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Product development of lever cam follower using poka yoke

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ABSTRACT

Poka yoke is a very powerful set of technique that either keeps defects from occurring or indicating immediately when a defect occurs. It relies on creativity and common sense to create low cost, effective inspection devices. Like many quality tools, mistake-proofing is not a solution for every kind of defect or quality problem. The poka yoke aims to reduce the rejection, increase the production and avoid fatigue of worker. The beauty of this lies in that anyone, from manager to line supervisor to line employee can bring this concept into service. These devices are used either to prevent the special causes that result in defects, or to inexpensively inspect each item that is produced to determine whether it is acceptable or defective. The paper contains poka yoke fundamentals to improve the production of lever cam follower and to achieve the target of zero defects over the whole process machining.

Introduction

Poka Yoke is a Japanese term which means mistake proofing. A poka yoke device is one that prevents incorrect parts from being made or assembled, or easily identifies a flaw or error. It provides visual or other signal to indicate a characteristic state. Often referred to as 'error-proofing', poke-yoke is actually the first step in truly error-proofing a system Error-proofing is a manufacturing technique of preventing errors by designing the manufacturing process, equipment and tools so that an operation literally cannot be performed incorrectly. [1]

The goal of manufacturing[2] is to produce value-added products in a timely manner, which is free of defects. It is a given, however, that all processes contain natural variation. It then becomes the goal of manufacturing to continually strive to decrease variation. Quality theorists have placed variation in two categories, special and common cause. One method, which can be used to greatly decrease special cause variation, is poke yoke. Poke yoke literally translated means "inadvertent mistake proof." The basis for the poke yoke system is to create a process in which a worker cannot create an error. In other words, it is a method which designs parts and processes so that the desired results are inevitable.

Principles of Poka-Yoke

There are a few numbers of principles that is to follow:

- Build quality into process.
- All inadvertent errors and defects can be eliminated.
- Stop doing it wrong & start doing it right now
- Don't think up excuses, think about how to do it right.
- A 51% chance of success is good enough- implement your idea now.

Poke yoke devices

"Five best poka-yoke" for manufacturing

Characteristics of good poka-yoke devices

- Perform Source and 100 % Inspection
- Provide Immediate Feedback for Corrective Action

Lever cam follower

In order to reduce the rejection and improve quality of Lever am follower this technique poka-yoke (mistake proofing) is approached over the whole machining process.

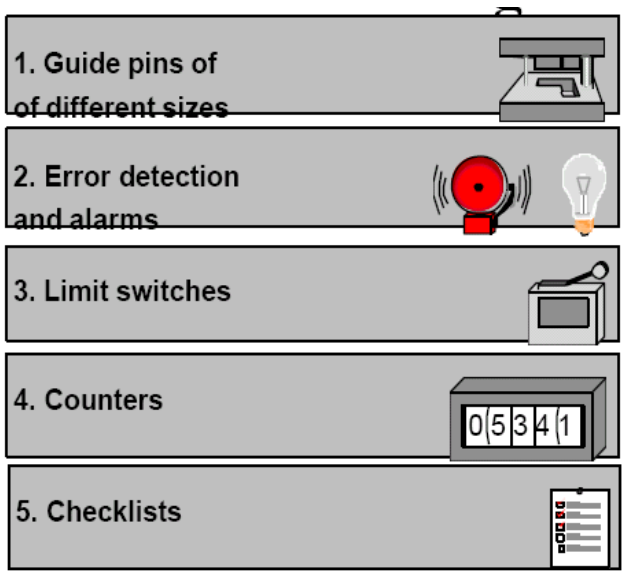

Fig 1. Five poka-yoke techniques

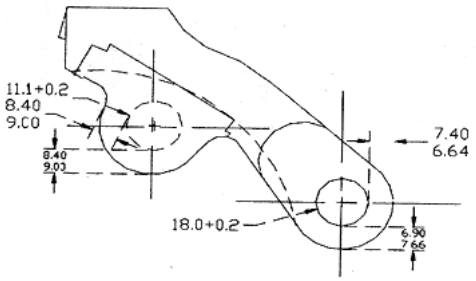

Fig 2. view of lever Front cam follower

Process Sheet of Component

Above shown in fig.2 component passes through various machines along the transfer line. First both sides facing of the component is accomplished over milling machine.

