**SOP FOR**

**1.0 Purpose : -** Safe Maintenance of Sinter machine for Optimum performance.

2.0 **Scope**: Sinter plant.

3.0 **Responsibility : -**Engineer In charge and workmen on the job

4.0 **Procedure** : **Maintenance of Sinter Machine**

**PPEs to be used**

         Helmet, Safety shoes, hand gloves, Dust mask and safety goggle.

Work No 1  :  Replacement of Pallet car

Work No 2 : Pallet car maintenance

Work No 3 :  Tightening of side wall bolts in pallet car.

Work No 4 :  Tightening of mounting bolts in sprocket teeth.

Work No 5 :  Positioning of Furnace refractory bricks

Work No 6 : Sector gate maintenance.

Work No 7 : Wind box bellow replacement

Work No 8 : Damper gate replacement.

Work No 9 : Replacement of Tail End sealing plate

Work No 10 : Replacement of Head sealing plate

Work No 11 : Replacement of track sealing.

Work No 12 : Replacement of Feed drum liner.

Work No 13: Adjustment of Sinter machine counter weights

Work No 14: Replacement of side wall bolts in pallet car.

Work No 15: Replacement of windbox liner.

Work No 16: Greasing of pallet car.

Work No 17: Arresting Windbox air leakages

Work No 18: Arresting Windbox air leakages by rope fitting.

Work No. 19 Segregation plate liner replacement

Work No. 20 Sinter Machine Water Jacket replacement

**Aspect - impact**

Dust Generation Resource Depletion

Scrap generation Air pollution, Resource depletion

**Hazards identified -**

**Mechanical hazard**

1. Inhaling of dust / Inhaling of LPG.
2. Fall of material.
3. Fire/Heat hazard / Burn injury
4. Failure of sling, chain pulley block, improper hooks welding.
5. Fall of a person.
6. Presence of CO
7. Dust infection to Eyes
8. Accident due to improper operation of valves / Malfunctioning of valves
9. Human behaviour.

**Physical Hazard:**

1. Highly inflammable gas
2. Fire
3. Burn injury
4. High temperature
5. CO poisoning near burner area

**Chemical hazard**:

1. LPG Gas

**Electrical hazard**

1. Electrical shock in welding.

**Procedure –**

**Work No 1 : Replacement of Pallet car**

1. Ensure pallet cars are empty and cooled for safe working
2. Take sinter machine shutdown from Electrical Department**.**
3. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
4. Press local push emergency button of the sinter machine
5. Place the pallet car at marked position before taking shut down as shown
6. Gap the two pallets car using jack



Lock the pallet car with stopper to ensure that pallet cars don’t move reverse direction.

1. Fix 2 slings suitable for 5T load on all wheel shaft to both sides of pallet car & hook it to EOT crane 32T hook. Suitable sling set of 2 slings can be used for easy operation



1. Place EOT crane properly at the centre to lift the assembly.
2. Ensure slings & hooks are engaged properly.
3. Lift the pallet assembly & keep it at servicing place.
4. Replace the Serviced pallet in place of removed pallet assembly by similar sling arrangement.
5. Remove the sling after proper positioning the pallet car on the track and remove the pallet car stopper.
6. Clear electrical shutdown and start the Sinter machine in manual mode to take trials.
7. Hand over the equipment to Production dept

**Work No 2 : Pallet car maintenance**

1. Lift the pallet car using jack (10 tonne) and free the roller (damaged bearing side) off the ground.
2. Provide proper support below pallet to facilitate removal of rollers.
3. Remove the bearing end cover.
4. Remove the lock plate.
5. Remove the old grease with help of cloth.
6. Remove the roller with bearings.
7. Replace the bearing & assemble the roller.
8. Fix end plate after putting grease inside roller bearings.
9. Fix lock plate with grease nipples.

Lift the pallet car using jack and remove the support.

**Work No 3: Tightening of side wall bolts in pallet car.**

1. Take sinter machine shutdown from Electrical Department**.**
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the sinter machine
4. Tighten the Pallet car side wall bolts with spanner or pneumatic wrench After finishing the work clear electrical shutdow**n**.
5. Hand over the equipment to Production dept.

