

WELCOME TO AQC



AUTO

QUALITY

CENTRE



F.M.E.A

FAILURE MODE &

EFFECT ANALYSIS



What is Process failure mode & effect analysis (PFMEA)?

PFMEA stand for process failure mode & effect analysis, method to identified potential failure mode in process & effect of those failure mode. It is risk management tool.

PFMEA is a team oriented systematic, qualitative, analytical method to evaluate potential risk of failure of process. With this we analyse the cause & effect of those failures, document preventive & detection action. Recommend action to reduce risk. In PFMEA we analyse technical risk to reduce failure and improve safety in product & process.

Failure mode & effect analysis (FMEA) Background

FMEA was developed by US aerospace & military sector in 1940. Later by 1960 FMEA was adopted by automotive industries as a tool to analyse potential failure modes in components, system & manufacturing process. Later this methodology was adopted by healthcare, electronics, software industries. By 1990 FMEA was integrated with Quality management system- TQM & Six sigma. AIAG added it as copyright standard & published various edition. Latest revision is AIAG- VDA 5th edition published in 2019. The new AIAG-VDA FMEA handbook was released in June 2019. Automotive Industry Action Group (AIAG) and Verband der Automobilindustrie (VDA), Germany's associations for automotive manufactures and suppliers issued the first edition of a joint FMEA book.

Why PFMEA is used?

With PFMEA we identify function of process steps, associate potential failure modes, effect of those failure mode, cause & control of those failure in process. Also recommend additional action to reduce potential risk.

PFMEA is joint activity done with CFT, in which we do brainstorming to identify failure modes. It is qualitative approach with single point failure analysis.

FMEA is meant to be a “before-the-event” action, not an “after-the-fact” exercise.

What are benefits of PFMEA?

FMEA is joint activity between customer & their business partners, with PFMEA we try to find maximum failure effects and severity & reducing risk by analysing over those technical risk.

Direct improvement can be seen in followings:-

- Product safety will improve
- Product quality will improve
- Smooth production launch
- Regulatory compliance
- Inter department communication
- Customer Satisfaction

When we need to do FMEA?

When there is new technology, new design & development & new process.

When there are changes in existing design & process like- Change in location, Engineering change in Existing design.

What are changes in latest FMEA with respect to New FMEA?

Major changes are in format. Some new item added in new FMEA. Changes are as followed:-

For continuous improvement, issue & revision history added

Structure analysis is new addition. Process divided into process item, process step & process work element

Functional analysis is expanded according to function of focus element, function of process step & work element.

Failure analysis- No change

Risk analysis (Occurrence control / Detection control)- RPN replaced by Action Priority

In Optimization, Recommended action divided by Prevention action & detection action, also status column added

Changes in Latest FMEA with respect to old FMEA



OLD FMEA

Planning & preparation is changed

Item _____ Process Responsibility _____ Page .__ of _____

Model Year/Program _____ Key Date _____ Prepared By _____

Core Team _____ FMEA Origin Date _____

PFMEA No. _____

NEW FMEA

Company Name: ABC Subject: Process Step Name

Manufacturing Location: Plant No- Sec, District, State PFMEA start Date: 02- Mar-2025 PFMEA ID no. ABC/FMEA/01/001

Customer Name: XYZ PFMEA Revision Date: 08-Aug-2025 Process Responsibility: Line No/Line leader Name

Model year/Program: 2020/X/123 Cross Function Team: Team List Confidential Level: Confidential/Business Unit

Major changes are in format

#	Continuous Improvement	Structure Analysis (Step 2)			FUNCTION ANALYSIS (Step 3)			FAILURE ANALYSIS (Step 4)			RISK ANALYSIS (Step 5)					Optimization (Step 6)							Remarks					
		1. Process Item System	2. Process Step Station No.	3. Process Work Element 4M Type	1. Function of Process Item System	2. Function of Process Step Station No. -Ve Failure Mode	3. Function Process Work Element 4M Type -Ve Failure Cause	1. Failure Effect (FE)	2. Failure Mode (FM) of the Process	3. Failure Cause (FC) of the work	Current Prevention Control PC of C	Occurrences (O) of FC	Current Detection Control DC of FC or FM	Detection (D) of FC or FM	MMEA AP - Action priority	Special product Characteristics	Filter Code	Prevention Action	Detection Action	Responsible Person Name	Target Completion Date	Status		Action taken (With Pointer)	Completion Date	Severity	occurrence	Detection
0		Break drum Machining Line 3	OP -10 Drilling	Operator	Internal function: Break drum machining	Drill 4 Holes	loads part on machine	Internal effect- Rework offline with wheel	6 Drill Miss	Operation Incomplete Power failure	Operator WI	5	100 % Visual Insp EOL	8	M	fixture modified in next operation	100 % Visual Insp EOL	Mr. XYZ	DDMMYY	Implemented	Kaizen sheet , Poka yoke master list	DDMMYY	6	2	4			Poka yoke Implemented.

