

IMPROVING PRODUCTIVITY OF FOUNDRY INDUSTRY

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Abstract : The Indian industries need overall operational experience and excellence in today's world of competitiveness. This paper also explains phase viz application of define-measure-analyze-improve-control methodology and it finally shows how improvement can be brought in quality and productivity in any foundry industry.

I. INTRODUCTION

Casting is basis of current manufacturing equipment and manufactured goods and it played a major role in the industrial revolution. Casting is one of the oldest manufacturing processes from which simple and complicated shapes can be made from any metal that can be melted. The various processes are induction casting, die casting, investment die casting (wax pattern), centrifugal casting, permanent mold casting, sand casting, etc. out of them investment die casting is one of the best method to produce casting components. There are different casting industries which produces metallic components by casting processes. Palm Alloy and Steel Ltd. is one of them; which is using induction casting. Any given company would always want to improve their productivity continuously by solving the problems which directly affect the productivity. So the company wants to produce more output by effectively utilizing the available resources; where Palm Alloy Steels Pvt. Ltd. is one of them. Ineffective layout, back flow of material, material handling problem, ergonomics, storage problem, etc. are the biggest problems which are associated with this company, so our main objective is to apply industrial engineering techniques to solve the problems which will eventually improve the productivity.

In all the processes involved in casting process there is risk of failure until finished product is manufactured. Casting process involves complex interactions among various parameters and operations related to metal composition, methods design, molding, melting, pouring, shake-out, fettling, machining like grinding and inspection etc. various operation carried out.

In this age of proliferation, producing castings according to the international standards needs widespread competitiveness. Foundry men need to move on from their motto of 'satisfying customer' and adopt and meticulously strive for 'customer delight' to compete globally. Meeting customer demands will not be sufficient, foundry men need to improve their quality and productivity. Gaining competitive edge should be the constant pursuit for the foundry industries worldwide. And to set oneself apart from the crowd one has to use various instruments, techniques and algorithms. For global competitiveness, foundry industries are trying many techniques such as quality circles, total quality management (TQM), International Organization for Standardization certifications, etc. Desired results can be achieved from these techniques, but the issues related with their implementation and time required to reap the benefits cannot be ignored. Lastly, these hold good for certain specified problems.

1. Objective:

- To increase overall production and efficiency of industry by eliminating and minimizing the problems by changing floor plant layout.
- To increases effectiveness of the plant layout by using various industrial engineering techniques and tools.
- To ensure minimum distance travel by product from raw end to finish point.

2. Problem Definition:

The existing floor plant layout of company is improper for achieving higher productivity and quality. The material and machines are not in proper place and they are consuming too much floor space. So by possible changes in plant layout there is proper utilization of plant area. The material flow is improper in the plant and results in more travelling of the material and related time with reference to it.

Some of the important factor are explained below:

➤ Improper Floor Plant Layout

The existing floor plan layout of company is improper for achieving higher productivity. The material and machines are not in proper place resulting in consumption of too much floor space. As we know if the resources available are not effectively utilized then the required quality and productivity will not be obtained.

➤ Materials Flow and Movement

As there is unsystematic arrangement of the materials and flow of material is improper in the plant area so it results in more travelling distance and related time thus affecting the productivity.

➤ Storage Problems

Storage of sand, cores, patterns, raw materials & finished goods etc. are not in proper place so movement of men and materials are improper therefore it causes material handling problems which takes much and more time and less effective for productivity.

➤ Material Handling Problems

The raw material, semi-finished & finished goods are required for transporting from one place to another again and again but they are arranged in not a systematic manner so effort man power is consumed too much in to that process as well as much more time is consumed.

➤ Manual Process

At present scenario in the casting industry most of the processes are done manually. There is no semi or fully Automation is involved in it. So motion and time for doing work & completion of work is much more. And also manual process required skilled workers to a greater extent.

➤ Ergonomics Problem

No proper ventilation for foundry department and there is a high temperature near the induction furnaces which can affect the performance of workers and hence indirectly affects the productivity of the industry.

II. LITERATURE SURVEY

1. Name: Barriers to energy efficiency in small industry clusters.

Author: N. Nageshan, P. Balachandra

Journal: ELSEVIER

Tools of techniques used: Analytic hierarchy process.

Summary: A new philosophy to transition metal casting towards more efficient and sustainable practices addressing also current and future competitiveness issues was presented, the definition of energy and material efficiency metrics was discussed for a generalized shape casting process.

