**Work Instructions Blowing down of the Blast furnace 1& 2**

* Objective : - Emptying the furnace till just above tuyere.
* Scope : - Blast furnace
* Ref. : - Blast Furnace Drawings, Safety Standards, Reference from

Other steel plants, blowing down of BF-3

**Responsibility** : -

1. **COO, PID** – Formulation of the Project and Overall, in charge of the Blow-down.
2. **HOD-Production, PID1:** Over all coordinator and Project Controller.
3. **Shift Superintend**: Implementer under the guidance of the Consultant and HOD-Production.
4. **Blast Furnace In-Charge, Control Engineer**: Implementer of the project under guidance of SS.
5. **Manager safety**: For ensuring the safe practices / process are being followed. Ensuring emergency services are healthy.

* PPE to be used : Helmet, Safety shoes, Hand gloves, Safety Goggles,

Safety Belts, CO Detector, Dust Mask

**Philosophy:**

The process of emptying out the furnace just below the tuyere level is named as Blowing Down.

Blowing Down process is extremely hazardous involving formation of explosive mixture of gases at high temperature and constantly fraught with the danger of formation of inflammable gas inside the furnace.

The process of Blowing Down involves continuous reduction of charge level by stopping charging of raw materials at the top and at the same time continuing blowing air through tuyeres from the bottom, so as to burn out all the coke remaining in stack column and removal through tap hole, whatever metal and slag forms during the process.

Lowering of charge level in an ‘On Blast’ furnace results in abnormal rise in top gas temperature. This is controlled by spraying water inside the furnace on the burden top.

Pouring of water on hot coke causes formation of steam and carbon monoxide.

C + H2O = CO + H2

At high temperature steam also dissociates to Hydrogen and Oxygen.

2H2O = 2H2 + O2

Proportion of these gases need to be controlled within a specified limit to avoid their burning and formation of explosive mixture. This is done by regulating the water flow from top and the air blown from bottom. Steam generated during the process acts as a purging agent for diluting the inflammable gases and reduce danger of explosion.

**PROCEDURE FOR BLOWING DOWN**

**Aspect**:

1. Heat Generation.
2. Generation of graphite dust.
3. Explosions.
4. Gas leakages.
5. Steam generation from flare stack

**Impacts**:

1. Air Pollution
2. Land Contamination
3. Health Impacts
4. Work Environment

**Identified Hazards**:

1. BF Gas poisoning.
2. Contact with hot metal, hot coke, dust, graphite, fire.
3. Catch of fire for top charging system.
4. Explosion inside the furnace due to water leakages
5. Contact with fumes, hot water.
6. Hit by flying objects caused by explosion.
7. **Standing Instructions**:
8. All persons should wear PPE.
9. Unauthorized operation or repair of any equipment is punishable offence.
10. Alert the persons in the following areas.
    1. GCS area
    2. Near Dust catcher
    3. PCM area
    4. Glendon Area
    5. Cast house area
    6. HBS area
    7. Coke bunker
11. Ensure that tuyere / tuyere cooler / cooling staves are not leaking.
12. Ensure full tap hole length for all cast.
13. Ensure enough stock of lancing pipes.
14. Alert all emergency services.
15. Ensure the availability of sufficient LPG cylinders for flare stack.
16. Ensure continuous monitoring of CO presence in the blowing down furnace’s vicinity.
17. Remove any flammable material in the vicinity of the furnace by at least 100mt.
18. Store representative to be present during blow down activity.
19. **Checking points**:

Preparatory shutdown of the blowing down to be taken on blowing down day for inserting blowing down water spray inside the furnace. The following are the check points for final shutdown.

