

Method for

**Rating industrial noise  
affecting mixed residential and  
industrial areas**

ICS 17.140.20



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## Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee EH/1, Acoustics, to Subcommittee EH/1/3, Residential and industrial noise, upon which the following bodies were represented:

Association of Consulting Engineers  
 Association of Consulting Scientists  
 Association of Metropolitan Authorities  
 Association of Noise Consultants  
 British Association for Shooting and Conservation  
 British Cement Association  
 British Coal Corporation  
 British Occupational Hygiene Society  
 British Scrap Federation  
 Chartered Institute of Environmental Health  
 Confederation of British Forgers  
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## Foreword

This British Standard has been prepared by Subcommittee EH/1/3. It supersedes BS 4142 : 1990, which is withdrawn.

This British Standard describes a method of determining the level of a noise of an industrial nature, together with procedures for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity. The user is reminded that this standard is not based on substantive research but rather on accumulated experience. It has been prepared under the direction of the Health and Environment Sector Board. First published in 1967, BS 4142 was amended in 1975, 1980 and 1982. It was revised in 1990 to align it with ISO 1996: Parts 1 to 3, which are implemented as BS 7445 : Parts 1 to 3. This revision clarifies aspects of the standard in the light of comments from the users. In particular, the term 'residual noise level' has been introduced and the term 'steady noise' deleted, the section dealing with measurement of specific noise level has been clarified and requirements for verification and traceability of instrumentation have been aligned with BS 7445 (ISO 1996).

Response to noise is subjective and affected by many factors (acoustic and non-acoustic). In general, the likelihood of complaint in response to a noise depends on factors including the margin by which it exceeds the background noise level, its absolute level, time of day, change in the noise environment etc., as well as local attitudes to the premises and the nature of the neighbourhood. This standard is only concerned with the rating of a noise of an industrial nature, based on the margin by which it exceeds a background noise level with an appropriate allowance for the acoustic features present in the noise. As this margin increases, so does the likelihood of complaint.

The standard is intended to be used for assessing the measured or calculated noise levels from both existing premises and new or modified premises. The standard may be helpful in certain aspects of environmental planning and may be used in conjunction with recommendations on noise levels and methods of measurement published elsewhere.

The standard is necessarily general in character and may not cover all situations. The likelihood that an individual will complain depends on individual attitudes and perceptions in addition to the noise levels and acoustic features present. This standard makes no recommendations in respect of the extent to which individual attitudes and perceptions should be taken into account in any particular case.

Although, in general, there will be a relationship between the incidence of complaints and the level of general community annoyance, quantitative assessment of the latter is beyond the scope of this standard, as is the assessment of nuisance.

It should be noted that noise assessment is a skilled operation and should be undertaken only by persons who are competent in the procedures.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 14, an inside back cover and a back cover.

## 1 Scope

This British Standard describes methods for determining, at the outside of a building:

- a) noise levels from factories, or industrial premises, or fixed installations, or sources of an industrial nature in commercial premises; and
- b) background noise level.

The standard also describes a method for assessing whether the noise referred to in (a) is likely to give rise to complaints from people residing in the building. The method is not suitable for assessing the noise measured inside buildings or when the background and rating noise levels are both very low.

NOTE. For the purposes of this standard, background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low.

Examples of how to use the standard to obtain noise ratings and to assess the likelihood of complaints are given in annex A.

## 2 References

### 2.1 Normative references

This British Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this British Standard only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

### 2.2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

## 3 Definitions and symbols

For the purposes of this British Standard, the following definitions apply.

NOTE. The convention applied to this standard is that all measured or calculated numbers are rounded to the nearest whole number with 0.5 being rounded up.

### 3.1 equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval,  $T$ , has the same mean-squared sound pressure as a sound that varies with time. It is given by the following equation:

$$L_{Aeq,T} = 10 \lg_{10} \left\{ (1/T) \int_{t_1}^{t_2} (p_A^2(t) / p_0^2) dt \right\} \quad (1)$$

where:

$L_{Aeq,T}$  is the equivalent continuous A-weighted sound pressure level determined over a time interval  $T = t_2 - t_1$ ;

$p_0$  is the reference sound pressure ( $20 \mu\text{Pa}$ );

$p_A(t)$  is the instantaneous A-weighted sound pressure (Pa).

The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

### 3.2 specific noise source

The noise source under investigation for assessing the likelihood of complaints.

### 3.3 reference time interval, $T_r$

The specified interval over which an equivalent continuous A-weighted sound pressure level is determined.

### 3.4 specific noise level, $L_{Aeq,T_r}$

The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.

### 3.5 measurement time interval, $T_m$

The total time over which measurements are taken.

NOTE. This may consist of the sum of a number of non-contiguous, short term measurement time intervals.

### 3.6 rating level, $L_{Ar,T_r}$

The specific noise level plus any adjustment for the characteristic features of the noise.

### 3.7 ambient noise

Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

### 3.8 residual noise

The ambient noise remaining at a given position in a given situation when the specific noise source is suppressed to a degree such that it does not contribute to the ambient noise.

### 3.9 residual noise level, $L_{Aeq,T}$

The equivalent continuous A-weighted sound pressure level of the residual noise.

### 3.10 background noise level, $L_{A90,T}$

The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 % of a given time interval,  $T$ , measured using time weighting,  $F$ , and quoted to the nearest whole number of decibels.

## 4 Measuring equipment

### 4.1 Equivalent continuous noise level

Equivalent continuous noise levels shall be measured in terms of  $L_{Aeq,T}$  using an integrating-averaging sound level meter or equivalent system conforming to type 2 or better of BS EN 60804.

NOTE. If the noise is steady, an approximation to  $L_{Aeq,T}$  can be obtained by visually averaging the indication of a sound level meter set to frequency weighting 'A' and the use of this method should be reported.

### 4.2 Background noise level

For measurement of background noise level,  $L_{A90,T}$ , the components of the measuring system shall conform to type 2 or better of BS EN 60651.

## 5 Measurement practice

### 5.1 Operational tests

Apply an acoustic calibrator or pistonphone conforming to BS 7189 to the microphone to check the sensitivity of the measuring equipment before and after measurements. Record the results of such tests.

### 5.2 Verification and traceability

In addition to the tests in 5.1, at certain time intervals, e.g. every two years, more extensive tests of the performance of the instrumentation may be prescribed by authorities responsible for the use of the results.

NOTE. In deciding on how comprehensive these tests should be, the level of accuracy involved in application of this standard in the particular case should be considered. For the highest level of verification, tests of the conformity of the calibrator or pistonphone to BS 7189 and verification of the complete measuring equipment to BS 7580 : Part 1 should be carried out either by a national metrology institute, or a competent calibration laboratory that can demonstrate that its measurements are traceable to national or international standards. In the UK, acoustical calibration laboratories are accredited by the United Kingdom Accreditation Service (UKAS); the relevant national metrology institute is the National Physical Laboratory. Where less comprehensive tests are prescribed these should also be reported under clause 10.

