Tape-Recorder Maintenance Program

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Whether your recorder is operated 4 to 8 hours a day, as is the author's, or less frequently, a regular program of care and maintenance will go far in assuring you top-notch recorded tapes.

IF YOUR tape recordings are plagued by poor frequency response, excessive flutter or wow, or a noticeable slow-down in tape speed toward the end of the reel, and your tape recorder is a good one, then you may not be keeping the recorder in top operating condition. A preventive-maintenance program will go far in keeping the performance high. Let's take a look at some of the problems and see how they can affect the performance of your tape recorder.

The Main Problems

Poor Frequency Response: This results in a "down-in-the-barrel" sound or loss of presence. Since the playback head is an electromagnet with a very narrow gap width, it is extremely sensitive to iron-oxide deposits. Only a few grains of iron-oxide rub-off from one of the tapes can effectively short out the higher frequencies.

A second cause of high-frequency loss can be traced to magnetized heads and tape guides. After running several miles of recorded tape through the recorder, all of the metal surfaces which come in contact with the tape become partially magnetized. When this happens, the magnetized surfaces actually erase the higher frequencies on pre-recorded tapes. A magnetized playback head also results in increased background noise level, which is particularly annoying during the lower passages of classical music.

The third major reason for poor frequency response is improper azimuth head alignment. Unless the playback and record heads are perfectly aligned, the higher frequencies will be greatly attenuated. Azimuth alignment should be performed periodically to compensate for uneven head wear and other factors which may have caused the heads to become slightly out of alignment.

Flutter and Wow: These are undesirable variations which occur in the pitch of sound, particularly noticeable in musical tapes. This type of distortion is generated by unsteady tape movement across the heads due to slippage somewhere between the drive motor and the tape. Generally this is caused by an oily drive belt, a dirty or misadjusted capstan pressure roller, dirty pressure pads, or other factors which produce excessive hold-back tension.

Tape Speed Slow-Down: Tape speed slow-down toward the end of a tape is a fairly common problem. As the amount of tape on the supply reel decreases, the hold-back tension increases. Any tendency to slippage between the capstan roller and the tape shows up at this point on the tape. The problem is aggravated if thin tape (one mil) is being used.

Preventive-Maintenance Program

Let's see what can be done to keep the recorder in top operating condition. First of all, use only good-quality tape. Avoid tapes which are noticeably deteriorating or improperly lubricated. Second, set up a preventive-maintenance program such as the one to be described.

Daily Cleaning Schedule: The tape guides, pressure pads, and pressure roller should be cleaned daily with isopropyl or denatured alcohol. The heads should also be scrubbed at this time with a special head cleaner solution, such as the *Ampex* 4010823 head cleaner. To prevent accidental damage to the heads, use a non-metallic cotton swab such as a "Q Tip" and discard after use to prevent contamination of the cleaning solution remaining in the container. When using head-cleaner solutions, avoid spilling the solution on any of the plastic surfaces as damage may result.

Weekly Demagnetization: Approximately once a week, the capstan, tape guides, and record and playback heads should be demagnetized, using a standard head demagnetizer. Proper demagnetization involves bringing the tip of the demagnetizer in slowly to the head gaps and gently moving it up and down the head gaps. Then slowly remove the demagnetizer to at least three feet away before turning off the power. The same demagnetization procedure should be followed for each of the metallic surfaces which come in contact with the tape during normal operation.

Semi-annual Check and Alignment: Approximately every six months the tape recorder should undergo a complete checkup. The record and playback heads should be aligned, the tape speed checked, record bias adjusted, and a complete record and playback frequency test performed. In addition, the six-month checkup should include a thorough cleaning of the interior of the recorder with denatured alcohol. Make certain the drive belts, idler wheel, and flywheel assembly are absolutely free of oil or other forms of contamination. Check the belts for signs of wear (replace if stretched or cracked). Oil the machine lightly according

to the instruction manual which accompanies the recorder. Avoid over-oiling as the excess oil may collect on the drive belts or other critical points.

