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Author(s): Lee Ann Daffner
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SURVEY OF COOL AND COLD STORAGE FACILITIES FOR FINE ART PHOTOGRAPH COLLECTIONS

Lee Ann Daffner

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Introduction

November 7, 2004 marks the 75th anniversary of the founding of The Museum of Modern Art in New York City. The anniversary will be celebrated with the opening of a newly renovated and expanded building complex: 400,000 square feet of new museum space for exhibition, offices, conservation labs and art storage on site at 53rd street in Manhattan and a new study center and art storage facility in Long Island City, *MoMA Qns*. As part of the planning and preparation of this expansion, in 1999 the author traveled to six institutions with cold storage of photograph collections to speak directly to curators and conservators about this aspect of the collection care, and to see, first-hand, cold storage systems. Five additional institutions were contacted by telephone. These institutions were selected either for their similarity to MoMA's collection, geographic accessibility, or specific approach to cold storage.

This report focuses on environmental specifications for fine art photograph collections. Libraries were included in the initial survey, and invaluable information was gathered, however, the findings will not be included in this report. Archives and libraries may have a different set of environmental specifications given the different demands of access, collecting, and storage placed on these collections. This report will also not address the mechanics of cold storage or discuss the role of the dew point in determining environmental set points in storage. The cost of constructing and maintaining a particular environment is a critical factor, since implementing and maintaining a climate-controlled storage vault at very cold temperature is very complex. It should be noted that, however, that these issues are critically important for the proper design and safe operation of a cool or cold storage vault.

Background

It has been clearly shown that the long-term preservation of the final image and support materials is greatly improved in cooler temperatures: the colder the temperature, the longer the useful life of the collection. Please see the selected bibliography for a list of excellent research on these topics. The driving force behind cold temperature storage implementation, however, is the inherent fragility of organic color dyes and other components found in photographic materials. Cold storage of photographic materials is a vital preservation strategy, complemented by careful exhibition, handling, and scholarly use. Designating specific combinations of relative humidity (RH) and temperature values depends on a number of considerations including the chemical and physical stability of the photographs, ease of access and human safety in storage. During the course of the survey, it was observed that there was a wide temperature range between the different facilities, alternatively described as either "cool" or "cold" or "freezing", but the range varied greatly within each category. According to the American National Standard Institute in

ISO 18920: 2000 *Imaging materials – Processed photographic reflection prints – Storage practices:*

> There are two levels of recommended storage conditions for photographic materials: medium-term storage and extended-term storage. Medium-term conditions can be used when it is desired to preserved information for at least 10 years. Extended-term term conditions shall be used when it is desired to preserved the information for as long as possible.

According to the ISO Standard, for organic dye color material, medium-term storage will have a maximum temperature of 77ºF and extended-term storage for organic color dye prints will be 36ºF and 30% relative humidity. For the purposes of this survey, it may be useful to think of medium term storage as "cool" and extended term storage as "cold".

The Survey

A conservator or curator from each of the following institutions discussed the specifics of their storage facilities. Selected comments and recommendations from each institution are included. Any errors in this reporting are those of the author.

Art Institute of Chicago (AIC)

A 700 square foot storage facility of the Art Institute of Chicago was opened in 1979 and is directly adjacent to study room. The 350 square foot cold vault opened in 1982, and in 1997 a second cool room of 350 square feet was added. There are 20,000 prints in the collection, 20% are color and housed in the cold room. The cold vaults are located within the cool room, where acclimatization takes place.

Photograph conservator Doug Severson's recommends working with a local mechanical contractor. Expert maintenance of a cold storage facility is the key to the successful operation of a cold vault. He points out the importance of redundant mechanicals such as two mid-size dehumidifiers to provide back up when one is down and stresses practical design features such as incorporating a large door for the entrance into the cold storage unit.

AIC Temperature and Relative Humidity Set Points:

Cool room	60º F and 40 % relative humidity, +/- 3º F or %
Cold room	40 º F and 40 % relative humidity, +/- 3º F or %
Study Room	72º F and 50 % relative humidity, +/- 3º F or %

The Museum of Modern Art, New York (MoMA)

The previous photograph storage room of The Museum of Modern Art in New York was built in 1984, including the purchase of low humidity, frost-free refrigerators. There are approximately 50,000 photographs in the collection, of which 1,000 are color.

All small and medium format organic dye color works are stored in refrigerators, including dye transfer prints. Medium-sized framed and mounted color photographs are kept in the main storage. Framed works larger then 4 by 4 feet are stored in painting storage on racks, which has gallery temperature and relative humidity.

