

REF: AS13652.241001.L1

WINCHESTER (HEAD OFFICE)

+44 (0) 1962 872 130
mail@clarkesaunders.com

4 October 2024

LONDON

+44 (0) 20 3479 7867
london@clarkesaunders.comIan Nicholls
Reading Borough Council
Civic Offices
Bridge Street
Reading
RG1 2LU

EXETER

+44 (0) 1392 342 978
exeter@clarkesaunders.com

Dear Ian

AS13652 56 – 90 BAMBURGH CLOSE, READING**ASHP Sound Impact Assessment**

As part of planning application reference 230909 submitted to Reading Borough Council (RBC), retrospective planning consent is sought for the installation of 18 air source heat pumps (ASHP) located externally and distributed around the perimeter of 56-90 Bamburgh Close, Reading, RG2 7UD.

The heat pumps have been installed as a lower carbon alternative to the previous heating plant servicing the council owned and maintained apartments. Of high importance is the context that the heat pumps have been operational for more than 12 months without complaint.

A description of the acoustic terminology used throughout this report is found in Appendix A.

Clarke Saunders Acoustics (CSA) has spoken with Ms Rebecca Moon, a Principal Environmental Health Officer at the RBC Environmental Protection & Nuisance Team, on 24th September 2024 to confirm assessment methodology and noise emissions criteria.

It was agreed that where it was not possible to obtain a secure long term sound monitoring location, attended manual measurements during the late night/early morning period would be sufficient to obtain a representative background sound level. Ms Moon has confirmed that it would be acceptable for plant noise emissions not to exceed the background sound level at the development, i.e. self-impact, where noise emissions to pre-existing off-site receptors should achieve 10dB below the background sound level.

Environmental Sound Survey

In the absence of a secure monitoring location, an attended survey was undertaken between 23:45 hours on Tuesday 24th and 00:45 hours on Wednesday 25th September 2024, at the location shown on the appended site plan, AS13652/SP1. The survey was conducted to determine typical night-time background sound levels experienced in the vicinity of the application site. Measurements were made following procedures in BS 7445:1991 (ISO1996-2:1987) *Description and measurement of environmental noise Part 2-Acquisition of data pertinent to land use* and BS4142:2014 + A.1:2019 *Methods for rating and assessing industrial and commercial sound*.

The following equipment was used during the survey:

- 1 no. Rion sound level meter type NL52;
- 1 no. Rion sound level calibrator type 1251.

Minimal activity occurred across the course of the survey, where the background soundscape was determined by distant road traffic. During the course of the survey, none of the ASHPs were found to be operating, where the background sound level is considered representative of the sound levels prior to their installation.

The measured L_{Aeq} and L_{A90} sound levels are summarised in , alongside the RBC targeted criteria for self-impact and at the nearest off-site receptor.

LOCATION	MEASURED SOUND LEVEL		TARGETED PLANT SOUND EMISSIONS CRITERIA	
	$L_{Aeq,T}$	L_{A90}	Self-Impact $L_{Aeq,T}$	Nearest Off-Site Receptor $L_{Aeq,T}$
Measurement Position 1	49 dB	32 dB	32 dB	22 dB

Table 1 – Summary of results from attended night-time survey & targeted plant sound emissions criteria [dB ref 20μPa]

Sound Impact Assessment

The air source heat pumps installed at the premises are:

- 18 no. Daikin EDLAO4EV3.

The heat pumps are installed in pairs at ground level, distributed around the perimeter of the block of flats. As the heat pumps were not operational during the course of the survey, it has been necessary to rely on the manufacturer's given sound level data. The manufacturer's spectral sound pressure level data is reproduced in Table 2 below.

PLANT	SOUND PRESSURE LEVEL AT 1M, L_p (dB)								
	63	125	250	500	1K	2K	4K	8K	dBA
Daikin EDLAO4EV3	49	51	42	43	37	33	25	17	44

Table 2 – Manufacturer's given spectral sound pressure levels

[dB ref 20μPa]

It was noted from the manufacturer's literature that there was an additional 'low noise' and 'ultra low noise' mode available. It has not been possible to confirm whether these modes have been activated on the ASHPs, however as a reference they provide reductions to the overall sound pressure levels of 3dB and 4dB respectively.

