

Caring for your collections: Motion picture film

For over a hundred years, the motion picture film industry has created a legacy of different film gauges and film types, manufactured for both the domestic and professional markets. Personal and institutional film collections contain material in a range of conditions resulting from variables such as the original manufacturing and processing methods and materials, and storage and handling specifics. Understanding the effect these elements have on the physical and chemical properties of film is central to the long term preservation of motion picture film collections. This leaflet aims to provide general information for the care of film collections. For details on identification, deterioration, care, and storage of specific film types, refer to the additional resources listed.



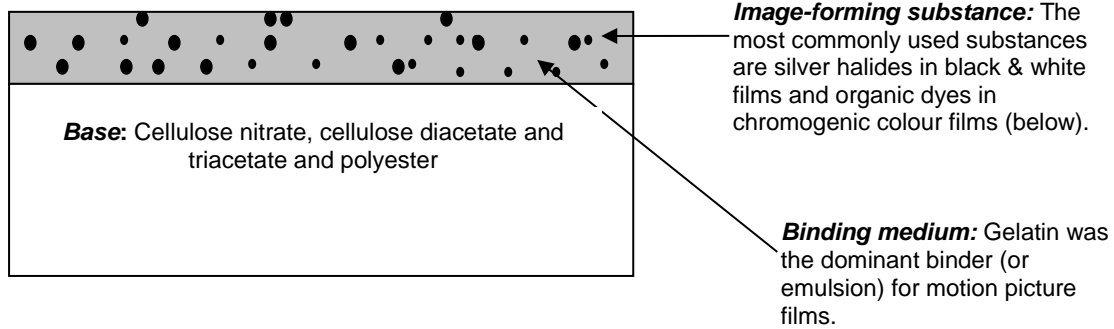
Common film gauges (left to right) standard 8mm, Super 8, 9.5mm, 16mm and 35mm

Structure of Motion Picture Film

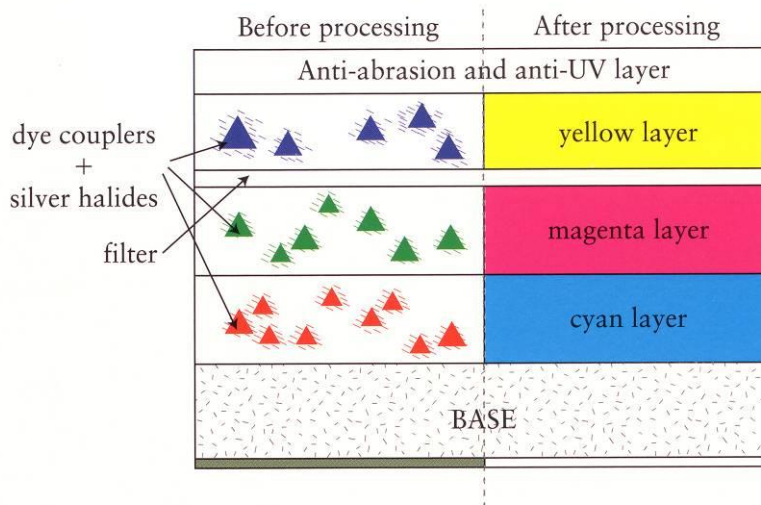
All motion picture film has a basic composite structure (see below) consisting of a binder layer containing the image forming substance on a flexible plastic support. The emulsion or binder, the photographic image, and the film base can be affected by different deterioration mechanisms. The plastic support or base can be cellulose nitrate, cellulose acetate, or polyester, and each base can have differing deterioration. For further information on film construction, bases, and deterioration, refer to the additional resources listed. The National Film and Sound Archive's film preservation handbook is a good reference.

<http://www.nfsa.gov.au/preservation/handbook/>.

The structure of black and white film



The basic structure of colour film



Film types

Many movies found in home collections are original reversal films. Reversal film is exposed in the camera, and then processed using additional steps so that the image forms a positive or transparency (like slide film), rather than a negative image. Though economical (film print not required), this means that extra care should be taken to protect this original item during projection and handling. It is also not uncommon for home collections to have negatives and prints of films. In this case, the negative held is often the original, and the print is a copy derived from this (in some cases only the print copy will exist). Release prints of commercially available films are also often found in collections.



Reversal (camera original positive, solid black edge), Negative copy (clear edge), Print (clear edge or solid black edge depending on printing)

Sound

Sound tracks using magnetic and optical systems can be found on many home movies. Magnetic audio tracks were produced either during manufacture directly onto raw film stock, or were striped onto the film by hand assisted striping devices. This combination is complex to preserve, as magnetic tracks have conflicting preservation requirements to the celluloid film on which they reside. Magnetic tracks must be kept away from any magnetic fields around the home (generated by appliances such as televisions, etc.) and should be kept under moderate temperatures and humidity. Optical sound tracks are produced by photographic exposure onto the film and are most commonly found on commercial release prints. Since these are created by the same photo-chemical process as the image itself (halides and dyes, etc.) they need no additional preservation precautions but are subject to considerations such as dye and image fade and scratching, etc.

