Supplier Quality Management

Continuous Improvement Training

Control Plan

Advanced Quality Team

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Agenda

Part 1 – Intro to Control Plan

- Training Objectives
- Background
- Linkage with other tools
- Control Plan Overview
- Control Plan Benefits
- Template
- Control Methods

Part 2 – Control Plan Example

- Example
- Reviewer’s Checklist
- What Makes an Effective Control Plan



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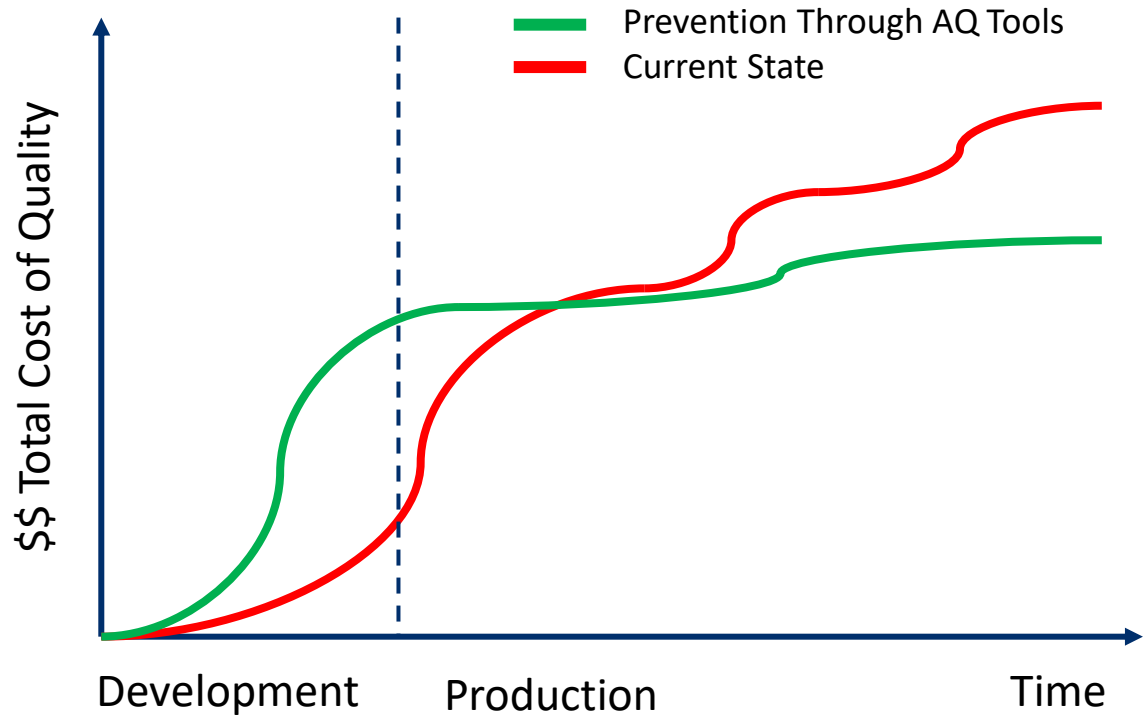
Training Objectives

- This course will enable participants to understand and effectively assess advanced quality tools to help suppliers transition from a reactive to a preventive mindset
- Introduce the key concepts of Control Plan (CP)
- Understand the benefits of Control Plan
- Be acquainted with the relationship between PFD / PFMEA / Control Plan

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Background





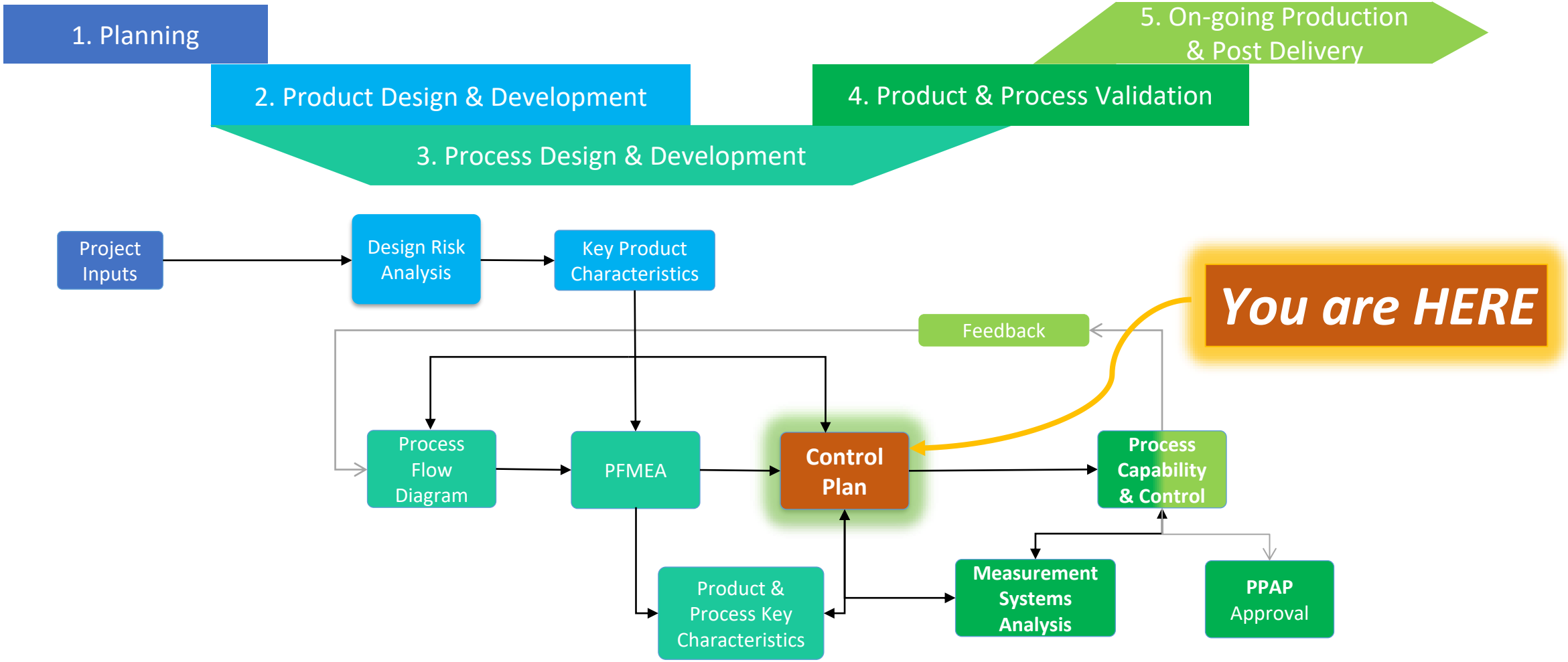
Value Proposition

Invest more in upfront planning to significantly reduce cost later in the product lifecycle!

