APQP → PPAP

APQP

A Perspective on 8-D and PFMEA and Control Plan During APQP and Afterwards

What is APQP?

- APQP is a "defined" process for a product development system for Ford, Daimler-Chrysler, GM and their suppliers.
- APQP is an attempt to provide a common path and synchronization of product development activities.
- APQP is an attempt to ensure communication both within a company and between a company and its customer

Benefits of APQP

- Ensures early planning takes place.
- Directs resources to the customer.
- Identifies required changes early in the process.
- Provides quality product on time and at lowest cost.
- Enables cross-functional inputs and outputs.
- Addresses potential problems early

Customer and Supplier Involvement

- Customer may initiate planning process.
- Supplier has the obligation to establish cross-functional team to manage process.
- Supplier should expect the same performance from their subcontractors.

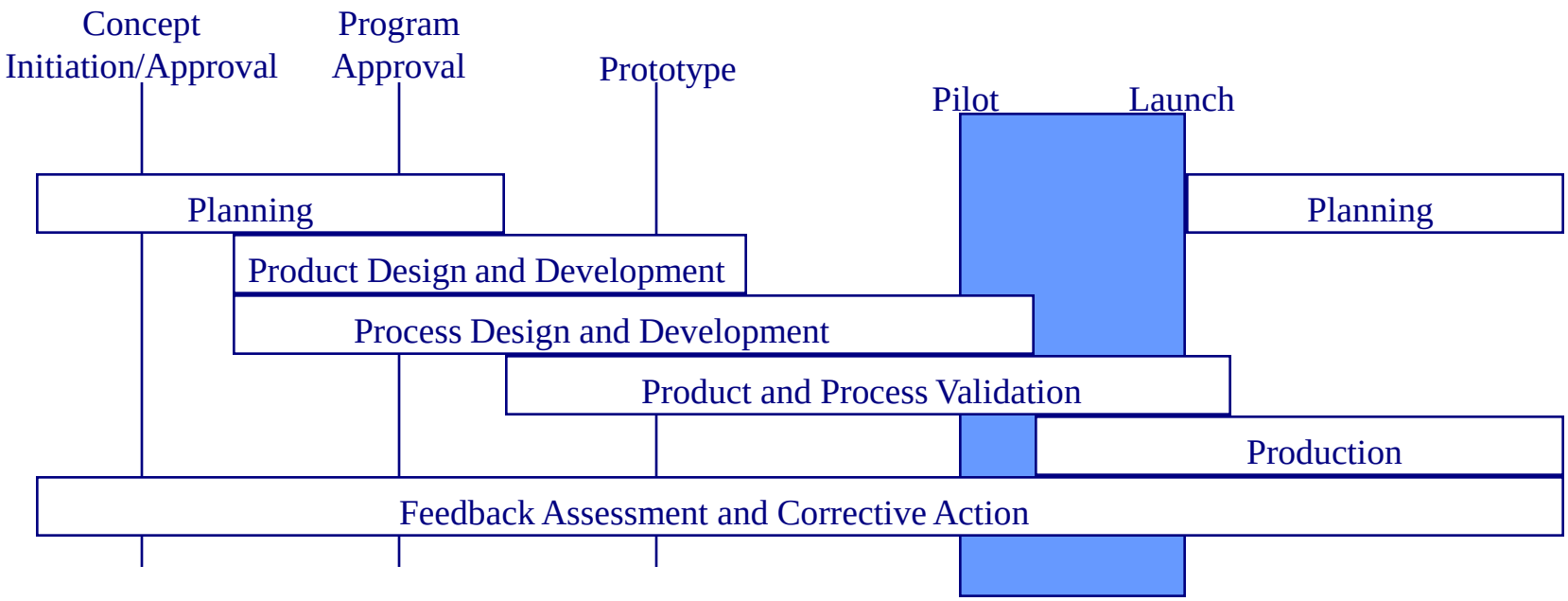
Determine Customer Requirements

- Print
- Purchase Request or Request for Quotation.
- Statement of Work (SOW)
- Customer visits and discussions.
- Product checklists.

Training

- Customer needs and expectations.
- Working as a team.
- Requirements of APQP
- FMEA
- APQP
- PPAP

