Centric Close, Oval Road
London, NW1 7EP

Mechanical Services Plant
Noise Impact Assessment

Report ref.
RK2892/19443/Rev 2

Issued to
ThirdWay Interiors

Prepared by
Rob Kirkaldy BSc (Hons) MIOA
Senior Consultant

Version	Remarks	Date
Rev 0	Initial report issue.	02.01.2020
Rev 1	Revised as per updated scheme.	14.01.2020
Rev 2	Revised as per updated scheme.	18.08.2020

SECTION **TITLE** **PAGE**

1. INTRODUCTION

Thirdway Interiors are seeking planning permission to install new mechanical services plant at Block A, 425 Centric Close in Camden. The proposed units would be located externally at the rear of a ground floor commercial unit which has flats directly above. Accordingly, a noise impact assessment is required.

Spectrum Acoustic Consultants have been instructed by Thirdway Interiors, to carry out a Noise Impact Assessment to support the application. This report is submitted with the intention of providing sufficient information to both inform and satisfy the requirements of the Local Planning Authority.

2. SITE DESCRIPTION & PROPOSALS

The development site is located at 425 Centric Close, Oval Road, NW1 7EP. The scheme is part of a wider development consisting of commercial units at ground floor level, with apartments directly above. Bounding the site to the north are existing flats. To the east are existing commercial and residential properties fronting on to Oval Road. Bounding the site to the south and west is a busy railway line leading Euston Station. An existing site location plan is included in Appendix A.

Proposals involve installing three external air conditioning condensers, as well as a ventilation system which discharges to atmosphere on the north side of the building. The units would provide cooling and ventilation air to a commercial unit which occupies the basement and ground floor levels of the building. The commercial unit would be used during normal office hours only i.e. typically 08:00 to 18:00. Scheme proposals are included in Appendix B.

3. NOISE CRITERIA

3.1 BS 4142:2014 METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND

The noise impact assessment relating to mechanical plant will be carried out in accordance with the procedures set out in BS 4142:2014 *Methods for rating and assessing industrial and commercial sound.* The principle of BS 4142 is to determine an initial estimate of impact of industrial/commercial sound on nearby residents by comparing the Rating Level (sound level from the industrial/commercial source, with a correction applied for any acoustic features that characterise the sound) with the Background Sound Level (L_{A90} as measured in absence of the industrial/commercial source).

Generally, the greater the difference by which the Rating Level exceeds the Background Sound Level, the greater the magnitude of impact. BS 4142 states that *'a difference of around +10 dB or more is likely to be an indication of a significant adverse impact […]. A difference of around +5 dB is likely to be an indication of an 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.'*

However, BS 4142 also advises that '*when making assessments and arriving at decisions […] it is essential to place the sound in context'* so in each case, the context in which the sound is placed must be considered and the initial estimate of impact should be modified accordingly. For example it advises '*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*.' It also indicates that impacts estimated during '*the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes.*'

3.2 GUIDELINES FOR COMMUNITY NOISE - WORLD HEALTH ORGANIZATION, 1999 (WHO)

Table 4.1 of WHO references a guideline façade level of $L_{Aeq,8\ hour}$ 45dB outside of bedrooms during the night time to avoid sleep disturbance. During the daytime and evening, Table 4.1 recommends a guideline noise level of $L_{Aeq,16\ hour}$ 55dB for outdoor living areas to avoid serious annoyance. Whilst noise levels outside of living rooms during the daytime are not listed in Table 4.1, a guideline internal level of $L_{Aeq,16\ hour}$ 35dB for habitable rooms is provided to avoid moderate annoyance. Given that a difference of 15dB(A) between noise levels outside and inside of bedrooms during the night time is stated, a guideline noise level of $L_{Aeq,16\ hour}$ 50dB outside of living rooms may be assumed.

3.3 CAMDEN COUNCIL'S PLANT NOISE CRITERIA

Industrial and Commercial Noise Sources

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

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

Table 1: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

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

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises. The periods in Table 1 correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted Leq,5mins noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area.

4. BACKGROUND NOISE MEASUREMENT SURVEY

To inform the noise impact assessment, measurements of existing background noise levels were carried out during a noise survey conducted at the site from Thursday 12 to Tuesday 17 December 2019. Weather conditions during the survey were warm and dry, with low wind speeds, presenting good conditions for noise measurement purposes.

Measurements of noise were carried out at the rear of the building at first floor level, in accordance with BS 4142:2014 using an unattended noise logger. The monitoring location is considered representative of the nearest noise sensitive residential receptor locations to the proposed condenser units. Measurements consisted of continuous 15 minute periods. The microphone was mounted on a pole at first floor level. The location of the microphone is shown on the existing site location plan included in Appendix A.

The following instrumentation was used during the survey.

- Bruel & Kjaer Type 2250 Sound Level Meter s/n 3010945
- Bruel & Kjaer Type 4189 Microphone s/n 3060807
- Bruel & Kjaer Type 4231 Acoustic Calibrator s/n 3010648

Before and after the survey, the sound level meter was field-calibrated in accordance with the manufacturer's guidelines, and no significant drift was observed. The meter, microphone and field calibrator are laboratory calibrated biennially in accordance with UKAS procedures or to traceable National Standards.

Measurements made were of the following parameters:

- Maximum Noise Level – defined as the maximum (L_{Amax} the maximum noise level)
- Residual Noise Level – defined as the Energy Average Level of a period, in the absence of noise from the proposed development (L_{Aeq})
- Background Noise Level – defined as level exceeded for 90% of a period, in the absence of the noise from the proposed development (L_{A90})

The measured noise profile at the noise monitoring location is shown in the following chart.

Chart 1: Ambient noise profile – Thursday 12 to Tuesday 17 December 2019.

When determining the representative background $L_{A90,T}$ level for the relevant period, BS 4142[1] guidance states "*a representative level ought to account for the range in background levels and ought not automatically to be assumed to be either the minimum or modal value."* With this in mind, statistical analysis has been used to determine the typical background $L_{A90,T}$ noise level. This analysis derives the Mode, Mean and Mean -1 standard deviation values. Once these three values have been established, a judgement is made as to which value is considered representative. In this instance, both the mean and modal values were the same. Therefore this value is regarded as being representative.

Table 2 shows the representative background noise level measured at the nearest noise sensitive receptor location, during the daytime period when the plant items would be operating.

Measurement Location	Period	Background Noise Level
Nearest Flats directly above	08:00 – 18:00	$L_{A90,1hour}$ 49 dB

Table 2: Summary of the representative background noise level measured during the sensitive night-time period

As shown in Table 2, the representative background noise level at the nearest noise sensitive receptors to the proposed mechanical plant is $L_{A90,1hour}$ 49dB during the daytime when the units would be operating. This reflects a typical steady noise profile controlled by other nearby mechanical plant in the area.

[1] *BS 4142:2014 Methods for rating and assessing industrial and commercial sound*

5. ASSESSMENT OF NOISE IMPACT

5.1 PROJECTED NOISE FROM MECHANICAL PLANT

The proposed mechanical services plant items would be located at the rear of the building. The external condenser units would be located within a dedicated acoustic enclosure. The manufacturer's data sheets are included in Appendix B. The noise outputs (sound power levels) generated by the units are set out in Table 3 below.