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APQP Relationship



* Reference 9145 Table 2 – Production part approval process file contents

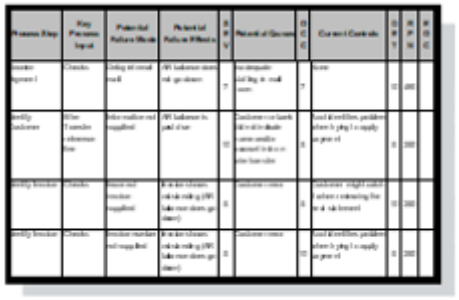
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Part 1
Introduction to Control Plan

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AQ Tools – Relationship

DFMEA

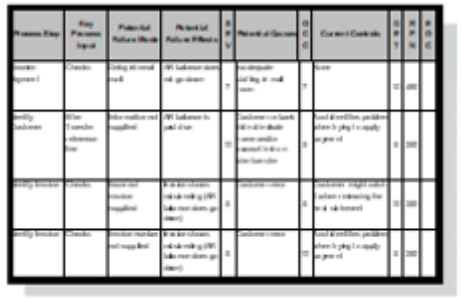


1) Analyzes risk in the design
2) How product could possibly not meet requirements, and
3) Not integrate with manufacturing

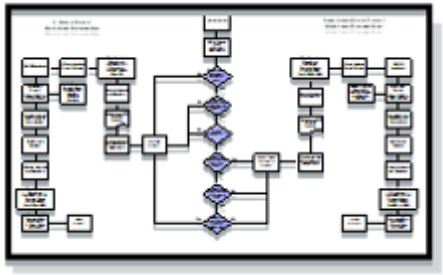
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AQ Tools – Relationship

DFMEA



Key Characteristics



Process Flow

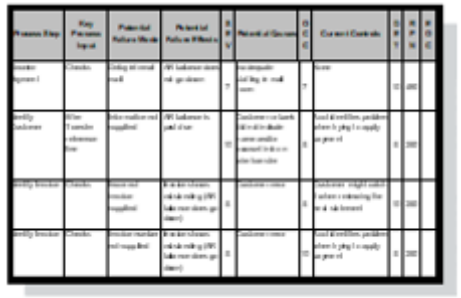
PFD: Outlines entire process
From Start to finish
Ex: Incoming material, manufacturing, test, rework and shipping

1) Analyzes risk in the design
2) How product could possibly not meet requirements, and
3) Not integrate with manufacturing

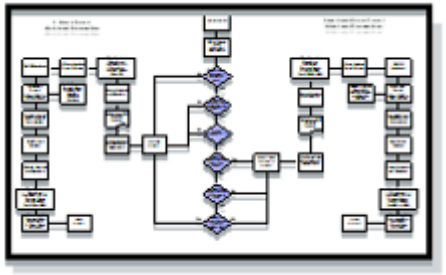
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AQ Tools – Relationship

DFMEA



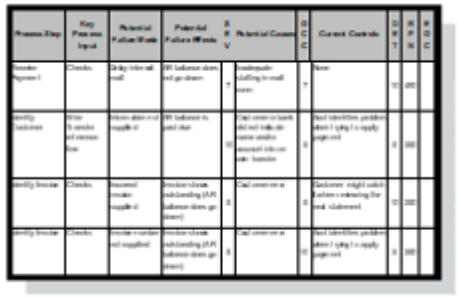
Key Characteristics



Process Flow

Process Steps

Key Characteristics



PFMEA

PFD: Outlines entire process
From Start to finish
Ex: Incoming material, manufacturing, test, rework and shipping

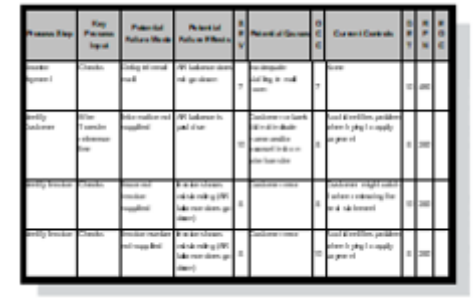
PFMEA indicates:
"*What Could go wrong*"
Risk analysis in each step and possibility of product not meeting requirements

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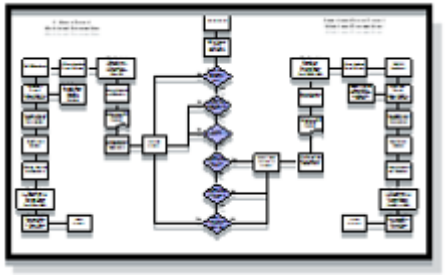
AQ Tools – Relationship

DFMEA

Key Characteristics

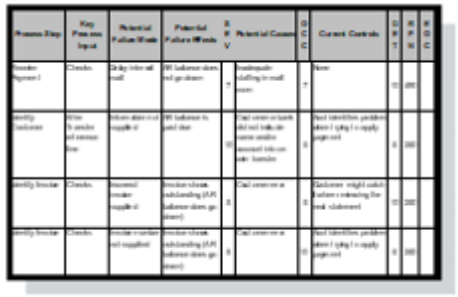


Key Characteristics



Process Flow

Process Steps



PFMEA

Risk Prioritized



Control Plan

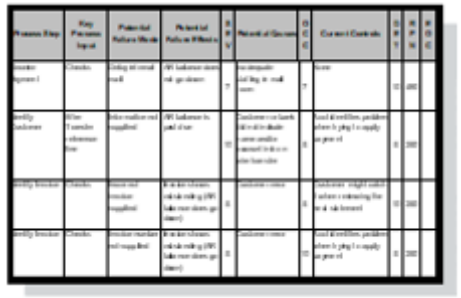
Based on PFMEA Outputs
Specific steps to identify risks
Focused in critical to quality

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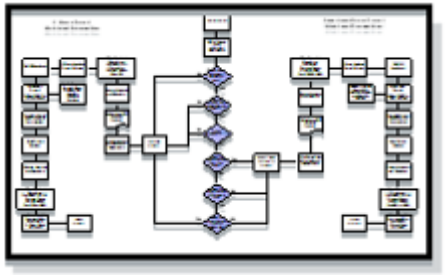
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AQ Tools – Relationship

DFMEA



Key Characteristics



Process Flow

Process Steps

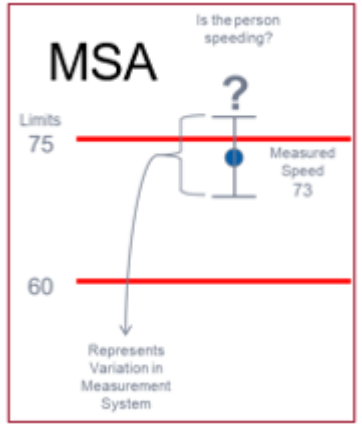
Key Characteristics

Measurement System Analysis
Assures measuring system being used to measure is accurate

