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Worked Examples BS 4142 : 1995 Draft

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1. Introduction

British Standards Committee EPC1/3 are in the process of revising BS 4142 : 1990. The drafting committee have sent a final draft of the text to the main committee and I have been given permission to issue the worked examples for comment.
It should be noted that the whole standard is in draft form and the details in the worked examples may change.

2. Main changes in the worked examples

The main changes are as follows:—

- Each example is illustrated by a **short** extract of the time history of the noise level.
- The residual noise is normally to be measured in terms of an $L_{Aeq, T}$. However if the specific noise is measured in lulls of the residual noise then the residual noise level shall be estimated from the background level at that time.
- We have introduced a commentary column which is sometimes deliberately repetitious.

3. The examples.

Example 1 is a straight forward example; the specific noise is considerably in excess of the residual noise and the section shown in the figure shows no contamination by traffic noise.

Example 2 illustrates the situation of a specific noise not much in excess of a fluctuating background and shows how to make the correction to the measured level of the specific noise.

Example 3 illustrates the situation where measurements have been made in the lulls in the residual noise. The specific source emits both squeaks and bangs — each of these could in their own right invoke an acoustic features correction of 5 dB but this standard states clearly that there is only to be a single correction of 5 dB no matter how many features are present.

Example 4 illustrates a source that cycles on and off and shows how to make intermittency corrections for the day time and at night.

Please note the figure numbers in the worked example are those that will be used in the standard and that is why they start at figure 4.
Table 1 from section 5 of the standard is reproduced in example 1.

WORKED EXAMPLES BS 4142 : 1995 DRAFT

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 section 9 of the standard would be included in the report and is not therefore given here.

Introduction

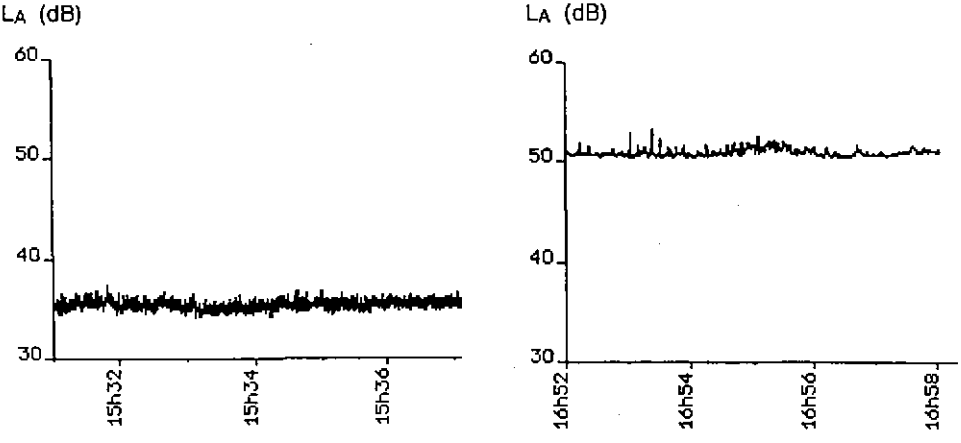
A factory that has recently become operational and works only during the day it produces a continuous steady hum that could be heard at the measurement location.

Figure 4 shows the noise level time history to include a few minutes immediately before the factory machinery is turned on in addition to a sample of the noise due to 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 factory is turned on.

The specific noise level, in this case from the entire factory, was measured in terms of a $L_{Aeq\ 7\ min}$ as this sample measurement was deemed to be a representative sample of the factory noise (note a longer measurement period up to one hour could have been used in this case).

The residual noise was measured when the specific noise was off but at a time which was considered representative of the condition when the specific noise was measured.

Figure 4 shows a short extract of the typical time variation of level before (when the background noise was measured) and after the specific noise source was turned on.



Noise source off

Noise source on

Figure 4 Noise level variation with time.