Small format color works are housed in archival paperboard boxes in large Marvelseal® bags sealed by folding over the open end several times and closing with clips. These are kept in the free-standing refrigerator. Staging is required, and works acclimatize first in the cool storage room, and are then brought out to the study room.

Pre- 2004 MoMA Temperature and Relative Humidity Set Points:

Cool room	60º F and 40 % relative humidity, +/- 3º F or %
Free-standing Refrigerator	35 º F and 30 % relative humidity, +/- 3º F or %
Gallery/Study Room	70 º F and 50 % relative humidity, +/- 3º F or %

Canadian Centre for Architecture (CCA)

The storage facility was built in 1988. There are 47,000 photographs, of which 1,000 are color. A cold room (for colour material) having temperature and relative humidity set points of 40º F and 40% RH and a cool room (for black and white material) having temperature and relative humidity set points of 55º F and 40% RH had been originally planned and built; however, the cold room of the storage vault of the CCA was never realized. The room temperature could not be brought down to the intended temperature without the pipes freezing. Instead the temperature was set at 55º F in both rooms of the photo vault. With the hiring a new HVAC engineer firm, the CCA staff is hoping to achieve a temperature set point of 45º F in the cold room by early 2004 while the cool room will remain at 55º F.

CCA Temperature and Relative Humidity Set Points:

Cool room	55º F and 40 % relative humidity, +/- 3º F or %
Study Room	70 º F and 50 % relative humidity, +/- 3º F or %

National Gallery of Canada

The storage facility of the National Gallery of Canada became operational in 1991. There are 21,000 prints in the cool room and 500 prints in the cold room, which primarily consist of organic dye image material. Staging is required for works removed from cold storage and is time dependant: more time is required for a full Solander box, less time for a single matted print.

Both framed and mounted prints are stored in the colder room. These are mostly large format works, so capacity is limited. The cold vault is located within the cool room, where acclimatization takes place. Conservator, Photographs John McElhone stresses the importance of instituting low-temperature storage, along with improving the physical housing of the collection. In addition, he recommends that when building a low temperature storage facility, choose a mechanical contractor that has extensive cold-room design experience and, if possible, some experience in designing low-temperature museum storage rooms with controlled RH. Meetings with the mechanical contractor at the outset of planning will ensure that the function of the room is well understood.

National Gallery of Canada Temperature and Relative Humidity Set Points:

Cool room	61º F and 40 % relative humidity, +/- 3º F or %
Cold room	39 º F and 40 % relative humidity, +/- 3º F or %
Study Room	68 º F and 45 % relative humidity, +/- 3º F or %

The Fogg Art Museum

The cold storage facility opened in 1993-94. Only the color photographs measuring less then 32 x 40 inches and some film-based materials are kept in the cold room. The small size of both the anteroom and the dumb waiter (by which works of art move between storage and study room) are the two limiting factors in terms of storing larger color materials in the cold room. All materials are acclimatized in the anteroom for 24 hours before being taken to the study room.

Fogg Art Museum Temperature and Relative Humidity Set Points:

Cold room	40º F and 30 % relative humidity, +/- 3º F or %
Anteroom	55 º F and 40 % relative humidity, +/- 3º F or %
Study Room	75 º F and 40-50 % relative humidity, +/- 10º F or %

J.Paul Getty Museum

The cold storage facility opened in 1996. There are 27,000 prints, 500 albums, 1,600 books, and 1,000 color prints. Framed works as well as works in Solander boxes are kept in the cold storage area. Conservator Marc Harnly says that it is most important to have a maintenance crew

perform regular checks and solve problems that arise. Institutions without their own facilities crews need to contract with an outside firm that will agree to learn all about their systems and respond quickly to an emergency.

J.Paul Getty Museum Temperature and Relative Humidity Set Points:

Cold Storage	40º F and 40 % relative humidity, +/- 3º F or %
Staging chamber	68º F and 40 % relative humidity, +/- 3º F or %
Gallery Conditions	70 º F and 50 - 55 % relative humidity, +/- 3º F

Maison Européenne de la Photographie (MEP)

The MEP opened its storage in July 1999. MEP houses 17,000 photographic works, 2,400 of which are color. Black-and-white and silver dye-bleach material is kept in the cool room. All other color works are stored in the cold storage, including those that are framed and mounted. Photograph Conservator and Director of the Atelier de Restauration et de Conservation des Photographies de la Ville de Paris, Anne Cartier-Bresson recommends a six-month security period to make sure your conditions are satisfactory before moving the collection into the new storage facility.

