**Guidelines for OPERATING BLAST FURNACES IN NORMAL CONDITIONS**

1. **PURPOSE:** To normalize furnace operation from abnormalities.
2. **SCOPE:** To produced desired grade production**,** maximizing furnace productivity
3. **RESPONSIBILITY:** **EMPLOYEES WORKING IN THE BLAST FURNACE OPERATION**
4. **PERFORMANCE INDICATORS:**

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| --- | --- | --- | --- | --- | --- |
| **Sr. No.** | **Measure** | **Unit** | **Frequency** | **Acceptance Criteria** | **Responsibility** |
| **Quality** | | | | | |
| 1 | Hot blast temperature | °C | Continuous | 1000 | Control room engineer |
| 2 | Hot blast Pressure | KG/CM2 | Continuous | 1.4 | Control room engineer |
| 3 | Top Gas Pressure | KG/CM2 | Continuous | 0.37 | Control room engineer |
| 4 | Blast volume | NM3/HR | Continuous | 31,000 | Control room engineer |
| **Safety** | | | | | |
| 1 | Top Gas Pressure | KG/CM2 | Continuous | 0.42 | Control room engineer |

1. **PROCEDURE:**

**Identified Hazards:**

### Fire & explosion

1. Electric shock
2. Contact with hot water
3. Gas poisoning
4. Coke spillage and hitting a person
5. Noise generation

**Significant Aspect:**

### 1. Fire & Explosion

Blast furnace operation is more of an art and needs judgement of experience personnel for proper control of the operation. However, following are given as guidelines for normal operation.