WORKED EXAMPLES BS 4142 : 1995 DRAFT

DRAFT REVISION

Example 1

			relevant clause	Commentary
Results				
Measured noise level	$L_{Aeq\ (7\ min)}$ =	51 dB	5.3	*(specific noise source on and the level unaffected by any other noise sources)*
Residual noise level	$L_{Aeq\ (7\ min)}$ =	36 dB	5.3	*(specific noise off to determine the correction to be made to the measured level using table 1.)*
Background level	$L_{A90\ (15\ min)}$ =	35 dB	6.3	*(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 hour.			5.2	
Correction from Table 1 is subtract 0dB				*(correction from Table 1 is zero since the 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.)*
Specific noise level $L_{Aeq\ (60\ min)}$ 51 - 0 =		51 dB	5.3	
Character correction		+5 dB	7.2	*(the factory produces a continuous steady hum)*
Rating level	51 + 5 =	56 dB	7.3	
Background level	$L_{A90\ (15\ min)}$	35 dB		
Excess of rating over background level				
	56 - 35 =	21 dB	8	

Assessment Indicates — complaints are likely. 8

Table 1. Corrections to noise level readings

Noise level reading, $L_{Aeq,Tm}$ minus residual noise level	correction, subtract from noise level reading
dB	dB
>9	0
6 to 9	1
4 to 5	2
3	3
< 3	see 5.3.2 to 5.3.5

Note 1 An estimate of the residual noise level during the measurement periods when the residual noise has subsided to mean minimum values, can be made by using the background noise level measured separately under similar conditions when the specific noise is off.

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 and the residual noise is fluctuating.

Introduction

A similar situation to example 1 but the assessment location is further away from the factory. The background noise level was measured over a thirty minute 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 features.

Figure 5 shows 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 twenty minute period (which was assumed to be a long enough representative sample) consequently a residual noise level was determined over a representative time period (ie 20 min in this case) when the specific noise was off. It was considered that the residual noise did not significantly change when the specific noise came on.

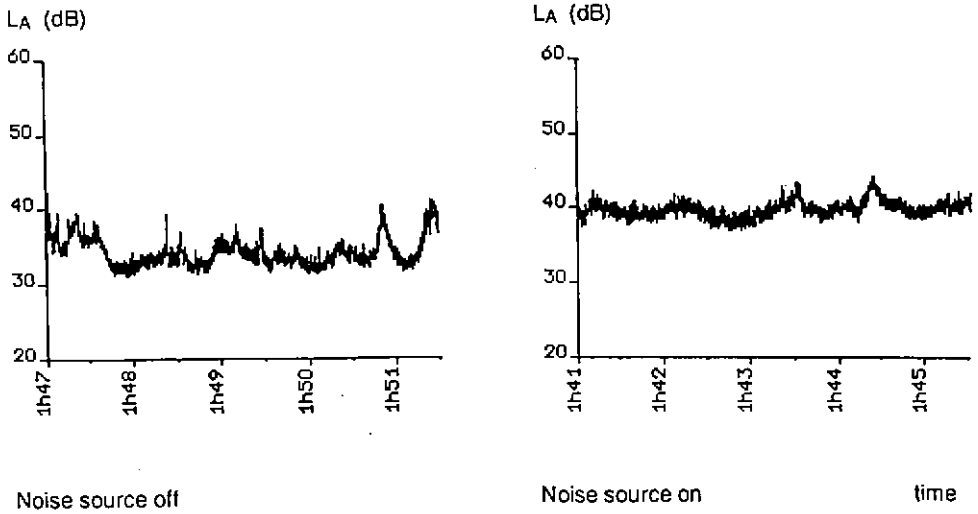


Figure 5 The measurement of the factory noise affected by the residual noise.

WORKED EXAMPLES BS 4142 : 1995 DRAFT

Example 2

			Relevant clause	Commentary
Results				
Measured noise level	$L_{Aeq\ (20\ min)}$ =	40 dB	5.3	*(specific noise on)*
Residual noise level	$L_{Aeq\ (20\ min)}$ =	35 dB	5.3	*(specific noise off to determine the correction to be made to the measured level using table 1.)*
Background level (day)	$L_{A90\ (30\ min)}$ =	33 dB	6.3	*(the background noise was measured in a temporary shutdown of the factory but otherwise representative of normal conditions.)*
Assessment to be made during the daytime thus the reference time period is 1 hour.			5.2	
Correction from Table 1 is subtract 2 dB				
Corrected measured level 40 - 2		38 dB	table 1	*(the measured level was 5 dB over the residual noise level then the measured specific noise has to be corrected (using table 1)*
Specific noise level $L_{Aeq\ (60\ min)}$		38 dB	5.3	*(Source operates continuously)*
Character correction		0 dB	7.1	*(No acoustic features were present)*
Rating level	38 + 0 =	38 dB	7.3	
Background level $L_{A90\ (30min)}$		33 dB		
Excess of rating over background level				
	38 - 33 =	5 dB	8	

