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CONTROL OF PRODUCTION

1.0. PURPOSE:

1.1 To describe planning activities for

- a) Raw material planning
- b) Process planning
- c) Maintenance of equipment of blast furnaces

1.2 To specify methods to be followed to achieve controlled conditions required for the following

- a) Raw material feeding
- b) Blast furnace operation
- c) Pig casting
- d) Slag processing
- e) Sampling and analysis of hot metal and slag.
- f) Carrying out preventive and routine maintenance.

1.3 To describe precautions to be observed and actions to be taken for maintaining suitable working environment and for compliance with statutory requirements in the following key areas :


- a) Safety
- b) Environmental control
- c) House keeping

1.0 SCOPE: Applicable to production of pig iron in blast furnace and planning activities required for **this**.

2.0 RESPONSIBILITY:

3.1 PLANNING

- a) Raw material planning - HOD (Production)
- b) Process planning - HOD (Production)
- d) Shut down planning - HOD (Production)

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3.2 OPERATION AND PROCESS CONTROL

- a) Raw material Feeding - HOD (Production)
- b) Blast furnace operation - HOD (Production)
- c) Pig casting - Incharge , HMH area
- d) Slag processing
- e) Sampling and obtaining analysis of HOD (Production)
hot metal and slag.

3.0 PERFORMANCE INDICATORS:

Sr. No.	Measure	Unit	Frequency	Acceptance Criteria	Responsibility
Quality					
1	Hot blast temperature	Deg 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					
	Top Gas Pressure	KG/C M2	Continuous	0.42	Control room engineer

- Hot blast temperature
- (v) Top Gas Temperature
- (ii) Blast volume
- (vi) Hot metal temperature
- (iii) Blast pressure
- (vii) Slag rate
- (iv) Top Gas Pressure

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4.0 PROCEDURES

4.1 PLANNING

4.1.1 Planning of Raw Material

4.1.1.1 Unauthorized operation or repair of any equipment is a punishable offence

Based on Annual Hot Metal Production Plan and the production targets for the financial year, Manager (Production) shall prepare a raw material requirement statement detailing the requirement of various raw materials on a monthly basis. This is based on the theoretical requirement and allowances.


4.1.1.2 HOD (Production) prepares and GM (PID) releases specifications of all raw materials for the above purpose

4.1.1.3 HOD (Prod) is to communicate with HOD (logistics) to organize the following.

- a)
Iron Ore including Siliceous Ore
Thro' Vedanta
Monthly Basis (daily deliveries)
- b)
Manganese Ore
Direct Purchase
Monthly basis (daily/ weekly deliveries)
- c)
Dolomite
Direct Purchase or Import
Daily delivery
- d)
Coke
Thro' MCD or import
Daily (MCD) or Bulk
- e)
Limestone
Direct Purchase or Import
Daily delivery.
- f)
Quartzite
Direct Purchase
Daily delivery.

4.1.2 Process Planning

The processing parameters for manufacture of pig iron are explained through a Work Instruction "Guidelines of Blast Furnace operation under normal conditions and flow sheet" .

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4.1.3 Shutdown of Blast furnace for Preventive maintenance.

4.1.3.1 Preventive Maintenance of equipment of blast furnaces is carried out every month. The schedule is subject to change on the basis of condition of equipment.

4.1.3.2 Work Instructions on shutdown and startup of Blast Furnaces (WI/Prod/06),

Furnace 1 and 2 respectively are made available at the Furnace control rooms.

4.1.3.3 The activities for the planned shutdown are listed out on the basis of condition of equipment, schedule of maintenance and check list.

The list of activities are prepared by section head mechanical & electrical which is approved by HOD-(Production) The date of shutdown shall be confirmed based on the condition of furnace. The status on completion of planned activities shall be indicated by the concerned department on the same list.

4.2 OPERATIONS AND PROCESS CONTROL

4.2.1 Raw Material Feeding

4.2.1.1 Raw material is checked daily for moisture and for other constituent parameters whenever required by Production dept to facilitate process control. The request for moisture determination is sent from Prod. Dept to Lab through a format (FRMT/Prod/04). The request for other constituents also is sent from Production . Department to Lab through the format (FRMT/Prod/04) Moisture is recorded in the respective furnace logsheet FRMT/Prod/01

4.2.1.2 Shift Superintendent is authorised to decide the burden to be fed into the BF based on the following:

a) Analysis of various raw materials available at the yard.

b) Requirement of slag basicity depending on the required product quality


4.2.1.3 The burden changes are recorded in the furnace log sheet

4.2.1.4 This burden calculation is utilized to programme the PLC for the raw material feeding system. For counter checking the burden change, a print out of the burden is taken with the help of PLC whenever there is a burden change.

4.2.1.5 Feed bunkers are used for iron ore and siliceous ore; similarly bunkers are used for limestone, dolomite, manganese ore, quartzite & scrap. All the iron ore and coke are screened before weighing.

4.2.1.6 Alternate charges of coke and iron ore along with additives are transported to the furnace top charging system through the PLC controlled batching system.

4.2.1.7 Raw material Sample are to be collected shift wise and sent to the laboratory for moisture analysis and the results are to be recorded in the logsheet.

