



AM GENERAL™
MISSION READY ★ FUTURE DRIVEN

Production Part Approval Process (PPAP) Training



Production Part Approval Process (PPAP)

The Automotive Industry Action Group (AIAG) developed the Production Part Approval Process (PPAP) to standardized the process used to ensure that a supplier can produce parts consistently and meet all customer engineering requirements before full-scale production begins. The PPAP has been adopted across multiple industries as a best –practice when manufacturing parts.

PPAPs are defined by 5-Levels and 18-Elements which shall both be explained in the following pages. Depending on the PPAP Level, not all 18-Elements are required

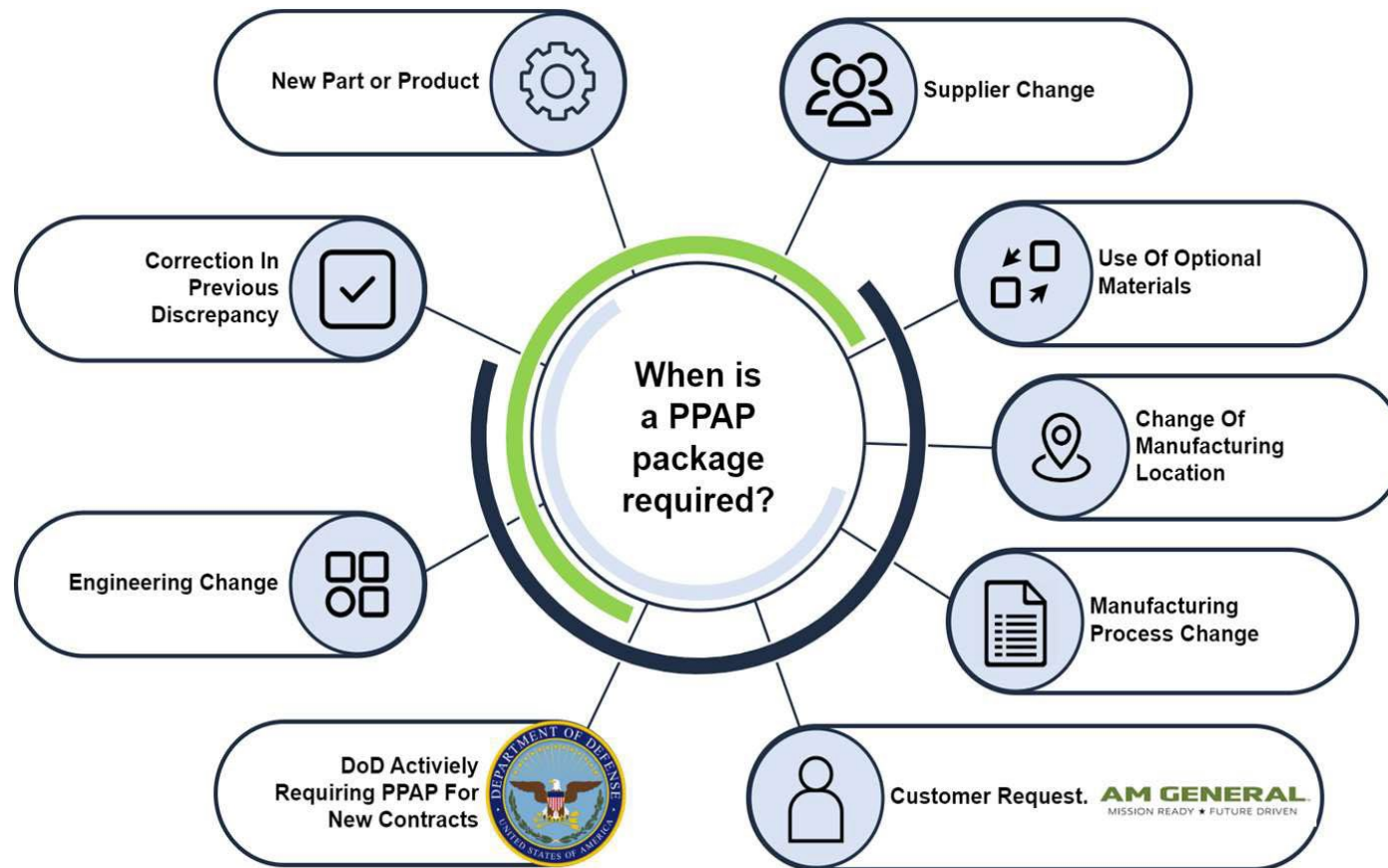
Level 1	Warrant only (and for designated appearance items, an Appearance Approval Report) submitted to the customer.
Level 2	Warrant with product samples and limited supporting data submitted to the customer.
Level 3	Warrant with product samples and complete supporting data submitted to the customer.
Level 4	Warrant and other requirements as defined by the customer.
Level 5	Warrant with product samples and complete supporting data reviewed at the organization's manufacturing location.

Level 3 is the default level for all submissions to AM General unless otherwise specified by the authorized AM General representative.



When is a PPAP Required?

A PPAP is typically required whenever there is a change that could affect the fit, form, function, reliability, manufacturability, or performance of a product. The purpose is to demonstrate that the supplier can consistently produce parts that meet all engineering and quality requirements.





PPAP Levels

AIAG Reference ONLY- *Mandatory and applicable requirements for a PPAP record are defined by AM General (Contact the authorized AM General representative for specific requirements).*

**** PLEASE NOTE:**
AM General PPAPs are submitted with a Cover Sheet (in addition to any required Elements). This Cover Sheet is denoted as an Element 0.

PPAP Element	Requirement	Level 1	Level 2	Level 3	Level 4	Level 5
1	Design Record (Ballooned Print)	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 Diagram	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 w/ Customer-Specific Requirements	R	R	S	*	R
	Additional Requirements (examples, but not limited to) Completed Sub-Tier PPAPs from subcomponents Packaging & Handling (Instructions, Picture of final packaging, etc.) ISO9000/TS16949 Certs (copy) Operator Instructions					
18	Part Submission Warrant (PSW)	S	S	S	S	R

S = The organization shall submit to the customer & retain a copy of records/ documentation at appropriate locations.

R = The organization shall retain at appropriate locations and make available to the customer upon request.

* = The organization shall retain at appropriate locations and submit to the customer upon request.



Commercial Off-The-Shelf (COTS)

A COTS part refers to a component, product, or item that is readily available from commercial suppliers and can be purchased and used without requiring custom design or modification. They are not custom-designed for a specific customer or application; and are typically supported by existing manufacturing, documentation, and supply chains

COTS parts require a less detailed PPAP.

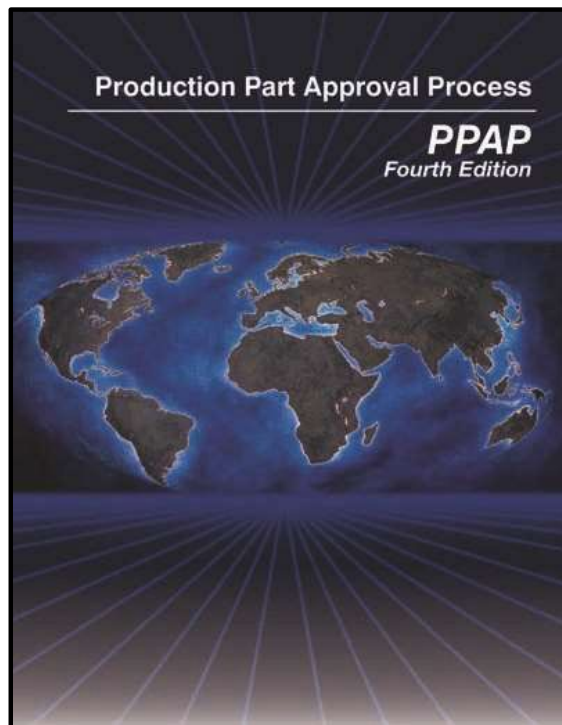
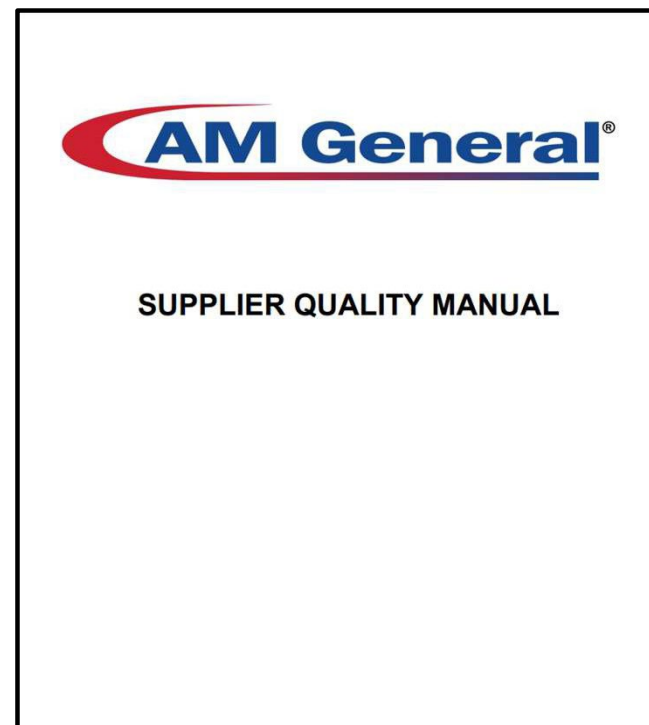
Element	Description	COTS Level 3
0	Cover Sheet	X
1	Design Record	X
2	Authorized Engineering Change Documents (if required)	X
3	Customer Engineering Approval (if required)	X
4	Design Failure Mode and Effects Analysis (Design FMEA)	
5	Process Flow Diagram(s)	
6	Process Failure Mode and Effects Analysis (Process FMEA)	
7	Control Plan	
8	Measurement Systems Analysis (MSA) Studies	
9	Dimensional Results	X
10	Records of Material / Performance Test Results	X
11	Initial Process Studies	
12	Qualified Laboratory Documentation	
13	Appearance Approval Report (AAR)	
14	Sample Production Parts	X
15	Master Sample (Actual or Picture)	X
16	Checking Aids	
17	Customer Specific Requirements (as necessary)	X
18	Part Submission Warrant	X



This training will provide direction on compiling a PPAP package using *AIAG PPAP Manual 4th edition*, *JLTV Specific Requirements*, and the *AMG PPAP Workbook: Supplier Quality Guidelines*.

The AM General (AMG) PPAP workbook includes all 18 elements in their respective forms, including instructions on accurate and thorough completion of required documentation.

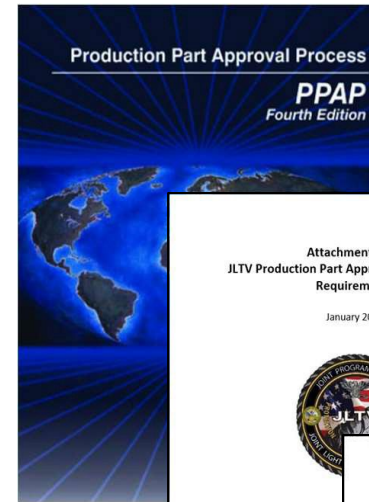
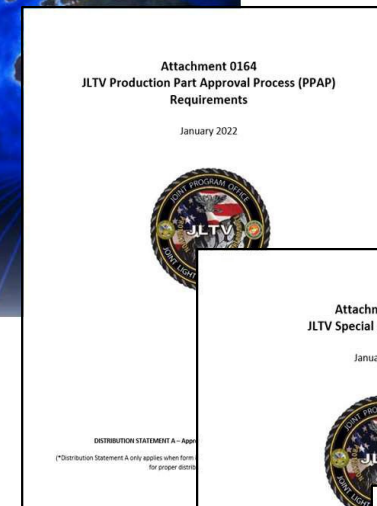
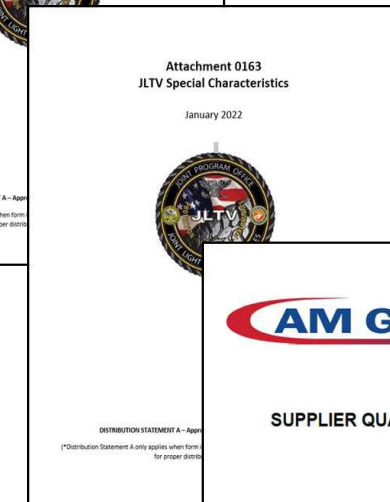
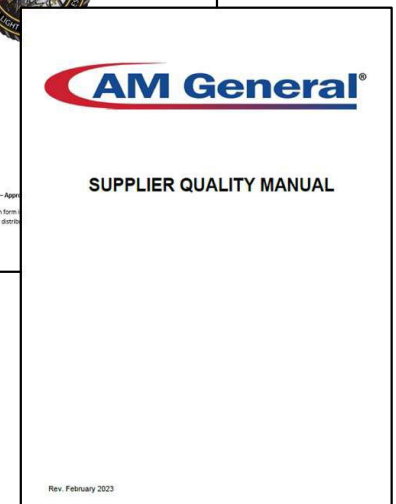
Unless specifically stated, all requirements of *AIAG PPAP Manual 4th edition* apply





PPAP Resources

- AIAG PPAP Manual 4th Edition
- JLTV PPAP Requirements - Attachment 0164
- JLTV Special Characteristics - Attachment 0163
- AM General Supplier Quality Manual
 - AM General Fastener Requirements
 - AM General Weld Requirements
 - AM General Paint/Coating Requirements
 - AM General Armor Material Requirements
 - AM General Radiographic Inspection Requirements
- Additional Commodity-specific JLTV requirements may apply



