Proposed air conditioning heat pump

Flat 2, Athenaeum Hall,
Vale of Health, Hampstead

Noise Assessment

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Limit of liability

This report has been prepared in connection the site identified on the title page on behalf of and for the benefit of Amos Goldreich Architecture only.

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Executive summary

Flat 2, Athenaeum Hall is being refurbished and air conditioning is to be installed as part of the refurbishment. The air conditioning system will include an external heat pump which is to be installed on the balcony at the rear of the property.

Noise from the heat pump will have the potential to affect the balconies of the flats below and above. A noise assessment has therefore been undertaken on the basis of:

- noise level figures for the proposed heat pump taken from the manufacturer's data sheet;
- the results of a background noise monitoring exercise; and
- appropriate national guidance.

It has been demonstrated that operational noise levels will be entirely satisfactory at potentially affected nearby sensitive receptors.

During the period 07.00 to 21.00 hours, with the heat pump operating on full load, the BS4142 rating noise level will also be 36.9 dB $L_{Aeq,t}$. This is 0.4 dB above the worst-case (ie lowest) background noise level prevailing during this period, which is 36.5 dB $L_{A90,1h}$.

As BS4142: 1997 considers a rating noise level that is 5 dB above the background noise level to be of "Marginal Significance" this situation is considered to be entirely satisfactory.

During the period 21.00 to 07.00 hours, with the heat pump operating on quiet mode, the BS4142 rating noise level will also be 27.9 dB $L_{Aeq,t}$. This is 0.2 dB above the worst-case (ie lowest) background noise level prevailing during this period, which is 27.7 dB $L_{A90,5m}$.

As BS4142: 1997 considers a rating noise level that is 5 dB above the background noise level to be of "Marginal Significance" this situation is considered to be entirely satisfactory.

Contents

Chapter 1 - Introduction

Flat 2, Athenaeum Hall is being refurbished and air conditioning is to be installed as part of the refurbishment. The air conditioning system will include an external heat pump which is to be installed on the balcony at the rear of the property. The location of the property concerned is shown on Figure 1, and the proposed floor plan is shown on Figure 2.

Noise from the heat pump will have the potential to affect the balconies of the flats below and above. A noise assessment has therefore been undertaken on the basis of:

- noise level figures for the proposed heat pump taken from the manufacturer's data sheet;
- the results of a background noise monitoring exercise; and
- appropriate national guidance.

Chapter 2 – Noise assessment criteria

A glossary of acoustical terms is reproduced in Appendix A.

It is appropriate to assess proposed developments that are potentially affected by road traffic noise and industrial noise using the guidance provided by:

- National Planning Policy Framework (NPPF) (Ref 1);
- Noise Policy Statement for England (NPSE) (Ref 2)
- BS4142: 1997 'Rating industrial noise affecting mixed residential and industrial areas' (Ref 3); and
- BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings' (Ref 4).

The content of the reference documentation referred to above is discussed below.

2.1 National Planning Policy Framework

The National Planning Policy Framework was published on 27 March 2012 and came into force with immediate effect. Amongst the documents listed as being replaced by this document is PPG24, which was formerly the central national planning guidance document relating to noise in the UK.

Whereas PPG24 provided quantified advice on the determination of the suitability of sites for residential development on the basis of prevailing noise levels in the form of Noise Exposure Categories, the NPPF provides purely quantitative guidance (although the NPSE refers to assessment criteria in a general sense).

Section 8 of the NPPF 'Promoting healthy communities' makes no reference to environmental noise, the only comments relating to noise being listed below.

Section 11 'Conserving and enhancing the natural environment' advises:

> "109. The planning system should contribute to and enhance the natural and local environment by:
>
> - …..
> - preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability;
> - ….."

and

> "123. Planning policies and decisions should aim to:

- avoid noise giving rise to significant adverse impacts[27] on health and quality of life as a result of new development;

- mitigate and reduce to a minimum other adverse impacts[27] on health and quality of life arising from noise from new development, including through the use of conditions;

- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of nearby land uses since they were established;[28] and

- identify and protect areas of tranquillity that have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."

(Footnote 27 refers to an explanatory note in the NPSE, which is discussed below. Footnote 28 refers to "the provisions of the Environmental Protection Act 1990 and other relevant law".)

Section 13 'Facilitating the sustainable use of materials' includes guidance relating to noise, but this is provided in the context of minerals extraction activities.

2.2 Noise Policy Statement for England

The Noise Policy Statement for England was published by the Department for Environment, Food and Rural Affairs (Defra) in March 2010. The complete document includes the Policy Statement itself and an Explanatory Note.

Key concepts used in the MPSE are:

- NOEL or "no observed effect", meaning the level (of noise) below which no effect on health or quality of life can be detected;

- LOAEL or "lowest observed adverse effect", meaning the level (of noise) above which adverse effects on health and quality of life can be detected; and

- SOAEL or "significant observed adverse effect", meaning the level (of noise) above which significant adverse effects on health and quality of life can occur.

The first aim of the NPSE is to: "Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of the policy on sustainable development".

The second aim of the NPSE is to: "Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of the policy on sustainable development".

The third aim of the NPSE is to: "Where possible, contribute to the improvement of health and quality of life through the effective management of environmental, neighbour and neighbourhood noise within the context of the policy on sustainable development".

The second aim refers to the situation lies somewhere between LOAEL and SOAEL.

However, paragraph 2.3 of the Explanatory Note makes it clear that the approach to the minimisation of noise from environmental and related sources should be reasonable and balanced in stating:

- "2.3 Furthermore, the broad aim of noise management has been to separate noise sources from sensitive noise receivers and to "minimise" noise. Of course, taken in isolation and to a literal extreme, noise minimisation would mean no noise at all. In reality, although it has not always been stated, the aim has tended to be to minimise noise "as far as reasonably practical". This concept can be found in the Environmental Protection Act 1990, where, in some circumstances, there is a defence of "best practicable means" in summary statutory nuisance proceedings.

2.3 BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings'

BS8233: 2014: 'Guidance on sound insulation and noise reduction for buildings' provides guidance on indoor ambient noise levels for dwellings which are applicable in this case and which are set out in Table 4 of the document. These are set out below.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16h}$	-
Dining	Dining room / area	40 dB $L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,16h}$

These standards have been adopted in this report.

The 1999 edition of the document also included an internal maximum noise level standard for bedrooms

at night, although this does not appear in the current version. In accordance with World Health Organisation guidance (which is still current), it the 1999 edition recommended that an internal noise level of 45 dB L_{Amax} should be exceeded no more than approximately 10 to 15 times per night in bedrooms.

In respect of noise levels in garden areas BS8233: 2014 states:

> "For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."

