The 5s-System for Organization of the Working Place during Machine Repairs

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Abstract: *The results of mechanic's work at their working places are influenced by technical, organizational and economical qualitative characteristics as well as the professional training and abilities of the mechanic itself. The essence of 5s-system is presented in the article as well as its application during the organization of the working places as the main advantages are directed to companies and workshops engaged with machine repairs. The main reasons for introduction of the 5s-system in the machine repair facilities are determined and defined as: making a good impression, to be noticeable, acceleration of the process of repair and simplicity of the repair process quality control. The essence and structure of all 5 steps (seiri, seiton, seiso, seiketsu u shitsuke) of the system are defined as well as the activities, related not only to clean and organized working places, but created an affordable conditions for improvement of the quality of the repaired machines. The typical mistakes allowed by the government of the machine repair facilities are presented and defined as lack of given personal effort by the government, giving a restrictions and sanctions without stimulation and improper approach to objections.*

Keywords*: 5S, Lean Repair Production, work place*

INTRODUCTION

The mechanic's work place in the machine repair facilities is considered as "human-machine" system. It is a working zone of performer with a high-qualified level in accordance to the complexity of the performed work in the "human-machine" system, which is equipped with a technical tools and gadgets necessary for qualitative and in-time performance of certain repairing tasks. The control of working place parameters is related to distribution of qualitative and quantitative characteristics. The result of the mechanic's activity is influenced by technical, organizational and economical characteristics as well as the professional education and skills of the mechanic itself [2, 5, 8, 12, 20].

The cleanness of the working places in the machine repair facilities causes an immediate impression for higher level of organization and quality, although the last does not depend directly from it, but the customer is accepting such at subconscious level. When the working places are clean, the mechanics spent lowest time to find the necessary tools, wrenches or spare parts, but the workshop is accepting an ordered general look. In fact, the customer most often meets the opposite side of workshops – they are chaotic, dirty, disordered and unwelcoming. Depending on how clean and ordered is the machine repair facility, the customer decides whether to accept the facility as reliable and serious or not [3, 6, 11, 16, 21].

We should note that in our geographical latitudes, we tend to save ourselves the "extra" effort to make the working place tidy and clean once the work is done. It's somehow easier to do it, after you've done the difficult job of machine repair to just throw the dirty tools in the toolbox, even if we or our colleague have to look for them afterwards. Or to skip cleaning the workplace when we are tired at the end of the work day, especially if this is a widespread practice. There are many similar examples in repair practice in the past, which are commonly seen nowadays as well [1, 5, 9, 16, 17].

One of the most reliable ways to solving the problems at the working places is by creating an appropriate organization of them. For the aim, many machine repair facilities worldwide use the 5s-system for organization of the workplace and engaging the mechanics through discipline and standards. This system is developed by Toyota Motor Corporation and implemented in many production companies in Japan, but it finds its application in the machine repair facilities nowadays. The main advantage of the system consists of the fact it can be implemented for each workplace in the certain facility nevertheless the type of activity as acceptors, mechanics, warehouse operatives, administration, etc. The flexibility of 5s creates an opportunity for

implementation into machine repair facilities with very minor adjustments and to improve the competitiveness of the facility at the market [2, 16-19].

The aim of the article is to reveal the essence of the 5s system and its application in the organization of the working places during machine repair.

STUDY OUTLINE

As stated above, the 5s system originates from Japan and it is shortly related to Kaizen philosophy, which means “continuous improvement of the quality” of the repaired machines and appears to be the first tool of Lean Repair Production approach [2, 6-8, 19, 21].

The 5s system is a standardized process which allow to create and support clean, organized, safety and effective workplace. It creates a clear visual control, which allows noticing each inconformity during machine repair process as shown at Fig. 1.

Fig. 1 Cycle of the 5s system

On the other hand, upon a closer look at the work environment, we usually find a total or partial lack of simple and visible methods for organizing, arranging and maintaining the cleanliness of the workplace. And methods that are detailed for each object, so that it is clear how to use and return. The 5S system aims for exactly this, the creation of rules that are easy for people to follow.

The reasons about implementation of the 5s-system in machine repair facilities are different, but some of them are defined as follow [18-21]:

− To create good impression, to be noticeable. Depending on how clean and organized are the working places in the machine repair facilities, the clients and partners will accept us as a professionals ensuring or not quality repaired machines. The presence of dirty and chaotic working places would be a sign for the customer that the people in the facility are unable to organize their own repair production process and will affect the sense of doubts about the overall quality of the given services.

