SUPER DRY® Totech EU® | MORE THAN JUST DRY AIR

A Member of the ASYS Group

Don't just store MSDs…DRY them!

A proven process for fast, secure drying of MSDs

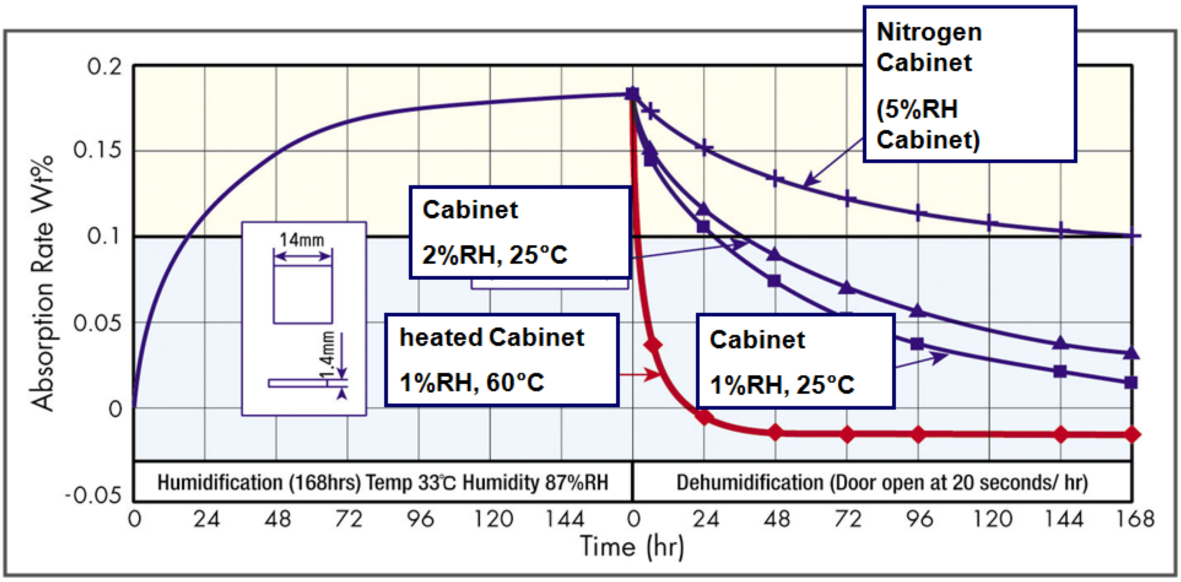
Enhanced Adsorption Drying Procedures for MSDs

It is well-known that SMD components like QFPs and BGAs are moisture sensitive devices but LEDs and even ceramic capacitors are similarly at risk as cited by the SMTA. Indeed, even printed circuit boards increasingly must be handled as MSDs, especially Multilayer- and Flex- printed boards. These components absorb vapor throughout the surface which enters the basic material by diffusion. The issue is further intensified by ongoing miniaturization and the increasing application of extremely hygroscopic flame retardants in PCB manufacturing as well as higher temperature lead free reflow profiles.

When the absorption of moisture exceeds a critical limit, there will be the typical technical failures associated with the release of the absorbed vapor during the soldering process. These include internal delamination of the semiconductor packaging material, bond damage, die lifting or even popcorning. Moisture control is an important task for the entire logistics chain, but historically the problem has only been addressed at final assembly, and often only after failures have already occurred. Over time, baking ovens have become a fixed part of many production lines. But more and more producers in the automotive, avionics, medical and telecoms engineering sectors are no longer satisfied with this approach. They are demanding an integrated Moisture Sensitive Management System which also includes the manufacturers of devices and the distributors, similar to that employed for ESD-protection.

The drying process

All of the components of the MSL classes 2a to 5a can be safely stored for an unlimited time according to the IPC/JEDEC-J-STD-033B.1 in an atmosphere with vapor content of less than 1,9g/m^3. If the dehumidification of the ambient air is increased, the difference of the vapor pressure will be so high that the water molecules in the devices will overcome their adhesion forces, release, and the devices will dry. High efficiency Storage systems that create an atmosphere of 1-2% RH at room temperature and vapor content of less than 0.6g/m^3 are essentially a "moisture vacuum," forcing the release of the previously absorbed humidity. This revertive drying process is extremely gentle as the components are not exposed to any thermal stress and therefore the risks of oxidation and intermetallic growth are avoided.



To shorten the dying time, this process may be thermally enhanced, but to avoid problems of oxidation, it is essential that this process occurs in a "moisture vacuum" as well. New technology offered by Totech (www.superdry.info) offers a solution to the demands for a reliable and effective drying system which can dramatically simplify material logistics and be easily integrated into the production process while making redundant the traditional tempering/baking at very high temperatures.

