

AIAG and VDA New FMEA Manual

A more clear and structured approach towards prevention of Failures !

The Automotive Industry Action Group (AIAG) and the German Association of the Automotive Industry, or VDA (Verband der Automobilindustrie), have been cooperanking in automotive quality management systems since the advent of the second edition of ISO/TS 16949 in 2002. The integration work that started with ISO/TS 16949 naturally evolved into an integration effort of the failure mode and effects analysis (FMEA) standards. The two FMEAs are quite different from each other in approach. Some of these differences will be illustrated in this article.

The current work is the outcome of three years of collaboration by a team of AIAG and VDA FMEA stakeholders. These comments are based on the draft document released for public comments on Nov. 27, 2017. It is assumed that the final release will incorporate these and other suggestions.

FMEA – a gist

- FMEA is a creative and structured process that works to improve product and manufacturing process design of a product.
- Traditionally, the failure mode “effect” has resulted in a “severity” ranking; the failure mode “cause” with “preventive action” have resulted in an “occurrence” ranking; and the “detection controls” have resulted in a “detection” ranking.
- The severity, occurrence, and detection rankings and the risk priority number (RPN, which is a result of $S \times O \times D$ or other 4 different approaches) were used in determining recommended actions or improvements to the product or manufacturing process design.
- FMEA experts have been working with both AIAG and VDA methodologies.
- They were working on an integrated approach to AIAG and VDA methodologies, and had participated in a few panels that presented papers on the two approaches, when the AIAG and VDA teams started working on a joint standard.

AIAG and VDA approaches

- There are several ways in which American and German manufacturers have differed in their approach to FMEA and design FMEA (DFMEA).
- Generally, the Germans have been historically focused on DFMEA and the Americans on process FMEA (PFMEA). Although this is generally true, during the past five years efforts have been made in the U.S. automotive industry to focus on DFMEA as well.
- Second, the VDA DFMEA approach has looked at the interaction of system, subsystem, and components when trying to improve designs.

- The U.S. approach, however, has focused on improving design in each of these elements separately.
- Third, the U.S. DFMEA approach has looked at the linkages between design FMEA and test plans, while the VDA approach does not mention it.
- Fourth, the VDA approach has previously used the same common strategy for both design and process FMEA, while the U.S. approach has acknowledged the different focuses between DFMEAs and PFMEAs, and therefore the need for different strategies.
- Finally, the U.S. approach for PFMEAs has focused on the interaction between process flow, PFMEA, control plans, and work instructions.
- This work was initiated as early as the 1990s, when the dimensional control plan was created by Ford Motor Co.'s Powertrain Division.
- This work was a result of Greg Gruska's work with Ford. Simultaneously, later the team created its approach in the early 1990s around a methodology called "Process Review," which focused on the linkages between process flows, PFMEAs, and control plans by product and process families.
- Both methodologies succeeded to a great degree, and the quality of German and U.S. vehicles have improved tremendously.
- It is worth looking at the results of preventive measures by citing J.D. Power's figures for initial car quality or things gone wrong (TGW).
- The TGW rankings are the number of "things gone wrong" in 100 cars. For this ranking, less is better.
- It is good to know that 100—or one reported problem per car—was the magic number that was thought to be untouchable years ago.

J.D. Power's initial car quality study

- The 2017 initial quality study (IQS) had this announcement to make in a press release: "The 'Detroit Three' American automakers—General Motors, Ford, and Chrysler—outperform import brands for the second year in a row, but for only the third time since the study was first published in 1987.
- In 2017, domestic brands receive a score of 93 PP100, compared with 99 PP100 for import brands.
- Last year, domestic brands also had fewer problems (103 PP100) compared with import brands (106 PP100)."
- The article gave kudos to both American and German cars that performed better than Japanese-owned car companies.

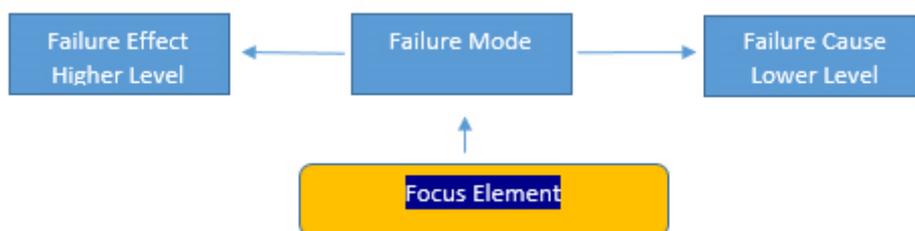
AIAG's and VDA's new FMEA, first edition

