

Storage and Care of KODAK Photographic Materials

Before and After Processing



The photographic materials that you use to record images deserve the same kind of care and attention as other valuable objects. Before you expose film or paper, you must store and handle it properly so that it can provide the finest possible results. After exposure, proper care in processing and in storing or displaying the negative, slide, transparency, print, or movie helps to preserve the long term usefulness of the image.

The length of time that people intend to keep and use a photograph varies from hours or days to many decades, depending on the value placed on the image. This publication provides guidelines for getting the best performance and longest life from your black-and-white and color photographic materials. It discusses the storage and handling of unprocessed and processed materials and gives recommendations for long-term keeping.

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STORAGE AND HANDLING OF PROCESSED PHOTOGRAPHIC MATERIALS

Prints

Photographic prints are everywhere: in wallets, on walls, in albums, on desktops. Prints are popular because you can view them anytime without special equipment, and because—in most cases—you can replace them if they fade or become damaged. But when you don't have the original negative to reprint, care of the print becomes very important.

Most guidelines for storing other photographic products also apply to prints. The dyes and emulsion layers in color papers make storage of color prints more critical than that of black-and-white prints.

Select the print material that best suits your needs. Many factors—light, heat, humidity, and atmospheric contaminants—can affect the life of a print. Even under the best conditions, a print on continuous display is likely to change in time. When prints are intended for display, store the original negatives or slides properly so that you can make new prints if the display prints begin to fade. Because KODAK PROFESSIONAL ENDURA and KODAK ROYAL and EDGE Papers have excellent dye stability, you can expect color prints made on these papers to keep for a long time—many decades for prints on display under typical home lighting, for example.

For applications that require physical durability, use KODAK PROFESSIONAL DURAFLEX Plus Display Material; this material has the same image-stability characteristics as Kodak color negative papers.

Provide a cool, dry, uncontaminated storage place. If you have prints that you don't expect to display or that you want to store for a long time before you display them, you may want to leave them unmounted. Unmounted prints occupy less space and involve fewer materials that can harm the images. Avoid storing prints in the original cardboard box or package. Packaging material that is suitable for unexposed sensitized materials may not be inert to processed materials. Use archivally safe boxes or envelopes. The best storage conditions for color prints are the same as those for most other photographic products. Store prints in the dark at 24°C (75°F) or lower and at 30- to 50-percent relative humidity.

For long-term storage, keep prints at lower temperatures. If you are going to store small prints in a freezer at -18°C (0°F), condition the prints at room temperature and at 25- to 30-percent RH before sealing them in moisture proof storage envelopes (see *Use storage envelopes*). Protect prints that are larger than 8 x 10 inches (20 x 25 cm) from moisture by using three layers of aluminum foil and sealing the folds and seams with moisture proof tape such as freezer tape or vinyl electrical tape; don't use "friction tape." Be sure that the storage area and the conditioning room are free of fumes that might be harmful to prints (see *Store opened packages carefully*). If you store several prints in one package, interleave them with acid-free paper.

Store prints in albums for convenient access. A less elaborate way to keep prints, and one that combines ready access with good long-term storage conditions, is in a photo album. To get the best results from storage in an album, keep it in a place where the temperature and humidity aren't excessive.



Caution!

Fumes from mothballs, mildew inhibitors, wood preservatives, paints, varnishes, and wood glues can contaminate drawers and harm photographic materials. Therefore, open bookshelves may be a better place to store albums and prints. Because the prints are in direct contact with the pages of a photo album, make sure that the materials in the album are suitable for long-term storage of photographs. Check these items—cover, pages, plastic sleeves, mounting corners or hinges, and ink used for identification (see *Use proper packaging materials*).

Mounting and displaying prints. The issue of whether or not to mount a print remains controversial. On the one hand, most custodians of photographic materials argue that photographic artifacts, vintage prints, or contemporary prints of considerable value should never be mounted. They abide by a principle of conservation that says original artwork must be preserved with absolutely no alterations. Mounting a valuable print can actually decrease its market value and jeopardize its authenticity. Also, older photographs may have stamps of past owners (e.g., museums or other institutions), size markings for use in publication (linking the print with a specific printed publication), or other important markings on the base side.

