

REPORT TITLE:

Fontwell, Arundel Rd, BN18 0SB - Filing Station: Environmental noise assessment

CLIENT DETAILS:

Allan B. Matthews R.I.B.A

DATE:

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REPORT REFERENCE:

PC-18-0262-RP1-RevB

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1. Introduction

Pace Consult has been commissioned to review the noise impact of proposed outdoor units in support of the planning application for a proposed development comprising:

- Replacement sales building.
- Canopy link removed.
- New bin store, delivery bay, front of store customer parking, replacement of condensers & 2 No new electric charging points.

The above are taking place in a Shell filling station located in Arundel Rd, BN18 0SB. The development is subject to the following conditions as mandated by the Arun District Council:

(3) All plant, machinery and equipment installed or operated in connection with the carrying out of this permission shall be so enclosed and/or attenuated so that the rating level of noise emitted does not exceed the background sound level, when measured according to British Standard BS4142: 2014 at any adjoining or nearby noise sensitive premises.

(4) Details, including acoustic specifications, of all fixed plant, machinery and equipment associated with air moving equipment [(including fans, ducting and external openings)], compressors, generators or plant or equipment of a like kind, installed within the site which has the potential to cause noise disturbance to any noise sensitive receivers, shall be submitted to and approved by the local planning authority before installation. The rating level of noise emitted from the use of this plant, machinery or equipment shall not exceed the background sound level when measured according to British Standard BS4142: 2014, at any adjoining or nearby noise sensitive premises.

The assessment has considered the most relevant guidelines and standards, including BS 4142:2014, *Methods for rating and assessing industrial and commercial sound*.

Equipment that is considered in this study consists of outdoor units; namely:

- 2 x PUHZ125 (by Mitsubishi)
- 3 x OP-MPL044VVLP01E (by Danfoss)
- 3 x CM08 Z.C4.MLZ-015 (by KARYER)
- 1 x MUZ-SF25VE (by Mitsubishi)

To the best of our knowledge there are no items apart from the above that are expected to produce noise and require our attention.

Weather during the measurements was noted to be:

- Temperature: 18/10 °C
- Humidity: 82%
- Wind: ~0 mph

2. Design Criteria

2.1 BS4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound

BS4142 has recently been revised and the 1997 edition has been replaced. The standard sets out a methodology for the assessment of whether noise from factories, industrial premises or fixed installations and sources of an industrial/commercial nature.

The procedure contained in BS4142 for assessing the likelihood of complaints is to compare the measured or predicted noise level from the source in question, the 'specific noise level', at the assessment position with the correct background noise level for the worst case time of operation.

Where the noise contains a 'distinguishable, discreet, continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks or clatters), or if the noise is irregular enough to attract attention' then a range of correction factors can be added to the specific noise level as appropriate to obtain the 'rating level'.

As this is a prescriptive report prior to equipment installation, overall rating noise levels will be specified for the new installation. Compliance with the rating value will be necessary to provide evidence that significant adverse impact has been avoided as required by the NPSE.

To assess the likelihood of complaints, the measured background noise level is subtracted from the rating noise level. BS4142 states:

The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessment and arriving at decisions, therefore, it is essential to place the sound in context.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (See Clause 8) from the rating level (see Clause 9) and consider the following.

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

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

- 1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

- 2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.*
- 3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as;*
 - i) Façade sound insulation treatment*
 - ii) Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
 - iii) Acoustic screening.*

In summary, the BS4142: 2014, 'Methods for rating and assessing industrial and commercial sound' would indicate that compliance with the wider aims of the NPSE is achieved when a rating level does not exceed the background sound level for the given time of operation.

2.2 Noise survey

Noise measurements were undertaken in free-field conditions between Wednesday 29th and Thursday 30th August 2018 at 2 different locations. The sound level meters were positioned at 1.5m above ground level (tripod mounted), and 3 metres from any reflective surface. The figure 2.1 includes the measurement locations.

The measurement locations are described below:

Measurement location P1. The sound level meter was located at the boundary of the filling station. The main noise levels affecting this position is road traffic from London Rd.

Measurement location P2. The sound level meter was located in front of a nearby property. The main noise levels affecting this position is road traffic from Arundel Rd.

Noise measurements were made with a calibrated precision grade sound level meters which achieves the requirements of BS EN 61672:2003. The survey was carried out in accordance with the principles of BS 7445:1997 Parts 1-3, 'Description and Measurement of Environmental Noise', British Standard BS4142: 2014: Methods for rating and assessing industrial and commercial sound.

