

Research on unit production and application of water meter enterprise

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Abstract: The unit production theory is applied to the production practice of water meter enterprises, and the case study is carried out. The radar map is used to systematically evaluate the management level of water meter production site, and the water meter production site is comprehensively improved from the aspects of unit operation mode, multi-function worker training, workbench design, 5S management and Kanban management in combination with the unit production theory, which effectively improves the production efficiency of water meter and the flexible manufacturing ability of the enterprise, and realizes the goal of the water meter enterprise to deal with the multi-variety and small-batch market.

1. Introduction

Unit production is a further improvement on the basis of lean production and is one of the most advanced production modes. Unit production is a group production technology, which combines multi-function work, flexible production and overall production management. Unit production, also known as cell production, is a production mode in which the processes with similar structure and processing methods are grouped and shared by one or more skilled workers. This production mode brings together the machines and personnel needed to complete a product, and directly completes the processing of the product, avoids long-distance transportation, facilitates management, and effectively improves the production efficiency. Mahyar Alimian^[1] believes that the goal of unit production is to form groups of parts and machines that maximize material handling and underutilization. Zheng Pu^[2] and Jiang Chunzhao^[3] believe that the application of unit production can enable enterprises to cope with the changing market and meet the needs of consumers. Chen Yuguang^[4] and Han Xiaolu^[5] believe that unit production can improve the subjective initiative of employees, effectively motivate employees and improve their work enthusiasm. Gao Xiaohong^[6], Ge Anhua^[7], Zhang Hongliang^[8] et al believe that the establishment of lean units effectively reduces the production costs of enterprises.

In recent years, the new investment in real estate and the demand for replacing the stock of the water meter industry have been increasing, and the development prospect of the water meter industry is good. However, due to the rising production cost of water meters, the transformation of the water meter market to a variety and small batch market, and the increasingly fierce competition in the water meter market, water meter enterprises must improve their own production mode and production site in order to develop. Thus, it can reduce the cost of enterprises, improve the

production efficiency of water meters, market competitiveness of enterprises and flexible manufacturing capacity.

2. The production status of water meter enterprises

Although the mass assembly line production mode adopted by water meter enterprises meets the demand of mass production in the early stage of the water meter market, with the change of the market and the continuous rise of enterprise costs, the drawbacks of mass assembly line production gradually emerge, and can no longer meet the development needs of water meter enterprises. The current production situation of water meter enterprises is evaluated. And the production problems of water meter enterprises are mainly divided into the following six aspects.

2.1. The degree of flexibility is not high, and the elasticity of the production system is small

Because the water meter enterprises adopt a mass production line, the product model produced in a production line is fixed, so in the face of a variety of small batch market, the product model of the production line needs to be changed frequently. When the product model needs to be changed in the production line, the materials and molds used between different water meter models are different. Therefore, it is difficult to switch the product model, the cost is high, the flexibility of the production line is low, and the elasticity of the production system is small.

2.2. High production line investment, long production cycle

Mass production of water meters requires the establishment of a specific long-distance production line, the production line also needs to be equipped with a large number of professional water meter production equipment, so in order to accommodate the long-distance production line, it is necessary to rent a large workshop to install the production line, and because the production line is too long, too many production links, high investment in the production line, long production cycle of water meters.

2.3. The accumulation of products in process is large, and the material flow is stagnant

In the production line, due to the different proficiency level of each operator, in order to prevent the stagnation of the whole production line, the work-in-process inventory will be set up in the production process. However, in the mass production line, unbalanced processes existed before and after. For example, the balance rate of eccentric direct reading meter production line was only 66.56%, and affected by the bottleneck process, the products in process in the assembly workshop accumulated. The accumulation amount of products in process was large, resulting in the stagnation of the flow of materials in the workshop.

2.4. Low production efficiency

Mass production lines employ a lot of workers, but because of the lack of standardized operations, operators in the production process of many production actions are repeated, there is a lot of action waste, so the overall production effect is not good, some water meters UPPH is only 7.4; In addition, there is a lack of Kanban management in the production site. There is a phenomenon that only a few people are busy on some production lines while other workers are waiting for their posts. There is a lack of forms or software such as JIT production management board to control production, and the production efficiency of water meters is low.