Risk Priori



Control Plan



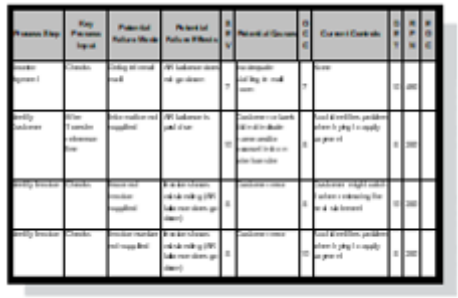
Correct Measurement Technique

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AQ Tools – Relationship

DFMEA



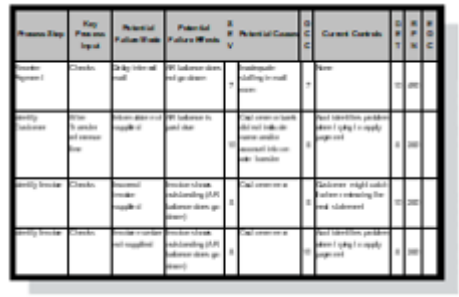
Key Characteristics

Key Characteristics



Used to assure process steps are capable of producing repeated conforming parts

Process Steps



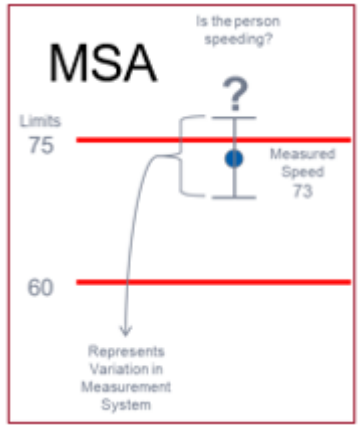
PFMEA

Risk Prioritized





Control Plan

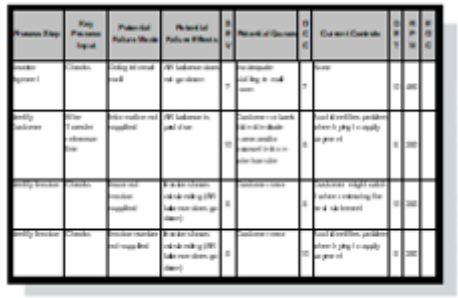


Correct Measurement Technique

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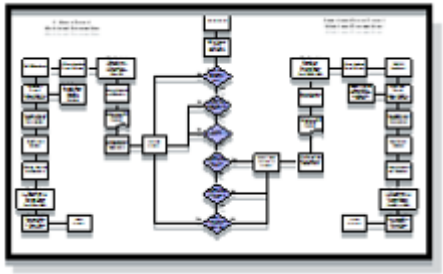
AQ Tools – Relationship

DFMEA



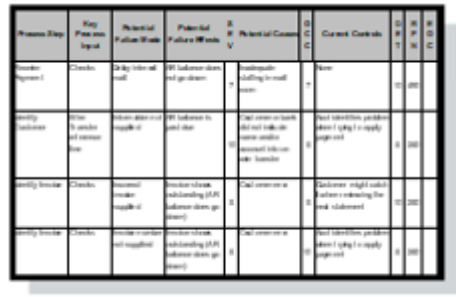
Key Characteristics

Key Characteristics



Process Flow

Process Steps



PFMEA

New/Revised Process Steps

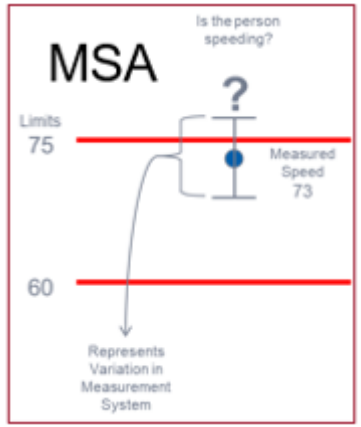
Risk Prioritized

Capability Analysis

Update PFD to reflect new or revised process steps.
This represents a continual risk mitigation strategy