− Acceleration of machine repair process. When there is order and organization, the additional time necessary for finding instruments, diagnostic tools, spare parts and consumables is being significantly reduced, which reduces the total time to repair the machines as well as easier notice the disappearance of certain tool. Over the time, this order becomes a habit and the so-called "muscle memory" is acquired by thinking about any tool in the workshop, for

example, for general use, and try to find it. If 5S system is implemented, it will take no more than 5 minutes, which contributes to quick and high-quality repair of machines.

− Simple control on machine repair process. The system is based on the simplest thing of the order – its visibility. The order can be always visible, but we should start still from the zone of acceptance in the facility. As long as everything is clearly defined, labeled and ordered, as much simple will be the control of the overall process even in the client's zone.

Except clean and ordered working places, obtained through implementation of the 5s-system, the machine repair facility earns the following:

− Increased safety of the machine repair process;
− Creating Kaizen philosophy base and increasing the client's satisfaction;
− Improved staff engagement and responsibility;
− Loss reduction;
− Increased effectiveness and quality of the repaired machines up to 30%;
− Higher profitability of the repair process.

A good arrangement in the repair facility or workshop is in itself a condition for the efficiency of the processes, as it saves time for the installers. On the other hand, it is also a barometer for the quality of repaired machines. By how the workers treat the tools they use, how they maintain the cleanliness of their workplaces, we can judge their attitude to the work itself and to the quality of the repaired machines. This depends on at least two things, the existence of a system and the discipline of the people. In summary, 5S gives us a comprehensive assessment of the commitment of workers and management to the repair company and its condition [11-15].

Briefly, 5S is a system for working place organization which supporting, by the means of different practical methods, ordered and clean working places and units in the repair facilities and workshops.

5S consists of five Japanese words which could be translated as follow:

− 1. Seiri - Sort
− 2. Seiton - Set in order
− 3. Seiso - Shine
− 4. Seiketsu - Standardize
− 5. Shitsuke - Sustain/self-discipline

Each of these five steps are related not only to clean and ordered working places, but creating better conditions for improved quality of the repaired machines.

Seiri is the first step consists of only necessary tools to present at the working places. During the daily activity we often accumulating lots of things supposed to be used in future (usable replaced details, tools, remains of various materials and so on, until the formation of bulk containing a variety of details and aggregates, where is not so clear which of them are most necessary for the repair process and which could be used later. When the implementation of 5s-system begins, everything should be sorted out and divided to necessary or not necessary. It means that we should look at each object and evaluate whether is needed or it should be moved out of the working place. The presence of unnecessary things is one of the obstacles preventing an effective and qualitative work during the repair process. Removing of damaged and unnecessary tools, instruments, equipment and accessories, ordering of the racks, shelfs and working places of the mechanics as well as removing of posters, stickers, flags or other similar things affecting the concentration of the mechanics would benefit to improvement of the quality. All usable things, which could be involved into further mechanic's work, are subject to change their initial place and moved to an appropriate storage unit or warehouse. At other side, the warehouse unit has its own limited area and space, so the phrase "Let's leave them there for a while" would become unacceptable due overfilling of the warehouse for a relatively shorter period [11, 17, 20].