1

Continuous Improvement

Issue#

History / Change Authorization (As Applicable) Optional

New addition for Continuous Improvement

Process Function Requirements

Process Name → Manual application of wax inside door

Requirement → To cover inner door lower surfaces at minimum wax thickness to retard corrosion

OLD FMEA

2

Structure Analysis (Step 2)

1. Process Item System

2. Process Step Station No.

3. Process Work Element 4M Type

New Addition in Latest FMEA

Here process structure is expanded to process item, process step & process work element (4M). Process work element is addition in which linkage of Man/M/c, Material & method is established with process step. It is detail version of process.

☐ In status column, we will consider Untouched, Under discussion, In process, Completed or Discarded.

What is methodology of FMEA?

Latest FMEA is based on 7 step implementation process. This FMEA is divided in 7 steps which provide systematic approach for failure mode analysis & risk mitigation.

7 steps are as followed:-

Planning & Preparation

Structure Analysis

Functional Analysis

Failure Analysis

Risk analysis

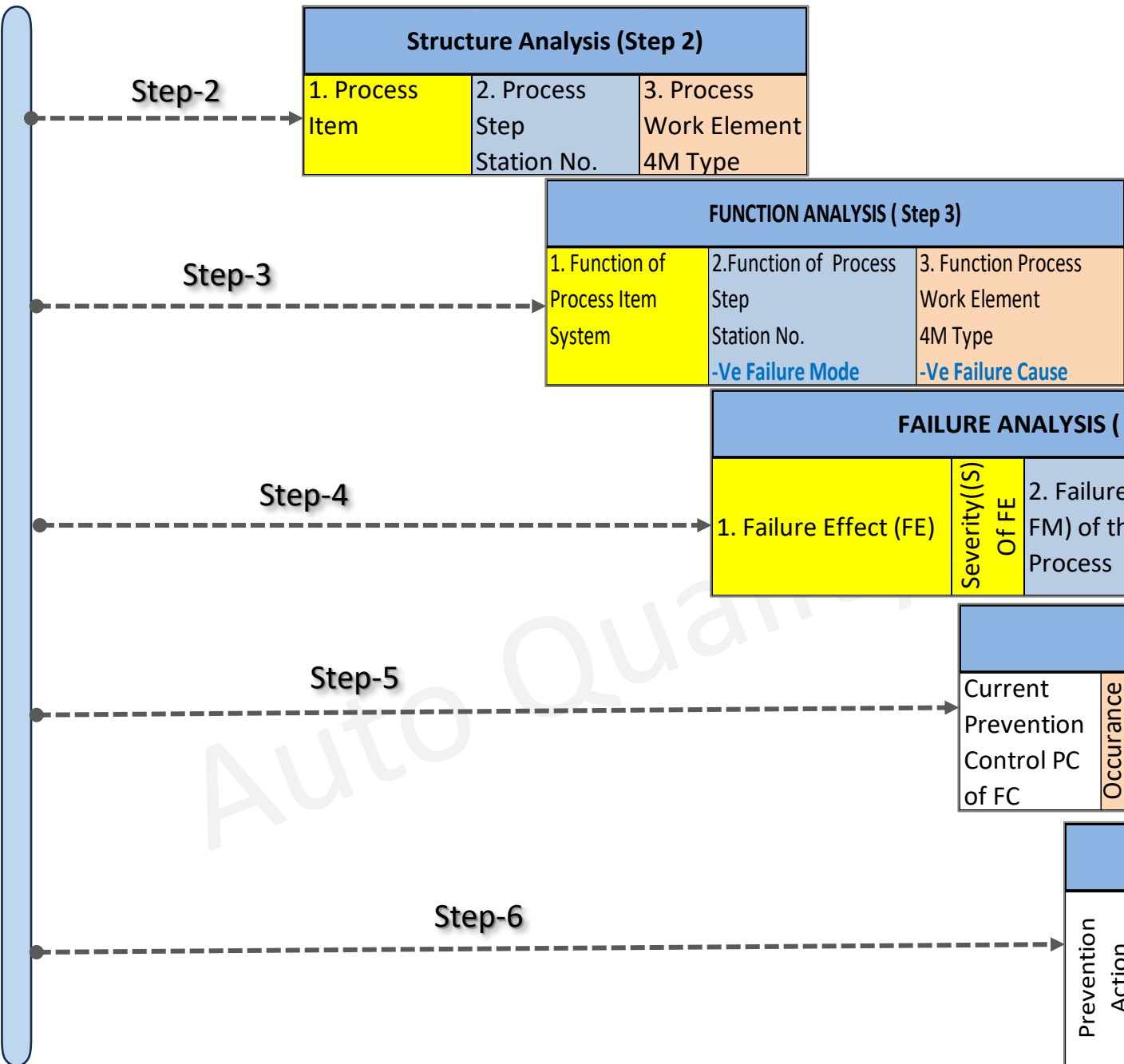
Optimization

Result documentation

Here first 3 are related to system analysis while 4-6 are related to failure analysis & risk analysis. Step7 is basically risk communication.

