Digital ArchiVing: guIdeline & aDvice 6

# DURABLE MAGNETIC MEDIA

## 1. Preface

Magnetic carriers can be used as long-term carriers for analogue and electronic record-keeping when all of the following conditions are met.

- ☑ the carriers are interchangeable and stable. There exists a great variaty of magnetic carriers, but only some kinds of magnetic carriers are appropriate for record-keeping. (see 2)
- ☑ the content is being stored in a durable, readable and platform independent way. (see 3)
- ☑ enough documentation is kept. (see 4)
- ☑ the carrier doesn't degenerate fast and doesn't lose any information. Regular quality checks warn for imminent los of information. Carriers are being replaced when their quality declines (prevention) (see 5)
- ☑ a contingency plan describes how to act in case of disasters, in order to recuperate as much information as possible. (see 6)
- ☑ a safety- and workcopy is made for every tape. (see 7)
- ☑ if possible, replace equipment and software before the content is being transfered.

These guidelines and advices are applicable on: video cassettes, audio cassettes, sound tapes (open reels), computer cassettes and computer tapes.

## 2. Choice of magnetic carrier

### Type of magnetic carrier

- ☑ use cartridges (1 reel) or cassettes (2 reels). Avoid open reels.
- ☑ choose an interchangeable, non-producent tied physical cassette- or tape format. Only use only standardised cassettes or cartridges. Check in advance how many times a carrier can be used. (insert & eject-cycles, passes)
- ✗ don't use hard disks or just any disk format for long-term preservation of computerfiles. These carriers are vulnerable, have a short life span and are written

in a producent- and/or version bound filingsystem.

### Composition of the magnetic tape and housing.

Magnetic tapes usually consist out of two layers: a magnetic layer and a basic layer. Use a layer with as:

- ☑ magnetic layer: MP (metal particulate) or barium ferrite particles.
- ☑ basic layer: polyester (polyethylene terefthalate (PET) or polyethylene naphtalate (PEN)), polyamide
- ☑ avoid tapes or cartridges with metal parts in the reel or cassette. The cassettes may not contain magnets or peroxide and may not damage the tapes. Preferably use cassettes or cartridges who can be disassembled if necessary.

You can find detailed description of the used materials in the productdocumentation supplied by the manufacturer.

### Recording method

- ☑ choose a magnetic carrier which applies the liniaire recording method (longutidunal or serpentine) for the archiving of computerfiles. F.i. DLT or LTO .
- ☒ avoid the use of the *helical scan* recording method. (except video). Helical scan tapes (f.i. DDS) are usable for back-ups, not for record-keeping.

## 3. Data recording on computertapes

- ☑ save the electronic records on labeled tapes. Apply the standards ANSI INCITS 27-1987 (R1998) (used to be: ANSI X 3.27) or ISO-1001.
  - ANSI INCITS 27-1987 (R1998): *File structure and labeling of magnetic tapes for information interchange*
  - ISO-1001 (1986): *Information processing -- File structure and labelling of magnetic tapes for information interchange*

↳ exchange levels:

Level 1: volume set consists of one file, all records are fixed-length, file names are limited to 17 characters.

Level 2: volume set exists of several files, all records are fixed-length, file names are limited to 17 characters.

Level 3: volume set can consists of several files, all records are fixed-length or variable-length , file names of up to 80 charactes.

Level 4: No limitations, filenames of up to 80 characters.

↳ fixed-length or variable-length blocks?

it doesn't make any difference from an archival point of vue whether you're using tapes with fixed-length blocks or variable-length blocks.

When variable-length blocks (level 3 and 4 of the ANSI- or ISO-standard) offers no exces value, choose fixed-length blocks (level 1 and 2 of the ANSI- or ISO-

standard).

↳ fill out the volume label:

| FIELDS (NUMBER OF CHARACTERS) | CONTENT |
|---|---|
| - label identifier (3) | VOL |
| - label number (1) | 1 |
| - volume identifier (6) | tape ID: choose a meaningfull ID such as an archivalnumber |
| - volume accessibility (1) | interspation: no limitations<br>any other character: limitations |
| - free positions (13) | |
| - implementation identifier (13) | software ID |
| - owner identifier (14) | ID owner/creator (f.i.. provenance name ) |
| - free positions (28) | |
| - standard label version (1) | standard version number (1, 2, 3 or 4) |

☑ if, for any reason, the tape cannot be written with ANSI-or ISO-labels, apply the *System Independant Data Format* (SIDF).

☑ keep the computerfiles in a standard fileformate (*Digital ArchiVing: guIdeline and aDvice 4. Standards for fileformats*).

✗ don't apply any hardware or software compressions.

✗ don't use back-up software. Back-up applications;

- deliver unlabelled tapes
- result in non-interchangeable tapes
- don't keep all of the information on the tape itself.

