CHAPTER VI

IMPLEMENTATION PLAN OF FMEA TECHNIQUE

6.1 Introduction

From table 3.12, the most top five number are listed as following. And FMEA technique will be implemented to these selected five part number.

Part number	Quality criteria
1 889-5034	Mating problem (Terminal bent)
2 889-4859	Alternation wire
3 889-4941	Wrong wire color be assembled
4 889-0692	Wire is out off housing
5 889-4529	Mating problem (Unlocked)

In this thesis, the process of selected part number will be only considered according to the customer complaints in chapter III. Manufacturing is the most activity area which customers have complained. This data shows in table 3.1 and table 3.2 Therefore, FMEA will be implemented to improve the process of product and also reduce and eliminate the potential quality criteria that possible occurred in the process. Consequently, customer complaints will be reduced according to this proactive program.

6.2 FMEA team member

To implement FMEA successfully, team is very important. Commitment from top management is also the key thing to support this implementation. FMEA team consists of mulitifunction people in the organization. In this thesis, there are ten people in FMEA team which are listed out as following. Moreover, the risk priority number come from the severity number (S or SEV) multiply by occurrence number (O or OCC) and multiply by the detection number (D or DET). Each number come from the consensus of team voting and experience of each member. However, the team voting will follow the standard of QS 9000 which rank SEV, OCC, and DET for ten level from 1-10 that described in Chapter II page 18-21. FMEA team has been assigned as following.

1 Mr.Tanakorn	Chief Engineer at Molex Thailand
2 Mr. Prasit	Senior Product Engineer at Molex Thailand
3 Mr. Rashed	QA Engineer at Molex Thailand
4 Mr. Chaichet	Production engineer at Molex Thailand
5 Mr. Saichon	Production supervisor at Molex Thailand
6 Mr. Narong	Production Supervisor at Molex Thailand
7 Mr. Prachub	Maintenance Supervisor at Molex Thailand
8 Mr. Venus	Tooling Supervisor at Molex Thailand
9 Mr. Phisit	Export Sales Engineer at Molex Thailand
10 Mr. Ampai	QA Supervisor at Molex Thailand

6.3 FMEA program time frame

In table 6.1, it shows the FMEA program time frame for implementing FMEA to improve the quality of the process for the five selected part number which are described in 6.1. From table 6.1, it start with training the FMEA technique and then FMEA team selection was considered. Then FMEA technique has implemented since the second week in December 1997. And it had completed the first round in the fourth week of February 1998.

6.4 FMEA implementation

According to table 6.1, FMEA team implement FMEA technique to the following part number by considering the potential and known failures that might be occurred in the process of each part number. Each flow chart of each selected five part number and the drawing of the selected part number are shown in appendix III

6.4.1 Part number 889-4941

This part number is selected to implement FMEA regarding to "wrong wire color be assembly" as an quality issue.

1 Main process of part 889-4941 are described as following
1.1 Crimping
1.2 Stripping
1.3 Manual insertion
1.4 QA inspection
1.5 Packing
1.6 Storage

2 FMEA implementation

In figure 6.1, it shows the result of FMEA team effort on part 889-4941. The highest risk priority number is equal to 112. This RPN is in the manual insertion process.

3 Recommended actions
3.1 Analyze color cable checker procedure
3.2 Train operator
3.3 Tighten sampling plan
After implementing recommended actions, RPN was reduced from 112 to 28.

6.4.2 Part number 889-4859

This part number is selected to implement FMEA regarding to "wire alternation" as an quality issue.

1 Main process of part 889-4859 are described as following
1.1 Crimping and Cutting
1.2 Stripping
1.3 Manual insertion
1.4 QA inspection

1.5 Packing
1.6 Storage

2 FMEA implementation
In figure 6.2, it shows the result of FMEA team effort on part 889-4859. The highest risk priority number is equal to 98. This RPN is in the manual insertion process.

3 Recommended actions
3.1 Manual insertion process analysis which is come up withcontinuity test for wire alternation
After implement recommended actions, RPN was reduced from 98 to 49.