To preserve important images, it may be wise to limit access to them, view them for only short periods, and store them archivally.

On the other hand, mounting photographic prints provides several advantages. Mounting provides rigidity, prevents wrinkling, and gives a degree of physical protection. Prints are usually mounted when they are being prepared for sale or display. Mounting is especially suited to contemporary or newly made prints when the original negative is kept in safe storage. Many identical prints can be made at the same time and the extras left unmounted for easier archival storage. If the negative or other original is not available, it is a good idea to make copies for mounting and display, and keep the original print in safe storage.

Just as you should select a print material that's appropriate for your needs, you should select an appropriate mounting material. When you mount prints of little value for short-term display, you do not need to use archival mounting materials and methods. However, when your objective is long-term keeping, the mount must be of archival quality. Long-term or conservation mounting requires that the procedure be reversible; that is, you must be able to remove the print from the mounting materials with no damage to the print. Therefore, you should always record on the back of the mount what mounting materials you used. You can use a No. 0 or No. 1 lead pencil for marking the mount, but do not use excessive pressure.

Mounting board is the most commonly used material for mounting photographs. Most mounting boards designed for photographic use are

acid-free and pH-buffered. (Use materials that are not acid-free and pH-buffered only for short-term mounting.) One method of long-term mounting involves attaching the print to conservation board with acid-free paper hinges or corner pockets. These materials are often used with a window mat placed over the photograph. Interleave mounted prints with acid-free paper when you store them.

Two types of dry-mounting tissue are recognized by American National Standard (ANSI) PH4.21-1979, Specification for Thermally Activated Dry-Mounting Tissue for Mounting Photographs. Type 1 tissue is permanent—you cannot remove the print from the mounting board without damaging the print or the board. Type 2 is a detachable type of tissue that allows you to remove the print from the mounting board by reheating the mounted print. KODAK Dry Mounting Tissue, Type 2, is an adhesive for mounting color or black-and-white prints made on RC or fiber-base papers with a platen temperature of 82 to 99°C (180 to 210°F). You can use some dry-mounting tissue for hot or cold mounting techniques. However, most dry-mounting tissue that is considered to be archival (at the time of this publication), is made for hot mounting. Starch paste and polyvinyl acetate (PVA) adhesive are satisfactory for short-term applications. Never use rubber cement; its high sulfur content will eventually cause chemical stains to form on prints.

Examination of old photographs shows that mounts that are considerably larger than the prints offer some protection from deterioration due to chemical penetration at the print

edges. When you mount prints, use a large enough mounting board to leave borders of approximately 3 inches (8 cm) at the top and sides of the print, and about 3 1/2 inches (9 cm) at the bottom. If mounts become damaged, you can trim the edges.

Protecting the surface of a print will help prolong its life. A hinged overlay or window mat that covers the print and mount offers some protection from atmospheric gases or materials that might come into contact with the print while it's being stored or transported. Protect prints that you plan to handle frequently with a sheet or sleeve of transparent material. Plastics suitable for this purpose include cellulose acetate and polyethylene terephthalate (polyester) without surface coating.

You can protect framed prints with a sheet of glass or rigid plastic such as Plexiglas UF-3, which absorbs ultraviolet radiation. Always leave a slight separation between the print and the glass or plastic.

Color prints are often lacquered to enhance their appearance; to protect them from soiling, scratching, and abrasion; or to provide a surface for pencil retouching. Many different lacquers are available, and manufacturers change formulas frequently. Therefore, it is difficult to say whether or not a particular lacquer will adversely affect long-term image stability. Because certain lacquer ingredients can accelerate dye fading in prints, it's best not to use a lacquer if you intend to store a print for a long time.

You can't always display prints in a way that promotes long-term keeping.

