Annex

d.c. and a.c. calibration

(This annex forms an integral part of the standard.)

A.1 Instruction

A.1.1 When using the d.c. method of calibration, it is essential that the combination of phototransducer and amplifier give the same output at 0 Hz or d.c. and the relevant measuring frequency as specified in ISO 6025, and that the combination have a linear voltage versus illumination relationship. If a silicon cell is used as the phototransducer, it shall be connected to a zero input impedance operational amplifier.

A.1.2 When using the a.c. method of calibration, a specially designed shutter wheel finished in non-reflecting black (see figure 3) shall be inserted in the path of the scanning beam. The width of the shutter blades shall be the same as the distance between them, and their dimensions shall be considerably larger than those of the scanning beam at the point of interruption.

A.1.3 The measuring instruments required include a d.c. voltmeter, a peak reading a.c. voltmeter, and an oscilloscope with a d.c. response, connected as shown in figure 4. It is essential to allow the system sufficient time to warm up before any measurements are taken.

A.2 d.c. Calibration

A.2.1 The photoreproducer shall, for constant illumination, have equal electrical peak output at the measuring frequency as specified in ISO 6025 and at 0 Hz.

A.2.2 The combination of the phototransducer and its operational amplifier shall be evaluated for drift and shown to have nominal effect (± 5 %) over the time interval required for measuring.

A.2.3 With no film in the reproducer, measure the maximum photoelectric output (MPO) by comparing the output voltage for direct illumination of the phototransducer by the scanning beam, with the output voltage obtained by complete occulting of the scanning beam, using a d.c. voltmeter.

A.2.4 With the audio-level test film running through the reproducer, measure the peak-to-peak amplitude of the output signal voltage using a peak reading a.c. voltmeter.

A.2.5 Repeat the measurement described in A.2.3 to verify that the drift is within the tolerance specified in A.2.2.

A.2.6 Calculate the photoelectric output factor (POF) using the procedure described in 6.3.

A.3 a.c. Calibration

A.3.1 Provision shall be made on the calibrating reproducer for the scanning beam to be interrupted by a mechanical shutter (see figure 3 and A.1.2), designed so as to give equal on-and-off durations at a nominally constant frequency.

A.3.2 The shutter shall have provision for speed adjustment, so that the frequency of interruption of the scanning beam matches the frequency of the sound record on the audio-level test film (± 5 %).

A.3.3 With no film in the reproducer, and the shutter operating, measure the peak-to-peak amplitude of the output signal voltage using a peak reading a.c. voltmeter. This amplitude reading shall be defined as the maximum photoelectric output (MPO) of the reproducer.

A.3.4 With the audio-level test film running through the reproducer, and the shutter removed or locked open, measure the peak-to-peak amplitude of the output signal voltage on the same peak reading a.c. voltmeter.

A.3.5 Repeat the measurement described in A.3.3 to verify that the drift is within the tolerance specified in A.2.2.

A.3.6 Calculate the photoelectric output factor (POF) using the procedure described in 6.3.

NOTE — If a theoretically derived photoelectric output factor is required, the result can be calculated for variable-area sound records from the following factors :

a) Transmission factor (T) :

A numerical difference obtained between the lightest (T_{hi}) and darkest (T_{lo}) sections of the sine wave on the sound record print, using a correctly adjusted densitometer ($T_{hi} - T_{lo}$).

b) Reduction factor (R) :

The ratio between 100 % modulation of a variable-area sound record and the width of the reproducer slit, as defined by the appropriate International Standard for the gauge. This reduction factor does not apply to variable-density sound records, since the track width is greater than the width of the reproducer slit.

c) Film modulation (M) :

For variable-area sound records, the modulation of the test film measured geometrically in relation to 100 % modulation as defined in the appropriate International Standards referenced in clause 2.

d) The theoretical photoelectric output factor is determined by the equation :

POF (theoretical) = $T \times R \times M$

A.4 Precautions applicable to both calibration methods

A.4.1 Measurements

It is advisable to take at least two or three separate measurements, and compute the mean value.

A.4.2 Scanning beam

The tolerance affecting the accuracy of the scanning beam, as specified in 7.3 and 7.4, should be strictly adhered to for accurate measurement. A slit which exceeds the correct length, as specified in ISO 2939, ISO 4243 or ISO 4244, could conceal the effect of non-uniform illumination and prevent accurate measurement.

A.4.3 Harmonic distortion

The accuracy in measuring the photoelectric output factor of an audio-level test film is not significantly affected by harmonic distortion contained within the test film, provided that total harmonic distortion as measured at the output of the reproducer is not greater than 3 %.

A.4.4 Peak measuring a.c. voltmeter

Peak-to-peak voltage measurements should be made with a true peak measuring voltmeter. Measurements made with an average meter corrected to give pseudo-peak values will not be correct.

NOTE — Audio-level test films showing considerable wear may no longer retain their original photoelectric output factor.

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