Paragraph 6.2.2 of the document also states that for moderate and heavy traffic flows a 16-hour L_{Aeq} noise level can be derived from an 18-hour L_{A10} level by subtracting 2 dB. This conversion factor was previously provided in Planning Policy Guidance note 24 'Planning and Noise' (PPG24)

2.4 BS4142: 1997: 'Rating industrial noise affecting mixed residential and industrial areas'

Noise arising from permanent industrial or commercial sources is normally assessed using BS4142: 'Rating industrial noise affecting mixed residential and industrial areas' the current edition of which was published in 1997.

The assessment methodology set out in BS4142: 1997 is based on a comparison being made between the noise levels associated with the noise industrial noise source(s) and the prevailing background noise in the absence of the specific industrial noise sources being considered. If necessary the measured or predicted L_{Aeq} for industrial noise source(s) concerned is initially corrected for percentage on-times and for significant tonal and / or impulsive components, yielding a 'rating level'. The prevailing background L_{A90} noise level (measured in the absence of the industrial noise source(s) concerned) is then subtracted from the rating level. BS4142: 1997 then provides the following guidance:

> "The greater this difference the greater 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 level then this is a positive indication that complaints are unlikely."

Chapter 3 – Noise monitoring exercise and derivation of reference noise levels

3.1 Background noise monitoring exercise and reference background noise level at night

Background noise levels were measured on the balcony at the rear of the property during the early hours of Friday 24 October 2014, the approximate location of the microphone being shown on Figure 2. Monitoring was undertaken using Type 1 precision, integrating equipment that carries current calibration certification, data being logged in terms of dB L_{Aeq}, dB L_{A10}, dB L_{A90} and dB L_{Amax}. Results were logged in 5-minute periods between midnight and 03.00 hours. Weather conditions were good until after 02.45 hours when it started to rain, and the results up until 02.50 hours may be taken to be fully representative. After 02.50 hours the L_{A90} results were elevated by the rain. In the absence of rain the only significant background noise source was distant road traffic.

Full details of the monitoring exercise and the results obtained are provided in Appendix B.

The lowest background noise level recorded was found to be 30.7 dB $L_{A90,5m}$ at the microphone, which was approximately 1.0 metre from the façade. This equates to 27.7 dB $L_{A90,5m}$ free field.

This figure has been taken to be the worst-case (ie lowest) noise level prevailing during the night.

3.2 Background noise levels at other times

As the only significant background noise source is distant road traffic, background noise levels during daytime and evening periods will be higher than the worst-case background noise levels prevailing during the early hours of the morning.

The table of typical hourly variations in road traffic flows provided in Appendix B includes a column showing the corrections for background L_{A90} noise levels due to distant road traffic noise sources for each hour of the day and night relative to the hour between 02.00 and 03.00 hours.

On this basis, the background level at the monitoring position during the day (ie between 07.00 and 19.00 hours) will be at least 11.6 dB higher than the worst-case background level, which equates to 39.3 dB $L_{A90,1h}$ free-field.

For the evening period (19.00 to 23.00 hours):

- the background noise level at the monitoring position will be 10.4 dB higher than the worst-case background level, which equates to 38.1 dB $L_{A90,1h}$ free-field between 19.00 and 20.00 hours;
- the background noise level at the monitoring position will be 8.8 dB higher than the worst-case background level, which equates to 36.5 dB $L_{A90,1h}$ free-field between 20.00 and 21.00 hours;
- the background noise level at the monitoring position will be 7.5 dB higher than the worst-case background level, which equates to 35.2 dB $L_{A90,1h}$ free-field between 21.00 and 22.00 hours; and
- the background noise level at the monitoring position will be 6.3 dB higher than the worst-case background level, which equates to 34.0 dB $L_{A90,1h}$ free-field between 22.00 and 23.00 hours.

Chapter 4 – Noise levels at potentially affected sensitive locations

It is proposed to employ a single Daikin 5MXS90E7V3B heat pump in this case, the data sheet for which is provided in Appendix C.

Free-field noise levels with the proposed heat pump are set out in Appendix D. Two predictions are provided, one for the heat pump on full load, and one for the heat pump in "night mode". It is understood that heat pumps of this are normally set to operate in night mode at night. In this case the unit will be set to operate in night mode during part of the evening as well, thus operating in night mode from 21.00 hours in the evening at the latest until 07.00 hours in the morning at the earliest.

4.1 Noise predictions with the heat pump operating on full load

From the noise predictions in Appendix E it can be seen that the operational noise level at the worst-case sensitive receptor (which is on the balcony below) with the heat pump operating on full load is predicted to be 36.9 dB $L_{Aeq,t}$ free-field. Noise from heat pumps of this kind does not normally contain distinct tonal components, so this is the BS4142 rating noise level will also be 36.9 dB $L_{Aeq,t}$.

During the daytime and evening period from 07.00 hours to 21.00 hours the background noise level is no lower than 36.5 dB $L_{A90,1h}$ free-field. Therefore, in the worst case the rating level will be 0.4 dB above the background noise level.

As BS4142: 1997 considers a rating noise level that is 5 dB above the background noise level to be of "Marginal Significance" this situation is considered to be entirely satisfactory.

4.2 Noise predictions with the heat pump operating in night mode

From the noise predictions in Appendix D it can be seen that the operational noise level at the worst-case sensitive receptor (which is on the balcony below) with the heat pump operating in night mode is predicted to be 27.9 dB $L_{Aeq,t}$ free-field. Noise from heat pumps of this kind does not normally contain distinct tonal components, so this is the BS4142 rating noise level will also be 27.9 dB $L_{Aeq,t}$.

During the night-time period from 23.00 hours to 07.00 hours the background noise level is no lower than 27.7 dB $L_{A90,5m}$ free-field. Therefore, in the worst case the rating level will be 0.2 dB above the background noise level.

As BS4142: 1997 considers a rating noise level that is 5 dB above the background noise level to be of "Marginal Significance" this situation is considered to be entirely satisfactory.

4.3 Additional comments

It is understood that for commercial fixed plant installations many inner city councils require rating noise levels to be 5 or 10 dB below the background noise level. It is also understood this criterion is applied in order to avoid background noise levels increasing over time in situations where a large number of items of fixed plant can be installed in relatively small areas. This situation is known as "creeping background", and often occurs in inner city locations where there is a high concentration of commercial premises with kitchen ventilation and external air conditioning plant.

However, in this case the site is a private residence rather than a commercial site, which is situated in an extremely quiet, purely residential part of Camden, well away from major road traffic sources. Therefore, there is no significant potential for background noise levels to be increased by the introduction of noise sources such as that proposed for this refurbishment. The item of plant in question has no potential to increase background noise levels at distances of more than a few metres from the source.