The best practice is to display them under subdued incandescent illumination, such as normal household lighting. Place them as far from the light source as possible and away from direct sunlight. Avoid temperatures above 24°C (75°F), relative humidities above 50 percent, and damaging chemicals and fumes. For important collections, you can use gas-monitoring devices to measure the concentrations of corrosive chemical gases. One manufacturer of gas-monitoring equipment is National Draeger, Incorporated, P.O. Box 120, 101 Technology Drive, Pittsburgh, PA 15230. If you can't avoid less-than-ideal display conditions, make several identical prints from your negative or transparency. Store the extras in a cool, dry, dark place. The extras will outlast the display print, and you can use them as replacements.

Negatives

Of all photographic sensitized products, processed negatives are usually given the least attention when it comes to storage. You don't normally display or look at them; often you print them and forget about them. Even when stored in the dark, however, color negative images do change. Negatives that you intend to reprint require the same care and attention as other photographic images.

Keep negatives clean. Avoid a buildup of fingerprints, dirt, and dust; these contaminants often contain chemicals or fungus spores that can harm the image. If you suspect that your negatives are dirty, clean them carefully before you store them.

If you use envelopes or plastic sleeves to protect the negatives, be sure that the material has no potential for harming them (see *Packaging Materials And Facilities For Long-Term Keeping*). The glossy surface of some plastic sleeves may cause ferrotyping (glazing) of a negative, which leads to density variations in a print made from it. Paper envelopes that meet the standards for photographic materials are better for long-term storage of negatives.

Control the temperature and humidity. Negatives intended for long-term storage require special care, but you can store negatives for short-term use under normal room conditions.

In climates where the relative humidity regularly approaches 60 percent, use a dehumidifier or other means of reducing the humidity in the storage area (see *Use silica gel to dehumidify*). Keep storage containers away from radiators, warm-air registers, and windows where sunlight can strike them. If you place storage containers against a wall, be sure the wall doesn't have a chimney or hot-air duct behind it. Keep the temperature low for long-term storage.

High temperature and high relative humidity can affect processed negatives. A temperature between 2°C (35°F) and 13°C (55°F) and a relative humidity between 30 and 35 percent are excellent conditions for long-term storage of negatives.

Even minor reductions from room temperature have a major beneficial impact on the stability of an image. Storing color negatives in a household freezer is a relatively inexpensive and reliable way to keep them for long periods; however you must seal them in moisture proof storage envelopes to protect them from humidity (see the following section). Even if you remove negatives from cold storage occasionally as part of normal use, virtually no dye changes will occur. The storage temperature for black-and-white negatives is not as critical as for color negatives, but you should control the relative humidity. An RH below 25 percent can lead to brittleness; an RH above 60 percent encourages mold and fungus growth.

Use storage envelopes. A low temperature combined with low humidity is not easy to obtain; the air inside refrigerators and freezers usually has a high relative humidity. However, you can condition negatives and place them in special moisture proof envelopes before storing them in a refrigerator or freezer. Place unsleeved negatives in a 25- to 30-percent RH atmosphere at 21°C (70°F) for at least 24 hours. You can use a dehumidified room or cabinet if it is free of dust and fumes. Before removing negatives from the dehumidified air, place them in the special storage envelopes for processed film. Remove excess air from each envelope before you seal it. The moisture proof barrier keeps the total amount of water in the film constant during storage. Do not store black-and-white and color negatives in the same envelope. To avoid pressure on stored negatives, do not pack the envelopes tightly or stack them. You can purchase moisture proof storage envelopes for processed film from dealers who specialize in safe storage and display products for photographic materials. Light Impressions Corporation, 439 Monroe Avenue, Rochester, NY 14607, sells vapor-seal envelopes for storing processed film. These envelopes are made of a laminate of paper, foil, and polyethylene.

Protect negatives from light. Light affects photographic dyes; for short-term storage, put negatives in a dark place— metal drawers or file boxes, for example. Metal is better than wood or plastic because wood and plastic may contain preservatives or volatile substances that can affect the negatives. You can print color negatives many times without the colors in the negative fading perceptibly.

