Monitoring the Defect Rate of Selected Products

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Abstract: *Controlling, tracking and then eliminating errors through various corrective measures ensures that the organisation is constantly striving to improve, to stand out from the competition and also to retain its customers. The objective of the paper was to track the defect rate of the selected product during quality control. Using statistical methods, we tracked and evaluated the selected product that had the most complaints. After finding the cause of non-conformance with the required parameters, we searched for corrective measures which were applied to the observed production process.*

Keywords: *complaint, customer requirements, quality features*

INTRODUCTION

Product quality is one of the most important factors in any manufacturing operation. It is not enough to produce products in the required quantity, it is important to ensure that the goods produced are of the right quality. If the consistent quality of the products produced is maintained, a manufacturing organization can continuously progress. Customers' requirements vary some are more focused on functionality and performance of products others are more concerned with appearance and other aspects (Hrubec, Cservenáková, 2018).

However, defects occurring on a product are common because the manufacturing process is never the same and perfect. It is important that we address these defects and look for a way to eliminate them. By eliminating them in a timely manner, we can prevent the production of defects, thus we can reduce costs and prevent products from being returned from the customer in the form of a claim or causing problems internally during the production process that could be transferred to other processes that the manufacturing organization has (Vasilko, 2010).

The monitoring of defects on products shall be checked, either visually, by measurement or by various methods designed for this purpose. These methods help to reduce or eliminate the defects in question (Paulová, 2013).

MATERIALS AND METHODS

Product quality control is one of the most important steps to help us move forward and stay in business. With this inspection we can find out where the problem may have occurred, what the cause was and we can also fix the problem. By focusing on quality, we can minimize defects, whether in the manufacturing process or specifically on the product. Reducing defectiveness will ensure that we do not have defective parts delivered to the customer that can be returned through a warranty claim. We will also reduce the cost of the product and with good products we can retain our customers and therefore our place in the market amongst the competition. In this paper we have discussed the detection of defect rates on selected products. We will focus on the product that has the highest defect rate - most units are returned from the customer in the form of a complaint. For this product, we will focus on the most common defects that occur on the product. When analysing, we will identify the cause of this or these defects and then we will address the elimination of this or these defects by proposing measures that will be effective and guarantee that the parts delivered to the customer will be free of defects (Hrubec, Cservenáková, 2018).

On the basis of the interim reports made according to the returned complaints, statistics are made for a certain period. Based on these statistics, we can directly determine which defects are most frequently found on specific products. These defects are then analysed and eliminated (Nenadál, 2008).

5x Why method

This is a method in which we ask the question WHY at least 5 times. This way we can find out the true cause of the problem. Sometimes more than one cause can be identified. This cause is found out by a group of people who are dealing with the issue. The great advantage of the method is that it is simple, there is even no need to train the people who use the method (Hučka, 2017).

This method is the most appropriate to use:
- the human factor influences the problem,
- there are several causes for the problem,
- in discussing the causes that occur every day in the production
- when dealing with complaints

1. Identify the problem. The problem is recorded in writing as this will better identify and describe the problem in detail.

2. Keep asking the question WHY a particular problem occurred and jotting down the answers.

3. If the answer to a particular question does not determine the root cause, we ask the WHY question again.

4. The question is repeated until the team agrees that the cause of the problem has been identified (Litvaj, 2018).

RESULTS

The organization produces products that are used as intake components. The products are produced in the form of blow molding. Newer production has included the manufacture of products by injection moulding. All products are well manufactured and properly inspected before being handed over to the customer. Customers may include various manufacturers who produce household products. We also include heating technology companies among other customers (Kuchtová, 2022).

Fig. 1 The products from the form of blow molding

Product characteristics

The product under investigation consists of two parts (Fig. 2, 3). It is used as a suction component in heating technology. The two parts are welded together. The product is produced by blow moulding.

The drilling process is performed after the product has been blown out. The second part of the product - Fig. 3 is inserted into the drilling station, where three holes are subsequently drilled. After drilling, the holes are checked to ensure that there are no drilling debris in the holes and that the holes are passable.

Fig. 2 First part of the product

Fig. 3 *Second part of the product*

The welding process is used to join two parts of a product. The two parts are inserted into a completion station, which is used to weld the two parts together. Welding is done without any additional material the process is only done by heating the material to the fusion point through a heating plate. The two parts of the product are pressed against each other for a certain period of time to the heating plate, then after heating they are pressed together and thus a solid joint is formed. The welded product is further checked with a ball of a specified diameter to ensure that the finished piece is passable and the foam used in the product as shown in Fig. 4 is also passable. Fig. 5 shows the process where two components are inserted in the welding station.