Accordingly, it is considered appropriate to apply a more relaxed assessment criterion, for instance rating level not to exceed the background noise level +5 dB. In this case, operational noise levels are predicted to be well below background noise level +5 dB at potentially affected nearby sensitive receptors, which is expected to be entirely satisfactory in practice.

Additionally it should be noted that all of the predicted noise levels will comply with the recommendations of BS8233: 2014 at both adjoining properties.

Chapter 5 – Conclusions and recommendations

It has been demonstrated that operational noise levels will be entirely satisfactory at potentially affected nearby sensitive receptors.

During the period 07.00 to 21.00 hours, with the heat pump operating on full load, the BS4142 rating noise level will also be 36.9 dB $L_{Aeq,t}$. This is 0.4 dB above the worst-case (ie lowest) background noise level prevailing during this period, which is 36.5 dB $L_{A90,1h}$.

As BS4142: 1997 considers a rating noise level that is 5 dB above the background noise level to be of "Marginal Significance" this situation is considered to be entirely satisfactory.

During the period 21.00 to 07.00 hours, with the heat pump operating on quiet mode, the BS4142 rating noise level will also be 27.9 dB $L_{Aeq,t}$. This is 0.2 dB above the worst-case (ie lowest) background noise level prevailing during this period, which is 27.7 dB $L_{A90,5m}$.

As BS4142: 1997 considers a rating noise level that is 5 dB above the background noise level to be of "Marginal Significance" this situation is considered to be entirely satisfactory.

References

1 National Planning Policy Framework; Department for Communities and Local Government; 2012

2 Noise Policy Statement for England; Department for Environment, Food and Rural Affairs; 2010

3 BS4142: 1997 ‘Rating industrial noise affecting mixed residential and industrial areas’

4 BS8233: 2014 ‘Guidance on sound insulation and noise reduction for buildings’; BSI

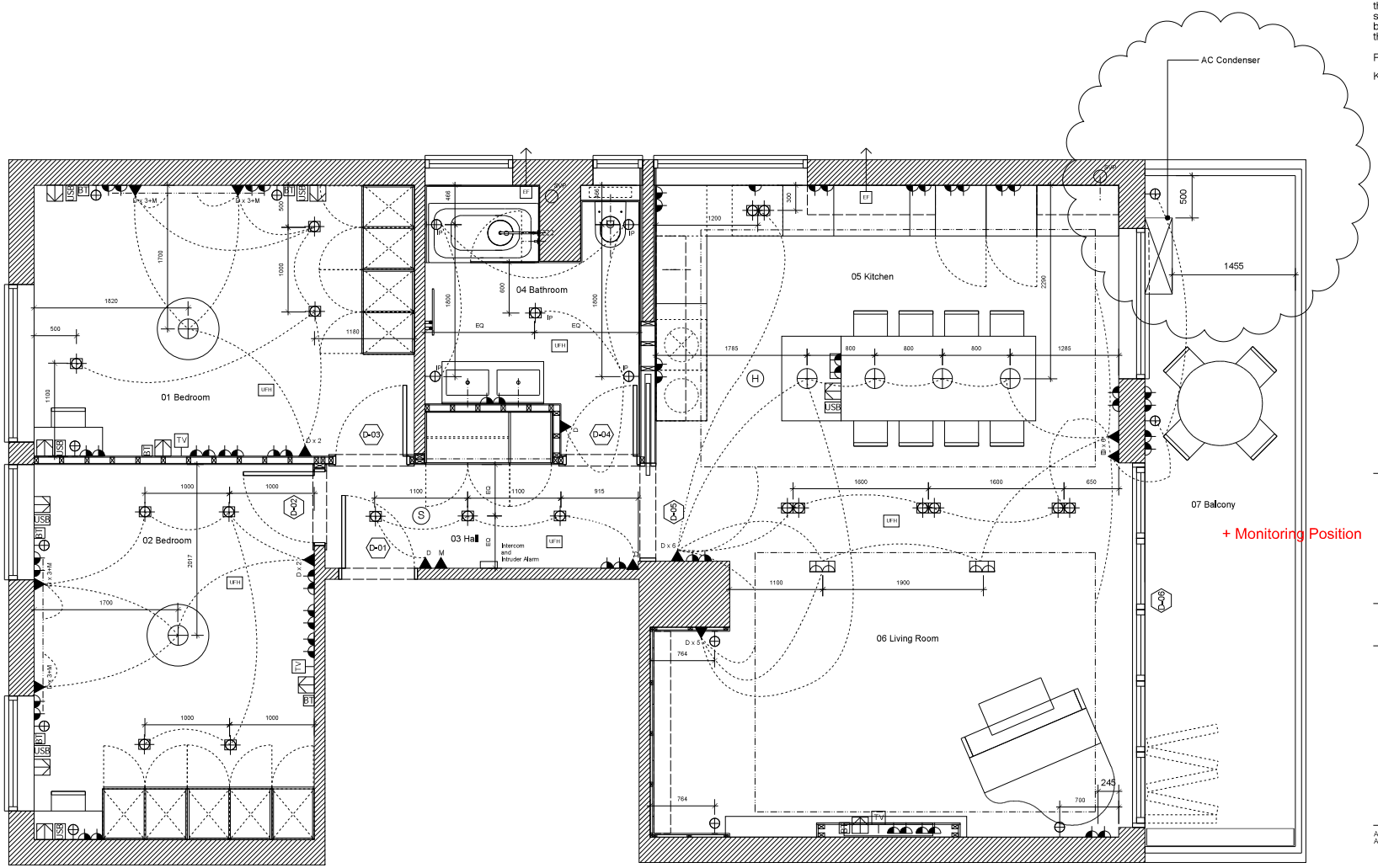
Figure 1

Site location


View
Vale House
Vale Lodge
Vale Cott
Blossom Villa
Willow Lodge
Fig Tree House
Spencer House
1 to 11
North Villa
South Villa
Rose Cott
Woodbine Cottage
The Old Cott
Sydney Cottage
Byron Villas
Vivary Cottage
Milton Cottage
Heath Villas
Villas on the Heath
Athenaeum Hall
1 to 4
Chestnut Cottage
Manor Lodge
Heath Villas
Lea-Steps

Figure 2

Proposed floor plan



1 Proposed Plan, M & E
Scale: 1:25

NOTES:

This drawing is issued for information only.

All dimensions to be checked on site and any discrepencies are to be raised with the drawing issuer for clarification. Dimensions are not to be scaled from this drawing. The iformation shown on this drawing is subject to measured surveys and structural engineer's designs. No building work is to be carried out on the basis of this drawing, without the written consent of Amos Goldreich Architecture.

Print with page scaling set to none.