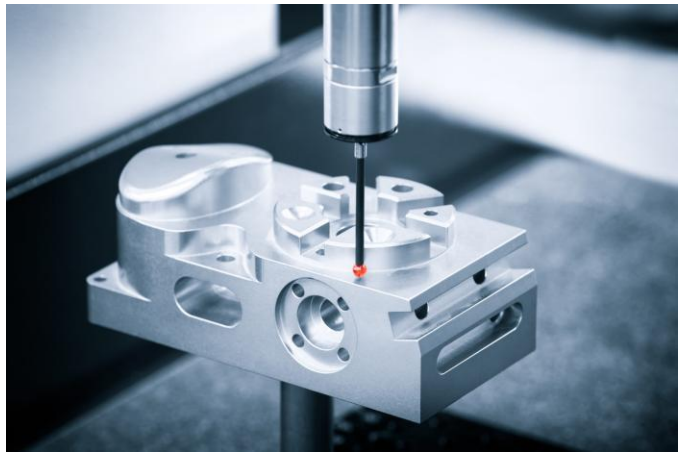
Control Plan

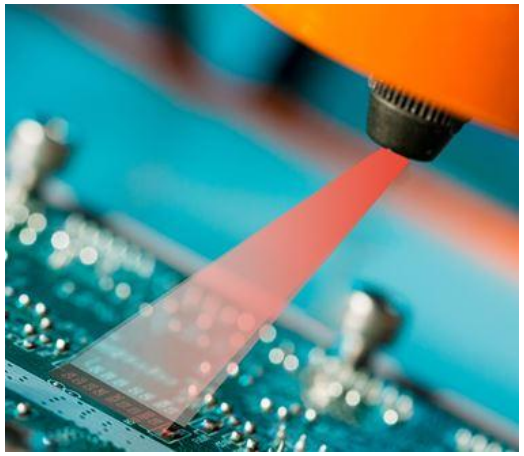


Correct Measurement Technique

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Control Plan - Overview





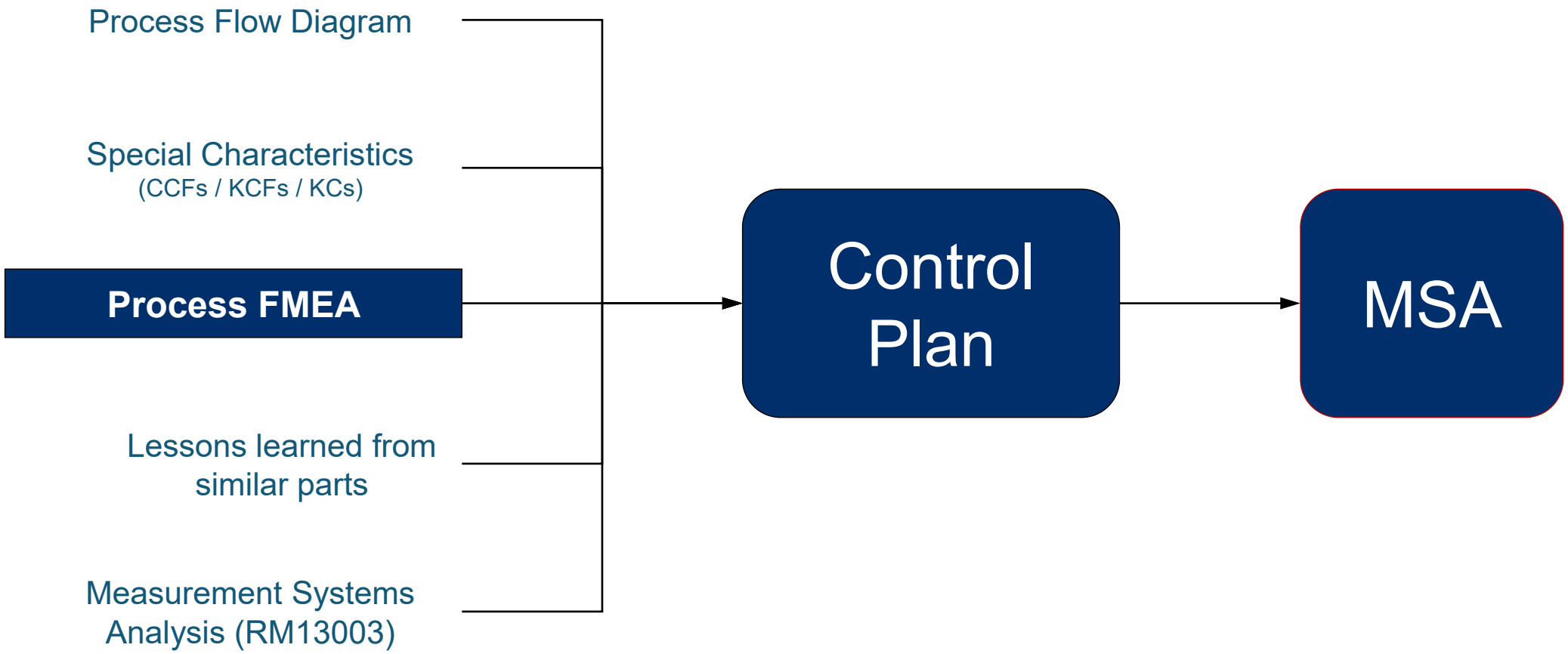


- The Control Plan is a summary of the process controls required to assure product quality
- The PFMEA will identify many Preventive and Detection Controls, and these form a basis for the Production Control Plan
- Good manufacturing practice should consider the following:
  - Control the process inputs to obtain the desired product outputs
  - Employ prevention rather than detection (e.g., use of error-proofing instead of operator dependent work or inspection) (Prevention Controls)
  - Verify output at the earliest possible operation/step within the process (Detection Controls)

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Control Plan Inputs

Inputs to Control Plan



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Control Plan - Overview

☐ Prototype ☐ Pre-launch ☐ Production		Key Contact/Phone	Date (Original)	Date (Revised)
Control Plan Number				
Part Number/Latest Change Level		Core Team	Customer Engineering Approval/Date (If Required)	
Part Name/Description		Supplier/Plant Approval/Date	Customer Quality Approval/Date (If Required)	
Supplier/Plant	Supplier Code	Other Approval Date (If Required)	Other Approval/Date (If Required)	

Operation / Process Number	Process Name/ Operation Description	Tools for Mfg	Characteristics			Special Charcarteristic Classification	Methods					Reaction Plan
			Product/Process Characteristic ID	Product Description	Process Description		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample		Control Method	
									Size	Frequency		

Owners: Quality Engineer, Manufacturing Engineer

Led by: Manufacturing Engineer, Cross Functional Team

Note: The Control Plan is a living document that is revised and updated in response to product/process changes or new quality issues!

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Control Plan - Benefits

A control plan bridges the gap between designing a process and keeping it stable on the shop floor. It serves as the playbook that ensures the improvements made during root cause analysis or PFMEA actually stick long term.

Here is exactly what makes it so critical for advanced manufacturing:

Locks in the process: It eliminates tribal knowledge. Instead of relying on a veteran operator to just know when a machine is running hot, the control plan dictates the exact tolerances, the measurement system required, and the sample frequency.

Drives the reaction plan: When a process drifts out of spec, operators do not have to guess what to do. The plan explicitly tells them the immediate corrective action to take, containing the fallout before it becomes an expensive nonconformance.

Validates the PFMEA: It takes the mitigation strategies from your failure mode analysis and turns them into daily actions. If the PFMEA identifies a high risk of dimensional variation, the control plan outlines the exact statistical process control charts used to monitor those critical features.

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Control Plan - Benefits

Proves readiness: In rigorous frameworks like AS9145, the control plan acts as the proof within the PPAP submission that a supplier has a verified, repeatable process ready for rate production.

Simplifies training: It gives new team members a single source of truth. They know exactly what to check, how often to check it, and what gauges to use without digging through heavy engineering drawings.

It fundamentally shifts a team from constantly fighting fires to managing a predictable, sustainable baseline.

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Control Plan Template

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Control Plan – Template

☐ Prototype	☐ Pre-launch	☑ Production	Key Contact/Phone	Date (Original)	Date (Revised)
Control Plan Number			Sid Smith / 888-123-4567	2/15/2018	6/17/2018
123-456					
Part Number/Latest Change Level			Core Team	Customer Engineering Approval/Date (If Required)	
88-123456-123 / RevA			Avionics	6/30/2018	
Part Name/Description			Supplier/Plant Approval/Date	Customer Quality Approval/Date (If Required)	
Circuit Board			6/17/2018	7/10/2018	
Supplier/Plant		Supplier Code	Other Approval Date (If Required)	Other Approval/Date (If Required)	
Sid's Solder House		A123456	n/a	n/a	

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods					Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample		Control Method	
									Size	Frequency		
2	Soldering Connections	Wave Solder Machine	2	Solder Connection			Solder joint per J-STD	Visual	100%	Continuous Visual	Visual	Reject and repair
2	Drive two screws to secure side support	Wave Solder Machine	4		Wave solder level		2.0 +/- .25 mc	Sensor continuity check	100%	Continuous	Automated inspection (mistake-proofing)	Adjust and retest
2	Soldering Connections	Wave Solder Machine	5		Flux concentration		Standard #302B	Test sampling, lab environment	1 pc	4 hours	X-mR chart	Segregate and retest

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Control Plan – Template

Stages

☐ Prototype	☐ Pre-launch	☑ Production	Key Contact/Phone	Date (Original)	Date (Revised)
Control Plan Number			Sid Smith / 888-123-4567	2/15/2018	6/17/2018
123-456					
Part Number/Latest Change Level			Core Team	Customer Engineering Approval/Date (If Required)	
88-123456-123 / RevA			Avionics	6/30/2018	
Part Name/Description			Supplier/Plant Approval/Date	Customer Quality Approval/Date (If Required)	
Circuit Board			[illegible]	[illegible]	
Supplier/Plant	Supplier Code		Other Approval Date (If Required)	Other Approval/Date (If Required)	
Sid's Solder House	A123456		n/a	n/a	

Administrative Section

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods					Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample		Control Method	
									Size	Frequency		
2	Soldering Connections	Wave Solder Machine	2	Solder Connection			Solder joint per J-STD	Visual	100%	Continuous Visual	Visual	Reject and repair
2	Drive two screws to secure side support	Wave Solder Machine	4		Wave solder level		2.0 +/- .25 mc	Sensor continuity check	100%	Continuous	Automated inspection (mistake-proofing)	Adjust and retest
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Process & Tools | **Characteristics** | **Methods** | **Reaction Plan**

