

Research Article

# Improvement in the Lever Movement of the Fuel Tank Cap

Sandeep Sharma\*\*, Rohit Sharma# and Kushal Kamboj#

#Amity University Uttar Pradesh, Noida, India

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## Abstract

A fuel tank cap plays a very important role in the vehicle fuel system. FT Cap act as safety valve mounted on the vehicle fuel tank that provides safety to the biker so it is very important to do the proper function in the vehicle. This work mainly deals with a fuel tank cap and how to fix its lever operational movement. The main parts of Cover Top, Ring body, Cover cap, Actuator, Stator, Dowel, Steel ball, Washer. Fuel Tank Cap for HERO India has the problem of movement jam. This Fuel Tank Cap is a very important part of vehicle being used to close the fuel tank. This rejection is contributing major part in total rejection cost & top ranking in ppm data. This project is basically done to analyze & to get the solution of the causes of movement jam problem in Fuel Tank Cap by using PDCA cycle technique and why-why analysis and some graphical analysis also done. First of all, to reduce the cost and increase the efficiency of the operation, we have identified the problem, collected the Data, done Process study & analyze the problem. Data analysis was done by using the ABC analysis, Pareto graphs & brain storming. Some minor improvements were suggested and implemented there by upgrading the process & Quality requirements.

**Keywords:** Fuel tank cap, PDCA Cycle, Root cause analysis

## 1. Introduction

A fuel tank cap plays a very important role in the vehicle fuel system. FT Cap act as safety valve mounted on the vehicle fuel tank that provides safety to the biker so it is very important to do the proper function in the vehicle. A fuel tank cap helps to restrict hydrocarbon vapors into the atmosphere, and also plays a crucial role in the fuel saving and safety to the driver. In the absence of fuel tank caps, there is more possibility of the presence of flammable vapors around the automobile at all times.

atmosphere, safety to the both vehicle and the owner of the vehicle and helps in emission control.

## 2. Literature Survey

2.1 Quality Improvement Methodologies–PDCA Cycle, RADAR Matrix, DMAIC and DFSS

Sokovic *et al.* (2010) gave a brief about the various quality improvement techniques like PDCA tool and Six Sigma (DMAIC, DFSS) techniques and EFQM Excellence Model (RADAR matrix), which are generally used for the continuously improvement of products, processes and services. They compared all the four techniques and showed their main characteristics and contrasts. The PDCA cycle is a popular fundamental concept of continuous-improvement processes, RADAR matrix provides a dominant approach assessing the organizational performance, DMAIC is a systematic, and fact based sequence providing framework of results-oriented project management systems, DFSS is a systematic approach to new products or processes design focusing.

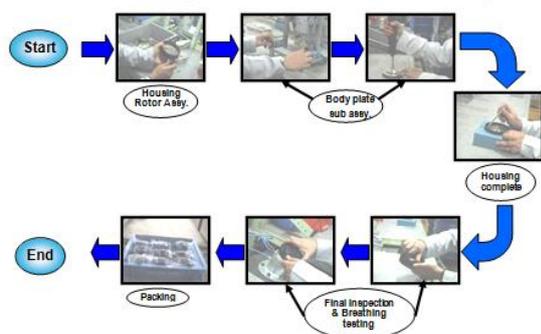


Fig.1 Manufacturing Process of Fuel Tank Cap

The caps are mounted on fuel tank for performing many functions such as not losing fuel to the

2.2 Foundation and History of the PDSA Cycle

Ronald Moen (2009) told about the history of W. Edwards Deming's PDSA Cycle for Improvement. It starts with a philosophy of science associated with

\*Corresponding author Sandeep Sharma is a Research Scholar

Galileo in the 1600's and goes through Deming's last version of the PDSA Cycle of 1993. It tells about the Shewhart Cycle of 1939, the Deming Wheel (circle) of 1950, The Japanese PDCA of 1951 and 1985, and the beginning of the Deming's PDSA from 1986 till 1993. Finally it concludes with Deming's reactions to the PDCA. The Japanese developed the PDCA based on Deming's JUSE seminars in 1950 (no one person claims authorship).

