**SOP FOR**

**1.0 Purpose : -** Safe Maintenance of Hammer crusher for Optimum performance.

2.0 **Scope**: Sinter plant.

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

4.0 **Procedure** : Maintenance of Hammer crusher (Flux)

**PPEs to be used**

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

Work No 1  :  Replacement of Hammer/hammer pin

Work No 2 : Replacement of Grizzly bar.

Work No 3  :  Replacement of Liner plates.

Work No 4 :  Replacement of Coupling Bush.

Work No 5  :  Replacement of Coupling.

Work No 6 :  Replacement of Bearing.

Work No 7 :  cleaning of De-dusting duct

Work No 8 : Rotor maintenance

Work No 9: Replacement/maintenance Hammer crusher grizzly bar bracket.

WORK NO 10: REPLACEMENT OF HAMMER CRUSHER ROTOR ASSEMBLY.

WORK NO 11: DISMANTLING /ASSEMBLING OF HAMMER CRUSHER ROTOR

WOK NO 12: Hammer crusher Motor Replacement.

Work No 13: Vibrofeeder tube replacement and counter weight setting.

**Aspect - impact**

Dust Generation Resource Depletion

Scrap generation Air pollution

**Hazards identified -**

**Mechanical hazard**

1.      Trapping between Rotor and crusher body

2.      Fall of material

3.      Accident due to improper shutdown

4.     Flying of Chips during hammering**.**

5.      Failure of sling, chain pulley block, improper hook welding

6.      Fall of a person.

**Electrical hazard**

1. Electrical shock in welding

**Procedure –**

1. Take Work Permit from the shift Superintendent / in charge after following all the necessary safety points indicated in the work permit**.**

**Work No 1 : Replacement of Hammer/hammer pin.**

1. Check weight of spare hammers to ensure proper balancing of rotor assembly. The weight should have minimum deviation of +/- 0.2 kg to that of 14kg.
2. Take the electrical shutdown from the authorized electrical person as per electrical isolation procedure.
3. Clean the area surrounding to hammer crusher.
4. Open Inspection doors to facilitate removal of hammers from sides.
5. Open cover plate for removal of Pin.
6. Position pin in line of cover plates both sides
7. Remove bolts of locking plate pin & locking plates from both sides.
8. Remove the pin by hammering, while removing pin ensure that the spacers / hammers are kept in sequence.

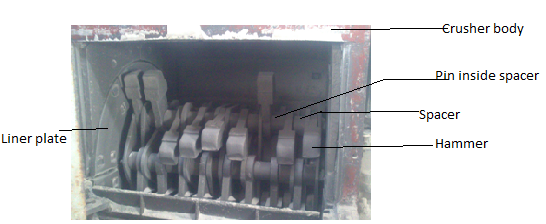


1. Inspect pin for wear if any & replace
2. Check hammers weights. Before installation & make it equal.



Typical Hammer Distribution for Rotors having Six Rows of Hammers.

1. Insert pin with new hammers/spacers as per sequence.

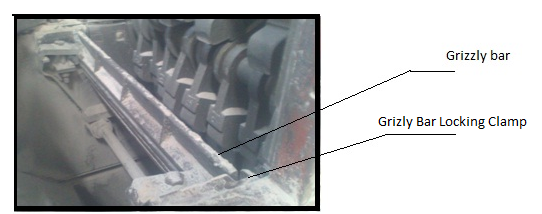


1. Fix locking plates/ bolts.
2. Same procedure to be followed for remaining pins/ hammers.
3. Fix pin cover plate.
4. Close Inspection doors; tighten all bolts with proper packings.
5. Check for free rotation of rotor, adjust gap as per requirement
6. Clear electrical shut down as per isolation procedure, then take trial.
7. Note down vibration level in microns
8. Follow housekeeping procedure as per instruction specified by WI/MAINT/91
9. Hand over to operation.

DO: Ensure hammer weights, before installation, it should be equal for all the pins.

**Work No 2** : **Replacement of Grizzly bar.**

1. Take the electrical shutdown for hammer crusher & related screen as per electrical isolation procedure.
2. Clean the area surrounding to hammer crusher.
3. Open Inspection doors to facilitate removal of Grizzly bar.
4. Remove top locking clamp.



1. Remove grizzly bars inspect & replace if required.
2. Clamp grizzly bars.
3. Adjust grizzly bar with respect to hammers as per grain size requirement.
4. Close Inspection doors; tighten all bolts with proper packings.
5. Check for free rotation of rotor, adjust gap as per requirement
6. Clear electrical shut down as per electrical isolation procedure, take trial.
7. Follow housekeeping procedure as per instruction specified by WI/MAINT/91
8. Hand over to operation.

