

REPORT N° 62102328-001

UNIVERSITY OF READING CHANCELLORS BUILDING

PLANNING NOISE REPORT

CONFIDENTIAL

AUGUST 2016

CHANCELLORS BUILDING

PLANNING NOISE REPORT

University of Reading

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1 INTRODUCTION

1.1 GENERAL

- 1.1.1 The existing Chancellors Building at the University of Reading's Whiteknights campus is proposed for a building services plant fit-out. WSP|Parsons Brinckerhoff Ltd (WSP|PB) has been commissioned by the University of Reading to undertake an acoustic assessment for the scheme.
- 1.1.2 This report is intended to accompany the planning application for the scheme, and demonstrate that noise breakout at sensitive receptors will meet with appropriate limits.
- 1.1.3 A glossary of acoustics terminology is provided in Appendix A-1.

1.2 SITE DESCRIPTION

- 1.2.1 The location of the Chancellors Building is at the eastern end of the Whiteknights campus. To the west is open grass land and woodland bounded by the B3350, beyond this is a large residential area. Bounding the campus to the south is Pepper Lane, beyond this are further University facilities and a large residential area. To the west is open grassland, which is bounded by the busy A327 trunk road, beyond this is another large area of residential housing, with some light industrial and commercial units.

1.3 NOISE SURVEY

- 1.3.1 A baseline noise survey has been carried out at Whiteknights Campus in October 2015. During the survey the main noise sources affecting the site were the combined traffic noise from the A327 and surrounding road network, although the survey has identified that this is not significant. Other noise sources include infrequent vehicle movements along the smaller roads surrounding the site, occasional aircraft, and diffuse noise from existing building services plant on University buildings within the campus.

2 POLICY AND GUIDANCE

2.1 GENERAL

2.1.1 This assessment makes use of the following standards and guidance:

- National Planning Policy Framework: 2012
- BS 7445: 2003 'Description and Measurement of Environmental Noise' Parts 1 to 3
- BS 4142:2014 'Methods for rating and assessing industrial and commercial sound'

2.2 NATIONAL PLANNING POLICY FRAMEWORK

2.2.1 The NPPF sets out clearly central government's requirements for the national planning policy and directs how it is to be implemented in order to achieve sustainable development. Sustainable development is about positive growth - making economic, environmental and social progress for this and future generations.

2.2.2 The NPPF states that 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 noise pollution and remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate'.

2.2.3 The NPPF states that planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts 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 changes in nearby land uses since they were established; and
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

2.2.4 In order to deliver sustainable development, NPPF states 'to help economic growth, local planning authorities should plan proactively to meet the development needs of business and support an economy fit for the 21st century.'

2.3 AMBIENT NOISE SURVEY - BS7445

2.3.1 All noise monitoring was conducted in accordance with the guidance set out in BS 7445-2: 2003 'Description and measurement of environmental noise Part 2: Guide to the acquisition of data pertinent to land use'. This standard details additional information that should be recorded during the survey such as meteorological data, and a description of the noise source itself.

2.4 INDUSTRIAL NOISE AFFECTING RESIDENTIAL DWELLINGS – BS4142

2.4.1 BS 4142 (2014) 'Methods for rating and assessing industrial and commercial sound'; offers guidance on the assessment of industrial and commercial noise affecting residential and industrial areas. It describes a method for assessing the impact of noise from industrial and commercial sources.

2.4.2 The method set out in BS 4142 compares a rating of the noise from the specific source being assessed with the background sound climate existing at relevant noise-sensitive receptors (NSRs) in the absence of the source operation. The difference in levels established is taken as an indication of the magnitude of the noise impact, subject to contextual considerations [from BS 4142]:

- a. *"Typically, the greater this difference, the greater the magnitude of the impact.*
- b. *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- c. *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- d. *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. 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."*

3 AMBIENT NOISE SURVEY

3.1 AMBIENT NOISE SURVEY

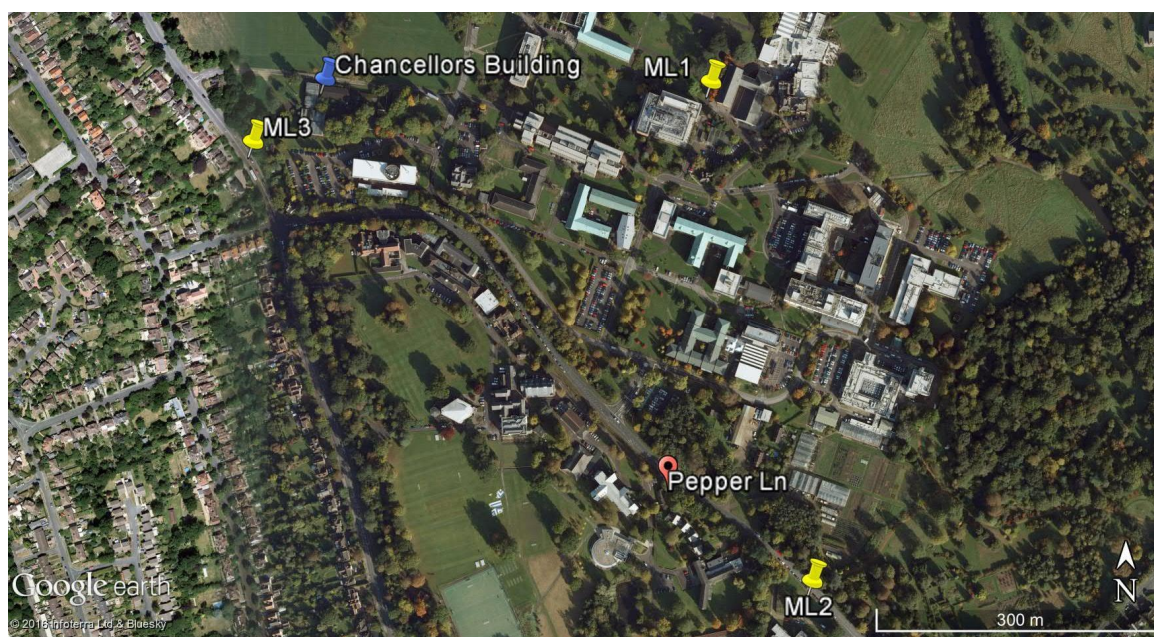
3.1.1 A noise survey was undertaken at the Whiteknights Campus in October 2015 and conducted in accordance with the guidance set out in BS 7445. The full set of results for the short term sampling measurements, including measurement locations, photographs, meteorological conditions and subjective notes from the on-site engineer during the survey, are presented in the Noise Monitoring Forms in Appendix A-3. A summary of the findings is provided below.

