

The Combustibility of Magnetic Tape

The 1959 Pentagon fire that destroyed two computers and many rolls of magnetic tape has provoked numerous questions about the combustibility of magnetic tape. This bulletin will attempt to state how combustible magnetic tape is, to explain how fire damage to magnetic tape can be minimized, and to suggest how fire involving magnetic tape can be avoided in the first place.

Combustion

For magnetic tape to burn, there must be a breakdown of the organic materials contained in it. The organic materials in magnetic tape are the plastic backing and the binder. To burn, these must first vaporize—thus increasing their exposure to the oxygen in the atmosphere—and then rapidly oxidize to form light and heat. The magnetic oxide in the coating of the tape will not burn because it has already

reached its maximum potential to oxidize; since it cannot react with any more oxygen, it is inert.

"SCOTCH" BRAND magnetic tapes can be classified, according to their rate of burning, as "slow burning to self-extinguishing." If we define the point at which a material in contact with a flame will ignite as the material's *flame temperature*, and the point at which combustion occurs without direct contact with a flame as its *self-ignition temperature*, we can say that "SCOTCH" BRAND magnetic tapes will not ignite until they reach a flame temperature between 500°F. (cellulose acetate) and 700°F. (polyester), or a self-ignition temperature between 700°F. (cellulose acetate) and 1000°F. (polyester). At these temperatures an ample supply of oxygen is required to sustain the burning; magnetic tape, in the absence of air, will not burn. (It is not possible, in a discussion of this length, to be specific about temperatures because of the variables involved: type and thickness of backing, binder formulation, coating thickness, etc. The temperatures indicated are intended as general guides.)

A single strand of magnetic tape will burn more readily than a whole reel, just as a wood

shaving will burn more easily than a block of wood, because of the high ratio of surface area to weight. The temperature ranges given above refer to a single strand of tape, since there is no recognized test for rate of burning of magnetic tape in a roll.

Effects of Heat on Tape

Excessive heat causes deterioration of cellulose acetate backing and shrinkage of polyester. Polyester film, for instance, will shrink 1½% at 300°F., and 25% at 325°F. Ideally, magnetic tape should be stored at a room temperature of 70°F. and at a relative humidity of 50%. (See Bulletin No. 1 in this series for a full discussion of the handling and storage of magnetic tape.)

If magnetic tape in a roll is heated to the following approximate temperatures and then cooled, the indicated effects would be noted: 250°F.—distortion of backing; 320°F.—softening of both backing and binder, and consequent cementing together of adjacent layers of tape; 500°F. to 600°F.—darkening and embrittlement of backing and binder; self-ignition temperature—charring of backing and binder. When charring occurs, you can't unwind the tape because it flakes in hand. Since tape is a poor conductor, the inner wraps of a roll will remain below destruction temperature a longer time than the outer wraps.

The magnetic oxide, if it reaches a sufficiently high temperature, called its Curie point, will lose all its magnetic properties. Such a loss of magnetic properties is not a problem in practice because the backing of the tape would melt long before the tape reached the Curie point of its oxide.

Minimizing Damage

Winding and storing magnetic tape properly lessens the possibility of damage in the event of fire. A firm stack, an even wind with no

tape edges protruding, will keep air away from the tape, thus not supporting any combustion that might occur.

Various accessories, such as a leader on a reel of tape, tend to protect the tape from the radiant effect of heat. The more solid the flange area of the reel, the greater the protection afforded the tape. The neoprene ring on the hub of the "SCOTCH" BRAND precision reel guards tape against expansion stresses caused by heat.

Polyester based tapes are less combustible than those with a cellulose acetate base. Certain metals such as magnesium can burn, while aluminum does not; therefore, reels made of aluminum cannot support combustion. Storing tape in a plastic case, such as the "SCOTCH" BRAND Seal Tite case, is safer than storing it in its cardboard carton, while storing it in a metal container is the safest method of all. In fact, if you are seriously worried about the possibility of fire, you should consider storing magnetic tape in metal containers.

We recommend the CO₂-type fire extinguisher for combating burning magnetic tape. Since CO₂ is clean, there is no water damage to tape this way. Water can cause swelling of cellulose acetate.

Carefully rewinding fire-damaged tape at minimum tension will often restore the tape so that information on it can be transferred to another reel of tape.

Preventing Fire

To prevent fire involving magnetic tape, store tape in a non-combustible area and make sure that no combustible materials are stored in the vicinity. An example of a "non-combustible area" would be a room with metal shelves and sheet metal walls. For maximum fire security, store magnetic tape in a fire-proof vault.