### 5.3 Measurement positions

Choose measurement positions that are outside buildings and that will give results that are representative of the specific noise level and background noise level at the buildings where people are likely to be affected.

To minimize the influence of reflections, make the measurements at least 3.5 m from any reflecting surface other than the ground.

NOTE 1. The preferred measurement height is 1.2 m to 1.5 m above the ground.

NOTE 2. Where it is necessary to make measurements above ground floor level, choose a position which is 1 m from the facade on the relevant floor of the building.

NOTE 3. Report the measurement position, height and the distance from any reflecting structure other than the ground.

### 5.4 Precautions against interference

Take precautions to minimize the influence on the readings from sources of interference such as the following (and from any other sources):

- wind, passing over the diaphragm of the microphone of a sound level meter which can generate noise interference;
- heavy rain, falling on the microphone windshield or nearby surfaces which can cause noise interference;
- electrical interference, which can be caused in the sound level meter by, for example, nearby power cables or radio transmitters.

Use an effective windshield to minimize turbulence at the microphone.

NOTE. For the purposes of this standard, windshields are generally effective up to windspeeds of 5 m/s.

Measured levels shall be considered valid only if they exceed readings on the measuring instrument owing to the above influences by at least 10 dB.

### 5.5 Weather conditions

Record the weather conditions prevailing during all measurements.

NOTE 1. Weather conditions can affect noise levels by influencing sound propagation or generating noise which can be pertinent to the assessment.

NOTE 2. More than one assessment may be appropriate.

## 6 Specific noise level

### 6.1 General

Determine the specific noise level at the assessment location(s) as a discrete entity, distinct and free of influence from other noises contributing to the ambient noise, following the appropriate procedures in 6.3. Report in detail the methods used.

Take care that all sample measurements are representative of the period of interest.

### 6.2 Reference time interval

Evaluate the specific noise, in all cases, over the appropriate reference time interval which is as follows:

- 1 h during the day;
- 5 min during the night.

NOTE. The shorter reference time interval at night means that short duration noises with an on time of less than 1 h lead to a greater specific noise level when determined over the reference time interval during the night rather than during the day. The choice of day and night periods will depend on normal local circumstances. It is intended that the night period should cover the times when the general adult population are preparing for sleep or are actually sleeping.

### 6.3 Determination of the specific noise level

6.3.1 Determine the specific noise level by applying the procedures in 6.3.2 to 6.3.14.

**6.3.2** The ambient noise is comprised of the residual noise and the specific noise when present. When taking measurements of the ambient noise to determine the specific noise level, it is important to distinguish between the specific noise and the residual noise. Distinguish between the specific noise and the residual noise. Minimize the influence of noise from other sources by measuring at times and during intervals when the residual noise level has subsided to typically low levels.

**6.3.3** Compensate for the effect of the residual noise using the corrections set out in table 1. Measure the residual noise level in the absence of the specific noise.

NOTE. When measuring the residual noise level, all other conditions should be similar to the conditions that exist when the measurements are taken with the specific noise present.

| Table 1. Corrections to noise level readings   |  |
|--|--|
| Difference between noise level readings with specific noise present and absent<br>dB   | Correction to be subtracted from noise level reading with specific noise present<br>dB |
| > 9  | 0  |
| 6 to 9   | 1  |
| 4 to 5   | 2  |
| 3  | 3  |
| < 3  | see 6.3.4 to 6.3.7   |
| NOTE. An estimate of the residual noise level during the measurement time intervals when the residual noise level has subsided to typically low levels can be made by measuring the background noise level when all other conditions are similar to those when the measurements are taken with the specific noise present. |  |

**6.3.4** Where possible, determine the specific noise level directly by measurement at the assessment location(s).

NOTE. It is permissible to make measurements if there are periods of low residual noise (such as at night or at weekends) when the specific noise would not normally occur but might be turned on for measurement purposes. The specific noise should be representative of normal operating conditions.

**6.3.5** Where it is not possible to determine the specific noise level directly by measurement at the assessment location(s), for example, because of the influences of noise from other sources, determine the specific noise level by a combination of measurement and calculation. Report the method of calculation in detail and give the reason for using it.

NOTE. It may be possible to obtain a representative measurement at some other location and then use a method of calculation to estimate the specific noise level at the assessment location(s).

**6.3.6** Determine the specific noise level by calculation alone if measurement is not practicable, for example if the source is not yet in operation. In such cases, report the method of calculation in detail and give the reason for using it.

**6.3.7** Determine the specific noise level as separate component parts, when:

- the influence of other noise sources can be avoided only by measuring samples of the specific noise; or
- the specific noise is composed of contributions from several sources which have been measured separately and, if necessary, corrected for propagation effects.

Determine the equivalent continuous A-weighted sound pressure level of the specific noise,  $L_{Aeq,T}$ , over time interval,  $T$ , from the equivalent continuous A-weighted sound pressure levels of its components  $L_{Aeq,T_i}$  from equation (2).

$$L_{Aeq,T} = 10 \lg_{10} \left\{ (1/T) \sum T_i 10^{0.1 L_{Aeq,T_i}} \right\} \quad (2)$$

where:

$T = \sum T_i$  if components are sequential;

$T =$  maximum value of  $T_i$  if components are concurrent.

Ensure that the measurement time intervals are long enough to obtain representative values of the equivalent continuous A-weighted sound pressure level.

NOTE 1. The time interval,  $T$ , may contain intervals,  $T_i$ , during which the noise is off and the noise level is deemed to be 0 dB.

NOTE 2. The separate components may be sequential, such as when measuring during troughs in the residual noise, or concurrent, such as when measurements are made close to separate sub-sources which normally operate concurrently and combine to produce a composite noise further away.

**6.3.8** Take the measurement of the specific noise level over a time interval,  $T_m$ , which reflects all significant temporal and level variations of the specific noise.

NOTE. If the noise is steady, a short sample measurement will be sufficient. If it is cyclic or intermittent or varies randomly, a longer sample will be required to characterize it. It may be necessary to investigate the noise over relatively long periods to select an appropriate, representative measurement time interval.

**6.3.9** If the measurement time interval is equal to the reference time interval use the following procedure.

Measure the equivalent continuous A-weighted sound pressure level,  $L_{Aeq,T_m}$ , correct for the influence of residual noise and assign the result to the specific noise level.

**6.3.10** If the specific noise is continuous, such that measurements over the time interval,  $T_m (< T_r)$ , are representative of measurements over the reference time interval,  $T_r$ , use the following procedure.

Measure the equivalent continuous A-weighted sound pressure level,  $L_{Aeq,T_m}$ , correct for the influence of residual noise and assign the result to the specific noise level.

**6.3.11** If the specific noise fluctuates at random, use the following procedure.

Select the measurement time interval to give a reliable estimate of the equivalent continuous A-weighted sound pressure level over the reference time interval. Measure the equivalent continuous A-weighted sound pressure level,  $L_{Aeq,T_m}$ , correct for the influence of residual noise and assign the result to the specific noise level.

**6.3.12** If the specific noise is continuous and cyclic with a period less than or equal to the reference time interval, use the following procedure.