6.4.3 Part number 889-5034
This part number is selected to implement FMEA regarding to "terminal damaged" as an quality issue.

1 Main process of part 889-5034 are described as following
1.1 Crimping and cutting
1.2 Stripping
1.3 Manual insertion
1.4 QA inspection
1.5 Packing
1.6 Storage

2 FMEA implementation
In figure 6.3, it shows the result of FMEA team effort on part 889-5034. The highest risk priority number is equal to 112. There are two highest RPN. This RPN are in the crimping and cutting process and packaging process as well.

3 Recommended actions
3.1 Recommend actions for crimping and cutting process
1 Set standard setting procedure
2 Train setter
3 Add bin transit between operation
4 Tighten sampling plan

3.2 Recommend actions for packaging process
1 Change new carton
After implement recommended actions, RPN was reduced from 112 to 60 for crimping and cutting process. For packaging process, RPN was reduced from 112 to 40.

6.4.4 Part number 889-0692
This part number is selected to implement FMEA regarding to "wire is out off housing" as an quality issue.

1 Main process of part 889-0692 are described as following

1.1 Crimping and cutting
1.2 Stripping
1.3 Manual insertion
1.4 QA inspection
1.5 Packing
1.6 Storage

2 FMEA implementation

In figure 6.4, it shows the result of FMEA team effort on part 889-0692. The highest risk priority number is equal to 90. This RPN is in the crimping and cutting insertion process.

3 Recommended actions
3.1 Set standard procedure for setting-up
3.2 Train setter
3.3 Modify wire stopper
3.4 Tolerance analysis

After implement recommended actions, RPN was reduced from 90 to 72.

6.4.5 Part number 889-4529

This part number is selected to implement FMEA regarding to "unlocked" as an quality issue.

1 Main process of part 889-4529 are described as following
1.1 Crimping
1.2 Stripping
1.3 Manual insertion
1.4 QA inspection
1.5 Packing
1.6 Storage

2 FMEA implementation

In figure 6.5, it shows the result of FMEA team effort on part 889-4529. The highest risk priority number is equal to 96. This RPN is in the crimping and cutting process.

3 Recommended actions
3.1 Set standard procedure for setting-up
3.2 Train setter
3.3 Tighten sampling plan
3.4 Improve or tighten maintenance schedule

After implement recommended actions, RPN was reduced from 96 to 32.

After all five part number have been applied FMEA technique, summary are described as following.

Part number	Quality problem	RPN	RPN
1) 889-4941	wrong wire color be assembled	112	28
2) 889-4859	wire alternation	98	49
3) 889-5034	terminal damaged (cutting and crimping process)	112	60
	(packaging process)	112	40
4) 889-0692	wire is out off housing	90	72
5) 889-4529	unlocked	96	32

Part number 889-4941 used to face wrong wire color be assembled as quality problem and risk priority number (RPN) had reduced from 112 to 28 after implementing FMEA technique.

Part number 889-4859 used to face wire alternation as quality problem and risk priority number (RPN) had reduced from 98 to 49 after implementing FMEA technique.