Plant Item	No. of	Overall Sound Power Level dB(A)
Mitsubishi PURY-P250YNW-A	1	80
Mitsubishi PURY-P450YNW-A	1	89
Mitsubishi PUZ-ZM71VHA	1	70
HRU G.1 - Mitsubishi LGH-150RVXT-E	1	66
HRU G.2 - Mitsubishi LGH-200RVXT-E	1	68
HRU B.1 - Mitsubishi LGH-200RVXT-E	1	68
EF B.1 - TD-500/150 SILENT 3V	1	45
EF G.1 - TD-1300/250 SILENT 3V	1	54

Table 3: Sound power levels of the proposed external mechanical plant

The condenser units operate on thermostatic, speed and timer controls according to heat loads and occupation rates and so would not be operating 100% of the time. Whilst a typical on-time for this type of equipment might only 20-35%, a conservative and therefore more robust assessment assumes a 50% on-time for a typical worst-case scenario (ie 50% of all condensers operating at any one time).

Predictions of how the noise from the plant items propagates to the sensitive receptors is determined through modelling undertaken using proprietary software (Predictor[2]) which meets the requirements of ISO 9613 Part 2:1996[3]. The noise model takes account of the following in its calculations procedures:

- Source sound power level (for point, line and area sources)
- Reflection from nearby structures and source directivity
- Distance from noise source (geometric spreading)
- Atmospheric absorption
- Acoustic screening of intervening structures and topography
- Ground absorption
- Ground effects (which includes the height of ground relative to the noise source)

Detailed noise calculations of the totals at each receptor location are then computed. To illustrate the model, a diagram showing the distribution and locations of the mechanical plant noise sources, superimposed on a 3D view of the site is included in Appendix C.

---

[2] *Bruel and Kjaer – Predictor V11 Environmental Noise Calculation Software Package, Type 7810*

[3] *ISO 9613-2:1996 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation to determine Noise Levels*

A first model simulation has been completed, based on the sound power levels of standard (un-silenced) equipment. The results showed an excess over the noise limits, thereby indicating that the following equipment requires noise control mitigation, as specified in Table 4.

Required Noise Mitigation
• Operate each external condenser units in low noise mode. • Incorporate 10dB in-line silencers into the Heat Recovery Unit supply and extract ducts.

Table 4: Recommended noise control mitigation for mechanical plant items, as specified

The noise contour map and full table of results are also included in Appendix C for reference.

5.2 MECHANICAL PLANT NOISE IMPACT ASSESSMENT

The proposed plant items would run during office hours only. Therefore, the predicted plant rating levels will be compared with the representative $L_{A90,1hour}$ background noise level measured during the daytime at the nearest sensitive receptor locations.

Table 5 shows a BS 4142 assessment covering the mechanical plant noise impact during the daytime. None of the plant items emit any distinct impulses or tones. However, the plant does emit other characteristics that are distinctive against the existing residual acoustic environment. Therefore, a feature correction has been included in the rating level.

Residential Location	Specific Level (dB)	Character Correction (dB)	Rating Level (dB)	Background L_{A90} Noise Level (dB)	Assessment Level (dB) (Background excess)
R1. Plot 36	32	+3	34	49	-15
R2. Plot 37	24	+3	27	49	-22
R3. Plot 38	0	+3	3	49	-46
R4. Plot 70	33	+3	36	49	-13

Table 5: Predicted rating levels from the proposed plant items at the nearby sensitive receptor locations, compared with the representative background $L_{A90,1hour}$

As indicated in Table 5, the predicted rating levels would be 3-36dB at the nearby residential receptor locations. The predicted rating levels would be 13-46dB lower than the representative background $L_{A90,1hour}$ level. In line with BS 4142:2014, the noise impact would be very low. The difference between the rating levels and background levels is such that any uncertainty would have no significance on the outcome of the assessment.

The predicted rating levels would not exceed Camden Council's target noise criteria of no higher than 10dB(A) below the measured background noise level at all of the nearby residential receptor locations.

The predicted plant noise levels outside each of the nearest sensitive properties during the daytime are compared with the NR35 criteria below in Table 6.

Receiver Location	dB (A)	Octave Band Centre Frequency (Hz)							
		63	125	250	500	1000	2000	4000	8000
R1. Plot 36	32	27	27	24	19	21	15	8	3
R2. Plot 37	24	19	20	16	10	9	1	-	-
R3. Plot 38	0	-	-	-	-	-	-	-	-
R4. Plot 70	33	28	30	26	20	21	15	8	1
NR35		**63.1**	**52.4**	**44.5**	**38.9**	**35.0**	**32.0**	**29.8**	**28.0**

Table 6: Predicted plant noise levels compared with the NR35 daytime criteria curve

Specific noise levels from mechanical plant would be comfortably lower than the NR35 criteria. Furthermore, specific noise levels from mechanical plant would also be comfortably lower than the WHO $L_{Aeq,16\ hour}$ 50dB advised daytime criteria at all of the nearby residential receptor locations.

In view of the above, noise levels from mechanical services plant would have a very low impact and would therefore be acceptable.

6. CONCLUSIONS

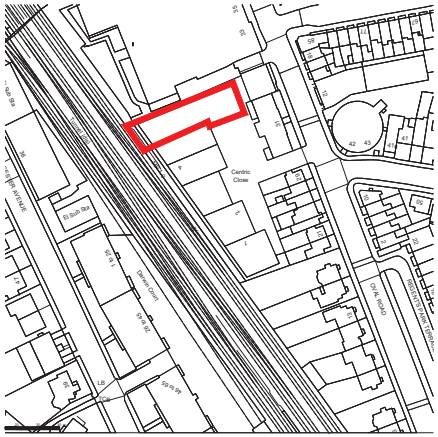
At the request of the Local Planning Authority, a noise assessment has been completed relating to the potential impact of noise produced by the operation of proposed mechanical services plant at Block A, 425 Centric Close in Camden, NW1 7EP.

A background noise measurement survey has been conducted at a location representative of the nearest noise sensitive receptors to the proposed plant and predictions of noise have been completed.

Noise limits for the proposed mechanical plant have been established for the sensitive daytime period, based on the representative background noise level and taking account of BS 4142, WHO and Camden Council's criteria for noise. Predictions have indicated that noise levels from mechanical services plant would have a very low impact and would therefore be acceptable.

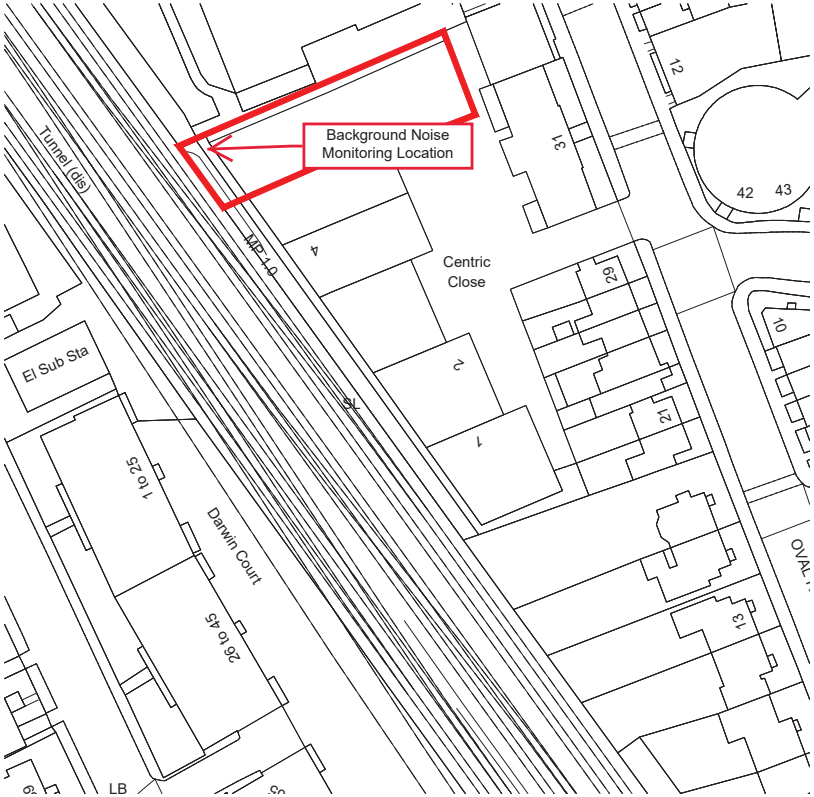
APPENDIX A

Existing Site Location Plan



01 SITE LOCATION PLAN
Scale: 1:1250

10 0 10 20 30 40 50
Metres



02 BLOCK PLAN
Scale: 1:500

10 0 10 20 30 40 50
Metres

THIRDWAY

C:\Users\Rob.South\Box\01. All TWI Client Projects\JON ADAM – CAMDEN – 19136\03. Design CAD\Construction Drawings\05_PLANNING\TWI 19136 PLN.dwg

