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ACOUSTICS PLUS

Proposed Installation of Mechanical Plant

12-14 Maresfield Gardens, London, NW3

Environmental Noise Assessment

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Project Address:	12-14 Maresfield Gardens London NW3 5SU
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Author:		**Phil Huffer**	**Principal Consultant**	**26/02/2020**
Reviewer:		**Andy Dodd**	**Senior Consultant**	**26/02/2020**

1. INTRODUCTION

1.1 Acoustics Plus Ltd (APL) is an independent firm of multi-disciplinary acoustic engineers. APL is engaged by both private and public sector clients. APL is a registered member of The Association of Noise Consultants (ANC) and the author is a corporate member of The Institute of Acoustics (IOA).

1.2 APL has been instructed by Rhodium Residence Management to consider and advise upon the noise implications of the proposed installation of mechanical plant to service a pair of semi-detached residential dwellings.

1.3 It is understood the Local Planning Authority (LPA) require further information on noise levels from the proposed installation in order to fully assess the noise impact upon the surrounding neighbourhood. This report provides the response to the LPA, on behalf of the Applicant.

1.4 This report has been prepared by Acoustics Plus Limited (APL) with all reasonable skill, care, and diligence in accordance with generally accepted acoustic consultancy principles and taking account the services and terms agreed between APL and our client.

1.5 Any information provided by third-parties and referred to herein may not have been checked or verified by APL unless expressly stated otherwise. Certain statements made in the report are predictions based on reasonable assumptions and good industry practice.

1.6 Such statements involve risk and uncertainty which could cause measured and predicted results to differ materially. APL does therefore not guarantee or warrant any prediction contained in this report.

2. BASELINE SITUATION

2.1 The Application Site (the "site") is situated at 12-14 Maresfield Gardens, London, NW3. The site is a pair of semi-detached Victorian houses on the east side of Maresfield Gardens. The properties are four storeys arranged over lower ground, ground, first and second floors. Both properties were used for teaching and clinical purposes, the intention is to apply for planning consent to revert their use back to C3.

2.2 As part of the refurbishment of the site it is the intention to remove existing external condenser units and install a new mechanical climate control system to provide comfort cooling to the habitable rooms in each dwelling. This will require the installation of 2no. external condenser units (1no. for each property). It is understood that both dwellings will feature a wine store which will also require the installation of an external condensing unit (1no. for each property).

2.3 Both condenser units for each new dwelling will be located in bespoke acoustic enclosures which will be fully specified during the detailed design phase of the project.

2.4 The proposed layout of the lower ground floor of the site is shown in Diagram 1 below, with the new items of mechanical plant highlighted. These positions are indicative and are subject to detailed design following planning consent.

