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How To Use Silica Gel Desiccants

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Using Silica Gel Desiccant Packs

What are desiccants?

A desiccant is a drying agent, which is packaged inside a porous pouch so that the moisture can get through the pouch and be absorbed by the desiccant.

The desiccant absorbs moisture vapour (humidity) from the air left inside the barrier bag after it has been sealed. Moisture that penetrates the bag will also be absorbed. Desiccant remains dry to the touch even when it is fully saturated with moisture vapour.

Desiccants are perfect for protecting enclosed items that are susceptible to damage from moisture like electronic components, computer chips, loaded & vacuum packed JEDEC trays.

The synthetic and natural materials have an absorption performance suited to a wide range of product types, environments and humidity levels.

What to consider when using Silica Gel

There are 6 factors that have to be considered when wanting to know how much desiccant to use to keep the Relative Humidity (RH) inside a package below 50% and therefore minimise the risk of deterioration of the goods inside.

These are:

1. The area of the moisture barrier (outside packaging).
2. The type of moisture barrier.
3. The volume of air inside the barrier.
4. The weight and type of any packaging material inside the barrier.
5. The length of time protection is required.
6. The type of climate – temperate or tropical ?

Formulas to use

The factors before are used to give the following formulae for calculating the amount of basic desiccant required. Non-indicating silica gels to BS:2540 and BS:7554 meet the requirements of this basic desiccant.

1. For temperate climates	W = 11 x A x R x T + DF
2. For tropical climates	W = 40 x A x R x T + DF
3. For hermetically sealed containers	W = 170 x V + DF

Formula key

W The weight in grams of basic desiccant.

A The area in square meters of the moisture barrier.

R The moisture vapour transmission rate of the barrier in grams per square meters per 24 hours, measured at 90% RH and 38oC. This varies considerably depending on the type of barrier used.

V The volume in cubic meters of the container.

T The expected storage/transit time, in months.

DF The dunnage factor. This takes into account any packaging inside the moisture barrier or hermetically sealed container that may have inherent moisture in it. It is calculated as:

M/5 for timber with > 14% moisture content.

M/8 for felt, carton board and similar materials.

M/10 for timber with < 14% moisture content.

M The weight in grams of the relevant packaging material.

Notes of Explanation and Expansion

Hermetically sealed containers/packages

Where practical, we consider 'packages' as hermetically sealed (equation 3). This simplifies calculations, as factors such as time and construction of the package do not need to be taken into account. The formula **W = 170 x V + DF** only requires the volume (and packaging inside) to be considered.

Glass bottles, rigid plastic containers, tins, metal cabinets etc. can all be considered under this heading, as, assuming they are sealed, no moisture can get in once closed.

Non-hermetically sealed packages

With outer barriers such as plastic bags, cardboard, wood and, to a much lesser extent, foil bags, moisture can gradually pass through the outer barrier and affect the material inside. This is covered by equations 1 and 2.

Variables

- In non-hermetically sealed packages, the time factor, **T**, has to be considered. The longer the 'package' is in the open, the more moisture can pass through the barrier, so more silica gel is required to adsorb it.
- The factor, **R** (moisture vapour transmission rate) is a property of the outer barrier. It is a measure of how much moisture will pass through it in a given time. **R** is known for most plastic bags. The thicker the plastic the lower the value of **R**, i.e., less moisture will pass through. With aluminium foil bags the value of **R** is very low. (**R** for the glass, metal, rigid plastic mentioned above is considered to be 0). The higher the value of **R** the more silica gel is required.
- The area of the barrier, **A**, is the third variable. The more area exposed to the air, the more moisture that can be transmitted through into the 'package'.
- With **DF** (the dunnage factor), by restricting the potential moisture sources that are inside the 'package', much less desiccant can be used.

While **A** can be measured, **T** is often unknown and **R** difficult (impossible in some cases) to determine. The difference between **equations 1 and 2** (the 11 and 40) is taking into account that in tropical climates the humidity will be much greater (more moisture in the air) than in temperate climates. There is a direct correlation between all of these factors and the amount of silica gel needed inside the package.

Contd.

The longer the time (**T**), the larger the area (**A**), and the higher the value of the moisture transmission rate (**R**), the more silica gel is predicted.

While **A** cannot usually be varied, **T** and **R** can sometimes be changed to help reduce the amount of silica gel required. Simply by using two polythene bags (or a single heavier gauge bag) the amount of silica gel needed is halved. Ensuring that items are not stored too long before use (or transit) can also greatly reduce the silica gel need.

One thing to remember

Please remember that this is not an exact science. It can be difficult to get the exact weight of desiccant required from the above formulae owing to the many variables that have to be considered, some of which are difficult to measure.

The formulae can, however, be **a useful guide** to indicate the amount of desiccant required to give adequate protection. Sachets are generally only made in standard sizes and we would recommend taking the next larger size after any calculation is made.

An approximate 'rule of thumb' for 'hermetically sealed' packages is that 5 grams of silica gel are required per cubic foot of package (170 grams per cubic meter).

Follow the QR code to the left for our Silica Gel Desiccant. For any further information, contact our team.

Notes:

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