Given the distribution of the ASHPs around the perimeter of the 56-90 Bamburgh Close, the extent of potential noise impact is dependent on the specific location of the receptor to the ASHP. Three receptor locations have been identified that are expected to experience higher levels of impact than those adjacent to them, which are either further away, exposed to noise emissions from less units, or benefit from screening due to the building massing. The identified receptors are shown alongside the 9 groupings of 2 no. ASHP in the appended site plan, AS13652/SP1.

For the purposes of the assessment, it is assumed that:

- Receptor 1 is exposed to noise emissions from 8 no. ASHPs located to the west façade of the building (Group 1)
- Receptor 2 is exposed to noise emissions from 2 no. ASHPs located to the north façade of the building (Group 2).
- Receptor 3 is exposed to noise emissions from 8 no. ASHPs located to the north façade of the building (Group 3).

In the case of each assessment, due to increased separation distances and directivity corrections, contributions from other ASHPs are expected to be negligible.

Heat pumps are typically assessed under two schemes:

- **Permitted Development:** In accordance with Microgeneration Certification Scheme (MCS-020)¹ - MCS Planning Standards for Permitted Development Installations of Wind Turbines and Air Source Heat Pumps on Domestic Premises. The MCS-020 scheme provides an assessment method to determine whether a proposed domestic heat pump remains below an absolute criterion of L_p 42 dB(A) at the nearest affected dwellings.
- **Planning Consent:** Mechanical plant falls into the category of an industrial noise source, where assessments are therefore typically undertaken following the procedures in BS4142:2014+A.1:2019². This assessment compares the calculated noise levels at the receptor, inclusive of any relevant penalties for characteristic features, to the representative background sound level when the sound source is not operating.

The Institute of Acoustics (IoA) has also prepared a professional guidance note³ with regards to heat pump noise impact assessments. The guidance note suggests that *“where it is practical to do so, it is recommended that the installation sound rating level does not exceed 35dB at any noise sensitive façade of neighbouring residential premises”*.

Where retrospective planning consent is sought, the assessment follows procedures in BS4142:2014+A.1:2019, however the absolute criterion provided in the MCS-020 assessment and the professional guidance note published by the IoA provide a useful reference as to what may be considered acceptable.

Based upon the manufacturer's spectral noise level data and the proposed operation of the ASHP, i.e. continuous heating for prolonged durations, no distinguishable acoustic features are anticipated. No penalty corrections or acoustic screening has been accounted for in subsequent assessment calculations to external receptors. A +3dB correction has been applied for the reflection effects owed the heat pumps positions against an external façade. This correction is considered pessimistic, where external walls are not fully reflective, and the condenser units are relatively directional owed to the fan component. Whilst no directivity data is given by the manufacturer, in likelihood the reflection effect is somewhere between 0dB and 3dB. The full calculations are given in Appendix B, with a summary of BS4142:2014+A.1:2019 given in Appendix C.

Self-impact has also been considered with regard to noise emissions from the ASHP to the nearest affected dwelling within 56-90 Bamburgh Close. For this assessment, a 5 dB acoustic screening loss has been included within the calculations, where it is assumed that the ASHP is not directly visible from the window of the neighbouring apartment. Where the nearest affected windows are behind the ASHPs, no corrections have been added for reflections off of the façade. A distance correction to 1.5 metres has been applied, however local directivity effects are not accounted for due to lack of relevant test data. From experience with other fan appliances however, further reductions in sound level could be expected based on the position of the nearest affected window to the fan element of the heat pump.

The predicted noise levels are summarised alongside the respective noise emissions criteria in Table 3. It should be noted that where there are no acoustic characteristic penalties applied, the Specific Sound Level and Rating Level are equivalent.

