www.singhamarpreet.com

MSD– Handling Procedure

Amarpreet Singh

Zenaca Consulting
Amarpreet Singh

Revision 1
July 31, 2023

Agenda

- Introduction
- Definitions
- Handling Procedure
- Reconditioning Procedure
- Implementation Plan

Amarpreet Singh

Moisture Sensitive Devices

Moisture Sensitive Devices (MSDs) in the electronics industry refer to electronic components or integrated circuits that are sensitive to moisture and can be damaged if exposed to excessive humidity. The damage happens on these devices during the reflow or other soldering methods.

Some of the moisture sensitive component packages are BGA, QFP, TSOP, CSP etc.

The moisture sensitivity level of a device is classified based on its moisture sensitivity level (MSL) rating, which is indicated by a numerical value (such as MSL 1, MSL 2, MSL 3, etc.) using a moisture-sensitive label on the components.

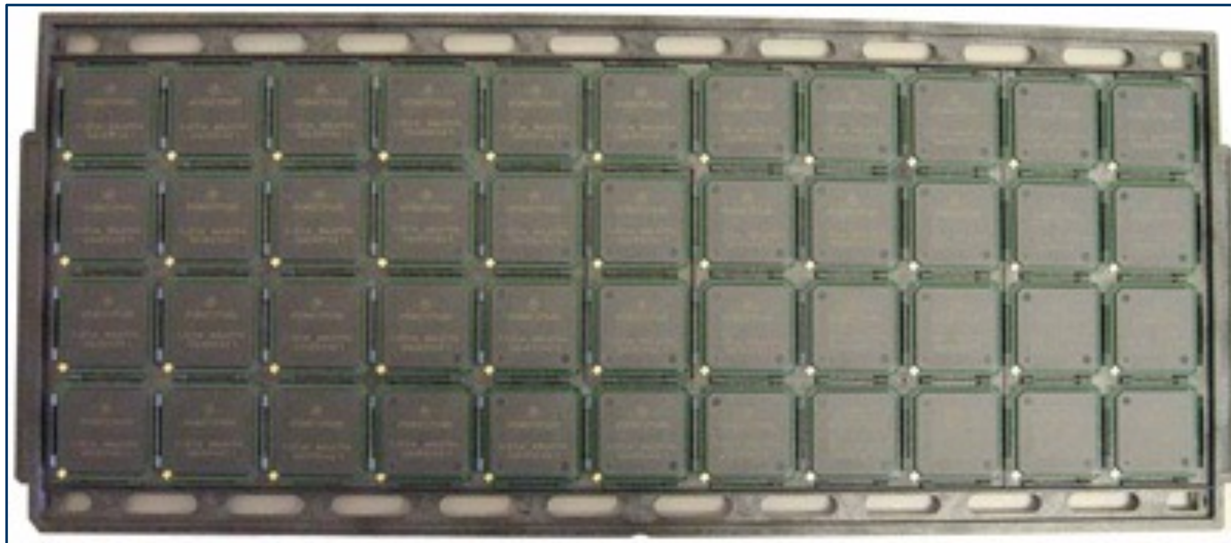
Amarpreet Singh

www.singhamarpreet.com

AMAR

Moisture Sensitive Devices

MSD Components are usually shipped in MBB (Moisture Barrier Bags) by the manufacturer and can be identified easily during the receiving process.



