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APPLICATION OF QUALITY ENGINEERING IN ADVANCEMENT OF THE CAR'S COCPIT ELEMENTS ASSEMBLY PROCESS

21.1 INTRODUCTION

Multifaceted improvement of the company has now become the superior philosophy of effective managers. Continuous improvement, i.e. the constant pursuit of effectiveness and efficiency in improvement, is not only a function of normative management systems [1, 2, 3, 4], a condition of competitiveness and existence of enterprises in the market [5, 6]. This article is a good example of the effective application of quality engineering and teamwork methods to improve the manufacturing process, in particular the elimination of defectiveness problems. The company where the improvement process took place produce lacquered parts of the car cockpit. The first part of the article issues regarding the quality of manufactured components is presented. In the following part the main reasons for the unacceptable quality level, along with the set of improvement actions, are enumerated. Assessment of the effectiveness of these actions, one shall find in the final part of this study.

21.2 ISSUES OF ELEMENTS ASSEMBLY PROCESS

The company is specialized in manufacturing of parts for the automotive industry. In the given case, these are lacquered interior fittings – the car's cockpit. The company has a production hall producing moldings from melted granules, plastic paint shop, assembly hall and auxiliary departments.

The production process is relatively simple. The lacquered elements go to the assembly hall where the given process takes place. "Matching" ie wrapping the "cushion" of the element to prevent its loud operation. The next stage of assembly is the operation named "Clipping" i.e. the clinch that is needed in the further assembly stages. Last operations are final inspections and packing.

During the final inspection a significant number of defective items were identified. It has been estimated that the number of defects is a serious problem that needs to be resolved without delay in order to avoid a complaint. In order to solve the problem of defect, the assembly staff analyzed the data and presented the structure of

defects using the Pareto-Lorenz graph. In Figure 21.1. A summary of the defects identified in one of the selected months of 2015 is presented.

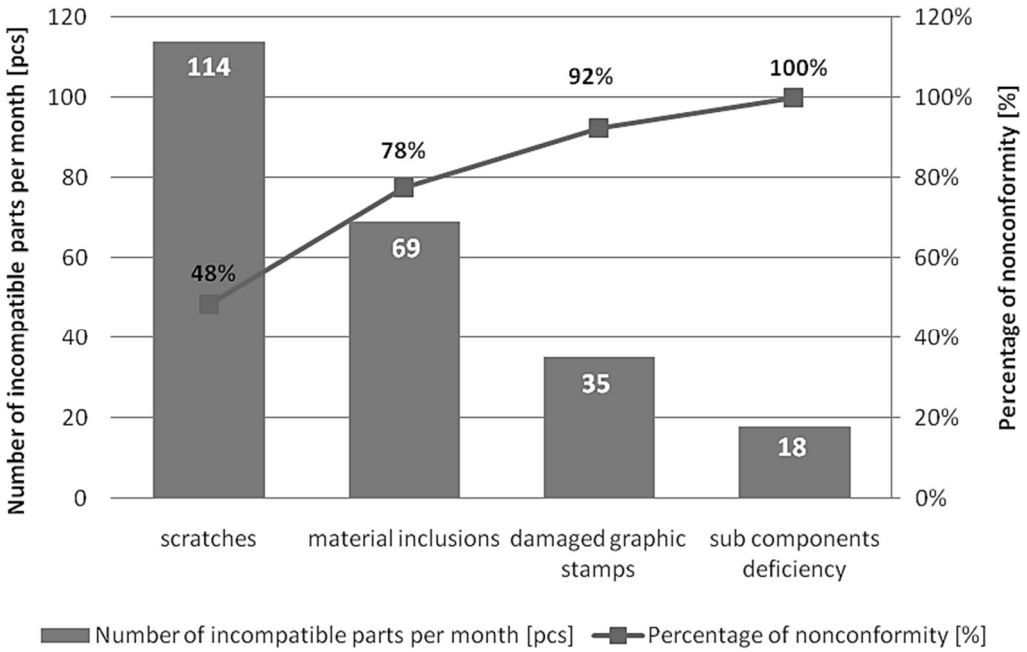

Fig. 21.1 Pareto-Lorenz Diagram for defects of details prior to improvement
Source: own

The analysis showed that the main problem was the defect in the form of scratches. Elements with this drawback accounted for 48% of all defects. It is worth emphasizing that the elements on the assembly section had a glossy layer of fine paint. This situation requires great care and, in principle, delicacy in the assembly operations performed on the given element.

