INTERNATIONAL STANDARD

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Cinematography — Background acoustic noise levels in theatres, review rooms and dubbing rooms

Cinématographie — Niveaux de bruit de fond dans les salles de projection, de visionnement et les auditoriums de doublage

Reference number
ISO 9568:1993(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9568 was prepared by Technical Committee ISO/TC 36, *Cinematography*.

Annex A of this International Standard is for information only.

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Cinematography — Background acoustic noise levels in theatres, review rooms and dubbing rooms

1 Scope

This International Standard specifies measurement methods and maximum ratings for indoor background sound pressure levels in theatres, review rooms and dubbing rooms.

It applies to noise emitted by heating, ventilating and air-conditioning systems, intrusive noise from the projector(s) associated with the theatre and noise emitted by any other mechanical or electrical equipment in the theatre building. It is intended for application when the background noise is essentially a steady-state sound, without strong time-varying components.

It does not apply to intrusive noise from other sources outside the theatre, such as aircraft, highway traffic, or adjacent theatres, or to noise resulting from the operation of the sound system in the theatre, or the vibration of the theatre, i.e. movement of the building below 20 Hz.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 266:1975, *Acoustics — Preferred frequencies for measurements.*

IEC 651:1979, *Sound level meters.*

3 Test conditions

3.1 The air-handling system of the theatre shall be brought to the noisiest state in which it is used during screenings, generally "on", with cooling compressors operating. Any other mechanical or electrical equipment, such as projector exhaust fans, sump pumps, transformers, or the like, within the theatre building shall be brought to the noisiest state that will occur during screenings. The projector system shall be running normally, with film. Power to the theatre sound system shall be turned off.

3.2 Measurement equipment shall conform to IEC 651, using a class II octave band filter or class III third-octave band filter in accordance with ISO 266.

3.3 The measurement system shall be set to "slow" reading.

3.4 The measurement system shall be calibrated immediately before use by means of an acoustic calibrator accurate to within $\pm$ 0,5 dB for sound pressure level. The calibration shall be checked after use, and if changes greater than 0,5 dB are found, the measurements shall be considered invalid. The acoustic calibrator shall be checked at least once per year against a known source.

3.5 At high frequencies, room background noise levels are often in the same range as ordinary measurement equipment noise. Therefore, care should be taken to ensure that the measured levels are not influenced in any band by noise in the measurement instrument(s) by testing the measurement instrument(s) under all relevant conditions, including switch settings of any attenuators or gain controls. Do not report noise levels at or below the capability of the instrumentation in use.

4 Measurements

4.1 Measurements shall be recorded in octave bands over the range from 31,5 Hz to 16 kHz as sound pressure levels.

4.1.1 The preferred octave band centre frequencies are 31,5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz and 16 kHz.

4.1.2 If third-octave band measurement equipment is available rather than octave band or switchable bandwidth equipment, measurements may be made in third-octave bands and converted to octave bands by logarithmic addition of three bands (one at the octave band centre and the two surrounding it).

The octave band sound pressure level, L, is then:

$$L = 10 \log_{10} (10^{L_1/10} + 10^{L_2/10} + 10^{L_3/10})$$

where

L_1 is the sound pressure level of the first third-octave;

L_2 is the sound pressure level of the second third-octave;

L_3 is the sound pressure level of the third third-octave.

4.2 The measurements to be recorded shall be made by taking the mean of the readings at a sufficient number of locations to provide means with standard deviations under 2 dB; usually, six locations chosen at random within the seating area at seated ear height at least 1,2 m (4 ft) from any wall surface will suffice unless there is an unusual spatial distribution of background noise. If the total range of the measurements in an octave band is less than 4 dB, the arithmetic mean may be used; if it is more than 4 dB, the logarithmic mean shall be used. Some review rooms can be so small that strong room modes will influence the low-frequency band measurements. Thus a small standard deviation can be unobtainable. In such cases, the low-frequency bands can be unreliably reported and shall therefore be neglected in any calculations.

4.3 Plot the spectrum resulting from the recorded measurements on octave band noise criteria graph paper such as that shown in figure 1. The point of the highest excursion of the background noise spectrum compared to the noise criteria (NC) curves is the NC rating.

NOTE 1 The original NC curves (see 5.1) have been extrapolated to the 31,5 Hz and the 16 kHz octave bands for the purposes of this International Standard.

5 Sound pressure level classifications

5.1 Dubbing rooms, review rooms and premier showings (see A.3 and A.4) shall have a minimum rating of NC-20 and a maximum rating of NC-25.