Unauthorized operation or repair of any equipment is a punishable offence

1. Control room engineer should maintain maximum available W. V. with 4 blowers, in allowable current limit and cold blast pressure limit of 1.42kg/cm2, unless instructed by the Shift Supdt. Depending upon the furnace conditions.
2. Unless instructions by the Shift Supdt, maximum available blast temperature to be maintained from 950°C to 1050°C depending upon the furnace conditions.
3. Top gas pressure to be maintained in between 0.33 to 0.38 Kg/ cm2. by keeping the differential pressure of 2400 mm WC across both venturies. (Dpi = 800 & dp2 - 1600 mmWC).
4. Top gas temperature not to exceed 225°C. if so, open top spray water till it comes down to the normal temperature. Total water through top spray to be logged down on log sheet.
5. When OCS trip alarm comes then immediately control room engineer should inform mechanical & electrical shift engineer.
6. When B phase, R phase & Y phase high alarm comes inform electrical engineer.
7. When the cold blast pressure increases above 1.45kg/cm2 surge valve will open.
8. When surge valve opens, gradually reduce wind vol. by closing IVC and maintain cold blast pressure below 1.4kg/cm2
9. Raw material bunkers to be filled shift wise and keep minimum half bunker always full.
10. Batching to be maintained as per the log sheet specifications and charging time to be recorded in dumping register.
11. If there is a problem in coke bunker filling or batching, first contact to 27 Mts. level (raw material) on PA or by walky talkie regarding the problem.
12. If zero speed alarm comes immediately inform 27mts incharge and if he asks to reset the alarm, then reset it once.
13. If the problem persists then inform service dept.
14. If there is a burden change, change the burden when batching is completed and the particular weighing bin should hold batch ready tag.
15. Dumping level is to be maintained as per log sheet instruction/ SS instruction.
16. If any VC batching is slow then inform 27 Mtr engineer immediately to clean VC before furnace goes off rod.
17. Any abnormalities to be informed to the respective service depts. and log down.
18. All checklist registers to be filled in each shift by concerned engineers.
19. Hot metal temperature to be maintained more than 1450°C.
20. Chemical analysis of hot metal to be maintained as specified in furnace log sheet.
21. Tapping to be opened within 1 hr 10 minutes after closing previous dry cast.
22. In case cast is not dry next tapping to be opened within 45 minutes and dry it.
23. Granulate all slag & inspect the slag spout and granulation pit screens for proper granulation.
24. If there is any problem in power supply or shortage of the electricity or water, take slag in emergency launder.
25. Dust catcher to be opened & blown once in every first and second shift and after startup of the furnace.
26. Saturator drip pot to be flushed at least three times in a shift.
27. Taphole water jacket to be flushed at least once in a shift.
28. Slag sample to be taken from main runner during casting and sent to laboratory with identification slip for analysis.
29. Hot metal sample to be taken from PCM runner while pouring and send to laboratory with identification slip for chemical analysis.
30. Proper shell cooling to be ensured. Maintain the cooling tower water header pressure at 3.29 Kg/cm2
31. Gas monitoring being done online gas samples sent to lab in case of special activities like Gunning, Blow down.
32. Iron ore, fluxes and coke samples to be sent to laboratory for moisture analysis.
33. All analysis to be recorded in log sheet.
34. Maintain overhead and GCS water tank level.
35. Ensure proper slurry discharge from thickner.
36. Proper functioning of gas cleaning system to be checked
37. Any online CO monitor installed near drip pots shows high reading in control room, the control room engineer should cross check with the area in charge or engineer responsible to check if any drip pot has given way.
38. The Pig Iron to be shifted, cast wise with identification slip to dispatch yard and put cast number tag.
39. Shift all slag, cast house, ladle debris, flue dust & coke fines shift wise to the respective areas.
40. Before taking shutdown or temporary stoppage of charging for some reasons, switchover the auto stock rod operation to manual mode to avoid unwanted dumping which may cause explosion on furnace top.
41. Nobody should adjust the stock rod wire rope or pulley without disconnecting it from the cylinder, also while putting the rope in to the pulley, hook or some tool has to be used.
42. Ensure proper pressure of the MO2 cylinder by checking once in each shift and arrange to replace the cylinder immediately if the pressure drops below 20 kg /cm2.
43. Ensure one key is always attached to the cylinder.
44. Ensure that the mask is in good working condition.
45. Ensure proper use of safety appliance and safe working conditions.
46. Use safety appliances viz. Safety helmets, safety shoes, hand gloves, safety goggles & ear plugs in the noise prone area.
47. Do not cross over metal or slag runner during casting.
48. While cleaning the Runner ensure that grating is placed across the runner for crossing over and the same has to be removed after cleaning. In non-drainable runner practice, do not cross the main runner or metal runner with or without grating also.
49. Ensure rod barrication at both side of non-drainable runner after cast house is ready.
50. The equipment namely drill machine, mudgun and ladle crane should be operated by the trained operators only.
51. Stay out of the swing area of the drilling machine and mudgun during opening and closing of the cast.
52. Before opening casting, metal and slag runners should be kept ready properly cleaned and the working area should be kept neat and clean.
53. Before opening the cast, check the taphole center and take the mudgun trial. Also ensure that the empty ladle is placed in position below metal spout.
54. During casting, take the temperature of hot metal in siphon pit after diverting the slag from the main runner and take the slag sample. Record online temperature once slag is diverted.
55. Take the hot metal sample from PCM runner when the ladle becomes half empty while pouring in pig casting machine.
56. The mudgun operator should immediately send the metal & slag samples to laboratory along with their identification slips.
57. Take care while moving near ladle in crane bay when metal pouring is in progress.
58. Going to the furnace top when furnace is in operation is strictly prohibited, and the shift-in charge should ensure that the furnace top entrance gates on either side of CB-5 walkway are locked before start-up of the furnace. Also do not go to the bustle platform while furnace in operation in case of emergency use gas mask / gas detector.
59. Monitor all the furnace refractory, cooling members’ outlet temperatures at regular intervals and note down all the readings on register. Monitor runner temperature also, ensure runner cooling working all the time.
60. Fill the shutdown checklist and fulfill all safety points before handing over the furnace to service department. ( Electrical & Mechanical)
61. Fill the start-up checklist and fulfill all safety points before start-up of the furnace.
62. Do not take rest near gas prone areas such as gas cleaning plant, HBS area & below the cast house etc.
63. It is strictly forbidden to hand over the key belonging to Blast Furnace Bosh area, Gas Cleaning System, Furnace Top, Gas Holder, Hearth Bottom Region ( Kitchen Floor) and similar gas prone areas to anyone other than the concerned Company Official, who has taken the Work Permit from the concerned area in charge.
64. Handle all the equipment and materials carefully & safely to avoid accidents
65. Inform any abnormal rise in hearth / taphole temperature immediately to the HOD Production & development/Manager Production and Plant Head and take shutdown of the furnace if the taphole / hearth temperature rises to 9000C in BF1, BF 2 and wait for further instruction.
66. Close all the manholes properly if they are opened for cleaning or inspection.
67. While cleaning the manhole the surrounding area has to be barricaded and the same has to be
68. Supervised by a responsible person.
69. Work permit has to be made and proper shutdown of the equipment has to be taken before
70. Carrying out any maintenance or cleaning job.
71. HBS drain valves are closed with Dummy. To be drained/cleaned in planned shutdown only.
72. Change the rotary hopper direction on every Monday and Thursday.
73. Return water sump pit drain valve should be kept closed after draining.
74. Do not remove any material from the conveyor when it is running.
75. Barricade should be provided in the cast house debris area, metal and slag runner spouts while cleaning metal & slag runner spouts to avoid personnel falling down.
76. Metal spout jobs should be carried out after removing the ladle from underneath, personnel involved in spout job should wear safety belts.
77. Any of the inspection chambers are to be cleaned only in general shift.
78. Return water sump to be drained once in a shift.
79. All the personnel moving around the dust prone area should wear dust mask.
80. All personnel working in the hot metal handling area should wear cotton socks.
81. No personnel should stand on the runner platform without grating support.
82. As a line supervisor all engineers and officers should inspect all the working area for safety hazards and report the same to the shift superintendent or get it rectified with the help of proper agency before starting normal activities.
83. Discuss /explain the safety hazards of the area to the subordinates before starting the jobs.
84. Enough care to be taken while climbing up / down on stair cases.
85. Nobody should go to the restricted area alone (e.g.: ODS pit, Slag granulation settling ponds & bosh platform etc.)
86. Ensure proper functioning of the equalization valves and should be cleaned properly in every planned shutdown.
87. If any gas leakage is observed during normal operation, furnace shutdown should be taken to rectify the leakages.
88. Ensure that the leakage from the stock rod is minimum by checking it during every planned / un-planned shutdown.
89. No personnel are allowed to work more than 16.00 Hrs. in a day.
90. Do not reset the zero speed more than 2 times. Call concerned person and get it rectified.
91. GPH cleaning to be taken up during plant shutdown or in special cases if DP continuously remaining > 300mmwc.