Learning: Significant challenges and opportunities arise, this work will present the founding metrics of a novel approach to metal casting with development of a new philosophy called small is beautiful.

2. Name: Review on quality and productivity improvement in small scale foundry industry.

Author: Mr. Jitendra A Panchiwala, Dr. Darshak A Desai, Mr. Pares Shah.

Journal: International Journal of Innovative Research in Science, Engineering and Technology.

Tools of techniques used: Defect Diagnostic Approach.

Summary: This study aims to review the research work done by several researchers and it is an attempt to get an effective and technical solution for minimizing the various casting defects and to improve the entire process of casting manufacturing using the techniques adopted by them.

Learning: The study involves defect diagnostic approach to reduce the casting defects thereby increasing the productivity of the industry.

3. *Name:* Overall Productivity Improvement in Casting Industry by using Various Industrial Engineering Techniques.

Author: Mayank Dev Singh, Swati Singh, Derasari Keyur, Soni Saumil, Patel Niki, Panchal Harshal.

Journal: International Journal of Innovative Research in Science, Engineering and Technology.

Tools of techniques used: 5s technique- An industrial case study.

Summary: To accomplish objective of increase in the overall production of the industry by effective utilization of plant area, changing the plant layout, processes layout, applying work and motion study and reduction of non-productive time.

Learning: This study involves defect diagnostic approach to reduce the casting defects thereby increasing the productivity of the industry.

4. *Name:* A literature review on Quality and Productivity Improvement in foundry industry.

Author: Yatin Damor, Hemant R Thakkar

Journal: Journal of Emerging Technologies and innovative Research.

Tools of techniques used: DMAIC Six Sigma methodology.

Summary: Some of the solutions and quality control aspects are explained in this paper in a very simplified manner to eliminate unawareness of the foundry and also show how improvement can be brought in quality as well as productivity of the concerned foundry industry.

Learning: The implementation of Six Sigma technique has resulted in understanding the problems from all aspects, from quality as well as productivity point of view.

III. DATA COLLECTION AND ITS ANALYSIS

There are total 18 unskilled helpers, 3 supervisor and semi-skilled operator at Palm Alloy Steels Ltd. Tools & technique used in foundry industry based on quality and productivity aspect like 7 QC –tools, DOE, Taguchi method, method study, TQM, TQC, just in time, casting simulation techniques, six sigma – DMAIC method, entity relation diagram flow chart etc. Understanding and implementation of this technique in foundry industry helps to get more benefits in terms of productivity and qualitatively.

