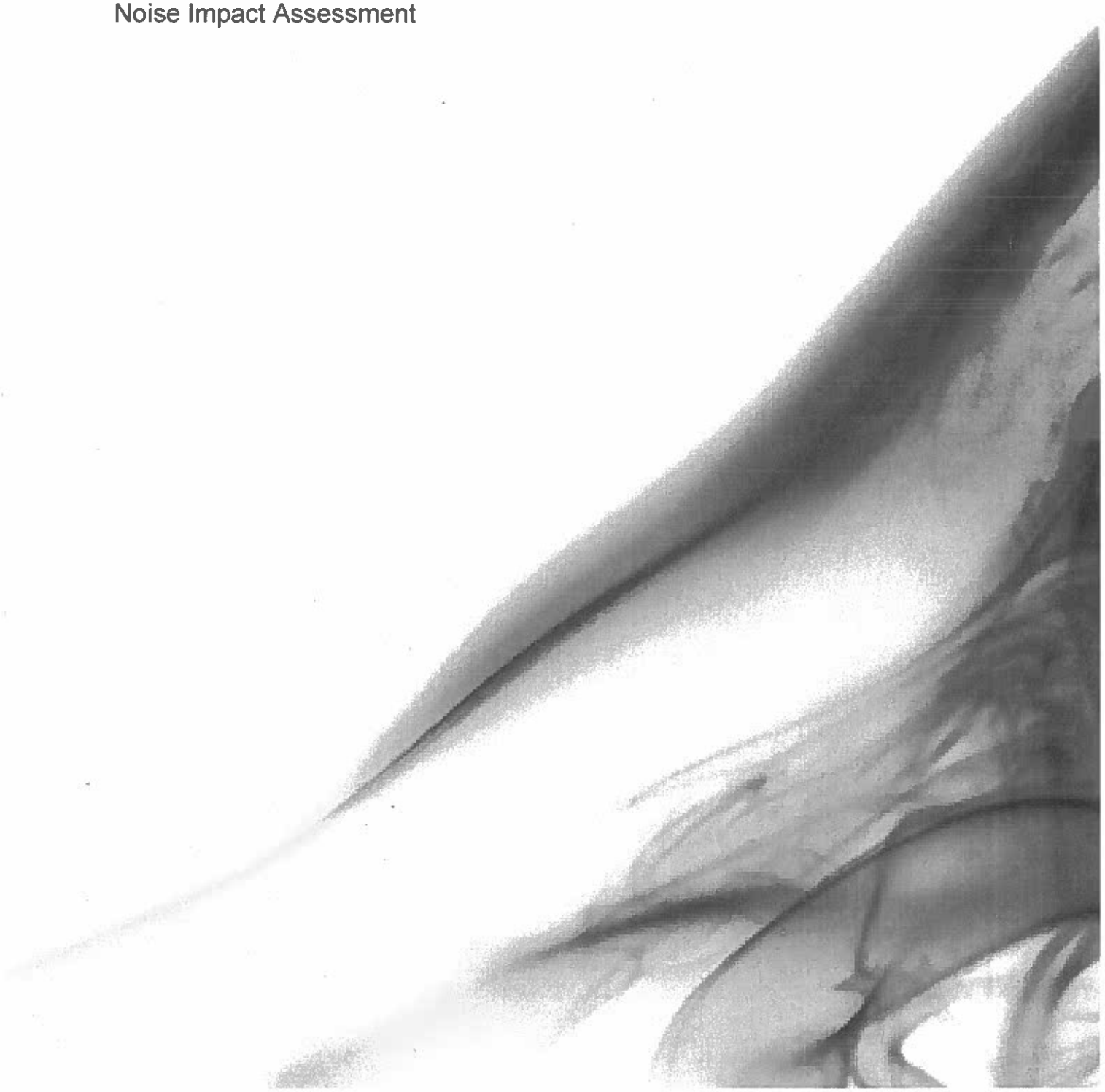
MACH TESTING

8 SMARTS PLACE, COVENT GARDEN

Noise Impact Assessment



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Noise Impact Assessment

Peter Salter

Revision	Description	Issued by	Checked By	Issue Date
00	First Issue	Rory Peliza	Patrick Shuttleworth	27/04/2016

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1.0 INTRODUCTION

MACH Testing has been appointed by Peter Salter to undertake a noise assessment relating to proposed mechanical plant installation at 8 Smarts Place, Covent Garden. Proposals are for a residential flat to be situated at roof level of the existing building, with associated mechanical plant. Additionally, the existing plant servicing the offices below is to be removed and new plant will be installed in a new location. Manufacturer data and on site measurements have been used to carry out noise assessments according to BS 4142:2014 and BS 8233: 2014.

The purpose of the assessment is to determine the noise impact of the proposed pant. In order to assess noise emissions from plant to existing receptors, an assessment has been carried out according to BS 4142: 2014 *"Methods for rating and assessing industrial and commercial sound"*. This assessment has been benchmarked against a background noise survey carried out between the 5th and 6th of April 2016. In order to assess the noise emissions from the plant to the proposed residential flat an assessment has been carried out according to BS 8233: 2014 *"Guidance on sound insulation and noise reduction for buildings"*.

2.0 SITE DESCRIPTION

The existing plant is situated approximately 10 meters from the nearest residential receptor and around 15 meters from the nearest commercial receptor. The proposed site in relation to its surroundings is shown in the map in Figure 2-1 below.

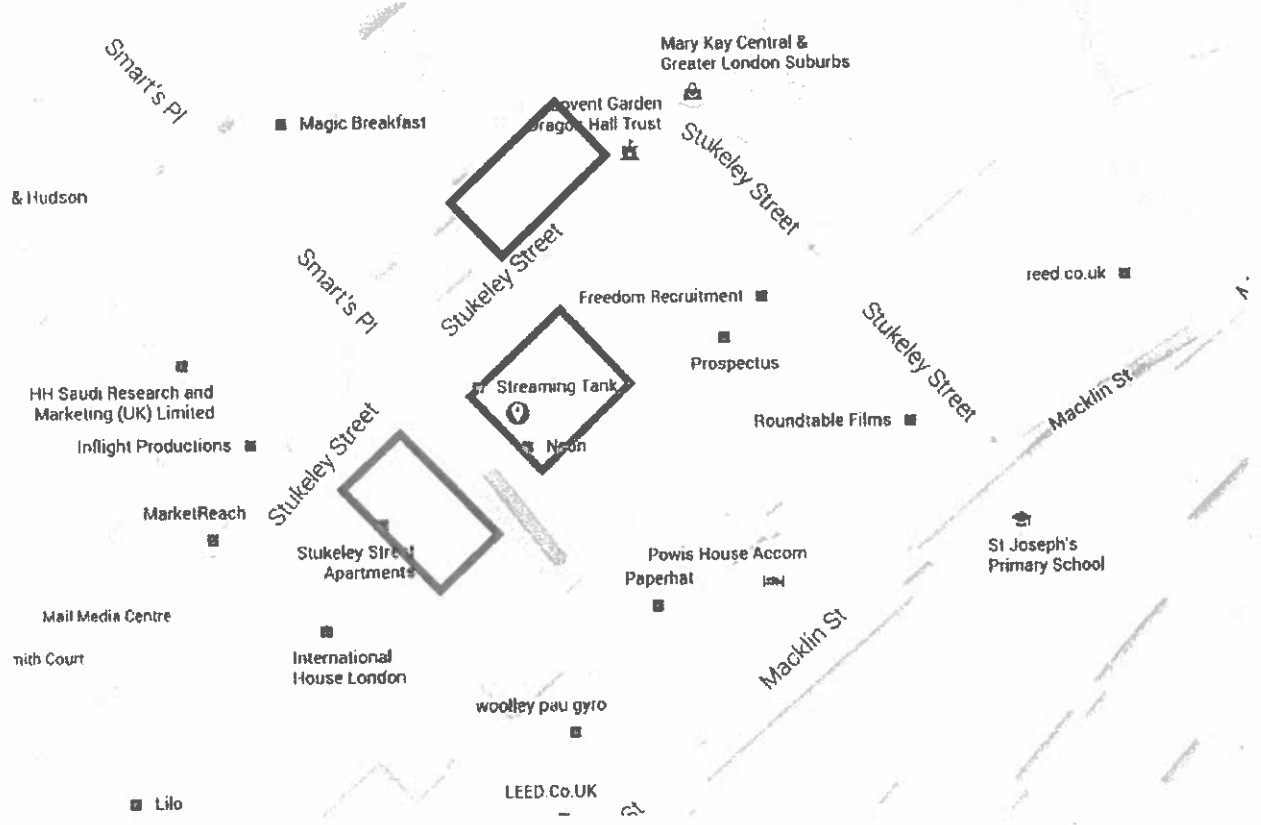


Figure 2-1: Showing the location of the nearest residential and commercial receptor in red and blue. The position of the proposed Smarts Place residential is marked in green.

In order to ensure that a noise disturbance is avoided at nearby sensitive receivers, the proposed development must be assessed against the existing noise climate. The primary contributor to background noise levels on site is High Holborn Road located to the west.

Background noise levels are moderate, due to fairly constant road traffic on High Holborn Road. In order to account for background noise levels over the operational hours of the plant, MACH Testing have monitored background noise over a typical 24-hour period. The environmental noise survey is described in more detail in section 3.0 below.

3.0 NOISE SURVEY

In order to establish existing background noise levels on site, continuous 5–minute samples of the acoustic parameters $L_{Aeq,T}$, $L_{A90\ T}$, and $L_{Amax,T}$ were measured across a 24 hour period. This period has been selected in order to account for a worst case of background noise levels at the nearest noise sensitive receptors.

The noise assessment serves to evaluate the noise from the proposed plant at the nearest existing residential and commercial properties. Therefore, the measurement location has been chosen to be representative of background noise levels on Stuckeley Street and Smarts Place.

MACH Testing's fixed measurement location (F) is illustrated in below in Figure 3-1, additional images can be found in Appendix A. In order to establish a worst case for background noise levels during the 24-hour period, monitoring was undertaken between 13:37 on 05/04/16 and 12:05 on 06/04/16.

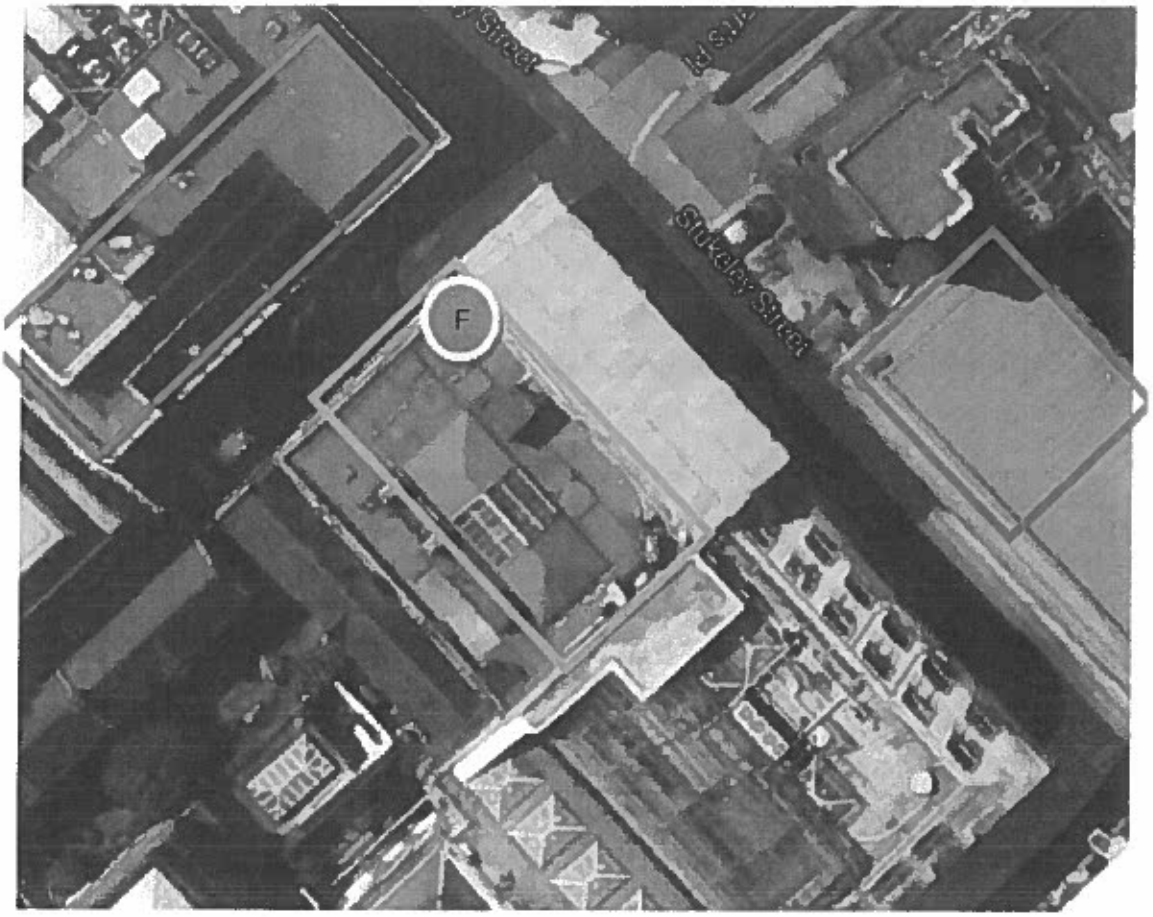


Figure 3-1: Fixed measurement location F

The long term meter was set to measure consecutive 'A' weighted 5-minute time samples. The results of the environmental noise survey are provided within Section 4.0 of this report.

