Layout Optimization in the Process Flow of Pressure Die Casting Industry

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Abstract - Right now, the pressure die casting is an energetic, strong and valuable gathering process for the creation of high volume, metal portions that are all around formed and firmly avoidance. Regularly, the making of any number of parts from thousands to millions going before requiring substitution is possible. In such a case, the format must be adaptable for the workers, so the work won't be hindered by any reason. This can be accomplished by systematically making the design. The procedure will move in the direct stream and this manner decreasing the time and increment the effectiveness. In the pressure die casting industry, the layout advancement may give the conservative arrangement of machines and use the space or the work territory in a powerful way. It likewise uncovers the inert time of the laborer by putting the machine in the progressive work station. The present layout describes the hour of assembling will be eaten up and the profitability of the procedure is improved by getting faultless completed items.

Key Words: *Plant Layout, Pressure die casting industry, layout optimization, Process time reduction, layout improvement*

1. INTRODUCTION

Layout Optimization is about the assessment of various layout situations, to plan the ideal design that normally diminishes material taking care of expenses, improves effectiveness, limits space necessities, and lessens vitality bills. This design is about the streamlining of the procedure of the PDC process. Pressure die casting is a metal casting process that is depicted by convincing fluid metal under high pressure into a structure opening. The greater part of the die is delivered utilizing non-ferrous metals. Depending upon the sort of metal being tossed, a hot-or cold-chamber machine is used and depending upon the weight used, ongoing progressions prepared for the utilization of plastic in the pressure die casting and is known to be injection moulding. The whole procedure is comparative while the utilization of materials like aluminium and different combinations in pressure die casting, plastic polymers in the injection moulding. In pressure die casting the main advantages is the complicated designed produced can be cast in the ease. Great castings, of aluminum mixes, nearby magnesium, and other low mellowing point amalgams, are ordinarily conveyed through this system. A few activities are engaged with the entire PDC process, from the spraying and blowing out the die to opening and closing of the die, regardless of whether the primary advances are the filling of the shot chamber, the injection of the metal into the pass on, the hardening and the further extraction of the casting[1].

2. METHODOLOGY

The layout optimization is done with the help of any CAD packages like AutoCAD, CATIA, SOLIDWORKS, etc. this software helps the user to perform the modeling of machines in 2D as well as in 3D. In AutoCAD software, there are some inbuilt features like doors, chairs, etc. and they are designed in the standard approach. It helps the user to copy and paste these blocks in the respective places. Concerning requests and necessities are given by the equipment, extra imperatives concerning the site and the procedure are accepted [2].

3. UNOPTIMIZED LAYOUT

The Unoptimized Layout of Pressure Die Casting Process is shown in Figure.1. In the current Pressure die casting plant layout, the procedure stream isn't direct. While the plant works in these conditions as a matter of first importance the raw material is acquired and it is analyzed in the material testing zone and the outcome is gotten whether the material is reasonable for the customer's fulfillment. The material is protected and ignored the furnace dependent on the raw material, kind of furnace ought to be picked. In which the raw materials are melted and poured as liquid metal and these liquid metals are passed to the Pressure die casting machine. After the procedure is finished, it is then sent to the shot impact region. In which the extinguishing, tempering happens as far as metals, and cutting activity as far as plastic materials.

The item is moved towards the testing zone where the material measurement exactness is checked and gone to store territory where the consumer loyalty is fulfilled that is painting, stickering, and so on. The completed item is moved to the quality office and consequently giving the last check and it is prepared for the moving. The fundamental drawback is the arrangement of the machine and this may build the time utilization of one item and along these lines lessening the

productivity of the plant. The viewpoint on structure thought drew in with Molding and Die-casting which gives the chance of the movement of an endeavor from the period of taking transport to till dispatch of the contraption [3].

