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Quality and Reliability Program

SEP ELECTRONIC CORP.®

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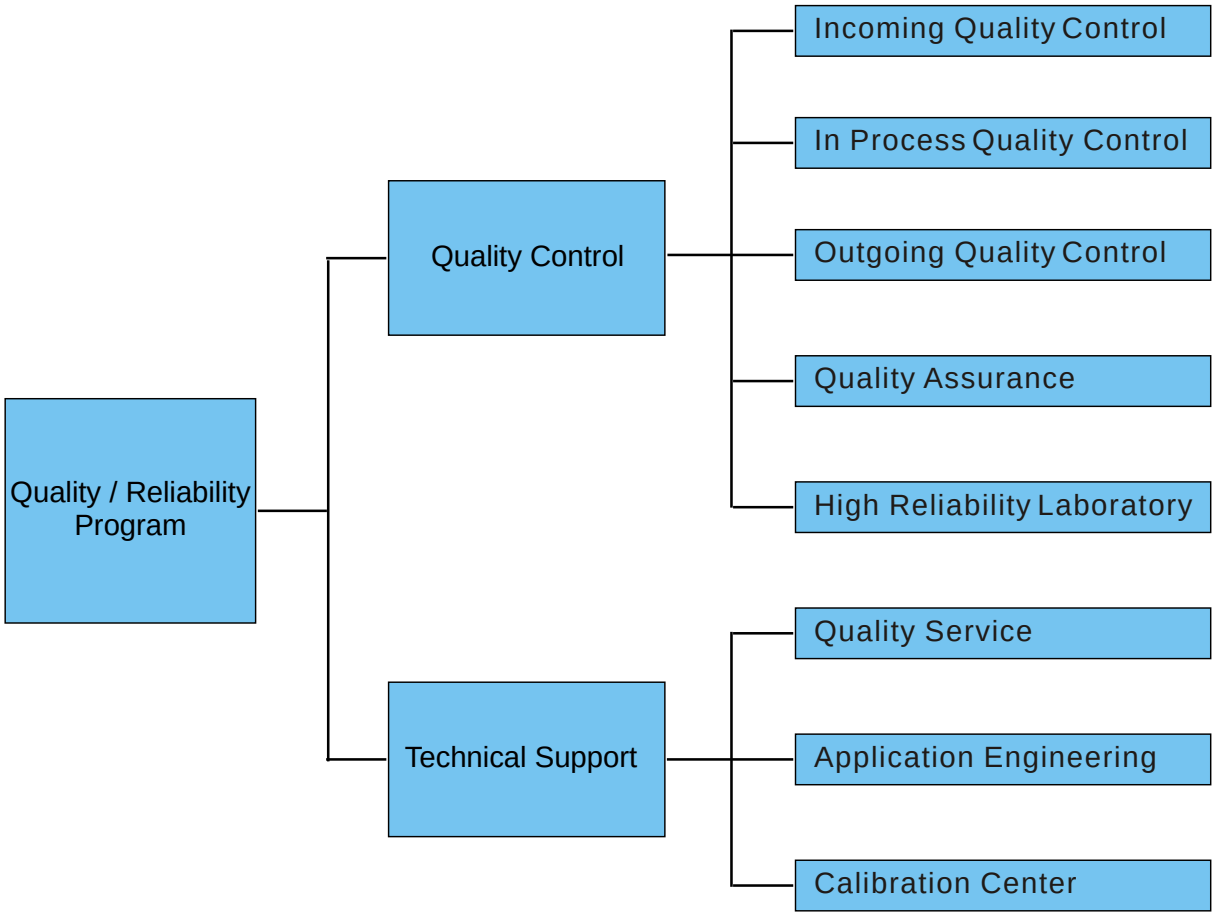
1. Quality Control System-Basic Concepts

SEP achieved ISO-9001:2000 status in 2003. Naturally, SEP has modeled its internal quality and reliability standards around the ISO-9001 model. In addition, all departments are required to attend regularly schedule training sessions on topics such as Statistical Process Control (SPC), Just-Time (JIT), Zero Defect Programs, and TQM.