Always use a heat-absorbing glass between the lamp and the negative in the enlarger or printing equipment to protect the negative from heat. If you know that you will produce a large number of prints of a particular subject, make more than one exposure of the scene. Then you can keep one negative under the best possible storage conditions while you print the others.

Provide proper atmospheric conditions. Do not store negatives in areas where ozone-generating machines such as photocopiers are used. Air conditioning and climate control can significantly reduce the level of airborne pollutants, but be sure to change filters regularly. Chemical fumes can harm negatives (see the footnote in Store opened packages carefully). Check your storage area for harmful fumes. If necessary, you can use gas monitoring devices to detect harmful gases and vapors.

Color Slides, Movies, and Large Transparencies

Color slides and movies are created to be viewed. However, you normally use a projector with a bright light to view them for a short time only, and then replace them in dark storage. This makes their storage requirements much like those of color negatives. Transparencies that are used for photomechanical reproduction or duplication have similar storage requirements. However, many large transparencies are viewed on an illuminator for longer periods. When transparencies are part of a window display, sunlight can damage them as well. The following paragraphs provide tips for preserving color slides, movies, and transparencies.

Use protective mounts or sleeves.

Cardboard or thermoplastic mounts are adequate for storing slides if the mount is suitable for long-term storage (see *Packaging Materials And Facilities For Long -Term Keeping*). Glass mounts do not have any significant effect on the useful life of slides except to help protect them from dirt and scratches. (Before you mount slides in glass mounts, be sure that the glass surfaces are clean.) Moisture may condense on the inside of glass mounts when you project them with high-wattage lamps. You can eliminate this problem by storing the slides with silica gel (see *Use silica gel to dehumidify*). You can protect large transparencies with photographic sleeves if the plastic material does not cause ferrotyping (see *Keep negatives clean*).

Use metal storage containers. For the reasons listed in the section “Protect negatives from light,” use metal file boxes or drawers for storing slides and transparencies if you don’t store them in a refrigerator or freezer. If you find that plastic slide trays are more convenient, test the trays for possible effects on slides (see *Packaging Materials And Facilities For Long-Term Keeping*). Keep the trays in a cool, dry, dark place away from atmospheric contaminants. KODAK CAROUSEL®, EKTAPRO, and EKTAGRAPHIC Slide Trays and KODAK Slide Clip Sets are suitable for long-term storage of slides.

Avoid light, heat, and high humidity. When you’re not viewing or displaying your slides, transparencies, or movies, store them in the same way that you store color negatives. For long-term keeping, store them in a freezer at -18°C (0°F) or lower. You can maintain low relative humidity by storing transparencies and slides in special moisture proof storage envelopes as described for color negatives. Use vapor-seal storage envelopes or metal cans to store movies for long periods. Seal the cans with several layers of moisture-resistant tape such as vinyl electrical tape. Every few years, remove the tape, condition the film (see *Prints*), and reseal the can. Use this procedure only when you plan to store the slides, transparencies, or movies for a very long Time.

Recommended Relative Humidity and Temperature Conditions for Storing Processed Motion-Picture Films

Film Type	Medium-Term Storage (10 years) Extended-Term Storage			
	Relative Humidity Range (%)	Maximum Temperature	Relative Humidity Range (%)	Maximum Temperature
Silver Gelatin	20-50	25°C (77°F)	20-30	21°C (70°F)
Color	20-30	10°C (50°F)	20-30	2°C (36°F)

If adverse storage conditions cause any color balance changes to your slides, you can restore them by using duplicating procedures. For instructions, write to the Kodak Information Center (KIC), 343 State Street, Rochester, NY 14650-3100, or call 1-800-242-2424.

Use reasonable viewing and display conditions. Prolonged exposure to light and heat adversely affects most photographic dyes. Do not subject valuable original slides to prolonged or repeated projection, e.g., in a commercial display. The same holds true for transparencies. Although the level of illumination is usually lower in light boxes, prolonged exposure to light is harmful, especially if direct sunlight (which contains a large amount of ultraviolet radiation) strikes the transparency. Use an ultraviolet absorber for fluorescent lighting displays. Rosco Laboratories, Incorporated, 36 Bush Avenue, Port Chester, NY 10573, produces such an ultraviolet absorber. Use duplicates of valuable originals for displays. Store the originals under the best possible storage conditions, as described in the preceding section.