3.1 Measurement Equipment

The measurement equipment illustrated in Table 3-1 was used during the survey, all equipment complies with BS EN 60942:2003 i.e. a class 1 device.

Name	Serial Number	Last Calibrated	Calibration Due
Norsonic Precision Sound Analyser Type 118	30562	July 2014	July 2016
Norsonic Type 1206 Pre-amplifier	30249	July 2014	July 2014
Norsonic Type 1225 Microphone	57530	July 2014	July 2014
Norsonic Sound Calibrator Type 1251	30779	July 2014	July 2014

Table 3-1: Details of equipment used during measurement.

3.2 Weather Conditions

The following climate conditions were recorded for the site:

Wind: Less than 5 m/s.
Humidity: The weather was clear.
Temperature: 7 ^{o}C.

The above weather conditions are suitable for the measurement of environmental noise in accordance with BS7445 *Description and Measurement of Environmental Noise.*

4.0 NOISE SURVEY RESULTS

4.1 Fixed Measurement Results

Figure 4-1 and Table 4-1 show the measured noise levels at fixed measurement location "F" on site (the position of the on-site measurements can be found in Figure 3-1 and Appendix A). Figure 4-1 below provides the LAmax, LAeq and LA90 levels measured over the length of the noise survey; all measurements are shown in dB. The complete set of measurement data is available on request.

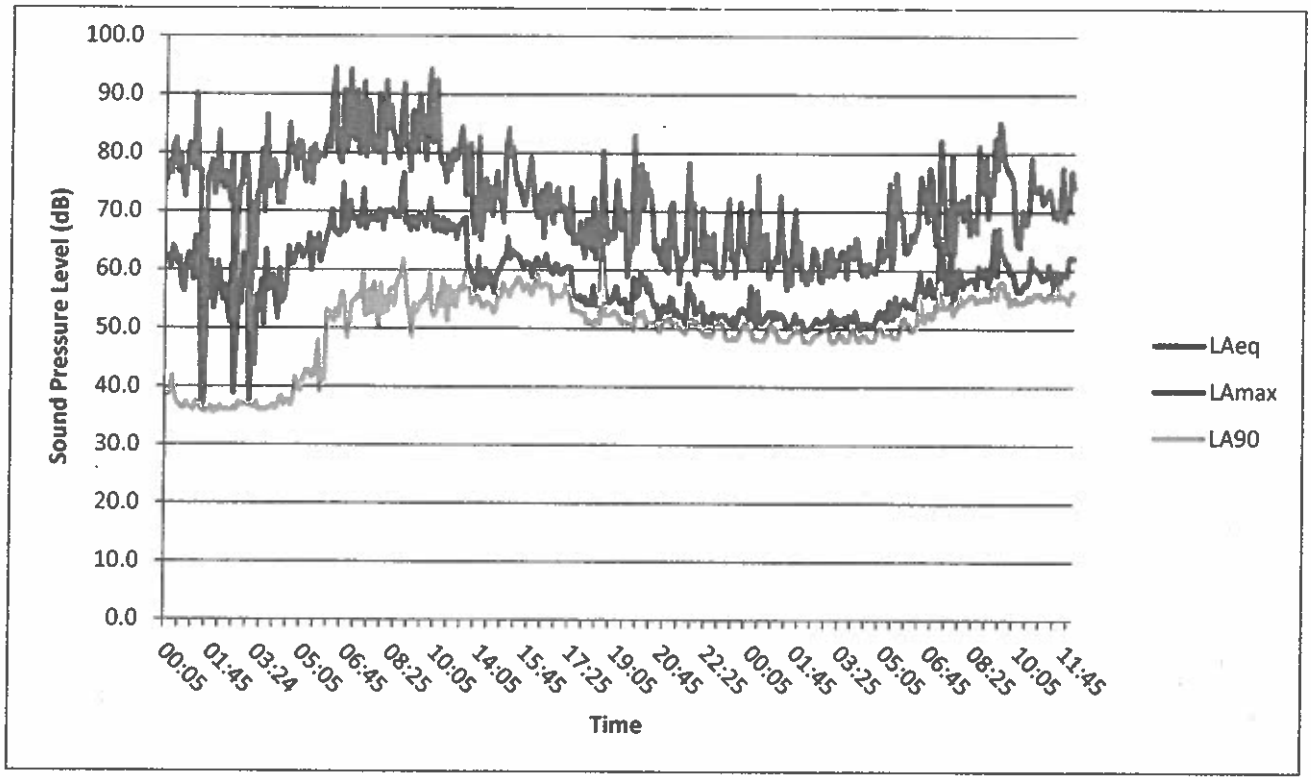


Figure 4-1: Noise survey results

Measurement	Maximum	Minimum	Average
L_{Aeq}	77	51	64
L_{A90}	62	49	55
L_{Amax}	94	58	81

Summary of results - Daytime (07:00 - 23:00)

Measurement	Maximum	Minimum	Average
L_{Aeq}	75	37	61
L_{A90}	56	36	48
L_{Amax}	95	44	79

Summary of results - Night Time (23:00 - 07:00)

Table 4-1: Overview of noise survey results.

4.2 Selection of Assessment Noise Levels (Background Sound Level)

BS4142: 2014 states that 'in using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. for this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.'

BS4142 further states that 'a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value'. Hence BS4142 does not provide a black and white method of obtaining the assessment level for background noise.

In order to establish a representative LA90 for both day and night, it has been necessary to discount periods where the existing plant has affected measured levels. The LA90 levels selected for both day and night are representative of baseline levels, without influence of the existing plant.

Time Interval	Assessment L_{A90} (dB)
Day (07:00 - 23:00)	52
Night (23:00 - 07:00)	48

Table 4.2: Assessment of background noise during the day and night

5.0 ASSESSMENT METHODOLOGY - GUIDANCE DOCUMENTATION

5.1 BS 4142: 2014 CRITERIA

BS 4142:2014 "Methods for rating and assessing industrial and commercial sound" describes a method of determining the level of noise of an industrial nature, together with the procedures for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity. As such, an assessment to BS 4142 is typically called for within planning conditions. The likelihood of complaints in response to a noise depends on various factors. BS 4142 assesses the likelihood of complaints by considering the margin by which the noise in question exceeds the background noise level.

BS 4142 states that one should *'obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following:*

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.*

The aforementioned rating level is based upon the specific noise level of the noise source in question. A correction should be applied to the specific noise level to obtain an increased rating level if *'a tone, impulse or other characteristic occurs, or is expected to be present, for new or modified sound sources.* To summarise, BS4142 section 9.2 advises the following in regards to corrections for acoustic characteristics:

- Tonality – *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 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.*
- Impulsivity – *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.*
- Other sound characteristics – *Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied*
- Intermittency – *When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied*

It is believed that the noise emanating from the proposed plant would not be tonal. This conclusion is based on objective data attained from the manufacturers (see Figure 8-3 and Figure 8-4). The figures show that each of the bands are similar in level, therefore it is believed that the listener would hear a broadband noise rather than a tone.

The noise emanating from the proposed plant should be intermittent. During measurements taken on site it was noted that the plant was not on continuously. Therefore, it is expected that a listener would find the noise more noticeable and a correction of +3dB will be added for this.

5.2 BS 8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings

BS8233:2014 *'Guidance on sound insulation and noise reduction for buildings'*, provides guidance for acceptable internal noise levels within dwellings. Although the recommendations of the World Health Organisation provide acceptable levels for external noise, the likelihood of disturbance within dwellings is perhaps the most important consideration. BS8233 states that to achieve adequate living conditions, background noise levels should be 35 dB L_{Aeq} or less within Living rooms, and 40 dB L_{Aeq} within dining rooms during the day. The advised levels are tabulated below.

Activity	Location	0700 - 2300
Resting	Living Room	35 dB $L_{Aeq, 16\ Hour}$
Dining	Dining Room	40 dB $L_{Aeq, 16\ Hour}$

Table 5-1: Shows the BS 8233 guidelines for living rooms and dining rooms

6.0 PLANT NOISE LEVELS AND LOCATION

The proposed plant is four RYYQ10T Daikin units and a single RZQG71L8V1 Daikin unit. The positions of these units can be seen in Figure 6.1. An overview of the noise data provided by Daikin can be found in Table 6.1. More detailed information can be found in Appendix C.

Manufacturer	Unit	dBA (dB)
Daikin	RZQG71L8V1	64
Daikin	RYYQ10T	79

Table 6.1: Plant sound power data

Propagation of noise has been calculated from the proposed units over a distance of 10 metres to the nearest residential and 15 meters to the nearest commercial receptor. A summary is provided in section 0 and a more detailed view of these calculations is provided within Appendix B. Propagation of noise has also been calculated to the proposed dwelling, a summary is provided in section and a more detailed view can be found in Appendix B.

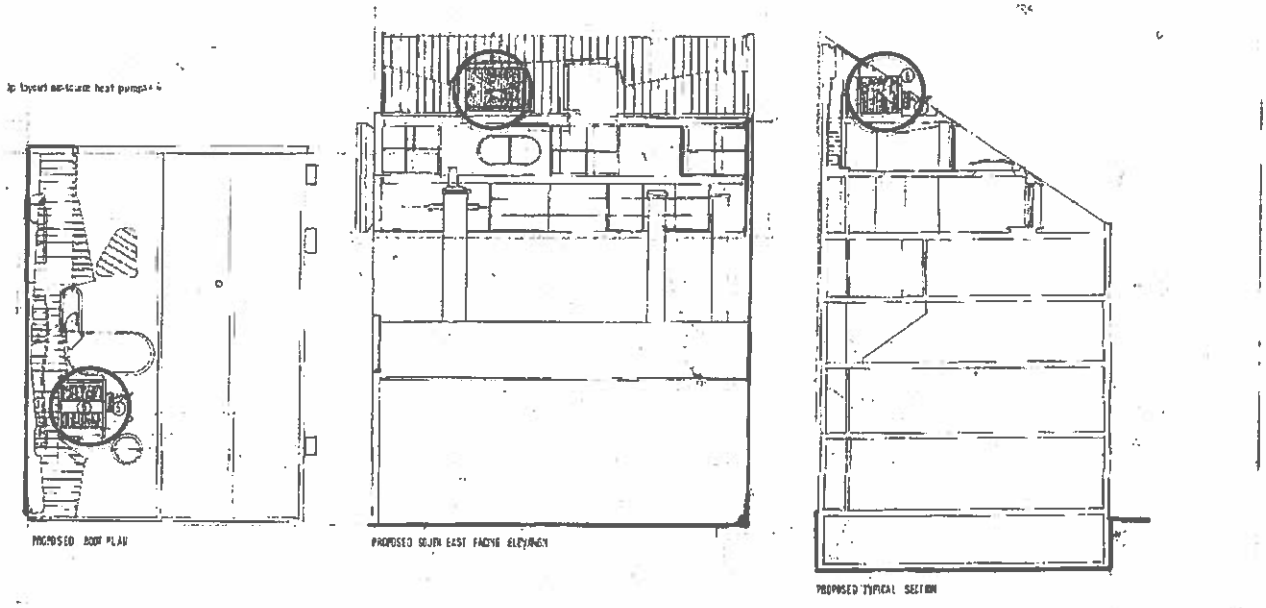


Figure 6-1: Plant location on 8 Smarts Place outlined in red.