**Work No 3 :  Replacement of Liner plates**.

1. Take the electrical shutdown for hammer crusher & related screen as per electrical isolation procedure.
2. Clean the area surrounding to hammer crusher.
3. Open Inspection doors.
4. Remove bolts of worn out liner plates.
5. Remove liner plate from site; replace the same by new one.
6. Fix the bolts & tighten it.
7. Close Inspection doors; tighten all bolts with proper packings.
8. Check for free rotation of rotor, adjust gap as per requirement
9. Clear electrical shut down as per electrical isolation procedure, take trial.
10. Follow housekeeping procedure as per instruction specified by WI/MAINT/91
11. Hand over to operation.

**Work No 4 : Replacement of Coupling Bush.**

1. Take electrical shut down of hammer crusher as per electrical isolation procedure after getting clearance from production department.
2. Remove coupling guard.
3. De couple the motor.
4. Remove the cover plates of coupling and remove damaged bushes.
5. Fix new bushes ( Ensure the marking on both coupling & coupling cover are in line before inserting pins )
6. Fix the cover plates of coupling to avoid Teflon pins not coming out in operation.
7. After completion of the job restore all safety guards (bolting),
8. Take electrical clearance and complete the restoration of equipment as per electrical shut down procedure.
9. Follow housekeeping procedure as per instruction specified by WI/MAINT/91.
10. Do use dust mask in dusty area.
11. Hand over to operation.

**Work No 5 : Replacement of Coupling.**

1. Take electrical shut down of hammer crusher as per electrical isolation procedure after getting clearance from production department.
2. Remove coupling guard
3. De couple the motor.
4. Remove foundation bolts of motor
5. Use 5 T chain pulley block , sling the motor and turn 90 degree on motor base
6. Remove damaged coupling half with help of suitable puller arrangement. If hydraulic jacks are used, care should be taken for providing correct spacers and supports
7. Take the actual dimension of the shaft with micrometer and vernier calliper
8. Check machined coupling bore as per the dimension, if required get it corrected.
9. Fit back coupling along with the key.
10. Fit back motor to the position tighten the foundation bolts of motor.
11. Align the coupling axis of motor and crusher shaft. Fix lock nuts in foundation bolts
12. Fix new bushes & bolts
13. After completion of the job restore all safety guards, take electrical clearance and complete the restoration of equipment as per electrical shut down procedure.
14. Follow housekeeping procedure as per instruction specified by WI/MAINT/91.
15. Do use dust mask in dusty area.
16. Hand over to operation.
17. Note down the vibration reading
18. Follow the procedure [WI/MAINT/12 for material handling.](http://sgl-panj-sp-01:8080/QEHS%20SYSTEM%20(PIP)/ALL%20DEPT%20MANUAL/MECH%20DM/AppData/Local/Microsoft/Windows/Temporary%20Internet%20Files/Content.Outlook/pending/WIMAINT12%20MATERIAL%20HANDLING%20.doc)

**Work No 6 : Replacement of Bearing**.

1. Follow same procedure as that of replacement of coupling
2. Open both side plummer blocks for bearing removal.
3. Unlock the circlip on shaft and remove bearing with puller / mild hammering
4. Clean seating area of bearing , plummer blocks, shaft with cleaning liquid / diesel.
5. Fix new bearings and lock with circlip
6. Fill grease of EP2 grade and fix back top cover of plummer block.
7. Position the rotor assembly suitable to plummer block mountings.
8. Tighten the foundation bolts of plummer blocks with rated torque.
9. Fit back coupling and follow same procedure of coupling replacement and alignment
10. After completion of the job restore all safety guards, take electrical clearance and complete the restoration of equipment as per electrical shut down procedure.
11. Note down vibration readings
12. Follow housekeeping procedure as per instruction specified by WI/MAINT/91.
13. Do use dust mask in dusty area.
14. Hand over to operation.

**Work No 7 :  Cleaning of De-dusting duct.**

1. Take the electrical shutdown for De-dusting fan as per electrical isolation procedure .
2. Open man holes in de-dusting line for cleaning the duct.
3. After cleaning duct by operation dept, manholes to be closed properly by sealing with gasket/asbestos rope.
4. After completion of the job restore all safety parameters, take electrical clearance and complete the restoration of equipment as per electrical shut down procedure.
5. Follow housekeeping procedure as per instruction specified by WI/MAINT/91.
6. Do use dust mask in dusty area.
7. Hand over to operation.