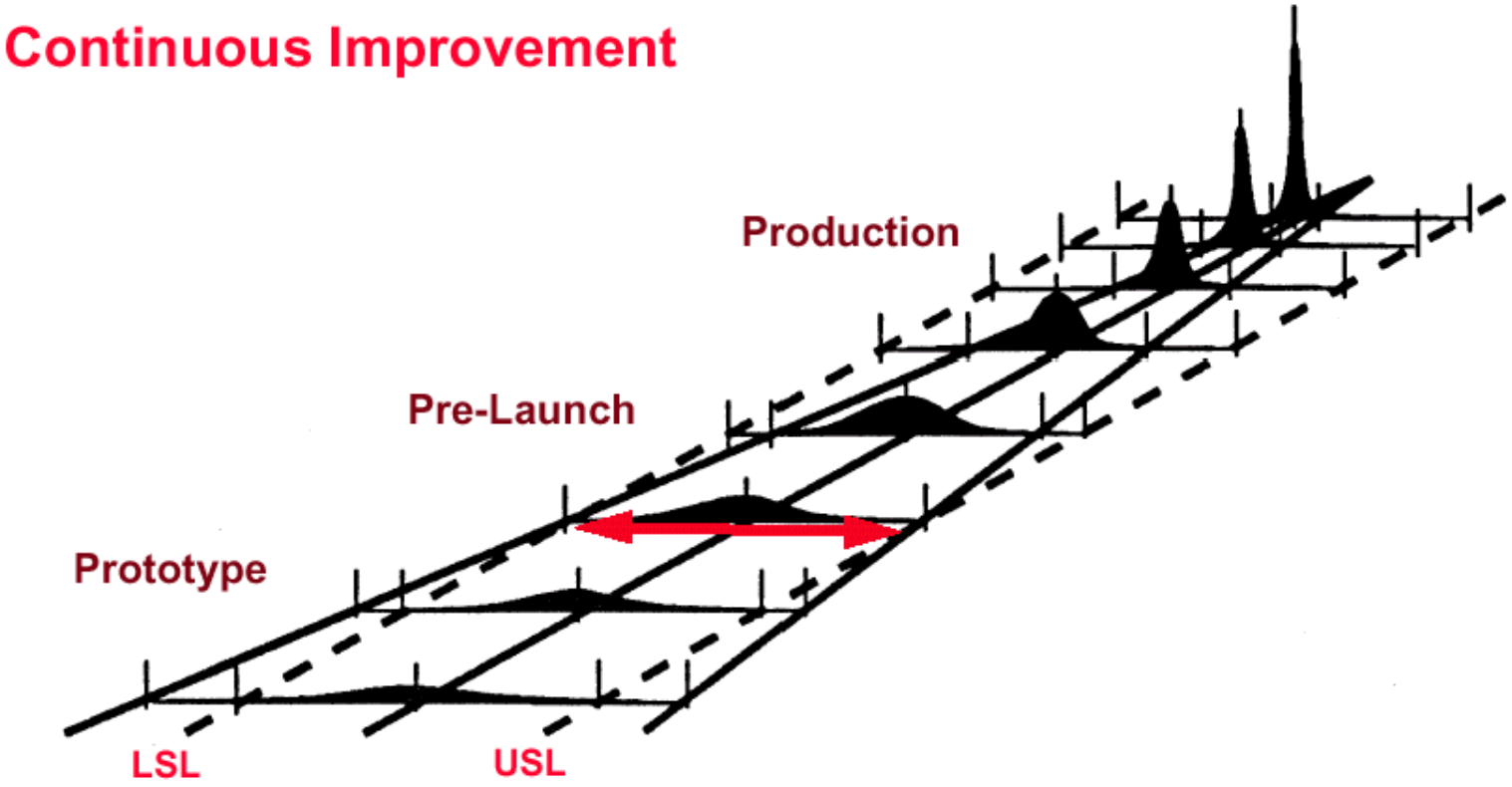
APQP Five Phase Process



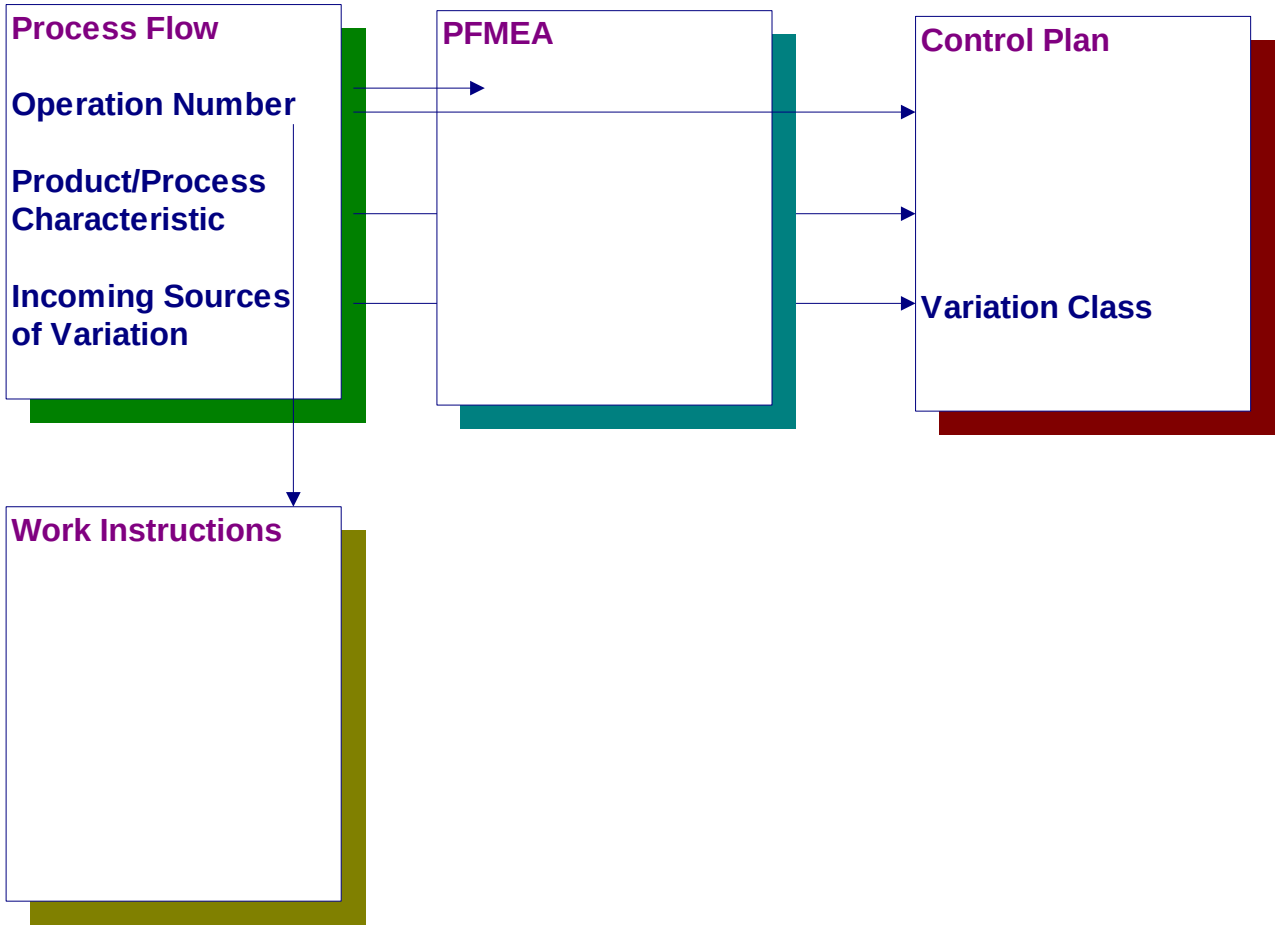
Links Between the Tools

Contract Review Program Plan	Determine Customer Expectations and Plan for Quality	Phase I
DFMEA	Identify Key Characteristics	Phase II
Team Feasibility Commitment	Determine Risk and Feasibility	Phase II
Produce Process Flow Diagrams	Associate Characteristics with Process Steps and Identify Key Characteristics	Phase III
Conduct Process FMEA	Expose Sources of Variation and Finalize Key Characteristics	Phase III
Develop Control Plan	Determine Methods to Improve Process and Control Variation	Phase III
Work Instruction Development	Implement Control Plan and Standardize the Process	Phase III
Product and Process Validation	Ensure Customer Expectations are Met	Phase IV
Ensure Continuous Improvement	Exercise Management Oversight	Phase V

The Target and The Goal



Link Between the Documents



Process Flow Diagrams

- Updated after production trial run.
- Need to indicate special characteristics generated at each step.
- Completed Along with Control Plan (APQP Process).
- Generally contains same information as process traveler.

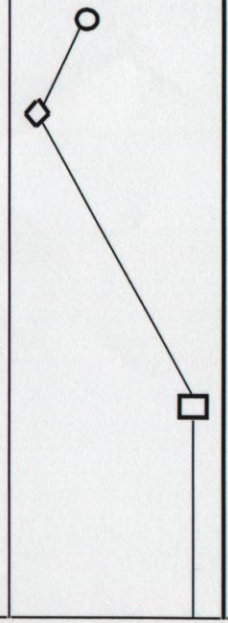
Process Flow Diagram Example

Process Flow Diagram

Part Number:
Part Description:
Prepared By:

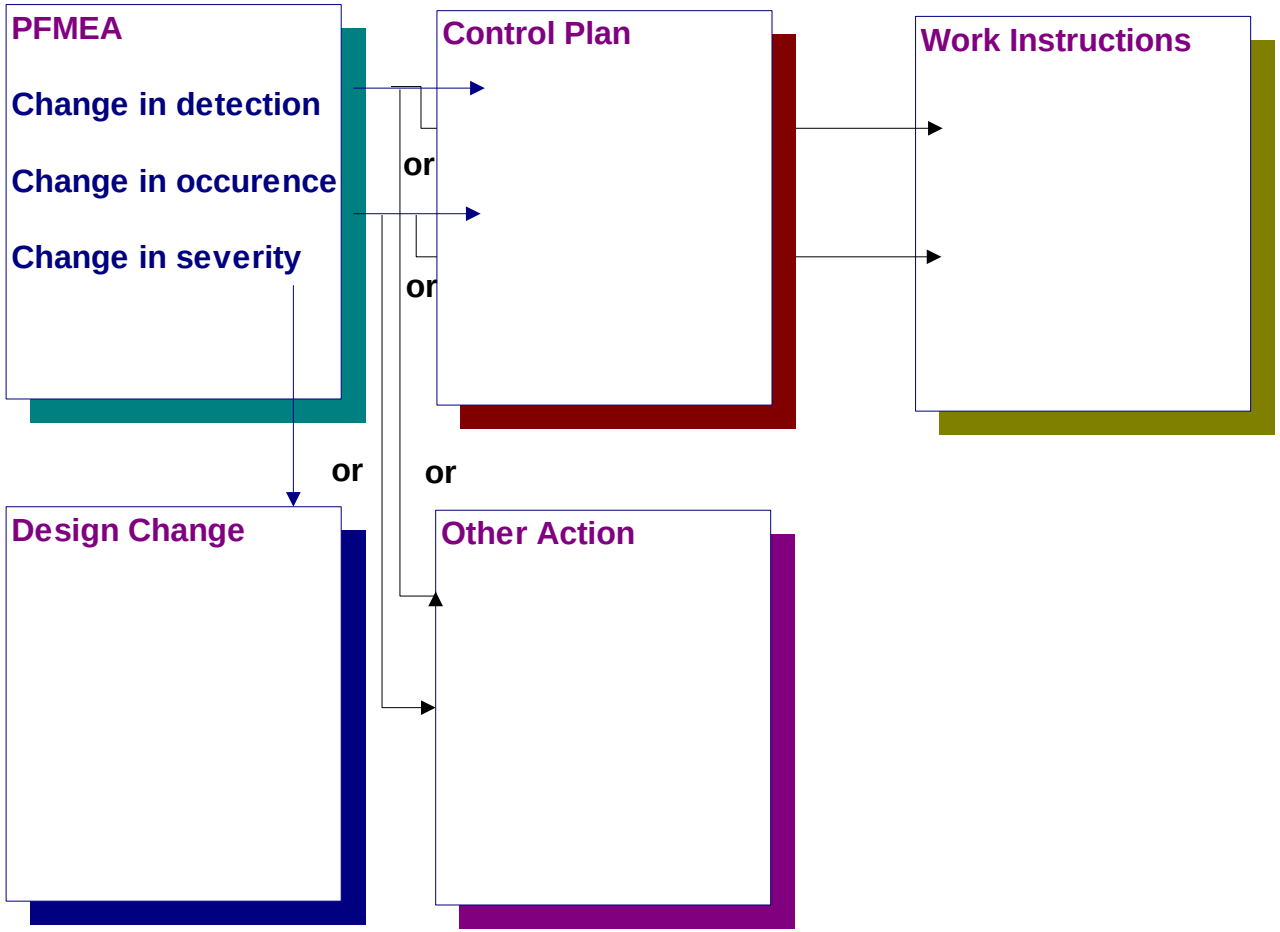
Date: 4/5/93
Rev. : C

Approved By:
QA Manager
Operations Manager
Senior Advisor
QA Engineer



Step	Operation Description	Item	#Key Product Characteristic	Item #	Key Control Characteristic
1	Move "OK" Vinyl Material From Storage Area and Load Into Press.	1.0	Material Specs	1.0	Material Certification Tag
2	Auto Injection Mold Cover In Tool #	2.0	Tearstrip In Cover	2.1 2.2	Tool Setup Machine Setup
		3.0	Hole Diameter In Cover	2.1 2.2	Tool Setup Machine Setup
		4.0	Flange Thickness In Cover	2.1 2.2	Tool Setup Machine Setup
		5.0	Pressure Control Protrusions Height	2.1 2.2	Tool Setup Machine Setup
3	Visually Inspect Cover	6.0	Pressure Control Protrusions Filled Out	2.1 2.2	Tool Setup Machine Setup
		7.0	Cover - Flash Free	2.1 2.2	Tool Setup Machine Setup
		8.0	Cover Filled Out	2.1 2.2	Tool Setup Machine Setup
		9.0	Free Of Foreign Material	2.2	Machine Setup

APQP Links to PFMEA



Process FMEA

- Must follow flow of the process flow diagram.
- Must include ALL process special characteristics (as a minimum).

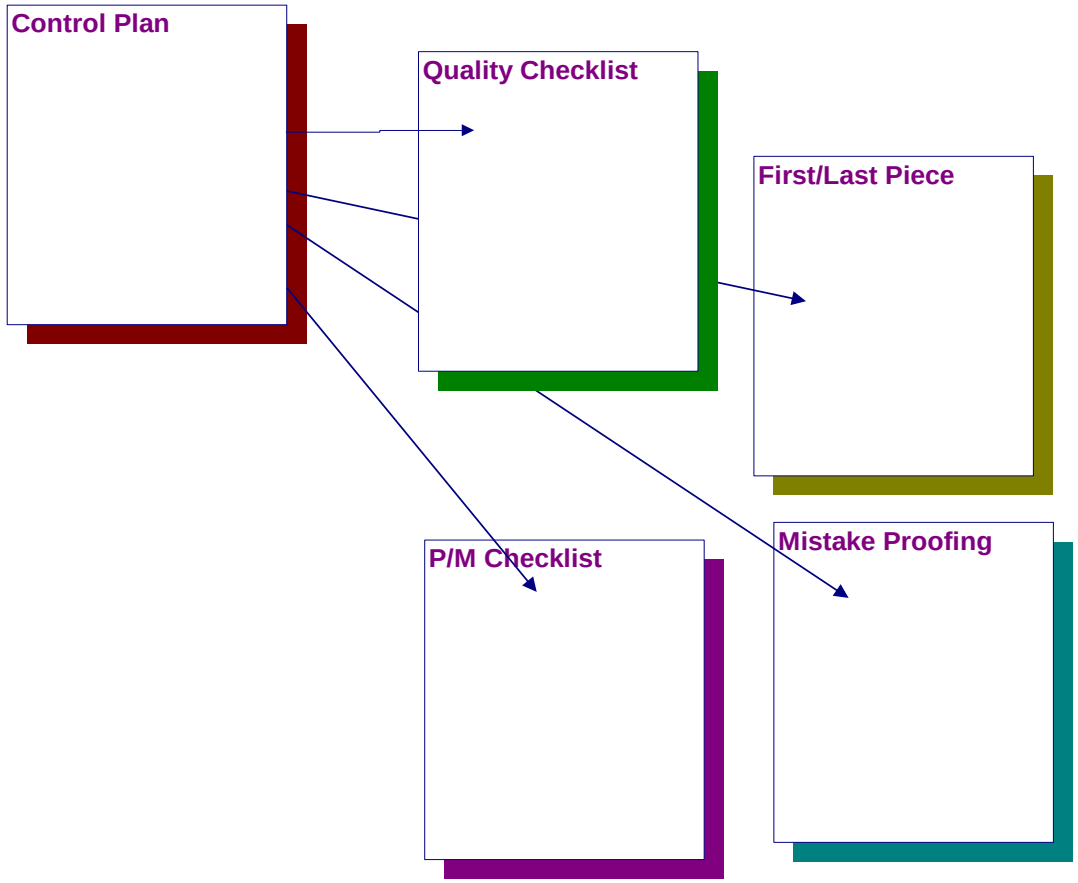
How a PFMEA Works

- Where does the data for the PFMEA come from?
- What types of people are a part of the PFMEA team?
- What types of activities should we spend a lot of time on?