**Work No 4** :  **Tightening of mounting bolts in sprocket teeth**

1. Take sinter machine shutdown from Electrical Department**.**
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the sinter machine.
4. Use safety belts wherever required.
5. Tighten the Sprocket teeth mounting bolts with rated torque. Ensure that the bolts are tightened diagonally.
6. Clear shutdown temporarily after coming out from working area
7. Rotate sprocket to required position for bolt tightening.
8. Restore the electrical shut down and start tightening.
9. Repeat same for tightening bolts in all teeth’s. Ensure that the bolts are tightened diagonally.
10. Ensure no loose material/ unwanted items is kept in the work area
11. After finishing the work clear electrical shutdown.
12. Hand over the equipment to Production dept after taking trial.

**Work No 5:**    **Positioning of Furnace refractory bricks**

1. Take clearance from production department (Work Permit) from the shift Superintendent / in charge after following all the necessary safety points indicated in the work permit and take sinter machine and google valve shutdown clearance from Electrical Department**.**

**2** If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box

1. Ensure that all the valves(shut off valve , Google valve) in BFG line are closed

Ensure that the nitrogen purging of the BFG line is done.

1. Check presence of BF gas with CO monitor
2. Remove the side panel of the furnance.
3. If the bricks have come down from its position tighten the anchor bolts which are projected in the furnace platform to bring back the bricks to its position
4. Use hydraulic jack for lifting the brick. Once the brick is lifted providing sufficient gap (25 mm) tighten the anchor bolts.
5. Release the jack.
6. Put back the side panel of the furnance.
7. Ensure all tools have been cleared from the vicinity
8. Clear electrical shutdown & and work permit.

**Work No 6 : Sector gate maintenance.**

1. Ensure that the surge bin is empty before taking up the job.
2. Take clearance from production department in the form of work permit and electrical shutdown of feed drum, Z2 conveyor from electrical department.
3. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
4. Press local push emergency button of the feed drum.
5. Always have CO monitor while working in drum feeder area.
6. Remove skirt rubber over sector gate.
7. Check for damage at the hinge / dislocation of sector gate.
8. If broken from the hinge. Weld it properly.
9. Put back skirt rubber.
10. Remove all tools and tackles from the vicinity.
11. Clear electrical shut down and clear work permit.

**Work No 7 : Wind box bellow replacement**

1. Take electrical shutdown of the Main fan, Sinter Machine .
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the sinter machine
4. Check temperature of wind box for comfort of working.
5. Proper lifting arrangement to be made above bellow.
6. Remove Bellow top & bottom flange bolts .Fix slings to the bellow.
7. Cut bottom bend to facilitate bellow removal & reposition of new one.
8. Fix flange joint if required.
9. Positions bellow (in proper direction as marked on it)& tighten flange bolts with proper asbestos rope packing to avoid air leakage.
10. Ensure bolts to be tightened properly with washers.
11. Remove all tools and tackles from the vicinity.
12. Clear electrical shut down and handover to production

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**Work No 8 : Damper gate plate replacement.**

1. Take electrical shutdown of the Main fan, sinter machine & damper actuator and work permit from operation dept.
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the equipment.
4. .
5. Check temp of wind box for comfort of working.
6. Remove pallet cars for specified damper zone.
7. Ensure damper is in closed condition at the time of shut down.
8. Proper working platform has to fix inside sinter machine wind box hopper.
9. Cut & remove damaged plate of damper gate.
10. Fix new plate to damper gate & check by operating manually for smoothness.
11. Weld plate fully with shaft.
12. Remove working platform.
13. Ensure / remove metal pieces from main duct.
14. Take trial of damper gate.
15. Position pallet car in place
16. Normalise all shutdowns.
17. If satisfactory hand over to operation.
18. Remove all tools and tackles from the vicinity.

**Work No 9 : Replacement of Tail End sealing plate.**

1. Take electrical shutdown of the Main fan, sinter machine & damper-12 actuator in closed condition.
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the equipment.
4. Check temp of wind box for comfort of working.
5. Remove pallet cars for specified end sealing.
6. Remove the dust cover with the help of EOT crane.
7. Remove all bolts from end sealing plate.
8. Remove end sealing plate.
9. Fix new end sealing plate & fasten it.
10. Check for level & adjust sealing plate by adjusting jack bolts.
11. Check flexibility of end sealing plate.
12. Position the pallet car in position.
13. Normalise all shut downs.
14. If satisfactory hand over to operation.
15. Remove all tools and tackles from the vicinity