If I ask you which step out of these 7 step is important, guess what it could be?

7 steps in FMEA (AIAG+VDA)



Step-1 → Planning & Preparation

Company Name: ABC	Subject: Process Step Name	
Manufacturing Location Plant No- Sec, District, State	PFMEA start Date 02- Mar-2025	PFMEA ID no. ABC/FMEA/01/001
Customer Name XYZ	PFMEA Revision Date: 08-Aug-2025	Process Responsibility Line No/Line leader Name
Model year/Program 2020/X/123	Cross Function Team: Team List	Confidential Level: Confidential/Business Unit

Step-1: Planning & Preparation

It is clear definition of the scope, set by the management team. Planning is done based on Five T's. Information from this step is basis for step-2. So, this is very important step of FMEA.

Purpose:- To describe what product /processes are to be included for review in the PFMEA Project .

During planning & preparation objective is to project plan, consideration of analysis boundaries, project identification for this following information need to collect

What are customer expectations (Internal & External).

Technical requirements

Drawings & specifications

BOM & Risk assessment

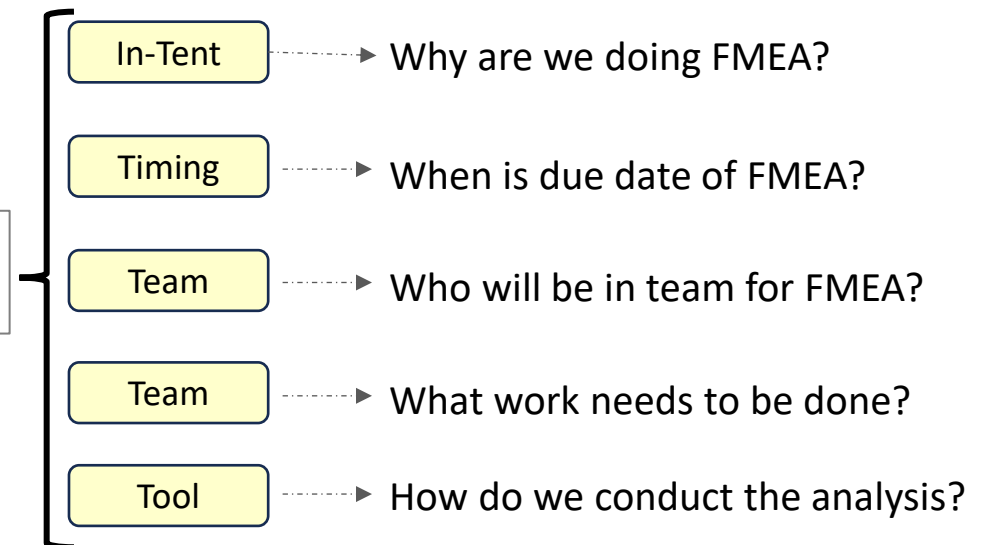
Error proofing requirements

QFD – Quality function deployment (CFT)