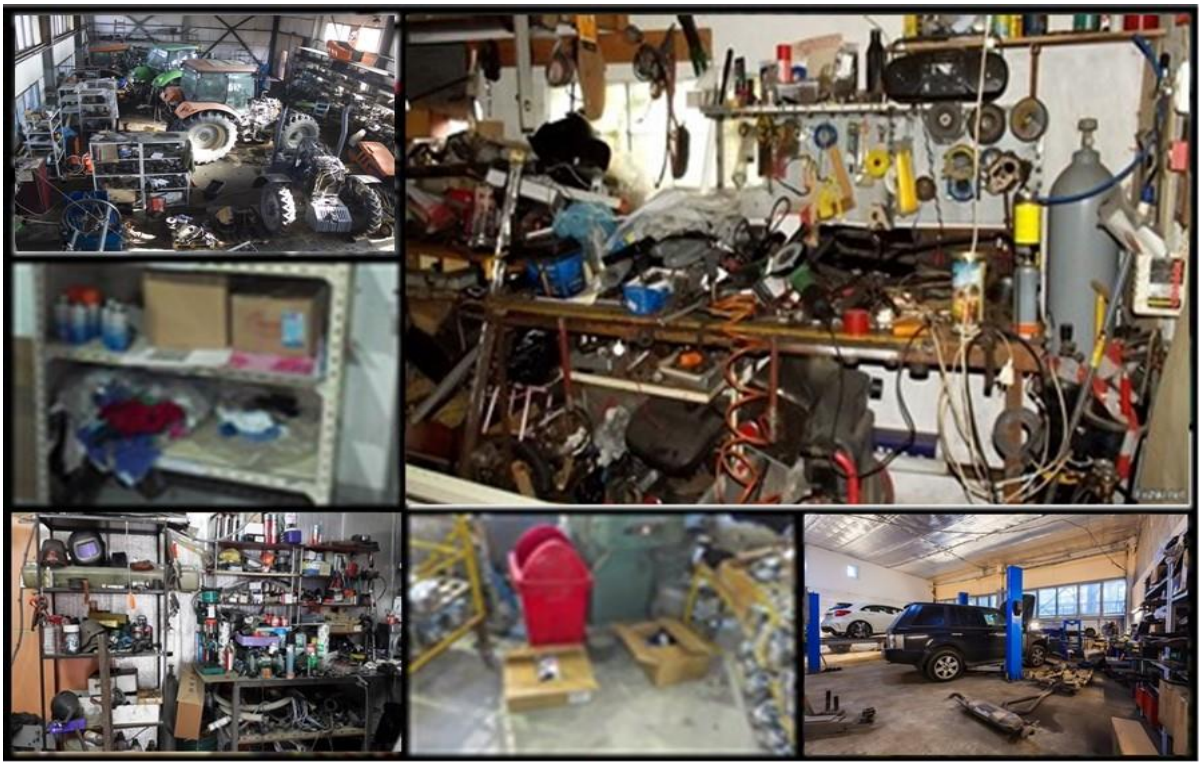

Fig. 2 Status of the repair facility before sorting

When there is an object necessary for the mechanics daily work, it should remain on the desk, although some objects are defined and relating to the so-called "desirable" things. Such group includes objects defined as good-for-use in near future or such with an emotional value to the mechanic. During the sorting process should define whether any certain tools or instruments, classified as unnecessary for us, will be used onto another working place, so would be good to define where they will be used and move them to the appropriate places [7, 12].

Once the first step sorting is implemented, the working area "enlighten" due the lack of unnecessary things, the working place become clear and easier to locate any sort of problems during repair process and improving the quality of the repaired details and aggregates.

Seiton is the second step of the 5S-system and includes two elements – order and system. Order means to ensure an appropriate and reachable space for each item left after sorting process. All necessary objects should ordered in such manner determining their exact locations and easy access as an attention should take about all instruments, which are recently unavailable, but necessary in further repair activity, so the last should have determined and permanent space.

The storage units should contain clear markings and labels as the borders of each working area are marked with red, yellow, blue or gray paint, resistant to wear and oils. All racks, shelfs and storage boxes should contain labels to read the inventory number of the item, description, storage place and recommended minimum and maximum quantity. One most frequently used method to reduce the time, necessary to find the needed instrument or material is by creating of so-called visual tool boards allowing ordering of all instruments and tools near each other. At other side, instruments and tools that are not frequently used should be stored in racks, depending of their usage frequency [4-7].

During process of order there is a need of reducing or removing the vast from the mechanic's work, so face-to-face communication with the mechanics operating at given work place helps to solve this problem as well as reducing of their unnecessary operations and movement. As long, the working place is in good order as much the mechanics is able to perform faster checking of the equipment needed and avoiding lack of energy. For example,

the hammer as one of the most used tools should always be at nearest area around the mechanic.

Very often, during the daily activity, there is just one ordering process performed, but it appears as ineffective due the lack of stable order system. The methods included in seiton avoiding the chaos and supporting qualitative order of tools, instruments, materials, spare parts and consumables at the work place as such, so even clients can oriented themselves about the locations of the tools; presence or absence of missing parts as well as exceed storage quantity. After the implementation of the first two steps of the system, the repair facility should appears as well-organized airport terminal as seen at Fig.3.

