



Conserve O Gram

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Cold Storage for Photograph Collections – An Overview

Introduction

Photographic materials present complex preservation challenges for collection caretakers. Since the introduction of photography in the late 1830's, many different photographic processes and materials have been explored. As photographers experimented with a variety of techniques, they found that photographs changed over time and exhibited certain deterioration characteristics. It is now known that cold storage greatly reduces the rate of deterioration and extends the longevity of photographic media. This preventive conservation measure can help avert or postpone costly conservation treatment of individual objects.

The What and Why of Cold Storage

The term “cold storage” will be used in this *COG* to represent a range of temperatures from 0°F to 55°F with an appropriate relative humidity (RH). “Cool rooms” commonly have a temperature of 55–65°F with an RH of 30–40% while “cold rooms” commonly refers to conditions below 55°F, and can be as cold as 0°F.

Because any decrease in storage temperature below ambient conditions improves the longevity of vulnerable materials, the selection of cold storage conditions is based on what is achievable, initially and in consideration of ongoing energy costs and other maintenance issues. Energy costs rise proportionally as storage temperature set points are lowered. For smaller collections, using a few upright household freezer units provides the benefits of low temperature conditions with much less energy use than a large specially-designed cold room. Where collections require the capacity of a cold storage vault, a temperature of 35–50 °F is recommended to provide a significant improvement in longevity while keeping costs manageable.

Scientific research by the Image Permanence Institute (IPI), conservation professionals, and others confirms that there is a dramatic increase in film and color dye stability as the temperature and relative humidity in storage are lowered (see table 2). However, while lowering the humidity from 50% to 30% at room temperature can double the life expectancy of film, lowering the temperature has an even more dramatic effect on increasing life expectancy.

Cold storage can help keep the condition of collections “in stasis” until they can be duplicated. Since many collections are near or at the point where significant deterioration occurs, providing cold storage should be the first step in a collection preservation strategy over reformat-

COOL CONDITIONS	COLD CONDITIONS	
55 – 65 F	0 - 55 F	
	Above Freezing 33 - 54 F	Below Freezing 0 - 32 F

Table 1. Cool and Cold Condition Temperatures.

ting or duplication. Focus duplication or scanning efforts on materials that are frequently accessed before placing them in cold storage as it can take many years and significant resources to create copies of large collections.

Temp	RH	Years to Significant Change
75°F	50%	25
75°F	30%	45
55°F	50%	105
55°F	30%	190
32°F	50%	625
32°F	30%	1170
10°F	30-50%	>3700

The IPI Preservation Calculator for Photo Storage at www.imagepermanenceinstitute.org provides an overall 'life expectancy rating' based on known temperature and relative humidity in storage.

Table 2. Average Film Deterioration Rates.

Museum standards for photographic media recommend or require cold temperatures to preserve film and color media. The Code of Federal Regulations - *Facility Standards for Records Storage* (36 CFR 1228.232 (b.) Subpart K, Sept 2005) that applies to federal archives and museums **requires** cold storage for film and color photographic materials at 35F or below and 35%RH. The criteria set by the International Standards Organization (ISO) 18911 - *Safety Film Storage* **recommends** cold storage at 35F or below at 30-40% RH (or cool storage at lower RH) for the extended storage of the above-mentioned materials. Under Directive 1571 - Appendix A the U.S. National Archives and Records Administration lists cold storage as a standard.

Selecting Collections for Cold Storage

All photographic media benefits from storage at temperatures lower than the normal or room temperature conditions generally used for

mixed-media museum and archives storage. For more information on the care of these materials refer to COGs 14/2, 14/4, 14/6, 14/8, 14/9 and 2/20. However, certain photographic processes, and/or the materials that make up their structure, are particularly vulnerable to rapid deterioration at elevated temperature and RH.

Most historic films and color photographic materials require cold storage for their long-term preservation due to the instability of the plastic supports and/or color dyes. Because most collections contain films and color media that have been stored in unstable environments for decades, rapid deterioration may have already begun. Some older materials may be in advanced stages of deterioration.

*Materials that **greatly benefit from cold storage at temperatures below freezing** are:*

- All cellulose nitrate film-based materials
- All cellulose acetate film-based materials
- All color photographic media; transparencies (slides), prints and negatives

*Materials that **greatly benefit from cold storage** are:*

- Albumen prints
- Deteriorated photographic prints; prints that are very faded or brittle from poor-quality mounts
- Poorly processed prints (which often exhibit staining)

*Materials that **benefit from cool or cold storage at any temperature but are much less vulnerable to deterioration in normal archival conditions** are:*

- Black and white (B&W) silver gelatin photographic prints

- Polyester-based B&W silver gelatin film-based materials

There are also some materials that benefit from cooler temperature storage, but because of their component structure should not be frozen.

*Materials that **should not be frozen** are:*

- Glass plate negatives and lantern slides
- Cased photographic images; daguerreotypes, ambrotypes, tintypes etc.
- “Instant” prints such as Polaroid® prints (especially integral pack type such as SX-70). Color dyes benefit from cold, but the complex multi-component structure of these prints can be damaged in some situations.

