

# Failure Mode Effects Analysis

Bawani Thambu  
Acme  
2007-Mar-05 : 15:29:25

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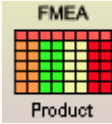



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## Project Introduction

### Project Details

<b>Project Name</b>	FMEA
<b>Description</b>	Failure Mode Effects Analysis
<b>Objective</b>	To identify potential failures and draw actions to reduce the Risk Priority Numbers.
<b>Abstract</b>	FMEA is an important tool to identify potential failures early in the design stage.
<b>Project Leader</b>	Bawani Thambu
<b>Commencement Date</b>	15-Jul-2006
<b>Project Completion Date</b>	15-Jul-2006
<b>Completion Date</b>	
<b>Status</b>	Not Completed

## Project Flow

Stages	Objective	Activities	Deliverables	Applet
1	Product FMEA	Import data from QFD Function Matrix and conduct a failure mode analysis	Ranked RPN of factors analyzed (B)	
2	Process FMEA	Import data from QFD Quality and Function Matrix and conduct a failure mode analysis	Ranked RPN of factors analyzed	
3	Product and Process FMEA	Import data from QFD Production Matrix and conduct a failure mode analysis	Ranked RPN of factors analyzed (B)	
4	Production FMEA	Input data into a standalone failure mode analysis	Ranked RPN of factors analyzed (B)	

# Failure Mode Effects Analysis

FMEA Product

Bawani Thambu  
Acme  
2007-Mar-05 : 15:26:12

## Applet Introduction

### Applet Details

<b>Applet Title</b>	FMEA-Product
<b>Description</b>	FMEA Product
<b>Objective</b>	
<b>Abstract</b>	
<b>Team Leader</b>	Bawani Thambu
<b>Commencement Date</b>	03-Mar-2007
<b>Expected Completion Date</b>	
<b>Completion Date</b>	
<b>Status</b>	Not Completed
<b>Team Name</b>	
<b>Team Members</b>	<i>No Team Members are selected.</i>

# Header Information

Header Information	
Part Name	
Part No .	
Drawing No.	
EO/PCO No.	
Change Letter	
Model	
Process Responsibility	
Prod Trails Target Date	
Pre-Prod Target Date	
PQCM Target Date	
Prepared By	
Approved By	
FMEA No.	
FMEA Date	
Rev No.	

## Criteria

Description	Rank	
<b>Severity</b>		
None	1	No effect
Very Minor	2	Fit & finish or squeak & rattle item does not conform. Discriminating customers notice defect.
Minor	3	Fit & finish or squeak & rattle item does not conform. Average customers notice defect.
Very Low	4	Fit & finish or squeak & rattle item does not conform. Most customers notice defect.
Low	5	Product is operable, but comfort or convenience item(s) operate at a reduced level of performance.
Moderate	6	Product is operable, but comfort or convenience item(s) are inoperable.
High	7	Product is operable, but at reduced level of performance.
Very High	8	Product is inoperable with loss of primary Function.
Hazardous - with warning	9	Failure affects safe product operation or involves noncompliance with government regulation with warning.
Hazardous - no warning	10	Failure affects safe product operation or involves noncompliance with government regulation without warning.
<b>Occurrence</b>		
Remote: Failure is unlikely	1	1 in 2
Very Low: Relatively few failures	2	1 in 3
Low: Relatively few failures	3	1 in 8
Low: Relatively few failures Some what low	4	1 in 20
Moderate: Occasional failures	5	1 in 80
Somewhat High	6	1 in 400
High: Repeated failures	7	1 in 2 000
High: Repeated failures	8	1 in 15 000
Very High: Failure is almost inevitable	9	1 in 150 000
Very High: Failure is almost inevitable	10	1 in 1 500 000
<b>Detection</b>		
Almost Certain	1	Design Control will almost certainly detect a potential Cause of failure or subsequent Failure Mode
Very High	2	Very high chance the Design Control will detect a potential Cause of failure or subsequent Failure Mode
High	3	High chance the Design Control will detect a potential Cause of failure or subsequent Failure Mode



<b>Moderately High</b>	<b>4</b>	Moderately high chance the Design Control will detect a potential Cause of failure or subsequent Failure Mode
<b>Moderate</b>	<b>5</b>	Moderate chance the Design Control will detect a potential Cause of failure or subsequent Failure Mode
<b>Low</b>	<b>6</b>	Low chance the Design Control will detect a potential Cause of failure or subsequent Failure Mode
<b>Very Low</b>	<b>7</b>	Very low chance the Design Control will detect a potential Cause of failure or subsequent Failure Mode
<b>Remote</b>	<b>8</b>	Remote chance the Design Control will detect a potential Cause of failure or subsequent Failure Mode
<b>Very Remote</b>	<b>9</b>	Very remote chance the Design Control will detect a potential Cause of failure or subsequent Failure Mode
<b>Absolute Uncertainty</b>	<b>10</b>	Design Control does not detect a potential Cause of failure or subsequent Failure Mode; or there is no Design Control

# Properties of S, O and D

Before conducting an FMEA, it is important to understand the properties of Severity, Occurrence and Detection. This will help the team in Consensus Reaching for items discussed during FMEA. Severity, Occurrence and Detection can all take Integer values between 1 and 10 inclusive. The product of Severity and Occurrence is called Criticality. The product of Severity, Occurrence and Detection is called RPN.

