* Objective     : -Cleaning of Ceramic burner inside Combustion burner .
* Scope         : -  Hot Blast Stove’s combustion chamber
* Ref.                : -  Hot Blast Stove Drawing,  Ceramic Burner Drawings,
* Swirl Drawing, SP 44, WI/MAINT/12, WI/MAINT/101.
* Responsibility: -
  + - For supply of Refractory Material            :   Refractory Engineer.
    - Refractory Jobs : Production Engineer in-charge.
    - For Blanking of Combustion Chamber :  Refractory Engineer.
    - Scaffold Making :  Refractory, Production engineer, and Erection Party.
    - Removal of Hot Blast expansion Bellow, removal of CA valve, flanges etc. : Mechanical Engineer.
    - Thermocouple insertion in the combustion chamber: Instrumentation.
    - Inspection of scaffold after erection :  Mechanical Engineer.
    - Procedural Inspection :  Operational Engineer / Safety Personnel.
    - Attending continuously at the ID fan :  Electrical Technician.
    - Overall co-ordination :  Manager Production.

PPE to be used         : Helmet, safety shoes, hand gloves, safety belt, and complete sealed goggles, CO monitor, safety over coat, Rescue System.

* Activity No 1:  Reaching on Ceramic Burner through Hot Blast main opening
* Activity No 2 (If required):  Removing top part of Ceramic Burner from its original position and taken out from Stove

Hazards identified

Mechanical

1. Fall of bricks, steel, hammer, rope, wooden plank etc. On human body as well as on Ceramic Burner from top of Combustion Chamber.
2. Fall of objects, broken part of refractory from Hot Blast main opening.
3. Collapsing of Combustion chamber wall
4. Collapsing of Stove Dome
5. Collapse of checker layers
6. Trapping in between objects like rope, fall arrester, electric cable, compress air hoses
7. Impact due to object like bricks, checkers, and hand lamp.
8. Fall of person inside combustion chamber
9. Fall of person from platform, staircase
10. Failure of rope, fall arrester, Aluminum ladder, electrical cable.
11. Failure of channel, platform due to overloading
12. Failure of “Confine entry and rescue system”.
13. Jamming of ceramic burner air passage.

**Physical**

1. Temperature.
2. Dust.
3. Back Pain due to sudden or heavy load like ceramic burner blocks.
4. BF Gas inhalation
5. Dust Inhalation
6. Suffocation
7. Burn injury from hot surface / Temperature of Partition wall.
8. Heat
9. Hot Blast leakage from HBV
10. Deficiency of oxygen level.

**Electrical**

* 1. Electrical shock from Cable.
  2. Improper lighting

**Behavioral Hazard:**

1. Workmen under influence of alcohol
2. Violation of procedure
3. Not wearing PPE’s
4. Not concentrating while operating rope, fall arrester, rescue system etc.
5. Human Behavior – Fear of confined spaces

For this activity the following extra valves need to be removed than checker cleaning.

Environmental aspect

1. Use of compressed air
2. Dust generation

**Procedure:**

**This is confined space activity please refer SP 44Y for requirement and detailed guidelines for working.**

**Please follow the following procedure**

Confined Space Checks before job start up:

