Technical Details on the Family of
AMPEX STUDIO MASTERING TAPES

Ampex
Low Noise/High Output
406/407 SERIES

Performance-proven daily in studios throughout the world. Available in 1.0 and 1.5 mil durable polyester base films. Backcoated to improve mechanical handling at all play/rewind speeds, and to eliminate electrostatic pick up of contaminating particles. The electromagnetic oxide system has been designed to meet the stringent studio requirements for high signal-to-noise ratio, low distortion and high saturation capability. The oxide binder system has been engineered to meet the high number of passes required during mix down. Ampex 406/407 mastering tapes are rapidly becoming the standard in the mastering industry.

Ampex "Super Tape"
GRAND MASTER™
SERIES

A product of Ampex research. Provides electromagnetic performance properties previously unattainable.

- Identical bias requirement as Ampex 406 tape
- Higher output
- Lower distortion
- Greater saturation capability
- A new standard in sound reproduction

Manufactured on durable polyester base film, with high conductivity backcoating for improved mechanical handling at all play/rewind speeds and for elimination of electrostatic pickup of contaminating particles. Ampex Grand Master is the tape to use in recording sessions requiring the ultimate in sound reproduction.

Technical details on these Ampex studio mastering tapes are provided on the following pages, and include a table of electromagnetic and physical properties, graphs illustrating electrical performance characteristics, and a description of the test methods used.

AMPEX

AMPEX 406/407 SERIES AND GRAND MASTER™ STUDIO MASTERING TAPES

Technical Details

Electromagnetic, Magnetic and Physical Properties

	Test Note	Units	406/407		Grand Master
Electromagnetic Properties					
Recommended Bias Setting, ΔE_{10}	1	dB	3.0		3.0
Sensitivity at 1 KHz	2	dB	+0.8		+2.0
Sensitivity at 10 KHz	2	dB	+1.5		+4.0
Third Harmonic Distortion at Reference Level (1 KHz)	3	%	0.3		0.1
Output Level at 3% Third Harmonic Distortion (1 KHz)	4	dB	+8.8		+12.3
Weighted Signal-To-Noise Ratio					
a. related to reference level	5	dB	63		64.3
b. related to output level at 3% third harmonic distortion	5	dB	71.8		76.6
Modulation Noise Ratio	6	db	54.5		52.5
Intermodulation Distortion	7	%	1.5		1.0
Print-through	8	dB	58/57		55.0
Magnetic Properties					
Coercivity (Hci)	9	Oe	290		295
Retentivity (Brs)	9	Gs	1150		1400
Physical Properties			**406**	**407**	
Thickness: Oxide Coating	10	mils	0.50	0.50	0.50
Base	10	mils	1.42	0.88	1.42
Backcoating	10	mils	0.05	0.05	0.05
Total	**10**	**mils**	**1.97**	**1.43**	**1.97**
Tensile: Yield Strength	11	lbs/qtr in.	5.7	3.8	5.7
Breaking Strength	12	lbs/qtr in.	11.2	7.9	11.2
Backcoating Resistivity	13	ohms/sq	5×10^4		5×10^4
Measuring Conditions					
Tape Speed		ips	15		
Reference Level		nWb/m	260		
Record Head: Gap Length		mils	0.25		
Track Width		mils	0.70		
Reproduce Head: Gap Length		mils	0.25		
Track Width		mils	0.70		
Reproduce Equalization		us	50 + 3180		
Record Equalization			none		

Test Notes and Definitions

1. Recommended Bias Setting ΔE_{10} is determined by adjusting the bias current for maximum sensitivity at 10 kHz; then increasing the bias until the sensitivity changes by the amount $\Delta E_{10} = 3.0$ dB. The adjustment is made with a constant input voltage at approximately 10 dB below reference level. The recommended bias setting corresponds to low third harmonic distortion and high output at 1 kHz.

2. Sensitivity is a measure of the output level compared to a standard reference tape (MTDED 315-2) when the recording is made at a constant input voltage approximately 10 dB below reference level and at the recommended bias setting.

3. Third Harmonic Distortion is the ratio between the level of the third order harmonic and the fundamental frequency (1 kHz) expressed in percent when recorded at reference level and at the recommended bias setting.

4. Output Level at 3% Third Harmonic Distortion is a measure of the output level capabilities of a tape at 1 kHz when recorded at 3% third harmonic distortion and at the recommended bias setting.

5. Weighted Signal-To-Noise Ratio is defined as the ratio in dB between the 1 kHz output at reference level or at 3% third harmonic distortion and the ASA weighted (NAB standard) noise level. The noise measurement is made with the recommended bias and without input signal.