## Consensus of Values

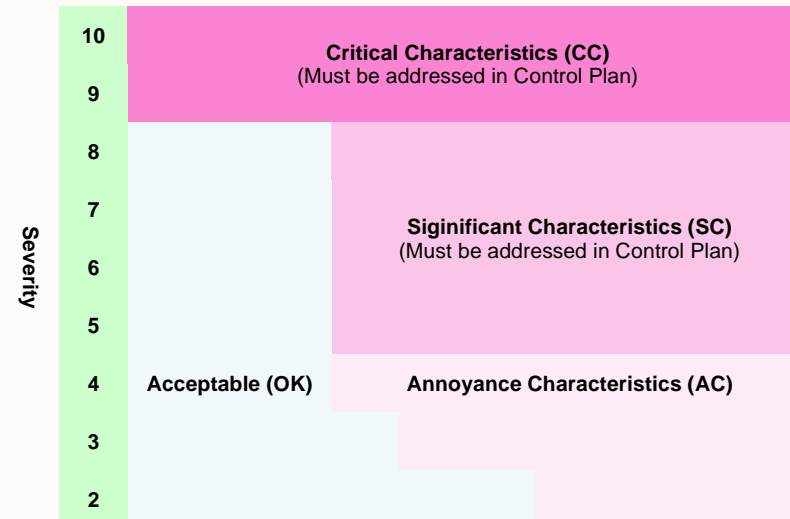
As a standard guide review the item if

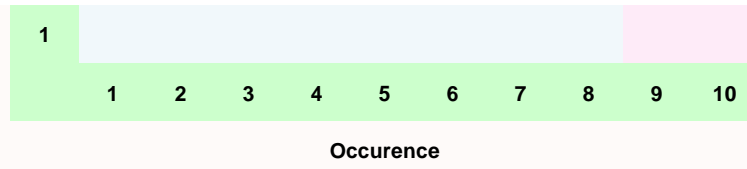
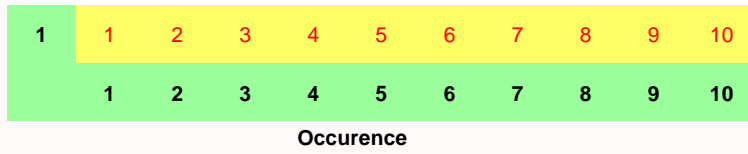
- Severity is  $\geq$
- Occurrence is  $\geq$
- Criticality is  $\geq$
- Detection is  $\geq$
- RPN is  $\geq$

## Criticality

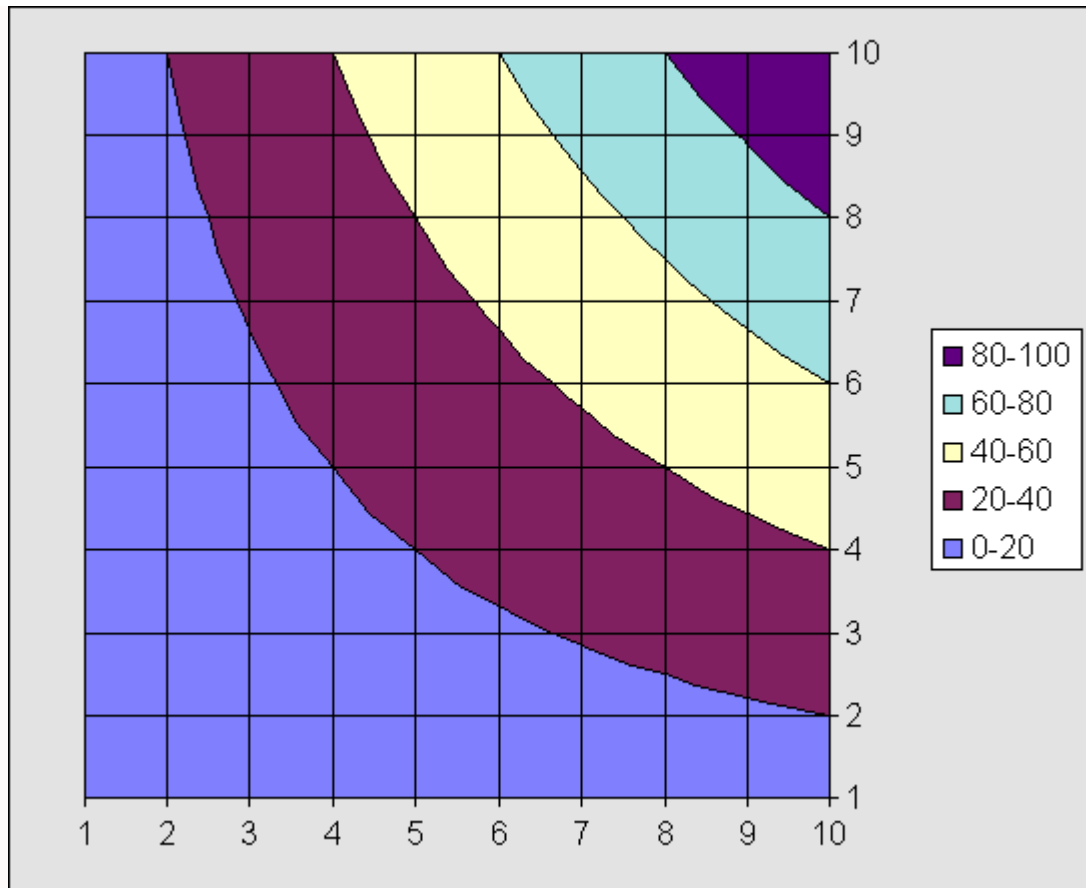
Although Severity and Occurrence can both take integer values between 1 and 10 inclusive the product does not include all values between 1 and 100 as shown in the table below.

10	10	20	30	40	50	60	70	80	90	100
9	9	18	27	36	45	54	63	72	81	90
8	8	16	24	32	40	48	56	64	72	80
7	7	14	21	28	35	42	49	56	63	70
6	6	12	18	24	30	36	42	48	54	60
5	5	10	15	20	25	30	35	40	45	50
4	4	8	12	16	20	24	28	32	36	40
3	3	6	9	12	15	18	21	24	27	30
2	2	4	6	8	10	12	14	16	18	20



