



# SURFACE VEHICLE STANDARD

J1739™

JAN2021

Issued 1994-07  
Revised 2021-01

Superseding J1739 JAN2009

(R) Potential Failure Mode and Effects Analysis (FMEA)  
Including Design FMEA, Supplemental FMEA-MSR, and Process FMEA

## RATIONALE

This standard has been revised to emphasize the process of FMEA selection, creation, documentation, reporting, and change management. New additions include the table of contents, supplemental DFMEA for monitoring and system response (DFMEA-MSR) with rating critiera for frequency and monitoring, and an introduction of the action priority method. The standard includes more information about how information flows from DFMEA to validation planning and PFMEA to control planning. Revisions have been made to the rating criteria for severity, occurrence, and detection for both DFMEA and PFMEA. This standard serves as a common starting point for the development of an effective DFMEA and PFMEA.

This document contains content from the AIAG and VDA Handbook, First Edition, 2019.

## FOREWORD

This document was revised by a balanced committee and represents current thoughts and practices on the subject from the viewpoint of OEMs (original equipment manufacturers), suppliers, and consultants. The rating charts and action priority charts are part of harmonization efforts between SAE, AIAG, and VDA. This document serves as a standard that includes requirements and additional recommendations for best practices in the application of FMEA. The goal of this document is to adhere to basic principles of FMEA knowing that procedures for how to perform FMEA will vary by company. This document is referenced in other publications by IATF, ISO, SAE, AIAG, and VDA.

## TABLE OF CONTENTS

1.	SCOPE.....	6
1.1	Purpose .....	6
2.	REFERENCES.....	6
2.1	SAE Publications.....	6
2.2	ISO Publications.....	6
2.3	Other Publications.....	6
3.	DEFINITIONS, EXAMPLES, TERMS .....	6
4.	GENERAL REQUIREMENTS .....	9
4.1	What is FMEA? .....	9
4.2	Why FMEA? .....	10
4.3	Who Performs FMEA? .....	10
4.3.1	Management .....	10
4.3.2	Owner.....	11
4.3.3	Facilitator (Moderator).....	11

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2021 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

**TO PLACE A DOCUMENT ORDER:** Tel: 877-606-7323 (inside USA and Canada)  
Tel: +1 724-776-4970 (outside USA)  
Fax: 724-776-0790  
Email: CustomerService@sae.org  
<http://www.sae.org>

For more information on this standard, visit  
[https://www.sae.org/standards/content/J1739\\_202101](https://www.sae.org/standards/content/J1739_202101)

SAE WEB ADDRESS:

4.3.4	Team Members .....	11
4.3.5	Customer.....	11
4.3.6	Fully Owned Risks versus Partnership Interface Risks .....	11
4.4	When is the FMEA Created? .....	12
4.4.1	Start.....	12
4.4.2	Completion .....	12
4.4.3	Revisions.....	12
4.5	FMEA Worksheet.....	12
4.6	FMEA Rating Criteria .....	12
4.7	FMEA Risk Prioritization .....	12
4.8	FMEA Process Steps.....	12
 5.	 DESIGN FMEA .....	14
5.1	Project Planning (Step 1) .....	14
5.1.1	Determine the Scope of the Project .....	14
5.1.2	Perform Preliminary Risk Assessment for Design FMEA .....	15
5.1.3	Determine Number and Types of FMEAs Needed for Project.....	16
5.1.4	Prioritize Design FMEAs .....	17
5.1.5	Develop DFMEA Plan for Project.....	17
5.2	DFMEA Preparation (Step 2) .....	17
5.2.1	Determine the Scope of the FMEA .....	17
5.2.2	Create Visual Depiction of Scope .....	17
5.2.3	Assemble the FMEA Team .....	19
5.2.4	Establish Ground Rules and Assumptions/Gather FMEA Information .....	19
5.2.5	Identify and Prioritize Functions and Requirements .....	21
5.3	Technical Risk Analysis (Step 3) .....	26
5.3.1	Transfer Prioritized Functions and Requirements into Analysis .....	26
5.3.2	Determine Potential Failure Modes.....	27
5.3.3	Determine Potential Effects of Failure .....	28
5.3.4	Determine Potential Cause(s) of Failure.....	28
5.3.5	Identify Current Prevention and Detection Controls .....	30
5.4	Risk Assessment and Prioritization (Step 4).....	32
5.4.1	Assess Severity of Effects .....	33
5.4.2	Assess Likelihood of Occurrence.....	33
5.4.3	Assess Ability to Detect.....	33
5.4.4	Assess Risks and Prioritize Actions.....	34
5.4.5	Identify Potential Special Characteristics.....	38
5.4.6	Supplemental FMEA for Monitoring and System Response (as needed) .....	39
5.5	Reduce and Communicate Risks (Step 5).....	47
5.5.1	Develop Recommended Actions.....	48
5.5.2	Acceptance/Disposition of Risks by Management.....	49
5.5.3	Implement Recommended Actions .....	49
5.5.4	Reassess Risks.....	50
5.5.5	Continue FMEA Until Risks Have Been Reduced to an Acceptable Level.....	51
5.6	Document Results (Step 6).....	51
5.6.1	Prepare Summary of Key Findings .....	51
5.6.2	Provide DFMEA Effectiveness Feedback .....	51
5.6.3	Implement DFMEA Version Control.....	53
5.6.4	Identify DFMEA Linkages .....	53
5.6.5	Change Management.....	56
 6.	 PROCESS FMEA.....	56
6.1	PFMEA Planning (Step 1).....	56
6.1.1	Determine the Scope of the Project .....	56
6.1.2	Perform Preliminary Risk Assessment for Process FMEAs .....	57
6.1.3	Determine the Processes that Require PFMEAs for a Project .....	58
6.1.4	Prioritize PFMEAs .....	59
6.1.5	Develop PFMEA Plan for Project.....	59

