

A Review on Improvement in Assembly Shop at Tata Motors using Work Instruction Sheet and Quality Tools

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ABSTRACT

Most of the leading manufacturing sectors are facing the problem of spending more time for inspection and controlling the dimensional specifications of a product manufactured by them. This is due to the unavailability of controlling methods because most of the industries do not provide the control plan to the operator. The main objective of this paper is to study the various quality concepts being implemented in the automobile industry and help in improvement of quality standards by presenting a method with work instructions and a control plan.

Keywords: Work Instruction Sheet, TQM, Pokayoke.

1. INTRODUCTION

In this project we studied the various quality tools being implemented in the Tata Motors Ltd., and helped in the improvement of quality standards by presenting a method with work instructions and a control plan.

TCF is the car assembly shop in TATA MOTORS PVBU. It consists of 6 assembly lines:

1) Trim 1; 2) Trim 2; 3) Trim 3; 4) Underbody1&2; 5) Mechanical 1&2; 6) Canopy 1&2.

The operations performed on each line can be summarized as given below:

- Trim 1:

Under carpet wire harness routing, fitment of AC unit, fitment of stud, fitment of rack and pinion, VIN plate fitment and floor unit.

- Trim 3:

Air bag unit fitment, dashboard fitment, Cockpit tightening and Fuel and AC line Fitment.

- Trim 2:

Front Strut fitment, windshield fitment, rear bumper fitment, seatbelt fitment.

- Underbody 1&2:

Fuel tank, engine dress up and crossbar fitment.

- Mechanical 1&2:

GSL fitment, electrical testing and fuel filling.

- Canopy 1&2:

Wheel alignment, brake testing and overall car testing.

The main objective of this study was to update all the preexisting Work Instruction Sheets on all the assembly lines, make a detail study of quality control tools such as FIFO, 5S, Kaizen and to do a case study on existing Pokayoke.

The work instruction sheet is used to provide the detailed information about the sequence of operations carried out which converts the raw material into the final product. This will also provide the list of tools and gauges used in every process, tool

changing instructions and the diagrammatic representation of the component. It also contains the name of the operation to be carried out, machine name and the codes for tools, gauges, jigs and fixtures, if any.

Total Quality Management (TQM) and Total Quality Control (TQC) literature make frequent mention of seven basic tools which are FIFO, KANBAN, 5S, Kaizen, JIT, Control charts, Ishikawa.

2. LITRERATURE REVIEW

2.1 Quality Control

Quality control, or QC for short, is a process by which entities review the quality of all factors involved in production. ISO 9000 defines quality control as, "A part of quality management focused on fulfilling quality requirements". This approach places an emphasis on three aspects:

- Elements such as controls, job management, defined and well managed processes, performance and integrity criteria, and identification of records.
- Competence, such as knowledge, skills, experience, and qualifications.
- Soft elements, such as personnel, integrity, confidence, organizational culture, motivation, team spirit, and quality relationships.

Controls include product inspection, where every product is examined visually, and often using a stereo microscope for fine detail before the product is sold into the external market. Inspectors will be provided with lists and descriptions of unacceptable product defects such as cracks or surface blemishes for example. The quality of the outputs is at risk if any of these three aspects is deficient in any way. ^[1]

Concept from Quality Gurus

- Deming's Approach to Total Quality Management (TQM) ^[1]
- Ishikawa's Approach to Total Quality Management (TQM) ^[1]
- Juran's Approach to Total Quality Management (TQM) ^[1]

2.2 Quality Tools

- Check Sheets

The main purpose of Check Sheets is to insure that the data collected is carefully and accurately by operating personnel.

- Pareto Diagram

The Pareto (pah-ray-toe) chart is a very useful tool whenever one needs to separate the important from trivial. A Pareto Chart is simply a frequency distribution (or Histogram) of attribute data arranged by category. ^[2-3]

- Scatter Diagrams

The scatter diagram is the simplest of the seven tools and one of the most useful. The scatter diagram is used to determine the correlation (relationship) between two characteristics (variables). ^[2-3]

- Flow Charts

The Flow Chart provides a visual representation of the steps in a process or a diagram that uses graphic symbols to depict the nature and flow of the steps in a process. ^[2]

- Histogram

Histogram is a special bar chart for measurement data. Histograms are used to chart frequency of occurrences. ^[2-3]

- Control Charts

Variable control charts are used to study a process when characteristics is a measurement, for example, cycle time, processing time, waiting time, highest, area, temperature, cost or revenue. Measurement data provides more information than attribute data: consequently, variables charts are more sensitive in detecting special cause variation than are attribute charts. ^[2-3]

- Cause and Effect Diagram

The Cause-and-Effect (C&E) diagram is a tool used to organize the possible factors that could be negatively impact the stability, center, spread, and shape of a critical to quality (CTQ) characteristics measure. ^[3]

3. QUALITY TOOLS USED IN TATA MOTORS

3.1 Poka Yoke

Poka Yoke is an essential technique to ensure error free functioning and hence is implemented in all manufacturing industries. Tata Motors being one of the largest automobile manufacturing companies in the world realizes the importance of it. Numbers of Poka Yoke's are installed in each manufacturing plant for safety purpose as well as to ensure error free functioning of the plant. These Poka Yoke's can be broadly classified into two types:

- i. Fail safe: They are installed from safety point of view. They ensure the safety of the operator by installing specific triggers which stop the functioning of the line if the operator activates them, willingly or by mistake.
- ii. Fool proof: They are installed from quality point of view. They ensure that no quality lapse takes place in error prone procedures by full proofing hence eliminating any margin of error present.