7.0 NOISE IMPACT ASSESSMENT

7.1 Mitigation of Noise from Plant Units

Due to the high sound power levels of the plant units a number of screens will be necessary in order to mitigate the disturbance to the proposed and existing receptors. The screens should at least be on all sides of the unit cluster apart from the bottom and top sides. The screens should be at least 2.3 m high and should break line of site from all of the unites to all sensitive commercial and residential receptors in the area. All the units should be within the screened area.

The screen should meet the following specifications in Table 7-1. The required transmission loses can be met by using a Gillberts series 27 louver. It is advised that the client take advice from the manufacturer of the screen/louver when installing. This will ensure an effective placement of screens and plant units.

Frequency (Hz)	125	250	500	1000	2000	4000
transmission loss	-6	-10	-16	-20	-16	-11

Table 7-1: Shows the minimum required transmission losses for the screen / louver.

To model the losses due to the placement of the screens the direct path and the indirect path have both been considered and summed at the receptors, see Figure 7-2.

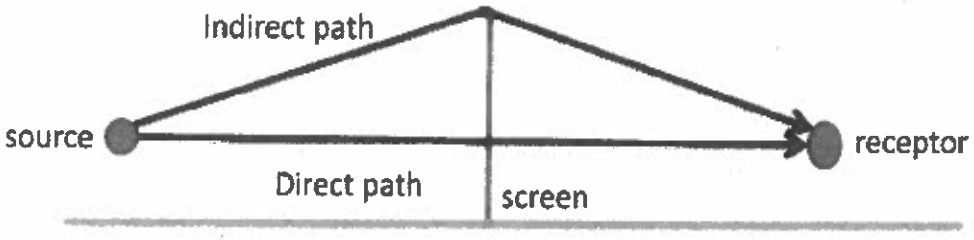


Figure 7-1: Shows the direct and indirect sound paths over a screen.

The noise propagation calculations can be found in Appendix B.

The units should also be placed on vibration isolating mounts. The client should take advice from the manufacturers of the mounts to ensure that the most effective mounts are chosen. This is important to ensure that there is minimal vibration through the ceiling façade.

7.2 Assessment to Existing Receptors (BS 4142)

Based on the outcome of the noise propagation calculations, including the transmission losses due to the proposed screens, Table 7.1 below provides the outcome of the assessment in line with BS 4142: 2014.

Receptor/ Time Interval	Background Noise Level (L_{A90} dB)	Specific Noise Level (L_{Aeq} dB)	Acoustic Feature Correction	Rating Level	Assessment Outcome
Residential / Day	52	45	3	48	-4
Residential / Night	48	45	3	48	0
Commercial / Day	52	42	3	45	-7
Commercial / Night	48	42	3	45	-3

Table 7-2: Noise Impact assessment at the nearest residential and commercial receptors.

As can be seen in Table 7-2, the assessment has indicated that the rating level of the proposed plant is below background noise levels in both residential and commercial receptor locations for day and night. As such, the proposed development is seen to be compliant with the provisions of BS 4142: 2014.

It should be noted that these calculations include the transmission losses due to the screen. Therefore, this proposal would not be compliant without some kind of attenuation of the plant noise.

7.3 Assessment to Proposed Receptors (BS 8233)

The BS 8233 guidelines are in Table 5-1. As the plant units are associated with the proposed dwelling, and is likely to be the loudest noise source to the proposed development a more stringent target has been suggested.

In this case a level of 20 dB $L_{Aeq,16hr}$ is recommended. The reason for this more stringent target is to try and minimise the risk of complaints, it is also taking into account the fact that the units are likely to be operational for a large proportion of the day.

When considering the noise entering the proposed dwelling Mach Testing have modelled the direct sound path and a path through a closed window on the nearest façade (see Figure 7-2).

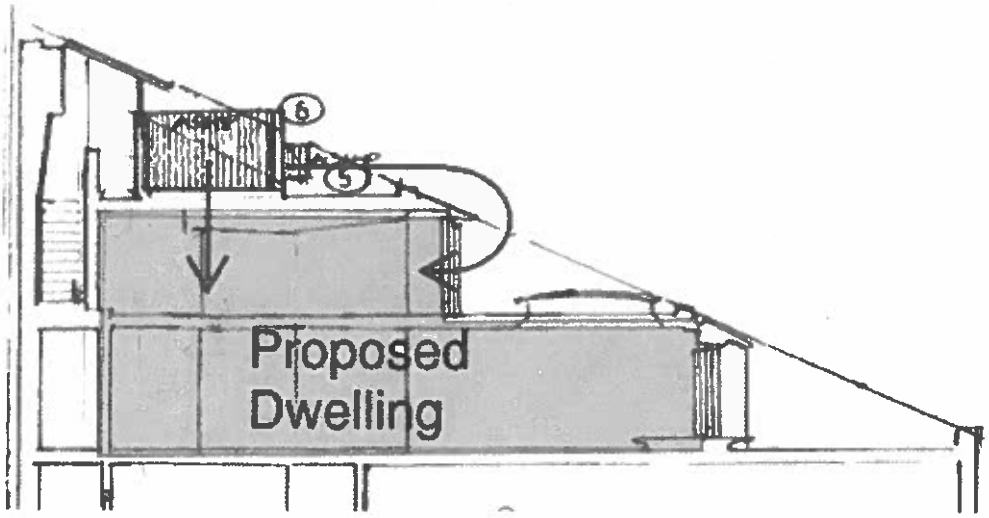


Figure 7-2: Showing the Paths of sound considered into the proposed residential property.

The Distance to the roof façade has been estimated to be 0.2 meters and 2 meters to the nearest closed window of the proposed development.

In order to carry out the assessment in line with BS 8233 guidelines (see Table 5-1) measurements must be averaged over 16 hours. Hence it is necessary to estimate the percentage of time which the new plant units will be operational. From the long term measurements carried out by Mach Testing it has been estimated that the plant would be operational for 75% of the time. This is a conservative estimate and therefore should show the worst case results.

The correction value will be added as seen in equation 1 in Appendix D.

7.3.1 Noise through Ceiling

In order to provide predictions for internal noise levels within the proposed residential dwelling, the manufacturer data for the plant has been used in line with BS 8233: 2014. The distance from the plant units to the ceiling has been estimated as 0.2 meters. Based on the calculations for sound pressure level at the ceiling (see Appendix B), it is predicted that the proposed dwellings will experience noise levels of 83 dBA at the outer leaf of the ceiling facade.

Using Insul modelling software the sound insulation of a ceiling has been estimated (see appendix D). This ceiling includes, 2 x 18 mm RCM CemBoard (cement particle board), 15 mm Gyproc SoundBloc, 200 mm gap filled with 150 mm of rockwool insulation (48 kg/m^3), 2 x 20 mm Gyproc SoundBloc susspended on timber frame attached to acoustic hangers. (see Figure 7-3 below).

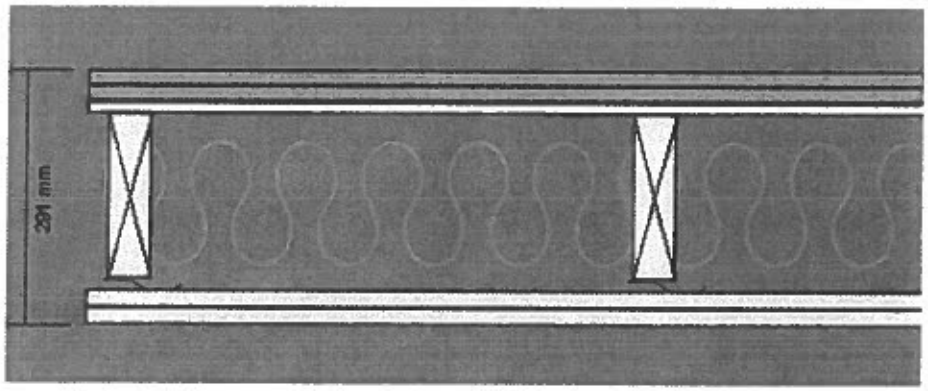


Figure 7-3: Shows proposed ceiling construction, 2 x 18 mm RCM CemBoard (cement particle board), 15 mm Gyproc SoundBloc, 200 mm gap filled with 150 mm of rockwool insulation (48 kg/m^3), x2 20 mm Gyproc SoundBloc suspended timber frame attached to acoustic hangers.

The results in Table 7-3 show that the sound pressure level in the proposed dwelling will be 22 dBA, in order to compare this level with the BS 8233 guidelines it is necessary to convert this to a $L_{Aeq,16hr}$, which requires we estimate the amount of time the plant units will be operational for.

	Octave Band Centre Frequencies, Hz						
	125	250	500	1000	2000	4000	dB(A)
SPL @ Residence Façade	90	81	81	76	72	67	83
Ceiling losses	53	60	65	67	63	71	
SPL @ Residence	37	21	16	9	9	-4	22

Table 7-3: Shows the breakthrough noise from the plant into the proposed dwelling through a standard ceiling

As previously discussed the value of 75% on time will be used. This means that the proposed dwelling will be exposed to 17 dB $L_{Aeq,16hr}$.

7.3.2 Noise through closed window and vents

This following assessment has assumed closed windows. If the client wised to comply with BS 8233 with an open window, then the sound emanating from the plant would have to be attenuated further.

In order to provide predictions for internal noise levels within the proposed residential dwelling, the manufacturer data for the plant has been used in line with BS 8233: 2014. The distance from the plant units to the ceiling has been estimated as 2 meters. Based on the calculations for sound pressure level at the windowed façade (this includes transmission losses due to the louvers, see Appendix B), it is predicted that the proposed dwellings will experience noise levels of 47 dBA at the nearest windowed façade.

From this value it is possible to specify the required window and ventilation (see Appendix B for calculation). The results of these calculations can be found in Table 7-4.

	Octave Band Centre Frequencies, Hz						
	125	250	500	1000	2000	4000	dB(A)
Glazing specification	25	27	30	30	25	20	
Trickle vent specification	30	33	38	32	32	30	
Resultant SPL inside dwelling	30	21	14	10	6	10	20

Table 7-4: Shows the minimum specification for the glazing and trickle vents, and the resultant SPL in the proposed dwelling.

As Table 7-4 shows, the sound pressure level inside the proposed dwelling should be 20 dBA, using an operational time of 75% this becomes a value of 15 dB $L_{Aeq,16hr}$.

7.3.3 Combined levels

The results from Table 7-3 and Table 7-4 have been used to calculate the overall level in the proposed dwelling. The results are shown below in Table 7-5. The results show that if sufficient noise attenuation of the plant noise is applied the sound levels inside the dwelling can reach the target of 20 dBLAeq,16hr by 1 dB.

Sound passing through	Sound levels (dB Laeq,16 hr)
Ceiling	17
Window	15
Combined	19
Target	20

Table 7-5: Shows the combined LAeq,16hr value inside the proposed dwelling.

It should be noted that in order to achieve this target the window must be closed and some kind of noise attenuation strategy of the plan units must be implemented.

8.0 SUMMARY

MACH Testing have been appointed by Peter Salter to undertake an environmental noise assessment for the proposed residential flats including additional plant at 8 Smarts Place, Covent Garden. Proposals are for air source heat pumps to be installed; these are associated with newly proposed flats.

In order to assess the impact of the proposed development on the nearest existing residential and commercial receivers, MACH Testing have conducted an assessment in line with BS4142: 2014. The assessment has indicated that the rating level of the proposed development is unlikely to cause annoyance during the day or night. This is reliant upon satisfactory implementation of noise control strategies to attenuate the noise from the plant. In the scenario outlined in this report, the development is seen to be compliant.

