SMPTE RECOMMENDED PRACTICE

Use and Care of Sound Test Films

1 Scope

1.1 This recommended practice describes the proper method for use of sound test films, the reliability of the conclusions to be drawn from their output, the precautions necessary for reasonable accuracy, and the proper storage for preservation of calibration.

1.2 This recommended practice is intended to apply to all sound test films, some of which bear a photographic recording and some a magnetic recording.

2 Preparation for reproduction

2.1 Prior to running a test film, it is desirable to make the following checks on the transport:

2.1.1 The transport should be clean, particularly at all film contact points of the film path and its associated devices, and at any optical or magnetic scanning point.

2.1.2 The mechanical alignment should be checked so that the film is properly transported and guided, and so that distortions of the web do not occur.

2.1.3 Proper supply and take-up reels should be provided, true and undamaged, free from burrs and other defects, properly aligned and seated on their spindles, and with the largest practical hub diameter, in all cases at least equal to the minimum recommended for the test film.

2.2 Prior to running any magnetic test film, the magnetic heads should be demagnetized. The entire film path should be checked for residual magnetism and demagnetized as needed.

2.3 Each test film should be examined for possible physical distortion at the time of use. If distorted, its reliability is questionable.

2.4 Each test film should be examined for dirt and, if obvious, should be cleaned before use. A photographic test film can be cleaned with any good motion-picture film cleaner. A magnetic test film can be cleaned only with a magnetic tape cleaner.

2.5 Sound test films should be run in the sequence recommended herein for the initial setup of a machine. A test film presupposes that the prior adjustments have been verified, and that the results may not conform to the intent of the calibration if this is not valid.

2.5.1 Proper widthwise alignment of the scanning beam or magnetic gap

2.5.2 Azimuth coincidence

2.5.3 Flutter

2.5.4 Amplifier gain adjustment for individual tracks and amplifier gain adjustment and balance for multiple tracks

2.5.5 Frequency response

3 Accuracy of test films

3.1 Quantitative test films are intended to be evaluated on reproduction by objective instruments whose readings provide a figure of merit by which equipment performance can be described and rated. If adjustment of performance is intended to follow evaluation, the readings from the reproduction of quantitative test films

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indicate the magnitude of such adjustments or corrections.

3.2 Test films in manufacture usually are calibrated to a level of accuracy higher than that common to the equipment they are intended to check.

3.2.1 Test film transports with associated equipment and instrumentation are of laboratory-reference quality.

3.2.2 The calibration limits of test films when released are shown in the appropriate standard or parent document.

3.3 Test films generally are reproduced and used for the evaluation of equipment that is of commercial quality.

3.4 Test films in the field and evaluated by reproduction in the overall system may appear to have greater variability or uncertainty than the initial calibration shows.

3.4.1 Although test films are made as precisely as possible, there are uncertainties in measurement that limit accuracy of performance in the field. Some equipment even may indicate relative differences among test films that appeared identical on the more precisely defined calibration equipment.

3.4.2 The limits of repeatability of a test film run on one system at various times, or on several systems consecutively, cannot be predicted quantitatively without careful study. These isolated values are also less meaningful than the record of trends recommended in 3.5. Frequently, the observed "normal" variability is about twice the specified limits of accuracy in the original calibration.

3.4.3 Improper storage and/or the introduction of dirt and physical defects will further increase the probable error.

3.5 Equipment performance trends measured by test films are frequently more significant than individual readings, and become essential if close control is required.

3.5.1 It is recommended that for each piece of equipment to be examined, a chart or table be kept of the results obtained at each pass of a particular test film. The test film serial number, the date and time, and the conditions of the run should be noted. This definitive record of trends is essential if close control of performance and intelligent maintenance are to be achieved.

3.5.2 When possible, two copies of each test film should be on hand, one used frequently and a second used infrequently and stored in a different location.

3.5.3 The two copies should be reproduced in consecutive playback on some suitable schedule for occasional direct intercomparison.

3.5.4 When the frequently used test film becomes worn out, the less frequently used one should take its place, and a new film introduced into the backup position.

3.5.5 Trends observed in the results from both test films identify equipment problems. Trends observed in the results from only one film indicate test film problems.