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Control Plan – Template

Stages

Administrative Section

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Part Name/Description			Supplier/Plant Approval/Date	Customer Quality Approval/Date (If Required)	
Circuit Board			[illegible]	[illegible]	
Supplier/Plant	Supplier Code		Other Approval Date (If Required)	Other Approval/Date (If Required)	
Sid's Solder House	A123456		n/a	n/a	

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods				Control Method	Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample Size	Sample Frequency		
2	Soldering Connections	Wave Solder Machine	2	Solder Connection			Solder joint per J-STD	Visual	100%	Continuous Visual	Visual	Reject and repair
2	Drive two screws to secure side support	Wave Solder Machine	4		Wave solder level		2.0 +/- .25 mc	Sensor continuity check	100%	Continuous	Automated inspection (proofing)	Adjust and retest
2	Soldering Connections	Wave Solder Machine	5	Flux			Standard #302B	Test sampling lab	1 pc	4 hours	X-mR chart	Segregate and retest

1 **What is the Operation, Step & Equipment Used?**

2 **What do I check? Product Characteristic or Process Parameter?**

3 **How do I check it? Equipment, Method & Frequency**

4 **How do I record & analyze the results?**

5 **What do I do if I find nonconformance?**

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Control Plan – Template

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Control Plan Number			Sid Smith / 888-123-4567	2/15/2018	6/17/2018
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Supplier/Plant	Supplier Code		Other Approval Date (If Required)	Other Approval/Date (If Required)	
Sid's Solder House	A123456		n/a	n/a	

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods				Control Method	Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample Size	Sample Frequency		
2	Soldering Connections	Wave Solder Machine	2	Solder Connection			Solder joint per J-STD	Visual	100%	Continuous Visual	Visual	Reject and repair
2	Drive two screws to secure side support	Wave Solder Machine	4		Wave solder level		2.0 +/- .25 mc	Sensor continuity check	100%	Continuous	Automated inspection (mistake-proofing)	Adjust and retest
2	Soldering Connections	Wave Solder Machine	5		Flux concentration		Standard #302B	Test sampling, lab environment	1 pc	4 hours	X-mR chart	Segregate and retest

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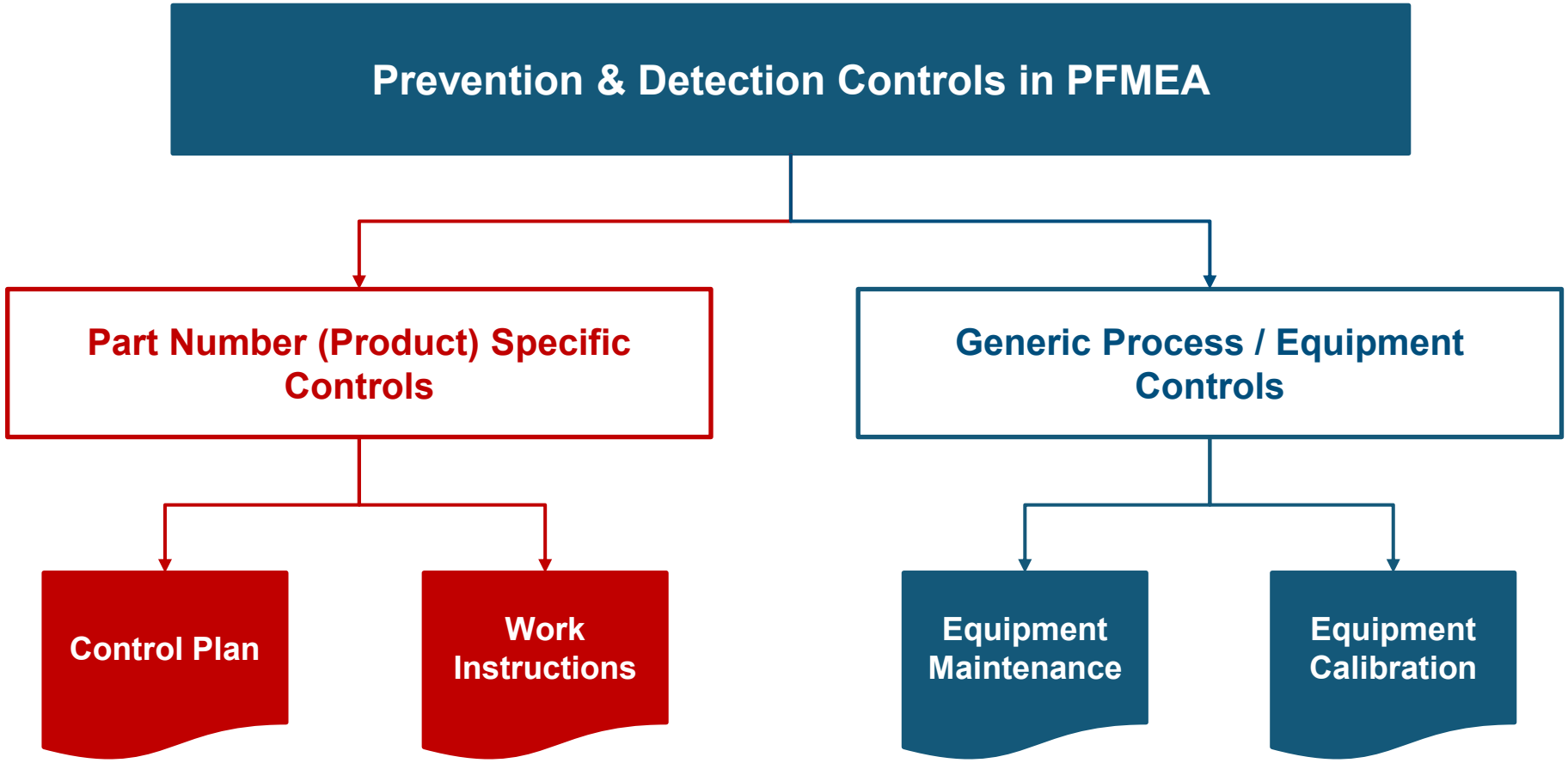
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Sources of Control Plan data in the PFMEA

Requirement	Failure Mode	Potential Effect	Severity	Class.	Potential Cause	Prevention Controls	Occurrence	Detection Controls	Detection	RPN
Hole Diameter 10.0 mm +/- 0.1mm	Hole Diameter Too Big	Engine Vibration	6		Wrong Drill Used (oversize)	Tool Pre-setting	6	CMM Check at Op450		
		Scrap Part	7		Spindle Alignment Error	Preventive Maintenance Schedule – laser alignment check every 6 months	3	CMM Check at Op450		
								CNC Ball Bar Check weekly		
		Concession	2		Part Loose in Fixture	Operator fixture check before machining	2	CMM Check at Op450		

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Sources of Control Plan data in the PFMEA



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Control Plan: Carry over information from the PFMEA

