SANDY BROWN

Consultants in Acoustics, Noise & Vibration

17303-R01-B

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19-21 Great Queen Street

Plant noise assessment

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Version	Date	Comments	Author	Reviewer
A	17 Jul 17		Richard King	Richard Muir
B	18 Jul 17		Ben Southgate	Richard King

Summary

Sandy Brown has been commissioned to conduct a plant noise assessment in support of a planning application for the change of use of the basement and ground floor at 19-21 Great Queen Street, London.

The proposals are made for a change of use from Class A1 (shops) to Class A3 (restaurants and cafes). The upper floors of the building are currently being converted to residential use (4 units).

Residential properties also occur in the adjacent buildings at 18 and 22 Great Queen Street, and to the rear on 34 Parker Street, although this is screened from the plant area at 19-21 Great Queen Street.

Condensers are due to be installed in a ground floor light-well adjacent to No. 18.

There will be three fans which provide ventilation supply, toilet extract and kitchen extract to the restaurant. These will all be located internally, but ducted to the roof.

A noise survey was previously undertaken in 2015 by Ion Acoustics Ltd. This set out measurements of existing background noise and also set plant noise limits. However, since this report was produced, the London Borough of Camden have adopted new noise limits in its local plan, which are 5 dB more onerous than in 2015. Therefore, the more onerous limits will apply.

A plant noise limit of $L_{Ar,T}$ 40 dB will apply to all residential receptors.

To achieve the required plant noise limit, one of the following mitigation options should be applied:

- Apply a night time set-back to the PURY-P300-YJM-A unit achieving at least 3dB reduction
- Apply an absorbent facing to the long wall of the light-well opposite the condensers to a height of 2 m.

Atmospheric attenuators as specified in this report are required to achieve 40 dBA at the nearest noise sensitive receptors.

Provided the mitigation measures proposed are implemented, then the proposals should achieve compliance with the requirements of the London Borough of Camden and will not cause significant harm to the amenities od the nearest residential occupiers.

Contents

1 Introduction

Sandy Brown has been commissioned to conduct a plant noise assessment in support of a planning application for the change of use of the basement and ground floor at 19-21 Great Queen Street, London.

The proposals are made for a change of use from Class A1 (shops) to Class A3 (restaurants and cafes). The upper floors of the building are currently being converted to residential use (4 units).

Residential properties also occur in the adjacent buildings at 18 and 22 Great Queen Street, and to the rear on 34 Parker Street, although this is screened from the plant area at 19-21 Great Queen Street.

4 condensers are due to be installed in a ground floor light-well adjacent to No. 18. There will be three fans which provide ventilation supply, toilet extract and kitchen extract to the restaurant. These will all be located internally, but ducted to the roof.

There is a residential apartment above the pub at No. 18, but this is screened by a full height wall surrounding a rooftop terraced area. As such, the new apartment on the first floor of No. 19-21 is the nearest noise sensitive receptor.

The nearest residential premises with line of sight to the duct terminations is approximately 20 m away at 34 Parker Street. The fifth floor residential apartment at No. 19-21 will be the closest receptor, but will be completely screened.

A glossary of terms can be found in Appendix A.

2 Local plan

In its latest local plan (dated June 2017) the London Borough of Camden states:

> *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 (15 dB if tonal components are present) should be considered as the design criterion).*

Based on this, the plant noise criterion level (L_{Aeq}) is recommended to be 10 dB below the measured existing background noise level (L_{A90}) without plant items operating. It should be noted that this criterion is 5 dB more onerous than the previous guidance provided by Camden, which required noise from plant items to be 5 dB below the existing background noise level.

3 Previous noise survey report

A noise survey was previously undertaken by Ion Acoustics Ltd, reference 'Acoustics Report A838/R01' dated 18 October 2015. This set out the measurements of existing background noise and set plant noise limits. However, since this report was produced, Camden Council have adopted new noise limits in its local plan, which are 5 dB more onerous than in 2015 (discussed in Section 2). Therefore, the more onerous limits will apply to the proposals.