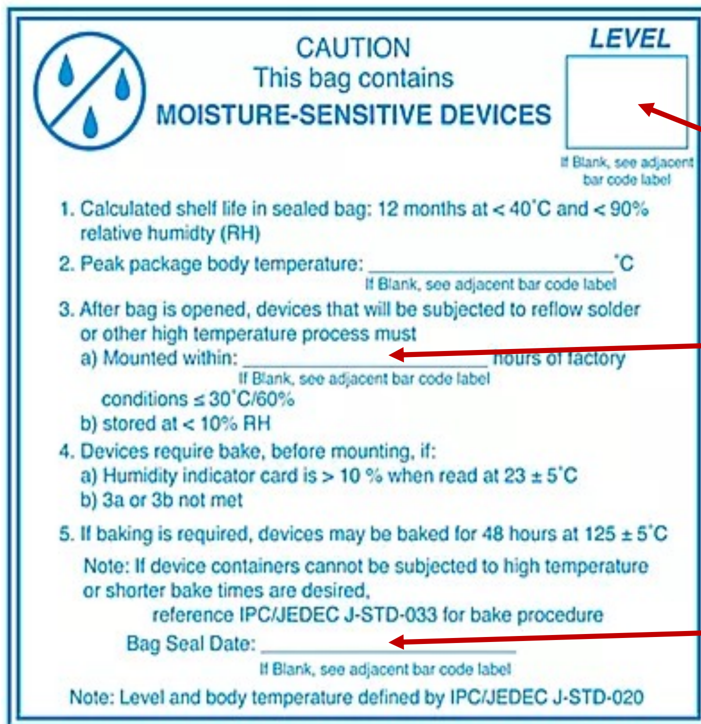
MSD Components in Open Condition

Sealed MSD Components

www.singhamarpreet.com
AMAR

Moisture Sensitive Devices

Component manufacturer puts a MSD Sensitive label on the component packaging



MSD Label

The key information on an MSD label is

- ***MSL Level*** - It explains the level of sensitiveness of components to moisture
- ***Floor Life*** – It specify the maximum time for which a component can be exposed to shop floor environment, before getting soldered on the PCBA
- ***Bag Seal date*** – The date on which the bag was last sealed.

Amarpreet Singh

www.singhamarpreet.com
AMAR

Desiccant

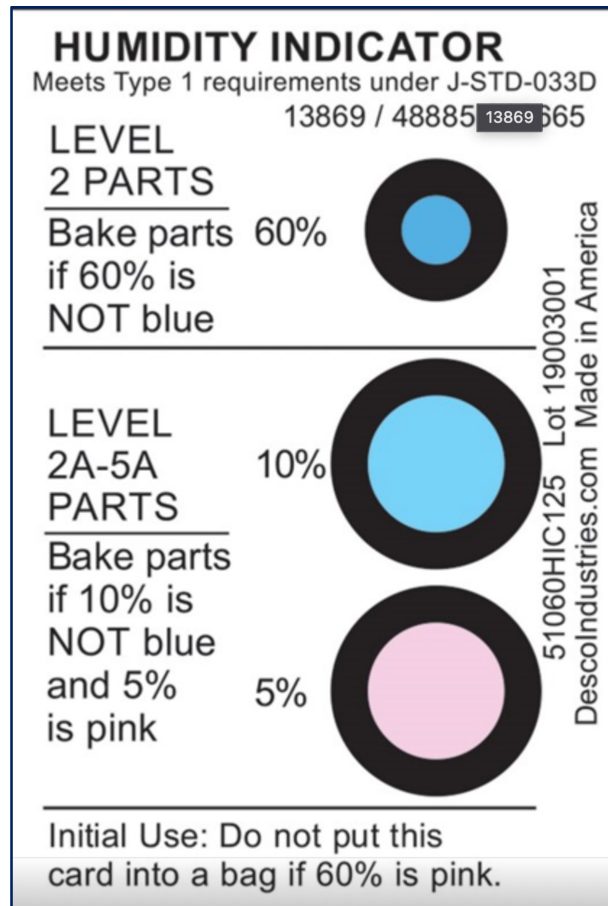
Silica Gel

- ✓ The air inside the MBB is sucked out by vacuum before sealing. However, there are still some air still left behind.
- ✓ The desiccant placed inside the MBB will absorb whatever moisture in the air remained in the bag to maintain a dry atmosphere.
- ✓ Desiccant cannot be recycled or reused for fresh packaging process. For repackaging process, a fresh/new desiccant have to be taken out from sealed container, kept in Desiccator.

Amarpreet Singh

www.singhamarpreet.com

Humidity Indicator Card (HIC)



HIC Card

- The HIC is placed inside the MBB to monitor the level of moisture inside the bag.
- The chart has a few blue circles to indicate level of moisture by percentage.
- The color of the circle will change from blue to pink depending on the level of humidity inside the sealed bag.
- HIC Cannot be recycled or reused for fresh packaging process. For repackaging process, a fresh/new HIC to be taken out from sealed container, kept in Desiccator.

www.singhamarpreet.com
AMAR

Desiccator (Dry Cabinet)

- Desiccator to be purge with N2 to maintain a dry environment of less than 10% RH and temperature of 25 $\pm$ 5°C.
- There is a RH recorder to monitor the environment to ensure it is less than 10% RH at all the time.
- If recorder chart shows a short spike above 10% RH for < 1 hour, it is OK. but drift stays above 10% RH for >1 hour, it signals the need for improvement by the process engineering.
- Always maintain the door closed, open only when necessary.