PFMEAs/Control Plans and 8-Ds During APQP

- PFMEAs should be driven by real data, including 8-Ds (internal and external), warranty and returned part analysis
- PFMEAs should be completed by process experts and should be a driver of the control plans and work instructions
- Work instructions (Post control log, process parameter logs, preventive maintenance, etc.) implement the control plan in the process
- When there is a quality problem there is an opportunity to improve the control plan and the work instructions

APQP Links to Control Plan



Control Plans

- Includes product and process special characteristics.
- Includes SPC requirements.
- Follows flow of process flow chart and PFMEA.
- May require customer approval.

Types of Control Plans

- Prototype build control plan(s)
- Pre-launch control plan
- Production control plan

Prototype Build Control Plan

- A description of the dimensional measurements.
- Material tests
  - Functional tests that will occur during prototype build.

Pre-launch Control Plan

- Description of dimensional measurements, materials, and functional tests.
- Adds additional product and process controls.
- Purpose is to contain potential nonconformities utilizing:
  - More frequent inspections and/or tests.
  - More in-process and finsl inspection and/or check points.
  - Statistical evaluations.
  - Increased audits.

Production Control Plan

- Up-date pre-launch control plan.
- Add:
  - Sampling plans
  - Control method
  - SPC, inspection, attribute data and mistake proofing.
  - Reaction plan
- Nonconformances clearly identified, quarantined and disposition made.
- Requires customer approval unless otherwise specified.

Control Plan Use

- Initial: To document and communicate initial process control.
- Next: Guidance in controlling processes and to ensure product quality.
- Last A living document reflecting current methods of control and measurement systems used.

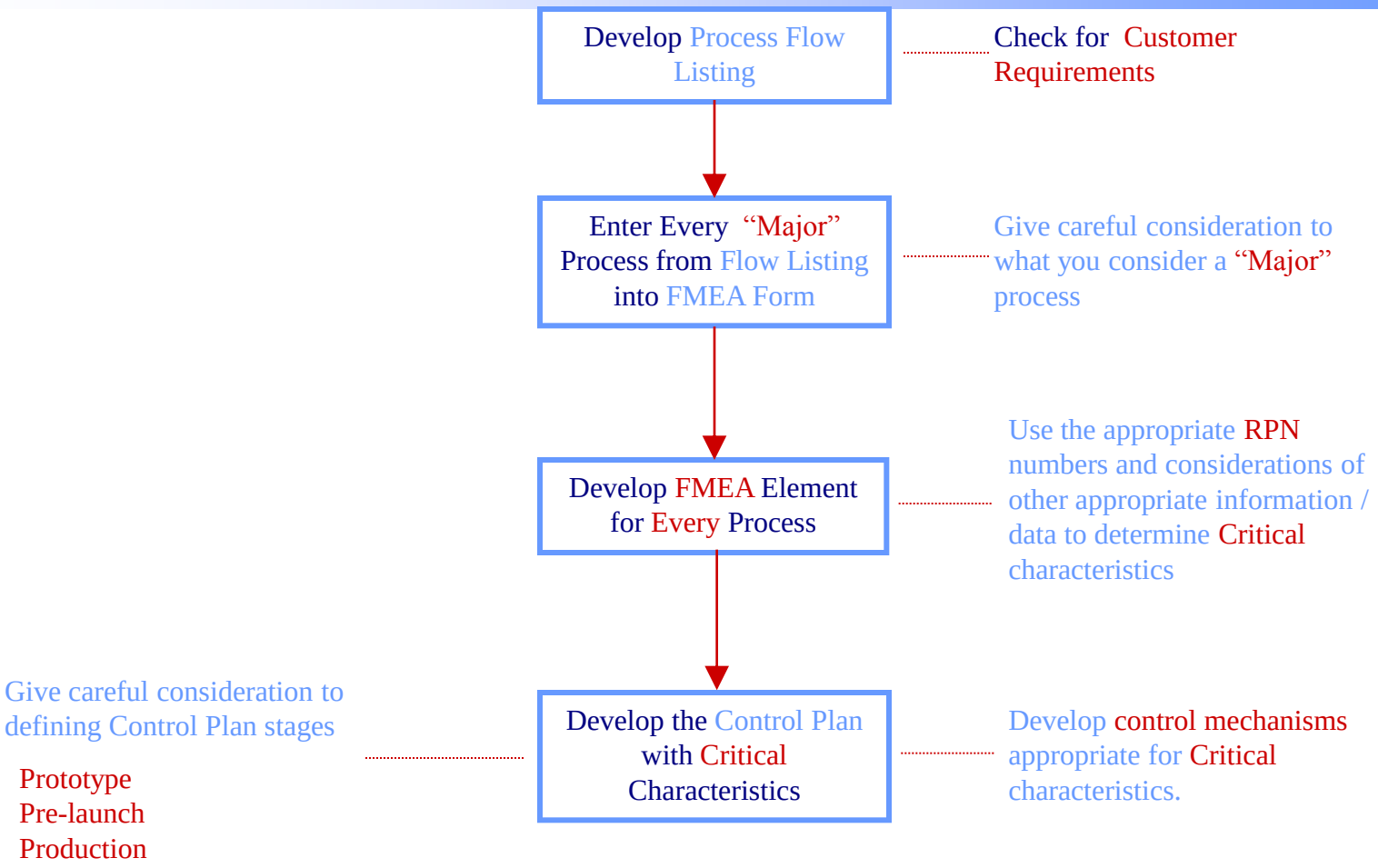
Multiple Molds, Tools, Dies and Patterns

- Complete dimensional layer required from one part from each cavity as a minimum.
- Supplier must identify specific cavity for each part submitted.

