STATUTORY INSTRUMENTS

1982 No. 600 (S.80)

PUBLIC HEALTH, SCOTLAND

The Noise Levels (Measurements and Registers) (Scotland) Regulations 1982

Made - - -	21*st April* 1982
Laid before Parliament	12*th May* 1982
Coming into Operation	1*st August* 1982

In exercise of the powers conferred on me by sections 64(2) and (8), 104(1), and 105(1) of the Control of Pollution Act 1974(a) and of all other powers enabling me in that behalf, I hereby make the following regulations:—

Citation, commencement and extent

1. These regulations may be cited as the Noise Levels (Measurements and Registers) (Scotland) Regulations 1982, shall come into operation on 1st August 1982 and shall extend to Scotland only.

Interpretation

2.—(1) In these regulations, unless the context otherwise requires—

"the Act" means the Control of Pollution Act 1974, and any reference in these regulations to a numbered section shall be construed as a reference to the section bearing that number in the Act;

"local authority" means an islands or district council;

"classified premises" means premises of any specified class to which a noise abatement order under section 63 of the Act for the time being applies;

"the scheduled memorandum" means the memorandum on measurement and calculation of noise levels incorporated in the Schedule to these regulations and expressions used in that memorandum have the meanings given to them therein.

Application

3. These regulations apply to the measurement and calculation by local authorities of levels of noise emanating from classified premises in Scotland and to the keeping by local authorities of registers in which those levels, levels of noise determined for such premises under section 67 and other relevant matters are recorded.

(a) 1974 c.40.

Measurement and calculation of noise levels

4.—(1) Subject to the following paragraph, the methods described in the scheduled memorandum are, according to circumstances as indicated therein, the methods by which levels of noise emanating from classified premises are to be measured, or, in so far as they cannot be measured by such methods, calculated, for the purposes of sections 64 to 66 (including section 66 as it has effect by virtue of section 67(5)).

(2) If it appears to the Secretary of State, whether in consequence of representations made to him or otherwise, that, in order to facilitate the effective, or more effective, performance by a local authority of its functions in pursuance of any of the provisions of sections 64 to 66, it is necessary or expedient in any circumstances to provide for the measurement or calculation of noise levels by methods other than those described in the scheduled memorandum, or by those methods with modifications, he may in those circumstances determine the methods by which levels of noise emanating from premises are to be measured or calculated by the local authority and may give directions to the authority accordingly.

Effect of calculation of noise levels

5. Noise levels calculated in accordance with these regulations or in accordance with directions given by the Secretary of State under the preceding regulation may be treated, for the purposes of the provisions of section 64 relating to the measurement of noise levels, to the recording of measurements in the noise level register and to measurements when so recorded, as measured by a method determined in pursuance of section 64(8)(a).

The Noise Level Register

6.—(1) The noise level register which, by virtue of section 64(2), a local authority is required to keep for the purpose of recording levels of noise from classified premises shall be so kept as to show, in relation to each of the premises in respect of which an entry falls to be made—

(*a*) the address, or other sufficient indentification, of the premises and the specified class to which they belong, or, where section 67(1) applies, will belong;

(*b*) such of the particulars required by paragraph (2) below as are appropriate;

(*c*) any cancellation or alteration of an entry in the register and the reason for the cancellation or alteration;

(*d*) the date on which each entry, cancellation or alteration is made.

(2) The record in the register of a noise level which has been ascertained by methods of measurement or calculation or by a combination of such methods, shall contain particulars of the methods employed, particulars, where appropriate, of any methods determined by the Secretary of State under regulation 4(2) above, and the details of all relevant measurements and calculations including—

(*a*) the location (including height) of each point at which the measurements were taken, or for which the calculations were made;

(*b*) relevant details of any equipment used for the purpose;

(*c*) the dates and times when any such measurements were taken and relevant details of the prevailing weather conditions.

(3) The register shall include an index, which may be in the form of, or may incorporate, a map.

(4) Subject to the foregoing provisions, the noise level register shall be kept in such a form (whether in one or more parts), and may include such additional material (including plans, drawings and photographs) in relation to any of the matters recorded therein, as the local authority considers appropriate.

George Younger,
One of Her Majesty's
Principal Secretaries of State.

New St Andrew's House,
Edinburgh.
21st April 1982.

SCHEDULE

MEMORANDUM ON MEASUREMENT AND CALCULATION OF NOISE LEVELS

Interpretation

1. In this memorandum—

"dB(A)" is a measure of sound pressure level in decibels indicated by measuring equipment using A-scale frequency weighting (A-weighting) as described in the British Standard Specification for a precision sound level meter which was published on 14th September 1967 under the number B.S. 4197: 1967;

"L_{eq} " has the meaning given to it in paragraph 6(1) below;

"period of interest", in relation to any measurement or calculation of a sound level, means the period for which the measurement or calculation in question is taken or made.

Where to measure

2.—(1) Noise emanating from classified premises in a noise abatement zone should be measured at points on a line ("the noise control boundary") drawn so as to enclose all significant noise sources on the premises. The precise alignment of the noise control boundary will depend on particular circumstances. In general the perimeter of the premises would be the appropriate line, but special factors (e.g. the presence of obstructions) may make it impracticable or inappropriate to measure noise from the premises at the perimeter.