Key to M & E:

- Master switch
- Single Toggle switch
- Single Dimmer switch
- Double Dimmer switch
- Triple Dimmer switch and Master switch
- Quadruple Dimmer switch
- five Dimmer switch
- Telephone socket outlet
- Telephone Master socket
- USB outlet
- CAT 5
- Media outlet
- 5 AMP Double Floor Socket
- Double Floor Socket
- Single Switch Socket Outlet
- Double Switch Socket Outlet
- Surface mounted single luminaire, 'Tweeter on', Delta
- Surface mounted double luminaire, 'Tweeter on', Delta
- IP rated double surface mounted luminaire
- Pendant light
- Surface mounted diffuser, Dia 50cm, 'Up', Vibia
- Surface mounted diffuser, Dia 73cm, 'Up', Vibia
- IP rated wall mounted light fixture, 'Micro', Vibia
- Wall mounted light fixture, 'Alpha', Vibia
- LED strip - cove lighting
- Recessed Wall Light
- Extractor Fan
- Smoke Detector
- Heat Detector
- Under Floor Heating

rev	date	initials	description
A	23.09.14	TM	Alterations
B	28.10.14	AG	Alterations

location

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project

Flat 2 Athenaeum Hall

drawing title

Proposed Plan
M&E and plumbing

drawn		
TM		
date	scale @ A1	status
September 2014	1:25	Construction
project number	drawing number	rev.
078	PP_101	B

Appendix A

Glossary of acoustical terms

Glossary

Below are explanations of terms as they are used in the PPG; they are not definitions.

Decibel (dB): a unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 Pa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

dB(A): decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).

Hertz (Hz): unit of frequency, equal to one cycle per second. Frequency is related to the pitch of a sound.

$L_{A10,T}$: the A weighted level of noise exceeded for 10% of the specified measurement period (T). It gives an indication of the upper limit of fluctuating noise such as that from road traffic. $L_{A10,18h}$ is the arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06.00 to 24.00.

$L_{A90,T}$: the A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 1990 it is used to define background noise level.

$L_{Aeq,T}$: the equivalent continuous sound level -the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter. It is written as L_{eq} in connection with aircraft noise.

L_{Amax}: the highest A weighted noise level recorded during a noise event. The time weighting used (F or S) should be stated.

Additionally, the term *SPL* refers to the quantity Sound Pressure Level as discussed under *Decibel (dB)* above. This can be either a broad-band quantity including all octave-band figures or can refer to individual octave-bands for instance.

The above text is reproduced in full from PPG24

Appendix B

Background noise monitoring exercise and road traffic noise corrections

Results obtained at	Balcony at rear of Flat 2				MP-B
	Microphone poitioned 1.5 m above balcony floor				
	Façade reflection(s) estimated to have added		3.0	dB to results obtained	
Results obtained on	Friday 24 October 2014				
Svantek 945A kit	Calibration at start	ok	Battery level at start	ok	
Fast response	Calibration at end	ok	Battery level at end	ok	

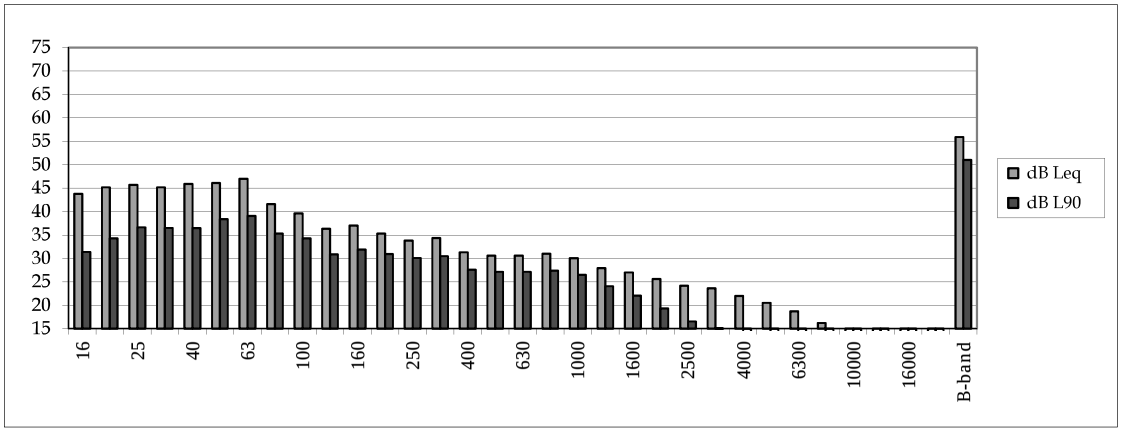
Sources: Main noise source is distant road traffic
No other significant noise sources
Weather: 14 degrees C, dry, cloudy, very little air movement
Road surfaces dry throughout

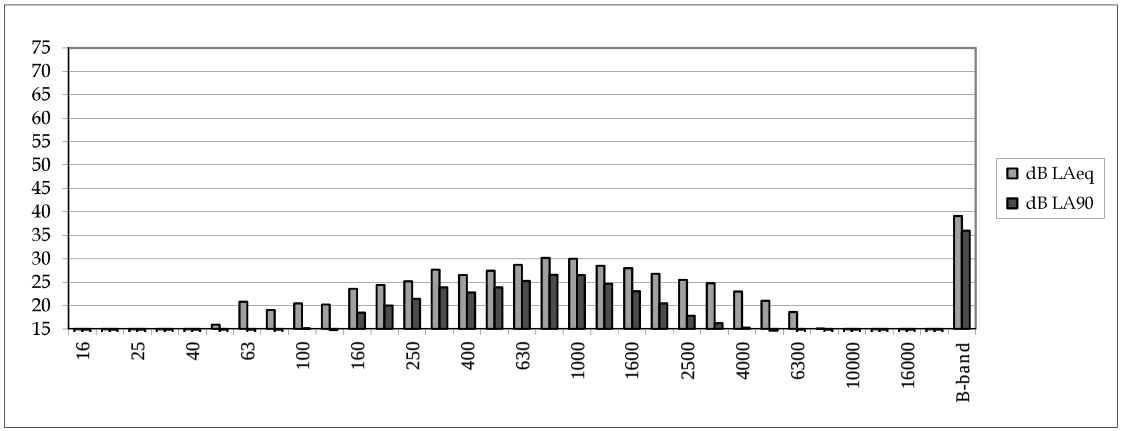
Start time	LAeq	LA10	LA90	LAmax	Notes
00.00	38.9	40.7	36.7	44.8	
00.05	39.9	40.5	36.5	61.5	
00.10	38.9	41.3	36.2	48.1	
00.15	38.5	39.8	36.3	51.4	
00.20	40.9	40.9	36.0	58.8	
00.25	38.1	39.9	36.0	46.6	
00.30	37.7	39.3	35.8	41.1	
00.35	42.0	43.6	37.5	58.7	
00.40	37.7	39.0	36.0	46.4	
00.45	37.4	39.4	34.9	47.6	
00.50	38.6	40.9	35.0	44.7	
00.55	38.5	39.5	34.4	54.8	
Averages:	39.1	40.4	35.9	54.8	including any façade reflection(s)
Averages:	36.1	37.4	32.9	51.8	corrected for free-field conditions
Lowest:	37.4	39.0	34.4	41.1	including any façade reflection(s)
Lowest:	34.4	36.0	31.4	38.1	corrected for free-field conditions