Table 2 of the report detailed the lowest background noise levels measured. This is shown below in Figure 1.

Table 2: Lowest background noise level measured at logging positions

Location	Day (L_{A90}) 07.00 – 20.00	Evening (L_{A90}) 20.00 -- 23.00	Night (L_{A90}) 23.00 – 07.00
P1 (Rear Extension Rooftop)	52 dB	51 dB	50 dB

Figure 1 Table 2 from Ion Acoustics report

It is possible that the proposed restaurant may decide to apply for an extended license at some point, and the night time background noise would be used to determine the plant noise limit.

On this basis, a plant noise limit of $L_{Ar,T}$ 40 dB will apply to all residential receptors.

As the plant selected consists of condenser units and fans, the plant noise data indicates that there is no significant tonal or intermittent element, and so no penalty is to be applied. Therefore, the plant noise limit is L_{Aeq} 40 dB.

4 Plant noise assessment

4.1 Condensers

Proposed condensers will be located in a light-well at ground floor as shown in Figure 2.

Figure 2 Plan showing condenser location

There will be one PURY-P300-YJM-A and three PUHZ-ZRP60VHA units. Manufacturer's unit specifications for both models are provided in Appendix D.

A section showing the light well and the residential unit above can be seen in Figure 3.

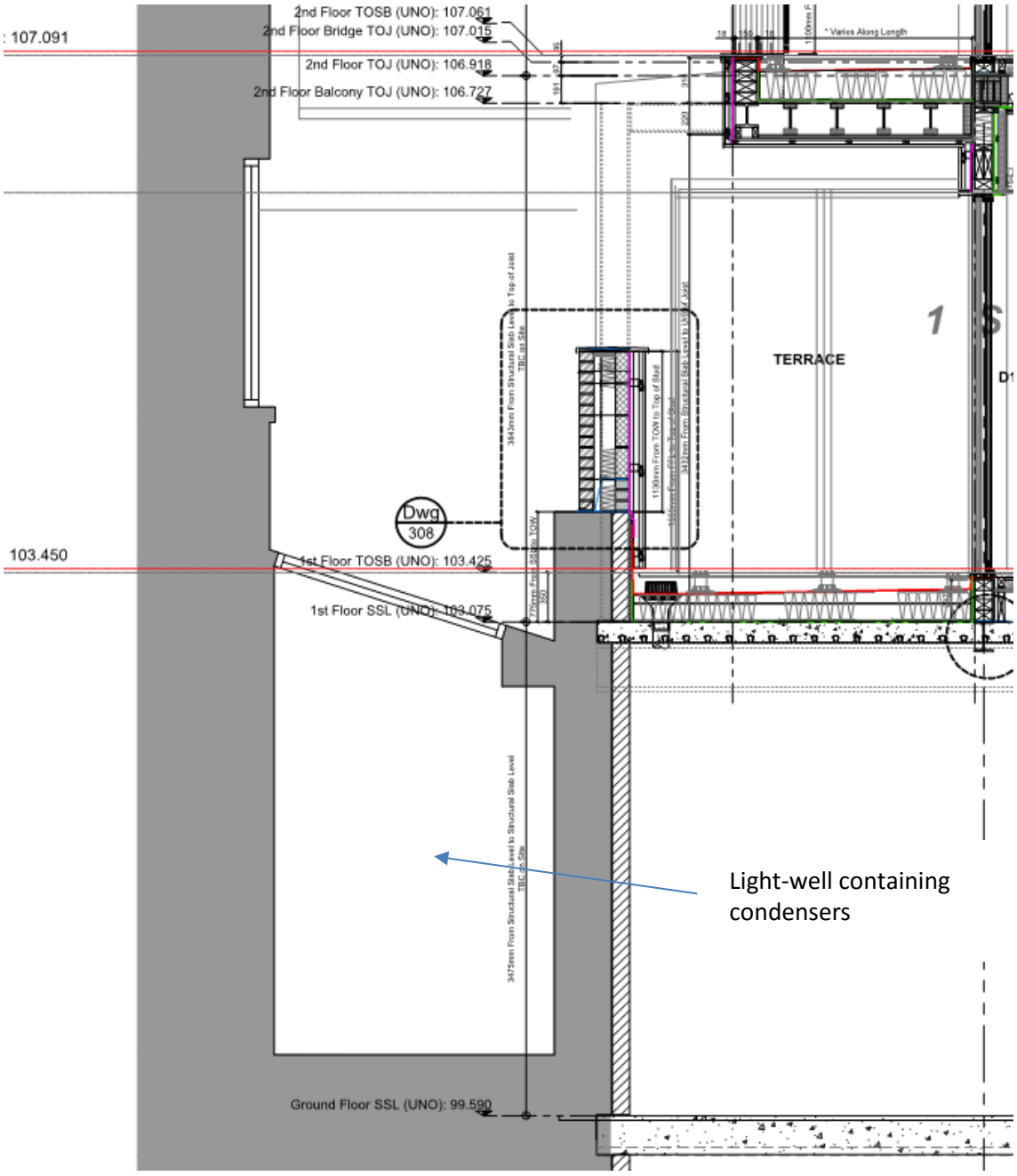

Figure 3 Section showing light-well and receptor

The nearest noise sensitive receptor is the first floor residential unit at 19-21 Great Queen Street. The predicted noise level with all the units running at full duty is 41 dBA. This is in excess of the plant noise limit of 40 dBA.

Therefore to achieve the required plant noise limit, one of the following mitigation options should be applied:

- Apply a night time set-back to the PURY-P300-YJM-A unit achieving at least 3dB reduction
- Apply an absorbent facing to the long wall of the light-well opposite the condensers to a height of 2 m

The absorbent panel should consists of 75 mm mineral wool behind perforated steel or 'expamet', with minimum 30% open area. A glass fibre tissue face will be required between the mineral wool and perforated steel to contain the fibres and prevent fibre migration. The mineral wool should be non-hygroscopic and suitable drainage allowed.