(2) The simplest situation is one where all the noise sources are close to the ground, where there is open land between the sources and the site perimeter and where the perimeter is marked by fencing of open construction. In such circumstances it will be convenient to locate the measurement points around the perimeter (as indicated below) at a height of 1·2 metres.

Determination of measurement points

3.—(1) The number and position of measurement points will be dictated by the degree of control proposed to be exercised over the level of noise from any premises. The most complete control will be obtained by adopting the approach illustrated in Fig. 1 supplemented as necessary by the additional measurement points referred to in paragraph 3(3). The first measurement point is designated A in Fig. 1. A measurement made at point A will adequately take account of the noise leaving the area XY of the building. A measurement at point B will cover the noise from the area YZ. The distance between points A and B will be determined by the angle θ. This angle should be between 45° and 65° if

rigorous control is to be maintained. Where θ is less than 45° the number of measuring points is unnecessarily increased. Where θ is greater than 65° there will be fewer measurement points, and this will have implications for the subsequent control of noise emanating from the premises.

(2) It is essential that measurement points can be re-located for the purpose of future monitoring of noise levels. Hence it is important that a reliable way of noting the positions of points is used. A plan on which the positions are marked may be advantageous, supplemented, if necessary, by further description, photographs, etc.

(3) For rigorous control the basic coverage provided by the method described in paragraph 3(1) may need to be supplemented for a variety of reasons, for example where there is a permanent noise source, such as a ventilator, close to the perimeter, or where it is anticipated that new noise generating sources might be introduced in the future. Where the noise has noticeable pure tone (i.e. single frequency) components, standing wave patterns of noise (which are characteristically indicated by significant variations in noise level over short distances) may occasionally result. The effect is generally only noticeable at some distance from the source. Since the standing wave pattern may vary from time to time it is possible for the levels at a fixed position to change where the power output of the source has not changed. Where standing wave patterns are encountered, measurements made at fixed points on the boundary should be supplemented by a record of the maximum noise levels between the fixed positions.

(4) Where the perimeter of the premises comprises the external walls of a building which flank directly onto the highway, the noise control boundary must be outside the perimeter of the site as indicated in Fig. 2. In this case the pavement width will probably limit the distance between the noise control boundary and the perimeter of the site, unless it is convenient to take measurements on the opposite sides of the surrounding roads. As a general rule more measuring positions will be required in such a case than where the external walls of a building do not flank directly onto the highway. The number of measuring positions using an angle equal to 60°–65° would be about half the number of positions with the angle equal to 45°, and should give adequate coverage. Here it is particularly important to take account of any prominent noise sources (such as ventilation or cooling equipment, windows and doors along the perimeter), either by introducing extra positions or by varying the angle around the noise control boundary so that there are measuring positions close to such sources.

Height of measuring positions

4.—(1) As previously indicated the convenient height in a simple case would be 1·2 metres but the appropriate height at any particular point will depend on the circumstances.

(2) For the maximum noise level emanating from the premises to be measured, the points from which noise is emanating should be visible from the measurement point. Where the site is enclosed by a wall or other sound-opaque structure at the perimeter, the measuring positions should normally be established at points high enough to measure the noise coming over the top of the wall.

(3) Fig. 3 illustrates a situation where measurement along the site perimeter on top of the wall would not adequately measure noise from the ventilation equipment on the roof of the premises, because of shading from the edge of the building. In some situations it might be practicable to increase the height of the microphone without moving away from the perimeter, but it would usually be more convenient to take measurements at a normal measuring height at a point away from the perimeter which, though still as close as possible to the premises, will give a view of the ventilation equipment from the measuring height.

When to measure

5.—(1) The aim should be to determine typical levels of noise from the premises. Measurements should therefore be made when activity is as near normal as possible. When making measurements the following situations should be borne in mind:—

(i) In some cases plant may be running below its maximum capacity for a long period, e.g. 6 months or a year. If the registered noise levels are determined during this period a note should be made for inclusion in the noise level register that plant was operating below full capacity.

(ii) Noise levels at the perimeter of the premises may vary between summer and winter because doors and windows are left open in the summer in order to increase ventilation. Where doors and windows must be opened for ventilation the registered noise levels should be determined with them open.

(2) The intervals or continuous periods in which measurements are taken should be selected to meet the particular needs at each measurement point. Within the constraints set by the availability of resources, the period will be determined by the pattern of variation of noise and the type of control of the noise that is needed.

(3) For rigorous control of noise which varies throughout the day and between weekdays and the weekend the noise levels should be measured over appropriate day-time and night-time periods and registered accordingly, allowing separate control of noise levels over these periods. For less rigorous control the separate noise levels may be combined to form an equivalent noise level over a longer period. Where the noise level is measured for several periods for registration separately, the object of the measurements should be to determine the typical noise level for each of the periods chosen.