**Work No 10 : Replacement of Head End sealing plate.**

1. Take electrical shutdown of the Main fan, sinter machine & damper actuator no one in closed condition and work permit from operation department.
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the equipment.
4. Carry a CO monitor and check for CO presence. Keep the CO monitor contnuosly while working for CO presence checking.
5. Check temp of wind box and furnance for comfort of working.
6. Remove pallet cars for specified end sealing.
7. Remove all bolts from end sealing plate.
8. Remove end sealing plate.
9. Fix new end sealing plate & fasten it.
10. Check for level & adjust sealing plate by adjusting jack bolts.
11. Check flexibility of end sealing plate.
12. Position the pallet car in position.
13. Normalise all shut downs.
14. If satisfactory hand over to operation.
15. Remove all tools and tackles from the vicinity

**Work No 11 : Replacement of track sealing.**

1. Confirm for the electrical isolation of the Main fan, sinter machine & all 12 nos damper in closed condition. Take work permit from operation department.
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the equipment.
4. Check temp of wind box / furnace for comfort of working.
5. Remove all pallet cars for specified track sealing zone.
6. Remove all bolts from slide track
7. Remove track sealing plate.
8. Fix new slide track & fasten it.
9. Check for level & adjust slide track by packing plates.
10. check level difference(115mm) slide track and rail
11. .Position the pallet car in place.
12. Normalise all shut downs.
13. If satisfactory hand over to operation.
14. Remove all tools and tackles from the vicinity.

**Work No 12 : Replacement of Feed drum liner.**

1. Take work permit from SS /control room engg. After taking all related safety indicated in the work permit list and take feed drum and Z-2 shutdown of equipment (loto) from electrical department.
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the feed drum.
4. Carry a CO monitor and check for CO presence. Keep the CO monitor continuously while working for CO presence checking
5. Ensure Surge bin hopper is emptied before taking shut down by opening the gate fully.
6. Feed drum to be cleaned thoroughly.
7. Old liner counter sunk bolt to be removed out. Grind the tack welding if welded.
8. Chain block to be used for removing the old liners.
9. Once again clean the drum shell for mounting the new liners.
10. Check the bolt threading if required replace with new one.
11. Position the new liners (In halves).
12. Tighten the counter sunk bolt fully with spanner. See that new liners overlapped fully on the drum.
13. Tack weld the liners if required.
14. Note: Direct earthing to be given for drum to carry out the welding jobs.
15. Remove all the tools and tackles from the feed drum area.
16. Clear electrical shut down to take no load trial.
17. Handover the work permit

**Work No 13: Adjustment of Sinter machine counterweights.**

1. Take work permit from SS /control room .Safety guard of both counter weight (near tail end) to be removed out to carry the job.
2. Position the chain block on top of counter weight assembly for lifting.
3. Put the chain block hook for counter weight rope.
4. Lift the weight at both ends to release the load on the counter weight assembly.
5. Add/Remove the weights as per the requirements.
6. Release the chain blocks at both ends.
7. Position the Safety guard of both counter weights (near tail end).
8. Clear the work permit.
9. monitor the gap.

**Work No 14: Replacement of side wall in pallet car.**

1. Take clearance from production department and take sinter machine shut down clearance from Electrical Department with LOTO**.**
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the sinter machine.
4. Loosen the side wall bolts using spanner and remove the old side wall
5. Position the new side wall on the pallet car.
6. Put the bolts and tighten using spanner or torque wrench
7. After finishing the work clear electrical shutdown.
8. Hand over the equipment to Production dept.

**Work No 15: Replacement of windbox liner.**

1. Take clearance of main fan, sinter machine and damper in closed position from production department (Work Permit) from the shift Superintendent / in charge after following all the necessary safety points indicated in the work permit shutdown clearance from Electrical Department**.**
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the sinter machine.
4. Check temp of wind box for comfort of working.
5. Remove pallet cars for specified windbox whose liner is to be replaced.
6. Remove the old liner bolts of the windbox liner.
7. Position the new liner in the windbox and tighten the bolts
8. Position the removed pallet cars in place.
9. Release the electrical shutdown and work permit.

**Work No 16 : Greasing of Pallet car wheels.**

1. Take shutdown of sinter machine**.**
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the sinter machine.
5. Connect the greasing hose to the header of the automatic lubrication line.
6. Start the grease pump.
7. Remove the grease nipple from the pallet car wheel and fix the grease gun to the lubrication point Grease till old grease just starts coming out from the wheel gap.
8. After completing the greasing Release the electrical shutdown.