2.5. Staff enthusiasm is not high, the enterprise does not pay much attention to the staff

Factors such as high intensity, monotonous and repetitive work and long working hours of mass production line lead to low enthusiasm and high working pressure of employees, and even cause serious psychological problems of employees. In addition, employees have to bend over to complete the assembly of water meters during the production of water meters, which is easy to fatigue. And mass production is more focused on the product, the lack of attention to the physical and mental health of employees and incentive policies for employees.

2.6. The production site is not standard

There is no fixed position or container for placing production materials on the production site, the size and material of containers are not fixed, and the storage quantity of materials is not fixed. In addition, there are extensive material supply methods in the production process, semi-finished products are piled up in the field, dead corners exist in some areas of the production site, and the arrangement and placement effect of some tools and materials racks on the site are not good. The production site as a whole presents a non-standard state.

3. The idea of unit production of water meter enterprise

If water meter enterprises want to reduce their production costs, meet the market demand and improve their market competitiveness, they need to comprehensively improve their production mode and production site, establish unit production system and carry out "5S" management, so as to improve the production efficiency of water meter and the flexible manufacturing capacity of the enterprise and standardize the production site.

3.1. Establish lean unit operation model

Analyze the data of water meter products, analyze the production process of water meter products that occupy a large proportion, and improve the products with similar production process into groups. Process improvement of water meter production by applying ECRS improvement principles (Eliminate, Combine, Rearrange, Simplify) can improve the balance rate of the production line and improve labor efficiency. Based on data analysis, select similar processes in several products for improvement. The specific improvement method is to cancel the unnecessary actions in this series of processes. Some unnecessary operations can be canceled, so as to optimize the production operation and reduce the waste in the action. The process of similar operation content is merged to reduce the consumption of transmission, and the work of workers is more concentrated, improving the efficiency of work. To rearrange and simplify the production sequence of water meters, optimize the production process of water meters, improve the production line production balance rate and production efficiency of water meters. After the application of ECRS principle to improve the production process of water meters, establish the operating standards of water meters, so as to ensure that employees can work according to the operating standards in the production of water meters, ensure the smooth progress of water meter production and product quality.

3.2. Conduct multi-functional training for employees

(1) For preparation work, the engineering group shall make new staff training courseware, examination papers of various titles, assessment application forms at all levels, and staff archives.

(2) Develop training plan

1) The proportion of multifunctional workers on the production line should be kept above 40%, and at least three junior technicians should be trained for each production line every month

2) According to the production process, the training plan for multifunctional workers is formulated for each production line, which is collected and sorted out by the leader of the process group on the 1st day of each month

3) The team leader of the production line arranges the training plan of the multifunctional workers by himself after mastering the station.

(3) Training implementation

1) According to the multifunctional training plan, training on the production site or training venue;

2) Carry out process operation according to operation standard;

3) During staff training, the process team specialist will provide guidance (operation essentials, operation points, etc.) and post skill evaluation and identification;

4) Assess the skill level of employees on a weekly basis.

3.3. Design employee workbench

The unit production mode of water meter is mainly standing operation, the workbench is too low, the staff is easy to fatigue when working, and will produce the waste of action, so the design of the table of water meter production.

(1) Height of table

The height of the workbench is better than the height of the elbow 1-5cm, this is the best working height. 102cm is the average elbow height for Asian men and 96cm is the average elbow height for women, so 92-97cm for men and 86-91cm for women are the best height for standing tables. According to different work content, the height of the table is adjusted appropriately. Since the production of water meters is light work, the height of men's workstations should be 90-95cm and that of women's workstations should be 85-90cm. In the production of water meters should be adjusted according to the specific situation of each employee.

(2) Working activity clearance

When working standing up, the scope of employees' work will become larger. In order to ensure that employees can work flexibly, it is necessary to reserve some activity gaps for employees. The distance between the table and the wall behind the operator should be no less than 760mm, and it is best to keep it at 910mm; Operator through the width of not less than 510mm, the best distance is 810mm; The width of the walking space should not be less than 305mm, and the best distance is 380mm.

3.4. Production site "5S" management

3.4.1. Tidy up

It is necessary to determine what needs to be sorted out and thoroughly inspect the production site to see if there is any garbage, and if there is any accumulation of useless things on the production workbench. It is necessary to inspect every corner of the production site and distinguish between necessary and non-essential items on the production site. The unwanted items are marked with red labels. Red is more conspicuous. The unwanted items with red labels are gathered together for centralized processing, so that immediate action can be realized. No accumulation of unwanted items in the production site, immediate action, and the whole process should be repeated, so as to achieve the best results.