1. Before Entering in Confined Space ensure –
2. Inside temperature should be less than 40°C.
3. CO Level should be 0 ppm and O2 level must be 19.5% to 23.5%
4. Attendant must ensure proper illumination, if illumination not found ok, he must inform concern electrical person to provide hand lamp or halogen.
5. Take the work permit from production-in-charge, Safety, electrical, mechanical for entering Confined Space.
6. The workmen (Entrant) who is trained and certified by SBU Head and having valid confined space gate pass should perform the activity and he can be replaced (in emergency) only by certified entrant.
7. A standby (attendant) who is trained and certified by SBU Head and having valid confined space gate pass should perform the activity and he can be replaced (in emergency) only by certified attendant.
8. Standby person who shall be positioned outside the confined space, must have no other duties other than monitoring people and conditions inside the confined space and coordinating with rescue personnel (he must have contact number of rescue team members) if required.
9. Standby (Attendant) person has to log down the In/Out entry of all entrants and ensure that entrant should be come out after 30 minutes from confined space for normal jobs.
10. In some cases, In/Out time may be relaxed /extended based on the risk involved in the particular confined space.
11. Check Internal atmosphere of the space for sufficient oxygen content (19.5% to 23.5 %) flammable gases and vapors, and the potential for toxic air contaminants by the use of multi gas detector, if required use pump with extension before entering. If there is any deviation, do not enter into confined space.
12. Check for the presence of Chemical asphyxiates such as Carbon monoxide (CO gas detector). It should be 0 PPM
13. Check inside temperature and it should be in the tolerable range (25°C to 40°C). If the temperature is not within limits, then appropriate ventilation to be used to normalize the temp.
14. Check for suitability of equipment that is used at the confined space.
15. Check any dust due to which visibility is reduced or respiratory tract is irritated.
16. The sign-in and sign-out of all persons entering into confined Space should be recorded.
17. Use 24V DC supply illumination to avoid electrocution/electric shock.
18. Cutting or welding jobs inside the confined space should be carried out after checking for any explosive environment (LEL should be <10%) and by providing localized suction or heavy-duty exhaust systems to prevent accumulation of gases inside the space.

**Activity No 1:  Reaching on Ceramic Burner Hot Blast Main**

* 1. Before starting of job, Stove combustion chamber’s temperature should be less than 35°C and CO gas free. For cooling the stove, **VL/IMS/PID I/PROD/WI/97** shall be followed. For working at ceramic burner, the ID fan provided at gas main after removing the Gas line valve and shall be kept running.
  2. For measuring temperature at combustion chamber, one thermocouple shall be put inside from peephole flange. The thermocouple tip should touch the partition wall.
  3. All top bricks lining combustion chamber wall and stove wall shall be checked for stability. If all found ok, then only burner work is to be started.
  4. Two no’s hand lamp,24V shall be lowered inside for illuminating the combustion chamber through steel grating and physical checking of combustion chamber wall shall be done by using binocular. If all found ok, then only burner work is to be started.
  5. Ventilation required to be for combustion chamber shall be provided with compressed air line / fan
  6. Electrician will be positioned at stove bottom to ensure uninterrupted running of the suction fan. Responsibility: Electrical Engineer.
  7. Hot Blast expansion bellow shall be removed after taking furnace shut down. For removing expansion below follow WI / MAINT/107. Responsible: Mech. Engineer.
  8. After removing Expansion bellow, temperature of that area shall be checked. It should be below 35°C for work. Responsible: Prod. Engineer.
  9. The transition piece between combustion air regulating valve and combustion air shut off valve to be removed and blanked on combustion air regulating valve side.
  10. Opening of the Hot Blast main towards furnace shall be closed with brickwork and dummy flange. Two dense working layers with two back up insulating layer shall be provided for closing. Above the blank asbestos cloth to be covered to avoid contact with hot surface of the blank.
  11. Open the Hot Blast Valve and lock manually (by welding in open condition). Responsible: Mech. Engineer.
  12. Responsible Engineer need to check the condition of the checker brick wall and after combustion wall found from dome as well as combustion chamber wall found ok, then only ceramic burner modification is done.
  13. Two persons wear safety belts, tied their safety belt to secure point for lowering Aluminum ladder from the dome. One Aluminum ladder (4 mts)/ rope ladder is lowered from the combustion chamber with the help of rope, place the legs of ladder securely and close the combustion chamber on top with channels and blanks as per the work instruction WI/MAINT/101 REV 0. Responsible: Prod Engineer.
  14. Inspection of the ladder for its condition shall be done by Mechanical Engineer. Responsible: Mechanical Engineer
  15. Before entering into the combustion chamber, water as well as ORS sachets are arranged at the site. Responsible: Prod Engineer.
  16. If the combustion chamber wall condition is found ok one trained person will get down and check temperature and CO gas, oxygen level (oxygen level should be 19.5% to 23.5%) level there with the help of “Confine space entry and rescue system”/Aluminum. He will carry a walky-talky, CO gas monitor, O2 Monitor and Raytek gun. He will also check combustion wall condition for damage. If the atmosphere, wall condition and place are workable, he will reach to the top of burner. The person standing at Hot Blast Valve platform, the person in the combustion chamber and outside gas main will also have walky-talky for communication all the time. Responsible: Production Engineer.
  17. Condition with stopping ID fan at grating inspection also checked. Time is noted without ID fan. If this time is enough to escape the person to come out of the stove, then work will be preceded further. (The temperature raise from 35oC to 45oC is noted, this time should not be less than 10 minutes).
  18. Aluminum ladder to be secured properly. Only confined space trained persons to carry out burner cleaning activity.
  19. Ensure no other work is being carried out when inspection, cleaning is in progress.
  20. Burner valve ports for combustion air entry to be cleaned with the help of compressed air.
  21. Physical monitoring for any damage, cracks or any choke up for burner to be done, if minor damages then can be repaired in house. In case of major damages, burner can be replaced.

