

Applications of automotive lean production tools on die casting industry

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It is seen that waste-free processes created by lean manufacturing techniques provide advantages in competitiveness. According to those observations and advantages of it, usage of lean production tools which is already used in automotive world gets wider during last years in metal casting industry. In fact, one of the important step is applying this lean production tool before industry 4.0. In order to do this, companies must systematically operate the Man, Machine, Method and Material components called 4M. This harmony can be likened to the gearwheel of a watch. The main purpose is to ensure that the clock performs its task regardless of whether or not each wheel is large or small. All productivity targets are planning and commissioning to ensure gearweel working properly. The whole of this compliance is called the system. The correct identification, fast control and access information were required to system work properly. A simple but effective follow-up and identification format has been created to meet the customer needs of the process. This form is also defined as the main chain link that connects all the lean production tools. This main chain is called "Process Requirement Tablo". In this study, the contribution of a simple but effective table to the production system was observed.

KEYWORDSS: AUTOMOTIVEM, LEAN MANUFACTURING, DIE CASTING, INDUSTRY 4.0, PROCESS REQUIREMENT;

INTRODUCTION: NEED OF PRODUCTION SYSTEM IN DIE CASTING INDUSTRY

In the researches, the concept of lean manufacturing techniques has become widespread with the Toyota production system and it has been observed that the companies have become more systematically more efficient with the implementation of the applications. It is seen that waste-free processes created by lean manufacturing techniques provide advantages in competitiveness. According to those observations and advantages of it, usage of lean production tools which is already used in automotive world gets wider during last years in metal casting industry. In fact, one of the important steps is applying this lean production tool before Industry 4.0. In order to do this, companies must systematically operate the Man, Machine, Method and Material components called 4M. This harmony can be likened to the gearwheel of a watch. The main purpose is to ensure that the clock performs its task regardless of whether or not each wheel is large or small. All productivity targets are planning and commissioning to ensure gearweel working properly. The whole of this compliance is called the system. Prometal has experien-

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is also determined as the main chain link that connects all lean production tools. The name of this ring was PRT/ Process Requirements Table (Fig.1). This form has been arranged to be used within the company in casting processes. Since there was more than one group of people and work in the company, it was necessary to collect them

systematically and for this purpose, it was foreseen to create the concept of work area. The concept of work area

Date of Update

Indicates the date the form was last updated. Work area documents are living documents. The intention here is that it can be constantly updated and its content can be changed.

The most common causes of change:

- Change in the number and form of operations
- Changes made after a quality analysis in the work area
- Changes due to KAIZEN activities to improve work area
- Change in tools used in work area

Work Area Number

It is used for addressing work area and ordinary numbering can be done according to the request of the business.

Common numbering methods:

- 10-20-30 ... shaped like
- 100-200-300 ... shaped like

In case of intermediate work area, intermediate numbering is used.

- 10-15-20-25 ... shaped like
- 100-150-200 ... shaped like

Work Area Name

It is the designation given to the work station.

Operations by Machinery, Device and Automatic Systems

The job defined in the work area can be performed by machine only or human only, or human-machine can perform operations together. In this section, operations pertaining to the machine, device or automatic system are defined in both operating states.

The use of a macro expression by grouping provides a disadvantage in the time management phase of the works. Therefore, as far as possible, every phase that undergoes

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When you do not define the equipment required for the operations in a working area, it cannot be said that the operation is carried out at the desired time with the desired quality and efficiency. In such a case, the sorting activity, which is the first step of the 5S activity, is not performed correctly. In such a case, the sorting activity, which is the first step of the 5S activity, cannot be performed correctly. The decision-making mechanism is left to the individual to distinguish the equipment and material required in the work area from the unnecessary. With this incomplete definition, it is a fact that there is a risk of serious occupational accidents, even experienced. This situation is explained as follows.

