

# Mechanical Carriers

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## Mechanical Carriers

Within the group of documents commonly labelled audiovisual (photographic still and moving images, audio and video recordings) are sound recordings on cylinders and discs. The common factor with this group of documents is the method of recording the information. This is by means of a groove cut into the surface by a cutting stylus and which is modulated by the sounds, either directly in the case of acoustic recordings or by electronic amplifiers.

There are no official standards for the preservation of these materials but there are, however, a number of standard reference publications available. These are listed in the bibliography that follows. In addition, the Proceedings of the series of Technical Symposia organised by the international archive federations (FIAF, FIAT, IASA and ICA) on the preservation of sounds and moving images contains many papers of interest.

### Typology and history

#### Phonograph Cylinders

Cylinders, originally developed for use as dictating devices, have been used since around 1889 for original recordings in the academic world and later also as mass produced recordings for the entertainment industry in competition with early gramophone (shellac) discs. While industrial production ceased in the late twenties, they continued to be used for field recording until the 1950s (!). Most cylinders are made of wax ; some of the mass replicated cylinders are made from celluloid. There are about 300,000 cylinders in the custody of recorded sound collections world-wide. They are extremely brittle and fragile and if they have been stored under conditions which are too humid, they suffer from mould. Fortunately, most of these holdings have already been transferred onto modern media and thus their contents, which are frequently of unique historical value, are already safeguarded.

#### Shellac Discs

Coarse groove gramophone discs, commonly called shellacs or 78s, were the main mass produced audio format of the first half of our century. It is estimated that the world-wide stocks of this format amount to 10 million discs. They were produced from 1898 until the mid-fifties. The discs consist of various mineral substances bound together by organic substances like shellac or similar binding materials. Although breakable if dropped, these gramophone records are fairly stable and there are no reports of a systemic instability problem.

#### Instantaneous Discs

Prior to the introduction of magnetic tape, which occurred in the late 1940s and early 1950s, the "instantaneous discs" - so called because they can be played immediately after recording the sounds without the need for the lengthy processes required for mass produced discs - were the only medium for audio recordings that could be played back immediately. The total number in existence amounts to about three million. Practically all of these discs are irreplaceable originals, many of them of great cultural, historical and scholarly importance.

Unfortunately, the largest group of these instantaneous discs, the "acetate discs", are at the greatest risk. These discs are laminates consisting of a core plate, usually of aluminium but plates of glass, steel and card are also known, with a lacquer coating of nitrate or acetate cellulose which is soft enough to be cut by a recording machine, but hard enough to withstand several replays. With age, the coating shrinks and becomes brittle by a hydrolytic process : the stresses between the shrinking lacquer and the stable core increase until, suddenly, the lacquer breaks apart, and flakes off. By this

means a considerable portion of the holdings world-wide have already been lost. Even if programmes to transfer the sounds were hastily established, further losses of irreplaceable information cannot be prevented. Every day, apparently intact records are being affected by this phenomenon.

## Microgroove Discs

From the late 1940s onward microgroove discs (vinyl or LP records) replaced shellac discs and only relatively recently (since about 1990) has this format been replaced by the compact disc (CD). The total number of microgroove discs in sound archives world-wide is estimated to be more than 30 million. They are made mainly of polyvinylchloride. No systematic stability problems on a great scale have arisen so far, but their stability in the long term, thinking in centuries, is unknown.

## Typology of mechanical carriers - synopsis

carrier	date of manuf.	media	type of recording	composition	recording process
cylinder - recordable	1886- 1950s	sound	analogue	wax	mechanical
cylinder - replicated	1902- 1929	sound	analogue	wax nitrocellulose with plaster ("Blue Amberol")	mechanical
coarse groove disc - replicated	1887- 1960	sound	analogue	mineral powders bound by organic binder ("shellac")	mechanical
microgroove disc ("vinyl") - replicated	1948-	sound	analogue	polyvinyl chloride - polyacetate co-polymer	mechanical
coarse and microgroove discs - recordable ("instantaneous discs")	1930-	sound	analogue	various homogenous and laminated materials : acetate lacquer disc : acetate or nitrate cellulose coating on aluminium or zinc base	mechanical

## Causes of deterioration

The main factors related to instability of mechanical carriers and retrievability of information can be summarized as :

- humidity and temperature,
- mechanical deformation,
- dust and dirt of all kinds.

## Humidity and Temperature

Humidity, as with all other data carriers, is a most dangerous factor. While shellac and vinyl discs are less prone to hydrolytic instability, most kinds of instantaneous discs are extremely endangered by hydrolysis. Additionally, all mechanical carriers may be affected by fungus growth which occurs at humidity levels above 65 % RH.

Elevated temperatures beyond 40° C are dangerous, especially for vinyl discs and wax cylinders. Otherwise, as with other carriers, the temperature determines the speed of chemical reactions like

hydrolysis and should, therefore, be kept reasonably low and, most importantly, stable to avoid unnecessary dimensional changes.

## Mechanical Deformation

Mechanical integrity is of the greatest importance for mechanical carriers. It is imperative that scratches and other deformation caused by careless operation of replay equipment are avoided. The groove that carries the recorded information must be kept in an undistorted condition. Only specialist personnel should, therefore, be allowed to handle and replay mechanical carriers.

While shellac discs are very fragile, instantaneous and vinyl discs are more likely to be bent by improper storage. Generally, all mechanical discs should be shelved vertically. The only exceptions are some soft variants of instantaneous discs.

## Dust and Dirt

Dust and dirt of all kinds will deviate the pick-up stylus from its proper path causing audible cracks and clicks. Fingerprints are an ideal adhesive for foreign matter. A dust-free environment and cleanliness is, therefore, essential.

## Preventive Measures

Obsolescence of hardware is not yet a major issue for mechanical carriers. Replay equipment for microgroove and 78rpm discs is still available and several sound archives have constructed cylinder replay machines which offer excellent performance for cylinders of all formats. With the exception of instantaneous discs and cylinders, mechanical carriers are not generally at risk. Because the discs wear when played, migration to a modern digital format will be necessary for items in frequent demand.

Because of the extreme risk to the future survival of instantaneous discs, all existing holdings must be transferred with highest priority.

Recommended Climatic Storage Parameters						
	temperature	±/24h	±/year	RH	±/24h	±/year
	°C	°C	°C	%	°C	°C
<b>preservation storage</b>	Between 5 and 10	±1	±3	30	±5	±5
<b>access storage</b>	about 20	±1	±3	40	±5	±5

Operation areas (studios) should have the same climatic conditions as access storage areas.

*It is of utmost importance to control both temperature and humidity simultaneously. Archivists and librarians are explicitly warned to not to cool the storage environment without dehumidification because such action will normally lead to an unacceptable rise of relative humidity and may encourage the growth of moulds and fungi.*

## Standards

IASA TC-03	The Safeguarding of the Audio Heritage : Ethics, Principles and Preservation Strategy. 1997.
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