Assessment indicates — a marginal situation. *8*

3. This example is to illustrate the situation where measurement has been made in the lulls in the residual noise.

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 peaks in the ambient noise in this case were produced by passing cars and are above the steady noise of the specific source that is to be rated. The noise source was measured during those periods when there is no passing traffic (this was achieved by pausing the measurement during the passage of individual vehicles).

Figure 6 shows a 6 minute extract of the hour long measurement of the background noise level at night. (An hour was used because of the variability of the noise level). With the specific source on the noise level was measured during the indicated periods.

The specific noise was not sufficiently above the residual noise so as to be un-affected. In this case when measurement of the specific noise has been made in the lulls in the residual noise an estimate of the residual noise during the lulls is given by the background noise level.

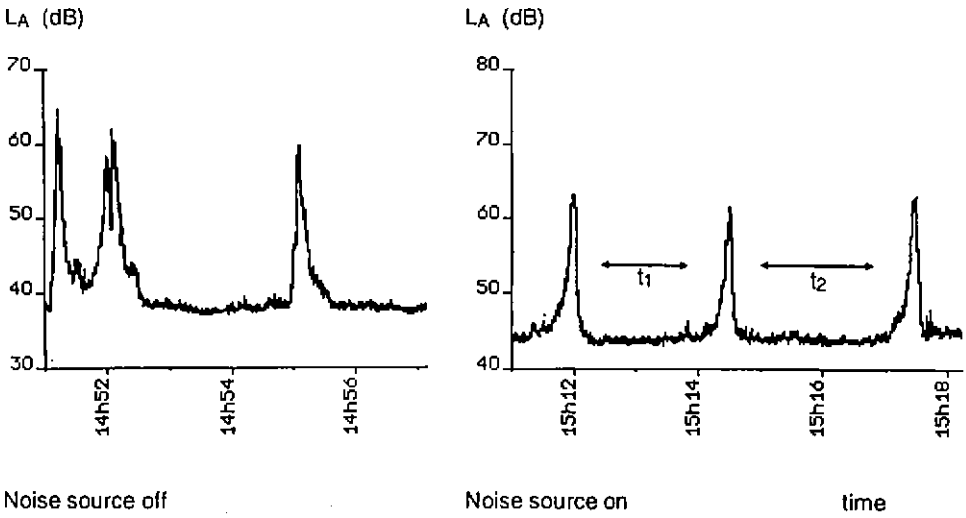


Figure 6 The measurement of the specific noise was made during the lulls in passing vehicles.

WORKED EXAMPLES BS 4142 : 1995 DRAFT

Example 3

			Relevant clause	Commentary
Results				
Measured noise level	$L_{Aeq\ (4\ min)}$	44 dB	5.3	*(the specific noise could clearly be heard in the lulls in the passing night time traffic)*
Residual noise level	(estimate)	38 dB	5.3	*(residual noise estimated from the measured background noise level)*
Background level (night)	$L_{A90\ (60\ min)}$	38 dB	6.3	*(a relatively long measurement was used because of the fluctuating level - the background level can be measured over a longer time period than the reference time period)*
Correction from Table 1 is subtract 1 dB				
Corrected measured level	44 - 1 =	43 dB	table 1	*(the measured level was only 6 dB over residual thus correction from table 1 is 1 dB)*
Night time				
Assessment to be made during the night time thus the reference time period is 5 min.			5.2	
Specific noise level $L_{Aeq\ (5\ min)}$ =		43 dB		
Character correction		+5 dB	7.2	*(There is only a single correction of 5 dB even though the noise emits both squeaks and bangs.)*
Rating level	43 + 5 =	48 dB	7.3	
Background level $L_{A90\ (60min)}$		38 dB		
Excess of rating over background level				
	48 - 38 =	10 dB	8	
Assessment indicates — complaints are likely.			*8*	

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Example 4 is given to illustrate a source that cycles on and off.

