ONLINE HOLLOW BLOOM LUBRICATION SYSTEM BY USING GRAPHITE AS LUBRICANT

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ABSTRACT

In Hot Mill section, lubrication of the mandrel bar and hot bloom is an essential task. This task can be carried out at intense care by hollow bloom lubrication system. It provides the lubricant in between the mandrel and bloom through a nozzle. In our project, we have enhanced an online lubrication system that reduces wastage of lubricant and provides only an adequate amount of lubricant that is required for the system. This setup consumes the lubricant is thoroughly. It reduces the friction in between mandrel and nozzle that prevents the sticker in push bench. This method eventually improves the life expectancy of the mandrel from the earlier lubrication methods. It can provide good internal finish to the bloom, reduce the downtime and reduce the wear on the mandrel surface. Our project is implemented in Hot Mill/ SSTP. We hope that the Hot Mill will get all benefits our project. Our calculations will bring profit to the company and also improve the productivity.

***KEYWORDS**: Mandrel bar, Hollow bloom, Lubricant, Graphite, Valve, Nozzle, Crimping, Friction, Push bench.*

INTRODUCTION

BHEL-SSTP was set up in 1979, with equipment supplied by M/s. DEMAG-MEER of West Germany, the World leader in this field.

SSTP has the manufacturing capacity of 40,000 Tons of tubes per annum in the size range of 21 to 127 mm outer diameter and 2 to 12.5 mm wall Thickness. SSTP is planning a major modernization plan by augmenting new technology to enhance the production capacity to 85000 Tons per annum.

The Three main production centers in SSTP are

1) HOT MILL 2) COLD MILL 3) SFW

In Hot Mill, the primary tube making mill adopts Vertical Piercing and Push Bench process method to manufacture tubes. Tubes thus produced in Hot Mill are further processed in Cold Mill for the following reasons:

- Dimensional Control
- Improvement in physical and mechanical properties
- Better surface finish
- Economic of mass Vs Batch type production.
- In Cold mill, cold (Plug) drawing using a fixed plug is adopted.

Depending on the applications and tolerances, required hot finished or cold finished tubes are used.

SSTP produces quality tubes for boilers and other industries. These tubes have good strength, corrosion resistance and chemical characteristics under adverse operating conditions.

HOTMILL PROCESS FLOW CHART

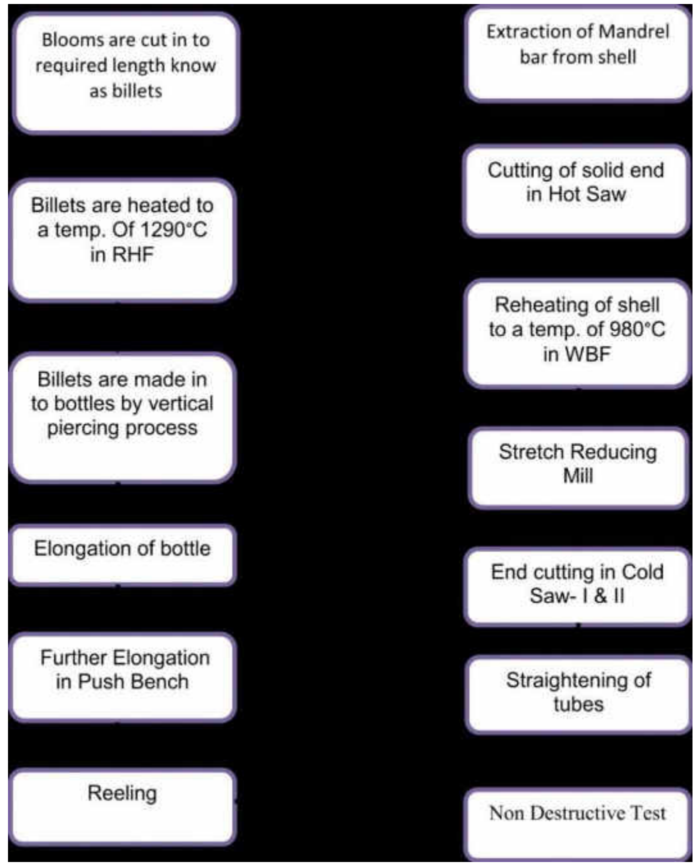

Fig 1: HOTMILL PROCESS FLOW CHART

The raw material, otherwise named as billet is heat from Rotary Hearth Furnace and it is passed to Piercing press which is then elongated through elongator. From elongator mandrel is inserted through bloom and allowed move through push bench for reduction in wall thickness and diameter. Mandrel is removed from the extractor and the crimped end of the bloom is cut by hot saw.