RECEPTOR LOCATIONS

3.1.2 Figure 1 shows the Whiteknights campus and surrounding area. The measurement locations included in the ambient noise survey, shown on Figure 1 as yellow pins, are listed as follows:

- ML1 - Adjacent to University Library
- ML2 - Adjacent to residential properties on Pepper Lane
- ML3 - Adjacent to residential properties on A327

FIGURE 1: SURVEY MEASUREMENT LOCATIONS AT WHITEKNIGHTS CAMPUS



NOISE SURVEY RESULTS

3.1.3

It is current practice to quote all statistics to one decimal place, apart from L_{A90} data which are rounded to the nearest whole numbers. All data is free-field, unless otherwise stated. Table 1 presents a summary of the short term sampling measurements taken during the day, evening and night-time periods.

TABLE 1: SUMMARY OF THE SHORT TERM SAMPLING MEASUREMENTS

Measurement Location	Daytime		Evening		Night-time	
	$L_{Aeq, 15mins}$ (dB)	L_{A90} 15mins (dB)	$L_{Aeq, 15mins}$ (dB)	L_{A90} 15mins (dB)	$L_{Aeq, 15mins}$ (dB)	L_{A90} 15mins (dB)
ML1	48.1	44	50.2	45	39.6	38
ML2	59.0	52	59.5	51	43.9	34
ML3	68.1	59	67.8	58	54.0	32

4 BS4142 ASSESSMENT

NOISE SENSITIVE RECEPTORS

- 4.1.1 The worst-case NSRs (i.e. nearest or most exposed to the proposed new noise sources) relevant to the Chancellors Building are listed in Table 2.

Table 2: List of Nearest Noise-Sensitive Receptors

REF.	RECEPTOR	CLASSIFICATION	SHORTEST HORIZONTAL DISTANCE FROM SITE BOUNDARY, M (APPROX.)
NSR 1	Whiteknights Campus Hotel	Residential	450
NSR 2	Residential on Pepper Lane	Residential	250
NSR 3	Residential on A327	Residential	95

NOISE CONSTRAINTS AT RECEPTORS

- 4.1.2 The survey indicated that background sound levels surrounding the site are generally dominated by road traffic noise during the day and diffuse building services plant noise at night. Following analysis of the data measurement on-site, the lowest typical measured noise levels for the day and night time period have been used to inform the assessment. The background sound levels presented in Table 3 and are considered to be representative for the relevant receptor locations.

Table 3: Background Sound Levels

REF	RECEPTOR	ASSESSMENT PERIOD	REPRESENTATIVE BACKGROUND SOUND LEVEL, L _{AF90}	ASSESSMENT PERIOD	REPRESENTATIVE BACKGROUND SOUND LEVEL, L _{AF90}
NSR1	Whiteknights Campus Hotel	Day 0700-2300hrs	44	Night 2300-0700hrs	38
NSR2	Residential on Pepper Lane	Day 0700-2300hrs	52	Night 2300-0700hrs	34
NSR3	Residential on A327	Day 0700-2300hrs	59	Night 2300-0700hrs	32

SPECIFIC NOISE LEVELS

- 4.1.3 Manufacturers warranted noise data for the proposed building services plant has been taken from the specifications (provided in Appendix A-5). The source noise data for all identified external building services plant items is summarised in Table 4 overleaf.

Table 4: Summary of Manufacturers Warranted Noise Source Data

PLANT ITEM	SPECIFICATION REFERENCE	SOUND PRESSURE LEVEL, dB*
Heat Pump	FDC400KXZE1	60
Heat Pump	FDC450KXZE1	61
Inverter Fan	FDC100VNP	61
Inverter Fan	SRC35ZMP-S	49

*Measurement distance not specified in the plant specifications. Sound pressure level distance assumed to be measured at 1m.

4.1.4 All specific sound levels have been calculated using standard acoustic propagation calculation techniques. All specific noise levels are predicted external to the relevant receptors, in accordance with the requirements of the BS 4142:2014 assessment method. The calculations are presented in Appendix A-2.

4.1.5 A number of assumptions are incorporated into the noise predictions:

- Distances have been approximated from the best available information as shown in the calculation sheets, and;
- Ground absorption between the site and receptors is negligible (in practice some absorption would be expected, which would result in slightly lower noise levels than predicted).

RATING NOISE LEVELS

4.1.6 BS 4142 indicates that penalties could be applicable for noise characteristics such as intermittency, impulsivity and tonality. As noise from the proposed plant items is not yet present, establishing a rating for sound characteristics likely to increase distinctiveness (perception) or annoyance (response) requires professional judgement. Our professional experience with plant such as boilers and air handling units is that any tonal components are audible only at close range where masking sound is low relative to the noise emission, as such no tonal penalty has been applied.

4.1.7 When installed, the building services plant will operate more or less continuously, however, the system will ramp up and down depending on load conditions and will operate at low duty during the night. As such, the proposed plant may be considered to have intermittent characteristics, for which a maximum 3 dB penalty is considered appropriate.

4.1.8 Impulsive noise characteristics have been discounted from this assessment. The main noise producing elements would be from fans, which will produce a steady noise with no impulsive characteristics.

IMPACT ASSESSMENT

4.1.1 The impact assessment for each receptor is summarised below in Tables 5 to 10. It is noted that the assessments address the worst-case operation; actual impacts would be expected to be lower than indicated.

