# ACTIVITY: COOLING TOWER & ITS ACCESSORIES MAINTENANCE

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* Objective : - Safe working/maintenance on cooling tower for optimum output
* Scope : - Blast Furnace Accessories
* Ref. : -
* Responsibility : - Area In charge & Maintenance Fitter on job

**PPE s to be used :**

 Helmet, Safety shoes, hand gloves, safety goggles and dust mask, safety belt

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| --- | --- | --- |
| Work No 1 | : | Working/maintenance of cooling tower pump |
| Work No 2 | : | Flushing /cleaning of duplex filter |
| Work No 3 | : | Procedure for changing input side oil seal |
| Work No 4 | : | Procedure for gear box oil changing |
| Work No 5 | : | Cleaning nozzles of furnace cooling tower cells |
| Work No 6 | : | Procedure for monthly maintenance/checking of cooling |
| **Aspect - Impact** |  | Tower Fan |
| Scrap generation |  | Resource Depletion |
| Oil Spillage |  | Land contamination |

Oil traced waste generation Land contamination & Resource Depletion

Fumes Health

|  |  |
| --- | --- |
| Draining of water | Resource Depletion |
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**[Hazards identified](file://///Maint212/qehs%20mech%20on/ohsas/4%20RISK%20ASSESMENT/WIMAINT44%20MAINTENANCE%20OF%20PUMP.xls)**

**Physical Hazard -** Pressure, temperature, dust inhalation, congestion, Drowning in water

# Mechanical hazard –

* Trapping in between coupling, impeller, guard, dismantled pump and motor, or while operating/handling valve/pump/filter etc.
* Entanglement in between moving parts, guard, coupling.
* Fall of spare parts, rod, slinged items, tools, hammer, etc.
* Fall of person from platform & height, slipping.
* Impact of moving/slinged items.
* Injury from slip of pump component while assembly / dismantling.
* Impact of fan blade due to wind /while rotating manually
* Impingement of fingers, hand while fitting assembly of pump, bearing fixing, impeller fixing, filter fitting.

**Electrical Hazard** – Shock from welding machine, electrical cable.

**Chemical hazard -** Co gas poisoning & Fire

**Biological Hazard** - Bee sting

**Human Behavior aspect of operators**:

Operator nature, alcoholism, casual approach, horse play, use of mobile at workplace, back pain & non usage of PPE?s

# For carrying out any activity on cooling tower

1. Take the work permit from Production and ensure that all incoming water line valves are fully closed and fitted with LOTO
2. Take electrical shutdown LOTO for the required equipment in consultation with electrical & production departments.
3. Other procedures to follow:

VL/IMS/PID1/MECH/WI/12,VL/IMS/PID1/MECH/WI/44, SP44

# Work No 1: Operating Procedure for furnace cooling water pumps installed at cooling tower

1. Two nos. circulating water pumps are installed at new cooling tower to pump the water from cooling tower to Blast furnace for shell cooling. Both these pumps are connected with a common VFD so as to maintain the header pressure of 3.1 to 3.9 kg/sq cm (set as per requirement) by increasing or decreasing the pump speed with the help of PID control. Under normal working condition pump will run on VFD supply and standby pump will be available on direct supply through a star delta starter. Status of pumps can be seen at BF I/II PLC
2. Changeover of these two pumps from VFD supply to star delta supply and vice versa can be done with the help of changeover switches provided on to the MCC panel at their respective feeder.
3. All the three nos. of changeover switches must be either on position I or II at all the time. If position of all the changeover switches is on I, then pump no.1 (toilet side) can be started on VFD supply and pump no.2 on star-delta supply. (its discharge valve shall be kept closed fully). If positions of all the changeover switches are on II, then pump no.2 (MCC panel room side) can be started on VFD supply and pump no.1 on star-delta supply. Changeovers switch no. 3 is located rear side of the VFD feeder.
4. In case of problem with the VFD, pump has to be started in star delta mode and header pressure should be maintained by controlling pump discharge valve.
5. In case, pump, which is running on VFD, trips due to any reason, stand by pump can be started directly in star delta mode.
6. To do the pump changeover from 1 to 2, first start standby pump-2 in star delta mode and open its discharge valve. Stop the pump-1, which is running on VFD, close its discharge valve and then again start pump-1 in star delta mode and open the discharge valve.
7. Then stop pump no. 2 and start it in VFD mode and then stop pump no.1.
8. To do the pump change over from 2 to 1 reversing pump numbers may follow same procedure.
9. The above changeover procedure of pump will ensure us that here is no stoppage of water supply to blast furnace cooling.
10. Generally as a planned way we will change over pump during monthly shutdown only. In case of breakdown or emergency starting spare pump should be started in star delta only. Normalization to VFD will be done by maint, elect and production jointly.
11. Every Monday production shall start standby pump in star delta mode (along with pump running on VFD) for minimum running hrs of half an hour duration, which will give us the healthiness of the standby pump.
12. Keep the 400nb gate valve at the out let of spare pump in closed condition for quick start up. Keep the valve F handles ready for use.
13. For General maintenance of the Pump follow procedure [WI/MAINT/44](http://192.168.6.19/shama/INTIGRATED%20SYSTEM-SIL/QEHS%20SYSTEM/ALL%20DEPT%20MANUAL/MECH%20DM/DIPESH/Local%20Settings/to%20compile/For%20Approval/qehs%20on%20Jprakash/departmental%20manual/11%20%20Work%20instruction/WIMAINT44%20MANTENANCE%20OF%20PUMP.doc) .Take work permit from production department. Take electrical shutdown after informing production. Ensure LOTO is put on pump inlet and outlet valves.

