

## The storage lifetime of removable media - Backup/Restore

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Data storage needs are increasing exponentially for most organizations. On top of that, new regulations such as HIPAA for the medical industry, Securities and Exchange (SEC) Act Rules 17a-3 & 4 for the financial services industry, the Sarbanes-Oxley Act for public corporations, and the Homeland Security Act are all requiring a great deal of long-term record retention for both large and small businesses, as well as government agencies.

Half-inch high capacity tape and optical media are the common removable media technologies used today to meet the growing data storage and record retention requirements. Tape has been a part of backup and storage solutions since its introduction in 1953. Optical media formats were breaking ground 20 years ago, and today users can choose from a wide array of CD and DVD formats to meet their storage requirements.

One of the more frequent questions that organizations have about their removable media is how long will it last, or what is its lifetime? The lifetime of removable media is defined as the length of time that the media can be successfully written to, stored and successfully read. The life expectancy for removable media can depend on many different factors including the quality of manufacturing, the care with which it has been handled, the conditions under which it has been stored, and how much it has been used. Another factor that has the potential of affecting the media lifetime is changes in technology. In this article, we will explore in-depth how each of these factors can affect the life of removable media.

### Media Manufacturing

Manufacturers of removable media typically build their media under rigorous process controls to guarantee that product specifications are met for durability and archival stability. Environmental and stress testing are two measures taken to assure that the product will withstand the test of time.

Significant research has been performed to determine the lifetime and archival stability of magnetic media. The National Media Laboratory (NML), 3M and Carnegie-Mellon University have performed joint and independent studies to assess chemical, thermal and archival stability of advanced metal particulate coatings, and results projected that magnetic media may reasonably be expected to have a lifetime of 15 to 30 years under normal usage conditions. These conclusions are

based on magnetic performance only and do not take into account other factors, like handling and environmental conditions, that may affect media lifetime and archival stability.

## Handling and Care of Tape Cartridges

Together with the hardware manufacturers, media manufacturers recommend the conditions under which tape cartridges should be handled, transported, stored and used, in order to ensure that the product will perform to standards over this 15- to 30-year time period. Data can be affected by environmental factors such as debris, high temperature or humidity, drastic temperature or humidity changes, and stray magnetic field sources, as well as improper handling of the cartridges by either operations personnel or by the hardware. If not properly handled, high-capacity tape cartridges are susceptible to damage due to the increased linear density, increased track density and subsequent positioning of the data and servo tracks closer to the edges of the tape.

Some basic rules for handling tape cartridges include:

- \* Stack or carry no more than six cartridges at a time to minimize the risk of dropping the stack
- \* Do not place cartridges that are dirty or damaged in a drive
- \* Use the finger grips, if present, to carry a single cartridge
- \* To prevent tape damage, do not remove leader blocks or open drive doors
- \* Do not touch tape surfaces, as residue from a fingerprint can create greater head-to-tape separation and result in loss of signal (data)
- \* Respond to drive messages for cleaning as directed, and only use cleaning cartridges recommended by the hardware provider
- \* Assure that drives are maintained and serviced per the hardware manufacturer's specifications.

## Dropped Cartridges

If a half-inch tape cartridge is dropped, there is always a possibility that the media inside may have been damaged. Even if

there is no visible evidence of damage on the outside of the cartridge, the cartridge's life may be shortened. Tape-edge damage or misalignment of internal components, such as hub(s) and tape pack(s), may occur. This damage may not present itself initially, but may develop over time. For this reason, it is recommended that a procedure for retiring dropped cartridges be developed.

## Transportation and Storage of Tape Cartridges

Proper packaging of cartridges for shipping is imperative to guarantee the life of the cartridge and the integrity of the data contained on it. Cartridges shipped with inadequate packaging could be damaged, which may result in data loss or reduced cartridge life.

The packaging itself should be strong enough to withstand shipping damage, not allow for cartridges to hit or rub against each other, minimize the internal forces within the package, not contaminate the cartridges, and be able to be used for repeated shipments without degradation of the packaging materials.

In order to ship a single cartridge, the cartridge should be enclosed in a plastic bag that is approved for use with data tape cartridges. The cartridge should then be placed in a shipping carton lined with several layers of bubble wrap. If shipping more than one cartridge in the same container, a package must be used which will allow for all cartridges to be shipped safely, without impacting the quality of any of the cartridges surrounding it.