Methods of measurement: general

6.—(1) The noise level to be measured at each measuring position is the equivalent continuous noise level (L_{eq}), measured in dB(A), over a stated period of time. The definition of L_{eq} is that level of continuous noise which has over any defined period the same energy content as the actual noise during that period. Measurements of L_{eq} should be supplemented by measurements of the maximum noise level during the period. The method of measurement of L_{eq} to be used will depend on the way in which the noise level varies, and different methods are described in the paragraphs which follow. This is not intended to preclude the noting of characteristics of the noise, such as pure tones or impulsive character, and the activities giving rise to the noise at a particular measurement point which might be relevant to future control.

(2) No matter which measuring technique is used, the measurements should be carried out by competent staff and detailed records kept of the measurements, so that the techniques can be repeated during the different stages of noise monitoring and control.

(3) The acoustic performance of the measuring equipment must conform to the relevant standards (see paragraphs 7 to 10 below). Its calibration must be maintained and the overall acoustic performance checked before and after each measurement, using high-quality calibration equipment with a calibration level known within $\pm 0{\cdot}5$ dB(A). A microphone windshield of a type which does not appreciably affect the calibration should be used in all measurements.

(4) The effects of extraneous noise on the measurements should always be considered carefully. In some situations it may be possible temporarily to silence the sources of extraneous noise while noise from the premises is measured, or to silence sources of noise within the premises while extraneous noise is measured. Measurements will not be affected where the extraneous noise is 10 dB(A) or more below the noise from the premises. Where extraneous noise is 7 to 10 dB(A) below the noise from the premises the measurements will only be affected slightly. Where extraneous noise is 6 dB(A) or less below the noise from the premises a subtractive correction to the noise level of between 1 and 3 dB(A), using Fig. 6, should be made in registering the noise level at the point. Where extraneous noise dominates noise from the premises, and it is not possible to measure the noise in the way described above, a calculation method should be used (see paragraph 11).

Steady noise

7.—(1) A sound level meter which meets the requirements of B.S. 4197: 1967 is adequate for the purpose of measuring steady noise. The meter should incorporate A-weighting and be set at the "SLOW" dynamic characteristic (as defined in B.S. 4197: 1967). The noise is deemed steady for this purpose if fluctuations of the meter reading do not exceed ± 4 dB(A).

(2) If the sound level averaged visually from the meter over a short time (i.e. 30–60 seconds) remains substantially unchanged throughout the period of interest, the indicated reading is numerically equal to L_{eq} for that period.

Noise having distinguishable levels

8.—(1) Noise which changes in level from time to time, remaining steady at each separate step, can be measured adequately with a sound level meter as described in paragraph 7. The separate levels should be determined and their durations ("on-times") noted. For each level the extraneous noise level should be taken into account when the noise level from the premises is measured.

(2) The pattern of the distinguishable levels is unlikely to recur exactly each day, and it would usually be unnecessarily restrictive to enter the levels separately in the noise level register. Instead the period of measurement should be chosen as described in paragraph 5, and the distinguishable levels observed during the period should be combined to form the L_{eq} for the period. To do this the duration of each distinguishable level should be expressed as a percentage of the period of measurement. A correction should be made, using Fig. 4, to convert each level to the equivalent continuous level over the period of measurement, and the corrected levels should be combined to give a value of L_{eq} for entry in the noise level register. (The procedure for combining the corrected levels is the conventional one for adding sound levels, as indicated in the example in paragraph 8(3)). This single figure specification of the noise level would allow very high noise levels over short periods unless accompanied by some further specification of the noise level. Where appropriate (i.e. where control of the maximum noise level is required) the maximum noise level measured should be noted for entry in the noise level register in addition to the L_{eq} level.

(3) The following example illustrates this method of measurement of noise. Fig. 5 shows the pattern of noise levels from a factory during the period 0700 to 1700 hours over which registered noise levels are to be determined. At a particular measuring position three noise levels occur at different times during the period of measurement. Noise A is a continuous level of 60 dB(A) present throughout the period. Noise B comprises this continuous noise plus noise from riveting, typically present for two separate half-hour periods, and gives a measurable level of 65 dB(A). Noise C comprises the continuous noise, plus the noise of hammering, and occurs typically for one half-hour period at a level of 75 dB(A). The duration corrections should be applied as follows (using Fig. 4):—

Noise	Noise level	Percentage "on-time"	Correction	Corrected level
A	60 dB(A)	85	− 1 dB(A)	59 dB(A)
B	65 dB(A)	10	− 10 dB(A)	55 dB(A)
c	75 dB(A)	5	− 13 dB(A)	62 dB(A)

The corrected noise levels should then be combined, using Fig. 7. Combining 59 and 55 dB(A) gives 60·5 dB(A) which is then combined with 62 dB(A) to give a single value of 64·3 dB(A) as the L_{eq} noise level for the period to be entered in the noise level register. In addition it will be appropriate to note the maximum noise level of 75 dB(A) for entry in the noise level register where control over the maximum noise level is required.

Varying noise levels

9.—(1) Where the noise level varies so that there are no distinguishable steady noise levels, the methods described above cannot be applied. The method described here, or the method in paragraph 10, should be used instead. The method of measurement described here is not appropriate for noise with impulsive character.