Select the measurement time interval,  $T_m$ , to cover at least one complete cycle (or more). Measure the equivalent continuous A-weighted sound pressure level,  $L_{Aeq,T_m}$ , correct for the influence of residual noise and assign the result to the specific noise level (see figure 1).

NOTE. If continuous measurements over the measurement time interval,  $T_m$ , cannot be made, select short term measurement time intervals, so that each represents a part of a cycle and so that, together, they represent a complete cycle or number of cycles.

**6.3.13** If the specific noise is intermittent and either steady or cyclic and the reference time interval,  $T_r$ , is at a representative time, and the on-time is less than the reference time interval, use the following procedure.

Determine the on-time,  $T_o$ , and select the measurement time interval,  $T_m \leq T_o$ , to obtain a representative value for the equivalent continuous A-weighted sound pressure level  $L_{Aeq,T_m}$ , for the noise while it is on (see figure 2). Correct for the influence of residual noise.

Calculate the specific noise level as follows:

$$L_{Aeq,T_r} = L_{Aeq,T_m} + 10 \lg T_o/T_r \quad (3)$$

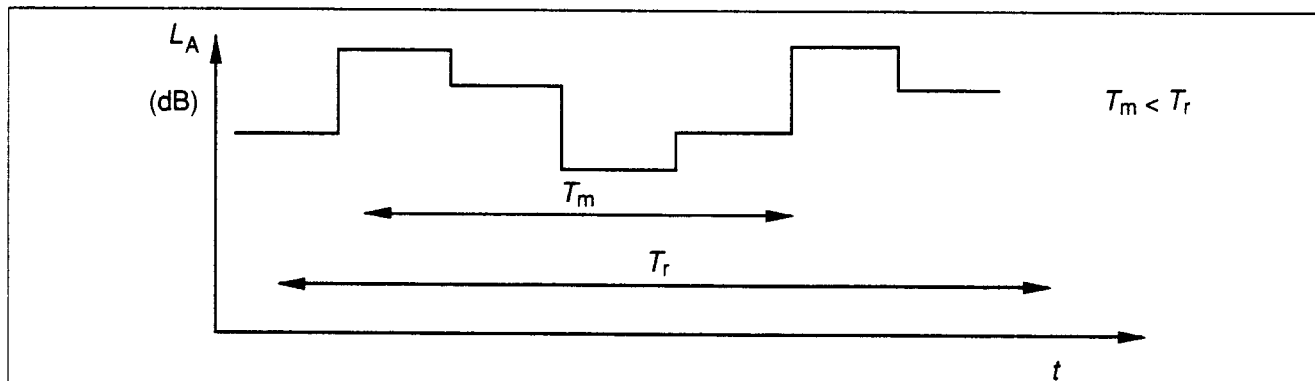


Figure 1. Selecting the measurement time interval

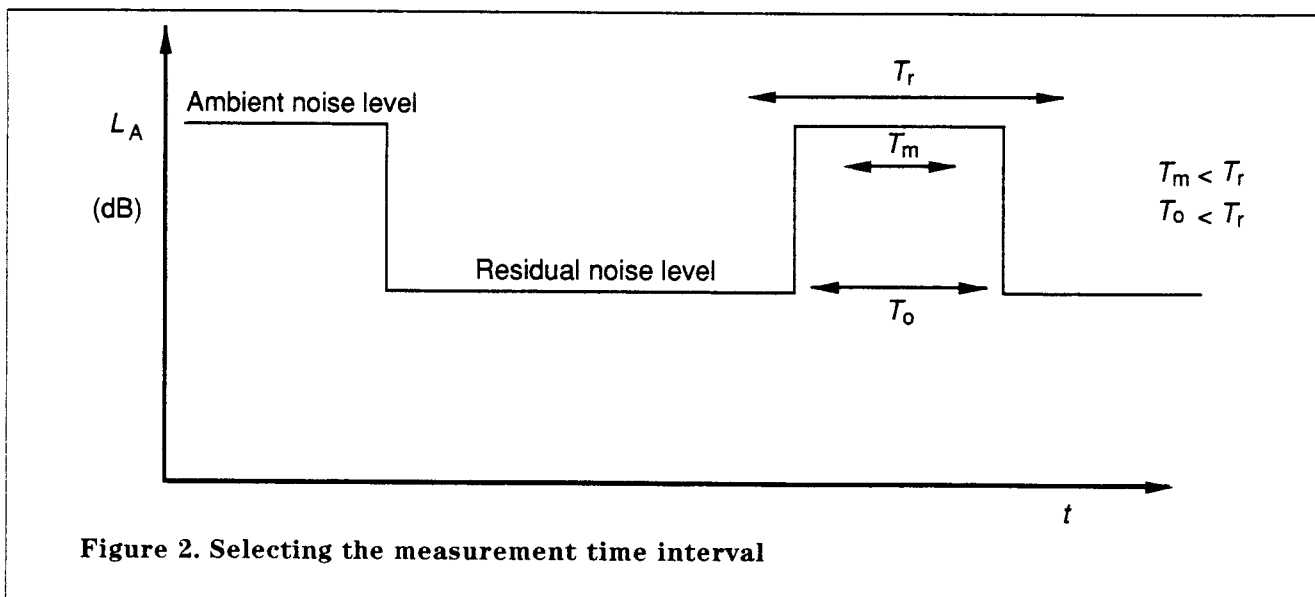


Figure 2. Selecting the measurement time interval



**6.3.14** If the specific noise is intermittent or cyclic, and the reference time interval is at a representative time and the on-time is equal to or greater than the reference time interval, use the following procedure.

Select the measurement time interval,  $T_m$ , to obtain the highest representative value for the equivalent continuous A-weighted sound pressure level  $L_{Aeq,T_m}$ . Correct for the influence of residual noise and assign the result to the specific noise level (see figure 3).

## 7 Background noise level

NOTE. For the measurement of background noise level, this standard distinguishes three situations in which:

- a new specific noise source is to be commissioned or a modification is to be made to an existing specific noise source (see 7.2);
- there is an existing specific noise source not operating continuously (see 7.3);
- an existing specific noise source is operating continuously (see 7.4).

### 7.1 General

**7.1.1** Where possible, measure the background noise level at the assessment location(s). If it is not possible to measure the background noise level at the assessment location(s) then measure the background noise level at another position where it is presumed to be equivalent and report the reasons for presuming it to be equivalent.

**7.1.2** Ensure that the measurement time interval is sufficient to obtain a representative value of the background noise level.

NOTE. The background noise level can often be significantly affected by meteorological conditions, particularly where the main background noise sources are remote from the assessment location. In such cases, it may be necessary to repeat the background noise measurements on a number of occasions to obtain a representative measurement sample. More than one assessment may be appropriate.

**7.1.3** Make measurements during periods when the background noise level is typical of the background noise when the specific noise source is or will be operating, but is not actually operating at the time of measurement.

**7.1.4** Measure the background noise level during periods when weather conditions are appropriate to the assessment similar to those which prevail when the specific noise level is determined, or are likely to be similar to those during the operation of a new or modified specific noise source.