I. Current Layout

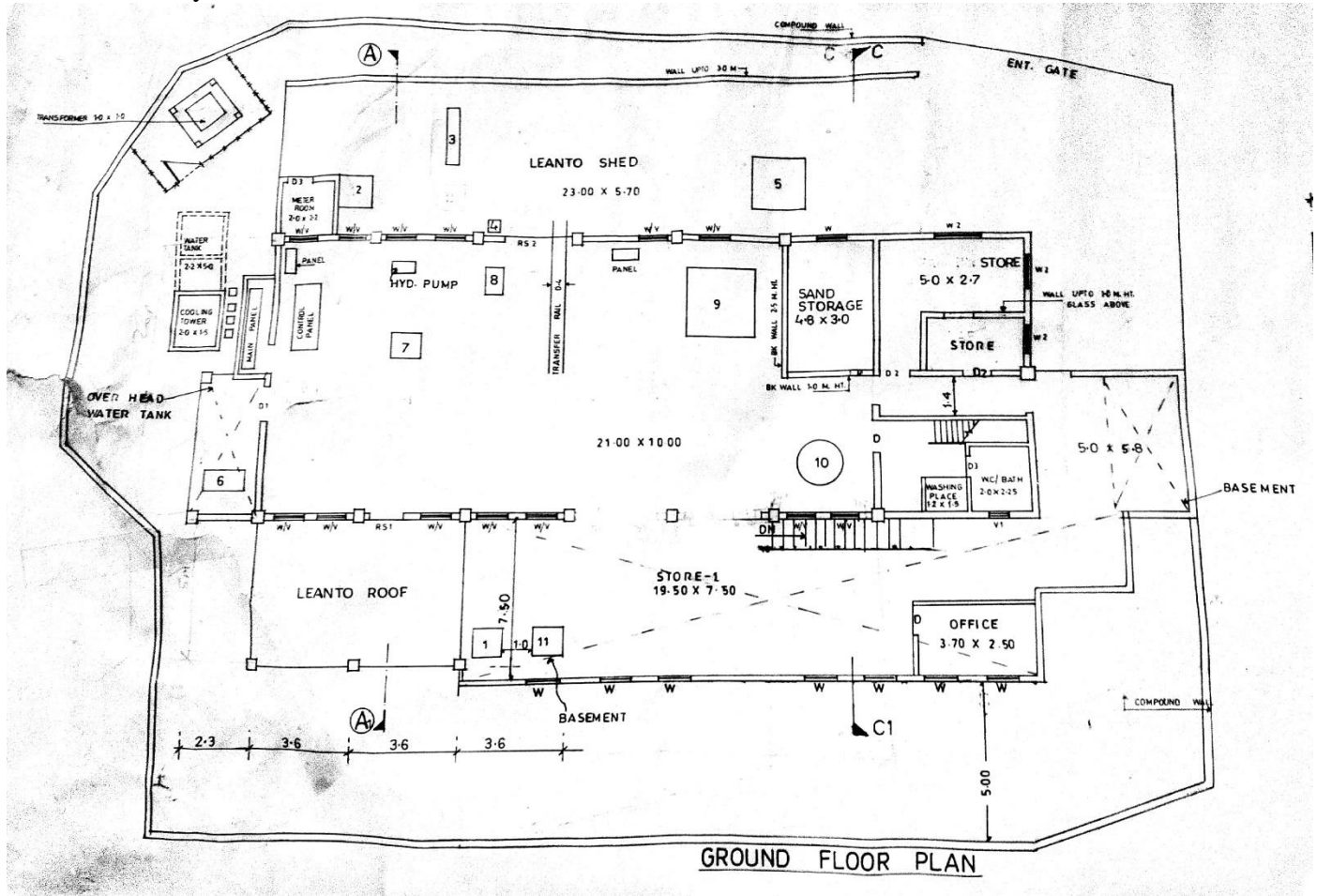


Figure 3.1.1

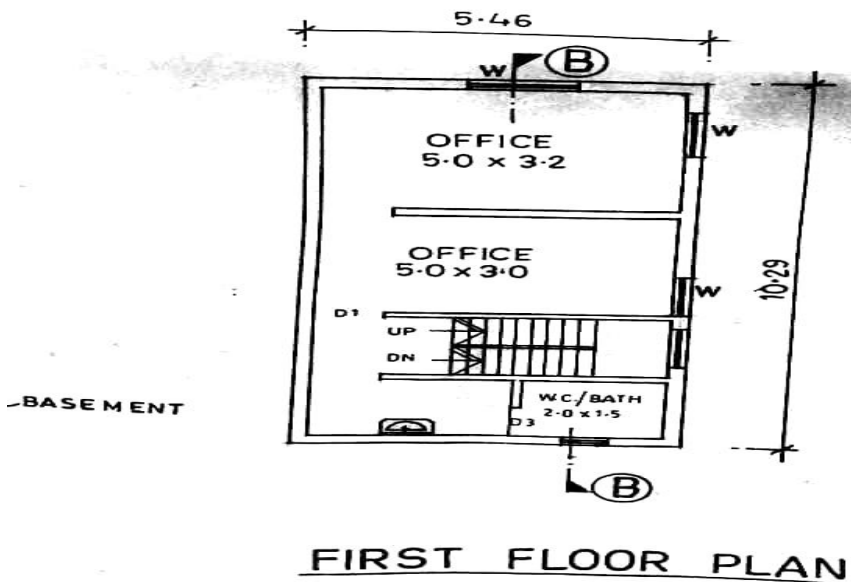


Figure 3.1.2

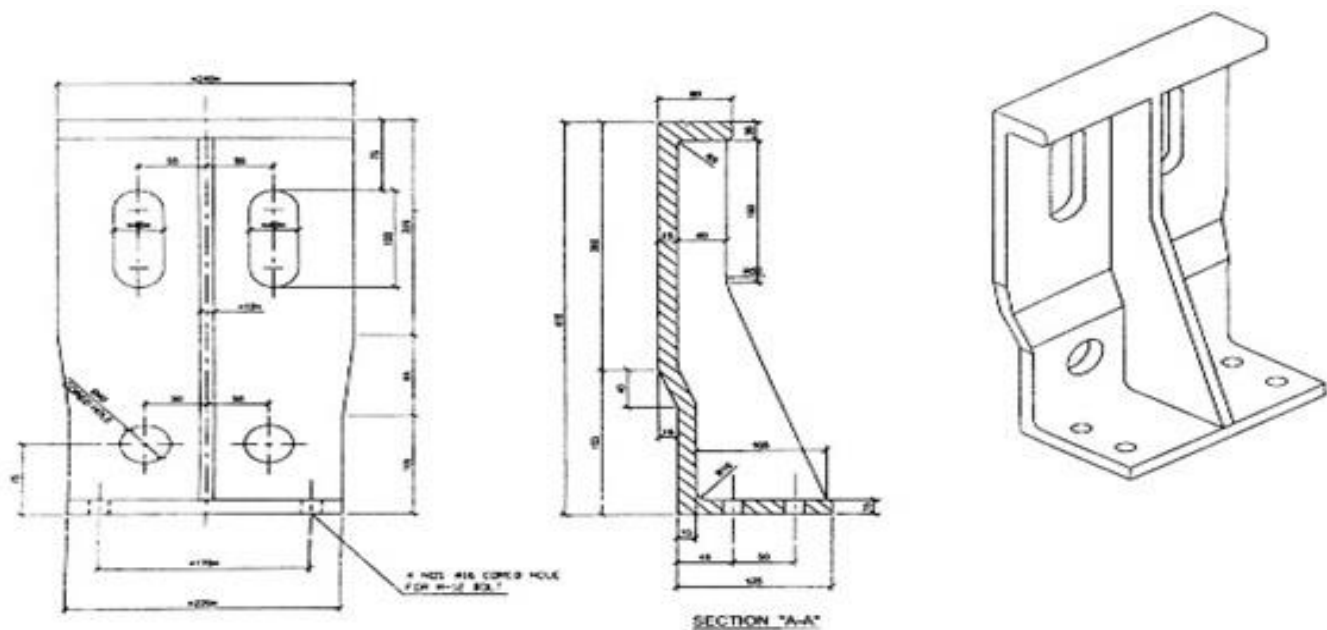


Figure 3.1.3.