CONTROL PLAN

☐ Prototype ☐ Pre-Launch ☑ Production

Control Plan Number : 123B456	Key Contact / Phone : Jo Hicks 247835	Date (original) 24/02/15	Date revision : 12/09/17
Part Number & Latest Issue level: ABC Rev D	Core Team : See attached distribution	Customer Engineering Approval / date (if required) N/a	
Part Name / Description : 65B67G76H Manifold	Organisation / Plant Approval / Date T. Bell 24/02/15	Customer Quality Approval : N/a	
Organisation Plant : Bristol HY / Organisation Code: 126578	Other Approvals / date (if required) N/a	Other Approvals / date (if required) N/a	

Part / Process Number	Process Name / Operation Description	Machine / Jig / Device for MFG	Characteristics			Special Char	Methods					Reaction Plan
			No.	Product	Process		Product / Process Specification / Tolerance	Evaluation / Measurement Technique	Size	Freq	Control Method	
10	CNC Drilling	Hermele Model No. 3762 with in cycle probing	Fixture Check		x		No signs of damage / wear	Visual	100%	each loading operation	Fixture Inspection Issues sheet	Stop process & repair fixture or use alternative
		Fixture dh67F2	Part Damage - pre machining	x			no damage beyond limits defined in Spec 87B	Visual to RSQC 001	100%	every part	Attribute SPC chart	Stop process and identify correct cause.
			Dimensions 1 - 72	x			Various	CMM Mitutoyo XRC3 only	100%	each part	Pre-control charts	Stop process and correct special cause.
			Dimension No. 1	x		x	10mm +/- 1 mm	Bore micrometer CVR07 or BGH09	First part	1 per batch	Set up sheet	Adjust process and ensure feature is in central third of tolerance.
			Part Damage - post machining	x			no damage beyond limits defined in Spec 87B	Visual to RSQC 001	100%	every part	Attribute SPC chart	Stop process and identify correct cause.

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Control Methods – Error and Mistake Proofing

Error proofing and mistake proofing techniques prevent nonconforming material from reaching the customer

- Error proofing prevents defects from being produced
- Mistake proofing prevents created defects from being passed on

Error and mistake proofing techniques still have risks and are included in Control Plans for monitoring

- Error and mistake proofing techniques or devices may become worn, misplaced, or inoperable, or not perform correctly

Error & mistake proofing techniques require reaction plans to **monitor and address all Risks**

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POP QUIZ: Which of these Controls belong in the Control Plan?

Prevention Controls		Detection Controls	
1	Part X Operator Fixture Check pre-machining at OP05	6	Diameter Check on CMM at OP250
2	CNC Weekly Coolant Strength Check	7	CNC Spindle Alignment weekly ‘ball bar check’
3	CNC Planned Maintenance	8	Visual Inspection for Damage by Inspector at OP300
4	CNC Spindle Alignment Calibration	9	Valve Leak test at OP500 by Laboratory
5	Part X Fixture – Air Detect System to ensure part position in Fixture	10	Serial Number check at OP300 by Inspector

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POP QUIZ: Which of these Controls belong in the Control Plan?

Prevention Controls		Detection Controls	
1	Part X Operator Fixture Check pre-machining at OP05	**6**	Diameter Check on CMM at OP250
2	CNC Weekly Coolant Strength Check	7	CNC Spindle Alignment weekly ‘ball bar check’
3	CNC Planned Maintenance	**8**	Visual Inspection for Damage by Inspector at OP300
4	CNC Spindle Alignment Calibration	**9**	Valve Leak test at OP500 by Laboratory
5	Part X Fixture – Air Detect System to ensure part position in Fixture	**10**	Serial Number check at OP300 by Inspector

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Grouping Characteristics in the Control Plan

	Process FMEA									
		Req							Detection Controls	
OP 20	1	Length 100mm +/- 1 mm							1st off & CMM	
	2	Diameter							CMM	
	3	Depth							CMM	
	4	Roundness							CMM	
	5	Flatness							CMM	
	6	Radii							CMM	
	7	Height							CMM	
	8	FOD							Visual	
	9	Damage							Visual	

In this example there are 7 dimensional features and 2 visual checks. This can be broken down into just 3 lines in the Control Plan.

Control Plan					
Op 20	Length 100mm +/- 1 mm	Caliper	1st piece		
	Dimensions 1 - 7	CMM Check	100%		
	FOD	Visual Inspection to spec xyz	100%		
	Damage	Visual Insp to spec efg	100%		

The 1st feature is controlled using a 1st off check by the operator using a Caliper.
All dimensional characteristics are over checked using a CMM program within this operation and can therefore be treated as a single operator activity.
FOD & Damage have defined visual inspection requirements.

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Part 2
Control Plan – Example

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Control Plan – Template

1: Stages

☐ Prototype	☐ Pre-launch	☑ Production	Key Contact/Phone	Date (Original)	Date (Revised)
Control Plan Numb			Sid Smith / 888-123-4567	2/15/2018	6/17/2018
123-456					
Part Number/Latest Change Level			Core Team	Customer Engineering Approval/Date (If Required)	
88-123456-123 / RevA			Avionics	6/30/2018	
Part Name/Description			Supplier/Plant Approval/Date	Customer Quality Approval/Date (If Required)	
Circuit Board			6/17/2018	7/10/2018	
Supplier/Plant		Supplier Code	Other Approval Date (If Required)	Other Approval/Date (If Required)	
Sid's Solder House		A123456	n/a	n/a	

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods					Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process	Evaluation	Sample		Control Method	
2	Soldering C										isual	Reject and repair
2	Drive tw o s support				der						utomated spection mistake-roofing)	Adjust and retest
2	Soldering Connections	Machine	5		concentration			lab environment			X-mR chart	Segregate and retest

1. Prototype – a description of the dimensional measurements and material and performance tests that will occur *during* Prototype build

2. Pre-Launch – a description of the dimensional measurements and material and performance tests that will occur *after* Prototype *and before full Production* (Pre-Production)

3. Production – a comprehensive documentation of product/process characteristics, process controls, tests, and measurement systems that will occur during regular production

Control Plan - Template

Operation/Process Number
List process step, usually listed in the process flow being charted

Process Function / Operation Description
The CRITICAL steps in the production of the part
(***not every process step or risk from the PFMEA***)
The steps can be identified from the Process Flow Diagram.