### 7.2 New or modified specific noise source

Measure the background noise on days of the week and at times of the day when the specific noise source will be operating.

### 7.3 Existing specific noise source not operating continuously

Measure the background noise level in the absence of the specific noise on days and at times when the specific noise source would normally be operating, either:

- during a temporary shutdown of the specific noise source; or
- during a period immediately before or after the specific noise source operates.

### 7.4 Existing specific noise source which operates continuously

Measure the background noise level at a position which is not influenced by the specific noise and where the background noise level is considered to be equivalent to that of the assessment location and report the reasons for presuming it to be equivalent.

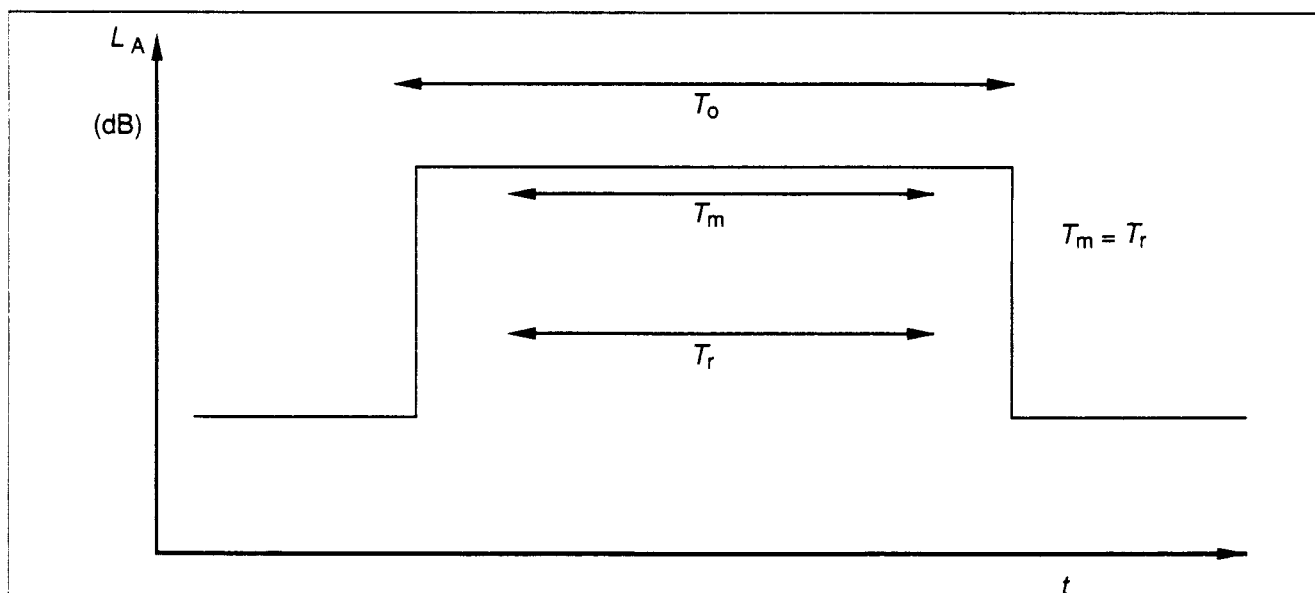


Figure 3. Selecting the measurement time interval

## 8 Rating level

**8.1** Certain acoustic features can increase the likelihood of complaint over that expected from a simple comparison between the specific noise level and the background noise level. Where present at the assessment location, such features are taken into account by adding 5 dB to the specific noise level to obtain the rating level.

**8.2** Apply a 5 dB correction if one or more of the following features occur, or are expected to be present for new or modified noise sources:

- the noise contains a distinguishable, discrete, continuous note (whine, hiss, screech, hum, etc.);
- the noise contains distinct impulses (bangs, clicks, clatters, or thumps);
- the noise is irregular enough to attract attention.

NOTE. The rating level is equal to the specific noise level if there are no such features present or expected to be present.

## 9 Assessment method

Assess the likelihood of complaints by subtracting the measured background noise level from the rating level.

NOTE. More than one assessment may be appropriate.

The greater this difference the greater the likelihood of complaints.

A difference of around +10 dB or more indicates that complaints are likely.

A difference of around + 5 dB is of marginal significance.

If the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely.

## 10 Information to be reported

The following information shall be reported:

- a) source under investigation as follows:
  - 1) description of source and of specific noise;
  - 2) hours of operation;
  - 3) mode of operation (e.g. continuous, twice a day, only in hot weather);
  - 4) description of premises in which source is situated (if applicable).
- b) subjective impressions including:
  - 1) dominance or audibility of specific noise;
  - 2) main sources contributing to the residual noise.

- c) location of measurement positions, their distance from the specific noise source and the topography of the intervening ground, distance from specific noise source and any reflecting surface other than the ground including a dimensioned sketch with a north marker;
- d) noise measuring instruments including calibrator or pistonphone used:
  - 1) type;
  - 2) manufacturer;
  - 3) serial number;
  - 4) details of the latest verification test including dates.

- e) operational test:
  - 1) reference level of calibrator or pistonphone;
  - 2) meter reading before and after measurements with calibrator or pistonphone applied.

- f) weather conditions, including:
  - 1) wind speed and direction;
  - 2) presence of conditions likely to lead to temperature inversion (e.g. calm nights with little cloud cover);
  - 3) precipitation;
  - 4) fog.

- g) date and time of measurements;

- h) specific noise level;
  - 1) measured noise level(s);
  - 2) residual noise level and method of determination;
  - 3) specific noise level and method of determination;
  - 4) justification of methods;
  - 5) details of any corrections applied.

- i) measurement time intervals;

- j) reference time interval(s);

- k) rating level;
  - 1) specific noise level;
  - 2) any acoustic features of the specific noise;
  - 3) rating level.

- l) background noise level and measurement time interval and in the case of measurements taken at an equivalent location, the reasons for presuming it to be equivalent;

- m) excess of the rating level over the measured background noise level and the assessment.

## Annex A (informative)

### Examples of how to use the standard to obtain noise ratings

NOTE. These examples are merely meant to illustrate how the standard could be applied and are not to be taken as a definitive interpretation of how it should be used.

#### A.1 EXAMPLE 1

This example deals with a situation where the noise that is to be rated is considerably in excess of the background noise. It is assumed that full information as required in clause 10 of this standard would be included in the report and is not therefore given here.

A factory that has recently become operational and works only during the day produces a continuous steady hum that can be heard at the measurement location.

Figure A.1 shows the noise level time history to include a few minutes immediately before the machinery is turned on, in addition to a sample of the noise caused by the factory. The noise levels before and after turning the factory on are relatively steady and continuous.

This means that it is reasonable to assume that sample measurements are representative, provided that there is no reason to believe that either the background noise or the factory noise would significantly change over a longer period of time. It is further reasonable to assume in this case that the background level does not change after the machinery is turned on.

The specific noise level, in this case from the entire factory, was measured in terms of  $L_{Aeq(7min)}$ , as this sample measurement was deemed to be a representative sample of the factory noise.

