
TQM Approach of Resolving Issues Related to Customer and In-House Complaints-A Case Study

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ABSTRACT

The growth of any organization depends largely on the quality of its products. Quality is the degree to which the product/service was produced correctly to perform its intended function. This paper discusses the approach and methodologies used to resolve in-house and customer related issues in industries. The approach is QRQC (Quick Response to Quality Concerns) & the methodology used is “seven QC (Quality Control) tools”. The problem in this study has been analyzed using QC tools such as brain storming, why-why analysis, cause and effect diagram, root cause analysis, Pareto analysis etc. The root cause has been identified and the remedial measures have been implemented. The paper addresses the case of customer complaints about missing parts in a rear axle assembly using poka-yoke as a mistake proofing mechanism.

KEY WORDS: QRQC, Poka-Yoke, PPM, PPAP and SOP.

I. INTRODUCTION

Spicer India limited was established in 1993 for the manufacture of axles, drive-shafts and universal joints. The Company is a joint venture between Dana Corporation, USA, and Anand Group. It is a tier-1 company and supplying axle to OEMs (Original Equipment Manufacturer) like TATA motors, Mahindra, Ford, General motors' etc. This study deals with the rear axle assembly and particularly the differential. The aim of this work is to determine the probable causes for a missing part in an axle assembly and to prevent such mistakes in future. Rear Axle Assembly is one of the main components of the transmission system of an automobile which performs the function of transferring torque from the transmission (gear box) to the wheels. A differential is a mechanical device made up of several gears. It is used in almost all mechanized four-wheeled vehicles to transmit the power from the driveshaft to the drive wheels. The main function of a differential is to allow the drive wheels to turn at different RPMs (Revolutions Per Minute) allowing the wheels to go around corners while still receiving power from the engine.

A customer complaint reported by TATA Motors to the company that, in one of the axle assembly of SUMO 209 model, the diffshaft was missing. A diffshaft is that part in a differential which is placed between cross bores of differential casing. It serves the function of holding the two spherical gears in their positions thus, enabling them to rotate in one axis with respect to the two side gears.