Table 5: Summary of Daytime BS4142 Assessment for Receptor NSR1 – Campus Hotel

PARAMETER	VALUE	BS 4142 CLAUSE	COMMENTARY
Assessment period, T_r	Daytime 1 hour	7.2	0700-2300hrs
Background sound level, L_{AF90}	44 dB	8.1, 8.2	Background sound level derived from statistical analysis of measured ambient noise at ML 3 (rooftop location).
Specific noise level, $L_{Aeq,T}$	13 dB	7.3	Specific level calculated from number of proposed units, and acoustic propagation to receptor location. No adjustment for residual sound is necessary.
Acoustic feature penalty	3 dB	9.2	Plant likely to have tonal characteristics and will ramp up and down depending on load conditions. The plant may be considered to have intermittent and tonal characteristics in the near field.
Rating noise level, $L_{Ar,Tr}$	16 dB	9.1	Specific noise + feature penalty.
Difference in rating noise relative to background sound	-28 dB	11	Initial indication of no noise impact.
Initial assessment	No impact	11	-

Table 6: Summary of Night-time BS4142 Assessment for Receptor NSR1 – Campus Hotel

PARAMETER	VALUE	BS 4142 CLAUSE	COMMENTARY
Assessment period, T_r	Night-time 15 minutes	7.2	2300-0700hrs
Background sound level, L_{AF90}	38 dB	8.1, 8.2	Background sound level derived from statistical analysis of measured ambient noise at ML 3 (rooftop location).
Specific noise level, $L_{Aeq,T}$	13 dB	7.3	Specific level calculated from number of proposed units, and acoustic propagation to receptor location. No adjustment for residual sound is necessary.
Acoustic feature penalty	3 dB	9.2	Plant likely to have tonal characteristics and will ramp up and down depending on load conditions. The plant may be considered to have intermittent and tonal characteristics in the near field.
Rating noise level, $L_{Ar,Tr}$	16 dB	9.1	Specific noise + feature penalty.

PARAMETER	VALUE	BS 4142 CLAUSE	COMMENTARY
Difference in rating noise relative to background sound	- 22 dB	11	Initial indication of no impact.
Initial assessment	No impact	11	-

Table 7: Summary of Daytime BS4142 Assessment for Receptor NSR2 – Pepper Lane

PARAMETER	VALUE	BS 4142 CLAUSE	COMMENTARY
Assessment period, T_r	Daytime 1 hour	7.2	0700-2300hrs
Background sound level, L_{AF90}	52 dB	8.1, 8.2	Background sound level derived from statistical analysis of measured ambient noise at ML 3 (rooftop location).
Specific noise level, $L_{Aeq,T}$	19 dB	7.3	Specific level calculated from number of proposed units, and acoustic propagation to receptor location. No adjustment for residual sound is necessary.
Acoustic feature penalty	3 dB	9.2	Plant likely to have tonal characteristics and will ramp up and down depending on load conditions. The plant may be considered to have intermittent and tonal characteristics in the near field.
Rating noise level, L_{Ar,T_r}	22 dB	9.1	Specific noise + feature penalty.
Difference in rating noise relative to background sound	- 30 dB	11	Initial indication of no impact.
Initial assessment	No impact	11	-

Table 8: Summary of Night-time BS4142 Assessment for Receptor NSR2 – Pepper Lane

PARAMETER	VALUE	BS 4142 CLAUSE	COMMENTARY
Assessment period, T_r	Night-time 15 minutes	7.2	2300-0700hrs
Background sound level, L_{AF90}	34 dB	8.1, 8.2	Background sound level derived from statistical analysis of measured ambient noise at ML 3 (rooftop location).
Specific noise level, $L_{Aeq,T}$	19 dB	7.3	Specific level calculated from number of proposed units, and acoustic propagation to receptor location. No adjustment for residual sound is necessary.

PARAMETER	VALUE	BS 4142 CLAUSE	COMMENTARY
Acoustic feature penalty	3 dB	9.2	Plant likely to have tonal characteristics and will ramp up and down depending on load conditions. The plant may be considered to have intermittent and tonal characteristics in the near field.
Rating noise level, $L_{Ar,Tr}$	22 dB	9.1	Specific noise + feature penalty.
Difference in rating noise relative to background sound	- 12 dB	11	Indication of no impact.
Initial assessment	No impact	11	-

Table 9: Summary of Daytime BS4142 Assessment for Receptor NSR3 – Residential on A327

PARAMETER	VALUE	BS 4142 CLAUSE	COMMENTARY
Assessment period, T_r	Daytime 1 hour	7.2	0700-2300hrs
Background sound level, L_{AF90}	59 dB	8.1, 8.2	Background sound level derived from statistical analysis of measured ambient noise at ML 3 (rooftop location).
Specific noise level, $L_{Aeq,T}$	27 dB	7.3	Specific level calculated from number of proposed units, and acoustic propagation to receptor location. No adjustment for residual sound is necessary.
Acoustic feature penalty	3 dB	9.2	Plant likely to have tonal characteristics and will ramp up and down depending on load conditions. The plant may be considered to have intermittent and tonal characteristics in the near field.
Rating noise level, $L_{Ar,Tr}$	30 dB	9.1	Specific noise + feature penalty.
Difference in rating noise relative to background sound	- 29 dB	11	Initial indication of no impact.
Initial assessment	No impact	11	-

Table 10: Summary of Night-time BS4142 Assessment for Receptor NSR3 – Residential on A327

PARAMETER	VALUE	BS 4142 CLAUSE	COMMENTARY
Assessment period, T_r	Night-time 15 minutes	7.2	2300-0700hrs
Background sound level, L_{AF90}	32 dB	8.1, 8.2	Background sound level derived from statistical analysis of measured ambient noise at ML 3 (rooftop location).
Specific noise level, $L_{Aeq,T}$	27 dB	7.3	Specific level calculated from number of proposed units, and acoustic propagation to receptor location. No adjustment for residual sound is necessary.
Acoustic feature penalty	3 dB	9.2	Plant likely to have tonal characteristics and will ramp up and down depending on load conditions. The plant may be considered to have intermittent and tonal characteristics in the near field.
Rating noise level, L_{Ar,T_r}	30 dB	9.1	Specific noise + feature penalty.
Difference in rating noise relative to background sound	-2 dB	11	Indication of no impact.
Initial assessment	No impact	11	-

4.1.2

The results of the BS4142 assessment identify that a result of no impact is predicted at the noise sensitive receptor locations as a result of the operation of the proposed building services plant for the scheme.