After this component passes to rough drilling machine, where both operations the rough hole for pin & shaft is drilled. Third operation is for the gap milling of component.

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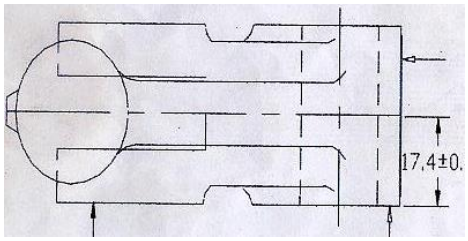

Fig.3: first side facing

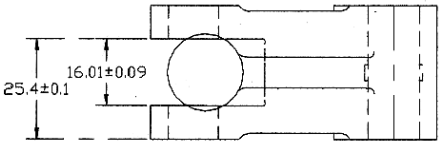

Fig.4 roller gap milling

Then after that component is passed to boring machine, where boring operation is performed over rough drilled pin & shaft hole by using reamers.

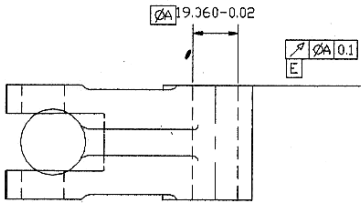

Fig 4 shaft hole boring

Next operation is socket bore drilling which is done over socket bore drilling machine.

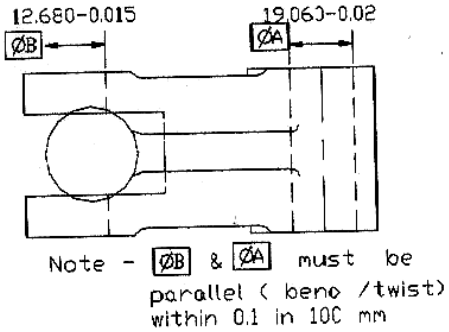

Fig.5 Pin hole boring

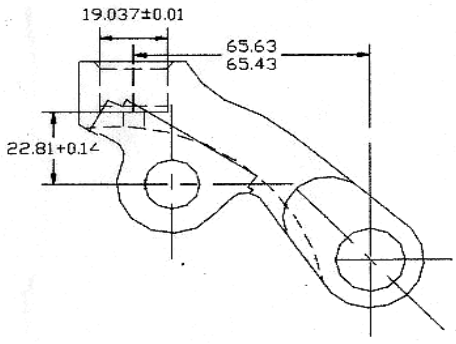

Fig.6 Socket bore drilling

It's mandatory to have this bore within correct stated depth & diameter, because whole valve functioning of engine depends on this socket bore Long oil hole is prominent operation; it is carried over the long oil hole drilling m/c. It is prominent because if it is not drilled correctly, then there may oil starvation problem to the roller. Second last operation is angular oil, drilled over the machine next to long oil hole drilling machine. Through Identifies angular oil hole lubricant reaches to the roller. [4]

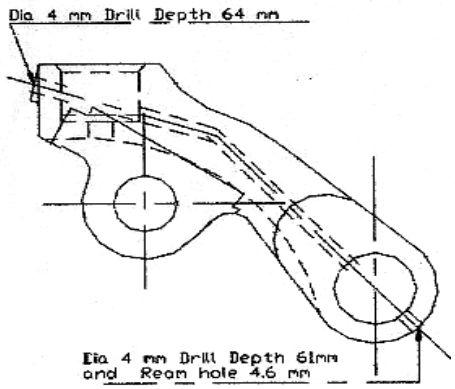

Fig7 long oil hole

Poka Yoke Solutions [5]

Duplex Milling Machine

In duplex milling machine two cutters are used and both side facing is done simultaneously and also cost per unit reduces and it also ensures parallelism.

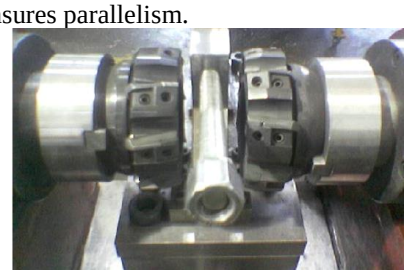

Fig.8 Duplex milling machine

Counter

The counter is used to count the component and after the particular number of component the tool is required to replace. The counters count the component & after which it again required to reset.