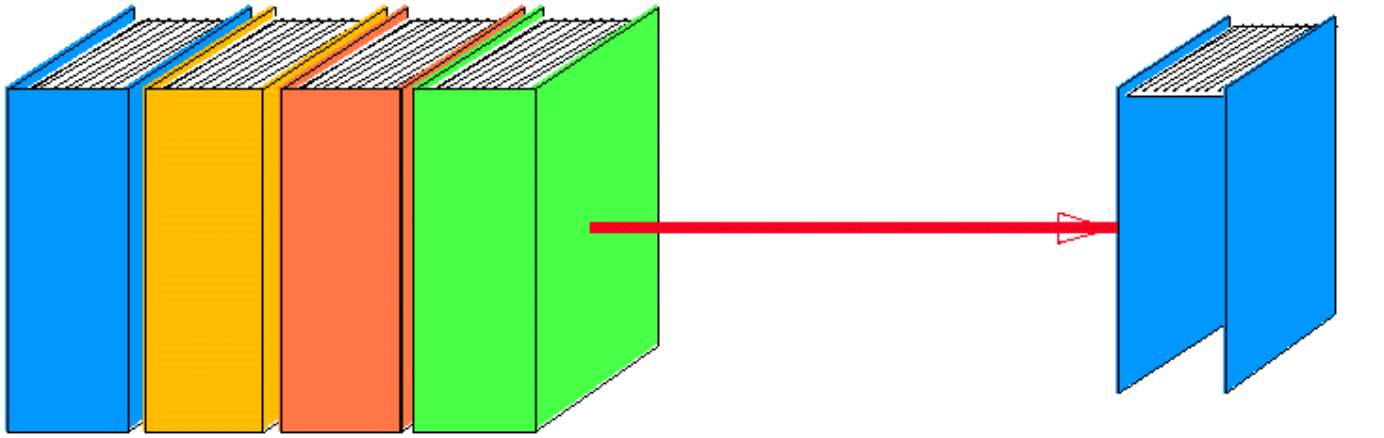
Part Submission Status

- Never ship production parts before receiving customer approval.
- Supplier must ensure that future production continues to meet customer requirements.
- No production parts can be shipped until approval is received.

Automotive Documentation Development



PPAP



The End Product of APQP!

Production Part Approval Process

- Provides Proof of Capability
- Made up of Documents from APQP

PPAP Purpose

- Ensure that customer design record and specification requirements are understood.
- Ensure that the process has the potential for producing product meeting those requirements

PPAP Scope

- Production parts - generally 300 pieces.
- Includes internal and external sources for information.
- Submission required prior to first production shipment.

Base Documentation

- Critical characteristics matrix.
- Process flow diagram.
- Design FMEA (supplied by customer).
- Process FMEA.
- Control plan.

General

- Supplier is responsible for meeting all applicable specifications.
- Do not submit parts and documentation results if they are outside specification.
- Take corrective action to meet all design record requirements.
- Contact customer if unable to meet all requirements
- Comply with customer developed material specifications and/or approved source list.

General

- Suppliers are required to complete and maintain copies of all documentation identified in “requirements for approval” regardless of submission level.
- Records of PPAP are to be retained for the life of the part plus one calendar year.

Elements of a PPAP

- Part submission warrant
- Subcontractor warrants
- Design record (customer/design documentation)
- Sample/Master sample (Master sample retained by supplier)
- Dimensional analysis
- Test data
- Flow diagram
- Control plan
- PFMEA
- Measurement Systems Analysis (GR&R)
- Capability studies

Parts Submission Warrant

- Upon satisfactory completion of all required measurements and tests, enter all required information on the warrant.
- A separate is required for each part number.
- Responsible supplier official verifies
  - Measurements and tests conform to customer requirements
  - Required documentation is available for proper submission level.
  - Signs warrant and provided date, title and telephone number.

Part Submission Warrant

Customer Traceability # tracibility number

Part Name: part name | Part Number: part1

Safety or Government Regulated Item: ☑ Yes ☐ No | Engineering Drawing Change Level And Date: change level | Dated: 01/03/99

Additional Engineering Changes: additional enginnering changes incorporated in | Dated: 1/3/99

Shown on Drawing Number: drawing number | Purchase Order Number: purchase order no | Part Weigh: 76.897kg

Checking Aid Number: checking aid number | Engineering Change Level: level | Dated: 1/4/99

Supplier Manufacturing Information

supplier name | 001 supplier
Supplier

001 street add
supplier city,state ,48089
Supplier Manufacturing Address

Submission Information

☑ Dimensional ☐ Materials/Functional ☐ Appearance

Customer Name/Division: customer

Buyer Name and Buyer Code: buyer name and code

Application: MPACT

Note: Does this part contain any restricted or reportable substances. ☑ Yes ☐ No

Are plastic parts identified with appropriate ISO marking codes. ☑ Yes ☐ No

Reason for Submission

- ☑ Initial Submission
- ☑ Engineering Change(s)
- ☑ Tooling: Transfer, Replacement, Refurbishment, or additional
- ☑ Correction of Discrepancy
- ☑ Tooling Inactive > than 1 year
- ☑ Change to Optional Construction Or Material
- ☑ Sub-supplier or Material Source Change
- ☑ Change in Part Processing
- ☑ Parts Produced at Additional Location
- ☑ Other - please specify

other

Requested Submission Level

- ☑ 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.