5

SUMMARY

- 5.1.1 WSP | Parsons Brinckerhoff were commissioned to undertake a noise study to support the planning application for a plant fit-out at the Chancellors Building, Whiteknights Campus, University of Reading.
- 5.1.2 The report presents the results of the background noise survey and assesses breakout noise from the rooftop plant in line with the BS4142:2014 methodology.
- 5.1.3 The results of the study identify a result of no noise impact at sensitive receptor locations as a result of the proposed scheme.

Appendix A

APPENDIX A-1

GLOSSARY OF ACOUSTIC TERMINOLOGY

GLOSSARY OF ACOUSTICS TERMINOLOGY

Noise	A noise can be described as an unwanted sound. Noise can cause nuisance.
Ambient Sound	The totally encompassing sound in a given situation, at a given time, including sound from any source in any direction.
Specific Sound	A component of the ambient sound, associated with a specific source/s under consideration.
Residual Sound	Another component of the ambient sound, associated with any sources other than the specific source(s) under consideration.
Background sound	A component of the residual sound, comprising the steady sounds underlying sources that fluctuate in level within a period of consideration. This can be evaluated using the L_{A90} metric.
Decibel (dB)	The decibel scale is used in relation to sound because it is a logarithmic rather than a linear scale. The decibel scale compares the level of a sound relative to another. The human ear can detect a wide range of sound pressures, typically between 2×10^{-5} and 200 Pa, so the logarithmic scale is used to quantify these levels using a more manageable range of values.
Sound Pressure Level (SPL)	The Sound Pressure Level has units of decibels, and compares the level of a sound to the smallest sound pressure generally perceptible by the human ear, or the reference pressure. It is defined as follows: $\text{SPL (dB)} = 10 \log_{10}(P/P_{\text{ref}})^2 \quad \text{where } P = \text{RMS Sound Pressure (in Pa)}$ $P_{\text{ref}} = \text{Reference Pressure } 2 \times 10^{-5} \text{ Pa}$ An SPL of 0dB suggests the Sound Pressure is equal to the reference pressure. This is known as the <i>threshold of hearing</i>. An SPL of 140dB represents the <i>threshold of pain</i>.
Loudness	The loudness of a sound is subjective, and differs from person to person. The human ear perceives loudness in a logarithmic fashion, hence the suitability of the decibel scale. Generally, a perceived doubling or halving of loudness will correspond to an increase or decrease in SPL of 10dB. Note that a doubling of sound energy corresponds to an increase in SPL of only 3dB.
Sound Power Level (SWL)	The Sound Power Level defines the rate at which sound energy is emitted by a source, and is also expressed in dB. It is defined as follows: $\text{SWL (dB)} = 10 \log_{10}(W/W_{\text{ref}}) \quad \text{where } W = \text{Sound Power (in Watts)}$ $W_{\text{ref}} = \text{Reference Power } 1 \text{ pWatt}$
A-Weighting	The human ear can detect a wide range of frequencies, from 20Hz to 20kHz, but it is more sensitive to some frequencies than others. Generally, the ear is most sensitive to frequencies in the range 1 to 4 kHz. The A-weighting is a filter that can be applied to measured results at varying frequencies, to mimic the frequency response of the human ear, and therefore better represent the likely perceived loudness of the sound. SPL readings with the A-weighting applied are represented in dB(A).

Equivalent Continuous Level ($L_{eq,T}$)	The Equivalent Continuous Level represents a theoretical continuous sound, over a stated time period, T, which contains the same amount of energy as a number of sound events occurring within that time, or a source that fluctuates in level. For example, a noise source with an SPL of 80 dB(A) operating for two hours during an eight-hour working day, has an equivalent A-weighted continuous level over eight hours of 74 dB, or $L_{Aeq,8hrs} = 74$ dB. The time period over which the L_{eq} is calculated should always be stated.
Maximum Sound Level (L_{max})	The maximum sound level, L_{max} (or L_{Amax} if A-weighted) is the highest SPL that occurs during a given event or time period.
Minimum Sound Level (L_{min})	Similarly, the minimum sound level, L_{min} (or L_{Amin} if A-weighted) is the lowest SPL that occurs during a given event or time period.
L_{90} or L_{A90} and other percentile measures	This represents the SPL which is exceeded 90% of the time, expressed in dB or dB(A). L_{A90} is used to quantify background noise levels (see below). Other percentiles exist and are used for various types of noise assessment. These include L_{01} , L_{10} , L_{50} , L_{99} .
Noise Sensitive Receptors (NSRs)	Any identified receptor likely to be affected by noise. These are generally human receptors, and may include residential dwellings, work places, schools, hospitals, community facilities, places of worship and recreational spaces.
Octave	In reference to the frequency of a sound, an octave describes the difference between a given frequency and that which is double that frequency, e.g. 125Hz to 500Hz, or 4kHz to 8kHz.
Octave/Third Octave Bands	A sound made up of more than one frequency can be described using a frequency spectrum, which shows the relative magnitude of the different frequencies within it. The possible range of frequencies is continuous, but can be split up into discrete bands, often an octave or third-octave in width. Each octave band is referred to by its centre frequency, generally 63Hz, 125Hz, 250Hz, 500Hz, 1kHz etc.
Point Source	A theoretical source of sound, with zero size and mass, often used as an approximation to model small sources. Sound from a point source radiates spherically in all directions.
Line Source	A theoretical source of sound, with length only, often used to model long, thin sound sources, such as roads.
Area source	A real or theoretical source that radiates as a planar surface. Sound from an area source at close range is radiated as plane waves rather than spherical waves, close range being considered as where the source is large relative to the wavelength of the sound produced. In the far field, the sound waves from an area source become spherical.
Time Weighting	A constant value used to calculate short-term RMS sound pressure by weighted averaging over the specified time range. RMS sound pressure levels may then be evaluated over a longer period (e.g. Equivalent Continuous Level). 'Fast' corresponds to a 125 ms time constant, 'Slow' corresponds to a 1 second time constant and 'Impulse' has a time constant of 35 ms.
RMS	Root-mean-square. Instantaneous sound pressure can take positive or negative values around the mean (atmospheric pressure). To describe the energy in pressure waves the instantaneous pressure is squared, and averaged over a finite time (see time-weighting above). The square root reduces the mean-square value to linear, rather than squared, units.