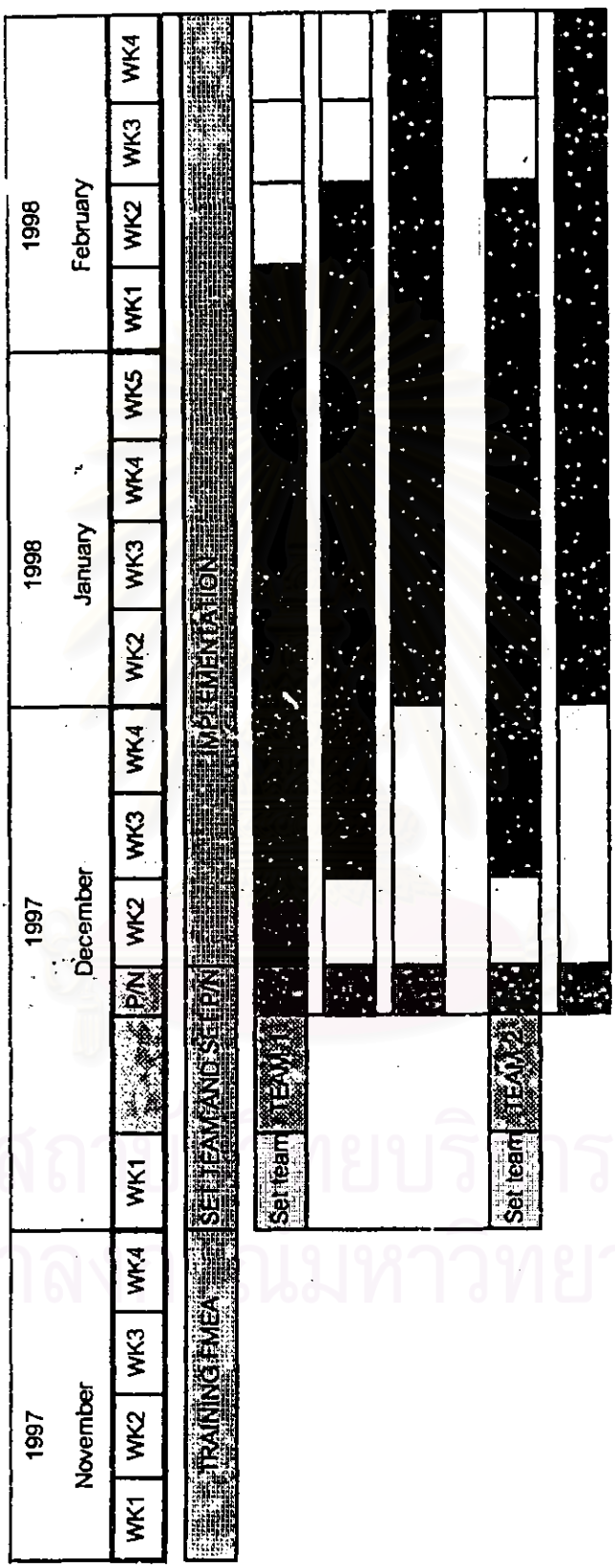
Part number 889-5034 used to face terminal damaged as quality problem. For cutting and crimping process, the risk priority number (RPN) had reduced from 112 to 60 after implementing FMEA technique. For packaging process, the risk priority number (RPN) had reduced from 112 to 40 after implementing FMEA technique.

Part number 889-0692 used to face wire is out off housing as quality problem and risk priority number (RPN) had reduced from 90 to 72 after implementing FMEA technique.

Part number 889-4529 used to face unlocked as quality problem and risk priority number (RPN) had reduced from 96 to 32 after implementing FMEA technique.

All evaluation of the FMEA implementation's result will be described in Chapter VII

Table 6.1- FMEA Program Time Frame



Process | Potential | Potential | S | Potential | O | Detection | D | R | Recommended | Individual / Area | Action Results

(1) Process name: Harness Assembly
(1A) Part name: 889-4941-00
(2) Mfg or design responsibility: Engineering
(2A) Person responsibility: Tanakorn / Prasit
(3) Involvement of others: Manual Insert
(4) Supplier involvement: None
(5) Model/product: Hipro Elec. / Power Supply
(6) Engineering release date: May/13/1997
(6A) Key prod. date: May/19/1997
(7) Prepared by: Tanakorn
(8) FMEA date: Jan/05/1998
(9) FMEA rev. date: ____
Page 1 of 2 pages

