Computer Talk

A Technical Service to the Industry from the makers of Scotch Magnetic Tape

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STATIC ELECTRICITY AND ITS EFFECTS

Generally, static electricity is not a major problem today because the magnetic coatings of most Computer Tapes now available are conductive and the tape transports are equipped with static reduction devices. The effects of static on tape signal output and equipment maintenance merit a review of the conditions which concern static buildup and its neutralization. Static electricity (electrical charges caused by friction) is created by a temporary surplus or deficiency of electrons. Its presence on recording tape is a result of the tape contacting itself when leaving the tape reels and also when passing over the various tape transport components. Static electricity may cause problems at the high tape speeds and rapid start-stop times used in modern tape transports. Tape drag or skew are some of the problems created by static which can affect signal output or promote excessive tape and magnetic head wear. Also, static buildup on the tape or transport may attract dust which can contaminate the tape coating causing write and read errors.

STATIC BUILDUP

An excess or deficiency of electrons on the tape surface will create corresponding negatively or positively charged areas. The voltage potential of the static buildup is related to the electrical resistance of the tape coating. A high resistance coating causes a tape to build up a greater static charge potential than a tape with low coating resistance which dissipates a static charge easier (Figure 1). The increase of tape transport speeds and faster start-stop times create additional static buildup on the tape surface because the tape contacts itself when leaving the reels and the transport components at very high speeds.

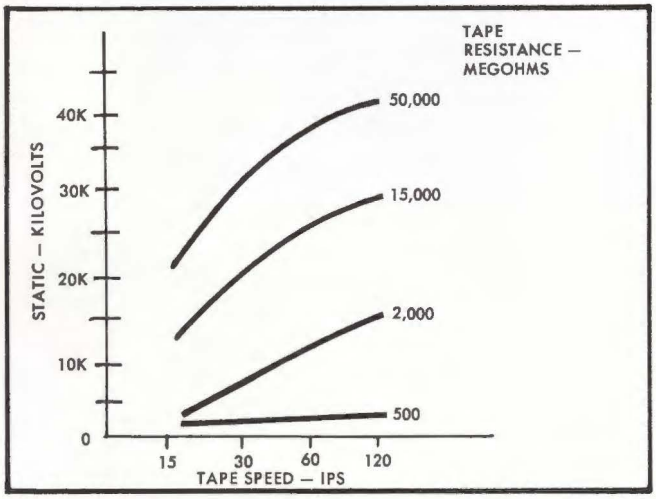

FIGURE 1. STATIC BUILDUP VS TAPE SPEED AND TAPE RESISTANCE

Another major factor concerning static buildup on tape is the relative humidity level in the area where the tape transport is operating. Humidity is important in that the airborne moisture particles provide a path for static dissipation. Very dry air has a relatively high dielectric strength and tends to insulate the tape surfaces causing very rapid and high potential static electricity buildup. A temperature of about 70° Fahrenheit and a relative humidity of about 50% is considered optimum for maximum operating efficiency. Higher humidity levels are not necessary and may cause hydroscopic adhesion.

EFFECTS OF STATIC BUILDUP

Because of the polarity of static charges, the tape can be attracted to itself or to the components of the transport. The static attraction that creates "drag" may cause displacement of the time base which can affect signal output. Static may also be manifested as tape flutter and oscillations in the transport vacuum chambers resulting in tape speed variations.

Occasionally, when using a tape with relatively high resistance, electrostatic discharges or "arcing" may occur from head to tape or on the tape reels. Although this situation is not dangerous or damaging to the tape or transport, it can result in recorded noise or data errors. This condition is aggravated by the use of high resistance tape in a low humidity environment. One of the detrimental effects of static electricity on tape is the attraction

of dust and other contaminants. When this debris is wound into a reel of tape, it may adhere to the magnetic coated surface which can result in signal losses that cause write or read errors.

These errors occur because the debris lifts the tape surface from the magnetic heads and causes reduced signal output. This output loss is especially critical when recording high densities.

METHODS OF STATIC CONTROL

The ability to dissipate a static charge is dependent on the electrical properties of the material. Conductive materials, such as metals, have highly mobile electrons and will easily neutralize a static buildup. Nonconductive materials or insulators, such as plastics, cannot easily neutralize static. The dissipation of a static charge may be either through the surrounding air or through a direct transfer, such as when the charged material is brought into physical contact with a grounded material. It might be reasoned that the magnetic material used in magnetic coatings would be a good conductor allowing sufficient drain of a static buildup. In many magnetic coatings, however, this is not true.

By carefully controlling the special compounds used in the tape coating, the resistance value of the tape can be maintained at a desirable low level (Figure 1). It is not practical to reduce oxide resistance to near zero level as experience has shown that this type of tape exhibits a tendency to cling to itself and stick to adjacent layers after several passes through a transport. As a result the magnetic coatings used in the manufacture of modern tapes allow uniform static drain characteristics. These coating formulations offer a resistance of less than 500 megohms per square (a square of tape is a tape length that is equal to its width). There are some high resistance magnetic coatings that are generally unsuitable for computer use which exhibit tape resistance that may be as high as 100 times greater than the recommended maximum. In comparison, there are computer tapes now available with coating resistances of 100 megohms per square which virtually eliminate tape associated static problems.

An excellent method now in use by most transport manufacturers to reduce static buildup is accomplished by lining the transport vacuum chamber walls and other large surface areas which contact the tape with a material which reduces the surface-to-surface contact. A typical material has a glass-beaded surface such as SCOTCHLITE Brand #234 – which allows the tape to contact only the outermost points of the minute spherical surfaces (Figure 2). The smooth beaded material allows only a minimum of surface contact which reduces static buildup, attraction, and drag.

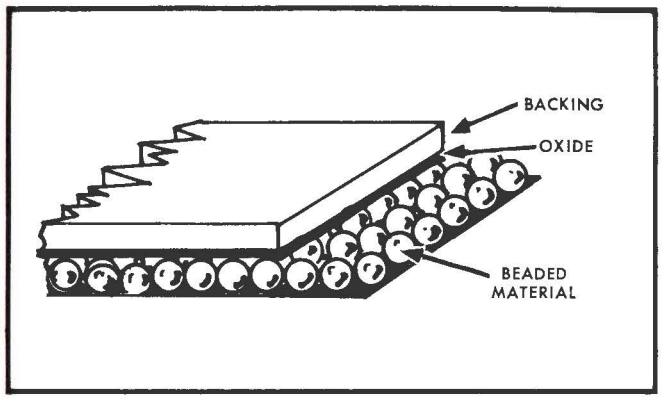

FIGURE 2. SURFACE REDUCTION METHOD

SUMMARY

The consideration of static electricity has influenced the development of magnetic coatings as used in modern tapes. Most coatings now in use provide the low resistance quality without sacrificing magnetic efficiency or durability. The benefits of controlling the resistance levels of the coating are the substantial reduction in tape drag and flutter resulting from static. A most important factor in static control is the reduction in the attraction of dust particles to the tape surfaces. To properly reduce dust damage, control of the relative humidity and overall cleanliness is essential. Generally speaking, if precautions to maintain cleanliness and atmospheric control of the tape transport operating area are observed, and high resistance tapes are avoided, the undesirable effects of static electricity will be greatly minimized.

If at any time additional information on this topic is desired, it is available by simply writing to:

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