Implementing either option should reduce the noise levels to achieve the 24 hour plant noise limit. The noise data for the units can be seen in Appendix B, and the calculation in Appendix C.

4.2 Fans

The fans will require room-side attenuators to achieve the required project internal noise requirements. If these are not yet set out, the following noise limits are recommended:

- Kitchen area NR 40
- Restaurant NR 35
- Toilets NR 45

These do not relate to planning requirements although in the overall system design to accommodate atmospheric requirements the contractor for conversion of the unit, will need to consider room-side attenuation.

Atmospheric attenuation is required to comply with the planning noise limits. The minimum insertion losses together with guide dimensions are shown in Table 1.

Table 1 Minimum attenuator insertion loss, dB

Description	Nominal dimensions (mm)			Minimum insertion loss (dB) at octave band centre frequency (Hz)							
	W	H	L	63	125	250	500	1k	2k	4k	8k
Kitchen exhaust	625	700	1500	6	8	15	32	44	27	16	12
Toilet exhaust	350	450	1200	7	13	23	43	46	33	23	18
Supply inlet	600	675	1200	5	7	13	29	39	24	15	11

Provided these insertion losses are achieved, the plant noise limit of 40 dBA can be achieved at the nearest noise sensitive receptor.

The in-duct sound power levels of the proposed fans can be found in Table 2 in Appendix B.

5 Conclusions

A plant noise assessment has been undertaken in relation to the 4 condensers and 3 fans for the proposed restaurant at ground floor and basement level of 19-21 Great Queen Street.

Noise limits are taken from the previous noise survey from 2015, but with the new requirements of the London Borough of Camden Local Plan.

Provided the mitigation measures proposed are implemented, then the proposals can achieve compliance with the requirements of the London Borough of Camden. It is recommended that these mitigation measures are required by planning conditions to the planning permission of the change of use of the unit.

