TECHNICAL TALK

FROM THE MAKERS OF "SCOTCH" BRAND MAGNETIC TAPE

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EFFECTS OF STATIC ELECTRICITY ON MAGNETIC RECORDING

The presence of static electricity in recording systems has long been a source of problems, but has become more prominent in computer and instrumentation recording due to the higher tape speeds and the use of polyester film in tape manufacture.

Static pull or "drag" can cause displacement of the time base to affect output in some types of recording and frequency misinterpretation in others. It can create tape skew to affect azimuthal alignment to cause reduced output. It attracts dust which contaminates the coating surface to contribute to dropout errors. And generally, due to the sporadic tape motion created by static, it can promote excessive tape wear.

In computer applications static often manifests as tape drag in vacuum chambers. In analog operations static can evolve as recorded "noise" from electrostatic arcs between recording heads and ground, and as FM "noise" resulting from speed variations.

Of the above affects from static, the presence of dust is probably most detrimental to good recording results. Dust wound into a reel can cause "picking" of the oxide from the base material to create non-magnetic areas resulting in signal omission. Dust between the oxide coating and the recording head, lifts the tape surface from the head to cause reduced output, especially in recording of high frequencies (or in high density pulse recording systems).

Static (electrical charges created by friction between dissimilar materials) is of little concern if the separated positive and negative charges can neutralize themselves. However, poor conductivity of the materials involved will resist such neutralizing, allowing the charge-separations to build up through continued friction exposure, to the point where their strength surpasses the dielectric character of the surrounding air before draining. Charges exposed to the less electrically resistant "path" of the air seek to neutralize, often manifesting as "arcing".

It has been said that polyester as a backing material is subject to greater amounts of static than other base materials. This is less true than the fact that polyester allows static charges to build to greater magnitude before neutralizing, due to the excellent dielectric qualities of the material.

Also, where it might be reasoned that ferric oxide used in magnetic coatings would be a good conductor allowing sufficient drain of static buildup, in most magnetic coating formulas this is not the case. The formulation of ferric oxide with a binder, (a plastic component), renders the coating surface poorly conductive. To formulate a more conductive coating using common oxides and binders would result in a coating possessing a lesser degree of wear ability and poor magnetic characteristics.

Some tape transport designs permit facility to

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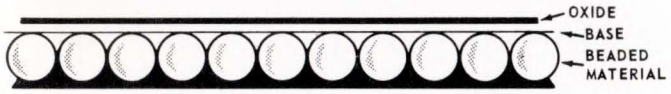
isolate a tape guide as a shielded ground to serve as a static drain terminus, limiting the amount of static buildup occurring in the tape. However, extreme care must be exercised in adding such guides to a transport, since the resulting friction can possibly upset the critical balance of tensions; thereby compounding the problem of tape drag. Also, proximity of such guides to the record head, and use of guides with insufficient radius for smooth tape travel, can introduce poor head-to-tape contact and excessive tape wear.

Studies have been conducted into other methods of reducing static, one of which concerns reducing the potential for static buildup: This is accomplished by lining computer vacuum chamber walls with a glass beaded material to greatly reduce surface-to-surface contact:



The tape contacts only the outermost points of the minute spherical surfaces, minimizing the possibility of static by minimizing the tape area subjected to friction. The beaded material should be smooth, but one of the exposed bead types such as "SCOTCHLITE" Brand #234.

Other work has been undertaken to develop materials which would provide instantaneous neutralization of static charges without actually contacting the tape as it passes through the recorder, based on the principle of ionization of air. While several advancements have been made in this area, unavailability of the materials developed, and/or their incompatibility with other factors in the recording operation, render this method presently impractical.

The consideration of static in the development of a coating for heavy duty tapes brought about studies of various oxide/binder formulations. The purpose was to determine which binder and oxide would best combine to provide optimum conductivity without sacrificing magnetic efficiency or durability.

As a result, the high potency oxide coating currently used in the manufacture of heavy duty tapes provides many times less resistance, allowing a more uniform static drain before it can build to the point where it influences static pull or arcing. This newer oxide formulation offers a resistance of 100-megohms per square or less, where common oxide coatings will show resistances of as much as 1,000 times greater.

Very notable benefits of this increased coating conductivity are the substantial reduction in tape drag resulting from static; less head-to-ground arcing; and, most important, less evidence of dust particles on coating surfaces.