

# IMPLEMENTATION OF PROCESS FAILURE MODE EFFECT ANALYSIS (PFMEA) IN A SMALL AND MEDIUM SCALE PUMP INDUSTRY

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## Abstract

The globalization of Indian economy, India has moved from a highly protected market to a free market economy with severe competition from international manufacturers. Attention to the quality of product in terms of functionality, reliability, dependability and cost has increased in several industrial sectors. The failure rate many of mass produced products/parts has to be confined within a few parts per million. Percentage defectives are no longer acceptable and hence there is a need to practice tools and techniques, which would help in "Doing things right at first time". Process failure mode and effects analysis (PFMEA) is an engineering technique used to define identify and eliminate known and/or potential failures, problems and errors in the manufacturing process before they reach the customer. Therefore, PFMEA along with other quality tools support the practice and philosophy of failure prevention and continuous improvement, which are the key elements of any Total Quality Management (TQM) system. This project deals with the meaning and methodology of PFMEA with a practical study and implementation of PFMEA system in a pump manufacturing company.

**Keywords:** Use of (FMEA), Design Process, Failure Mode, Lean Technique PFMEA Result, Conclusion.

## 1. Introduction:

Considering the degree of competition between companies in the world, advantages in competition will be won by those companies who focus on performance improvement, customer satisfaction, reducing the costs and increasing the efficiency, and overlay try to purify their organizations and Processes. In this way, production strategies and lean thinking can help us to identify and eliminate non value added resources. Besides, issues like competition, increase in expectations,

changes in requirements, and alterations in technology, leads to more responsibility for producers on removing products deficiencies and deviation in processes. Otherwise, companies will lose their market share, due to customer dissatisfaction. In order to do so, today companies use tools called FMEA Lean thinking is not an analytical method, yet implementing its operational principles and applications, can lead to changes in organizational culture, increase in efficiency and proficiency and better customer relationship. In order to avoid any kind of failures in production and development processes, and also estimating the problems and finding the most economical way to stop them, we use FMEA or prevention strategies. Today, companies need powerful methods for their business, in order to survive and promote their place in international competitions. In this article, we try to integrate two famous methods and represent a new methodology based on this integration. We hope this works, lead to satisfying the needs of today's companies.

## 2. Purpose of failure mode effect analysis:

The purpose of this manual is to guide facility managers through the Failure Mode, Effects and Criticality. Analysis (FMECA) process, directing them how to apply this type of analysis to a command, control, communications, Computer, intelligence, surveillance, and reconnaissance (C4ISR) facility. These facilities incorporate several redundant systems used to achieve extremely high availability that require specialized tools, which are described in this manual, to conduct an accurate analysis.

In all Foundries, Automobile sectors, heavy Engineering industries during initial product & process development stages FMEA is a mandatory document

## 2.1 Define a process:

A documented analysis which begins with a team's thoughts concerning requirements that could go wrong and ending with defined actions which should be implemented to help prevent and/or detect problems and their causes.

## 2.2 Why do FMEA'S?

Examine the system for failures. Ensure the specs are clear and assure the product works correctly ISO requirement-Quality Planning

**“Ensuring the compatibility of the design, the production process, installation, servicing, inspection and test procedures, and the applicable documentation”**

An FMEA should be the guide to the development of a complete set of actions that will reduce risk associated with the system, subsystem, and component or manufacturing/assembly process to an acceptable level.

## 2.3 Design FMEA:

The designers used to work according to the performance requirements and the reliability was secondary. This method was greatly dependent upon the experience of the designers. With the FMEA, the design parameters could be analysed, the design process is sound and complete. Focus in Minimize failure effects on the design.

## 2.4 Types of the FMEA:

Teams may include:

1. Manufacturing Engineer
2. Design Engineer
3. Tooling Engineer
4. System Safety Engineer
5. PEM Engineer
6. Handling Specialist-PMT
7. Line Foreman/Operators Others as required.

## 3. Objectives of FMEA:

- From Road map is given to identify the potential design and process failures before they occur and to minimize the risk of failure by either proposing design changes or proposing operational procedures.
- Identify the equipment or subsystem, mode of operation and the equipment.

- Identify potential failure modes and their causes.
- Evaluate the effects on the system of each failure mode.
- Identify the measures for eliminating or reducing the risks associated with each failure mode.
- Step by step process, provide information to the operators and maintainers so that they understand the capabilities and limitations of the system to achieve best performance.
- . Develop a process map and identify process steps.

