SMPTE ENGINEERING GUIDELINE

EG 16-2002
Revision of EG 16-1997

Measurement Methods for Motion-Picture Camera Acoustical Noise — Field Method

1 Scope and field of application

1.1 This guideline provides a simple method for measuring the acoustical noise output of motion-picture cameras in use on the set of a production. The guideline applies to noise occurring in only one circumstance: in front of a given camera in a specific acoustical environment. Thus, the measurements given by this guideline are not comparable with others made in different situations.

1.2 This guideline also gives limits on acceptability of measured camera noise due to the combined effects of the camera and its environment. Methods for reducing camera noise which are practicable on the set are included.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this guideline. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this guideline are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below.

IEC 60651 (1979-01), Sound Level Meters

3 Definitions

For the purpose of this guideline, the following definitions apply:

3.1 sound pressure level, L_p , in decibels: Twenty times the logarithm to the base 10 of the ratio of the sound pressure to the reference sound pressure. The frequency weighting network used shall be indicated; for example, A-weighted sound pressure level, L_{pA}. The reference sound pressure is 20 μPa.

3.2 reference point: The center of the film aperture in the camera gate.

3.3 measurement distance: The distance between the reference point and the measurement point.

3.4 background noise: The A-weighted sound pressure level at the microphone position with the camera inoperative.

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4 Acoustical environment

4.1 Criteria for adequacy of the test environment

Ideally, the test environment should be free from reflecting objects other than a single reflecting plane so that the source radiates into a free field over a reflecting plane. In practice, measurement to this guideline shows the effects of the environment. No environmental correction factor is applied in order to keep the measurement simple, but users are cautioned that the results are not directly comparable from one situation to another.

4.2 Criterion for background noise

At the microphone positions, the A-weighted sound pressure level due to the background noise shall be at least 3 dB below the A-weighted sound pressure level with the source operating. (Background noise levels which are less than 3 dB below the sound level of the source to be measured are too high for the purposes of this guideline. Under such circumstances, it is not possible to determine the A-weighted sound pressure level of the source to reasonable accuracy. However, the result determined with higher background noise levels may be useful as an indication of the upper limit of the sound pressure level of the source.)

5 Instrumentation

5.1 General

A sound level meter that meets the requirements of IEC 60651 shall be used switched to the “impulse” characteristic.

To minimize the influence of the observer on the measurements, a cable should preferably be used between the microphone and the sound level meter. The observer shall not stand between the microphone and the source whose sound pressure level is being measured.

5.2 Calibration

At least before each series of measurements, an acoustical calibrator with an accuracy of $\pm$ 0.5 dB shall be applied to the microphone for calibration of the entire measuring system, including cable, if used, at one or more frequencies. One calibration frequency shall be in the range of 250 Hz to 1000 Hz. The calibrator shall be checked annually to verify that its output has not changed.

6 Camera installation and operation

6.1 General

The camera to be tested shall be installed and mounted with respect to the reflecting plane in the position that is representative of normal use. The camera shall be provided with all noise-control means normally employed, such as any blimp, barney, or optical clear-glass filters in front of the lens.

6.2 Auxiliary equipment

Care shall be taken to ensure that any auxiliary equipment does not radiate significant amounts of sound energy in the test environment in conformity with 4.2. If practicable, all auxiliary equipment necessary for the operation of the device under test shall be located outside of, or acoustically isolated from, the test environment.

6.3 Operation of the camera during tests

During the acoustical measurements, the source shall be operated as follows:

– with a film load at least similar to the film stock to be used;

– with each phase of perforation engagement, to produce maximum noise by trying each relative engagement between the film and the sprocket teeth in the camera, moving one perforation at a time;

– with the lens to be used;

– at each angle that the camera is to be tilted or panned, to find the point of maximum noise.

7 Measurement of frequency and time-weighted sound pressure level

7.1 Meter

Measure the A-weighted sound pressure level with the sound level meter set to impulse responding.

7.2 Measurements

All sound level measurements are made at a distance of 1 meter from the reference points, along lines which extend forward (toward the intended subject) from the reference point.

7.2.1 Make the primary measurement along a line extending 45° upward from the reference point and parallel to the lens axis (see figure 1).