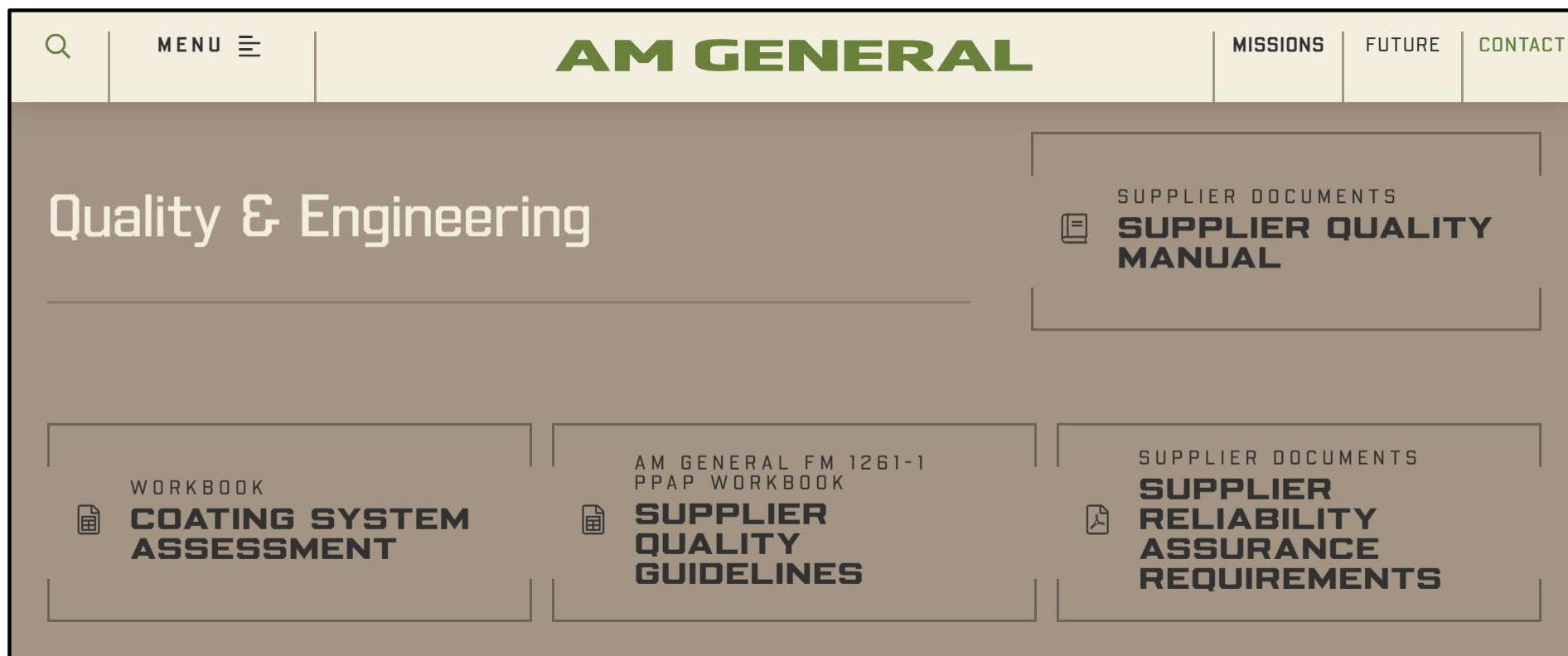


AM General (AMG) provides resources to all suppliers to ensure that PPAP packages provided to AMG will be standardized. These resources are provided on AMG's official website:

[AM General Supplier Resources](#)

Resources are listed under “*Quality & Engineering*”:

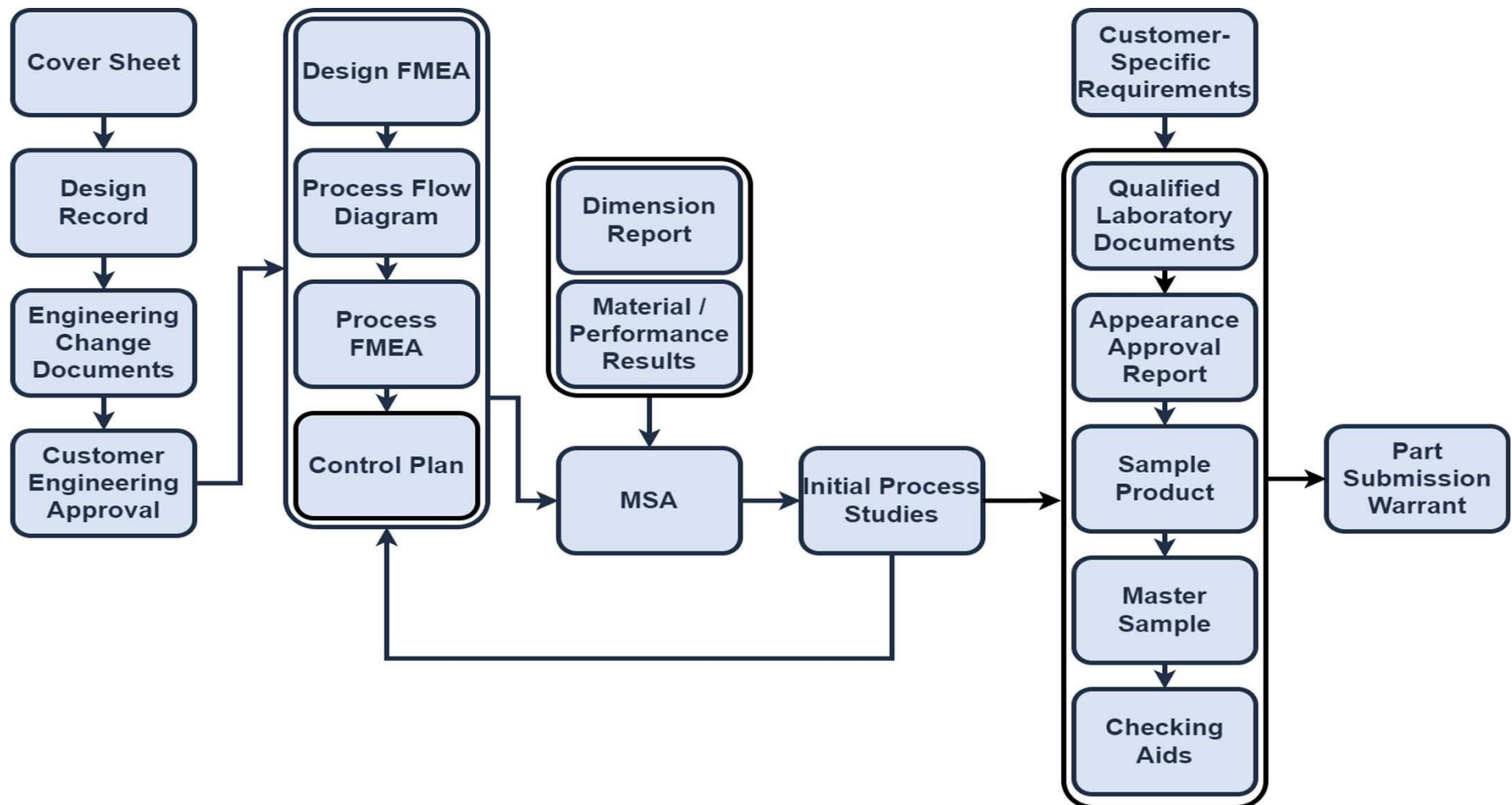
- *Supplier Quality Manual*
- *PPAP Workbook: Supplier Quality Guidelines*
- *Coating System Assessment*
- *Supplier Reliability Assurance Requirements*





JLTV PPAP Workflow

The following training material provides instruction for the completion of all level 3 PPAP requirements for the JLTV program, including the definition, purpose, and how to satisfy requirements of each element defined by the *AIAG PPAP Manual 4th edition*. A sample PPAP workbook has been provided as a part of this training as guidance for accurate PPAP completion.





Element 0. - Cover Sheet

The PPAP Cover Sheet must be attached with the PPAP package with information for the PPAP part, submission date, and the type of PPAP approval.

This document provides information needed to identify the PPAP and its status

AM GENERAL MISSION READY ★ FUTURE DRIVEN			
Production Part Approval Process (PPAP)			
PPAP PART NUMBER:	2584771		
PPAP PART REVISION LEVEL:	E		
PPAP PART NAME:	Base, Mounting		
PPAP SUBMITTAL DATE:	2030-01-23		
PPAP INTERIM	☐		
PPAP FINAL	☒		
<small>Non-Applicable Elements - List below the ELIGIBLE elements that are non-applicable to this PPAP (Ex. 4, DFMEA) AM GENERAL/SUB-CONTRACTORS SHALL COMPLY AS APPLICABLE IF ANY NON-APPLICABLE ELEMENT LISTED BECOMES APPLICABLE</small>			
Element 2 - Engineering Change Documents Element 3 - Engineering Approval Documents Element 4 - DFMEA - Not Design Responsible			
PRINT NAME John Doe	SIGNATURE John Doe	TITLE Quality Engineer	DATE 1/23/2030
<small>1AP0003 Qa, PPAP Cover Sheet Printed Copy Uncontrolled. Latest Edition on AMG Intranet Site (http://www.amgeneralintranet.com) Rev 2/30/2024</small>			

A PPAP Cover Sheet must include:

- Customer's Name
- Supplier's Name
- PPAP Part Number
- PPAP Part Revision Level
- PPAP Part Name
- Submittal Date
- PPAP Interim or Final
- "Submitted By:"
Full name, signature, title, date

Ensure that all information is complete. Names and/or Part Description/Name cannot be truncated or cut-off.

The "Submitted By:" must be completed - an electronic signature is acceptable.

Failure to be in compliance with the above will result in PPAP rejection.



Element 0. - Cover Sheet

PPAP PART NUMBER:	2584771	1
PPAP PART REVISION LEVEL:	E	2
PPAP PART NAME:	Base, Mounting	3
PPAP SUBMITTAL DATE: YYYY-MM-DD		4
PPAP INTERIM	☐	5
PPAP FINAL	☐	6

1

PPAP Part Number: The unique identifier assigned to a part.

2

PPAP Part Revision Level: Identifier of design record revision used.

3

PPAP Part Name: Nomenclature, descriptive title or label for a part.

4

PPAP Submittal Date: Date PPAP package was submitted to the customer.

5

PPAP Interim: Specifies that the PPAP package is in an interim status.

6

PPAP Final: Specifies that the PPAP package is in a final status.



Element 0. - Cover Sheet

Non-Applicable Elements - List below the ELIGIBLE elements that are non-applicable to this PPAP (Ex 4. DFMEA) AM GENERAL/SUB-CONTRACTORS SHALL COMPLY AS APPLICABLE IF ANY NON-APPLICABLE ELEMENT LISTED BECOMES APPLICABLE			
<div>7</div> <i>Example</i>			
<u>PRINT NAME</u>	<u>SIGNATURE</u>	<u>TITLE</u>	<u>DATE</u>
8	9	10	11

7

Non-Applicable Elements

List: List of Elements not required for submission.

8

Print Name: Printed name of personnel who completed this form.

9

Signature: Signature of personnel who completed this form.

10

Title: Title of personnel who completed this form.

11

Date: Date of when this form is completed by personnel.



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(CFAT Parts only) Element 0a. - CUI Sheet

Parts requiring Component First Article (CFAT) Testing in the Design Record Notes must have a CUI Sheet submitted with the PPAP Package as Element 0a.

CUI

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CUI

ATTENTION

Controlled by: PEO CS&CSS JPO JLTV
Controlled by: AM General, LLC
CUI Category(ies): CTI
Distribution Statement C
POC:
Matthew Fillio
Matthew.Fillio@amgeneral.com
(574-264-2979)

ATTENTION

All individuals handling this information are required to protect it from unauthorized disclosure.

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Standard Form 981 (11-10)
Prescribed by GSA FPMR (41 CFR) 101-11.6

CUI

1AF0354 Printed copy uncontrolled. Latest edition on AMG Intranet. CUI

Page | 1
11/16/2023



SIZE	DWG. NO.	REV.
A	PRT-MFG-237465	A.2
SCALE: 1:1		



Element 2. - Engineering/Supplier Change Documents

The Engineering/Supplier Change Document outlines any changes to the design not included in the design record that is implemented on the product, part, or tooling.

Change Documents may be referred to by several names, but are commonly known as: ECR, SCR, ECO, or ECN. These are approved change records that show *any design or specification changes* made to the part since the last revision.

The purpose of Element 2 is to show that any design changes made after the original drawing were: approved, documented, and controlled. Element 2 explains what changed and who approved the change.

ECR

The ECR form is titled "Engineer Change Request" and is from ARIZONA ELECTRIC POWER COOPERATIVE, INC. ENGINEERING DEPARTMENT. It includes fields for Change Order No., Date, Project Title, Engineering Work Order No., and Purchase Order (P.O.)/Contract No. The form is divided into sections for "COMPLETED BY ORIGINATOR" and "COMPLETED BY CONTRACTOR". It includes a "Description of requested Change:" field and a "Basis for Contract Adjustment" section with checkboxes for "Labor Only", "Material Only", and "Both". It also has a "Time & Material" section and a "Contractor's signature/date:" field.

ECO

The ECO form is titled "ENGINEERING CHANGE ORDER". It includes a "DATE" field and a "REASON FOR CHANGE" section with checkboxes for "Design", "Material", "Process", "Cost Savings", and "Vendor". It also has a "Description of Change" field and a "Basis for Contract Adjustment" section with checkboxes for "Labor Only", "Material Only", and "Both". It includes a "Time & Material" section and a "Contractor's signature/date:" field.

ECN

The ECN form is titled "Engineering Change Notice". It includes a "DATE" field and a "REASON FOR CHANGE" section with checkboxes for "Design", "Material", "Process", "Cost Savings", and "Vendor". It also has a "Description of Change" field and a "Basis for Contract Adjustment" section with checkboxes for "Labor Only", "Material Only", and "Both". It includes a "Time & Material" section and a "Contractor's signature/date:" field.



Element 2. - Engineering/Supplier Change Documents

Typically pending changes submitted by the supplier to AMG are requested on an SCR.