The information listed below is intended as a general overview of SEP's quality and reliability capabilities. Further details and explanations can be found in the SEP Quality Manual.

2. Quality / Reliability Program Chart



3. Quality Control Flow Charts

In process quality control (IPQC) is a key element of the SEP quality process. Below are flow charts of major in process QC inspection points of products.

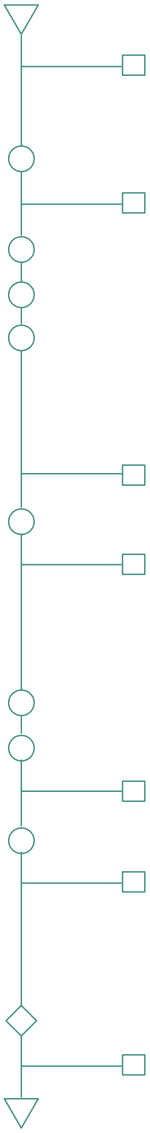
3-1 Flow Chart of the Cell Manufacturing Process

PROCESS	DESCRIPTION
Raw Material Input	* Parts received from approved supplier.
Incoming Inspection	* Perform incoming inspection of parts and material and record the results.
Soldering	* Furnace profile checked bi-weekly.
In-process Inspection-I	
Etching	* Die size control.
Junction Coating	* Process condition of curing and timing control.
In-process Inspetion-II	* Visual inspection.
Elect.Test	* Electrical testing.
In-process Inspection-III	* Electrical function, cosmetic, dimension test.
Visual Inspection & packing	* can packing verification.
Lot Outgoing Quality Control or Final Inspection	* Electrical characteristics, external visual and verification of any special customer specification.
Warehouse	
Quality Audit	* QA audit for Packing of carton, inner box.
Shipment	

3-2 Flow Chart of the Bridge Rectifier and Power module Manufacturing Process

PROCESS	DESCRIPTION
Raw Material Input	* Parts received from approved supplier.
Incoming Inspection	* Perform incoming inspection of parts and material and record the results.
Soldering	* Furnace profile checked bi-weekly.
Elect.Test	* Electrical testing.
In-process Inspection-I	
Molding / Potting	* Molding / Potting of plastic encapsulated / epoxy device temperature, pressure and clamping time Verification.
Elect.Test	* Electrical testing..
Marking	* Marking legibility marking.
In-process Inspection-II	* Electrical function, cosmetic, dimension test.
Visual Inspection & packing	* Box / Bulk packing verification.
Lot Outgoing Quality Control or Final Inspection	* Electrical characteristics, external visual and verification of any special customer specification.
Warehouse	
Quality Audit	* QA audit for Packing of carton, inner box.
Shipment	

3-3 Flow Chart of the Axial Lead Rectifier Manufacturing Process



PROCESS	DESCRIPTION
Raw Material Input	* Parts received from approved supplier.
Incoming Inspection	* Perform incoming inspection of parts and material and record the results.
Soldering	* Furnace profile checked bi-weekly.
In-process Inspection-I	
Etching	* Die size control.
Junction Coating	* Process condition of curing and timing control.
Molding	* Molding of plastic encapsulated device temperature, pressure and clamping time Verification.
In-process Inspection-II	* Visual, mechanical inspection.
Plating	* Temperature, PH value, and timing verification.
In-process Inspetion-III	* Visual inspection, solderability thickness test. * Special test of temperature cycling, gross and fine leak lest.
4-Bin Sorting Tester	
Marking & Elect.Test	* Marking legibility marking, correct electrical-polarity function.
In-process Inspection-IV	* Electrical function, cosmetic, dimension test.
Visual Inspection & packing	* Bulk / tape-reel packing verification.
Lot Outgoing Quality Control or Final Inspection	* Electrical characteristics, external visual and verification of any special customer specification.
Warehouse	
Quality Audit	* QA audit for Packing of carton, inner box.
Shipment	

4. Main Function of Quality / Reliability Departments

4 - 1 I.Q.C (Incoming Quality Control)

1. New vendor evaluation.
2. Vendor survey.
3. Incoming (materials, parts, chemicals) inspection.
4. Incoming quality analysis.
5. Purchasing specificaitons.
6. Lead evaluation.
7. Die analysis.
8. Solder analysis.
9. Silicon rubber function test.
10. Molding compound evaluation.
11. Corrective action follow up for defective materials.
12. First in, first out check.