* 1. Over-head tank is full.
  2. All pumps should be in healthy condition.
  3. All stoves are properly heated before blow-down.
  4. N2 line connection at 10.5m and 12m BF platform
  5. Gas sampling points are connected to uptake and to be checked with gas suctioning motor (electrical to be contacted)
  6. Availability of 4 bladder for gas sample collecting
  7. Alternate source of power and water.
  8. Healthiness of both stock rods.
  9. Water sprays angle in the furnace as per guidance.
  10. Laboratory has been informed about hourly basis gas analysis.
  11. Ensure availability of LPG cylinders.
  12. Provision of recorder nearer water flow meter for the following instrumentation.
      1. Top gas pressure.
      2. Top gas temperature.
      3. Wind volume.
      4. Hot blast pressure
      5. Flow of water.
      6. H2 reading
  13. Raw material bunkers filled in such away so that bunkers are empty at the end of the blow down.
  14. Open all the tuyere before start-up for blow-down if any tuyere is plugged.
  15. Ensure the availability of peep hole glass, mica and clean peephole glass for all tuyeres.
  16. Ensure 40mm dia. drill bits for the last two casts of the blow down.
  17. All PCI lances to be removed before blow-down.

1. **Blow down Operation Instructions**:
   1. For Blowing down of the furnace, furnace should be hot and smooth.
   2. After starting furnace, stop charging the furnace.
   3. Keep HBT around >900⁰C
   4. During lowering of the burden, top temperature to be maintained below 400⁰C and when it rises above 350⁰C, water at the top is to be increased and it should be closed/adjusted when temperature starts decreasing. Top temperature should not decrease below 150 ⁰C.
   5. Blast Volume to be regulated to prevent uncontrolled rise in temperature.
   6. Ensure flare stack are flaring, and LPG stock is full.
   7. Write down the readings (Time, Stock rod level, Wind volume, Hot blast pressure, Top pressure, Online gas analysis, Water flow) on logbook after every half an hour.
   8. One person should stand near the manual top spray valve.
   9. One person should stand near the flare stack LPG cylinders with CO monitor and walkie talkie for proper communication.
   10. After every one-hour gas sample should be sent to laboratory.
   11. Safety representative to take round of surrounding areas with CO monitor.
   12. **Control of top gas temperature**:
       1. Control with top spray.
       2. Control with wind volume.
       3. Control with N2 after charge comes down below the N2 injection point.
   13. **BFG analysis**: There are two gas analyzing systems.
       1. Online analyzing system.
       2. Laboratory analyzing system.
   14. **Stock level Monitoring**: There are two stock rods in normal operation.

The above two stock rods are used only during normal operation of Blast furnace. Blowing down of the stock shall be carried until 16mt.

* 1. **Casting and cast house practice:**
     1. All the casts should be ensured through with good tap hole length.
     2. Casting schedule shall be as per the normal practice and no delay shall be allowed.
     3. All casts should be drilled with normal drill size.
     4. Last cast shall be hard blown to take out maximum liquid metal / slag.
  2. **Final Blowing down process:**
     1. Before blowing down, reduce humidification gradually to maintain enough thermal condition of the furnace.
     2. When CO2 reduces to min. value, it indicates that the burden level has reached just above belly and when CO2 starts increasing it indicates that the burden level reaches to belly or bosh possibly.
     3. As the blown down progress the CO in top gas increases and the CO2 in the top gas reduces. When CO2 comes around 5-6 % this means there is no iron bearing material is left for reduction. The CO2 again rises as the burden level comes down and when the CO2 is equals to CO % the blow down is to be stopped.
     4. When stock rod reaches 15 meters, Last casting should be opened and when the stock level reaches 16 meters, furnace should be dried and shutdown to be taken.
     5. Keep one coke batch ready in coke weighing bin for emergency purpose. (It will be emptied manually afterwards).

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| **Prepared By:**  Head – Production PID I | **Reviewed & Issued By:**  Management Representative | **Approved By:**  Head – Production PID |
| **Signature:** | **Signature:** | **Signature:** |
| **Date: 15.07.2022** | **Date: 15.07.2022** | **Date: 15.07.2022** |

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