NOTE. A longer measurement period up to 1 h could have been used in this case.

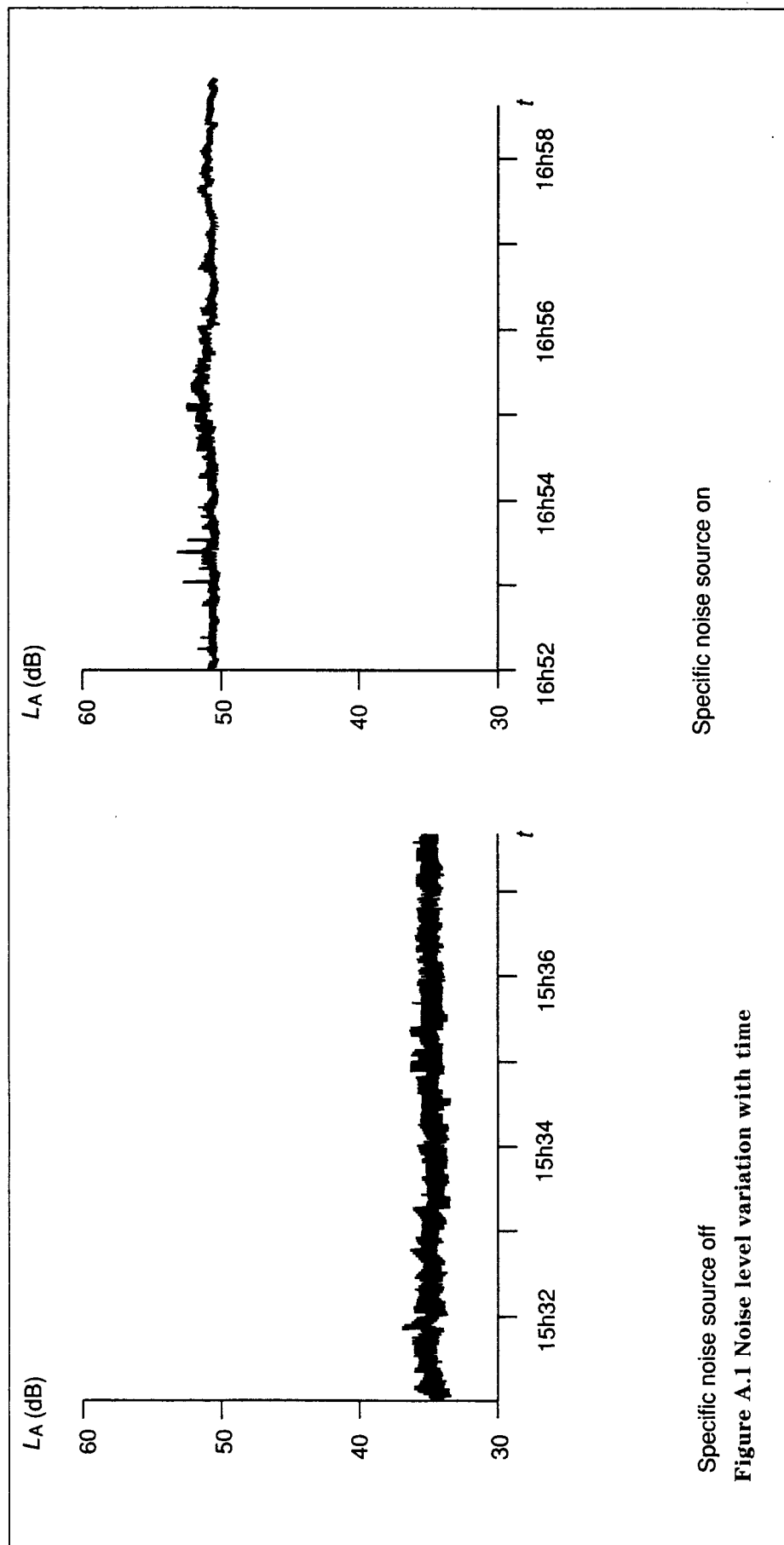
The residual noise was measured when the specific noise was off but when conditions contributing to the fluctuations in the residual noise were similar to those when the specific noise level was measured.

Figure A.1 shows a short extract of the typical time variation of noise level before (when the residual noise was measured) and after the specific noise source was turned on.

#### Example 1

##### Results

|  |   | Relevant clause | Commentary   |
|--|---|-----------------|--|
| Measured noise level   | $L_{Aeq(7 min)} = 51 \text{ dB}$                        | 6.3             | (specific noise source on and the level unaffected by any other noise sources)   |
| Residual noise level   | $L_{Aeq(7 min)} = 36 \text{ dB}$                        | 6.3             | (specific noise off to determine the correction to be made to the measured level using table 1)  |
| Background level   | $L_{A90(15 min)} = 35 \text{ dB}$                       | 7.3             | (measured just before the factory started up and was deemed to be representative of the background noise when the factory was in operation)  |
| Assessment to be made during the daytime thus the reference time period is 1 h |   | 6.2             |  |
| Correction from table 1 is 0 dB  |   |                 |  |
| Specific noise level   | $L_{Aeq(60 min)} = (51 - 0) \text{ dB} = 51 \text{ dB}$ | 6.3             | (correction from table 1 is zero since measured level is more than 10 dB in excess of residual level. There is no correction for duration as the specific noise operates continuously when on) |
| Acoustic feature correction  | + 5 dB  | 8.2             |  |
| Rating level   | $(51 + 5) \text{ dB} = 56 \text{ dB}$                   | 8.3             | (the factory produces a continuous steady hum)   |
| Background level   | $L_{A90(15 min)} = 35 \text{ dB}$                       |                 |  |
| Excess of rating over background level   | $(56 - 35) \text{ dB} = 21 \text{ dB}$                  | 9               |  |
| Assessment indicates complaints are likely.                                    |   | 9               |  |



Specific noise source on

Specific noise source off  
Figure A.1 Noise level variation with time

**A.2 EXAMPLE 2**

This example illustrates the procedure and calculations to be undertaken when the noise to be assessed is not significantly in excess of the residual noise, which does not have any identifiable low level periods in which the specific noise level could otherwise have been measured.

This is a similar situation to example 1, but the assessment location is further away from the factory. The background noise level was measured over a 30 min period when the specific noise source was not operating. The measurement of the factory noise was affected by the residual noise; consequently a correction has to be made.

At this location the factory noise had no discernible acoustic features.

