Potential Failure Mode and Effects Analysis

FMEA

Fourth Edition

POTENTIAL FAILURE MODE AND EFFECTS ANALYSIS (FMEA)

Reference Manual
Fourth Edition

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FOREWORD
4th Edition

The FMEA 4th Edition is a reference manual to be used by suppliers to Chrysler LLC, Ford Motor Company, and General Motors Corporation as a guide to assist them in the development of both Design and Process FMEAs. The manual does not define requirements; it is intended to clarify questions concerning the technical development of FMEAs. This manual is aligned with SAE J1739.

Summary of Changes in the 4th edition FMEA Reference Manual

The DFMEA and PFMEA methods described in the 4th edition FMEA Reference Manual include those associated with design at the system, subsystem, interface, and component level and the process at manufacturing and assembly operations.

General Changes

- The formatting used in the 4th edition is intended to provide easier reading.
  - An index is included.
  - Icons are used to indicate key paragraphs and visual cues are used.
- Additional examples and verbiage have been provided to improve the utility of the manual and to provide a closer tie into the FMEA process as it develops.
- Reinforcement of the need for management support, interest, and review of the FMEA process and results.
- Define and strengthen the understanding of the linkage between DFMEA and PFMEA as well as defining the linkages to other tools.
- Improvements to the Severity, Occurrence, Detection ranking tables so that they are more meaningful to real world analysis and usage.
- Alternative methods are introduced that are currently being applied in industry.
  - Additional appendices which have example forms and special case application of FMEA.
  - The focus on the “standard form” has been replaced with several options that represent the current application of FMEA in industry.
- The suggestion that RPN not be used as the primary means for assessing risk. The need for improvement has been revised including an additional method, and the use of thresholds on RPN is clarified as a practice that is not recommended.

Chapter I provides general FMEA guidelines, the need for management support and having a defined process for developing and maintaining FMEAs, and the need for continuous improvement.

Chapter II describes the general application of the FMEA methodology, which is common between DFMEA and PFMEA processes. This includes the planning, strategy, action plans, and the need for management support and responsibility in FMEAs.

Chapter III focuses on DFMEA (Design Failure Mode Effects and Analysis), establishing the scope of the analysis, use of block diagrams, various types of DFMEAs, formation of the teams, basic procedure for analysis, action plans, and follow-up, alternatives to RPN, and connection to PFMEAs and validation plans.

Chapter IV focuses on PFMEA (Process Failure Mode Effects and Analysis), establishing the scope of the analysis, use of flow diagrams, formation of teams, basic procedure for analysis, action plans, the connection to DFMEAs and the development of control plans.

The **Appendices** have several examples of forms for DMFEA and PFMEA and addresses different applications and procedures for addressing design and process risk.

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Chapter I

General FMEA Guidelines

Introduction

This manual introduces the topic of Potential Failure Mode and Effects Analysis (FMEA) and gives general guidance in the application of the technique.

FMEA Process

FMEA is an analytical methodology used to ensure that potential problems have been considered and addressed throughout the product and process development process (APQP – Advanced Product Quality Planning). Its most visible result is the documentation of the collective knowledge of cross-functional teams.

Part of the evaluation and analysis is the assessment of risk. The important point is that a discussion is conducted regarding the design (product or process), review of the functions and any changes in application, and the resulting risk of potential failure.

Each FMEA should ensure that attention is given to every component within the product or assembly. Critical and safety related components or processes should be given a higher priority.

One of the most important factors for the successful implementation of an FMEA program is timeliness. It is meant to be a “before-the-event” action, not an “after-the-fact” exercise. To achieve the greatest value, the FMEA must be done before the implementation of a product or process in which the failure mode potential exists. Up-front time spent properly completing an FMEA, when product/process changes can be most easily and inexpensively implemented, will minimize late change crises. Actions resulting from an FMEA can reduce or eliminate the chance of implementing a change that would create an even larger concern.

Ideally, the Design FMEA process should be initiated in the early stages of the design and the Process FMEA before tooling or manufacturing equipment is developed and purchased. The FMEA evolves throughout each stage of the design and manufacturing development process and may also be used in problem solving.

FMEA can also be applied to non-manufacturing areas. For example, FMEA could be used to analyze risk in an administration process or the evaluation of a safety system. In general, FMEA is applied to potential failures in product design and manufacturing processes where the benefits are clear and potentially significant.