In order to assess the impact of the proposed development on the proposed residential development, MACH Testing have conducted an assessment in line with BS8233: 2014. MACH Testing have recommended an advanced target, motivated by BS 8233: 2014. The assessment has indicated that the sound levels of the proposed plant units should be in line these targets during the dat. This is reliant upon satisfactory implementation of noise control strategies to attenuate the noise from the plant. In the scenario outlined in this report, the development is seen to be compliant.

APPENDIX A – SITE PHOTOS

Figure 8-1 Shows the location of long term microphone (highlighted in red) and the nearest residential receptor.

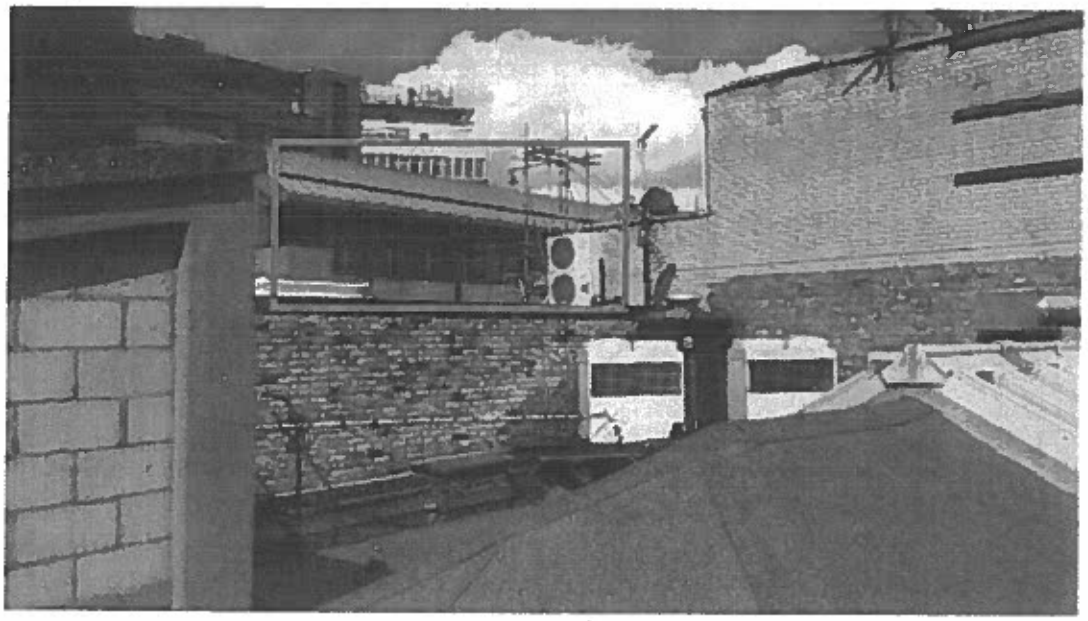


Figure 8-2: Shows the nearest commercial receptors to the proposed residential property (highlighted in blue)

APPENDIX B – Propagation Calculation

MACH ACOUSTICS	Octave Band Centre Frequencies, Hz						
	125	250	500	1000	2000	4000	dB(A)
SPL direct path (through the louvre)	53	46	40	31	31	31	43.0
SPL indirect path (over the top of the louvre)	52	44	41	33	26	19	42.1
SPL combined	56	48	44	35	32	31	45.6

Table 8-1: Predicted sound pressure levels of the plant at 10 meters (at the nearest residential receptors)

MACH ACOUSTICS	Octave Band Centre Frequencies, Hz						
	125	250	500	1000	2000	4000	dB(A)
SPL direct path (through the louvre)	50	43	36	28	27	28	39.5
SPL indirect path (over the top of the louvre)	49	41	38	30	23	16	38.6
SPL combined	52	45	40	32	29	28	42.1

Table 8-2: Predicted sound pressure levels of the plant at 15 meters (at the nearest commercial receptors

MACH ACOUSTICS		Octave Band Centre Frequencies, Hz						
		125	250	500	1000	2000	4000	dB(A)
SWL Radiating from	RYYQ-10T (x4)	87	84	84	79	75	70	84.7
Louver / breakout losses		0	0	0	0	0	0	
Other losses (screening, etc)		0	0	0	0	0	0	
Radiation Directivity	2	*(1 = free space, 2 = hemispherical, 4 = 1/4-sphere, 8= 1/8 sphere)*						
@ Distance (m)	0.2 0							
SPL @ Residence		93	90	90	85	81	76	90.7
SWL Radiating from	FAQ71C/RZQG71L8 V1	71	63	62	59	53	51	64.0
Louver / breakout losses		0	0	0	0	0	0	
Other losses (screening, etc)		0	0	0	0	0	0	
Radiation Directivity	2	*(1 = free space, 2 = hemispherical, 4 = 1/4-sphere, 8= 1/8 sphere)*						
@ Distance (m)	0.2 0							
SPL @ Residence		77	69	68	65	59	57	70.0

Table 8-3: Predicted sound pressure levels of the plant at 0.2 meters (at the louver and the ceiling façade).

MACH ACOUSTICS	Octave Band Centre Frequencies, Hz						
	125	250	500	1000	2000	4000	dB(A)
SPL direct path (through the louvre)	57	50	44	35	35	35	47.0
SPL indirect path (over the top of the louvre)	48	42	39	31	24	17	39.7
SPL combined	58	51	45	37	35	35	47.7

Table 8-4: Predicted sound pressure levels of the plant at 2 meters (at the nearest windowed façade).

APPENDIX C - Manufacturer Data

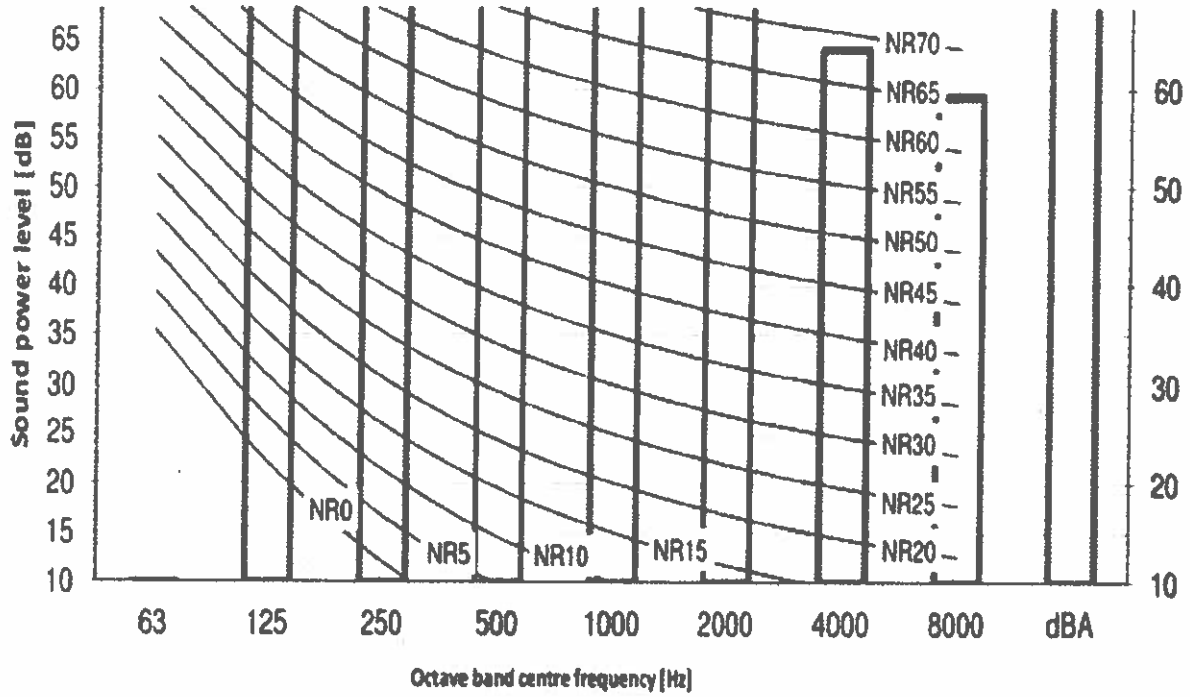


Figure 8-3: Manufacturer data for RYYQ - 10T unit.

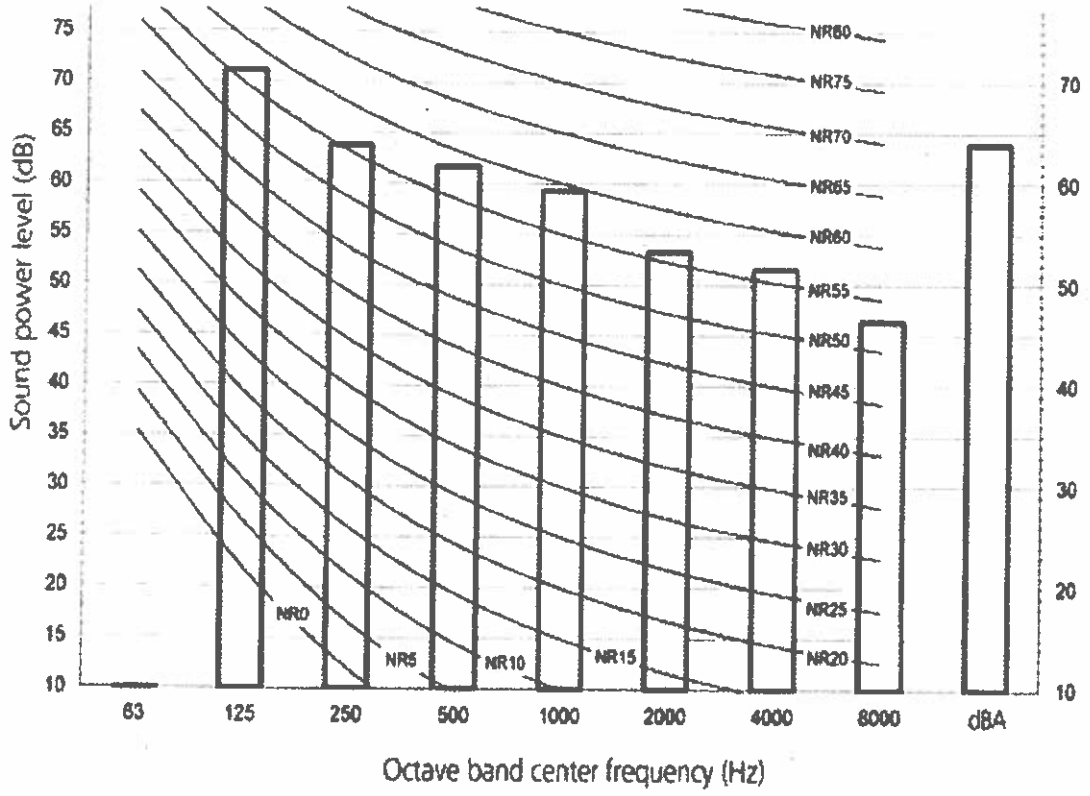


Figure 8-4: Manufacturer data for RZQG-L8_7V1 unit.

APPENDIX D – Façade modelling

Rw 65	100-3150 C -2	63	125	250	500	1k	2k	4k
DnTw 67	Ctr -3	41	53	59	64	66	62	70

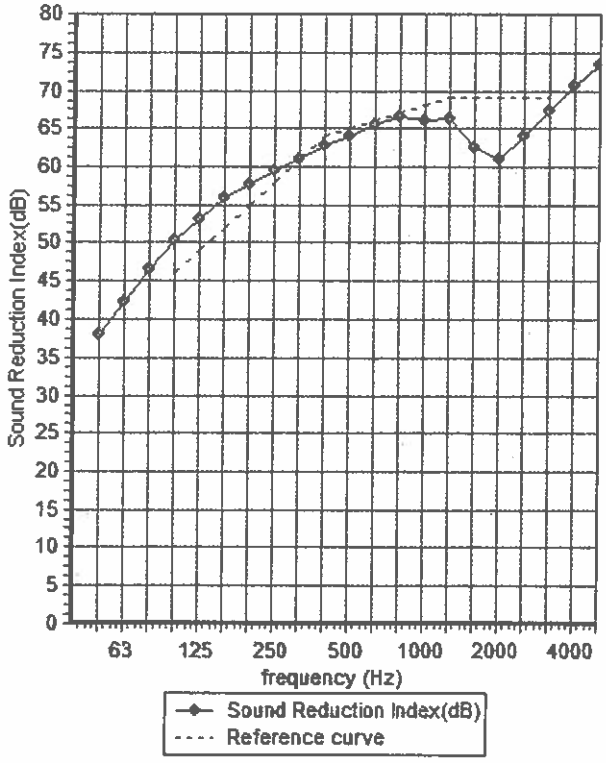


Figure 8-5: Shows the predicted insulation of, 2 x 18 mm RCM CemBoard (cement particle board), 15 mm Gyproc SoundBloc, 200 mm gap filled with 150 mm of rockwool insulation (48 kg/m³), x2 20 mm Gyproc SoundBloc suspended timber frame attached to acoustic hangers.