¹ <https://mcscertified.com/wp-content/uploads/2021/10/MCS-020.pdf>

² BS 4142:2014 +A1:2019 *Methods for rating and assessing industrial and commercial sound*

³ [briefing_note_-_heat_pumps_-_professional_advice_note_-_publication_8.pdf \(ioa.org.uk\)](https://www.ioa.org.uk/briefing_note_-_heat_pumps_-_professional_advice_note_-_publication_8.pdf)

LOCATION	CALCULATED SOUND EMISSIONS LEVEL, L_{AR}	BS4142:2014+A.1:2019 ASSESSMENT LEVEL	TARGETED PLANT SOUND EMISSIONS CRITERIA, $L_{Aeq,T}$ dB
Receptor 1	28 dB	-4 dB	22 dB
Receptor 2	27 dB	-5 dB	22 dB
Receptor 3	28 dB	-4 dB	22 dB
Self-Impact	35 dB	+3 dB	32 dB

Table 3 – Calculated sound emissions levels at nearest affected receptors

[dB ref 20µPa]

Discussion – Sound Impact

When assessed using BS4142:2014+A.1:2019 (BS4142), the Rating Level is seen not to exceed the background sound level with the exception of self-impact. BS4142 states that *“Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context”*. Regarding self-impact, the assessment level is below +5dB, in which BS4142 states that *“A difference of around +5dB is likely to be an indication of an adverse impact depending on the context.”*

The calculations indicate that the resulting sound impact to the most affected receptors, as well as receptors within 56-90 Bamburgh Close (self-impact) is therefore low, consistent with the context that the ASHPs have operated for more than 12 months without complaint.

The Rating Level at the nearest noise sensitive façade of neighbouring residential premises is also significantly below the absolute target Rating Level given in the IoA guidance note ($L_{Ar,Tr}$ 35 dB).

It is noted that the RBC criteria advised by Ms Moon is not achieved where there are exceedances of up to 6 dB. It is important to note that the assessment has included a number of pessimistic assumptions, as follows;

- All of the heat pumps in each group are operating concurrently.
- +3dB correction for reflections off of the Bamburgh Close façades, where this could be lower due to the inherent directionality of the ASHP fans.
- The ASHPs are operating at 100% duty, and do not assume use of the low noise modes, which could provide a further 3dB or 4dB reduction.

Given the above, it is likely that typical sound emissions from the ASHPs will be closer to the targeted Local Authority criteria.

Consideration should also be given to the nature of the target set by RBC. In accordance with the RBC Development Plan *CD4.25 Policy EN 17 – Noise Generating Equipment*, mechanical plant sound emissions target a level 10dB below the existing background sound level to minimise risk of background sound creep.

The UK government provides further advice with regards to BS4142 assessments and background creep⁵ in its BS4142 Method Implementation Document (MID). It states that:

“A +5 dB difference may not be acceptable if it is likely that other future developments will add to ambient sound levels. This can lead to so-called ‘creeping background’. More correctly, this is creeping ambient sound as the $L_{Aeq,T}$ is more likely to be influenced than the $L_{A90,T}$. This is a concern that sometimes arises around developing industrial areas. This concern can be valid in some cases, but in others it may not be so serious.”

⁵ <https://www.gov.uk/government/publications/method-implementation-document-mid-for-bs-4142/method-implementation-document-mid-for-bs-4142>

Where this site is residential and not inherently industrial or commercial in nature, the likelihood of further mechanical sound sources or other industrial sound sources is low, with the exception of further replacement of domestic heating plant. Risk of further background creep is therefore generally considered low.

Conclusion

It can be seen that regardless of whether the ASHPs are operating in a low noise mode or not, their sound emissions are expected to be controlled to below the absolute levels given in the IOA professional guidance note and MCS-020. When assessed using BS4142:2014+A.1:2019, the resultant assessment levels indicate a low impact, depending on the context.

Where a low level of background creep could be expected as part of the installation, there is little scope for further background creep given the residential nature of this area.

Contextually:

- The ASHPs have been operational for more than 12 months without complaint, indicating a negligible-to-low impact;
- The ASHP were installed as a lower carbon alternative to existing heating plant. Whilst not possible to determine the original impact, the previous gas or oil boilers installed at the properties will have contributed to the existing soundscape to some degree;
- Background sound levels at the application site, are very low, where the Local Authority's targeted emissions levels are therefore onerous;
- It has not been possible to determine whether the ASHPs are operating in a 'low noise mode'. Regardless the assessment is based upon a number of pessimistic assumptions, where it is likely that the sound emissions level will typically be lower.

We trust the above is sufficient for your requirements. Should you have any queries please do not hesitate to contact the undersigned.