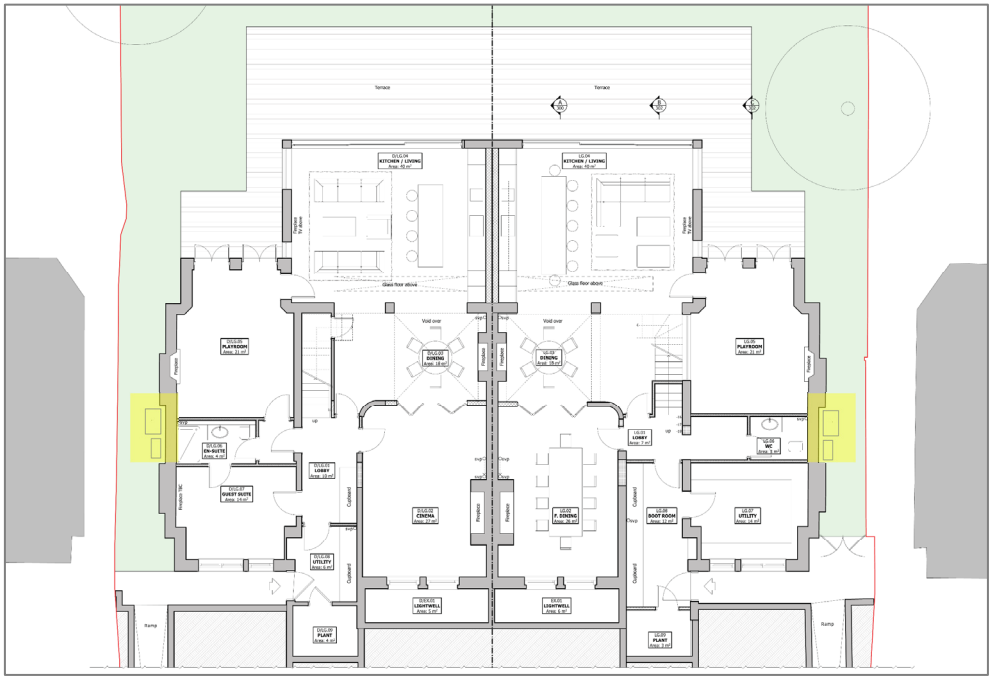

Diagram 1

2.5 The nearest noise sensitive façades to the proposed location of the external mechanical plant are the adjacent properties. The side access and its proximity to the plant can be seen in Figures 1 to 16. There are no windows to habitable rooms on the side elevation of the adjacent properties so no habitable rooms will have direct line of sight with the proposed location of plant.

3. NOISE OUTLINE

3.1 In order to produce an environmental noise assessment, consideration must be given to the prevailing background noise in the locality of the installation.

3.2 Measurements of background noise were obtained over a 24 hour period at a location deemed representative of background noise levels experienced at the nearest noise sensitive façades. Given the proposed installation of plant is nearer the rear of the site, measurements of background noise were obtained at the rear of the site at ground floor level, where the noise climate was considered to be lower than the front of the site.

3.3 The particulars of the measurement exercise are recorded below. The weather conditions were considered appropriate to monitor environmental noise.

Date: 28th – 29th January 2020
Start Time: 12:45 hrs
Location: garden level rear of site

3.4 Given the plant could operate at any time over a 24 hour period, minimum background and average noise levels during this time period are shown in Table 1 below. The level vs time history is shown in Diagram 2 (L_{Aeq} and L_{A90}).

Time period	Background noise measurements	
	Lowest $L_{A90,15min}$	Average $L_{Aeq,T}$
Day 07:00-23:00hrs	40dB	50dB
Night 23:00-07:00hrs	34dB	41dB

Table 1

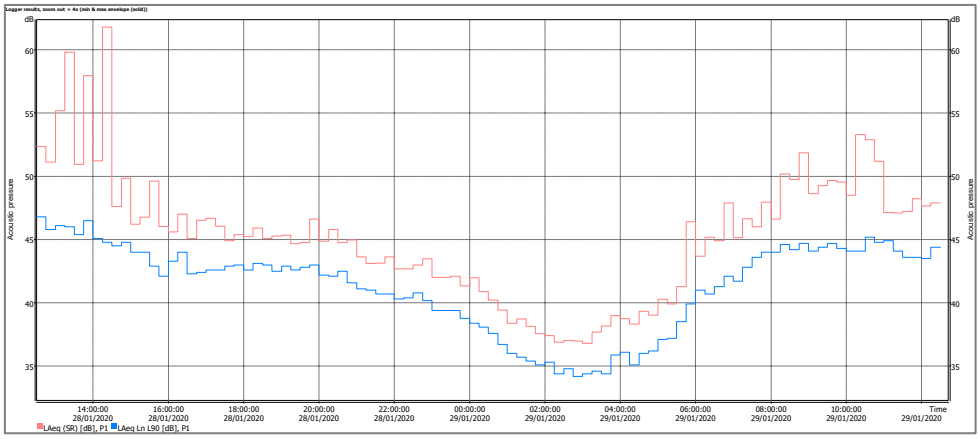

Diagram 2

4. DESIGN CRITERIA

4.1 Information regarding the noise levels not to be exceeded by the proposed installation was extracted from the LPA (London Borough of Camden) Camden Amenity CPG (adopted March 2018) and the referenced Local Plan Appendix 3 Noise thresholds.

