Research and Practice of Star Site Construction in Machine Shop of Servo Valve Processing Enterprise

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Abstract. This paper focuses on the relevant work carried out in the field renovation of the servo valve machining workshop, focusing on how to optimize the process flow, optimize the production layout, how to focus on customer concern, improve the requirements and means of product quality control, and improve the quantitative control ability of the process through the research and practice of key characteristics. By improving the quality of personnel, constantly improve the efficiency and effectiveness of the site. Finally, a national five-star scene was created.

Keywords: modern business management, servo valve machine modification, national five-star site.

1 Introduction

Beijing Institute of Precision Mechatronics and Controls is a supporting servo mechanism design and manufacturing integration unit, the core component servo valve has a complex component supporting relationship, high precision requirements, process difficulties and other characteristics, parts processing has been restricting the servo mechanism to shorten the development cycle, improve the quality of an important link. To this end, the unit is now carrying out the construction of enterprise production line, and the workshop site has carried out a series of improvement work such as process flow and production layout optimization, technical specification system/production information construction, process improvement, 6S and visual management, application of quality tools and methods, and training of multi-functional workers, which has achieved good results and achieved the role of improving production capacity. And won the five-star site in the national site management star evaluation.

The background of the construction of the valve parts processing line mainly comes from the following aspects:1) Improve the ability to process the complete set, shorten the complete set cycle, and ensure product delivery. With the increase of product development varieties and the shortening of development cycle, according to the production target, the annual fixed working hours need to be increased by 30%, and the product processing cycle should be shortened from the original 8-12 months to 6-8 months;2) Strengthen the process control of key parts and improve the manufacturing quality of key parts. The servo valve is currently debugging and matching with the performance of the whole machine, and there are still not high and unstable problems, the important reason is that the consistency of the processing quality of the

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key parts needs to be improved, and the process control needs to be strengthened. For example, nozzles and throttling holes are representative of small hole parts, there are problems of unstable quality of small hole jets, which need to strengthen process control and technical improvement;3) Introduce advanced management methods to improve management level. The existing methods and means of production management[1] in enterprises are still the traditional ones, which can no longer meet the needs of product development by dividing production teams and manual information transmission according to the types of work.

Figure 1 shows the three stages of on-site improvement: the first stage is the stage of the integration of production and research, implementing the divisional system, implementing 6S management, and improving the quality system; The second stage is the production line construction stage, the process optimization, production layout adjustment, information construction; The third stage is the field management improvement stage, which implements the excellent performance model and introduces the star field management[2][3].

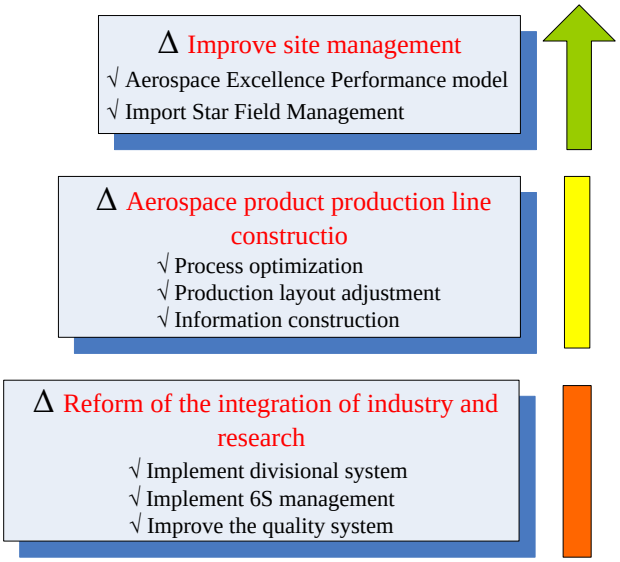

FIG. 1 Three stages of site improvement

2 The main work content

2.1 According to the classification of product manufacturing characteristics, carry out the optimization of process flow and production layout