5.2 First-run theatres shall have a maximum rating of NC-30.

5.3 Subsequent-run theatres shall have a maximum rating of NC-35.

5.4 Levels beyond NC-45 will result in poor audio reproduction.

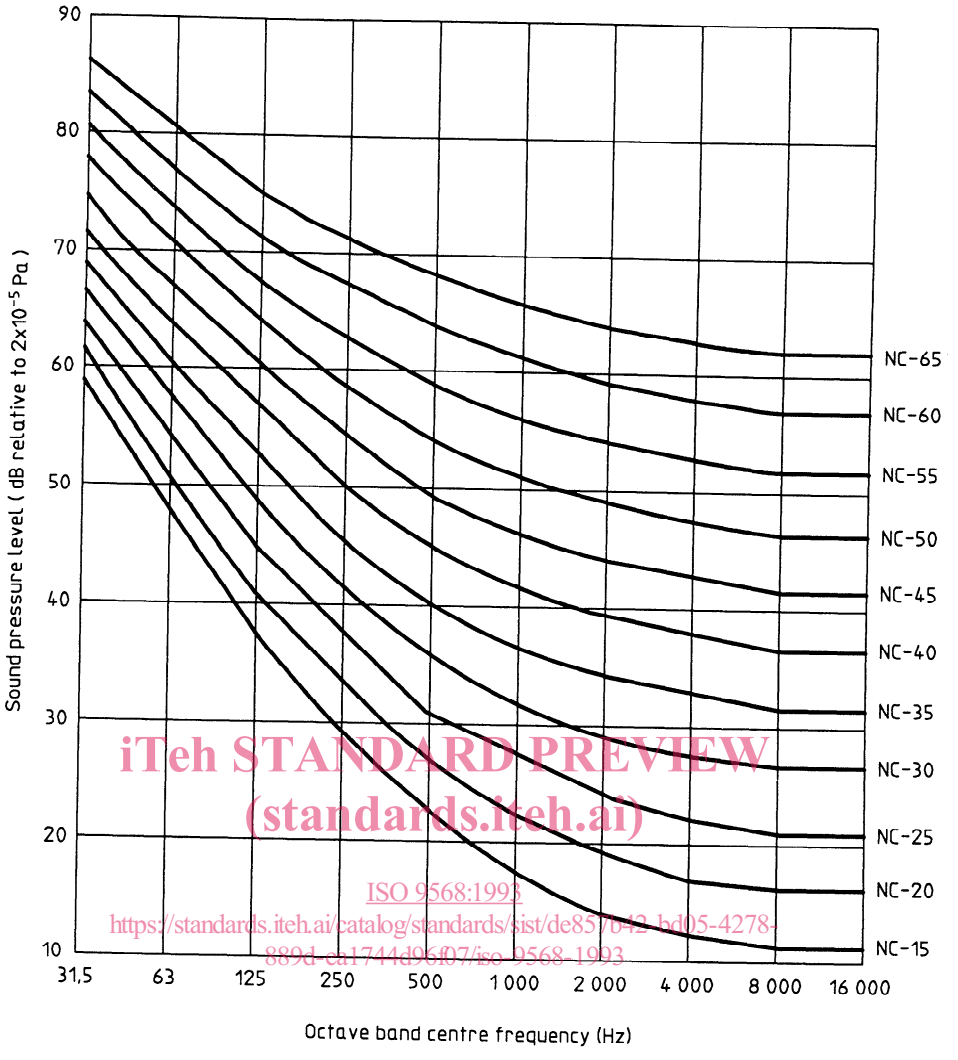

Figure 1 — Noise criteria curves

Annex A
(informative)

Additional information

A.1 The noise criteria curves are for use in rating indoor noise levels. The curves, if followed as design criteria, do not result in neutral sounding background noise spectra. Many listeners observe that an NC spectrum sounds too "rumbly" and too "hissy", having too much very low-frequency and very high-frequency energy. A constant sloped spectrum at – 5 dB per octave from low- to high-frequencies has been observed as producing a more neutral sounding spectrum and is probably more suitable for design purposes.

A.2 The NC rating of a space does not represent the spectrum of the background noise; valuable information about the "quality" of the noise in a space is missing from any single number rating. It can be useful to retain records of the complete spectrum, since there exist methods to further characterize the noise, such as the RC method, which can yield more information. In particular, spectra with narrow band concentrations of energy sound "tonal"; subjectively, they might be increased in rating by as much as 8 dB relative to the continuous spectrum, depending upon how far above the average spectrum the tonal component lies.

A.3 Too little noise in a theatre or review room can be a problem as well as too much. With too much noise, detail is obscured and, ultimately, intelligibility suffers. With too little noise, intermittent intrusive noise may become audible and annoying; therefore, it is advisable to use reasonable background noise levels to mask intrusive noise sources.

A.4 Dubbing studios are advised that if the background noise levels in studios are much lower than those in theatres, low-level sounds which are audible in the dubbing studio can be inaudible in theatres because of masking.

A.5 As a guide to whether high levels of vibration are present, measurement of the "linear" weighting of a Type 1 sound level meter compared with the octave band sound pressure level can provide useful information; if the level of linear measurement exceeds the logarithmically added sum of the band levels from 31,5 Hz to 16 kHz by more than 3 dB, then vibration which is detectable by the audience is present.

A.6 As a practical matter, large diameter microphones are useful for measuring the sometimes very low theatre noise levels due to their low self-noise, but large diameter microphones also show relatively strong diffraction effects at high frequencies. To obtain an adequate spatial average of high frequencies, the microphone should be rotated at least about a line perpendicular to the floor and a line perpendicular to the side walls to obtain the average reading at each location for the high-frequency bands.

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