Industrial and Commercial Noise Sources

A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing noise sensitive receptor	Assessment Location	Design Period	LOAEL (green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dB L_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dB L_{Amax}

*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

4.2 Since the Camden Local Plan was issued, BS4142:2014 has been revised with additional explanatory information. BS 4142:2014+A1:2019 primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific' sound from the proposed development) at residential NSRs (noise sensitive receptors).

4.3 The specific sound level may then be corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and it is then termed the rating level, whether or not a rating level penalty is added.

4.4 The 'residual' sound is defined as the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

4.5 The specific sound levels should be determined separately in terms of the LAeq,T index over a period of T = 1-hour during the daytime and T = 15-minutes during the night-time. For the purposes of the Standard, daytime is typically between 07:00 and 23:00 hours and night-time is typically between 23:00 and 07:00 hours.

4.6 BS 4142:2014 requires that the background sound levels adopted for the assessment be representative for the period being assessed. The Standard recommends that the background sound level should be derived from continuous measurements of normally not less than 15-minute intervals, which can be contiguous or disaggregated. However, the Standard states that there is no 'single' background sound level that can be derived from these measurements.

4.7 BS 4142:2014+A1:2019 states that measurement locations should be outdoors, where the microphone is at least 3.5 m from any reflecting surfaces other than the ground and, unless there is a specific reason to use an alternative height, at a height of between 1.2 m and 1.5 m above ground level. However, where it is necessary to make measurements above ground floor level, the measurement position, height and distance from reflecting surfaces should be reported, and ideally measurements should be made at a position 1 m from the façade of the relevant floor if it is not practical to make the measurements at least 3.5 m from the façade.

4.8 The background noise levels were assessed using statistical analysis of the measured data, as directed in BS4142. The histograms can be seen in Diagram 3 and 4 and show the statistical analysis of the background noise level that would occur during the operational hours of the units (at any time).

4.9 With regards to the rating correction, paragraph 9.2 of BS 4142:2014+A1:2019 states:

"Consider the subjective prominence of the character of the specific sound at the noise sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention"

4.10 The commentary to paragraph 9.2 of BS 4142:2014+A1:2019 suggests the following subjective methods for the determination of the rating penalty for tonal, impulsive and/or intermittent specific sounds:

Tonality

4.11 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 converted to a rating penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

4.12 If the subjective method is not sufficient for assessing the audibility of tones in sound or the prominence of impulsive sounds, BS4142:2014 suggests using the one-third octave method and/or the reference methods, as appropriate.

4.13 The ⅓ octave method tests for the presence of a prominent, discrete-frequency spectral component (tone) and typically compares the LZeq,T sound pressure level averaged over the time when the tone is present in a ⅓ octave band with the time-average linear sound pressure levels in the adjacent ⅓ octave bands. For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the ⅓ octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent ⅓ octave bands by some constant level difference. The level differences between adjacent ⅓ octave bands that identify a tone are:

- *15 dB in the low-frequency one-third-octave bands (25Hz to 125Hz);*
- *8 dB in the middle-frequency one-third-octave bands (160Hz to 400Hz); and*
- *5 dB in the high-frequency one-third-octave bands (500Hz to 10,000Hz).*

Impulsivity

4.14 A correction of up to +9 dB 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 converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

Intermittency

4.15 When the specific sound has identifiable on/off conditions, the specific sound level should be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Other Sound Characteristics

4.16 Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

4.17 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level of the specific sound. In the context of the Standard, adverse impacts include, but are not limited to, annoyance and sleep disturbance. Typically, the greater this difference, the greater is the magnitude of the impact:

- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- *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*.

4.18 The background noise levels vary during the day and night period when the mechanical plant would be operational. The most commonly occurring background noise level during the daytime was 42dB $L_{A90,15min}$ (relevant to noise impact upon garden amenity and adjacent living room façade at upper ground level).