Submission Results

The results for ☐ dimensional measurements ☑ material and functional tests ☑ acceptance criteria ☑ statistical process packag

These results meet all drawing and specification requirements: ☐ Yes ☑ No If 'No' - Explanation required below

Mold / Cavity / Production Process: explanation1

Declaration

I hereby affirm that the samples represented by this warrant are representative of our parts, have been made to the applicable Production Part /

I further warrant these samples were produced at the production rate of 98

/ 8 hours. I have noted any deviations from this declaration below

Explanations/Comments: comments xxx

Print Name: name | Title: title | Phone No.: xxx-xxx-xxxx | FAX No.: xxx-xxx-xxxx

Supplier Authorized Signature _____ Date _____

FOR CUSTOMER USE ONLY

Part Warrant Disposition: ☐ Approved ☐ Rejected ☐ Other

Part Functional Approval: ☐ Approved ☐ Waived

Part Disposition

Customer Name _____ Customer Signature _____ Date _____

July 1999 **CFG-1001**

The original copy of this document shall remain at the suppliers location while the part is active (See Glossary).

Optional: Customer Tracking Number: _____

Part Weight

- Determine part weight without packaging or shipping material.
- Report weight in kilograms to three decimal places.
- Weight determination
  - Weigh 10 parts randomly selected and report the average weight.
  - For parts less than 0.100 kilogram, weigh 10 parts together and report the average weight.

Master Sample

- Retain same as PPAP, or
- Until new master sample is produced for the purpose of a customer approval.
- Identify master sample by:
  - Part number
  - Drawing level or revision level
  - Customer approval date

Preliminary Process Capability Studies

- Characteristics identified in the control plan.
- Usually 100 pieces minimum.
- May be 30 if run is less.
- Ppk $\geq$ 1.67 is acceptable unless otherwise specified.
- Ppk $\leq$ 1.67 requires action plan unless otherwise specified.

Production Trial Run

- Production tooling, equipment, environment, facilities and cycle time.
- Process Instructions and control plans.
- Minimum quantity set by the customer.
- Generally 300 parts.

Production Trial Run Product Used For

- Preliminary process capability studies.
- MSA (if not completed earlier)
- Final Feasibility.
- Process review.
- Production Validation Testing.
- PPAP
- Packaging evaluation
- First time capability
- Quality planning sign-off

Measurement System Analysis (MSA)

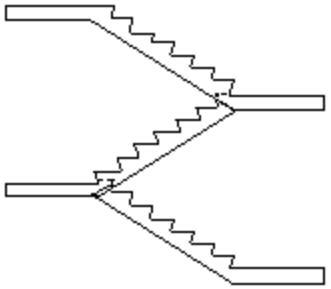
- Complete studies as defined in the MSA plan.
- Minimum are those identified in the control plan.
- Subjected to evaluation prior to or during production trial.

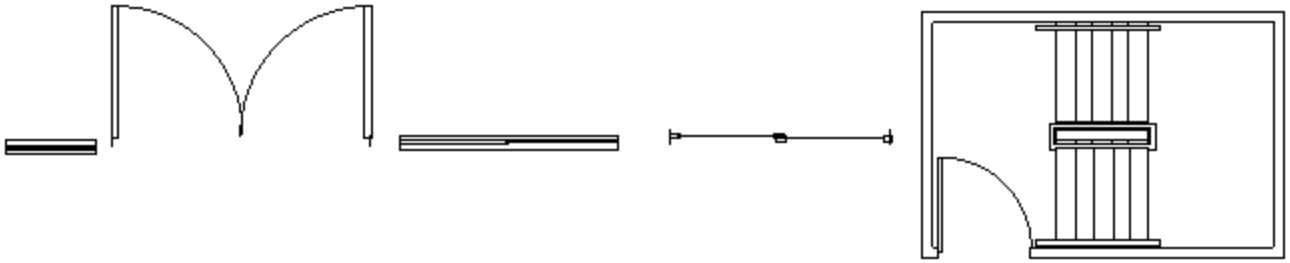
Packaging Evaluation

- Packaging must conform to specifications developed by customer or supplier.
- Assess protection of product.
- Customer specified packaging must be evaluated by team.
- Pilot or production trial run parts usually used in evaluation.

Floor Plan Layout

- Determine acceptability of inspection and test points.
- Control chart locations
- Visual aides
- Interim repair stations
- Nonconforming material storage
- Keyed to material flow and control plan