Identification of the causes of the problem and their removal were entrusted to a dedicated team of process controllers, quality specialists, accountancy specialists and two experienced assembly line operators, who identified the main causes of the scratches. It should be emphasized that there was also a likelihood of scratching the elements during previous operations (eg painting) and during interoperable transport.

21.2 ANALYSIS OF DEFECTS ISSUE

The team's aim was to reduce the scratches identified during the final inspection to 1 piece per day. Identification of causes was made using the 5Why method. A detailed analysis of operations in the assembly process was required. The team carefully analyzed the workplace by asking a few questions including:

- Why are scratches occuring? Answer: The position is not properly prepared.
- Why? Answer: Old ideas were used for the new type of parts.
- Why? Answer: No experience with this type of parts.

The general cause of the problems was the lack of experience of the assembly department with the production of lacquered parts. This has resulted in inadequate assembly standards and maintenance failures. The main result of the work of the team was the decision to adjust the assembling position to the character of the assembled parts. It was recommended to implement the 5S practice, which was aimed at creating a well-organized and orderly workstation, adequate to the fragility of the paintwork of the assembled part.

21.3 LINKING CORRECT ACTIONS

Within the implementation of the 5S practice, the material of workstation table was changed among other things. The material covering the table, resembled a rough carpet and was changed to a smooth leather-like material. Primary standards did not include cleaning of the liner, which itself contained hard fibers, and additionally "stored" the sharp remains that was the main cause of the scratches. The lining has been replaced with a leather-like material that is gentle on the elements and is very easy to keep clean.

Another cause of defects was the lack of standardization of workstations. Each operator worked differently. That is why the division into the work zone and tool area was put on the assembly stations. This allowed to eliminate objects that might have become a potential cause of scratching the part.

Manufactured parts have a great ease in attracting dust, which demands cleaning them before packing and shipping to the customer. Originally, the details were cleaned with the usual cloths used. As it turned out, in these cloths often remained sharp particles, which during the cleaning scratched the paint on the elements. An alternative cleaning method has been introduced to eliminate such scratches. At present, compressed air removes dust from the element. This is safe for the lacquered surface, and furthermore, this method is used to clean the workstation.

The next implemented action was organizational changes in the form of increased supervision. Daily inspection of workplaces was carried out for which the group leader was responsible. The last stage of improvement was to create an auxiliary assembly device that is isolated from the surface of the table. The special frame to which the detail is attached due to its immobilisation facilitates the assembly process. This solution prevents scratches and damage to the paint on the components. All planned improvement activities were implemented comprehensively for three months.

21.4 EFFICIENCY OF CORRECTION ACTIVITIES

The effects of implementing corrective actions are shown in Figure 21.2. There was a reduction in the number of inconsistencies associated with paint damage from the original 35 to 7 pcs/month. Subcomponent defects were eliminated completely. The biggest achievement of the team implementing corrective actions was the

reduction of the number of scratches. The effectiveness of measures implemented in this area is illustrated in Figure 21.3.

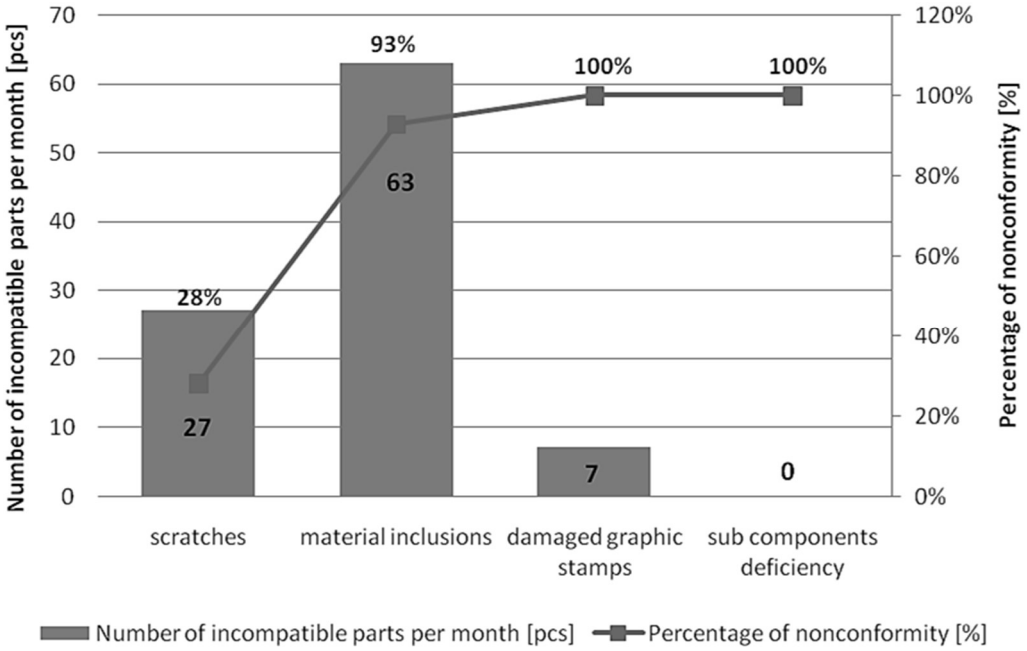

Fig. 21.2 Structure of defects of details after implementation of improvement activities
Source: own