4 - 2 I.P.Q.C (In-Process Quality Control)

1. Quality control.
2. Processing analysis.
3. Statistical analysis.
4. Failure analysis.
5. Soldering analysis.
6. Etching analysis.
7. Control charts.
8. Engineeing change notifications
9. Review of operating insructions.
10. Production yield analysis.
11. Scrap material control.
12. Rejected lot analysis.
13. Corrective action.
14. Check testing equipment calibration.
15. Pull, break, bend, twist and flammability tests.

4 - 3 O.Q.C. (Outgoing Quality Control)

1. Outgoing inspection and product analysis.
2. Customer specification review.
3. Internal specificaions review.
4. Routine inspections / customer records.
5. Documentation check.
6. Provide certification.
7. Statistical analysis.
8. Correlation with customer.
9. Sampling check.
10. Package standards review.

4 - 4 HI-REL (High Reliability Laboratory)

1. Environmental and life qualification assurance
   * Terminal strength
   * Solvent resistance
   * Solderability
   * Solder resistance
   * Forward surge
   * Thermal shock
   * Humidity test
   * Pressure cooker test
   * Operating life
   * Thermal fatigue
   * High temperature reverse bias
2. Product family surveillance analysis.
3. Customer specification qualification.
4. Test procedure set up.
5. New process device & packing evaluation
6. Failure analysis.
7. Corrective action.
8. Product standards.

4 - 5 QA (Quality Assurance)

1. QC system evaluation.
2. Quality cost evaluation.
3. Calibration system monitoring.
4. Specification & drawing review.
5. Quality improvement activities.
6. Quality control circle.
7. PPM Program.
8. Design review.
9. Review first-in first-out at warehouse of finish products.

4 - 6 QS (Quality Service)

1. Reply to customer's claim.
2. Marketing quality survey.
3. Failure mode defects analysis, and verification.
4. Product shipment, packing and storage analysis.
5. Product safety specification review.

4 - 7 A.E. (Application Engineering)

1. Sample order preparation.
2. Issue internal product specifications.
3. Customer specification review.
4. Evaluation of new products.
5. Product failure analysis.
6. Catalog and data sheet preparation.
7. Rectifier application consulting.

4 - 8 Calibration Center

1. Equipment calibration and set up.
2. Evaluation, calibration and accuracy checking of new Equipment.

5. Reliability Experiment

ITEM	TESTING ITEM	CONDITION	REF. DOC.
1	Steam Aging Test Solder Ability	230±5°C for 5±0.5 sec or 7±0.5 sec	MIL-STD-202F METHOD-208
2	High Temperature Reverse Bias Test	T_A=100±5°C / 125±5°C V_R=80% Rated V_R 1000 hrs / 96 hrs	MIL-STD-750C METHOD-1026
3	Thermal fatigue	ON: 300 secs OFF: 300 secs 1000 cycles / 300 cycles	MIL-STD-750C METHOD-1036
4	Pressure Cooker Life Test	15 psi T_A=121°C 8 hrs	
5	High Temperature Storage Life	150°C±5°C / 1000 hrs / 96 hrs	MIL-STD-750C METHOD - 1031
6	Solder Resistance	260±5°C for 10±2 sec	MIL-STD-750C METHOD-2031
7	Thermal Shock	0±5°C / 5 min and 100±5°C / 5 min Total 10 cycles	MIL-STD-750C METHOD-1056
8	Humidity	T_A=65±5°C, RH=98±10% 1000 hrs/168 hrs	MIL-STD-202F METHOD-103B

6. Calibration System

EQUIPMENT	INTERNAL OR EXTERNAL	CYCLE
Digital Mul Timeter Oscilloscope	External	6 Mon.
Measuring Instrument	External	1 Year
Testing Instrument	Internal	3 Mon.
Measuring Instrument	Internal	6 Mon.