6.2	PFMEA Preparation (Step 2) .....	59
6.2.1	Determine the Scope of the PFMEA.....	59
6.2.2	Create Visual Depiction of Scope .....	59
6.2.3	Assemble the PFMEA Team.....	64
6.2.4	Establish Ground Rules and Assumptions/Gather FMEA Information .....	64
6.2.5	Identify and Prioritize Functions and Outputs (Requirements) .....	65
6.3	Technical Risk Analysis (Step 3) .....	65
6.3.1	Transfer Prioritized Functions and Requirements into Analysis .....	66
6.3.2	Determine Potential Failure Modes.....	67
6.3.3	Determine Potential Effect(s) of Failure .....	68
6.3.4	Determine Potential Cause(s) of Failure.....	69
6.3.5	Identify Current Prevention and Detection Controls .....	70
6.4	Risk Assessment and Prioritization (Step 4).....	71
6.4.1	Assess Severity of Effects .....	72
6.4.2	Assess Likelihood of Occurrence.....	72
6.4.3	Assess Ability to Detect.....	73
6.4.4	Assess Risks and Prioritize Actions.....	74
6.4.5	Confirm Special Characteristics.....	77
6.5	Reduce and Communicate Risks (Step 5).....	78
6.5.1	Develop Recommended Actions.....	78
6.5.2	Acceptance/Disposition of Risks by Management.....	79
6.5.3	Implement Recommended Actions .....	80
6.5.4	Reassess Risks.....	80
6.5.5	Continue FMEA Until Risks Have Been Reduced to an Acceptable Level.....	80
6.6	Document Results (Step 6).....	81
6.6.1	Prepare Summary of Key Findings .....	81
6.6.2	Provide PFMEA Effectiveness Feedback .....	81
6.6.3	Implement PFMEA Version Control .....	83
6.6.4	Identify PFMEA Linkages .....	83
6.6.5	Change Management.....	86
7.	NOTES .....	86
7.1	Revision Indicator.....	86
APPENDIX A	SUGGESTED SEVERITY EVALUATION CRITERIA - DFMEA AND DFMEA-MSR .....	87
APPENDIX B	SUGGESTED OCCURRENCE EVALUATION CRITERIA - DFMEA .....	88
APPENDIX C	SUGGESTED DETECTION EVALUATION CRITERIA - DFMEA .....	90
APPENDIX D	SUGGESTED FREQUENCY EVALUATION CRITERIA - DFMEA-MSR.....	91
APPENDIX E	SUGGESTED MONITORING EVALUATION CRITERIA - DFMEA-MSR .....	92
APPENDIX F	SUGGESTED SEVERITY EVALUATION CRITERIA - PFMEA .....	93
APPENDIX G	SUGGESTED OCCURRENCE EVALUATION CRITERIA - PFMEA .....	94
APPENDIX H	SUGGESTED DETECTION EVALUATION CRITERIA - PFMEA .....	95
APPENDIX I	SAMPLE ACTION PRIORITY FOR DFMEA AND PFMEA .....	97
APPENDIX J	RATING CRITERIA USED IN THE DEVELOPMENT OF ACTION PRIORITY.....	99
APPENDIX K	SAMPLE ACTION PRIORITY FOR FMEA-MSR.....	100
APPENDIX L	DFMEA BLANK FORM .....	101
APPENDIX M	DFMEA-MSR BLANK FORM .....	102