**Work No 8 : Rotor maintenance**

* Take work permit & shut down for vibrofeeder & HRC
* Emptied the hopper and Close rod gate & remove vibrofeeder & top hood of hammer crusher.
* Follow same procedure of replacement of coupling.
* Open drive side Plummer blocks for bearing removal
* Unlock the bearing lock nut on shaft and remove bearing with puller/mild hammering
* Remove disc lock nut. Remove out disc & spacers from rotor assembly.
* Fix back new disc & spacers in sequence.(note – check key position & wear out ;if required replace the same)
* Tighten the check nut & ensure the disc & spacers are not loose. Fix back bearing & Plummer block.(ensure bearing lubrication before installation.)
* Position the rotor assembly suitable to Plummer block mountings.
* Tighten the foundation bolts of Plummer blocks with rated torque.
* Fit back coupling and follow same procedure of coupling replacement and alignment
* After completion of the job restore all safety guards, take electrical clearance and complete the restoration of equipment as per electrical shut down procedure.
* Note down vibration readings
* Follow housekeeping

Work No 9: Replacement/maintenance Hammer crusher grizzly bar bracket.

1. Take work permit from SS /control room engg after taking all related safety indicated in the work permit list.
2. Obtain the electrical shutdown of equipment (loto) as per electrical isolation procedure.
3. Hammer crusher area to be cleared (dust spillages) before opening the doors of HRC.
4. Both side doors to be opened by removing the bolt nuts.
5. Grizzly top accumulated material to be cleared manually.
6. Grizzly bracket gap to be made zero by adjusting the screw at de/nde side.
7. Remove the fastener bolts of locking plates at both sides.
8. Wear safety belt while removing the grizzly bars.
9. Remove out the grizzly bar by tapping/sliding.
10. Working platform to be made by welding exactly below bracket for easy replacement of brackets.
11. Remove the mounting bolts of bracket.
12. Tie the nylon rope to the bracket at both ends & pull out from one side.
13. Same fashion another side bracket also to be removed out.
14. Check the dimensions of new bracket.
15. Insert the new brackets from one side.
16. Fasteners bolt to be put.
17. Working platform made exactly below bracket to be dismantled by cutting.
18. Grizzly bars to be positioned inside the bracket by sliding.
19. Locking plates at both sides to fitted.
20. Adjust the bracket as per the requirement.
21. Rotate the disc assembly manually to check the clearance between the hammers & grizzly bar assembly
22. Close the covers at both ends manually.
23. Release the electrical shutdown as per electrical isolation procedure.
24. Start the crusher in manual mode & confirm hammers are not getting in touch with grizzly.
25. If satisfactory then hand over it to operation.

**WORK NO 10:** **REPLACEMENT OF HAMMER CRUSHER ROTOR ASSEMBLY.**

1. Ensure that Top rod gate should be in closed condition & top feeder or hopper should be made empty before taking the job.
2. Take work permit from the shift Superintendent / production in charge and obtain the electrical shutdown of vibrofeeder & Hammer Crusher as per electrical isolation procedure.
3. Remove the coupling guard.
4. Decouple the motor by removing the coupling bushes.
5. Before start of the activity maintenance team should fix 3 nos of 5T chain pulley block with proper wire sling/belt sling length.
6. Top vibrofeeder /crusher top covers to be removed out first with suitable chain block & slings.
7. HRC side covers to be opened manually by removing the bolt nuts.
8. Plummer block top side covers to be removed out for lifting the rotor assembly.
9. Dismantle the hammers/pins as per work instruction to reduce the weight for easy removal.
10. Remove out the Plummer block bolt nut, Lift the rotor assembly with 5tn chain block & belt sling.
11. Reposition the new rotor assembly with 5tn chain block & belt sling.
12. Plummer block top side covers to be fitted back by using proper packing.
13. Align the rotor assembly properly by bolting the Plummer blocks.
14. Crusher top covers to be fitted back by using proper packing,
15. Top vibrofeeder to be mounted back with suitable chain block &slings.
16. Start fitting the hammers as per work instruction.
17. Rotate the rotor assembly manually for checking.
18. Fit both side hinge covers manually & bolt it.
19. Do the alignment of motor /HRC with dial gauge.
20. Couple the motor by inserting the coupling bushes.
21. Clear shutdown.
22. Take the trial of the HRC.
23. Handover to production.
24. Housekeeping to be followed after completion of the job.