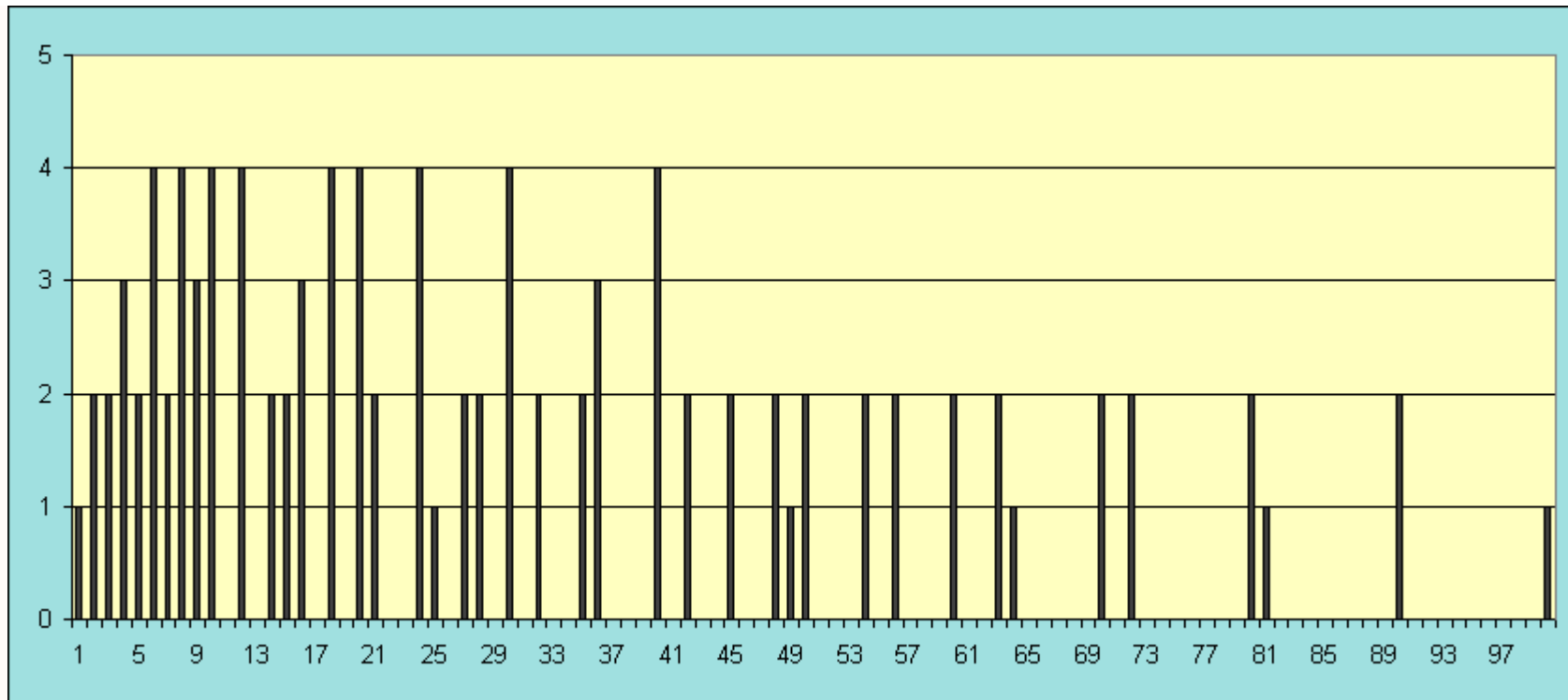


## Contour Map of Criticality



**Note:** The contour map shows areas of isotopic Criticality (i.e. Severity x Occurrence)

## Frequency Distribution of Criticality Values



**Note:**

Not all values between 1 and 100 are possible.

There are only 42 distinct values.

Minimum 1

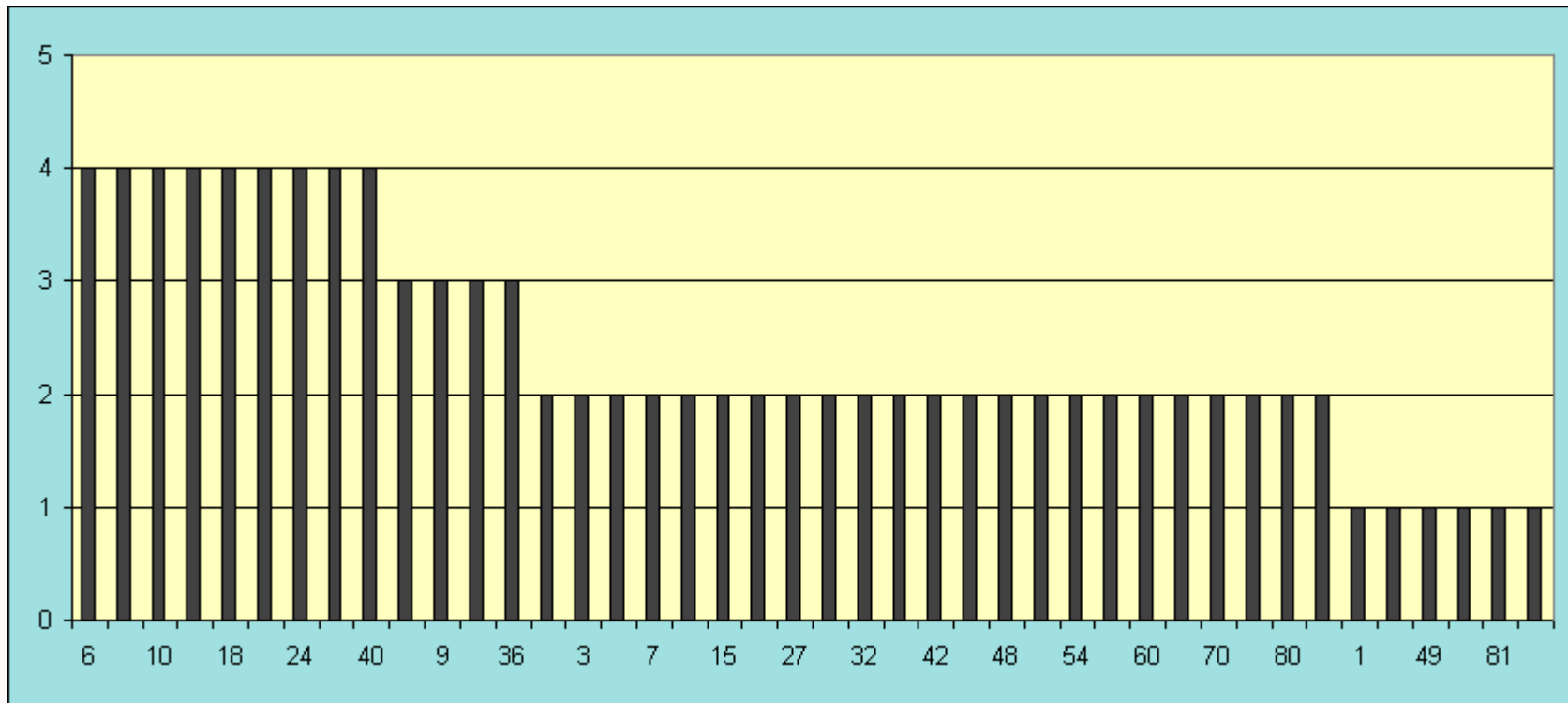
Maximum 100

Average 30.250 Returns the arithmetic mean of the numbers.