APPENDIX A-2 **BS4142 PLANT NOISE CALCULATIONS**

**Building Services Plant
Noise Calculations**



Receptor 1 Whiteknights Campus Hotel						
Source	Point Source Sound Power, dB(A)	Distance to Receiver, m	Distance Attenuation, dB	Hemispherical radiation correction, dB	Screening Correction, dB	SPL at Receiver, dB(A)
Heat Pump FDC400KXZE1	76	450	53.1	8	5	10
Heat Pump FDC450KXZE1	77	450	53.1	8	5	11
Inverter FDC100VNP	69	450	53.1	8	8	0
Inverter SRC35ZMP-S	57	450	53.1	8	8	-12
Total predicted noise level at Receptor 1 :						13

Receptor 2 Residential on Pepper Lane						
Source	Point Source Sound Power, dB(A)	Distance to Receiver, m	Distance Attenuation, dB	Hemispherical radiation correction, dB	Screening Correction, dB	SPL at Receiver, dB(A)
Heat Pump FDC400KXZE1	76	250	48.0	8	5	15
Heat Pump FDC450KXZE1	77	250	48.0	8	5	16
Inverter FDC100VNP	69	250	48.0	8	8	5
Inverter SRC35ZMP-S	57	250	48.0	8	8	-7
Total predicted noise level at Receptor 2 :						19

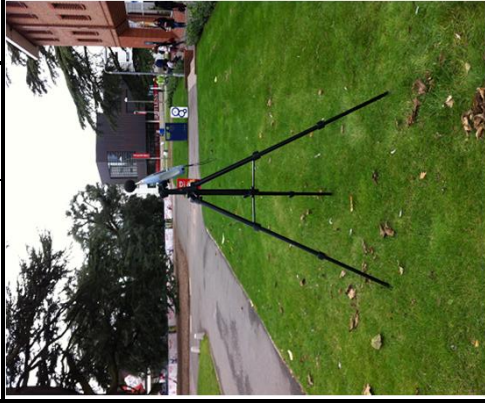
Receptor 3 Residential on A327						
Source	Point Source Sound Power, dB(A)	Distance to Receiver, m	Distance Attenuation, dB	Hemispherical radiation correction, dB	Screening Correction, dB	SPL at Receiver, dB(A)
Heat Pump FDC400KXZE1	76	95	39.6	8	5	23
Heat Pump FDC450KXZE1	77	95	39.6	8	5	24
Inverter FDC100VNP	69	95	39.6	8	8	13
Inverter SRC35ZMP-S	57	95	39.6	8	8	1
Total predicted noise level at Receptor 3 :						27

Noise Monitoring Form

PARSONS
BRINCKERHOFF

Project:	Reading University Library			Job Number:	3516669A_BML
Equipment:	NA-28			Engineer:	Adam Price & Angela Lorenzo
Pre-Calibration Level:	94.0			General Weather Description:	Dry and Overcast
Post-Calibration Level:	94.0			Location:	ML 1

Measurement Period		Weather			Statistical Noise Levels / dB				Description of Audible Noise	
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Wind Direction (from)	Temperature (°C)	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A10}	L _{A90}	
22/10/2015 11:43	15	2-3	S	8 -12	49.0	49.9	48.6	51.2	46.3	People crossing, airplanes, road traffic noise
22/10/2015 17:55	15	1-2	S	8 -12	48.1	46.2	44.4	51.0	43.7	People crossing, road traffic noise
22/10/2015 19:12	15	1-2	S	8 -12	50.2	59.9	44.8	51.5	45.1	Road Traffic Noise, pedestrians, student singing and playing guitar
23/10/2015 01:07	15	1-2	S	8 -12	40.8	40.9	40.0	41.4	39.8	People collecting rubbish. Plant noise from JJ Thompson Building and Carrington Building
23/10/2015 02:54	15	1-2	S	8 -12	39.6	54.4	38.4	40.4	38.2	Plant noise from JJ Thompson Building and Carrington Building

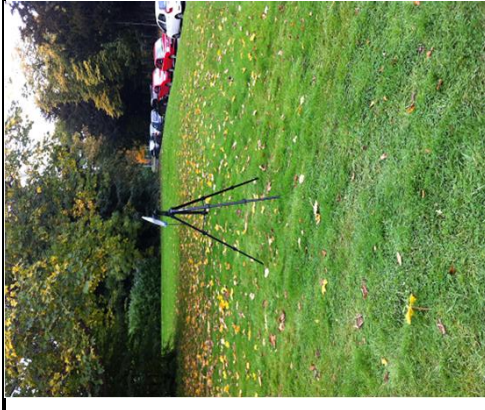
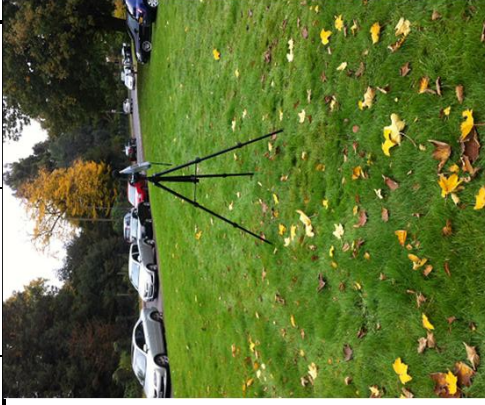


Noise Monitoring Form

**PARSONS
BRINCKERHOFF**

Project:	Reading University Library	Job Number:	3516669A_BML
Equipment:	NA-28	Engineer:	Adam Price & Angela Lorenzo
Pre-Calibration Level:	94.0	General Weather Description:	Dry and Overcast
Post-Calibration Level:	94.0	Location:	ML 2