Bloom is reheated again at the walking beam furnace. It is further reduced to required dimensions in the stretch reducing mill.

HOLLOW BLOOM LUBRICATION SYSTEM

Hollow bloom lubrication is an online lubrication system. It delivers the lubricant inside the walls of the hollow bloom. It sprays the lube uniformly throughout the inner walls. It provides adequate amount of lubricant between the mandrel and the bloom.

2 MAIN COMPONENTS

- Main tank
- Agitator
- Motor pump
- Gate valve
- Solenoid valve
- Recirculation line
- Compressed air line

HOLLOW BLOOM LUBRICATION SYSTEM

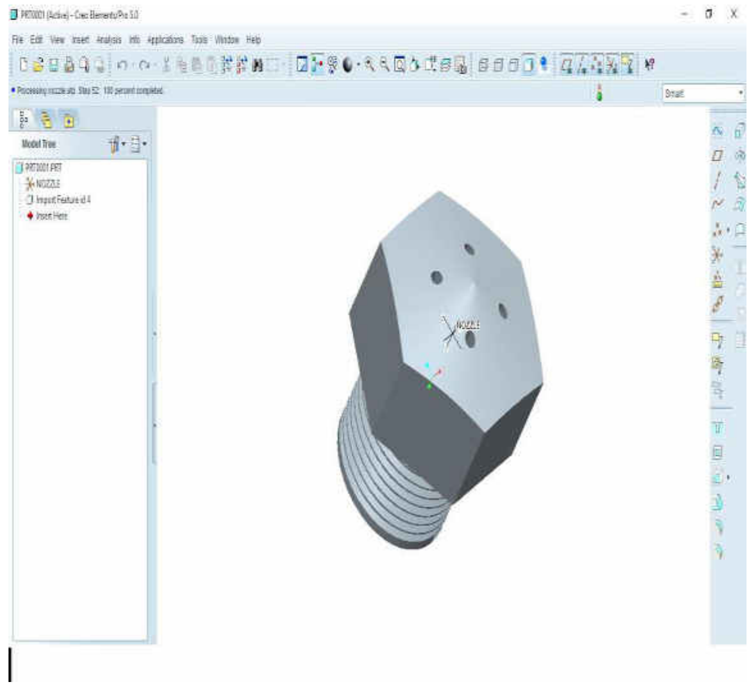

Fig 2 : HOLLOW BLOOM LUBRICATION SYSTEM

The hollow bloom lubrication is an online lubrication system that prevents the mandrel bar and the hollow bloom from sticker. It reduces the friction between the mandrel and bloom. It reduces loading in the push bench and also reduces the wear on the mandrel surface. In this system, the lubricant is used at an adequate amount which reduces the wastage of lubricant from the previous method.

DESIGN

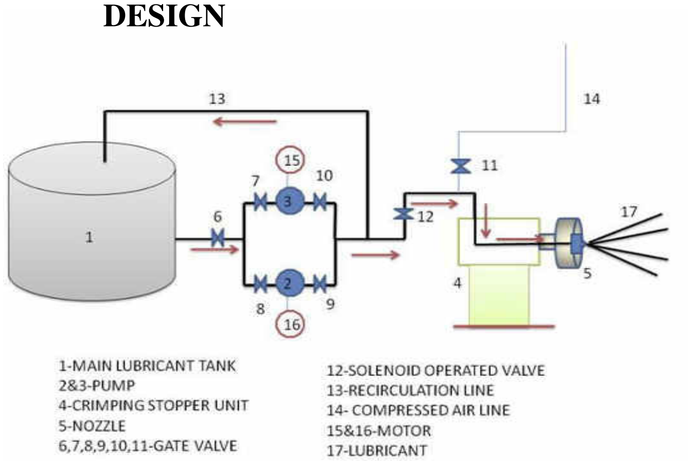

Fig 3 : Design a Nozzle

Fig 3: A nozzle is a device designed to control the direction or characteristics of a fluid flow (especially to increase velocity) as it exits an enclosed chamber or pipe. A nozzle is a varying cross sectional area, and it can be used to direct or modify the flow of a fluid. Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the

stream that emerges from them. In a nozzle, the velocity of fluid increases at the expense of its pressure energy.