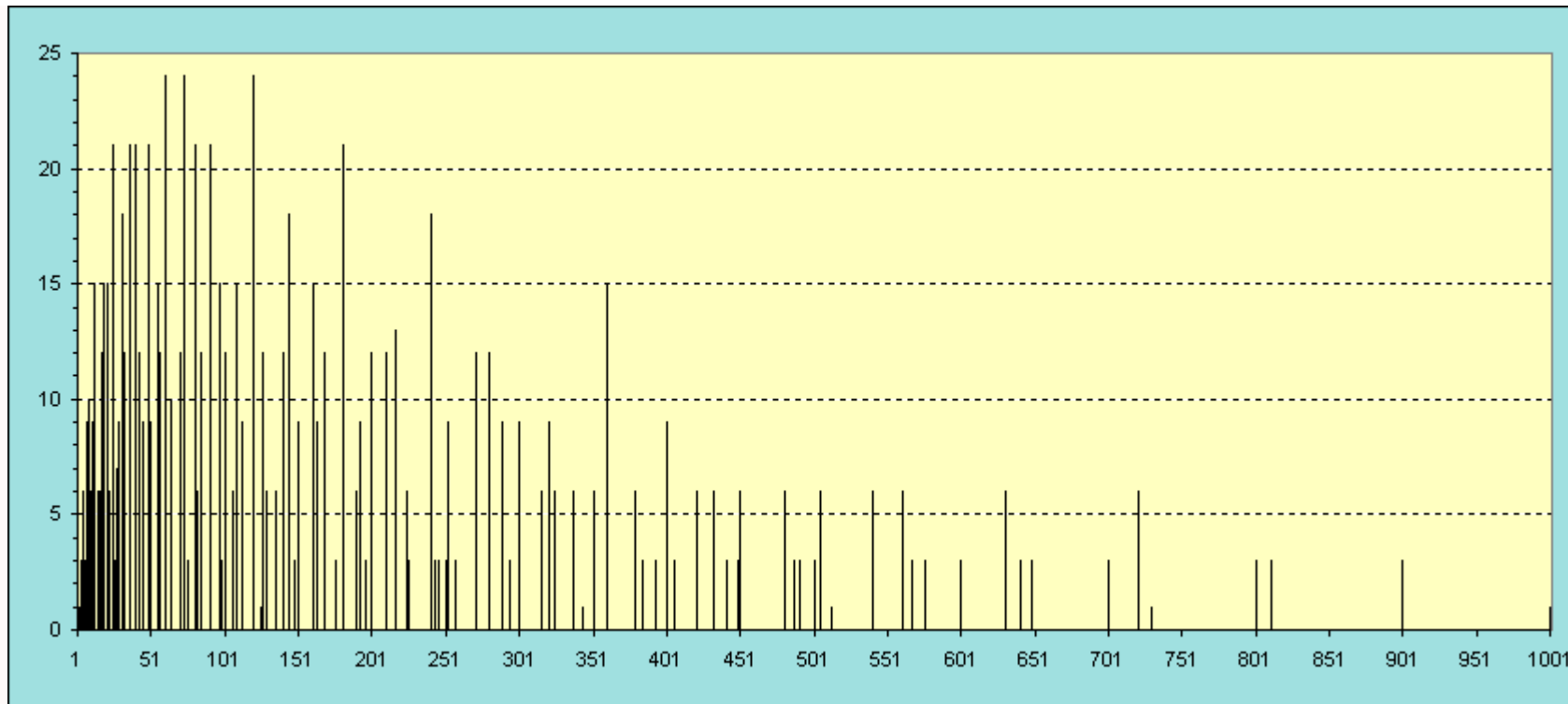
Mode 6 Returns the most frequently occurring, or repetitive, value in an array of data.

Median 24 The median is the value at the center of an ordered range of numbers.

## Frequency Distribution of Distinct Values of Criticality



Frequency Distribution of SOD Values



**Note:**

Not all values between 1 and 1000 are possible.

There are only 120 distinct values.

Minimum 1

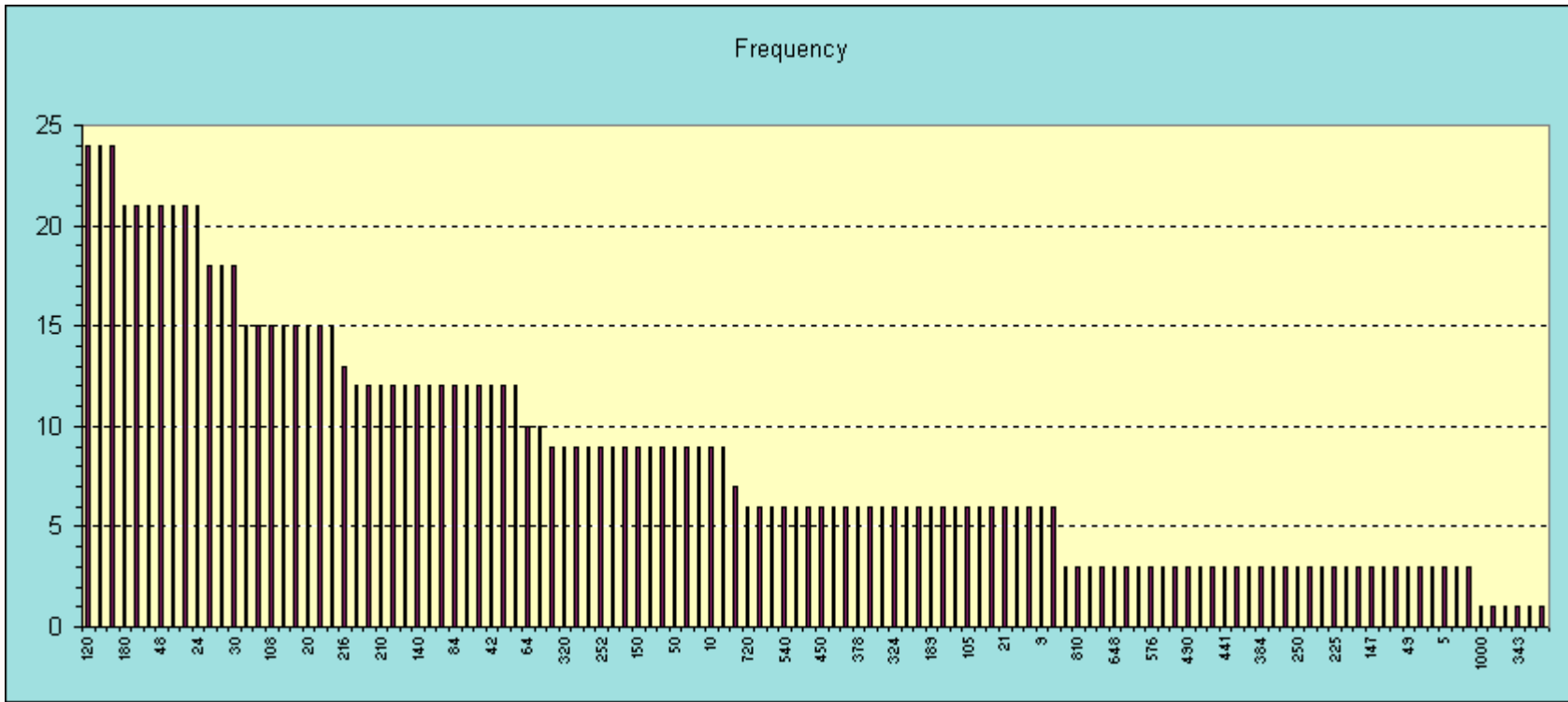
Maximum 1000

Average 166.375 Returns the arithmetic mean of the numbers.