Process Function	Potential Failure Mode	Potential Effect(s) of Failure	SEV	Potential Cause(s) of Failure	OCC	Detection Method	DET	RPN	Recommended Action	Individual / Area Reponsible and Completion Date	Action Results: Action Taken	SEV	OCC	DET	RPN
(1) Crimping	1.Insulator over/under crimp	1.Wire out of housing	8	1.Poor tooling set-up 2. Poor feeding wire during crimp process 3. poor feeding of terminal from reel	4	1.QC inspec. 2.crimping	2.5	80							
	2. Terminal bent	1.Creat insert problem 2. Poor retention force 3. Electrical failure	8	1. Poor tooling setup 2. Tool wear / tear 3. Terminal jam	3	1. Self inspec by operator / setter	4	96							
	3.Lance height out of spec.	1.Incomplete locking in manual insert 2. Poor retention force 3. Unlocked	8	1. Poor setup of crimp applicator 2. Defective of material itself	2.5	1. Self inspec by operator / setter 2. Incoming sampling plan	3	60							
(2) Stripping	1.strip length out spec.	1.Fail pull test 2.TTL out spec. 3.Extrude wire 4.Insul come off	3	1. Poor set-up of application tooling 2. Tooling set up 3. No machine calibration	3	1. Self-inspec by tool setter 2. QC inspector	3	27							

Figure 6.1- FMEA for Wrong wire color be assembled (Sample 889-4941)

Process	Potential	Potential	S	Potential	O	Detection	D	R	Recommended	Individual / Area	Action Results				
(3) Manual insert	1. wire alternation	1.Electrical failure	7	1.Human error	4	1.QC inspect 2.Manual operator	3.5	98							
	2.Wrong color wire be assy.	1.Customer didn't get color they need	7	1.Operator	4	1.self inspec.	4	(112)	1.Analyse colour cable checki 2.Train operators 3.Tighten sampling plan	1.K.Prasit ECD Mar/06/98 2.K.Saichon ECDMar/06/9 3.K.Rashe ECDMar/06/98	Done Done Done	7	2	2	28
(4) QA inspection															
(5) Packing															
(6) Storage															

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Figure 6.1- (Continue) page 2 of 2

MOLEX FAILURE MODE AND EFFECTS ANALYSIS

(1) Process name: Harness Assembly
(1A) Part name: 889-4859-00
(2) Mfg or design responsibility: Engineering
(2A) Person responsibility: Tanakorn / Prasit
(3) Involvement of others: Manual insertion
(4) Supplier involvement: None
(5) Model/product: Inherit / Aron remote
(6) Engineering release date: Mar/28/ 997
(6A) Key prod. date: Apr/1/1997
(7) Prepared by: Tanakorn
(8) FMEA date: Jun/21/ 1997
(9) FMEA rev. date:
Page 1 of 2 pages

Process Function	Potential Failure Mode	Potential Effect(s) of Failure	SEV	Potential Cause(s) of Failure	OCC	Detection Method	DET	RPN	Recommended Action	Individual / Area Reponsible and Completion Date	Action Results: Action Taken	SEV	OCC	DET	RPN
(1) Crimping & Cutting	1.Insulator over / und crimp	1.Wire out of housing	8	1.Poor tooling set-up 2. Poor feeding wire during crimp process 3. Poor feeding of terminal from reel 4. Various striplength 5.Mismatched wire stopper 6. No standardize in machine setup 7. Untrain operator	4.5	1.QC inspec. 2.Self inspec by operator / setter	2.5	90							
	2. Terminal bent	1.Creat insert problem 2. Poor retention force 3. Electrical failure	8	1. Poor tooling setup 2. Tool wear / tear 3. Terminal jam	4	1. Self inspec by operator / setter	3	96							
	3. One side crimping	1. Poor retention force between terminal and insulator	5	1. Poor alingnment of punch / avil with terminal and wire 2. Terminal jam 3.Poor alingnment of termainal carrier	2.5	1. Self inspec. by operator / setter 2. Incoming sampling plan	3	37.5							

Figure 6.2- FMEA for Wire alternation (Sample 889-4859)

