ACTIVITY: STAVE AND ITS ACESSORIES MAINTENANCE

1. **PURPOSE:** Safe back flushing of staves, tuyere, middle water jacket & large water jacket. & also replacement of stave cooling lines.
2. **SCOPE:** Blast Furnace Accessories
3. **RESPONSIBILITY:** Mechanical & Operation Engineer in charge & workmen on the job
4. **PROCEDURE:** Back flushing/ Pressure testing/ Pressure testing of Staves, tuyere, middle water jacket & large water jacket

PPE –s to be used:

       Safety shoes, helmet, cotton cloth, goggles and hand gloves. CO Monitor

Aspect – Impact

|  |  |
| --- | --- |
| Scrap Generation | Resource depletion |

Work No 1 **:** Back flushing of Staves

Work no 2 : Bubble testing of staves

Work No 3 : Staves Pressure testing

Work No 4 : Separation of staves

[Hazards identified](file:///C:/Users/HP/AppData/Local/Microsoft/Windows/INetCache/harry.SGL01/AppData/Local/Microsoft/Windows/Temporary%20Internet%20Files/Content.Outlook/Local%20Settings/Temporary%20Internet%20Files/Content.IE5/4%20RISK%20ASSESMENT/WIMAINT41%20MAINTENANCE%20OF%20RAMMER.xls)

Mechanical   a) Human behavior aspect of operators, Operator nature, alcoholism, casual approach & non usage of PPEs,

                       b) Jamming of finger while fixing hose on to the connector

                         c) Slipping / skidding due to poor housekeeping

                       d) Fall from the gap between bustle platform & furnace.

                       e) Impact with supporting angles of header, pipeline etc.

                       f) Impact with structures due to lesser head room.

Physical    a) Splashing of water into the eyes

                       b) Bursting of hoses

                      c) Heat radiation from the blast furnace shell

Chemical      a) Gas poisoning

**Behavioral Hazards:** working without all required PPE’s

Working under influence of alcohol

Horse play

Casual approach

Not following SOP/WI while carrying out the job

**BACKFLUSHING/BUBBLE TESTING/PRESSURE TESTING & SEPERATION OF STAVES**

Presently there are 14 rows of Staves for Blast Furnace, named 1 to 14.

Rows 5-8 are Copper staves and are interconnected. There is a total of 120 Copper staves i.e 30 in each row. For Copper staves there are 120 Inlets & 120 Outlets.

Below is the schematic representation of Staves:



Work No 1**:** Back flushing of Staves

1. **Take clearance & work permit from Operation cast house engineer for back flushing.**
2. **Ensure back flushing is carried out in presence of Operation in-charge only**
3. **Identify the inlet and outlet line along with valves of the ~~equipment~~ staves to be back flushed from the header.**
4. **CO monitor to be used during backflushing of staves.**
5. Hose to be fixed at the open end of the 3-way valve in the inlet header
6. Hose to be connected to Outlet By-pass valve (3).
7. The hose connected to outlet by-pass valve, other end to be connected to nearest point provided at Medium pressure header (4).
8. Outlet Valve (2) to be closed.
9. Valve 4 to be opened, water will enter through Outlet by-pass line & exit through Inlet line valve (TWV).

The above procedure can be followed for any row of staves – For better & complete understanding of stave circuit above drawing can be referred & Tuyere backflushing to be done in furnace shutdown only.

1. Keep above mentioned arrangement for 5-10 mins. & then revert back to its original condition by following above steps.
2. Open the main inlet valve, then open main outlet valve.

**Backflushing:**

STAVE

INLET 1

TWV

Medium Pressure Header

Flexible Hose

Medium Pressure Header

4

3

2

Outlet 2

Outlet By-pass

**Work 2 - Bubble** testing of staves

**Bubble Testing**

INLET

Outlet 2

Outlet By-pass

Flexible Hose

Water Can – 20L

Medium Pressure Header

* **Take clearance & work permit from Operation SS for bubble test.**
* **Ensure bubble test is carried out in presence of Operation in-charge only**
* **Identify the inlet and outlet line along with valves of staves of which bubble test to carried out.**
* **CO monitor to be used during bubble test of staves.**
* Fix dummy on the inlet three-way valve where dummy is not fixed.
* Fix hose to the outlet by-pass valve & put the other end of the same hose inside the Water transparent Can. (20-L)
* Fill the can fully first with water.
* Throttle the Inlet valve (reduce inlet flow of water ) to check for any puncture of internal piping, in case of any puncture bubbles will be visible in the transparent can & CO level will rise.
* If no bubble is visible then staves is OK, then check the CO level near bottle mouth by placing CO detector.
* After bubble test enure that water is properly coming from outlet valve.

Work instruction No 3 **:** Staves Pressure testing

1. **Take clearance & work permit from Operation Shift SS for pressure testing.**
2. **Ensure pressure testing is carried out in presence of Operation engineer.**
3. **Identify the inlet and outlet line along with valves of the ~~equipment~~ staves to be pressure tested from the header.**
4. **Use CO monitor while pressure testing**
5. Fix Pressure Gauge at the outlet by-pass valve.
6. Close the inlet valve
7. Close the outlet valve
8. Check for any pressure drop in the gauge in case pressure holds then no leakage in that circuit.
9. In case pressure drops then individual staves of that circuit to be pressure tested & the punctured one to be separated.
10. **~~Fill the transparent water container using 1” rubber hose till its neck~~**~~.~~
11. **~~Now slowly throttle main inlet valve till the flow of water becomes streamline. Now check in the bottle for at least 2 mins if pressures are coming or not.~~**
12. **~~If not, then stave is ok. If pressures are found, then check the CO level near the bottle mouth by placing CO detector~~**~~.~~
13. **~~Measure and note down the value.~~**
14. **After conducting the pressure test, open the discharge valve and close the outlet bypass valve** . **Then open the main inlet valve** E **fully.**
15. **Ensure water is coming from outlet valve**

Pressure Gauge

INLET

Outlet By-pass

Medium Pressure Header

Work 4 – Separation

* **Take clearance & work permit from Operation SS for staves seperation**
* **Ensure staves seperation is carried out in presence of Operation in-charge only**
* **Identify the inlet and outlet line along with valves of staves of which staves separation to carried out.**
* **CO monitor to be used during bubble test of staves.**
* In case pressure drop is witnessed in a particular series of staves then pressure testing of individual staves is to be done & the punctured stave is to be separated.
* The above stated procedure is to be followed for all the rows except for Copper stave rows i.e

Row 5-8.

For Cu staves below procedure to be followed :

In the below shown drawing, assume if stave -1 of Row 6 is found punctured then

1. The inlet valve of that circuit is to be closed by fitting a blind.
2. The loop where puncture is observed is to be opened & blanked.
3. The inlet of next stave (Row-7 Stave-1) is to be given directly from Row 5 Stave-1 using a flexible hose of higher length.
4. Grouting to be done to puncture stave by informing operation.
5. After normalizing ensure that water is coming properly from outlet valve of particular staves.

**NOTE: WATER TO BE STOPPED FOR THAT PARTICULAR SEGMENT, THIS ACTIVITY TO BE CARRIED OUT PREFERABLY IN SHUTDOWN, AFTER 4 HOURS OF SHUTDWON WHEN TEMPERATURE WILL BE LESS. PRODCUTION HEAD IS TO BE CONSULTED FOR THIS ACTIVITY.**



**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:** |
| **Date: 23.11.2022** | **Date: 23.11.2022** | **Date: 23.11.2022** |