II. Data analysis

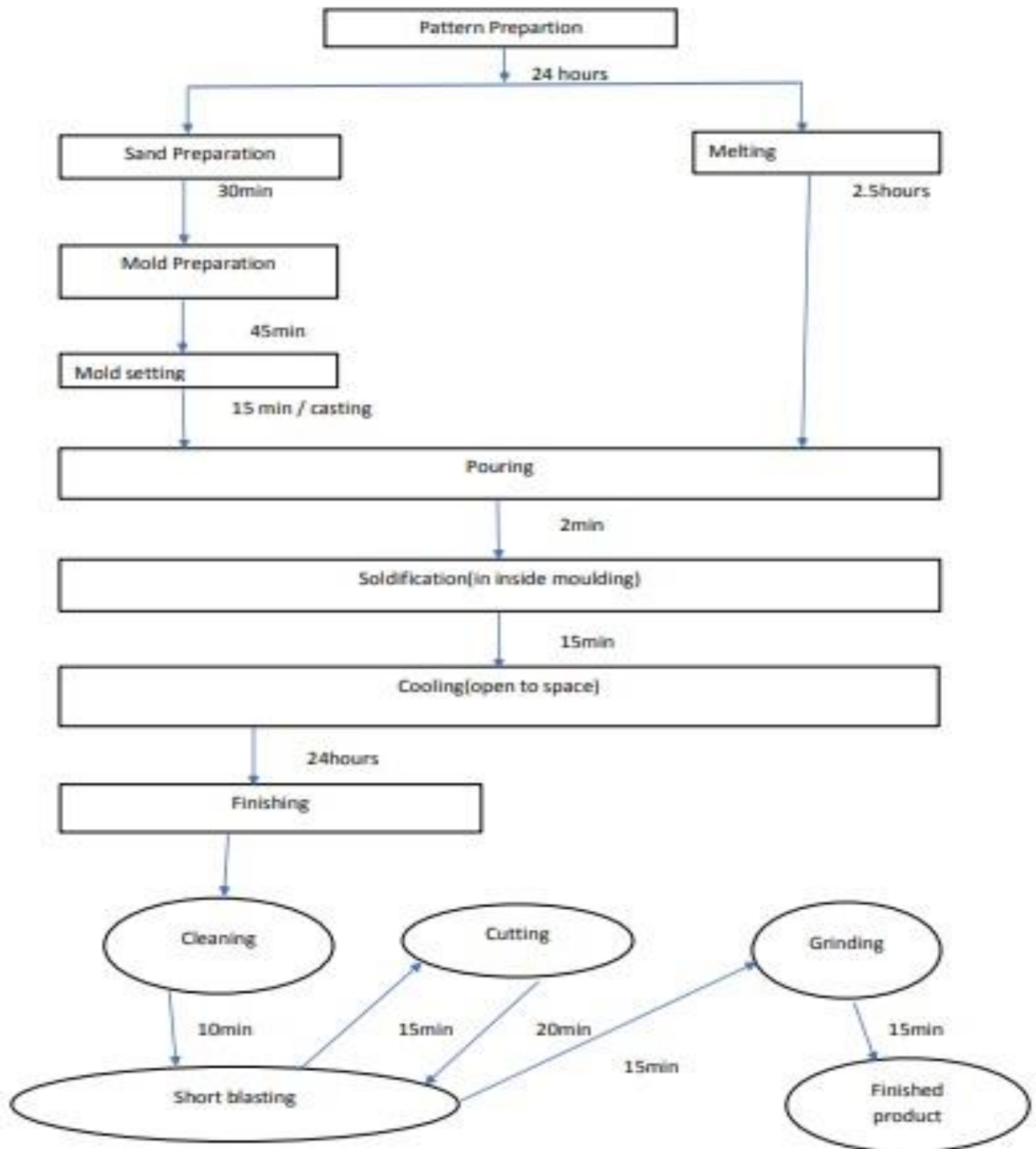
According to the data collected and after analyzing it, it is found out that there is room for improvement in the company.