Amarpreet

www.singhamarpreet.com

Moisture Sensitive Level (MSL)

The moisture sensitivity of an MSD component is categorised as MSL level of the component. Here are the floor life details of each MSL Level

MSL	Floor life
1	Unlimited floor life @ <85 RH and ≤ 30ºC
2	1 Year
2a	4 Weeks
3	168 Hours
4	72 Hours
5	48 Hours
5a	24 Hours
6	* Mandatory Before Use

- Floor life – The time which is allowed for a component to be in an open condition before getting soldered on the PCBA.
- If the component is opened for more than the defined floor life, it must be baked before mounting on the PCBA.
- Level 6 components must be baked before mounting.

Amarpreet Singh

www.singhamarpreet.com
AMAR

MSD Components : Receiving

- It is a good practice to identify the MSL level of all the components used in the BOM at the company level.
- Once the component is received the warehouse team should get a prompt that it is an MSD component, and the required procedure needs to be followed accordingly.
- The seal date on the bag should not be more than nine months old.
- While opening a bag of MSD components, there must a desiccant and and HIC card inside the bag.
- The HIC card must not be pink for 10% or more circles. If the 10% or bigger circle is red the component must be baked as per manufacturer recommendations.

Amarpreet Singh

www.singhamarpreet.com
A M A R

MSD Components : Storage

- All MSD Components should be stored in an original manufacturer packing.
- If the components are opened for counting, inspection or verification the same needs to be stored in a desiccator. As an extra precaution, some organisations even store the sealed components in desiccators.

Amarpreet Singh

www.singhamarpreet.com
AMAR

MSD Components : SMT Loading

- Open only one pack of component (of the same part number) and load only about maximum of 1std pack for usage in the machine for the case of tray ICs. The remaining components should be kept in the Desiccator.
- When machines run-out of components, replenish the components taken from the Desiccator.
- If there is a machine downtime or line stops for more than 2 hours, MSD components must be removed from the machine and store in the Desiccator. Reload the components only when the machine is up and the line is ready to run again.

Amarpreet Singh

www.singhamarpreet.com

MSD Components : Rework Procedure

- If an MSD component needs to be removed from the PCBA, the PCBA must be baked for 48 hours at 125°C. This is to avoid any further damage to the component during the rework process.

- For rework, MSD components must be taken from the desiccator. The component to be replaced needs to be drawn immediately before mounting (to control the floor life).

- The floor life of the components must be tracked during the rework process.

Amarpreet Singh

www.singhamarpreet.com
AMAR

MSD Components : Tracking

The floor life of MSD components needs to be tracked using two different methods

1. ***MES (Software Control)*** : As soon as the MBB bag is opened it is scanned in the MES (Manufacturing Execution System) and the software tracks the floor life of the components. If the components have exhausted the floor life, the software blocks the tray or packet to be doesn't allow using the same component without baking.

This methods provides effective tracking of the MSD components and helps to trace back the field failures if there are any.

Amarpreet Singh

www.singhamarpreet.com
AMAR

MSD Components : Tracking

2. ***Manual Tracking*** : A label is implemented to track the floor life of the components and each activity is tracked on the label.

   i. The label is placed on the MBB as soon as the bag is opened during the loading process. The label needs to be monitored for the remaining shelf life by the line technicians.

   ii. Once the bag is sealed or kept in desiccator, the same needs to be tracked on the label as the floor life is paused once the bag is sealed or the component is in desiccator.

   iii. It needs extensive training, discipline and controls on the shop floor to implement manual tracking of floor life of MSD components.

Amarpreet Singh

www.singhamarpreet.com

Tracking Label Format

Moisture Sensitive Component Exposure Tracking Tag

Tag#:

Tag must be placed on reel or beside IC trays. Do not remove or separate the previous/old tag. (*-Cancel whichever inappropriate)

tag lama.(*-Potong mana yang tidak berkenaan)

Operator's Information

Name:________________________________ Emp #:__________________

Component's Information

Customer:____________________________ Model Name:______________

Part No:_____________________________ Component Qty:___________

Exposure Information

* Open MBB / Remove from Baking Oven / Remove from Desiccator:

(Date / Time):________________________________ am / pm

Exposure allowed (Details can be obtained from SIC / previous tag):_____hrs

Expired by (Date / Time): am / pm

Remove from SMT Machine

Removal from SMT m/c (Date / Time):_________________________ am / pm

Remaining exposure hours allowed:______________hrs. (If < 2 hours, send components for re-baking)