Here is the information of step-1

Company Name: ABC	Subject: Process Step Name	
Manufacturing Location Plant No- Sec, District, State	PFMEA start Date 02- Mar-2025	PFMEA ID no. ABC/FMEA/01/001
Customer Name XYZ	PFMEA Revision Date: 08-Aug-2025	Process Responsibility Line No/Line leader Name
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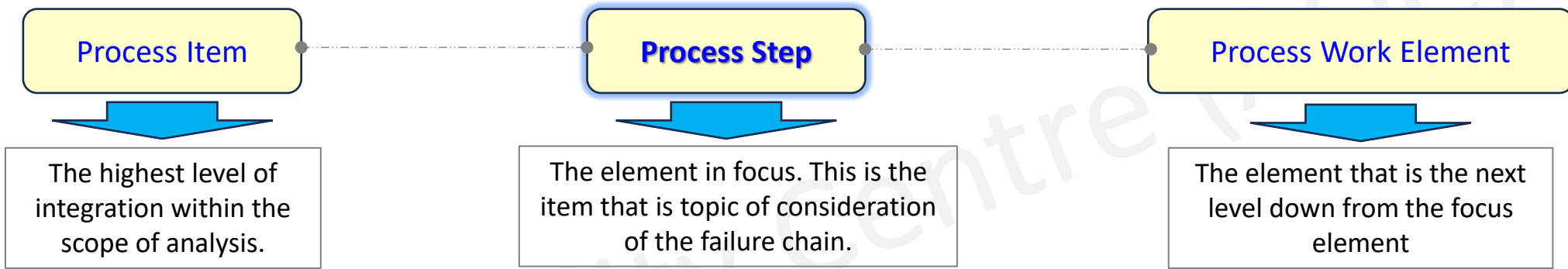
Project planning is done based on 5 T's.



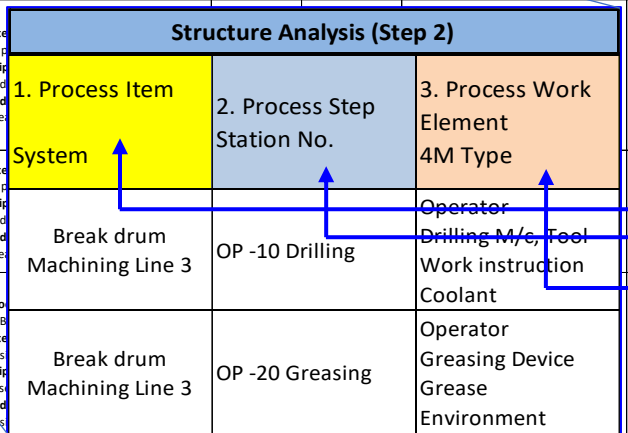
Step-2: Structure analysis

This step is used to identify and breakdown the system (Design or Process) into the system, subsystems and component element so that a comprehensive risk assessment can be conducted. This information is the basis for the next step.

Purpose:- to identify and breakdown the manufacturing system into process items, process steps and process work elements. Objective of this step is to make structure tree of process, identification of process step & sub steps, to be base for function analysis.



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0		Break drum Machining Line 3	OP -10 Drilling	Operator	Function of Process Item system	Function of Process Step Station No.	Function Process Work Element 4M Type	Failure Effect (FE)	Failure Mode (FM) of the Process	Failure Cause (FC) of the work	Current Prevention Control PC of FC	Occurrences (O) of FC	Current Detection Control DC of FC or FM	Detection (D) of FC or FM	FMEA AP - Action priority	Special product Characteristics	Filter Code	Prevention Action	Detection Action	Responsible Person Name	Target Completion Date	Status	Action taken (With Pointer)	Completion Date	Severity	occurrence	Detection	Special product Characteristics	FMEA AP - Action priority	Remarks
		Break drum Machining Line 3	OP -10 Drilling	Drilling Machine	Function of Process Item system	Function of Process Step Station No.	Function Process Work Element 4M Type	Failure Effect (FE)	Failure Mode (FM) of the Process	Failure Cause (FC) of the work	Current Prevention Control PC of FC	Occurrences (O) of FC	Current Detection Control DC of FC or FM	Detection (D) of FC or FM	FMEA AP - Action priority	Special product Characteristics	Filter Code	Prevention Action	Detection Action	Responsible Person Name	Target Completion Date	Status	Action taken (With Pointer)	Completion Date	Severity	occurrence	Detection	Special product Characteristics	FMEA AP - Action priority	Remarks
		Break drum Machining Line 3	OP -10 Drilling	Drill	Function of Process Item system	Function of Process Step Station No.	Function Process Work Element 4M Type	Failure Effect (FE)	Failure Mode (FM) of the Process	Failure Cause (FC) of the work	Current Prevention Control PC of FC	Occurrences (O) of FC	Current Detection Control DC of FC or FM	Detection (D) of FC or FM	FMEA AP - Action priority	Special product Characteristics	Filter Code	Prevention Action	Detection Action	Responsible Person Name	Target Completion Date	Status	Action taken (With Pointer)	Completion Date	Severity	occurrence	Detection	Special product Characteristics	FMEA AP - Action priority	Remarks