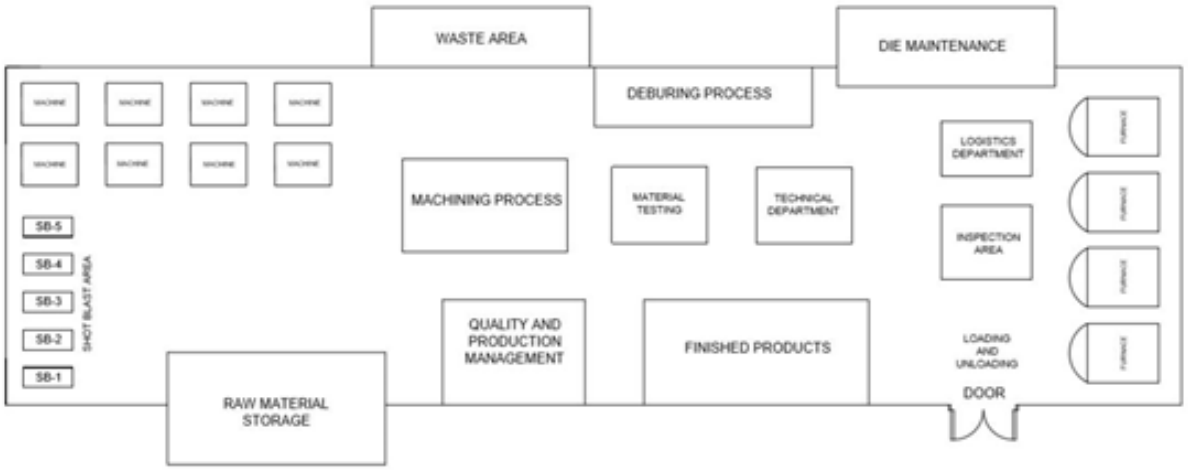

Fig - 1. UnOptimized Layout of Pressure Die Casting Process.

4. OPTIMIZED LAYOUT

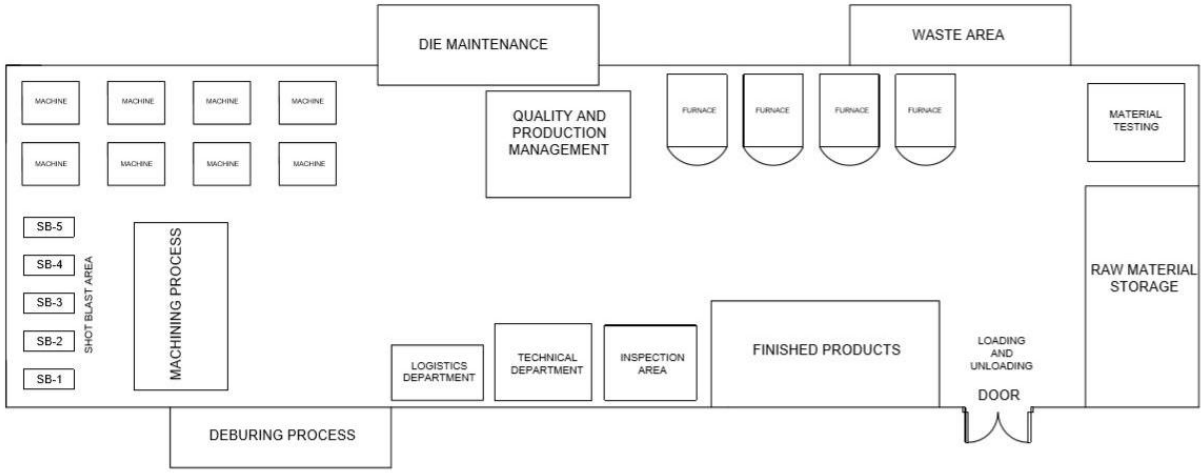

Fig- 2. Optimized Layout of Pressure Die Casting Process

The Optimized Layout of Pressure Die Casting Process is as shown in Figure 2. The raw materials are checked by industries that are given by customers. The received materials are then stored in the raw materials storage area in industries. The storage of raw materials will be seriously monitored by the supply chain management and operation department of the company. Most probably the preferred material for casting is aluminum alloy with some required compositions to achieve the needed component. Once the aluminum alloy is melted to a certain temperature with the melting furnace. After that, the temperature of the molten metal has to maintain by the use of a holding furnace. Then the production of pressure die castings starts by pouring liquid metal into a steel shot sleeve.

Rapid action of piston accelerates and transports the molten metal into a steel die, serving in high metal filling of tough shaped castings with thin wall thickness, such as ribs, before metal solidification is inaccurate. During the solidification, the metal contracts, leaving shrinkage porosity in the casting. This process tries to conquer these physical phenomena by pressing liquid metal into the die using several atmospheres[1].

Then the quenching and trimming processes are carried out and moved for the testing area. It is seen for eye point error followed by scan testing. If any error found, the part is considered a defect and it is been rejected. If the part is perfectly done, it moves for further process like fettling, trimming, shot blasting before dispatch as per customer wish. Once again, it moves for the final inspection for rechecking and moved for dispatch. During this process, we need to overcome the cycle time, setup uptime, delay time and so on. Customers expecting the components with fine quality at the right time of production in their assembly or production unit. Techniques required to develop another imaginative format considering

the need to manufacture as far as possible using office orchestrating and plan procedures and to deliver structures with improving efficiency [4]. The Process flow of Pressure Die Casting is as shown in Figure 3.

