**WORK INSTRUCTIONS FOR** **OPERATING & MAINTAINENCE PROCEDURE FOR SIDE STREAM FILTER FOR BF COOLING TOWER**

**Objective:** Filtering water to TSS < 5 PPM

**Scope :** Operation of side stream filter

**Responsibility:** Hot blast stove engineer

**Identified Hazards:**

**Mechanical hazards**

1. Trapping between the moving parts
2. Impact of hammer, tools and components
3. Fall of materials such as hammer, bolts, spanners, sling items
4. Material handling hazards in WI/MAINT/12
5. Cut injuries from sharp edges of items
6. Failure of sling, chain pulley block
7. Entanglement of person with pipelines running over ground
8. Entanglement of clothing in rotating motor of pump
9. Slip and fall due to slippery surface
10. Impact of compressed air due to compressed air line burst

**Physical hazard**

1. Falling of person from height.
2. Burn injury to workmen while cutting.
3. Falling of person in the cell of cooling tower.
4. Flood due to Side stream filter vessel damage
5. Suffocation of a person inside vessel while carrying out maintenance of the side stream filter vessel
6. Drowning of a person in cooling tower basin

**Electrical hazards**

1. Electric shock due to welding
2. Electric shock while carrying out PLC maintenance or Pneumatic valve maintenance.

**Chemical hazards**

1. Fire
2. Contact with chemically treated water

**Behavioral**

1. Not adhering to WI or use of PPE

2. Following improper sequence of valve operation

**Health Hazards**

1. Contact of chemically treated cooling water causing allergies

Environmental aspect

1. Use of water
2. Generation of slurry

**Side filter in service mode.**

1. Unauthorized operation or repair of any equipment is a punishable offence
2. Open the pump suction valve of the cooling tower cell to be taken in line.
3. Start the pump
4. To fill the filter, open the inlet valve (V1) and open the air release valve (V6)
5. Close air release valve (V6) after water is seen flowing from it
6. Open discharge valve (V2) to cooling tower
7. Check the flow physically and differential pressure gauge and note down the reading.
8. Ensure followings valves, backwash inlet V3, backwash outlet V4, raise outlet drain V5 are kept close during filtration process.
9. In case of changeover of cell first open the suction valve of the pump to be taken in line and then close the suction valve of the cell which was in line.

**Back wash procedure if differential pressure is more than 0.8kg/cm2 or every 24 hrs whichever is earlier.**

1. Ensure cooling tower level should be full.

2. Close the filter inlet (V1) and outlet (V2) valves.

3. Open inlet (V3) and outlet (V4) valves of the filter.

4. Run the system for 10 minutes

5. Check for clear water.

6. Reverse the process from top to bottom.

7. Take filter in service.

**The side stream filter will work in total Auto mode and any deviation will be indicated in the BF II control room.**

**Technical details**

1. Service operation: Discharge flow rate: 100 m3/hr. time of operation: 24 hr.
2. Drain down operation: flow rate: nil time: 5 min.
3. Backwash operation: flow rate: 100 m3/hr. time: 10 min. to be in line when differential pressure – 0.8 kg/cm2 or after 24 hrs. Whichever is first or once in each shift, depending upon the inlet/outlet TSS.
4. Rinse operation; flow rate: 100 m3/hr time: 5 min after back wash.
5. Vessel fill operation.: Flow rate: 100 m3/hr time: 2 min.

**SAFETY, PRECAUTIONS AND DO AND DO NOT’s GUIDELINES:**

**DO’s:**

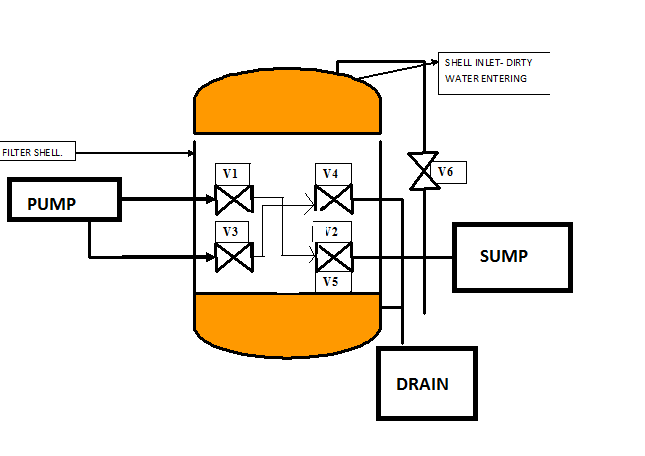
* To operate the plant strictly as per the basic guidelines provided for necessary process inputs.
* To operate the plant by the trained and experienced persons only.
* To follow the safety guidelines provided for the Mechanical, Electrical equipments and handling of filter media.
* To always ensure the system vessels are full of water and free of air, during the plant operation.
* To record the plant parameters during regular operation for review and evaluate the performance of the system components and equipment.
* To record replacements of spares for equipment and to maintain individual history cards for each equipment.
* To always use original spares to safeguard the overall integrity and reliability of the system against loss of performance.
* To implement the preventive maintenance schedule for equipment to prevent unexpected break down of equipment and the system.
* To ensure that the system is operated within the capacity designed and to request for our guidance whenever required especially if there is any major deviations in the raw water quality.
* Any maintenance activity shall be carried out only after electrical shut down of the system.
* Only authorized personnel shall open the PLC panel
* In case of any alarm sounded from PLC panel emergency stop on the PLC panel to be operated and Instrumentation shift technician to be informed.
* If the cooling tower cell level goes down, side stream filter to be stopped by operating Emergency stop from PLC panel and Instrumentation shift technician to be informed.

