इंटरनेट मानक

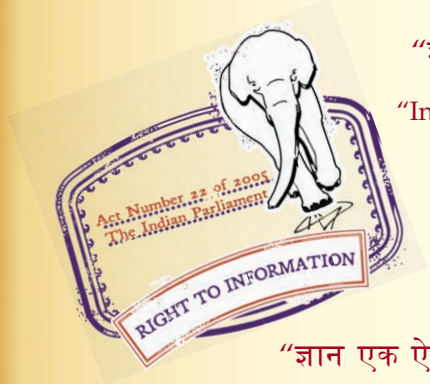
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 9989 (1981): Assessment of Noise with Respect to Community Response [LITD 8: Electronic Measuring Instruments, Systems and Accessories]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

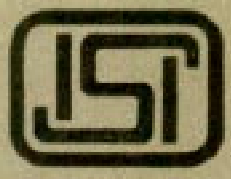
BLANK PAGE

IS : 9989 - 1981
(Reaffirmed 2001)

Indian Standard

ASSESSMENT OF NOISE WITH RESPECT TO COMMUNITY RESPONSE

UDC 699·84 : 534·84



INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Price Rs 7·00

February 1982

Indian Standard

ASSESSMENT OF NOISE WITH RESPECT TO COMMUNITY RESPONSE

Acoustics Sectional Committee, LTDC 5

Chairman	*Representing*
DR M. PANCHOLY	In personal capacity (*Emeritus Scientist, National Physical Laboratory, New Delhi*)
Members	
DR K. ACHYUTHAN	Ministry of Defence (R & D)
SHRI R. S. VOHRA (*Alternate*)	
COL T. R. BHALOTRA	Ministry of Defence (DGI)
LT COL KISHAN LAL (*Alternate*)	
DR A. F. CHHAPGAR	National Physical Laboratory (CSIR), New Delhi
DR P. N. GUPTA	Department of Electronics, New Delhi
SHRI TEK CHANDANI (*Alternate*)	
SHRI R. K. JAIN	Electronic Component Industries Association, (ELCINA), New Delhi
SHRI L. K. VISHWANATH (*Alternate*)	
SHRI K. S. KALIDAS	Railway Board, New Delhi
SHRI V. JAYARAMAN (*Alternate*)	
SHRI J. S. MONGA	Botton Industrial Corporation, New Delhi
SHRI M. S. MONGA (*Alternate*)	
SHRI B. C. MUKHERJEE	National Test House, Calcutta
SHRI J. K. BHATTACHARYA (*Alternate*)	
SHRI K. D. PAVATE	Central Electronics Engineering Research Institute (CSIR), Pilani
SHRI M. R. KAPOOR (*Alternate*)	
SHRI A. V. RAMANAN	Films Division, Bombay
RESEARCH ENGINEER	Directorate General of All India Radio, New Delhi
SHRI SANDEEP AHUJA	Ahuja Radios, New Delhi
SHRI S. P. JERATH (*Alternate*)	
SHRI SARWAN KUMAR	Directorate General of Civil Aviation, New Delhi
SHRI K. CHANDRACHUDAN (*Alternate*)	
DR (MISS) SHAILAJA NIKAM	All India Institute of Speech & Hearing, Mysore
SHRI M. SHANKARALINGAM	Directorate General of Supplies & Disposals, New Delhi
SHRI R. S. ARORA (*Alternate*)	

(*Continued on page* 2)

(*Continued from page* 1)

Members	*Representing*
SHRI M. N. SHUKLA SHRI S. K. TANDON (*Alternate*)	Posts and Telegraphs Board, New Delhi
SUPERINTENDENT SURVEYOR OF WORKS (FOOD)	Central Public Works Department, New Delhi
SHRI L. K. VISHWANATH SHRI K. D'SA (*Alternate*)	Peico Electronics & Electricals Ltd, Bombay; and The Radio Electronics and Television Manufacturers' Association, Bombay
SHRI R. C. JAIN, Head (Electronics)	Director General, ISI (*Ex-officio Member*)

Secretary

SHRI PAVAN KUMAR
Assistant Director (Electronics), ISI

Indian Standard

ASSESSMENT OF NOISE WITH RESPECT TO COMMUNITY RESPONSE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 August 1981, after the draft finalized by the Acoustics Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The reduction or limitation of noise is of increasing general importance. This standard suggests methods for measuring and rating noise in residential, industrial and traffic areas with respect to their interference with rest, working efficiency, social activities and tranquility.

