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Performance optimization of 1800MT capacity stacker - Reclaimer in coal handling plant in 600MW/660MW sub/super critical units

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Abstract
Stacker cum Reclaimer is the heart of the coal handling plant. Without stacker reclaimer, no body can think, to survive the material handling system, stacker reclaimer has become the more important for the CHP life and for the safe operation of CHP as a result, the design, installation and interpretation of measured parameters values of hydraulic oils to the S/R machine behavior is reflected.
The importance by a continuous process of evolution using the latest techniques and technologies available to ensure the performance of stacker reclaimer for continuous operation without failure. To enhance the reliability of the stacker reclaimer hydraulic system is to be more focused and the oil quality UPTO 6 to be maintained always. Regular filters, oil quality and particle counts to be checked at 15 days interval.
The oil quality and quality is more important to develop hydraulic pressure and hose leakages and spares management is the key parts to maintain the stacker always is challenge to us. The S/R technical details is giving details of technical specification of each equipment and SOP & SMP of equipment are to be followed on regular basis for smooth operation of coal handling system.
This article will give you brief introduction of power generation and will provide the entire details about the stacker reclaimer.
The spare parts are required of which size for the stacker reclaimer is given in detail. Best feature of this article is that now the unmanned stacker reclaimer is designed by f.l. Smith such development is new thing to known to us. And what is the constrained regarding operator in production in dusty atmosphere. The abstract is just giving view of m/c & its uses for CHP. The details specification is showing the design, procurement operation and maint. All features of CHP. This paper is giving entire information about Stacker reclaimer operation & maint. Along with data.

Keywords: stacker cum reclaimer, coal handling plant, SOP & SMP

Introduction

A General overview of Power Generation in Brief

Coal/Burn

The coal is precious/Vital reserve resource for generation of electricity in power plant. The consumption of precious coal consumption to be optimized to sustain the health of the power plant and for nation in general, to contribute in GDP growth for the nation. We should handle the coal in such a way that no losses took place anywhere in the processing for the power generation Even a small quantity of coal, say one M.Ton accounting in saving to contribute in power generation at large. The Losses management in CHP is the main focus to save the revenue which impact on power generation in totality.

CHP OPN

Coal handling, coal processing and coal preservation are not simple task to accomplish rather the tough one from every point of view, like safety, fire, health hazards, pollutions, preservation of its latent value which is likely to be lost due to weathering/atmospheric effect. coal handling and coal operation processes needs more maintenance and replacements of parts due to more rotary parts wear &tear.

CHP sustainability

Timely replacement and maint. of worn & torn out parts can only ensure, the healthy CHP& 100% Availability of CHP by which uninterrupted coal supply to power generation could be ensured & PLF of power generator could be achieved to meet the pious goal of the nation building and growth of GDP for nation building.

Coal transportation

In the coal based thermal power plants, the coal is transported from the mines to the power station through railway wagon or merry go round system. Coal is also transported to Power Station through road transport to meet the requirement in emergency situation.

System Reliability

Coal handling system has two stream of conveyor system and each have to interconnection & flexibility. CHP have Max. no. of rotary and mobile equipment's such as conv. belt pulleys idlers, paddle feeders crushers, screens, stacker reclaimer, due to which more prone to maint. & spares parts consumption.

Rail Bobron

Coal is unloaded from railways wagon tpo underground conv belt in tunnel/track hopper and sent to the crusher, it is fed directly to bunker. Or stacked in coal yard.

Pulverizering

Crushed coal from bunker is fed to coal mills by coal feeder, the mills pulverized the coal 200 mesh size this powder or

pulverized coal of 200 mesh size which is carried out to boiler heater, The pulverized coal air mixture is burnt in the boiler. Combustion zone i.e. boiler furnace for steam generation purpose where tangential firing system is used. The coal nozzles /guns form tangential circle in the center of furnace. The temp. of fireball of the order of 1300 degree centigrade.

Steam generation

The boiler is a water tube boiler hanging & fixed from top of the boiler. Water is converted into steam in the boiler and steam is separated from water in the boiler drum. The saturated steam from the boiler drum is taken the low temp super heater, platen super heater & final super heater respectively for superheating.