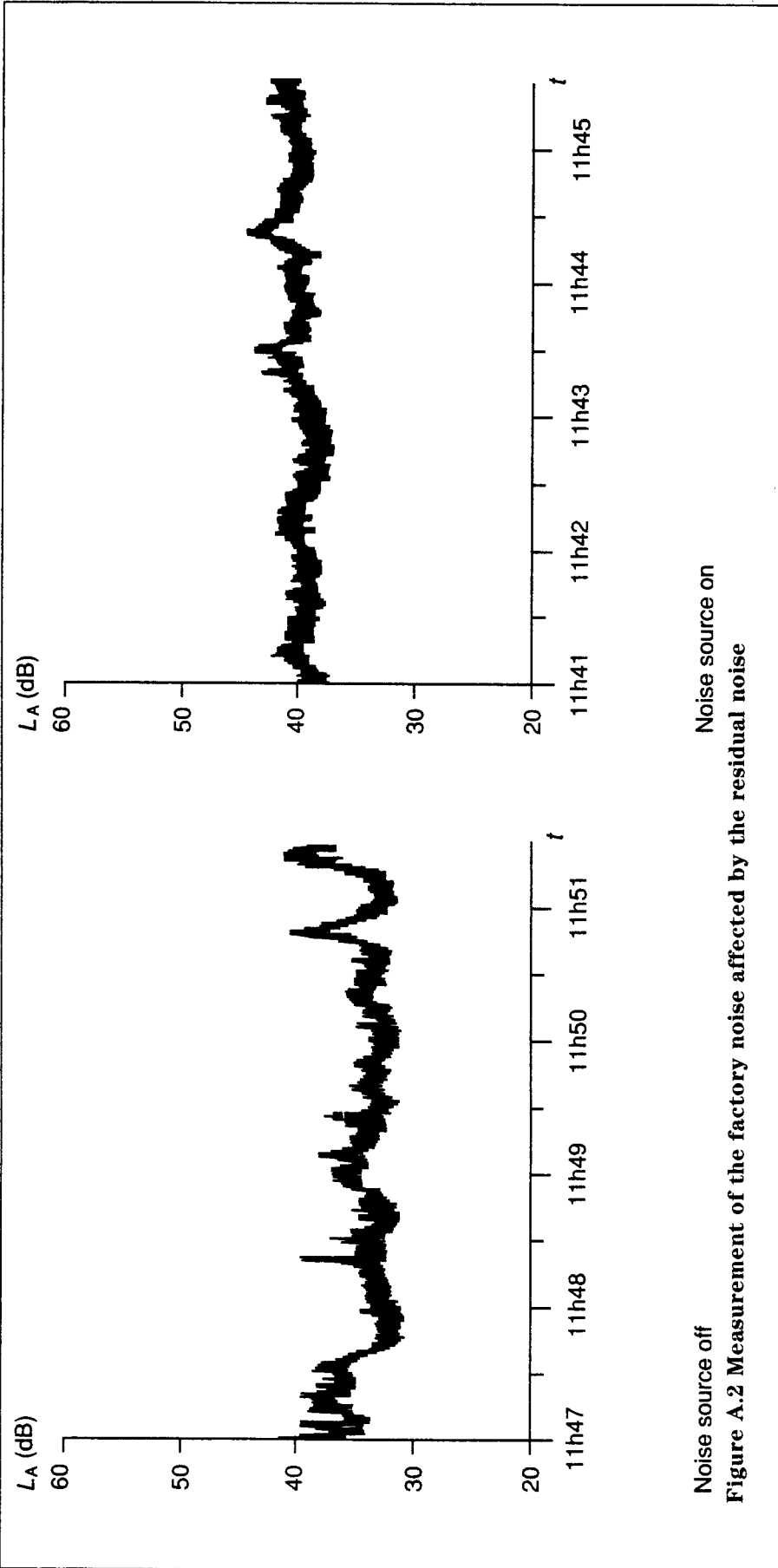
Figure A.2 shows a short extract of the typical time variation of the level before and after the specific noise source was turned on. Since the measured noise level is not much in excess of the residual noise level the choice is either to apply a correction to the measured level or to measure the level on another occasion when the residual noise is lower.

In this example, the specific noise was measured over a 20 min period. This was assumed to be representative of any longer term fluctuations in the specific noise.

The residual noise level was determined over a similar representative time period of 20 min when the specific noise was off.

**Example 2****Results**

|  |   | <b>Relevant clause</b> | <b>Commentary</b>   |
|--|---|------------------------|---|
| Measured noise level   | $L_{Aeq}(20 \text{ min}) = 40 \text{ dB}$ | <b>6.3</b>             | <i>(specific noise on)</i>  |
| Residual noise level   | $L_{Aeq}(20 \text{ min}) = 35 \text{ dB}$ | <b>6.3</b>             | <i>(specific noise off to determine the correction to be made to the measured level using table 1)</i>                                  |
| Background level (day)   | $L_{A90}(30 \text{ min}) = 33 \text{ dB}$ | <b>7.3</b>             | <i>(the background noise was measured in a temporary shutdown of the factory but otherwise representative of normal conditions)</i>     |
| Assessment to be made during the daytime thus the reference time period is 1 h |   | <b>6.2</b>             |   |
| Correction from table 1 is 2 dB  |   |                        |   |
| Corrected measured level   | $(40 - 2) \text{ dB} = 38 \text{ dB}$     | <b>table 1</b>         | <i>(the measured level was 5 dB over the residual noise level then the measured specific noise has to be corrected [using table 1])</i> |
| Specific noise level   | $L_{Aeq}(60 \text{ min}) = 38 \text{ dB}$ | <b>6.3</b>             | <i>(Source operates continuously)</i>   |
| Acoustic feature correction  | 0 dB                                      | <b>8.1</b>             | <i>(No acoustic features were present)</i>  |
| Rating level   | $(38 + 0) \text{ dB} = 38 \text{ dB}$     | <b>8.3</b>             |   |
| Background level   | $L_{A90}(30 \text{ min}) = 33 \text{ dB}$ |                        |   |
| Excess of rating over background level   | $(38 - 33) \text{ dB} = 5 \text{ dB}$     | <b>9</b>               |   |
| Assessment indicates marginal significance.                                    |   | <b>9</b>               |   |



Noise source off  
Noise source on  
Figure A.2 Measurement of the factory noise affected by the residual noise

**A.3 EXAMPLE 3**

This example is to illustrate the situation where measurement has been made when the residual noise has subsided to typically low levels.

An existing factory installed a machine which has operated during the day without complaint. They wish to assess the likelihood of complaint if it were to operate at night. The machine operates continuously emitting squeaks and bangs.

The maximum noise levels were produced by the passing traffic and were above the steady noise of the specific noise source. The specific noise source was measured during those periods between passing traffic (this was achieved by pausing the measurement during the passage of individual vehicles).

Figure A.3 shows a 6 min extract of the hour long measurement of the residual noise at night. An hour was used because of the variability of the noise level. The specific source on the noise level was measured during the indicated periods.

In this case when measurement of the specific noise has been made in the typical low level periods of residual noise, an estimate of the residual noise during the typical low level periods is given by the background noise level.