Mode 60 Returns the most frequently occurring, or repetitive, value in an array of data.

Median 105 The median is the value at the center of an ordered range of numbers.

## Frequency Distribution of SOD Values





# FMEA Product

CC    SC    AC    OK

No.	Part / Function	Potential Failure Mode	Potential Effects of Failure	S	Potential Causes of Failure	O	Class	Current Controls Prevention	Current Controls Detection	D	RF
- 1											

**Note :**

Deleting an item deletes all information in that row.  
To refresh FMEA items from QFD, import without deleting the row information.  
Importing QFD items will import QFD Items without distorting the FMEA order.  
You can then re-arrange the row items as you wish

## Import

Link to F-Matrix application in **Project Flow**.

# Failure Mode Effects Analysis

## Process FMEA for APQP

Bawani Ho

Acme

2007-Mar-05 : 15:27:25

## Applet Introduction

### Applet Details

<b>Applet Title</b>	Proc-FMEA							
<b>Description</b>	Process FMEA for APQP							
<b>Objective</b>	The Proc-FMEA is used to identify the potential failure modes, causes and controls							
<b>Abstract</b>	FMEA is a very important tool in the APQP process							
<b>Team Leader</b>	Bawani Ho							
<b>Commencement Date</b>	16-Aug-2006							
<b>Expected Completion Date</b>								
<b>Completion Date</b>								
<b>Status</b>	Not Completed							
<b>Team Name</b>	Pro-FMEA							
<b>Team Members</b>	<table border="1"><tr><td>1</td><td>IR0015</td><td>Cho Boon Siah</td></tr><tr><td>2</td><td>IR0004</td><td>Azzizi Azizi</td></tr></table>		1	IR0015	Cho Boon Siah	2	IR0004	Azzizi Azizi
1	IR0015	Cho Boon Siah						
2	IR0004	Azzizi Azizi						

## Header Information

### Header Information

Part Name	
Part No .	
Drawing No.	
EO/PCO No.	
Change Letter	
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Process Responsibility	
Prod Trails Target Date	
Pre-Prod Target Date	
PQCM Target Date	
Prepared By	
Approved By	
FMEA No.	
FMEA Date	
Rev No.	

# Criteria

Description	Rank	
<b>Severity</b>		
None	1	The Failure Mode has no Effect.
Very Minor	2	Minor disruption to production line. A portion of the product may have to be reworked on-line but in-station. Fit & finish or squeak & rattle item does not conform. Discriminating customers notice the defect.
Minor	3	Minor disruption to production line. A portion of the product may have to be reworked on-line but out-of-station. Fit & finish or squeak & rattle item does not conform. Average customers notice the defect.
Very Low	4	Minor disruption to production line. Product may have to be sorted and a portion reworked. Fit & finish or squeak & rattle item does not conform. Most Customers notice the defect.
Low	5	Minor disruption to production line. 100% of the product may have to be reworked. Product is operable, but some comfort / convenience items operate at a reduced level of performance.
Moderate	6	Minor disruption to production line. A portion of the product may have to be scrapped (no sorting). Product is operable, but some comfort / convenience item(s) are inoperable
High	7	Minor disruption to production line. Product may have to be sorted and a portion scrapped. The product is operable, but at a reduced level of performance.
Very High	8	Major disruption to production line. 100% of product may have to be scrapped. The product is inoperable with loss of primary Function.
Hazardous - with warning	9	May endanger machine operator or assembly operator. Failure affects safe product operation or noncompliance with government regulation. Failure will occur with warning.
Hazardous - no warning	10	May endanger machine operator or assembly operator. Failure affects safe product operation or noncompliance with government regulation. Failure will occur without warning.
<b>Occurrence</b>		
Remote: Failure is unlikely	1	1.670
Very Low: Relatively few failures	2	1.500
Low: Relatively few failures	3	1.330
Low: Relatively few failures Some what low	4	1.170
Moderate: Occasional failures	5	1.000
Somewhat High	6	0.830
High: Repeated failures	7	0.670
High: Repeated failures	8	0.510
Very High: Failure is almost inevitable	9	0.330
Very High: Failure is almost inevitable	10	0.000
<b>Detection</b>		
Almost Certain	1	Current Controls almost certain to Failure Mode or Cause. Reliable detection controls are known with similar processes.
Very High	2	Very high likelihood current Controls with detect Failure Mode or Cause
High	3	High likelihood current Controls with detect Failure Mode or Cause
Moderately High	4	Moderately high likelihood current Controls with detect Failure Mode or Cause
Moderate	5	Moderate likelihood current Controls with detect Failure Mode or Cause
Low	6	Low likelihood current Controls with detect Failure Mode or Cause
Very Low	7	Very low likelihood current Controls with detect Failure Mode or Cause
Remote	8	Remote likelihood current Controls with detect Failure Mode or Cause
Very Remote	9	Very remote likelihood current Controls with detect Failure Mode or Cause
Absolute Uncertainty	10	No known Controls available to detect Failure Mode or Cause

## Properties of S, O and D

Before conducting an FMEA, it is important to understand the properties of Severity, Occurrence and Detection. This will help the team in Consensus Reaching for items discussed during FMEA. Severity, Occurrence and Detection can all take Integer values between 1 and 10 inclusive. The product of Severity and Occurrence is called Criticality. The product of Severity, Occurrence and Detection is called RPN.

### Consensus of Values

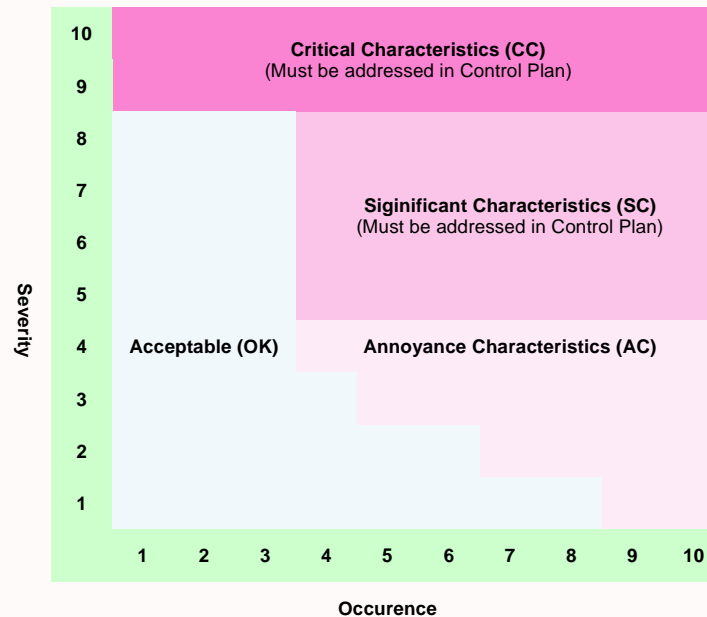
As a standard guide review the item if

- Severity is  $\geq 6$
- Occurrence is  $\geq 6$
- Criticality is  $\geq 5$
- Detection is  $\geq 50$
- RPN is  $\geq 300$