Yours sincerely
for CLARKE SAUNDERS ASSOCIATES



Andrew Nesbitt MIOA

email: anesbitt@clarkesaunders.com



Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
Noise	Sound that is unwanted by or disturbing to the perceiver.
Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A .
L_{eq}:	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90}:	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max}:	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.
NR	<i>Noise Rating</i> . A single figure noise level rating that takes into account the frequency content of an acoustic environment.
R	<i>Sound Reduction Index</i> . Effectively the Level Difference of a building element when measured in an accredited laboratory test suite in accordance with the procedures laid down in BS EN ISO 10140-2:2010 and corrected for its size and the reverberant characteristics of the receive room.
D	The sound insulation performance of a construction is described in terms of the difference in sound level on either side of the construction in the presence of a sound source on one side and the reverberant characteristics of the adjoining 'receive' space. D is the arithmetic Level Difference in decibels between the

source and receive sound levels when filtered into frequency bands.

D_{nT}	<i>Weighted Standardised Level Difference.</i> As defined in BS EN ISO 717-1, representing the Weighted Level Difference, when standardised for reference receiving room reverberant characteristics.
$D_{n,e}$	Normalised sound insulation of small building elements of fixed dimensions, such as vents, measured in an accredited laboratory test suite in accordance with the procedures laid down in BS EN ISO 10140-2:2010.
$D_{n,f}$	Flanking sound insulation of lightweight elements, such as curtain wall mullions, measured in an accredited laboratory test suite in accordance with the procedures laid down in ISO 10848-2:2006
R_w D_w $D_{nT,w}$ $D_{n,e,w}$ $D_{n,f,w}$	Value of parameter, determined as above, but weighted in accordance with the procedures laid down in BS EN ISO 717-1 to provide a single-figure value.
C, C_{tr}	Spectral adaptation terms to be added to a single number quantity such as $D_{nT,w}$, to take account of the sound insulation within frequency ranges of particular interest.
$L'_{nT,w}$	<i>Weighted Standardised Impact Sound Pressure Level</i> as defined in BS EN ISO 717-2, representing the level of sound pressure when measured within a space where the floor above is under excitation from a calibrated tapping machine, standardised for the receiving room reverberant characteristics.
ΔL_w	Change in impact sound pressure level when a floor is fitted with a 'soft' or resilient covering, as measured in an accredited laboratory test suite in accordance with the procedures laid down in BS EN ISO 10140-3:2010.

Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band.

In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000
------------------------------------	----	-----	-----	-----	------	------	------	------

Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a

APPENDIX A

ACOUSTIC TERMINOLOGY AND HUMAN RESPONSE TO BROADBAND SOUND

guide to the subjective interpretation of changes in environmental sound level can be given.

INTERPRETATION

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.

APPENDIX B

AS13652 - 56-90 Bamburgh Close

PLANT SOUND TO RECEPTOR 1		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Source Group 1										
ASHP - Daikin EDLA04EV3	Lp @ 1m	49	51	42	43	37	33	25	17	44
Number of	8no	9	9	9	9	9	9	9	9	
Reflection		3	3	3	3	3	3	3	3	
Screening Loss	No Screen	0	0	0	0	0	0	0	0	
Distance Loss	24m	-28	-28	-28	-28	-28	-28	-28	-28	
Specific sound level at receptor	L _{eq} 1hr	33	35	26	27	21	17	9	1	28

PLANT SOUND TO RECEPTOR 2		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Source Group 2										
ASHP - Daikin EDLA04EV3	Lp @ 1m	49	51	42	43	37	33	25	17	44
Number of	2no	3	3	3	3	3	3	3	3	
Reflection		3	3	3	3	3	3	3	3	
Screening Loss	No Screen	0	0	0	0	0	0	0	0	
Distance Loss	14m	-23	-23	-23	-23	-23	-23	-23	-23	
Specific sound level at receptor	L _{eq} 1hr	32	34	25	26	20	16	8	0	27

PLANT SOUND TO RECEPTOR 3		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Source Group 3										
ASHP - Daikin EDLA04EV3	Lp @ 1m	49	51	42	43	37	33	25	17	44
Number of	8no	9	9	9	9	9	9	9	9	
Reflection		3	3	3	3	3	3	3	3	
Screening Loss	No Screen	0	0	0	0	0	0	0	0	
Distance Loss	25m	-28	-28	-28	-28	-28	-28	-28	-28	
Specific sound level at receptor	L _{eq} 1hr	33	35	26	27	21	17	9	1	28