The fully completed, AMG approved SCR form must be submitted in Element 2 with a ballooned Red Line dwg to which the PPAP was completed

LEF1368 - Supply Chain Request - Request Form

Revised: 2/26/2024

SUPPLIER CHANGE REQUEST FORM	
AM GENERAL MISSION READY ★ FUTURE DRIVEN	
Submission Date: <input type="text"/>	Change Control #: <input type="text"/>
CHANGE REQUEST TYPE	
☐ Temporary Process Change	☐ Permanent Product/Drawing Change
☐ Temporary Product Change	☐ Supplier Cost Reduction Proposal
CHANGE PRIORITIZATION	
Is this an Emergency Request: ☐ YES ☐ NO (Emergency = Will impact AM General production if not implemented in less than 30 days.)	
Priority 1 - No Build: ☐ YES ☐ NO	Priority 3 - Corrections (ie drawing updates): ☐ YES ☐ NO
Priority 2 - High Risk to Build: ☐ YES ☐ NO	Priority 4 - Cost / Process Improvement: ☐ YES ☐ NO
SUPPLIERS SHALL FULLY COMPLETE THIS FORM AND SUBMIT AS NOTED BELOW	
ALL REQUESTS ARE TO BE UPLOADED TO THE FTP FOLDERS DUE TO ITAR/EAR/CUI DRAWINGS/PICTURES NOTIFICATION OF UPLOAD SHALL BE SENT TO: supplierchangenotifications@amgeneral.com NOTE: Please submit this notification at least 90 Days prior to the planned change implementation!	
PART INFORMATION	
☐ MHC Production Part ☐ AFTC - Aftermarket Part ☐ Technology Engineering Center (TEC) ☐ Powertrain Assembly Plant (PTAP)	
Part Number: <input type="text"/>	Revision Level: <input type="text"/> Dated: <input type="text"/>
Part Description: <input type="text"/>	
Supplier Part Number: <input type="text"/>	Revision Level: <input type="text"/> Dated: <input type="text"/>
Safety / Government Regulation: ☐ Yes ☐ No	CFAT Requirement Note On Drawing: ☐ Yes ☐ No
Critical Characteristic / Special Characteristic On Drawing: ☐ Yes ☐ No	
Supplier Manufacturing Information	
Supplier Name: <input type="text"/>	Supplier ID: <input type="text"/>
Street Address: <input type="text"/>	
City, State, Zip: <input type="text"/>	
Supplier Point of Contact: <input type="text"/>	Phone #: <input type="text"/>
AM General Point of Contact: <input type="text"/>	Phone #: <input type="text"/>
Design Responsibility: ☐ AM General ☐ USG ☐ Supplier ☐ Other <input type="text"/>	
Description of Deviation / Change Requested / Supplier Cost Reduction Proposal:	
<input type="text"/>	

All documents must have the correct part revision, the part number, and part description/name.

Documents must be signed and dated.

If the PPAP was completed to a Red Line dwg, Element 2 & 3 must be present. The Red Line ballooned dwg must be in Element 2

If any of the above are missing the PPAP will be rejected.



Element 3. - Customer Engineering Approval

Customer Engineering Approval consists of documentation that the customer's engineering has already evaluated and approved the part—often through special testing, tryouts, or fit checks. The purpose of Element 3 is to confirm the customer's engineering team has formally accepted the part's performance in the actual application. Element 3 documents that the design/process changes work and are approved by the customer.

While Element 2 (Engineering Change Documents) and Element 3 (Customer Engineering Approval) are similar, they are not the same!

Element 2 = Documentation showing the part was built to the correct and latest design.

Element 3 = Evidence that the customer's engineers have evaluated and approved the part in testing/trials.

Objective Evidence of Approval must be submitted in Element 3.

Both of the following must be present:

- **RFV/ECP Red Line drawing approved/signed off by AMG**
- **Preliminary Black Line drawing for the next drawing revision**

Documents must be signed and dated.

If the PPAP was completed to a Red Line dwg, Element 2 & 3 must be present.
The approved Red Line and preliminary Black Line drawings must be in Element 3.

If any of the above are missing the PPAP will be rejected.



Element 4. - Design Failure Modes & Effects Analysis

**DESIGN FAILURE MODES & EFFECTS ANALYSIS (DFMEA)
IS ONLY SUBMITTED BY THE DESIGN HOLDER OF THE PART**
(if Supplier is not the Design Holder, Element 4 is N/A)

A DFMEA (Design Failure Mode and Effects Analysis) is a systematic, structured method used during product design to identify how a design could fail, what the effects of those failures would be, and how to reduce or eliminate the risks before the product goes into production.

The DFMEA is a necessary tool used to identify and prioritize risk areas in the design and their mitigation plans prior to volume production. The information in the DFMEA will flow to following elements such as the Process Flow Diagram, PFMEA, and the Control Plan.

A DFMEA table contains:

1. Design Function / Requirement
2. Potential Failure Mode
3. Potential Effects of Failure
4. Severity rating (S)
5. Potential Causes of Failure
6. Occurrence rating (O)
7. Current Design Controls
8. Detection rating (D)
9. Risk Priority Number ($RPN = S \times O \times D$)
10. Recommended Actions & Revised Ratings

Application: Bracket on Ship		Rev: E		Design Responsibility:			Bureau of Ships		FMEA Number:		128850						
Part Number: 2584771				Key Date:			7/8/2023		Prepared by: Jane Doe								
Part Name: Base, Mounting					Location:			Washington D.C.		Date (Orig):		7/5/2023					
Team: John Doe, Jane Doe, Brian Doe										Date (Rev):		7/8/2023					
Action Results																	
Item/Function	Requirements	Potential Failure Mode	Potential Effect(s) Of Failure	Severity	Potential Causes/Mechanisms Of Failure	Current Design Controls Prevention	Occurrence	Current Design Controls Detection	Detection	RPN	Recommended Action	Responsibility & Target Completion Date	Action Taken	Severity	Occurrence	Detection	RPN
1/ Interpret Drawing dimensions and tolerances to specifications	ASME Y14.100-2017 ASME Y14.5-2018	Dimensions and Tolerances not interpreted according to spec	Part dimensions are incorrect, production interruption	8	Specification not available	APQP planning process - Obtain and provide drawing specifications	2	Part Production Approval Process verify specifications	1	16							0
2/ Material / Steel Alloy	Aloy 4130, COND F, SAE AMS-S-8758	Incorrect material	Material fails testing, resulting in field failures	7	Incorrect purchasing agreement	Part Drawing verification at time of PO	1	PO verification Material CoC	2	14							0
3/ Remove Sharp edges	No sharp edges on part	Part has sharp edges	Injury to operator or end customer	6	Process design fails to remove sharp edges	PFMEA design to incorporate sharp edge removal process	3	PFMEA Design validation	1	18							0
4/ Electroless Nickel Plating	ASTM B733-04 Type V Class 3	Incorrect plating	Material fails testing, resulting in field failures	8	SC	Process design fails to ensure correct plating process	PFMEA Design to incorporate Electroless Nickel Plating process verification in accordance with requirements	6	PFMEA Design validation	4	192	Implement Reverse PFMEA audit schedule with high frequency Implement Process Manager Audit schedule with high frequency	Quality Manager, Systems Manager Reverse PFMEA and Process Audit schedules created. Plating process audited via Reverse PFMEA and Process Audits on 15month frequency for each audit	8	6	1	48
5/ Item Identification	MIL-STD-130 80064-004889355 NFR Cage Code	Items not identified per spec	Items incorrectly identified, failed PPAP submission, delayed production start	8		Specification not available	APQP planning process - Obtain and provide drawing specifications	2	Part Production Approval Process verify specifications	1	16						0
6/ Part Dimension	250	Part fails to meet dimensional spec	Part dimensions are incorrect, production interruption	8		Tooling failure	PFMEA and Control Plan to mitigate risk	2	PFMEA and Control Plan detection control process	3	48						0



Element 4. - Design Failure Modes & Effects Analysis

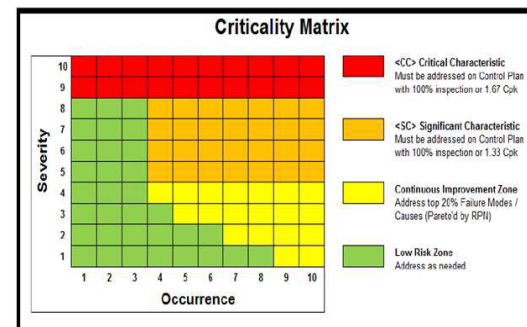
DESIGN FAILURE MODES & EFFECTS ANALYSIS (DFMEA) IS ONLY SUBMITTED BY THE DESIGN HOLDER OF THE PART (if Supplier is not the Design Holder, Element 4 is N/A)

A completed DFMEA form will include all failure modes, severity, occurrence, detection, and RPN data populated according to AIAG/JLTV design requirements. This includes any mitigated RPN value under Action Results being lower than the RPN of the initial design – RPN values require mitigation when exceeding the Supplier's documented maximum acceptance value.

Application:	Bracket on Ship	Design Responsibility:	Bureau of Ships	FMEA Number:	128858
Part Number:	2584771	Key Date:	7/8/2023	Prepared by:	Jane Doe
Part Name:	Base, Mounting	Location:	Washington D.C.	Date (Orig.):	7/5/2023
Team:	John Doe, Jane Doe, Brian Doe			Date (Rev.):	7/8/2023
Rev:	E				

Item/Function	Requirements	Potential Failure Mode	Potential Effect(s) Of Failure	Severity	Characteristics	Potential Causes/Mechanisms Of Failure	Current Design Controls Prevention	Occurrence	Current Design Controls Detection	Detection	RPN	Recommended Action	Responsibility & Target Completion Date	Action Taken	Severity	Occurrence	Detection	RPN
1/ Interpret Drawing dimensions and tolerances to specifications	ASME Y14.100-2017 ASME Y14.5-2018	Dimensions and Tolerances not interpreted according to spec	Part dimensions are incorrect, production interruption	8		Specification not available	APQP planning process - Obtain and provide drawing specifications	2	Part Production Approval Process verify specifications	1	16							0
2/ Material / Steel Alloy	Alloy 4130, CONDF, SAE AMS-S-6758	Incorrect material	Material fails testing, resulting in field failures	7		Incorrect purchasing agreement	Part Drawing verification at time of PO	1	PO verification Material CoC	2	14							0
3/ Remove Sharp edges	No sharp edges on part	Part has sharp edges	Injury to operator or end customer	6		Process design fails to remove sharp edges	PFMEA design to incorporate sharp edge removal process	3	PFMEA Design validation	1	18							0
4/ Electroless Nickel Plating	ASTM B733-04 Type V Class 3	Incorrect plating	Material fails testing, resulting in field failures	8	SC	Process design fails to ensure correct plating process	PFMEA Design to incorporate Electroless Nickel Plating process verification in accordance with requirements	6	PFMEA Design validation	4	192	Implement Reverse PFMEA audit schedule with high frequency Implement Process Audit schedule with high frequency	Quality Manager, Systems Manager	Reverse PFMEA and Process Audit schedules created. Plating process audited via Reverse PFMEA and Process Audits on 1/month frequency for each audit	8	6	1	48
5/ Item Identification	MIL-STD-130 80064 - 004889355 MFR Cage Code	Items not identified per spec	Items not identified, failed PPAP submission, delayed production start	8		Specification not available	APQP planning process - Obtain and provide drawing specifications	2	Part Production Approval Process verify specifications	1	16							0
6/ Part Dimension	250	Part fails to meet dimensional spec	Part dimensions are incorrect, production interruption	8		Tooling failure	PFMEA and Control Plan to mitigate risk	2	PFMEA and Control Plan detection control process	3	48							0

Item 4 identified as
Significant Characteristic





Element 5. – Process Flow Diagram

The Process Flow Diagram (PFD) provides a high-level view of the process, typically from receiving → manufacturing operations → inspection → packaging → shipping.

The process flow is denoted with symbols/icons denoting:

- Operation
- Inspection/Test
- Transport
- Delay
- Storage

Application	1	Issue Date	4
Supplier Name	2	Part Name	5
Supplier Code	3	Part Number	6

Legend:
○ Operation ⇨ Transportation □ Inspection ▢ Delay ▽ Storage

Step	Operation or Event	Description of Operation or Event	Evaluation and Analysis Methods
10	⇨	Transporting Material to Plant	Material received in warehouse
20	□	Inspect Material Once Arrived	Visual inspection of material to check for damage
30	▽	Store Material Until Use	Material stored in racks inside warehouse
40	⇨	Bring Material to Line	Material moved on rack to designated line
50	○	Cut Outer Shape from Steel	Outer shape cut from material using sharp machine

1 Application: Specific use or purpose of a process, system, or equipment.

2 Supplier Name: Name of the company or entity providing materials or services.

3 Supplier Code: Known as CAGE (Commercial and Government Entity) Code.

4 Issue Date: Official release date of the Process Flow Diagram.

5 Part Name (Nomenclature): Descriptive title or label for a part.

6 Part Number: Unique identifier and revision letter assigned to a part.

7 Step: Operational sequence number denoting the operation steps.

8 Operation or Event: Defined operation type. (See Legend)

9 Description of Operation or Event: Manufacturing operation name.

10 Evaluation and Analysis Methods: Process methods of operation or inspection.

A PFD clearly identifies:

- Every step required to build the product
- Inputs and outputs of each step
- Critical or Significant Characteristics as denoted on the part drawing (or from the DFMEA if Design Holder)
- Where inspections/measurements occur
- Where materials move or wait



Element 5. – Process Flow Diagram

The Process Flow Diagram is a living document subject to on-going revisions. Subsequent process changes must be documented in the Process Flow Diagram and alternate process paths/formal rework loops should be documented as part of the main flow diagram. Ensure to use symbology to identify all Key Characteristics in the Process Flow Diagram.

