Production System that Copes with Production Volume Fluctuation

Setsuo Miyairi Kesatomo Fujisawa Yousuke Rokugawa

1. Introduction

Our Power Systems business has relatively large fluctuation in work volume throughout the year. Due to the global recession that started in late 2008, difficult circumstances have continued for the Power Systems Division, which has had to work with a greatly decreased and fluctuating work volume. To overcome this situation, we have attempted to build a production system in which man-hours are thoroughly controlled so that productivity can be maintained at a constant level without being affected by work volume.

2. Basic Activities

In order to establish a production system that copes with work volume fluctuation, we have two basic activities. One is the fundamental 5S activity, and the other is activity to increase productivity.

5S activity was started in 2007. We have eliminated unnecessary materials and implemented the maintenance of tools used for production by mainly focusing on the organization and arrangement of our workplace.

The activity to increase productivity was started as in-house project in July 2008, and it focuses on the theme of elimination of waste and efficient manufacturing.

3. Goal Setting

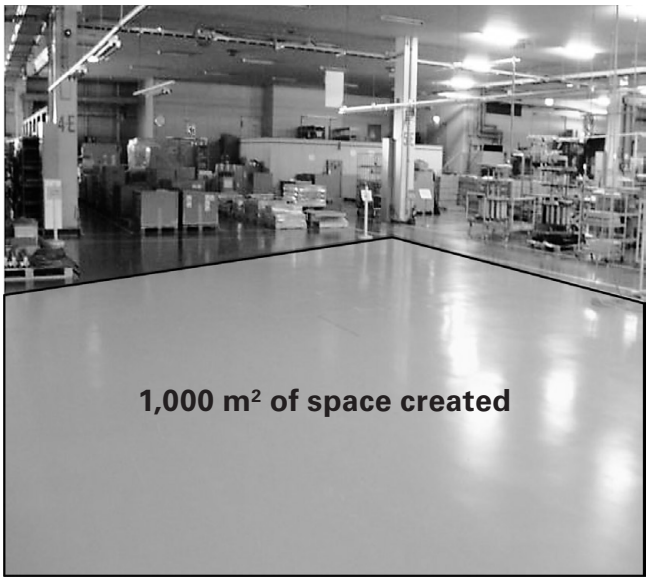
The goals for the 5S activity were set as "establishing quality management that creates no failure" and "reducing inventory and its storing space by 50%."

We set a quantitative goal for the activity to increase productivity. Based on the productivity achievements from June 2008, we set a goal to increase the target value to 200% by June 2009.

4. Major Activities and Accomplishments

4.1 5S activity

We implemented the red tag operation to eliminate things unnecessary for production. The purpose of this operation was to define the waste (unnecessary things) in the workplace, and separate "necessary things" and "unnecessary things." A vast amount of unnecessary things were eliminated through four red-tag operations. To efficiently utilize the space created, we made minor layout changes and created approximately 1,000 m^2 of space as a result.



Photograph 1: Space created by the 5S activity

4.2 Activity to increase productivity

The following are the descriptions of three major policies.

4.2.1 Improvement operations

In order to share a sense of participation among all employees, we started from improvements that the

operators could perform. With a goal of 20 improvements per month for each person, operators went over every minute problem in operations and improved them over and over again in order to eliminate waste and improve work efficiency. Improvement of operations largely depended on consciousness improvements from the operators.

4.2.2 Execution of improvement meetings

As the next step, an improvement meetings were help. After deciding the target model for improvement, the members from production, design, material, and quality control divisions gathered for the improvement meeting. Waste in the operation, parts, and inspection were eliminated by extracting and analyzing the problems for each production process.

