TECHNICAL INFORMATION BULLETIN

Storage and Handling of Unprocessed Film

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Maintaining Film Quality with Refrigeration

Refrigerating camera films reduces the photographic effects of long-term storage, but refrigeration cannot reduce the effects of ambient gamma radiation. Naturally occurring gamma radiation increases the D-min and toe densities and also increases grain. Higher speed films are affected more by gamma radiation than lower speed films. A camera film with an EI (Exposure Index) of 800 has a much greater change than an EI 200 film. Exposed and unprocessed film that has been properly refrigerated retains the speed and contrast of the exposure conditions, but the overall D-min, toe and grain will continue to increase. For more information on effects of radiation, click here: Film Storage Information.

You should test camera films stored for longer than six months to ensure that the product will perform appropriately. If you must store film, a relative humidity (RH) of 50% is recommended at the following temperatures:

- For general storage, store unexposed camera films at 13°C (50°F) or lower.
- For periods exceeding six months, store unexposed camera films at -18°C (0°F) or lower.

For more information on raw film stock, click here: Film Storage Information.

Although very low temperatures do not damage film, you must allow sufficient time for the film to come to room temperature before loading it into a camera. Conditioning times depend on the roll size and the ambient temperature and humidity of the surrounding air. A 100 ft 16 mm roll may take thirty minutes to come to room temperature, while a 1000 ft 35 mm roll may take up to 3 hours. Use gradual warming to reduce moisture spotting and to avoid condensation on the film.

Storage Conditions

	Short Term (less than 6 months)		**Long Term (more than 6 months)**	
	Temp	**% Relative Humidity**	**Temp**	**% Relative Humidity**
Raw Stock (in original sealed cans)	13°C (55°F)	below 60%	-18 to -23°C (0 to -10°F)	below 60%
Exposed Unprocessed (sealed in cans)	-18 to -23°C (0 to -10°F)	below 60%	Not Recommended (see text below)	

Warm-Up Time

	Warm-Up Time (hours) for Sealed Packages	
Film Package	**14°C (25°F) Rise**	**55°C (100°F) Rise**
Super 8	1	1 1/2
16 mm	1	1 1/2
35 mm	3	5

A detailed explanation of film storage is on the Kodak Motion Picture Imaging Technical support site. You can find other storage recommendations in the specific product technical datasheet for each film type, or read more on rawstock storage in Tips and Techniques and also in the publication H-2 Cinematographer's Field Guide.

Frozen Film

Frozen film will be brittle and may crack during camera loading or transport. Furthermore, condensation may build up as the film equilibrates to the temperature of its environment. Condensation may cause ferrotyping and moisture static (tacky film) which may cause a static discharge.

Let the film warm up to ambient temperature before the can is unsealed. This will prevent any cold-induced problems. Typical warm up times for 16 mm film is one hour (1) for a 14°C rise (25°F), 35 mm film is three hours (3) for 14°C rise (25°F). If the film is used in subzero temperatures there are devices available to warm the camera and magazines so that the film can run smoothly and silently. Contact your local Kodak Sales and Engineering Representative for more specific information.

Newton's Rings and Ferrotyping

Concentric bands of colored light, sometimes seen around the areas where two transparent surfaces, such as two pieces of glass or two pieces of film (as in contact printing) are not quite in contact, are referred to as Newton's Rings. The rings are the result of interference and occur when the separation between surfaces is of the same order as the wavelength of light.

Ferrotyping describes a smooth and shiny blotch or series of blotches on the emulsion surface. Ferrotyping is caused by the presence of heat and/or moisture with pressure. Sources of ferrotyping can be improper drying conditions on the processing machine, the wound roll of film was wound under excess moisture (high humidity conditions), or the wound roll was subjected to high heat either before or after processing. For more information click here: ferrotyping.

Effects of Humidity

Motion picture raw stock is packaged in taped cans. Until opened, the cans are water and vapor tight and do not require humidity-controlled storage. However, avoid storage at relative humidities of 60 % or above. Such high humidities can damage labels and cartons (from moisture and mold) and can rust the cans.

Note: Keep raw stock in its original taped can until you are ready to use the film.

High humidity can promote mold growth and ferrotyping. Low humidity can create static marks when printing or cause buckling due to uneven moisture loss. Exposed film, particularly color film, deteriorates more rapidly than unexposed film. Kodak recommends exposing and processing all camera films soon after purchase and no longer than six months after

purchase. Immediately after exposure, return the film to its can and retape the can to help prevent any increase in moisture content. Process the film as soon as possible after exposure.

Do not keep film in the camera or magazine longer than necessary. If you load magazines a long time ahead of use, protect them from excessive temperature and relative humidity until you need to load the camera.

Humidity lower than 50 % usually increases static problems and dirt attraction to processed film. At very low humidity, film curl may become a problem (e.g. Newton's Rings). See definition of Newton's Rings above or go to Motion Picture Imaging's storage information: Storage - Relative Humidity.

Effects of Contaminants

Certain gases such as formaldehyde, hydrogen sulfide, hydrogen peroxide, sulfur dioxide, ammonia, illuminating gas, motor exhaust, and vapors from solvents, mothballs, cleaners, turpentine, mildew or fungus preventatives, and mercury can damage unprocessed and processed film. Keep film away from such contaminants.

Airport X-ray Fog

Airports use x-ray equipment to scan checked and carry-on baggage. Film can tolerate some x-ray exposure but excessive amounts result in objectionable fog (an increase in base film density and a noticeable increase in grain). The faster the film the greater the effects of the x-rays. Not only is there danger from X-rays, but security and customs agents may open containers of unprocessed film, ruining weeks of work.

Write to the airport manager well in advance of your arrival and explain the relevant details of your trip. If possible, speak with the airport manager and customs people and make as many advance arrangements as possible. Give them your arrival time, flight number, and departure time. List the equipment and film you will be carrying. Ask if there are any steps you can take to expedite matters and ensure the safety of the film. Repeat the process on your return trip.

If you are traveling overseas you may work with an export company or a customs broker. There are private companies that expedite the handling of international shipments and do all the necessary paper work. Check the telephone directory yellow pages under "Exporters." You can also have the film processed where it was exposed. Eastman Kodak Company can help you find a local laboratory.

For more information on avoiding airport x-ray fog to motion picture film see: http://www.kodak.com/US/en/motion/support/technical/xray4P.shtml#p. For more general x-ray fog information and to see examples of x-ray fogged film go to: http://www.kodak.com/global/en/service/tib/tib5201.shtml.

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