in three stage cooling tower in series & reused it to distillery after processing it in CPU unit.
- All taps & cocks in toilet, bath room & urinary were replaced by push type cock to avoid wastage of water.
- Stopped the practice to apply cold water externally for mill bearing cooling
- Mechanical seal fitted to all juice, syrup, hot & cold water pumps to avoid wastage & leakage of water & juice.
- Wherever necessary for gland cooling of juice pumps we used spray pond inlet water through injection header line instead of applying fresh cold water .
- All cooling applied water was taken in re-circulation i.e. boiler feed pump, compressor, vacuum pumps etc.
- All hand washing & cleaning water cocks & pipes were blocked & only one single push type tap was given to workers.
- All type of water leakages in sugar plant through pipe, flange joint, pin hole, drain valve, steam trap were arrested.
- New Farm pond of 1.5 Crore liter was constructed & rain water, road water was saved & re-used for distillery & co-gen.

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Yours Faithfully

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