Tests and Adjustments

Playback Frequency Test and Azimuth Head Alignment: Before beginning the frequency-response test, carefully clean and demagnetize the heads and tape guides. If the recorder is not equipped with an accurate vu meter, connect a v.t.v.m. or external vu meter to the preamp output jacks.

Play a standard alignment test tape, such as the *Ampex* 01-31321-01, on the recorder. (Alignment tapes are available for full-track, half-track, and quarter-track recorders at 3¾ or 7½ in/s speeds.) Record the output readings.

The first tone on the tape (as identified by a narrator's voice) is a 700-Hz tone used to adjust the playback volume to a convenient and easy-to-read point on the vu meter. Since all of the tones on the test tape are recorded at the same level, the recorder should play back each of the tones on the test tape at the same level as the 700-Hz tone.

The next frequency tone is 15,000 Hz, which is used to adjust the playback head azimuth. With a small screwdriver (or Allen wrench, if this is required) rotate the azimuth screw until the highest possible reading is obtained on the output meter. At this point the playback head is in proper azimuth alignment.

Continue playing the tape through the remainder of the test frequencies. A good recorder will reproduce the entire range of frequencies from 50 to 15,000 Hz at a level of ± 4 dB of the original reference level.

Record Adjustments: After the playback section of the recorder is known to be in satisfactory operating condition, the record section can then be aligned. Never attempt to make any of the record adjustments without first aligning the playback section. Note that all record indications are dependent upon the playback circuitry.

The first step in the record alignment procedure is the selection of a blank tape which represents the type of tape most often used for recording on your machine. If a wide assortment of tapes will be used in recording, the *Scotch* 111 may be used as a standard. The selection of an average tape is important as the optimum record bias setting varies from one brand and type of tape to another. Record bias, in turn, affects the record frequency response.

The next step consists of connecting an audio generator to the line input of the recorder. Use the same vu meter connections as were used in servicing the playback section. You are now ready for the record alignment procedure.

Record Bias Adjustment: Set the audio generator to a frequency of 400 Hz and place the machine in the record position. Set the bias oscillator adjustment to the point which produces a maximum output reading on the vu meter.

Record Head Alignment: Set the generator to a frequency of 10,000 Hz and continue recording on the blank tape. Adjust the record head azimuth or tilt for maximum output on the vu meter. If the recorder has a combination record/playback head, this step can be omitted.

Record Frequency Response Check: Set the generator to a frequency of 700 Hz and adjust the record output level to the same point on the vu meter as was selected earlier for the playback frequency test. Note the audio generator level and hold it at that level throughout the record frequency test. Go through the same audio frequencies as were contained on the frequency alignment tape. Compare the record output readings with those obtained in the playback frequency response test. The record and playback readings should be within 2 dB of each other.

Recorder Speed Test: For best performance using pre-recorded tapes, the machine should be within 2% of standard speed. Improper speed alters the pitch of the recorded sound.

In order to test the speed of the recorder, construct a timing tape by accurately measuring off a 150-foot length of tape and marking the beginning and end points with white leader tape.

Set the recorder to a speed of 7½ in/s and carefully time how long it takes to play the tape. An elapsed time of less than four minutes indicates your recorder is slightly fast. More than four minutes reveals a slower-than-normal tape speed.

The following formula can be used to determine the exact percentage of error at 7½ in/s:

$$\%\ of\ speed\ error = \frac{No.\ of\ seconds\ slow\ or\ fast}{240} \times 100$$

At 3¾ in/s, it should take exactly eight minutes to play the timing tape. To determine the percentage of error, substitute 480 for 240 and use the above formula.

An error of 2% or less indicates the recorder is in satisfactory operating condition.

The maintenance schedule described in this article is based on a recorder being operated from four to eight hours daily. This schedule can be scaled up or down proportionally depending on the amount of use. A good maintenance program can keep your recorder operating at peak performance and greatly extend its useful life. ▲