REDUCING HOT SAW RELATED DELAYS (168 MINUTES TO 0 MINUTE)

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ABSTRACT: The process of deforming the bloom into different shape and size based on the customer requirement. These deformation process done in blooming mill. The blooms attain final stage by passing various sections, such as blast furnace, reversible mill, continuous mill, hotsaw etc. We took case study in each section. Based on this study, we finalized highest delay occur in hotsaw. So, we took several measures to prevent delays in hotsaw with best of our knowledge and company guidance.

Keywords: Blooming Mill, Machine & Manufacturing

1. INTRODUCTION:

The JSW groups foray into steel manufacturing began in 1982, when it set up the JINDAL iron and steel company with its first steel plant at Mumbai. JSW Steels is India’s second largest integrated private steel manufacturing company in corporate India. It has been ranked ninth among the top thirty world class steel makers. JSW steel ltd believes in creating sustainable growth while balancing utilization of natural resources and social development in its business decisions. JSW is committed to promote integrated responsible behavior and value for social and environmental well being. JSW commitment to do business responsibly is built into the core values of the company to conduct every aspect of business responsibly and sustainably. It relies on a dynamic leadership and it practices that seek to sustain and enhance the long term competitive advantage of JSW with care for the society and environment. Where the unique feature company product in round size are Ø 65-20 in RCS the size are 65 high precision rolling reducing and sizing block in bar and rod mill and DSIR approved R&D centre with sophisticated modern equipments. It provides a wide range of sizes and grades all under one roof. It also has a phased array technology that detects internal defects. More than 70% of capacitive power generation is done through waste heat. One of the few plants to use energy optimization furnace for special steel production.
2. LAYOUT OF STEEL MANUFACTURING

The industrial production of coke from coal is called coking. The coal is baked in an airless kiln, a coke furnace or coking oven, at temperatures as high as 2,000 °C (3,600 °F) but usually around 1,000–1,100 °C (1,800–2,000 °F). The non-volatile residue of the decomposition is mostly carbon, in the form of a hard somewhat glassy solid that cements together the original coal particles and minerals. Bituminous coal must meet a set of criteria for use as coking coal, determined by particular coal assay techniques.

Steels grade I (Ash content not exceeding 15%).
Steels Grade II (Exceeding 15% but not exceeding 18%).
Washery Grade I (Exceeding 18% but not exceeding 21%).
Washery Grade II (Exceeding 21% but not exceeding 24%).
Washery Grade III (Exceeding 24% but not exceeding 28%).
Washery Grade IV (Exceeding 28% but not exceeding 35%).

STEEL MELTING: Steel melting is an oxidation process with the exception of reducing conditions being specifically required to eliminate sulphur. It involves selective oxidation of impurities like C, Si, Mn, P etc., from pig iron.

SMS: It consists of basic oxygen furnace (BOF) shop complex and continuous slab costing shop complex. The steel makings are provided by blast furnace.

EOF (ENERGY OPTIMIZING FURNANCE): It is a primary steel making furnace. This process was developed by the mini steel works. This process is presently being operated in India at JSW Siscol plant of Mulcand.
**LRF (LADLE REFINING FURNACE):** It is used to raise the temp and adjust the chemical composition of molten metal. Without LRF higher top temperature are normally required from steel making furnace due to heat losses during refining with conventional ladles.

**CCM (CONTINUOUS CASTING MACHINE):** It is also known as strand casting, is the process where a metal is heated until it liquefies. The motion metal is then allowed to solidify until it becomes a semi-finished slab that is later rolled in the finishing mill.

**ROLLING MILL:** It is a metal forming process. Metal stock is passed through one or more pairs of rolls reduce the thickness.

**3. STUDY OF BLOOMING MILL:** A high-capacity rolling mill for the reduction, into blooms, of steel ingots of large cross section, with masses up to 12 tons and larger. In metallurgical plants the blooming mill is an intermediate link between the steel casting shops and the rolling shops, which turn out the finished product.
3.1 LAYOUT OF BLOOMING MILL

3.2 FURNACE

The blooms are charged by means of Paul beam mechanism into the furnace. This mechanism lifts the beam, moves the beam forward and returns to its initial position. This beam mechanism carries and places the bloom into the furnace. The door opening and closing is done using a hydraulic mechanism manually or automatically using a Hot Metal Detector (HMD). The blooms undergo the process of soaking inside the furnace which is heated using oxygen and fuel pipes at temperatures of 800, 1000 or 1200°C. Inside the furnace, there are eight beams actuated by the walking beam mechanism. It is a work piece transfer mechanism having a walking beam carried by a slide mounted for reciprocal movement on a bed or table.
3.3 DESCALER

Descaling is the process of removing oxide deposits from a heated stock, either before or during forging operations. Scales are formed on a metal surface during heat treatment processes. The bloom is conveyed through a header unit consisting of water jets which supply highly pressurized water at about 250 bars. For this purpose, an accumulator is used rather than a pump.

