Concept and Understanding of PPAP

PPAP – Production Part Approval Process

**This is for basic understanding against each elements of PPAP according to AIAG guideline.
To understand the details on each element, required separate presentation and guidance to perform and evaluate.

Jankrut Dave

Introduction of PPAP

- PPAP : Production Part Approval Process
- The Production Part Approval process is a framework of requirements for series parts used in the automotive environment. PPAP is used to prove the quality of suppliers and their manufacturing processes.
- PPAP is a very useful and valuable tool for establishing confidence in component suppliers and their production processes. As today's competitive manufacturing environment, controlling on cost and maintain high level of quality is become vital to the success of any organization.
- Increasing of equipment , material and labor cost combined with expanding world markets have resulted in an increase of outsourced parts. Many component parts are being outsourced to overseas manufacturers. This often results in longer lead times and larger order quantities.

- Hence it have become imperative to provide quality parts that meet the customers requirements the first time and every time. Initially PPAP was utilized by the automotive and aerospace industries. PPAP is now being utilized by several industries to improve communication and provide qualitative products to the customers. Within the automotive industry the ultimate resources for PPAP information is the manual published by the Automotive Industry Action Group (AIAG)

The PPAP process builds confidence in customers for suppliers through clearly defined specifications and guidelines. In addition, PPAP enables manufacturers to demonstrate how risk is identified and mitigated through extensive documentation as proof. It ensures that the manufacturer is capable of meeting customer’s requirements.

Introduction of PPAP

- The purpose of the PPAP is to ensure that the customer's design has been understood by the supplier and to prove that the supplier is capable of producing parts that meet all the requirements consistently.
- The Production Part Approval Process (PPAP) handbook is an industry standard that outlines the process to demonstrate engineering design and product specifications are met by the supplier’s manufacturing process. Through PPAP, suppliers and customers agree upon the requirements needed to obtain approval of supplier manufactured parts. Applicable to all parts and commodities, PPAP principles help reduce delays and non-conformances during part approval by providing a consistent approval process.

History of PPAP

The **Production Part Approval Process (PPAP)** has its origins in the automotive industry and has evolved over time to become a critical quality assurance tool. Here's a brief history of how PPAP developed:

Early Quality Requirements (Pre-1980s)

•Before formalized quality systems, automotive manufacturers relied on informal approval processes for supplier parts.
•Quality control was often reactive, focusing on inspection rather than defect prevention.

1980s: Emergence of AIAG & Standardization

•In 1982, major U.S. automotive companies (Ford, General Motors, and Chrysler) established the **Automotive Industry Action Group (AIAG)** to standardize quality and supply chain practices.

•AIAG introduced the **Advanced Product Quality Planning (APQP)** framework, which included PPAP as a key element.
•The first version of PPAP was developed by AIAG to ensure suppliers followed a structured approach to part approval.

1990s: PPAP as an Industry Standard

•In 1994, the first official **PPAP manual** was published by AIAG, outlining 18 key elements required for part approval.
•PPAP became a requirement for suppliers to U.S. automakers, ensuring consistent documentation and validation of production parts.
•The **QS-9000** standard (precursor to ISO/TS 16949 and IATF 16949) mandated PPAP for supplier quality management.

History of PPAP

2000s: Global Adoption with ISO/TS 16949

•In 1999, **ISO/TS 16949** was introduced, integrating QS-9000 and international quality standards.

•PPAP became a globally accepted process across the automotive supply chain, extending beyond North America to Europe and Asia.

2010s-Present: PPAP & IATF 16949

•In 2016, **IATF 16949** replaced ISO/TS 16949, maintaining PPAP as a core requirement.

•The latest **PPAP 4th Edition (2006)** is still widely used today, emphasizing risk management, statistical analysis, and continuous improvement.

•PPAP principles have been adopted in other industries, including aerospace, engineering, and electronics manufacturing.

Future Trends

•Digitalization and Industry 4.0 are transforming PPAP documentation with electronic submissions and real-time data tracking.

•AI and automation are being explored to improve defect detection and approval processes.

Objectives of PPAP

The **Production Part Approval Process (PPAP)** has several key objectives to ensure that suppliers meet customer requirements before mass production begins. The main objectives of PPAP are:

1. Ensure Consistency & Quality in Production

•Verify that a supplier's manufacturing process consistently produces parts that meet customer specifications.

•Prevent quality issues by ensuring stability before full-scale production.

2. Validate the Manufacturing Process

•Confirm that the supplier's production process is capable of producing parts at the required volume without defects.

•Identify and mitigate risks in the manufacturing process using quality tools like **Process Flow, PFMEA, and Control Plan**.

3. Demonstrate Compliance with Customer Requirements

•Ensure that the produced part meets all design, engineering, and regulatory requirements.

•Provide documented evidence that the part has been manufactured correctly.

4. Reduce the Risk of Defects & Rework

•Identify potential issues early in the development process to minimize costly defects, scrap, and rework.

•Improve supplier reliability and reduce the need for extensive inspections.

5. Establish a Standardized Approval Process

•Provide a structured framework for approving production parts across the automotive and other industries.

•Standardize communication between suppliers and customers, ensuring alignment on expectations.

6. Improve Supplier & Customer Collaboration

•Strengthen relationships between manufacturers and suppliers through transparency and structured documentation.

•Encourage continuous improvement and proactive quality control.

Goal of PPAP and Its Purpose to study

The **goals of PPAP (Production Part Approval Process)** align with its objectives but focus more on the expected outcomes. Here are the key goals:

1. Ensure Product & Process Readiness

•Confirm that the supplier's production process is capable of consistently making parts that meet customer requirements.

•Ensure that all manufacturing controls are in place before full production begins.

2. Minimize Quality Risks & Defects

•Identify and eliminate potential issues early in the development phase.

•Reduce the risk of defects, non-conformances, and warranty claims.

3. Standardize the Approval Process

•Provide a structured and uniform method for part validation across industries.

