# THE STEPS USED AT PULL KANBAN SYSTEM IMPLEMENTATION ON A SHOCK ABSORBERS ASSEMBLY LINE TO BILSTEIN SA SIBIU

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**Abstract:** Kanban is the essence of the concept that a supplier or a products deposit must distribute the components in place and at the time the production needs them so that there are no stocks in the production area.

This paper presents a pull Kanban system implementation on a shock absorbers assembly line to Bilstein SA Sibiu. The implementation of the concept is done through a process based on 13 phases that establish fundamental elements which allow to be functional. The old layout of the line, the relocation – a new layout - and the proposal for reorganizing the available production space are olso presented.

## 1. INTRODUCTION

Kanban is a set of principles which make the work process better day-by-day, based on the pull-system and the control of maximum work-in-progress at one time.

The Kanban method suggests that a scientific approach is used to implement continuous, incremental and evolutionary changes. The method does not prescribe a specific scientific method to use.

There are multiple reasons [1] for implementing the Kanban system; some of them are:
- rationalization;
- decrease of the stock level;
- optimization of the unfinished production;
- increased flexibility;
- simplification of the organization;
- easier control and coordination;
- obtaining a better material flow process.

After the decision to implement Kanban has been made the goals that need to be reached through this project need to be defined. These must be quantifiable and easy to measure [3]:

- production time reduction – the reduction of the elapsed time from launching the product into production to the obtaining the final product (until maximum x days);
- stock decrease (with x EUR per project);
- decrease of faulty material level (with x%);
- simplifying production planning (number of operating steps to be reduced to x)
- increase in flexibility (obtaining the product in x days after launch).

Those five core properties that had been observed to be present in each successful implementation of the Kanban method.

~*Visualize the workflow*

The workflow of the knowledge work of today is inherently not visible as it is "hidden" in information systems. Visualizing the flow of work and making it visible is core to building an understanding how work works. Without understanding the workflow making the right changes is harder. A common way to visualize the workflow is to use a card wall with cards and columns. The columns on the card wall representing the different states or steps in the workflow.

~ *Limit WIP*

Limiting work-in-progress implies that a pull system is implemented on parts or all of the workflow. The pull system will act as one of the main stimuli for continuous, incremental and evolutionary changes to the system.The critical elements are that work-in-progress at each state in the workflow is limited and that new work is “pulled” into the new information discovery activity when there is available capacity within the local limit.

*~ Manage flow*

The flow of work through each state in the workflow should be monitored, measured and reported. By actively managing the flow the continuous, incremental and evolutionary changes to the system can be evaluated to have positive or negative effects on the system.

*~ Make Process Policies Explicit*

Until the mechanism of a process is made explicit it is often hard or impossible to hold a discussion about improving it. Without an explicit understanding of how things work and how work is actually done any discussion of problems tends to be emotional and subjective. With an explicit understanding it is possible to move to a more rational and objective discussion of issues. This is more likely to facilitate consensus around improvement suggestions.

*~ Improve Collaboratively* (using models & the scientific method)

The Kanban method encourages small continuous, incremental and evolutionary changes that stick. When teams have a shared understanding of theories about work, workflow, process and risk, they are more likely to be able to build a shared comprehension of a problem and suggest improvement actions which can be agreed by consensus.

## 2. IMPLEMENTING THE KANBAN PULL SYSTEM ON A PROCESSING/ ASSEMBLY SHOCK ABSORBERS LINE AT BILSTEIN SA SIBIU

Traditional systems consider quality as being expensive, faulty products/defects are caused by workers and the minimum quality level that can satisfy the customer is sufficient. Companies that have implemented Kanban consider that improving quality leads to decreasing costs that most errors are caused by systems and that quality can be improved inside the Kaizen system. Kanban is an organizational form of transition to decentralizing responsibility.