6. Modulation Noise Ratio is defined as the ratio in dB between the 1 kHz output at reference level and a DC noise level. The DC noise level is determined by recording the recommended bias and a DC current equal to the rms value of the audio current at reference level. The measurement is made with a 250 Hz high-pass filter specified in WT-001572 (federal specification).

7. Intermodulation Distortion is a measure of non-linearity characterized by the appearance of frequencies in the output equal to the sums and differences of integral multiples of the component frequencies present in the input signal. The measurement employs a 4:1 (SMPTE) low frequency to high frequency voltage ratio. The recording is made at reference level and at the recommended bias setting.

8. Print-through is the level of the accidental printing effect due to a signal recorded on an adjacent layer of tape. The printing signal is recorded at 1 kHz at reference level and the tape is held at 70°F for 24 hours.

9. Coercivity and Retentivity Coercivity is the magnetic field required to reduce the magnetization of a saturated magnetic specimen to zero. The coercivity is a direct measure of the bias current requirement of a tape.

Retentivity is the maximum remanent magnetization possible in a magnetic material. The long wavelength saturated output is directly proportional to the retentivity.

Coercivity and retentivity values are obtained from a 60 Hz B-H loop tester with 1000 Oersted field calibrated to that maintained by the National Bureau of Standards.

10. Thickness measurements are made on a Pratt and Whitney Sigmatic mechanical comparator.

11. Yield Strength is defined as that force which produces 2% elongation of the samples. The measurement is made on an Instron tensile tester at a jaw separation of 5 inches and a crosshead speed of 2 inches per minute.

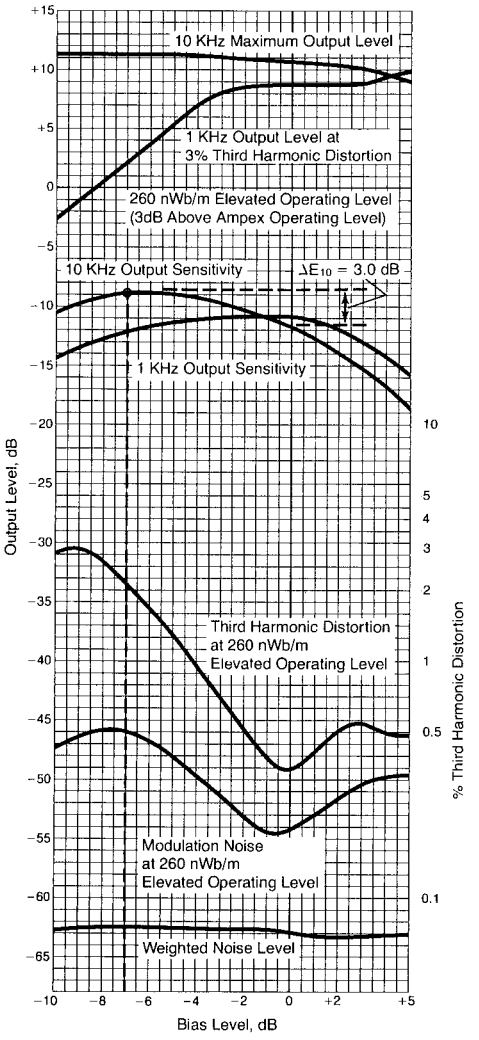
12. Breaking Strength is the ultimate tensile strength indicating the force at which the tape breaks and is measured on an Instron tensile tester at a jaw separation of 5 inches and a crosshead speed of 2 inches per minute.

13. Backcoating Resistivity relates to the tendency of magnetic tape to retain static charges. A resistivity value of 5×10^4 ohms per square is sufficiently low to prevent static buildup which might result in tape damage on high speed bin loop duplicating systems or in normal use at low humidity conditions.