## 4. Documentation

Save at least the following documentation for magnetic tapes with computerdata

- fixed-length or variable-length blocks?
- block seizes and records lengths
- density
- filesystem in which the data is placed on tape. (standard + level)
- name of the software application that is used (+ version)
- encoding: EBCDIC, ASCII or binairy

# 5. Save keeping and treatment

## 5.1 preservation

- preserve the tapes in good climatological circumstances:
  - temperature: 18° C for work copies, 10°C for master copies (max. tolerance: 2°C/24h)
  - relative humidity: 40 % (max. tolerance: 5 %/24h).
  - avoid fluctuations in temperature and relative humidity. If fluctuations in temperature can not be avoided (f.i. after transport), insert an acclimatization process before reading in the tape. Count 4 hours acclimatization for every 10°C difference before reading in the tapes. Tapes that aren't climatized break easily or leave fluid in the play-back equipment.

- put the tapes immediately back in their box after their usage. Don't leave the tapes in the machine after their usage. Use plastic boxes that support the reel and holds the tape in it's place to preserve the right tension. Use non-metalic boxes that can protect the tapes against dust, pollution and humidity. Avoid the use of paper or cardboard boxes, preferably use boxes made out of polypropylene. Make sure that the open reels are being supported by their coil and not by the edges. The sole purpose of the edges is to protect the tape.
- preserve the tapes in a neat environment; dust-free, clean air, away from cigarette smoke and ashtrays.
- don't keep the tapes near a source of heat (f.i. radiators).
- keep the tapes away from magnetic fields and radiation (f.i. sound boxes, loudspeakers, TV's, magnetes, motors, headphones, micros, elevator installations, etc.) Do not put the tapes on top of electronic equipment.
- don't expose the tapes to ultraviolet radiation. Keep the tapes out of the sunlight. Don't put them on a windowsill and store the tapes as much as possible in a dark space.
- avoid any contact with water. Don't store magnetic carriers near water pipes. Damages caused by water are less damaging then damages caused by fire: sprinkler systems are allowed near magnetic tapes.
- use air filters in environments with polluted air.

## 5.2 Treatment

- do not stack the tapes horizontally on top of each other, but place them vertically on the shelf. Move or transport them vertically.
- do not stow away half played tapes. Always wind the tape completely to the beginning or the end. The tapepack reaches the best tension when you wind up the tape at normal play off speed. In this way you're making sure that the tape contains no data on the starting sector, as there's a possibility damages where the play-back equipment catches the tape. Tis is best done on a sector containing no data. Equipment with rotating guiding pins usually produces the tapes with the best quality of packing. A tape pack with edges sticking out is usually the result of rewinding to fast.
- avoid the use of the "pause" – function.
- manipulate the magnetic carrier as little as possible. The tape can be damaged with every treatment.
- touch the cassette or reel with clean hands only. Never touch the magnetic band itself with your hands. Do not put any fingers in the gap of the cassettes or cartridges. Always hold the tape at its reel or cassette. Wear dust free gloves when cleaning the tapes.
- do not play any damp or damaged tapes.
- don't drop or shake the tapes.

- label the tape clearly. Make sure that the label doesn't damage the magnetic tape. Write the label with ballpoint pen or felt-tip pen, before putting the label on the box or cassette. Don't use pencil because pencil graphite can pollute the tape. Don't write on the labels anymore once they're attached to the box or cassette.
- only use well functioning equipment. Check the recording- and play-back equipment regularly. Clean the readers regularly. Play audio- and videotapes preferable with equipment with rotating guiding pins.
- use magnetic carriers of high quality (high grade). Check how many insert and eject or loadcycles are foreseen.

### 5.3. Controle and remplacement

- check in advance whether the empty tapes contain any errors.
- rewind every tape at least once every year at normal play off speed.[1]
- this to avoid magnetic print through and to take away to high tension, if necessary.
- play a certain amount of magnetic carriers once a year and check them for errors[2]. Tapes with more than 10 errors have to be replaced.
- check the quality of the tape pack. Open reel tapes can be checked visually: the surface of the tape pack has to be smooth and flat (no edges sticking out) These out stretching edges of an irregular surfaces pack are extremely vulnerable. Tapes and cartridges can be checked by playing them.
- transfer the content of the tape to another medium after a maximum of 10 years.

## 6. Restoration and recuperation

| | |
|---|---|
| Water<br>! Do not freeze ! | Contrary to paper documents, damp tapes may under no circumstance be frozen in. Freezing a damp tape would damage the tape even further. Cooling results in a lower tension and furthermore the treat of pollution exists when water and dirt enter the tape pack through the gaps. When freezed in, particels of lubricant rise to the tape surface. The possibility that this lubricant will be re-absorbed when heated, is extremely small. |

[1] There is some disagreement about the frequention of rewinding. For instance the Ampex-guide recommands to rewind the tape every three years. (AMPEX, *Guide to the Care and Handling of Magnetic Tape*).

[2] For instance, NARA prescribes that for a collection of 1800 tapes or less, 20% of the tapes need to be controlled on a yearly bases. If the collection transcends 1800, then 378 tapes need to be checked.

