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A REVIEW ON DEVELOPING WORKSTATION FOR ACRV

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Abstract – *For assembling several child parts of product, a workstation is required which will minimize the time required for complete assembly. This papers shows overview of procedure used to develop a workstation used to assemble anti-compounding relay valve (ACRV). The work station is developed to assemble ACRV with minimum cost and minimum time while prescribing to the standard industrial safety rules and regulations. It will increase the productivity as well as quality of product to be assembled. A workstation must be developed with taking into account various factors such as less motion of operator, easy material handling, cost reduction, operator safety and improvement in productivity.*

Key Words: **assembly, workstation, productivity, quality**

1. INTRODUCTION

Anti-compounding Relay Valve (ACRV) is a component used in pneumatic braking system to prevent simultaneous application of the service and the parking brake. There are several child parts need to be assembled like o-rings, pistons, diaphragm, valve body, silencer, nylon piston, cap screws etc. A systematic way must be followed to develop a workstation for complete assembly.

2. METHODOLOGY

2.1 Study of the Product:-

The complete study of product with the help of drawing or by visual inspection is of prime importance. The inlet outlet pressures; torques required to tight the nut are observed. This will help in deciding the sequence of assembling operations and tool selection.

2.2 Prepare manufacturing feasibility:-

This involves method study. A number of ways are determined for the assembly of ACRV. The best way is selected by taking into account time reduction, simplicity and operator safety. First valve and piston assembly is done then the nylon piston assembly is done and later the cap screw fitment is done. As the cap screws are the outermost part of component, it is assembled in the last. The number and the types of tools are determined that are required on workstation for performing a specific task. e.g. nut runner for tightening of screws.

2.3 Prepare a process flow sheet:-

From Drawings of ACRV and observing various child parts of it, it is clear that all child parts will be assembled in three processes only i.e. valve & piston assembly, nylon piston assembly and cap screw fitment. The Workstation is divided into three sections as the orientation of the component is different while performing corresponding assembling operations. A complete process sheet is prepared.

2.4 Identification of stages where fixtures are required and their designs:-

After dividing number of assemblies into three sections, there is requirement of 3 different fixtures for each of the section. A number of fixtures is developed by using 3-2-1 principle and finally best one is selected for each section on the basis of cost and other factors. The clamps are used for easy loading and unloading of component.

2.5 Fixture material and its position on workstation:-

The material for the fixture is of nylon or delrin as it has high impact strength and are resistant to wear and tear. This prevents damage to the product. The base plate is made of mild steel for proper foundation. Toggle clamps are used as they are less costly and prove effective for the function. Fixtures are mounted according to the operations and with proper spacing.

2.6 Selection of tools:-

The tools are selected from catalogue satisfying the functional requirement. Such as Nut runner of Ingersoll Rand for torque of 1.7-9 Nm, Toggle clamp of steel smith for 150 Kg holding capacity.

2.7 Foolproofing the workstation with the help of interlocks:-

While performing the assembling operations, there is possibility that the operator may miss out some part e.g. diaphragm, or putting grease to the component. Also there is need to check whether the screws are tight with proper torque or not. It is achieved by providing Poke-yoke on 4 steps which are very much important and without having those steps done; part shouldn't be sent for further assembly.

e.g. proximity sensors are used for the pick-up of grease, dust cover etc. for ensuring the correct torque, torque wrench of click type is used. For providing interlocks Programmable logic controller (PLC) is used. A Human-Machine interface is used for controlling the operations.

2.8 Cycle time and capacity estimation:-

Plan Time is the time which is assigned for production activities each day. Thus, Plan Time = 510 minutes (8.5 hrs). Available Time is the actual time for which the operator performs the production activity. Thus,

Available Time = Plan Time – Allowances

= 510-60

=450 min (7.5 hrs)

Demand is the quantity of product required by the costumer on yearly basis. Takt Time is the rate at which a finished product needs to be completed in order to meet customer demand.

Takt Time = Available Time/Demand.

As the yearly demand of the product is less, the takt time for product is more. The total cycle time is calculated using video analysis. And it is found that it satisfies the demand.

Capacity is the maximum level of output of goods or services that a given system can potentially produce over a set period of time.

Capacity = Available Time/ Observed Time

A Time study sheet is required to prepare so as to analyze the process. Any bottleneck is tried to minimize.

3. CONCLUSION

The followed procedure is found to be effective. The developed workstation satisfies the current demand and also accommodates increased demand in future. Defining the process flow has resulted in standardization of operations to be performed on workstation. Developed fixtures are found to facilitate proper and easy assembling of ACRV and also increase safety in material handling. The selected nut runners, toggle clamps, Filter Regulator Lubricator (FRL), torque wrench, sensors and Programmable Logic Controller (PLC) are found adhering to the specifications defined for assembling ACRV. Poka-Yoke as a quality control technique is implemented. It has resulted in full-proof operation of applying torque, greasing and dust cover pick-ups.

4 FUTURE SCOPE

This system can be improved with the help of full-automation. As there are many manual operations are incurred in the assembly, it leads to human errors and also time loss. This can be eliminated by incorporating robot for complete assembly.

As the demand of the product is less, the Workstation is developed for a single operator. In case if demand crosses the capacity of the station, line balancing can be done along with three operators on three sections.

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