**Work No 18: Arresting Windbox air leakages by flange welding.**

1. Take electrical shutdown of Main ID fan, Sinter Machine from Electrical Department**.**
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the equipment.
5. Remove the pallet car with EOT crane.
6. Close the windbox damper before starting the job and ensure the temperature Is in a comfortable range.
7. Fix a temporary platform at the windbox opening.
8. Weld the flange faces.
9. After completing welding, remove the temporary platform.
10. Put back the pallet car in position.
11. Clear the electrical shutdown.

**Work No 19: Arresting Windbox air leakages by rope fitting.**

1. Take electrical shutdown of Main ID fan, Sinter Machine from Electrical Department**.**
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the equipment.
4. Loosen the bolt of the flanges whose rope is to be replaced.
5. Remove the old rope and fix new rope.
6. After replacement tighten the bolts
7. Clear the electrical shutdown.

Work No. 19 Segregation plate liner replacement

1. Take work permit from SS /control room engg. After taking all related safety indicated in the work permit list and electrical shutdown of feed drum,vibro motor and Sinter Machine from Electrical Department**.**
2. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
3. Press local push emergency button of the feed drum.
4. Carry a CO monitor and check for CO presence. Keep the CO monitor continuously while working for CO presence checking
5. Ensure Surge bin hopper is emptied before taking shut down by opening the gate fully.
6. Segregation plate to be cleaned thoroughly.
7. Remove the old liner plate and fix new plate
8. Remove all the tools and tackles from the area.
9. Clear electrical shut down to take no load trial.
10. Handover the work permit

**Work No. 20** Sinter Machine Water Jacket replacement

**Work Instruction**

Inform the person in control room and ensure that all the valves (shut off valve, Goggle valve) in BFG line are closed and LOTO on goggle valves near Sinter Plant and water seal near PCI . **Refer working on BFG line in SP (**WI/SP/MAINT/14)

1. Take work permit from the shift Superintendent / production in charge and obtain the shutdown clearance.
2. Take electrical shut down of sinter machine.
3. Take electrical shutdown of LPG system and ensure sparking electrode (ignition transformer) supply is also OFF.
4. Close inlet water line valve and Outlet water line valve and ensure its Mechanical isolation.
5. If more than one worker is relying on the protection of an isolation, then all workers should apply their own locks in master lock out box
6. Press local push emergency button of the SINTER MACHINE.
7. Check CO concentration in working area. (Do not start work if CO level exists or until CO level is zero)
8. With the help of CPB (2Ton) support the 1st plate of the water jacket to ensure it doesn’t fall after cutting the inlet line connection & outlet line connection.
9. Cut the inlet & outlet water line connection and with the help of CPB (2Ton) lower the plate to the ground level.
10. Repeat step 8 & 9 for removal of remaining 4plates.
11. Erect the plates one by one with the help of CPB (2Ton).
12. Connect the inlet water lines of first plate, outlet line of first plate and intermediate water lines of all plates by welding.
13. Release all the mechanical shutdown and electrical shutdown to normalise the system.
14. Ensure water line valves are opened and water jacket is filled with water before clearing the permit
15. Check for any water leakages from welded joints & rectify if any.
16. Ensure housekeeping of the work area, ensure all tools have been cleared from the vicinity and clear all the permits.

**Important Note :-**

* 1. Ensure each plate of jacket is pressure tested for a maximum of 6kg/cm2 pressure
  2. Ensure filling of water in the jacket plate before clearing of the permit or handing over the equipment.

**DO’s**

1. Use Co monitor to check the concentration of gas
2. Ensure the workers are using hand gloves
3. If required move the machine forward to reduce the heat in the working vicinity.
4. Ensure proper slinging

**Don’ts**

1. DO not start the work immediately after stopping the furnace. Equipment’s will be at high temperature.

2. Release the permit until the water jacket is filled with water.

**Reference: -**

**Amendement Record**

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| **Date** | **Manual Section Ref. & Para** | **Brief details of Revision** | **New Rev.** |
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| **Prepared By:**  Associate Manager- Sinter Plant Mechanical | **Reviewed & Issued By:**  Management Representative | **Approved By:**  **Manager- Mechanical PID2** |
| **Signature:** | **Signature:** | **Signature:** |
| **Review Date: 06.11.2022** | **Review Date: 10.11.2022** | **Review Date: 12.11.2022** |