Measurement Period		Weather			Statistical Noise Levels / dB				Description of Audible Noise	
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Wind Direction (from)	Temperature (°C)	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A10}	L _{A90}	
22/10/2015 12:17	15	0-1	S	8 -12	59.0	61.3	50.6	62.3	52.2	Road traffic noise, airplanes, buses
22/10/2015 18:22	15	0-1	S	8 -12	60.2	66.1	53.8	62.5	55.2	Road traffic noise, airplanes, buses
22/10/2015 19:33	15	0-1	S	8 -12	59.5	64.5	46.5	62.8	50.6	Road traffic noise, airplanes, buses, police siren
23/10/2015 01:27	15	0-1	S	8 -12	49.0	60.1	34.2	52.7	34.1	Source of noise in front of us from the Reading University
23/10/2015 03:14	15	0-1	S	8 -12	43.9	61.4	34.0	42.1	33.6	Source of noise in front of us from the Reading University

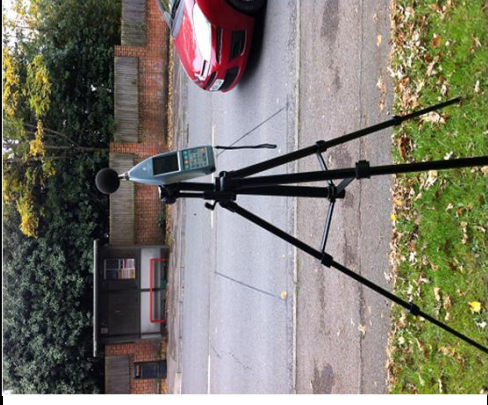


Noise Monitoring Form

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BRINCKERHOFF**

Project:	Reading University Library			Job Number:	3516669A_BML
Equipment:	NA-28			Engineer:	Adam Price & Angela Lorenzo
Pre-Calibration Level:	94.0			General Weather Description:	Dry and Overcast
Post-Calibration Level:	94.0			Location:	ML 3

Measurement Period		Weather			Statistical Noise Levels / dB				Description of Audible Noise	
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Wind Direction (from)	Temperature (°C)	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A10}	L _{A90}	
22/10/2015 12:47	15	2-3	S	8-12	68.2	62.7	59.0	71.5	58.9	Road Traffic noise, Heavy vehicles like vans
22/10/2015 18:47	15	1-2	S	8-12	68.1	73.0	57.7	71.6	58.9	Road traffic noise, heavy vehicles like buses and vans
22/10/2015 20:02	15	1-2	S	8-12	67.8	79.3	55.0	71.2	58.3	Road traffic noise, heavy vehicles like buses and vans
23/10/2015 01:50	15	1-2	S	8-12	57.5	72.5	34.0	60.5	34.6	Road traffic, airplane
23/10/2015 03:33	15	1-2	S	8-12	54.0	71.7	31.4	55.7	31.7	Road traffic, airplane, bird singing



APPENDIX A-4 **CALIBRATION CERTIFICATES**

Calibration Report

Certificate Number:-17766

Rion Type: NL52 Serial no: 01021288

Customer: Parsons Brinckerhoff
Address: Queen Victoria House,
Redland Hill, Bristol. BS6 6US.
Contact Person: Adam Price - Graduate Acoustic Engineer
Order No: PB83700

Instrument software version: v1.5

Microphone :	Rion	Type: UC59	Serial no: 04344	Sens:-27.33dB
Preamplifier	Rion	Type: NH25	Serial no: 21330	
Calibrator:	Rion	Type: NC-74	Serial no: 35125825	Level:93.80dB
Wind screen	Rion	Type: WS10		

Mains adapter was included

Interface cable was included

This sound level meter has been calibrated as specified in BS 7580. PART 1: 1997. The results are traceable to NPL, UK.
Measurement Results:

Indication at the calibration check frequency - BS7580 Clause 5.4	Passed
Noise test - BS 7580 Clause 5.5.2	Passed
Level Linearity Test - BS 7580, Clause 5.5.3	Passed
Frequency weightings: A Network - BS 7580 Clause 5.5.4	Passed
Frequency weightings: C Network - BS 7580 Clause 5.5.4	Passed
Frequency weightings: Z Network - BS 7580 Clause 5.5.4	Passed
Time weightings F and S - BS7580 Clause 5.5.5	Passed
Peak response - BS7580 Clause 5.5.6	Passed
RMS accuracy - BS7580 Clause 5.5.7	Passed
Integrating Test : Time averaging - BS7580 Clause 5.5.9	Passed
Integrating Test : Pulse range - BS7580 Clause 5.5.10	Passed
Integrating Test : Sound exposure level - BS 7580 Clause 5.5.11	Passed
Overload SPL Test - BS 7580 Clause 5.5.12	Passed
Overload Leq Test - BS 7580 Clause 5.5.12	Passed
Acoustic tests - BS 7580 Clause 5.4 and 5.6	Passed
Summation of acoustic tests - BS 7580 Clause 5.5.4	Passed

Comment:

Correct level with associated calibrator is 93.9dB(A).

Measurement procedure: TP02

Environmental conditions:

Pressure:	Temperature:	Relative humidity:
98.44 kPa	22.3 °C	44.2 %RH

Date of calibration: 15/01/2015

Date of issue: 15/01/2015

Supervisor: Darren Batten Tech IOA
Engineer


Palanivel Marappan B.Eng (Hons), M.Sc

Software version: 6.1



Campbell Associates
www.campbell-associates.co.uk

APPENDIX A-5 **PLANT SPECIFICATIONS**



VRF KXZ heat pump outdoor unit

Product Code: **FDC400KXZE1**

The KXZ heat pump 2-pipe systems offer high performance VRF for applications that require either cooling only or heating only, ideal for open plan areas.