Results obtained at Balcony at rear of Flat 2 MP-B
Microphone poitioned 1.5 m above balcony floor
Façade reflection(s) estimated to have added 3.0 dB to results obtained

Average spectra for Friday 24 October 2014 including any façade reflection(s)

Centre Freq Hz	Averages dB Leq	Averages dB L90	Averages dB LAeq	Averages dB LA90
16	43.8	31.4	-12.9	-25.3
20	45.2	34.2	-5.3	-16.3
25	45.7	36.6	1.0	-8.1
31.5	45.2	36.5	5.8	-2.9
40	45.9	36.4	11.3	1.8
50	46.1	38.4	15.9	8.2
63	47.0	39.1	20.8	12.9
80	41.6	35.3	19.1	12.8
100	39.6	34.3	20.5	15.2
125	36.3	30.9	20.2	14.8
160	37.0	31.9	23.6	18.5
200	35.3	30.9	24.4	20.0
250	33.8	30.1	25.2	21.5
315	34.3	30.5	27.7	23.9
400	31.3	27.6	26.5	22.8
500	30.6	27.1	27.4	23.9
630	30.6	27.2	28.7	25.3
800	31.0	27.4	30.2	26.6
1000	30.0	26.5	30.0	26.5
1250	27.9	24.1	28.5	24.7
1600	27.0	22.1	28.0	23.1
2000	25.6	19.3	26.8	20.5
2500	24.2	16.5	25.5	17.8
3150	23.6	15.1	24.8	16.3
4000	22.0	14.3	23.0	15.3
5000	20.5	14.1	21.0	14.6
6300	18.7	14.1	18.6	14.0
8000	16.2	14.1	15.1	13.0
10000	12.8	14.1	10.3	11.6
12500	10.6	14.1	6.3	9.8
16000	5.6	14.1	-1.0	7.5
20000	1.0	14.1	-8.3	4.8
B-band	55.9	51.0	39.1	35.9





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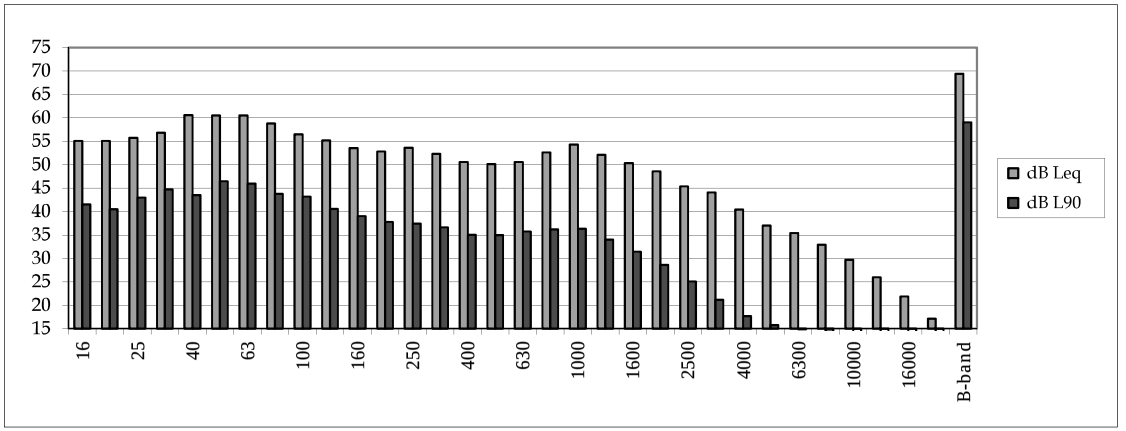
Road surfaces dry throughout

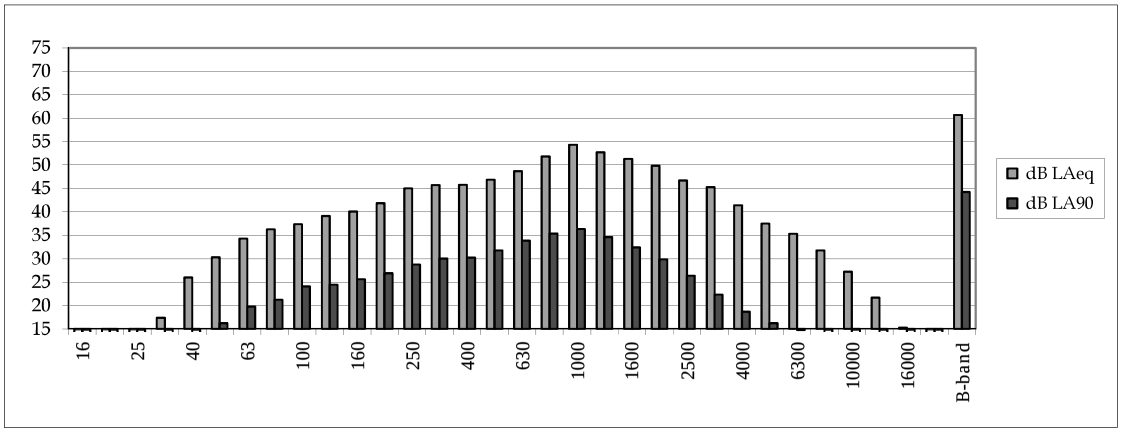
Start time	LAeq	LA10	LA90	LAmax	Notes
01.00	39.0	41.2	35.4	55.9	
01.05	37.5	39.7	34.6	44.2	
01.10	37.3	39.6	34.2	50.1	
01.15	38.4	40.3	35.1	54.3	
01.20	37.8	40.7	33.8	46.1	
01.25	37.5	39.6	34.5	50.4	
01.30	36.5	38.8	33.9	42.7	
01.35	37.3	39.1	34.3	55.1	
01.40	35.6	37.4	33.1	46.1	
01.45	35.2	37.2	32.8	41.0	
01.50	38.6	40.9	33.6	53.6	
01.55	34.3	36.3	32.0	41.9	
Averages:	37.3	39.2	33.9	51.2	including any façade reflection(s)
Averages:	34.3	36.2	30.9	48.2	corrected for free-field conditions
Lowest:	34.3	36.3	32.0	41.0	including any façade reflection(s)
Lowest:	31.3	33.3	29.0	38.0	corrected for free-field conditions

