Failure Mode and Effects Analysis
(FMEA)

AIAG – VDA, 2019
Latest version

Objective of this initiative :

- To help the FMEA practitioners to follow right ranking methods, while performing the FMEAs
- For free circulation only

Process FMEA

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FMEA Ranking tables

Severity [S]

Occurrence [O]

Detection [D]

- ✓ These SOD ranking tables are aligned to the Version 2, 2nd June 2020
- ✓ All who have qualified by us on the latest version – may take a note of these tables to implement
- ✓ Best wishes

Process FMEA : SEVERITY (S) Table

*(Reference : Pg 108 & 109 of FMEA (AIAG – VDA) Handbook 1st edition *)*

Process General Evaluation criteria severity (S)					
Potential Failure Effects rated according to the criteria below.					Blank until filled in by user
S	**Effect**	**Impact to your plant**	**Impact to Ship- to plant (When Known)**	**Impact to End User (When Known)**	**Corporate or product Line examples**
10	**High**	Failure may result in ~~*an acute*~~ **health and/or safety risk** for the manufacturing or assembly worker	Failure may result in ~~*an acute*~~ **health and/or safety risk** for the manufacturing or assembly worker	Affects **safe operation** of the vehicle and/or other vehicles, the health of driver or passenger(s) or road users or pedestrians.	
9		Failure may result in in-plant regulatory noncompliance	Failure may result in in-plant regulatory noncompliance	Noncompliance with regulations	
8	**Moderately high**	100% of production run affected may have to be scrapped. ~~*Failure may result in in-plant regulatory noncompliance or may have a chronic health and/or safety risk for the manufacturing or assembly worker*~~	Line shutdown greater than full production shift; stop shipment possible; field repair or replacement required (Assembly to End user) other than for regulatory non compliance. ~~*Failure may result in in-plant regulatory noncompliance or may have a chronic health and/or safety risk for the manufacturing or assembly worker*~~	**Loss** of primary vehicle function necessary for normal driving during expected service life.	
7		Product may have to be sorted and a portion (less than 100%) scrapped; deviation from primary process; decreased line speed or added manpower	Line shutdown from 1 hour up to full production shift; stop shipment possible; field repair or replacement required (Assembly to End user) other than for regulatory noncompliance.	**Degradation** of primary vehicle function necessary for normal driving during expected service life.	
6	**Moderately low**	100% of production run may have to be reworked off line and accepted.	Line shutdown up to one hour	**Loss** of secondary vehicle function.	
5		A portion of the production run may have to be reworked off line and accepted	Less than 100% of product affected; strong possibility for additional defective product; sort required; no line shutdown.	**Degradation** of secondary vehicle function.	
4		100% of the production run may have to be reworked in – station before it is processed	Defective product triggers significant reaction plan; Additional defective products not likely; Sort not required.	Very objectionable appearance, sound, vibration, harshness, or haptics	
3	**Low**	A portion of the production run may have to be reworked in – station before it is processed	Defective product triggers minor reaction plan. Additional defective products not likely; Sort not required.	Moderately objectionable appearance, sound, vibration, harshness, or haptics.	
2		Slight inconvenience to process, operation, or operator.	Defective product triggers no reaction plan; additional defective products not likely; sort not required; requires feedback to supplier	Slightly objectionable appearance, sound, vibration, harshness, or haptics.	
1	**Very low**	No discernible effect.	No discernible effect or no effect	No discernible effect.	

* Note : This table has been aligned to Errata Version 2, June 2020

Process FMEA : OCCURRENCE (O) Table

*(Reference : Pg 197 of FMEA (AIAG – VDA) Handbook 1st edition *)*

Occurrence Potential (O) for the process				
Potential Failure Causes rated according to the criteria below. Consider Prevention Controls when determining the best Occurrence estimate. Occurrence is a predictive qualitative rating made at the time of evaluation and may not reflect the actual occurrence. The occurrence rating number is a relative rating within the scope of the FMEA (process being evaluated). For prevention controls with multiple Occurrence Ratings, use the rating that best reflects the robustness of the control.				Blank until filled in by user
O	**Prediction of failure cause occurring**	**Type of control**	**Prevention Controls**	**Corporate or product Line Examples**
10	**Extremely high**	None	No prevention controls	
9	**Very high**	Behavioural	Prevention controls will have little effect in preventing failure cause	
8				
7	**High**	Behavioural or Technical	Prevention controls somewhat effective in preventing failure cause	
6				
5	**Moderate**		Prevention controls are effective in preventing failure cause	
4				
3	**Low**	Best practices; Behavioural or Technical	Prevention controls are highly effective in preventing failure cause	
2	**Very low**			
1	**Extremely low**	Technical	Prevention controls are extremely effective in preventing failure cause from occurring due to design (e.g. Part geometry) or process (e.g. fixture or tooling design). Intent of prevention controls – Failure mode cannot be physically produced due to the failure cause.	