Legend:			
○ Operation	⇨ Transportation	□ Inspection	D Delay
			▽ Storage
Step	Operation or Event ○ ⇨ □ D ▽	Description of Operation or Event	Evaluation and Analysis Methods
10	⇨	Transporting Material to Plant	Material received in warehouse
20	□	Inspect Material Once Arrived	Visual inspection of material to check for damage
30	▽	Store Material Until Use	Material stored in racks inside warehouse
40	⇨	Bring Material to Line	Material moved on rack to designated line
50	○	Cut Outer Shape from Steel	Outer shape cut from material using sharp machine
60	○	Drill Holes	Hole features produced by using a custom ø.545 drill
70	○	Remove Sharp Edges	Sharp edges removed through trimming
80	○	Add Nickel Plating	Add the Electroless Nickel Plating
90	○	Add Item Identification	Item Identification stamped through press
	□	Final Inspection of Part	Final part inspected to match print
	○	Package Part	Part packaged through current packaging instructions
	▽	Store Final Product	Final product stacked in warehouse in final packaging
150	⇨	Ship to Customer	Item shipped to customer out of warehouse

SC Identified

Op. 80 identified as Significant Characteristic



Element 5. – Process Flow Diagram

The PFD should be documented on the below preferred form (or a similar form containing the same information).

All documents must have the correct part revision, the part number, and part description/name.

The symbol/icon legend must be on the 1st Page.

Application:	JLTV A2:	Issue Date:	01/01/2026
Supplier Name:	ABC Company	Part Name:	RANDOM PART
Supplier Code:	987654	Part Number:	12345678 Rev.: A

Step	Operation or Event	Description of Operation or Event	Evaluation and Analysis Methods
12345678			
10	Transportation	Transporting Material to Plant	Material received in warehouse
20	Inspection	Inspect Material Once Arrived	Visual inspection of material to check for damage Check of Major Dimension & Mill Sheet
30	Operation	1st Turning	Check of Turning Dimension based on working standard
40	Operation	2nd Turning	Check of Turning Dimension based on working standard
50	Operation	MCT	Check of MCT Dimension based on working standard
60	Operation	Heating	Management of H/T character
70	Operation	External Hard Turning	standard and assembling diameter
80	Inspection	Final Inspection	Check of Roughness and external diameter Dimension Visual Inspections

A PFD must align with:

- **DFMEA/PFMEA/Control Plan**
 - Every process step must appear in all three – Op# and Op Name must be the same

If these don't match, it is an audit finding



Element 6. - Process Failure Modes & Effects Analysis

Process Failure Mode & Effects Analysis (PFMEA) is a disciplined review and analysis of a new or revised process and is conducted to anticipate, resolve, or monitor potential process problems for a new or revised product program. The PFMEA is a living document.

A PFMEA table contains:

1. Operation/Process Step
2. Potential Failure Mode
3. Potential Effects of Failure
4. Severity rating (S)
5. Potential Causes of Failure
6. Occurrence rating (O)
7. Current Design Controls
8. Detection rating (D)
9. Risk Priority Number (RPN = $S \times O \times D$)
10. Recommended Actions & Revised Ratings

A PFMEA helps teams:

- Identify weakness in the manufacturing process
- Evaluate the severity (S), occurrence (O), and detection (D) of each risk
- Prioritize what needs improvement
- Reduce scrap, rework, and downtime
- Prevent defects before they reach the customer

Application:		Bracket on Ship		Design Responsibility				PFMEA Number		Prepared by		Date (Orig.)		Date (Rev.)		Revision		Revision	
Part Number:		Rev. #		Key Date		Prepared by		Date (Orig.)		Date (Rev.)		Revision		Revision		Revision		Revision	
Part Name:		Base Mounting		Location		Prepared by		Date (Orig.)		Date (Rev.)		Revision		Revision		Revision		Revision	
Item:		Base Mounting		Location		Prepared by		Date (Orig.)		Date (Rev.)		Revision		Revision		Revision		Revision	
PFMEA Table																			
Action Results																			
Item/Process Step	Potential Failure Mode	Potential Effects of Failure	Severity	Occurrence	Potential Causes of Failure	Current Controls	Detection	RPN	Recommended Action	Responsibility & Target Completion Date	Action Taken	Severity	Occurrence	Detection	RPN	Revision	RPN		
10/Transporting Material to Plant	Damage to Material in transit	Material cannot be used	7	3	Material not properly secured	3	5	105	Method to check that material is secured before shipping for each shipment	Supplier 7/10/23	Method created to check material is properly secured through gauges before transporting	7	3	1	21				
	Wrong material	Material with incorrect plating used	7	3	Mis-identified material	3	5	126	Implement inspection criteria and Work Instructions	Quality 7/10/23	WI and inspection criteria created to guide verification of S&A to material received	5	2	1	12				
20 / Inspect Material once arrived	Unable to select damaged material	Damaged material is put through process, waste of time and labor	5	3	Lack of gauges to check for damaged material	3	4	72	Create gauge to check material for damage before storage	Quality 7/10/23	Gauges implemented to check the material for damage	5	2	1	12				
30 / Store material until use	Damage to Material in Storage	Material needs to be repaired before going on the line	5	3	Improper storage of material, not stacked correctly	3	4	60	Create gauge to check that material is being properly stored	Quality 7/10/23	Gauges implemented to check the material is not experiencing sag while stored	3	3	3	27				
40/Bring Material to Line	Material damaged while being moved	Material needs to be repaired before going on the line	5	3	Improper support during moving	3	5	75	Ensure rack that material is stored on creates proper support during transport	Quality 7/10/23	Rack has proper shape to ensure damage isn't incurred during movement	3	2	3	18				
50/Cut Outer Shape from Steel	Shape of robot too large	Post processing needed to get the correct shape	5	3	Undetected wear in machine	3	5	108	Automated check of machine shape at end of each shift	ME 7/12/23	Program created to datum machine and check hole location	7	3	4	36				
60/Drill Holes	Incorrect location of holes	Scrap part	5	3	Improper datum	3	5	90	More automated system for setting the datum of the machine and checking hole location after	ME 7/12/23	Program created to datum machine and check hole location	7	3	3	63				
70/Remove Sharp Edges	Not removing all sharp edges	Robot process to remove the rest of the sharp	3	3	Process losses efficiency over time	3	4	60	Visual check to see if all sharp edges removed	ME 7/12/23	Program created to automate checking for sharp edges and degradation of assets	2	3	3	18				
80/Add Nickel Plating	Plating not added	Failure to meet customer specifications	8	3	Plating process failure	3	5	238	Implement system for validating process within specifications	ME CE 7/12/23	Scheduled PPS to verify machine performance	8	2	2	32				



Element 6. - Process Failure Modes & Effects Analysis

A completed PFMEA form will include all failure modes, severity, occurrence, detection, and RPN data. This includes any mitigated RPN value under Action Results being lower than the RPN of the initial design – RPN values require mitigation when exceeding the Supplier's documented maximum acceptance value.

Application: Bracket on Ship

Part Number: 2584771

Part Name: Base, Mounting

Team:

Rev: E

Key Date:

Location:

Design Responsibility:

PFMEA Number:

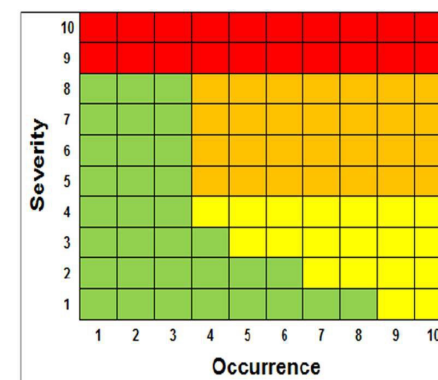
Prepared by:

Date (Orig.):

Date (Rev.):

Ensure information is filled correctly. Reference PFMEA Ratings provided in tab "6b PFMEA Ratings". PFMEA should align with S. Flow.

Item/Process Step	Potential Failure Mode	Potential Effect(s) Of Failure	Severity	Characteristic s	Potential Cause(s) Of Failure	Occurrence	Current Controls	Detection	RPN	Recommended Action	Responsibility & Target Completion Date	Action Results				
												Action Taken	Severity	Occurrence	Detection	RPN
10/Transporting Material to Plant	Damage to Material in transit	Material cannot be used	7		Material not properly secured	3		5	105	Method to check that material is secured before shipping for each shipment	Supplier 7/10/23	Method created to check material is properly secured through gauges before transporting	7	3	1	21
	Wrong material	Material with incorrect plating used	7		Mis-identified material	3	CoA	6	126	Implement Inspection criteria and Work Instructions	Quality 7/10/23	WI and Inspection criteria created to guide verification of CoA to material received	6	2	1	12
20 / Inspect Material once arrived	Unable to detect damaged material	Damaged material is put through process, waste of time and labor	6		Lack of gauges to check for damaged material	3	Visual check of material	4	72	Create gauge to check material for damage before storage	Quality 7/10/23	Gauges implemented to check the material for damage	6	2	1	12
30 / Store material until use	Damage to Material in Storage	Material needs to be repaired before going on the line	5		Improper storage of material, not stacked correctly	3	Material has standard storage process that has support for material	4	60	Create gauge to check that material is being properly stored	Quality 7/10/23	Gauges implemented to check the material is not experiencing sag while stored	3	3	3	27
40/Bring Material to Line	Material damaged while being moved	Material needs to be repaired before going on the line	5		Improper support during moving	3	Material remains on rack it was stored in	5	75	Ensure rack that material is stored on creates proper support during transport	Quality 7/10/23	Rack has proper shape to ensure damage isn't incurred during movement	3	2	3	18
50/Cut Outer Shape From Steel	Shape of output too large	Post processing needed to get the correct shape	6		Undetected wear in machine	3	Visual check of machine	6	108	Automated check of machine shape at end of each shift	ME 7/12/23	Program created to check shape of machine creating output	3	3	4	36
60/Drill Holes	Incorrect location of holes	Scrap part	6		Improper datum	3	Manual datum of machine, gauge to check location of holes after	5	90	More automated system for setting the datum of the machine and checking hole location after	ME 7/12/23	Program created to datum machine and check hole location	7	3	3	63
70/Remove Sharp Edges	Not removing all sharp	Re-run process to remove the rest	3		Process loses efficiency over	5	Visual check to see if all sharp edges removed	4	60	More automated system for checking for sharp edges and	ME 7/12/23	Program created to automate checking for	2	3	3	18
80/Add Nickel Plating	Plating not added	Failure to meet customer specifications	8	SC	Plating process failure	6	Error-Proof system for validating process within specifications	6	288	Scheduled PM to validate machine performance Process Start of Shift, Mid Shift, End of Shift checks	ME QE 7/12/23	PM's scheduled and verified Shift Process checks verified	8	2	2	32



- <CC> Critical Characteristic**
Must be addressed on Control Plan with 100% inspection or 1.67 Cpk
- <SC> Significant Characteristic**
Must be addressed on Control Plan with 100% inspection or 1.33 Cpk
- Continuous Improvement Zone**
Address top 20% Failure Modes / Causes (Pareto'd by RPN)
- Low Risk Zone**
Address as needed

Op. 80 identified as
Significant Characteristic



Element 6. - Process Failure Modes & Effects Analysis

The PFMEA should be documented on the below preferred form (or an AIAG compliant form)

Application: Bracket on Ship		Design Responsibility:		PFMEA Number:	
Part Number: 2584771	Rev: E	Key Date:		Prepared by:	Ensure information is filled correctly. Reference PFMEA Ratings provided in tab "6b PFMEA Ratings". PFMEA should align with 5. Flow.
Part Name: Base, Mounting		Location:		Date (Orig.):	
Team:				Date (Rev.):	

Item/Process Step	Potential Failure Mode	Potential Effect(s) Of Failure	Severity	Characteristic =	Potential Cause(s) Of Failure	Occurrence	Current Controls	Detection	RPN	Recommended Action	Responsibility & Target Completion Date	Action Results				
												Action Taken	Severity	Occurrence	Detection	RPN
10/Transporting Material to Plant	Damage to Material in transit	Material cannot be used	7		Material not properly secured	3		5	105	Method to check that material is secured before shipping for each shipment	Supplier 7/10/23	Method created to check material is properly secured through gauges before transporting	7	3	1	21
	Wrong material	Material with incorrect plating used	7		Mis-identified material	3	CoA	6	126	Implement inspection criteria and Work Instructions	Quality 7/10/23	WI and Inspection criteria created to guide verification of CoA to material received	6	2	1	12
20 / Inspect Material once arrived	Unable to detect damaged material	Damaged material is put through process, waste of time and labor	6		Lack of gauges to check for damaged material	3	Visual check of material	4	72	Create gauge to check material for damage before storage	Quality 7/10/23	Gauges implemented to check the material for damage	6	2	1	12
30 / Store material until use	Damage to Material in Storage	Material needs to be repaired before going on the line	5		Improper storage of material, not stacked correctly	3	Material has standard storage process that has support for material	4	60	Create gauge to check that material is being properly stored	Quality 7/10/23	Gauges implemented to check the material is not experiencing sag while stored	3	3	3	27
40/Bring Material to Line	Material damaged while being moved	Material needs to be repaired before going on the line	5		Improper support during moving	3	Material remains on rack it was stored in	5	75	Ensure rack that material is stored on creates proper support during transport	Quality 7/10/23	Rack has proper shape to ensure damage isn't incurred during movement	3	2	3	18
50/Cut Outer Shape From Steel	Shape of outout too large	Post processing needed to get the correct shape	6		Undetected wear in machine	3	Visual check of machine	6	108	Automated check of machine shape at end of each shift	ME 7/12/23	Program created to check shape of machine creating outout	3	3	4	36
60/Drill Holes	Incorrect location of holes	Scrap part	6		Improper datum	3	Manual datum of machine, gauge to check location of holes after	5	90	More automated system for setting the datum of the machine and checking hole location after	ME 7/12/23	Program created to datum machine and check hole location	7	3	3	63
70/Remove Sharp Edges	Not removing all sharp edges	Rerun process to remove the rest of the sharp	3		Process loses efficiency over time	5	Visual check to see if all sharp edges removed	4	60	More automated system for checking for sharp edges and degradation of process	ME 7/12/23	Program created to automate checking for sharp corners and	2	3	3	18
80/Add Nickel Plating	Plating not added	Failure to meet customer specifications	8	SC	Plating process failure	6	Error-Proof system for validating process within specifications	6	288	Scheduled PM to validate machine performance Process Start of Shift, Mid Shift, End of Shift checks	ME QE 7/12/23	PM's scheduled and verified Shift Process checks verified	8	2	2	32

- Verify the Process Flow and PFMEA Operation Numbers align from document to document.
- Ensure the document header is lined up with drawing.
- Operation Steps are clearly defined and in order
- Make sure any SC and/or CCs are identified.