NOTES

THIRDWAY INTERIORS DO NOT ACCEPT LIABILITY FOR ANY ERRORS AND OMISSIONS ARISING FROM THE PREPARATION OF BASE BUILD DRAWINGS WHICH ARE DERIVED FROM ORIGINAL MATERIAL PROVIDED BY OTHERS.

ALL DISCREPANCIES ARE TO BE REPORTED TO THIRDWAY INTERIORS.

GRID LINES ARE FOR REFERENCE PURPOSES ONLY.

ALL DIMENSIONS TO BE VERIFIED BY CONTRACTOR ON SITE PRIOR TO ANY WORKS COMMENCING.

DO NOT SCALE FROM THIS DRAWING.

THIRDWAY INTERIORS

N

STATUS

- **Approval / Comment**
- **Building Control**
- **Contract**
- **Construction**
- **As-Built**

REVISION DETAIL

REV	DETAIL	BY	DATE
A	ISSUE FOR PLANNING	RS	10/12

CLIENT

JOHN ADAM FASHION

PROJECT ADDRESS

MODE, CENTRIC CLOSE
OVAL ROAD
CAMDEN,LONDON.
NW1 7EP

PLANNING APPLICATION

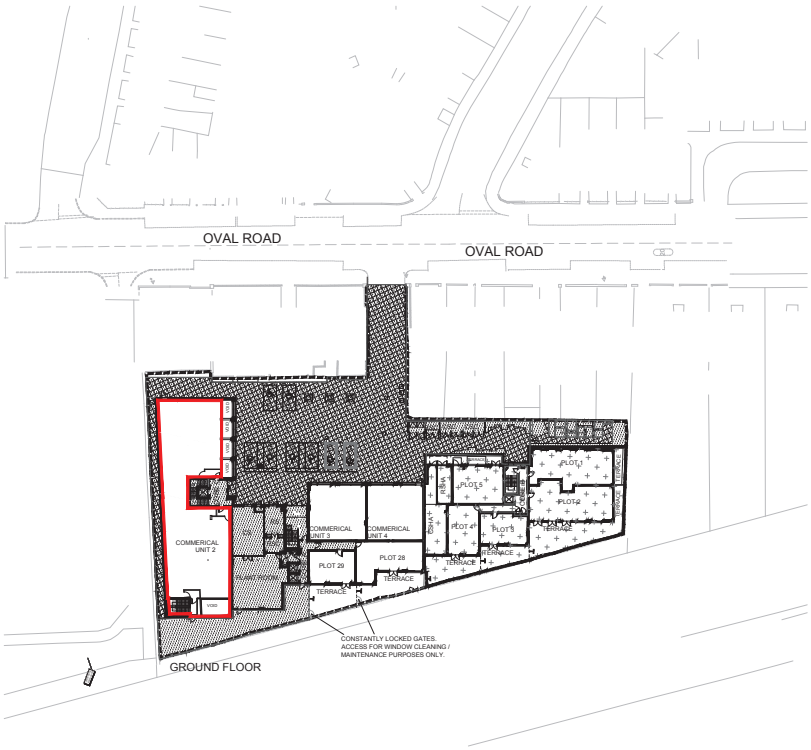
DRAWING TITLE

EXISTING SITE LOCATION AND BLOCK PLAN

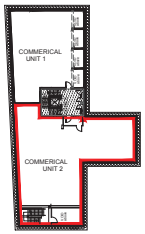
DWG NO:	**19136 PLN 01**
REVISION:	**A**
SCALE @A1:	**AS SHOWN**
DATE:	**10/12/19**
DRAWN BY:	**RS**
CHECKED BY:	**TL**

APPENDIX B

Scheme Proposals and Manufacturer's Data Sheets

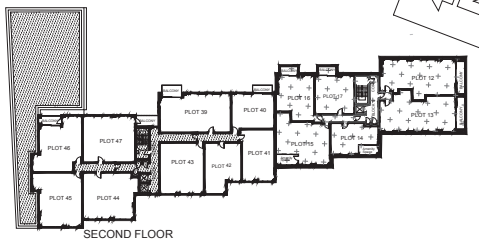


GROUND FLOOR

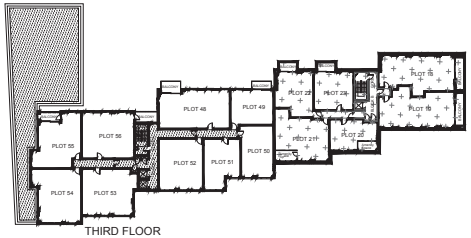


BASEMENT PLAN

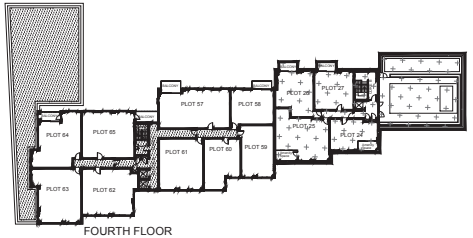
FIRST FLOOR



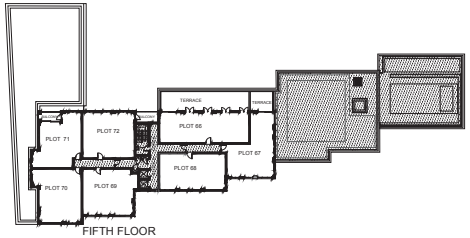
SECOND FLOOR



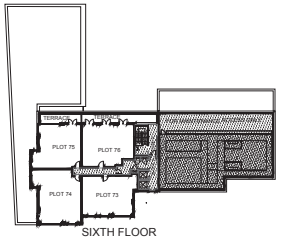
THIRD FLOOR



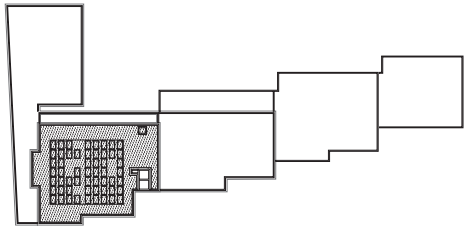
FOURTH FLOOR



FIFTH FLOOR



SIXTH FLOOR



ROOF PLAN

FOR APPROVAL

NOTES:

KEY:

- Site Boundary
- Commercial Unit Premises Demise
- Housing Association Freehold area
- Vehicular / pedestrian right of way
- Area of Management Company responsibility
- Private roads to be maintained by management company with HA right to pass and re pass with or without vehicles.
- DPHA — Disabled Parking bay for Housing Association
- UDP** — Disabled Parking bay (** indicates Plot Number bay is allocated to)
- DPC — Disable Parking for Commercial / Community Unit
- CSHA — Cycle Store for use by HA units
- CS — Cycle Store/Stands for use by Private units
- CSC — Cycle Store/Stands for use by Commercial Units.
- RS — Refuse/Recycling Store for Private units
- RSHA — Refuse/Recycling Store for Housing Association
- RSC — Refuse/Recycling Store for Commercial units
- SS — Sub-Station
- Double Car Charging Point
- Tree pit / tree grid

DRAFT AWAITING APPROVAL

REV	AMENDMENTS	BY	DATE

Fairview NEW HOMES Ltd.
Technical Department,
50 Lancaster Road, Enfield, Middlesex EN2 0BY
Telephone No: 020-8366-1271 Facimile No: 020-8342-3861
Website: www.fairview.co.uk E-mail: technical@fnhltd.co.uk

Drawn:	Date:	Scale:
P.J	20-07-17	1:1000 @ A3
Checked:	Approved:	

Title:

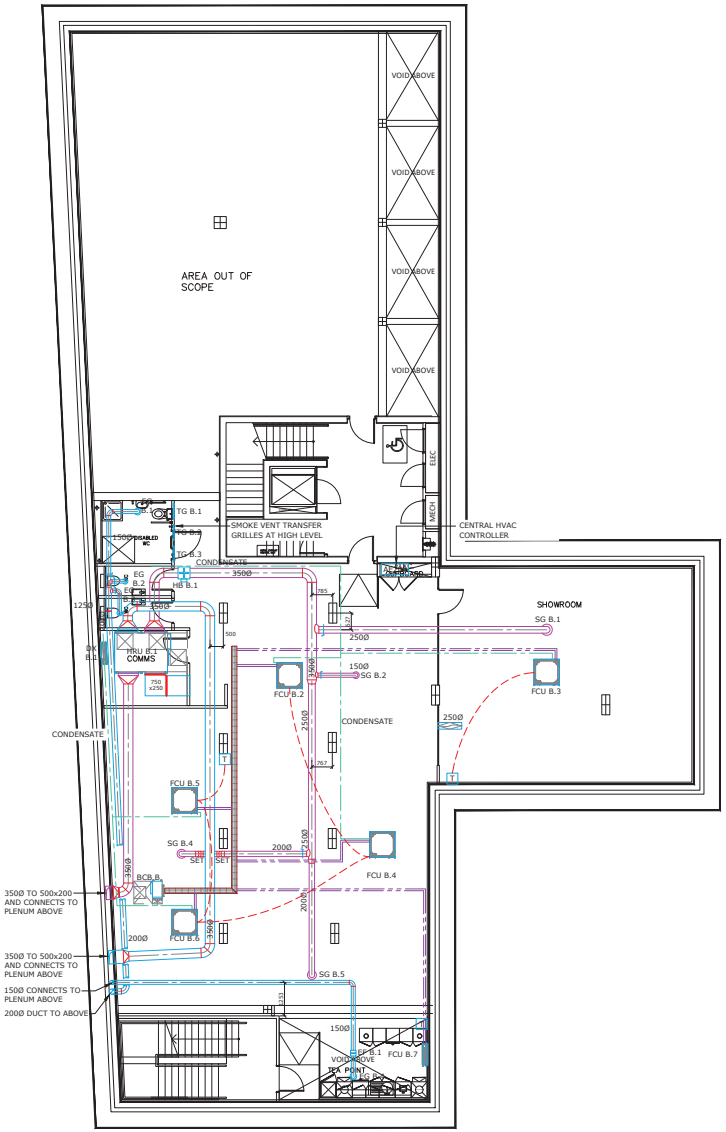
Commercial Unit 2 Ground Floor and Basement Demise

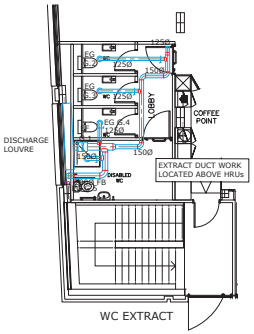
Project: 425 Centric Close Camden NW1-7EP

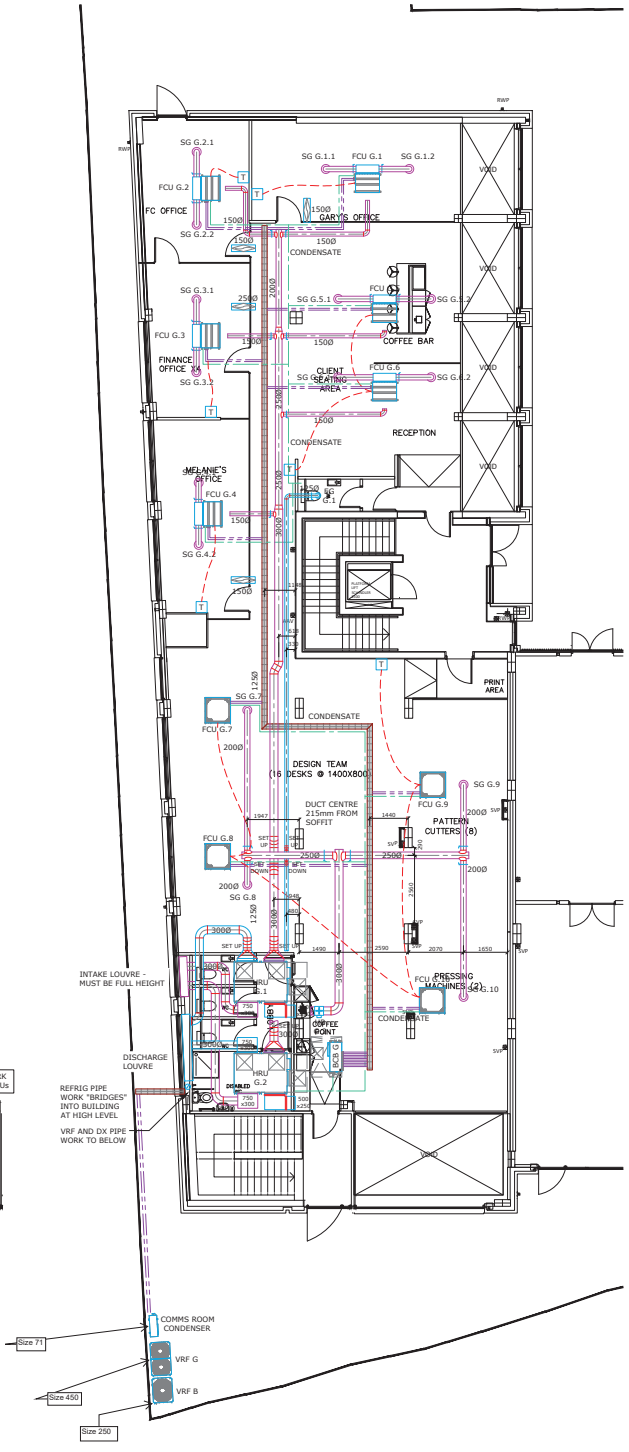
Drawing Number: FNH 425-Comm. Unit 2_01 Rev:

dwg: FNH 425 CENTRIC CLOSE.dwg A1

Issued : Daniel Kong 09/10/2019 09:24:05
Dwg file path: O:\05 FNH PROJECTS\FNH400-449\425 Centric Close, Oval Road, Camden Town, NW1 7EP\03 Legals\31 Legal Plan







NOTES:

THIS DRAWING SHOWS A CONSTRUCTION STAGE LAYOUT BUT WILL BE SUBJECT TO CHANGE AS THE PROJECT DEVELOPS.