The noise assessment locations were representative of the background noise levels at the nearest noise sensitive receptors which have the potential to be affected by the noise emission from the proposed equipment.

The table below includes the lowest background noise levels measured during the assessment period at the nearest noise sensitive receptors.

Table 2.1: Lowest measured L_{A90} , dB levels during survey.

P1	
Day 14:45 / 23:00	$L_{A90,1 \text{ hr min (dB)}} = 45$
Night 23:00 / 06:25	$L_{A90,15 \text{ min (dB)}} = 30$
P2	
Day 14:30 / 23:00	$L_{A90,1 \text{ hr min (dB)}} = 46$
Night 23:00 / 06:18	$L_{A90,15 \text{ min (dB)}} = 31$

2.3 Equipment

- Svantek precision grade sound level meters. Serial numbers: 34927 and 34937.
- Nor-1251 Calibrator. Serial number 32199.
- Environmental wind shield.

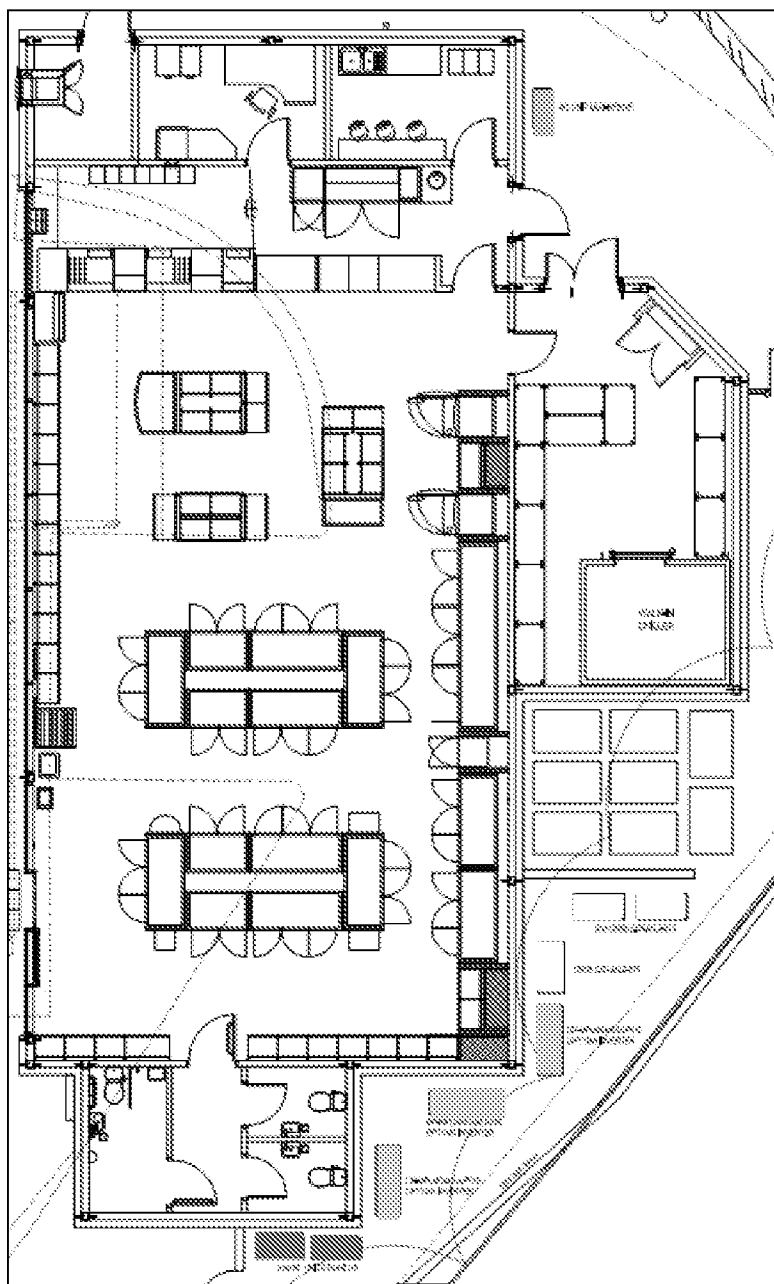
The sound level meters were calibrated before and after the survey. No significant drift was noted between the two reference checks.



Figure 2.1: Site map and measurement locations (excerpt from Google Maps).