•Align supplier and customer expectations regarding quality, documentation, and production capability.

4. Reduce Costly Delays & Rework

•Prevent production disruptions caused by poor quality or process instability.

•Lower costs associated with defects, scrap, rework, and late design changes.

5. Improve Supplier & Customer Communication

•Enhance transparency between suppliers and customers through documented quality evidence.

•Establish clear requirements, reducing misunderstandings and rejections.

6. Support Continuous Improvement

•Encourage suppliers to implement robust quality controls and ongoing process improvements.

•Drive long-term supplier performance improvement by focusing on defect prevention.

When PPAP is Required to Perform?

PPAP approval is required in various situations to ensure that a supplier's production process is capable of consistently manufacturing parts that meet customer requirements. Here are the key instances when PPAP approval is required

1. New Part Introduction

•When a new part is being introduced into production for the first time.

•Ensures that the supplier's process is ready for mass production.

2. Engineering Change (Design or Process Change)

•When there is a change in the part design, specifications, or material.

•When the manufacturing process undergoes significant modifications (e.g., new machines, tools, or methods).

3. Change in Manufacturing Location

•If production is moved to a new plant, supplier facility, or different location.

•Ensures the new location can meet quality and process standards.

When PPAP is Required to Perform?

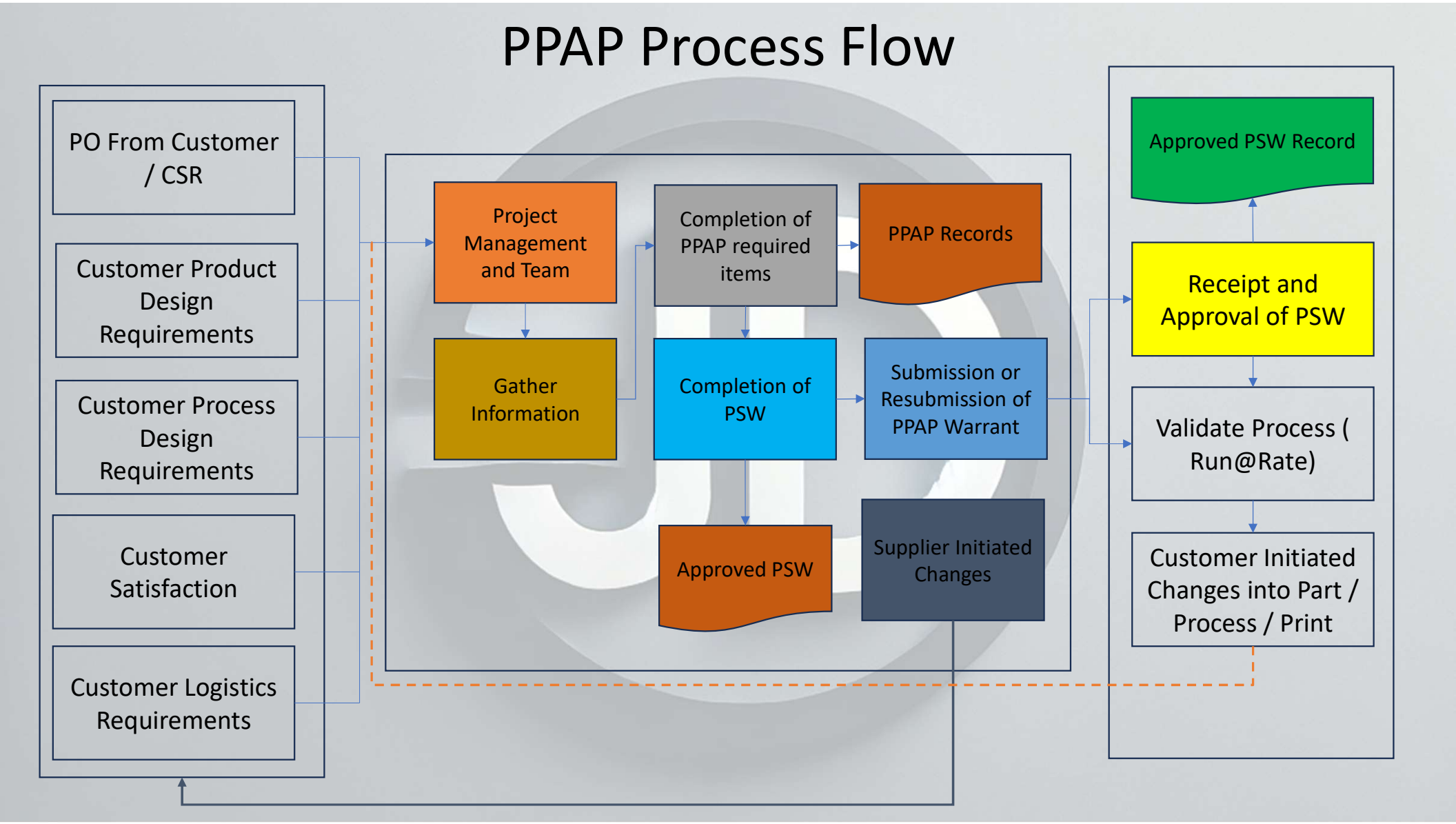
4. Change in Supplier or Sub-Supplier
•If a component, raw material, or process is sourced from a new supplier.
•Required to verify that the new supplier can meet the same quality and performance standards.
5. Change in Manufacturing Process or Equipment
•If new machines, tools, molds, dies, or production methods are introduced.
•If major repairs or replacements are done on existing tools.
6. Change in Material or Sourcing
•If raw material properties change (e.g., grade, supplier, or country of origin).
•Ensures the new material does not impact part performance.
7. Change in Production Volume
•If there is a significant increase or decrease in production volume that may affect quality.
8. Production Restart After Long Interruption
•If production has been inactive for an extended period (usually **12 months or more**).
•Ensures that processes are still capable of producing conforming parts.
9. Customer Request
•If the customer specifically requires a PPAP submission due to quality concerns or audits.