3.4.2. Rectify

Place the necessary items in a reasonable and visible place on the production site to prevent the loss of work efficiency due to the confusion. Three rules should be made for the placement of necessities: fixed location, fixed items and fixed quantity. The necessities should be placed on the shelf according to the frequency of use, and placed separately according to the category of items. If necessary, some specific items can be marked, such as: the classification of different water meter products should be placed on the fixed production shelf. Use dyes to differentiate production sites, separate workspaces from employee workspaces or passageways for freight machines, and hang cleaning tools on walls to save space.

3.4.3. Sweep

After finishing and rectifying the production site, the production space becomes larger and the place where items were placed before is cleared out. At this time, the production site needs to be cleaned immediately. Cleaning is to clean the equipment, workbench, etc., to keep the production site clean and tidy. Due to the accumulation of dust caused by the long time storage of goods, if the production site is not cleaned, it will lead to the deterioration of the production environment, the health of employees will be harmed, the quality of products is difficult to guarantee, the equipment is prone to failure, leaving a bad image for customers, etc., so it is necessary to clean the production site. In cleaning, the first thing to do is to formulate rules and regulations, so that employees can clean the equipment and tools they use regularly, so that employees can clarify their responsibilities and implement the cleaning on each employee. Secondly, establish the system of regular cleaning, formulate the time and content of regular cleaning, and make appropriate changes to different places. (The corridor and other working areas are cleaned every 30 minutes, and the dead corner of the workbench is cleaned once a week). Thirdly, analyze the source of dirty production site and improve it fundamentally. Finally, establish the standard of cleaning.

3.4.4. Clean

Cleaning is the maintenance of the production site after sorting, rectifying and cleaning. The premise of cleaning is that the enterprise can carry out sorting, rectifying and cleaning well, so that the production site can be clean and tidy, so as to further implement cleaning. In the concrete implementation of cleaning, we should first let employees develop the habit of cleaning, educate them and establish their awareness of cleaning. Secondly, the management of the enterprise regular inspection, strengthen supervision, to timely find employees and production site problems and timely correction.

3.4.5. Accomplishment

Literacy is to educate all employees to abide by the rules. Literacy education needs to face all employees, including leaders, managers, field operators, zero-hours workers, etc. If employees abide by the rules and leaders do not pay attention to the rules, then the "5S" management implemented by the enterprise will be meaningless. Literacy education mainly includes laws and regulations, common sense and company regulations. The implementation of literacy, first of all, to let all staff can correctly understand the rules of the enterprise, and can clearly violate the rules will be what kind of punishment. Secondly, a positive incentive mechanism should be established, and employees should be evaluated regularly to select and commend those who abide by the rules and perform well. Thirdly, establish a good communication mechanism between superiors and subordinates, so that if employees have any opinions, they can be quickly understood by the leaders

and solved in time. Finally, execute immediately, refuse to hesitate, in the implementation of "5S" management to make a quick decision, do not hesitate.

3.5. Kanban management

Whether it is the smooth implementation of unit production or the on-site "5S" management, it is necessary to understand the specific situation of the production site, be able to monitor the production progress and master the production efficiency, so as to quickly solve the problems in the production site.

Set up unit line production Kanban in the production shop, so as to understand the specific situation of unit line production. Through the production Kanban, the output, efficiency, abnormal information and other data of every hour of the production line will be monitored in real time during the continuous operation of the production line, so that the production line status can be timely mastered and anomalies can be discovered for continuous improvement.

4. Implementation effect

Water meter enterprises adopt the unit production mode, which effectively improves the production efficiency of water meter and the balance rate of production line, and greatly reduces the number of products in process of production. To the staff training and the design of the table, improve the quality of the staff and staff comfort, stimulate the enthusiasm of the staff work; Carry out "5S" management on the production site, and make the layout of production equipment and staff work area more standardized and comfortable.

5. Conclusion

Taking the production of water meters as an example, this paper applies the theory of unit production, "5S" management and multi-function to improve the production of water meters, realizes the unit production of water meters, standardizes the production site of water meters, and improves the flexible manufacturing capacity and competitiveness of enterprises. It is expected that the application of unit production in water meter production can be learned and applied by more manufacturing enterprises to enhance the competitiveness of enterprises.

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