Rev	Date	Revision	Drawn	Apvd
F	20.07.20	UPDATED LAYOUT INCORPORATED	IK	-
E	15.07.20	UPDATED TO CLIENT COMMENTS DIMS ADDED	IK	-
D	10.07.20	DX AND CONTROLS RELOCATED	IK	-
C	01.07.20	COORDINATED WITH LIGHTING	IK	-
B	30.06.20	CONDENSER UNITS, REFRIG PIPE WORK AND CONTROLLERS SHOWN	IK	-
A	30.06.20	HRU B,1 RELOCATED, SMOKE VENT TRANSFER GRILLES ADDED	IK	-

361° a degree further

air conditioning, ventilation, heating, energy controls, service+maintenance

Client: THIRDWAY INTERIORS

Project: JON ADAM FASHION

Title: MECHANICAL SERVICES HVAC LAYOUT

Scale: 1:100 @ A1

Date: 25.06.20

Drawing No.: 361-BG-22381-M

Rev: F

TECHNICAL CHARACTERISTICS

TD-SILENT	Speed (r.p.m.)	Maximum absorbed power (W)	Maximum absorbed current (A)	Maximum airflow (m^3/h)	Sound pressure level* (dB(A))	Min-Max air temperature (°C)	Weight (kg)	Duct diameter (mm)	3-speed switch	Speed controller	Wiring diagram** (nº)
TD-160/100 N SILENT	2400	29	0,17	180	24	-20/+40	1,4	100	COM-2 REGUL-2	RMB-1,5 REB-1	9, 10
	2200	18	0,11	150	22						
TD-250/100 SILENT	2210	27	0,12	250	25	-20/+40	5,4	100	COM-2 REGUL-2	RMB-1,5 REB-1	9, 10
	1680	21	0,1	200	20						
TD-350/125 SILENT	2100	27	0,12	330	23	-20/+40	5	125	COM-2 REGUL-2	RMB-1,5 REB-1	9, 10
	1650	21	0,1	260	18						
TD-500/150-160 SILENT 3V	2480	59	0,26	550	27	-20/+60	6	150/160	COM-3 INTER 4P	RMB-1,5 REB-1	9, 10
	2060	50	0,22	450	22						
	1610	45	0,2	350	17						
TD-800/200 SILENT 3V	2170	102	0,5	910	28	-20/+60	8,7	200	COM-3 INTER 4P	RMB-1,5 REB-1	9, 10
	1870	92	0,47	780	24						
	1660	90	0,46	690	22						
TD-1000/200 SILENT 3V	2450	130	0,55	1.040	29	-20/+60	8,7	200	COM-3 INTER 4P	RMB-1,5 REB-1	9, 10
	2210	127	0,55	910	27						
	1920	122	0,53	790	24						
TD-1300/250 SILENT 3V	2530	204	0,85	1.320	36	-20/+60	20	250	COM-3 INTER 4P	RMB-1,5 REB-1	12, 13
	2230	163	0,68	1.160	33						
	2030	144	0,6	1.040	31						
TD-2000/315 SILENT 3V	2670	293	1,25	1.770	39	-40/+60	25	315	COM-3 INTER 4P	RMB-1,5 REB-2,5	12, 13
	2490	232	0,97	1.610	38						
	2240	190	0,78	1.480	36						

* Sound pressure level radiated at 3 m at free air conditions with rigid ducts at the inlet and at the outlet.
** See section of Wiring Diagrams.

TD-SILENT	Speed (r.p.m.)	Maximum absorbed power (W)	Maximum absorbed current (A)	Maximum airflow (m^3/h)	Sound pressure level* (dB(A))	Min-Max air temperature (°C)	Weight (kg)	Duct diameter (mm)
TD-160/100 NT SILENT	2400	29	0,17	180	24	-20/+40	1,4	100
TD-250/100 SILENT T	2140	28	0,12	250	34	-20/+40	2	100
TD-350/125 SILENT T	2050	26	0,11	330	33	-20/+40	2	125
TD-500/150-160 SILENT T 3V**	2590	53	0,21	560	35	-20/+60	2,7	150
	2150	44	0,19	470	31			
	1820	41	0,18	390	26			
TD-800/200 SILENT T 3V**	2170	102	0,5	910	28	-20/+60	8,7	200
	1870	92	0,47	780	24			
	1660	90	0,46	690	22			
TD-1000/200 SILENT T 3V**	2450	130	0,55	1.040	29	-20/+60	8,7	200
	2210	127	0,55	910	27			
	1920	122	0,53	790	24			

* Radiated sound pressure level measured at 3 m, in free field conditions, with rigid ducts at the inlet and outlet.
** Temporisation only on high speed

TECHNICAL CHARACTERISTICS

TD-SILENT	Speed (r.p.m.)	Maximum absorbed power (W)	Maximum absorbed current (A)	Maximum airflow (m^3/h)	Sound pressure level* (dB(A))	Min-Max air temperature (°C)	Weight (kg)	Duct diameter (mm)	3-speed switch	Speed controller	Wiring diagram** (nº)
TD-160/100 N SILENT	2400	29	0,17	180	24	-20/+40	1,4	100	COM-2 REGUL-2	RMB-1,5 REB-1	9, 10
	2200	18	0,11	150	22						
TD-250/100 SILENT	2210	27	0,12	250	25	-20/+40	5,4	100	COM-2 REGUL-2	RMB-1,5 REB-1	9, 10
	1680	21	0,1	200	20						
TD-350/125 SILENT	2100	27	0,12	330	23	-20/+40	5	125	COM-2 REGUL-2	RMB-1,5 REB-1	9, 10
	1650	21	0,1	260	18						
TD-500/150-160 SILENT 3V	2480	59	0,26	550	27	-20/+60	6	150/160	COM-3 INTER 4P	RMB-1,5 REB-1	9, 10
	2060	50	0,22	450	22						
	1610	45	0,2	350	17						
TD-800/200 SILENT 3V	2170	102	0,5	910	28	-20/+60	8,7	200	COM-3 INTER 4P	RMB-1,5 REB-1	9, 10
	1870	92	0,47	780	24						
	1660	90	0,46	690	22						
TD-1000/200 SILENT 3V	2450	130	0,55	1.040	29	-20/+60	8,7	200	COM-3 INTER 4P	RMB-1,5 REB-1	9, 10
	2210	127	0,55	910	27						
	1920	122	0,53	790	24						
TD-1300/250 SILENT 3V	2530	204	0,85	1.320	36	-20/+60	20	250	COM-3 INTER 4P	RMB-1,5 REB-1	12, 13
	2230	163	0,68	1.160	33						
	2030	144	0,6	1.040	31						
TD-2000/315 SILENT 3V	2670	293	1,25	1.770	39	-40/+60	25	315	COM-3 INTER 4P	RMB-1,5 REB-2,5	12, 13
	2490	232	0,97	1.610	38						
	2240	190	0,78	1.480	36						

* Sound pressure level radiated at 3 m at free air conditions with rigid ducts at the inlet and at the outlet.
** See section of Wiring Diagrams.

