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WIP Reduction in Aluminium Billet Using Lean Principles

Noorul Hug. R[1], Pandiyan.D[2], Praveen. B[3]

Department of Mechanical Engineering, Magna College of Engineering, Magaral, Chennai, India[1,2,3]

ABSTRACT: Lean principles aims to reduce wastes and provide value for the customers. These wastes are categorized as overproduction, work in progress, unnecessary transport, over processing, excess inventory, unnecessary motion, defects. In this paper a case study is presented where aluminum billets are cut and stored as inventories. Further these billets WIP are reduced using lean principles. This paper presents a lean roadmap that Is sustainable in the current environment and achieves cost savings.

KEYWORDS: Aluminium billets, inventories

I. INTRODUCTION

In the production of aluminium extrusions cast aluminium "logs" are cut into relatively short sections, billets that are used as feedstock for the extrusion process. A particular press produces 50% of the revenue for an individual production facility. This facility is a member of a division of a multi-national corporation that historically is not able to obtain the returns on the capital employed expected by the management and ownership.

The facility managers perceive that lean concepts will be able to improve the facilities return and decide to focus on an effort to reduce the W.I.P. between the billet saw and the extrusion press. The major emphasis on this effort centers on an attempt to cut the billets on a per order schedule in contrast the current practice of maintenance of a stock of billets without regard to the daily job schedule in the press department. The current facility runs an average of 8 billets per order and produces

An action plan is issued to begin a cut to order program for all billet production. The existing stock will be absorbed by using it before cutting any new material. Scheduling will be based on the quoted allowances per extrusion. No overages will be cut without the approval of plant management. The present scheduling and production control systems have been in place for an extended period of years. It is the perception of the floor management and of the work force that this system will not achieve the stated goals but actually reduce the economic returns currently enjoyed on this production line.

Within the industry this press is of such a configuration that it has been sold our and remains sold out for the foreseeable future. Any downtime does negatively impact shipping schedules and results in lost sales that may not be recovered. All of the equipment employed in these operations is reliable within the normal limits for the industry. Extended unscheduled outages are infrequent. there are only two different alloys produced in this facility. the on-site casting facility is a reliable source for logs which are the feedstock for the billet saw.

Step 1: Evaluate the Lean Implementation

Key to the success of this implementation is a complete approach that includes a progression through the process to obtain success in each of the following areas:

- ⇨ Planning for lean implementation
- ⇨ Workplace Design
- ⇨ Efficient Flow Design
- ⇨ Reduction of the variation by design

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- ⇨ Support function design
- ⇨ Supply chain design
- ⇨ Sustainable by design

An organizational commitment to the lean process has been granted and a champion has been assigned and has completed each of the basic steps to implement this lean system within the ideal conditions. The system has not been sustainable because the ideal conditions do not exist in the actual environment. The goal of this assignment will be to bring reliability to lean implementation of the billet saw operations.

Step 2: Initial Assessment

The goal of the a sustainable-reliable lean implementation would be one that will provide a system that will obtain the reduction of inventory desired coupled with the flexibility and reliability to handle the dynamics of the manufacturing environment. This effort will first evaluate the four components of personnel, equipment, scheduling and materials. Central to this evaluation will be the identification of the component that represents the weakest value stream.

Scheduling:

The current scheduling system has been designed to hold a number of billets in each alloy and length. The total number retained is adjusted to reflect any production orders greater than 25 billets.

Equipment:

The reliability of the equipment would appear to be within the accepted limits.

Materials:

Almost every billet required in the extrusion operation is produced in the on-site casting facility. The large diameter extrusion press is provide first priority in all casting and cutting schedules.

Personnel

The current scheduling system has been designed to hold a number of billets in each alloy and length. The total number retained is adjusted to reflect any production orders greater than 25 billets.

Summary

The lean process as normally instituted will allow for the variances in equipment, materials, and personnel. These components will not be evaluated as the critical path for this step in the lean implementation.

Scheduling is the process that is not currently performing at an optimum level and it is being chosen as the first component to be evaluated in the lean process.

Scheduling:

A detailed evaluation of the scheduling process will begin with the construction of a Hierarchical Tree Diagram as seen below. Its purpose is to illustrate the weakness of the existing system. This weakness will be treated as the critical path for further development.