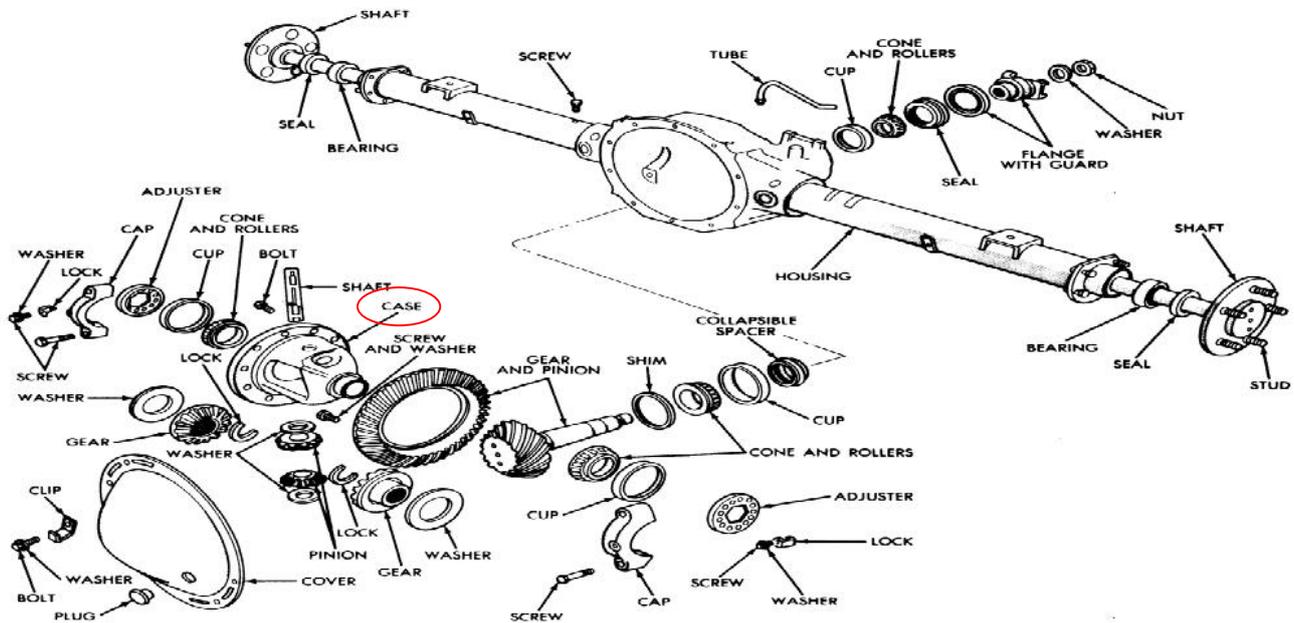


Fig.1. Line Diagram of a Rear Axle Assembly

II. LITERATURE REVIEW

The plant level operational performance by quality achievement can be obtained through the implementation of TQM philosophy. This implementation requires the top management commitment through a four stage process of adoption, adaptation, acceptance and use, Sanjaya et al. [2]. Aquilani et al.[1] suggested that TQM must start at the top, where serious obsession and commitment to quality and leadership need to be demonstrated” even if it is true that “middle management also has a key role to play in communicating the message. Patil et al. [3] reviewed many concepts of TQM philosophy and summarized “Poka Yoke” as the most revolutionary concept among all. A Poka Yoke is any idea generation or mechanism development that helps the operator to avoid mistake. Adrian Pugna et al. [5] rightly mentioned that the desire to achieve business excellence in the Automotive Industry by promoting the “Zero Defects” and first time right production philosophy requires the integration of Poka Yoke in all its activities (design and production). Vinod et al. [4] presented their collective outcome about the need of implementation of Poka-Yoke in the sectors of health care, financial service, agriculture and online retailing.

III. MODELLING METHODOLOGY

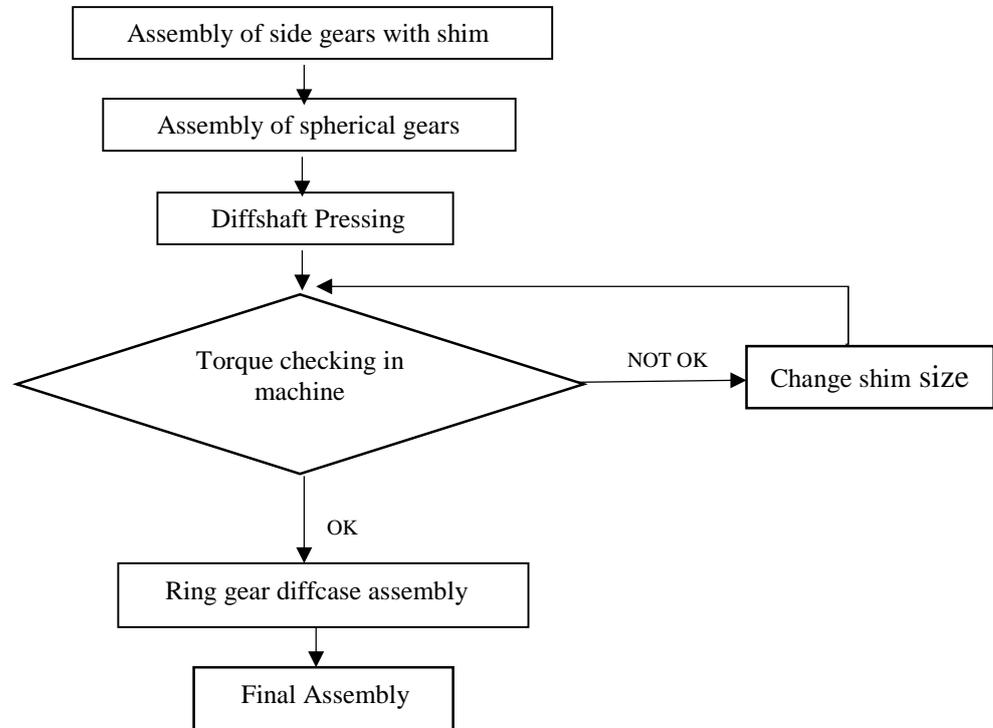
Quick Response Quality Control (QRQC) is not only a quality control tool and method for troubleshooting but also an innovative concept in the field of global quality management. QRQC integrates a simple and logical solution to a given production or business operation problem and has applications in many different segments along supply chains including project management, manufacturing, logistics and others. QRQC focuses on quality control to ensure that the problem is identified, isolated and a solution is found and implemented quickly and effectively.

Description of the Problem: A customer complaint reported by TATA Motors that in one of the axle assembly of SUMO 209 model, the diffshaft was missing.

