AMPEX

# MAGNETIC TAPE TRENDS

APPLICATION ENGINEERING BULLETIN

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TO ALL PRECISION TAPE USERS:

This is issue Number 2 of Magnetic Tape "Trends" - - - a new engineering service from Ampex Corporation, Magnetic Tape Division. It is part of a series of application notes containing information on the latest trends in magnetic tape development and use throughout the industry.

The technical information appearing in "Trends" is designed to be retained as basic reference material and each sheet is punched for easy insertion into a three ring binder.

We hope you will route "Trends" to others in your organization by using the routing space provided on the mailing folder. These names may also be added to the regular mailing list (see below).

The last page of this issue is a multi-purpose "coupon" for your convenience in:

* Adding other names to the "Trends" mailing list.
* Making suggestions for future subjects to be covered.
* Requesting information on other Ampex products.

"Trends" is for you... we hope you will find it useful and informative.

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## I. EFFECTS OF STRAY FIELDS ON MAGNETIC TAPE

A major advantage of magnetic tape as a storage medium is its ability to be erased and recorded over many times. Normally this is accomplished by one of two methods. One approach is to use a bulk eraser that is capable of erasing entire reels in seconds, which is done by slowly rotating and moving the reel through a concentrated AC field. The second technique is the more familiar erase head incorporated in the tape transport. The erase head is energized during the record mode to insure that a new recording is never made over previously recorded information.

Virtually all equipment incorporating an erase head contains a simple interlock to minimize unintentional erasure. The danger of unintentional erasing is recognized by most operators, and their attention to it minimizes the problem. However, a less understood phenomenon is the effect of stray fields on tape during handling and storing.

An understanding of the relationship between gauss and oersted as applied to measurement of field strength will help to clarify the effects of stray fields on tape.

Both the gauss and the oersted are units of magnetic measurement. The oersted is the measure of magnetizing force and the gauss is a measure of the resultant magnetic intensity. When measuring field strength in air the gauss and oersted are numerically equal. This relationship is altered in magnetic materials such as tape which have a greater permeability than air. In these materials of high permeability the oersted - gauss relation is a function of the permeability.

Different types of stray fields affect tape in different ways. The first field to consider is a steady DC field, such as that produced by a permanent magnet. If a reel of tape remains within a DC field, the resultant effect is that an extra signal is recorded on the tape. This will take the form of background noise, and will vary in strength in proportion to an exponential of the applied field and proportional to the length of time the field is applied.

This will be similar to the effect that a magnetized recording head which was not properly degaussed will have on tape during recording. This points up the need and advisability of degaussing heads frequently. (Consult equipment operating guide for specific degaussing procedures.)

A different phenomenon occurs when tape is exposed to an AC field. If a tape is moved rapidly through an AC field, the effect is about the same as recording on the tape without using AC bias. A highly distorted time variant signal can be left on the tape. This noise is recorded in much the same manner as significant data coming through the record head in normal operation. With a stray AC field present, the possibility of erasure always exists, and the degree of erasure is nonlinear with respect to the AC field strength. If the peak strength of the field is less than the coercivity of the tape, it is impossible to have a complete erasure regardless of how long the tape remains in the field. In AC fields greater than the tape coercivity (usually 250-260 oersteds), the signal on the tape will be completely obliterated. Tape erasure in an AC field may be considered a time function. A brief exposure to a 700-1000 oersted field will completely erase the signal on the tape, whereas longer exposures to weaker fields will be required for complete erasure.

Another effect suffered from exposure to stray fields is that of increased print-through. This can occur at relative small field strengths. For instance, a five minute exposure to an RMS field of 20 oersteds will cause a print-through increase of 10 db. The print-through increases roughly at the rate of 2 db for every additional 5 oersteds.

The effect on tape of the earth's magnetic field of approximately 0.5 oersteds is negligible. Generally stated, a stray field of up to approximately 10 oersteds should have no detrimental effects on magnetic tape. When tape is exposed to more powerful fields, up to about 100 oersteds, low-level and short wave length signals may be erased. As the field strength increases, the longer wave-length and higher level signals will be affected. Field strengths of 700 oersteds or more will completely destroy all magnetic data previously recorded on the tape.