LUBRICANT

Dry lubricants or solid lubricants are materials which despite being in the solid phase, are able to reduce friction between two surfaces sliding against each other without the need for a liquid oil medium. The four most commonly used solid lubricants are:

1. Graphite - Used in air compressors, food industry, railway track joints, brass instrument valves, open gear, ball bearings, machine-shop works, etc. It is also very common for lubricating locks, since a liquid lubricant allows particles to get stuck in the lock worsening the problem.

2. Molybdenum disulfide ($MoS2$) - Used in CV joints and space vehicles. Does lubricate in vacuum.

3. Hexagonal boron nitride - Used in space vehicles. Also called "white graphite."

4.Tungsten disulfide - Similar usage as molybdenum disulfide, but due to the high cost only found in some dry lubricated bearings.

GRAPHITE

Graphite is structurally composed of planes of polycyclic carbon atoms that are hexagonal in orientation. The distance of carbon atoms between planes is longer and therefore the bonding is weaker. Graphite is best suited for lubrication in air. Water vapor is a necessary component for graphite lubrication.The adsorption of

water reduces the bonding energy between the
hexagonal planes of the graphite to a lower level
than the adhesion energy between a substrate and the graphite. Because water vapor is a requirement for lubrication, graphite is not effective in vacuum. Because it is electrically conductive, graphite can promote galvanic corrosion. In an oxidative atmosphere, graphite is effective at high temperatures up to 450 °C continuously and can withstand much higher temperature peaks.

GRAPHITE PROPERTIES

Graphite is best suited for lubrication in atmosphere. Water vapour is a necessary component for graphite lubrication. The adsorption of water reduces the bonding energy between the hexagonal planes of the graphite to a lower level.

- Graphite type - Synthetic
- Graphite size - 2 Microns
- Solubility - Water Miscible
- Colour - Black Fluid
- pH value - Neutral
- Dilution ratio - 1:3 (Lubricant : Water)
- Property - Commercial graphite
- Bulk Density (g/cm^3) - 1.3-1.95
- Porosity (%) - 0.7-53
- Modulus of Elasticity (GPa) - 8-15
- Compressive strength (MPa) - 20-200
- Flexural strength (MPa) - 6.9-100
- Coefficient of Thermal Expansion ($x10^{-6}$ °C) - 1.2-8.2
- Thermal conductivity (W/m.K) - 25-470
- Specific heat capacity (J/kg.K) - 710-830
- Electrical resistivity(Ω.m)-$5x10^{-6}$-$30x10^{-6}$

LUBRICANT STRUCTURE

• Graphite is structurally composed of planes of polycyclic carbon atoms that are hexagonal in orientation.

• The distance of carbon atoms between planes is longer and therefore the bonding is weaker.

• Its peculiar microstructure composed of hexagonal planes of hybridized sp2-sp3 carbon-carbon bonds, has very good lubricating properties.

• Interlayer bonds are weak so the material tends to flake easily.