TD-SILENT	Speed (r.p.m.)	Maximum absorbed power (W)	Maximum absorbed current (A)	Maximum airflow (m^3/h)	Sound pressure level* (dB(A))	Min-Max air temperature (°C)	Weight (kg)	Duct diameter (mm)
TD-160/100 NT SILENT	2400	29	0,17	180	24	-20/+40	1,4	100
TD-250/100 SILENT T	2140	28	0,12	250	25	-20/+40	2	100
TD-350/125 SILENT T	2050	26	0,11	330	23	-20/+40	2	125
TD-500/150-160 SILENT T 3V**	2590	53	0,21	560	27	-20/+60	2,7	150
	2150	44	0,19	470	22			
	1820	41	0,18	390	17			
TD-800/200 SILENT T 3V**	2170	102	0,5	910	28	-20/+60	8,7	200
	1870	92	0,47	780	24			
	1660	90	0,46	690	22			
TD-1000/200 SILENT T 3V**	2450	130	0,55	1.040	29	-20/+60	8,7	200
	2210	127	0,55	910	27			
	1920	122	0,53	790	24			

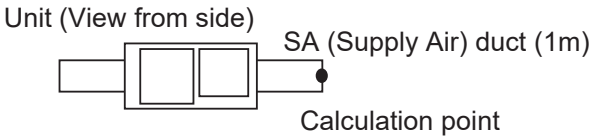
* Radiated sound pressure level measured at 3 m, in free field conditions, with rigid ducts at the inlet and outlet.
** Temporisation only on high speed

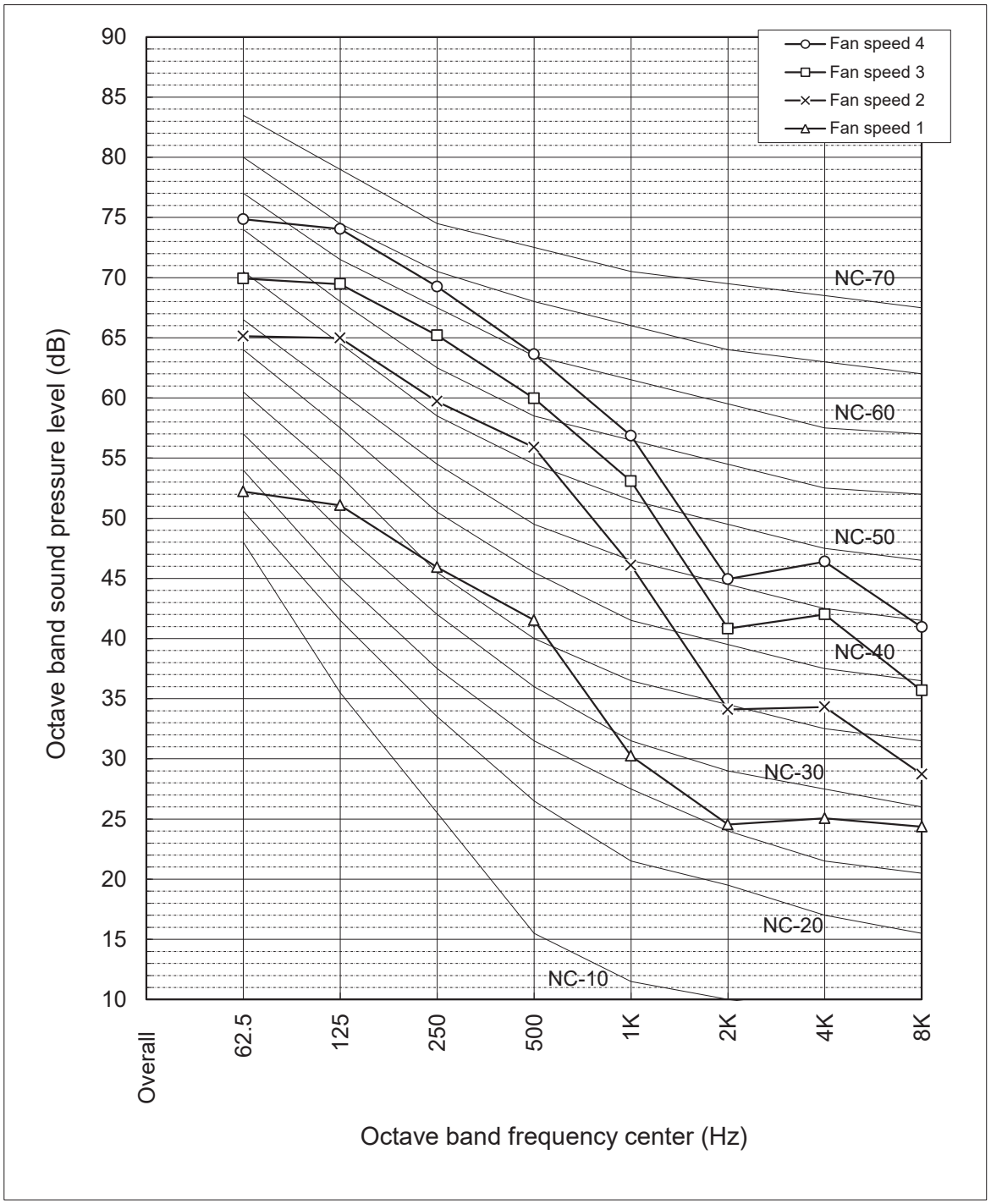
MITSUBISHI ELECTRIC
Changes for the Better

MITSUBISHI ELECTRIC CORPORATION
NAKATSUGAWA WORKS

NC Curves (Calculated induct PWL)

Model	LGH-150RVXT-E
Background noise [dB]	25dB or less (A range)
Measurement site	Anechoic chamber
Ventilation mode	Lossnay ventilation
Power supply	Single phase 230V, 50Hz





N15HHGT0029A

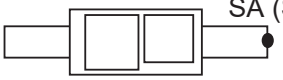
MITSUBISHI ELECTRIC
Changes for the Better

MITSUBISHI ELECTRIC CORPORATION
NAKATSUGAWA WORKS

NC Curves (Calculated induct PWL)

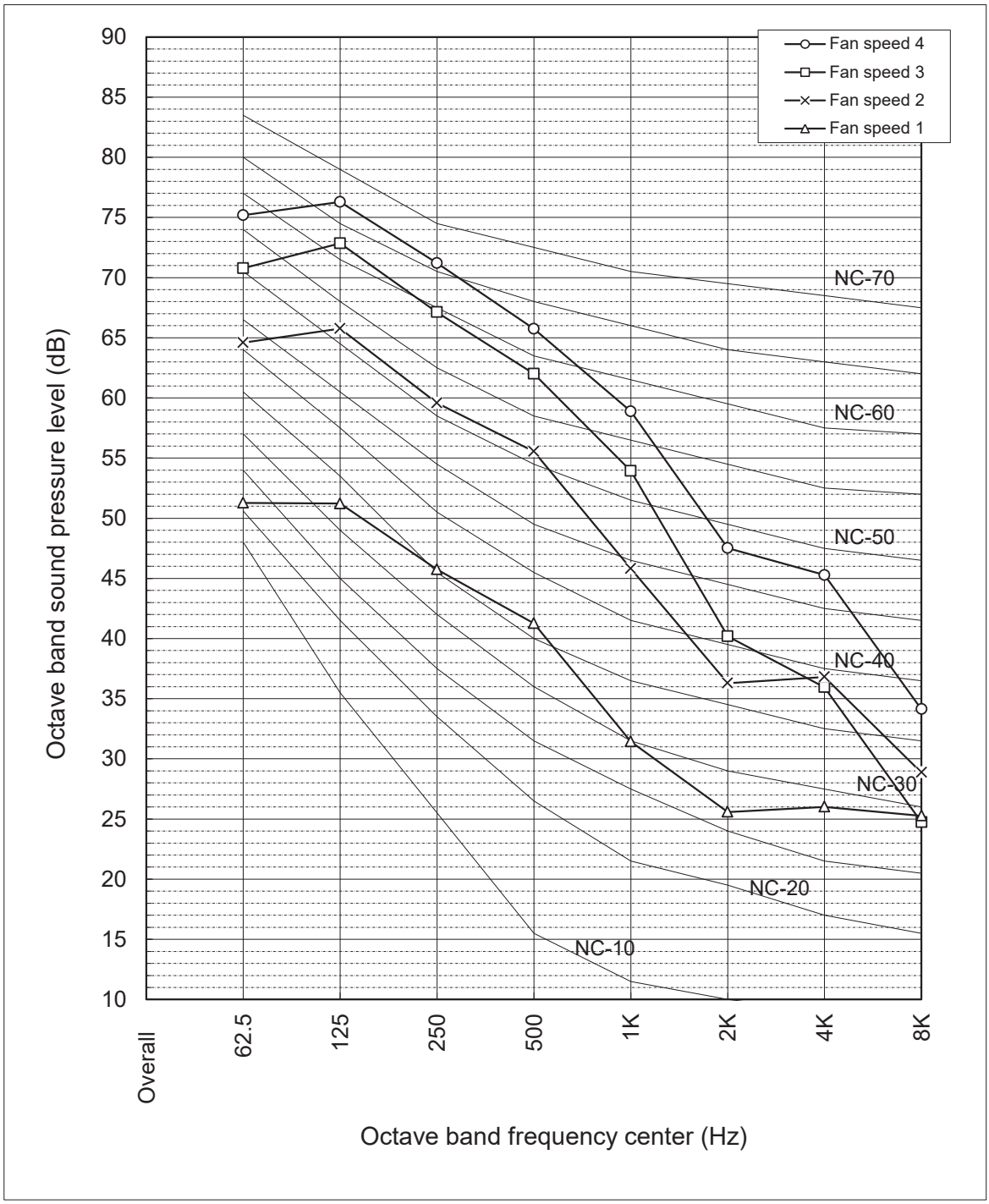
Model	LGH-200RVXT-E
Background noise [dB]	25dB or less (A range)
Measurement site	Anechoic chamber
Ventilation mode	Lossnay ventilation
Power supply	Single phase 230V, 50Hz