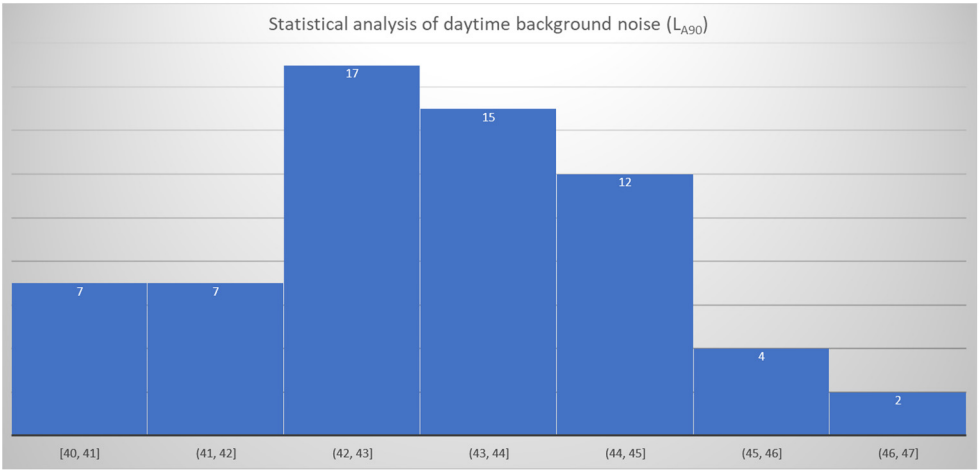

Diagram 3

4.19 The most commonly occurring background noise level during the night-time was 34dB $L_{A90,15min}$ (relevant to noise impact upon adjacent bedroom façade at first floor level).

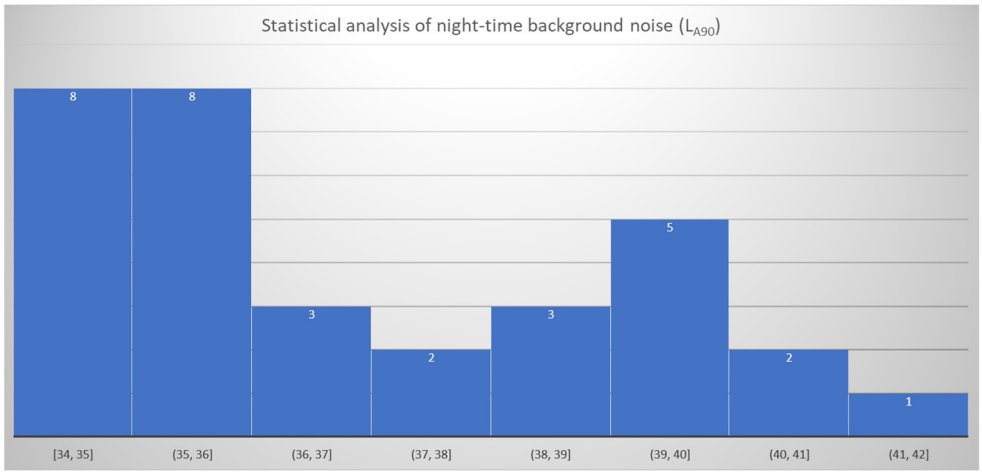

Diagram 4

4.20 The plant noise emission criteria that should not be exceeded is therefore based on Diagram 3 and 4 and is shown in Table 2 below. This level should not be exceeded at the nearest noise sensitive façade and is indicative of being 10dB less than the considered measured background noise. At such a level, there is an indication that the specific sound source will have a low impact.

Noise emission rating limit for mechanical plant	
Daytime L_{Aeq} ≤32dB	Night time L_{Aeq} ≤24dB

Table 2

4.21 The proposed equipment list is itemised below. Technical data sheets are contained in Appendix A.

(a) Wine store condenser unit – Panasonic U-36PZH2ES

(b) Comfort cooling condenser unit – Panasonic U-10LE1E8

5. EQUIPMENT

5.1 All background noise measurements were obtained using the following equipment:

- Svantek Svan 971 Class 1 Serial No. 51704
- Rion Calibrator Type NC-74 Class 1 Serial No. 00410215

5.2 The relevant equipment carries full and current traceable calibration. The equipment, where necessary, was calibrated prior to and after the measurements were carried out.