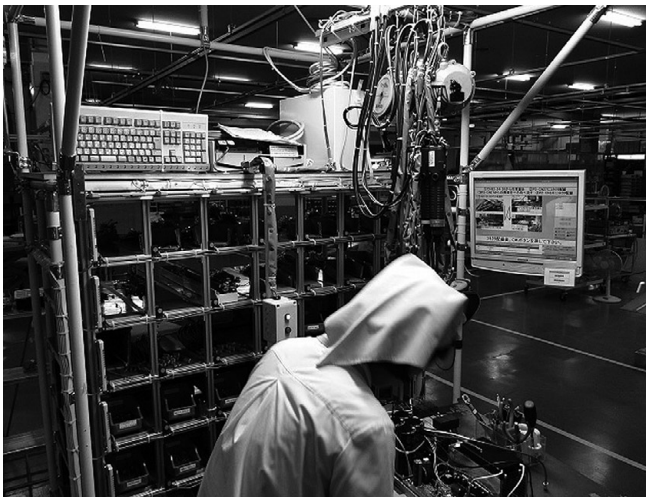
By allowing all division to tackle problems that could not be solved by just the production division, workability of the production process was improved.

4.2.3 Adoption of the production guidance system

As a tool to improve productivity, the production guidance system was implemented. This is a unique production system from our company.

Normally, assembly and wiring of the product are performed in accordance with diagrams or operation instructions. Every time one operation is finished, confirmation of the next operation was performed, so the total work time was increased due to the accumulated confirmation time.

We implemented a production guidance system that places electronic copies of the conventional printed operation instructions developed by a different division into a database and displays them on a monitor from the computer in real-time, so that when one operation finishes, the next step in the operation automatically appears. With this system, the time used to confirm operations was reduced drastically.



Photograph 2: Production guidance system

This system also has a feature where operators cannot advance to the next operation if there are any loose screws or any mistakes in the parts, which results in maintaining the quality. Also, this system allows new operators to learn operations in approximately one week instead of in one month with previous methods.

By continuously performing the above activities, we achieved 200% productivity by February 2009.

5. Measures for Fluctuations in Work Volume

Fig. 1 shows the relationship among work volume, productivity, and retained workforce.

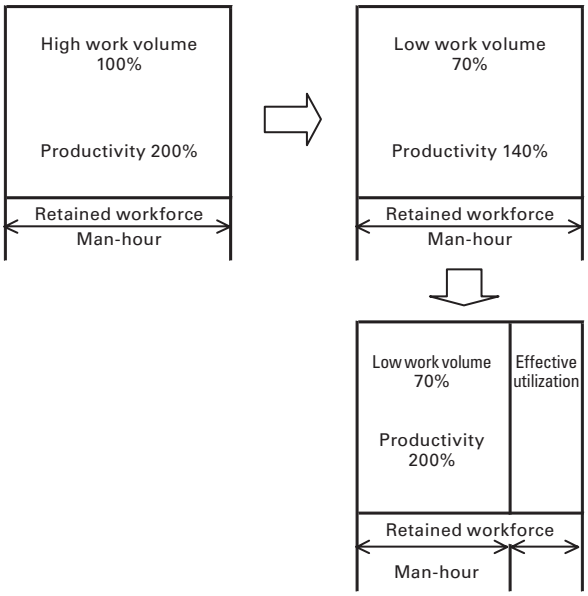


Fig. 1: Relationship among work volume, productivity, and retained workforce

If the work volume is 100% at high points in the year, the fluctuation in work volume results in a work volume of 70% at low points. As noted previously, productivity reached 200% when there was a comparatively high work volume (top left of Fig. 1), and therefore, when the work volume dropped to 70% for the same man-hours, this theoretically represented a 140% drop in productivity (top right of Fig. 1). A situation similar to this actually resulted. To maintain productivity without changing the retained workforce when the work volume decreases, the man-hours must be managed to 70% (bottom right of Fig. 1) . By doing so, 30% surplus man-hours are generated, but the method for handling this will be explained later.

6. Policies to Maintain Productivity

As explained in Section 5, in order to maintain high productivity regardless of fluctuations in the work volume, the man-hours must be managed depending on the work volume.

Further measures were implemented to completely control the man-hours applied for each process, equalizing the work.

The following information outlines the major policies.

6.1 Implementation of "production control board"

In order to control the man-hours, we must have a firm grasp on the man-hours required for the work volume.

The "production control board" (Photograph 3) was implemented as a tool to promptly and effectively secure this information.

