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Newly Optimized Drying Process for Moisture Sensitive Devices.

Newly developed high performance desiccant drying units for the first time make it possible to dynamically adjust the necessary desiccant regeneration process according to actual demand. In contrast to cyclical methods, this saves significant energy and increases system availability and performance. Combined with a modular enclosure design, a suitable custom fit solution exists for every application. In this way an optimal relationship between applied energy and the required use can be achieved.

The principle of Adsorption drying.

All devices of the MSL-Classesⁱ 2a – 5a can be stored for an indefinite period at a water vapor level of less than 1.9 g/m³ⁱ in line with the IPC/JEDEC-J-STD-033B.1ⁱⁱⁱ. If more moisture is drawn from the surrounding air, the vapor pressure difference rises so that the water molecules in the components overcome their adhesion force and the moisture is released out again into the surrounding air. The components are thereby dried.

The drying speed is strongly dependent on the vapor pressure differential. The lower the pressure in the storage atmosphere, the faster moisture is withdrawn from the wet components and circuit boards. The storage systems developed by Super Dry achieve an atmosphere of < 0.5 % RH at room temperature^{iv} and produce a “moisture vacuum” at a vapor level of less than 0.05 g/m³. This leads to a strong “revertive” drying process in the materials, as the previously assimilated moisture is released out again. This is very protective of the devices, because they are not subjected to thermal stress and thus neither a danger of oxidation or intermetallic growth exists.

The Dynamic Drying Unit

A newly developed, dynamic high performance drying unit U-5002, achieves air moisture levels of under 0.17% RH, even at temperatures of 60°C. Unlike traditional technology, during cabinet door openings, air moisture levels barely rise above 5% and sink within a few minutes again to <1 %. Throughout the process the drying unit also consumes less energy than its predecessors. Whereas before it was necessary to regenerate the drying substance regularly (usually every 6 hours), it is now for the first time possible to control this process according to the load on the system. Through a microprocessor the state of the drying substance is permanently monitored and compared with the input set point values. Only when the moisture content in the cabinet exceeds the absorption capacity of the drying substance, is the thermal regeneration started. The strength of this process in turn is fitted individually to the desired set point moisture in the cabinet. This has led to a drastic reduction of energy demand in cabinets which are infrequently opened. Often a regeneration of only 15 minutes suffices many weeks of component drying.

In manufacturing environments, the regeneration behavior of the drying unit adapts itself dynamically to the needs of short opening cycles of the doors and multi-layer loading.

Through this the availability and efficiency is improved considerably in comparison to a fixed regeneration cycle.

Data Collection

To collect the data for process management and documentation, a fast reacting, precision sensor^v is used. A data logger integrated into the sensor enables the collection of all relevant data (time, moisture and temperature) in offline-mode. Additionally this data can be stored via a standard serial interface online and monitored against set threshold values. This forms the basis of reliable documentation in the framework of moisture-sensitive-management.

Recalibration of the entire system is both ISO-conforming and economical by means of replacement with a calibrated sensor, available in an exchange process complete with certification.

Modular drying cabinet design

With the modular MSD series (Image. 2) Super Dry offers a flexible system based on the dynamic drying unit U-5002. Through its innovative modular design, the extension of storage capacity with the addition of passive modules is possible at any point in time. Additional parts or drying units can be integrated into the system according to needs. Here the closed-loop regeneration capability automatically adjusts to the changing demand of the newly expanded cabinet

Heat accelerates the drying process

To further shorten drying times, the adsorption process can be thermally enhanced. To avoid oxidation problems, it is absolutely essential that this process also takes place in a “moisture vacuum”. Under these conditions, the electrolyte (air moisture) is not present and thus no oxidation can take place.^{vi}With the XSD-Series, Super Dry Totech has responded to numerous customer requirements for a reliable, effective drying system that can also be easily integrated into the production process. In many cases the traditional tempering becomes excessive at very high temperatures.

The XSD-Series (Image 3) enables not only an efficient energy application, but also a very homogenic temperature spread throughout the cabinet which employs double walled construction in combination with premium insulation. This technique can be put to use at IPC-conforming^{vii} tempering of sensitive devices at 40 °C as well for drying of reels or tubes at 50 °C or printed circuit boards at 60 °C. A strong air circulation inside makes the opening and repeated shrink-wrapping of component parts in tape unnecessary. This saves not only costs and time, but also protects the devices themselves.

Conclusion

With the dynamic drying unit in the adsorption drying cabinets from Super Dry, components sensitive to moisture are dried quickly, gently, and in a process secure manner. The storage in a dry atmosphere at the same time provides optimal oxidation protection. These maintenance free drying units deliver both industry leading drying performance, and energy efficiency.

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ⁱ In accordance with the IPC/JEDEC-J-STD-020D, 5. Procedure process + Table 5.1
ⁱⁱ Corresponds to a relative air moisture level of 4.9 % at 35 °C
ⁱⁱⁱ IPC/JEDEC J-STD-033B.1, October 2005, Table 7.1
^{iv} 25 °C, 0.17 %RH correspond to 0.04 g/m³
^v Rotronic HygroClip, Measuring interval 0,7 s, Precision at 23 °C +/- 0.8 %RH, (optional up to 0.6 %rF) and +/- 0.1 K.
^{vi} Hereto the text book on Metal corrosion, Prof. Karl Müller, 5th Ed., Published by the Eugen G. Leuze Verlag
^{vii} IPC/JEDEC J-STD-033B.1, October 2005, Table 4.1

**Comparison Totech and Yeal
(drying temp = 50°C)
Reels "MLX90255BAR" Totech / Reels "MLX90255BAR" Yeal**

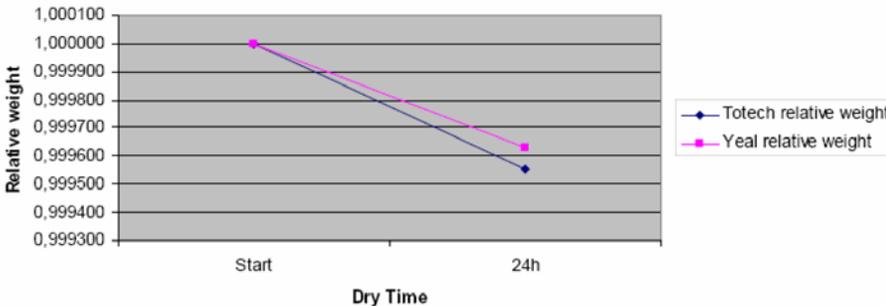


Image 1: Comparison of vacuum- oven with adsorption drying storage cabinet at 50 °C at Reelsⁱⁱ.



Image 2: Modular combination with 1x active and 2x passive modules of the MSD-Series



Image 3: Up to 60°C drying cabinet of the XSD-Series

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