Approach of PPAP

The **PPAP approach** follows a structured process to ensure that production parts meet customer requirements and manufacturing processes are capable of consistent quality. The approach consists of the following key steps:

1. Understand Customer Requirements
2. Plan & Prepare for PPAP
3. Develop and Validate the Manufacturing Process
4. Collect & Compile PPAP Documentation
5. Submit PPAP for Approval
6. Implement Feedback & Corrective Actions
7. Maintain & Continuously Improve the Process

PPAP Process Flow



Levels of PPAP Submission

Level 1	Part Submission Warrant (PSW) only. Used for simple parts with minimal risk.
Level 2	PSW + limited supporting documents (e.g., material test reports, dimensional results).
Level 3	Full PPAP submission (PSW + all 18 elements). The most common level used.
Level 4	PSW + customer-specified documents. The customer defines which documents to submit.
Level 5	Full PPAP package + on-site review by the customer. Used for high-risk or critical components.

Elements of PPAP : Submission Level wise

		Submission Level				
Requirement		*Level 1*	*Level 2*	*Level 3*	*Level 4*	*Level 5*
1.	Design Record	R	S	S	*	R
	- for proprietary components/details	R	R	R	*	R
	- for all other components/details	R	S	S	*	R
2.	Engineering Change Documents, if any	R	S	S	*	R
3.	Customer Engineering approval, if required	R	R	S	*	R
4.	Design FMEA	R	R	S	*	R
5.	Process Flow Diagrams	R	R	S	*	R
6.	Process FMEA	R	R	S	*	R
7.	Control Plan	R	R	S	*	R
8.	Measurement System Analysis Studies	R	R	S	*	R
9.	Dimensional Results	R	S	S	*	R
10.	Material, Performance Test Results	R	S	S	*	R
11.	Initial Process Studies	R	R	S	*	R
12.	Qualified Laboratory Documentation	R	S	S	*	R
13.	Appearance Approval Report (AAR), if applicable	S	S	S	*	R
14.	Sample Product	R	S	S	*	R
15.	Master Sample	R	R	R	*	R
16.	Checking Aids	R	R	R	*	R
17.	Records of Compliance With Customer-Specific Requirements	R	R	S	*	R
18.	Part Submission Warrant (PSW)	S	S	S	S	R
	Bulk Material Checklist (see 4.1 above)	S	S	S	S	R

R : Records

S : Submission

Selection of PPAP level to be perform

How to select the correct PPAP Level for Your Project?

Selecting the correct PPAP level is a crucial decision as it ensures that the PPAP submission meets the expectations of the customer, maintains quality, and helps to manage risk. Let's understand these factors further:

Industry Standards and Company Requirements

The first factor that influences PPAP levels of submission is the company's internal standards or industry regulations.

Part Complexity

If the part geometry is complex or includes critical functions, then more comprehensive documentation will be required. It is imperative to ensure that every aspect of the design and manufacturing process is validated and thus, the PPAP submission may require the manufacturer to include Design and Process FMEA along with other documentation. Accordingly, a higher level of PPAP submission i.e. levels 3, 4, or 5 may be required.

Part Function

If the overall function of the part is critical, then thorough documentation will be required. There may be extensive testing and an engineering team's approval required to ensure that all specifications are met. Thus, higher levels of PPAP submission i.e. levels 3, 4, or 5 will be required if the criticality of the part function is higher.

Requirements of PPAP Process

Elements of PPAP

- Design Record
- Authorized Engineering Change Documents
- Customer Engineering Approval
- Design FMEA
- Process Flow Diagram(s)
- Process Failure Mode and Effects Analysis (Process FMEA)
- Control Plan
- Measurement System Analysis Studies
- Dimensional Results
- Records of Material/Performance Test Results
- Initial Process Studies
- Qualified Laboratory Documentation
- Appearance Approval Report (AAR)
- Sample Production Parts
- Master Sample
- Checking Aids
- Customer-Specific Requirements
- Part Submission Warrant (PSW)

Element 1 : Design Records

Element 1 : Design Records

Design record include both a copy of the customer and the suppliers' drawings.
It should also include a copy of the purchase order received to the supplier.