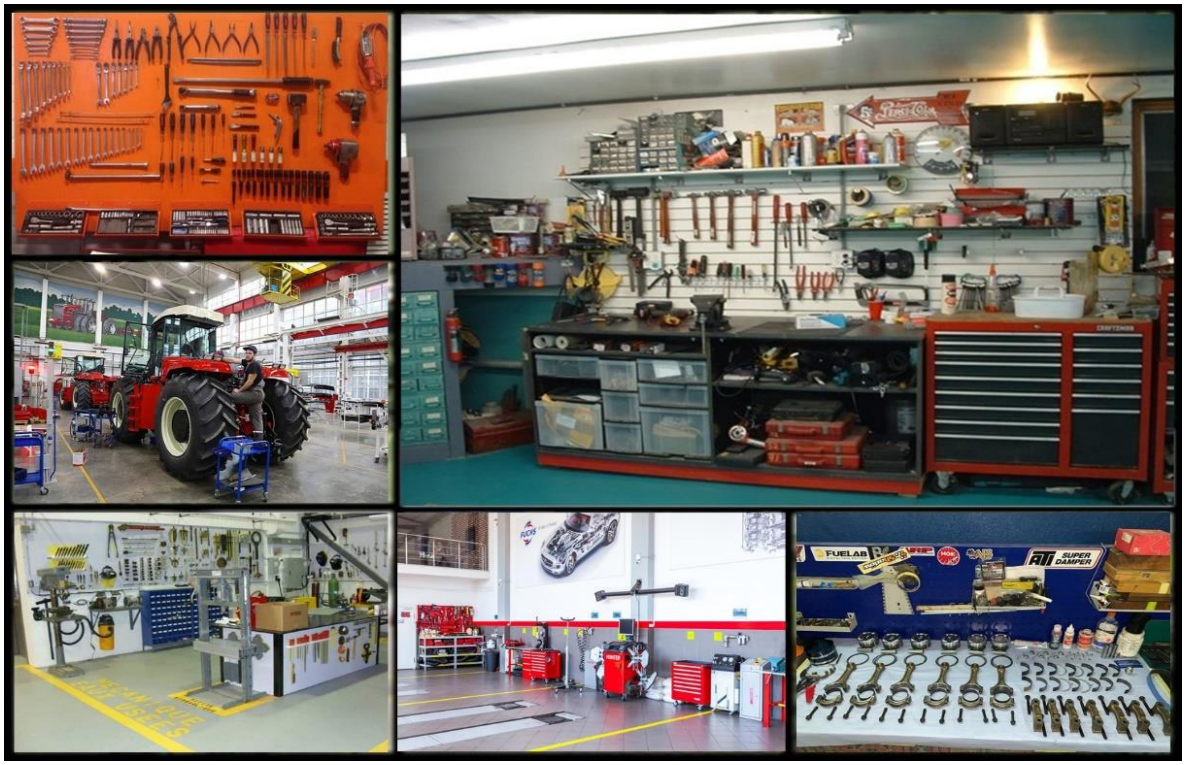

Fig. 3 Status of the repair facility after sorting and systematic order at the working place

Seiso is the third step that is possible for applying after the fullest implementation of the first two steps. It relates to process of cleaning of the work place, unit or whole facility. The presence of any sort of contaminations on the surfaces of the equipment is leading to higher losses of time and possible issues in regards to the safety cautions [15, 17, 20].

An effective support of cleanliness and order at the work place can ensure only the mechanic who is working at this place as the last is responsible for the overall condition of the tools, instruments, machines and materials. The mechanic's responsibility is consists of the following main tasks:

− Cleaning after the repair process of each repaired machine;
− Cleaning at the beginning and end of the working day(chemically or water spraying);
− Order and cleaning of the equipment when there is a lack of repair activity

The cleaning process is not limited only to removing of the contaminations, but require a checking control for problems, damages or abnormalities as oil and grease leakage, worn or damaged cables, burned bulbs, dirty sensors, etc. Thus, when there are any issues from the last, so they could easily noticed and repaired.

Consequently, seiso is a step of control cleaning and it is a requisition for answering some questions like "Where the leakage comes from?", "How to keep the working surface clean during operation?", "Why there is an overflowing of materials?", "What is the reason about these misalignments?" and so on. The cleaning is helping to support the previous two steps at highest possible level as well as earlier detecting of problems in regards to machine repair. Two

requisitions for improvement of the overall cleaning process are creating of so-called cleaning graphics and splitting the repair facility area into smaller cleaning zones in regards to easier maintenance [2-4].