Element 7. – Control Plan

The Control Plan (CP) is a written description of the systems for controlling production parts and processes. The control plan is a living document and should be updated to reflect the addition/deletion of controls based on corrective actions and experience gained by producing parts.

The CP tells the manufacturing team:

“What needs to be controlled, how it is controlled, how often, with what tools, and what to do if something goes wrong.”

A Control Plan table contains:

1. Operation/Process Step
2. Process Name/Description
3. Machine/Device/Jig for Mfg
4. Characteristics (No., Product, Process)
5. Special Char. Class
6. Specification/Tolerance
7. Evaluation/Measurement Technique
8. Sample (Size, Frequency)
9. Control Method
10. Reaction Plan

1. Prestage		2. Pre-Production		3. Production		4. Key Contact/Phone		5. Date (Yr/Mo)		6. Date (Yr/Mo)							
Control Plan Number		10000000				Area 1 (1) 10000000		21-10-2024		21-10-2024							
Part Number/Revision		10000000		B		Area 1 (1) 10000000		Customer Engineering Approval Date (If Any)									
Part Name		CABLE ASSEMBLY (1) CABLE		Supplier Part Approval Date		AMGENERAL 10000000 10000000		Customer Quality Approval Date (If Any)									
Supplier Name		AMGENERAL 10000000		Other Approval Date (If Any)				Other Approval Date (If Any)									
PART NUMBER / REVISION	PROCESS NAME / OPERATION DESCRIPTION	MACHINE / DEVICE / JIG FOR MFG	NO.	PRODUCT	PROCESS	SPECIAL CHAR. CLASS	METHODS				REACTION PLAN						
							EVALUATION / MEASUREMENT TECHNIQUE		SAMPLE								
CHARACTERISTICS							SPECIFICATION / TOLERANCE		CONTROL METHOD		REACTION PLAN						
10	Purchasing	N/A	N/A		Purchase		1. Verify part is not purchased. 2. Material purchased from authorized supplier.	Visual	100%	100%	1. Verification of original manufacturer COC 2. Authorized supplier for verification	Non-Conforming Output Process: 100% 100% 100%					
20	Receiving	N/A	N/A		Receiving		1. Part number, supplier, and quantity should match as per PO 2. Materiality part number with correct label 3. Non-conform inspection, COC verification part dimensions, and verification need drawing	Visual	100%	100%	1. Non-Conforming Output Process: 100% 100% 100%	1. Non-Conforming Output Process: 100% 100% 100%					
30	Inventory Material Inspection	N/A	N/A		Raw Material		Verify material as per PO & Material Data Sheet	Visual & Dimensional	Sampling Inspection	As per Sampling Plan QV-000000	1. Follow Incoming Inspection Procedure 2. Follow Sampling Plan	Analysis the issue and take appropriate action					
40	Move material to inventory	N/A	N/A		Transport		1. No damage on material 2. Correct material as per PO	Visual	100%	100%	Inspect material in holding inspection and before taking it to operation	Analysis the issue and take appropriate action					
50	Label Printing	Label Printer 10000000	0		Printing		1. Label printing as per customer requirement 2. Label per and type, color, printing pattern, label font size as per manufacturing drawing only 3. Label content should be verified 4. Label content should be verified 5. Label content should be verified 6. Label content should be verified 7. Label content should be verified 8. Label content should be verified	Visual	1	Per Lot	1. Label printing as per customer requirement 2. Label per and type, color, printing pattern, label font size as per manufacturing drawing only 3. Label content should be verified 4. Label content should be verified 5. Label content should be verified 6. Label content should be verified 7. Label content should be verified 8. Label content should be verified	Reprint & Inform MD to take appropriate action					
60	Label Printing Inspection Sampling Inspection	N/A	0		Inspection		Correct Label Printing as per MD and customer specifications	Visual	Sampling Inspection	As per Sampling Plan QV-000000	Follow Inspector's Work Instruction	Analysis the issue and take appropriate action					
70	HST Cutting	Cutting Machine 10000000	2		Cutting		1. Length cutting should be as per customer requirement 2. Change of finished cutting part 3. Change of finished cutting part 4. Change of finished cutting part	Calibrated measuring tool LD-Me-10000000 Cable Date: 10-10-2024 Cable Date: 10-10-2024	1	100%	1. Specified tool/instruction to be used for cutting process 2. Operator will check length to process sheet lot & HST cutting 3. HST length measured as sheet & part number on the surface 4. Part number inspection to be carried out for HST cutting length as defined in drawing. Non-conforming cutting is change	Reprint & Inform to production Analysis the issue and take appropriate action					
80	HST Cutting Free Piece Inspection	N/A	N/A		Inspection		Length cutting should be as per customer requirement & MD	Calibrated measuring tool LD-Me-10000000 Cable Date: 10-10-2024 Cable Date: 10-10-2024	1	100%	Follow Drawing/Procedure for inspection	Analysis the issue and take appropriate action					
90	Cable Cutting	Manual Cable Cutter	2		Cutting		1. Length cutting should be as per customer requirement 2. Change of finished cutting part 3. Change of finished cutting part 4. Change of finished cutting part	Calibrated measuring tool LD-Me-10000000 Cable Date: 10-10-2024 Cable Date: 10-10-2024	1	100%	1. Specified tool/instruction to be used for cutting process 2. Operator will check length to process sheet lot & HST cutting 3. Cable length measured as sheet & part number on the surface 4. Part number inspection to be carried out for HST cutting length as defined in drawing. Non-conforming cutting is change 5. Operator should check length as specified length before cutting & inspection should verify length	Reprint & Inform to production Analysis the issue and take appropriate action					



Element 7. – Control Plan

The Control Plan must include each process step identified on the Process Flow Diagram and Process FMEA.

- Include the controls identified in the Process FMEA
- Address product and process characteristics at each process step
- Describe and identify all Special Characteristics

☐ Prototype ☐ Pre-Launch ☒ Production												
Control Plan Number			Key Contact/Phone Jane Doe / ((55) 5) -4567					Date (Orig.)		Date (Rev.)		
Part Number/Revision 2584771/E			Core Team					Customer Engineering Approval/Date (If Req'd.)				
Part Name Base, Mounting			Supplier/Plant Approval/Date					Customer Quality Approval/Date (If Req'd.)				
Supplier Name RGSBI Aerospace & Defense		Supplier Code 8CGW6		Other Approval/Date (If Req'd.)					Other Approval/Date (If Req'd.)			
PART/ PROCESS NUMBER	PROCESS NAME/ OPERATION DESCRIPTION	MACHINE, DEVICE JIG, TOOLS FOR MFG.	CHARACTERISTICS			SPECIAL CHAR. CLASS	METHODS					REACTION PLAN
			NO.	PRODUCT	PROCESS		PRODUCT / PROCESS SPECIFICATION / TOLERANCE	EVALUATION / MEASUREMENT TECHNIQUE	SAMPLE		CONTROL METHOD	
								SIZE	FREQ.			
10	Transport Material to Plant	Forklift		Correct Material for process in the plant	Receive material and transport to storage			Material Container	100%	CoA Inspection Criteria Inspection Work Instructions	Control of Non-Conforming Material Procedure (XXX-QA-PR-001)	
20	Inspect Material	Gage 11		Material in good condition	Inspect material using gage for damage		No damage to material	3 pieces	Every Container	Inspection Work Instructions Gage Calibration schedule	Control of Non-Conforming Material Procedure (XXX-QA-PR-001)	
30	Store material	Forklift		Material stored in correct location with no damage	Store material in defined location using forklift and ERP system		No damage to material Stored in correct location	1 container	1/shift	ERP System Material Handling Procedure	Control of Non-Conforming Material Procedure (XXX-QA-PR-001)	
40	Bring Material to line	Forklift		Material delivered to production station	Deliver location to production station		No damage to material Stored in correct location	1 container	100%	ERP System Material Handling Procedure Op Verification	Control of Non-Conforming Material Procedure (XXX-QA-PR-001)	
50	Cut Outer Shape From Steel	Cutting Machine	13,14,17,18,21	Outer shape of final product	Cuts outer shape out of steel sheet		0.031	100	Per Shift	Automated check of shape before moving to next process	Control of Non-Conforming Material Procedure (XXX-QA-PR-001)	
60	Drill Holes	Drilling Machine	7,8,9,11,12,15,16,19	Two ø.545 holes	Drills two holes into the outer shape		0.01	100	Per Shift	Gauge check before moving to next process	Control of Non-Conforming Material Procedure (XXX-QA-PR-001)	
70	Remove Sharp Edges	Trimming machine	N/A	N/A	Removes outer sharp edges in next		All sharp edges removed	100	Per Shift	Visual check before moving to next process	Control of Non-Conforming Material Procedure (XXX-QA-PR-001)	
80	Add Nickel Plating	Plating Booth	4	Material receives Nickel plating	Part processes through plating booth	SC	ASTM B733-04 Type V Class 3	1	3x/Shift	Machine Validation Work Instructions HMI Machine specs	Control of Non-Conforming Material Procedure (XXX-QA-PR-001)	
90	Identification	machine			identification onto part		pressure when stamping part			to next process	Control of Non-Conforming Material Procedure (XXX-QA-PR-001)	

Op. 80 identified as
Significant Characteristic



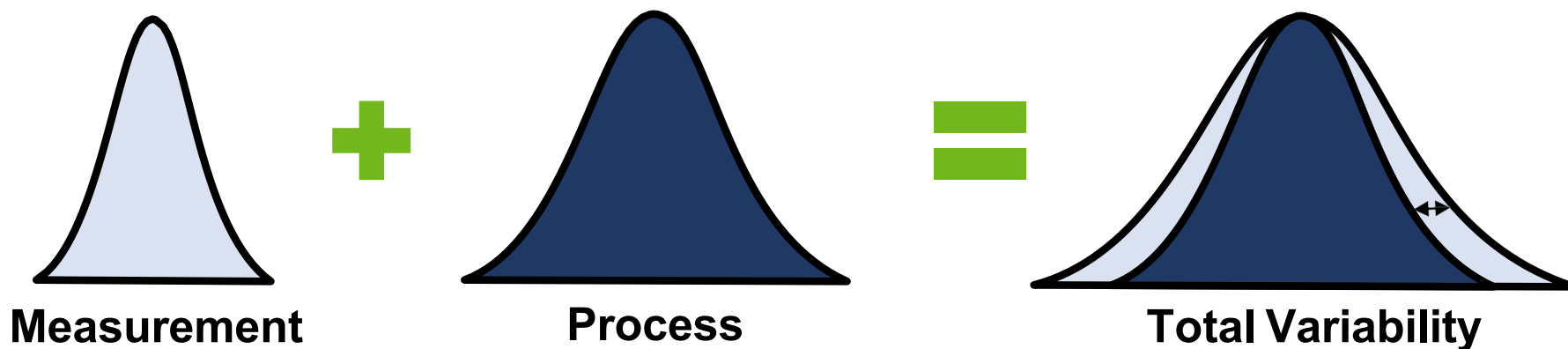
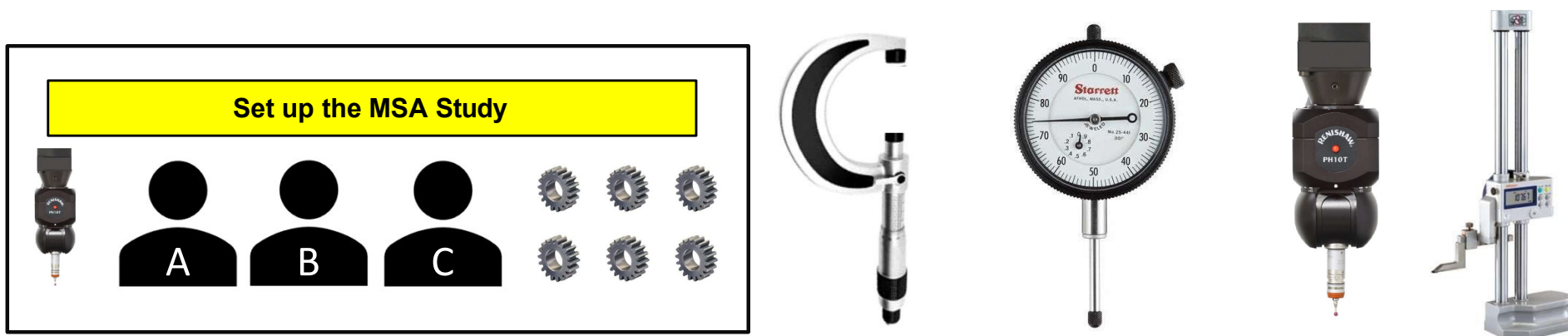
Element 7 – Control Plan



Element 8. – Measurement System Analysis

Measurement System Analysis (MSA) is the statistical method used to show the variation in the measurement system, which includes Gage R&R, Linearity, Stability, Bias, etc. An MSA is a formal analysis that evaluates whether your measurement system produces accurate, consistent, and reliable data.

Without a valid MSA, your measurements—and quality decisions—are not reliable.





Common MSA		
MSA Type	Used For	Examples
Gage R&R (Continuous)	Dimensional measurements	Calipers, CMM, micrometers
Attribute Agreement Analysis	Visual / pass-fail	Scratch inspection, cosmetics
Bias Study	Accuracy	Calibration blocks
Linearity Study	Accuracy across range	Scales, torque wrenches
Stability Study	Accuracy over time	Long-term monitoring

Typically, AMG PPAPs are submitted with either:

Gage R&R (Variable Analysis) and/or Attribute Agreement Analysis

All Measurement Techniques listed in the Control Plan must have an MSA.

All gauges denoted on the Dimensional Report must have an MSA.

If these are not present, it is an audit finding
The PPAP will be rejected

Variable Analysis

Anova Method is only acceptable method.

- Select a minimum of 10 parts.
- Select a minimum of 3 operators.