Outdoor Units (ODUs) Noise Levels

Unit	Color (Figure 3.1)	No. of units	SPL (given by manufacturer/supplier)	Measured	Directivity	SWL
PUHZ125		2	58 dBA	1.0m of the unit	Q=2	66 dBA
OP-MPL044VVLP01E		3	-	-	-	76 dBA
CM08 Z.C4.MLZ-015		3	68.5 dBA	1.8m of the unit	Q=2	82 dBA
MUZ-SF25VE		1	50.0 dBA	1.0m of the unit	Q=2	58 dBA



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In order to assess the total noise to the nearest residential property a distance calculation was undertaken; this is shown below.

Table 3.2: Noise Level calculation at nearest receptors.

Unit	No. of units	SWL	SPL contribution at closest receiver (for Q=8, r=42m)	SPL at closest receiver without acoustic treatment
PUHZ125	2	66 dBA	32 dBA	53 dBA
OP-MPL044VVLP01E	3	76 dBA	42 dBA	
CM08 Z.C4.MLZ-015	3	82 dBA	48 dBA	
MUZ-SF25VE	1	58 dBA	24 dBA	

As seen in the above table, resulting sound pressure level is 53 dBA which is 13 dBA above the $L_{A90,15 \text{ min}}$ (dB) = 30 dBA limit.

4. Acoustic treatment – Noise barrier

Data of the units are given as single-number dBA. In order to proceed with the required calculations certain reasonable assumptions should be made in order to come up with a noise spectrum for the units:

Table 4.1: ODUs' sound power levels, in dB (assumed).

Unit	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	Total (dBA)
PUHZ125	70	69	66	63	62	57	51	43	66
OP-MPL044VVLP01E	61	61	67	73	71	70	63	52	76
CM08 Z.C4.MLZ-015	67	67	73	78	77	76	73	59	82
MUZ-SF25VE	43	43	49	55	53	52	45	34	58

It should be highlighted that around 4 dBA noise reduction due to dense vegetation has been accounted for in the calculations.

Based on the above sound power levels, sound pressure levels are calculated at 42m away according to the formula:

$$L_p = L_w - \left| 10 \cdot \log \left(\frac{Q}{4\pi \cdot r^2} \right) \right|$$

Table 4.2: ODUs' sound pressure levels, in dB (at r = 42m and assuming a conservative Q=8 directivity).

Unit	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	Total (dBA)
PUHZ125	36	35	32	29	28	23	17	9	32
OP-MPL044VVLP01E	27	27	33	39	37	36	29	18	41
CM08 Z.C4.MLZ-015	33	33	39	44	43	42	39	25	47
MUZ-SF25VE	9	9	15	21	19	18	11	0	23

Total noise from units 2xPUHZ125, 3xOP-MPL044VVL01E, 3xCM08 Z.C4.MLZ-015 which are facing the noise sensitive receptors is:

Table 4.3: ODU's sound pressure levels combined, in dB (at r = 42m and assuming a conservative Q=8 directivity).

Total SPL from units at 42m (dB)	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	Total (dBA)
	41	41	45	50	48	47	44	30	53

In order to mitigate the noise, a solution would be to introduce a 2.5m high barrier (with an areal density not less than 15-20kg/m²). The calculation has been conducted assuming that the barrier is installed 1-2m in front of the units and is given below:

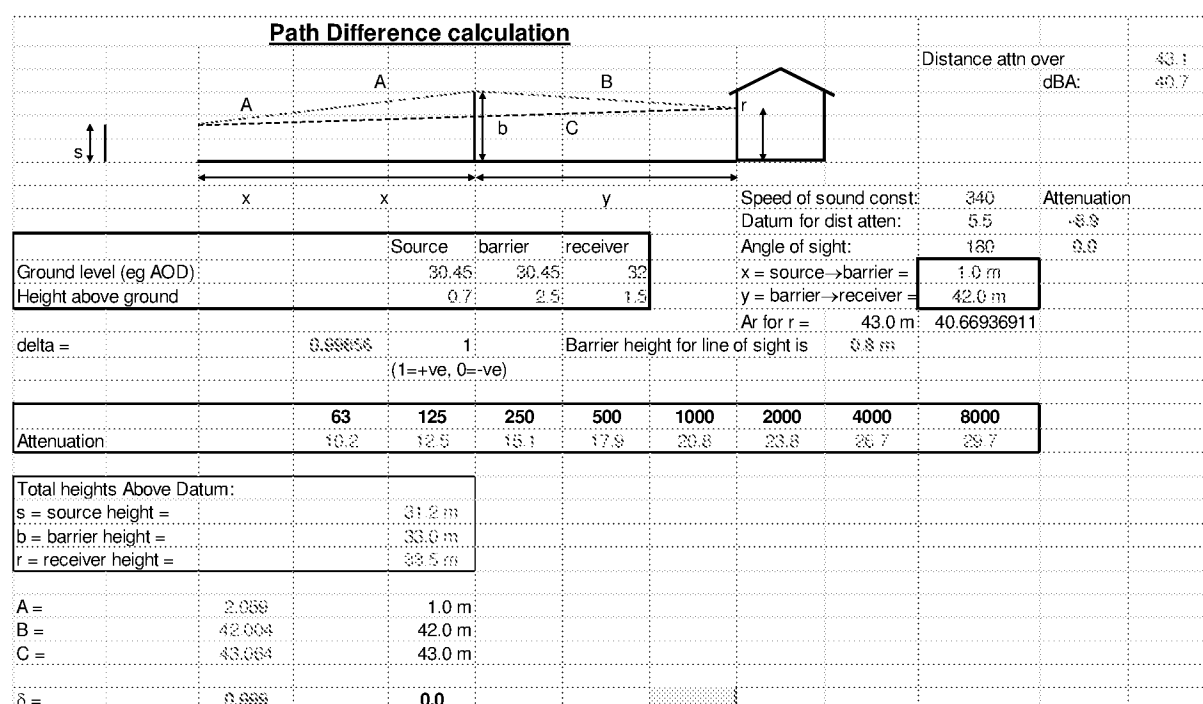


Figure 4.1: Barrier Calculation (excerpt from proprietary Pace Consult barrier calculation sheet)

Deducting the attenuation that the barrier provides we get:

Table 4.4: Calculation of noise levels with noise barrier.

Calculation	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	Total (dBA)
(1) Total SPL from units at 42m (dB)	41	41	45	50	48	47	44	30	53
(2) Barrier attenuation (dB)	10	12	15	18	21	24	27	30	-
(1)-(2) Total SPL with barrier	31	28	30	32	28	24	17	0	33

As seen from above, the noise barrier will reduce sound pressure levels of the units down to 33 dBA. Considering the dense vegetation, noise from the ODUs is expected to be reduced by additionally 4 dBA thus resulting to **29dBA**.

In case the operation of the ODUs - and subsequently the specific noise those introduce - is intermittent, as per BS4142 §9.2, a penalty of 3 dB is to be applied on top of the specific noise which would raise the noise rating around 2 dB above the background noise.