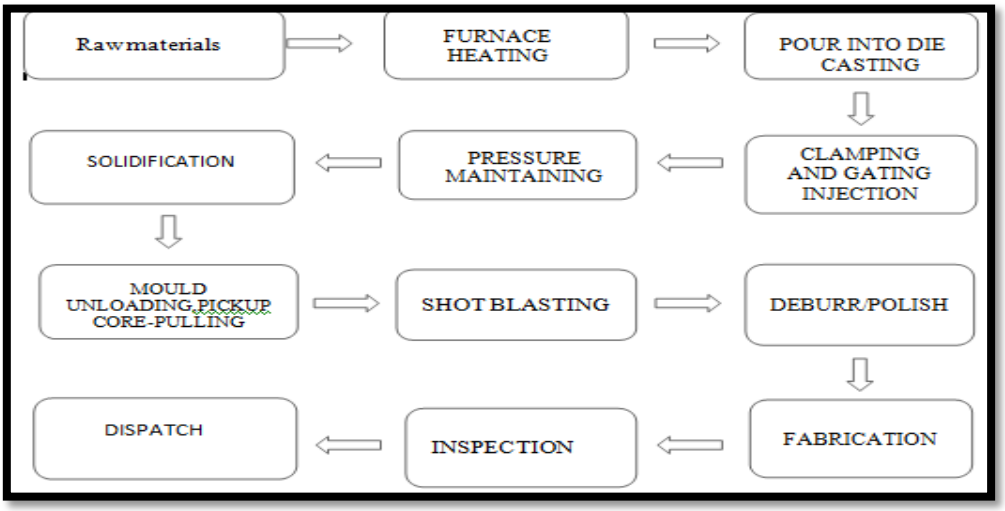

Fig- 3. Process flow of Pressure Die Casting

5. RESULT AND DISCUSSION

5.1 IMPROVEMENT IN CYCLE TIME

The total time from the beginning to the end of the process i.e. from the raw material input to the expected pressure die casted shape or product output. Cycle time is something which includes process time, in which a unit of work is acted upon to bring it closer to an output, and delay time, during which, it is spent time, waiting to proceed with the next action. The Lead time and cycle time is shown in Figure 4.

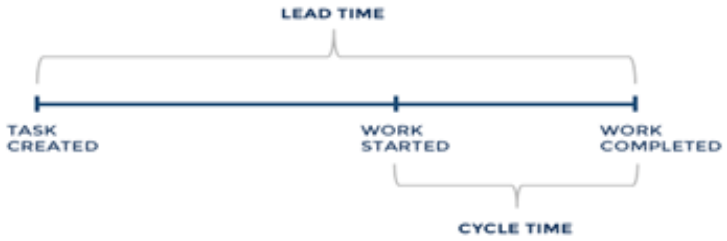

Fig- 4. Lead time and Cycle time

The cycle times of each die casting process and its machinery are analyzed, in order that the time required for completion of each process of pressure die casting will be recorded for further verifications. This has to be calculated for the good processing of the product. Here as the products are pressure die-casted, these might have chances of irregular output numbers due to several reasons. So, as the cycle time is been calculated several times by the process of video studies of the machines, examined and separated all the working stuff of men and machines and recorded the time taken for each of the smallest processes, thus the average cycle time taken for each machine is recorded and available any time for further uses. Further examined the developing behavior of two precipitation-hardenable Al-Mg amalgams dealt with utilizing high stunning and showed high potential for the future association in light-weight transportation applications [5].

5.2 IMPROVEMENT IN SETUP TIME

However, in this case, we have used the Single Minute Exchange of Die method. Single-minute exchange of die (SMED) is one among many lean production methodologies which is used to reduce the amount of wastes manufacturing process. In a manufacturing process, it provides a rapid and efficient way of converting current running product to run the next product. This transition is a key to reduce production lot sizes and thereby it improves the flow, reduces production losses and output variabilities. The setting time is one which caused a lot of time.

1. Videos were recorded for the entire setting work done by the operator from the start to finish and found that setting the machine causes more time.

2. Also, it is found that the time required for searching the fixture and tools for the setting is one which makes it time consuming.
3. Another video of the same machine is recorded. But this time the tools are brought and kept nearer to the machine. By following this method, the setting time can be reduced enormously.

6. CONCLUSION

Optimization of the complete process gives a transparent view of every process in the pressure die casting to manufacture products such as molds and parts with greater accuracy and increased efficiency optimization of the plant is true. The major benefit of optimizing the process is to adjust the production volume according to the needs. Every process is been monitored for better performance. The work process is been designed in such a manner to reduce the cycle time, in consideration with the lean management of the work time, all the other subsequent process takes place in the reduced period. The altered plant layout helps the operators to work in a combat zone with reduction in manpower. The modified design of the plant gives a clear outlook from the intake of the resources, next to the circulation of the material, later the refining of the part, also it includes the testing of the product and dispatch. The major profit of the modification is the increment in the production, efficiency of the products and reduced cycle time with lesser manpower in the manufacturing process.

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