Although field strength decreases significantly as we move away from the source, a safe storage space away from electric motors and other known sources of magnetic fields should be provided.

## II. CARE AND STORAGE OF MAGNETIC TAPE

Your recording of valuable data is done under precise and closely controlled operating and ambient conditions to insure exact reproducibility. Every care is taken to provide optimum performance of the machine, tape, and all components. It is equally important to provide the same care in the handling and storage of the tape to protect the valuable recorded data.

In order to understand more clearly the factors affecting magnetic tape storage, there are a few basic concepts to be understood. The magnetic ability of the oxide on a magnetic tape does not degenerate. In other words, the magnetic particles will never get tired and allow the data they are holding to "leak off". The only thing that will cause the particles to change their orientation is the influence of an external field.

However, degeneration can occur in another fashion. Basically, magnetic tape consists of three constituents: base material, binder, and oxide. The oxide does not lose its magnetic potency with time, however the base materials may become brittle, distorted, and lose their intrinsic properties if not stored under proper conditions. The binder system also may degenerate which will result in complete loss of stored data if proper precautions are not taken.

Base Material. The main broad function of the base material is to provide a means to hold the iron oxide and move it past the heads of the recorder in a controlled fashion. It must also electrically insulate one layer of oxide coating from the other to prevent print-through. Dimensional stability (resistance to physical change as a result of varying ambient conditions) is the keynote in a good base material. It must also maintain resilience so that in this flexible state it may provide good tape to head contact. It is obvious that if a base material becomes brittle, warped, or wavy, the tape will be useless regardless of how superior the oxide coating may be. Temperature and humidity extremes should be avoided to maintain the dimensional integrity of the base material.

Mylar* (or polyester) affords the best characteristics to meet the demands for magnetic tape base material. Plastic or Acetate base does not possess the dimensional stability and durability required for instrumentation and computer tape requirements.

Binder. The function of a binder system is more complex and critical. Actually there are several distinct functions that a binder must perform. The binder must provide even dispersion of the oxide particles and confine them within a very thin layer. It must maintain a durable, frictionless surface possessing long wear characteristics. All this must

*TM for Dupont Polyester Film

be accomplished while the binder provides an efficient bond (adhesion) of the oxide coating to the backing material, and an effective bond (cohesion) of the magnetic particles to each other. There must be no physical or chemical reaction between the binder and the tape backing or any material normally encountered in the tape handling mechanism. The life of the binder system is critically dependent upon the storage environment.

Ideal temperature and humidity conditions are shown on Fig. 1. In the case of long term storage, it is imperative that these conditions be met to eliminate unnecessary and accelerated degradation of magnetic tapes.

Physical Damage. All tapes in storage must have proper protection from physical damage. The reels should be sealed in dustproof bags, replaced in original cartons and stored on adequate shelves where they will not be moved or subjected to vibration. The storage area must be free from all external magnetic fields (See Part I: Effects of Stray Fields on Magnetic Tape.) The boxes of tape should be stored on edge with proper support to prevent them from falling.

The usual precautions of tape handling apply in the preparation of reels for storage. Tape should be used, handled, and packaged in a dust free, controlled ambient. Nothing should come in contact with the tape edges exposed through the flange windage holes. Tape should always be handled by the reel in such a manner that fingers never touch the tape. Reels should be handled by the hub. When handling a reel by the flanges you may pinch the flanges together to the point where they assume a permanent set and will not track properly on the transport. Final winding of the tape must be done as accurately as possible to minimize poor tape pack, internal stress, pack slip, etc. The rewind mechanism should be checked frequently and must always meet the published specifications of the equipment manufacturer, particularly in regard to braking systems, hold-back tensions, etc.

It is advisable that all tape in long term storage be rewound once a year. This is done to relieve any internal stress that may have built up within the tape pack during storage.

Stored tape should be normalized before it is used. If the storage ambient is different from the operating ambient, the tape should be placed in its operating ambient at least 6-8 hours prior to its use to insure the tape has reached thermal equilibrium.