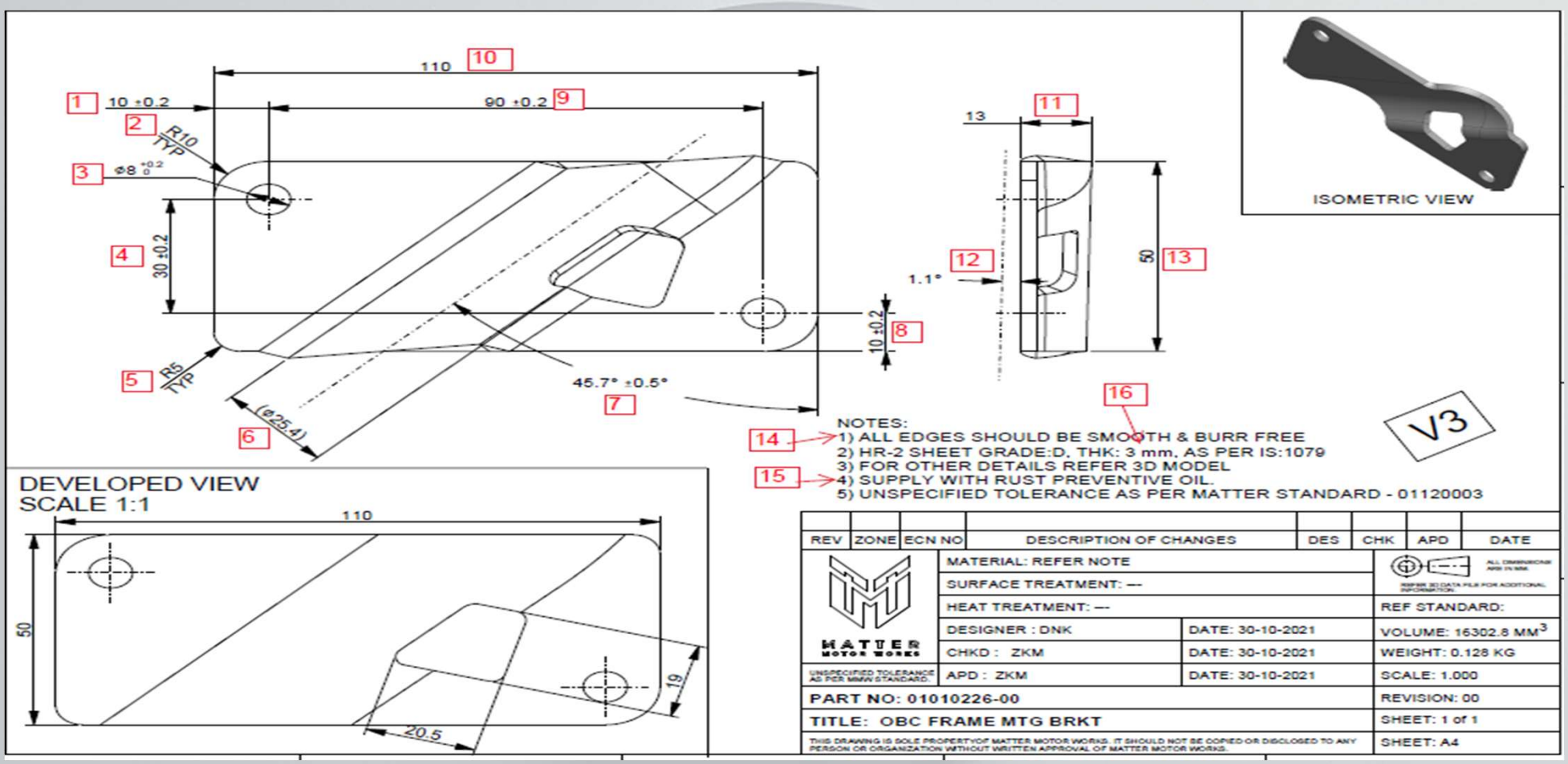
A part drawing of the component, usually provided by the customer. Each feature of the part drawing must be ballooned to match the inspection results. This needs to include print notes, standard tolerance notes and specifications, as well as any other information relevant to the design of the part.

The Purchase order is used to confirm that the correct part is being ordered and that it is at the correct revision level.

It’s the responsibility of the design engineer to verifying that drawings at supplier end match with customer drawing and all critical or key characteristics have been identified and recorded.

These documents include detailed engineering drawings, specifications, and any other relevant design-related information that define the part's dimensions, features, and functional requirements.

Example of Engineering Drawing



Element 2 : Engineering Change

Engineering change document is required due to a request for a change to a part or product, the documentation requesting and approving the change must be included in the PPAP Package.

It usually consists of a copy of the Engineering Change Notice (ECN) which must be approved by the customer engineering department.

showing the detailed description of a change, which is usually called a "technical change note". This document is only required when a change has been made

Element 3 : Customer Engineering Approval

When Customer Engineering Approval required as part of the PPAP, the supplier must provide evidence of approval by the customer engineering department

If it is required, pre-PPAP samples are ordered by the customer for onsite testing. The samples must be production intent and ship with a waiver so that testing can be done.

When testing is complete, the test engineers will provide an approval form for inclusion in the PPAP submission.

Note: A copy of a “Temporary Deviation” is normally required to submit parts to the customer prior to a PPAP approval.

Element 4 : Design Failure Mode and Effect Analysis

DFMEA is a cross functional activity that examines design risk by exploring the possible failure modes and their effects on the product or customer and their probability to occur.

Failure mode can include :

- Product Malfunctions
- Reduced performance or product life
- Safety and Regulatory issues.

DFMEA is a living document that should be reviewed and updated **throughout the product life cycle**.

Design Failure Mode and Effect Analysis (DFMEA) is an application of the Failure Mode and Effects Analysis (FMEA) that is specific to the design stage. The DFMEA allows the design team to document what they predict about a product's potential failures before completing a design and use this information to mitigate the causes of failure

DFMEA is a methodical approach used for identifying potential risks introduced in a new or changed design of a product/service. The Design FMEA initially identifies design functions, failure modes and their effects on the customer with corresponding severity ranking / danger of the effect. Then, causes and their mechanisms of the failure mode are identified. High probability causes, indicated by the occurrence ranking, may drive action to prevent or reduce the cause's impact on the failure mode. The detection ranking highlights the ability of specific tests to confirm the failure mode / causes are eliminated. The DFMEA also tracks improvements through Risk Priority Number (RPN) reductions. By comparing the before and after RPN, a history of improvement and risk mitigation can be chronicled.

Element 5 : Process Flow Diagram

The process flow diagram (PFD) explains the entire process for assembling the component or final assembly in a graphical manner.

It includes incoming material, Inspection , Press steps, Incoming sources of variation, characteristics of product and process, any test to be perform, rework and shipping of product.

The Process Flow Diagram shows all the steps required in the manufacturing of the part. It should include all of the main steps in the processing of the part including incoming components, measuring, and inspection. The Process Flow Diagram should match the control plan and the Process Failure Mode and Effects Analysis (PFMEA) and also includes the flow of non-conforming materials and parts.

