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Abstract
All too often FMEA (Failure Modes and Effects Analysis, Design Failure Modes and Effects Analysis or Failure Mode, Effects and Criticality Analysis) ends up costing a company hundreds of thousands of dollars to prepare and returns nothing by way of payback, increased reliability or improvement. Following are four reasons this usually happens and how you can make your FMEA efforts reap huge savings:

FMEA Fails Four Ways

How to fix FMEA for savings, reliability and profits

by Howard Cooper

All too often FMEA (Failure Modes and Effects Analysis), DFMEA (Design, Failure Modes, and Effects Analysis) or FMECA (Failure Mode, Effects, and Criticality Analysis) ends up costing a company hundreds or thousands of dollars to prepare and returns nothing by way of payback, increased reliability or improvement. Following are four reasons this usually happens and how you can make your FMEA efforts reap huge savings:

1. FMEA is treated as a job for a reliability engineer, who completes it and files it in the deliverables folder of ISO 9001 or the Six Sigma design for reliability deliverables folder. Engineers didn't create it, thus they don't study it and make the improvements indicated.
2. Design engineers see it as just another task to be done before they can get their design approved. They do it—usually late—but they get it turned in. It's filed in the deliverables folder. No improvements are made.
3. Design engineers get involved in FMEA after prototypes are delivered and it's too late to make design changes or to require resulting tests such as finite element analysis (FEA), highly accelerated life testing (HALT), computer-aided life cycle engineering (CALCE), etc., to increase reliability on critical items and functional devices. For example, HALT gets done on the wrong parts because no one focuses on the FMEA high severity or high risk priority numbers (RPN). When FMEA is completed after designs are finalized, why go back and change anything? So FMEA just gets filed in the deliverables folder.
4. I recently heard from a reliability engineer, who came from one of the major U.S. auto maker suppliers. The auto maker directed them not to use occurrence (OCC) or severity (SEV) scores above a certain number, so that the FMEA would look good if brought up in court on a recall issue. They missed the point and defeated the usefulness of the tool.

All four of these common practices result in huge costs without any improvement. There's no payback. To quote W. E. Deming, "It is not necessary to change. Survival is not mandatory."

Following are seven ways to fix your FMEA activity for big payback:

1. Do FMEA earlier and update it during each design phase. This way, there will be time to improve the design or implement mitigations before the deadline. FMEA before concept design helps solidify the best concept design. FMEA before final design can result in greatly improved prototypes. FMEA on prototypes results in finding prototype problems and improves production versions. FMEA on production versions can improve next year's model. FMEA, like HALT, can show critical failures and how to mitigate them, before you have

huge production runs in the field.

2. Involve a team of engineers on each FMEA. This team doesn't have to sit in the same room at the same time. Have the first four columns filled out first by engineers over modules or assemblies, then bring in (together or separately) the subsystem, system, reliability, maintainability and testability engineers—along with some good field-service people—to review and make comments on each failure mode (row), and rate or add to the columns of their expertise.
3. Focus on real design control and recommended actions. Rate the before and after risk priority numbers—occurence (OCC) rate and detectability (DET) effectiveness—before and after. Initial RPN should be scored as if no special design controls or recommended actions were being put in place. Then look at these two improvements (design controls and recommended actions) and do the second RPN rating as if they were in place. You'll see the difference in reduced RPN.
4. Then tie both design controls—which engineers will do themselves—and recommended actions—which will take a multiperson or multidepartment effort to accomplish—back to the design requirements so that they will get implemented.
5. Require a reliability engineer to sign off on the FMEA before each design review can be accepted and before the final design is released.
6. Reliability engineers should facilitate and motivate the engineering team to be specific and thorough. Let the cognizant engineer do the typing and take ownership of the tool. Reliability engineers should be good facilitators, maybe good functional interface stress hardening (FISHing) experts. Don't expect them to understand and analyze every design engineer's work, discipline and technology. FMEA requires a team effort.
7. Be specific and complete in the "Mechanism of Failure" column. Rescore DET and OCC scores on this "Mechanism of Failure" column to see the need for FISHing. You can greatly improve reliability by eliminating or hardening (protecting against) the stresses that cause malfunction and failure. (See more on FISHing.)

Six Sigma point of interest

Each row in a FMEA or FMECA is, by nature, a Six Sigma DMAIC. Treat each failure mode as a potential improvement opportunity, but remember Deming's words: "It is not necessary to change. Survival is not mandatory."

About the author

Howard Cooper is the founder of Amemco and has been a consultant for 20 years. He enjoys helping large companies eliminate up to 92 percent of their unscheduled equipment downtime, usually in less than 60 days. He coined the terms LM-LM (lean maintenance for lean manufacturing), FISH (functional interface stress hardening) and FISHing™ (field implemented stress hardening) for Six Sigma DMAIC.

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