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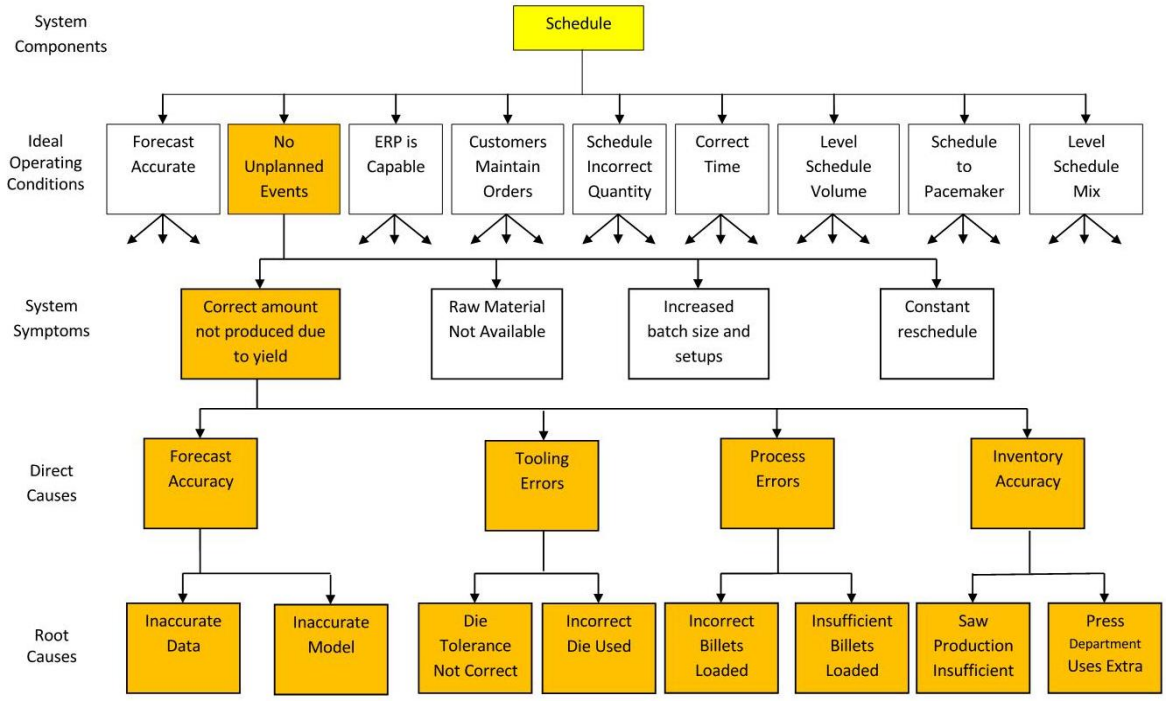

Figure 1: steps to determine reliability of a system

Step 3: Modified FEMA

A Modified Failure Mode Analysis has been completed on the scheduling component of the process to better quantify the state of the process. It is presented below complete with the RAV rankings that are used to determine the constraint and ultimately its root cause. This analysis has been completed by looking at the data for a single week. Limiting the time to a shorter period provides for a realistic evaluation of the process and frames the time to facilitate changes and then evaluate their impact.

The RAV analysis shows that the first four items in order of severity are Die Tolerance, Incorrect Billets Incorrect Die, and insufficient billets. A key weakness in the lean implementation has been exposed in that the die quality and identification are vital to the success of the program. A failure to address these key components will result in a failure in the complete system

Step 4: Lean Phase II

It has now been shown that there are two areas that impact the reliability of this system and it becomes necessary to complete a root cause analysis on each to further define the direction of this lean implementation. The following risk analysis evaluates the four highest RAV rated items. In summary these graphics show the following:

Item	Factor #1	Factor # 2
Tooling errors – Die Tolerances	Rush Jobs	Poor Records
Tooling errors – Incorrect Die	Poor eyesight	Shift Change Communication
Process Errors – Incorrect Billets Loaded	Operator Error	Operator distracted
Process Errors – Insufficient Billets Loaded	Operator serving 4 presses	Operator distracted

Table 2: The following risk analysis evaluates the four highest RAV rated items

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II. CONCLUSION

The following is a summary of the material to be presented to management as a proposal to further improve the lean implementation through the application of reliability to the existing system.

Planning for lean implementation
The stated goal of reducing the W.I.P. billet inventory is realistic and will provide tangible benefits. This effort will involve a different portion of the organization that previously addressed. The saw operations are not the source of the difficulties associated with the initial lean implementation but rather the billet loading operations, the die handling at the press and the scheduling function.

Workplace Design
Rush Jobs are happen too frequently and are too disruptive. The scheduling and production departments will be consulted to design a system that respects the need for expedited orders AND provides for a controlled production operation. Shop floor records will be improved using the shop personnel to create a simple effective system. Operator distraction the addition of an operator when running the fourth press is proposed.

Efficient Flow Design
Rush Jobs the efficient flow design will reduce the time to prepare a job for the press and thereby reduce the need for "rush" jobs. Proposed is a simple interactive system that will in a visual manner illustrate the state of the press, die preparation and billet inventory. Shop floor records will be a key input to the scheduling system. Operator distraction improved scheduling will make it possible for a single operator to serve all four presses.

Reduction of the variation by design
The introduction of six sigma concepts will provide the vehicle to reduce the variance in these operations.

Support function design
Any variances reported through the six sigma program must be addressed by the supporting functions. These may involve all aspects of the operation as indicted by the shop floor.

Supply chain design
The entire effort has been born out of a desire to improve the supply chain that supplies the press. The weakest link was not the supply of billets, but the variability of the press operations. The unreliability in the press scheduling and die operations has shown the source of this variability. It is anticipated that there will be an effort involving the billet W.I.P. system will be conducted as result of this effort.

Sustainable by design
Integral to the proposed solution is the feedback provided in the six sigma process. This will quickly illustrate the deficiencies and direct resources to increase the reliability of the individual component. The workplace is a dynamic environment and it will be necessary to review the complete analysis for additional insight to the strength of the system design.

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