**WORK NO 11: DISMANTLING /ASSEMBLING OF HAMMER CRUSHER ROTOR**

1. Keep the rotor assembly in maintenance room.
2. Remove the coupling by using puller, use gas cutter for heating if jam on shaft.
3. Remove the Plummer blocks by tapping.
4. Remove bearing lock/ nut then remove the bearings by using puller if not then by gas cutting to used (Ensure shaft will not be damaged during cutting).
5. Unlock the spacer nut/washer manually by tapping & remove it.
6. First slightly lift the rotor assembly with crane/hydra/chain block to remove the side disc.
7. Remove the DE side disc (which is mounted on shaft with key) by hammering.
8. Remove one by one spacers /discs. and to be marked & placed in sequence.
9. Check the shaft dimensions for any wear out, if require do the reconditioning by using suitable welding rods and afterwards by machining.
10. Check the dimensions of new discs/spacers due for replacement.
11. Insert the new discs on shaft with hydra/crane/chain block as per the drawing (as per dismantled passion).
12. Fit the DE side lock nut by tightening fully by tapping and lock it with lock washer.
13. Put the both side bearings by oil heating/induction heating.
14. Fit the bearing locknut by tapping and lock it with lock washer.
15. Mount the Plummer blocks when bearing looses it temperature.
16. Use temperature gun for checking the temperature.
17. Apply the grease with grease pump.
18. Check the coupling dimensions & mount coupling with oil heating.
19. Tag the overhauled assembly with job description, date of overhauling. And keep in allotted area.

WOK NO 12: Hammer crusher Motor Replacement.

1. Take electrical shut down of hammer crusher as per electrical isolation procedure after getting clearance from production department.
2. Remove coupling guard
3. De couple the motor.
4. Remove foundation bolts of motor
5. Use 3 nos 5 T chain pulley block , sling the motor and remove the motor to the desired location.
6. After removal of old motor similar way put the new motor with proper slinging arrangement
7. After Fitting back motor to the position do the alignment of motor with respect to the hammer crusher's rotor shaft and tighten the foundation bolts of motor.Fix lock nuts in foundation bolt.
8. Fix new bushes & bolts
9. After completion of the job restore all safety guards, take electrical clearance and complete the restoration of equipment as per electrical shut down procedure.
10. Follow housekeeping procedure as per instruction specified by WI/MAINT/91.
11. Do use dust mask in dusty area.
12. Hand over to operation.
13. Note down the vibration reading
14. Follow the procedure [WI/MAINT/12 for material handling.](http://sgl-panj-sp-01:8080/QEHS%20SYSTEM%20(PIP)/ALL%20DEPT%20MANUAL/MECH%20DM/AppData/Local/Microsoft/Windows/Temporary%20Internet%20Files/Content.Outlook/pending/WIMAINT12%20MATERIAL%20HANDLING%20.doc)

Work No 13: Vibrofeeder tube replacement and counter weight setting.

1. Ensure that Top rod gate should be in closed condition & top feeder or hopper should be made empty before taking the job.
2. Take work permit from the shift Superintendent / production in charge and obtain the electrical shutdown of vibrating tube & Hammer Crusher as per electrical isolation procedure.
3. Electrical team should disconnect the tube feeder's supply before lowering the tube feeder.
4. Fix 2nos of 5T chain pulley block at desired location and lower the vibrating tube by proper rigging practice and keep at the proper location to avoid any entanglement of person.
5. Similarly lift the tube feeder with similar practice to the desired location.
6. Once the tube feeder fixed its inclination to be fixed at 10 degree and to be ensured by responsible mechanical engineer.
7. Both Counter weight cover need to be removed by electrical team and its counter weight setting to be kept equal for all the sides of both the vibrator as per tube feeder's discharge requirement.
8. Once the counter weight setting has been done lower side of both the vibrator cover to be kept open for checking the direction of both the motors.
9. After removing manpower from the vicinity of the vibrator and at a visual distance temporarily release the electrical shutdown and start the trial by inching the vibrators in local mode. If both the vibrator's direction is away from the center of the feeder(Rotation should be opposite to each other) then take the electrical shutdown again and fix the counter weight's cover and clear the electrical shutdown as per electrical isolation procedure.
10. If direction need to be made correct then electrical has to do so as per previous steps and take the trial in similar way.
11. Once test trial found ok then hand over the tube feeder to operation department.
12. Follow the procedure [WI/MAINT/12 for material handling.](http://sgl-panj-sp-01:8080/QEHS%20SYSTEM%20(PIP)/ALL%20DEPT%20MANUAL/MECH%20DM/AppData/Local/Microsoft/Windows/Temporary%20Internet%20Files/Content.Outlook/pending/WIMAINT12%20MATERIAL%20HANDLING%20.doc)

**DO:**

* Wear all PPE'S while working, Ensure the usage of dust mask and safety goggles in dusty areas.
* Use proper tools.
* Study any usage of cut material for re usage so as the wastage will be minimum.

Clear all debris of oil, grease and other rubber and metal scrap.

**Reference: - SP-44**

**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: 18.06.2022** | **Review Date: 18.06.2022** | **Review Date: 18.06.2022** |