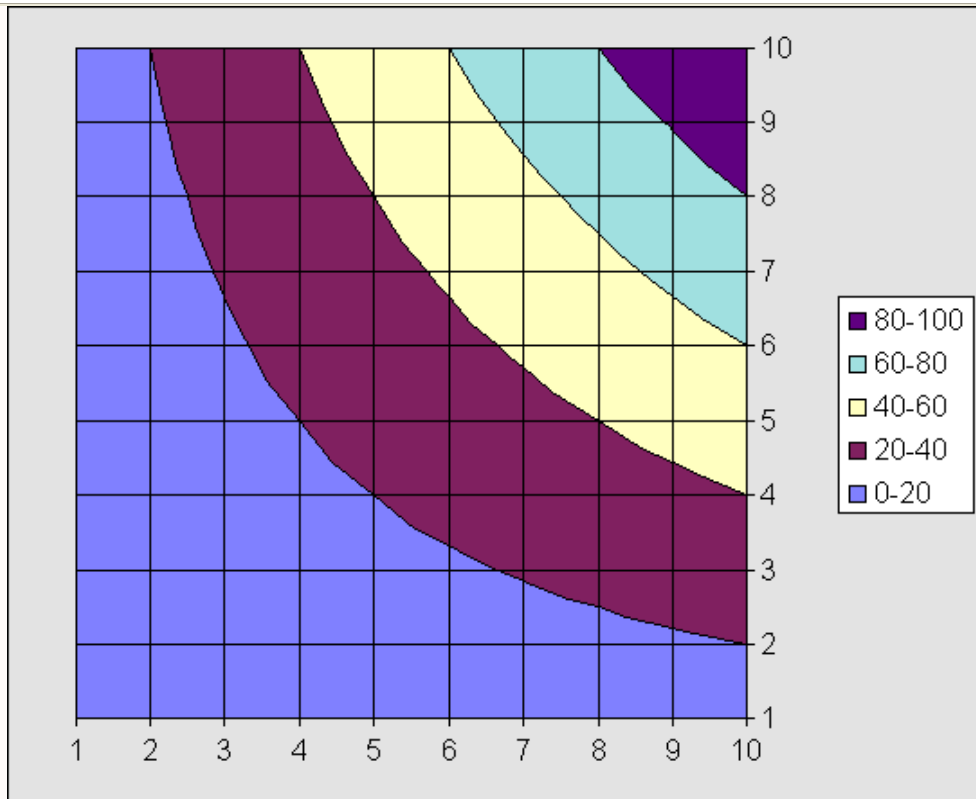
### Criticality

Although Severity and Occurrence can both take integer values between 1 and 10 inclusive the product does not include all values between 1 and 100 as shown in the table below.

10	10	20	30	40	50	60	70	80	90	100
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6	6	12	18	24	30	36	42	48	54	60
5	5	10	15	20	25	30	35	40	45	50
4	4	8	12	16	20	24	28	32	36	40
3	3	6	9	12	15	18	21	24	27	30
2	2	4	6	8	10	12	14	16	18	20
1	1	2	3	4	5	6	7	8	9	10
	1	2	3	4	5	6	7	8	9	10