(2) The noise level should be measured with equipment providing a statistical analysis of the sound levels, and L_{eq} calculated as described in paragraph 9(3). A typical set of equipment comprises a microphone and microphone amplifier, a graphic level recorder

(producing a visual record of the noise level over the period of measurement) and a statistical analyser performing the analysis required by paragraph 9(3). An alternative would be to use data-logging equipment which samples (i.e. periodically measures) the noise level and produces an output in digital form on magnetic tape. L_{eq} is then derived by replaying the tape through a suitably programmed calculator. The equipment used should have the same overall acoustic performance as a sound level meter used under similar conditions (see paragraph 7(1)).

(3) For the purpose of analysis the sound levels should be grouped in classes with widths of 5, 2·5 or 1 dB(A) as appropriate. The total duration within the overall period of measurement chosen for which the noise level lies in each class should be recorded. L_{eq} can then be calculated from the formula:

$$L_{eq}\ (\text{period specified}) = 10 \log_{10}\left[\frac{1}{100}\left(f_1.10^{L_1/10} + f_2.10^{L_2/10} + f_3.10^{L_3/10} \ldots\ldots\ldots + fn.10^{Ln/10}\right)\right]$$

where L_{eq} (period specified) is the equivalent continuous sound level in dB(A) over the period for registering noise levels;

f_1 is the percentage of the period for which the noise level lies within the first class-interval with centre-point L_1;

f_2 is the percentage of the period for which the noise level lies within the second class-interval with centre-point L_2;

f_3 is the percentage of the period for which the noise level lies within the third class-interval with centre-point L_3;

and so on up to fn where n is the total number of sound level class-intervals.

Rapidly varying noise levels

10.—(1) Varying noise levels including those which fluctuate over a wide range of levels, or have an impulsive characteristic, can be measured by a meter giving a direct reading of L_{eq} (i.e. an integrating meter). The meter should incorporate A-weighting in the measuring circuit and should give a value of L_{eq} according to the equation:

$$L_{eq} = 10 \log_{10} \frac{1}{T} \int_0^T \left[\frac{p\hat{a}(t)}{p\hat{o}}\right]^2 dt$$

where L_{eq} is the equivalent continuous sound level in dB(A) over the period of the measurement, T;

$P\hat{a}(t)$ is the instantaneous A-weighted sound pressure in newtons per square metre (pascals), varying with time t;

$P\hat{o}$ is the reference sound pressure whose value is 20×10^{-6} newtons per square metre (pascals).

(2) The integrating meter should meet all the relevant requirements of B.S. 4197: 1967. A dynamic range of at least 60 dB(A), and preferably 80 dB(A), is necessary when the instrument is required to measure impulse noise. The instrument should incorporate an instantaneous overload indicator to show if the noise level to be measured has exceeded the maximum level which the meter is capable of measuring.

(3) To measure maximum levels of impulsive noise the measurement equipment should have a response equivalent to that of the "FAST" response defined in B.S. 4197: 1967.

Dominant extraneous noise

11.—(1) The extraneous noise at any point on the noise control boundary is all noise which does not emanate from the premises in question. The following simple calculation method may be used where for the period of interest extraneous noise dominates the noise

emanating from the premises, and makes direct measurement of the noise emanating impracticable. This calculation method may be used for any period for which a noise level is to be registered. Measurements should be taken of the ambient noise at the noise control boundary ($\times$ dB(A) expressed as the L_{eq} over the period of interest), comprising the sum of the noise emanating from the premises and the extraneous noise. To calculate the level of noise emanating from the premises (i.e. the level to be treated as the measured level for entry in the noise level register) subtract from the measured ambient level:

(*a*) 6 dB(A) L_{eq} where the extraneous noise level is recognisably more than twice as loud as the level of noise emanating from the premises;

(*b*) 3 dB(A) L_{eq} where the extraneous noise is less dominant than described in (*a*) above.

(2) The method of measurement used may be any of those set out in paragraphs 7 to 10 which are appropriate to the situation.

(3) Where extraneous noise dominates the noise emanating from the premises at the perimeter of the premises, but does not dominate it at all points within the grounds belonging to the premises, the need to use the method described above may be avoided by locating the noise control boundary along a line (within or partly within the perimeter) on which extraneous noise is not dominant. There are limitations to this approach where sources of noise are likely to be introduced between the noise control boundary and the perimeter of the site.

(4) Calculation of the noise level at points on the line of the noise control boundary, as described above, may be supplemented where more rigorous control over noise is needed, by measurements to establish the noise level at isolated points close to the sources of the noise emanating from the premises. The measured levels should be recorded for entry in the noise level register. This may facilitate control over noise from these sources, but it would not by itself provide complete control over noise from the premises because of the possible addition of new noise sources.

Meteorological conditions

12.—(1) The effects of meteorological conditions on sound propagation are complex, and are most marked when either the source or the receiver, or both, are close to the ground and when sound is propagated over large distances. The meteorological conditions which are suitable for making measurements of noise levels are indicated in paragraph 12(2) to (5).

(2) Wind has a major influence over sound propagation:

(i) Particular care is required when the noise source is more than 50 metres from the measuring position. A positive wind component of up to 2 m/sec towards the measuring position, to ensure that the measured noise level is at a maximum, is desirable.

(ii) When the noise source is 25 metres to 50 metres from the measuring position, calm or a positive wind component of up to 2 m/sec towards the measuring position is desirable.

(iii) When the noise source is less than 25 metres from the measuring position, calm or any wind direction is acceptable.