		Key Contact/Phone	
		Sid Smith / 888-123-45	
Part Number/Latest Change Level		Core Team	Customer Engineering Approval/Date (If Required)
88-123456-123 / RevA		Avionics	6/30/2018
Part Name/Description		Supplier/Plant Approval/Date	Customer Quality Approval/Date (If Required)
Circuit Board		6/1[illegible]2018	7/10/2018
Supplier/Plant	Supplier Code	Other Approval Date (If Required)	Other Approval/Date (If Required)
Sid's Solder House	A123456	n/a	n/a

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods					Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample Size	Sample Frequency	Control Method	
2	Soldering Connections	Wave Solder Machine	2	Solder Connection			Solder joint per J-STD	Visual	100%	Continuous Visual	Visual	Reject and repair
2	Dri su				Wave solder level		2.0 +/- .25 mc	Sensor continuity check	100%	Continuous	Automated inspection (mistake-proofing)	Adjust and retest
2	So				Flux concentration		Standard #302B	Test sampling, lab environment	1 pc	4 hours	X-mR chart	Segregate and retest

Machine, Device, Jig, Tools for Mfg.
List the machine, device, jig, or tools that will be used in the manufacturing process

Control Plan - Template

Prototyp				Date (Revised)
Control Plan Number				6/17/2018
123-456				
Part Number/Latest Cha			ering Approval/Date (If Required)	
88-123456-123 / RevA				
Part Name/Description			Approval/Date (If Required)	
Circuit Board		6/17/2018	7/10/2018	
Supplier/Plant	Supplier Code	Other Approval Date (If Required)	Other Approval/Date (If Required)	
Sid's Solder House	A123456	n/a	n/a	

Product/Process Characteristic ID
Either a sequential tracking number or a cross reference number from other applicable documents such as the Process Flow Diagram or PFMEA

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods					Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample Size	Sample Frequency	Control Method	
2	Soldering Connections	Wave Solder Machine	2	Solder Connection			Solder joint per J-STD	Visual	100%	Continuous Visual	Visual	Reject and repair
2	Drive two screws to secure side support	Wave Solder Machine	4		Wave sold level						Automated spection mistake-roofing)	Adjust and retest
2	Soldering Connections	Wave Solder Machine	5		Flux concentra						-mR chart	Segregate and retest

Characteristics
The distinguishing feature, dimension, or property of a process or product on which variable or attribute data can be collected.
Use visual aids where applicable.

Control Plan - Template

Product Characteristics

List Product Characteristics that are important. The features or properties of the part, component or assembly that are listed on engineering drawings.

The team should identify the Product Characteristics by **referencing**: Engineering drawings, customer critical characteristics, key/critical characteristics that affect the product.

There may be several for each operation – can be dimensional, performance or visual criteria.

Control Plan												Date (Revised)
123-456												6/17/2018
Part Number/												
88-123456-1												
Part Name/De												
Circuit Board												
Supplier/Plan												
Sid's Solder H												

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods				Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample		Control Method
									Size	Frequency	
2	Sold	Wave Solder		Solder			Solder joint per			Continuous	Visual
2	D s										omated pection take- pfing)
2	S										R chart

Process Characteristics

List Process characteristics that are important. A Process characteristic (parameters) is a setting made within a process that effects the variation within the operation.

The team should identify process characteristics for which variation must be controlled to minimize product variation.

There could be one or more process characteristics listed for each product characteristic. Examples include: Temperature, Pressure, Speed, Feed, Torque, Flow Rate

Control Plan - Template

Characteristic Classification

- **Key Characteristics:** An attribute or feature whose variation has a significant influence on product fit, performance, service life, or producibility; that requires specific action for the purpose of controlling variation (reference 9103 standard).
- **Critical Items:** Those items (e.g., functions, parts, software, characteristics, processes) having significant effect on the product realization and use of the product; including safety, performance, form, fit, function, producibility, service life, etc.; that require specific actions to ensure they are adequately managed. Examples include: safety CIs, fracture CIs, mission CIs, Key Characteristics (KCs), and maintenance tasks critical for safety (reference 9103 standard).

The Engineering drawing will typically indicate key/critical characteristics. However the user may identify additional characteristics that are critical to quality.

Control Plan Numb	vised)
123-456	8
Part Number/Late	
88-123456-123 /	
Part Name/Descri	
Circuit Board	
Supplier/Plant	
Sid's Solder Hous	

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods					Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample		Control Method	
									Size	Frequency		
2	Soldering Connections	Wave Solder Machine	2	Solder Connection			Solder joint per J-STD	Visual	100%	Continuous Visual	Visual	Reject and repair
2	Drive two screws to secure side support	Wave Solder Machine	4		Wave solder level		2.0 +/- .25 mc	Sensor continuity check	100%	Continuous	Automated inspection (mistake-proofing)	Adjust and retest
2	Soldering Connections	Wave Solder Machine	5		Flux concentration		Standard #302B	Test sampling, lab environment	1 pc	4 hours	X-mR chart	Segregate and retest

Control Plan - Template

Methods
The procedures, instructions and tools to control the process

Product/Process Specification/Tolerance
Specifications and tolerances are obtained from engineering specifications or a key process characteristic.

☐ Prototype	☐ Pre-launch	☑ Production	Key Contact/Phone	Date (Original)	Date (Revised)
					6/17/2018

Supplier/Plant	Supplier Code	Other Approval Date (If Required)	Other Approval/Date (If Required)
Sid's Solder House	A123456	n/a	n/a

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods					Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample Size	Sample Frequency	Control Method	
2	Soldering Connections	Wave Solder Machine	2	Solder Connection			Solder joint per J-STD	Visual	100%	Continuous Visual	Visual	Reject and repair
2	Drive two screws to secure side support	Wave Solder Machine	4								Automated	test
2	Soldering Connections	Wave Solder Machine	5									d retest

Control Method
This column contains a brief description of how the characteristic will be controlled.
Example include:

- X-bar/R-chart
- np chart
- Pre-control chart
- Checklist
- Log sheet
- Mistake proofing
- 1st piece inspection
- Lab report

Control Plan - Template

Sample Size & Frequency

This column defines how many parts will be measured and how often.
Examples include: Final testing, visual criteria, 100% inspection, SPC, audit, sample size & frequency

☐ Prototype ☐ Pre-launch ☑ Production

Control Plan Number			
123-456			
Part Number/Latest Change Level		Core Team	Customer Engineering Approval/Date (If Required)
88-123456-123 / RevA		Avionics	6/30/2018
Part Name/Description		Supplier/Plant Approval/Date	Customer Quality Approval/Date (If Required)
Circuit Board		6/17/2018	7/10/2018
Supplier/Plant	Supplier Code	Other Approval Date (If Required)	Other Approval/Date (If Required)
Sid's Solder House	A123456	n/a	n/a

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods					Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample Size	Sample Frequency	Control Method	
2	Soldering Connections	Wave Solder Machine	2	Solder Connection			Solder joint per J-STD	Visual	100%	Continuous Visual	Visual	Reject and repair
2	Drive two screws to secure side support	Wave Solder Machine	4		Wave solder level		2.0 +/- .25 mc	Sensor continuity check	100%	Continuous	Automated inspection (mistake-proofing)	Adjust and retest
2	Soldering Connections	Wave Solder Machine	5									and retest

Evaluation Measurement Technique

Identifies how the characteristic is going to be measured
Examples include calipers, attribute gages (go/no-go), fixtures, test equipment, or visual

Control Plan - Template

Reaction Plan

The reaction plan specifies what happens when the characteristic or parameter is found to be out of control.

MUST include:

- Segregation of nonconforming product
- Correction method
- Contact supervisor

MAY include:

- Sorting
- Rework/Repair
- Customer notification

The actions should normally be the responsibility of the people closest to the process, the operator or supervisor.