Log sheet maintenance & other activities.

Procedure:

1. Control room engineer should record all parameters hourly in furnace log sheet.
2. He should record all LAB analysis in log sheet timely.
3. In the beginning of the shift, see that all record of tuyeres, sleeves, blower status, dumping level, grade requirement parameters, coke gates are mentioned in the log sheet.
4. He should ensure proper batching of all raw material without any error.
5. He should cross check batching record of previous shift and his shift also ( he should check on hard copy of batch report, sign and take counter signature of the furnace in charge/SS
6. Whenever set point of the batching changed, print out is to be taken, cross checked and counter sign of furnace in charge/SS need to be taken.
7. Any burden corrections in excel sheet is to be counter checked with online log sheet burden. He has to ensure both should be matched.
8. He should ensure all keys, walky talkies, CO monitors & other equipments are available in the C/R at the beginning of the shift and record the same in the checklist.
9. If there is failure of any equipment, immediately inform service dept.
10. All registers & equipment checklist should be kept on identified place to follow 5S instructions.
11. He should record work permit issued on the board.
12. He should closely monitor hot metal, slag analysis. If CO goes up more than 24% inform furnace in charge/SS to take action. Also keep a watch on wind vol. If it increases by itself as it is a first sign of furnace going on colder side.
13. Interlock bypass register and work permit register to be maintained.
14. **REFERENCES:**
15. **RECORDS:**

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| **Sr. No.** | **Record No.** | **Record Title** | **Maintained by** | **Soft/Hard form** | **Retention Time** |
| 1. | Log sheets | BF Log sheet | CRE | Hard | 3 years |
| 2. |  |  |  |  |  |
| 3. |  |  |  |  |  |
| 4. |  |  |  |  |  |
| 5. |  |  |  |  |  |
| 6. |  |  |  |  |  |

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