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Humitector™ Type 2 Non-Reversible Humidity Indicator Cards from Clariant help assure the integrity of moisture-sensitive surface-mount devices

To produce advanced digital technology – computers, cell phones, industrial automation, televisions, and home electronics, to name a few – manufacturers depend on a specialized supply chain. One of the most important and sensitive segments of that supply chain involves the protection, transport, and storage of moisture-sensitive surface mount devices (SMDs). SMDs include many of the most powerful and essential processors, chipsets, and integrated circuits that power today’s technology.

Following their initial manufacture and testing, SMDs are frequently transported to other manufacturers where they are assembled onto printed circuit boards, or built directly into finished digital technology products. SMDs are connected through a process called reflowing, in which their solder connections are heated until they liquefy and flow, then cool to create a solid bond with a substrate, such as a printed circuit board.

Many SMDs – and their reflowable solder connections – are extremely sensitive to moisture. If there is any excess moisture present in SMDs when they are subjected to the high temperatures associated with reflow processing, they or the solder connections can fail in a variety of ways, including cracking, delamination, “popcorning” or other problems.

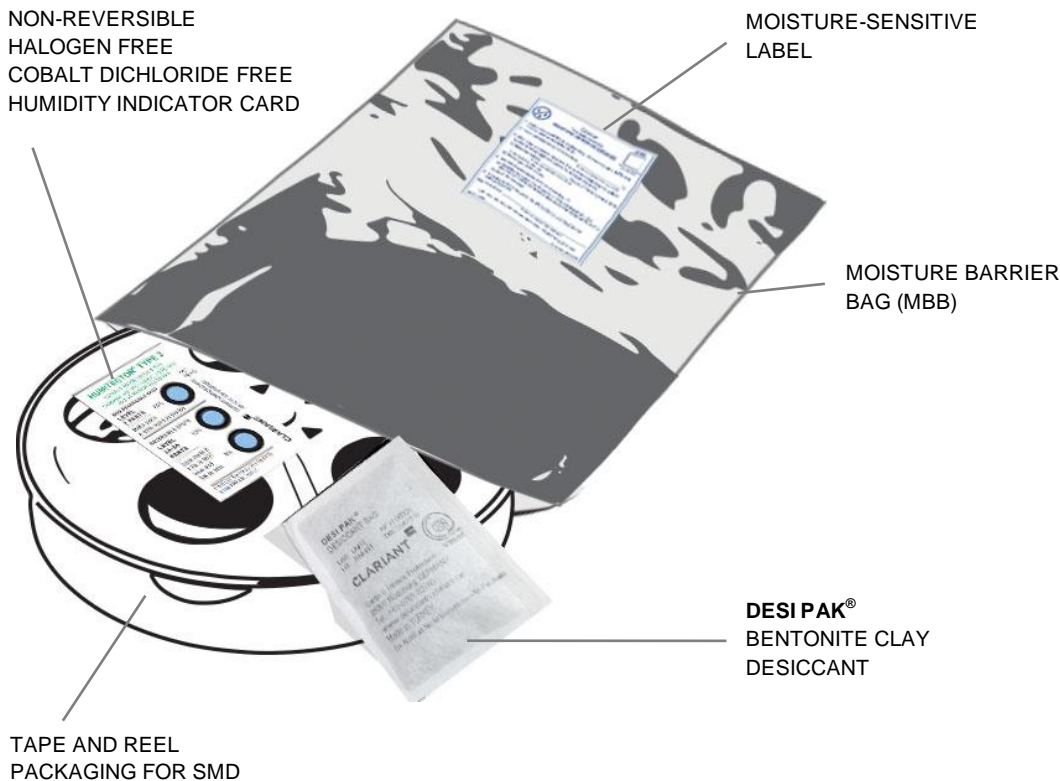
To minimize or eliminate these problems, industry standards have been established to classify SMDs according to moisture sensitivity, provide SMDs with moisture protective packaging, and eliminate excess moisture from SMDs prior to reflow processing. Moisture Sensitivity Levels (MSLs) for SMDs are defined in the joint IPC/JEDEC standard, J-STD-020, ranging from Level 2 (least moisture sensitive) to Level 6 (most moisture sensitive).

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IPC/JEDEC J-STD-033, "Handling, Packing, Shipping and Use of Moisture/Reflow and/or Process Sensitive Devices," sets the industry standard for dry packaging of moisture-sensitive, reflowable SMDs. It requires that moisture-barrier bags (MBBs or "dry packs") containing these items provide a shelf life of 12 months and contain an active desiccant packet and a humidity indicator card (HIC). Historically, the purpose of the HIC has been to provide a visual indication of the level of humidity present in the dry packs at the time they are opened. In properly sealed and undamaged dry packs, HICs have been assumed to be reliable indicators that the SMD has not been damaged by exposure to high humidity.

