



Conserve O Gram

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Cold Storage for Photograph Collections – Vapor-Proof Packaging

Introduction

This *Conserve O Gram* outlines a packaging system for items in cold storage that helps to maintain the desired microclimate inside individual containers. It also prevents condensation from forming on the objects due to high relative humidity (RH), dramatic changes in RH, or moving directly from the cold to room temperature. Proper packaging techniques, especially the use of vapor-proof packaging, is essential for all cold-storage freezer units and simple cold rooms that do not have interior relative humidity (RH) control.

The Packaging Concept

Cold storage units without RH control, which include all household freezers, experience numerous daily changes in RH as they go through the defrost cycle. This rapid fluctuation of RH can put undue stress on collections. Proper packaging alleviates this problem because the interior of the package does not respond to the change in RH experienced by the freezers.

Testing shows that the RH in the freezers may go from 65% to 85% over the course of an hour, but the RH inside the packages will only change about 1% within the same time frame. This small RH change also occurs in film-based materials as they are taken out of cold storage

for access. Condensation forms on the outside of the packages, but the barrier created by the packaging does not allow the materials inside to take on additional moisture.

Constructing the Package

Double-bag the outside of boxes or containers using appropriate methods and materials to ensure the preservation and safety of collections while in cold storage.

Use good-quality vapor barrier film for an inner bag. This film has a multi-layer structure incorporating polypropylene or polyethylene with a very thin metal sheet or fine metallic dispersion.

Some examples of acceptable barrier films for vapor-proofing in cold temperatures are Marvelseal[®], Dri-Shield[™], and Static Shield[™]. However, Marvelseal[®] and Dri-Shield[™] are opaque due to a metallic layer, making it difficult to monitor the interior of the bag. Static Shield[™] bags, widely used for packing computer components, are “semi-transparent,” making it possible to read box labels through the bag (see figure 1).



Figure 1. Semi-transparency of Static Shield™ bags allows for readable text.

Use heavyweight (6 mil is preferred) polyethylene, “press-to-close” (zipper-lock) bag for the outer bag. This durable outer layer gives extra protection from condensation as the bags are removed from the freezer and helps prevent damage or tears to the inner bag as items are moved and stacked.

Reduce the amount of air trapped inside the boxes and bags before closing and seal with clear plastic packaging tape. If excess air is trapped inside the bags the packages will tend to puff up or “pillow”. This affects the microclimate, makes the packages difficult to stack and retrieve from the freezer, and puts pressure on bag seams and sealed closures.

Preparation of Materials

Maintain physical and intellectual control of objects that are placed in cold storage. Prior to placement into cold storage, prepare a box-level inventory indicating the range of item numbers or contents of each box, and the box number in that series.

Separate photographic prints from their corresponding negatives prior to introduction into cold storage. This provides more space in

the freezer for additional high-risk collections and allows the print to be stored at room temperature for use by researchers. Use separation sheets as outlined in the *Museum Handbook*, Part II Appendix D <http://www.nps.gov/history/museum/publications/handbook.html>. Enter the new storage location into the Automated National Catalog System databases.

Use white, paper, foil-backed labels to identify the contents of all boxes/containers and adhere them in two locations (on two sides of the box). Applying two labels to each box helps to ensure one will be visible however the boxes are arranged in the freezer. Printed labels or hand-written ones in graphite are appropriate. Include the catalog or archival series number, and specific storage location to facilitate retrieval.

Determining Bag Dimensions

Ensure that the storage bags properly fit the box or container. Measure each container or box to determine the appropriate bag dimensions. Make sure to measure the largest dimensions including protruding lids and/or clasps. The following will assist in calculating the correct bag size for the inner and outer bags:

- **Width:** Measure the container/box width (or shortest side). Add container/box height to this measurement, plus an additional inch. This figure is the estimated width of the bag to be used for packaging.
- **Length:** Measure container/box length (or longest side). Add container/box height to this measurement, plus an additional inch. This figure is the estimated length of bag to be used for packaging.
- **Ordering bags:** Order bags closest in dimension to the estimated measurement

you calculated. Round up to the closest size bag available. It is desirable for the open end of the bag to be on the shorter dimension. This will help minimize the size of the opening that needs to be sealed. If possible, make a “mock-up” before ordering large quantities.

Relative Humidity Indicator Cards

Because monitoring the RH plays an important role in maintaining a good cold storage environment, each vapor-proof package includes two RH indicator cards. There is one for each bag layer, as outlined in the packaging procedures below. Color changes in the cards will indicate if either the inner or outer bag is leaking due to holes.

This type of indicator card relies on the reaction of cobalt salt to the moisture content of the air. It is temperature sensitive and reads higher than the actual RH when placed in very cold conditions. Cards will tend to read 5% higher at 35°F and 10-15% higher when the temperature is below 20° F.

To monitor your bags for leaks, record the RH of the containers once they have come down to the temperature in the freezer. This is your baseline RH of the newly frozen packages. If, over time, the RH rises substantially above the baseline RH, the bags may have a leak. In that case, remove the container. If, after coming to room temperature, the RH is still very high, the bag has a leak and needs to be replaced. Check packages every three months for a change. As long as the frozen temperature RH reads 50% or less (especially in the inner bag) there is little cause for concern. Packages reading 90-100% RH require immediate attention.