In addition to shipping cartridges in an appropriate multiple-cartridge container, it is recommended that this container be placed in an over-packed box to further reduce the potential of damage due to shipping. It is recommended that periodic inspections be done of multiple cartridge containers after repeated shipments to assure that all of the requirements mentioned above are met.

Customers should not accept any shipment of new cartridges that has not been delivered in the original, product-specific packaging. This packaging has been tested under extreme conditions to assure that the product will reach the customer without any compromise in quality.

## Operating Environment

To maximize tape life, tape cartridges should be kept in an atmosphere free of contaminating dust particles and corrosive gases or chemicals. Cartridges should always be acclimated to the operating environment prior to mounting the cartridge on the drive. A minimum of 24 hours of acclimation time is generally recommended to make sure the cartridge is at the

same humidity and temperature as the drive for newly received tapes.

## Durability

Assuming that the quality of the media, handling, drive maintenance and environmental conditions are all within specification, the most significant parameter that contributes to media lifetime is how much the media has been used, or its "durability." Durability is measured and specified in terms of short- and long-length durability, and also various simulations of real-world applications such as Virtual Storage Management (VSM). Together, the durability tests predict the useful life of the cartridge under various usage patterns. Durability is tested by the media manufacturer and is normally quoted in their product specifications. On a high-density half-inch tape cartridge, assuming the customer uses a cartridge to write at least 10GB per week, durability lifetime ranges are projected to run from 10 to 30 years. If only 1GB per week is written per cartridge, lifetimes increase by an order of magnitude.

## Handling & Care of Optical Media

As with tape media, manufacturers also have specific recommendations on how optical media should be handled, transported, stored and used. With proper care and handling, most of the common optical media formats have a storage life of 30 years or more. Some basic recommendations for optical media care include:

- \* Handle the disc only by the outer edge to prevent fingerprints and smears on the surface. Never touch the recording surface (unlabeled side) or set it down on a hard surface
- \* Use a soft, lint-free cloth for cleaning the disc to remove spots, dust or fingerprints
- \* Always wipe from the center to the outer edges and never wipe in a circular motion
- \* Do not use abrasive or solvent cleaners, audio disc cleaners, or conventional vinyl record cleaning solution on the disc. Chemical-based cleaners and cleaners that are safe for audio discs might not be safe for CD-R, CD-RW or DVD discs
- \* Store the disc in a protective case, to avoid scratches on the disc surface
- \* Store discs in a cool, dry environment away from direct light. Discs stored between 23 degrees F (-5 degrees C) and 86 degrees F (30 degrees C) can last up to 100 years

\* Do not leave the disc in direct sunlight or in a hot, humid environment--like your car on a summer day--as these conditions could warp and damage the disc

Do not allow moisture to condense on the disc. Use only soft-tipped, permanent ink pens and write only on the clear inner diameter or designated label area of your CD or DVD. Water-soluble pens work best--their ink dries quickly and minimizes smearing. Ballpoint pens or other hard-point writing utensils may damage the disc

Use only labels with high-quality adhesive designed not to corrode the reflector layer of the disc. Be sure to apply it properly. Labels applied off-center or with ripples can harm your CD and/or DVD drive.

## Technology Changes

Since digital information is dependent on the availability of hardware and software, removable media is particularly susceptible to technological changes. In addition, each technological advance typically allows the user to store more data more quickly in a smaller space. Therefore the media may be migrated off the existing platform prior to the expected life of the media.

Even with a relatively high usage rate, media lifetime ranges are projected in decades, which is significantly longer than what has been seen historically in the hardware and software technologies used to run them. For example, round reel 3420-type drives present in 1974 were replaced starting in 1984 by square tape made with chromium dioxide magnetic particles. In 1995, even though the square tape format was retained, high capacity cartridges utilizing tape made with metal particulate (MP) magnetic particles required a complete change of hardware. Though drive manufacturers are committed to maintain the square tape format to assure that automation can be used for future products, the need for higher and higher densities requires changes to magnetic media technologies. These changes in magnetic media technologies then drive changes to the hardware and software for the system.

## Summary

As we've seen, there are many factors that can go into predicting the lifespan of removable media. Under specified conditions, removable media should last several decades and be a viable solution to any long-term backup plan. Additionally, the hardware life cycle should be a key element of the plan.

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