Process flow and production layout optimization[4][5][6]is an important basis for the improvement of production site management, the fundamental starting point, servo valve machine workshop through the construction of product production line, set up a "based on structural characteristics, common processing needs of servo valve parts processing unit production line", the idea is to first classify the parts according to structural characteristics, Then the process flow is optimized and the manufacturing unit[7] is constructed according to the feature categories. The operation process is to divide the parts into three categories

according to the structural characteristics: Shaft sleeve parts, shell parts and small hole parts processing unit, shaft sleeve parts mainly include spool, valve sleeve, feedback rod, etc., highlighting the processing characteristics of the key parts of the servo valve, its shape (structural characteristics) processing is mainly based on turning, after the sequence of precision holes, cylindrical processing technology for precision electrical machining (wire cutting), honing/grinding and grinding processing. Shell parts mainly include the main shell, the upper shell, etc., although the parts are few, but the processing elements are more, the manufacturing cycle is relatively long, and the shape (structural characteristics) processing is mainly based on CNC milling (machining center), auxiliary electrical spark, fitter, some parts need to be honed after precision holes, research and processing. The small hole parts include nozzles, orifice holes, etc., which are difficult to process and require high precision, and the flow needs to be matched during processing, and the main process is processed by the Turner. For the classified parts, the feature manufacturing unit is formed in the shape processing stage. In the precision machining stage, the common machining unit is formed. At the same time, carry out the unit capacity analysis, solve the bottleneck link, balance the unit capacity and other work. After the parts are classified according to the structural characteristics, the process optimization work is carried out. Through the preparation of typical process flow, the manufacturing process with closely related manufacturing characteristics and quality requirements is taken as a process group to form a manufacturing unit, and the inspection point (detection content and quantity ratio) is set up according to the process capability. Through the construction of the line, the establishment of 3 characteristics, 3 common manufacturing units, while carrying out more than 10 process technology research, research and improvement work, the development and introduction of more than 10 sets of special equipment and equipment, the development of production and manufacturing execution system (MES), so that the unit capacity to improve and balance. Figure 2 shows the optimized typical shaft sleeve and shell parts operation flow and unit division diagram. Figure 3 shows the comparative analysis of production capacity before and after the adjustment of unit layout, and the balance is significantly improved.

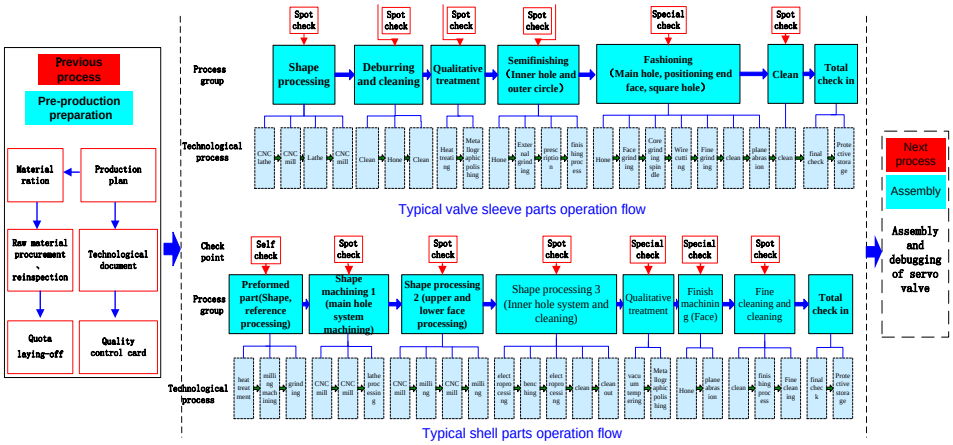

FIG. 2 Typical operation flow and unit division diagram of shaft sleeve and shell parts after optimization

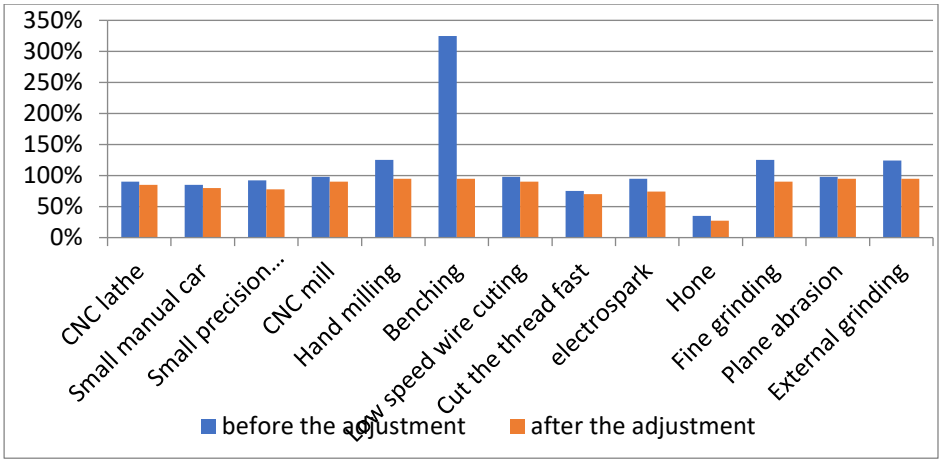

FIG. 3 Comparison of productivity balance after adjustment of unit layout

2.2Focus on customer concern, improve product quality control requirements and means