The fourth step **Seiketsu** appears as the most important step of the system. It relates to creating, accepting and establishment of standards (rules, instructions and procedures) for visualization of the improvements to support the previous steps of the system. The effectiveness of the system requires its understanding and application on behalf of all people engaged in the repair facility. Therefore, the methods of standardization helps to develop the previous steps within the 5S system at all working places within the facility by creation of rules, followed through the daily activity [2, 3, 5, 7, 1, 11, 18-21].

Fig. 4 State of the workshop after standardization of jobs

The process of standardization uses leaflet instructions, control lists, photos, tables, graphics and other documents. A visual control testing appears an effective method as the results are recording in a working lists containing information about the type of service and mechanic's name. The equipped tool cart, pictured with pull-out-shelfs as the pictures placed onto the cart afterwards, in order for a clear vision by the mechanic. Color identification of the working zones is possible, but should respond to the rules of 5S-system. It is suitable to create a graphics, related to the cleaning of the working places.

The absence of written standards is stimulating the chaotic work and improvisation by the mechanics, which performing the tasks according their personal vision and avoiding the 5S system implemented rules. Such behavior is leading to losses and lower quality of the repaired machines. Throughout the standardization of the repair process, there is a possibility to avoid possible errors or mistakes in order to increase the overall effectiveness of the machine repairs.

The last, fifth, step of the 5S system is **shitsuke** and it closely depends of the realization of the previous four steps. Consequently, it is the most difficult to follow in Bulgaria as we facing with the opinion that without the discipline at the beginning – nothing significant is achieved. Generally, it is difficult to expect that the mechanics will order the tools and instruments on their own will if there is a lack of developed ordering system, especially when there is a bulk of unsorted objects, many of them unusable in future. **Shitsuke** relates to

development of audit procedure aiming to supporting and implementation of 5S in the overall organization. The main purpose of the maintenance is consists of implementation the 5S system rules in the daily activity of each staff member, nevertheless its position in the repair facility. Presence of daily control list, distribution of the responsibility and assignment of responsible contact person would benefit to keep the achievements within mechanic's work. The main task of the assignment responsible officers is to control the application of all principles and standards as well as to react to each deviation of the requirements. At the beginning, the mechanics and officers to restrain the 5S system due lack of habits, but once everything is sorted, ordered and cleaned as well as higher working standards exists, so the facility staff become satisfied and rather engaged within the daily application of the system [16-20].

Generally, the fifth steps of the system are logically connected each other and it is characterized by simplicity, easy usage and higher efficiency. The system is not a single act, but process for transformation of the rules into habits through appropriate supporting activities. The following of the system is leading to clean and ordered work places as well as comfortable and pleasant atmosphere in the repair facility.

There are some typical mistakes of the government of each repair facility during the process of implementation of the 5S system, considered as follow [2, 5, 6, 11]:

1. Lack of personal effort by the government – when the tasks relating to support of the order in the facility there are difficulties during the process of implementation. The manager of the facility should directly participate into all optimization processes, to follow the system rules and possess a personal effort in such way. The work place of the manager should follow the rules of the 5S system as well at point of order and cleanliness.

2. On each step, the government of the facility may facing formality and neglected attitude by the side of individual officers to the rules and principles of the system. Imposing fines, surcharges and sanctions every time influence the performance of the officers. A successful implementation of the 5S system is possible, when there is a positive attitude by the government through positive stimulation and prizes for the officers, which follows and apply the rules during their daily activity.

3. Inappropriate approach to possible complains – the implementation of the system may cause complains by the staff members as follow: "This is not suitable for me", "I'm still well oriented at my work place" or "I'm supporting the creative disorder". These or many others examples are typical type of complains, so the government of the facility should explain to the staff members about all advantages of the 5S system and its application. Generally, the biggest challenge for each system is the change of the stereotypes existing in the members of the repair facility.

CONCLUSIONS

1. The essence of the 5S system and its application into the organization of the work places during machine repair as well as its advantages to the repair facilities are defined.

2. The main reasons for implementation of the 5S system in the repair facilities are determined and defined as follow: to make a good impression, to be noticeable, acceleration of the machine repair process and simplicity of the control during machine repair

3. The essence and contain of each step of the 5S system (seiri, seiton, seiso, seiketsu и shitsuke) are defined and related to clean and ordered work places as well as better conditions for improved quality of repaired machines.

4. The typical mistakes of the government of the repair facilities during implementation of the 5S system are announced and defined as follow: lack of personal effort by the government, imposing charges without positive stimulation and inappropriate approach to possible complains.

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