Appendix A

Glossary of terms

Sound levels

Sound or noise levels are commonly measured in terms of the sound pressure level in decibels (dB). The sound pressure level is often 'A-weighted' to simulate the human ear's response to sounds at different frequencies (pitch). Examples of A-weighted sound pressure levels from typical noise sources are shown in diagram given in Figure A1

dB	Decibel - A logarithmic scale applied to acoustic units such as sound pressure and sound power. Sound Pressure in Pa becomes dB Sound Pressure Level. Sound Power in watts becomes dB Sound Power Level.
L_{PA}	The "A" weighted sound pressure level. The ear is less sensitive to noise at low and very high frequencies than at mid-frequencies. To reflect this subjective response, the "A" weighting network was devised applying corrections to a noise, dependent on frequency, so the resultant "A" weighted sound pressure level is representative of the overall noise perceived by the human ear.
L_{A90}	This is the "A" weighted sound pressure level exceeded 90% of the period over which a noise is measured. It is used to represent the "background noise level".
L_{Aeq}	Equivalent "A" Weighted sound pressure level of a steady noise that has the same acoustic energy as a fluctuating noise over the measurement period. It can be considered the average noise level, and is an internationally accepted parameter for assessing annoyance caused by noise from most sources.
L_{A10}	The "A" weighted sound pressure level exceeded 10 % of the period over which a noise is measured. It is the accepted noise index for describing traffic noise.
L_{Amax}	The maximum rms "A" weighted sound pressure level measured in the period.