6. CALCULATIONS

6.1 A prediction exercise was undertaken. The calculation exercise utilised information provided by equipment manufacturers. The manufacturers data sheets are contained within Appendix A. The following noise impacts were considered:

(a) Noise impact of condenser units during day period

(b) Noise impact of condenser units during night period

6.2 In order to predict the noise impact of the operation of the condensers, consideration has been given to noise egress to the nearest noise sensitive façade. In considering the propagation of noise from the condensers, consideration was given to point source propagation.

6.3 Noise leaving the condenser units during the day was propagated over 7m to the nearest noise sensitive façade (dining room) at upper ground floor level. Noise leaving the condenser units during the night-time was propagated over 10m to the nearest noise sensitive façade at first floor level (bedroom).

6.4 The following corrections were accounted for to determine a rating level:

Results	Correction	Relevant clause	Commentary
On time correction	-3dB	7.3.14	The condenser is likely to switch on and off as required on a demand for cooling basis. The condenser is assumed to be operating for half the assessment period
Acoustic feature corrections	+2dB +3dB	9.2 9.2	Just perceptible tonality Readily distinctive intermittency

Table 3

6.5 A further correction to account for building edge diffraction of -5dB was assumed. This was extracted from the Department of Energy and Climate Change Planning Standard MCS020. This was due to the location of the condenser units within the side alleyway.

6.6 The planning standard MCS020 states the following (Note 5):

"Note 5: Barriers between the heat pump and the assessment position (STEP 5)
A correction should be made for attenuation due to barriers between the air source heat pump and an assessment position. A correction will be necessary if an installer is unable to see an assessment position from the top edge of the air source heat pump. Use the following instructions to determine whether a correction is appropriate:

- *For a solid barrier (e.g. a brick wall or a fence) that completely obscures an installer's vision of an assessment position from the top edge of the air source heat pump attenuation of -10 dB may be assumed.*
- *Where a solid barrier completely obscures an installer's vision of an assessment position from the top or side edges of the air source heat pump, but moving a maximum distance of 25 cm in any direction to the air source heat pump allows an assessment position to be seen, attenuation of -5 dB may be assumed.*
- *If it is possible for an installer to see any part of an assessment position from the top or side edges of the air source heat pump no attenuation may be assumed. "*

6.7 Following discussion with a manufacturer of acoustic enclosures, it has been assumed that attenuation values as detailed could be achieved. The smaller condenser associated with the wine store has a significantly lower noise output and therefore this unit will require minimal noise control. Up to 10dB attenuation has been assumed based on using an acoustic shroud. The larger unit associated with comfort cooling has a much higher noise output and therefore is beyond the scope of a standard acoustic louvre enclosure. This would need a bespoke type panelwork enclosure. Up to 20dB attenuation has been assumed for this enclosure which would nominally be 2400mm (w) x 1500mm (d) x 1700mm (h). This would need to be combined with using the condenser in a setback mode (silent 1) which should be acceptable given the much reduced cooling demand during night time operation.

6.8 The calculation exercise for daytime use is shown in Table 4.

Calculation steps (daytime noise impact)	**L_p dBA**
1no. Panasonic U-36PZH2ES (-10dB acoustic enclosure)	33 (43-10)
1no. Panasonic U-10LE1E8 (-20dB acoustic enclosure)	43 (63-20)
Distance attenuation (7m)	-17
Reflective plane correction (x2)	+6
Building edge correction (no line of sight)	-5
BS4142 acoustic feature corrections	+2 [-3+2+3]
Rated noise level at nearest noise sensitive façade	**30** dBA

Table 4

6.9 The calculation exercise for night time use is shown in Table 5.

Calculation steps (night-time noise impact)	**L_p dBA**
1no. Panasonic U-36PZH2ES (-10dB acoustic enclosure)	33 (43-10)
1no. Panasonic U-10LE1E8 (-20dB acoustic enclosure)	40 (60-20)
Distance attenuation (10m)	-20
Reflective plane correction (x2)	+6
Building edge correction (no line of sight)	-5
BS4142 acoustic feature corrections	+2 [-3+2+3]
Rated noise level at nearest noise sensitive façade	**24** dBA

Table 5

6.10 In order to comply with the requirements of the LPA, any noise from the proposed installation of mechanical plant should not exceed a level of 32 dBA at 1m from the nearest noise sensitive façade (during the day time period) and 24dBA (during the night time period).