Power Generation

The superheated steam from the final super heater is taking to the high pressure steam turbine HPT. In HPT high pressure superheated steam is utilized to rotate the turbine coupled with generator. & the resultant is electrical energy generated so called electricity produced.

Electricity production

From the HPT, out coming steam is taken to the heater in the boiler to increase the temperature as the steam become wet at the HPT Outlet. After reheating this steam is taken back to the intermediate pressure turbine IPT. & then to low pressure turbine LPT. The outlet of LPT is sent to the condenser for condensing back to water by a cooling water system. This condensate water is collected in the hot well and is again sent to the boiler in a closed cycle.

The rotational energy imported to the generated by high pressure superheated steam is converted to electrical energy.in the generator.

Theme discussion

Here I am going to introduce the most vital equipment of CHP which is stacker reclaimer which is the heart of the CHP. I will focus on its technical details and its features in details as theme. Details of the stacker reclaimers are as below.

Capacity of stacker reclaimer

Technical details of stacker reclaimer 1800 ton capacity stacking 1400MT reclaiming.

This the only machine by which we can handle both the crushing stacking and reclaiming.

New innovation in s/r operation

Stockyards around the globe are typically facing the same, daily operational challenges that affect the overall profitability.

These challenges, which represent an unexploited optimization potential, are more than often related to factors which are within our control but not always sufficiently or optimally addressed, - factors like:

Constrained faced

- Non constant operator performance
- Complex planning and coordination of operation during and between shifts
- Operator “errors” rendering the machines unavailable
- Excessive manual tidying-up of piles
- Increased maintenance caused by equipment overload
- Insufficient information relating to the state and content of the stockyard
- Environmental interferences (weather, dust, etc.)

Challenges

The variety of operating methods and the multiplicity of material’s has traditionally made it difficult to rely on anything else but skilled operators and to some extent semi-automatic or remote systems. However with the patented FLSmidth® Bulk Expert™ technology it will now be possible to implement a completely unmanned operation for any combination of Stacker/Reclaimer.

Logical creativity by machine designer

FLSmidth recently announced it has acquired technologies and products related to unmanned operation and process optimization of stackers/reclaimers and train loading systems from the German company iSAM AG.

The acquired technologies and products will reportedly enable FLSmidth to offer and supply complete, unmanned integrated bulk handling solutions to mining, stockyard and port facility customers. The technologies and products are expected to be integrated into FLSmidth’s operations in coordination with iSAM AG to ensure undisrupted service.

New innovation in the field of material handling.

These well-proven technologies can be used worldwide within Bulk Materials and will strengthen FLSmidth's offerings to its customers. The trend is moving towards unmanned operation and the technology can be easily integrated with FLSmidth's current business," Group CEO Jorgen Huno Rasmussen comments.

CHP-KPIs

1. Overall CHP - availability - target 98% - achieved 99% - 100%
2. System reliability - 89% - achievement 90%.
3. MTBF OF STACKER RECLAIMER - 03 months - 04 months
4. Mttr - BWSR - 40 hrs - 36hrs,
5. To achieve average maint. Cost of coal handling per mt 8.5 /-tons. - 8.9/-mt.
6. To achieve auxiliary power consumption up to 1.10 kwh/mt - 0.99kwh/mt.
7. Belt loading factorPH-1,2 & 3-4 - 60%-70% achieved - 65-75%
8. To achieve & sustain coal feeding of 100% to all apl bunkers in conformance with plant requirement as well as to have a coal stock of 2, 50,000 mt in apl coal piles. - 95%
9. To achieve &maintain the availability of all chp critical equips above 95%-achieved 98%
10. 100% compliance of all chp notifications-100% - 99-100%

Table 1: Availability of Equipment's

Equipment	PH-I&II	PH-III	PH-IV
Stacker Reclaimer availability	96.10	98.92	98.92

Other Maint Practices Also Covered For Stacker Reclaimer
Fmea, Disha, Rca-
Preventive Maint
Condition Base Maint.
Corective Maint.