MEP Temperature and Relative Humidity Set Points:

Cool room	66º F and 50 % relative humidity, +/- 3º F or %
Cold room	39 º F and 40 % relative humidity, +/- 3º F or %
Staging Room	54 º F and 45% relative humidity, +/- 3º F

National Gallery of Art, Washington DC (NGA)

The photograph collection storage rooms opened March 2002. The NGA houses approximately 10,000 accessioned objects, including contact sheets, roll film, and approximately 150 color works, many of which are oversized.

NGA Temperature and Relative Humidity Set Points:

Cool room	62º F and 40 % relative humidity, +/- 5º F or 3%
Cold room	50 º F and 40 % relative humidity, +/- 5º F or 3%
Study Room	70 º F and 50% relative humidity, +/- 5º F and +/- 3%

There are also eleven free-standing frost-free freezers for film negatives and color slides, and x-rays stored in Marvelseal® pouches along with mat board, paper boxes, or blotter paper conditioned to 40 - 50%RH, within zip-lock bags. Photographs in the cold room are acclimatized in the cool room before they are brought into the study room. Framed color works as well as works in Solander boxes are stored in the colder room.

If planning to use plastic bags as a humidity regulating barrier in freezers, Senior Photograph Conservator Connie McCabe recommends Marvelseal® pouches, which are the photographic film manufacturer's standard packaging. The metal foil of Marvelseal® offers a reliable vapor barrier, and the seams and closures can be trusted.

Amon Carter Museum, Fort Worth

The Amon Carter photograph storage opened in October 2001. There are 300,000 photographic works dating from 1840 to present. However, there are approximately 35,000 single photographs and albums. The core of the storage facility is a cold room for color materials and black and white negatives that operates at 20ºF and 30%RH. A ramping temperature and relative humidity vestibule is used to acclimatize works going in and out of this cold storage room.

Amon Carter Museum Temperature and Relative Humidity Set Points:

Cool room	60º F and 40 %relative humidity, +/- 3º F or %
Cold room	20 º F and 30 % relative humidity, +/- 3º F or %
Study Room	70 º F and 50 % relative humidity, +/- 5º F or %

IN THE PLANNING STAGE

The Metropolitan Museum of Art (Met)

The Met's Department of Photographs houses 15,000 works, plus an additional 40,000 works in the Walker Evans Archive. Of the 15,000 in the main collection, approximately 1,000 are color. The Evans Archive includes close to 10,000 color transparencies, 30,000 black-and-white film-based images, and 150 instant color prints.

Based on the Art Institute of Chicago model as well as access needs, a cold room at 40ºF and 40%RH will house matted color works smaller than 40x 60" as well as film materials. Larger format color and smaller framed works requiring screen storage will be housed with the majority of the collection at 60ºF and 40%RH. A very cold room will be sought off-site for 0ºF storage with appropriate packaging for the duplicate color prints. Nora Kennedy, Sherman Fairchild Conservator of Photographs, recommends securing funding for consultants to review proposed specifications in relation to changing standards, institutional needs, and practical viability of achieving and maintaining systems.

Met Temperature and Relative Humidity Set Points:

Cool room	60º F +/- 2º and 40 %relative humidity, +/- 3 % (For large format and framed color works)
Cold room	40 º F +/- 2º and 40 % relative humidity, +/- 3 % (For color works smaller than 40 x 60")
Off-site storage	0 º F with appropriate packaging (For duplicate color works)

Whitney Museum of American Art

The Whitney has secured funding from the National Endowment for the Humanities, and from the Institute of Museum and Library Sciences for the construction and installation of a custom cold storage vault for the Museum's collections of photography (2,700 objects: 17% color) and film and video.

Following extensive research by Sylvia Wolf, Curator of Photography, and Suzanne Quigley, Head Registrar, the Museum has designed for a single refrigerated vault of 700 s.f. which will run at 40º F and 35% RH. The vault will be outfitted with screens on rolling racks, compact shelving, and flat files to accommodate growth of the collection to 9,000 objects by 2015. The vault is of modular design, which may be enlarged or reconfigured during a building expansion. An ante-chamber will be designed as a staging room to run at 55 ºF and 45% relative humidity.

As of July 2003, approximately 20% of the Whitney's collection contained contemporary works that are laminated, framed, or made with mixed media materials that would run the risk of physical instability at temperatures below 40 degrees. Taking these considerations into account, along with space restraints that do not allow for a two-vault system, a single vault for the entire collection of photographs, film, and video was determined to be the most efficient and stable means of preservation.