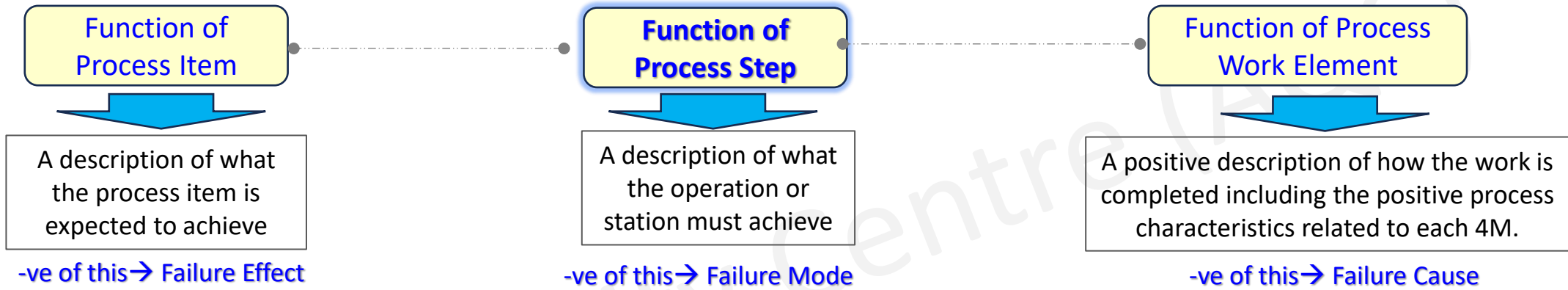
1 It is the end result of all of the successfully completed Process Steps.

2 It is a manufacturing operation or station.

3 It is the lowest level of the process flow or structure tree. It contain potential causes of failure.

Step-3: Functional Analysis

This step is used to analysis of indented function & requirements of system element identified in step-2. Objective is to visualization of product & process functions. Finding requirement & characteristic of functions. This will become base for Failure analysis.



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		Break drum Machining Line 3	OP-10 Drilling	Drilling Machine	Internal function Break drum machining as per specification Ship to plant : Assemble with wheel assy, and qualify function test. End User - stops vehicle when applies break	PCD as per spec.	Maintain PCD	Internal Ship to plant with wheel assy and qualify function test. End User - stops vehicle when applies break													DDMMYY	Implemented	Machine history card,	DDMMYY	8	2	4	CC	L	PM check sheet updated.	
		Break drum Machining Line 3	OP-10 Drilling	Drill	Process Item: Solder components with PCB with treacibility Internal function Comp Assy. On PCB with desired solder joint . Ship to plant : Assemble with Housing Assemble with indicator assembly End User - Turn signal should ON with desired flash rate.	Drill Dia 10+/-10mm	Do drill	Internal Ship to plant with wheel assy and qualify function test. End User - stops vehicle when applies break																							

FUNCTION ANALYSIS (Step 3)

1. Function of Process Item System Opposite -VE Failure Effect	2. Function of Process Step Station No. -Ve Failure Mode	3. Function Process Work Element 4M Type -Ve Failure Cause
Internal function Break drum machining as per specification Ship to plant : Assemble with wheel assy, and qualify function test. End User - stops vehicle when applies break	Drill 4 Holes Drill Dia PCD as per spec Lubricate Drill	loads part on m/c right tool Sequences of drill Coolant flow

Product Characteristic

Process Characteristic

4M Related to Process Characteristic

Action Priority:

- High Action Priority:- The team must identify an appropriate action to improve prevention and or detection control or justify and document why current controls are adequate.
- Medium Action Priority:- The team should identify an appropriate action to improve prevention and or detection control or justify and document why current controls are adequate.
- Low Action Priority:- The team could identify an appropriate action to improve prevention and or detection control.

Auto Quality Centre (AQC)

Step-7: Result Documentation

This is final step, here we documented the FMEA study. The results of the FMEA investigation should be summarized in a report .

The report should be to communicate the results throughout the organization

The results need to show the success & relevance of the analysis.

THANKS