Bases

Cellulose Acetate Deterioration

Majority of home movie collections are filmed on acetate cellulose base film, rather than cellulose nitrate and polyester. The table below shows the distinct stages of acetate deterioration.

Stage	Deterioration description
1	Film gives off a vinegar (acetic acid) odour, early signs of base shrinkage and embrittlement. <i>Film is still usable but it is important to duplicate if film considered important. Affected film should be isolated from other collections at this stage. Regular testing of acidity levels with A-D strips (see Supplier List) should begin at this stage. If possible, place film in suitable cold storage to slow down deterioration.</i>
2	Film begins to distort dramatically and shrinkage increases. Shrinkage greater than 1% is problematic for motion picture film.

3	Base embrittlement and shrinkage increases, film in this condition can be easily damaged due to lost flexibility. Bubbles form between emulsion layer and base. <i>Film is rendered unusable from this stage onwards.</i>
4	As the gelatin binder does not shrink at the same rate as the base, dimensional stress occurs causing the gelatin to separate from the base. This affects the image quality significantly. Formation of white crystals can occur on the film surface
5	Film becomes either flaccid or crystalline and emulsion layer becomes sticky

Storage and Handling Recommendations

It is well documented that proper climate control leads to significant improvement in the chemical stability of both acetate and nitrate film, and chromogenic colour images. Lower temperatures and drier conditions slow down the degradation rate appreciably. Stringent International Organization for Standardization (ISO) standards are available for film storage and many institutions with large film collections and well-funded preservation programs use these standards as guidelines, adapting them to their own collection requirements. As the cold storage vaults recommended by the ISO standards are expensive and costly to maintain (as low temperature as possible, 20-30 %RH), this approach is not practical for most small organisations and home collectors, and creating a stable environment can prove challenging.

Listed below are a number of simple and affordable methods of improving your film's storage and handling conditions.

- Minimise fluctuations in temperature and relative humidity by locating storage areas away from external walls and sources of heat and moisture such as kitchens and bathrooms.
- Ensure storage areas have good air movement, avoiding stagnant air pockets. The use of strategically positioned fans can assist with this.
- Be aware that significant daily fluctuations can occur when air conditioning units are switched on during the day and off at night.
- Create a buffer against ambient conditions by placing films in archival quality film cans.
- Keep area clean and regularly check for pest and mould activity.
- Re-house films by obtaining new plastic cans that meet the Photographic Activity Test (ISO 14523) (such as those made from polypropylene or polystyrene, please see Suppliers List). Discarding old metal cans and cardboard boxes will help create a relatively chemically inert micro-environment.
- All foreign matter such as paper and rubber bands should be removed (but don't forget to store copies of any useful information about the films).
- New leader can be attached to the start and end of films for added protection, and clear labeling should be carried out on both the film leader and the film can.
- Store cans horizontally on open metal shelving to maximise air movement. Cans should not be over-stacked, ensuring pressure on the films is minimised.



- If possible ensure stable material is stored separately to deteriorated film.

Handling

Surface dirt and other residual matter not only affects the appearance of a film but can trigger deterioration. Dust is attracted to film through static electricity, and dirt and sticky residue build up over time such as during use on projector mechanisms and by the effects of decomposing film splicing tape. The cleaning of film should be approached with caution to ensure that further damage will not be incurred. Please seek professional advice first.

Considerable physical damage can occur to films if not handled correctly. Films should be checked for signs of physical damage by carefully examining over a light box with film winding arms, or by rewinding the film on a projector (without passing through the film gate).

Tears, perforation and edge damage can all cause further destruction if not physically repaired before projecting. Projection equipment should be checked and thoroughly cleaned before use, paying special attention to the film gate. Scratches to the film (black vertical lines represent 'base scratching' and white or coloured lines represent 'emulsion scratching') can be avoided with careful projection and projector maintenance and good handling techniques. When winding a film, be careful not to 'cinch' it by allowing the film to tighten suddenly. The effects of cinching can be seen as horizontal scratches and can also be incurred while the film is in transit if it is wound too loosely.

Duplication

Creating access copies of the films for viewing such as a digital file (refer to Film Transfers List below), will help protect original films from the effects of over-use. Storing film copies separately to the original films, such as in separate areas of the house or off-site to your home, will assist in creating a back-up system in case of disasters such as flooding and fires. After a transfer is made, it is very important to preserve the original film material. It is also likely you will need to create further copies on new home media in the future due to the constantly evolving technology market, and the relatively short commercial and physical life span of digital and analogue video media.