Results obtained at Balcony at rear of Flat 2 MP-B
Microphone poitioned 1.5 m above balcony floor
Façade reflection(s) estimated to have added 3.0 dB to results obtained

Average spectra for Friday 24 October 2014 including any façade reflection(s)

Centre Freq Hz	Averages dB Leq	Averages dB L90	Averages dB LAeq	Averages dB LA90
16	40.7	29.4	-16.0	-27.4
20	43.6	32.9	-6.9	-17.6
25	43.8	34.7	-0.9	-10.0
31.5	41.9	34.0	2.5	-5.4
40	43.5	34.2	8.9	-0.4
50	43.2	35.6	13.0	5.4
63	43.7	35.9	17.5	9.7
80	39.5	32.6	17.0	10.1
100	37.8	31.8	18.7	12.7
125	33.0	28.1	16.9	12.0
160	34.2	29.3	20.8	15.9
200	32.7	28.7	21.8	17.8
250	31.7	28.0	23.1	19.4
315	32.3	28.6	25.7	22.0
400	29.3	25.6	24.5	20.8
500	28.6	25.2	25.4	22.0
630	28.7	25.2	26.8	23.3
800	29.3	25.4	28.5	24.6
1000	28.3	24.5	28.3	24.5
1250	25.9	22.1	26.5	22.7
1600	25.2	20.1	26.2	21.1
2000	24.5	17.6	25.7	18.8
2500	22.9	15.9	24.2	17.2
3150	21.9	14.8	23.1	16.0
4000	20.4	14.3	21.4	15.3
5000	18.8	14.1	19.3	14.6
6300	17.5	14.1	17.4	14.0
8000	14.9	14.1	13.8	13.0
10000	11.0	14.1	8.5	11.6
12500	7.2	14.1	2.9	9.8
16000	1.4	14.1	-5.2	7.5
20000	-0.5	14.1	-9.8	4.8
B-band	53.2	48.7	37.3	33.9





MP-B

Results obtained at	Balcony at rear of Flat 2				
	Microphone poitioned 1.5 m above balcony floor				
	Façade reflection(s) estimated to have added		3.0	dB to results obtained	
Results obtained on	Friday 24 October 2014				
Svantek 945A kit	Calibration at start	ok	Battery level at start	ok	
Fast response	Calibration at end	ok	Battery level at end	ok	

Sources: Main noise source is distant road traffic
No other significant noise sources

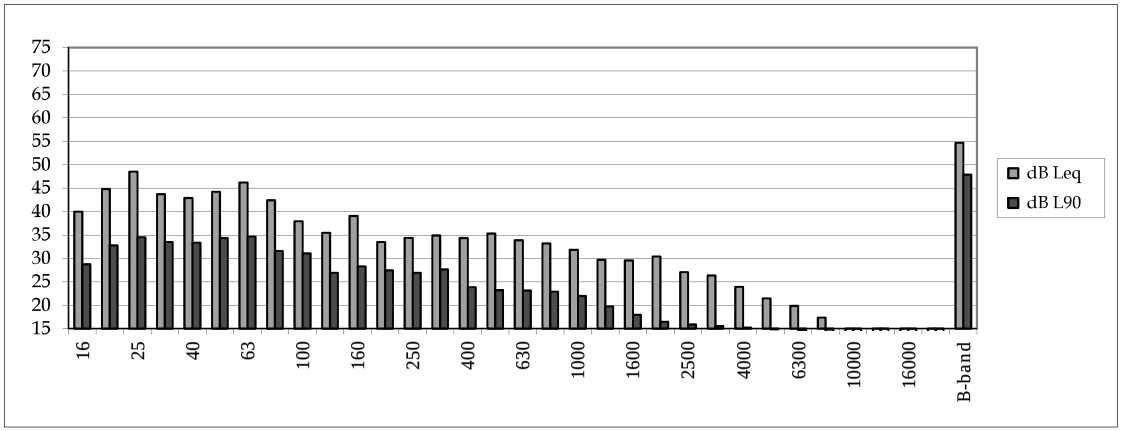
Weather: 14 degrees C, dry until approximately 02.45 hours, cloudy, very little air movement
Road surfaces dry until approximately 02.45 hours

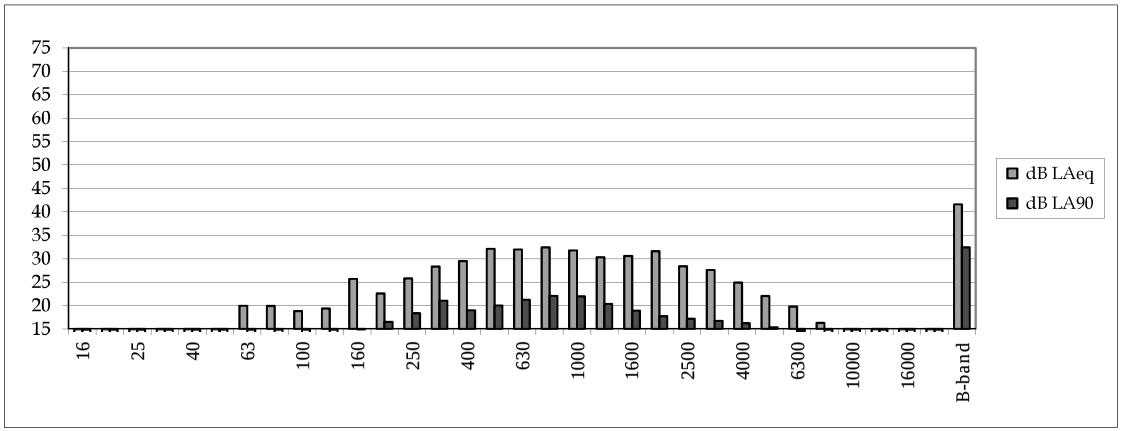
Start time	LAeq	LA10	LA90	LAmax	Notes
02.00	35.1	36.6	32.3	46.8	
02.05	36.0	37.5	32.3	48.9	
02.10	35.9	37.9	32.7	49.5	
02.15	33.9	35.6	32.2	38.2	
02.20	35.7	37.8	32.8	44.4	
02.25	50.1	52.4	31.2	67.2	
02.30	33.8	36.5	31.3	42.4	
02.35	34.5	36.2	32.0	45.8	
02.40	35.4	37.8	31.7	51.6	
02.45	34.8	37.0	30.7	48.3	
02.50	42.2	39.8	33.6	60.4	LA90 level elevated by rain
02.55	43.9	47.2	36.5	48.7	ditto
Averages:	41.6	39.4	32.4	57.6	including any façade reflection(s)
Averages:	38.6	36.4	29.4	54.6	corrected for free-field conditions
Lowest:	33.8	35.6	30.7	38.2	including any façade reflection(s)
Lowest:	30.8	32.6	27.7	35.2	corrected for free-field conditions