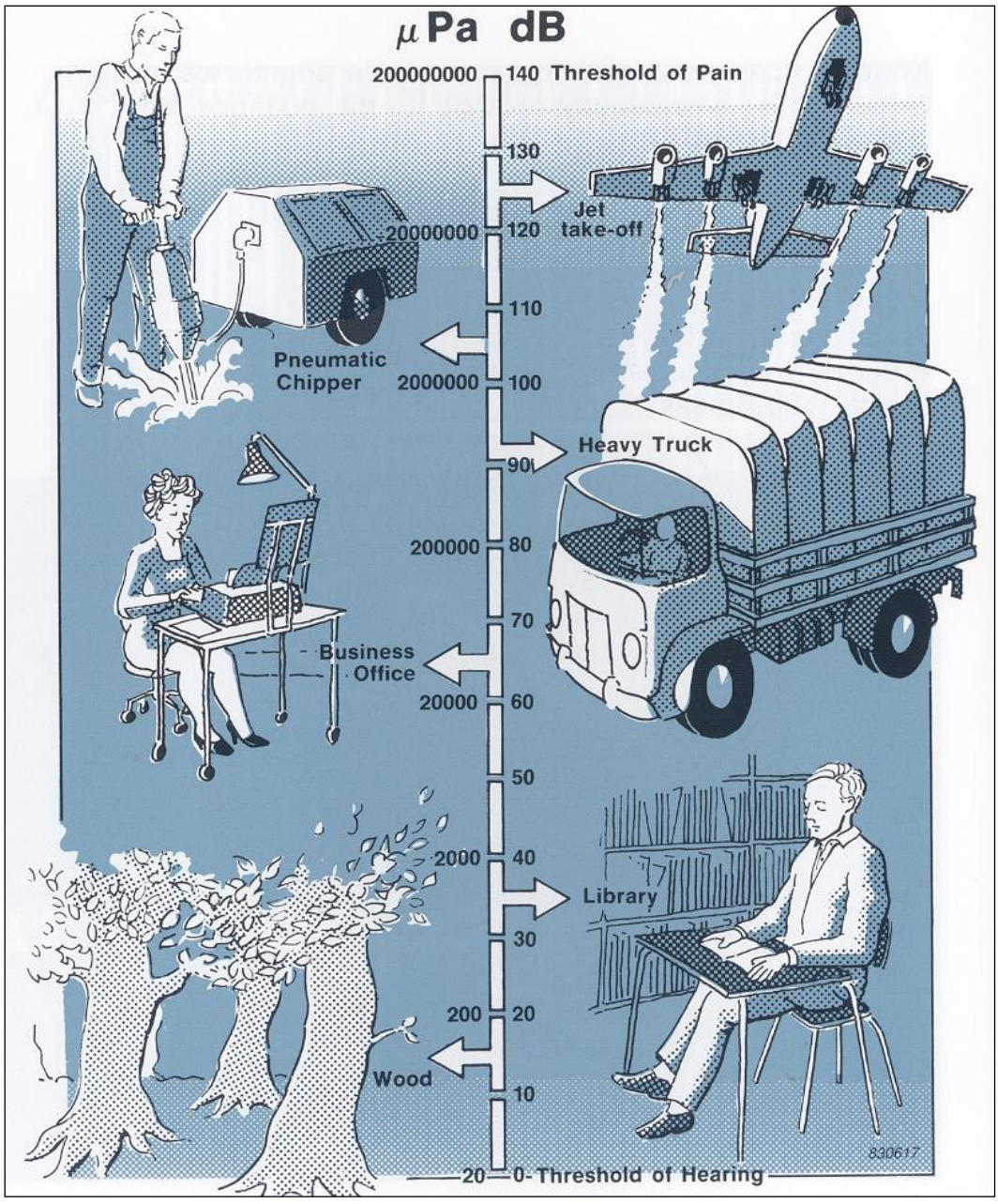

Figure A1 Weighted sound pressure levels from typical noise sources

Sound absorption

Sound absorption is a term used to describe the amount of sound absorbed by a finish or object within a room. It is inversely analogous to light reflectance of a material, i.e. a finish with a low sound absorption reflects sound like an 'acoustic mirror'. Fabric upholstered seating would provide a high level of sound absorption while a masonry wall finished with ceramic tiles would provide a low amount of sound absorption

Sound absorptive finishes are required to control reverberation times (RTs) within rooms.

α_w The Weighted Absorption Coefficient – The value used to characterise how much sound is absorbed by a material in a room. It varies from α_w = 0.0 (for minimal absorption) to α_w = 1.0 (for very effective absorption). Sound absorbent treatments are divided into Absorption Classes A (α_w < 0.90, or 90% absorptive), B (α_w < 0.80), C (α_w < 0.60), and D (α_w < 0.30).

Reverberation time

Reverberation is a term used to describe the time it takes for sound to decay within a space. Large rooms with hard finishes, such as cathedrals, typically have long reverberation time. Living rooms with carpets and fabric-upholstered furniture typically have short reverberation times.

If the reverberation time in a room is too long it can adversely affect speech intelligibility.

The mid-frequency reverberation time T_{mf} used in this report is the arithmetic average of the reverberation time in the 500 Hz, 1 kHz, and 2 kHz frequency octave bands.

T_{mf} Mid-frequency Reverberation Time in seconds – The target decay time for sound in a room when measured at 500, 1000, and 2000 Hz arithmetically averaged. It is based on the absorption characteristics of the room finishes.
The maximum T_{mf} is used as the reference reverberation time when determining $D_{nT(T_{mf,max}),w}$ and $L'_{nT(T_{mf,max}),w}$ above.

Sound insulation

Sound insulation is a general term to describe the reduction of sound transfer between separate spaces or through a building element (eg a door). It is inversely analogous to light translucency of a material, ie low sound insulation is analogous to high translucency.

Airborne sound insulation is used to describe the reduction of sound from people speaking, road traffic, music etc. Impact sound insulation is used to describe the reduction of structure-borne sound caused by impacts on a structure, such as from footfalls on a floor.

Common measures of airborne sound insulation are:

- Weighted Sound Reduction Index, R_w (or R_w+C_{tr}) which is used to describe the sound insulation provided by a building element in a certified laboratory and published. Construction proposed to be verified (by laboratory test report or calculation report).
- Weighted Standardised Sound Level Difference, $D_{nT,w}$ which is used to describe the sound insulation provided between two rooms.
- Weighted Standardised Impact Sound Pressure Level, $L'_{nT,w}$ which is used to describe the maximum noise level allowed in a room, whilst operating a laboratory calibrated tapping machine on the floor of the room directly above.
- Weighted Element Normalised Sound Level Difference, $D_{n,e,w}$ which is used to describe the sound insulation provided by small building elements.