3.4 REVERSIBLE MILL

This is where the blooms cross section is reduced to the required dimension. It consists of a 3.5MW motor coupled to a gear train which is coupled to a roller having several passes which have gradual reduction in size. There are two units which control the bloom manipulators and fingers. There are 12 entry and 8 exit rollers. The 6 manipulators guide the bloom into different passes. The fingers tilt the bloom 90°. The entire operation is controlled manually from a Pull pit.

3.5 CONTINUOUS MILL

If the stock has to be further reduced to a circular cross section and upto 110mm diameter, it is proceeded to the continuous mill. This mill has eight stands named ST2, ST3, ST9. Arbitrarily the first stand is named ST1 which is the reversing mill. The horizontal mills are odd numbered stands and the vertical mills are even numbered stands. The rotational speed of each stand gradually increases so as to pull the stock out with the required diameter.

3.6 BAR TRANSFER ROLLER TABLE (BTRT)

BTRT serves as a time intermediary between rolling out the stock and cutting the stock. In other words, this avoids what is called as choke. The BTRT consists a total of 108 rollers, 54 of which aligned with the Hot Saw cutting axis and the remaining 54 are aligned with the continuous mills axis. The lifting and lowering of the train is done by hydraulic mechanism and the horizontal motion for transferring the stock from the continuous mills axis to the hot saw axis is done by a chain drive which is powered by motor. The BTRT transfers two stocks at once to the hot saw axis.

3.7 HOT SAW

Hot saw means cutting the hot bloom for required shape and size to the customer.

HOT CIRCULAR SAW BLADE

Hot saw blade is a cutting instrument which cuts the stock to the required length of the customer. Here Blecher hot saws are used. They run at 1355 rpm powered by 355 kW motor. In the cutting region there are three hot saw blades namely 2, 3, 3a. Of these 3a is movable and 2 and 3 are fixed. COOLING BED: There are two types of cooling used normal air cooling and slow cooling. Normal cooling uses an array of pillars supported on a frame which follow a mechanism similar to walking beam mechanism. Slow cooling takes place in a closed box where a set of stocks are placed in hot condition inside a box.
3.9 BUNDLING MACHINE

Once cooling is done, a set of stocks are bundled by means of a bundling machine and sent to packing. Bundling of bloom is done by using steel ropes.

4 SELECTION OF PROBLEM (GRAPH SHOWING HIGHER DELAYS IN HOT SAW)

DELAY REPORT FOR BLOOMING MILL FOR YEAR (2015-2016)

1. DELAY REPORT FOR BLOOMING MILL FOR YEAR (2016-2017)
2. DELAY REPORT FOR BLOOMING MILL FOR YEAR (2017-2018)

3. DELAY REPORT FOR BLOOMING MILL FOR YEAR (2018-2019)
5. DELAY REPORT FOR BLOOMING MILL FOR YEAR (2019-2020)

6. PROBLEM OCCURS IN HOT SAW

Major problems appear on hot saw

Entry horizontal clamp guide rod came out from square block. Exit rear end linear bearing damage and length variation in cutting due to that. Entry horizontal clamp piston rod thread worn out. Linear bearing bolt sheared. Exit apron plate dislocated.
## WHY WHY ANALYSIS

<table>
<thead>
<tr>
<th>Cause No:</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason for Gap:</td>
<td>Entry horizontal clamp guide rod came out from square block.</td>
</tr>
<tr>
<td>Why 1</td>
<td>Thread of guide rod damage.</td>
</tr>
<tr>
<td>Why 2</td>
<td>Thread of guide rod not fully tight with the front block.</td>
</tr>
<tr>
<td>Why 3</td>
<td></td>
</tr>
<tr>
<td>Why 4</td>
<td></td>
</tr>
<tr>
<td>Why 5</td>
<td></td>
</tr>
<tr>
<td>Root Cause</td>
<td>Thread type of guide rod is not withstanding the load.</td>
</tr>
<tr>
<td>Counter Measure:</td>
<td>Introduction of lock plate arrangement and grip screw in guide rod and front block respectively.</td>
</tr>
</tbody>
</table>

**BEFORE**

![Before Image](image1.png)

**AFTER**

![After Image](image2.png)
<table>
<thead>
<tr>
<th>Cause No:</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason for Gap:</td>
<td>Exit rear end linear bearing damage and length variation in cutting due to that.</td>
</tr>
<tr>
<td>Why 1</td>
<td>Vibration takes place.</td>
</tr>
<tr>
<td>Why 2</td>
<td>Linear bearing inner two bolts are not able to mounting.</td>
</tr>
<tr>
<td>Why 3</td>
<td></td>
</tr>
<tr>
<td>Why 4</td>
<td></td>
</tr>
<tr>
<td>Why 5</td>
<td></td>
</tr>
<tr>
<td>Root Cause</td>
<td>The gap between sub tank and linear bearing is low.</td>
</tr>
<tr>
<td>Counter Measure:</td>
<td>Increase the gap between sub tank and bearing.</td>
</tr>
</tbody>
</table>