Equation 1

$$L_{Aeq,xhrs} = L_A + 10\log_{10}\frac{T_{on}}{T_{off}}$$

Where L_A is the dBA value, T_{on} time in hours that the plant is on for and T_{off} is the time in hours that the plant is off for.

63	125	250	500	1000	2000	4000	dB(A)
	56	50	47	38	32	32	**48**
Glaz-Dbl							
Glaz-Dbl 10 - Rw 34 - Double - 6/12/12							
Glazing							
0	25	27	30	30	25	20	
0	-33	-35	-38	-38	-33	-28	
-99.0	26.3	18.3	12.0	3.5	2.2	7.6	15.9
TrVnt-Aco							
TrVnt-Aco 8 - Rw 38 - Acoustic: Typical							
Trickle Vent							
0	30	33	38	32	32	30	
-1	-31	-34	-39	-33	-33	-31	
2.4	28.3	19.3	11.0	8.5	2.2	4.6	16.7

63	125	250	500	1000	2000	4000	dB(A)
4.3	**30.5**	**21.9**	**14.7**	**10.1**	**6.3**	**9.8**	**19.6**
-61	-25	-25	-26	-28	-29	-23	20
Pass	*Pass*	*Pass*	*Pass*	*Pass*	*Pass*	*Pass*	**Pass**

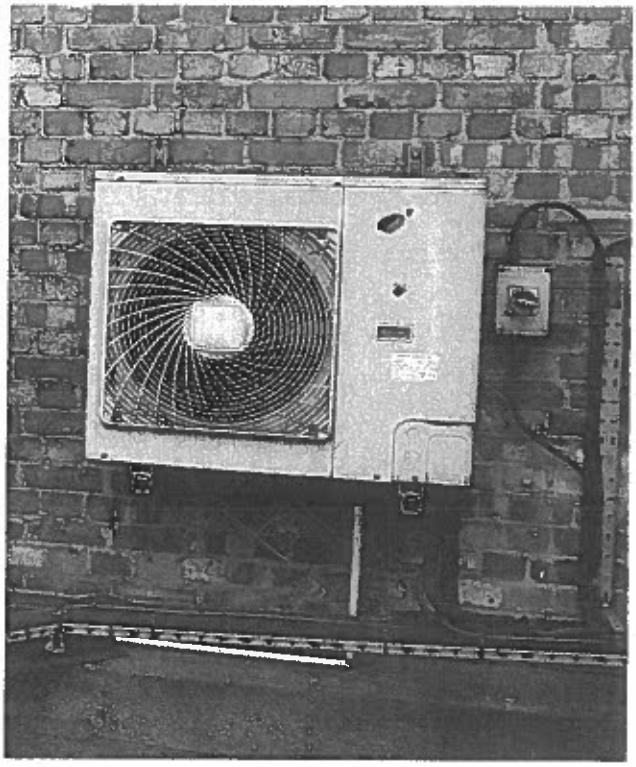
Table 8-5: shows modelling of noise breaking through a closed window and trickle vent.

DAIKIN

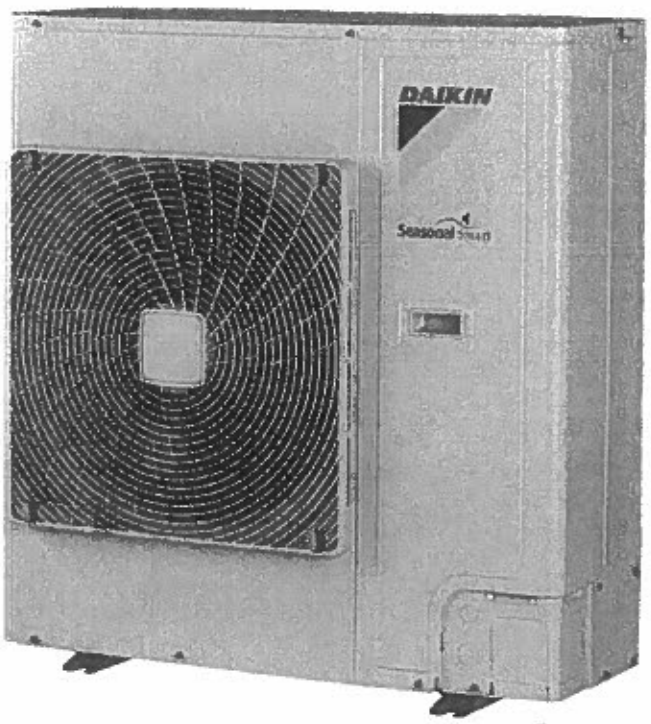
Air Conditioning

Technical Data

Old (illustration only not to scale)



1 off New



EEDEN14-100

RZQG-L8/7V1

2 Specifications

2-3 Nominal Capacity And Nominal Input				FDQ125C/RZQG125L8V1
Seasonal efficiency (according to EN14825)	Cooling	Energy label		A+
		Pdesign	kW	12.00
		SEER		5.81
		Annual energy consumption	kWh	723
	Heating (Average climate)	Energy label		A+
		Pdesign	kW	12.71
		SCOP		4.21
		Annual energy consumption	kWh	4,227
Nominal efficiency (cooling at 35°/27° nominal load, heating at 7°/20° nominal load)	EER			3.75
	COP			3.83
	Annual energy consumption		kWh	1,600
	Energy label	Cooling		A
		Heating		A

Notes

(1) EER/COP according to Eurovent 2012, for use outside EU only

2-4 Nominal Capacity And Nominal Input				FAQ71C/RZQG71L8V1	FAQ100C/RZQG100L8V1
Cooling capacity	Nom.		kW	6.8	9.5
Heating capacity	Nom.		kW	7.5	10.8
Power input	Cooling	Nom.	kW	2.00	2.63
	Heating	Nom.	kW	2.03	3.00
Seasonal efficiency (according to EN14825)	Cooling	Energy label		A++	
		Pdesign	kW	6.80	9.50
		SEER		6.51	6.11
		Annual energy consumption	kWh	366	544
	Heating (Average climate)	Energy label		A+	
		Pdesign	kW	6.33	10.20
		SCOP		4.02	4.01
		Annual energy consumption	kWh	2,204	3,561
Nominal efficiency (cooling at 35°/27° nominal load, heating at 7°/20° nominal load)	EER			3.40	3.62
	COP			3.70	3.61
	Annual energy consumption		kWh	1,000	1,315
	Energy label	Cooling		A	
		Heating		A	

Notes

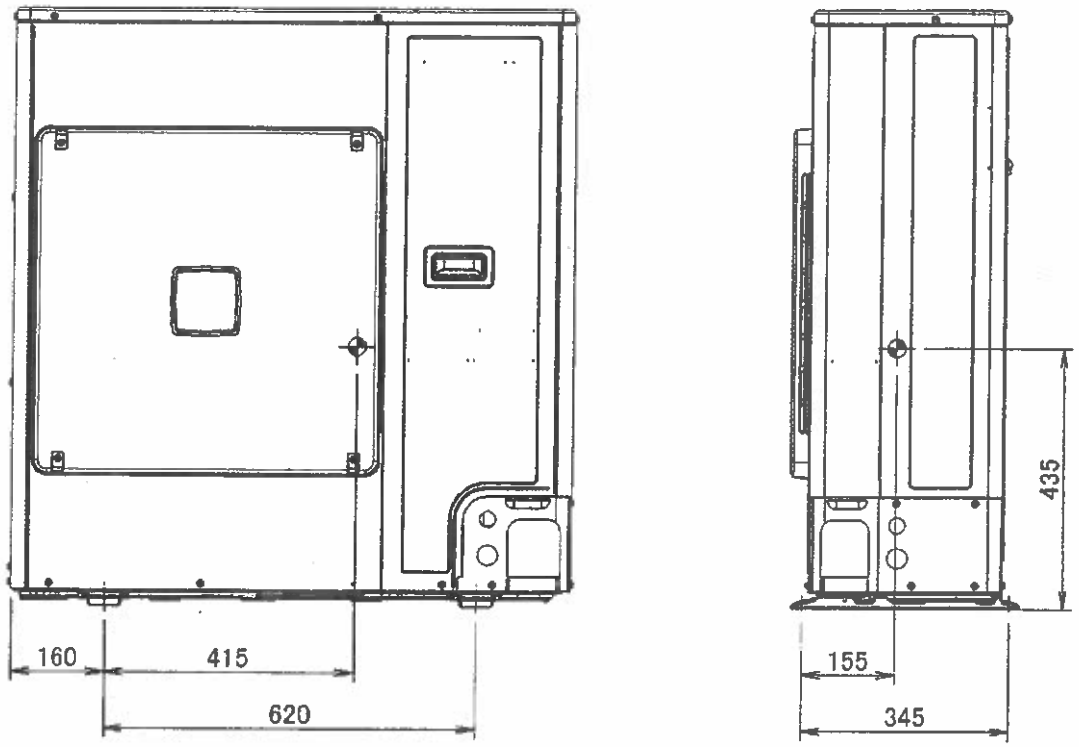
(1) EER/COP according to Eurovent 2012, for use outside EU only

2-5 Nominal Capacity And Nominal Input				FBQ71C8/RZQG71L8V1	FBQ100C8/ RZQG100L8V1	FBQ125C8/ RZQG125L8V1	FBQ140C8/ RZQG140L7V1
Cooling capacity	Nom.		kW	6.8	9.5	12.0	13.4
Heating capacity	Nom.		kW	7.5	10.8	13.5	15.5
Power input	Cooling	Nom.	kW	1.94	2.44	3.15	4.02
	Heating	Nom.	kW	2.05	2.57	3.53	4.30
Seasonal efficiency (according to EN14825)	Cooling	Energy label		A++	A+		-
		Pdesign	kW	6.80	9.50	12.00	-
		SEER		6.11	5.80	5.81	-
		Annual energy consumption	kWh	390	573	723	-
	Heating (Average climate)	Energy label		A+	A++	A+	-
		Pdesign	kW	6.00	11.30	12.71	-
		SCOP		4.01	4.61	4.21	-
		Annual energy consumption	kWh	2,095	3,432	4,227	-

8 Centre of gravity

8 - 1 Centre of Gravity

RZQG71L8V1



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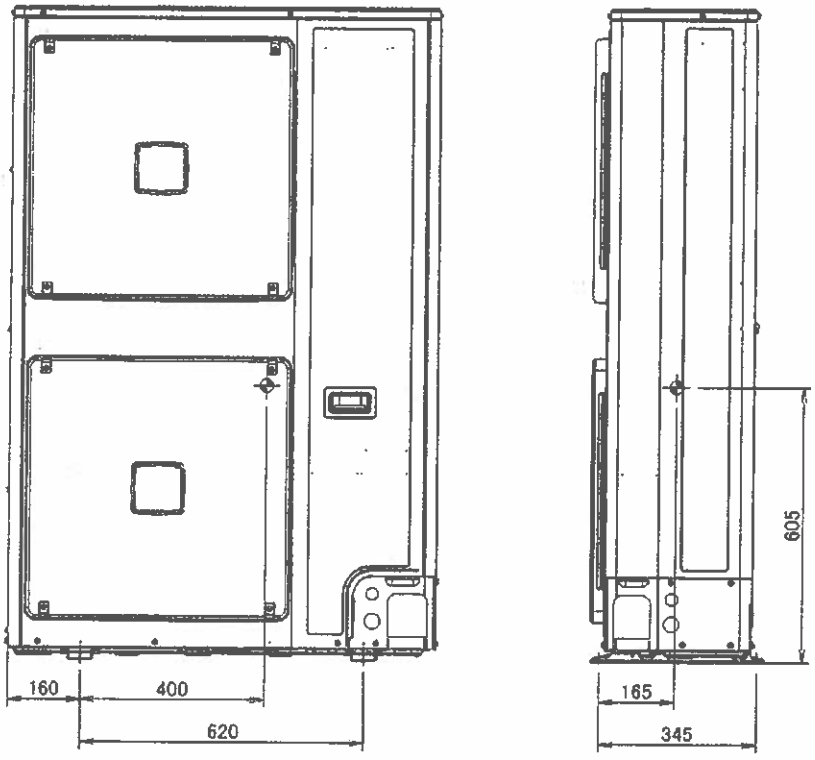
RZQG100-140L8/7V1



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12 Installation

12 - 1 Installation Method

RZQG-L8/7V1

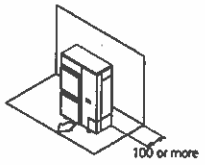
Installation service space

The measure of these values is "mm".