**DO NOT’s**

* Do not operate the system when the feed water limiting factors are not as per our recommended specifications
* Do not use substandard and duplicate spares for equipment.
* Never isolate cooling tower cell in line without opening valve of new cell to be taken in line
* Never Touch any Pneumatic valve while the Side stream filter is in operation
* Never operate pneumatic valves manually without instrumentation engineer’s advice while the filter is in running
* For maintenance of filter: Never open the manhole of side stream filter without electrical shut down and after ensuring that the filter has been drained completely

**Diagram for the side stream filter system:**

***OPERATION PROCEDURE FOR SIDE STREAM FILTER FOR BF COOLING TOWER***

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**V1 - INLET**

V2 - OUTLET

V3 - BACKWASH INLET

V4 - BACKWASH OUTLET

**V5 - RINSE OUTLET (drain)**

**V6 - AIR RELEASE**

**Steps for operation of the filter:**

1. To fill the vessel open Valve1 & Valve6

And close Valve2, Valve3, Valve4, and Valve5.

1. For backwash cycle open Valves3 & Valves4.

Close Valve1, Valve2, Valve5, Valve6.

1. To rinse the shell open Valve1 & Valve5.

Close Valve2, Valve3, Valve4, Valve6.

1. For servicing of the system open Valve1 & Valve2.

Close Valve3, Valve4, Valve5, Valve6.

***Table for reference:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S.No | Mode | Stages | Valves Open | Valves closed | Pump | Duration |
| 1 | Backwash Mode | Drain Down | V5 & V6 | V1, V2, V3, V4 | Off | 2 min |
| Backwash | V3 & V4 | V1, V2, V5& V6 | On | 5 min |
| Rinse | V1 &V5 | V2, V3, V4 &V6 | On | 3 min |
| Vessel filling | V1 & V6 | V2, V3, V4 &V5 | On | 1 min |
| 2 | Service Operation | Service | V1 & V2 | V3, V4, V5 &V6 | On | 8 hrs |

***BACKWASH CYCLE FOR CLEANING PROCESS:***

* A differential pressure switch is located across the inlet and outlet of the filter.  On a predetermined pressure drop of 0.8 kg/cm2 the differential   pressure switch through the PLC will trigger closing of inlet and outlet valves and will open the backwash inlet and backwash outlet valve.
* After a predetermined time (which will be set as per the site conditions) the backwash inlet and outlet valves will close and the unit will be put back in service mode.

**MAINTENANCE PROCEDURE FREQUENCY**

|  |  |
| --- | --- |
| INSPECT UNIT FOR LEAKS | A |
| INSPECT UNIT FOR FAILED COMPONENTS | A |
| COLLECT OPERATIONAL DATA | A |
| EXTENDED BACKWASH | B |
| OPEN BACKWASH | C |
| OBSERVATION AND MAKE UP OF FILTER  MEDIA. | D |
| REPLACEMENT OF FINE FILTER MEDIA. | E |

A - Daily

B - Weekly or when the pressure drop across the filter exceeds 1 kg/cm2, whichever occurs first?

C - Twice a year

D - ONCE IN A YEAR, MAKE UP LOSSED QUANTITY DURING BACKWASH

E – Whenever activated carbon does not restore the media.

**Base line for providing side stream filter in BF Cooling tower:**

* Raw water obtained from various sources like rivers, lakes, sea and deep artistic bore wells may contains various types of impurities like suspended matters (TSS) of both organic and inorganic nature, dissolved Minerals salts (TDS), dissolved gases and Micro-Biological contamination etc.
* Treatment of water implies changing its physical and chemical parameters to the accepted level as per the end consumer's requirements.
* Hence, the selection of treatment scheme and components depends upon quality of water available, and quality of water needed.

**ALARMS PROVIDED IN BF2 CONTROL ROOM:**

* Side Stream Filter Fault – It is a common fault which will be activated if
* System goes to Backwash mode from Service mode
* Emergency push button is pressed
* Side Stream Filter Feed Pump Off

Side stream filter diagram showing the filter media in the following sequence

1. Anthracite 300 mm
2. Filtering Sand 300 mm (16/32 mesh -0.5 mm to 1.0 mm)
3. Medium 200 mm (3 mm to 5 mm)
4. Coarse 100 mm (6 mm to 8 mm)
5. Pebbles 100 mm (1” to 1.5”)

|  |  |  |
| --- | --- | --- |
| **Prepared By:**  Head – Production PID I | **Reviewed & Issued By:**  Management Representative | **Approved By:**  Head – Pig Iron Division |
| **Signature:** | **Signature:** | **Signature:** |
| **Date: 10.07.2023** | **Date: 10.07.2023** | **Date: 10.07.2023** |

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