PDSA is used for testing and implementing. Deming never embraced the PDCA. And finally resulted in PDCA and PDSA which are only related through the scientific methods.

### *2.3 An examination of the application of PLAN-DO-CHECK-ACT cycle in product development*

Lodgaard and Aasland (2011) investigated that Plan-Do-Check-Act (PDCA) cycle is a high level method for achieving continuous improvement. It is a main tool in continuous improvement and is widely used in various sectors as an improvement tool to managing improvement projects especially within manufacturing. This paper analyses the continuous improvement methods are done compared to the PDCA cycle increase efficiency as necessary for a company's long term survival in a demanding market and to better understand the improvement processes in a PD environment. The results from the case study shows that the PDCA cycle is PDCA cycle is an impressively systematic approach for improvement, but is also incredibly time consuming and improvement issue needs both time and size of the problem before this systematic and rigorous approach can be evaluated for cost versus benefit.

### *2.4 Maximizing knowledge work productivity: A time constrained and activity visualizes PDCA cycle*

Maruta (2012) conducted the analysis about how to improve the productivity of knowledge work. To do this, the Plan, Do, Check, and Act (PDCA) cycle is used for productivity improvement in manufacturing redefined to be applicable to individual knowledge work. This study redefined PDCA cycle to accounts collection has resulted in a remarkable improvement of on-time payment collection ratios and the transformation of a simple collection clerk into a knowledge worker. On the basis of this, the concept of redefined PDCA cycle was converted into a management system applicable to general knowledge work. This was done by implementing four key mechanisms to push workers for the objective achievement.

### *2.5 Continuous Improvement Methodology- PDCA*

Haussen (2012) introduced the PDCA cycle as a present tools and concepts to facilitate problem solving, which can be applied to any problem in any situation. Explain the concepts with a healthcare

application of PDCA and Continuous improvement is an ongoing effort to improve products, services, or processes. Continuous and incremental improvements remove unnecessary activities and variations providing increased capability, reduced costs, improved efficiency and quality over time. A complete transformation process takes time, but continuous improvement allows teams to change the organization one problem at a time.

### *2.6 Understanding How to Use the 5-Whys for Root Cause Analysis*

Mike Sondalini generated 5-Why root cause analysis method is simple in concept but it requires real evidence, logic and discipline while using it to find the true root cause of a failure event or problem. 'Why' is the key word asked to find every single cause until arrive at the root cause of the incident. Unfortunately we arrive at the wrong conclusion. A Why question can be answered with number of answers, and unless there is proof that indicates which answer is right, which can improve our odds of using the 5-Why method correctly if we adopt some simple rules and practices.

### *2.7 Analysis of Breakdowns and Improvement of Preventive Maintenance on 1000 Ton Hydraulic Press*

Kumar R and Rudramurthy (2013) told to increase the availability a machine and to reduce the down time of a machine, to maximize production capacity and to improve new Preventive maintenance schedule. The project is carried out on hydraulic press were all repeated breakdowns analyzed Along with the critical parts, which were under breakdown condition is also identified and analyzed. Also the reason for the breakdown has been analyzed and inspected by the method of Fish bone diagram and why-why analysis.

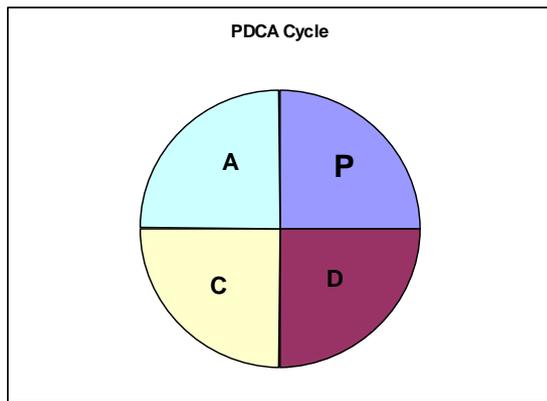
By this analysis and methods the root causes of the breakdowns were identified. This in turn helped to develop and improve a new Preventive maintenance checklist for the machine. This method is used to prevent the failure of equipment before it actually occurs. This project work is aiming at reducing idle time i.e., breakdown and towards optimizing plant performance by increasing availability and MTBF of critical manufacturing equipments This has been achieved by optimal utilization of time for maintenance, inspection frequency by considering manufacturer recommendation and previous experience. By all these procedures the availability of the machine will increases to a certain extent and also increases the production capacity, minimizes the maintenance cost and reduces the down time.