Control insect damage to color film.

Insects, such as carpet beetles, sometimes attack color slides and negatives, as well as unprocessed film. Don't store slides, cameras, or film in drawers, closets, or cupboards where you keep clothing or fabric, or where lint has accumulated. These materials attract egg-laying adult insects. Because damage to slides by carpet beetles invariably occurs close to the mounts, you can often salvage damaged slides by masking the edge and covering the damaged area. Before repairing a slide, dust it with a soft brush or forced air to remove any eggs or larvae. Where insect damage is apparent, remove all the slides and fumigate the boxes or file drawers with paradichlorobenzene moth crystals. Leave the paradichlorobenzene crystals in place in the closed box or drawer for several days so that any emerging larvae will be killed. Because the vapors of paradichlorobenzene may seriously damage or weaken cardboard mounts, shake all the crystals out of the slide container and air it out thoroughly before replacing the slides.

PACKAGING MATERIALS AND FACILITIES FOR LONG-TERM KEEPING

Use proper packaging materials. Do not store processed material in the original packaging. Over time, some adhesives, glues, and by-products from the manufacture of paper and plastics are harmful to photographic products.

All mounting boards, interleaving paper, album covers and pages, and plastic sleeves and sheets must be free of acids, peroxides, plasticizers, metal particles, wood fibers, sulfites, nitrates, and chlorides. High-quality acid-free mounting board is essential for long-term keeping of a mounted print. Any material used to mount color prints must be free of ground wood, alum, or alum-rosin size, and should have a pH of 7 to 7.5. (A pH of 7 to 9.5 is considered acceptable for mounting black-and-white prints).

Acceptable materials—often described as conservation, museum, or archival grade—are available from some photo retailers and archival-supply dealers such as Light Impressions Corporation, 439 Monroe Avenue, Rochester, NY 14607; Talas Division of the Technical Library Service, 213 West 35th Street, New York, NY 10001; University Products, Incorporated, P.O. Box 101, 517 Main Street, Holyoke, MA 01041; Conservation Resources International, Incorporated, 8000-H Forbes Place, Springfield, VA 22151; and Process Materials Corporation, A Lindenmeyer Company, 301 Veterans Boulevard, Rutherford, NJ 07070.

Test materials if in doubt. If you don't know if a material is satisfactory, test it for photographic activity. A simple, straightforward test is described in American National Standard IT9.2-1988, *Imaging Media — Photographic Processed Film s, Plates, and Papers—*

Filing Enclosures and Storage Containers. This standard also includes specifications for papers, plastics, adhesives, and inks, and for the construction of storage envelopes. You can obtain a copy from the American National Standards Institute, Incorporated, 11 West 42nd Street, New York, NY 10036.

Other ANSI publications that you might find helpful are IT9.11-1992, *Processed Safety Film — S to rage*, and PH1.48-1982 (R1987), *Practice for Storage of Black-and -White Photographic Paper Prints*

Use silica gel to dehumidify.

Note: Use of silica gel and other desiccants is not an acceptable means of protecting processed negatives, slides, or prints during long-term storage. Fine dust from desiccants can be abrasive to or reactive with stored photographic materials. Desiccants also require periodic reactivation. *Use desiccants for short-term storage only.*

If you seal photographic materials in storage envelopes or other airtight containers when the relative humidity is high, you will be sealing in a high level of water vapor. When no other means of reducing relative humidity is available under exceptionally humid conditions, you can use a desiccant such as silica gel as a temporary drying agent. When you enclose silica gel with the photographic material, it absorbs the water vapor and lowers the humidity in the container. (Satisfactory drying of motion-picture films with silica gel isn't possible because moisture moves very slowly through a large roll of film.)