6.11 The calculation exercise (Tables 4 and 5) demonstrate that the proposed installation meets the LPA criteria.

7. CONCLUSION & MITIGATION MEASURES

7.1 The foregoing assessment indicates that the proposed installation will meet the requirements imposed by the LPA. Further mitigation measures, other than those identified, will not be required. The mitigation measures that must be implemented are as follows:

- *Acoustic shroud over the condenser associated with the wine store to provide minimum attenuation of 10dB.*
- *Acoustic enclosure around condenser associated with comfort cooling to provide minimum attenuation of 20dB.*
- *Condenser associated with comfort cooling to be used in Silent 1 mode during the night time period.*

7.2 If an alternative supplier or manufacturer of condenser is chosen, the acoustic performance should be checked prior to installation to ensure that the installation will still meet the requirements imposed by the LPA.

7.3 It is also recommended that the condensing units are positioned on vibration isolation mounts to minimise structural borne vibration and re-radiated noise into the adjacent building. Rubber turret mounts are suitable for this kind of application, available from the following, as shown in Diagram 5 below.

	Christie & Grey Limited Morley Road, Tonbridge, Kent, TN9 1RA, United Kingdom T: +44 (0)1732 371100 F: +44 (0)1732 359666 E: sales@christiegrey.com OR Mason UK Ltd Unit 6 Abbey Business Park Monks Walk Farnham Surrey GU9 8HT Tel: (01252) 716610 Fax: (01252) 716630 info@masonuk.co.uk