Process Function	Potential Failure Mode	Potential Effect(s) of Failure	SEV	Potential Cause(s) of Failure	OCC	Detection Method	DET	RPN	Recommended Action	Individual / Area Reponsible and Completion Date	Action Results: Action Taken	SEV	OCC	DET	RPN
(2) Stripping	1.Strip length out spec.	1.Fail pull test 2.TTL out spec. 3.Extrude wire 4.Insul come off	3	1. Poor set-up of application tooling 2. Tooling set up 3. No machine calibration	3.5	1. Self-inspec by tool setter 2. QC inspector	3	31.5							
(3) Manual insert	1. Wire alternation	1.Electrical failure	7	1.Human error	4	1.QC inspect 2.Manual operator	3.5	98	1. Add continuty test 2. Train operator	1. K.Narong ECD Feb/18/98 2.K.Saichon ECD Feb/18/98	Done Done	7	2	3.5	49
(4) QA inspection															
(5) Packing															
(6) Storage															
(7) Packing															
(8) Storage															

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Figure 6.2- (Continue) page 2 of 2

MOLEX FAILURE MODE AND EFFECTS ANALYSIS

(1) Process name: _Harness Assembly
(1A) Part name: ____889-5034-00
(2) Mfg or design responsibility: _Engineering
(2A) Person responsibility: Tanakorn / Prasit

(3) Involvement of others Manual Crimp, Warehouse
(4) Supplier involvement: JWT, Wonderful, HR, Longwell
(5) Model/product: _Delta #3, DFS-145 FBA
(6) Engineering release date May/19/1997

(6A) Key prod. date: _May/19/1997
(7) Prepared by: _Tanakorn
(8) FMEA date: _ Jan/05/1998
(9) FMEA rev. date: _______
Page __1__ of __2__ pages

Process Function	Potential Failure Mode	Potential Effect(s) of Failure	SEV	Potential Cause(s) of Failure	OCC	Detection Method	DET	RPN	Recommended Action	Individual / Area Reponsible and Completion Date	Action Results: Action Taken	SEV	OCC	DET	RPN
(1) Crimping & Cutting	1.Insulator over/under crimp	1.Wire out of housing	8	1.Poor tooling set-up 2. Poor feeding wire during crimp process 3. poor feeding of terminal from reel	3.5	1.QC inspec. 2.crimping	3	70							
	2. Terminal bent	1.Creat insert problem 2. Poor retention force 3. Electrical failure	8	1. Poor tooling setup 2. Tool wear / tear 3. Terminal jam	3.5	1. Self inspec by operator / setter	4	(112)	1. Set standard tooling set-up 2. Train setter 3. Add bin transit betwee operations 4.Tighten sampling plan	1.K.Prachub ECD Mar/05/98 2.K.Prachub ECD Mar/05/98 3.K.Saichon ECD Mar/05/98 4.K.Rashe ECD Mar/05/98	Done Done Done Done	8	3	2.5	60
	3. One side crimping	1. Poor retention force between terminal and insulator	8	1. Poor alingnment of punch / avil with terminal and wire 2. Terminal jam 3.Poor alingnment of termainal carrier	3	1. Self inspec. b operator / setter 2. Incoming sampling plan	3	72							
(2) Stripping	1.strip length out spec.	1.Fail pull test 2.TTL out spec. 3.Extrude wire 4.Insul come off	3	1. Poor set-up of application tooling 2. Tooling set up 3. No machine calibration	3.5	1. Self-inspec by tool setter 2. QC inspector	3	31.5							

Figure 6.3- FMEA for Terminal bent (Sample 889-5034)

Process Function	Potential Failure Mode	Potential Effect(s) of Failure	SEV	Potential Cause(s) of Failure	OCC	Detection Method	DET	RPN	Recommended Action	Individual / Area Reponsible and Completion Date	Action Results: Action Taken	SEV	OCC	DET	RPN
(3) Manual insert	1. wire alternation	1.Electrical failure	7	1.Human error	3.5	1.QC inspect 2.Manual operator	4	85.75							
	2.Wrong color wire be assy.	1.Customer didn't get color they need	7	1.Operator	3.5	1.self inspec.	3	73.5							
(4) QA inspection															
(5) Packaging	1. Terminal bent	1.Creat insert problem 2. Poor retention force 3. Electrical failure	8	1. Poor tooling setup 2. Tool wear / tear 3. Terminal jam	3.5	1. Self inspec by operator / setter	4	112	1.New packaging - 5 layers	1.K.Chaichet ECD Mar/05/9	Done	8	2	2.5	40
(6) Storage															