Table 2: Belt Utilization factor (BUF) MONTHLY

Coal Feeding (MT)	104121	125186	203313	635753
Belt Running Hours	367	307	264	471
Loading factor % (Target)	>60	>60	>60	>60
Loading factor % (actual)	69	68	61	67
Remarks:-	Considering the idle running hrs of the system			

Table 3: Compliance of SAP Notifications MONTHLY

Notifications	Dept.	Total orders	Comp. Work order	Pending order	%completion
Preventive	C&i	62	62	0	100%
Maint	Electrical	112	112	0	100%
Order	Mechanical	116	116	0	100%
	TOTAL	290	290	0	100%
Corrective	C&i	62	62	0	100%
Maint	Electrical	55	55	0	100%
Order	Mechanical	70	69	1	99%
	TOTAL	187	186	1	99.66%

Re-lubrication of bearing of STACKER RECLAIMER - Lubrication must be on running hours basis.
For BWSR bearings re-lubrication Formula to be applied G=0.005XDXB where D=OD of Brg. B=Width of Brg. It will save many drums grease during Lubrication.

1. DATA COLLECTION 1.0 MATERIAL AND PILE DATA
Material Conveyed..... Crushed Coal
Bulk density. ..... 0.8 – 1.2 t/m3
Lump size (max)..... -25 mm
Angle of repose..... 35˚
Moisture. ..... 30 % to 40%
Height of stockpile..... 10 m
Width of stockpile..... 45 m
Stockpile Section. ..... 317.3 m2 (approx)
Stockpile Length. .....425 m (approx)
2. CONVEYING CAPACITY
Average Stacking Rate..... 1800 t/h

Equivalent to. 2250 m3/h
Design Stacking Rate. ..... 2250 t/h
Equivalent to. 2812.5 m3/h
Average Reclaiming Rate. ..... 1400 t/h
Equivalent to. 1750 m3/h
Peak Reclaiming Rate. ..... 1800 t/h
Equivalent to. 2250 m3/h
3. SITE CONDITIONS
Max. Temperature..... 50°C
Max. Wind in operation. ..... 18 m/s
Max. Wind out of Operation..... 39 m/s
4. BUCKET WHEEL
Bucket Wheel diameter..... 8 m
Bucket Wheel Type..... Cell-less type
Bucket Wheel Speed. ..... 5.56 rpm
Number of Buckets ……9
Volume of Buckets..... 750 Liters
Number of Discharges. 50 min-1
4.1 BUCKET WHEEL DRIVE
Type. ..... Hydraulic.
Make. ..... Calzoni-Parker.
Motor Power. ..... 132 KW
Speed..... 1500 rpm
Quantity. ..... 1 No.
5. BOOM CONVEYOR
Boom Length. 41.5m
Centre Distance..... 43.25m
Conveying Height. ..... 6.0m (approx)
Belt Width..... 1600 mm
Troughing Angle..... 35 deg.
Belt Speed. ..... 2.9 m/s
Belt Rating. 630/4
Drive Pulley Dia..... 800 mm
Bearing Type..... Spherical roller bearing.
Type of Take-up.....Hydraulic
Take-Up Distance. ..... 1100 mm
Tail / Take –Up Pulley Dia. ..... 630 mm
Troughing Carrier Rollers..... 152.4 x 600 mm
Carrying Idler Spacing..... 1000 mm
Lower Idler..... 152.4 x 1800 mm
Return Idler Spacing..... < 3000 mm
5.1 BOOM CONVEYOR DRIVE
Type. ..... Electro Mechanical.
Motor Power. ..... 110 KW
Speed..... 1500 rpm
Quantity. ..... 1 No.
6. LUFFING SYSTEM
Type. ..... Hydraulic.
Working / Traversing Speed. ..... 3.0 m/ min
Number of Cylinders 2
Cylinder Stroke. ..... 1200mm(approx)
Boom Inclination..... +5 / -9 deg.
System Life..... Luffing mechanism bearing along with
expected life (25 years) considering 10 hrs per day operation.
6.1 HYDRAULIC DRIVE FOR LUFFING SYSTEM
Motor Power. ..... 37 kW
Speed..... 1450 rpm
Quantity..... 1 No.
7. SLEWING SYSTEM
Slewing Angle..... ± 90 deg.

