

The New Standard for Weighted Peak Flutter Measurements

There are now international standards that all agree on the correct methods of measuring and reporting flutter characteristics.

THE NEW American National Standard Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment, ANSI S4.3-1972 [1] has several advantages over the old obsolete standard [2]:

1. The ranking of the degradation of sound quality due to flutter, when measured objectively with the weighted peak flutter measurement, will predict fairly well that which would be given by a listening panel judging subjective flutter. (The measurement of flutter content [2] bore little relationship to how a recorder would sound.)

2. The requirements for the measuring equipment, the flutter meter, that are given in the new standard are sufficiently complete so that different equipment built to this standard will not only give the same readings on a calibrating sine wave, but will also give the same readings on a dynamic flutter waveform. (The previous standard [2] gave only general ranges for requirements, and no specific requirements for the dynamic response.)

3. Measurements according to the new standard are identical to those used internationally in IEC Recommendation 386, and CCIR Recommendation 409-2, and to the German standard DIN 45 507 which has been widely used in Europe. This greatly enhances the exchange of information on recorder performance and facilitates sales and purchases of equipment in overseas areas.

The technical background of the new standard has been published elsewhere [3][4], and this paper is a summary of the contents of the standard itself.

SCOPE

"This standard specifies the weighted peak method of measurement for predicting subjective flutter of sound recorders and reproducers for normal audio usage." [1, sec. 1].

DEFINITIONS

"Flutter, wow, drift, and frequency-modulation noise are all forms of distortion caused by undesired frequency modulation introduced into the signal by an irregular motion of the recording medium during the recording." Although

flutter, wow, drift, and frequency-modulation (friction) noise (scrape flutter) are defined, the standard covers only the measurement of weighted peak flutter.

Weighting is defined as "the use of a psychoacoustically determined time response in an objective measuring equipment. This is done in order to obtain indications which better predict the subjective values than would wideband measurement with a meter having either an instantaneous time response or a long-time average or rms response."

Weighted peak flutter is defined as "flutter and wow indicated by the weighted peak flutter measuring equipment specified in IEEE standard 193-1971" [1, sec. 2].

THE FLUTTER METER SPECIFICATION

"The measuring equipment shall consist of a frequency demodulator which produces an output voltage proportional to the relative frequency change ($\Delta f/f$), followed by a weighting filter, a peak rectifier, and an indicator." [1, sec. 5].

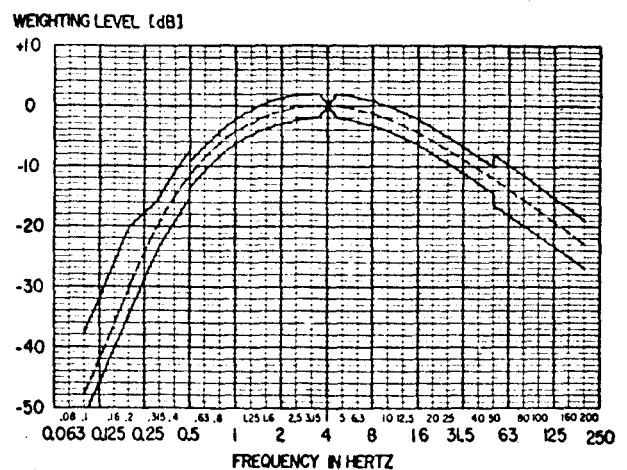


Figure 1. The standard weighting curve.

John G. (Jay) McKnight is (or should be) well known to audio professionals. He is presently engineering vice president of Magnetic Reference Laboratories of Palo Alto, California.

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The test frequency now specified is the "preferred frequency" of 3150 Hz. The response curve of the combination of the demodulator, the weighting filter, and the indicator is to be as shown in FIGURE 1. A peak-to-peak rectifier is used, but the meter is calibrated in the peak value (one half of the peak-to-peak value).

The dynamic characteristics of the flutter meter are specified in terms of the indication for a pulse train of frequency modulation, as shown in FIGURE 2. The pulses have constant amplitude, constant 1-s repetition rate, and adjustable length of 10 to 100 rms. They have the same peak-to-peak amplitude as the 4-Hz sine wave. The flutter meter reading with the sine wave of frequency modulation is taken as reference (100 per cent). Then the relative meter readings are measured for the pulse train of frequency modulation. The flutter meter readings must be as shown below (tolerances are also given in the standard).

Pulse Length	A/[ms]	10	30	60	100
Relative Indication	B/[%]	21	62	90	100

The other dynamic requirement is for the decay time. When the 100-ms pulse is used with a 1-s repetition rate, the decay time of the flutter meter must be such that between the pulses the indicator falls to a reading of from 36 to 44 per cent of the maximum.