1. Number of workers assigned for sand preparation is more than required.
2. Number of workers for mould preparation is not sufficient.
3. The location of sand storage is wrongly located.
4. Mould preparation and mould setting should be done in the same place.

Table 2.1.

Material	Suppliers	Location
Sand	1)R K Minerals 2)Jyoti Minerals	1)Thane 2)Mumbai
White Sand	Sara Minerals	Popatpura, Gujarat
Mild Steel	Krishna Steel Trading	Mumbai
Stainless steel	1)Vinayak Steel 2)Laxmi Stain Alloy	1)Ahmedabad, Gujarat 2)Khetawadi, Girgoan
Resin coated sand	Shri Satyam Minerals	Pune

III. Process Flow Chart



IV. Methodology to be used:

- Flow Chart
- Entity Relation Diagram
- 7 QC –tools
- DOE (Design of Experiments)
- Taguchi method
- TQM (Total Quality Management)
- TQC (Total Quality Control)
- Just in Time
- Casting Simulation Techniques
- Six Sigma
- DMAIC method (Define, Measure, Analyze, Improve and Control)
- SPC (Statistical Process Control)

V. RESULTS AND DISCUSSIONS

Modern method of casting components is a boon for industry sector that uses several software and simulation technology. To have a good competition worldwide, foundry industry have to move ahead from the tagline of satisfying customer and have to adopt rigorously endeavor for their customer delight and to stay in the competition, foundry industry need breakthrough strategy improvements in both Quality as well as Productivity. Main focus is not only to meet customer demand (in terms of quantity) but also have to satisfy quality with increasing demand. Many experiments and research are conducted to find out best sand processing method that can enhances the quality of castings. This results in reducing casting defects up to 6%, this percentage can increases in future which will results into the best quality casting with less production time. Design of experiments, Total Quality Management are the few techniques that can be implemented in any foundry industry. There are number of small scale industry in India that can implement such technology to increase the yield, provides standard processing parameter and increases the effective productivity of the unit.

VI. CONCLUSION

At Palm Alloy Steel Ltd. we found that layout was not that good for minimum material distance flow. Implementation of different methodology such as Six Sigma can results in understanding the problems in terms of all aspects with qualitatively as well as quantitatively whereas tool like DMAIC helps to increase both effectiveness as well as efficiency. Different simulation software can also help to reduce the casting defects which ultimately save the time of for correction hence increases the productivity. Tools like SPC are very expensive in comparison for use in small scale foundry industry but this gives the best result from all of the above mention tools in methodology. SPC is not only useful to reduce the rejection in the system but also helps to identify correct and optimum values for all the process parameters.

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