7. Quality Improvement and Monitoring Program

To measure the effectiveness of test and inspection programs and to monitor the long-term reliability of current products and processes. Parts are randomly sampled from production and subjected to the following test :

7 - 1 Weekly Test

7-1-1 High Temperature Storage :

To determine electrical and mechanical characteristics of device. (at T_J maximum / 24 hrs.)

7-1-2 Solderability :

To determine the solder coverage on the device. (MIL-STD-202F method 208)

7-1-3 Solvent Resistance :

To verify that the marking or color-coding will not become illegible discolored or show any other type of deterioration. (MIL-STD-202F method 215)

7 - 2 Monthly Test

7-2-1 Solder Resistance : (MIL-STD-750C, method 2031.1)

To determine the device resistance to the high temperature encountereduring soldering operation

T_A=260±5°C / T=10-12 sec.

7-2-2 Humidity Test: (MIL-STD-202F, method 103.1)

To evaluate the properties of materials subjected to high humidity. Condition :

RH=98% / T_A=65°C / T=24-1000hrs

7-2-3 Pressure Cooker :

To verify the properties and quality of the molding compound

TA = 121°C / 15 PSIG / T=24-96 hrs.

7-2-4 Thermal Shock : (MIL-STD-750C, method-1056)

To detemine tha resistance of ht device with suden extreme changing temperaure.

Condition :

T_H = 100°C 5 min.

T_C = 0°C 5 min. Total 10 cycles

7-2-5 Forward Life : (MIL-STD-750C, method-1027)

To determine the ability of the device to withstand operation at rated forward current.

7-2-6 Forward On-Off Life Test : (MIL-STD-750C, method-1036)

To determine electrical application of the device with practical simulation.

7-2-7 High Temperature Reverse Bias : (MIL-STD-750C, method-1026)

To determine characteristics of device under high temperature reverse bias.

7-2-8 High Temperature Stroage : (MIL-STD-750C, method-1031)

To determine electrical and mechanical characteristics of device under high temperature conditions.

7 - 3 Test and Measure Quarterly

7-3-1 Vibration Test : (MIL-STD-202F, mathod 201A)

To evaluate the endurance of a device against vibration.

7-3-2 Impact Shock : (MIL-STD-202F, method 207A)

To determine the ability of various parts to withstand shock.

7-3-3 Thermal Resistance : (MIL-STD-750C, method-4066-2)

To test the devices thermal resistance between junction and ambient.

7-3-4 Forward Surge : (MIL-STD-750C, method-4066-2)

To determine the surge capability of the device.

7-3-5 Terminal Strength : (MIL-STD-750C, method-2036)

To determine the mechanical / stress ability of the device.

8. Customer Returns

SEP's Global Customer Return or Incident process is focused on formal Problem Solving and Responsiveness. We use the 8D (8 Discipline) Problem Solving Methodology to determine Containment, Root Cause, and Corrective / Preventive Actions.
The eight disciplines are:

D1 - Establish the Team

Establish a cross functional team of people with the process/product knowledge to solve the problem.

D2 - Describe the Problem

Specify the customer's problem by identifying in quantifiable terms the who, what, where, why, how, and how many, for the problem.

D3 - Implement and Verify Containment

Define and Implement containment actions to isolate the effect of the problem from customers until the corrective actions are implemented.

D4 - Define and Verify Root Cause

Identify all potential causes that could explain why the problem occurred and how it escaped our testing. Isolate and verify root cause by testing each potential cause against the problem description.

D5 - Choose and Verify Permanent Corrective Action

Identify all potential corrective actions for the Occur and Escape Root Causes. Verify which actions will correct the root cause.

D6 - Implement Permanent Corrective Action

Provide action plans for implementation of the verified corrective actions. Follow up on any outstanding actions.