The 60°C Adsorption Drying Cabinet

Adsorption is a process by which a thin layer of molecules adheres to the surface of another substance. The structure of the Zeolite desiccant used in these cabinets acts as a molecular sieve in removing water molecules from the air. The XSD Series Adsorption Drying Cabinets extend the energy-efficient drying process of all sensitive components with a balanced heat profile and robust insulation. Thus, it can be utilized for both the IPC-conforming tempering at 40°C and for the drying of reels or tubes at 50°C or of printed boards at 60°C.
These newly-developed high-performance drying cabinets achieve moisture parameters below 0.5% RH. Even opening the door causes humidity increases of barely 5% and recovery occurs within 300 seconds back below 1% RH. All settings are input via user-friendly Touch-screen interface. An integrated data-logger enables continuous recording of all relevant performance data such as moisture, temperature and door opening cycles. Measured data is provided by an extremely high speed response precision sensor which gives the basis for a reliable documentation in the context of Moisture-Sensitive-Management. Data is recorded on a SD-card for convenient external readout.

Is nitrogen storage still reasonable?

Still in use are nitrogen storage systems, with the nitrogen used to displace moist air present inside the cabinet. For this purpose however vast quantities of nitrogen are required. This is energy-consuming and produces high operating costs. To reach a humidity level of 5% RH, nitrogen cabinets must be flooded with a high volume flow rate lasting several minutes-replacing the cabinet volume several times. Moisture parameters of 1 or 2% RH are factually not achievable and for this reason there is no redrying that takes place. In high access rate situations, the cabinet is almost permanently flooded with nitrogen which leads to immense operating costs and enriches the ambient air with nitrogen. The benefits of this system arguably lie only with the nitrogen supplier.

Oxidation protection by dry storage

In an extremely dry atmosphere there is no corrosion. There are two prerequisites for the occurrence of corrosion: there must be an oxidizing agent and an aqueous solution which operates as electrolyte. The oxygen in the air makes the oxidizing agent, the vapor the electrolyte. The critical limit at which an oxidation process with atmospheric oxygen takes place, lies, depending on the metal or alloy/composition, at 40 to 70% RH. This means that there are more than 8 grams of vapor per m^3 present. The absolute humidity in the adsorptive dry cabinets is lower than 1.4g/m^3 at a temperature of 60°C and 1%RH, at 40°C they deliver 0.5g/m3. Under that condition there is no cathode reaction and so no oxidation can take place.

Conclusion

With the use of adsorption dry storage cabinets all moisture- sensitive devices can be not only stored safely, bit also dried quickly, gently and in a process-secure way. Storage in a dry atmosphere simultaneously offers optimum oxidation protection as well. The high efficiency, maintenance-free Zeolite desiccant units are very “green,” energy-efficient and deliver extremely low cost of ownership.

Reference Conditions for Drying Mounted or Unmounted SMD
Floor life begins counting at time =0 after drying

Packages that were exposed to Conditions □□60% RH
(For ICs with Novolac, Biphenyl and Multifunctional Epoxies)

Body Thickness	Level	Drying at 1% RH (HSD+XSD-Series)			Drying at 2% RH (SD+SDA-Series)		**Drying at 5% RH (N^2-Cabinets)	
		25°C 1% RH	**40°C 1% RH**	**60°C 1% RH**	**25°C 2% RH**	**40°C 2% RH**	**40°C 5% RH**	**90°C 5% RH**
Thickness ≤1.4 mm	2a	5 days	2 days	12 hours	7 days	3 days	**5 days**	**23 hours**
	*** 3**	**8 days**	3 days	**18 hours**	**12 days**	5 days	**8 days**	**33 hours**
	4	9 days	4 days	24 hours	13 days	6 days	**9 days**	**37 hours**
	5	10 days	5 days	30 hours	14 days	7 days	**10 days**	**41 hours**
	5a	10 days	6 days	36 hours	15 days	9 days	**10 days**	**54 hours**
Thickness >1.4 mm ≤2.0 mm	2a	22 days	10 days	2 days	30 days	15 days	**22 days**	**3 days**
	3	23 days	11 days	2 days	35 days	16 days	**23 days**	**4 days**
	4	28 days	14 days	3 days	40 days	17 days	**28 days**	**5 days**
	5	35 days	16 days	4 days	50 days	24 days	**35 days**	**6 days**
	5a	56 days	18 days	4 days	67 days	27 days	**56 days**	**8 days**
Thickness >2.0 mm □4.5 mm	2a	67 days	20 days	5 days	80 days	30 days	**67 days**	**10 days**
	3	67 days	22 days	5 days	80 days	31 days	**67 days**	**10 days**
	4	67 days	22 days	5 days	80 days	31 days	**67 days**	**10 days**
	5	67 days	22 days	5 days	80 days	31 days	**67 days**	**10 days**
	5a	67 days	22 days	5 days	80 days	31 days	**67 days**	**10 days**