Silica gel is like a sponge; it absorbs large amounts of water vapor and doesn't react with most common materials. It often contains a humidity indicator that changes color when the desiccant needs reactivation. You can reactivate and reuse it if you dry it in an oven at about 175°C (350°F) for 1 to 3 hours. To prevent re-absorption of water vapor, allow it to cool in a closed metal container. Seal the container unless you are going to use the silica gel immediately. You need only 1 1/2 ounces (40 grams) of silica gel to control the relative humidity in 1 cubic foot (0.03 cubic meter) of sealed space. Silica gel is available either in bulk or in small perforated aluminum containers called "Silica Air Dryers" from W. R. Grace and Company, Davison Chemical Division, P.O. Box 2117, Baltimore, MD 21203. Multiform Desiccants, Incorporated, 960 Busti-at-Niagara, Buffalo, NY 14213, offers Drican, a convenient 40-gram (1.4-ounce) perforated canister that contains indicator with silica gel. Solvay Performance Chemicals Inc., 41 West Putnam Avenue, Greenwich, CT 06830, makes Sorbead Blue, an indicator silica gel that is sold in bulk. You can write to the manufacturer for the name of a distributor near you.

Choose the storage area carefully. You can avoid harmful storage conditions by storing your photographic files on a main or upper floor—not in a damp basement or in a hot attic. Avoid areas with a high RH or a great shift in temperatures. (Relative humidity can be high in attics and basements, especially if they are unheated or un-insulated. Moisture from condensation can come into contact with photographic materials if they are stored in such areas.) Avoid heating ducts and registers (sources of heat) and water

pipes (which might leak). Ideally, the storage room should have conditioned, filtered air to keep it free from dust, dirt, and contaminating fumes. If a room has been painted with an oil-based paint, allow it to air out for at least four weeks before using it to store prints and negatives. Use metal files and containers or cardboard or plastic boxes (or trays) that are intended for long-term storage of photographic materials.

Water from floods, fire-fighting, sprinkler systems, overflowing sinks, burst pipes, backed-up sewers, and leaky roofs can cause serious damage to films and prints. Store containers of photographs at least 6 inches (15 cm) above the floor; avoid basements, attics, and places where leaks can occur.

Protect against fires. Fire, of course, can be devastating to film and prints. A "fireproof" storage vault located and constructed in accordance with local building codes and underwriters' regulations offers additional protection for large collections. The vault should have enough insulation to provide satisfactory temperature control all year around, prevent moisture condensation on the walls, and provide significant resistance to internal temperature increases in the event of fire.

For smaller collections, a fire cabinet or safe will provide protection. Examine any safe carefully before using it. Many fire-resistant safes and cabinets have a type of insulation that releases moisture when heated; the interior can become filled with steam during a fire, which can damage photographic emulsions. Before storing any films or prints in this type of safe, seal them in moisture proof and photographically inert storage envelopes.

Specifications for fireproof vaults, files, or safes are usually based on the charring or combustion point of paper. The gelatin emulsions of films and prints are subject to damage well below this point. Therefore, such storage devices may not provide protection for photographic materials at the stated specifications. Heat may cause extreme dryness that may result in brittleness or other physical damage. Similarly, heat can cause the gelatin surface of photographic materials to soften so that it is subject to damage through melting, embossing of the surface, digs, pick-offs, and adhesion to other surfaces. Generally, if the storage device prevents the temperature from rising above 38°C (100°F), most materials would not be adversely affected. As temperatures exceed 66°C (150°F), most photographic materials would be susceptible to damage. Between 100 and 150°F, results vary by product and condition. When selecting or designing fire-resistant storage facilities, keep the lower tolerance of the photographic material in mind.

For the latest version of technical support publications for KODAK Products, visit Kodak on-line at: http://www.kodak.com
If you have questions about KODAK Products, call Kodak. In the U.S.A.: 1-800-242-2424, Monday-Friday 9 a.m.-7 p.m. (Eastern time) In Canada: 1-800-465-6325, Monday-Friday 8 a.m.-5 p.m. (Eastern time)

Note: The Kodak materials described in this publication are available from dealers who supply Kodak products. You can use other materials, but you may not obtain similar results.

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