* Note : This table has been aligned to Errata Version 2, June 2020

*(Reference : Pg 198 of FMEA (AIAG – VDA) Handbook 1st edition *)*

PFMEA Occurrence (O) with Incidents per Thousand Values

Occurrence Potential (O) for the Process				
Potential Failure Causes rated according to the criteria below. Consider Prevention Controls when determining the best Occurrence estimate. Occurrence is a predictive qualitative rating made at the time of evaluation and may not reflect the actual occurrence. The occurrence rating number is a relative rating within the scope of the FMEA (process being evaluated). For prevention controls with multiple Occurrence Ratings, use the rating that best reflects the robustness of the control.				Blank until filled in by user
O	**Incidents per 1000 items / vehicles**	**Type of control**	**Prevention Controls**	**Corporate or product Line Examples**
10	≥ 100 per thousand >/= 1 in 10	None	No prevention controls	
9	50 per thousand 1 in 20	Behavioural	Prevention controls will have little effect in preventing failure cause	
8	20 per thousand in 1 in 50			
7	10 per thousand in 1 in 100	Behavioural or Technical	Prevention controls somewhat effective in preventing failure cause	
6	2 per thousand 1 in 500			
5	.5 per thousand 1 in 2000		Prevention controls are effective in preventing failure cause	
4	.1 per thousand 1 in 10,000			
3	.01 per thousand 1 in 100,000	Best practices; Behavioural or Technical	Prevention controls are highly effective in preventing failure cause	
2	< .001 per thousand 1 in 1,000,000			
1	Failure is eliminated through prevention control	Technical	Prevention controls are extremely effective in preventing failure cause from occurring due to design (e.g. Part geometry) or process (e.g. fixture or tooling design). Intent of prevention controls – Failure mode cannot be physically produced due to the failure cause.	

* Note : This table has been aligned to Errata Version 2, June 2020

*(Reference : Pg 199 of FMEA (AIAG – VDA) Handbook 1st edition *)*

PFMEA Occurrence (O) with Time Based Failure Prediction Values

Occurrence Potential (O) for the Process				
Potential Failure Causes rated according to the criteria below. Consider Prevention Controls when determining the best Occurrence estimate. Occurrence is a predictive qualitative rating made at the time of evaluation and may not reflect the actual occurrence. The occurrence rating number is a relative rating within the scope of the FMEA (process being evaluated). For prevention controls with multiple Occurrence Ratings, use the rating that best reflects the robustness of the control.				Blank until filled in by user
O	**Time based failure cause prediction**	**Type of control**	**Prevention Controls**	**Corporate or product Line Examples**
10	Every time	None	No prevention controls	
9	Almost every time	Behavioural	Prevention controls will have little effect in preventing failure cause	
8	More than once per shift			
7	More than once per day	Behavioural or Technical	Prevention controls somewhat effective in preventing failure cause	
6	More than once per week			
5	More than once per month		Prevention controls are effective in preventing failure cause	
4	More than once per year			
3	Once per year	Best practices; Behavioural or Technical	Prevention controls are highly effective in preventing failure cause	
2	Less than once per year			
1	Never	Technical	Prevention controls are extremely effective in preventing failure cause from occurring due to design (e.g. Part geometry) or process (e.g. fixture or tooling design). Intent of prevention controls – Failure mode cannot be physically produced due to the failure cause.	

* Note : This table has been aligned to Errata Version 2, June 2020

Process FMEA : DETECTION (D) Table

*(Reference : Pg 200 & 201 of FMEA (AIAG – VDA) Handbook 1st edition *)*

Detection Potential (D) for the Validation of the Process Design				
Detection Controls rated according to the Detection Method Maturity and Opportunity for Detection				Blank until filled in by user
D	**Ability to Detect**	**Detection method maturity**	**Opportunity for detection**	**Corporate or Product Line Examples**
10	Very low	No testing or inspection method has been established or is known	The failure mode will not or cannot be detected	
9		It is unlikely that the testing or inspection method will detect the failure mode	The failure mode is not easily detected through **random** or sporadic audits	
8	Low	Test or inspection method **has not been** proven to be effective and reliable (e.g. plant has little or no experience with method, gauge R & R results marginal on comparable process or this application, etc)	Human inspection (Visual., tactile, audible), or use of manual gauging (attribute or variable) that should detect the failure mode or failure cause.	
7			Machine-based detection (automated or semi-automated with notification by light, buzzer, etc), Or use of inspection equipment such as a coordinate measuring machine that <u>should</u> detect failure mode or failure cause.	
6	Moderate	Test or inspection method **has been** proven to be effective and reliable (e.g method; gauge R & R results are acceptable on comparable process or this application etc.,)	Human inspection (Visual, tactile, audible), or use of manual gauging (attribute or variable) that will detect the failure mode or failure cause (including product sample checks).	
5			Machine-based detection (semi-automated with notification by light, buzzer, etc), or use of inspection equipment such as a coordinate measuring machine that <u>will</u> detect failure mode or failure cause (including product sample checks)	
4	High	System has been proven to be effective and reliable (e.g plant has experience with method on identical process or this application), gauge R & R results are acceptable , etc	Machine-based automated detection method that will detect the failure mode **downstream**, prevent further processing or system will identify the product as discrepant and allow it to automatically move forward in the process until the designated reject unload area. Discrepant product will be controlled by a robust system that will prevent outflow of the product from the facility.	
3			Machine-based automated detection method that will detect the failure mode **in-station**, prevent further processing or system will identify the product as discrepant and allow it to automatically move forward in the process until the designated reject unload area. Discrepant product will be controlled by a robust system that will prevent outflow of the product from the facility	
2		Detection method has been proven to be effective and reliable (e.g plant has experience with method, error-proofing verifications, etc.,)	Machine-based detection method that will detect the cause and prevent the failure mode (discrepant part) from being produced	
1	Very high	Failure mode cannot be physically produced as-designed or processed, or detection methods proven to **always** detect the failure mode or failure cause.		

* Note : This table has been aligned to Errata Version 2, June 2020