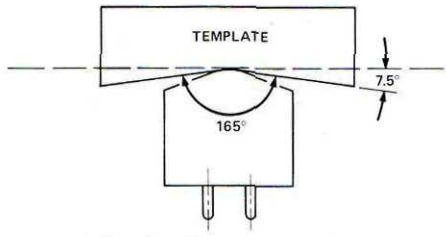

Fig. 4 — Tape wrap angle.

Wear Pattern can be used to verify the actual tape wrap to insure balanced tape wrap on both sides of gap line, and also the Zenith (face parallel to tape guides) which can cause *variation in wrap from top to bottom of contact area. Use* DYKEM™ Sheet Metal Layout Blueing obtainable in Aerosol cans from industrial hardware stores. Spray it on a cotton swab and then apply to the head nose. Then run tape or film across head until the dye is worn off. (Do not use your alignment tape!)

3. HIGH FREQUENCY RESPONSE

The high frequency or short-wavelength response of a playback head is determined by the gap length and also by the type of tape. (This assumes the self-resonant frequency is above the highest needed frequency as discussed in the section on *"Self Resonance".*)

A rule of thumb is that the playback gap should be between 1/10 and 1/4 the wavelength of the highest reproduced frequency. The longer gap of 1/4-wavelength will produce a gap loss of no more than 1 dB at the shortest wavelength. A shorter gap than necessary will gain very little in high frequency response, but will reduce the head sensitivity and degrade the signal-to-noise ratio. Typical recommended gap sizes are 200 micro-inches (200-U) for 15 ips, 100-U for 7.5 ips, 50-U for 3.75 ips, and 50-U for 1.875 ips.

Record gap size is not critical, as recording is done with only the "trailing edge" of the gap. Record-only heads have wider gaps to reduce head inductance and improve flux penetration into the tape oxide. Typical record gaps are 500-U for 1/4-inch tape and 200-U for cassettes.

4. AZIMUTH, GAP AND SPACING LOSSES

The high frequency losses from an improperly azimuthed head are proportional to the wavelength of the signal, the track width of the head, and angle of mis-azimuth. A wide track head will be much more critical than one with a narrow track. This is one reason the cassette and 8-track systems with their 20-mil tracks can produce such good high frequency response at slow tape speeds.

To calculate gap, azimuth, and spacing losses the curve and formulae below can be used:

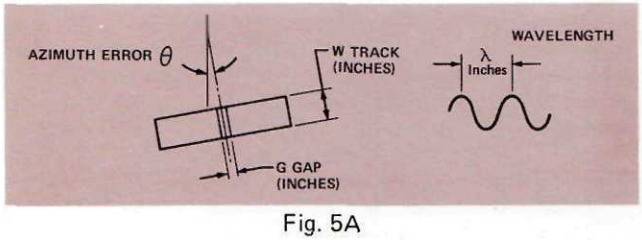

Fig. 5A

CALCULATED GAP LOSSES AT 1-7/8 IPS TAPE SPEED

Gap	1 kHz	5 kHz	10 kHz	15 kHz
100-U	–.1 dB	–1.2 dB	–4.5 dB	–13 dB
80-U	0	–.8 dB	–2.5 dB	–7 dB
50-U	0	–.5 dB	–1.2 dB	–2.5 dB
40-U	0	–.4 dB	–1.0 dB	–1.8 dB

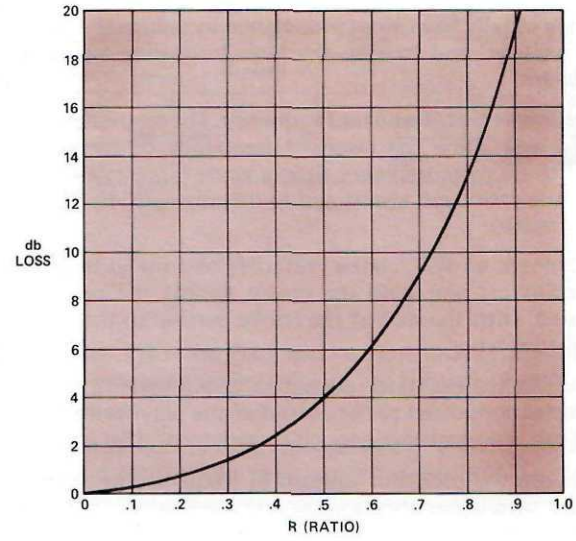

Fig. 5B

1. Gap Loss Calculation:

$R = \frac{G}{\lambda}$ $\lambda = \frac{IPS}{HZ}$ Wavelength

"What is the playback gap which gives a 3 dB loss at 10 kHz at a tape speed of 3.75 ips?"

R = .44 (from graph at 3 dB)

$\lambda = \frac{3.75}{10{,}000}$ = .000375 In.

G = R λ = .44 λ = .000165 In. (165 micro-in.)

2. Azimuth Loss Calculation:

$R = \frac{W \tan \theta}{\lambda}$

"What is the azimuth misalignment which will give a 5 dB loss at 5 kHz at 1 ips with track width of .020?"

R = .55 *(from graph at 5 dB)*

$\lambda = \frac{1}{5000}$ = .0002 In.

$\tan \theta = \frac{\lambda R}{W} = \frac{.0002 \times .55}{.020}$ = .0055

θ = 19 MIN

3. Spacing Loss Calculation:

Spacing loss in db = $20 \log_{10} \left(e - \frac{2\pi d}{\lambda}\right) = 54.6 \frac{d}{\lambda}$

where d = spacing between gap and tape

λ = wavelength

"What is the playback signal loss in dB on an application with .0001 in. space between gap and tape on a 5 kHz signal at 3.75 ips?"

wavelength $\lambda = \frac{3.75}{5000}$ = .00075

dB loss = 54.6 $\frac{.0001}{.00075}$ = 7.3 dB

5. SELF-RESONANT FREQUENCY

It is very important, for a playback head, to choose a head inductance which, in association with its own distributed capacitance and shunt circuit capacitance, will result in a resonant frequency equal to, or above the maximum playback frequency. Typical top frequencies for various playback head inductances are 15 kHz for 800 mHy, 25 kHz for 200 mHy, 35 kHz for 100 mHy, and 80 kHz for 20 mHy. This is particularly critical for the Master Playback Head on a high speed duplicator where the play frequencies may run 8 or 16 times normal. Record heads are not such a problem,