ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Vol 2, Issue 2, February 2017

Quality Assurance Level up in Transmission Line Problem: Knock Pin Miss on Gear Adaptor

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Abstract: **— Our study is to ensure the presence of Knock pins after the pressing operation is performed. This is because, there were some causes when these knock pins were missing on the adaptor of the gear housing which made it difficult for the assembly of the gear house casing in the transmission line. Hence the study is made regarding to find the root cause for the miss of pins and a Poka-yoke is developed in order to prevent the pin miss in the future.**

***Index Terms*—Adaptor, Gear housing, Knock pin, Poka-yoke**

I. INTRODUCTION

Toyota kirloskar Auto Parts Pvt. Ltd. is a branch of Toyota located in Bidadi Industrial Area, near Bengaluru. It is a plant where gears, shafts and engines for Hilux, and Fortuner is being manufactured and assembled.

In the sub-assembly line of the gear box, an operation of Knock pins on the gear box adaptor is being performed , for the assembly of Hilux(4x4)B type, gear box casing. Slots is being provided on the casing to guide these pins and thus the casing is held in a perfect position for further assembling operations.

Thus Knock pins acts like a guides/support to hold the adaptor and casing together during assembly.

II. POKA-YOKE

History

Poka-yoke (pronounced "POH-kah YOH-kay") was invented by Shigeo Shingo in the 1960s. The term "poka-yoke" comes from the Japanese words "poka" (inadvertent mistake) and "yoke" (prevent). The essential idea of poka-yoke is to design your process so that mistakes are impossible or at least easily detected and corrected.

Shigeo Shingo was a leading proponent of statistical process control in Japanese manufacturing in the 1950s, but became frustrated with the statistical approach as he realized that it would never reduce product defects to zero. Statistical sampling implies that some products to go untested, with the result that some rate of defects would always reach the customer.

While visiting the Yamada Electric plant in 1961, Shingo was told of a problem that the factory had with one of its products. Part of the product was a small switch with two push-buttons supported by two springs.

Occasionally, the worker assembling the switch would forget to insert a spring under each push-button. Sometimes the error would not be discovered until the unit reached a customer, and the factory would have to dispatch an engineer to the customer site to disassemble the switch, insert the missing spring, and re-assemble the switch. This problem of the missing spring was both costly and embarrassing. Management at the factory would warn the employees to pay more attention to their work, but despite everyone's best intentions, the missing spring problem would eventually re-appear.

III. ABOUT KNOCK PINS:

Knock pin is made of S45 material and is heat treated. Two pins are used on a single adaptor. Pin is of 11mm diameter and 11mm thick. Meanwhile the slot diameter is 10mm. thus it requires a Hydro-Pneumatic pressing machine to press the pins into the slot to a depth of 6mm.

Also the other 5mm part remains on the top of surface which is guided into the casing, for holding the casing and adaptor together in the required manner.

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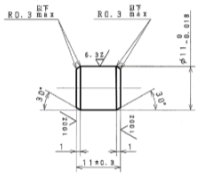
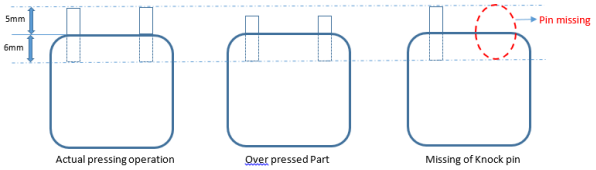
1. *Material: S45*
2. *Diameter: 11 mm*
3. *Length: 11 mm*
4. *End Chamfer angle: 30 deg.*
5. *Chamfer length: 1 mm*

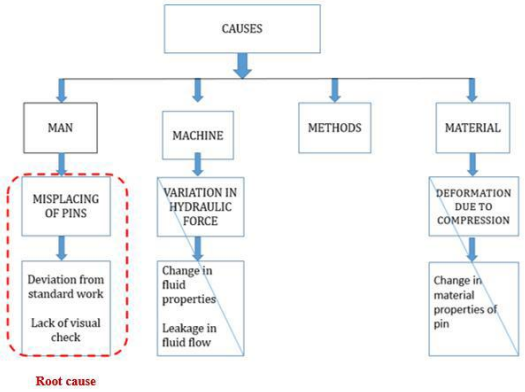


IV. PIN PRESSING OPERATION



V. TO FIND ROOT CAUSE

On analyzing for the causes for missing of pins it was found that missing of pins can happen only due to human errors. The reason may be either deviation from standard work or the member may not fix the pins to the pressing ram properly. Although the main cause for the missing of pins is considered as deviation from standard work, also there is lack of visual check for the presence of knock pins after the pressing operation. Hence we consider this as the root cause for the problem.

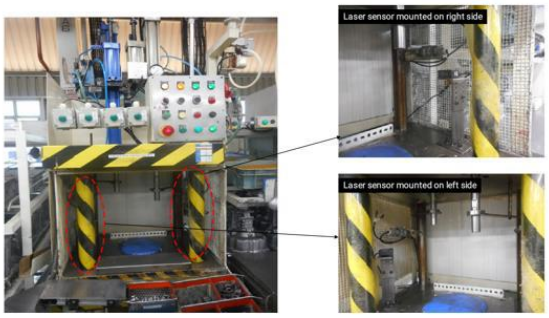


VI. TO DETERMINE THE FEASIBLE SOLUTION AND DEVELOPMENT OF POKA-YOKE

Main aim of the feasible solution is to develop a model which ensures the presence of pins at the required height over the surface, after the pressing operation. This can be done by using a laser sensor of short range, which will be mounted on a model and is fixed on either sides (right side and left side) of the base over which part is placed for pressing operation. Each of the pins is verified by individual laser sensors.

Working of laser sensor:

After the pressing operation, the laser sensor gets activated and the presence of pins will be verified at the required height by measuring the distance between the laser sensor and the pressed pins. The amplifier device ensures the pre-defined distance and an 'ALL-SET' signal is sent to the operator using a light provided on the control panel of the machine. In case any of the pins is missing then the respected laser fails to read the distance and thus the amplifier send a NG signal to the operator along with a siren, indicating required rework for the operator to perform on the same part.



VII. CONCLUSION

The use of sensor mounting on the pressing machine in the assembly line ensures the presence of pins, thus preventing pin miss errors and the problems related to missing of pins. Hence this study ensures the 'Quality assurance level-up in the transmission line', by avoiding the loss due to the pin missing errors.

REFERENCES

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