Diagnostic Journey:

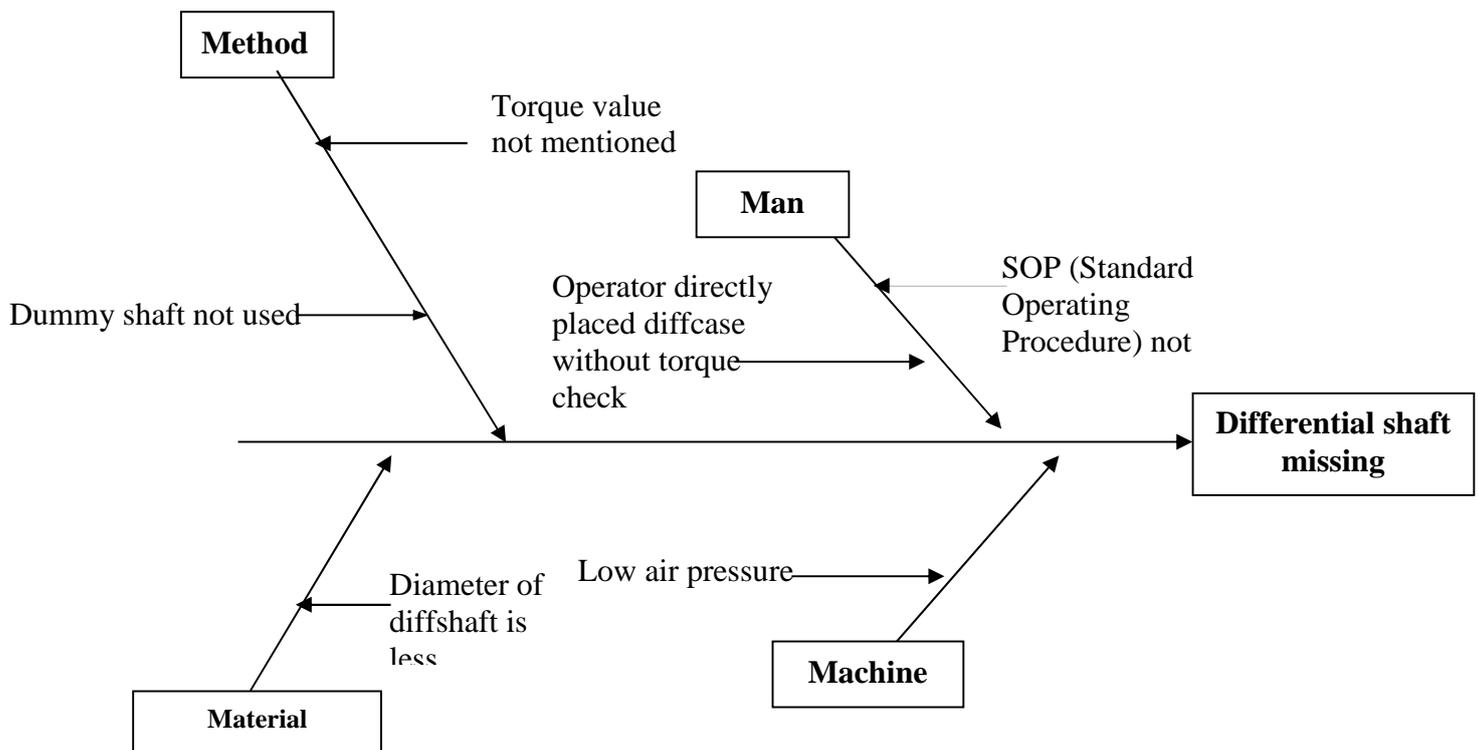
A: Analysis of the Process

Process Flow Chart



B: Brainstorming for causes:

Cause & Effect Diagram:



C : Why – Why Analysis

Table 1. (For probable causes)

Sr. No.	Probable Cause	Why	Why
1	Low air pressure	While pressing diffshaft in casing the pressure release valve was open	Operator forgot to close valve after initial setup
2	Diameter of diffshaft is less	Only sample inspection of incoming material	Supplier track record is qualifying for sample inspection
3	Operator directly placed diffcase without torque checking	SOP is not clear	Operator negligence
4	Torque value not mentioned	It is not mandatory to write torque value after each measurement	Writing torque in every diffcase will increase cycle time
5	Dummy shaft not used	Absence of dummy shaft in the work station	Misplaced dummy shaft

D: Most Probable /Root Causes proved to be valid:

Hypothesis-1: Operator directly placed diffcase without torque check.

) Method/s of testing used.: - Visual check.

) Observations: - In most of the cases the operators were not checking the torque and directly putting the diffcase in the pallet.

) Inferences from the Observations & Analysis: - If operator checks the torque of a diffcase without shaft then the reading will be less than required value and part is under suspicion.

) Conclusion: - The hypothesis is valid.

E: Remedial Journey:

I. Proposed Remedies:

1. Next in-house customer (next station) receives the part only with marking on shaft & torque value written on diffcase by permanent marker.
2. Detection type poka-yoke made at next station which ensures the presence of shaft.