Element 5 : Process Flow Diagram

			Organization Name							Document NO : Rev No : Implement Date :
Item:			Process Responsibility :			Process Identification :				
Process flow no:-										
Part no.			Customers Part No :							
Model Year:						Prepared by				
Core Team:			Key Date		Date (Originated)			Date (Revised)		
Operation :										
Operation No.	**Brief Description**	**Machine / Equipment**	**Incoming Source of Variation**	**Process Flow Diagram**					**Product Characteristic**	**Process Variable / Process Characteristic**
				Operation	**Inspection**	**Transport**	**Delay**	**Storage**		
									Major	
10 A	Raw material receipt Bought outs	Stacker , Bins , Trolly	Wrong documents, wrong quantity, damaged parts due to packaging						No damage or Defects from transit.	Verify Quantity and incoming part description with PO description
	Inspection	Related Measuring instruments / Equipments and Test Certificate.	Defective parts from supplier, wrong material certificate, wrong material, dimension variation						As per Drawing of Child part.	As per incoming Quality Assurance Plan(QAP).
									Free from Corrosion, shelf life	Storage as per defined location,

Element 6 : Process Failure Mode and Effect Analysis

PFMEA is a methodical approach used for identifying risks on process changes. The process FMEA initially identifies process functions, failure modes their effects on the process.

If there are design inputs, or special characteristics, the effect on end user is also included. The severity ranking or danger of the effect is determined for each effect of failure. Then the causes and their mechanisms of the failure mode are identified.

The assumption that the design is adequate keeps the focus on the process. The detection ranking determines the ability of specific tests to confirm the failure mode / causes are eliminated. The PFMEA also tracks improvements through Risk Priority Number (RPN) reductions. By comparing the before and after RPN, a history of improvement and risk mitigation can be chronicled

For detail about PFMEA : Refer AIAG guideline for FMEA

Why to perform PFMEA

Risk is the substitute for failure on new processes.

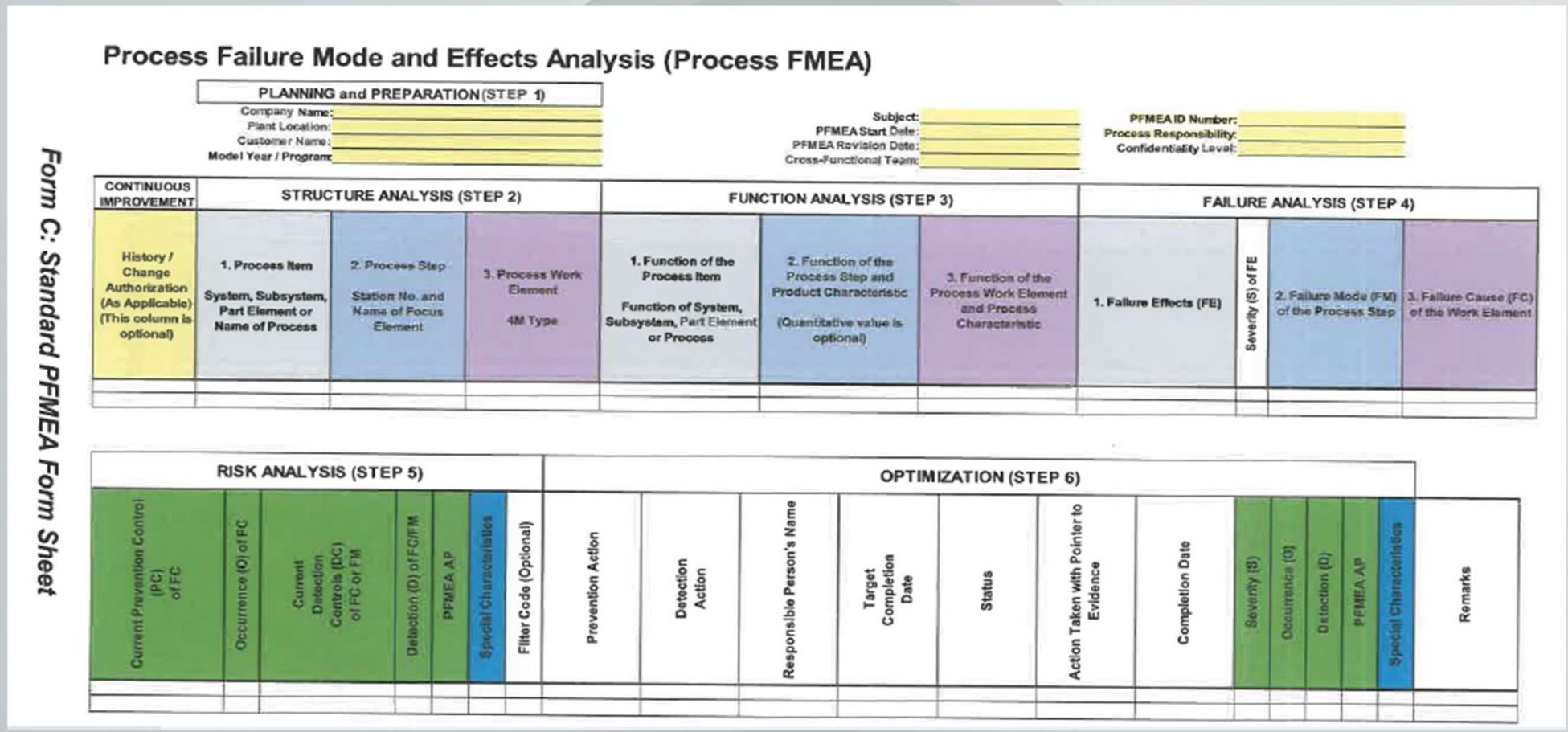
It's a good habit to identify risks for each process step as early as possible for a robust process.
The main goal is to identify risk prior to tooling acquisition. Mitigation of the identified risk prior to first article or PPAP will validate the expectation of superior process performance.

