

8MM ROTARY TRANSPORTS
CARE AND FEEDING NEEDED
TO REDUCE PROBLEMS AND REPAIRS

PRESENTED BY
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Don Madden began his career in magnetic recording technology in 1954 with the repair and maintenance of tape drives used for aircraft and missile test data. Since then he has continued with tape, disk and optical drives in the areas of test, quality control, repair, and design of computer data storage devices and subsystems, as well as research in new recording technologies. He has worked with, among others, Burroughs, Pertec, Archive, and is now the lead tape drive engineer in the research and development division of Sprague Magnetics, Inc. repair labs.

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While this talk is directed at the 8mm rotating head technology drives, given the similarity of the 4mm DAT drives, at least in this area, my comments are also directly applicable to that technology. Additionally, given the large installed base of quarter inch cartridge drives, and the continuing development both in the quarter inch and half inch cartridge drives, many of these comments will apply to those technologies as well.

We, at Sprague Magnetics, are in a rather different position than most of you. We are in the business of repairing tape heads and tape drives. As a result, we see the condition that these drives are in after they have been in the field, we see them after they have failed, and to repair them, we must understand which components of the drive have failed and why. Thus, we see drives from a variety of different end users and manufacturers, and we see them after the warranty period has expired and they have been in the field longer, which gives us a perhaps longer term understanding than many manufacturers. Despite this cross section, the most common failure is still head related due to wear or inadvertent misuse by the end user.

The introduction of rotating head data storage devices has greatly increased the performance of tape cartridge based drives by substantially increasing the capacity of data which can be stored on any one cartridge. The improved performance is a direct result of the increased packing density of the magnetic media contained within the cartridge.

This had two diametrically opposed results. It increased the likelihood of data errors in the recording/retrieval process, while at the same time penetrating a customer base whose requirements were less tolerant of the possibilities of errors.

The manufacturers, VARs and software vendors have tried to reconcile these results through the use of sophisticated error correction codes and other steps, but they have largely ignored the education of the end user.

In order to achieve the higher packing density on the cartridge, the rotating head drives have far greater mechanical complexity than the quarter inch drives. Careful attention by the end user is required to maintain the condition of the tape cartridges and the drives to keep the system in a good state of health. As in many other areas, prevention of problems cost less than correcting them after the fact.

Drives rarely burn out. Tapes and drives wear due to misuse and normal aging. For our purpose, misuse means any actions or lack of care which leads to premature failures or other problems. Of course, few people deliberately mistreat their equipment, but many do mistreat their equipment due to lack of knowledge and proper care.

Normal aging includes tape and cartridge wear, but does not include scratches, creases or contamination of the media. Rubber and other soft parts such as capstans and drive belts may deteriorate or become dirty in normal use. Contamination with harsh or improper cleaners or lubricants can cause early failure. Tape guides, motors, capstans and other rotating parts have bearings that will rarely cause problems if left alone, but be wary of solvents or other chemicals

washing out the lubricant or otherwise damaging them.

Magnetic heads will wear to some extent through normal use. Dust or dirt, especially on the magnetic tape, is very abrasive and will cause increased wear or even breakage of the tiny ferrite rotary heads. Non-data grade tape, with different composition will also significantly increase head wear. It is in this latter area that the rotating head drives are in a relatively unique position. Standard 8mm video cartridges and standard audio grade DAT cartridges will fit interchangeably into these drives, but their composition varies based upon the application for which they were designed, which was not for data storage use. Unfortunately, until just recently, the media and drive manufacturers did not offer the end user a clear distinction, and even now, given the cost differential between types of media, many manufacturers are still not placing sufficient emphasis on the importance of using the proper grade of tape so as to effectively educate the end user.

Contamination of the magnetic heads with tape wear particles can be a problem on any type of drive. Non-rotating heads are easily cleaned, but again, more emphasis and education needs to be focused on the methods the end user is to use to accomplish this important preventative maintenance task. Special emphasis needs to be placed on only following the manufacturers recommendations.

Rotating heads are usually inaccessible to the end user, which is a good thing given how small these heads are, and the fact that they are usually made of brittle ferrite. However, they also usually have a space between the active head element and the drum which exposes the edges of the active element to damage and provides a space where the tape wear particles can accumulate. This space can become packed with tape wear particles which in turn can cause not only damage to the tape, but also may result in read or write errors. The best way to avoid problems like this is to buy the best, data grade, tapes available and to retire these tapes when they begin to give excessive errors, or better yet, at regular intervals. Once again, better education of the end user is needed, and must be emphasized more by the manufacturers. Better education of and understanding by the end user will minimize problems and keep them happy with the manufacturers product.