0.2.1 Besides noise there may be other factors in connection with sound production and radiation, for example, mechanical vibrations, which also give rise to annoyance in particular situations and this makes the assessment more complex. No general method exists at present to take account of these factors, and the application of numbers and corrections, other than those described in this standard, may be desirable in some cases.

0.2.2 The method given for rating noises with respect to community response forms a basis on which limits for noises in various situations may be set by the competent authorities.

0.2.3 The method of rating involves the measurement of the A-weighted sound level in decibels [commonly called dB (A)].

0.2.4 Where corrective measures are required, a frequency analysis may be necessary. The resulting data may be compared with noise rating curves, for instance the NR-curves, in order to identify the intrusive frequency bands. This more elaborate procedure is described in Appendix A.

0.3 In the preparation of this standard, assistance has been derived from ISO/R 1996-1971 'Assessment of noise with respect to community response' issued by the International Organization for Standardization.

0.4 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard is intended as a guide to the measurement of the acceptability of noise in communities. It specifies a method for the measurement of noise, the application of corrections to the measured levels (according to duration, spectrum character and peak factor), and a comparison of the corrected levels with a noise criterion which takes account of various environmental factors.

2. TERMINOLOGY

2.1 For the purpose of this standard, the terms and definitions given in IS : 1885 (Part III)* shall apply.

3. MEASURING EQUIPMENT

3.1 The measurements should be made with a sound level meter as specified in IS : 9779-1981†. The A-weighting network and fast response should be used. The sound level should be measured at the place and time of the annoyance.

NOTE — Other measuring equipment including, for example, a level recorder or tape recorder, may be used if the overall performance conforms with the characteristics of a sound level meter with A-weighting network and with fast response.

4. CONDITIONS OF MEASUREMENT

4.1 Outdoor measurements should be made at 1·2 to 1·5 m above the ground and, if practical, at least 3·5 m from walls, buildings or other sound reflecting structures. When circumstances indicate, measurements may be made at greater heights and closer to the wall (for example 0·5 m in front of an open window), provided this is specified and taken into consideration.

NOTE 1 — Care should be taken to avoid the influence of unwanted sound signals on the result, for example noise of wind on the microphone of the measuring equipment, noise from electrical interference or noise from extraneous sources.

NOTE 2 — When the noise source is distant, the measured sound level may depend significantly on climatic conditions. It is recommended that extreme conditions be avoided. If possible, a typical value and an indication of the range of variation should be obtained.

4.2 Indoor measurements should be made at a distance of at least 1 m from the walls, 1·2 to 1·5 m above the floor, and about 1·5 m from the window(s). In order to reduce disturbances from standing waves, the sound levels measured indoors should be averaged over $\pm$ 0·5 m of each of at least 3 positions. This is especially important when measuring low-frequency noise. The arithmetic average of the readings determines the value to be taken.

*Electrotechnical vocabulary: Part III Acoustics.

†Sound level meters (*Superseding* IS : 3931-1966 and IS : 3932-1966).

4.2.1 The measurements should generally be made with windows closed. If the room is regularly used with open windows, measurements should also be made under this condition.

4.2.2 If the noise is not steady, the level and duration of the noise must be determined; if necessary, records of the level may be made. The period of time in which the time history of the sound level is observed must be chosen according to the character of the variations of the noise. If possible, the period should cover more than one typical variation cycle.

5. DETERMINATION OF THE RATING SOUND LEVEL L_r

5.1 In many cases, corrections to the measured sound level, L_A, are needed to obtain a better estimate of the community response to the noise. These corrections are dependent on the character of the noise with respect to peak factor, spectrum character, duration and fluctuation. The sum of L_A and possible corrections is termed the rating sound level, L_r, that is the sound level of a steady noise without impulsive character or pure tones which is assumed to cause the same community response as the measured noise.

5.2 The procedure is as follows:

5.2.1 Steady noise (such as rain noise) without impulsive character or audible tones is rated by the sound level L_A in dB(A), measured by means of the sound level meter.