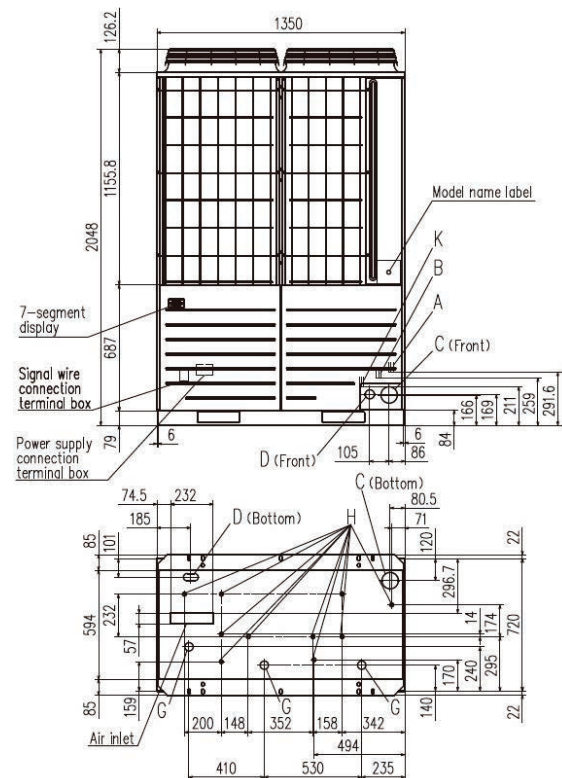
- Connect multiple indoor units.
- wide operating range, down to -15°C in cooling
- High efficiency with high COP's and EER's
- KX6 employs DC inverter compressors only.
- Long pipe lengths, up to 1000m and a maximum pipe run of 160m.
- Blue Fin coating on outdoor unit coil

unit details

MODEL NUMBER		FDC400KXZE1
CONNECTION KIT		NA
capacity code - horse power		400 - 14
nominal cooling	kW	40.0
nominal heating	kW	45.0
maximum number of indoor units		34
min - max connected cap. code		200 - 520
EER - COP		tbc
SEER (office profile)		tbc
SCOP (office profile)		tbc
number of modules		1
size of modules		14HP
height	mm	2048
width*	mm	1350
depth	mm	720
weight	kg	317
sound pressure level	dB(A)	60.0
airflow rate	l/s	4667
max external static pressure**	Pa	50
gas pipe size	in	1 1/8"
liquid pipe size	in	1/2"
discharge pipe size	in	na
R410A refrigerant base charge	kg	11.5
power supply	V-Ph-Hz	400 - 3 - 50
suggested fuse size	A	tbc
power input cool - heat	kW	10.96 - 10.69
running current cool - heat	A	17.5 - 17.5
starting current	A	tbc

* assumes a 20mm gap between modules, where applicable

** conditions apply, see technical manual for details



for product information visit www.ampair.co.uk



VRF KXZ heat pump outdoor unit

Product Code: **FDC450KXZE1**

The KXZ heat pump 2-pipe systems offer high performance VRF for applications that require either cooling only or heating only, ideal for open plan areas.

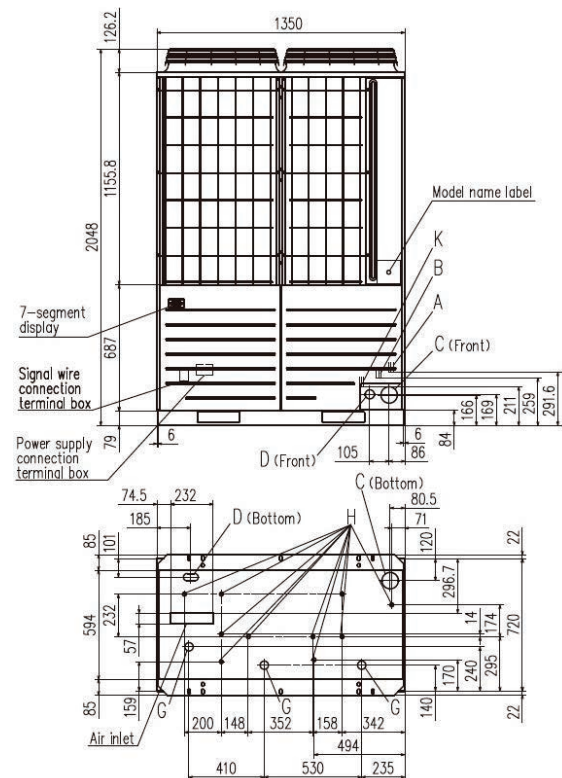
- Connect multiple indoor units.
- wide operating range, down to -15°C in cooling
- High efficiency with high COP's and EER's
- KX6 employs DC inverter compressors only.
- Long pipe lengths, up to 1000m and a maximum pipe run of 160m.
- Blue Fin coating on outdoor unit coil

unit details

MODEL NUMBER		FDC450KXZE1
CONNECTION KIT		NA
capacity code - horse power		450 - 16
nominal cooling	kW	45.0
nominal heating	kW	50.0
maximum number of indoor units		39
min - max connected cap. code		225 - 585
EER - COP		tbc
SEER (office profile)		tbc
SCOP (office profile)		tbc
number of modules		1
size of modules		16HP
height	mm	2048
width*	mm	1350
depth	mm	720
weight	kg	317
sound pressure level	dB(A)	61.0
airflow rate	l/s	4667
max external static pressure**	Pa	50
gas pipe size	in	1 1/8"
liquid pipe size	in	1/2"
discharge pipe size	in	na
R410A refrigerant base charge	kg	11.5
power supply	V-Ph-Hz	400 - 3 - 50
suggested fuse size	A	tbc
power input cool - heat	kW	13.98 - 12.50
running current cool - heat	A	22.4 - 20.4
starting current	A	tbc

* assumes a 20mm gap between modules, where applicable

** conditions apply, see technical manual for details



for product information visit www.ampair.co.uk

PAC standard inverter outdoor unit (FDC**VNP)