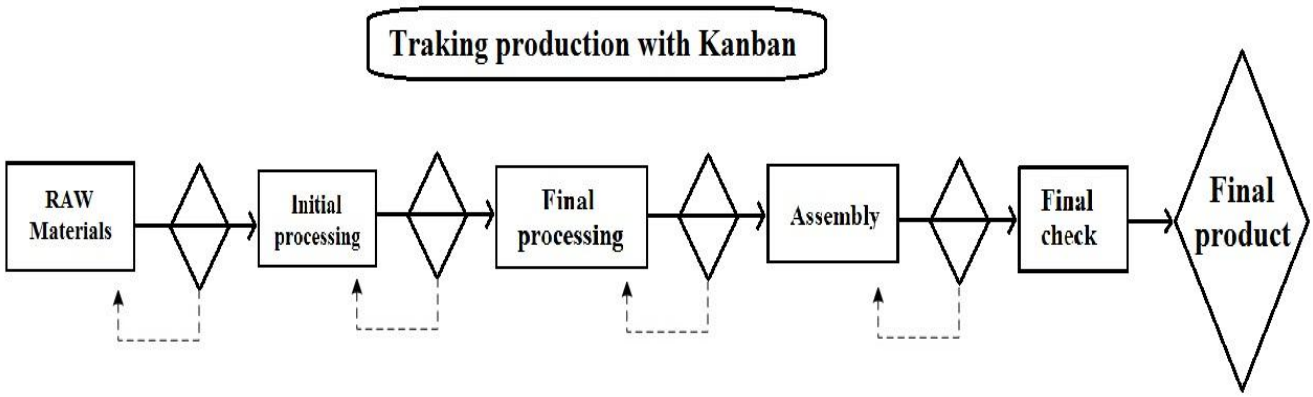



***Fig. 1 The pull Kanban systems***

The essence of the Kanban principle (fig.1) is that a supplier or a storage location needs to distribute the components in the exact place and at the exact time that production needs them so that there will be no stocks in the production area.

For optimizing the logistical process of rapidly transferring the products to the multiple working stations in the production line a clean and well organized working environment is necessary. This king of work station will assure an increase in work safety (labour protection), in a "pleasant" state of mind of the employees and in productivity. In addition to the tasks directly related to the production line, the team members should also be responsible for maintaining the work stations clean and orderly and for a good maintenance of the working tools and equipment.

The system must be built on a foundation that will permit the creation of the necessary lots, which may take a lot of time. For the system to be able to maintain its credibility it is not permitted to fail. Therefore a generous time period needs to be scheduled for the preparation of the systems and the safety lots.

The Kanban systems are among the easier ones from an operational point of view however they ask for a change in the mentality of the operator. Performing an unscheduled inventory or abandoning their working station, unless absolutely necessary, is not desired. These simple rules are in reality quite difficult to implement, once their superiority is understood however, they can become a way of life [2].

For implementing the Kanban system the support of the employees and their motivation are crucial factors. They must be aware of the fact that the new system will make their work easier, will lead to a salary increase and one very important factor, they will not lose their jobs. In this regard the employees must be prepared, they must take part at a series of trainings where the Kanban concept will be explained to them, where they can find out how the Kanban system works, what is expected from them, how they can get involved and most of all what benefits they will have. They must be informed about the company's plans so that they will be sure not to lose their jobs because those of them that will no longer be working on these new lines will go to ones that are now in a project phase. If these terms and conditions will be taken into account the risk of workers sabotaging the implementation of the Kanban system on this line will be significantly diminished or even eliminated.

Considering the fact that the demand for shock absorbers is increasing and that there already is a project on building a second montage line the company seeks to increase the capacity of the Mercedes production line in parallel to obtaining new production space by reorganizing the available area to be able to fit the lines that are still in project phase.

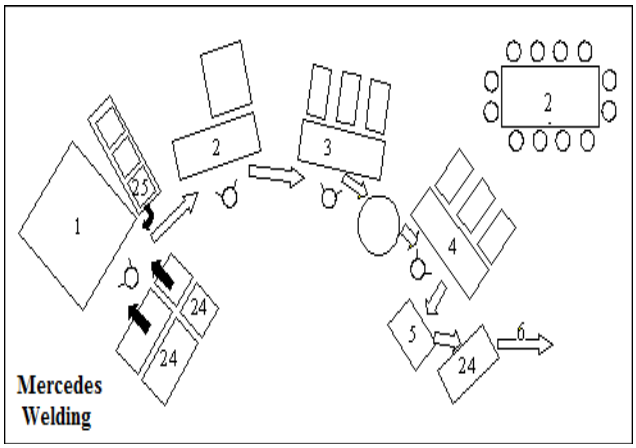
The relocation of the Mercedes line in parallel to the implementation of the Kanban system will lead to the optimization of the montage activities and to an increase of the produced shock absorber ordered by the client in the next years.