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- a) Iron ore sample once in every shift
- b) Coke twice in every shift
- c) Fluxes once in a day (every first shift)

4.2.2 Blast furnace operations

4.2.2.1 Blast furnace charging and manufacture of hot metal are controlled from furnace control room.

4.2.2.2 The actual time of charging is determined through the dump level indication available in the Furnace control room.

4.2.2.3 The following process parameters/product characteristics are monitored during blast furnace process.

a) Process Parameters


- Blast Volume
- Blast temperature
- Hot metal temperature
- Slag rate
- Slag basicity
- Coke rate
- Top gas parameters

b) Product characteristics

- Hot metal analysis (C,S,Si,Mn,P)
- Slag analysis
(CaO,SiO₂,MgO,Al₂O₃,Na₂O,K₂O,TiO₂,MnO, FeO,S)

4.2.2.4 The following process parameters are controlled during blast furnace process to achieve the desired quality of hot metal.

- Burden composition
- Blast temperature
- Blast volume

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- Top gas pressure

Above parameters to be maintained within specified limits.

Control limits for the following are provided to the control room engineer on the daily log sheets.

- a. Hot metal Silicon
- b. Hot metal manganese(if required)
- c. Hot metal sulphur
- d. Slag basicity
- e. Burden composition

4.2.2.5 Log sheets (operations report of Blast furnace FRMT/Prod/01) are maintained for the following process parameters in the furnace control room separately for Blast furnace 1 and Blast furnace 2

- a) Charges (per hour and cumulative)
 - b) Blast parameter (Volume, Temperature, Pressure, and Humidity).
- c) Hot metal temperature
- d) Top gas parameters (pressure, temperature, stack temperature and BF Gas analysis
- e) Cast details
- f) Hot metal analysis (carbon, sulphur, silicon, Manganese, Phosphorous)
 - g) Slag analysis (CaO,SiO₂,MgO,Al₂O₃,Na₂O,K₂O,TiO₂,MnO, FeO,S)
- h) Burden composition.
- i) Breakdown details.

4.2.2.6 The process and product parameters scheduled for each day are notified in the furnace log sheet by shift in charge of 1st shift every day.


4.2.2.7 Blast furnace gas is analyzed online via Online Gas analyzer.

4.2.2.8 Completed log sheets are maintained as records

4.2.2.9 The tapping of hot metal and slag is done periodically at an average of 12 per day.

4.2.3 Pig Casting

4.2.3.1 Hot metal is taken into ladle through the runner and then poured into the pig casting machine.

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4.2.3.2 Pouring of hot metal is controlled so that production of undersized pig iron (ie. approximately below 3 KGs) as well as splashing of metal outside the pig mould is controlled. While pouring, consideration is given to safety aspects also.

4.2.3.3 The pigs formed are cooled and discharged on the ground.

4.2.3.4 The cooled pigs are loaded by Magnetic crane /wheel loader into trucks, weighed and dumped on to a separate heap in the dispatch yard, cast wise. With each trip a pig dispatch note (FRMT/Prod/02) is sent to Dispatch Section.

4.2.3.5 Criteria for workmanship

a) Pigs have to be at least 3 kgs in weight and should have a shape as in the pig mould.

b) Ladle crane operators are trained on the correct rate of pouring so as to result in the yield of a high percentage of saleable pigs.

4.2.4 Slag Processing

4.2.4.1 The hot slag is granulated directly as it comes out of the BF using a jet of high-pressure water.

4.2.4.2 The granulated slag is loaded by Grab bucket/wheel loader into truck and shifted to slag dryer area.

4.2.5 Sampling and Analysis of hot metal and slag

4.2.5.1 Samples of hot metal and slag are drawn in test moulds during tapping operation and sent to Lab alongwith request for analysis through Pneumatic sample transport system (FRMT/Prod/03)

4.2.5.2 For the purpose of customer, ladle sample is collected and analysis is reported from ladle sample. Some times, sample is taken from runner during tapping for process control.

4.2.5.3 Test pieces of hot metal and slag are analyzed by lab chemist, and informed to respective Control room Engineer for entering in the log sheet.

4.2.5.4 The result of the above analysis are utilized to make modifications, if required, in the blast furnace feed (burden).


4.2.6 Management information on process control.

a) Cumulative monthly data on hot metal production, slag production per ton of hot metal and consumption of raw materials per ton of hot metal are computed and reported to Management by HOD (Production).

b) Average monthly figures of the following parameters are also computed and reported to Management by HOD (Production):

(i) Hot blast temperature

(v) Top Gas Temperature

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|-----------------------|----------------------------|
| (ii) Blast volume | (vi) Hot metal temperature |
| (iii) Blast pressure | (vii) Slag rate |
| (iv) Top Gas Pressure | (viii) Coke rate |

REFERENCES: QEHS systems Procedure

- Control of Records

SP/02

4.0 RECORDS:

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.					

Prepared By: Head – Production PID I	Reviewed & Issued By: Management Representative	Approved By: Head – Pig Iron Division
Signature:	Signature:	Signature:
Date: 12.07.2021	Date: 12.07.2021	Date: 12.07.2021