Risks are identified on new technology and processes, which if left unattended, could result in failure. The PFMEA is applied when :

- There is a new technology or new process introduced
- There is a current process with modifications, which may include changes due to updated processes, continuous improvement, KAIZEN or COQ(Cost of Quality).
- There is a current process exposed to a new environment or change in location (No physical change made to process)

There are five primary sections of the Process FMEA. Each section has a distinct purpose and a different focus. The PFMEA is completed in sections at different times within the project timeline, not all at once. The Process FMEA form is completed in the following sequence:

PFMEA Sample as per AIAG VDA FMEA Guidline



Form C: Standard PFMEA Form Sheet

Process Failure Mode and Effects Analysis (Process FMEA)

PLANNING and PREPARATION (STEP 1)

Company Name:
Plant Location:
Customer Name:
Model Year / Program:

Subject:
PFMEA Start Date:
PFMEA Revision Date:
Cross-Functional Team:

PFMEA ID Number:
Process Responsibility:
Confidentiality Level:

CONTINUOUS IMPROVEMENT	STRUCTURE ANALYSIS (STEP 2)			FUNCTION ANALYSIS (STEP 3)			FAILURE ANALYSIS (STEP 4)			
History / Change Authorization (As Applicable) (This column is optional)	1. Process Item System, Subsystem, Part Element or Name of Process	2. Process Step Station No. and Name of Focus Element	3. Process Work Element 4M Type	1. Function of the Process Item Function of System, Subsystem, Part Element or Process	2. Function of the Process Step and Product Characteristic (Quantitative value is optional)	3. Function of the Process Work Element and Process Characteristic	1. Failure Effects (FE)	Severity (S) of FE	2. Failure Mode (FM) of the Process Step	3. Failure Cause (FC) of the Work Element

RISK ANALYSIS (STEP 5)							OPTIMIZATION (STEP 6)											
Current Prevention Control (PC) of FC	Occurrence (O) of FC	Current Detection Controls (DC) of FC or FM	Detection (D) of FC/FM	PFMEA AP	Special Characteristics	Filter Code (Optional)	Prevention Action	Detection Action	Responsible Person's Name	Target Completion Date	Status	Action Taken with Pointer to Evidence	Completion Date	Severity (S)	Occurrence (O)	Detection (D)	PFMEA AP	Special Characteristics	Remarks

Element 7 : Control Plan

The **Control Plan** is an output from the PFMEA. The Control Plan lists all product Special Characteristics and inspection methods required to deliver products that continually meet the customer quality requirements.

The control plan document describes the actions(Measurements, Inspections, Quality Checks or monitoring or process parameters) required at each phase of a process to assure the process outputs will conform to pre-determined requirements. In a simple manner, the control plan provides the operator or inspector with the information required to properly control the process and produce quality parts or assemblies. It should also include instructions regarding actions taken if a non conformance is detected. The control plan does not replace detailed operator instructions(Work Instructions). In some cases the Control Plan is used in conjunction with and inspection sheet or checklist. The Control Plan helps assure quality si maintained in a process in the event of employee turnover by establishing a standard for quality inspection and process monitoring. Control Plan are living documents that should be periodically updated as the measurement methods and controls are improved throughout the life cycle of the product.

Developing and implementing Control Plan Methodology has several benefits. The use of Control Plans helps reduce or eliminate waste in a process. Businesses today must reduce waste everywhere possible. The Control Plan improves product quality by identifying the sources of variation in a process and establishing controls to monitor them. Control Plans focus on the product characteristics most important to the customer and the business. By focusing on what is critical to quality during the process, you can reduce scrap, eliminate costly reworks and prevent defective product from reaching the customer. When scrap and reworks are reduced, throughput of the process is inherently improved. Manufacturing efficiency is improved and your company’s bottom line is impacted in a positive manner

Element 7 : Control Plan

The Control Plan should be developed by a Cross Functional Team (CFT) that has an understanding of the processs being controlled or improved. It is a Plan developed by the team to control the process and ensure the process produces quality parts that met the customer requirements. The information contained in the control plan can originate from several sources, including but not limited to the following :

Process Flow Diagram (PFD)
Design Failure Mode and Effect Analysis (DFMEA)
Process Failure Mode and Effect Analysis (PFMEA)
Matrix of Special Characteristics (SC,CC,Key)
LLC from similar parts
Design Reviews
Team knowledge about the process
Field or warranty issues

Throughout the life cycle of a product, the information contained in the list above frequently changes or the content grows. Therefore the Control Plan must be a living document, continuously updated as new information is added. The Control Plan therefore is an integral part of an effective product quality system.

Element 7 : Control Plan

MATTER	Matter Motor Works		CONTROL PLAN													
Proto type	**Pre Launch**	**Production**	Key Contact													
Control Plan no.			Core Team						Engg. Approval / Date:		--		Date (Orig)			
Part / Assembly No.																
Part Name.			Plant:						Quality Approval / Date:		--		Rev #			
Process Name and No																
Latest Drawing Change level.:			Plant Approval / Date:						Other Approval / Date		--		Date (Rev.)			
Model No :																
Part / Process no.	Process Name / Operation Description.	Machine, Device, Jig, Tools for Mfg.	No.	Characteristics Product	Process	Spl. Char. Class	Product / Process Specification/ Tolerance	Methods Evaluation Measurement Techniques	Least Count	Sample Size	Sample Freq	Control Method	R E S P	Reaction Plan		

Element 8 : Measurement System Analysis (MSA)

MSA is defined as an experimental and mathematical method of determining the amount of variation that exists within a measurement process. Variation in the measurement process can directly contribute to our overall process variability. MSA is used to certify the measurement system for use by evaluating the system's accuracy, precision and stability.

WHAT IS MEASUREMENT SYSTEM :

A Measurement system has been described as a system of related measurement system and some of the common sources of variation. A measurement system has been described as a system of related measures that enables the quantification of particular characteristics. It can also include a collection of gauges, fixtures, software and personnel required to validate a particular unit of measure of make an assessment of the feature characteristic being measured. The sources of variation in a measurement process can include the following :

- Process – test method, specification
- Personnel – the operators, their skill level, training, etc.
- Tools / Equipment – gages, fixtures, test equipment used and their associated calibration systems
- Items to be measured – the part or material samples measured, the sampling plan, etc.
- Environmental factors – temperature, humidity, etc.