The only effective way in which the end user can clean the rotating heads is through the use of a cleaning cartridge. Any other method is likely to damage the heads. Yet, many of the cleaning cartridges available, such as for 8mm video or for audio DAT, can also damage the heads. It bears repeating yet again, more emphasis and education needs to be focused on the methods the end user is to use to accomplish this important preventative maintenance task. Special emphasis needs to be placed on only following the manufacturers recommendations. In fact, it might be beneficial to include a recommended cleaning cartridge with each and every drive sold, or the media manufacturers of data grade tape might seriously consider packaging an appropriate cleaning cartridge with each pre-packaged batch of media.

There have been many cost estimates done on the value of lost data. Most of these have focused on loss of data off the main on-line storage devices such as hard drives. However, those

estimates also apply to near-line, off-line, or archived data storage on tape.

The cost of lost data is based on the expense to re-create it. If it is simple backup data, conceptually it would be easy enough to write a new tape. But this assumes that you still have the main storage device available, another tape drive is available, that no data has been lost or deleted off of it, and that you recognized at or near the time of the backup that you had lost the data. However, if the tape had point-of-sale transactional data, distribution or other original data either from outside your operation or is the only remaining data from your archives, the difficulty is much greater and more expensive.

These costs can be categorically broken down to the man-hours necessary to recreate the data, any interruption of normal operation to replace the drive, and any loss of data or inability to backup data during the period when the drive is out of the system for repair. If the tape was damaged by the drive failure, the cost of replacement of media is added to the total. The repair cost of the drive can be as low as the time to clean the head or as high as replacing the complete drive and/or controller. If the end user does not have the facilities to repair the drive themselves, a third party, such as SPRAGUE MAGNETICS, can be used. The cost of such failure is, of course, the total of all of the above losses.

On the other hand, the cost of proper care and feeding are also variable, and are related to the size of the operation. High quality data grade tape costs more than the bargain variety, sometimes up to double. The cost of storage cabinets and space for them is a consideration. Maintenance materials such as head cleaners are relatively inexpensive, however, cleaning cartridges are more expensive. The time it takes to perform the maintenance is low, but is added to the total along with these other costs.

It is easy to see that the costs of failure easily outweigh the costs of maintenance where tape drives are concerned. Yet the manufacturers and distributors of both the tape drives and the media fail to provide sufficient education to the end user to maximize the chance for proper preventative maintenance. Placing such information as the type of media and the cleaning methods in the back of a long user manual or in type size so small when packaged with the media as to be easily ignored does not accomplish the purpose of educating the end user in the proper care and feeding of the product.

Probably the most important aspect of proper care and feeding is to buy and use only the best quality data grade media of the proper size and type for the drive, and to take good care of that media. Always keep the cartridge in its storage case when it is not in use. Store the tapes in a rack or cabinet in a cool, clean, dry area with the cartridge in a vertical position. Keep the tapes away from monitors, motors or any other source of strong magnetic fields. Whenever media has been exposed to temperature and/or humidity extremes, such as during shipment, re-condition it by storing it in the system environment for at least twenty four hours. Perform a retention cycle on the new tapes after re-conditioning and on any tape after repeated start-stop operations. Even in the streaming mode, the tapes may start and stop many times due to mismatches in the data transfer rates of the system and that of the drive. Clean the head at the

intervals recommended by the manufacturer using the materials and methods recommended by the manufacturers. If using alcohol, DO NOT use rubbing alcohol or any other type except the "dry" denatured type. Keep the container capped as the alcohol will readily absorb moisture from the air. It is very important to use only cleaning cartridges recommended by the manufacturer because some types could damage the guides or head of the drive. Make sure that all cables are plugged in correctly, completely and securely. Do not forget the ground wire to the frame or the case.

WHEN ALL ELSE FAILS, READ THE BOOK. Notice that I saved this for last. The reality is that this is the attitude of most end users. The manual on the drive itself is basically used as a choice of last resort. In fact, if the end user would like to minimize potential problems, they should read the book first. But how many user manuals contain preventative maintenance and cleaning instructions in the first chapter overview, or in the installation section which is all that most end users ever read?

TO SUMMARIZE:

- Many of the problems encountered in the use of tape drives are preventable.
- The major cost of failure is the loss of data and productive time.
- It costs less to prevent problems than to repair the damage they cause.
- Generally, the cost of repair of the drive is relatively low, compared to the other costs of lost data.
- Buy only the best data grade media and take care of it.
- Perform maintenance on the drive, following manufacturers guidelines.
- When you have a need for repair, call SPRAGUE MAGNETICS. We are in the business to help you.