Results

- Number of distinct categories shall be 5 or greater.
- For Powertrain and like type components Total Gage R&R shall be less than 10%.
- For all other components Total Gage R&R shall be less than 20%.
- Please consult your SQE for any variable results over these limits.

Attribute Agreement Analysis

Attribute Risk Method is only acceptable method.

- Select a minimum of 3 operators, perform 3 trials.
- Select a minimum of 50 parts.
- Validate selected parts with variable gage such as CMM.
- 10% below and above boundary limits.
- 25% at and around upper and lower boundary limit.
- 30% between boundary limits to represent range of normal process variation.

Results

- Kappa coefficient between operators must exceed 0.70, greater than 0.80 preferred.
- Kappa coefficient operator to standard must exceed 0.70, greater than 0.80 preferred.



EXAMPLE: Gage R&R (Variable Analysis) – ANOVA Method

SUPPLIER NAME: RGS Aerospace & Defense		GAGE NAME: 0-1 Micrometer		NOMINAL: 0.25	DATE: 7/3/2023
PART NO.: 2584771 Rev: E		GAGE NO.: GN-1010		TOL(+): 0.001	PERFORMED BY: John Doe
CHARACTERISTIC:		GAGE TYPE: Outside Micrometer		TOL(-): 0.001	

APPRaiser A NAME: Jane Doe		PART										AVERAGE	
		1	2	3	4	5	6	7	8	9	10		
TRIAL	1	0.2483	0.2483	0.2492	0.2493	0.2498	0.2467	0.2475	0.249	0.2488	0.2476	0.2485	
	2	0.2482	0.2465	0.2481	0.2482	0.2457	0.2481	0.2479	0.2455	0.2478	0.2488	0.2476	
	3	0.2503	0.2469	0.2464	0.2474	0.2496	0.2481	0.2499	0.2481	0.2471	0.2455	0.2479	
AVERAGE		0.249	0.247	0.248	0.249	0.248	0.248	0.248	0.248	0.248	0.247	0.2479	X-BAR-A
RANGE		0.002	0.002	0.003	0.002	0.004	0.001	0.002	0.003	0.002	0.003	0.00249	R-BAR-A

APPRaiser B NAME: John Smith		PART										AVERAGE	
		1	2	3	4	5	6	7	8	9	10		
TRIAL	1	0.2494	0.2485	0.2492	0.2485	0.2483	0.2462	0.2486	0.2476	0.248	0.2476	0.2482	
	2	0.2465	0.2473	0.2456	0.2504	0.2504	0.2459	0.246	0.2463	0.2458	0.2474	0.2472	
	3	0.2468	0.2487	0.2501	0.249	0.2505	0.2479	0.2464	0.247	0.2475	0.249	0.2483	
AVERAGE		0.248	0.248	0.248	0.248	0.249	0.247	0.247	0.247	0.247	0.248	0.24788	X-BAR-B
RANGE		0.003	0.001	0.004	0.002	0.002	0.002	0.003	0.001	0.002	0.002	0.00226	R-BAR-B

APPRaiser C NAME: Brian Doe		PART										AVERAGE	
		1	2	3	4	5	6	7	8	9	10		
TRIAL	1	0.2465	0.2493	0.2483	0.2491	0.25	0.2496	0.2463	0.2475	0.2472	0.2495	0.2484	
	2	0.2481	0.2463	0.2485	0.2504	0.2479	0.2491	0.247	0.2481	0.2484	0.2459	0.2479	
	3	0.2457	0.2471	0.2491	0.2481	0.2499	0.2477	0.2479	0.2483	0.2486	0.2457	0.24821	X-BAR-C
AVERAGE		0.247	0.248	0.248	0.248	0.249	0.248	0.247	0.248	0.248	0.247	0.24821	
RANGE		0.003	0.002	0.001	0.002	0.002	0.002	0.001	0.003	0.003	0.004	0.00218	R-BAR-C

GAGE R & R SUMMARY			
MEASUREMENT UNIT ANALYSIS		WARNINGS	
REPEATABILITY (EV) (EQUIPMENT VARIATION): 0.00703	Number of Distinct Categories: 0.54492	-WARNING, NOT ENOUGH DISTINCT CATEGORIES	
REPRODUCIBILITY (AV) (APPRaiser VARIATION): 0.00088	R & R: 0.00709	-WARNING, IF POWERTRAIN COMPONENT, TOTAL GAGE R&R TOO HIGH	
PART VARIATION (PV): 0.00271		-WARNING, TOTAL GAGE R&R TOO HIGH	
TOTAL VARIATION (TV): 0.00759			
% PROCESS VARIATION (PTV)		% TOLERANCE VARIATION (TOL)	
% EQUIPMENT VARIATION: 92.88	351.62		
% APPRAISER VARIATION: 11.85	44.19		
% TOTAL GAGE R & R: 93.41	354.39		
% PART VARIATION: 35.71	135.49		

REPEATABILITY RANGE CONTROL CHART

APPRaiser A

APPRaiser B

APPRaiser C

PART APPRAISER AVERAGE CHART

APPRaiser A

APPRaiser B

APPRaiser C

All calculations are based upon predicting 5.15 sigma (99% of the area under the normal distribution curve).
AV - If a negative value is calculated under the square root sign, the appraiser variation (AV) defaults to zero (0).



EXAMPLE: Attribute Agreement

Attribute Agreement Analysis

Part Number	2584771	Rev: E	Gage Name	Go/No-Go Pin Set	Date Performed	7/3/2023	Appraiser A	Jane Doe
Part Name	Base, Mounting		Gage Number	GN-1020	Gage Type	Gage Pins	Appraiser B	John Smith
Characteristic	7		Pass Condition	0.5555	Fail Condition	0.5355	Appraiser C	Brian Doe

Ensure information is filled correctly. Complete Gage R&R Attribute Agreement with reference to 8b. GR&R Requirements. For the Pass/Fail conditions, the Pass is the maximum condition and Fail is the minimum condition. The "Reference" column is to show if the information in the data matches the expected outcome. The "Code" column is for pass or fail of the gage, with

DATA TABLE

PART	A-1	A-2	A-3	B-1	B-2	B-3	C-1	C-2	C-3	Reference	Reference Value	Code
1	1	0	1	1	0	1	0	1	1	1	0.5479	x
2	1	1	1	1	1	1	1	1	1	1	0.5537	+
3	1	1	1	1	1	1	1	1	1	1	0.5455	+
4	0	0	0	0	0	0	0	0	0	0	0.5602	x
5	1	1	1	1	1	1	1	1	1	1	0.5529	+
6	1	1	1	1	1	1	1	1	1	1	0.5531	+
7												

AB Tabulation

	1	2	3
d	a	d	
d	d	d	
d	d	d	
b	c	d	
d	d	d	
d	d	d	

BC Tabulation

	1	2	3
b	c	d	
d	d	d	
d	d	d	
a	d	d	
d	d	d	
d	d	d	

AC Tabulation

	1	2	3
b	c	d	
d	d	d	
d	d	d	
b	c	d	
d	d	d	
d	d	d	

Risk Analysis

A * B Crosstabulation

		B		Total
		0	1	
A	0	Count	1	2
	0	Expected Count	0.2	1.8
	1	Count	1	16
	1	Expected Count	1.8	15.0
Total		Count	2	18
		Expected Count	2.0	18.0

B * C Crosstabulation

		C		Total
		0	1	
B	0	Count	1	2
	0	Expected Count	0.2	1.8
	1	Count	1	16
	1	Expected Count	1.8	15.0
Total		Count	2	18
		Expected Count	2.0	18.0

A * C Crosstabulation

		C		Total
		0	1	
A	0	Count	0	2
	0	Expected Count	0.2	1.8
	1	Count	2	16
	1	Expected Count	1.8	15.0
Total		Count	2	18
		Expected Count	2.0	18.0

Kappa	A	B	C
A	-	0.44	-0.12
B	0.44	-	0.44
C	-0.12	0.44	-

DETERMINATION	
A x B	Some Agreement
A x C	Poor Agreement
B x C	Some Agreement



A Dimensional Test Report lists every note and dimension on the drawing with their respective tolerances, and shows the measurement results from actual production parts, confirming they are within tolerance. While Basic/BSC and REF dimensions may be listed, both lack dimensional tolerance and should have the tolerance listed as N/A.

<ul style="list-style-type: none"> • Balloon/Item Number • Drawing characteristic description • Specification / Nominal value • Upper and lower tolerance limits • Measurement Technique • Actual measurement from the sample part <ul style="list-style-type: none"> • AM General requires 6-sample parts • Should the Supplier not be able to provide data on 6-samples, contact your AM General Representative • Pass/Fail status 	<p>All documents must have the correct part revision, part number, and part description/name.</p> <p>Dimensional Test Reports must be signed and dated.</p>
--	---

Dimensional Test Reports must be signed and dated.

[illegible]



Element 9. – Dimensional Test Report

Example: Dimensional Test Report

SUPPLIER NAME:		TRUE		PART NUMBER: 2584771											
SUPPLIER CODE:		8CGW6		PART NAME: Base, Mounting											
NAME OF INSPECTION FACILITY:				REVISION: E											
DATE:		7/3/2023													
Supplier required to provide marked up drawing to identify items inspected.															
ITEM	DIMENSION / SPECIFICATION	TOLERANCE		SPECIFICATION / LIMITS		GAGE TYPE*	QTY. TESTED	MEASUREMENT RESULTS (DATA)						OK	NOT OK
		-	+	MIN	MAX			Piece 1	Piece 2	Piece 3	Piece 4	Piece 5	Piece 6		
N1	INTERPRET DRAWING IN ACCORDANCE WITH ASME Y14.100-2017, DIMENSIONS AND TOLERANCES IN ACCORDANCE WITH ASME Y14.5-2018.	0.000	0.000	1	1	Validation	6	1	1	1	1	1	1	X	-
N2	STEEL, ALLOY 4130, COND. F, H4-S-4758 MATERIAL: 4130, COND. OPT. SPEC. ASTM A305 D TENSILE ST. 20733 OR STEEL, COND. A OR B, SPEC. MIL-S-28798, D TENSILE ST. 20733.	0.000	0.000	1	1	Validation	6	1	1	1	1	1	1	X	-
N3	VE SHARP EDGES.	0.000	0.000	1	1	Validation	6	1	1	1	1	1	1	X	-
N4	WLESS NICKLE PLATING PER 733-04 TYPE V CLASS 3.	0.000	0.000	1	1	Validation	6	1	1	1	1	1	1	X	-
N5	M IDENTIFICATION LY PER MIL-STD-130 64 - 004889355 t - (MFR CAGE CODE)	0.000	0.000	1	1	Validation	6	1	1	1	1	1	1	X	-
6	250	250	0	0	250	Profilometer	6	125	100	125	90	120	110	X	-
7	0.5455	0.0105	0.0105	0.535	0.556	I.D. Mic.	6	0.540	0.539	0.540	0.541	0.544	0.546	X	-
8	2	0.000	2.000	2	4	Count	6	2.000	2.000	2.000	2.000	2.000	2.000	X	-
9	0.000	0.000	0.000	0	0	Visual	6	0.000	0.000	0.000	0.000	0.000	0.000	X	-
10	0.500	0.063	0.063	0.4375	0.5625	CMM	6	0.484	0.530	0.513	0.471	0.480	0.476	X	-
11	0.125	0.063	0.063	0.0625	0.1875	CMM	6	0.108	0.171	0.102	0.160	0.100	0.078	X	-
12	0.500	0.031	0.031	0.46875	0.53125	CMM	6	0.469	0.499	0.520	0.522	0.496	0.522	X	-
13	1.6875	0.063	0.063	1.625	1.75	CMM	6	1.748	1.660	1.737	1.661	1.625	1.655	X	-
14	2.375	0.031	0.031	2.344	2.406	CALIPER	6	2.366	2.386	2.346	2.365	2.393	2.397	-	X
15	0.750	0.000	0.000	0.75	0.75	CMM	6	0.750	0.750	0.750	0.750	0.750	0.750	X	-
16	1.250	0.063	0.063	1.1875	1.3125	CMM	6	1.280	1.264	1.245	1.280	1.232	1.222	X	-
17	1.125	0.063	0.063	1.0625	1.1875	CMM	6	1.085	1.177	1.119	1.071	1.088	1.106	X	-
18	2.500	0.063	0.063	2.4375	2.5625	CMM	6	2.506	2.505	2.559	2.515	2.552	2.549	X	-
19	2.469	0.000	0.000	2.469	2.469	CMM	6	2.469	2.469	2.469	2.469	2.469	2.469	X	-
20	0.250	0.015	0.015	0.235	0.265	0-1 Mic.	6	0.230	0.264	0.263	0.234	0.257	0.251	-	X
21	0.625	0.063	0.063	0.5625	0.6875	CMM	6	0.632	0.566	0.601	0.568	0.566	0.573	X	-



Element 9. – Dimensional Test Report (Weld Dimensional Report)

A completed Weld Dimensional Results form will have all the items filled out for all the necessary Weld dimensions in the ballooned drawing. It will also determine if the parts pass or fail the inspection.

SUPPLIER NAME:		PART NUMBER: 2584771	
SUPPLIER CODE: 8CGW6		PART NAME: Base, Mounting	
NAME OF INSPECTION FACILITY:		REVISION: E	
DATE: 7/3/2023		11/18/1980	

Supplier required to provide marked up print to identify ALL Weld items.

ITEM	WELD DESCRIPTION	WELD SYMBOL	WPS#	PQR# (IF NOT PRE-QUALIFIED)	Gage	Weld Check Results									OK	NOT OK
						Piece 1			Piece 2			Piece 3				
						WELD WIDTH	WELD LENGTH	WELD PASS/FAIL	WELD WIDTH	WELD LENGTH	WELD PASS/FAIL	WELD WIDTH	WELD LENGTH	WELD PASS/FAIL		
W1	Double Fillet		MBW-WPS-STL-013	Enter if required	Caliper	0.25	2.75	Pass	0.25	2.75	Pass	0.25	2.75	Pass	X	-

Ensure information is filled out correctly. Weld Symbol and Weld Description will come from the bubbled print.

PQR#: Procedure Specification Record WPS#: Welding Procedure Specification

Weld requirements will be reflected in the Weld Code.