**Activity No 2 (If required): Removing top part of Ceramic Burner from its original position, taken out from Stove and Replace with New.**

1. Only two persons are allowed to work inside the combustion chamber for replacement of the burner tiles. The persons are allowed to work 30 minutes and another team of two members need to be send into the combustion chamber to execute the job.
2. Ensure air passage opening of the ceramic burner is not blocked fully so to have effective ventilation.
3. For conveniently standing on the ceramic burner, wooden planks are covered on the ceramic burner. For dismantling the ceramic burner only half of the wooden planks are opened.
4. The person standing inside will open the wooden blank partially and take the rod and hammer to break one CB 13 blocks near to the gas main. First one-piece CB 13 will be loosen/break by rod without disturbing CB 14 blocks.
5. The removed CB 13 bricks shall be lowered with the help of rope through the gas main. For this process better coordination is to be done in between the people inside the combustion chamber and the people at gas main outside the stove.
6. Before placing New CB 13 bricks, clean the combustion air main in the ceramic burner with lancing pipe. (No compressed air shall be used for cleaning)
7. New CB 13 bricks are also shifted through gas main with the help of jumbo lime bag. Placement of CB13 bricks Refer the Drawing No: 2040-01647 B Sheets 1 of 2. This should be placed later to accommodate the swirl.
8. Remove 4 blocks of old CB 13 blocks and replace with 2 new CB 13 blocks.
9. Repeat this procedure this procedure till 6 nos of blocks are placed.
10. Place the wooden plank above the newly lined CB 13 blocks.
11. Shift all the CB 13 blocks into the stove and place above said wooden planks securely.
12. Shift Swiryl through gas main into stove and insert swirl.
13. Complete the burner lining with rest of CB 13 blocks which are placed above wooden planks.
14. In case, CB 14 need to repaired/replaced, whole layer of CB 13, CB 14 will be taken out by taking one by one and place new CB 13 first and then lining of CB14 need to be done.
15. Care has to be taken to avoid falling of material in the combustion air passage of ceramic burner.
16. Any broken parts inside airline will be cleared from air main opening**.**

Monitoring & Supervising:

a.      One Engineer shall be monitoring the persons working inside continuously from the Hot Blast main.

b.      The Engineer is responsible for ensuring all the safety measures are properly available and necessary emergency services.

c.       Two hand lamps are provided for working inside combustion chamber.

d.      One torch light is to be available at the site during this operation.

e.       CO monitor, Oxygen analyzer is to be provided outside the combustion chamber and inside the combustion chamber.

f.       Drinking water shall be provided at site always.

g.      ORS sachets are made available during the combustion chamber work.

Drawing of RF BRICK, CERAMIC BURNER,CB 13



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| **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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