# Work No 2 : Flushing of Triplex filter

BACK FLUSHING OF FILTER WITH WATER

1. Take work permit and inform Shift superintendent. Keep one production engineer during change over of filter and during flushing
2. Keep 2 filters in line under normal condition. Differential pressure across should be less than 0.35 kg/cm2.
3. Check the differential pressure of filters, whichever is more than 0.35 kg/cm2 should be isolated from the system.
4. Close inlet valve (A) & outlet valve (B) completely for the filter which is to be isolated for back flushing.
5. Open the 25 nb air relief valve (C) on top of the filter to ensure that there is no leakage from outlet/inlet valve.
6. Open 80nb-flushing valve (D) & 80 nb drain valve (E) till all dirt flushes out. Do this operation for 2 to 3 minutes.
7. After completion of back flushing of filter close flushing valve (D) and keep drain valve (E) open for some time, to ensure flushing valve is closed fully. Then close the drain valve (E) and take the filter in line by opening inlet & outlet valves, A & B respectively
8. Continue same operation for filter 2 & 3
9. Check the differential pressure of the filter and ensure that the pressure across filter has come to less than 0.1 kg/cm2, if not follow the above operation again.

# VALVE IDENTIFICATION DETAILS FOR COOLING TOWER TRIPLEX FILTER

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Filter No** | **Inlet Valve** | **Outlet Valve** | **Air**  **Relief**  **Valve** | **Flushing** **Valve** | **Drain valve** | **Flushing** **air valve** | **Header valve**  **of air line** |
| **Filter 1** | **1A** | **1B** | **1C** | **1D** | **1E** | **1F** | **G** |
| **Filter 2** | **2A** | **2B** | **2C** | **2D** | **2E** | **2F** | **G** |
| **Filter 3** | **3A** | **3B** | **3C** | **3D** | **3E** | **3F** | **G** |

BACK FLUSHING OF FILTER WITH COMPRESS AIR

1. Back flushing of filter with compress air should be carried out if the differential pressure does not fall below 0.2 kg/cm2 after flushing with water.
2. Isolate the filter by closing inlet & outlet valve and check the compress air pressure on the gauge.
3. Ensure that the air inlet valves of other two filters are closed.
4. Open the drain valve and start the compress air gradually by opening the air inlet valve.
5. Do this operation for 1-2 minutes.
6. Close the air inlet valve and again carry out the back flushing of filter with water to ensure that all dirt collected in the filter basket are flushed out.
7. Take the filter in line as per point no 8 & 9, & close main header valve (G)
8. Clear work permit and give clearance to production.

# Work No 3: Procedure for changing FAN gearbox input side oil seal

1. Take work permit from production for working on cooling tower. Ensure all incoming water lines are isolated with LOTO fitted on them.
2. Take electrical shutdown of the fan required to be taken for maintenance
3. Open the inspection door to enter inside the fan area on the walkway provided on the fan stack. .
4. Fan area can also be approached by the walkway at the bottom of RCC beam.
5. Wear full body harness.
6. Gas cutting, welding and usage of any inflammable material is prohibited while working inside cooling tower as fins may catch fire.
7. Mark the cordon shaft and coupling before dismantling. Decouple the cordon shaft

(input) from gear box by standing on the platform provided and take it outside

1. Remove the coupling fitted on gearbox (while doing coupling side oil seal replacement)
2. Drain the oil from the gear box
3. Gearbox fan cover & fan of gear box to be removed, flange bolts to be loosened, and damaged oil seal to be removed
4. New oil seal to be fitted, & tighten all flange bolts which were removed.
5. Add fresh oil (par than 460) in the gearbox from oil filling piping, qty required approx 13lit. check for oil leakage if any.
6. Fit the coupling. Couple the input shaft with cordon shaft
7. Then remove all materials, tools & accessories out of the fan area before clearing the shutdown.
8. Close the inspection door of the fan stack.
9. Clear electrical shutdown and take trial. Check for leakages
10. Clear work permit and give clearance to production.