3.5.6 The scatter of the data is a measure of the repeatability of measurement under actual operating conditions.

4 Subjective test films

4.1 Certain sound test films are intended for normal listening evaluation rather than for quantitative measurement.

4.2 When the test film contains program material or other selections designed for subjective evaluation to establish whether a system is adequate and pleasing, the reproduction must be in an environment as specified by the instructions. The acoustic characteristics of the listening area must not distort the program material in an unanticipated way, thereby giving a false impression of system performance as it is normally operated.

4.3 When the purpose of reproducing the test film is to alter the response of a system in order to compensate for the deficiencies of the loudspeaker or of the listening environment, it must be recognized that this system no longer can be compared with other systems in any simple manner.

5 Storage of test films

5.1 Two storage requirements can be distinguished: the storage of test films in intermittent use, for periods of a few days to perhaps a month between runnings, and the storage of test films for longer periods (to serve as references and arbiters in examining long-term performance of equipment or films). The basic precautions are the same, but it will be obvious that certain of these precautions should be applied prudently to all storage, and that others become most significant when the storage period is long.

5.2 Preparation of test films for interim storage

5.2.1 Estimate whether the test film has been dried to excessively low humidities such as 10% or lower (by use in a very dry environment, or by subjection to projection in an intense radiant beam, etc.), or whether it has been moistened by excessively high humidities such as 80% or above (as by use in a humid environment, or in a comfort-conditioned area that does not reduce the moisture significantly below the dew point, etc.). If either is the case, allow the film to equilibrate in an environment known to be between 20% and 60% relative humidity, as a very loosely-wound roll with open spaces between all convolutions, for 6 to 16 hours. The film should then be wound as specified in 5.2.4. The rather wide humidity tolerance of film permits the use of a low-cost desk- or home-type indicator for determining relative humidity.

5.2.2 Select a good reel for storage: true, free of defects, and with a hub diameter at least equal to the minimum recommended.

5.2.3 Films in storage should be wound tail out. If the take-up reel used in normal operation is not suitable for storage, two rewindings will be necessary to put the film in preferred configuration.

5.2.4 Wind the film onto the reel so that the roll is firm but not rigid, and such that the alignment of convolutions is good and the sidewall of the wound roll does not show protruding convolutions. Fasten the outside end of the film in place with a nonbleeding, pressure-sensitive tape.

5.2.5 Enclose the film in a metal or impermeable plastic can. If storage is to be for more than one or two weeks, tape the can closure.

5.2.6 The film should be rewound immediately before use to put it in head-out orientation.

5.3 Protection of film during interim storage

5.3.1 Test films should be stored where the temperature will not go above 80°F (27°C). Lower temperatures are preferred.

5.3.1.1 If test films are stored below 60°F (16°C), the film should be allowed to warm up in the unopened can until it has substantially reached the temperature of the test area.

5.3.2 All test films in an unsealed container should be protected from exposure to acidic, corrosive, or reactive gases or vapors.

5.3.3 Magnetic test films should be stored as far as possible from magnetic fields associated with motors, transformers, etc., and never closer than five feet to such equipment. Fields not in excess of four times the earth's magnetic field may be assumed safe even for extended storage.

5.4 Preparation of test films for extended storage

5.4.1 The equilibrium relative humidity of the test film during storage should be as follows (see clause 9 (a)):

5.4.1.1 Cellulose ester base films, 15%-30% relative humidity for dye images, 15%-20% relative humidity for silver images and magnetic films.

5.4.1.2 Polyester base films, 25%-30% relative humidity for dye images, 25%-50% relative humidity for silver images and magnetic films.

5.4.2 The storage temperature should be below 60°F (16°C) , and preferably below 35°F (2°C) for dye images. A storage temperature below 70°F (21°C) is satisfactory for silver images and magnetic films. Film may be safely stored at temperatures below freezing.

5.4.2.1 When test films are removed from low-temperature storage and brought into a room whose dew point is above that of the package, moisture will condense upon the container. The sealed package should be allowed to come essentially to room temperature before opening, to avoid such condensation upon the film. A 16-mm roll in a taped can, set on edge, will warm up from 35°F (2°C) to a safe room temperature in 1-2 hours; a 35-mm roll in 5-7 hours.