(3) A temperature gradient (i.e. variation of temperature with height) can also have a significant effect on sound propagation. In particular, measurements of noise levels should not normally be made in conditions of temperature inversion (often associated with calm, clear nights and a tendency for the formation of mist or fog).

(4) Strong winds can themselves create noise at the microphone and affect the readings. The use of a microphone windshield is effective in some situations, but not always. As a general guide, measurements should not be made if the wind-generated noise is within 10 dB(A) of the total noise reading. Wind-generated noise should be checked in some relatively quiet situation exposed to wind conditions similar to those experienced at the noise measuring positions on the noise control boundary.

(5) The reception of noise can also be affected by a layer of snow on the ground and measurements should not normally be made in these conditions. As a general rule, noise measurements should not be taken in adverse meteorological conditions such as snow, rain, or fog, but frost alone would not affected measurements.

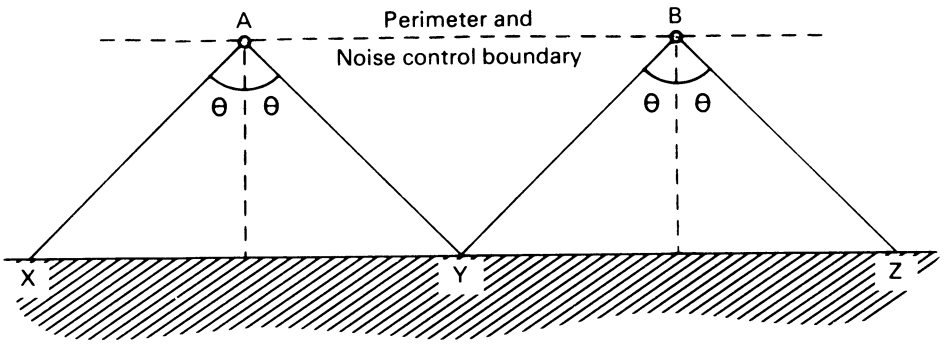


Figure 1

Determination of measuring positions

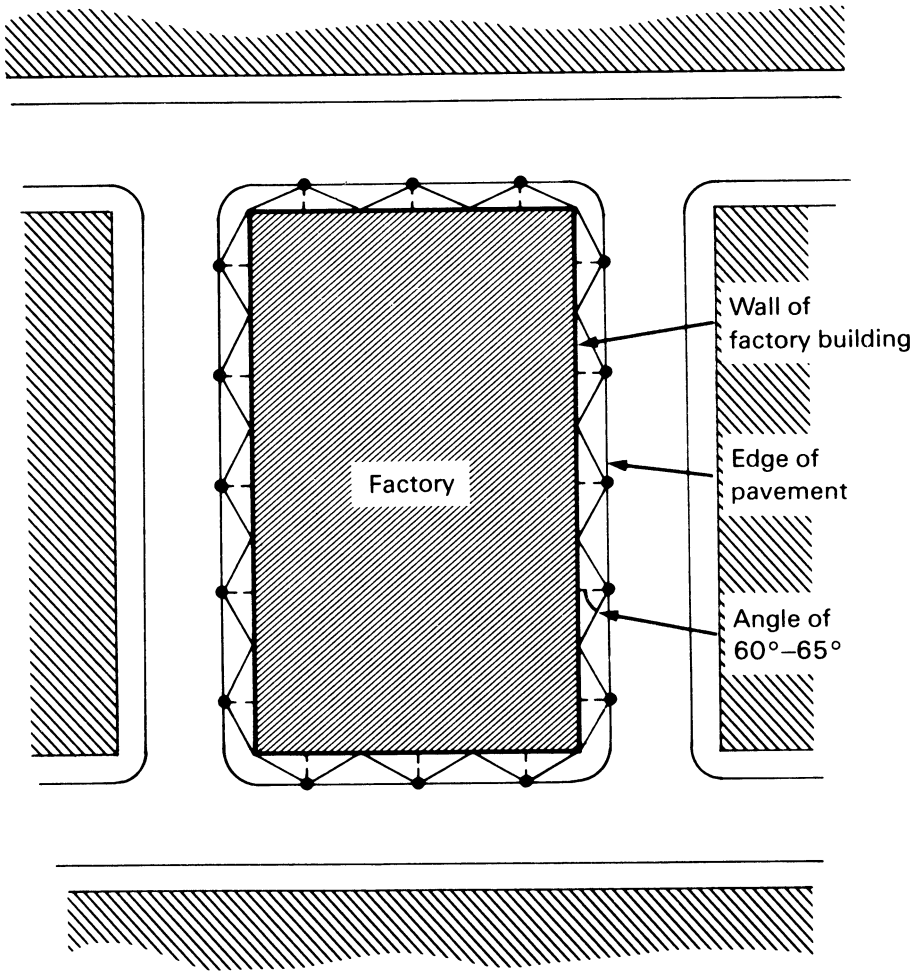


Figure 2

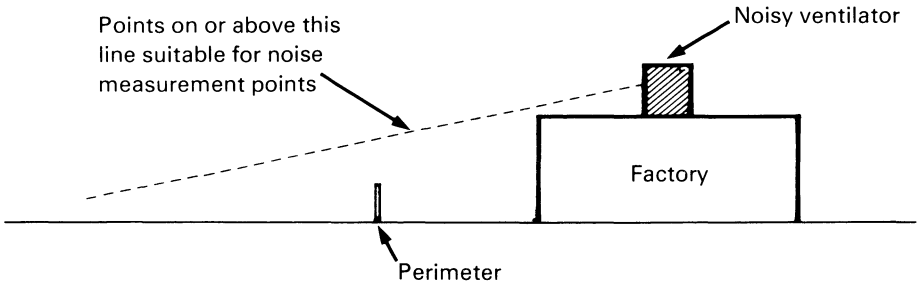

Points on or above this line suitable for noise measurement points
Noisy ventilator
Factory
Perimeter