Work No 4: Procedure for gearbox oil changing

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1. Take work permit from production for working on cooling tower. Ensure all incoming water lines are isolated with LOTO fitted on them.
2. Take electrical shutdown of the fan required to be taken for maintenance. Wait for fan to completely stop rotating before entering the gear box area.
3. Open the inspection door to enter inside the fan area on the walkway provided on the fan stack.
4. Fan area can also be approached by the walkway at the bottom of RCC beam. Tie one of the blade of fan with manila rope to avoid rotation of fan when person is inside at gearbox or on platform.
5. Wear full body harness.
6. Gas cutting, welding and usage of any inflammable material is prohibited while working inside cooling tower as fins may catch fire.
7. Drain the gear box oil by using a pneumatic hose by connecting it to the breather pipe. Oil will flush out through the oil filling pipe.
8. Then add fresh oil 1/4th liter and flush the gear box. Add fresh oil (PARTHAN 460) 13 liters till the level on the sight glass is at the middle.
9. After completion do not keep any material such as cotton waste, cloth and tools inside fan area.
10. Clear the shutdown and take trial to check for any leakage.
11. Give clearance to production.

# Work No 5 : Cleaning nozzles of furnace cooling tower cells

1. Take work permit from production department; take electrical shutdown of the CT-fan of cell which requires nozzle cleaning.
2. Then enter inside the fan deck area by opening the fan stack inspection door and FRP cover on the top slab.
3. Inlet sump valves should be kept open initially to check the nozzle condition. After ascertaining nozzle choking condition close all the inlet sump valves of this cell and ensure valves are locked with LOTO. Open bypass valves of trough drain to prevent water overflowing out. Bypass line water will go in cell bottom and prevent overflowing of trough of other cells when one cell is taken for maintenance.
4. After entering inside the fan deck area first start removing the drift eliminators in the vicinity of the bottom walkway.
5. Once the eliminators are removed RCC beams get exposed. Then fix the suspended platform of chain & step grating in between two beams. Similarly all the drift eliminators can be removed. Stack them properly outside the deck area.
6. Then tie safety belt to the top platform angle and carefully land on the step grating.
7. Remove the nozzles which are around the suspended platform which are accessible to remove. Nozzles have threading and can be removed by rotating anticlockwise. They are 110 nos for each cell.
8. Once the nozzle is removed, clean if chocked and also clean the pipe by inserting a rod.
9. As such all nozzles can be removed and water will simply flow through the pipe.
10. Clean all the nozzles outside the fan deck area.
11. Open the inlet sump valve of the cell to flush all the pvc line of nozzle. Close the valve again for nozzle fitting.
12. After the pipes and nozzles are cleaned fit them back similarly using the suspended platform. Ensure that smaller dia. nozzles are fitted to the pvc pipe along the periphery of the cell. Take trial by opening the inlet valve & ensure equal flow through all nozzles.
13. If flow through all nozzles is ok, then fit back all the drift eliminators as per above procedure (point 6&7)
14. Clear the inside area and do not keep anything inside.
15. Put back the fan stack inspection door & RCC top slab cover.
16. 17) Clear electrical shutdown and give clearance to production.

# Work No 6: Procedure for monthly maintenance of cooling tower Fan

1. Take work permit from production for working on cooling tower.
2. Take electrical shutdown of the fan required to be taken for maintenance.
3. Ensure that LOTO wheel pads are put for the valve for incoming water line to the cooling cells to ensure that no one should operate the valve.
4. Open the inspection door to enter inside the fan area on the walkway provided on the fan stack.
5. Fan area can also be approached by the walkway at the bottom of RCC beam.
6. Wear full body harness.
7. Gas cutting, welding and usage of any inflammable material is prohibited while working inside cooling tower as fins may get fire.
8. Check the entire monthly checklist points.
9. Then remove all materials, tools & accessories out of the fan area before clearing. the shutdown.
10. Close the inspection door of the fan stack.
11. Clear electrical shutdown.
12. Clear work permit and give clearance to production,

For Fabrication erection job on cooling tower and its pipelines follow procedure [WI/MAINT/94](http://192.168.6.19/shama/INTIGRATED%20SYSTEM-SIL/QEHS%20SYSTEM/ALL%20DEPT%20MANUAL/MECH%20DM/DIPESH/Local%20Settings/to%20compile/For%20Approval/qehs%20on%20Jprakash/departmental%20manual/11%20%20Work%20instruction/WIMAINT94%20%20FAB%20DISMANTLING%20&%20ERECTION.doc)

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# DO’s

* Ensure house keeping
* Ensure proper care to avoid hitting of fan blade during off condition due to manual rotation / wind
* Take precaution to avoid drowning in the water. If required keep water level in sump low. Use life bouy / jacket wherever required.
* Lock the frp fan blade to avoid hitting, if it rotates in shut off condition.
* Clear all scraps & unwanted structures from platforms / work area
* Ensure that the people working near water knows swimming
* Report damaged / corroded structures immediately

# DONT’s

* Work under the influence of alcohol
* Indulge in the Horse Play

**Amendement Record**

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| **Date** | **Manual Section Ref. & Para** | **Brief details of Revision** | **New Rev.** |
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| --- | --- | --- |
| **Prepared By:**  Area Engineer | **Reviewed & Issued By:**  Management Representative | **Approved By:**  Mechanical Head |
| **Signature** | **Signature:** | **Signature:** |
| **Review Date: 12.12.22** | **Review Date: 12.12.22** | **Review Date: 12.12.22** |