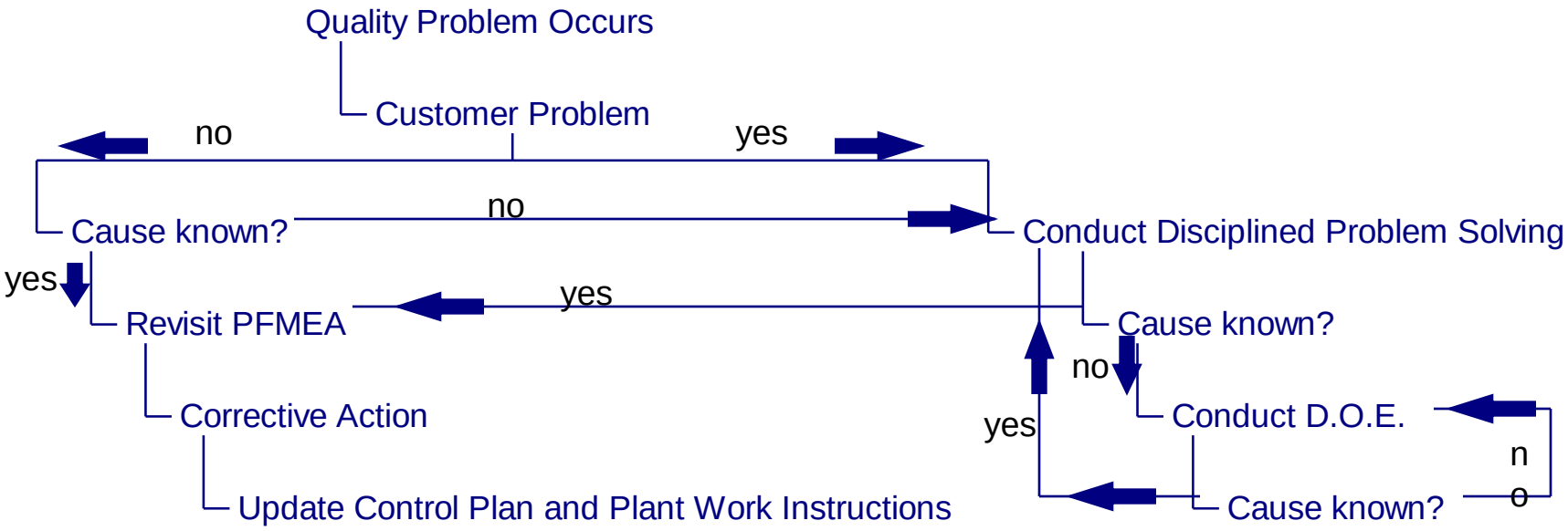




Review and Sign-Off

- Process instructions in place and **followed!**
- Flow charts in place and **followed!**
- GR&R plans exist and are followed
- Publish final feasibility report
- Obtain formal sign-off
- Schedule and conduct management review
- Obtain management commitment to assist in open issues

Quality Problems



Cause unknown

- Use PFMEA

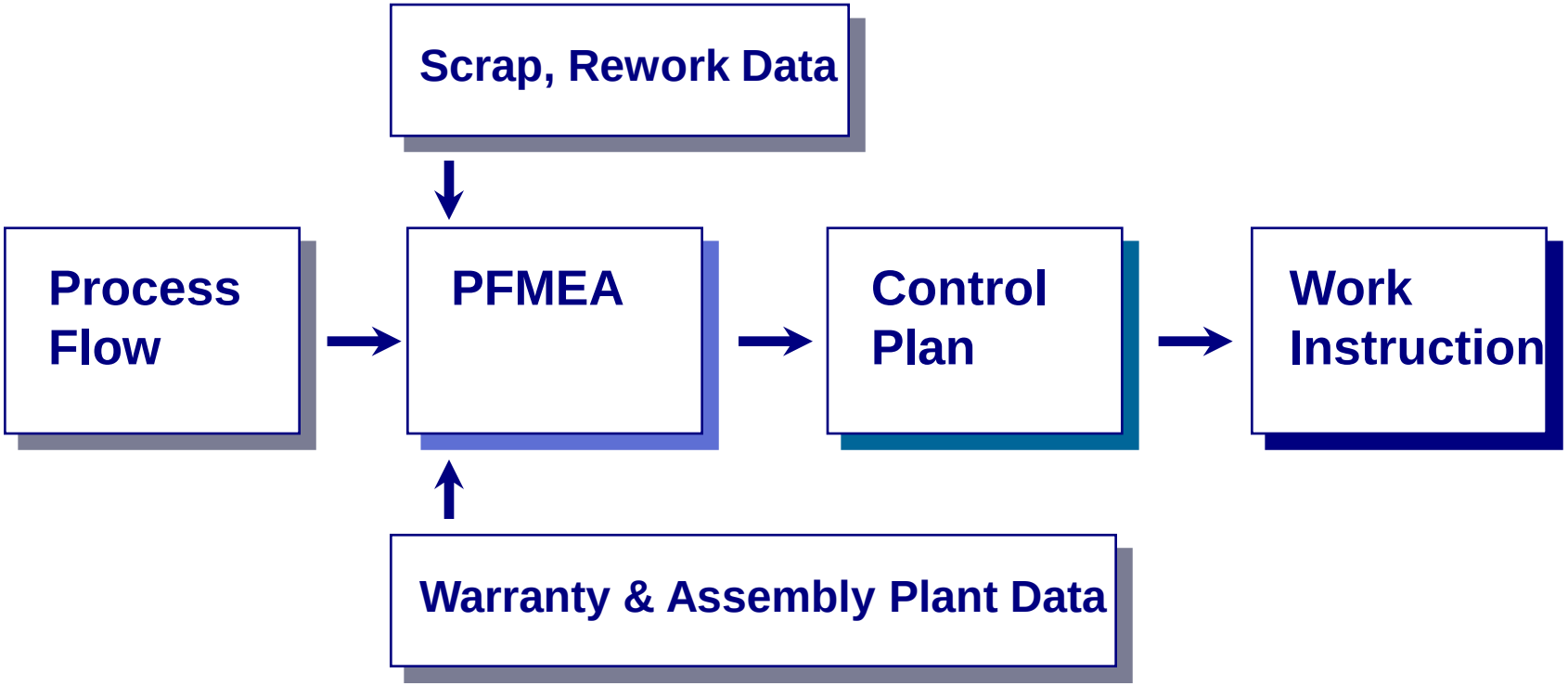
Note: When a customer problem occurs, follow customer prescribed methodology

When to use 8-D

- When the cause is unknown
- When you need to get input from several parties
- When customers dictate use

Note: We use voting techniques, X to Y variable testing, and IS/IS Not to determine the root cause. However, you still may not know what the root cause is?

Update the PFMEA & Control Plans



After the 8-D is completed, the PMEA and the control plan should be revised and updated as applicable