Slewing Speed..... 5-32 m/ min
Slewing Ring Dia..... 3550 mm (approx)
Grease System..... automatic
7.1 SLEW DRIVE
Type..... Hydraulic
Motor Power..... 22 kW
Speed..... 1500 rpm
Quantity..... 2 Nos.
Make..... Calzoni-Parker
8. TRAVEL SYSTEM FOR MACHINE
Max. Wheel Load in Operation..... 270 KN (Maximum)
Rail Profile..... 52Kg/m
Wheel Gauge..... 8200 mm
Travel Distance..... 420.65 m (approx)
Travel Speed..... 0 to 20 m / min
No. of Wheels …..32
No. of Driven Wheels 16
Wheel Dia..... 630 mm
Rail Clamps..... 2 Automatic + 2 Manual rail clamps
Grease System..... Automatic
8.1 TRAVEL DRIVE
Type..... Geared Motor.
Motor Power..... 5.5 KW
Speed..... 150 - 1500 rpm
Quantity..... 16 Nos.
Type..... VFD drive.
8.2 AUTOMATIC RAIL CLAMP
Drive Power..... 2.2 KW (approx)
Quantity..... 2 Nos.
Clamping Capacity..... 30 Tones.
9. ELECTRIC
Feeding Voltage. ..... 11 kV
Operating Voltage..... 415 V
Frequency..... 50 Hz
Number of E- Houses 1
Feeding Point..... mid of travel
Number of Cable Reels 2

Standard maintenance practices to be followed in s /reclaimer.

1. DEFINITION: Applicable for all STRCKER RECLAIMER
2. WORK INSTRUCTIONS:
    1. Apply for PTW in the respective control room.
    2. Isolate the corresponding HT/LT feeder properly.
    3. If the Power fuses and control fuses is there it should be removed.
    4. Put a Lock and "DANGER & MEN AT WORK" Board
    5. Obtain the PTW and confirm the isolation status with the respective control room.

Job: procedure for maintenance of Strcker Reclaimer.

A. Boom conveyor

1. Check Hydraulic oil level and top-up if found low.
2. Check gear box for any leakages and attend if required.
3. Check and if required, tighten the bucket mounting bolts.
4. Check the condition of pins and bushes of flexible coupling and change if require.
5. Clean all the bearings externally and grease (Servo Gem-2).
6. Check the Condition of Belt if found damage patching will be carried out.
7. Check the condition of feed table & condition of liner and attend if required.
8. Carry all the activities as per the work instructions for conveyor.
9. Check the torque arm tightness of boom conveyor Drive.

B. Travel mechanism

1. Clean all the bearings externally and grease bearings (Servo Gem-2)
2. Check the thrusters brake setting and adjust if required.
3. Inspect rail clamp device for proper operation.

C. Slewing mechanism

1. Check the slew drive Gear box and other drive components for Temperature, Leakage, vibration and

unusual noise during running.
2. Check the Gear box for oil level (maximum or minimum) & oil leakage if any. Top up if required.
3. Check the holding bolts of slew bearing for proper tightening.
4. Check & ensure proper lubrication of slew bearing raceway & slew pinion drive shaft through centralized lubrication system.
5. Check visually alignment and backlash of slew pinion with respect to slew gear & checking holding bolt of pinion drive shaft casing.

D. luffing mechanism
1. Check the Power pack unit for any oil leakage and rectify it. Clean the spillage oil.
2. Check the power pack motor, pump and oil lines with operating the power cylinders for any abnormal noise, vibration and temperature.
3. Check the Luffing cylinder operation and its oil line.
4. Check the breathing system of the power pack and clean it if required.
5. Check the oil filter and clean it if required.

E. Intermediate conveyor
1. Carry all the activities as per the work instructions for conveyor.
2. Check the Exciter for Temperature, Leakage, vibration and unusual noise during running.
3. Check the Exciter for oil level (maximum or minimum) & oil leakage if any. Top up if required.
4. Check the holding bolts of Exciter for proper tightening.
5. Check the condition of Garland Idler.
6. Check the condition of Pan & Liner.

Clean the work area and dispose the waste & scrap generated during maintenance in their designated waste bin / scrap yard.