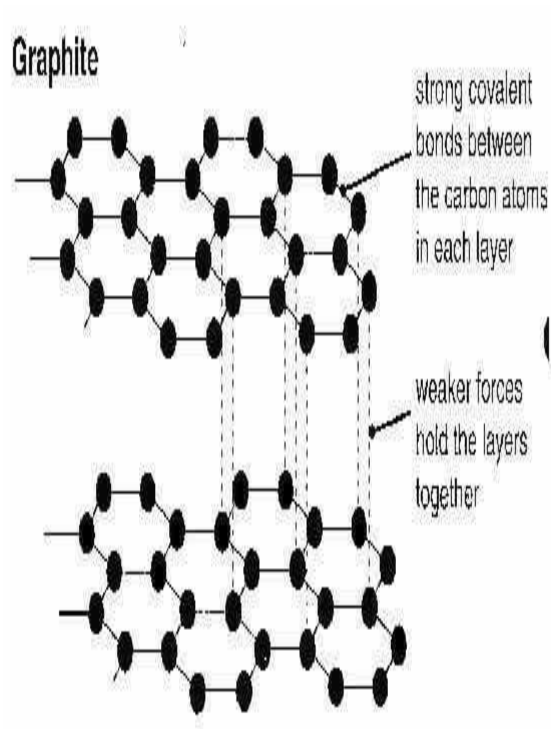

Fig 4: GRAPHITE STRUCTURE

COMPARE BEFORE AND AFTER THE PROJECT

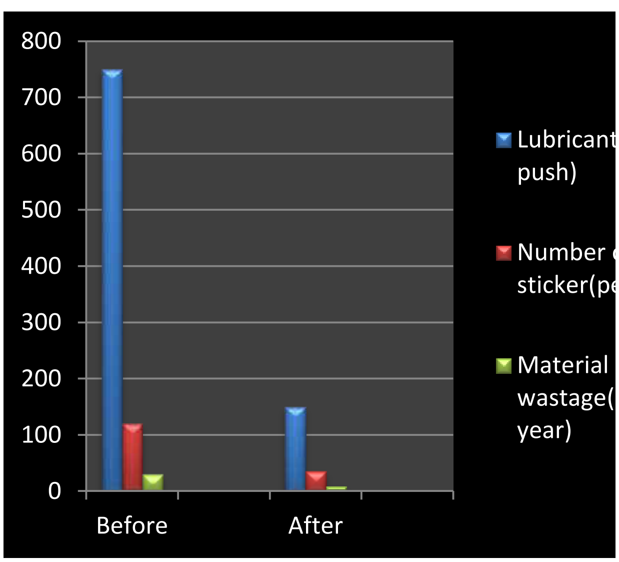

Fig 4: COMPARE BEFORE AND AFTER THE PROJECT

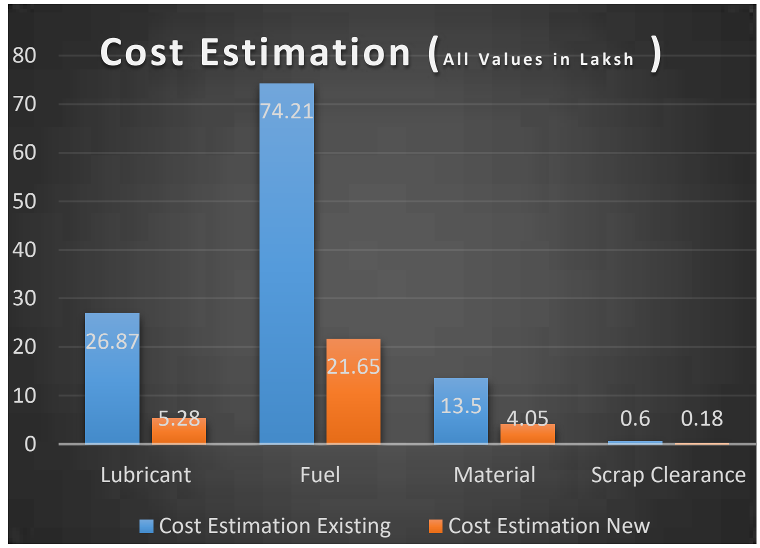

Fig 5: COMPARE COST ESTIMATIN BEFORE AND AFTER THE PROJECT

CONCLUSION

Sticker occurrence in push bench has various reasons to deal with. But the major reason for sticker occurrence in push bench is friction. To avoid sticker, the friction between the mandrel bar and the hollow bloom has to be reduced. For this, a lubricant is introduced in between them to reduce friction and improve internal quality of the hollow bloom. Hollow bloom lubrication system provides the lubricant with at most care. This is an online lubrication system which serves the lubricant at appropriate amount required in the setup. This system provides the lubricant directly and reduces the wastage of lubricant. This also protects the wear on the mandrel surface and reduces the stress developed on the mandrel. It improves the life expectancy of the mandrel bar from the previous lubrication system. It provides the hollow bloom with superior internal finish The lubricant is best served with our setup and the amount of lubricant consumed is reduced from excess to adequate. This serves the company with improved productivity and profit.

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