Element 10. – Material and Performance Test Results

Documents required for Element 10, Material/Performance Test Results provide evidence that both material composition and part performance meet the engineering requirements before production approval.

Examples of drawing Note callouts:

- Material certifications (chemical, mechanical, physical tests)
- Performance tests (mechanical, environmental, electrical, durability – including CFAT)
- Lab reports confirming conformance to AM General specs
- Armour Traceability
- Standards and methods used for testing

Material and Performance Test Results

AM GENERAL MISSION READY ★ FUTURE DRIVEN		MATERIAL AND PERFORMANCE TEST RESULTS (ATTACH COPY OF ALL LAB TESTING DOCUMENTATION TO ELEMENT 17, RECORDS OF COMPLIANCE)				
SUPPLIER NAME:				PART NUMBER:	2584771	
SUPPLIER CODE:		8CGW6		PART NAME:	Base, Mounting	
NAME OF INSPECTION FACILITY:				REVISION:	E	
DATE:		7/3/2023				
Material / Performance Spec. Number	Specification / Limits	Test Date	QTY Tested	Test Results	OK	NOT OK
WSS-M2P177-C3 Corrosion Cycle	C3 -9 weeks rust > 1mm spread	1/1/2023	6	EXAMPLE 6 parts -9 week cyclical testing; Exhibits >1mm rust	X	



Element 10. – Material and Performance Test Results

All certifications referenced in the Dimensional Results and the Material Performance Test Results matrix. Should include a header box that includes the Drawing Number, Revision, and Characteristic note that it pertains to.

<div style="border: 1px solid red; padding: 5px; display: inline-block;">Print#12615030 Rev A Note 2</div>	Part # <div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block; vertical-align: middle;"></div> <div style="border: 1px solid black; width: 100px; height: 40px; display: inline-block; vertical-align: middle;"></div>
	<div style="display: flex; justify-content: space-between;"><div><small>Element Materials Technology 51229 Century Court Wilcom, MI 48393-2074</small></div><div><small>P: 248 960 4900 T: 888 786 7555 F: 248 960 4970 info@wilcom@element.com</small></div></div>

- Material and Performance Test Results sheet (or equivalent) summarizing all reports/certs must be submitted.
- Material callout must match the material cert.
- All specifications for Plating, Finish, etc denoted on documentation must match those on the dwg.
- Heat#, Lot#, Batch# must link reports and certs
- All reports/certs must be signed dated



Element 10. – Material and Performance Test Results

For part numbers which require Component First Article Testing (CFAT) to be provided with the PPAP, please use the AMG CFAT Workbook (1AF0354) found on the Supplier Resource website. Use the same document for all First Article Testing (FAT) as well.

CFAT Reports are to be submitted in Element 10.

CUI

AM GENERAL
MISSION READY ★ FUTURE DRIVEN

CUI
ATTENTION

Controlled by: PEO CS&CSS JPO JLTVM
Controlled by: AM General, LLC
CUI Category(ies): CTI
Distribution Statement C

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CUI

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11/16/2023
CUI



AM GENERAL
MISSION READY ★ FUTURE DRIVEN

Element 10. – Material and Performance Test Results

Part numbers requiring Armor Traceability must have documentation and certifications submitted in Element 10. This Requirement will be called out in the drawing notes.

Reference:

- AM General Armor Material Requirements



Element 11. – Initial Process Study

The Initial Process Study demonstrates that the manufacturing process is stable and capable of producing parts that consistently meet specifications before full production begins. It focuses mainly on special characteristics (critical, significant, or safety-related) which are designated on the drawing – features requiring a Study are denoted as such on the AM General drawing.

An Initial Process Study (IPS) evaluates:

Process stability → Is the process predictable over time?

Process capability → Can it meet specifications consistently?

The key metrics for the Study are Process Capability Indices:

Cp = Potential capability (spread vs tolerance)

Cpk = Actual capability (centered performance)

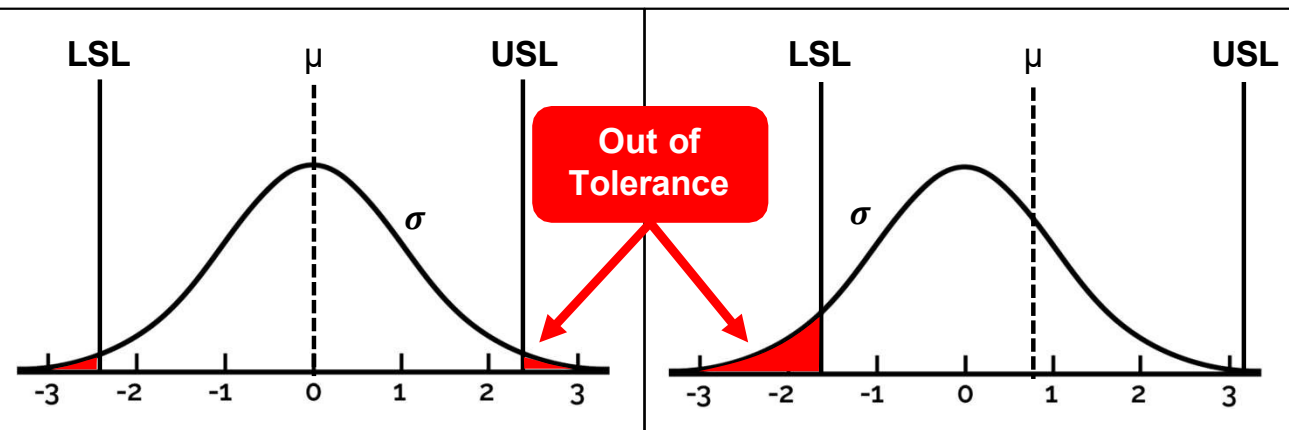
<u>Capability Acceptance Criteria</u>	
Index Value	Interpretation
≥ 1.67	Preferred (critical characteristics)
≥ 1.33	Acceptable
1.00 – 1.33	Needs improvement / action plan
< 1.00	Not capable



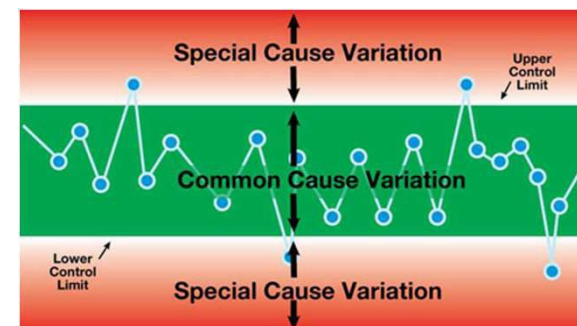
Element 11. – Initial Process Study

SPC charts are provided to prove processes producing critical/significant characteristics have stable variability that meet the organization's standard. **If Process is not stable**, the organization shall identify, evaluate and, wherever possible, eliminate special causes of variation prior to PPAP submission.

	<u>Idealistic</u> <i>Natural Variation</i>	<u>Realistic</u> <i>Process Centering</i>
Capability <i>Under Statistical Process Control</i>	$C_p = \frac{USL - LSL}{6\sigma_{cp}}$	$C^{pk} = \text{Min} \left(\frac{USL - \bar{x}}{3\sigma_{cp}}, \frac{\bar{x} - LSL}{3\sigma_{cp}} \right)$ <p>$\sigma_{cp} \rightarrow \text{sample set}$</p>
Performance <i>New Process</i>	$P_p = \frac{USL - LSL}{6\sigma_{pp}}$	$P_{pk} = \text{Min} \left(\frac{USL - \bar{x}}{3\sigma_{pp}}, \frac{\bar{x} - LSL}{3\sigma_{pp}} \right)$ <p>$\sigma_{pp} \rightarrow \text{entire dataset}$</p>



Statistical Process Control:
The application of statistical methods to monitor and control the quality of a production process



$$\bar{X} = \frac{x_1 + x_2 + x_3 + \dots + x_n}{n}$$

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$



Data Requirements for an Initial Process Study

- Minimum 25 subgroups (preferred)
- Typically:
 - 100+ data points for variable data
- Data must come from:
 - Production conditions
 - Actual equipment, operators, materials

PPAP Submissions should include:

- Capability study report
- Control charts (X-Bar & R or Individual Chart)
- Data collection records
- Summary of Cp/Cpk or Pp/Ppk
- Action plans (if applicable)

NOTE: Ensure the measurement system is validated (MSA first!) before conducting an IPS



Element 12. – Qualified Laboratory Documents

Element 12 – Qualified Laboratory Documents is intended to verify that all inspection and testing used for PPAP are performed by competent, approved laboratories that meet recognized quality standards. It applies to both Internal (supplier-owned) and External (third-party) labs.

This requirement ensures that:

- Test results submitted in PPAP are credible and reliable
- Laboratories performing tests are qualified and controlled

PPAP Submissions should include:

- Proof the lab is qualified to perform required tests:
 - ISO/IEC 17025 accreditation (preferred)
 - Or AM General-approved lab scope
- Laboratory Qualification Evidence:
 - For External Labs:
 - Accreditation certificate (ISO 17025 or equivalent)
 - Scope showing relevant test methods
 - For Internal Labs:
 - Must show:
 - Documented quality system
 - Defined test procedures
 - Qualified personnel
 - Equipment calibration system
 - Record retention



The Appearance Approval Report (AAR) confirms that a part's visual and cosmetic characteristics meet AM General expectations and design requirements

An AAR, is a formal document used to:

- Document evaluation of a part's appearance
- Obtain AM General approval for cosmetic attributes before PPAP approval

Sample parts are evaluated pass/fail based on an approved standard, and/or styling requirement

An AAR is required when the part has:

- Color requirements
- Texture or grain
- Surface finish
- Gloss level
- Fit & visual quality

When required, the AAR must be approved by AM General

The following must be present in the PPAP Package:

- Final sign-off by AM General representative
- Approval date
- Comments or conditions



If an Appearance Approval Report is required, fill out the form with the appropriate appearance measurements. These appearance requirements will be called out in the Design Record.

Appearance Approval Report

SUPPLIER NAME:		PART NUMBER:	
SUPPLIER CODE:		PART NAME:	
NAME OF INSPECTION FACILITY:			REVISION:
DATE:			
Reason For Submission:			
PART SUBMISSION WARRANT ☐		SPECIAL SAMPLE ☐	RE-SUBMISSION ☐
PRE TEXTURE ☐		FIRST PRODUCTION SHIPMENT ☐	ENGINEERING CHANGE ☐
OTHER ☐			

ORGANIZATION SOURCING AND TEXTURE INFORMATION	APPEARANCE EVALUATION	PRE-TEXTURE EVALUATION	AUTHORIZED CUSTOMER REPRESENTATIVE
		CORRECT AND PROCEED	SIGNATURE AND DATE
		CORRECT AND RESUBMIT	
		APPROVED TO ETCH/TOOL/EDM	

COLOR EVALUATION																							
COLOR SUFFIX	TRISTIMULUS DATA					MASTER NUMBER	MASTER DATE	MATERIAL TYPE	MATERIAL SOURCE	HUE				VALUE		CHROMA		GLOSS		METALLIC BRILLIANCE		COLOR SHIPPING SUFFIX	PART DISPOSITION
	DL*	Da*	Db*	DE*	CMC					RED	YEL	GRN	BLU	LIGHT	DARK	GRAY	CLEAN	HIGH	LOW	HIGH	LOW		

COMMENTS:																						
ORGANIZATION:					PHONE NO.					DATE					AUTHORIZED CUSTOMER REPRESENTATIVE SIGNATURE					DATE		
SIGNATURE:																						



Element 14. – Sample Parts

The purpose of Element 14- Sample Part is to require the supplier to submit actual production parts so AM General can verify that the manufacturing process produces conforming product.

These are physical parts made from the production process and used for verification and approval of the PPAP.

Sample parts must be produced using:

- Production tooling
- Production materials
- Actual manufacturing process
- Trained operators

Samples must be:

- Clearly labeled (e.g., “PPAP Sample”)
- Identified by part number, revision, and lot

Fill out all the appropriate information on the Sample Part label and attach it to the sample part. Take pictures of the part and include them in the Sample Part tab.

STOP!

MOVE TO QUALITY HOLD

Instructions for using this label:

This label is to be secured to all four sides of all the dunnage for the **Quality Hold** material. This label must be printed on **YELLOW 8.5X11** paper so that it will be clearly visible.

INSPECTION VERIFICATION REQUIRED	
Part Number	1234567
Part Print Revision	A
Material Revision	A
Supplier Name	ABC Company
Supplier Code	98745
Supplier Inspected By & Date	Quality Inspector, 1/1/2026
Reason (as applicable):	
PTR / PPAP	☐ Check box for PTR Submission
CAR #	
Deviation #	
Special Inspection Required	☐ Check box if special inspection required
Safety Items - Certification Required	☐ Check box if certifications required
First Shipment, New Revision	☐ Check box if first shipment of a new revision
Note:	



Element 15. – Master Sample

Element 15 requires the supplier to retain an approved “Master Sample” as the physical reference standard for the life of the program.

The master sample serves as:

- Visual comparison standard
- Training tool for inspectors/operators
- Benchmark for:
 - Appearance
 - Fit/function
 - Workmanship

The master sample must be:

- Clearly labeled (e.g., “MASTER SAMPLE”)
- Linked to:
 - Part number
 - Revision level
 - Approval date

Element 15 = The “gold standard” part

- Single, approved reference part
- Used for comparison and training
- Must be controlled, labeled, and retained
- Ensures consistency throughout production



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Element 15 = The “gold standard” part

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- Used for comparison and training
- Must be controlled, labeled, and retained
- Ensures consistency throughout production



Element 15. – Master Sample

Example #1 Acceptable Master Sample Photo(s)

AM GENERAL
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PPAP Master Sample "Picture" Documentation

SUPPLIER NAME		PART NUMBER:	12685069
SUPPLIER CODE:	6437784	PART NAME:	SWITCH ASSEMBLY, COMBAT OVERRIDE
		ENGINEERING CHANGE LEVEL	B

Supplier is required to visually document the Master Sample (PPAP Parts):

- 1.) Document how the parts are labeled. To include any date codes, vendor codes, etc.. (if applicable)
- 2.) Document the parts as a whole what they look like in the final state in which they are provided to AM General LLC.