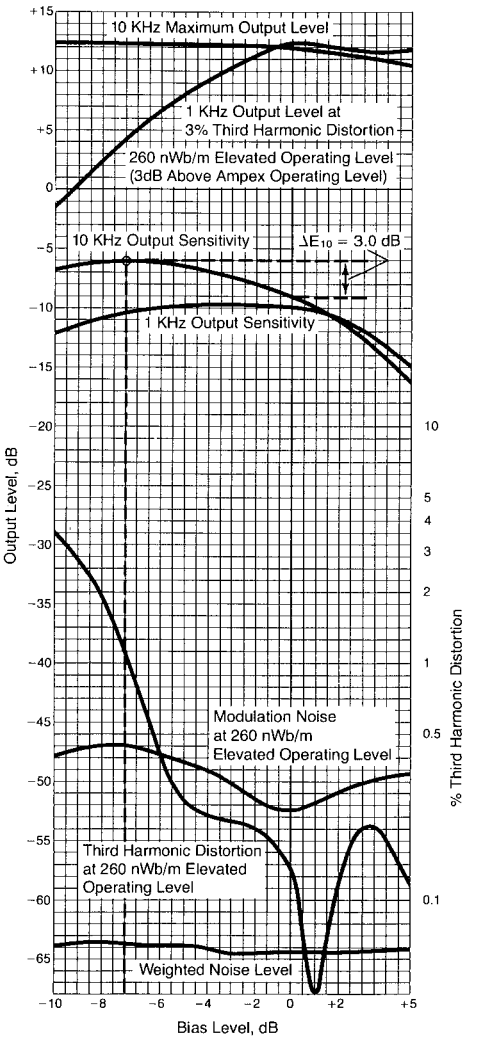
Electrical Performance Characteristics

Effect of Bias On Recording Parameters

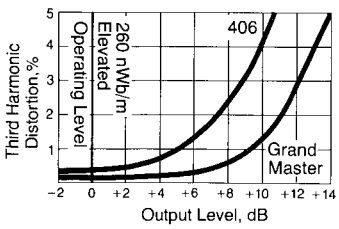
406/407



Grand Master

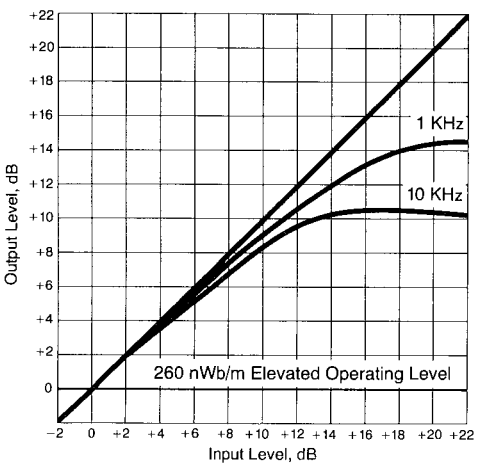


Distortion vs. Output

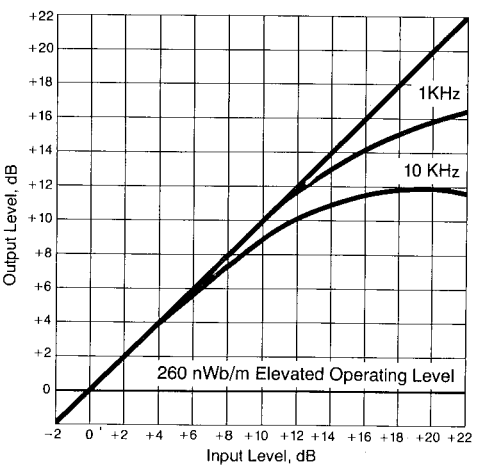


Input-Output Characteristics

406/407



Grand Master



Optimization Table

	Maximum Signal-to-Noise Ratio		Maximum Headroom	
	406/407	Grand Master	406/407	Grand Master
Overbias at 10KHz, 1 mil gap	1.0	1.0	1.0	1.0
1/2 mil gap	2.5	2.5	2.5	2.5
1/4 mil gap	3.0	3.0	3.0	3.0
Adjusted Operating Level	+3.0	+6.0	0.0	+3.0

Optimizing Your Recorder for Ampex Mastering Tapes

This optimization table shows the suggested settings which will enable you to obtain either the full signal-to-noise improvement or the increased headroom available from the tape. Values in this table are expressed in decibels (dB).

Optimizing to obtain full signal-to-noise improvement is done by increasing the level recorded on the tape the maximum consistent with its better distortion properties.

Optimizing for increased headroom utilizes a more conservative record level to achieve a low distortion and provide increased capability for handling peak levels without reaching saturation.

Setting the Bias

The optimum bias setting is made at 15 ips using a 10 kHz input signal at approximately 0 dB. Adjust bias current until the output is maximum. Then increase the bias until the output level has dropped the amount indicated in the table. The shorter the gap length of the record head, the more overbias is required. For example, the Ampex AG-440 and MM-1000 have 1/2 mil record head gaps so 2.5 dB overbias is required for optimum performance. The Ampex MM-1100 has a 1/4 mil gap length and requires 3.0 dB overbias. The AG-350 and early MM-1000's had 1 mil gaps and need only 1.0 dB overbias.

Setting Operating Level

The adjusted operating level is established by playing the Ampex alignment tape (operating level section 185 nWb/meter) and resetting the reproduce gain so that the volume indicator (VU meter) reads less than zero dB by the amount indicated on the table. For example: if a recording level of +3.0 dB is required, the reproduce gain should be set to play back the standard Ampex operating level at −3.0 dB on the VU meter. This insures that, if normal recording practices are followed, all levels will be recorded 3.0 dB higher than they would have been before the adjustment.

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