Keep inside Desiccator

Keep inside Dessicator (Date / Time):__________________________ am / pm

Remaining exposure hours allowed:______________hrs. (If < 2 hours, send components for re-baking)

Remover's information

Name:_________________________________ Emp #:__________________

www.singhamarpreet.com
AMAR

MSD Components : Reconditioning

- ***Monitor production performance:*** MSD Components needs to be reconditioned in case
  - Open life exceeds recommended floor lire or bag seal date exceeded shelf life of nine months.
  - HIC is turned pink at 10% or more level.
  - The condition of the MBB or the component is unsure.
- The baking conditions needs to be as per the manufacturer recommendations. In case the manufacturer baking recommendations are not available a generic guideline can be followed as explained in the next slide.
- We also needs to be sure that the component packaging can sustain the baking condition.

Amarpreet Singh

MSD Components : Baking Recommendations

Package Body	Level	Bake @ 125°C		Bake @ 90°C ≤5% RH		Bake @ 40°C ≤5% RH	
		Exceeding Floor Life by >72 h	Exceeding Floor Life by ≤72 h	Exceeding Floor Life by >72 h	Exceeding Floor Life by ≤72 h	Exceeding Floor Life by >72 h	Exceeding Floor Life by ≤72 h
Thickness ≤1.4 mm	2	5 hours	3 hours	17 hours	11 hours	8 days	5 days
	2a	7 hours	5 hours	23 hours	13 hours	9 days	7 days
	3	9 hours	7 hours	33 hours	23 hours	13 days	9 days
	4	11 hours	7 hours	37 hours	23 hours	15 days	9 days
	5	12 hours	7 hours	41 hours	24 hours	17 days	10 days
	5a	16 hours	10 hours	54 hours	24 hours	22 days	10 days
Thickness >1.4 mm ≤2.0 mm	2	18 hours	15 hours	63 hours	2 days	25days	20 days
	2a	21 hours	16 hours	3 days	2 days	29 days	22 days
	3	27 hours	17 hours	4 days	2 days	37 days	23 days
	4	34 hours	20 hours	5 days	3 days	47 days	28 days
	5	40 hours	25 hours	6 days	4 days	57 days	35 days
	5a	48 hours	40 hours	8 days	6 days	79 days	56 days
Thickness >2.0 mm ≤4.5 mm	2	48 hours	48 hours	10 days	7 days	79 days	67 days
	2a	48 hours	48 hours	10 days	7 days	79 days	67 days
	3	48 hours	48 hours	10 days	8 days	79 days	67 days
	4	48 hours	48 hours	10 days	10 days	79 days	67 days
	5	48 hours	48 hours	10 days	10 days	79 days	67 days
	5a	48 hours	48 hours	10 days	10 days	79 days	67 days
BGA package >17 mm x 17 mm or any stacked die package (See Note 2)	2-6	96 hours	As above per package thickness and moisture level	Not applicable	As above per package thickness and moisture level	Not applicable	As above per package thickness and moisture level

MSD Components : Reconditioning

www.singhamarpreet.com
AMAR

After Baking:

- Ensure the components are secured properly in the standard packaging.
- Put a new HIC and new desiccant on top of tray/tubes and seal them into a suitable size MBB.
- Vacuum seal the MBB and make sure the seal is good without air leaks.
- Add moisture sensitive caution label and fill in the required information on the label before moving these components to the central storage location.

Amarpreet Singh

www.singhamarpreet.com
AMAR

MSD Program Implementation Plan

- An internal controlled procedure needs to be developed by the organisation to manage MSD during the manufacturing and warehouse processes.
- Every employee needs to be trained before deploying on the shop floor.
- A refresher training to be carried out every three months (followed by a test) for all the employees engaged in handling of MSD components.
- All the capital equipment investments (Software, Dry Cabinet) are to be made before starting the manufacturing activities.
- All the consumables needs to be procured and managed through the planning system.
- The compliance of MSD procedures to be ensured during the daily process audits.
- The global standards to be followed while implementing MSD procedure are J-STD-020 & J-STD-033.

Amarpreet Singh

Do you have more questions on topic ?

Please reach me at

Email : amar@singhamarpreet.com

Contact : +91 96866 83783

www.singhamarpreet.com

Amarpreet Singh

www.singhamarpreet.com

Thank You

Amarpreet Singh