5.2.2 Steady noise with an impulsive character (such as hammering or riveting) or with discrete noise impulses is rated by the sound level L_A in dB(A) plus the correction given in Table 1, first entry.

5.2.2.1 The reading to be taken is the average of the maximum deflections of the pointer.

NOTE 1 — Other techniques for measuring and rating impulsive noise may become appropriate, especially when recommendations for suitable measuring instruments are published.

NOTE 2 — If the sound level varies over a large range, the procedure described in **5.2.5** should be used.

5.2.3 Steady noise which contains audible tone components (for example whine, screech or hum) is rated by the sound level L_A in dB(A) plus the correction given in Table 1, second entry.

5.2.4 If the noise is interrupted by pauses (for example, almost unchanging factory noise lasting for several hours followed by a pause), a correction according to Table 1, third entry, should be applied to the sound level L_A to take account of the reduced duration of the noise.

TABLE 1 CORRECTIONS TO THE MEASURED SOUND LEVEL IN dB(A)

(*Clauses* 5.2.2, 5.2.3, 5.2.4 *and* 5.2.5)

Characteristic Features of the Noise		Correction dB (A)
Peak factor	Impulsive noise (for example, from hammering)	+ 5
Spectrum character	Audible tone components present (for example, whine)	+ 5
Duration of the noise with sound level L_A as a percentage of the relevant time period	Between:	
	100 and 56	0
	56 and 18	− 5
	18 and 6	− 10
	6 and 1·8	− 15
	1·8 and 0·6	− 20
	0·6 and 0·2	− 25
	Less than 0·2	− 30

5.2.4.1 The duration of the noise should be reckoned over a relevant time period which may be set according to the specifications by local authorities, for example, the most unfavourable 8 consecutive hours during daytime and the most unfavourable half-hour of the evening or the night. For noise during the night, it may also be advantageous to set an absolute limit for the sound level.

NOTE 1 — The time limits for day, evening, and night may vary in different countries and may be defined by local authorities according to the way in which the ambient traffic noise varies and according to the habits of people. (For instance, in some areas day lasts from 06·00 until 18·00, evening from 18·00 until midnight, and night from midnight until 06·00).

NOTE 2 — By specifying a shorter period or an absolute limit during evening and night, the influence of noises with high levels and short duration is emphasized. Such noise may be disturbing for sleep.

NOTE 3 — If a particular noise source is to be considered at weekends, measurements must take into account the circumstances of the weekend, for example, by measuring the background noise at the relevant time.

5.2.5 If the noise varies with time in a more complicated manner than is appropriate for the use of Table 1, the equivalent sound level L_{eq} should be obtained, for example, from a statistical analysis of the time history of the A-weighted sound level. The corrections in Table 1 for peak factor or noise spectrum character should also be applied when appropriate.

5.2.5.1 The statistical analysis can be based on analogue or digital recordings of the sound level. For estimating purposes, it may in some cases be sufficient to determine the statistical distribution by observing the sound level meter readings at intervals of time by a sampling technique.

5.2.5.2 The class intervals for the sound level must be chosen according to the character of the noise; in most cases an interval of 5 dB will be appropriate.

5.2.5.3 The equivalent sound level L_{eq} is calculated from a formula based on the equal energy principle:

$$L_{eq} = 10 \log_{10} \left[\frac{1}{100} \sum f_i 10^{L_i/10} \right]$$

where

L_{eq} = is the equivalent sound level in dB(A);

L_i = is the sound level in dB(A) corresponding to the class-midpoint of the class i [for class intervals not greater then 5 dB(A) the arithmetic means can be used; for larger intervals logarithmic averaging should be used];

f_i = is that time interval (expressed as a percentage of the relevant time period) for which the sound level is within the limits of class i.

5.2.5.4 The relevant time period shall be chosen according to the specifications of the local authorities (*see* **5.2.4**).

5.3 Hence, the rating sound level is determined as follows:

a) for noises of constant level, by
$L_r = L_A + 5$ when the noise is impulsive or when it contains audible tone components or both + correction for duration when the noise is intermittent; and

b) for noises of fluctuating level, by
$L_r = L_{eq} + 5$ when the noise is impulsive or when it contains audible tone components or both.