Sound insulation is measured in decibels (dB).

Appendix B

Plant noise data

Table 2 Plant in-duct sound power levels, dB re $1x10^{-12}$ W and condenser sound pressure levels, dB re $2x10^{-5}$ Pa

	Octave band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Kitchen extract								
Inlet	84	94	84	81	78	71	68	65
Outlet	80	97	90	85	83	73	71	67
Breakout	64	76	73	68	66	58	48	43
Toilet extract								
Inlet	81	88	83	72	69	68	61	64
Outlet	90	90	94	84	77	72	64	58
Breakout	66	69	69	63	56	50	40	33
Supply								
Inlet	92	97	92	86	83	78	72	66
Outlet	89	96	91	90	86	81	75	70
Breakout	58	72	80	75	72	65	56	49
Sound pressure level @ 1m								
PURY-P300-YJM-A	65	64	61	56	53	49	45	43
PUHZ-ZRP60VHA	57	55	50	44	43	39	32	27

Appendix C

Calculations

Comments	Octave band centre frequency (Hz)								Rating 1	
	63	125	250	500	1k	2k	4k	8k		
Sound pressure level @ 1m										
PURY-P300-YJM-A	65.0	63.5	61.0	56.0	53.0	48.5	45.0	42.5		
PUHZ-ZRP60VHA	56.5	55.0	50.0	44.0	43.0	39.0	32.0	27.0		
PUHZ-ZRP60VHA	56.5	55.0	50.0	44.0	43.0	39.0	32.0	27.0		
PUHZ-ZRP60VHA	56.5	55.0	50.0	44.0	43.0	39.0	32.0	27.0		
Total Lp @ 1m	66.5	65.0	61.9	56.8	54.1	49.8	45.6	42.9		
Nearest residential premises is above										
Distance 3.5m	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9		
Lightwell rev correction	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0		
Screening from top of light well	-6.3	-7.4	-9.0	-11.3	-14.1	-17.0	-20.0	-23.0		
delta = 0.217m										
Additional loss from 3.5 to 8.2m	-7.4	-7.4	-7.4	-7.4	-7.4	-7.4	-7.4	-7.4		
Facade correction for 45° incider	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		
Resultant Lp	53.0	50.4	45.6	38.2	32.8	25.5	18.3	12.5	L_A=	41.4
Design criteria										40.0
With light well lining on one face										
Distance 3.5m	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9		
Lightwell rev correction	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Screening from top of light well	-6.3	-7.4	-9.0	-11.3	-14.1	-17.0	-20.0	-23.0		
delta = 0.217m										
Additional loss from 3.5 to 8.2m	-7.4	-7.4	-7.4	-7.4	-7.4	-7.4	-7.4	-7.4		
Facade correction for 45° incider	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		
Resultant Lp	50.0	47.4	42.6	35.2	29.8	22.5	15.3	9.5	L_A=	38.4
Design criteria										40.0

Appendix D

Manufacturer's unit specification

OUTDOOR UNIT
R2 Series
PURY-P YJM-A(-BS)