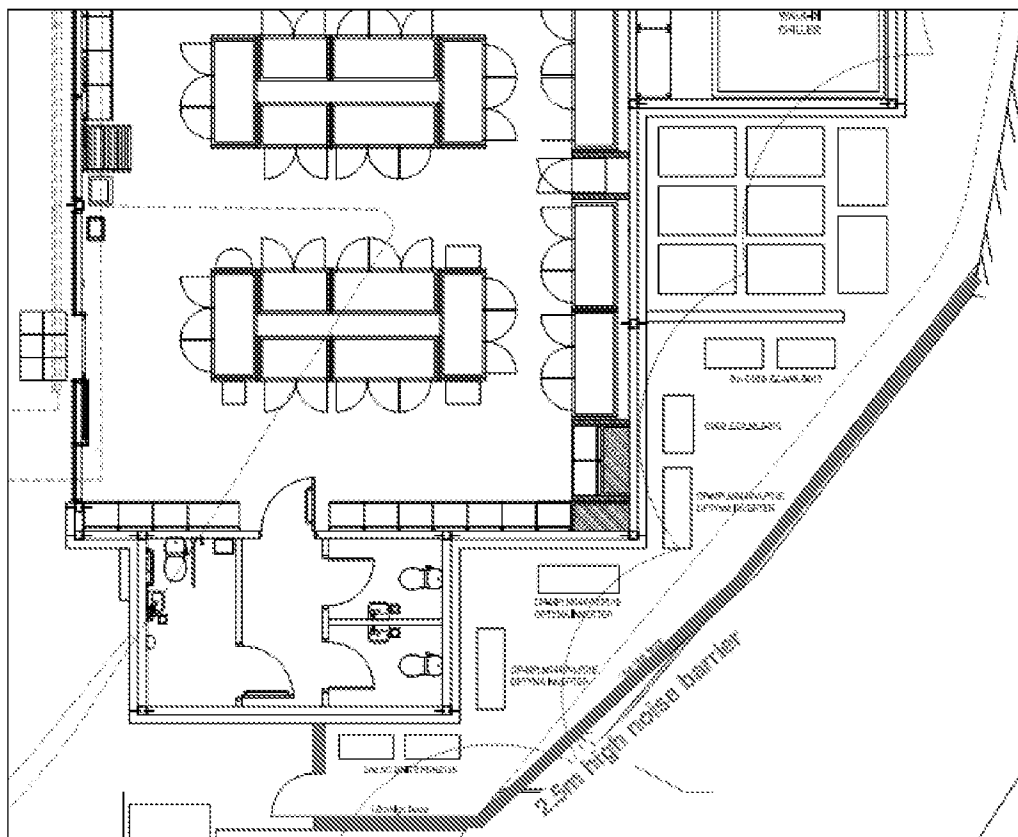


Figure 4.2: Noise barrier location.

5. Conclusion

The proposed outdoor units' noise levels have been assessed. Considering no acoustic treatment, the noise levels to the nearest receptor is expected to be more than 20 dBA above the environmental noise limit (measured as $L_{A90,15 \text{ min}} \text{ (dB)} = 30$). Thus, a 2.5m noise barrier (of 15-20kg/m² areal density) is proposed to be installed in front of the units. Resulting noise is calculated to not exceed the existing background noise with the introduction of the aforementioned noise barrier.

Appendix 1 – ANC Accreditation



Pace Consult Ltd

has been elected by the Company to
Full Membership
of the Association

Date of Election December 2009

Signature

(Company limited by guarantee registered in England No. 5298022)

This Certificate remains the property of the Association, returnable on demand

Appendix 2 – Noise data

OP-MPL044VVLP01E

Danfoss

Application Guidelines

Product description

Optyma™ Plus INVERTER, R404A

Model	Capacity (kW)	Capacity (kcal/h)	Capacity (Btu/h)	Capacity (ton)	Capacity range (kcal/h) at evaporator temperature 5 °C					Capacity (kW)	Capacity (kcal/h)	Capacity range (kcal/h) at condenser temperature 35 °C	
					27 °C	32 °C	37 °C	42 °C	47 °C			27 °C	32 °C
OP-MPL044VLP01E	11430100	16,2000	30	27	3546	1920	2340	2910	3390	75.0	60.3	993	1402
				32	3450	1800	2210	2700	3200				
				36	-	-	-	-	-				
				45	-	-	-	-	-				
			50	27	3860	2000	2400	2970	3460	75.9	60.9	1000	1400
				32	4510	2100	2500	3070	3560				
				36	4300	2000	2400	2900	3400				
				45	2110	2000	2370	2970	3470				
			75	27	4000	2000	2400	2970	3460	76.5	61.5	1007	1400
				32	4710	2100	2500	3070	3560				
				36	4500	2000	2400	2900	3400				
				45	3470	2000	2370	2970	3470				
			100	27	5000	2000	2400	2970	3460	76.7	61.7	1004	1400
				32	4800	2100	2500	3070	3560				
				36	4900	2000	2400	2900	3400				
				45	4000	2000	2370	2970	3470				
OP-MPL044VLP01E	11430200	16,2000	30	27	3340	1850	2260	2830	3310	73.1	58.1	1147	1548
				32	3810	1750	2160	2630	3110				
				36	-	-	-	-	-				
				45	-	-	-	-	-				
			50	27	3800	1900	2310	2880	3360	73.6	58.6	1160	1548
				32	4400	2000	2410	2980	3460				
				36	4070	1900	2300	2870	3350				
				45	2640	1900	2260	2830	3310				
			75	27	4000	1900	2300	2870	3350	74.4	59.4	1179	1548
				32	4600	2000	2400	2970	3450				
				36	4200	1900	2300	2870	3350				
				45	3010	1900	2260	2830	3310				
			100	27	4400	2000	2400	2970	3450	75.4	60.4	1167	1548
				32	5000	2100	2500	3070	3550				
				36	4900	1900	2300	2870	3350				
				45	4000	1900	2260	2830	3310				
OP-MPL044VLP01E	11430300	16,2000	30	27	3400	1800	2210	2780	3260	73.1	58.1	1203	1600
				32	3800	1700	2110	2680	3160				
				36	-	-	-	-	-				
				45	-	-	-	-	-				
			50	27	4070	1900	2300	2870	3350	73.6	58.6	1218	1607
				32	4600	2000	2400	2970	3450				
				36	3600	1800	2210	2780	3260				
				45	3300	1800	2210	2780	3260				
			75	27	4200	1900	2300	2870	3350	74.5	59.5	1260	1600
				32	4800	2000	2400	2970	3450				
				36	4200	1800	2210	2780	3260				
				45	3010	1800	2210	2780	3260				
			100	27	4600	2000	2400	2970	3450	75.3	60.3	1271	1607
				32	5200	2100	2500	3070	3550				
				36	4900	1800	2210	2780	3260				
				45	4000	1800	2210	2780	3260				