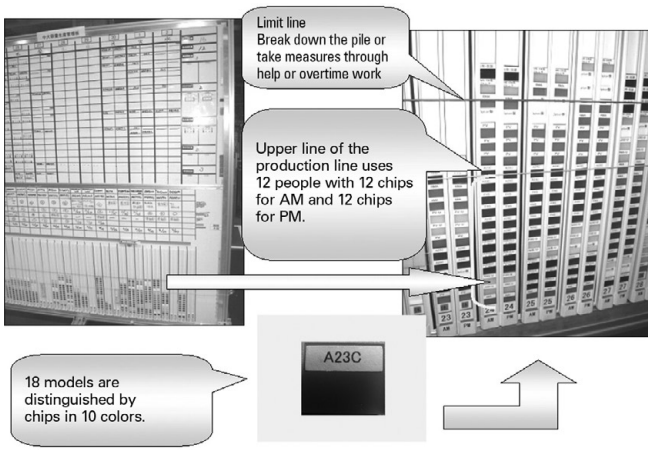
The "production control board" is a matrix with the calendar as the horizontal axis and man-hours as the vertical axis, and it is used as a production planning tool that can describe the production information for each line.

Table 1 shows the specific topics enacted by using the "production control board."

By implementing the "production control board", we can grasp the man-hours several weeks to a month ahead of time. By breaking things down further, we even minimized the variation in man-hours worked daily.

Table 1: Measures taken with the production control board

No.	Item	Implementation	Remarks
1	**Grasp the work volume**	· Clarify man-hours by piling up the "man-hour chips" for each model (Photograph 3).	· Clarified the required man-hours by piling up the chips. · Clarified the number of people in the workforce. · Visualized the fluctuation of work volume.
2	**Equalize the work volume**	· Equalize work volume by viewing the piled "man-hour chips" and breaking down the pile.	· Eliminated the variation in man-hours. · Established control over man-hours including overtime.
3	**Operation instruction**	· Clarify who is to operate on which model until when (Photograph 4).	· Enabled operators to start the operation without instruction from the manager.



Photograph 3: Production control board 1

Photograph 4: Production control board 2

6.2 Training of cross-trained workers

The next step is to have appropriate workforce for the work volume. Conventionally, operators were essentially fixed to one production line or model. Operations also differed across departments and divisions, creating a problem against having a flexible work force. To solve this problem, we implemented training of cross-trained workers so that a single operator can perform multiple operations. The following information shows the topics of the cross-training.

1) Operation instructions were revised. Important points in the operations were emphasized in order to create an environment where operators can easily perform operations even when performing them for the first time.
2) For complex operations, we videotaped operations as performed by experienced operators so that operators may learn the important points of operation by watching.
3) For operations that can only be performed by experts, we trained multiple operators for each operation.
4) In order to learn about the operations of other departments, operators were rotated across departments and divisions.

As a result of these actions, we now have cross-trained operators who can perform multiple processes. This allows us to have a flexible workforce.

Through the above policies, we achieve a constant grasp on man-hours and create a flexible workforce, thus allowing us to appropriately control man-hours. With these policies, we were able to create our goal of a production system and we achieved high productivity even when there was a reduction in work volume. Surplus man-hours are used effectively by applying them towards 5S activities and work on activities to increase production.

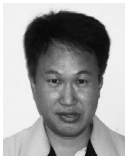
7. Conclusion

We introduced the “production system that copes with fluctuations” in this article.

Through these efforts, we established control over man-hours and achieved significant results through a system that maintains a constant level of productivity regardless of fluctuation in work volume. We believe that we have weathered the recession due to these effective activities and measures.

We will continue these two fundamental activities and work on enhancing productivity even further.

Setsuo Miyairi
Joined Sanyo Denki in 1974
Power Systems Division, Production Dept.
Worked on production management of the UPS and photovoltaic power generation system.



Kesatomo Fujisawa
Joined Sanyo Denki in 1984
Power Systems Division, Production Dept., Sect. No. 1
Worked on production management of the UPS and photovoltaic power generation system.

Yousuke Rokugawa
Joined Sanyo Denki in 1979
Power Systems Division, Production Dept., Sect. No. 3
Worked on production management of the power generator, distributed power supply, and monitoring equipment.