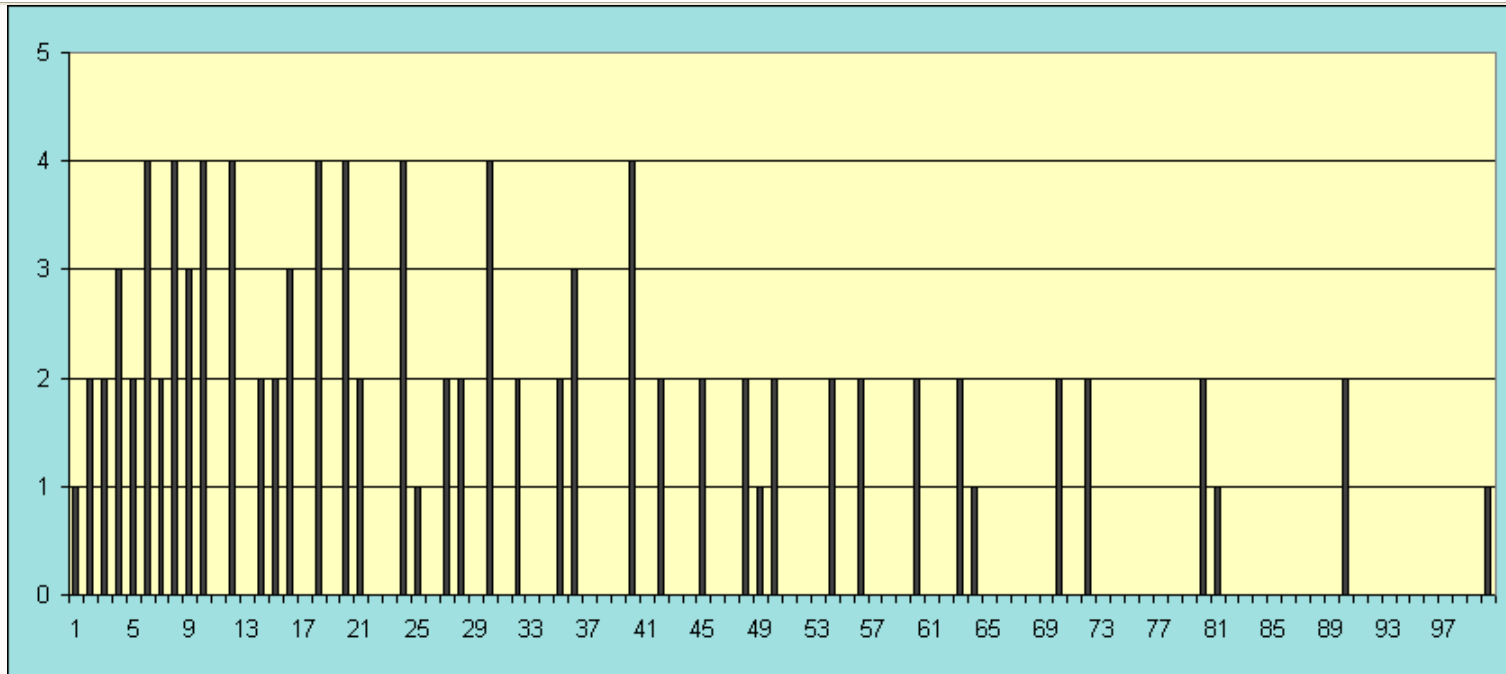
## Contour Map of Criticality



**Note:** The contour map shows areas of isotopic Criticality (i.e. Severity x Occurrence)

## Frequency Distribution of Criticality Values





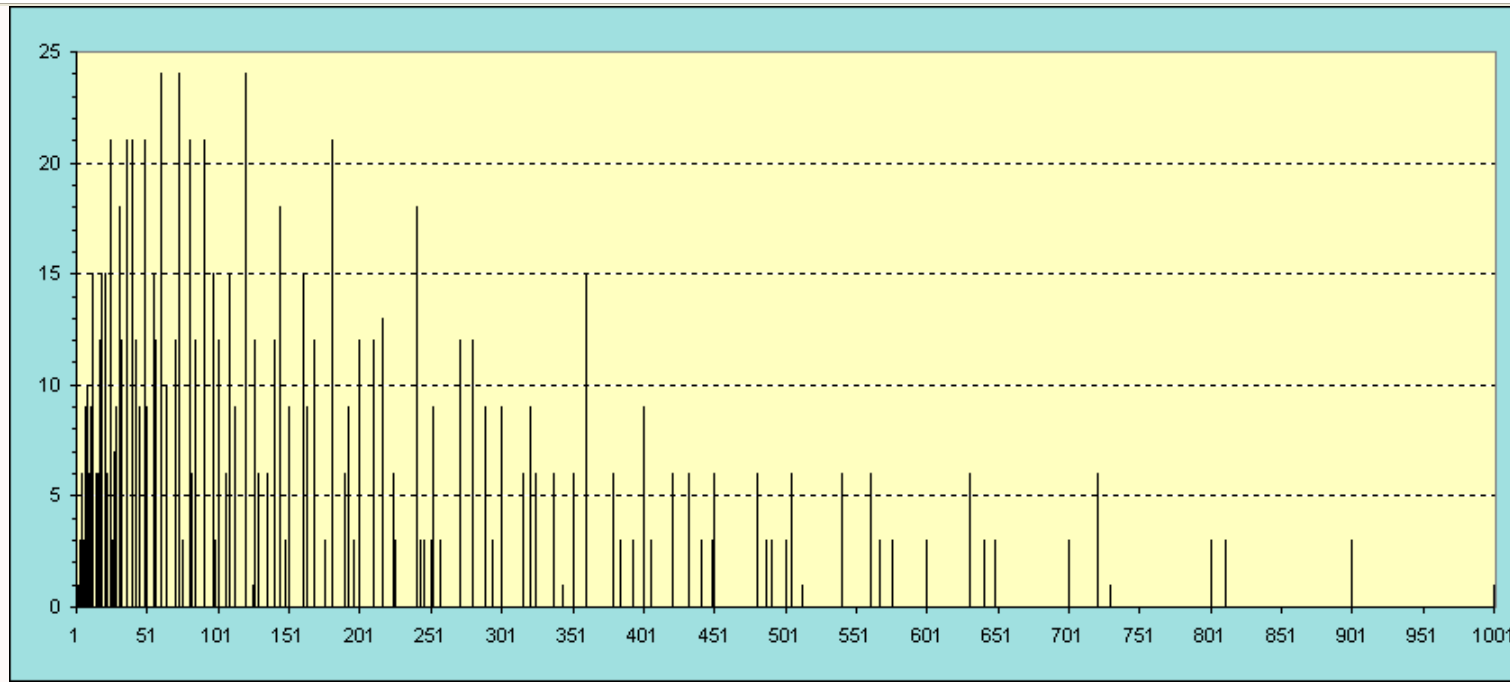
**Note:**

Not all values between 1 and 100 are possible.  
 There are only 42 distinct values.

- Minimum 1
- Maximum 100
- Average 30.250 Returns the arithmetic mean of the numbers.
- Mode 6 Returns the most frequently occurring, or repetitive, value in an array of data.
- Median 24 The median is the value at the center of an ordered range of numbers.