## **3. Materials and Methods**

### *3.1 Mythology*

Methodology is based on Deming Cycle PDCA (Plan, Do, Check, and Act).

A complete PDCA approach



*Plan Phase: Identification, Selection of The Problem, Plan Of Activities, Define The Problem.*

Movement Jam in FC-4907B Cap

What? When applying force to cable wire to get FT Cap open. Actuator did not get actuated as force applied to cable wire, Actuator does not make lever slide back, that is called Movement Jam

Where? At the Stage of Housing Assembly

When? During the Housing Assembly operation.

*Do Phase Analysis of the Problem, Identification of the Probable & Actual Root Cause*

Validation of the Causes

S. No.	Probable causes	When	Where	How	Checked result	Conclusion
1	Retainer ring fitment not ok	After housing complete assembly	Housing complete assembly stage	Visual	No piece found reject	Not the cause of movement jam
2	Setting of steel ball not ok	Before housing complete assembly	Housing complete assembly stage	Visual	No piece found reject	Not the cause of movement jam
3	Air pressure high	On the line	On the line	By pressure gauge	No piece found reject	Not the cause of movement jam
4	Tolerance stack up for gap	Before housing rotor assembly	Housing rotor assembly stage	Visual	6 pieces found reject	The cause of movement jam
5	Housing groove under size	Before housing rotor assembly	Housing rotor assembly stage	By vernier caliper	No piece found reject	Not the cause of movement jam
6	Retainer ring OD oversize	Before housing complete assembly	Housing complete assembly stage	By vernier caliper	All pieces found within specifications	Not the cause of movement jam
7	Powder coating observed at sliding area of actuator	Before body plate punching	Body plate sub assembly	Visual	8 pieces found reject	The cause of movement jam

Development of solutions

S.No.	Root Cause	Containment Action	Trial Implementation	Status Ok/Not Ok	Corrective Action.
1.	Height of boss observed less	Filing done on 100pcs at the boss surface	Assembly of 100 pcs done on the line	Ok	Tool preventive maintenance frequency frozen
2.	Powder coating observed at sliding area of actuator	Filing done on 100pcs on the actuator	Assembly of 100 pcs done on the line	Ok	Actuator replacement frequency frozen
3.	Excess frictional force between actuator and spring washer	Deflashing of 100 pcs done with knife	Assembly of 100 pcs done on the line	Ok	SOP of the screw tightening torque is added

*Check phase Initiate the Countermeasure/Solution, Trial Implementation of Solutions, Initiate the Countermeasure/Solution*

Action plan-Final Solutions

Sr.	Action
1	Powder coating should be avoided in boss (spring mounting area) to overcome thickness variation
2	Boss step height tolerance to be given in +ve side (1.8 was open to 1.8+0.1)
3	Spring washer to be replaced with plain washer
4	Assembly drawing to be updated for change of spring washer to plain washer
5	Torque to be maintained for this screw between 6~8 kgf-cm
6	Vibration and repeated operation durability test to be conducted after plain washer implementation to evaluate the looseness during vibration or durability

Review phase monitoring the effectiveness after implementation of solutions, regular implementation of solutions, follow up and review, monitoring the effectiveness after implementation of solutions

#### Standardization of the Actions

S.No	Description	What	Where	Status
1	Modification, updation of design, system, SOP etc.	Gap design during free actuator movement	MCL-Noida	Done
2	DFMEA updation for function	DFMEA	Design	Done

#### Conclusion

For any business to be worth, the first and foremost pre requisite is quality. Quality is conformance to specification. There was time when the components were passed based on inspection only. Ok parts were used to supply to the customer and rejected parts scraped. This overall process leads to piling up the rejection and moreover there is no guarantee that products are 100% O.K.

Minda Corporation Limited is exporting Mechanical & Electronic Security System to most 2wheeler & 4wheeler industries in India as well as to different countries. Each and every product undergoes stringent quality control.

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