Product Code: **FDC100VNP**

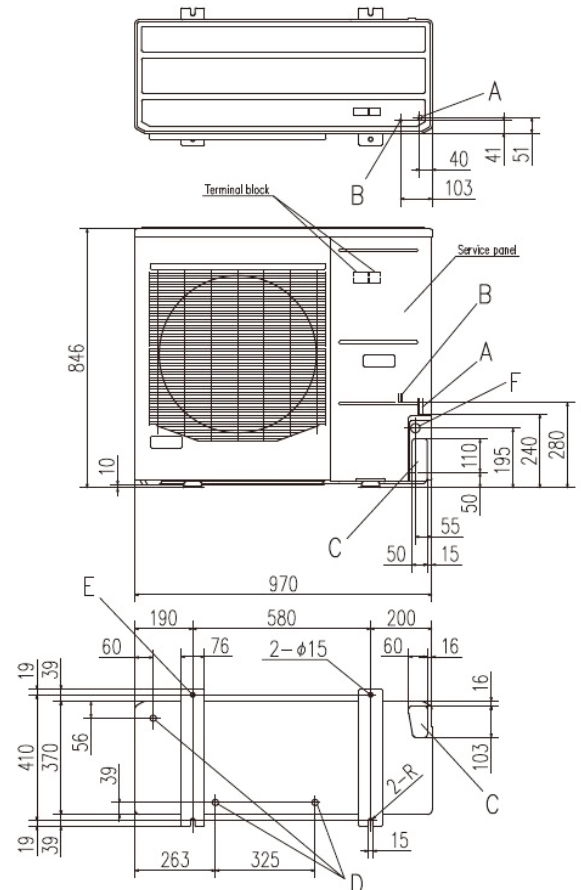


unit details

MODEL NUMBER	FDC100VNP	
nominal cooling*	kW	10.0
nominal heating*	kW	11.2
height	mm	845
width	mm	970
depth	mm	370
weight	kg	70
operating range - cooling		46°C to -15°C
operating range - heating		20°C to -15°C
sound pressure level - cooling	dB(A)	57
sound pressure level - heating	dB(A)	61
pipe connection size - gas	in	5/8"
pipe connection size - liquid	in	3/8"
max pipe run**	m	30
max height difference**	m	20
refrigerant		R410A
precharged for**	m	15
factory charge	kg	2.55
additional charge**	g/m	20
suitable for replacement tech.		yes
power supply	V-Ph-Hz	230 - 1 - 50
suggested fuse size**	A	25
interconnecting cables		3 core + E

* exact cooling and heating capacities will depending on connected indoor unit(s)

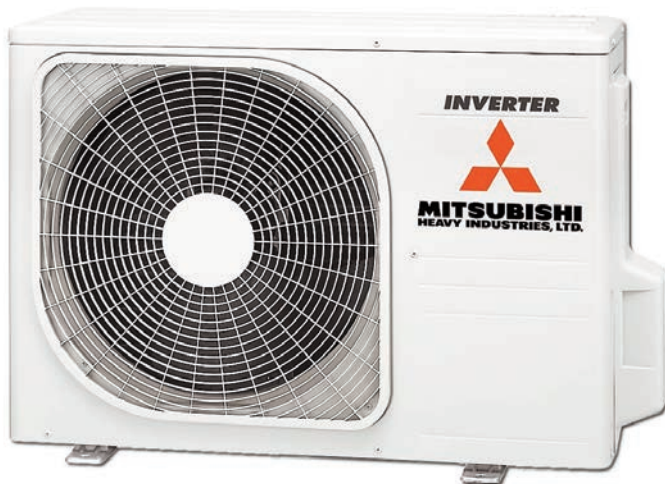
** data correct for one to one systems, details may change for twin, triple and quad configurations, please contact amp for confirmation



for further information visit www.ampair.co.uk

RAC standard inverter outdoor unit (SRC**ZMP-S)

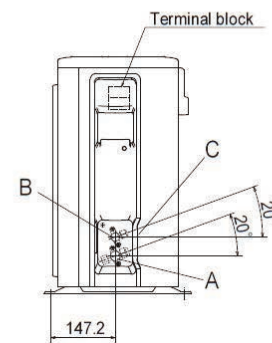
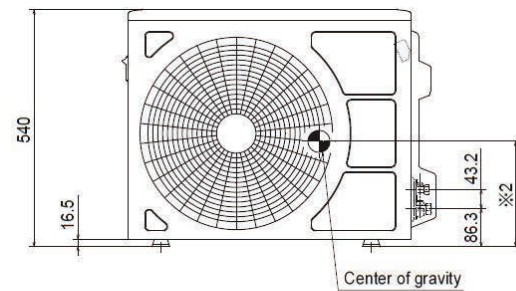
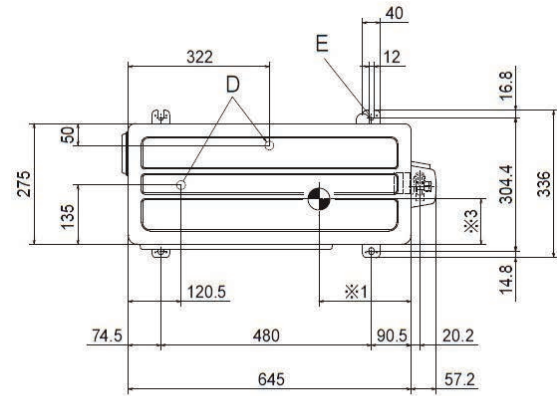
Product Code: **SRC35ZMP-S**



unit details

MODEL NUMBER		SRC35ZMP-S
nominal cooling*	kW	3.2
nominal heating*	kW	3.6
height	mm	540
width	mm	645 (+57)
depth	mm	275
weight	kg	27
operating range - cooling		46°C to -15°C
operating range - heating		24°C to -15°C
sound pressure level - cooling	dB(A)	49
sound pressure level - heating	dB(A)	48
pipe connection size - gas	in	3/8"
pipe connection size - liquid	in	1/4"
max pipe run	m	15
max height difference	m	10
refrigerant		R410A
precharged for	m	15
factory charge	kg	0.81
additional charge	g/m	na
suitable for replacement tech.		yes
power supply	V-Ph-Hz	230 - 1 - 50
suggested fuse size	A	13
interconnecting cables		3 core + E

* exact cooling and heating capacities will depending on connected indoor unit(s)



for further information visit www.ampair.co.uk