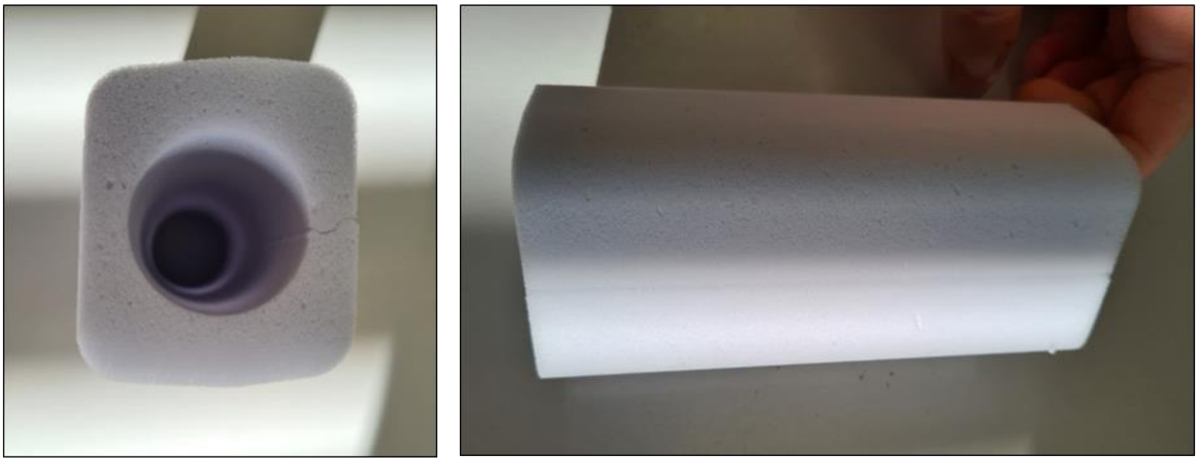

Fig. 4 Foam used

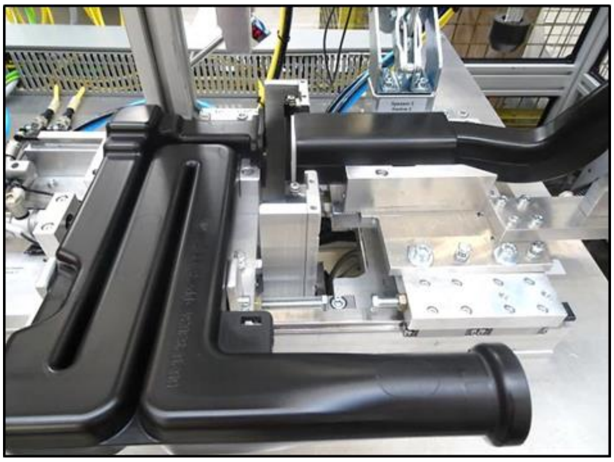

Fig. 5 Product in the welding process

Evaluation

Based on the tracking and evaluation of the complaints, we found that the product with the highest defect rate is the product numbered 0020283634, which we will deal with next. The number of products complained about is 269.

The two biggest defects are deformation of the foam during welding and missing drilled holes. It is necessary to eliminate these two main errors as quickly as possible to avoid complaints from the customer.

Problem Analysis - Foam deformation during welding process

Based on the air flow tests performed by the customer, several dozen units were returned to us that did not meet the customer required criteria. Upon receipt of the recalled parts, we N.I.O. disassembled and analysed the parts to look for the cause of the underperformance. The foam in the parts was slightly deformed in most cases.

Deformed foam

The foam inside the welded part must retain its shape and the necessary diameter, it cannot happen that the foam already in the welded part deforms, folds, or otherwise changes its shape, otherwise the part is non-functional for the customer and there is not enough air flow through the part. Figure 6 shows a cut product that is non-functional and the second Figure 7 shows a product that meets the function.

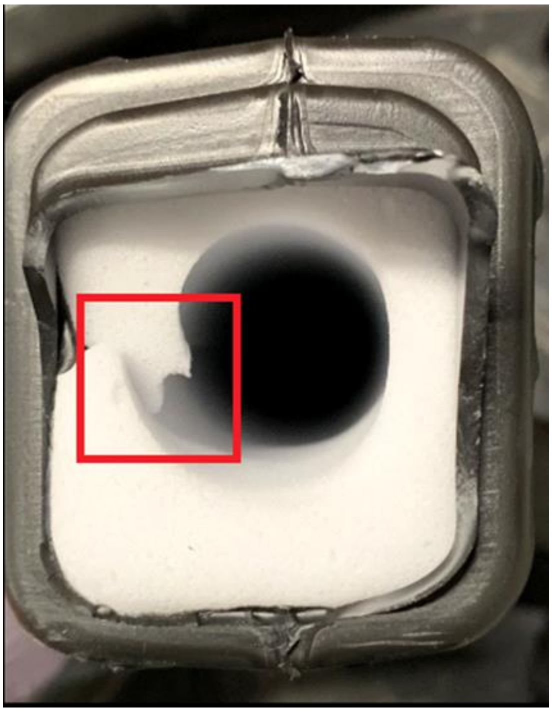

Fig. 6 Deformed foam

Fig. 7 *Foam without damage*

Analysis 5x WHY

The monitoring of the defect rate on a given product and therefore the subsequent elimination of these defects was carried out using the 5x WHY method. This method is relatively simple but effective. All we need to do is to create questions through which we can determine the cause in question. The questions and answers are grouped in a table. The questions always start with the word WHY. There are at least 5 or more of these questions, depending on when the real cause of a particular problem is identified and the problem can be solved based on that.