6 Protection from physical deformation

6.1 All test films depend for reliable performance upon the film's being straight and true, free of differential size changes that force it out of a coherent plane. Test films when certified have such near perfection. Distortions may be introduced into the film from stresses producing plastic flow, and from the gain or loss of volatile components.

6.2 Physical stresses producing plastic flow

6.2.1 The deformation thresholds for plastic materials such as motion-picture films are greatly dependent upon time. The yield point stress, beyond which nonelastic and irrecoverable deformation occurs, will be nearly as high as the break stress for suddenly applied shock loads, and may be nearly zero for stresses maintained over a period of years. The relative importance of potentially deforming stresses, therefore, depends upon both the magnitude of each stress and the time over which it continues to act.

6.2.2 Misalignment of the film path introduces unbalanced stresses.

6.2.3 Films handled at high tensions over rollers and other components, particularly over relieved rollers, guides, etc., may have the edges stretched to become longer than the mid-line.

6.2.4 Untrue and distorted flanges may pick at the edges of the test film and produce localized stretching.

6.2.5 Films wound to small diameters and held for a time acquire an excessive elongation of the outermost surface with respect to the innermost of each convolution, which in later use transposes to a higher than normal curl level.

6.2.6 Films wound on noncylindrical cores or wound so that the convolutions are not essentially cylindrical, and held for a time, develop localized "sets" that position differently in reproduction.

6.3 Gain or loss of volatile components

6.3.1 The temporary gain or loss of moisture by interchange with the environment will increase or decrease the dimensions of the film correspondingly.

6.3.2 Sustained dimensional differentials, as by the subjecting of a tightly wound roll to a relative humidity gradient such that the exposed edges of the film will condition rapidly while the centerline may require weeks to interchange moisture by diffusion, will induce plastic flow.

6.3.3 The irreversible loss of solvents, plasticizers, and other film constituents will reduce the film dimensions and may induce distortion. Such loss is retarded by storage in sealed containers.

6.4 Films manufactured with internal strains may change dimension and shape on extended storage from the gradual release of such strains.

7 Photographic image stability

Test films in which a photographic image is significant, as in photographic sound test films, should be protected from changes in the optical parameters of the image. The important effects and their control have been described for silver images by J. M. Calhoun and for dye images by P. Z. Adelstein et al (see clause 9). Common factors which may affect image stability are:

(a) Residues of processing chemicals;
(b) Noxious or acidic gases;
(c) Continued exposure to high light levels;
(d) High relative humidity; and
(e) High temperature

8 Magnetic record stability

8.1 Test films in which a magnetic record is significant should be protected from alteration of the magnetic state. The important effects have been described by W. K. Grimwood et al (see clause 9(c)).

8.2 Short wavelength recordings are the most easily altered, and frequency-response test films may show the most significant changes with use.

8.3 Magnetic fields may disrupt recorded information.

8.3.1 Use on a transport with magnetized heads or with bias leakage or with magnetized objects along and in proximity to the film path.

8.3.2 Storage in an area permeated by a significant magnetic field, as in proximity to electrical power equipment facilities (see 5.3.3).

8.4 Excessive mechanical flexture may bring about a reduction in the amplitudes of short wavelength recordings.

8.5 Temperatures in excess of those recommended for protection from physical distortion may also affect the magnetic stability.

8.6 Solvent vapors, and possibly other atmospheric contaminants, may permit a softening and differential flow within the magnetic layer, and thereby alter the magnetic state.

9 References

(a) Adelstein, P. Z., Graham, C. L. and West, L. E. Preservation of motion-picture color films having permanent value. Journal of the SMPTE, vol. 79, November 1970, pp 1011-1018.

(b) Calhoun, J.M. The preservation of motion-picture film. Am Archivist, vol 30, July 1967, pp 517-525.

(c) Grimwood, W. K., Kolb, F. J. Jr., and Carr, D. L. Standardized audio response from magnetically striped motion-picture films. Journal of the SMPTE, vol. 78, June 1969, pp 435-456.