## Frequency Distribution of Distinct Values of Criticality

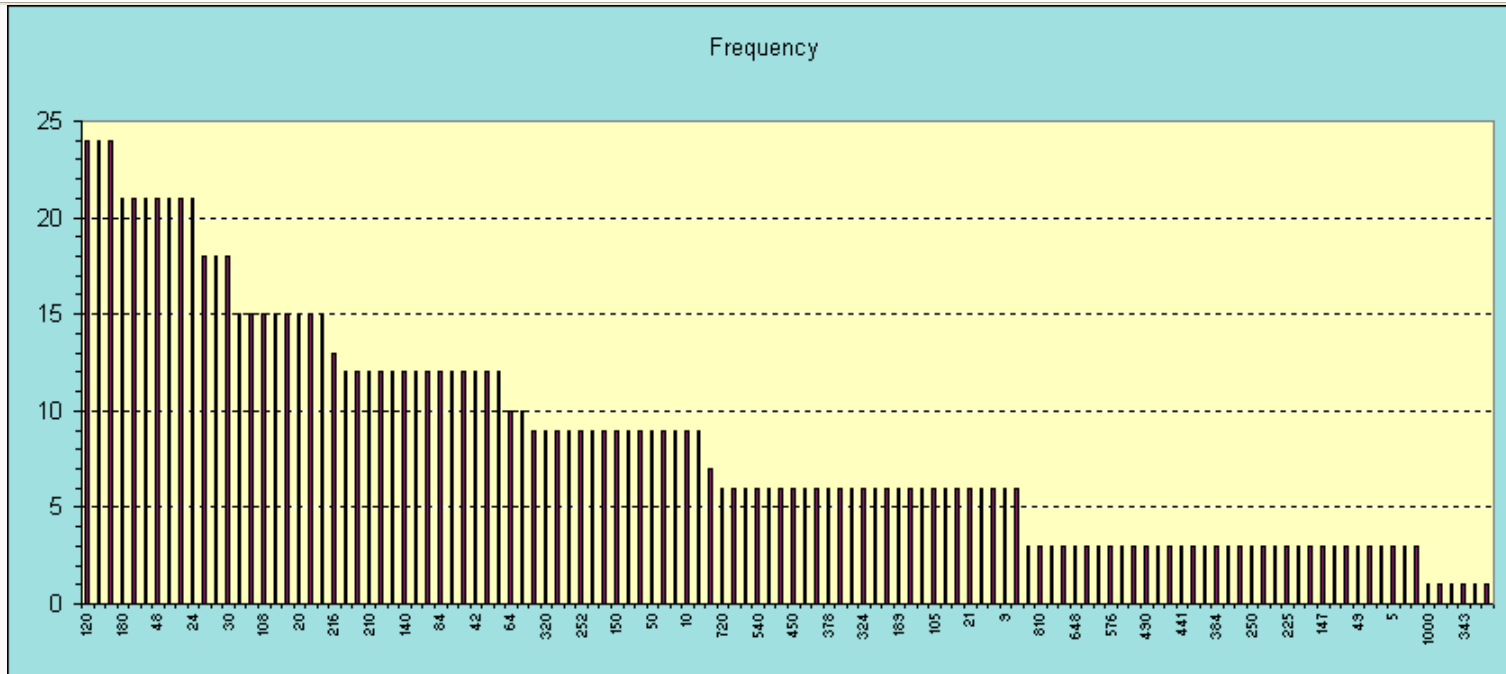




**Note:**

Not all values between 1 and 1000 are possible.  
 There are only 120 distinct values.  
 Minimum 1  
 Maximum 1000  
 Average 166.375 Returns the arithmetic mean of the numbers.  
 Mode 60 Returns the most frequently occurring, or repetitive, value in an array of data.  
 Median 105 The median is the value at the center of an ordered range of numbers.

**Frequency Distribution of SOD Values**



# FMEA Process

CC SC AC OK

No.	Part / Function	Potential Failure Mode	Potential Effects of Failure	S	Potential Causes of Failure	O	Class	Current Controls Prevention	Current Controls Detection	D	RPN	Recommended Action	Responsibility	Target Date	Sr	Or	Dr	RPNr	Review	
1	Previous Imported Data																			
1.1	Material Data Sheet	Non compliance	Breakage	6	Material not as specified	3	OK	MDS attached to cover	Included in pocket	8	144	Operator signoff	Operator	2006/08/01	6	4	3	72	S D	
1.2	Off-round shape	Difficult to hold	Pen slips	4	High form pressure	4	AC	Form pressure checked daily	Technician monitors size	5	80	Periodic dimensional check	Technician	2006/08/09	4	3	4	48	D	
1.3	Viscosity test	Ink hardens	Does not write	6	Insufficient plasticizer	6	SC	Rheological test	Writing test	5	180	Continue as current	QA Supervisor	2006/08/14	6	3	2	36	S O D	
1.4	Dimensional checks	Non fitting parts	Unable to assemble	5	Contraction of material	4	OK	Period check	Operator monitors size	5	100	Periodic dimensional check	Operator	2006/08/16	5	3	4	60	D	
1.5	Anodised surface	Scratches on pen	Old look	4	Thin anodization	6	AC	Control chart	Scratch test	4	96	Optimize anodization	Engineering	2006/08/08	4	2	3	24	O	
1.6	Spring clip	Brittle spring	Attachments fall apart	6	Hard material	3	OK	Use tempered steel	Pull up clip	1	18	Continue as current	Purchasing	2006/08/09	6	3	3	54	S	
1.7	Rimmed ridge	Broken ridge	Cannot hold body	5	Material storage too warm	6	SC	Thermostatic warehouse	Water condensation on pail	1	30	Continue as current	Warehouse Operator	2006/08/17	5	3	2	30	O	
1.8	Printed manual	Missed in package	Wrong handling	4	Procedure not followed	6	AC	Placed in kit	Tick Checklist	5	120	Operator SOP	Operator	2006/08/21	4	3	3	36	O D	
1.9	Tight rollers	Roller housing crimp	Stuck roller	9	Crimping force high	5	CC	Monitor crimp force	Writing at QA inspection	3	135	Process optimization	Engineering	2006/08/30	8	3	3	72	S	
1.10	Paper based	Non paper based	Not degradable	2	Not following SOP	1	OK	Changed in Process	Look and feel of material	1	2	Continue as current	Operator	2006/08/28	2	1	1	2		
1.11	Sensor touch checks	Rough surface	Not shining	3	Mold lubricant	4	OK	Visual inspection	Check piece visually	4	48	Inspect every pen	QA Inspector	2006/09/02	3	3	2	18		
1.12	Shadowgraph plot	Shadowgraph reading	Wrong sized barrel	3	Parallax in reading	5	AC	Train operator	QA Inspection	3	45	Train new operator	Human Resources	2006/09/12	3	4	4	48		
1.13	Standard sizes	Non fitting of parts	Barrel and cover cannot fit	7	Mold variability	6	SC	Do not mix molds	Test first piece	3	126	Monitor molds	Tooling	2006/08/21	7	5	3	105	S O	
1.14	Microfoil burst	Marking pressure high	Press through paper	5	Hight setup tension	6	SC	Train operator	Stretched microfoil	5	150	Calibrate machine	Technician	2006/09/06	1	1	1	1	O D	
1.15	Incoming Inspection	Issued without QA	Line failure	8	Mixed material batches	3	OK	Materia control FIFO	QA Accept stamp	3	72	Ensure FIFO	Manufacturing Supervisor	2006/08/16	8	2	2	32	S	
1.16	Aluminium alloy	Impure aluminium	Streaky finish	4	Supplier quality	2	OK	MSDN conformance	None	2	16	Continue as current	QA Inspector	2006/08/18	4	2	2	16		
1.17	Freephone number	No contact person	No supplies	5	Not accessible	4	OK	Fixed line number	Test call	4	80	Migrate to online	Computer Department	2006/08/15	5	4	3	60		
1.18	Measured time	Takes too long	Delayed use	6	Poor screw thread	4	OK	Thread without flash	Look for visible flash	3	72	Change threader after 1000 parts	Technician	2006/09/29	6	3	2	36	S	
1.19	Calculate content	Low recycle content	Reduced concern	4	Supplier quality	5	AC	MSDN conformance	QA Acceptance	3	60	Request supplier SPC	Manufacturing Supervisor	2006/08/22	4	4	2	32		
1.20	Recycle organics	No recycling	Environmental hazard	5	High inorganic content	6	SC	Recycling SOP	Account for containers	1	30	Continue as current	Manufacturing	2006/08/10	5	4	1	20	O	

**Note :**  
 Deleting an item deletes all information in that row.  
 To refresh FMEA items from QFD, import without deleting the row information.  
 Importing QFD items will import QFD Items without distorting the FMEA order.  
 You can then re-arrange the row items as you wish

## **Import**

**Link to QF - Matrix application in Project Flow.**