All of these possible sources of variation should be considered during Measurement System Analysis. Evaluation of a measurement system should include the use of specific quality tools to identify the most likely source of variation. Most MSA activities examine two primary sources of variation, the parts and the measurement of those parts. The sum of these two values represents the total variation in a measurement system

Element 9 : Dimensional Results

Dimensional layout of sample parts is required to validate the product meets the print specifications. The samples should be randomly selected from a significant production run usually at least 30 pieces. Each dimension on the drawing is measured on the final assembly to make sure that it falls within specification. The results are recorded in a spreadsheet and included within the PPAP submission.

Dimensional layout required all dimensional , GD&T , Attribute as well as notes available into final print into separate spreadsheet with dimensional decisions. For all CTQ’s there should be separate capability study has to be performed.

Element 10 : Records of Material / Performance Tests

This element should contain a copy of DVP&R. The DVP&R is a summary of every validation test performed on the product /part. Result of each and every test has to be recorded and review during PPAP.

This also include copies of all the certification documents for all materials(Steel, Plastics, Rubber, Non ferrous etc.) listed on the prints. The material certification shall show compliance to the specific call on the print.

For material data bank and records , supplier also upload all material specifications into MDS (Material Data Sheet) web portal to review and maintaining material properties for final product/ assembly to the customer.

For **Matter Mobility** , SQA can share below details to their supplier for Material data upload .

Website : https://www.mdsystem.com
Organization name : Matter Mobility Pvt. Ltd.
Company ID : 279428.

For **Matter Motors** , SQA can share below details to their supplier for Material data upload .

Website : https://www.mdsystem.com
Organization name : Matter Motor Works Pvt. Ltd.
Company ID : 246756

Element 11 : Initial Process Studies

Initial Process Studies will be done on all the production processes and will include Statistical Process Control (SPC) charts on the critical characteristics of the product. These studies demonstrate that the critical processes are stable, demonstrate normal variation and are running near the intended nominal value.

For initial production run for PPAP : It is recommended to perform Pp and Ppk studies at supplier to understand common and special causes of variations into process.

Element 12 : Qualified Laboratory Documents

Qualified laboratory documentation consists of the industry certifications for any lab that was involved in completing validation testing. This could be for an in-house test lab or any offsite contracted test facilities that were used for validation or material certification testing.

Qualified laboratory should have NABL or other equivalent certification which can ensure correct calibration / testing to be performed as per international standard procedure.

If an organization having any laboratory or testing performed inhouse, in that case organization should have submit their internal lab scope and their certification equivalent to NPL / IPL.

Element 13 : Appearance Approval Report

The appearance Approval Report (AAR) is applicable for components affecting appearance only. This report verifies that the customer has inspected the final product and it meets all the required appearance specifications for the design. The appearance requirements could include information regarding the color, textures etc.

APPEARANCE APPROVAL REPORT

Part Name/ Details :	0	**Date :**	
Part Number :	0	**Drawing Number**	0
Customer Name & Location			

REASON FOR SUBMISSION:

☐ New Part Development	☐ Drawing Revision	☐ New Mould/Tool Development
☐ Supplier Process Modification	☐ Supplier Change	☐ RE-PPAP

VISUAL APPEARANCE

Part Image Front /Top	Part Image Back/ Bottom

CONCLUSION :

Supplier Approval	Customer Approval

Element 14 : Sample Production Parts

- Sample production parts are sent to the customer for approval and are typically stored at either the customer or supplier's site after the product development is complete.
- A picture of the production parts is usually included in the PPAP documentation along with documentation regarding the location that the parts are being stored.

Element 15 : Master Sample

- A master sample is a final sample of the product that is inspected and signed off by the customer.
- The master sample part is used to train operators and serves as a benchmark for comparison to standard production parts if any part quality questions arise.
- In some cases where customer required to retain the product sample taken from the PPAP run, similar sample to be stores and kept into controlled environment with proper identification and traceability at Customer as well as supplier location with sign off by Customer SQA and Supplier Quality team.

Element 16 : Checking Aids

Checking Aids used by production is listed down under this element.

It should include all tools(Measuring and Monitoring Devices) used to inspect, test or measure parts during the assembly / manufacturing process.

It should describe the device and having calibration schedule for the device.

It may include check fixtures, contour, variable and attribute gauges, models , templates.

A detailed MSA may be required for all checking aids based on customer requirements to ensure correct device to be use for measuring and decision making.

Element 17 : Customer Specific Requirement (CSR)

In this element, each and every requirement which are specially raised by the customer are recorded and fulfilled by the supplier.

Supplier should demonstrate the requirement to be followed by documentation as well as witness during PPAP run.

For any customer who supposed to be in the supply chain for any OEM, their Supplier Quality Manual is the part of CSR for any Tier 1 , Tier 2 and throughout the supply chain.

Element 18 : Part Submission Warrant(PSW)

PSW form is a summary of the entire PPAP Submission.

PSW is required for each of part number unless otherwise stated by the customer.

PSW Includes :

1. The reason for submission (Design Change, Re validation, New submission, any tool change or transfer of tools, or an 4M changes into process or product)
2. Documents submitted to the customer according to PPAP Level.
3. Declaration of part conformity to the customer. Includes production Run @ Rate
4. Authorized person from supplier signature with contact details
5. An area for the customer declaration of the PPAP result.

Other Elements for a Healthy PPAP Package

Element 19 : Run @ Rate Study

A **Run@Rate study**, also known as a **Production Run at Rate**, is a critical part of the PPAP process. It's essentially a trial production run conducted at the supplier's facility to demonstrate that the manufacturing process can consistently produce parts that meet the customer's quality and quantity requirements at the planned production rate.