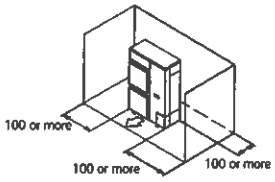
(A) When there are obstacles on suction sides.

- **No obstacle above**

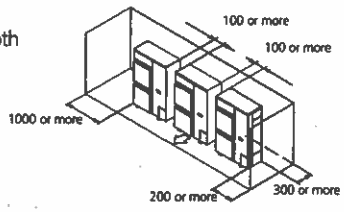
① Stand-alone installation
- Obstacle on the suction side only



- Obstacle on both sides and suction side, too

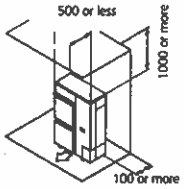


② Series installation (2 or more) (Note 1)
- Obstacle on the suction side and both sides

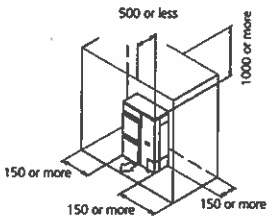


- **Obstacle above, too.**

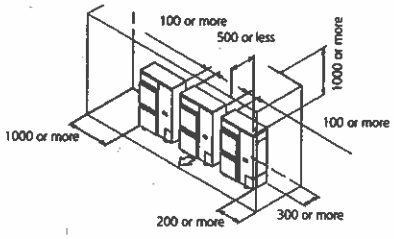
① Stand-alone installation
- Obstacle on the suction side, too



- Obstacle on both sides and suction side, too



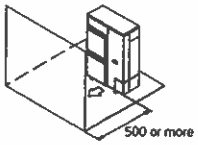
② Series installation (2 or more) (Note 1)
- Obstacle on the suction side and both sides



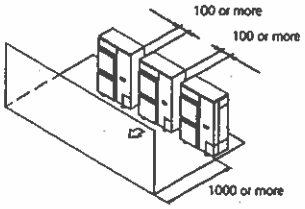
(B) When there are obstacles on discharge sides.

- **No obstacle above**

① Stand-alone installation
- Obstacle on the discharge side only

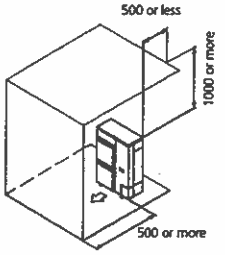


② Series installation (2 or more) (Note 1)
- Obstacle on the discharge side only

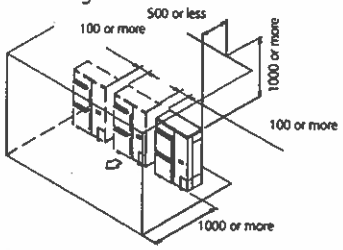


- **Obstacle above, too**

① Stand-alone installation
- Obstacle on the discharge side only, too



② Series installation (2 or more) (Note 1)
- Obstacle on the discharge side



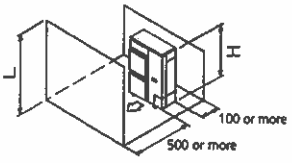
(C) When there are obstacles on both suction and discharge sides.:

Pattern 1

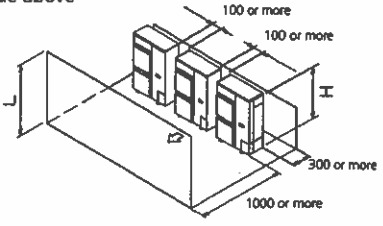
When the obstacles on the discharge side is higher than the unit. (L>H)
(There is no limit for the height of obstructions on the suction side.)

- **No obstacle above**

① Stand-alone installation
- No obstacle above



② Series installation (2 or more) (Note 1)
- No obstacle above



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12 Installation

12 - 1 Installation Method

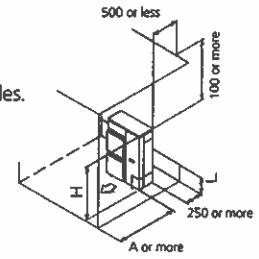
RZQG-L8/7V1

• Obstacle above, too

① Stand-alone installation (Note 2)
- When there are obstacles on suction, discharge and top sides.

The relations between H, A and L are as follows.

	L	A
L ≦ H	L ≦ 1/2 H	750 or more
	1/2 H < L ≦ H	1000 or more
L > H	Set the stand as : L ≦ H Refer to the column of L ≦ H for A	

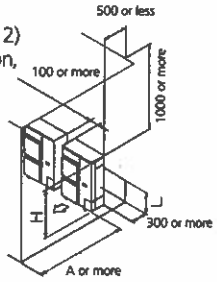


② Series installation (2 or more) (Note 1, 2)
- When there are obstacles on suction, discharge and top sides.

The relations between H, A and L are as follows.

	L	A
L ≦ H	L ≦ 1/2 H	1000 or more
	1/2 H < L ≦ H	1250 or more
L > H	Set the stand as : L ≦ H Refer to the column of L ≦ H for A	

Limit of series installation is 2 units.

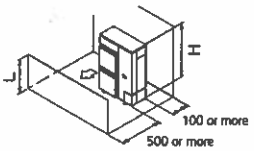


Pattern 2

When the obstacle on the discharge side is lower than the unit (L ≦ H)
(There is no limit for the height of obstructions on the suction side.)

• No obstacle above

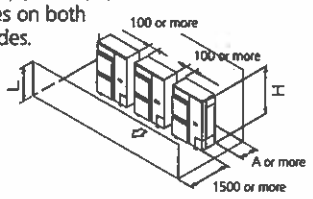
① Stand-alone installation
- No obstacle above



② Series installation (2 or more) (Note 1, 2)
- When there are obstacles on both suction and discharge sides.

The relations between H, A and L are as follows.

L	A
L ≦ 1/2 H	250 or more
1/2 H < L ≦ H	300 or more

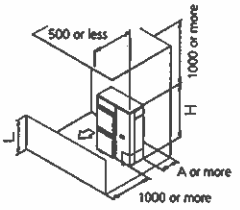


• obstacle above

① Stand-alone installation (Note 2)
- When there are obstacles on suction, discharge and top sides.

The relations between H, A and L are as follows.

	L	A
L ≦ H	L ≦ 1/2 H	100 or more
	1/2 H < L ≦ H	200 or more
L > H	Set the stand as : L ≦ H Refer to the column of L ≦ H for A	

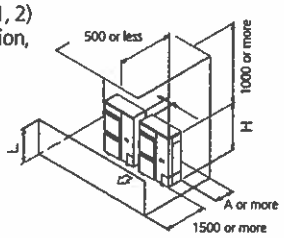


② Series installation (2 or more) (Note 1, 2)
- When there are obstacles on suction, discharge and top sides.

The relations between H, A and L are as follows.

	L	A
L ≦ H	L ≦ 1/2 H	250 or more
	1/2 H < L ≦ H	300 or more
L > H	Set the stand as : L ≦ H Refer to the column of L ≦ H for A	

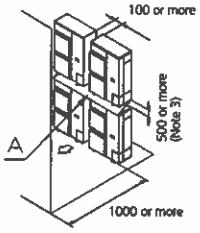
Limit of series installation is 2 units.

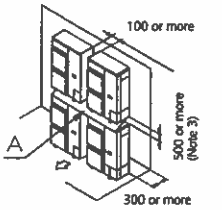


(D) Double-decker installation

① Obstacle on the discharge side. (1)
- Do not exceed two levels for stacked installation.
- Install a roof cover similar to A (field supply), as outdoor units with downward drainage are prone to dripping and freezing.
- Install the upper-level outdoor unit so that its bottom plate is a sufficient height above the roof cover. This is to prevent the buildup of ice on the underside of the bottom plate.

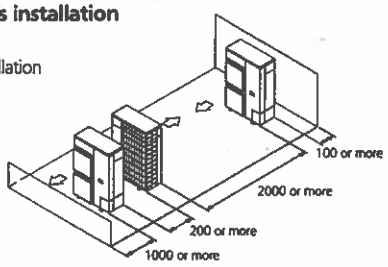
② Obstacle on the suction side. (1)
- Do not exceed two levels for stacked installation.
- Install a roof cover similar to A (field supply), as outdoor units with downward drainage are prone to dripping and freezing.
- Install the upper-level outdoor unit so that its bottom plate is a sufficient height above the roof cover. This is to prevent the buildup of ice on the underside of the bottom plate.





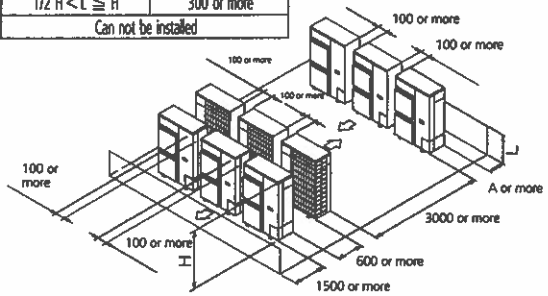
(E) Multiple rows of series installation (on the rooftop, etc.)

① One row of stand-alone installation



② Rows of series installation (2 or more)
The relations between H, A and L are as follows.

	L	A
L ≦ H	L ≦ 1/2 H	250 or more
	1/2 H < L ≦ H	300 or more
L > H	Can not be installed	



NOTES

1 In case of the sideway's piping, make a 100mm gap between the unit above.
2 Close the bottom of the installation frame to prevent the discharged air from being bypassed.
3 It is not necessary to install a roof cover if there is no danger of drainage dripping and freezing. In this case, the space between the upper and lower outdoor units should be at least 100mm. Close off the gap between the upper and lower units so there is no reintake of discharged air.

