



**Audio
Test
Tape**

AMPEX

Audio Test Tape

INTRODUCTION

Ampex Corporation produces a number of standard alignment and reference test tapes of which this is one. These tapes are carefully prepared under laboratory conditions for use in the measurement of certain parameters of magnetic tape recorders. A basic understanding of the proper use of these "tools" is essential if their full capability is to be realized. In laboratory and maintenance operations, it is necessary to measure frequency response, distortion, record and playback level and flutter of the tape recording equipment under test. This booklet describes the nature and use of the various test tapes offered by Ampex.

REPRODUCE ALIGNMENT TAPES

Reproduce alignment tapes are available in various speeds, tape widths and curves. As the name suggests, these tapes can be used to adjust reproduce head alignment, equalization and level. In checking any magnetic tape recorder, the reproduce channel (i.e., the playback amplifier and head) should first be adjusted to the desired standard. The reproduce alignment tape has been recorded on accurate equipment, whose record current versus frequency was adjusted to produce flat playback response when reproduced with a theoretically "ideal" playback head and

amplifier with correct complementary curve. In practice, small variations from the ideal are to be expected even when using these tapes on the best professional equipment.

Each reproduce alignment tape contains a high-frequency tone for adjusting the azimuth of the playback head gap. Since the test tape is made with the record head gap perpendicular to the longitudinal axis of the tape, the playback head of the machine under test must be adjusted slowly to obtain maximum output while playing the test tape's azimuth adjustment tone. Care should be taken to insure that the highest peak is found, as some heads will indicate one or two lesser "false peaks" which do not reflect the correct azimuth adjustment.

The next step is to set the "reference" level tone to the proper output level as indicated on the measurement equipment in use. Also, care must be taken to insure that the reproduce amplifier output is properly terminated. The recommended load for a specific recorder may be found by consulting the manual accompanying the instrument. High-quality AC voltmeters with high impedance inputs should be employed for maximum accuracy. The proper load resistor may be shunted across the meter inputs. It is good practice to first set the gain control on the recorder to give normal output level from the operating level on the tape. The reason for this is that certain tape machines are frequency discriminatory at various volume control settings.

Once the reference level tone is noted, the remaining tones may be reproduced and measured with the voltmeter. If the response is not uniform, the heads should be checked for accumulated tape oxide or foreign matter. If the check indicates the heads are clean, the high-frequency playback equalizer should be adjusted, if possible, to correct the non-uniform response. After any equalization adjustment, the reference level tone should be again checked to insure that it is at the same level.

In the day-to-day checking of professional recorders, the playback level control may be advanced to secure a convenient reference reading on the machine's own VU meter, thus making the use of external test equipment unnecessary. Further, for the sake of convenience, all Ampex 15 and 30 in/s reproduce alignment tapes are recorded **AT OPERATING LEVEL**.

When using 3.75 and 7.5 in/s alignment tapes, care must be taken to return the level control to the proper position after making the frequency response measurement. This is accomplished by playing the operating level tone and setting the level control to give a reading of zero on the VU meter.

The 15- and 30-in/s reproduce alignment tapes contain the following information in sequence:

1. A 700-Hz tone at operating level for reproduce gain calibration and reference.
2. A 15-kHz tone at operating level for reproduce head alignment.
3. A series of tones (12 kHz, 10 kHz, 7.5 kHz, 5 kHz, 2.5 kHz, 1 kHz, 500 Hz, 250 Hz, 100 Hz, 50 Hz and 30 Hz) at operating level for reproduce frequency response measurements.

The 7.5-in/s reproduce alignment tapes contain the following information in sequence:

1. A 700-Hz tone at 10 dB below operating level for reference.
2. A 15-kHz tone at 10 dB below operating level for reproduce head alignment.
3. A series of tones (12 kHz, 10 kHz, 7.5 kHz, 5 kHz, 2.5 kHz, 1 kHz, 500 Hz, 250 Hz, 100 Hz and 50 Hz) at 10 dB below operating level for reproduce frequency response measurements.
4. A 700-Hz tone at operating level for reproduce gain calibration.