In the three-shift system, when the operator working at the injection machine is putting the part into the mold, because of the tight fit;

1. The shift operator pre-places the part in the mold and starts the injection activity by hitting it with a metal hammer
 - a. Since the metal hammer is not defined, the use of unnecessary equipment increases the cost and carries a safety risk.
 - b. By hitting the part with a metal hammer, the risk of geometric deformation of the part on the mold increases.
 - c. There is a risk that the part will go to the customer as a quality defect and be recalled.
 - d. In case the hammer accidentally hits the mold surface, it causes deformation on the mold, resulting in cost loss.
 - e. A defined area is required for the hammer.
2. The shift operator pre-places the part into the mold and places it by hitting it with the help of the same part. In this case;
 - a. There is a risk of deformation of both the part in the mold and the part used for striking.
 - b. The piece is used out of purpose by using a hammer.
 - c. There is a risk of occupational accident due to the risk of being cut in the hand while using the hammer.
3. The shift operator pre-places the part into the mold and

presses it down to make sure it fits with just his hand

These activities are carried out in this way during the period when there is no PRT (Process Requirements Table). However, thanks to PRT, the operations to be performed by the operator in the work area are specified and the equipment, if any, to be used for these operations are defined in the "tools used" step.

In this way, we can define and monitor the tools and equipment that should be in a work mail during the project period. Thanks to this definition, there are no missing tools and equipment in occupational safety risk analysis, and we make the first step of 5S activities according to this definition. Thanks to this column, the process requirements table provides the information and standard that other lean production tools need.

Required Environmental Conditions

It has been observed that environmental conditions are the subject that is often neglected while performing operations in the process. In the quality control work area, the operator performs visual control. In this visual inspection, it has been determined that the light intensity of the environment is important so that the operator can make a healthy control on the part. Excessive light intensity will tire the operator, and insufficient light will deteriorate the control quality. While starting the lean transformation, these standards did not form an idea about how the environmental conditions should be.

The process requirements table is prepared separately for each work area.

As environmental conditions:

- Ventilation
- Audio
- Ergonomic conditions
- Cleaning
- Definitions are made.

Figure 2 shows the sample form for lighting. With this definition, the occupational safety risks of the business area are minimized and it is possible to create a risk-free process that will respond to quality standards and customer requests.

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It is essential that the employee who will ensure efficiency in the work area and fulfill the customer requests can perform the activities specified in the transaction requirements table, and that the information and trainings that the employee who will observe the standard conditions and fulfill the requirements must have.

Thanks to this definition, the trainings to be given and the competencies to be gained should be defined before placing an operator in a work area. With this definition, the trainings that should be prioritized in the annual training plans of human resources have been determined. At the same time, the follow-up of the basic and compulsory trainings that should be given to the employees, especially the laws numbered 4857 and 6331, and the giving of the trainings are made easier to monitor.

Examples of basic competencies that the operator should

have:

- Work area risk analysis
- Ergonomic activities in the workplace
- Visual management in the work area 3S+2S
- Workplace regulations
- Workplace training

Relation of Processing Requirements Table with Prometal Production System Tools

The senior management had a full determination that the first condition for competitiveness was the necessity of system installation by increasing productivity at Prometal. These studies are carried out in large corporate enterprises in 10-15 years, accompanied by large investments and organizations.

If these studies are not considered as a whole, it will reveal a single-ring chain and its effectiveness will be weak. For this reason, firstly, the transaction requirements table was prepared and its integration with other tools was ensured.

Fig.3 - Relation of Process Requirements Table with Prometal Production System Tools.

CONCLUSION

When all these substances were applied in the enterprise, it was observed that there were noticeable improvements in quality. Thanks to the serious reductions in the 8D analyzes made by the quality unit due to the decreasing complaints, the stress decreased and the motivation increased. A 50% improvement in quality in the first 7 months continues as a zero error in a 1-year period as a result

of the studies that were commissioned and continued. On the one hand, the company has experienced improvement in quality, and the quality level of seat belt parts, which are of great importance for human life, has been appreciated by the customer and paved the way for new investments and collaborations. Thanks to the tools and systems commissioned during the development of the system, serious improvements were experienced in logi-

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