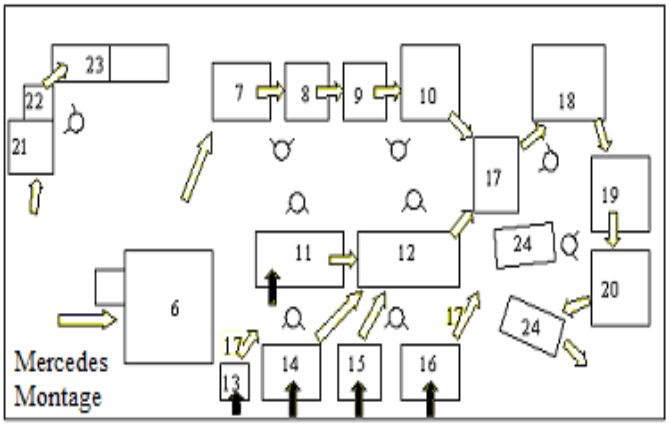
The old layout of the line is presented in figure 4 and the proposal for the relocation is presented in figure 2. Presently a number of approximately 800 shock absorbers per shift are produced which satisfies the current demand for 400.000 shock absorbers per year. The forecast is however that the demand will rise to 600.000 shock absorbers per year which will mean that each shift will need to produce approximately 1200 pieces. Currently a maximum of 850-900 pieces can be welded per shift. For obtaining the minimal threshold of 1200 pieces the welding robots need to be optimized. For montage the only working stations with problems are the ones with montage ensemble piston rod and montage inferior vent which have a capacity of 950-1000 pieces/shift.

By implementing the Kaban system these working stations will be optimized through increasing the ergonomics of the working stations and through a better supply with materials. Therefore the worker will not need to stand up 5-6 times a shift for collecting the necessary part types but the number of the parts at the working station will be enough to cover the demand for minimum a shift.

The major disadvantage of the relocation of the line is that the welding robots are closer to the montage, a fact that is not desired. However the welding is at a distance to the montage tables that will assure it not to be a problem.

Another problem on the way of achieving the target of 1200 pieces/ shift is the fact that the machine for closing the shock absorbers [3] cans only handle 950-970 pieces/shift. The proposal is to purchase a new crimping station that can operate at a capacity of 1450-1500 pieces/shift. By using this machine a plus of approximately 500 shock absorbers/shift can be achieved.




Material flow  Parts warehouse

***Fig. 2 The old layout of the line***

Positions 1...26 are workstations for the production/assembly flow.