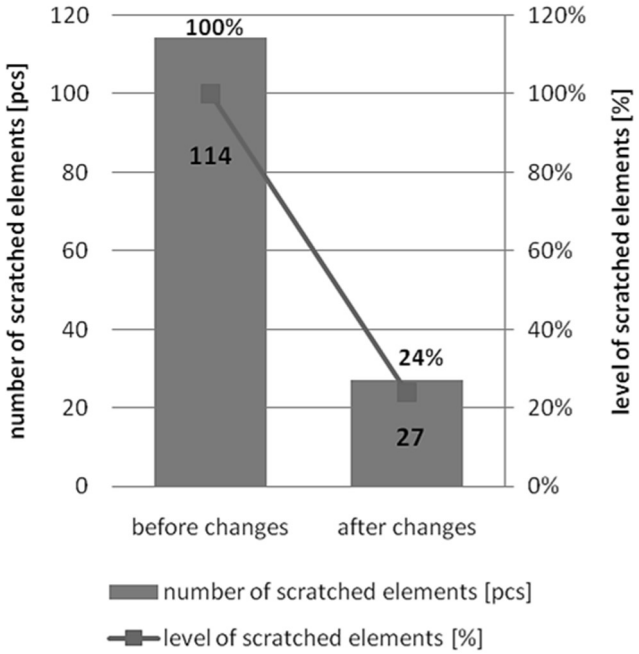

Fig. 21.3 Effectiveness of eliminating scratches

Source: own

The assumed target of the number of scratched details (about 30 scratched pcs/month) was achieved. Reduction of scratches to 24% of the original state should be considered a success. This result was obtained mainly through the implementation

of previously described technical and organizational solutions in the assembly process

21.5 CONCLUSION

The case of improvement of the assembly process described in this article demonstrates the usefulness of quality engineering methods such as the Pareto-Lorenz diagram, the5 Why Method, and the 5S practice.

Reducing defects in the form of scratches to 24% of the original level should be considered a success, although for the company under study it is only the first stage of improvement. It is also worth considering the problems – a very delicate paint coating. Such features in the car cockpit element do not bode well for future car users. Changing the paint technology or the paint in general to a more durable one should solve not only manufacturing problems. This solution will certainly improve the durability and aesthetics of the cockpit for future vehicle owners. Unfortunately, the quality of products often loses the fight against production costs.

The causes of defective manufacturing processes and the improvement activities described in this paper may provide a useful source of knowledge for management staff dealing with similar issues in the quality of production of delicate lacquered components.

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APPLICATION OF QUALITY ENGINEERING TO IMPROVE OF THE CAR'S COCKPIT ELEMENTS ASSEMBLY PROCESS

Abstract: *The article presents an example of the use of quality engineering methods to improve the assembly process in the production company car accessories – varnished elements of the cockpit. The main part of the article is a description of the improvement project that was carried out in the selected company. This section describes problems with defect of the assembly process and its improvement. The end of the article is an assessment of the effectiveness of the improvement actions undertaken.*

Key words: *quality improvement, 5why method, Pareto Chart*

ZASTOSOWANIE INŻYNIERII JAKOŚCI W DOSKONALENIU PROCESU MONTAŻU ELEMENTÓW KOKPITU SAMOCHODOWEGO

Streszczenie: *W artykule przedstawiono przykład zastosowania metod inżynierii jakości do doskonalenia procesu montażu w przedsiębiorstwie produkcyjnym elementy wyposażenia samochodów – lakierowane elementy kokpitu. Głowna część artykułu stanowi opis projektu doskonalenia jaki został przeprowadzony w wybranym przedsiębiorstwie. W tej części zawarto opis problemów z wadliwością procesu montażu oraz działania podjęte w celu jego udoskonalenia. Artykuł zawiera także ocenę skuteczności wdrożonych rozwiązań.*

Słowa kluczowe: *doskonalenie jakości, metoda 5why, diagram Pareto.*