SELF IMPACT FROM PLANT SOUND		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Nearest ASHP										
ASHP - Daikin EDLA04EV3	Lp @ 1m	49	51	42	43	37	33	25	17	44
Number of	1no	0	0	0	0	0	0	0	0	
Distance Loss	1.5m	-4	-4	-4	-4	-4	-4	-4	-4	
Screening Loss	Line of Sig	-5	-5	-5	-5	-5	-5	-5	-5	
Specific sound level at receptor	L _{eq} 1hr	40	42	33	34	28	24	16	8	35

Where no BS4142:2014+A.1:2019 characteristic penalties are applied, the specific sound level is equivalent to the rating level.

BS4142 is designed to allow contextual assessment of impact from commercial, or industrial sound on sensitive receptors. Examples covered by the Standard include:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment.
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises, and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

In brief, the assessment procedure involves establishing sound levels from the items or processes of interest, (the specific sound source(s)), corrected for any acoustic features to derive the Rating Level, (L_{Ar,T_r}), at the relevant assessment position(s). The Rating Level is compared against the existing Background Sound Level, ($L_{A90,T}$), to provide an initial estimate of impact. The Standard offers the following guidance with regard to the significance of estimated impact:

- Typically, the greater this difference, the greater the magnitude of the impact;*
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
- A difference of around +5dB could be an indication of an adverse impact, depending on the context;*
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context. The lower the rating level is relative to the background sound level, the less likely it is that the specific sound source will have an adverse impact.*

Where relevant, the initial estimate should then be modified by accounting for contextual aspects of the operation of the specific sound source and / or the context of the character of the area.

Other Assessment Parameters and Guidance on Character Corrections

The Specific Sound Level (L_s) is expressed in terms of an L_{Aeq} for a reference time interval, (T_r) of one-hour during the daytime (07:00 – 23:00 hours) and a fifteen-minute period during the night-time (23:00 – 07:00 hours). The Rating Level is also expressed in terms of the reference time interval, T_r .

The Specific Sound Level can be determined by various means, which can include prediction based on manufacturer's data and accompanying propagation calculations to the assessment position(s). This method could be used, for instance, where the specific sound source is not yet in-situ, or is in-situ but not yet operational.

Where the specific sound source is already operational and in-situ, measurements of the sound climate resulting from both the specific sound source and all other contributing sources, (known as the Ambient Sound Level, $L_a = L_{Aeq,T}$) should be measured over a representative time period, ideally at the assessment position(s).

Depending on the relative contribution of other sources not related to the specific sound, (known as the residual sound), the Specific Sound Level can be derived by logarithmically subtracting the Residual Sound Level, $L_r = L_{Aeq,T_r}$, from the Ambient Sound Level.

With justification, representative proxy locations can be used for the measurement of the ambient and/or residual sound climate. Where these measurement locations are not fully representative of the assessment position(s), measurement can be supplemented with calculation.

The Background Sound Level should ideally also be measured at the assessment position(s) but can be measured at representative proxy locations where suitable reasons can be provided. The Background Sound Level should be measured over a period which is suitable to characterise the background sound climate during the period of interest and should normally be at least 15 minutes.

When deriving the Rating Level from the Specific Sound Level, consideration is given to the character of the sound. The Standard provides several methods for deriving appropriate character corrections, offering the following advice for subjective assessment:

Tonality

For sound ranging from not tonal to prominently tonal, the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be allocated as a penalty of 2 dB for a tone which is just perceptible at the sound receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9dB can be applied for sound that is highly impulsive considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be allocated as a penalty of 3dB for impulsivity which is just perceptible at the receiver, 6dB where it is clearly perceptible and 9dB where it is highly perceptible.

Other sound characteristics

Where the specific sound contains characteristics that are neither tonal nor impulsive, but are otherwise startling, disturbing or incongruous with the residual acoustic environment, a penalty of +3dB can be applied.

Intermittency

When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3dB can be applied.