Whitney Museum Temperature and Relative Humidity Set Points:

Cold room: 40º F and 35 %RH, +/- 5º or 3 % RH
Staging Room: 55 ºF and 45 %RH, +/- 5 % RH
Viewing Room: 70 º F and 50 % relative humidity, +/- 5º F or 3%RH

The Museum of Modern Art, New York (MoMA)

At the time this article goes to press, MoMA is finalizing storage room layouts. The on-site storage located in the museum in Manhattan will be composed of a large cool room. Within this cool room will be a reach-in compartment for unframed color works measuring up to 30 x 40". The large-scale works will be stored in Long Island at *MoMA Qns*, which MoMA plans to run at 40ºF and 40 %RH.

2004 MoMA Temperature and Relative Humidity Set Points:

Cool room	49º - 53º F and 40 %, +/- 2 % relative humidity
Cold compartment	30 º - 35ºF and 35 %, +/- 2 % relative humidity
Study Room	70 º F and 50 % relative humidity, +/- 2º F or %

The Comparison Chart

Specifications for nine existing cold storage systems were compiled into a chart. The dew point number (DP) is included to compare the safety of moving works from one cold chamber to the next.

Another useful tool in evaluating the long-term preservation gains of cold storage is the Preservation Index (PI), devised by the Image Permanence Institute. The purpose of PI is to compare and evaluate collection storage environments, which is represented as a "Lifetime" value in years. The year number comes from predictions for acetate film to deteriorate. IPI research has shown that acetate deterioration, color dye fading, magnetic tape deterioration and acidic paper embrittlement share similar deterioration rates.

Existing cool and cold storage vaults for fine art photography collections:

AIC - Cool Storage *60°F & 40% RH* DP = 35.6° PI = 96 years		**AIC** – Cold Storage *40°F & 40% RH* PI = 482 years
MoMA - Cool Storage (1984-2002) *60°F & 40% RH* DP= 35.6° PI = 96		**MoMA** Free-Standing Refrigerators *35°F & 30% RH* PI = 874
CCA - Cool Storage *55°F & 40% RH* DP = 31.2° PI = 141 years		
Nat'l Gallery Canada Cool Storage *61°F & 40% RH* DP = 36.5° PI = 96 years		**Nat'l Gallery Canada** Cold Storage *39°F & 40% RH* PI = 482 years
	Fogg Art Museum – Ante Room *55°F & 40% RH* DP =34 ° PI =141 years	**Fogg Art Museum** – Cold Storage *40°F/ 30% RH* PI = 655 years
	Getty - Staging Chamber *68°F & 40% RH* DP = 31.2° PI = 58 years	**Getty** - Cold storage *40°F & 40% RH* PI = 482 years
MEP Cool *66°F & 50%RH* DP = 46.9° PI = 50 years	**MEP** Staging Room *55°F & 45%RH* DP = 34.1° PI = 122 years	**MEP** Cold Storage *39°F & 40%RH* PI = 482 years
NGA – Cool Storage *62°F & 40% RH* DP = 37.4° PI = 84 years		**NGA** – Cold storage *50°F & 40% RH* PI = 211 years
Amon Carter – Cool Vault *60°F & 40%RH* DP = 35.6° PI =96	**Amon Carter** Temperature and relative humidity ramping vestibule	**Amon Carter** – Cold Vault *20°F & 30%RH* PI = 555 years

In evaluating the long-term preservation gains of cold storage, here we have used a system devised by The Image Permanence Institute (IPI) of Rochester, New York: Time Weighted Preservation Index (TWPI) and Preservation Index (PI), see above. The purpose of PI and TWPI is to compare and evaluate collection storage environments, which is represented as a "Lifetime" value in years. For example, at 68°F with 50% RH, the PI is 44 years if the object is never removed from storage. TWPI tells you the correct "PI" for a span of time during which conditions vary. The 44-year number comes from predictions for acetate film to deteriorate. IPI research has shown that acetate deterioration, color dye fading, magnetic tape deterioration and acidic paper embattlement share similar deterioration rates.

The benefits of cold storage of photographic materials are based on research and data that focuses on the long-term preservation of the final image dyes and primary supports, such as paper and acetate. But questions remain concerning the effects of low temperature and relative humidity on composite artworks, such as a work stored in artist's frames, mounted to linen or aluminum panels or face-laminated to Plexiglas (acrylic copolymer sheeting) or glass. Specific research is needed to evaluate the interrelationship of laminate structures in cycling environments and the possible effects of fatigue-induced deterioration.

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Lee Ann Daffner
Conservator
The Museum of Modern Art

Cold Storage of Photographic Materials
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