▸Specifications

Model			PURY-P200YJM-A(-BS)	PURY-P250YJM-A(-BS)	PURY-P300YJM-A(-BS)
Power source			3-phase 4-wire 380-400-415V 50/60Hz	3-phase 4-wire 380-400-415V 50/60Hz	3-phase 4-wire 380-400-415V 50/60Hz
Cooling capacity *1		kW	22.4	28.0	33.5
(Nominal) *1		BTU / h	76,400	95,500	114,300
	Power input	kW	5.18	7.05	8.67
	Current input	A	8.7-8.3-8.0	11.9-11.3-10.8	14.6-13.9-13.4
	COP	kW / kW	4.32	3.97	3.86
Temp. range of	Indoor	W.B.	15.0~24.0°C(59~75°F)	15.0~24.0°C(59~75°F)	15.0~24.0°C(59~75°F)
cooling *3	Outdoor	D.B.	-5.0~46.0°C(23~115°F)	-5.0~46.0°C(23~115°F)	-5.0~46.0°C(23~115°F)
Heating capacity *2		kW	25.0	31.5	37.5
(Nominal) *2		BTU / h	85,300	107,500	128,000
	Power input	kW	5.69	7.32	8.78
	Current input	A	9.6-9.1-8.7	12.3-11.7-11.3	14.8-14.0-13.5
	COP	kW / kW	4.39	4.30	4.27
Temp. range of	Indoor	D.B.	15.0~27.0°C(59~81°F)	15.0~27.0°C(59~81°F)	15.0~27.0°C(59~81°F)
heating *3	Outdoor	W.B.	-20.0~15.5°C(-4~60°F)	-20.0~15.5°C(-4~60°F)	-20.0~15.5°C(-4~60°F)
Indoor unit	Total capacity		50~150 % of outdoor unit capacity	50~150 % of outdoor unit capacity	50~150 % of outdoor unit capacity
connectable	Model / Quantity		P15~P250 / 1~20	P15~P250 / 1~25	P15~P250 / 1~30
Sound pressure level (measured in anechoic room)		dB <A>	56	57	59
Power pressure level (measured in anechoic room)		dB <A>	76	77	79
Refrigerant piping	High pressure	mm (in.)	15.88(5/8) Brazed	19.05(3/4) Brazed	19.05(3/4) Brazed
diameter	Low pressure	mm (in.)	19.05(3/4) Brazed	22.2(7/8) Brazed	22.2(7/8) Brazed
FAN	Type x Quantity		Propeller fan x 1	Propeller fan x 1	Propeller fan x 1
	Air flow rate	m^3/min	185	185	185
		L/s	3,083	3,083	3,083
		cfm	6,532	6,532	6,532
	Driving mechanism		Inverter-control, Direct-driven by motor	Inverter-control, Direct-driven by motor	Inverter-control, Direct-driven by motor
	Motor output	kW	0.92 x 1	0.92 x 1	0.92 x 1
*4	External static press.		0 Pa (0 mmH_2O)	0 Pa (0 mmH_2O)	0 Pa (0 mmH_2O)
Compressor	Type x Quantity		Inverter scroll hermetic compressor	Inverter scroll hermetic compressor	Inverter scroll hermetic compressor
	Starting method		Inverter	Inverter	Inverter
	Motor output	kW	5.4	6.8	7.8
	Case heater	kW	0.035(240 V)	0.035(240 V)	0.045(240 V)
External finish			Pre-coated galvanized steel sheets (+powder coating for -BS type) <MUNSELL 5Y 8/1 or similar>	Pre-coated galvanized steel sheets (+powder coating for -BS type) <MUNSELL 5Y 8/1 or similar>	Pre-coated galvanized steel sheets (+powder coating for -BS type) <MUNSELL 5Y 8/1 or similar>
External dimension HxWxD		mm	1,710(1,650 without legs) x 920 x 760	1,710(1,650 without legs) x 920 x 760	1,710(1,650 without legs) x 920 x 760
		in.	67-3/8(65 without legs) x 36-1/4 x 29-15/16	67-3/8(65 without legs) x 36-1/4 x 29-15/1	67-3/8(65 without legs) x 36-1/4 x 29-15/16
Protection devices	High pressure protection		High pressure sensor, High pressure switch at 4.15MPa (601 psi)	High pressure sensor, High pressure switc at 4.15MPa (601 psi)	High pressure sensor, High pressure switch at 4.15MPa (601 psi)
	Inverter circuit (COMP./FAN)		Over-heat protection, Over-current protection	Over-heat protection, Over-current protectio	Over-heat protection, Over-current protection
	Compressor		Over-heat protection	Over-heat protection	Over-heat protection
	Fan motor		Thermal switch	Thermal switch	Thermal switch
Refrigerant	Type x original charge		R410A x 9.5kg (21lbs)	R410A x 9.5kg (21lbs)	R410A x 9.5kg (21lbs)
Net weight		kg (lbs)	240(530)	240(530)	245(541)
Heat exchanger			Salt-resistant cross fin & copper tube	Salt-resistant cross fin & copper tube	Salt-resistant cross fin & copper tube
Optional parts			Joint: CMY-Y102SS-G2,CMY-Y102LS-G2,CMY-R160-J1 BC controller: CMB-P104,105,106,108,1010,1013,1016V-G1 Main BC controller: CMB-P108,1010,1013,1016V-GA1 Sub BC controller: CMB-P104,106V-GB1,CMB-P1016V-HB1	Joint: CMY-Y102SS-G2,CMY-Y102LS-G2,CMY-R160-J1 BC controller: CMB-P104,105,106,108,1010,1013,1016V-G Main BC controller: CMB-P108,1010,1013,1016V-GA1 Sub BC controller: CMB-P104,106V-GB1,CMB-P1016V-HB	Joint: CMY-Y102SS-G2,CMY-Y102LS-G2,CMY-R160-J1 BC controller: CMB-P104,105,106,108,1010,1013,1016V-G1 Main BC controller: CMB-P108,1010,1013,1016V-GA1 Sub BC controller: CMB-P104,106V-GB1,CMB-P1016V-HB1

