TORPAC®
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*Special Capsules * Capsule Machinery * Soluble Containers*

WINTER BULLETIN - CAPSULE STORAGE & FILLING

Dry or Winter Air is Hazardous to Empty Capsule Storage & Filling

We all know that dry winter air is a major cause of static electricity build-up and dry skin. Outside winter air heated to room temperature is drier than desert air! *For an explanation of why this occurs, see box on reverse of this sheet "What is Humidity?"*

Dry winter air is also hazardous to the smooth operation of your capsule filling department. This bulletin will help you prevent problems due to dry winter air.

Capsules are shipped with 13-15% moisture content. It is important that this moisture content be maintained year-round. During winter months heating results in a drop in the relative humidity. This creates two problems: static electricity and capsule brittleness.

At below 40% RH the air is less conductive and static charges can build up on capsules and plastic items. This causes capsules to stick to plastic items e.g. the orienter and plastic containers or scoops. At below 30% RH static build up is immediately noticeable.

At below 40% RH the drier air absorbs moisture from the empty capsule shells leading to increased capsule breakage or cracking and in extreme cases capsules can shrink in size. At below 30% RH empty capsules can lose 1-2% moisture within a few hours.

To prevent moisture loss, the air where capsules are stored should have a Relative Humidity between 40-60%. This is the ideal breathing conditions for humans. And, the air where the capsules are filled should have a Relative Humidity between 45-55%. For a definition of Relative Humidity see box on reverse "What is Humidity". Note: Capsules should be stored at a temperature between 60-75° F (15-25°C).

Quick Facts about Humidity Gauges

Accurate humidity measuring devices are not available for less than $50. We recommend the following gauges which are accurate to ± 5% RH available from Cole Parmer (www.coleparmer.com):

- Temperature/Humidity Digital Indicator (Cole Parmer Model EW-37100-05), $60.
- Temperature/Humidity Chart Recorder (Cole-Parmer Model EW-80010-00, $425.

Cheaper products will not provide the required accuracy!

Quick and Clean Humidity Control

If you are filling capsules in a small room (20 ft. x 20 ft.), we would recommend a steam humidifier with a humidistat control (available at a local hardware store) with the air jet directed *away from capsules (empty, packed or stored).* It is important to direct the air jet away from capsules to prevent heating/cooling the capsules, and of course, over humidifying the capsules. We recommend steam humidifiers, as there is less risk of bacterial contamination of the air than with evaporative or ultra-sonic humidifiers.

In your storage area, you can use evaporative or ultra-sonic humidifiers, as the capsules are not directly exposed to the air. We can recommend the Bemis Whole House Console Model 4D7300 or 4D7800 for $200. They are available from Ace and Tru Value Hardware Stores or directly from Essick Air, Tel. 800-547-3888 or www.essickair.com/humidifiers_2/index_humidifiers.htm.

Note: It is important to keep the humidifier clean and not to allow stagnant water to remain or you may have a bacteria build-up. If recommended by the manufacturer, make sure to use anti-microbial additives.

Important: Ensure the humidifier you have has a humidity sensor (humidistat) that shuts it off automatically when the target humidity is reached.

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What Is Humidity?

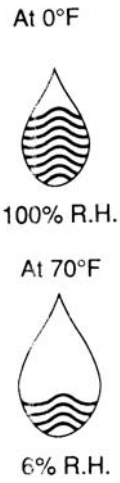
Humidity is defined as the amount of water vapor in air. Absolute humidity is a measurement of the actual water in a given volume of air, usually expressed in grains of water per cubic foot or pound of air.

Relative Humidity (or RH) is the amount of water vapor held in a given volume of air at a given temperature, expressed as a percentage of the maximum amount of water (100% RH) that can be held in the same amount of air at the same temperature.

Since air expands as it is heated, it will hold more water vapor as it approaches saturation.

When a volume of air at a known %RH is heated, the %RH decreases as the volume of air increases. The absolute humidity or total moisture available in the air remains the same. To increase the %RH of the air once it has been heated, it is necessary to add moisture.

Example: One cubic foot of air at 0°F holds 0.48 grains of water at 100% RH. One cubic foot of air at 70°F holds 8.10 grains of water at 100% RH. When air at 0°F is heated to 70°F, the amount of water remains at 0.48 grains per cubic foot. The relative humidity drops to 6%, (0.48 grains divided by 8.10 grains). See Figure 1 for an illustration.



Outside air, at a 35°F (1°C) and RH of 70% (typical winter conditions) when heated to 70°F (21°C) would have a RH of 20% - well below the recommended conditions for storing and filling empty capsules.

Do I Really Need to Be Concerned with Humidity in my Situation……

- **I have a well-insulated building with tight construction.**

Low Relative Humidity is still a problem during winter months as research has found that well insulated, tightly constructed buildings undergo about one complete air change per hour. Thus, you need to continuously add moisture to compensate for the moisture absorbed by air being brought in.

- **I live in a damp coastal region.**

There is no place in the continental US that does not have a low Relative Humidity problem during part of the year, especially in winter, if room conditions are maintained at 70° F.

- **I don't have a problem and I don't control RH.**

Low relative humidity can appear as occasional customer complaints of capsule breakage or brittleness many months after filling.

This is because the initial loss of moisture from the shell is not sufficient to cause capsule breakage. However, additional losses in moisture during subsequent handling may cause a problem.

It is very important to understand that capsules are particularly sensitive to Relative Humidity when they are unfilled. This is because the walls are unsupported and there is a tremendous volume of air contained inside the capsule that can extract or release moisture from the capsule walls. Once the capsule is filled, the walls are supported and the air inside the capsule is essentially eliminated. Thus, the sensitivity of capsules to environmental conditions is reduced.

For more information ask for our bulletin *Seven Steps to Success in Capsules*

Revised October 2009.