Figure 3

Correction to observed distinguishable noise level for percentage "on-time". (The correction should be subtracted from the observed level.)

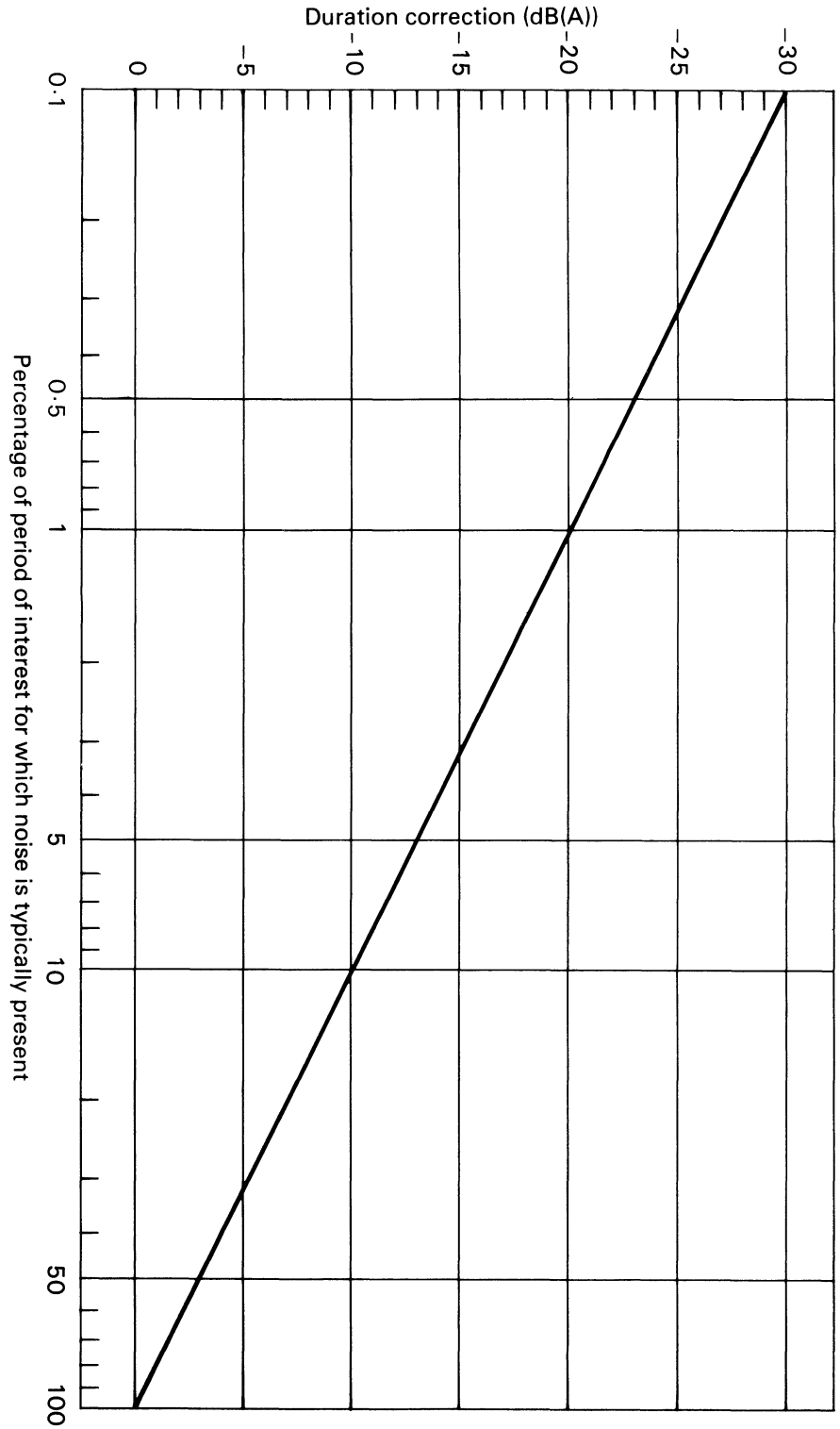


Figure 4

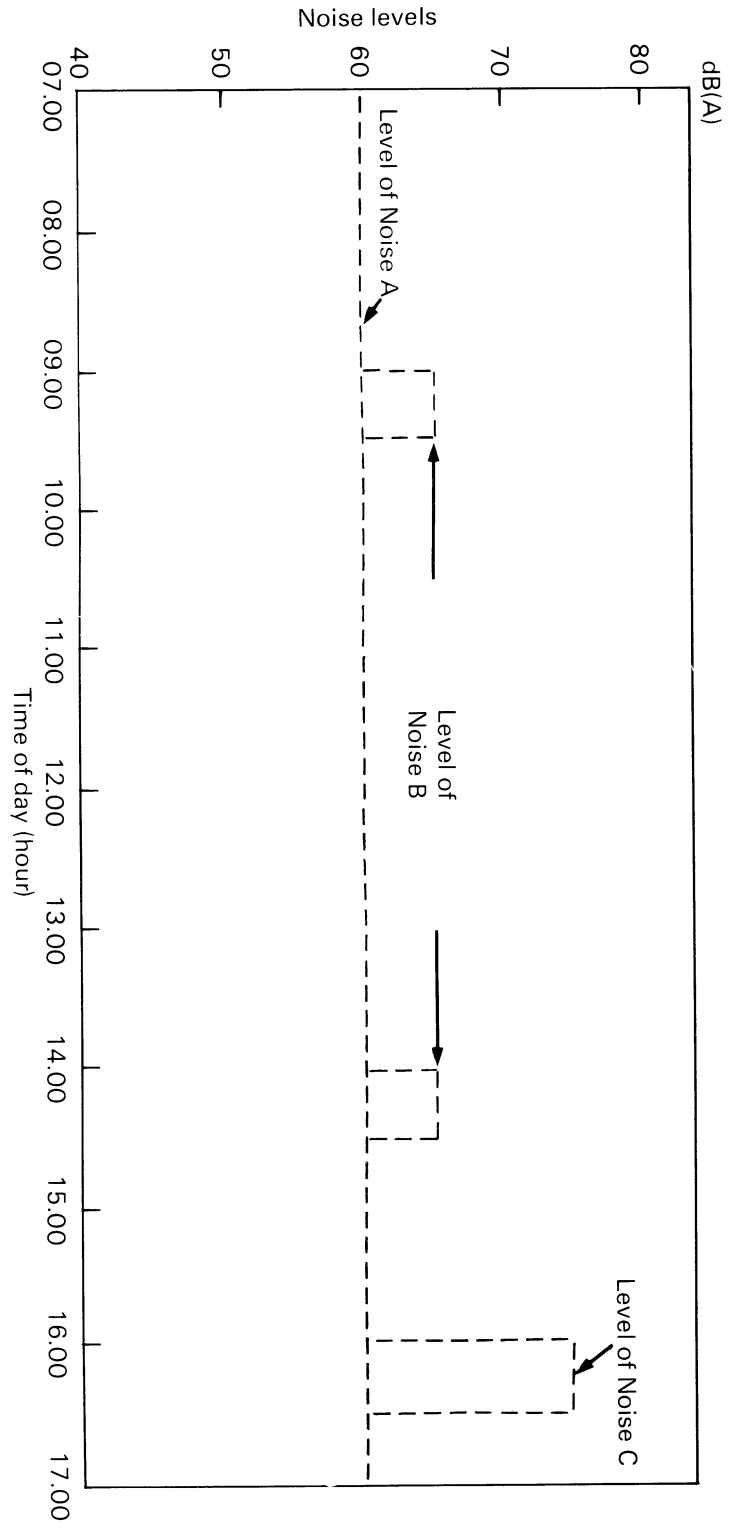


Figure 5. An example of the variation with time of the noise levels from a factory.