In the process of carrying out the star-level site construction[8][9][10][11] in the workshop, customers are always the center, the workshop team and the upstream and downstream processes are regarded as internal customers, and the design, installation and product customization outside the workshop are regarded as external customers, fully investigate, collect and identify the needs of internal and external customers, and continue to carry out improvement work around their focus.

2.2.1 Carry out the activity of "not bringing the problem to the next process"

The direct customer of parts processing is the next process, the implementation of the star site process, through a wide range of communication activities between teams, the realization of parts processing consistency, micro burr control, etc., is to affect the next process expectations. To this end, the workshop site spontaneously carried out the theme of "do not bring the problem to the next process", and implemented these needs into actual production by recording and other means, forming a fine quality awareness, and product quality and efficiency have been greatly improved.For the process personnel, his direct customers are production schedulers and operators, who require their process documents to be of high quality and to deal with problems effectively and timely. To this end, the activity of "process specification system construction, process document optimization and refinement" has been carried out, and 29 process technical specifications, 20 standardized process documents, and 20 post work guides have been formulated. Unify the process methods, process parameters, and processing requirements related to the manufacturing process of a class (kind) or multiple classes (kind) of products or materials, form typical process samples, and make the process documents unified and consistent. Figure 4 is the frame diagram of the process specification system.

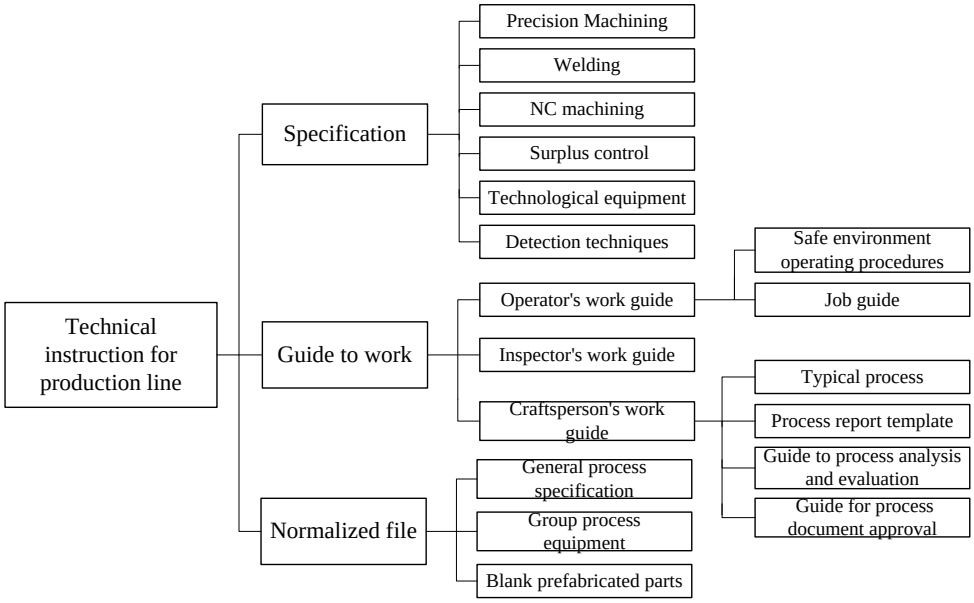

FIG. 4 Frame diagram of process specification system

2.2.2 Carry out research and practice on key characteristics to improve process quantitative control ability

External customers, especially design and product customization parties, pay more attention to key process control capabilities and process document refinement requirements. Therefore, for the key processes, the workshop carried out research on the key characteristics of process and process control. Based on the analysis of the key characteristics of design, PFMECA was adopted to analyze the weak links, fault prone points and outsourcing concerns of the whole process of servo valve realization one by one, and the ideas and methods of transforming the key characteristics of design into key characteristics of process and process control were given. Form three key characteristics of servo valve components processing table, develop the key process visual operation instructions, refine/quantify the process operation and control requirements, at the same time, the process capacity monitoring and analysis, put forward and implement process improvement. By implementing in the product during the process and production process, the servo valve function is reliable and the performance is stable and qualified.