Results obtained at Balcony at rear of Flat 2 MP-B
Microphone poitioned 1.5 m above balcony floor
Façade reflection(s) estimated to have added 3.0 dB to results obtained

Average spectra for Friday 24 October 2014 including any façade reflection(s)

Centre Freq Hz	Averages dB Leq	Averages dB L90	Averages dB LAeq	Averages dB LA90
16	40.0	28.7	-16.7	-28.0
20	44.8	32.8	-5.7	-17.7
25	48.5	34.5	3.8	-10.2
31.5	43.7	33.5	4.3	-5.9
40	42.9	33.4	8.3	-1.2
50	44.2	34.4	14.0	4.2
63	46.2	34.6	20.0	8.4
80	42.4	31.6	19.9	9.1
100	37.9	31.1	18.8	12.0
125	35.5	27.0	19.4	10.9
160	39.1	28.3	25.7	14.9
200	33.5	27.4	22.6	16.5
250	34.4	27.0	25.8	18.4
315	34.9	27.7	28.3	21.1
400	34.3	23.8	29.5	19.0
500	35.3	23.2	32.1	20.0
630	33.9	23.2	32.0	21.3
800	33.2	22.9	32.4	22.1
1000	31.8	22.0	31.8	22.0
1250	29.7	19.8	30.3	20.4
1600	29.6	18.0	30.6	19.0
2000	30.4	16.5	31.6	17.7
2500	27.1	15.9	28.4	17.2
3150	26.4	15.6	27.6	16.8
4000	23.9	15.3	24.9	16.3
5000	21.5	14.9	22.0	15.4
6300	19.9	14.6	19.8	14.5
8000	17.4	14.4	16.3	13.3
10000	14.3	14.2	11.8	11.7
12500	11.4	14.1	7.1	9.8
16000	7.8	14.1	1.2	7.5
20000	2.5	14.1	-6.8	4.8
B-band	54.7	47.9	41.6	32.4





Department for Transport statistics

Road Traffic and Speeds (http://www.dft.gov.uk/pgr/statistics/datatablespublications/roads/traffic)

Table TRA0307

Traffic distribution by time of day on all roads in Great Britain, 2010

Index: Average hour in week = 100

Time of day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekday Average	Correction Relative to 02.00-03.00
00:00-01:00	16	15	16	17	18	23	24	16	**2.1**
01:00-02:00	10	11	11	12	13	16	15	11	**0.6**
02:00-03:00	8	10	10	11	11	12	11	10	**0.0**
03:00-04:00	10	11	12	12	12	12	9	12	**0.6**
04:00-05:00	20	18	18	19	18	14	9	19	**2.7**
05:00-06:00	49	42	42	42	39	23	14	43	**6.3**
06:00-07:00	112	105	104	103	90	39	22	103	**10.1**
07:00-08:00	185	189	188	185	162	63	35	182	**12.6**
08:00-09:00	191	200	199	197	172	94	52	192	**12.8**
09:00-10:00	154	159	160	159	144	127	86	155	**11.9**
10:00-11:00	149	142	144	145	149	157	125	146	**11.6**
11:00-12:00	151	141	142	146	162	172	150	149	**11.7**
12:00-13:00	151	143	145	150	172	169	156	152	**11.8**
13:00-14:00	151	147	150	156	181	157	150	157	**11.9**
14:00-15:00	156	155	158	164	189	147	147	164	**12.1**
15:00-16:00	167	171	175	180	199	140	151	179	**12.5**
16:00-17:00	191	201	205	210	206	139	158	203	**13.1**
17:00-18:00	199	209	210	210	200	137	149	206	**13.1**
18:00-19:00	149	159	163	168	164	118	130	161	**12.1**
19:00-20:00	96	102	107	115	125	89	107	109	**10.4**
20:00-21:00	66	69	73	81	89	62	84	76	**8.8**
21:00-22:00	51	53	55	61	63	47	62	57	**7.5**
22:00-23:00	37	42	43	45	47	40	42	43	**6.3**
23:00-00:00	24	26	27	29	33	33	26	28	**4.5**

Telephone: 020 7944 3095
Email: roadtraff.stats@dft.gsi.gov.uk

Source: DfT Automatic Traffic Counters

Last updated: June 2011

Next update: June 2012

Notes & definitions (http://www.dft.gov.uk/pgr/statistics/datatablespublications/roads/traffic/#technical)

The figures in this table are not National Statistics.

Average weekday daytime hourly flow (07.00 to 23.00 hours)	146
Average weekday night-time hourly flow (23.00 to 07.00 hours)	30
Therefore correction for night-time period is (dB)	**-7.0**

Average weekday daytime hourly flow (07.00 to 23.00 hours)	146
Highest weekday peak hourly flow	206
Therefore correction for peak hours is (dB)	**2.0**

Appendix C

Heat pump data sheet

1 Features

- Outdoor units for Multi model application.
- Up to 5 indoor units can be connected to 1 Multi outdoor unit. All indoor units are individually controllable with remote control and do not need to be installed in the same room or at the same time. They operate simultaneously within the same cooling operation
- It is possible to combine different types of indoor units as well. (e.g. wall mounted, ceiling mounted cassette corner, concealed ceiling unit)
- Daikin outdoor units are neat and sturdy and can be mounted easily on a roof or terrace or simply placed against an outside wall.
- Outdoor units are fitted with a swing compressor, renowned for its low noise and high energy efficiency