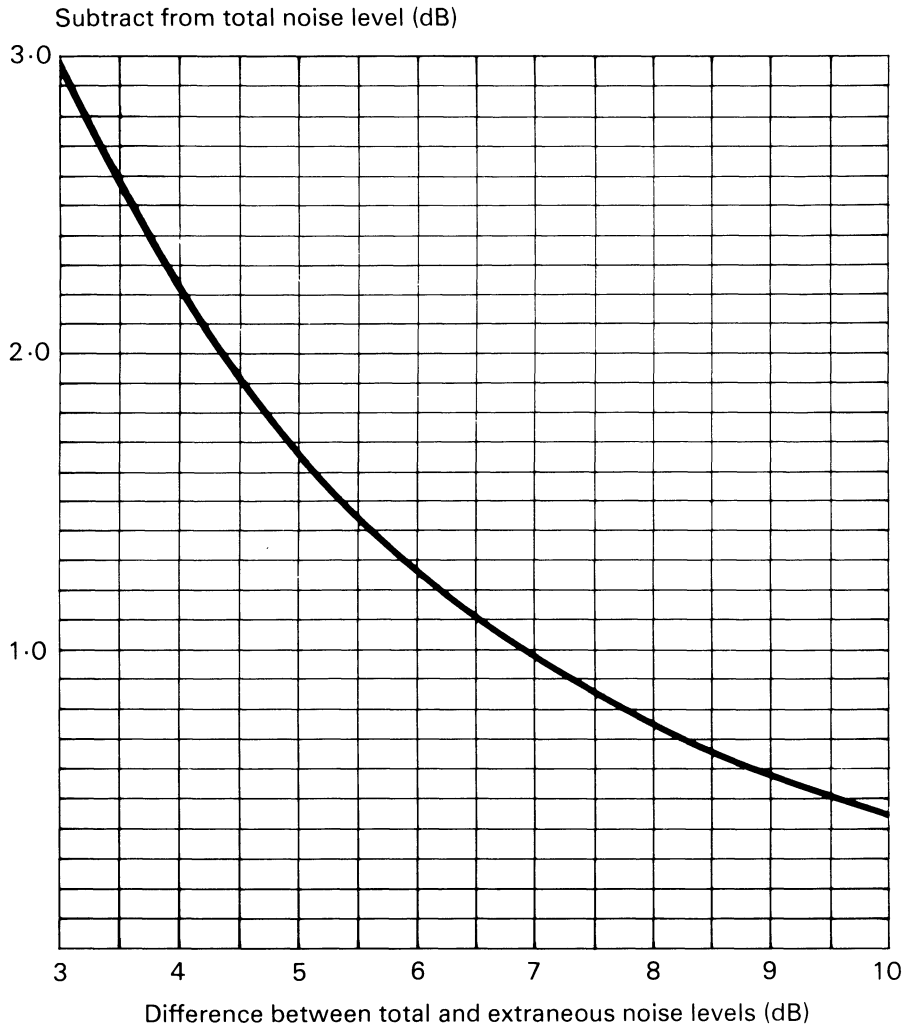


Figure 6

The subtraction of one noise level from another

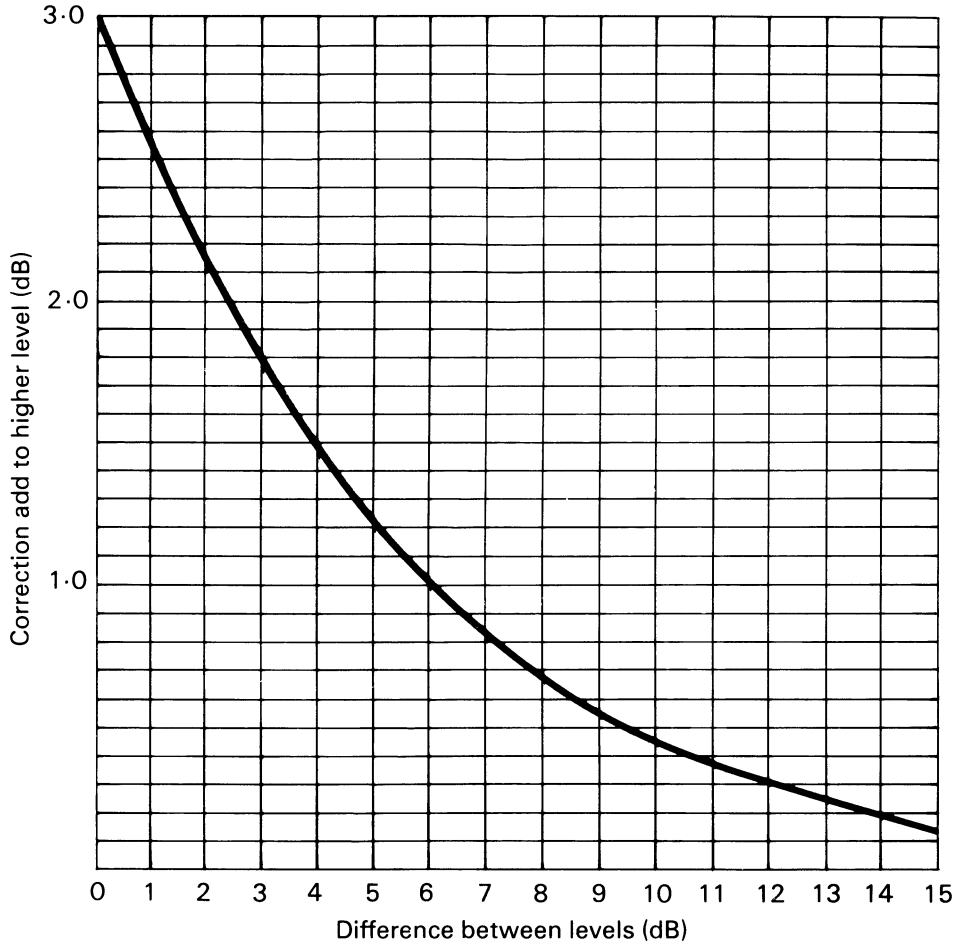


Figure 7

The addition of two noise levels

EXPLANATORY NOTE

(This Note is not part of the Regulations.)

These Regulations make provision, in pursuance of section 64(8) of the Control of Pollution Act 1974, with respect to the methods to be used by local authorities in Scotland when measuring, and, where necessary, calculating, levels of noise from premises of any specified class in a noise abatement zone. Methods for general use are described in the schedule. The Secretary of State is authorised in certain circumstances to determine special methods for use by a local authority (reg. 4(2)). In pursuance of section 64(8)(*b*) regulation 5 provides that calculated noise levels may be treated as measured for the purposes of provisions of section 64 which relate to the measuring of noise levels and the recording of measurements in a register.

The Regulations also make provision, in pursuance of section 64(2) of the Act, with respect to the keeping by a local authority of the noise level register in which measurements of noise levels and other particulars are required to be recorded.

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