Electrical model: Compressor 400V/50/60 Hz, fan 120V/1.50 Hz

MUZSF25VE

From: Geoffrey Thomas [REDACTED]
 Sent: 21 August 2018 10:00
 To: Rodney Whitwell [REDACTED]
 Cc: Scott Atkinson [REDACTED]
 Subject: Fwd: Fontwell 5/51N EXTERNAL PLANS

Hi Rodney,

Our A/C units to be installed are as followed:
 2 x PUHZ125 (3PH) – 70Dba for each unit.
 1 x MUHZ25 (1PH) – 50Dba for each unit.

Should it be necessary to move these 3 condensing units or refrigeration units to the end of the building. Will not affect the pipe sizes or operation or costs of the systems.

Should you have any questions, please do not hesitate to contact me.

Regards

Geoffrey Thomas
 [REDACTED]

From: Geoffrey Thomas [REDACTED]
 Sent: 23 August 2018 10:00
 To: David Herriman (Allan B Matthews)
 Cc: Scott Atkinson
 Subject: RE: Fontwell a/c condensers

Hi David,

Apologies, the correct unit is MUZSF25VE.

The data is SPL, I hope this helps

The dba is measured at 1m from the front of the unit and 1m off the floor (height)

Many thanks.

regards
 Geoff Thomas

CM08 Z.C4.MLZ-015

CM08 Z.C4.MLZ-015-DS5

COMPRESSOR	
Brand	Danfoss
Model	MLZ 615 FALP8
Cooling Capacity	12.543 Watts
Evap./Cond. Temp.	-10/+45°C
Refrigerant	R 404A
Compressor HP	1.2
Power Supply	1220 V/50 Hz
Noise Level (at 1.0 m)	68.53 dBA
Noise Level (at 10.0 m)	35.23 dBA
Compressor Discharge line (Ø inches)	1/2"
Compressor Suction line (Ø inches)	3/4"

EQUIPMENT		
	Brand	Model
Receiver	Frigicraft	Frigicraft 4R
Filter Drier	SAFARIA	Safaria D15-30036-1535
Sign Glass	SAFARIA	Safaria SY-42022
Low Pressure Control	Danfoss	Danfoss 061F8052 ACB-2UC32W
High Pressure Control	Danfoss	Danfoss 061F8077 ACB-2UC32W
Oil Separator	-	-

DIMENSIONS			
	X	Y	Z
Device mm (L/W/H)	1205 mm	875 mm	512 mm
Packing mm (L/W/H) (Include Oil Receiver)	1210 mm	760 mm	540 mm
WEIGHT			
	Kg		
Device	75		
Packing	75		
CONNECTION			
	Inches		
Liquid Line (Ø inches)	3/8"		
Suction Line (Ø inches)	3/8"		

CAPACITY		COP				
Q	-5	+10	-5	+10	+15	
40	4.613	3.946	3.175	2.84	2.46	2.02
45	4.254	3.543	2.925	2.54	1.98	1.67
50	3.886	3.251	2.568	2.31	1.64	1.38

CONDENSER AND FAN		Description
Brand	ZAPVER	
Model	ZD 15 - 35 m³	
Geometry	25.00 x 21.65 mm	
Copper Pipe Size	7mm x 0.30 mm-Intercoil Grooved	
Fin Spacing	2.1 mm	
Fin Type	Corrugated	
Heat Transfer Area	15.22 m²	
Fan Brand	CAPAN	
Fan Model	1 x Ø400	
Inlet Power (kW)	0.147	
IP Code	IP 54	