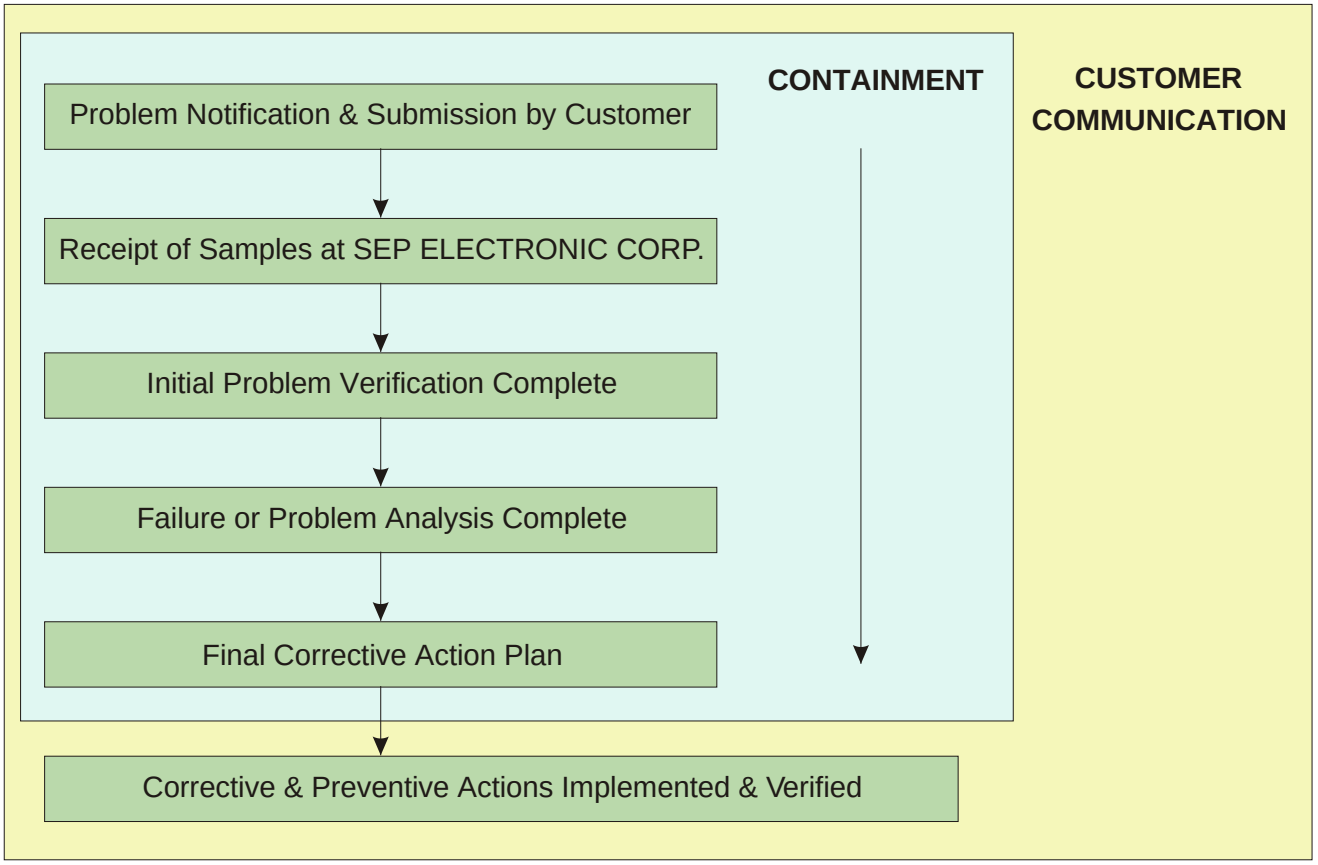
D7 - Prevent Recurrence

Implement actions to address the " system " failure. Update control plans, process specifications. Fan - Out Corrective Actions to appropriate manufacturing sites, and other Technologies.

D8 - Congratulate the Team

We communicate to the customer throughout the process.

Customer Incident Process Map



Customer Incidents are tracked in our Customer Incident information files. Monthly customer incident metrics are compiled and distributed corporate - wide. Responsiveness metrics are used to drive continuous improvement in the Cycle Time arena. Failure Mechanism parts are used to drive continuous improement in the Product and Administrative Quality arenas.

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