Cold Storage Options

Cool or cold storage for collections can be achieved by installing special climate-controlled storage rooms (cool or cold vaults) or the use of stand-alone freezer or refrigerator units.

Collection size, space availability, and resources will determine which option is most feasible for a particular site. If more than ten standard-size freezers (20-cubic foot capacity each) are required, then a vault may be more practical and cost-effective. Designated parks may have a centralized cold-storage vault available for use as a repository by other sites.

Cold storage requires special handling procedures, and in most cases, specific packaging protocols. The construction of cold-storage rooms requires performance-based procurement specifications to ensure proper fabrication, construction, and subsequent operation. Individual freezer units vary widely in their design and some specific features are desirable

when used to store photograph collections. Choosing the right freezer will help maximize the efficiency and performance of your storage. For detailed information on freezer options see *COG 14/11*.

When to Use a Freezer

The most economical method to maintain a cold-storage environment for small collections is to use standard household, upright freezers. Check major national brands as designs change each year. Although these units go through a defrost cycle during which the RH becomes high, this problem is easily and effectively alleviated with proper vapor-proof packaging of the contents. To learn the specifics of packaging for cold storage, see *COG 14/12*.

When considering the purchase and installation of freezers, first determine the specific needs of your collection. This requires a survey of your collection to estimate the packaging needs and the amount of space needed. Consider answers to the following questions:

- How many cubic feet of materials do I have? How much will the collections grow?
- How are items currently stored?
- What are the dimensions of my storage boxes or containers?
- How often is the collection used?
- Are prints or duplicate slides available for research use or will I have to scan some material prior to freezing?
- Will the space to house units be within the museum collection area or are other appropriate spaces available?
- Are resources available to monitor and maintain the environment?

Preparing Materials for Cold Storage

It is critical to maintain physical and intellectual control of collection at all times. Thoroughly organize and document collections before placing them in cold storage. Label all containers/boxes on the outside so that a box can be identified, located and easily retrieved. At a minimum, develop an inventory list and location register to facilitate retrieval and minimize handling.

Separate and remove duplicate photographic prints and slides from materials going into cold storage to maximize the space available for vulnerable media and to keep copies at room temperature for researchers use. (Refer to use of *separation sheets* as outlined in *Museum Handbook*, Part. II Appendix D)

It is not necessary to rehouse collections prior to cold storage unless the enclosures and or boxes are extremely brittle or structurally unsound. Cold storage slows down all deterioration processes for collections materials and for the enclosures.

Use appropriate vapor-proof packaging for the collection containers if the cold storage room or unit does not have RH control. See *COG* 14/12.

Duplication or Digitization Before Cold Storage

Although traditional photographic duplication for archival masters and digitization for “use copies” is encouraged, reformatting is not always feasible or necessary before collections are placed in cold storage. Where prints or duplicate slides exist, these can be used as reference copies from which scans may often be made (instead of using the negatives or

master slides). If feasible, heavily used items or small collections for which prints or duplicates are not available can be scanned to create “use copies” prior to being placed in cold storage. This makes them less subject to excessive handling. Materials can always be pulled from cold storage as digitization projects are implemented.

Access to Materials in Cold Storage

Acclimatizing or warming up cold materials to room temperature before they can be used delays access to collections in cold storage. If the contents are sealed in vapor-proof packages, the packages can be placed on a table or shelf at ambient conditions to warm up to room temperature. Place items or containers that are stored in RH-controlled cold storage rooms without special sealed packaging in a plastic bag before removing them from the cold room. The bagged items may safely warm up in the staging area. Acclimation can also be done using an insulated storage container (picnic cooler) where ambient conditions are excessively warm or humid or when materials need to be transported outside of a building.

To maintain the preservation benefit of cold storage, items should not be removed more than a few times per year or for long periods of time. Leaving the materials at room temperature diminishes the benefit of time spent in cold storage.

Maintenance and Equipment Failure

An important part of any cold-storage program requires proper maintenance of equipment according to manufacturer-supplied user manuals and the implementation of monitoring programs to ensure years of trouble-free operation.

The least problematic failure of a cold unit is a power outage or total breakdown of the equipment causing shut off and gradual warming to ambient conditions. As long as the cold unit is kept closed and any vapor-sealed packages remain intact, there is generally low risk to the contents. However, in rare mechanical failures, the unit may heat up inside. Failure of RH controls in vaults where protective vapor-proof packaging is not normally used can result in RH spikes up to 100%, causing the vault walls and ceilings to weep, and paper boxes to swell with moisture. In these situations, the unit must be shut down, doors opened to reduce heat or humidity, and contents removed if they are not packaged. Damp materials must be dried out immediately.

Although freezers and cold storage rooms may have audible alarms, it is best to have remote monitoring that signals a 24/7 remote monitoring station or dials a 24-hour emergency phone, especially where no staff is present during off hours. See *COG* 14/11.

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