Prot		evised)
Control Plan Number		18
123-456		
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88-123456-123 / Rev		
Part Name/Descriptio		
Circuit Board		
Supplier/Plant		
Sid's Solder House		

Operation / Process Number	Process Function / Operation Description	Machine, Device, Jig, Tools for Mfg	Characteristics			Characteristic Classification	Methods					Reaction Plan
			Product/Process Characteristic ID	Product	Process		Product / Process Specification/ Tolerance	Evaluation Measurement Technique	Sample		Control Method	
									Size	Frequency		
2	Soldering Connections	Wave Solder Machine	2	Solder Connection			Solder joint per J-STD	Visual	100%	Continuous Visual	Visual	Reject and repair
2	Drive two screws to secure side support	Wave Solder Machine	4		Wave solder level		2.0 +/- .25 mc	Sensor continuity check	100%	Continuous	Automated inspection (mistake-proofing)	Adjust and retest
2	Soldering Connections	Wave Solder Machine	5		Flux concentration		Standard #302B	Test sampling, lab environment	1 pc	4 hours	X-mR chart	Segregate and retest

Control Plan: Example

CONTROL PLAN

☐ Pre-Launch ☑ Production

Control Plan Number : 123B456		Key Contact / Phone : Jo Hicks 247835	Date (original) 24/02/15
Part Number & Latest Issue level: ABC Rev D		Core Team : See attached distribution	Customer Engineering Appr N/a
Part Name / Description : 65B67G76H Manifold		Organisation / Plant Approval / Date T. Bell 24/02/15	Customer Quality Approval : N/a
Organisation Plant : Bristol HY	Organisation Code: 126578	Other Approvals / date (if required) N/a	Other Approvals / date (if required) N/a

Part / Process Number	Process Name / Operation Description	Machine / Jig / Device for MFG	Characteristics No.	Characteristics Product	Characteristics Process	Special Char	Methods Product / Process Specification / Tolerance	Methods Evaluation / Measurement Technique	Methods Size	Methods Freq	Methods Control Method	Reaction Plan
10	CNC Drilling	Hermele Model No 3762 with in cycle probing	Fixture Check		x		No signs of damage / wear	Visual	100%	each loading operation	Fixture Inspection Issues sheet	Stop process & repair fixture or use alternative
		Fixture dh67F2	Part Damage - pre machining	x			no damage beyond limits defined in Spec 87B	Visual to RSQC 001	100%	every part	Attribute SPC chart	Stop process and identify correct cause.
			Dimensions 1 - 72	x			Various	CMM Mitutoyo XRC only	100%	each part	Pre-control charts	Stop process and correct special cause.
			Dimension No. 1	x		x		meter CVR07	First part	1 per batch	Set up sheet	Adjust process and ensure feature is in central third of tolerance.
			Part Damage - post machining	x			no damage limits defi 87		100%	every part	Attribute SPC chart	Stop process and identify correct cause.

Part/Process

Specifications/ Tolerance

Evaluation measurement technique

Control Method

Machine/Tools

Characteristics

Sample Size

Reaction Plan

Frequency

Control Plan – Reviewer's Checklist

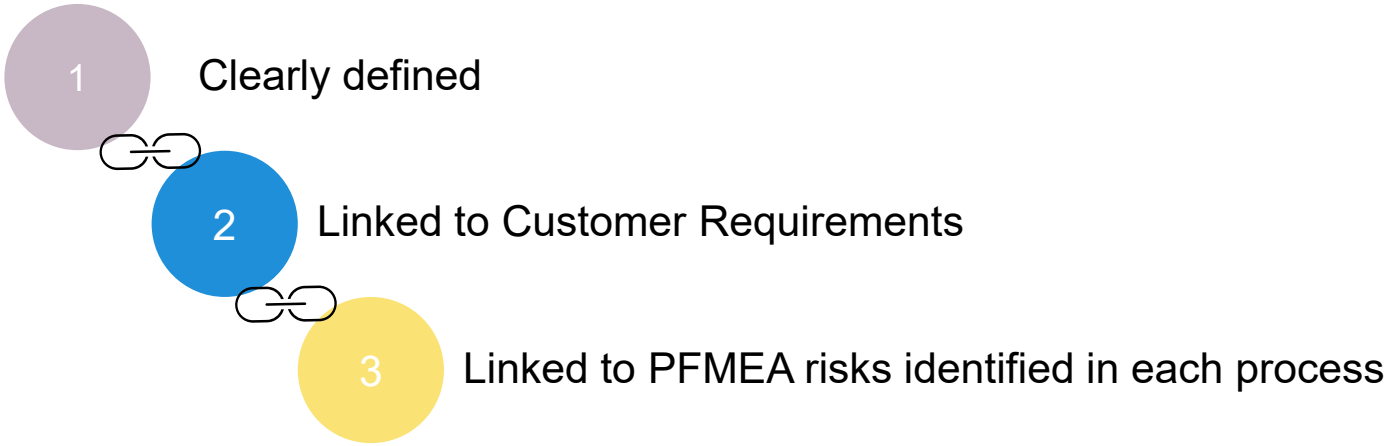
- **Create** using a cross-functional team
- **Build** based upon Process Flow Diagram and PFMEA (includes KCs & CIs from DFMEA)
- **Include** significant risk items from the PFMEA
- **Ensure** the control method is based on an effective analysis of the process
- **Confirm** that the Control Plan is in the document control system of the business
- **Translates** control methods and reaction plans into actionable manufacturing / inspection instructions, charts, logs or other means of consistent use / measurement



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What Makes an Effective Control Plan?

Having product specifications/characteristics that are:



- ✓ Set-up fixtures
- ✓ Visual aids
- ✓ Go/No-Go gauges
- ✓ Checklists
- ✓ Signs
- ✓ Lights
- ✓ Alarms
- ✓ Navigational objects
- ✓ Tool preventive maintenance

Effective Control Methods and Reaction Plans

- Emphasis is on controls at the point of manufacture (control input variation) to ensure conforming product
- Controls are focused on prevention (error proofing) before detection
- Process/product measurement methods are clearly defined and repeatable
- Reaction plans are detailed, including personnel responsible for execution

Effective controls are used at the point of manufacture to reduce the RISK of human error and machine/tool wear or malfunction

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Control Plan – References

- AS9145 Requirements for Advanced Product Quality Planning (APQP) and Production Part Approval Process (PPAP)
- Supply Chain Management Handbook (SCMH) Section 7.2 APQP
- AS13004 Process Failure Mode and Effects Analysis (PFMEA) and Control Plans
- AS13006 Process Control Methods
- Automotive Industry Action Group (AIAG) Advanced Product Quality Planning and Control Plan Blue Book



Resources:
IAQG – Supply Chain Management Handbook

AESQ – Aero Engine Supplier Quality Group

SCMH-7.2.13-Control-Plan-Template-Dated-26NOV2019.xlsx

rm13004-templates-and-examples-pfmea.xlsx

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