6. NOISE CRITERIA (*see* Appendix B)

6.1 In general, a noise is liable to provoke complaints whenever its level exceeds by a certain margin that of the pre-existing background noise, or when it attains a certain absolute level.

6.1.1 The method of rating noise is based on a comparison of the rating sound level with a criterion level which takes various features of the environment into account. The criterion is related to the pre-existing background level, either fixed for a certain zone in general or directly measured for special cases.

6.1.2 The method for deriving a criterion for rating noise in general (for example, for zoning purposes) is given in **6.2**; the method for rating

noise in special cases, based on the measured background level, is given in **6.3**. A rough connection between public reaction and noise exceeding the criterion is given in **7**.

6.2 Noise Criteria in General

6.2.1 Noise criteria in general, especially for the purpose of zoning, can be derived from one basic value by adding corrections for time of day and corrections for the different types of district.

6.2.1.1 The basic value for a country has to be established according to the living habits of the people.

NOTE — The basic criterion for residential premises should usually be in the range of 35 to 45 dB(A) for outdoor noise as recommended by ISO.

6.2.2 The corrections to the basic criterion for different times of day are given in Table 2.

TABLE 2 CONNECTIONS TO BASIC CRITERION FOR DIFFERENT TIMES OF DAY

TIME OF DAY	CORRECTION TO BASIC CRITERION dB (A)
Day	0
Evening	− 5
Night	−10 to −15

6.2.2.1 It may be appropriate to use only day and night corrections given above and to omit evening.

6.2.3 The corrections to the basic noise criterion for residential premises for different zones are given in Table 3.

TABLE 3 CORRECTIONS TO BASIC CRITERION FOR RESIDENTIAL PREMISES IN DIFFERENT ZONES

TYPE OF DISTRICT	CORRECTION TO BASIC CRITERION dB (A)
Rural residential, zones of hospitals, recreation	0
Suburban residential, little road traffic	+ 5
Urban residential	+ 10
Urban residential with some workshops or with business or with main roads	+ 15
City (business, trade, administration)	+ 20
Predominantly industrial area (heavy industry)	+ 25

6.2.3.1 Local experience in different countries will lead to different definitions of the relevant types of zones, taking into account existing laws or prescriptions.

6.3 Special Cases

6.3.1 For rating noise in special cases, for example in case of complaints of a certain noise source at a certain place, the background noise level serves as the criterion.

6.3.2 The background (ambient) noise level is the mean minimum sound level at the relevant place and time in the absence of the noise which is alleged to be offending. It should be obtained by observing the pointer of the sound level meter and by reading the lowest level which is repeated several times (mean minimum). When statistical analysis of the sound level is used, the background noise level should be taken as that level which is exceeded for 95 percent of the observation time.

NOTE 1 — The background noise level includes the influence of the type of district, the season and the time of day, and no correction has to be used. It serves in the same way for assessment of noise outside or inside a building, with windows open or closed, provided it is measured under the same conditions as the noise.

NOTE 2 — To prevent a creeping (gradually increasing) background noise level, it may be useful to compare the measured background level with the general criterion derived according to **6.2** for the relevant district and time.

7. ASSESSMENT OF NOISE WITH RESPECT TO COMMUNITY RESPONSE

7.1 In order to assess the noise with respect to the expected community response, the rating sound level as obtained according to **5** should be compared with the criterion value given in **6.2** or **6.3.**

7.2 If the rating sound level exceeds the criterion value, the noise is likely to evoke response from the community. Differences of 5 dB(A) or less are of marginal significance, complaints may certainly be expected if the difference reaches 10 dB(A) or more. An estimate of the public reaction which may be obtained where the rating sound level exceeds the criterion value by a certain amount is given in Appendix C.

8. STATEMENTS IN THE REPORT

8.1 The report shall state:

a) the measured sound level L_A in dB(A);
b) the duration of the noise or, for varying levels, the statistical distribution;
c) operating conditions of the noise source and weather conditions (where applicable);

d) the time of day on which the noise occurs and the measurements have been made;

e) the corrections applied to L_A;

f) the rating sound level L_r;

g) the measured background noise level (where applicable); and

h) the noise criterion value derived for the relevant time and district (where applicable).