Notes:

*1,*2 Nominal conditions

	Indoor	Outdoor	Pipe length	Level difference
Cooling	27°C DB/19°C WB (81°F DB/66°F WB)	35°C DB(95°F DB)	7.5m (24-9/16ft.)	0m (0ft.)
Heating	20°C DB(68°F DB)	7°C DB/6°C WB(45°F DB/43°F WB)	7.5m (24-9/16ft.)	0m (0ft.)

*3 -5°C DB (23°F DB) / -6°C WB (21°F WB) to 21°C DB (70°F DB) / 15.5°C WB (60°F WB) with cooling/heating mixed operation.
*4 External static pressure option is available (30Pa, 60Pa / 3.1mmH_2O, 6.1mmH_2O).
*Nominal condition *1,*2 are subject to JIS B8615-1.
*Due to continuing improvement, above specification may be subject to change without notice.

Service Ref.				PUHZ-ZRP60VHA PUHZ-ZRP60VHAR1(-ER/-ET)		PUHZ-ZRP71VHA PUHZ-ZRP71VHAR1(-ER/-ET)	
Mode				Cooling	Heating	Cooling	Heating
OUTDOOR UNIT	Power supply (phase, cycle, voltage)			Single, 50Hz, 230V			
		Max. current	A	19			
	External finish			Munsell 3Y 7.8/1.1			
	Refrigerant control			Linear Expansion Valve			
	Compressor			Hermetic			
		Model		SNB130FGCM1		SNB172FSHM1	
		Motor output	kW	1.2		1.3	
		Starter type		Inverter			
		Protection devices		HP switch Comp.shell thermo Discharge thermo			
	Crankcase heater		W	—			
	Heat exchanger			Plate fin coil			
	Fan	Fan(drive) × No.		Propeller fan × 1			
		Fan motor output	kW	0.06			
		Airflow	m³/min (CFM)	55 (1,940)			
	Defrost method			Reverse cycle			
	Noise level		Cooling dB	47			
			Heating dB	48			
	Dimensions		W mm (in)	950 (37-3/8)			
			D mm (in)	330+30 (13+1-3/16)			
			H mm (in)	943 (37-1/8)			
	Weight		kg (lb)	67 (148)			
	Refrigerant			R410A			
		Charge	kg (lb)	3.5 (7.7)			
		Oil (Model)	L	0.65 (FV50S)		0.70 (FV50S)	
REFRIGERANT PIPING	Pipe size O.D.		Liquid mm (in)	9.52 (3/8)			
			Gas mm (in)	15.88 (5/8)			
	Connection method		Indoor side	Flared			
			Outdoor side	Flared			
	Between the indoor & outdoor unit		Height difference	Maximum 30m			
			Piping length	Maximum 50m			