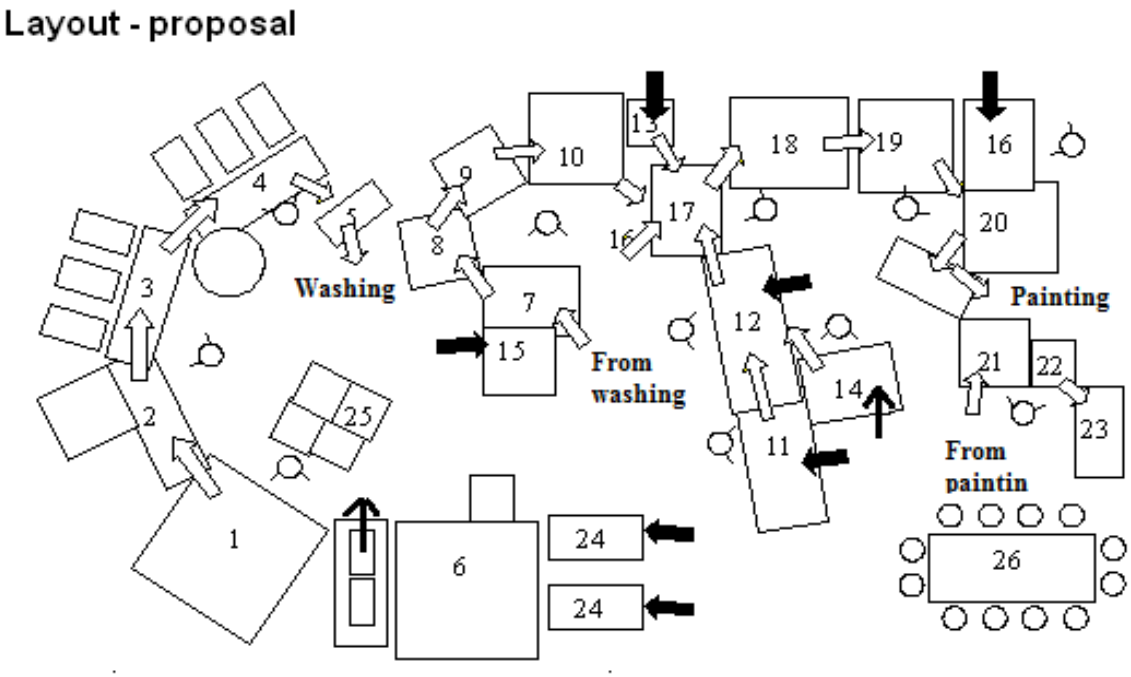



***Fig. 3 The proposal for the relocation (Layout proposal)***

By reassembling the line a better material flow can be achieved, decreasing the intermediary transport and handling times for the part types. A worker will be made responsible for supplying the line with part types which will need to follow a very exact schedule.

Because of the fact that the distance between working stations is small the times for transport and handling of the material is decreasing making the reduction of the employee numbers possible. For welding there is no need of 5 workers/ shift (4+1), for the working station for circular welding cap (2) and for circular welding torque (3) only one worker is needed. For calibration, marking, printing and oil bath through the new distribution of the machines only one worker is necessary to operate them all achieving a reduction of one working place.

Through the new layout of the production area another factor related to the motivation of the workers is accomplished – the workers operating the line can see the final product of their work because through the new layout each working station can see the packing of the shock absorbers. Also the workers will truly feel as a team without being divided between the two subgroups – welding and montage.

The workers need to be motivated to continuously come up with new ideas and proposals for improving the process. The proposals that will be afterwards implemented will need to be awarded to stimulate this process even more. Continues improvement in the Kaizen system is an extremely important factor in a company that respects itself. Concepts like Kanban, Kaizen must be familiar to all employees of a company.

From quality perspective the implementation of a Kanban system will first of all lead to lower reaction times. From the part types that are included in a shock absorber to the finished product there is a very short way that is why if a non–compliance is appears this will lead to a very rapid reaction so that there will be a limited number of non-compliant shock absorbers on the way. The cause can be eliminated and just a limited/smaller number of pieces will be affected.

The implementation of the Kanban system has also the Just in Time delivery as a prerequisite. It is absolutely crucial that these details are discussed with the suppliers. It

must be clarified that the lot has to have as few as possible non-compliant part types for making the activities at the assembly line more efficient. Concerning the JIT deliveries an agreement needs to be made with suppliers regarding a very strict delivery schedules. For supporting the Kanban implementation the lot definition needs to be done by the supplier. On a contract base the frequency of the deliveries, to respect Just in Time, as well as the lot characteristics need to be defined. The deliveries from the customers will be stored in a PreKanban storage area from where they will be taken directly to the production line. In these areas the part types will be prepared to be taken to montage.

The Kanban system that will be implemented will be the one with a single card. Therefore a clear lot definition will be made for each material type and it will also be decided in which containers they will be transported to the production line from the warehouse. It was decided that they will be brought to the line in boxes. There are part types that are big and need to be brought to the line on a daily basis (ex. tubes, cylinders, torques, aso) and there are other part types that can need to be supplied every two weeks, being smaller (e.g. sable). Therefore at the working stations where part types from the warehouse are being received (11 – montage piston rod, 14 – montage inferior vent, 16 – montage ensemble steering) Kanban shelves will be build on which the boxes will be placed.

For not needing to trigger an order, each box has a Kanban card attached. This card contains sufficient data for being able to recognize the part type, quantity, production line it belongs to, working station of destination aso. The workers take the empty boxes to the warehouse and take the full ones to the production line.

For implementing the Kanban system an investment needs to be made by the company fot purchasing equipment, pushcarts, baskets, boxes, Kanban shelves. Furthermore other expenditures concerning the relocation of the line, printing the Kanban cards, trainings will be made.

## 3. CONCLUSION

Production equilibrium and production flow, which anticipate and quantify the market demands, can be achived by having the orders placed by clients as a starting point, through obtaining the optimal combination of products in an optimum time interval

The paper presents a proposal for implementing the Kanban system on a shock absorbers processing/assembly line at Compa SA Sibiu. The implementation of the concept is done through a process based on 14 phases (steps) that establish fundamental elements which make this line operational. This system detects problems that occur on the line and does not allow parts to \"go\" on line, where they can no longer be processed.

Through the line redeployment is carried out a stream of material much better by subtracting intermediate times with transport and handling parts.

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