In our case, the questions are asked from the bottom of the table. At the top of table 1 is the identified cause of the problem, which we subsequently eliminated.

Table 1 Finding the cause of foam deformation.

\WHY?	Why wasn't the training focused on specific bug?	Because the error first occurred only now.
WHY?	Why was the training ineffective?	The training was insufficiently detailed or not focused on the specific fault.
WHY?	Why was the training inadequate?	Misunderstanding by the worker - ineffective training.
WHY?	Why did the worker put it in wrong?	Inadequate training.
WHY?	Why was the foam in the part deformed?	It could have been poorly inserted by a worker.

From the 5x WHY analysis, we evaluated the cause of the deformed foam as:

- incorrectly inserted foam by the worker who installed the foam in the suction unit.

We also found that the error encountered is new to the manufacturing process, therefore, when the worker was trained on this error, the training was not effective enough and the assemblers will need to be re-trained and the problem with the assembly of the foams into the products will need to be described in detail.

Inspection of the mounted foams must be carried out so that the mounted foam is free from any deformation and the round inner diameter must be maintained (Kuchtová, 2022).

New model

On the new types of parts - the part shown in Fig. 8. The foam is longer than the foam container itself, the foam after insertion is longer and causes a problem in welding so that the fusing mirror melts it because of its length (when it should only melt the part itself) and thus the foam in the suction cup is wrinkled. Unfortunately, after the parts are welded, the foam cannot be checked anymore, the deformation of the foam will only become apparent on tests at the customer´s site. The foam protruding from the product is shown in Fig. 9.

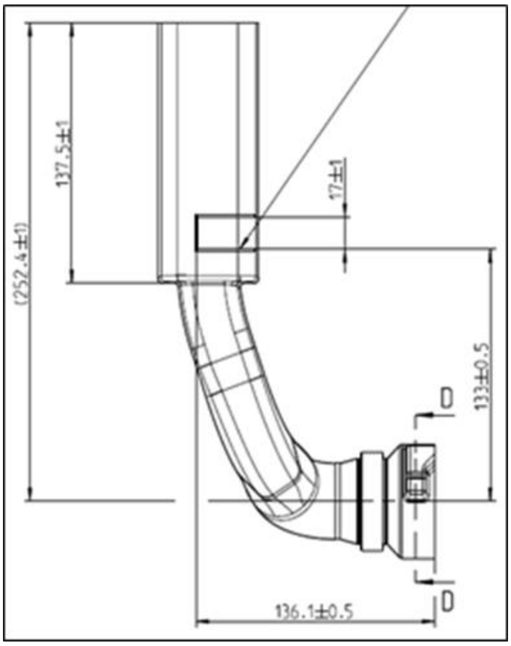

Fig. 6 *New types of model*

Fig. 7 *The foam protruding from the product*

This comparison shows that the foam was designed too long and shortening the foam could mean less risk of foam deformation during welding for us. As we are also basing on the experience we have gained on the previous model.

The measures we have taken to help us solve the problem with the two most common errors can be used in other ways as well.

Corrective measures for product defect detection are applied in the organization as follows:

– - foams made of new material,

– - foams made of new material are used in all types of products where the welding process takes place.

Due to the suitable properties and especially the heat resistance, this material is more suitable for handling. The strength of these foams will ensure that the foam will not deform during the welding process and will also not wrinkle if the worker inserts it into the product.

CONCLUSION

The production process is not always the same care must be taken to ensure that production workers are properly trained and alerted to any deficiencies that occur. Quality personnel must inspect the products produced as well as the workers and routinely perform exit checks to ensure that defective products do not reach our customers.

The aim of the present paper was to focus on the defectivity that occurs on specific products. Using selected methods, we monitored a selected product that had the highest number of complaints over a certain period. The biggest defect was the deformed foam in the product, which caused the product to have insufficient air permeability and therefore its functionality was not good. It was necessary to find out why the foam was deforming in the product. This problem was analysed using the 5x WHY method. In our investigation, we first evaluated the material because foam made of this material is easy to shape. Another reason could be the length of the foam. When measuring multiple pieces and foams, we found that not all foams have the same length. Based on communication with the customer and by mutual agreement, measures were determined. Changing the material for a stronger one and changing the length of the material to be appropriate to the length of the product.

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