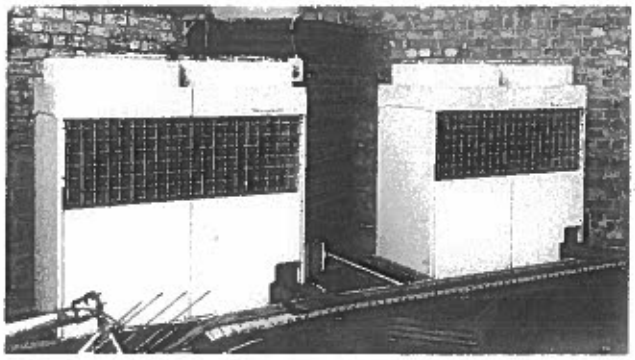
3D069554

DAIKIN

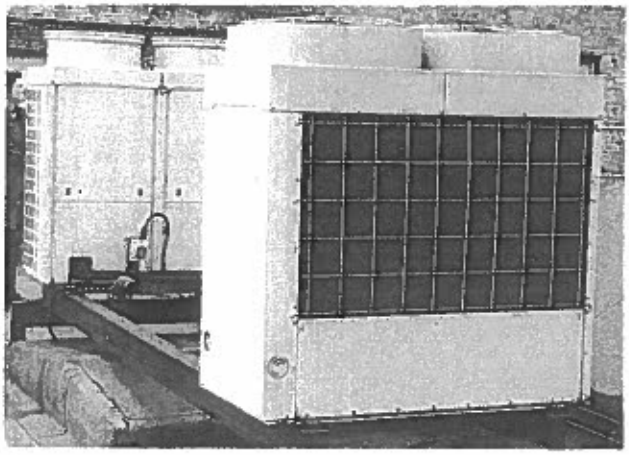
Air Conditioning
Technical Data

VRV IV heat pump, with continuous heating

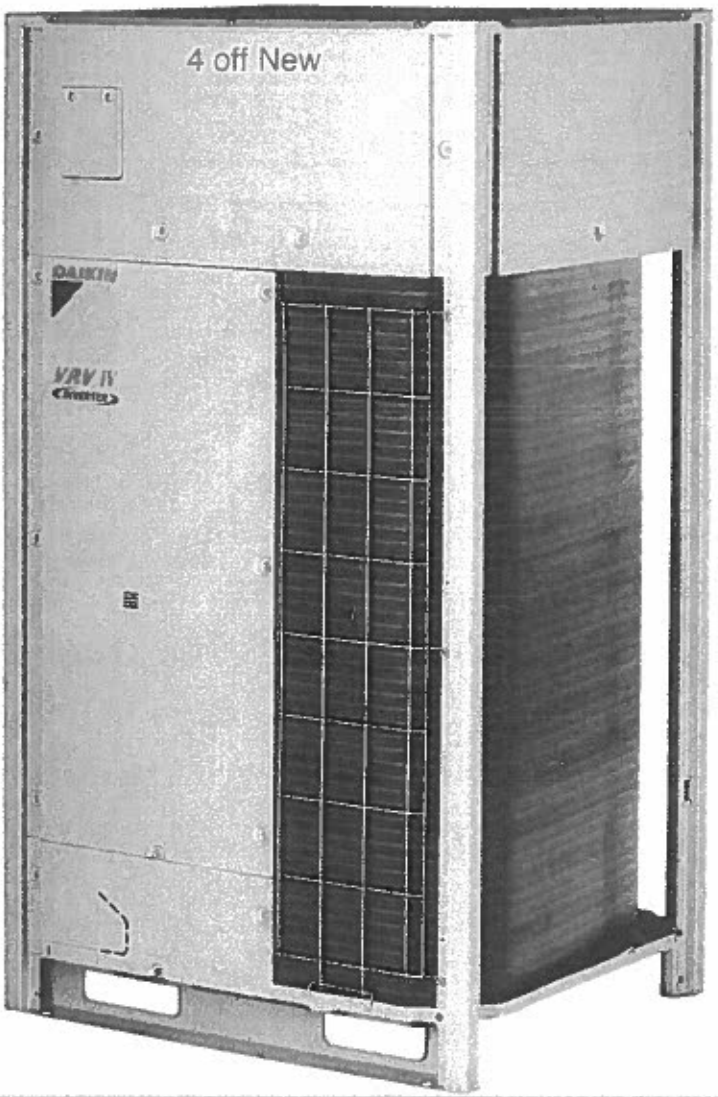
Old (illustration only not to scale)



Old (illustration only not to scale)



4 off New



EEDEN15-200_1

RYYQ-T

2 Specifications

2-1 Technical Specifications					RYYQ8T	RYYQ10T	RYYQ12T	RYYQ14T	RYYQ16T	RYYQ18T	RYYQ20T
Capacity range				HP	8	10	12	14	16	18	20
Cooling capacity	Nom.			kW	22.4 (1)	28.0 (1)	33.5 (1)	40.0 (1)	45.0 (1)	50.4 (1)	56.0 (1)
Heating capacity	Nom.			kW	22.4 (2)	28.0 (2)	33.5 (2)	40.0 (2)	45.0 (2)	50.4 (2)	56.0 (2)
	Max.			kW	25.0 (2)	31.5 (2)	37.5 (2)	45.0 (2)	50.0 (2)	56.5 (2)	63.0 (2)
Power input - 50Hz	Cooling	Nom.		kW	5.21 (1)	7.29 (1)	8.98 (1)	11.0 (1)	13.0 (1)	15.0 (1)	18.5 (1)
	Heating	Nom.		kW	4.75 (2)	6.29 (2)	7.77 (2)	9.52 (2)	11.1 (2)	12.6 (2)	14.5 (2)
		Max.		kW	5.51 (2)	7.38 (2)	9.10 (2)	11.2 (2)	12.8 (2)	14.6 (2)	17.0 (2)
Capacity control	Method				Inverter controlled						
EER					4.30 (1)	3.84 (1)	3.73 (1)	3.64 (1)	3.46 (1)	3.36 (1)	3.03 (1)
ESEER - Automatic					7.53	7.20	6.96	6.83	6.50	6.38	5.67
ESEER - Standard					6.37	5.67	5.50	5.31	5.05	4.97	4.42
COP - Max.					4.54	4.27	4.12	4.02	3.91	3.87	3.71
COP - Nom.					4.72	4.45	4.31	4.20	4.05	4.00	3.86
Maximum number of connectable indoor units					64 (3)						
Indoor index connection	Min.				100	125	150	175	200	225	250
	Nom.				200	250	300	350	400	450	500
	Max.				260	325	390	455	520	585	650
Dimensions	Unit	Height		mm	1,685						
		Width		mm	930			1,240			
		Depth		mm	765						
	Packed unit	Height		mm	1,820						
		Width		mm	1,000			1,310			
		Depth		mm	835						
Weight	Unit			kg	243	252		356		391	
	Packed unit			kg	250	259		363		397	
Packing	Material				Carton						
	Weight			kg	2.00			3.00			
Packing 2	Material				Wood						
	Weight			kg	17.00			18.50			
Packing 3	Material				Plastic						
	Weight			kg	0.50						
Casing	Colour				Daikin White						
	Material				Painted galvanized steel plate						
Heat exchanger	Type				Cross fin coil						
	Fin	Treatment			Anti-corrosion treatment						
Compressor	Quantity				1			2			
	Model				Inverter						
	Type				Hermetically sealed scroll compressor						
	Crankcase heater			W	33						
Fan	Type				Propeller fan						
	Quantity				1			2			
	Air flow rate	Cooling	Nom.	m³/min	162	175	185	223	260	251	261
	External static pressure	Max.		Pa	78						
	Discharge direction				Vertical						
Fan motor	Quantity				1			2			
	Model				Brushless DC motor						
	Output			W	750						
Sound power level	Cooling	Nom.		dBA	78	79	81		86		88
Sound pressure level	Cooling	Nom.		dBA	58		61		64	65	66
Operation range	Cooling	Min.~Max.		°CDB	-5~43						
	Heating	Min.~Max.		°CWB	-20~15.5						
Refrigerant	Type				R-410A						
	Charge			kg	5.9	6	6.3	10.3	10.4	11.7	11.8
Refrigerant oil	Type				Synthetic (ether) oil						
	Charged volume			l	0.8	0.5	0.7	1.8		1.7	1.9

2 Specifications

2-1 Technical Specifications						RYYQ8T	RYYQ10T	RYYQ12T	RYYQ14T	RYYQ16T	RYYQ18T	RYYQ20T
Piping connections	Liquid	Type				Braze connection						
		OD			mm	9.52		12.7			15.9	
	Gas	Type				Braze connection						
		OD			mm	19.1	22.2	28.6				
	Heat insulation					Both liquid and gas pipes						
	Piping length	OU - IU	Max.		m	165 (4)						
		After branch	Max.		m	90 (4)						
	Total piping length	System	Actual		m	1,000 (4)						
	Level difference	OU - IU	Outdoor unit in highest position		m	90 (4)						
			Indoor unit in highest position		m	90 (4)						
		IU - IU	Max.		m	30 (4)						
Defrost method						Reversed cycle						
Safety devices	Item	01				High pressure switch						
		02				Fan driver overload protector						
		03				Inverter overload protector						
		04				PC board fuse						
PED	Category					Category II						

Standard Accessories : Connection pipes;

Standard Accessories : Installation and operation manual;

2-2 Electrical Specifications				RYYQ8T	RYYQ10T	RYYQ12T	RYYQ14T	RYYQ16T	RYYQ18T	RYYQ20T
Power supply	Name			Y1						
	Phase			3N~						
	Frequency		Hz	50						
	Voltage		V	380-415						
Voltage range	Min.		%	-10						
	Max.		%	10						
Current	Nominal running current (RLA) - 50Hz	Cooling	A	7.2 (5)	10.2 (5)	12.7 (5)	15.4 (5)	18.0 (5)	20.8 (5)	26.9 (5)
Current - 50Hz	Minimum Ssc value		kVa	1,216	564	615	917	924	873	970
	Minimum circuit amps (MCA)		A	16.1	22.0	24.0	27.0	31.0	35.0	39.0
	Maximum fuse amps (MFA)		A	20	25	32		40		50
	Total overcurrent amps (TOCA)		A	17.3	24.6		35.4		42.7	
	Full load amps (FLA)	Total	A	1.2	1.3	1.5	1.8	2.6		
Wiring connections - 50Hz	For power supply	Quantity		5G						
	For connection with indoor	Quantity		2						
		Remark		F1,F2						
Power supply intake				Both indoor and outdoor unit						

Notes

(1) Cooling: indoor temp. 27°CDB, 19°CWB; outdoor temp. 35°CDB; equivalent piping length: 5m; level difference: 0m

(2) heating: indoor temp. 20°CDB; outdoor temp. 7°CDB, 6°CWB; equivalent refrigerant piping: 5m; level difference: 0m (nominal)

(3) Actual number of connectable indoor units depends on the indoor unit type (VRV indoor, Hydrobox, RA indoor, etc.) and the connection ratio restriction for the system (50% \<= CR \<= 130%)

(4) Refer to refrigerant pipe selection or installation manual

(5) RLA is based on following conditions: indoor temp. 27°CDB, 19°CWB; outdoor temp. 35°CDB

For more details on operation range see TW drawing

Voltage range: units are suitable for use on electrical systems where voltage supplied to unit terminal is not below or above listed range limits.

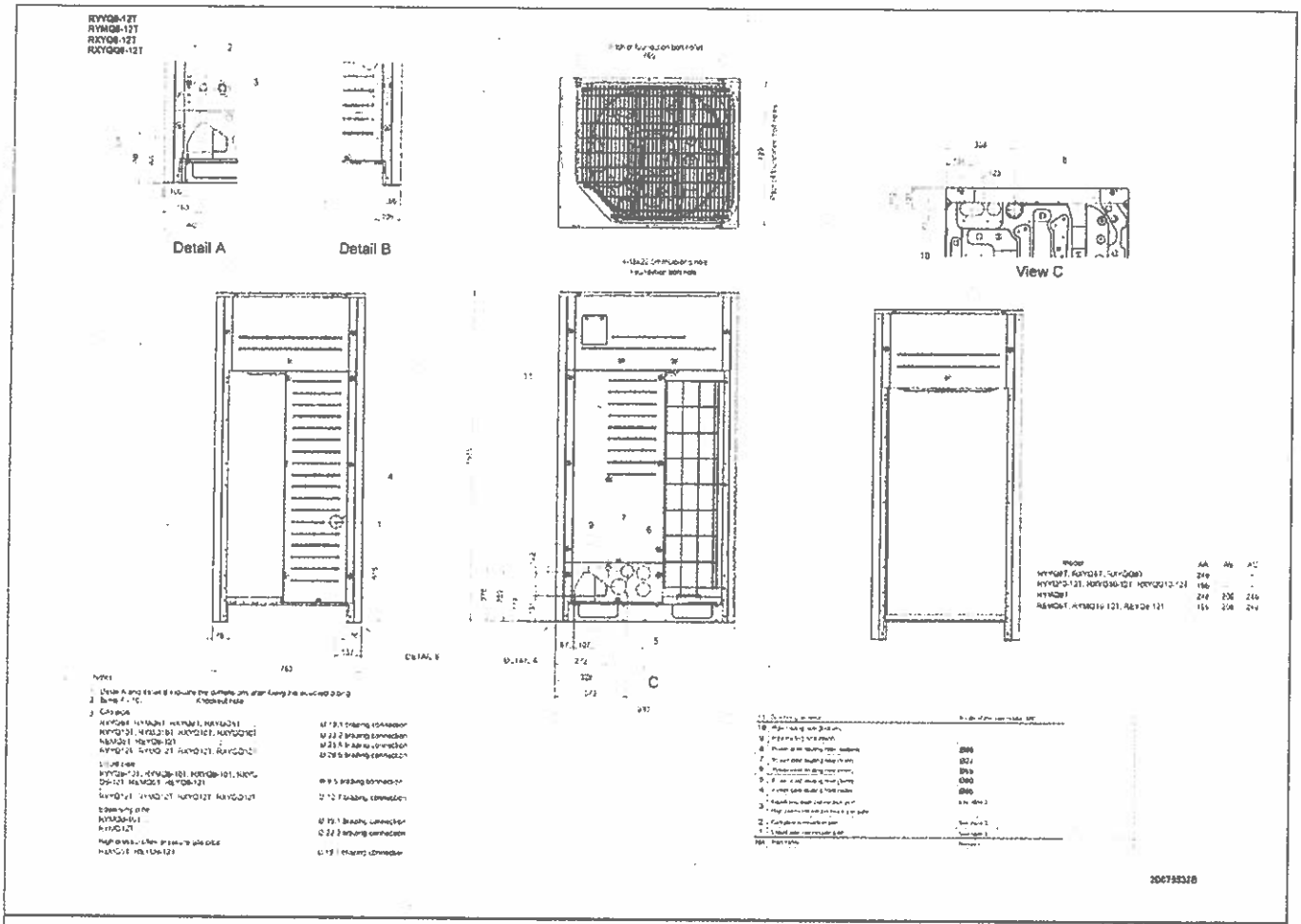
Maximum allowable voltage range variation between phases is 2%.