There were a total of 130+ Poka Yoke installed in the TCF shop with 80+ fool proof and the rest of them being fail safe. ^[4]

3.2 Ishikawa Diagram

Diagrams are posted in key locations to stimulate continued reference as similar or new problems arise. The diagrams are revised as solutions are found and improvements are made. The diagrams are useful in:

1. Analyzing actual conditions for the purpose of product or service quality improvement, more efficient use of resources and reduced costs.
2. Elimination of conditions causing nonconforming product or service and customer complaints.
3. Standardization of existing and proposed operations.
4. Education and training of personnel in decision-making and corrective-action activities.

- Solved Issue: Seat mount bolt mismatch.
There was mismatch while mounting of seat bolt in car Tata Bolt. This issue was solved by us using Ishikawa diagram. The fixture which was used previously was replaced by using new co-ordinates. ^[4]



Fig 1: Fixture used^[4]

3.3 FIFO (First In First Out)

Implementation of FIFO in TATA MOTORS:

- The parts used while assemblies were stored in bins.
- Operator was expected to lift the part and complete the procedure but was unable to differentiate the old part from new ones.
- To avoid this confusion the bins were kept on sloping surface as shown in figure.
- The bins were kept on the surface according to their manufacturing dates, which would create a flow and the object which was old was used first thus avoiding the stacking up of old parts. ^[4]



Fig 2: FIFO^[4]

3.3 Kaizen

Kaizen is a system that involves everyone – upper management to the cleaning team. Everyone is encouraged to come up with small improvement suggestions on a regular basis. Kaizen is based on making changes anywhere improvements can be made.

Kaizen is an approach that ,

1. Starts with people.
2. Focuses its attention on people's efforts.
3. Processes are continually improved.
4. Improved processes will improve results.
5. Improved results will satisfy the customers. ^[4]

4. WORK INSTRUCTION SHEET

A standard operating procedure, or SOP, is a set of step-by-step instructions compiled by an organization to help workers carry out routine operations. SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations "detailed, written instructions to achieve uniformity of the performance of a specific function".

The focus is always set on repeated application of unchanged processes and procedures and its documentation, hence supporting the segregation of origins, causes and effects.

The Quality Assurance Unit are individuals who are responsible for monitoring whether the study report and tests are meeting the SOP. SOPs can also provide employees with a reference to common business practices, activities, or tasks. New employees use an SOP to answer questions without having to interrupt supervisors to ask how an operation is performed. The international quality standard ISO 9001 essentially requires the determination of processes (documented as standard operating procedures) used in any manufacturing process that could affect the quality of the product.

Procedures are extensively employed to assist with working safely. They are sometimes called safe work method statements (SWMS). They are usually preceded by various methods of analyzing tasks or jobs to be performed in a workplace, including an approach called job safety analysis, in which hazards are identified and their control methods described. Procedures must be suited to the literacy levels of the user, and as part of this, the readability of procedures is important^[4]

4.1 Need for Work Instruction Sheet

- The work instruction sheet is used to provide the detailed information about the sequence of operations carried out which converts the raw material into the final product.
- It also provides the list of tools and gauges used in every process, tool changing instructions and the diagrammatic representation of the component.
- It also contains the name of the operation to be carried out, machine name and the codes for tools, gauges, jigs and fixtures, if any.

4.2 Contents of Work Instruction Sheet

- Sequence of operation to be performed by team member :
This column provides the operations to be performed in proper orderly manner. Every activity is precisely described.
- Photographs/pictures to be referred to perform activity clearly:
To provide more clarity for workers to perform their task by looking at the photographs. These photographs are put up in order of the activity to be performed or they are numbered according to the activity.
- Operation symbols:
In a particular operation there are certain tasks which are important from quality and safety point of view. Such operations are marked using certain operation symbols.
- Check method:
Certain operations are to be inspected by using touch, feel, count, listen. These are called check methods.
- Safety and quality:
Critical safety and quality requirements for certain operations are mentioned in this section.
- Part details:
Part number and details used in the operation are mentioned in this section.
- Equipment/tool details:
All the equipment used in that operation is mentioned with all their details and specification. Team leader has to keep updating this section with introduction of new equipment. This also helps to track the faulty equipment while down tracking some malfunction.
- If the activity not done what is the effect on next customer:
Whenever some operator doesn't perform his activity according to the given quality norms, its effects on the next customer are mentioned in this column. This column is important for reminding the operators to work keeping in mind the quality outcome.
- Reaction plan:
If at any point of time while performing a certain operation an error is incurred, proper reaction plan for such error are mentioned in this column. These reaction plans are to be worked out by the team leader.
- Personal protective equipment to be used:
All the protective equipment to be used by the operators from safety point of view is mentioned in this section. ^[4]

5. IMPLEMENTATION OF NEW WORK INSTRUCTION SHEET

- WIS will be process /part fitment wise, for each small process separate process sheet will be prepared. This can be used for any Lineup change.
- In these, detailed activity of each process is mentioned – Basis key point which are very important from quality and safety point of view are addressed. E.g. Critical checks during material pick up included, inspection of complete work after activity completion mentioned.
- Provision for any kind of manual updation in process sequence/ customer feedback/ new changes.
- Training record are available at Back side of WIS
- Provision for Revision History record details are available
- Signoff by Team leader, Group Leader, Planner And Team member at the back side WIS. ^[4]

6. CONCLUSION

- Operator training time reduced by more than 50%.
- World Class Quality (WCQ) level III achieved.
- Quality related issues minimized by over 10% due to standardized and simplified steps.
- Confusion during lineup change reduced.
- More emphasis on operator safety.
- Changes as per customer feedback done.
- Outdated WIS easily updated

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