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Figure 6.3- (Continue) page 2 of 2

MOLEX FAILURE MODE AND EFFECTS ANALYSIS

(1) Process name: _____ (3) Involvement of others: _Cut,Crimp,Manual insert (6A) Key prod. date: _____May 14 , 1997
(1A) Part name: _____ (4) Supplier involvement: _____ (7) Prepared by: _____Tanakorn
(2) Mfg or design responsibility: _____ (5) Model/product: _____ (8) FMEA date: _____ Dec 15, 1997
(2A) Person responsibility: _____Tanakorn / Prasit (6) Engineering release date: _____ (9) FMEA rev. date: _____
Page __1__ of __2__ pages

Process Function	Potential Failure Mode	Potential Effect(s) of Failure	SEV	Potential Cause(s) of Failure	OCC	Detection Method	DET	RPN	Recommended Action	Individual / Area Reponsible and Completion Date	Action Results: Action Taken	SEV	OCC	DET	RPN
(1) Crimping & Cutting	1.Insulator over / under crimp	1.Wire out of housing	8	1.Poor tooling set-up 2. Poor feeding wire during crimp process 3. Poor feeding of terminal from reel 4. Various striplength 5.Mismatched wire stopper 6. No standardize in machine setup 7. Untrain operator	4.5	1.QC inspec. 2.Self inspec by operator / setter	3	90	1. Set standard set-up procedure 2. Train setter 3. Modify wire stopper 4. tolerance analysis	1. K.Prasit ECD Mar/03/98 2. K.Prachub ECD Mar/03/9 3. K.Venus ECD Mar/03/98 4. K.Prasit ECD Mar/03/98	Done Done Done Done	8	3	3	72
	2. Terminal bent	1.Creat insert problem 2. Poor retention force 3. Electrical failure 4. Terminal unlocked	8	1. Poor tooling setup 2. Tool wear / tear 3. Terminal jam	3.5	1. Self inspec by operator / setter	3	84							
	3.Lance height out of spec.	1.Incomplete locking in manual insert 2. Poor retention force 3. Unlocked	8	1. Poor setup of crimp applicator 2. Defective of material itself 3. Untrain operator	3.5	1. Self inspec by operator / setter 2. Incoming sampling plan	3	84							
	4. One side crimping	1. Poor retention force between terminal and insulator	5	1. Poor alingnment of punch / avil with terminal and wire 2. Terminal jam 3.Poor alingnment of termainal carrier	3.5	1. Self inspec. b operator / setter 2. Incoming sampling plan	3	52.5							
	5. Tube is out of spec.	1. Poor retention force 2. Customer dissatisfaction	3	1. Poor accuracy of tube cutting machine 2. Old machine	2.5	1. self inspec. by setter 2. QC inspec.	3	22.5							
(2) Stripping	1.strip length out spec.	1.Fail pull test 2.TTL out spec. 3.Extrude wire 4.Insul come off	3	1. Poor set-up of application tooling 2. Tooling set up 3. No machine calibration	3	1. Self-inspec by tool setter 2. QC inspector	3	27							

Figure 6.4- FMEA for Wire is out off housing (Sample 889-0692)

Process Function	Potential Failure Mode	Potential Effect(s) of Failure	SEV	Potential Cause(s) of Failure	OCC	Detection Method	DET	RPN	Recommended Action	Individual / Area Reponsible and Completion Date	Action Results: Action Taken	SEV	OCC	DET	RPN
(3) Manual i	1. wire alternation	1.Electrical failure	7	1.Human error	3.5	1.QC inspect 2.Manual operator	4	85.75							
	2.Wrong color wire be assy.	1.Customer didn't get color they need	4	1.Operator	3	1.Self inspec.	3	36							
	3.Alternate housing	1.Electrical Failure 2.Mating problem	7	1.Human error	3.5	1.Self inspec.	3	73.5							
(4) QA inspection															
(5) Packing (6) Storage															
(7) Packing (8) Storage															