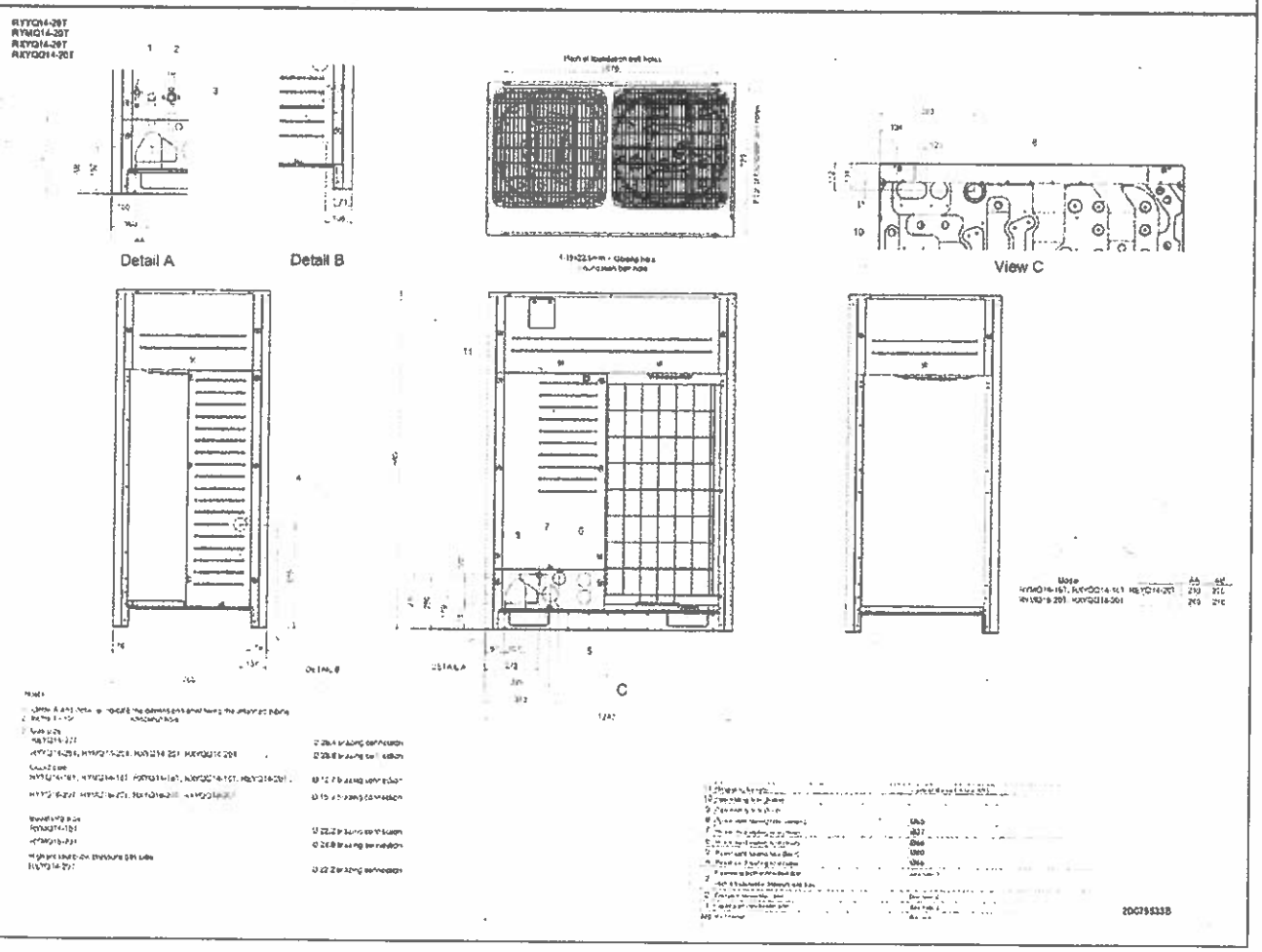
For more details on standard accessories refer to Installation/operation manual

MSC means the maximum current during start up of the compressor. VRV IV uses only inverter compressors. Starting current is always ≤ max. running current.

6 Dimensional drawings

6 - 1 Dimensional Drawings

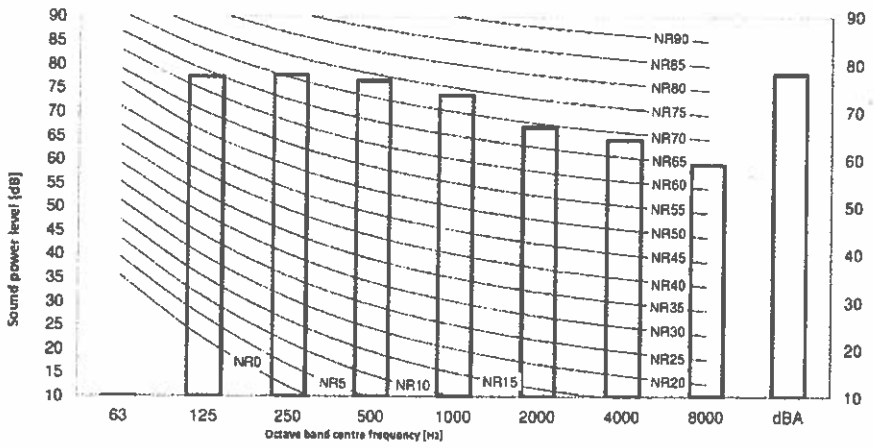




11 Sound data

11 - 1 Sound Power Spectrum

RYYQ8T
RYMQ8T
RXYQ8T
RXYQQ8T



Notes
1. dBA = A-weighted sound power level (A scale according to IEC)
2. Reference acoustic intensity 0dB = 10E-6uW/m²
3. Measured according to ISO 9744

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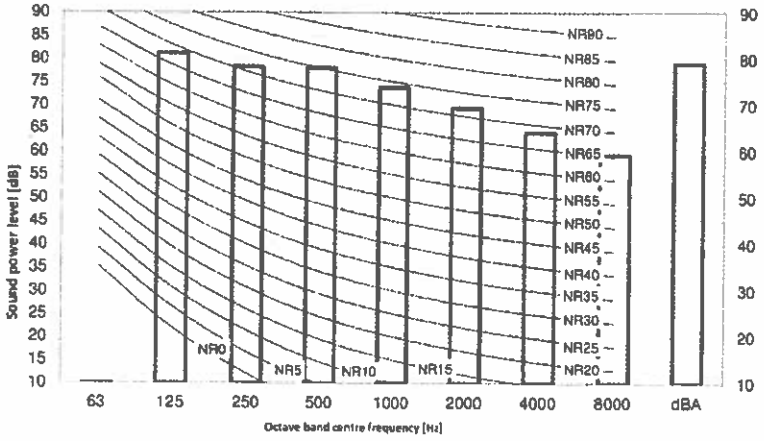
RYYQ10T
RYMQ10T
RXYQ10T
RXYQQ10T



Notes
1. dBA = A-weighted sound power level (A scale according to IEC)
2. Reference acoustic intensity 0dB = 10E-6uW/m²
3. Measured according to ISO 9744

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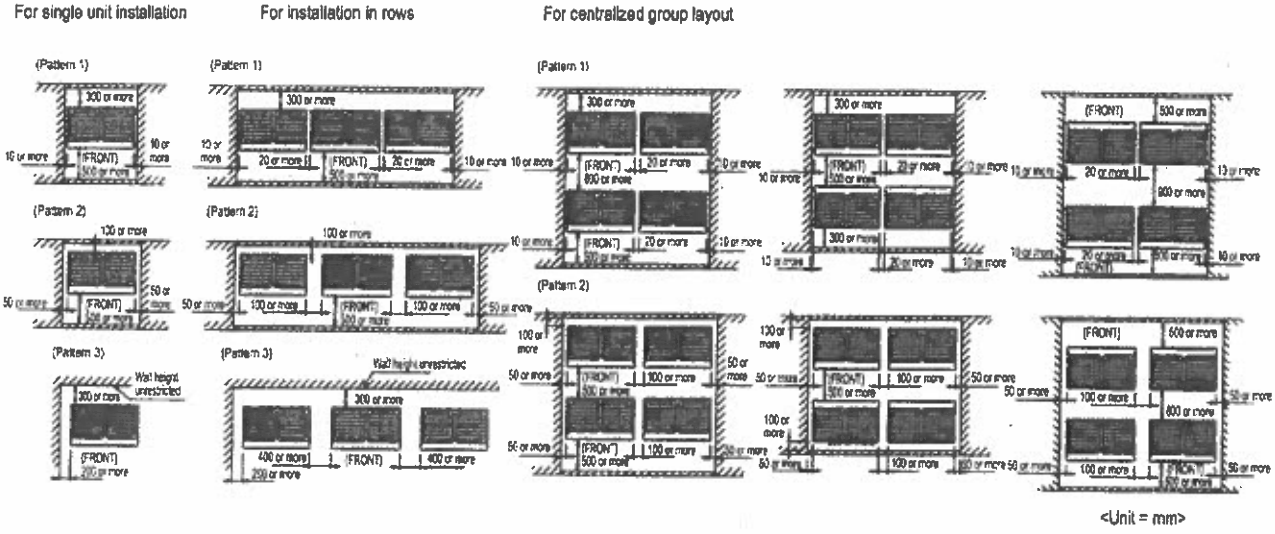
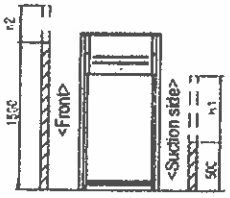
12 Installation

12 - 1 Installation Method

RYYQ-T
RYMQ-T
RXYQ-T
RXYQQ-T



<Unit = mm>



NOTES

1. Heights of walls in case of patterns 1 and 2:
   Front: 1500mm
   Suction side: 500mm
   Side: Height unrestricted
   Installation space as shown on this drawing is based on the cooling operation at 35 degrees outdoor air temperature.
   When the design outdoor air temperature exceeds 35 degrees or the load exceeds maximum ability of much generation load of heat in all outdoor unit, take the suction side space more broadly than the space as shown on this drawing.
2. If the above wall heights are exceeded then h2/2 and h1/2 should be added to the front and suction side service spaces respectively as shown in the figure on the right.
3. When installing the units most appropriate pattern should be selected from those shown above in order to obtain the best fit in the space available. Always keep in mind the need to leave enough space for a person to pass between units and wall and also for the air to circulate freely.
   (If more units are to be installed than are catered for in the above patterns your layout should take account of the possibility of short circuits).
4. The units should be installed to leave sufficient space at the front for the on site refrigerant piping work to be carried out comfortably.

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