The 3.75-in/s reproduce alignment tapes contain the following information in sequence:

1. A 500-Hz tone at 10 dB below operating level for reference.
2. A 7.5-kHz tone at 10 dB below operating level for reproduce head alignment.
3. A series of tones (5 kHz, 2.5 kHz, 1 kHz, 500 Hz, 250 Hz, 100 Hz and 50 Hz) at 10 dB below operating level for reproduce frequency response measurements.
4. A 500-Hz tone at operating level for reproduce gain calibration.

Record Adjustments

The machine is now ready for overall response and distortion checks. The methods to be employed are usually described in the manual for the specific tape machine. The following conditions, however, are common for all biased tape recorders and should be kept in mind:

1. Proper bias is dependent on tape characteristics; i.e., one bias setting will not necessarily be right for all brands of tape, or even for different types of the same brand. For critical work, it is advisable to standardize on one brand/one type and adjust the machine to it.
2. Noise and distortion are dependent upon the amount of bias current, the quality of the bias signal's wave form and the bias frequency.

It is well to follow the manufacturer's recommended procedure for checking overall frequency response.

By special techniques, we have recorded the reproduce alignment tapes at a high level to improve the convenience for the user. Usually, it will be necessary to record the frequency response test at a lower level than that employed in the making of the Ampex test tapes. Too high a level in recording will result in saturation of the tape at high frequencies with faulty readings as a result.

FLUTTER TEST TAPES

Another group of test tapes available from Ampex are Flutter Tapes. These are recorded on a highly refined special tape transport, and contain a 3000-Hz or a 3150-Hz tone recorded approximately 2 dB above standard operating level.

These tapes can be played on the machine under test, and the flutter reading taken on a suitable flutter meter. It is necessary to play the tape at the indicated speed because most flutter meters must receive a specific tone to operate properly. Flutter on these tapes is in the order of 0.03% rms (unweighted) in the frequency range of 0.5 to 250 Hz.

LEVEL SET TAPES

The third group of tapes, the Level Set Tapes, are recorded at the standard magnetic flux level accepted as the operating level within the industry. This level results in approximately 1% total harmonic distortion. The tapes are of sufficient length to make system level-set operations convenient. The single tone of 700 Hz will allow complete level calibration adjustments of complex recording chains such as are found in large recording and broadcasting installations.

CARE OF TEST TAPES

Tape intended for repeated use in standardization work must be properly cared for if the tape's usefulness is to be maintained. Physical deformation of the tape can be a serious problem. Edge damage can cause uneven tracking with constantly changing relative azimuth. For this reason, care should be taken to insure that the tape is smoothly wound under moderate tension and evenly spaced between the reel flanges. Contact of the tape pack with the reel flanges may result in irreparable edge damage, particularly if stored in this manner for long periods of time.

Magnetized heads and tape guides can cause serious short-wavelength signal loss in recorded tapes. It is good practice to demagnetize them frequently. Magnetic fields from motors, magnets, power lines, etc., can also be detrimental. Efforts should be made to store tapes in areas free of such fields and extremes in temperature and humidity, particularly temperature cycling. When a reproduce alignment tape is used for continuous checkout purposes, such as in production line work, age and wear become sources of trouble. Decreases of 2 dB at short wavelengths have been observed under such conditions. Of course, this amount may not be apparent in tapes with program material, but tapes used for critical adjustment should be periodically checked against a "standard" to insure that little change has taken place.

Production practice at Ampex has shown that each tape must be made individually. Each tape is a master; it is not a dubbing. Of course, the voice is dubbed, but the test signals are supplied directly to the record amplifier from a specially constructed programmable tone generator.

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Ampex Corporation, Audio-Video Systems Division
401 Broadway
Redwood City, California 94063