**BEFORE**

**AFTER**
### PREVENTIVE MAINTANCE SCHEDULE

<table>
<thead>
<tr>
<th>S.no</th>
<th>Equipment</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1    | Roller                  | Gear Box (Oil level indication-10mm). if <10mm then topup. Check for Oil Seal wear (55*10*100), if >0.5 mm then change the oil seal.  
Hollow shaft wear (55*40*180), if >0.5 mm then replace the shaft.  
Check the plumber block temperature, if > 50 degree then flush the cooling line.  
Check visually if the water in roller trough touches and wets the roller.  
Check the plumber block bolt tightness (M24*80). |
| 2    | Horizontal clamping system | Check for any oil leakage.  
Check the movable block wear, if > 5mm then replace the cylinder.  
Check for the free movement.  
Check the guide rod greasing.  
Check the guide rod mounting. |
| 3    | Vertical clamping system | Not in line.                                                                                                                                 |
| 4    | Tail discharging system | Not in line.  
Ensure the suction valve is open.  
Check for any water leakages from the pump. |
| 5    | Blade cooling system    | Check for vibration and temperature.  
Check for base bolt tightness.  
Lubricate the pump bearing. |
Check for coupling spider conditioning.

Check for ON/OFF valve for any water leakage.

Check for ON/OFF valve arm conditioning.

Check for ON/OFF valve pin wear, if > 1mm then change the pin.

Check oil level and high level air pressure >5bar in FRL

Check the condition of the nozzles and its position.

Check the vibration less than 10mm.

Check the temperature <60deg C.

Check the oil level.

Check the air pressure.

Check the coupling fastner condition.

Check the mounting unit.

Inspect the linear motion bearing condition.

Inspect the rail path any wear using profile, if >1mm rail has to be changed.

Ensure the travel cylinder mounting bolts are intact.

Ensure the pre movement of blade mounting cylinder arrangement.

Check the tightness of lock plate of mounting pins.

Check the mounting condition of the doors.

Gear Box (Oil level indication-10mm). If required topup.

Oil Seal Condition (55*10*100).

Hollow shaft condition (55*40*180), Keyway inspection.

Inspection of plumber block cooling line.
Plumber block greasing.

Check water flow in below roller to touch and wet the roller.

Check the plumber block bolt tightness (M24*80).

Check the gear box bracket bolt tightness (M10*50).

Check the gearbox bolt tightness (M20*50).

Check the rack mounting bolt tightness.

Inspect the measuring gauge cylinder mounting.

Check any oil leakage in cylinder.

Check the buffer unit.

Check the cylinder inlet & outlet oil hose connection.

Inspect the cylinder connecting pin and lock plate condition.

Ensure the measuring gauge stopper condition.

Inspect any water leakage in water tap.

Inspect to cylinder base weld checking.

Check the air pressure.

Check the FRL oil level.

Check the plumber block base bolt.

Check the plumber block cover bolt.

Check the greasing.

Kick off

Check the plumber block greasing.

Check the water flow in below roller to touch and wet the roller.

Check the plumber block bolt tightness (M24*80).

Check the gear box bracket bolt tightness (M10*50).

Check the gearbox bolt tightness (M20*50).

Check the rack mounting bolt tightness.

Inspect the measuring gauge cylinder mounting.

Check any oil leakage in cylinder.

Check the buffer unit.

Check the cylinder inlet & outlet oil hose connection.

Inspect the cylinder connecting pin and lock plate condition.

Ensure the measuring gauge stopper condition.

Inspect any water leakage in water tap.

Inspect to cylinder base weld checking.

Check the air pressure.

Check the FRL oil level.

Check the plumber block base bolt.

Check the plumber block cover bolt.

Check the greasing.

10 CGLS Not in line.
<table>
<thead>
<tr>
<th>Component</th>
<th>Effect on Failure Mode</th>
<th>Severity (S)</th>
<th>Occurrence (O)</th>
<th>Detection (D)</th>
<th>Risk Priority Number (RPN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component 1</td>
<td>High</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>Component 2</td>
<td>Low</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>Component 3</td>
<td>Medium</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>Component 4</td>
<td>High</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>24</td>
</tr>
</tbody>
</table>

**Summary:**
- The highest risk priority number is for Component 4 (RPN = 30).
- The lowest risk priority number is for Component 2 (RPN = 24).
- Components 1 and 3 have similar risk levels, while Component 2 has the lowest risk level.

**Recommendations:**
- Implement preventive maintenance for Component 4 to reduce its risk priority number.
- Monitor Component 2 to ensure its risk priority number remains low.

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**EFMEA**

- Equipment Failure Mode Analysis
- Evaluates potential equipment failures and their effects on the system.

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8. CONCLUSION:

The primary objective of this project training is to give a better solution to the problems and employ it practically. To the extent of our knowledge, we have solved the problems that were given and the solution for these has been successfully implemented and has given better results.