2 Specifications

2-1 TECHNICAL SPECIFICATIONS				2MXS40DAVMB	2MXS52E2V1B	3MXS52E2V1B	4MXS68E2V1B	4MXS80E7V3B	5MXS90E7V3B
Casing	Colour			Ivory White					
Dimensions	Unit	Height	mm	640	735	735	735	770	770
		Width	mm	685	936	936	936	900	900
		Depth	mm	285	300	300	300	320	320
	Packing	Height	mm	676	797	797	784	900	900
		Width	mm	800	992	992	992	925	925
		Depth	mm	366	390	390	390	390	390
Weight	Unit		kg	39	49	49	59	72	73
	Packed Unit		kg	42	56	56	65	80	80
Heat Exchanger	Dimensions	Length	mm	678	845	845	845	860	860
		Nr of Rows		1	2	2	2	2	2
		Fin Pitch	mm	1.4	1.80	1.80	1.60	1.40	1.40
		Nr of Stages		28	32	32	32	34	34
	Tube type			Hi-Xa(8)	ø7.94 grooved tubes 24	ø7.94 grooved tubes 24	Hi-Xa(8)	Hi-XSS(8)	Hi-XSS(8)
	Fin	Type		WF fin	Colgate fin	Colgate fin	WF fin	WF fin	WF fin
		Treatment		Anti-corrosion treatment (PE)	Anti-corrosion treatment (PE)	Anti-corrosion treatment (PE)	Anti-corrosion treatment (PE)		
Fan	Type			Propeller					
	Quantity			1	1	1	1	1	1
	Air Flow Rate (nominal at 230V)	Cooling	m³/min	35	45.0	45.0	51.0	54.5	54.5
		Heating	m³/min	32	45.0	45.0	47.6	46.0	
	Motor	Quantity		1	1	1	1	1	1
		Model		D50E-28	KFD-380-50-8A	KFD-380-50-8A	KFD-380-53-8C	KFD-280-66-8A	KFD-280-66-8A
Motor	Speed (nominal)	Cooling	rpm	880	720	720	790		860
		Heating	rpm	880		720	790		
Fan	Motor	Output	W	50	53	53	53	66	66
Compressor	Quantity				1	1	1	1	1
	Motor	Model		1YC23GXD	2YC36BXD	2YC36BXD	2YC45BXD	2YC63BXD#C	2YC63BXD#C
		Type		Hermetically sealed swing compressor					
		Motor Output	W	600	1100	1100	1380	1920	1920
Operation Range	Cooling	Min	°CDB	10	-10.0	-10.0	-10.0	-10.0	-10.0
		Max	°CDB	46	46.0	46.0	46.0	46.0	46.0
	Heating	Min	°CWB	-10	-15	-15	-15	-15	-15
		Max	°CWB	15.5	15.5	15.5	15.5	15.5	15.5
Sound Level (nominal)	Cooling	Sound Power	dBA	62	59.0	59.0	61.0	62.0	66.0
		Sound Pressure	dBA	47	46.0	46.0	48.0	48.0	52.0
	Heating	Sound Pressure	dBA	48	47.0	47.0	49.0	49.0	52.0
Sound Level (Night quiet)	Sound Pressure		dBA	43					
Refrigerant	Type			R-410A					
	Charge		kg	1.20	2.0	2.0	2.6	3.0	3.0
Refrigerant Oil	Type			FVC50K					
	Charged Volume		l	0.40	0.65	0.65	0.75	0.75	0.75

Appendix D

Operational noise predictions

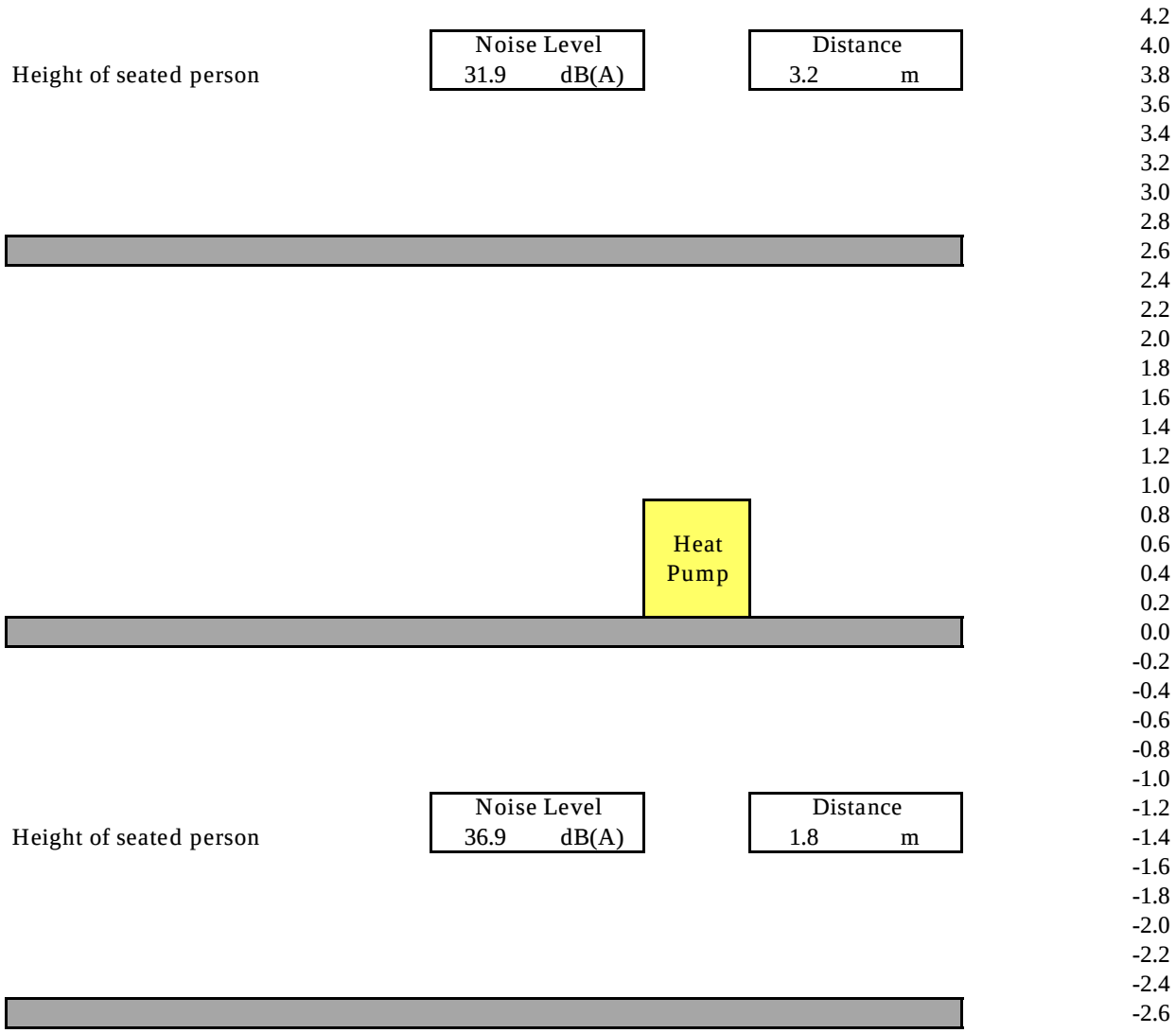
Predicted noise levels

Full Load

assuming 10.0 dB screening from balcony slabs

Source Noise Level 52.0 dB(A) at 1.0 m

Height relative to FFL of Flat 2



Height of seated person

Height of seated person

4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
-2.4
-2.6

Predicted noise levels

Night Mode

assuming 10.0 dB screening from balcony slabs

Source Noise Level 43.0 dB(A) at 1.0 m

Height relative to FFL of Flat 2