Diagram 5

Figures

12-14 Maresfield Gardens, London, NW3


Figure 1


Figure 2


Figure 3


Figure 4


Figure 5


Figure 6


Figure 7


Figure 8

12-14 Maresfield Gardens, London, NW3


Figure 9


Figure 10


Figure 11


Figure 12


Figure 13


Figure 14


Figure 15


Figure 16

Appendix A

1. Outdoor Unit

1-1. Specifications

Unit specifications

Outdoor Unit		MODEL		U-8LE1E8			U-10LE1E8		
Performance test condition				EN14511			EN14511		
Power supply		ø,Hz		3ø, 380/400/415V,50Hz			3ø, 380/400/415V,50Hz		
		V		380	400	415	380	400	415
COOLING	Capacity	kW		22.4	22.4	22.4	28.0	28.0	28.0
		BTU/h		76500	76500	76500	95600	95600	95600
	Current	A		9.60	9.15	8.80	14.7	14.0	13.5
	Input power	W		5.89k	5.89k	5.89k	9.00k	9.00k	9.00k
	EER	(W/W)		3.80	3.80	3.80	3.11	3.11	3.11
	Power factor	%		93	93	93	93	93	93
	Noise outdoor	dB-A (Normal)		60.0			63.0		
		Power Level dB (Normal)		81.0			84.0		
		dB-A (Silent 1)		57.0			60.0		
		dB-A (Silent 2)		55.0			58.0		
		dB-A (Silent 3)		53.0			56.0		
HEATING	Capacity	kW		25.0	25.0	25.0	28.0	28.0	28.0
		BTU/h		85300	85300	85300	95600	95600	95600
	Current	A		10.2	9.65	9.30	11.6	11.1	10.7
	Input power	W		6.22k	6.22k	6.22k	7.13k	7.13k	7.13k
	COP	(W / W)		4.02	4.02	4.02	3.93	3.93	3.93
	Power factor	%		93	93	93	93	93	93
Max Current (A) / Max Input power (W)				13.7 / 9.16k	13.7 / 9.16k	13.7 / 9.16k	19.6 / 13.1k	19.6 / 13.1k	19.6 / 13.1k
Starting current (A)				1	1	1	1	1	1
Time Delay fuse max size (A)				25			30		
Fan motor output		W / Pole number		120 / 8			120 / 8		
External static pressure		Pa		0 ~ 35			0 ~ 35		
Air flow		m^3/ min		150			160		
Refrigerant type / amount g				R410A / 6.3k			R410A / 6.6k		
Product dimension		Height	mm	1500			1500		
		Width	mm	980			980		
		Depth	mm	370			370		
Packing dimension		Height	mm	1642			1642		
		Width	mm	1095			1095		
		Depth	mm	529			529		
Weight		(NET) kg		132			133		
		(GROSS) kg		144			145		
Layers limit				2			2		
Operation condition (Outdoor)		Cool (DBT)		-10°C ~ 46°C			-10°C ~ 46°C		
		Heat (WBT)		-20°C ~ 18°C			-20°C ~ 18°C		
MAX. WORKING PRESSURE		High side bar (MPa)		38.0 (3.80)			38.0 (3.80)		
		Low side bar (MPa)		27.0 (2.70)			27.0 (2.70)		
PIPING	Pipe diameter mm (inch) (Under 90m for ultimate Indoor unit.)			(Liquid) 9.52(3/8) (Gas) 19.05(3/4)			(Liquid) 9.52(3/8) (Gas) 22.22(7/8)		
	Pipe diameter mm (inch) *1 (Over 90m for ultimate Indoor unit.)			(Liquid) 12.7(1/2) (Gas) 22.22(7/8)			(Liquid) 12.7(1/2) (Gas) 25.4(1)		
	Connecting method			flared(Liquid) , flared(Gas)			flared(Liquid) , brazing(Gas)		
	Max tubing length m			7.5	~	150	7.5	~	150
	Total Max tubing length m			7.5	~	300	7.5	~	300
	Indoor unit & Outdoor unit height difference (Outdoor unit upper / Outdoor unit Lower) m			50 / 40			50 / 40		
Max connectable indoor units pcs.				15 *2			15 *2		
Max allowable indoor/outdoor capacity ratio %				50 ~ 130			50 ~ 130		

*1: If the longest tubing equivalent length exceeds 90m, increase the sizes of the main tubes by 1 rank for gas tubes and liquid tubes.
*2: If the heating utilized , it is necessary to increase 1 size with respect to the main liquid pipe, depending on the combination of the indoor unit.
Max total refrigerant amount of 1 outdoor unit is 24kg.

Single Phase Condensing Units

Outdoor Unit Technical Data							
Model	**U-36PZH2E5**	**U-50PZH2E5**	**U-60PZH2E5**	**U-71PZH2E5**	**U-100PZH2E5**	**U-125PZH2E5**	**U-140PZH2E5**
Combinations	Single	Single	Single	Twin	Twin/Triple	Twin/Triple/Quad	Twin/Triple
Height (mm)	695			996	1416		
Width (mm)	875			940	940		
Depth (mm)	320			340	340		
Weight (kG)	43	43	44	68	99		
Airflow (m3/min) Cool/Heat	40/40	40/45	40/45	61/60	118/108	125/112	129/116
Sound Pressure Cooling (dBA)	43	45	46	48	52	53	54
Liquid (mm(inches))	6.35 (1/4)		9.52 (3/8)				
Gas (mm(inches))	12.7 (1/2)		15.88 (5/8)				
Max Pipe Run (m)	40			50	85		
Max Pipe Lift (m)	30 (15 if condenser is lower than IU)						
Pre-charged to (m)	30						
Standing Charge (kG)	1.15	1.15	1.45	1.95	3.05		
Refrigerant	R32						
Add Charge p/metre (g)	20	20	35	45	45	45	45
Phase	Single						
Power Supply to	IU (5A) and OU or OU with feed to IU						
Max Current (A)	11	12	16.4	17.5	24	27	28
Run Current (A)	3.2	5.25	6.95	7.9	9.95	14.5	18
Fuse Rating (A)	20	20	25	25	30	35	35
Interconnecting	2C Screen 0.75mm²						
Twin Pipe Kit	CZ-P224BK2BM						
Triple Pipe Kit	No Combination				CZ-P3HPC2BM		