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| !Dry at room temperature! | Damp tapes are dried at room temperature. It's important not to hasten the drying proces and to keep the tape damp till the beginning of the restoration proces or recuperation proces. When the tape is being dryed out, sediments in the tape will dry and that will make it harder to remove them later on. By leaving the damp tape in a plastic bag, together with a moist sponge or a moist towel, in a fresh room you can give priority to the paper records. You can keep a damp tape moiste for 14 days at the most. Keeping them damp longer can give cause to the growth of fungus. Magnetic carriers don't absorbe water. The only exception to this are the types of magnetic carriers who, as paper records, have to dry as soon as possible. Do not use extra heating (higher tension and greater chance at print through). Leave the magnetic carriers to dry for at least 48 hours. Cartridges and cassettes are best opened. If necessary, you can provide for a drying area with a low relative humidity. Pat the tape dry with a dust free towel. |
| ! Winding! | Rinsing the tape with distilled water is only necessary when the tape has been in contact with salted or polluted water. Salt can corrode metale components. A mild detergent can be used for the removal of tenacious dirt. Rinse the tape afterwards again with distilled water. The rinsing of the tape is a priority proceeding. Once the tape has been rinsed, priority can be given again to the paper records. |
| Warmth of fire | Under the influence of extreme heat and fire, the tape will melt and eventually so will his reel and case. A melted tape cannot be restored. If the melting is limited to the reel or case, then the tape will be rewinded and the original reels and case will be replaced. |
| Fungus | Tapes with funges should be isolated as soon as possible from the other tapes and put in an environment with low humidity. The fungus are removed with a vacuum cleaner. Make sure that the vacuum cleaner is provided with a filter so that the fungus isn't blown away and able to spread through the other archival materials. Also avoid direct contact between tape and vacuum cleaner. Transfer the content as soon as possible to another carrier because the fungus will stay active on the tape. If the vacuum cleaning method doesn't work, you can try to elliminate the fungus with a brush, dustfree towel and, eventually, destilled water. Afterwards, play the tape in a reel cleaner and transfer the content to another carrier. |
| Dust | Remove dust with a dustfree towel, a soft brush, a vacuum cleaner or a moist towel. Make sure that the edges aren't damaged. If possible, avoid opening the case. The use of a reel cleaner is, in principle, only necessary when dust has entered the tape pack. |
| Wrinkles | Rinse the wrinkled parts. The magnetic side is put on a teflon tray. Iron the the backside of the tape ( cover or substratum layer) with an iron at a low temperature. This wil remove the wrinkles in the tape. |
| Bad tension/ badly | Tapes with a bad tension, or who are badly winded, have to be rewinded.<br><br>The quality of the tape pack can only be controlled with professionel play-back equipment. If you don't possess this equipment, simply rewind the tape at normal speed. Whereupon the tape is put back in its box. (tails out storage) This is also the appropriate solution for a deformated tape pack. |
| Sticky shed syndrom | A solution for the *sticky shed syndrom* is the 'baking' or heating of the tape. The time and temperature of the baking depends on the width, |

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|---|---|
| | type and condition of the tape, but will be between 24 and 72 hours and between 45° and 55° C on average. This can turn around the sticky shed syndrom. The lomps of lubricate can evaporate or will be re-admitted by the tape. You have to be very carefull when baking a tape because this treatment can destroy a tape beyond restoration. The content of a baked tape should be put on to another carrier as soon as you play the tape again. Let the tape cool down before transferring the content to another carrier. While a baked tape has a very short life-span, this should take place in the first week after the baking procedure. This procedure can only be applied with reel-to-reel audio tapes and computertapes. Never bake acetate tapes! |
| Shortage of lubricate | You can add lubricate to the tape when their is a shortage of lubricate. This is specialistswork. Too much lubricate will damage the tape and the play-back equipment. (pollution caused by the reading heads.) |
| Deformation of the substrate layer/coverage | A deformation of the substrate layer or coverage as a consequence of fluctuations in temperature and relative humidity can be partially repeared through re-installing the temperature and relative humidity to the level that was used at the moment of recording. An other option is to re-rinse the tape. It will take several months for the substrate layer/coverage to retake its original form. |
| Acetate tapes | Carriers made out of acetate have to isolated from the collection in order not to sour the other carriers. The degeneration of acetate tapes can be slowed down by keeping them in an environment with low temperatures and a low humidity levell. The content of these tapes should be transfered to another carrier as soon as possible. |

## 7. Duplicates

Duplicates are the only protection against los, theft, destruction, erasion, fire and certain damages. Always make a safety copie and work copies. Save the master copie off line at another location in optimal storing conditions. Master tapes are kept at best at 10°C.

## 8. ? Questions ? Suggestions ?

Turn to DAVID for all your questions and suggestions:

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For more information;

F. BOUDREZ, *Magnetic carriers for the archives*, Antwerpen, 2002. (Dutch only)(http://www.antwerpen.be/david → cases)

F. BOUDREZ, *Standards for electronic records*, Antwerpen, 2002. (Dutch only) (http://www.antwerpen.be/david → cases)