For best results with medium or long term tape storage, it is recommended that Mylar base film tape be used. A 1.5 mil Mylar backed tape provides optimum strength and print-through characteristics.

# THE EFFECT OF ENVIRONMENT ON MAGNETIC RECORDING TAPE

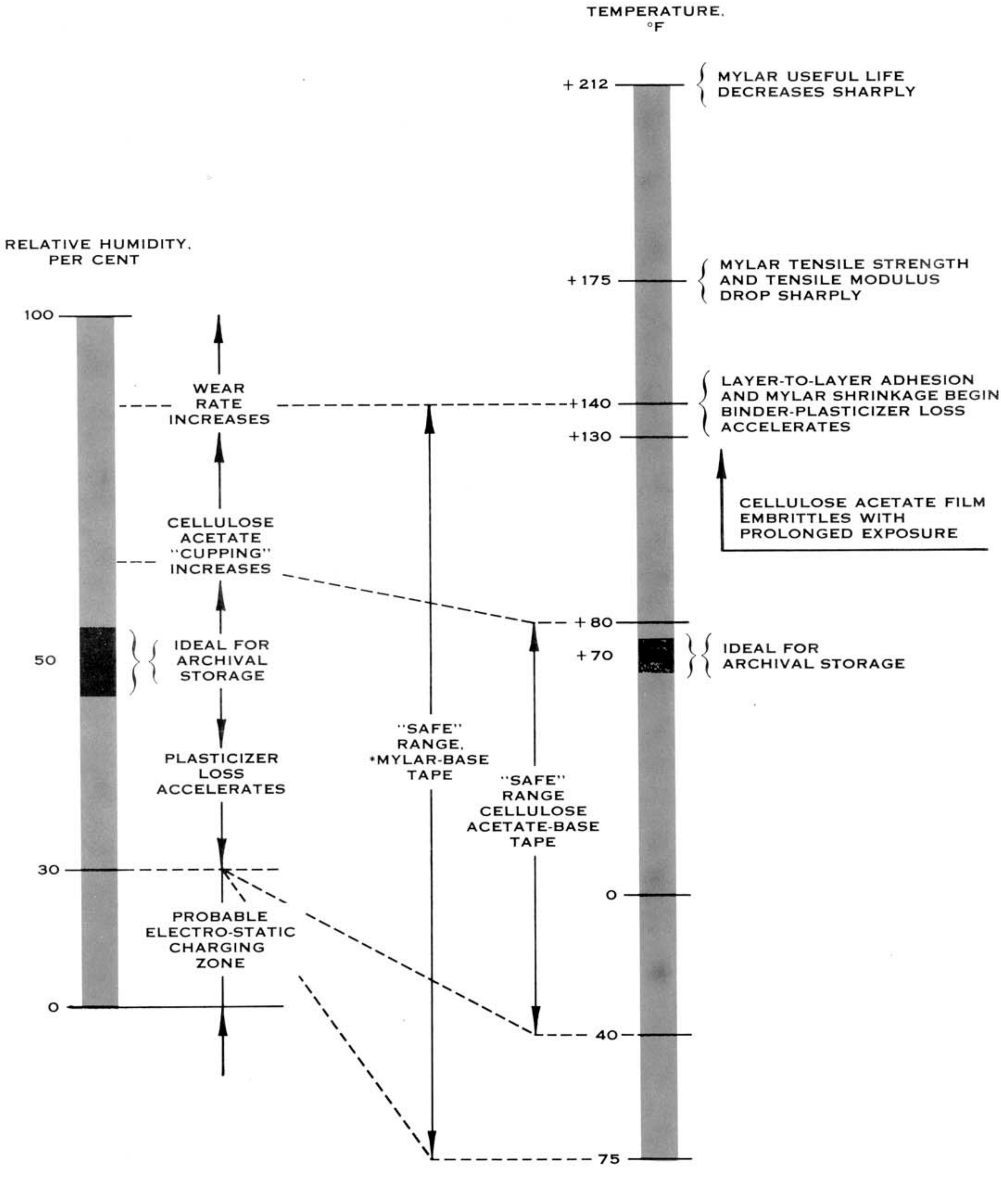


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Fig. 1