PICTURES OF MASTER SAMPLE LABELING

Part Number (P) 12685069 Country Code: USA Revision: B Container Code:	
Quantity (Q) 98 P.O. Number (K) 5500024934	
Supplier (V) 6437784 Part AMG-12685069-REVB Cage 19207-12685069-REVB MFR-9Y826	
Serial (S) 295080800	

PICTURES OF MASTER SAMPLE PART

--	--

PRINT NAME	SIGNATURE	TITLE	DATE
		PPAP Coordinator	8/1/2024



Element 15. – Master Sample

Example #2 Acceptable Master Sample Photo(s)

AM GENERAL PPAP Master Sample "Picture" Documentation
MISSION READY ★ FUTURE DRIVEN

SUPPLIER NAME		PART NUMBER	12602535L
SUPPLIER CODE	4NCW8	PART NAME	DUCT, HVAC, UPPER, WELDMENT

	ENGINEERING CHANGE LEVEL	C
--	--------------------------	---

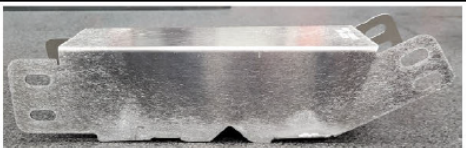
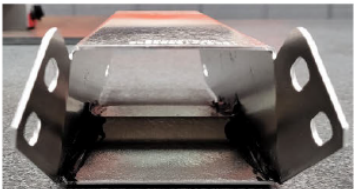
Supplier is required to visually document the Master Sample (PPAP Parts):

- 1.) Document how the parts are labeled. To include any date codes, vendor codes, etc.. (if applicable)
- 2.) Document the parts as a whole what they look like in the final state in which they are provided to AM General LLC.

PICTURES OF MASTER SAMPLE LABELING



PICTURES OF MASTER SAMPLE PART



PRINT NAME	SIGNATURE	TITLE	DATE
		PPAP Coordinator	7/27/2026



Element 16. – Checking Aids

Checking aids are tools used to verify that a part meets requirements when standard measuring tools aren't sufficient.

For Element 16, the supplier must provide evidence that:

- All checking aids used in production or inspection are available and controlled
- The aids are properly calibrated and maintained
- There is documentation showing:
 - Design (drawings or sketches) of the checking aids and that all aspects of the checking aid agree with the part's dimensional requirements.
 - Identification numbers or records
 - Calibration status

Checking aids are critical because they:

- Ensure consistent measurement accuracy
- Help maintain product quality and compliance
- Support reliable inspection results for PPAP approval

Examples of checking aids:

- Specialized Go/No-Go gauges (aka Functional Gauges)
- Custom fixtures
 - Devices designed specifically for a part.
- Templates for dimensional checks
- Special inspection jigs
- Coordinate measuring fixtures



Element 16. – Checking Aids

Example #1 – Checking Aid

AM GENERAL
MISSION READY ★ FUTURE DRIVEN

Checking Aids

SUPPLIER NAME		PART NUMBER	1905
SUPPLIER CODE	110561	PART NAME	SHAFT, DIFFERENTIAL STUD, MACHINING
TOOL/Fixture NUMBER		ENGINEERING CHANGE LEVEL	0
DATE	2024-06-14		

Supplier is required to identify and document checking aids with photos in PPAP notebook

PHOTO OF CHECKING AIDS

OP10
FORGING DIE : 2000001508

15011001 SHAFT DIFFERENTIAL STUD MACHINING	REGISTRATION DATE	2024-06-10
TOOL ID	PART NAME	FORGING DIE
PART NAME	MODEL	ALT-10
TOOL NUMBER	MANUFACTURE CO.	TE-00 LTD
TOOL HEIGHT	PROPERTY OF AMG CORPORATION	
TOOL WIDTH	EQUIPMENT NUMBER	2000001508
TOOL DEPTH	AMG PART NUMBER	000000

TOP, BOTTOM

SHUT

TRIMMING

OP40
Machine center jig : 2000001509

OP 50
GEAR HOBBING CUTTER : 2000001500

OP 50
GEAR HOBBING JIG : 2000001501

PRINT NAME	SIGNATURE	TITLE	DATE
		General Manager	2024-06-14



Element 16. – Checking Aids

Example #2 – Checking Aid

Checking Aids

SUPPLIER NAME		[REDACTED]		PART NUMBER: 12601939																	
SUPPLIER CODE		628181		PART NAME: CLUTCH COLLAR , 3 POSITION																	
TOOL / FIXTURE NUMBER:		300000211 etc		ENGINEERING CHANGE LEVEL																	
DATE:		2024-05-09		A																	
St <table border="1"><tr><td>12601939</td><td>CLUTCH COLLAR, 3 POSITION</td><td>[REDACTED]</td><td>469000015</td><td>04/16/2024</td><td>Net 60</td><td>470000042</td><td>03/11/2024</td><td>03/14/2024</td><td>Net 60</td><td>[REDACTED]</td><td>OP 10 Casting Mold : 2000001413 OP 20 Hobbing Tool : 2000001414</td></tr></table>						12601939	CLUTCH COLLAR, 3 POSITION	[REDACTED]	469000015	04/16/2024	Net 60	470000042	03/11/2024	03/14/2024	Net 60	[REDACTED]	OP 10 Casting Mold : 2000001413 OP 20 Hobbing Tool : 2000001414				
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TOOL SUPPLIER ID	628181																				

PRINT NAME	SIGNATURE	TITLE	DATE
[REDACTED]	[REDACTED]	Managing Director	2024-05-09



Element 17. – Records of Compliance with Customer-Specific Requirements (CSRs)

Element 17 requires documented proof that the supplier has identified, understood, and complied with all AM General-specific requirements (CSRs) related to the part or program.

These are additional requirements beyond standard drawings/specs, defined by the AM General, such as:

- Special engineering standards
- AM General-specific quality requirements
- Unique testing or validation requirements
- Packaging or labeling requirements

All sub-components must have full PPAPs submitted in Element 17.

Each PN must have its own PPAP Package (all necessary Elements including the Cover Sheet and PSW)

File name format:

17. Top Level PN_Rev Subcomponent PN_Rev PPAP

17. 9876543_A sub 1234567_B PPAP



Element 18. – Part Submission Warrant (PSW)

Element 18 is the Part Submission Warrant (PSW) — the official document that summarizes the entire PPAP submission and formally declares that:

- The part meets all AM General requirements
- All requested PPAP elements have been completed and are available

It is essentially the final approval document submitted to AM General.

The PSW is a standardized form that contains key information such as:

General Information:

- Supplier name and address
- Part number and part name
- Engineering change level / drawing revision
- Customer name

Compliance Declaration:

- Confirmation that all tests meet requirements
- Material and performance test results completed
- Dimensional results completed
- Capability requirements met (or explained if not)

Approval Section:

- Supplier authorized signature
- Customer approval status:
 - Approved
 - Interim approval
 - Rejected

Submission Details

- Submission level (Level 1–5)
- Reason for submission (new part, engineering change, tooling change, etc.)
- Weight of the part

Special Items:

- Any deviations or waivers
- Explanation of non-conformances (if applicable)

- The PSW is the official submission and sign-off document
- It acts as a summary of the entire PPAP package
- Without a properly completed PSW, the PPAP is not valid



Element 18. – Part Submission Warrant (PSW)

Interim PPAP approvals may be granted to authorize a supplier permission to ship for a limited period or in a limited quantity. Interim Approval will only be granted when the organization has both:

1. Clearly defined the non-compliances preventing approval
2. Prepared an action plan agreed upon by AM General

Interim approvals require action plans in place to meet full production PPAP approval and must be agreed to by AMG Supplier Quality. A supplier must submit both a Part Submission Warrant (PSW) and an Interim Recovery Worksheet for materials in need of Interim approval.

All interim approvals require action plans in place to achieve full PPAP approval within 120 days.

PPAP Element	Requirement	Interim Level 3	Full Level 3
1	Design Record (Ballooned Print)	X	X
2	Engineering Change Documents, if any	X	X
3	Customer Engineering Approval, if required	X	X
4	Design FMEA		X
5	Process Flow Diagram		X
6	Process FMEA		X
7	Control Plan		X
8	Measurement System Analysis Studies		X
9	Dimensional Results	X	X
10	Material / Performance Test Results	X May be accepted without CFAT report	X
11	Initial Process Studies		X
12	Qualified Laboratory Documentation	X	X
13	Appearance Approval Report (AAR), if applicable		X
14	Sample Product	X	X
15	Master Sample	X	X
16	Checking Aids	X	X
17	Records of Compliance w/ Customer-Specific Requirements		X
	Additional Requirements (examples, but not limited to)		
	Sub-Tier PSW's from subcomponents		
	Packaging & Handling (Instructions, Picture of final packaging, etc.)		
18	ISO9000/TS16949 Certs (copy)		
	Operator Instructions		
18	Part Submission Warrant (PSW)	X	X



Element 18. – Part Submission Warrant (PSW)

AM General PSW

All boxes must have a response. If a response is not applicable, write N/A.

AM GENERAL MISSION READY ★ FUTURE DRIVEN		Part Submission Warrant	
Part Name	Bracket, Strap, Rifle, LH	Part Number	12602383
Drawing Number	12602383	Eng. Dwg. Change Level	C
Purchase Order No.	0000029126	Tool Order No.	N/A
Scheduling Agreement	N/A	Change Level / Dated	N/A
Checking Aid / Test Equip. No.	N/A	Weight (kg)	0.123 kg.
Additional Engineering Changes	N/A	Dated	N/A
Do Technical Requirements contain an IPA/IPF/FAT/QAP? ☐ Yes ☒ No ☐ N/A			
Supplier Manufacturing Information		Customer Information	
Supplier Name	Supplier Code	Customer Name / Division	
		Mishawaka	
Street Address		Buyer	
		Pati Tucker	
City	State	Zip	Country
		53024	USA
Application		JLTVM A2	
Does this part contain any restricted or reportable substances? ☐ Yes ☒ No ☐ N/A			
Are plastic parts identified with appropriate ISO marking codes? ☐ Yes ☐ No ☒ N/A			
REASON FOR SUBMISSION (check at least one)			
☒ Initial Submission	N/A	☐ Change to Optional Construction or Material	
☐ Engineering Change(s)	N/A	☐ Sub-Supplier or Material Source Change	
☐ Tooling: Transfer, Replacement, Refurbishment, Additional	N/A	☐ Change in Part Processing	
☐ Correction of Discrepancy	N/A	☐ Parts Produced at Additional Location	
☐ Tooling Inactive > than 1 year	N/A	☐ Other- please specify below	
☐ Certificate of Conformance:	LOT # N/A	QTY	6
Submission Level (check one)			
☐ Level 1 - Warrant only (and for designated appearance items, an Appearance Approval Report) submitted to customer.			
☐ Level 2 - Warrant with product samples and limited supporting data submitted to customer.			
☒ Level 3 - Warrant with product samples and complete supporting data submitted to customer.			
☐ Level 4 - Warrant and other requirements as defined by customer.			
☐ Level 5 - Warrant with product samples and complete supporting data reviewed at supplier's manufacturing location.			
☐ Level P - Warrant and other Prototype requirements as defined by customer.			
Submission Results			
The Results For:	☒ dimensional measurements	☒ material and functional tests	☐ appearance criteria
These results meet all design requirements:	☒ Yes	☐ No	☒ statistical process package
(if No- Explanation Required)			
Declaration			
I affirm that the samples represented by this warrant are representative of our parts which were made by a process that meets all AM General specific requirements, drawings, specifications and meet all PPAP 4th Edition Requirements. I also certify that documented evidence of such compliance is on file and available for review.			
I further affirm these samples are made from specified materials on regular production tooling with no operations other than the regular production process produced at a rate of 176 pcs/hr. I have clearly written any exceptions from this declaration below.			
Explanation / Comments			
N/A			
List Molds / Cavities / Production Processes:			
Ship to Vendor - Receive From Vendor - Ship to Customer			
Organization Authorized Signature			
Date 7/9/2026			
Print Name			
Phone No.			
Fax N/A			
Title Quality Technician II			
Email			
For Customer Use Only			
PPAP Warrant Disposition:			
☒ Approved ☐ Rejected			
Supplier Quality Engineer Signature			
Date 7/9/2026			
Print Name			
Comment:			

Per JPO, QTY must be listed as 6 (QTY of PPAP samples)



Element 18. – Part Submission Warrant (PSW)

AM General Interim Approval Worksheet

Supplier Name		Part Name	
Supplier Code		Part Number	
Resubmission Date		Revision	Dated
Interim Expiration Date		Submission Level	
Application			

REASON FOR REQUEST **NOTE-Use ALT+Enter to go to a new line in the box below. Just using the Enter key will exit the box.**

ISSUE	Action Plan	Completion Date
(DIM, APP, Sub-Supplier, Process, Tooling, Capacity, Start-up, ...)		

WHERE APPLICABLE, ARE INTERIM ISSUES ADDRESSED ON THE EARLY PRODUCTION PRE-LAUNCH CONTROL PLAN? (e.g. 100% inspection, rework, temporary operations) Please explain below.

Organization Authorized Signature		Date	
Print Name		Phone No	
Title		Email	

For Customer Use Only

Interim Worksheet Disposition: ☐ Approved ☐ Rejected

Supplier Quality Engineer Signature:

Print Name:

Comment:



Lessons Learned

The following examples are commonly occurring issues found during the PPAP Reviews:

Element	Issue
Control Plan	Characteristics, tools, gages not listed
Dimensional Reports	Wrong tolerances listed for the note
Material Test Reports	Material Certifications not directly linked to characteristics on the Drawing
Master Sample Part	Part labels missing Cage code requirement on the drawing
Part Submission Warrant	Fill in N/A on empty boxes, include quantity of 6 for PPAP package
PFD/PFMEA/CPLAN	Misalignment between documents