Unit (View from side)



SA (Supply Air) duct (1m)

Calculation point



1. SPECIFICATIONS

Model				PURY-P250YNW-A (-BS)
Power source				3-phase 4-wire 380-400-415 V 50/60 Hz
Cooling capacity (Nominal)		*1	kW	28.0
			kcal/h	25,000
			BTU/h	95,500
	Power input		kW	5.97
	Current input		A	10.0-9.5-9.2
	EER		kW/kW	4.69
Temp. range of cooling	Indoor		W.B.	15.0~24.0°C (59~75°F)
	Outdoor		D.B.	-5.0~52.0°C (23~126°F)
Heating capacity (Max)		*2	kW	31.5
			kcal/h	27,100
			BTU/h	107,500
	Power input		kW	6.06
	Current input		A	10.2-9.7-9.3
	COP		kW/kW	5.19
(Nominal)		*3	kW	28.0
			kcal/h	25,000
			BTU/h	95,500
	Power input		kW	5.27
	Current input		A	8.8-8.4-8.1
	COP		kW/kW	5.31
Temp. range of heating	Indoor		D.B.	15.0~27.0°C (59~81°F)
	Outdoor		W.B.	-20.0~15.5°C (-4~60°F)
Indoor unit connectable	Total capacity			50~150%
	Model/Quantity			P15~P250/1~25
Sound pressure level (measured in anechoic room) *4			dB <A>	60.5/61.0
Sound power level (measured in anechoic room) *4			dB <A>	78.5/80.0
Refrigerant piping diameter	High pressure		mm (in.)	19.05 (3/4) Brazed
	Low pressure		mm (in.)	22.2 (7/8) Brazed
FAN	Type x Quantity			Propeller fan x 1
	Air flow rate		m^3/min	185
			L/s	3,083
			cfm	6,532
	Control, Driving mechanism			Inverter-control, Direct-driven by motor
	Motor output		kW	0.92 x 1
*5	External static press.			0 Pa (0 mmH_2O)
Compressor	Type			Inverter scroll hermetic compressor
	Manufacture			AC&R Works, MITSUBISHI ELECTRIC CORPORATION
	Starting method			Inverter
	Motor output		kW	7.0
	Case heater		kW	-
	Lubricant			MEL32
External finish				Pre-coated galvanized steel sheets (+powder coating for -BS type) <MUNSELL 5Y 8/1 or similar>
External dimension H x W x D			mm	1,858 (1,798 without legs) x 920 x 740
			in.	73-3/16 (70-13/16 without legs) x 36-1/4 x 29-3/16
Protection devices	High pressure protection			High pressure sensor, High pressure switch at 4.15 MPa (601 psi)
	Inverter circuit (COMP./FAN)			Over-heat protection, Over-current protection
	Compressor			-
	Fan motor			-
Refrigerant	Type x original charge			R410A x 5.2 kg (12 lbs)
	Control			Indoor LEV and BC controller
Net weight			kg (lbs)	229 (505)
Heat exchanger				Salt-resistant cross fin & copper tube
HIC circuit (HIC: Heat Inter-Changer)				-
Defrosting method				Auto-defrost mode (Reversed refrigerant cycle)
Drawing	External			WKS94T748
	Wiring			WKE94G339
Standard attachment	Document			Installation Manual
	Accessory			-
Optional parts				Joint: CMY-Y102SS-G2,CMY-Y102LS-G2,CMY-R160-J1 BC controller: CMB-P104,106,108,1012,1016V-J Main BC controller: CMB-P108,1012,1016V-JA,CMB-P1016V-KA Sub BC controller: CMB-P104, 108V-KB
Remarks				Details on foundation work, duct work, insulation work, electrical wiring, power source switch, and other items shall be referred to the Installation Manual. Due to continuing improvement, above specifications may be subject to change without notice.

Notes:

1.Nominal cooling conditions (subject to JIS B8615-2)
Indoor: 27°CD.B./19°CW.B. (81°FD.B./66°FW.B.), Outdoor: 35°CD.B./24°CW.B. (95°FD.B./75°FW.B.)
Pipe length: 7.5 m (24-9/16 ft.), Level difference: 0 m (0 ft.)
2.Nominal heating conditions (subject to JIS B8615-2)
Indoor: 20°CD.B. (68°FD.B.), Outdoor: 7°CD.B./6°CW.B. (45°FD.B./43°FW.B.)
Pipe length: 7.5 m (24-9/16 ft.), Level difference: 0 m (0 ft.)
3.Nominal heating conditions (subject to JIS B8615-2)
Indoor: 20°CD.B. (68°FD.B.), Outdoor: 7°CD.B./6°CW.B. (45°FD.B./43°FW.B.)
Pipe length: 7.5 m (24-9/16 ft.), Level difference: 0 m (0 ft.)
Eurovent registered
4.Cooling mode/Heating mode
5.External static pressure option is available (30 Pa, 60 Pa, 80 Pa/3.1 mmH_2O, 6.1 mmH_2O, 8.2 mmH_2O).
Consult your dealer about the specification when setting External static pressure option.

Unit converter

BTU/h	=kW x 3,412
cfm	=m^3/min x 35.31
lbs	=kg/0.4536

*Above specification data is subject to rounding variation.