Useful websites and resources

- Adelstein, Peter Z., *IPI Media Storage Quick Reference*, (Rochester, NY: Image Permanence Institute), 2004
- Film Forever (Home Film Preservation Guide Sponsored by AMIA) www.filmforever.org
- Little Film (history and preservation information on small gauge film) www.littlefilm.org
- Monique Fischer, *A Short Guide to Film Base Photographic Materials: Identification, Care, and Duplication* (Andover, MA: Northeast Document Conservation Center), 2007 www.nedcc.org/free-resources/preservation-leaflets/5.-photographs/5.1-a-short-guide-to-film-base-photographic-materials-identification,-care,-and-duplication
- National Film Preservation Foundation, *The Film Preservation Guide* www.filmpreservation.org/preservation-basics/the-film-preservation-guide-download



- National Film and Sound Archive, *Film Preservation Handbook*
www.nfsa.gov.au/preservation/handbook/
- Reilly, J.M., *IPI Storage Guide for Acetate Film* (Rochester, NY: Image Permanence Institute), 1996 www.imagepermanenceinstitute.org/webfm_send/299

Standards

Please note standards are updated regularly so ensure you are using the most current standard.

- ISO 10356 *Cinematography: Storage and handling of nitrate-base motion picture films* (Geneva: International Organization for Standardization), 1996
- ISO 18911 *Imaging materials – Processed safety films – Storage practices* (Geneva: International Organization for Standardization), 2000
- ISO 14523 *Photography: Processed Photographic Materials – Photographic Activity test for enclosure materials* (Geneva: International Organization for Standardization), 1999
- National Fire Protection Association, *NFPA 40- Standard for the Storage and Handling of Cellulose Nitrate Motion Picture Film*, (NFPA), 2000

Suppliers List

Gaylord Archival

PO Box 4901
Syracuse, NY 13221-4901, USA
Email: customerservice@gaylord.com
Website: <http://www.gaylord.com/>
Products: Archival supplies including film cans, film leader, film cement, splicing tape

Kodak Australasia

18 – 20 Prospect St, Box Hill, Vic, 3067
Telephone: 1300 456 325
Website: <https://www.kodak.com/AU/en/corp/default.htm>
Products: 16mm Cream Leader, 8mm leader, splicing tape, film cement

Image Permanence Institute

Rochester Institute of Technology
70 Lomb Memorial Drive, Rochester, NY
14623-5604 USA
Website: <http://www.imagepermanenceinstitute.org>
Product: IPI A-D strips – Test strips used to measure free acidity produced by degrading cellulose acetate film

Stil Casing Solutions

107 Quai Saint-André, suite 304
Québec, QC, Canada G1K 3Y3
Telephone: 418 694 0449 (ext.10)
Email: info@stilcasing.com
Website: <http://www.stilcasing.com/>
Product: Film canisters and audio tape boxes



Info guide

Tuscan Corporation

5301 S. Superstition Mountain Drive
Suite 104-113
Gold Canyon, AZ 85118, USA
Email: info@tuscancorp.com
Website: <http://tuscancorp.com/>
Product: Film canisters and audio tape boxes

University Products

517 Main Street
Holyoke, MA 01040, USA
Email: info@universityproducts.com
Website: <http://www.universityproducts.com/>
Products: Archival supplies including film cans and audiotape boxes.

Film Transfers List

DAMsmart

32 Essington Street, Mitchell, ACT 2911

Telephone: (02) 62426456

Email: joe@damsmart.com.au

Website: www.damsmart.com.au

Type of transfer offered: audiotapes, videotapes, 16 and 35mm films

DVD Infinity

PO Box 102, Artarmon, NSW 1570

Telephone: (02) 9966 4138

Email: info@dvdinfinite.com.au

Website: www.dvdinfinite.com.au

Type of transfer offered: Standard 8mm, Super 8, 9.5mm & 16mm, video tapes, photos, 35mm slides and negatives.

FATS Digital

PO Box 74, Moorooka, QLD 4105

Telephone: (07) 3846 4582

Email: fatsqld@fats.com.au

Website: <http://www.fats.com.au>

Type of transfer offered: audiotapes, video tapes Standard 8mm, Super 8, 16mm and 35mm (NSW facility)

Nano Lab

36 Grant St, Daylesford, Vic 3460

Telephone: 0400 748 864

Email: richard@nanolab.com.au

Website: www.nanolab.com.au

Type of transfer offered: Super 8 or Standard 8

The procedures described here have been used by State Library of Queensland in the care of its collections and are considered suitable by State Library as described; however, State Library will not be responsible for damage to your collections should damage result from the use of these procedures

Need further information?

(07) 3840 7810 | <http://www.slq.qld.gov.au/preservation>



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