APPENDIX A

(*Clause* 0.2.4)

FREQUENCY ANALYSIS

A-1. The recommended method of rating, based on measurements of the A-weighted sound level, is given in the body of this standard. However, a frequency analysis of the noise will in some cases be valuable for rating purposes and is essential if corrective measures to reduce the noise nuisance are to be evaluated. In this case, a set of noise rating curves (NR-curves), with which the measured spectrum of the noise can be compared, can be employed. This makes an identification of the intrusive frequency bands possible.

A-2. The NR-curves are given in Fig. 1 and the octave band pressure levels corresponding to the curves are tabulated in Table 4.

A-3. An octave band analysis of the noise in the range 31·5 to 8 000 Hz (centre-frequencies) should be made with filters according to IS : 6964-1973*. These octave band pressure levels shall be corrected, if necessary, according to 5. To each corrected band pressure level an NR-number, in accordance with Table 4 or Fig. 1, shall be assigned. These numbers can be compared with a criterion in NR-numbers, the numerical value of which may be taken as 5 lower than the criterion according to 7 in dB(A).

*Octave, half-octave and third-octave band filters for analysis of sound and vibrations.

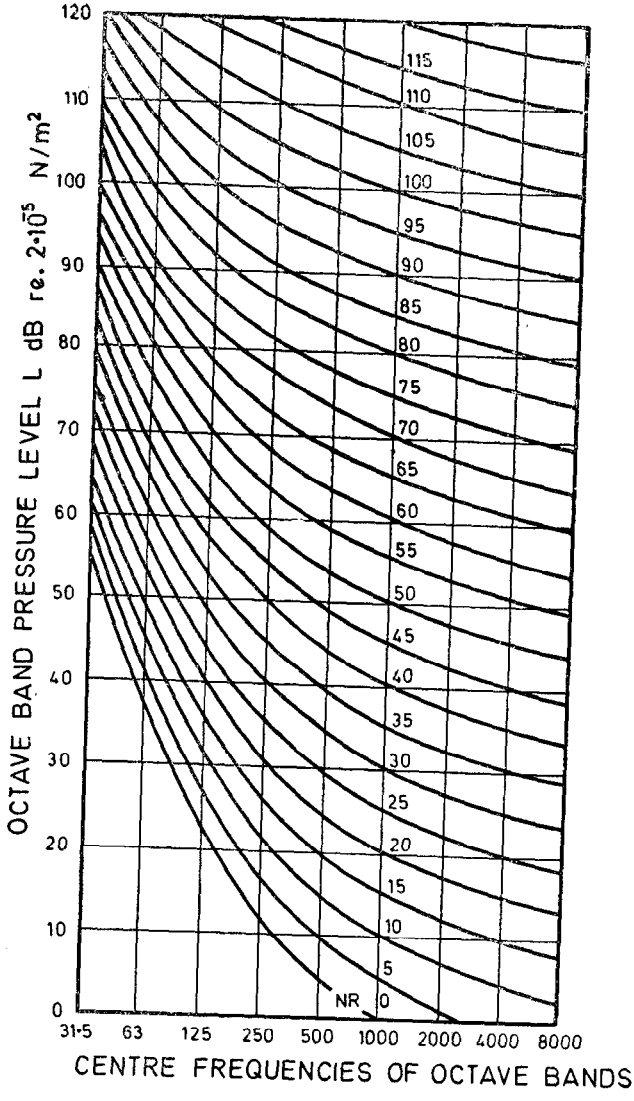


FIG. 1 NOISE RATING CURVES

TABLE 4 OCTAVE BAND PRESSURE LEVELS CORRESPONDING TO NOISE RATING NUMBER NR

(*Clause* Appendix A)