**Example 3****Results**

Measured noise level  $L_{Aeq}(4 \text{ min}) = 44 \text{ dB}$

Residual noise level (estimate) = 38 dB

Background level (night)  $L_{A90}(60 \text{ min}) = 38 \text{ dB}$

Correction from table 1 is subtract 1 dB

Corrected measured level  $(44 - 1) \text{ dB} = 43 \text{ dB}$

**Night time**

Assessment to be made during the night time thus the reference time period is 5 min

Specific noise level  $L_{Aeq}(5 \text{ min}) = 43 \text{ dB}$

Acoustic feature correction + 5 dB

Rating level  $(43 + 5) \text{ dB} = 48 \text{ dB}$

Background level  $L_{A90}(60 \text{ min}) = 38 \text{ dB}$

Excess of rating over background level  $(48 - 38) \text{ dB} = 10 \text{ dB}$

Assessment indicates complaints are likely.

**Relevant clause**

6.3

*(the specific noise could clearly be heard in the lulls in the passing night time traffic)*

6.3

*(residual noise estimated from the measured background noise level)*

7.3

*(a relatively long measurement was used because of the fluctuating level – the background level can be measured over a longer time than the reference time period)*

table 1

*(the measured level was only 6 dB over residual thus correction from table 1 is 1 dB)*

6.2

8.2

8.3

*(There is only a single correction of 5 dB even though the noise emits both squeaks and bangs)*

9

9

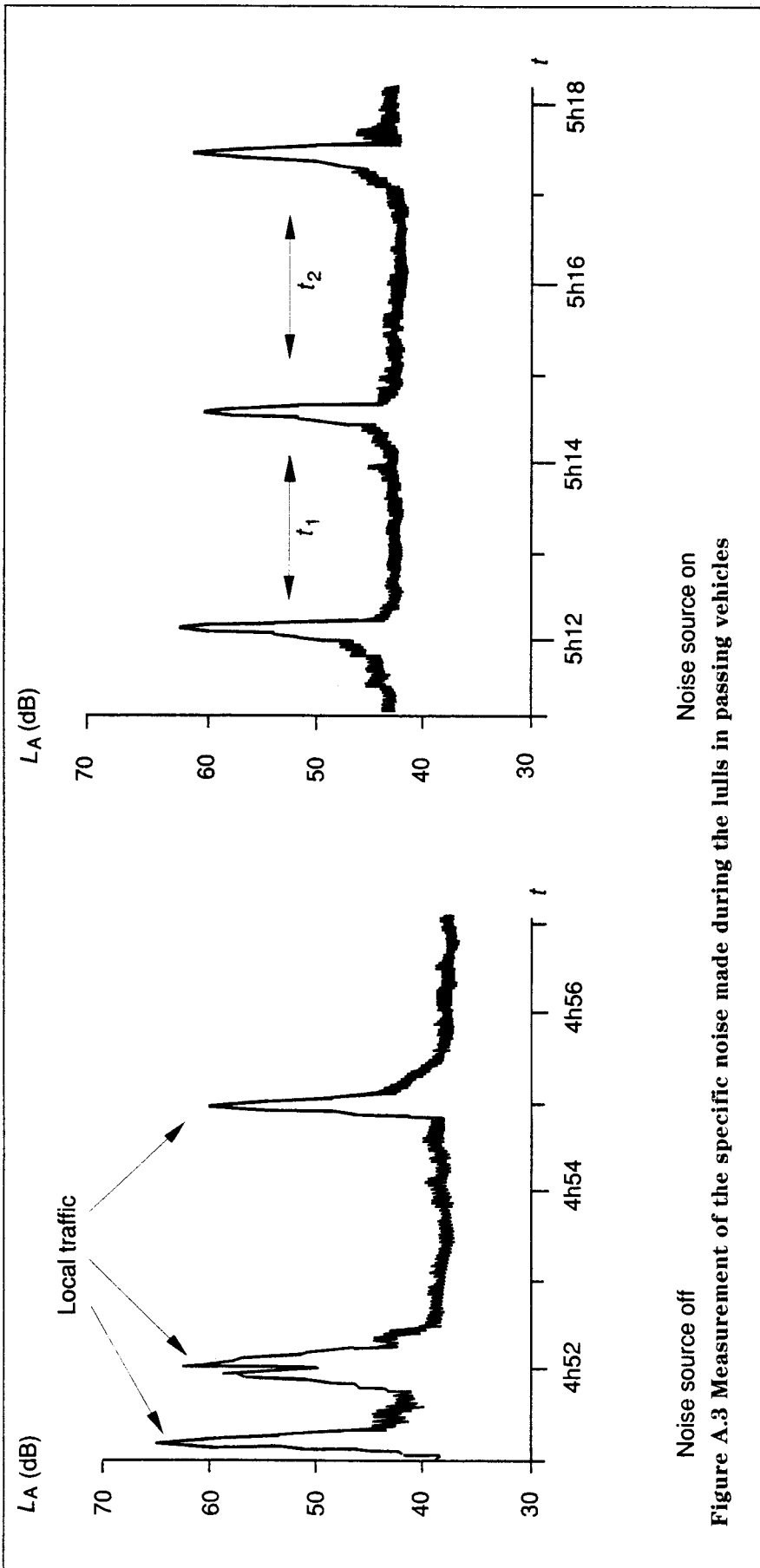


Figure A.3 Measurement of the specific noise made during the lulls in passing vehicles