Packaging Procedures

First, assemble all supplies and tools including:

- Barrier bags (inner bag)
- Polyethylene bags (outer bags)
- Cobalt salt humidity indicator cards
- Archival double-sided tape
- Packaging tape
- “Filler” material: Ethafoam™, crumpled archival paper, mat board or corrugated plastic etc.
- Scissors, pencils, paper, foil-backed labels, bone folders, linen twill tape, weights

Select a space for packaging with an RH that does not exceed 50%. If you cannot find a space with an RH less than 50%, lower the room RH with a room dehumidifier. Scheduling large packaging projects for winter (or dry season) makes this easy.

If your collection is not stored at or below 50%, let your collection equilibrate to these drier conditions prior to packaging if possible.

Once boxes or containers are inventoried, and labeled, fill any empty air space in boxes with “filler” material to prevent shifting (see figures 2 & 3).



Figure 2. Filler material is placed along one side and on the top to completely fill all extra space.



Figure 3. Roll small pieces of Ethafoam™ and tie with twill tape and use to fill voids in boxes.

Place a cobalt salt humidity indicator card on the box next to the label, in a location that will be visible after packaging. Use two strips of archival double-sided tape on the reverse to adhere the card to the box. Avoid placing the tape directly behind the indicator spots.

Insert the box or container into the first barrier bag with the front (labeled end) of the box towards the back of the bag. If using Static Shield™ bags, the label should be readable through the bag and not obscured by seams or fold overs.

Squeeze out the excess air in the bag by pressing with hands along the box sides and top. Small weights or strips of Plexi-glas® placed on top of the box can assist with this process and help to secure the bag for wrapping. “Gift wrap” the box by neatly folding up any excess bag materials at sides by forming creased flaps. Secure the flaps to the sides with packaging tape (see figure 4). After applying the tape use a bone folder to ensure it is adequately adhered (see figure 5).

Align the edges of the open end of the bag and fold the excess at least once in 1-inch increments. Lay the folded section along the end of the box, and tape it down across the length, sealing it against the box. Leave a tab

at the end of the tape by folding over its end to aid in later removal during pulling and reuse when re-filling the box.



Figure 4. Inner bag being wrapped. Excess material and flaps are tightly secured with tape along the sides.



Figure 5. A bone folder is being used to “burnish” tape to ensure it adheres to the package.

Place a second RH indicator card on the outside of the vapor-proof inner bag near the first humidity card so they can be monitored together easily by observing only one side of the box.

Insert the front end of the vapor-sealed box into the heavy-weight polyethylene bag so that the RH indicator cards are clearly visible once the outer bag is sealed.

Repeat the above wrapping procedure for the polyethylene bag. Close the zipper closure and tape it flat against the box taping over the entire end to keep it intact and provide an additional seal (see figures 6 & 7).



Figure 6. The sealed “zipper-lock” end of the outer bag is taped flat to the box.

Once all the boxes are sealed in their bags they can be placed in the freezer unit. Where possible, store in numerical order for ease of access. However, if this is not possible due to the interior dimensions of the freezer and types of boxes, fit the boxes to maximize storage and use the door bins for smaller materials.



Figure 7. This box is completely wrapped and ready for the freezer.

Prepare a shelf map that indicates where each box is located inside the refrigerator to facilitate retrieval. Place the shelf map and the inventory list on the refrigerator door with a copy of the guidelines for freezer storage and emergency contact information.

Accessing Collections in Cold Storage

To access collections for use (or to replace leaky bags), remove box from unit and let it warm to room temperature (65-75F and 30-50% RH) to prevent damage. **DO NOT** remove the vapor-proof bagging until all contents are warmed up. The containers can be placed on a work table or shelf during the acclimation time. Because water will condense on the outer package, place a blotter or towel underneath the container to wick up excess water. Acclimation can also be done using an insulated storage container (picnic cooler) where ambient room conditions are excessively warm or where materials need to be transported outside of a building. Place the sealed package in the cooler until it arrives safe at its destination and allow the package to thoroughly warm up.

Warm-up time varies with box size. Generally, you should wait eight hours or overnight, before opening the bag. Be sure to mark the box with a “caution” or “object” sign to highlight collections materials to other staff together with the estimated time it will be safe to open the bags.

Once the bag has acclimated and is no longer cool to the touch, wipe off any moisture with paper towel and open the bag by removing the tape. Discard the tape and replace any leaking bags.

When only a few items are needed for extended periods, repack the rest of the box and return to cold storage. Once the materials are ready to be returned to cold storage, special humidity conditioning with a dehumidifier is not usually required prior to re-packing unless environmental conditions exceed normal office/collection storage parameters (e.g., 72°F/50%RH).

To maintain the preservation benefit of cold storage, negatives, transparencies, and slides should not be removed more than a few times per year or for long periods of time.

Sources

Barrier Bag (inner bag) Static Shield Bag Type 111™ - open end

Uline www.uline.com

Tel 800-295-5510

Note: There are several other types of barrier bags and sheet films available.

Polyethylene Bag (outer bag) plain, clear, "press to close" (zipper-lock), 6 mil (thickness)

McMaster-Carr www.mcmaster.com

Tel 330-995-5500

Other supplies including *packaging tape (3M™ #313), archival double-sided tape (3M™ #415), cobalt salt humidity indicator cards, bone folders, weights, foil-backed labels and filler materials (Ethafoam™ sheets, twill tape, archival paper etc.)* can be purchased from suppliers of conservation and archival-quality materials.

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