Field Strength for Partial Erasure of Magnetic Tape

Derived from a report by Jay McKnight
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The question has been raised: “What field strength is required to erase a tape partially?”.

I cannot find a definitive answer in the literature, and most of the papers at all related give data in terms of the current in an unknown head or solenoid. Therefore the following represent the best speculations and interpolations.

1. Daniel and Eldridge [1] say (pg 106) “A field of at least 4 kA/m is required to produce a noticeable effect on conventional media, and a field in excess of 20 kA/m may be required to cause a substantial degree of erasure. A small, alternating field of about 1.6 kA/m may, however, promote short-wavelength demagnetization.” (Tape coercivity is 20- to 25 kA/m. Earth's field is 40 A/m. H in oersteds times 80 corresponds to H in A/m.)

2. From M_r-H loops [2], the first sign of remanent flux appears when the field strength is about 8 kA/m (Figs 1 and 2). From Preisach diagrams [3, Fig 6] [4, Figs 3a and 4a], the field strength for the distribution function to be 10 % of the maximum value is about 10 kA/m.

3. From erasure graphs [5], and calculations of the fields deep in the gap of the heads (from given head parameters), it appears from (Fig 8) that the first sign of erasure of a 180 µm wavelength occurs when the peak field deep in the gap of the head is about 10 kA/m. This same field (Fig 7) produces 10 dB of erasure at a 20 µm wavelength. This is apparently because the field from the gap is non-uniform, being greatest at the face of the head, corresponding to the surface of the tape--where all of the usable flux is recorded. References [6] and [7] show that a uniform field produced by a solenoid gives similar effects at long and short wavelengths, whereas [5] shows a large wavelength effect with a head. [6] shows the same effect.

Report [8] shows that the erasing field which first shows sensible erasure at short wavelengths is about 40 % of that for long wavelengths, or an estimated 4 kA/m.

FIELD STRENGTH MEASUREMENT

A simple method of measuring a uniform ac field with a search coil and an ac voltmeter is described in IEC Standard 60268-1 [9], Sec. 12.2 and Fig. 4. The coil has an inside diameter of 20 mm, an outside diameter of 33 mm, and a width of 16.5 mm. It is wound with 130 µm diameter enameled copper wire. For measuring a 50 Hz field, use 4500 turns on the coil; for measuring a 60 Hz field, use 3750 turns.

The sensitivity is: 1 A/m field strength produces an emf from the coil of 1 mV. (The voltage is proportional to both the magnetic field strength and the frequency.)

For uniform dc fields, comparatively inexpensive magnetometers ("gaussmeters") are available from R.B. Annis Co., Inc. , 1101 N. Delaware St., Indianapolis, IN 46202 , Voice: (317) 637-9282 , Fax: (317) 637-9282 .

CONCLUSIONS

1. A field greater than 10 kA/m is certainly going to cause noticeable erasure.

2. A uniform field less than 5 kA/m (63 Oe) seems unlikely to cause noticeable erasure at any wavelength.

3. A field from a short-gapped head should be less than 2- to 4 kA/m (25- to 50 Oe) to assure no noticeable erasure at any wavelength.

4. The data that I extrapolate agrees well with Daniel and Eldridge's estimates.

REFERENCES

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[3] K. Fritzsch and Chr. Scholz, “Zur Verwendung des Preisach-Modells in der Magnetspeichertechnik”, *Hochfrequenztechnik u. Elektroakustik 74*, 25...30 (1965 Feb.) (Draft translation, Bertram & McKnight)

[4] J. Struska, “Phenomenological Interpretation of the Print-thru Effect by Means of the Preisach Diagram”, AES Preprint 701 (1969).

[5] J.G. McKnight, “Erasure of Magnetic Tape”, *J Audio Eng Soc 11*, 223...233 (1963 Oct).

[6] E.D. Daniel and P.E. Axon, “Accidental Printing in Magnetic Recording”, *BBC Quarterly 5*, 7...22 (1950-51 winter).

[7] R. Herr and R.A. von Behren, “Selective Erasure of Magnetic Tape Cross-Talk”, *E1ectronics*, 11...12 (1952 Aug.)

[8] J.G. McKnight, “Tape Print-thru Reduction”, *Ampex Research Report 106*, (1957 Nov).

[9] IEC Standard 60268-1 “Sound system equipment, Part 1, General” (2nd Edition, 1985).

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