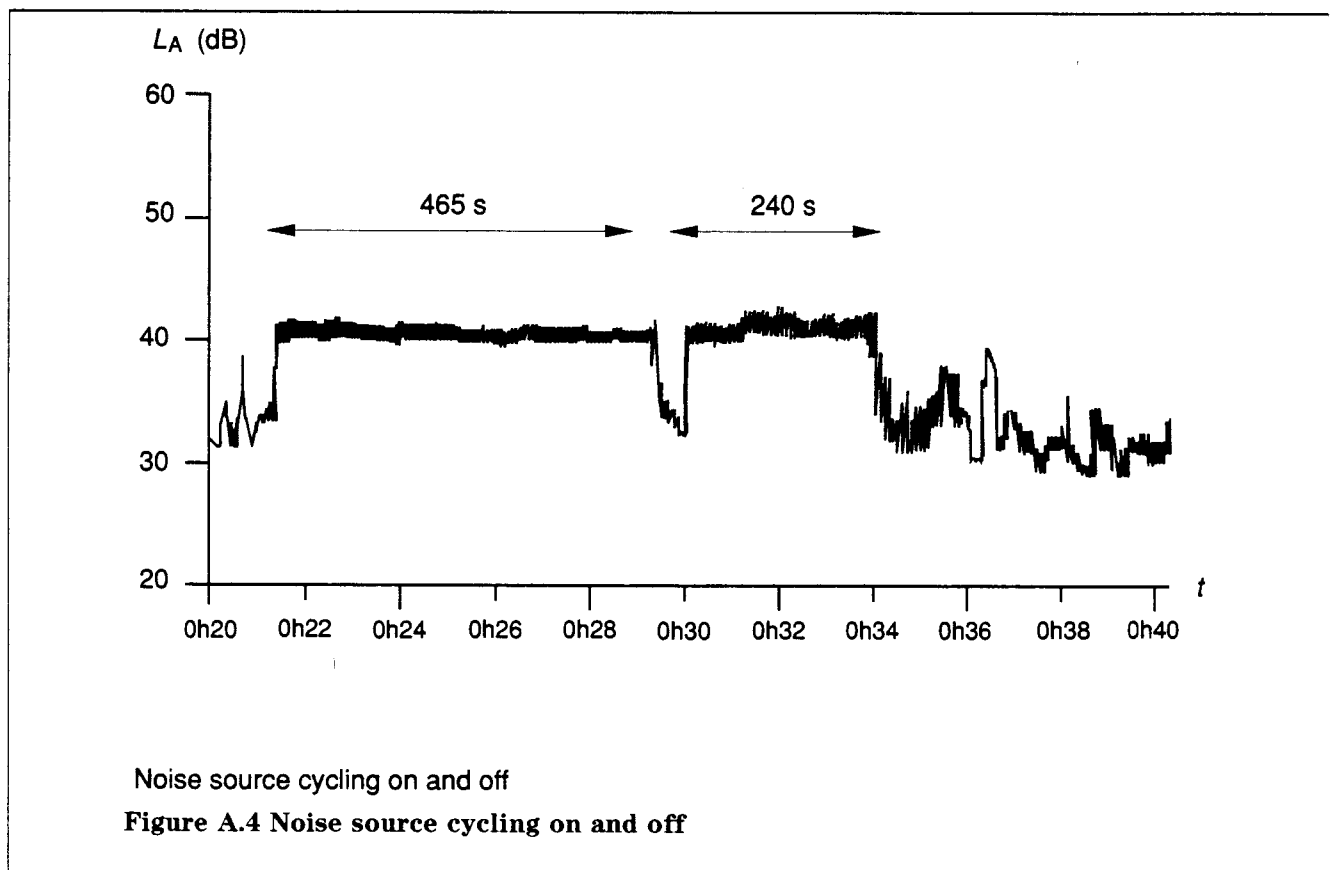
**A.4 EXAMPLE 4**

This example illustrates a source that is continuous and cyclic.

A factory on the edge of an industrial estate works 24 h a day and is to install a new process which has both a hiss and periodic clatter. The process will operate from 06.00 am to 02.00 am. Figure A.4 shows a typical cycle of operation: the source is on from 00.21:30 to 00.29:15 (465 s) and from 00.30:00 to 00.34:00 (240 s) then does not operate for the rest of the hour.

The background noise level, measured at the nearest residence in terms of  $L_{A90(1h)}$  was 31 dB at night and 39 dB during the day.

When the new operation noise was measured at a similar factory the  $L_{Aeq(12\text{ min})}$  was 40 dB. After the specific noise was measured it was turned off and the measured residual noise level was 36 dB.



**Example 4**

| <b>Results</b>   |   | <b>Relevant clause</b> | <b>Commentary</b>  |
|--|---|------------------------|--|
| Measured noise level   | $L_{Aeq}(12 \text{ min}) = 40 \text{ dB}$                       | <b>6.3</b>             |  |
| Residual noise level   | $L_{Aeq}(12 \text{ min}) = 36 \text{ dB}$                       | <b>6.3</b>             | <i>(the residual noise level was measured on the same night as the specific noise but when it was not on)</i>  |
| Background level (day)   | $L_{A90}(60 \text{ min}) = 39 \text{ dB}$                       | <b>7.3</b>             |  |
| Background level (night)   | $L_{A90}(60 \text{ min}) = 31 \text{ dB}$                       |                        | <i>(the background noise level was measured during the day time under similar weather conditions to those that prevailed when the specific noise was measured)</i> |
| Correction from table 1 is subtract 2 dB   |   |                        |  |
| Corrected measured level   | $40 \text{ dB} - 2 \text{ dB} = 38 \text{ dB}$                  | <b>table 1</b>         | <i>(the measured level was only 4 dB over residual thus correction from table 1 is 2 dB)</i>   |
| <b>Daytime</b>   |   |                        |  |
| Assessment to be made during the daytime thus the reference time period is 1 h                 |   | <b>5.2</b>             |  |
| The total on time during a reference period is $465 \text{ s} + 240 \text{ s} = 705 \text{ s}$ |   |                        | <i>(the source is on for two periods during the reference time of 60 min)</i>  |
| Thus on time correction is   | $10 \lg (705/3600) = -7 \text{ dB}$                             |                        |  |
| Specific noise level   | $L_{Aeq}(60 \text{ min}) = (38 - 7) \text{ dB} = 31 \text{ dB}$ |                        |  |
| Acoustic feature correction  | + 5 dB  | <b>7.2</b>             |  |
| Rating level   | $(31 + 5) \text{ dB} = 36 \text{ dB}$                           | <b>7.3</b>             |  |
| Background level   | $L_{A90}(60 \text{ min}) = 39 \text{ dB}$                       |                        | <i>(the noise has a hiss and a clatter)</i>  |
| Excess of rating over background level   | $(36 - 39) \text{ dB} = -3 \text{ dB}$                          | <b>8</b>               | <i>(measured when the specific source will be operating)</i>   |
| Assessment does not indicate that complaints are likely  |   | <b>8</b>               |  |
| <b>Night time</b>  |   |                        |  |
| Assessment to be made during the night time thus the reference time period is 5 min.           |   | <b>5.2</b>             | <i>(No time correction required since at least one of the on time periods is longer than 5 min)</i>  |
| Specific noise level   | $L_{Aeq}(5 \text{ min}) = 38 \text{ dB}$                        |                        |  |
| Acoustic feature correction  | + 5 dB  | <b>7.2</b>             |  |
| Rating level   | $(38 + 5) \text{ dB} = 43 \text{ dB}$                           | <b>7.3</b>             |  |
| Background level   | $L_{A90}(60 \text{ min}) = 31 \text{ dB}$                       |                        | <i>(the noise has a hiss and a clatter)</i>  |
| Excess of rating over background level   | $(43 - 31) \text{ dB} = 12 \text{ dB}$                          | <b>8</b>               |  |
| Assessment indicates complaints are likely.  |   | <b>8</b>               |  |

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## List of references (see clause 2)

### Normative references

#### BSI publications

BRITISH STANDARDS INSTITUTION, London

|                         |   |
|-------------------------|---|
| BS 7189 : 1989          | <i>Specification for sound calibrators</i>                        |
| BS 7580                 | <i>Specification for the verification of sound level meters</i>   |
| BS 7580 : Part 1 : 1996 | <i>Comprehensive procedure</i>                                    |
| BS EN 60651 : 1994      | <i>Specification for sound level meters</i>                       |
| BS EN 60804 : 1994      | <i>Specification for integrating-averaging sound level meters</i> |

### Informative references

#### BSI publications

BRITISH STANDARDS INSTITUTION, London

|                         |   |
|-------------------------|---|
| BS 7445                 | <i>Description and measurement of environmental noise</i>     |
| BS 7445 : Part 1 : 1991 | <i>Guide to quantities and procedures</i>                     |
| BS 7445 : Part 2 : 1991 | <i>Guide to the acquisition of data pertinent to land use</i> |
| BS 7445 : Part 3 : 1991 | <i>Guide to application to noise limits</i>                   |

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