NR	Octave Band Sound Pressure Levels (dB)								
	Centre frequencies (Hz)								
	31·5	63	125	250	500	1 000	2 000	4 000	8 000
0	55·4	35·5	22·0	12·0	4·8	0	−3·5	−6·1	−8·0
5	58·8	39·4	26·3	16·6	9·7	5	+1·6	−1·0	−2·8
10	62·2	43·4	30·7	21·3	14·5	10	6·6	+4·2	+2·3
15	65·6	47·3	35·0	25·9	19·4	15	11·7	9·3	7·4
20	69·0	51·3	39·4	30·6	24·3	20	16·8	14·4	12·6
25	72·4	55·2	43·7	35·2	29·2	25	21·9	19·5	17·7
30	75·8	59 2	48·1	39·9	34·0	30	26·9	24·7	22·9
35	79·2	63·1	52·4	44·5	38·9	35	32·0	29 8	28 0
40	82·6	67·1	56·8	49·2	43·8	40	37·1	34·9	33·2
45	86·0	71·0	61·1	53·6	48·6	45	42·2	40·0	38·3
50	89·4	75·0	65·5	58·5	53·5	50	47·2	45·2	43·5
55	92·9	78·9	69·8	63·1	58 4	55	52·3	50·3	48·6
60	96 3	82·9	74·2	67·8	63·2	60	57·4	55·4	53·8
65	99·7	86·8	78·5	72·4	68·1	65	62·5	60·5	58·9
70	103·1	90 8	82·9	77·1	73·0	70	67·5	65·7	64·1
75	106·5	94·7	87 2	81·7	77·9	75	72·6	70·8	69·2
80	109 9	98·7	91·6	86·4	82·7	80	77·7	75·9	74·4
85	113·3	102·6	95·9	91·0	87·6	85	82·8	81·0	79·5
90	116·7	106·6	100·3	95·7	92·5	90	87·8	86·2	84·7
95	120·1	110·5	104·6	100·3	97·3	95	92·9	91·3	89·8
100	123·5	114·5	109·0	105·0	102·2	100	98·0	96·4	95·0
105	126·9	118·4	113·3	109·6	107·1	105	103·1	101·5	100·1
110	130·3	122·4	117·7	114·3	111·9	110	108·1	106·7	105·3
115	133·7	126·3	122·0	118·9	116·8	115	113·2	111·8	110·4
120	137·1	130·3	126·4	123·6	121·7	120	118·3	116·9	115·6
125	140·5	134·2	130·7	128·2	126·6	125	123·4	122·0	120·7
130	143·9	138·2	135·1	132·9	131·4	130	128·4	127·2	125·9

APPENDIX B

(Clause 6)

RATING INDOOR NOISE

B-1. General criterion values for rating noise inside residential premises can be derived from those for outdoor noise specified in **6.2**, by adding corrections according to the decrease in sound level from outdoors to indoors with open and closed windows.

B-1.1 These corrections are given in Table 5.

TABLE 5 CORRECTIONS TO THE GENERAL NOISE CRITERION FOR OUTDOOR NOISE TO DERIVE GENERAL NOISE CRITERION FOR INDOOR NOISE

Window Conditions	Correction dB(A)
Windows open	− 10
Single windows shut	− 15
Double windows shut or non-openable windows	− 20

Usually, the noise criterion should not be set below 20 dB(A).

NOTE — The corrections are approximations and may vary with the area and the sound insulation of the windows and the sound absorption in the room. If measurements are available, the measured values should be inserted.

B-2. For noise inside non-residential premises, criteria are proposed in Table 6 according to the different purposes as long as no higher values can be derived for the local site by the criteria given in **6**, corrected according to Table 5.

B-2.1 These values refer mainly to room noises which originate outside the room.

TABLE 6 EXAMPLES FOR SUGGESTED NOISE CRITERIA FOR NON-RESIDENTIAL ROOMS

(*Clause* B-2 of Appendix B)

TYPE OF ROOM	NOISE CRITERION dB(A)
Larger office, business store, department store, meeting room, quiet restaurant	35
Larger restaurant, secretarial office (with typewriter)	45
Larger typing halls	55
Workshops (according to intended use)	45 to 75

APPENDIX C

(*Clause* 7.2)

ESTIMATED COMMUNITY RESPONSE TO NOISE

AMOUNT IN dB(A) BY WHICH THE RATING SOUND LEVEL L_r EXCEEDS THE NOISE CRITERION	ESTIMATED COMMUNITY RESPONSE	
	Category	Description
0	None	No observed reaction
5	Little	Sporadic complaints
10	Medium	Widespread complaints
15	Strong	Threats of community action
20	Very strong	Vigorous community action