3. Quality checks
1) All the parameters, activities are maintained within limits

4. Checks before release of permit
1) All Tools & materials and manpower are removed.
2) Clean the maintenance area properly.
3) Ensure safety protection cover / guards are fitted in its position.

5. Re-commissioning procedure
1) After completion of the work, cancel the PTW in the respective control room.
2) Normalized the corresponding HT/LT feeder properly.
3) Removed and handed over to control room operator for the "DANGER & MEN AT WORK" Board and Lock with Key.
4) Close the PTW by shift-in-charge and confirm the healthy status with the respective control room

6. Responsibility
Mechanical Engineers

7. Man power required
1 Engineer, 1 Technician., 1 Helper, 1 Rigger, 1 welder

DURATION: 24 hrs.

8. Other department to be intimated
Main Plant Operation /EMD/C&I

9. Details of hazard involve
1) Fall/ Slip due to height.
2) Fire.
3) Failure of lifting tools & tackles.
4) Exposure to high noise.
5) Contact with hot surface.
6) Exposure to process liquid.

10. Safety precaution required
1) Keep the fire extinguishers ready within reachable limit for any exigency.
2) Ceramic hand gloves to be used while handling thrust collar / hot surface.
3) Ensure use of periodically tested proper lifting tools & tackles.
4) Use of earplug is mandatory along with other general PPEs.
5) Ensure good housekeeping of maintenance bay.
6) Put barricade tapes around the equipment under maintenance

11. Permit type
Permit To Work Order.

12. Permit approving authority
Shift- In-Charge (Main Control Room)

13. Out put
Check Sheet

14. Frequency of maintenance
Annual Outage / In case of failures / when required.

Maint
- Condition monitoring and condition based preventive maintenance on S/Rs.
- All the scrapes are categorized based on metallic, plastic paper &cotton waste and collected separately.
- Oil changing of coupling hydraulic system gear boxes filtration of oil done and oil related parameters like viscosity, moisture impurities are checked at chemistry labs. Oil is changed on the basis of lab quality report.
- Lubrication is done on the basis of running hours of S/R and not on the monthly basis.

Uses of O&M SAP Module
- 100% monitor PM/CM/BDM/CBM/RCA/FMEA etc. Through SAP O&M tools.
- Monitor Equipment availability *Inventory management
- Spare management *Material Procurements
- Contracts works management*work orders management for PM/CM/BDM

RCA & FMEA For S/R
Philosophy of working: classified all equipment's based on

criticality like impact on generation loss, Health, safety &environment
Classification all equipment based on criticality.
1-generation loss Category -1:100%generation loss
Category -2: Partial load,
Category -3 No generation loss.
category -4 :No HSE Impact.

TARGET Achieved

1) Enhance the belt loading factor 50 to -65%
2) To achieve &sustain coal reclaiming &stacking of 99 %
3) To achieve axillary power consumption lesser about 2MW /day.
4) To maintain equipment availability of critical equipment's.100%

Results and discussions

Cost benefit analysis---S/R RELIABILITY INCREASED 95 TO 99%
Saving may be realized: ---by Increase of practices following benefit realization occured.
Sl.no. Benefit description Owner dept. Start End Impact in terms of rupees
1) S/R Availability CHP 1.2.2015 20.3.2015 Rs.430000/-

Conclusion & Future Scope of work

Conclusions. In S/R By only applying the Best practices of O&M of stacker/reclaimer, we can save a lot of resources and we can reduce drastically the budget of dept. which will reduce the cost of generation and we can survive in power industry.
On the basis of best practices the availability may be reached to 100% of each equipment by adapting the checklist and best methodology and keep equipment's updating on regular basis.
By practicing housekeeping we can save the environment.
By practicing the good ISO 9002-2008,14001, 18001, 50001 We can do the IMS –integrated mgmt. system. It will be the bench mark for any coal handling plant in thermal plant for any unit in India and abroad.

Future scope of work

This technical paper gives them a general study of Innovation to be adapted to all the thermal power plants at coal handling plants in India and abroad about S/R. This is the practical tested method in world best power plant in operation currently.
This paper is giving the platform to concerned CHP people about best Operation &Maintenance practice may be adapted to enhance the reliability of their systems.

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