HUMITECTOR™ TYPE 2

NON-REVERSIBLE
HALOGEN FREE
COBALT DICHLORIDE FREE
HUMIDITY INDICATOR CARD



Illustrative example of a dry pack configuration for Moisture Sensitive Devices (MSDs) using Clariant's Humitector™ Type 2 Non-Reversible Humidity Indicator Card and a Desi Pak® desiccant bag.

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Until recently, humidity indicator cards used in dry packs have been of one type: “reversible.” Typical reversible HICs offer three reversible color-change humidity indicators at 5%, 10% and 60% humidity exposure. Reversible HICs have a good track record of reliability when dry packs remain properly sealed and undamaged.

However, in certain situations, reversible HICs can fail to properly indicate actual humidity exposures. For example, in a dry pack with an improper, defective, or damaged seal, exposure to high humidity (>60%) can occur. At the time of the infiltration, a reversible HIC would register the humidity exposure in the bag as a color change (to pink - wet) on the 60% indicator. However, if the damaged dry pack were returned to a low humidity environment for a prolonged period, the reversible 60% spot would change color back to blue, indicating the current lower humidity level. There would be no indication of the earlier high humidity exposure and thus, possible damage to the SMD could go unnoticed.

Clear indication of any exposure to high humidity is vitally important for SMDs with moisture sensitivity levels greater than Level 2, as defined in J-STD-020.

Customers must be able to rely on accurate humidity indication as an assurance of SMD quality and fitness for processing and use. Without it, they might accept SMDs from suppliers that have already been irreparably damaged by moisture during storage or transit. Or, they might approve for processing SMDs that have been improperly or insufficiently heat-dried. Beyond the processing questions, there are financial questions: Where did the dry pack problems originate and who—supplier, customer, shipper—is financially responsible for the damaged SMDs?

A new solution – the Humitector™ Type 2 “non-reversible” Humidity Indicator Card

In response to the limitations of “reversible” HICs, some SMD suppliers and customers asked for improvements to humidity indicator cards. They asked for an updated HIC that would provide a much more complete history of moisture exposure and SMD integrity within dry packs.

In response, Clariant, the originator of the color change humidity indicator card, and a member of the JEDEC’s Subcommittee 14.1, “Reliability and Test Methods for Packaged Devices,” created a new “non-reversible” halogen and cobalt dichloride free humidity indicator card. This HIC combines two reversible indicators (5% and 10%) with a new non-reversible (60% RH) indicator spot. (Figure 1) The 5% and 10% reversible spots work the way similar indicators do: they change color from blue (dry), to lavender, to pink (wet) to indicate humidity exposure at the indicated levels. If humidity levels drop, they will gradually revert back to blue.

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However, the new, non-reversible 60% spot works differently. Instead of changing color from blue to lavender to pink like the 60% indicator on a reversible HIC, the non-reversible 60% humidity indicator stays blue, but when exposed to humidity for a prolonged period of time it begins to liquefy and spread until it overruns (migrates) outside its black indicator circle. (Figure 2).

Regardless of subsequent reductions in the humidity level in the package, including extended storage in dry conditions that cause reversible indicators to revert back to blue, the migration of the non-reversible blue spot on a HIC remains, providing a reliable, permanent indication of the prolonged high humidity conditions that affected the package and its contents.

A sustainable alternative – Halogen and Cobalt Dichloride Free HIC

When tested to current industry standards BS EN 14582, a widely accepted halogen test method, the results demonstrate that Clariant's Humitector™ Type 2 HICs meet the tough halogen-free requirements (≤ 900 ppm of Br or Cl, ≤ 1500 ppm Br + Cl combined) contained in IEC-61249-2-21 and IPC 4101-B. They are also free of cobalt dichloride and contain extremely low levels of cobalt bromide. As a result, the overall cobalt content of the Type 2 HIC has been reduced by more than 50 percent compared to the Type 1 card. (Figure 1)

A change to packaging standards

After considering the function and benefits of the non-reversible HIC from Clariant, IPC and JEDEC have revised and approved a new joint standard, J-STD-033 (Revision D), to allow its use. The revised standard revision allows for the use of both types of HIC cards in dry packs.

To avoid confusion, the revised J-STD-033 redefines HICs into two types. Reversible HICs are redefined as "Type 1 – Reversible," while the newer non-reversible cards are introduced as "Type 2 – Non-Reversible." Otherwise, the revision makes no changes regarding the use of Type 1 reversible cards.

Users of the new Type 2 non-reversible cards will find that they can be handled and used just like Type 1 cards with one exception: Type 2 cards must be retained in original manufacturer packaging (i.e. shrink-wrapped) until they are opened for use. Otherwise, prolonged exposure to high humidity in the ambient environment could render the non-reversible 60% indicator spot useless in the dry pack environment.