A factory on the edge of an industrial estate works 24 hours and is to install a new process which has both a hiss and periodic clatter. The process will operate at from 06.00 am to 02.00 am. Figure 7 shows a typical cycle of operating:— 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) and from 00.40:50 to 00.48:30 (460 s) then does not operate during the next half 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 the $L_{Aeq\ 12\ min}$ was 40 dB (source on all of that time). After the specific noise was measured it was turned off and the measured residual noise level was 36 dB.

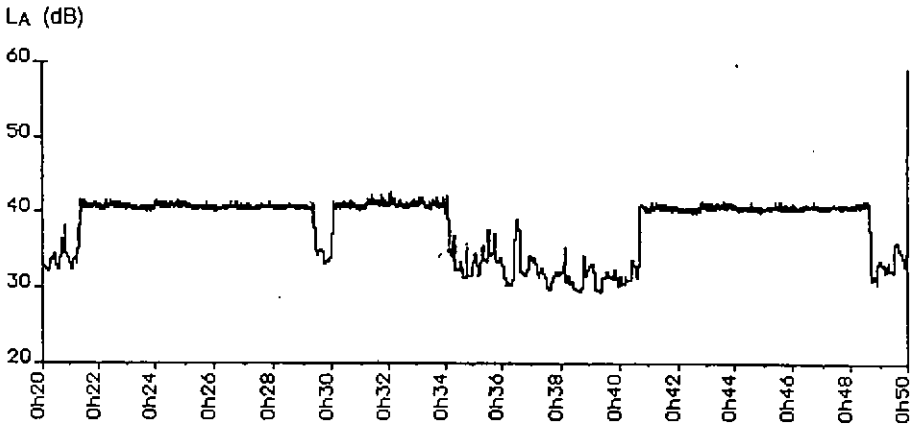

Figure 7 Noise source cycling on and off

WORKED EXAMPLES BS 4142 : 1995 DRAFT

Example 4

Results

			Relevant clause	Commentary
Measured noise level	$L_{Aeq\ (12\ min)}$	40 dB	5.3	
Residual noise level	$L_{Aeq\ (12\ min)}$	36 dB	5.3	*(the residual noise level was measured on the same night as the specific noise but when it was not on)*
Background level (day)	$L_{A90\ (60\ min)}$	39 dB	6.3	*(the background noise level was measured during the day time under similar weather conditions to those that prevailed when the specific noise was measured.)*
Background level (night)	$L_{A90\ (60\ min)}$	31 dB		
Correction from Table 1 is subtract 2 dB				
Corrected measured level 40 - 2		38 dB	table 1	*(the measured level was only 4 dB over residual thus correction from table 1 is 2 dB)*
Daytime				
Assessment to be made during the daytime thus the reference time period is 1 hour.			5.2	*(the source is on for three periods during the reference time of 60 minutes)*
The total on time during a reference period is 465 + 240 + 460 = 1165 s				
Thus on time correction is 10 lg(1165/3600) dB				
Specific noise level $L_{Aeq\ (60\ min)}$ = 38 - 10 lg(1165/3600) =		33 dB		
Character correction		5 dB	7.2	*(the noise has a hiss and a clatter)*
Rating level	33 + 5	38 dB	7.3	*(measured when the specific source will be operating)*
Background level $L_{A90\ (60min)}$		37 dB		
Excess of rating over background level 38 - 39 =		-1 dB	8	
Assessment — does not indicate that complaints are likely			*8*	
Night time				
Assessment to be made during the night time thus the reference time period is 5 min.			5.2	*(No intermittency required since at least one of the on time periods is longer than 5 minutes)*
Specific noise level $L_{Aeq\ (5\ min)}$		38 dB		
Character correction		+5 dB	7.2	*(the noise has a hiss and a clatter)*
Rating level	38 + 5 =	43 dB	7.3	
Background level $L_{A90\ (60min)}$		31 dB		
Excess of rating over background level 43 - 31 =		12 dB	8	
Assessment indicates — complaints are likely.			*8*	