* according 100TQFP-Test (Semiconductor Device (100TQFP) Dehumidifying Property)
** according to IPC J-STD-033B.1

The interims value has been calculated based upon the given data in the IPC-STANDARD. There it has been assumed that the drying time is 50 % shorter at a temperature of 10 °K. This factor can be found out by the measured data of the 100 TQFP-test at 25 °C and 60 °C.

Semiconductor Device (100TQFP) Dehumidifying Property

1. Purpose: The graphic shows semiconductor device dehumidifying property.
2. Device: 100TQFP (IPC-Level 3).
3. The experiment is divided by two steps: Humidifying and Dehumidifying
   Before reading the graphic, you need to ascertain the Adsorption Ratio!

First step: humidifying

When we do any experiment, we must define a point as 0.0Wt% for the experiment.

Test Condition:

A: Baking process performed on the device of 100TQFP for 120°C for 60 hours, defined as 0.0Wt%.

B: Humidifying process at 33°C and 87%RH for 168 hours. The volume weight is weighed at a daily basis, to check the adsorption ratio of wt%.

The humidifying experiment is a preceding term. The purpose is to set a condition to completely saturate the device with humidity.

Second step: dehumidifying

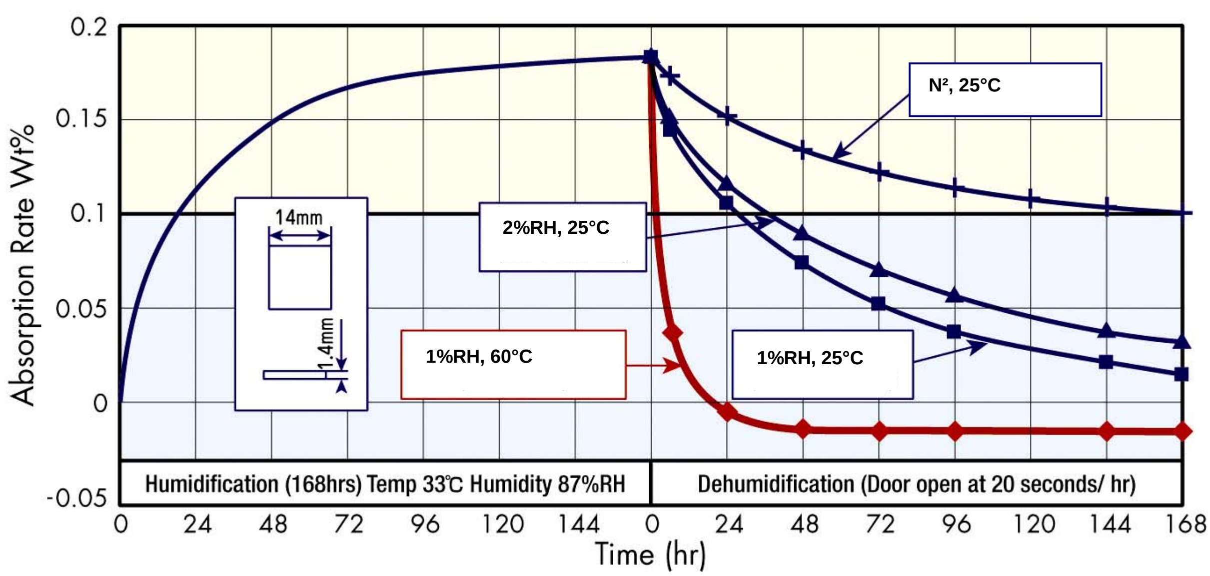
The saturated device with humidity is put into a cabinet to check the absorption performance.

Test Condition:

C. Opening of the cabinet door: 20 seconds every hour per day for continuous 7 days. The volume weight will be weighed every day to log the absorption ratio of wt%.

D: Cabinets used for test procedure and Setting points:

Totech, HSD-1106-01:	1%RH, 25°C
Totech, SD-1106-02:	2%RH, 25°C
Totech, XSD-1404/702	1%RH, 60°C
Totech, SDA-201:	N^2, 25°C



Conclusion: Different from the general baking system, due to no heating stress on the devices at all, no defect on products can be observed in use of cabinets.

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