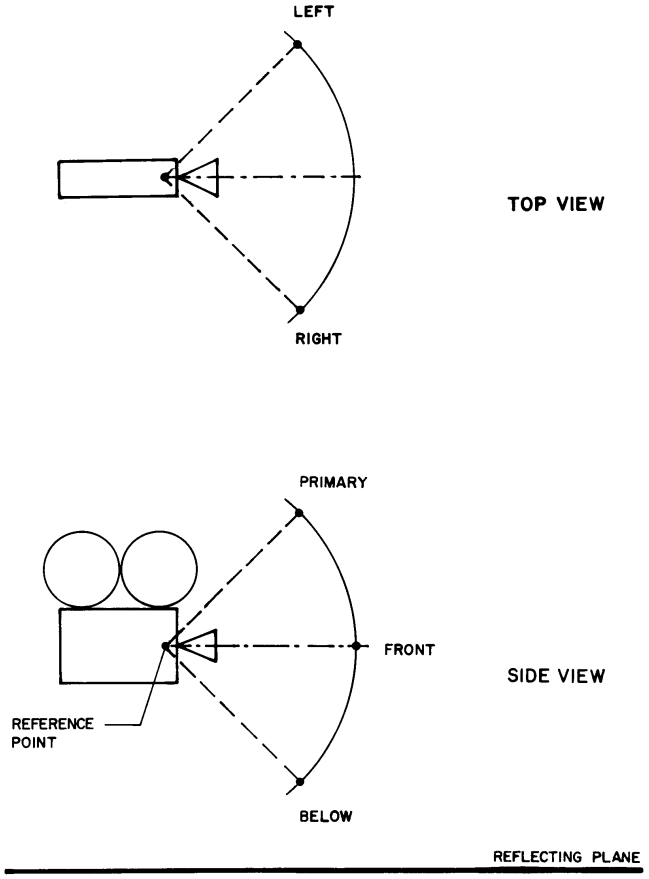

Figure 1 – Measurement locations

7.2.2 Make four secondary measurements: Make one secondary measurement on the lens axis. Make one measurement on a line extending 45° to the right of the reference point and one measurement on a line extending 45° to the left of the reference point, both parallel to the reflecting plane. Make one measurement on a line extending 45° downward from the reference point and parallel to the lens axis (see figure 1).

7.3 Corrections for background noise

The sound pressure levels recorded at each of the microphone positions shall be corrected for the influence of background noise according to table 1.

8 Limit on acceptability

Limit on acceptability shall be in accordance with table 2.

9 Means for reducing camera noise

9.1 Limit the source noise by:

– using blimps, barneys, and/or the addition of an extra optical clear-glass filter in front of the lens or, in the worst cases, sound rooms with optically clear glass;

– choosing the threading phase for lowest noise, that is, engage each perforation of the film in turn, advancing one perforation on each test, to find the lowest noise;

– minimizing lens radiation by choice of lens;

– eliminating vibration induced into tripod or floor by use of resilient mounting.

Table 1 – Background noise correction

Difference between sound pressure level measured with sound source operating and background sound pressure level alone	Corrections to be subtracted from sound pressure level measured with sound source operating to obtain sound pressure level due to sound source alone
dB	dB
3	3
4	2
5	2
6	1
7	1
8	1
9	0.5
10	0.5
>10	0.0

Table 2 – Limit on acceptability

Situation	Maximum permissible sound pressure level, L_{pA}, impulse reading
Quiet dialogue scene in close up	25
Medium shot of two or more actors at average level	30
Maximum above which ordinary shooting becomes impaired	33

9.2 Reduce the effective noise by:

– making the environment less reverberant by adding acoustical absorption;

– moving the camera away from the actor(s) and microphone(s).

9.3 Pick up less of the camera noise by microphone techniques:

– use directional microphones, pointing the lowest sensitivity direction of the microphone at the camera, and the highest sensitivity direction at the actor(s);

– position the microphone as close to the source and as far from the camera as practical.

Annex A (informative)
Background

A.1 This guideline started with a request that the Subcommittee on Audio Production and Post-Production for Motion-Picture and Television Entertainment Programming study the question of making a noise measurement of motion-picture camera noise in a practical way on a motion-picture set. Since neither a simple method nor a more precise one needed by manufacturers to rate camera noise existed, this work was undertaken.

A.2 Since measuring sound pressure level at a single point does not adequately characterize the noise of machinery, which may show strong spatial characteristics, reporting sound power level has been adopted in the art for adequate precision in comparing results of different tests (see, for example, ISO 3741-3746). But even the simplest measurement of sound power level is time consuming, requiring mathematical manipulation for spatial averaging, environmental reflections, background noise, and source size.

A.3 This guideline thus standardizes only the measurement positions and type of instrument to be used, with a simple correction for background noise. In addition, it gives advice on how to measure a camera spatially, so that the user can determine whether a full sound power test would reveal markedly different results.

A.4 The importance of camera noise varies greatly from scene to scene and set to set. Often, other noises on the set mask the camera noise, but in quietly played scenes on quiet sets camera noise can be the most obtrusive noise source. For this reason, a table of acceptability has been included.

Annex B (informative)
Bibliography

ISO 3741:1999, Acoustics — Determination of Sound Power Levels of Noise Sources Using Sound Pressure — Precision Methods for Reverberation Rooms

ISO 3743-1:1994, Acoustics — Determination of Sound Power Levels of Noise Sources — Engineering Methods for Small, Movable Sources in Reverberant Fields — Part 1: Comparison Method for Hard-Walled Test Rooms

ISO 3743-2:1994, Acoustics — Determination of Sound Power Levels of Noise Sources Using Sound Pressure — Engineering Methods for Small, Movable Sources in Reverberant Fields — Part 2: Methods for Special Reverberation Test Rooms

ISO 3744:1994, Acoustics — Determination of Sound Power Levels of Noise Sources Using Sound Pressure — Engineering Method in an Essentially Free Field Over a Reflecting Plane

ISO 3745:1977, Acoustics — Determination of Sound Power Levels of Noise Sources — Precision Methods for Anechoic and Semi-anechoic Rooms

ISO 3746:1995, Acoustics — Determination of Sound Power Levels of Noise Sources Using Sound Pressure — Survey Method Using an Enveloping Measurement Surface Over a Reflecting Plane