Previous revisions have allowed for the re-insertion/re-use of Type 1 HICs provided that the 60% humidity indicators have not changed color. The latest standard provides for re-use of both Type 1 and Type 2 HICs under the same circumstances, but prevents re-use of either type if the 60% humidity indicator has changed, since this can affect the accuracy of the other indicators.

The use of Type 2 HICs with a non-reversible 60% spot indicator is preferred by IPC/JEDEC standard J-STD-033D.

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Figure 1: Humitector™ Type 2 Non-Reversible Humidity Indicator Card – Halogen and Cobalt Dichloride Free

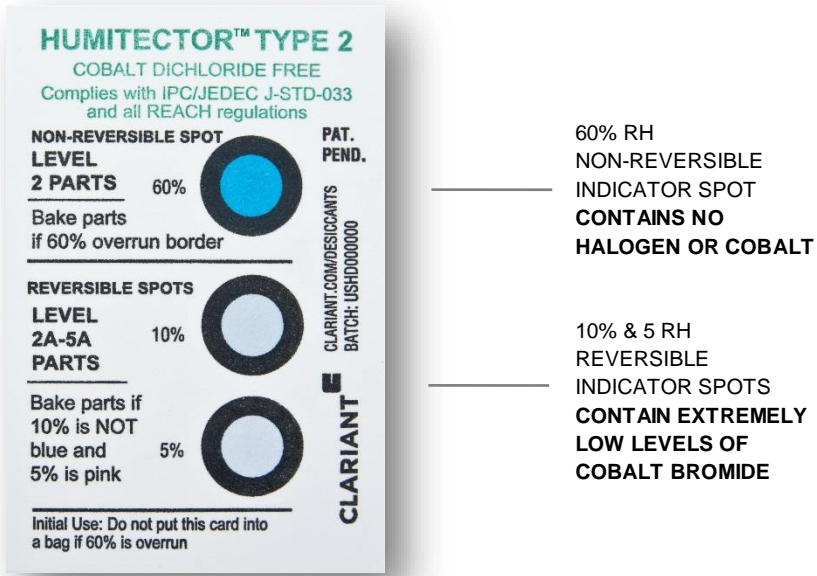
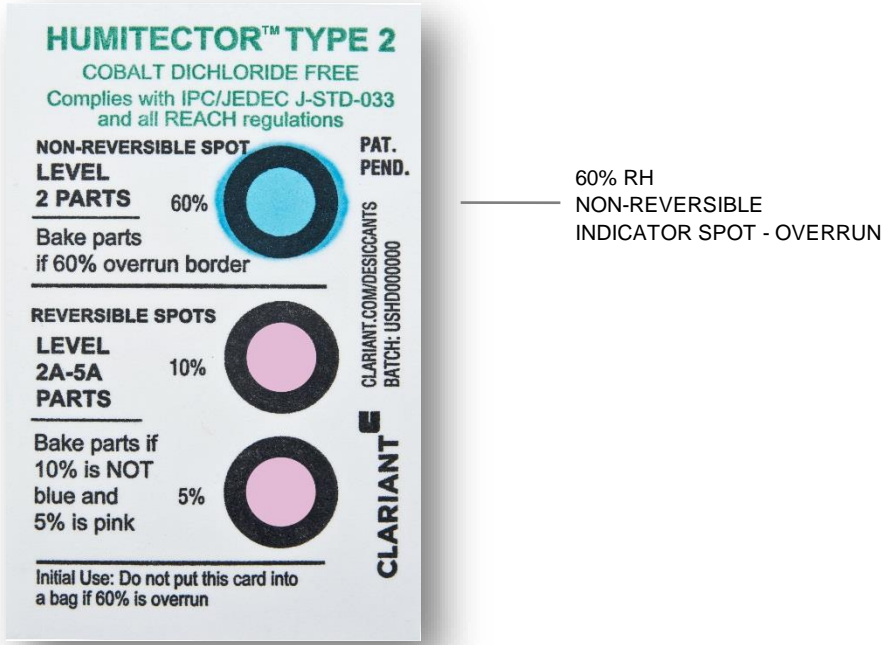


Figure 2: Humitector™ Type 2 Non-Reversible Humidity Indicator Card - exposed to humidity for a prolonged period of time



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Additional Resources:

[Humitector™ Type 2 Non-Reversible Humidity Indicator Card](#)

Infographic:

[Desi Pak® - Bentonite clay based desiccant](#)
ADVANTAGES OF A NATURAL MINERAL

[Desi Pak® Desiccant Calculator](#)

[Desiccant Bags](#)

[Desiccant Types](#)

[Humidity Indicator Cards & Plugs](#)

[Desiccants, Oxygen Absorbers, & Humidity Indicators](#)

[Clariant: Sustainability](#)



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