II. Testing of the remedies:

1st remedial action

a) Method/s of testing used: A trial lot of 50 units of diffcase made in one shift goes to the operator in the next assembly section who checks the marking on the shaft and jots down the torque value written on the diffcase in a note book.

b) Observations: All the 50 units of diffcase have diffshaft and correct torque value.

2nd remedial action

a) Method/s of testing used: After installation of poka yoke a diffcase without a shaft was used for assembly in the station.

b) Inferences from the Observations & Analysis: The assembling machine stops functioning and produces an alarm which signals the absence of shaft inside the diffcase.

Conclusion: - The Remedy is valid.

F: Remedies finally implemented:

1) Use of marker at assembly station to write torque value (shown in figure 3) and mark the shaft (shown in figure 2)



Fig.2.



Fig.3.

2) Implementation of a detection type poka-yoke to verify presence of shaft inside diffcase.

The Poka-Yoke consists of a retro- reflective type photo electric sensor (shown in figure 4) installed at the top center of index plate and a reflector (shown in figure.5) installed at bottom center of diffcase fixture. It works on the principle of reflection of light ray from a reflector when emitted from a light source (emitter) in case of a missing diffshaft.

Before the installation of Poka-Yoke, the machine which was meant for torquing the ring gear bolts used to de-clamp the job without detecting the absence of diff shaft. The installation of Poka-Yoke which is a retro reflective type photo electric sensor mounted on to the torquing machine detects the absence of diffshaft results in alarm and light indication with a cycle stop. Thus detecting the missing parts of the rear axle assembly.



Fig.4.



Fig.5.

G: Standardization of the Remedies:

- i. Poka-Yoke number allotted to the ring gear bolt torque machine.
- ii. PPAP (Production Part Approval Process) carried out for the changed process.
- iii. Necessary changes done in SOP & Control Plan.

RESULTS AND DISCUSSION

After detailed study of the process flow chart, a brain storming session has been conducted to determine the probable causes of the problem and represented in the form of “cause and effect “diagram. The why-why analysis was done for each of the probable causes which is represented in Table 1. Then, the remedial journey for the most probable cause (root cause) was initiated. The first remedy was to mark the diffshaft by permanent marker for its presence and the torque value was written on diffcase for immediate corrective action. The second remedial journey was the implementation of Poka-Yoke. It was observed that the defect was eliminated and resulted in zero PPM for the remaining months of the year as shown in Figure 6.

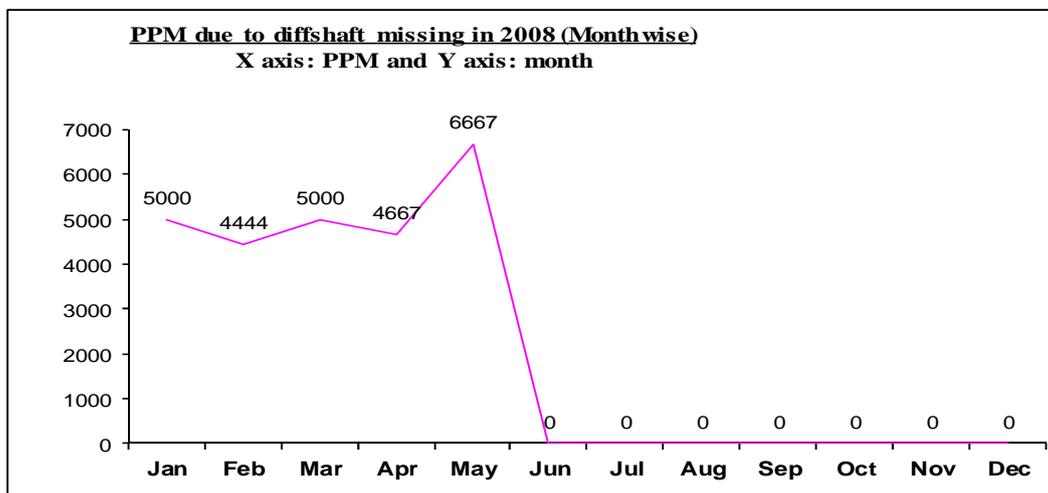


Fig.6

V. CONCLUSION

This QRQC approach supported by seven QC tools to tackle the complaints of both in-house and customers is the most successful approach of TQM (Total Quality Management) philosophy to improve product quality in industries which helps in elimination of defects, thus, resulting in zero PPM. With the expertise and confidence gained from this work, this new process can be horizontally deployed at other work tations where problems of similar nature exist.

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