2.3 To improve the quality of personnel as the goal, constantly improve the efficiency and effectiveness of the site

2.3.1 Carry out training for multi-functional workers

Multi-functional workers refer to employees with different types of equipment operation capabilities. The workshop has established and run multi-functional workers management methods, clarifying the personnel source consideration principles, selection sequence, training methods, mentoring responsibilities, assessment and rewards. Through the training of multi-

functional workers, it can solve the problem of unbalanced production capacity among different types of work, and realize the production unit and less human; Enrich staff work content, stimulate work passion, reduce job burnout; At the same time, it can reduce the turnover of employees and make employees work stable. Through training, the proportion of multi-functional workers in the workshop has reached 30%, which has promoted the improvement of on-site efficiency.

2.3.2 Carry out rationalization suggestions to improve work efficiency and effectiveness

Workshop site established the team quality analysis meeting, rationalization suggestions management methods, for the proposed rationalization proposals, the formation of a "one award" system, according to the monthly evaluation summary, and in the site management Kanban publicity, the formation of a large number of improvements, innovation, beneficial to promote work efficiency and quality improvement, saving the cost of resources.

2.3.3 Improve the visual management level of the site and improve work efficiency

6S and visual management is the basic tool of site management, through 6S and visualization can improve the site management level and work efficiency, the workshop through planning, the development of more than 50 management kanbans, more than 10,000 various signs, significantly improve the site work environment, visualization level, while improving work efficiency.

2.3.4 Develop manufacturing execution system (MES) to improve operation control ability

Information is an important part of the construction of servo valve parts processing production line, through the introduction of production and manufacturing execution system (MES), can solve the actual production arrangement of each unit balanced production, reduce excessive production (production quantity is too much, time ahead) and other problems, improve the workshop level of comprehensive management of production enterprises. MES architecture mainly includes planning management, workshop management, warehouse management, quality management, equipment management, production statistics several modules, focusing on solving the production scheduling, dispatch, process implementation feedback in the process of parts processing, and can be used for quality information statistics, feedback, etc. Especially for the complex on-site mixed-line production environment of the manufacturing workshop, solutions such as job optimization scheduling, document compliance control, and on-site change management are given to comprehensively solve the unified management of shop-level logistics, information flow and value flow, and improve the comprehensive management ability of the processing workshop.

3. Innovation points and application results

3.1 Innovation Points

Set up a unit production line based on product structure characteristics and common processing needs, so that the production capacity is balanced and improved; Established a specification system based on the process flow and oriented to the position, and improved the

level of process document optimization, refinement and quantification; Form the site visual management system and method, improve the efficiency of the site management; The workshop MES execution system was established to improve the efficiency of production management.

3.2 Application Effectiveness

3.2.1 Staff awareness and ability have been greatly improved, and a lean culture has gradually formed on site

Through vigorously carrying out all kinds of staff quality activities, a strong quality atmosphere is created within, forming a scene where everyone talks about quality, everyone cares about quality, and everyone implements quality requirements, and personnel quality awareness is greatly improved compared with that before the star-level site construction.Through various kinds of exchange training and the implementation of the system of teacher and apprentice, and competition training, we have created a well-trained technologists and technicians. And formed the momentum of training artisans, multi-skilled talents, for the pursuit of servo product quality excellence to make a solid foundation.

3.2.2 The production efficiency has been greatly improved and the cost has been saved

Workshop annual fixed working hour capacity increased by more than 30%; The manufacturing cycle can basically meet the needs of 6 months; Employee income has increased by more than 10% annually, and employee satisfaction has been improved.

3.2.3 The production site has been greatly improved, and the happiness of employees has increased

Through star site improvement, employees work in a clean, tidy, comfortable and orderly environment, improve their happiness and work enthusiasm, and enhance their sense of belonging.

4 Conclusion

Site improvement is endless, the ultimate goal of site management is to improve customer satisfaction, we will take the star site construction as an opportunity to further improve the ability; It provides a new personal development space for employees, strengthens the foundation for the unit to enhance competitiveness, and ultimately makes greater contributions to the solid development of our servo valve business and ensures success.

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