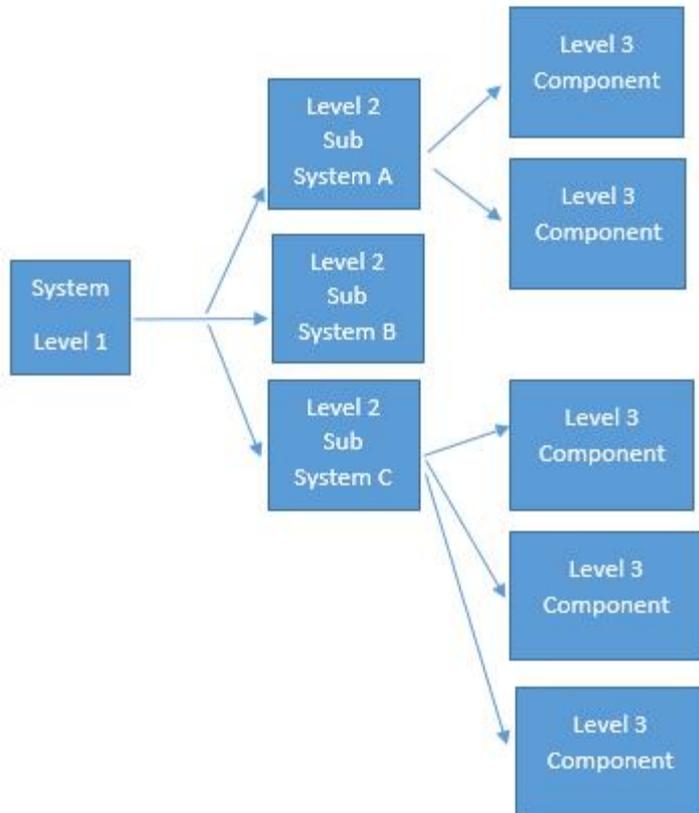
The new FMEA adopts a structured approach and six-step implementation process.



AIAG's & VDA's FMEA approach

- Those familiar with the VDA approach can see that a structured approach similar to that used by VDA was adopted by the consolidated approach to FMEAs.
- It also adopts a flat file—i.e., a form that is an one-dimensional relationship—when the relationships are more three-dimensional between failure effects, failure modes, and failure causes.
- Each of these failures arise from different parts of the bill of materials (BOM), or what is known as “structure analysis.”





Structure of the system or bill of materials (BOM)

- The focus element could be the system; subsystem a, b, c; or any of the components.
- The failure mode is singular or one, but the effects can be several at the higher level, and the causes at the lower level can be many.
- This is a one-to-many relationship at the higher level, and a one-to-many relationship to the lower level, thus making this three-dimensional relationship difficult to show in a flat file.
- The consolidated FMEA approach has also adopted the block diagram in the structure analysis, which the AIAG DFMEA and U.S. customers required.
- The new form relates to each of the steps of the FMEA approach after the initial scoping step.
- Hence, form titles are Structure Analysis, Function Analysis, Failure Analysis, Risk Analysis, and a final step of Optimization.
- In each of these steps, we can notice that the color changes between the three columns of each section.
- Each of the columns belong to one of the levels of the structure.
- The risk analysis has adopted the severity, occurrence, and detection rules that many of the customers in the United States have adopted in the recent past. This step is called action prioritization (AP); the new FMEA has finally given up on the RPN risk ranking.

Questions and thoughts to ponder

- In the consolidated FMEA approach model, the causes are always at the lower level, like the VDA approach.
- In other words the problems or “failures” in the current level are always because of a “cause” at the lower level.
- The failure at the lower level is because of a failure or cause at the level below that.
- This is at odds with the U.S. approach, which has always tried to improve the design at the current level without assigning cause to a lower level. because each level is most likely assigned to a different design team, the design teams above are assigning cause or failure to the lower-level design teams.
- Let us be clear: In the DFMEA, the structure and the linkage between the system, subsystem, and component is a much needed improvement; however, there is a missed opportunity here to commingle the U.S. and German approaches.
- The current approach, borrowing from the VDA, looks only at three levels, where in most systems there are more than three levels.
- It would be beneficial for the six steps to take a more complete system approach to think about the structure, functions, requirements, and failure flow-down of the entire system.
- The lack of linkages between DFMEA and test plans (DVP&R) and process flow, PFMEA, control plans, and work instructions, is another lost opportunity in this new consolidation.
- Moreover, IATF 16949 requires these linkages, and it is not clear how the consolidated FMEA approach will achieve it.
- Lastly, the six-step approach does not add value to the PFMEA.
- The U.S. approach of completing a process flow, PFMEA, and control plan would have been an improvement.
- The structure analysis and a seeming brainstorming of cause and effect between failure and causes using a 4M (man, machine, material, and environment) technique leaves much to be desired.
- There are many more observations and thoughts, but most important, we would like to applaud the U.S. and German teams in coming up with an integrated document.
- We hope there is much dialogue and discussion resulting in improvements and changes possible in the consolidated FMEA approach.

Citation: Q1