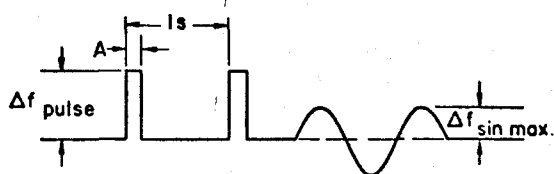


Figure 2. The pulse form for measuring dynamic characteristics.

A number of good engineering practice items are given: the instrument should work with test frequencies between 3000 and 3300 Hz in order to allow use with off-speed recorders or reproducers, and also with both old test records at 3000 Hz and new test records at 3150 Hz. A basic accuracy of at least plus or minus 10 per cent of full scale is suggested. A required input voltage of not more than 100 mV is suggested, and an input impedance of not less than 300 kilohms at 3150 Hz. Finally, provision for connecting external equipment (for example, an oscillograph) with or without the weighting filter is suggested.

AVAILABILITY OF FLUTTER METERS AND TEST RECORDS

Flutter meters which measure weighted peak flutter according to the standard are now available from several manufacturers: BKH; EMT and Woelke (Gotham Audio); Ferrograph; and Mincom Division of 3M (the Mincom instruments were developed by Bahrs Industries, and originally manufactured by Micom, later called DMC). Check with the manufacturers which models measure weighted peak flutter according to ANSI S4.3-1972. Note also that some of these meters have switched positions which allow non-standard measurements such as unweighted peak, or long averaging time—slow—etc. Be sure you know how to set the controls to get the standard weighted peak flutter.

The term *DIN flutter* has been used for weighted peak flutter. While DIN flutter is not incorrect, it is preferable in the USA to reference the American National Standard [1] and the IEC Recommendation 386, rather than the German Industrial Standard (DIN).

Test records with a 3150 Hz signal which may be used for flutter measurements according to the new standard may be obtained, for instance, from the following companies:

Tape records: Ampex Corporation, Redwood City, California; Standard Tape Laboratory, Oakland, California.

16-mm and 35-mm motion picture film records: Standard Tape Laboratory, Oakland, California

Disc records: Gotham Audio Corporation, New York, N.Y.

MEASUREMENT PROCEDURE

"The measurements of normal recording and reproducing systems shall be made on one element only of the system (either the recorder or the reproducer, but not on both) under such conditions that the weighted peak flutter in the remaining parts of the measuring system is negligible.

"When this condition cannot be fulfilled, a recorder/reproducer may be measured by recording a 3150 Hz test frequency and subsequently reproducing this record several times, measuring in each case the total weighted peak flutter and calculating the arithmetic average value of these measurements. Weighted peak flutter shall not be measured while simultaneously recording and reproducing" [1, sec. 3.3].

If, because of random flutter or very low-frequency flutter, the reading varies with time, the maximum value shall be read and reported. Since in most systems conditions vary in such a manner as to give different flutter readings, a choice of reporting forms is given: either report the reading for each condition, or else give the reading the worst combination of factors.

REPORTING RESULTS

Weighted peak flutter should be reported in the following manner:

"Weighted peak flutter of the recorder (reproducer) (recording and reproducing system); \pm ___%" [1, sec. 4].

The sign \pm is used to indicate that the peak rather than peak-to-peak value has been given.

A statement of conditions may also be required; for example, for a tape recorder, the speed and the reel size (minimum hub diameter, maximum outside diameter, etc.).

REFERENCES

1. *American National Standard Method of Measurement for Weighted Peak Flutter of Sound Recording and Reproducing Equipment*, ANSI S4.3-1972, ANSI, 1430 Broadway, New York, N.Y. 10018; price: \$3.00. Also *IEEE Std. 193-1971*, published in *IEEE Trans. Audio & Electroacoust.*, Vol. AU-20, pp. 81-88 (March 1972).
2. *Methods for Determining Flutter Content in Sound Recorders*, IEEE Standard 193-1953 and ANSI Z57.1-1954 (obsolete).
3. *Development of a Standard Measurement to Predict Subjective Flutter*, J. G. McKnight, *IEEE Trans. Audio and Electroacoust.*, vol. AU-20, no. 1 pp. 75-78 (March, 1972).
4. *On Measuring Frequency Variations*, E. Belger, *IEEE Trans. Audio and Electroacoust.*, vol. AU-20, no. 1, pp. 79-80 (March, 1972).