Fig.9 Counter

Toggle Clamp

It is used to tighten and apply constant force while fixing the job in jig or a fixture. It is manually operated provided with handle at the top as shown in figure.. In order to avoid worker carelessness this toggle clamp is used so as to ensure same constant force every time and proper tightening.

Fig 10 Toggle clamp

Automatic Pneumatic System

As the automatic pneumatic system is a combination of sensor, timer, and blow gun, after the completion of drilling operation as the component is removed the sensor sense the dismounting of component & which automatically 'ON' the timer for 15sec & after 15sec the "Automatic pneumatic system" automatically switch 'OFF'

Pad (Poka-Yoke At Drilling Stage)

Pad is snap gauge type arrangement provided at rough drilling stage in order to avoid the delivery of oversize Component to customer.

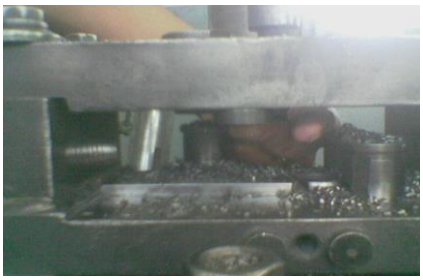

Fig.11 Pad at rough drilling stage

Use 75% of Gauge Tolerance

It is decided to use the gauge with having 75% gauge tolerance [3] so that never the component with oversize centres distance. Will be supplied to customer. Component with undersize bore diameter will never be fitted.

Torque Star Sensor

Here, the torque star sensor with burglar alarm is used to get constant feed rate for drilling. If torque exceed from its limit then burglar alarm will blow.

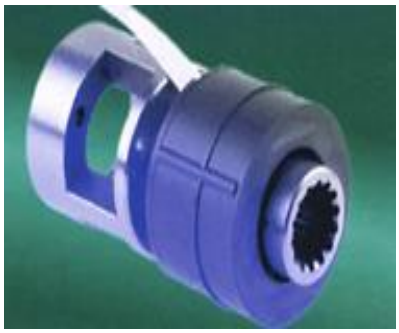

Fig.12 Torque star sensor

Stopper with Burglar Alarm

At the socket bore drilling stage stopper is provided for bore depth. depth, and as the drill head touches over the stopper. This insures the component with correct boredepth.

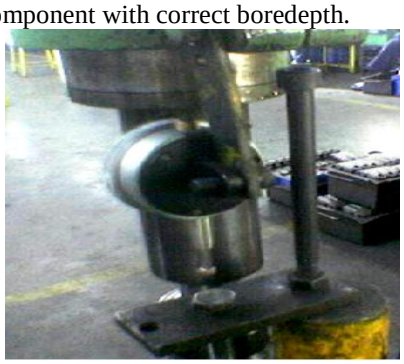

Fig.13 Stopper with burglar alarm

Ball test

In industry, initially through opening of long oil hole was checked visually but in that case sometime what happen that worker was unable to find out whether the long oil hole is thoroughly opened or not. So to overcome this problem ball test is recommended.

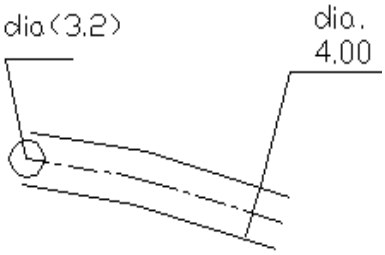

Fig.14 Ball with long oil hole

Flow Test

Flow test is use to assure that lubricant is passing through the angular oil hole. In flow test the lubricant is used as fluid.

Fig 15 Flow test

Tool cutter grinder

In case of grinding tool manually, sometimes irregular geometry of tool cutting points is obtained. And that may lead directly to the failure of component and sometimes may be hazardous to the worker. So, tool cutter grinder is advanced technique use to grind the tool. Instead of manual grinding here only loading & unloading of tool is done manually, and grinding is carried out totally by machine without interruption of human being. The use of tool cutter grinder will assure correct grinding i.e. all tool points in a periphery.

Fig. 16 Tool and cutter grinder

Conclusion

Poka yoke is the first step in error proofing the system. Error proofing is a manufacturing technique of preventing errors by designing the process, equipment and tool so that an operation cant be performed incorrectly. After a through study of process we came out with some preventive actions along the production line. Recommended preventive actions which have been implemented are giving satisfactory results.

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