

The Truth About Tape Lubricant

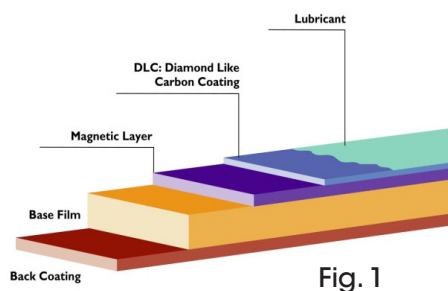
Introduction

There exists an ongoing perception in today's consumer and professional recording tape markets that mixing different brands of DV tape may potentially cause head clogs in your video tape recorder. The anecdotal cause of these clogs is the interaction of different lubricants used by different manufacturers, commonly referred to as 'wet' and 'dry' lubricant. Although this perception persists in many forms, it is difficult to find hard evidence to support it. So Sony set out to recreate the 'problem' using today's DV tape. The purpose of this paper is to separate fact from fiction by exploring the root of the perception and testing its validity in today's market.

Tape Lubricant in Manufacturing

In today's market there are two types of tapes in use, metal particle (MP) and metal evaporated (ME). Both types use a lubricant to reduce the coefficient of friction between the tape and the record/playback heads inside the video cassette recorder. This effectively helps to reduce stickiness and scrape-flutter as the tape passes through the machine. In the case of MP tape, used with such formats as Betacam SP®, Betacam SX®, Digital Betacam™, HDCAM®, and HDCAM SR™, the lubricant, as part of a binder material, is added to a mix of magnetic particles and coated onto a base film. With ME tape, used for smaller formats such as DVC (aka MinDV), DVCAM™ and HDV™, the lubricant is applied as a separate layer to the tape (see Fig.1).

As a raw material, the lubricant is supplied to manufacturing in either liquid or powder form. In the liquid form, it can immediately be introduced into the ME manufacturing process. In the powder form, it must be mixed with a solvent prior to use in manufacturing. Lubricant in these two forms is what has given rise to the common reference 'wet' (liquid) and 'dry' (powder) lubricant. Regardless of whether the lubricant, in its raw state, is a liquid or a powder; it is always applied to the surface of the tape as a liquid.



Mixing Brands of Tape

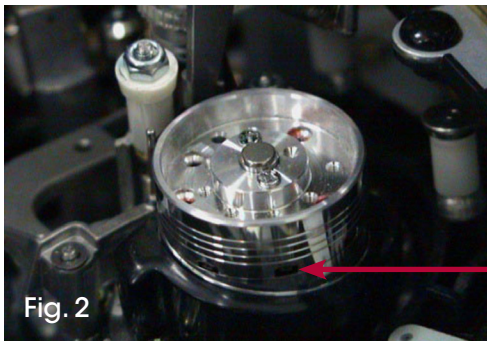
The perception that mixing brands of tape will 'ruin your heads' dates back decades when a new acquisition format, designed for use with metal particle tape, was marketed by the manufacturer as being compatible with metal evaporated tape. Unfortunately the manufacturer did not take into account the lower tension specification required for ME tape compared to MP tape. As a result, the lack of compatibility quickly became evident as complaints of head clogs began to be reported when users began running ME tape in equipment designed for MP tape. Subsequently, the mixing of tape brands became the quick diagnosis for most head clogs even in cases where different brands of only ME tape were being used.

With worn heads or buildup of other dirt and debris, the chance of experiencing head clogs increases. Under these conditions, the lubricant may become a contributing factor because it resides on the surface of the tape and is most likely to be removed from the tape by a worn or dirty head. If you use tape for several hundred hours without cleaning the heads there may be significant buildup on the heads of your recorder. Therefore, the likely cause of head clogs is lack of machine preventative maintenance versus lubricant interaction. Sony engineers have determined that there is no direct link between head clogs and the type of lubricant being used.

What is a Head Clog?

Head protrusion is a measurement of how far the heads stick out from the surface of the head drum. As heads wear, their protrusion gets reduced. Under normal circumstances, the heads will wear uniformly over several hundred hours with proper cleaning practices employed. If the heads are not maintained, and exhibit uneven wear patterns or damage, they could gradually pick up debris from the tape which could bond to the head, eventually creating a space between the head and the tape. Debris from the tape could include magnetic materials, lubricants, binder and even base film, any of which may compromise this head-to-tape contact which is critical in maintaining maximum data transfer integrity for proper record and playback. When the space becomes great enough, a dropout will occur.

Head clogs manifest themselves visually as *striping* on the screen with DVC (MiniDV) or DVCAM recording. This is because there are two heads on a typical DV head drum (see Fig. 2), each of which writes five alternate tracks of video to produce a frame of video. When one of the two heads becomes clogged, the video on the screen shows stripes, or bands, of disturbance on every other track (see Fig 3). This type of disturbance appears when a head becomes worn or damaged and can no longer record/playback the signal according to specification. A head clog with HDV recording will typically cause a freeze frame during playback.



Head

Fig. 2



Fig. 3

Test Results

Different brands of tape were subjected to full record and playback in Sony and non-Sony hardware and then analyzed for dropouts, errors and evidence of head clogs. The tests were conducted at room temperature, -5C, and 40C/80%RH. After extensive testing, Sony engineers again found no relationship between head clogs and the type of lubricant being used. Today, most manufacturers, including Sony, use a mix of different lubricants. In years past there were several manufacturers producing metal evaporated tape. Today there are half as many manufacturers producing metal evaporated tape, hence, the number of different lubricants in use has dropped considerably.

Recommendations for Proper Machine Maintenance

Cleaning cassettes should be used periodically to remove small particles/debris that can accumulate on video heads. These particles may originate from the tape or operating environment and can scratch or clog the video heads. Any time particles/debris comes between the video head and the tape, video and/or audio quality can potentially be degraded.

Sony recommends using a format-specific cleaning cassette once every 50 hours of recording or playback. If operating equipment in high temperature/humidity, or in an environment with dust or smoke, more frequent cleaning may be required. Cleaning tapes should never be rewound. Once you reach the end of the tape it should be discarded. This is because, with each use, the tape accumulates residue and debris from the guides and heads inside the machine and you do not want to re-deposit this material by reusing the same area of tape twice.

Conclusion

Hard evidence of this phenomenon has been hard to come by for as long as metal evaporated tape formats have been in existence. The perpetuation of this controversy, based solely on hearsay, is misleading to end users. Sony has done a significant amount of internal testing to simulate head clogs as a result of mixing tape lubricants, and has been unable to recreate the 'problem'. The fact is, mixing different brands of tape should cause you no problem, especially if your machine is properly maintained.

All tape manufacturers are required to produce tapes according to the DVC format specification to ensure compatibility in DVC hardware. It would not be in their best interest to not be compatible, as that would compromise the reliability of the format. Additionally, the inference that one brand of tape should be used over another because one causes head clogs and the other does not, is just not the case. But, if you are still skeptical, clean your heads with a format-specific cleaning cassette before trying another brand of tape.

If you have evidence that mixing different brands of tape is the sole reason for your head clog, please contact Sony via your supplier to arrange for a chemical analysis of the material on your heads.