## 4. System FMEA:

In Focus on Minimize failure effects on the design. Objectives of Maximize Design, Quality, reliability, cost and maintenance.

### 4.1 Types of the FMEA:

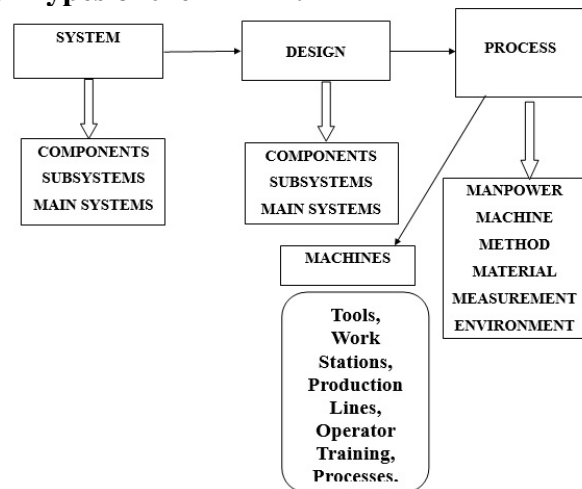


Fig. 1 Types of the FMEA

#### 4.2 PFMEA as a tool:

To access risk or the likelihood of significant problem Trouble shoot problems. Guide improvement aid in determining where to spend time and money Capture learning to retain and share knowledge and experience.

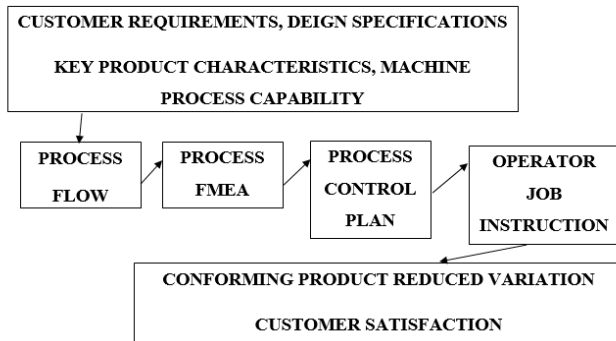


Fig. 2 PFMEA working Procedure

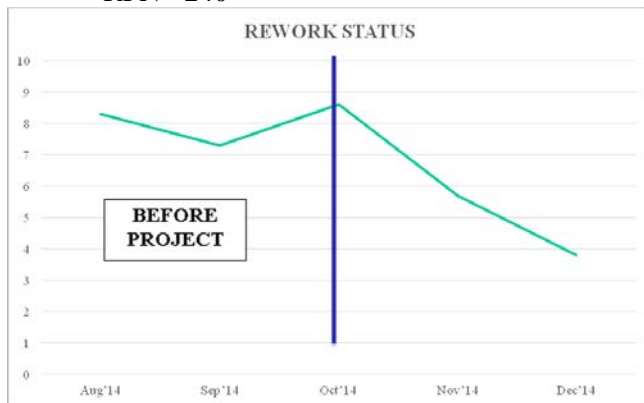
#### 5. PFMEA Result:

Once the investigation of the sub processes are completed, performance measures can be quantified and suggestions for change in the process can be given. One will see that there are definite opportunities for process improvements that will have a positive impact

$$RPN = SEV \times OCC \times DET - (\text{Severity, Occurrence and Detection})$$

$$5 \times 6 \times 8 = 240$$

Severity= 5  
 Occurrence= 6  
 Detection= 8  
 RPN= 240



After complete process evaluations were made on the new process, the final step was to implement a

Control Plan to insure that the Key Process Inputs would be properly documented, controlled, and monitored in order to prevent the failure modes identified in the FMEA from ever occurring.

1. Failure reduced thereby rework eliminated and delivery improved
2. Prevention techniques learned and taught to the organization
3. Effective control plan introduced



#### 6. Conclusion:

The study finds that the motivating factors for these companies to apply quality control come internally from the management and parent company or externally from customer. SPC and acceptance sampling are used widely by the companies. Six sigma, DOE, Taguchi methods, and capability studies are left behind from being used in these four industries, due to lack of knowledge in the technique. The selection of quality control technique in these companies is influenced by three factors: ease of use of the technique; ability to measure product specification fulfillment and ability to improve critical quality and productivity problem. Among service quality attributes, service reliability is one of the sources of customer dissatisfaction and should be managed proactively for business sustainability. The result from our initial literature survey indicated that service FMEA researches are still dominated by profit and single company orientation, and overlook on the utilization of service FMEA in supply chain operation.



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