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MOLEX FAILURE MODE AND EFFECTS ANALYSIS

(1) Process name: Harness Assembly
(1A) Part name: 889-4529-00
(2) Mfg or design responsibility: Engineering
(2A) Person responsibility: Tanakorn / Prasit
(3) Involvement of others: Manual insertion
(4) Supplier involvement: MXT, MXL,MXH
(5) Model/product: Smt REC / OTV
(6) Engineering release date:
(6A) Key prod. date: Aug/21/1997
(7) Prepared by: Tanakorn
(8) FMEA date: Dec/8/ 1997
(9) FMEA rev. date:
Page 1 of 2 pages

Process Function	Potential Failure Mode	Potential Effect(s) of Failure	SEV	Potential Cause(s) of Failure	OCC	Detection Method	DET	RPN	Recommended Action	Individual / Area Responsible and Completion Date	Action Results: Action Taken	SEV	OCC	DET	RPN
(1) Crimping & Cutting	1.Insulator over / under crimp	1.Wire out of housing	8	1.Poor tooling set-up 2. Poor feeding wire during crimp process 3. Poor feeding of terminal from reel 4. Various striplength 5.Mismatched wire stopper 6. No standardize in machine set-up 7. Untrain operator	4.5	1.QC inspect. 2.Self inspect by operator / setter	2.5	90							
	2. Terminal bent	1.Creat insert problem 2. Poor retention force 3. Electrical failure 4. Terminal unlocked	8	1. Poor tooling set-up 2. Tool wear / tear 3. Terminal jam	4	1. Self inspect b operator / setter	3	96	1. Train setter how to set-up 2. Set standard setting procedure 3. Improve maintainance schedule 4. Tighten incoming sampling plan	1) K.Prasit ECDFeb/18/98 2) K.Prasit ECDFeb/18/98 3) K.Prachaub ECD Feb/18/98 4) K.Paisit ECD Feb/18/98	Done Done Done Done	8	2	2	32
	3.Lance height out of spec.	1.Incomplete locking in manual insert 2. Poor retention force 3. Unlocked	8	1. Poor set-up of crimp applicator 2. Defective of material itself 3. Untrain operator	3	1. Self inspect b operator / setter 2. Incoming sampling plan	3	72				8	2	2	32
	4. One side crimping	1. Poor retention force between terminal and insulator	5	1. Poor alignment of punch / avil with terminal and wire 2. Terminal jam 3.Poor alignment of terminal carrier	3.5	1. Self inspect. b operator / setter 2. Incoming sampling plan	3	52.5							
	5. Tube is out of spec.	1. Poor retention force 2. Customer disatisfaction	3	1. Poor accuracy of tube cutting machine 2. Old machine	2	1. self inspect. b setter 2. QC inspect.	3	18							
(2) Stripping	1.strip length out spec.	1.Fail pull test 2.TTL out spec. 3.Extrude wire 4.Insul come off	3	1. Poor set-up of application tooling 2. Tooling set up 3. No machine calibration	3.5	1. Self-inspec by tool setter 2. QC inspector	3	31.5							

Figure 6.5- FMEA for Unlocked (Sample 889-4529)

Process Function	Potential Failure Mode	Potential Effect(s) of Failure	SEV	Potential Cause(s) of Failure	OCC	Detection Method	DET	RPN	Recommended Action	Individual / Area Responsible and Completion Date	Action Results: Action Taken	SEV	OCC	DET	RPN
(3) Manual i	1. wire alternation	1.Customer dissatisfation 2. Electrical failure	7	1.Human error	3	1.QC inspect 2.Manual operator	3.5	73.5							
	2.Wrong color wire be assy.	1.Customer didn't get color they need	4	1.Operator	2	1.Self inspec.	3	24							
	3.Alternate housing	1.Electrical Failure 2.Mating problem	7	1.Human error	3.5	1.Self inspec.	3	73.5							
(4) QA inspection															
(5) Packing (6) Storage															
(7) Packing (8) Storage															

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