Here are some key details about a Run@Rate study during PPAP:

Purpose of a Run@Rate Study:

- **Verify Production Capacity:** To confirm that the supplier can meet the agreed-upon production volume and rate.
- **Validate Process Capability:** To demonstrate that the manufacturing process is stable and capable of consistently producing parts within specifications under normal operating conditions.
- **Identify Potential Issues:** To uncover any potential problems in the production process, equipment, tooling, materials, or operator training before full-scale production begins.
- **Confirm Process Stability:** To ensure the process is repeatable and reliable over a sustained period.
- **Support PPAP Submission:** The Run@Rate study results are a crucial piece of evidence to support the supplier's PPAP submission, demonstrating their readiness for production.

Element 19 : Run @ Rate Study

Key Elements of a Run@Rate Study:

•**Planned Production Rate:** The study must be conducted at the production rate agreed upon with the customer. This rate should be realistic and sustainable for regular production.

•**Production Quantity:** The number of parts produced during the run should be statistically significant to provide confidence in the results. The exact quantity may vary depending on the part complexity and industry standards, but it's often enough to demonstrate process capability (e.g., enough parts for capability studies, dimensional checks, performance testing).

•**Production Conditions:** The study should mimic normal production conditions as closely as possible, including:

- **Equipment and Tooling:** Using the actual equipment and tooling intended for production.
- **Materials:** Utilizing the specified production materials.
- **Operators:** Employing trained operators who will be involved in regular production.
- **Process Parameters:** Operating within the defined process parameters and controls.
- **Shift Length and Breaks:** Following typical shift patterns and break schedules.

•**Data Collection:** During the run, critical data must be collected, including:

- **Production Output:** Tracking the number of parts produced over time to verify the production rate.
- **Quality Data:** Collecting dimensional measurements, performance test results, and defect data to assess part quality and process capability.
- **Process Parameters:** Monitoring and recording key process parameters to ensure they are within control limits.
- **Downtime and Issues:** Documenting any downtime events, equipment malfunctions, material issues, or quality problems encountered during the run.

Element 19 : Run @ Rate Study

•**Analysis and Reporting:** After the run, the collected data is analyzed to:

- **Calculate Production Rate:** Verify if the planned production rate was achieved.
- **Assess Process Capability:** Determine if the process is capable of meeting quality requirements (e.g., using statistical process control (SPC) techniques).
- **Identify and Address Issues:** Analyze any problems encountered and implement corrective actions.
- **Document Results:** Prepare a comprehensive report summarizing the Run@Rate study, including the methodology, data, analysis, findings, and any corrective actions taken. This report is typically included in the PPAP submission.

Specific aspects to consider for your Run@Rate study:

•**Customer Requirements:** Always refer to your customer's specific PPAP requirements and guidelines, as they may have expectations for the Run@Rate study, such as the duration, quantity, data to be collected, and acceptance criteria.

•**Industry Standards:** Consider relevant industry standards, such as those from AIAG (Automotive Industry Action Group) in the automotive sector, which provide detailed guidance on PPAP and Run@Rate studies.

•**Part Complexity and Criticality:** The complexity and criticality of the part will influence the scope and rigor of the Run@Rate study. For more critical parts, a more extensive study may be necessary.

•**Risk Assessment:** Conduct a risk assessment to identify potential failure modes in the production process and focus the Run@Rate study on mitigating these risks.

Element 20 : Packaging Standard

Packaging Standards are Important in PPAP:

•**Part Protection:** The primary goal of packaging is to protect parts from damage during transit, handling, and storage. This includes protection from:

- **Physical Damage:** Impact, vibration, compression, abrasion, and scratching.
- **Environmental Factors:** Moisture, dust, temperature variations, and corrosion.

•**Maintaining Part Quality:** Improper packaging can lead to defects that weren't present at the supplier's facility. This can include rust, deformation, surface damage, or contamination.

•**Customer Satisfaction:** Receiving parts in good condition, properly identified, and easy to handle is essential for customer satisfaction and smooth production processes at their end.

•**Traceability and Identification:** Packaging standards often include requirements for labeling and identification, ensuring parts can be easily tracked and identified throughout the supply chain.

•**Efficient Handling and Storage:** Standardized packaging facilitates efficient material handling, warehousing, and line-side delivery at the customer's facility.

•**Regulatory Compliance:** In some industries (like food, pharmaceuticals, or electronics), packaging may need to meet specific regulatory requirements for safety, material content, or environmental impact.

Packaging Standard

Document No:	MM:QA:DO:005
Rev.No / Date	01/00/00
Effective Date	01.07.2024
DATE:	

	Matter Part Number :		Part Name:	

Supplier code:

Supplier Name

Destination MMPL location (Plant name)

PHOTOGRAPH / SKETCH

Part Pic

Primary Packing- N/A

SECONDARY PACKAGING PP BIN

PACKAGING WITH LABEL

PACKING DETAILS

BIN	CARTON	TROLLEY
PCS PER BIN	PCS PER BOX	PCS PER TROLLEY
BIN COLOR	BOXES PER CARTON	TROLLEY COLOR
BIN SIZE (L X B X H)	CARTON SIZE (L X B X H)	TROLLEY SIZE (L X B X H)
BIN WEIGHT (EMPTY & FULL LOAD)	CARTON WEIGHT (EMPTY & FULL LOAD)	TROLLEY WEIGHT (EMPTY& FULL LOAD)
WRAPPING MATERIAL	WRAPPING MATERIAL	WRAPPING MATERIAL
COVERING MATERIAL	COVERING MATERIAL	COVERING MATERIAL
POLYBAG		NA
RETURNABLE / NON-RETURNABLE	RETURNABLE / NON-RETURNABLE	RETURNABLE / NON-RETURNABLE
RETURNABLE		RETURNABLE
IDENTIFICATION ON BIN	IDENTIFICATION ON CARTON	IDENTIFICATION ON TROLLEY

	Approving Agency - MMPL					
	Supply Chain	SQA	STORE	PPC	ME	Safety
Signature						
Name						

Final Approval

ACCEPTED

NOT ACCEPTED

COMMENTS :

For any doubt or required further inputs on any element, kindly connect:

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Thank You