1. SPECIFICATIONS

Model				PURY-P450YNW-A (-BS)
Power source				3-phase 4-wire 380-400-415 V 50/60 Hz
Cooling capacity (Nominal)		*1	kW	50.0
			kcal/h	45,000
			BTU/h	170,600
	Power input		kW	12.37
	Current input		A	20.8-19.8-19.1
	EER		kW/kW	4.04
Temp. range of cooling	Indoor		W.B.	15.0~24.0°C (59~75°F)
	Outdoor		D.B.	-5.0~52.0°C (23~126°F)
Heating capacity (Max)		*2	kW	56.0
			kcal/h	50,000
			BTU/h	191,100
	Power input		kW	13.48
	Current input		A	22.7-21.6-20.8
	COP		kW/kW	4.15
(Nominal)		*3	kW	50.0
			kcal/h	45,000
			BTU/h	170,600
	Power input		kW	10.91
	Current input		A	18.4-17.4-16.8
	COP		kW/kW	4.58
Temp. range of heating	Indoor		D.B.	15.0~27.0°C (59~81°F)
	Outdoor		W.B.	-20.0~15.5°C (-4~60°F)
Indoor unit connectable	Total capacity			50~150%
	Model/Quantity			P15~P250/1~45
Sound pressure level (measured in anechoic room) *4			dB <A>	65.5/70.0
Sound power level (measured in anechoic room) *4			dB <A>	83.0/89.0
Refrigerant piping diameter	High pressure		mm (in.)	22.2 (7/8) Brazed
	Low pressure		mm (in.)	28.58 (1-1/8) Brazed
FAN	Type x Quantity			Propeller fan x 2
	Air flow rate		m^3/min	315
			L/s	5,250
			cfm	11,123
	Control, Driving mechanism			Inverter-control, Direct-driven by motor
	Motor output		kW	0.46 x 2
*5	External static press.			0 Pa (0 mmH_2O)
Compressor	Type			Inverter scroll hermetic compressor
	Manufacture			AC&R Works, MITSUBISHI ELECTRIC CORPORATION
	Starting method			Inverter
	Motor output		kW	12.4
	Case heater		kW	-
	Lubricant			MEL32
External finish				Pre-coated galvanized steel sheets (+powder coating for -BS type) <MUNSELL 5Y 8/1 or similar>
External dimension H x W x D			mm	1,858 (1,798 without legs) x 1,240 x 740
			in.	73-3/16 (70-13/16 without legs) x 48-7/8 x 29-3/16
Protection devices	High pressure protection			High pressure sensor, High pressure switch at 4.15 MPa (601 psi)
	Inverter circuit (COMP./FAN)			Over-heat protection, Over-current protection
	Compressor			-
	Fan motor			-
Refrigerant	Type x original charge			R410A x 10.8 kg (24 lbs)
	Control			Indoor LEV and BC controller
Net weight			kg (lbs)	293 (646)
Heat exchanger				Salt-resistant cross fin & copper tube
HIC circuit (HIC: Heat Inter-Changer)				-
Defrosting method				Auto-defrost mode (Reversed refrigerant cycle)
Drawing	External			WKS94T749
	Wiring			WKE94G341
Standard attachment	Document			Installation Manual
	Accessory			-
Optional parts				Joint: CMY-Y102SS-G2,CMY-Y102LS-G2,CMY-R160-J1 Main BC controller: CMB-P108,1012,1016V-JA,CMB-P1016V-KA Sub BC controller: CMB-P104, 108V-KB
Remarks				Details on foundation work, duct work, insulation work, electrical wiring, power source switch, and other items shall be referred to the Installation Manual. Due to continuing improvement, above specifications may be subject to change without notice.

Notes:

1.Nominal cooling conditions (subject to JIS B8615-2)
Indoor: 27°CD.B./19°CW.B. (81°FD.B./66°FW.B.), Outdoor: 35°CD.B./24°CW.B. (95°FD.B./75°FW.B.)
Pipe length: 7.5 m (24-9/16 ft.), Level difference: 0 m (0 ft.)
2.Nominal heating conditions (subject to JIS B8615-2)
Indoor: 20°CD.B. (68°FD.B.), Outdoor: 7°CD.B./6°CW.B. (45°FD.B./43°FW.B.)
Pipe length: 7.5 m (24-9/16 ft.), Level difference: 0 m (0 ft.)
3.Nominal heating conditions (subject to JIS B8615-2)
Indoor: 20°CD.B. (68°FD.B.), Outdoor: 7°CD.B./6°CW.B. (45°FD.B./43°FW.B.)
Pipe length: 7.5 m (24-9/16 ft.), Level difference: 0 m (0 ft.)
Eurovent registered
4.Cooling mode/Heating mode
5.External static pressure option is available (30 Pa, 60 Pa, 80 Pa/3.1 mmH_2O, 6.1 mmH_2O, 8.2 mmH_2O).
Consult your dealer about the specification when setting External static pressure option.

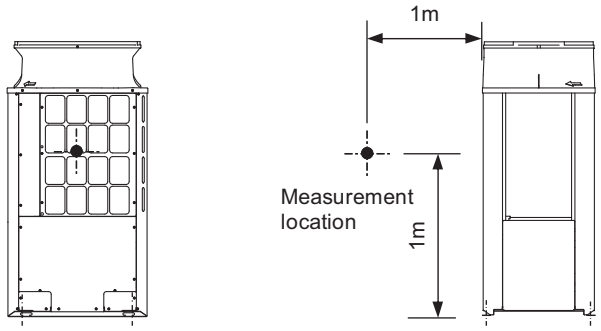
Unit converter

BTU/h	=kW x 3,412
cfm	=m^3/min x 35.31
lbs	=kg/0.4536

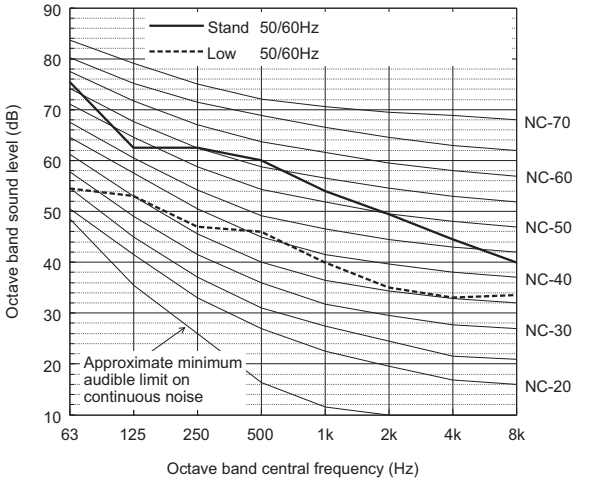
*Above specification data is subject to rounding variation.

5-1. Sound levels in cooling mode

Measurement condition
PURY-P200, 250, 300YNW-A(-BS)



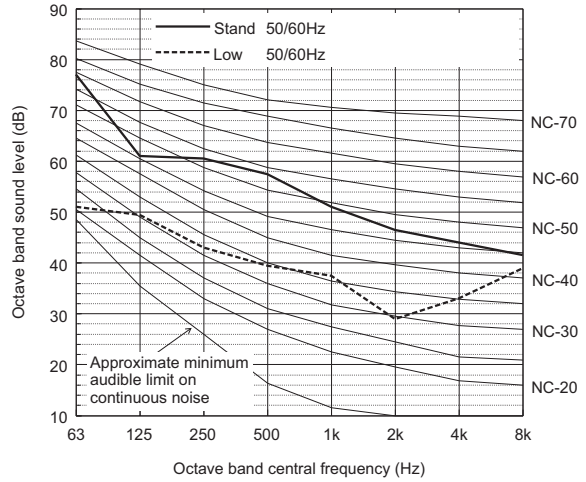
Sound level of PURY-P300YNW-A(-BS)



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	75.5	62.5	62.5	60.0	54.0	49.5	44.5	40.0	61.0
Low noise mode	50/60Hz	54.5	53.0	47.0	46.0	40.0	35.0	33.0	33.5	47.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

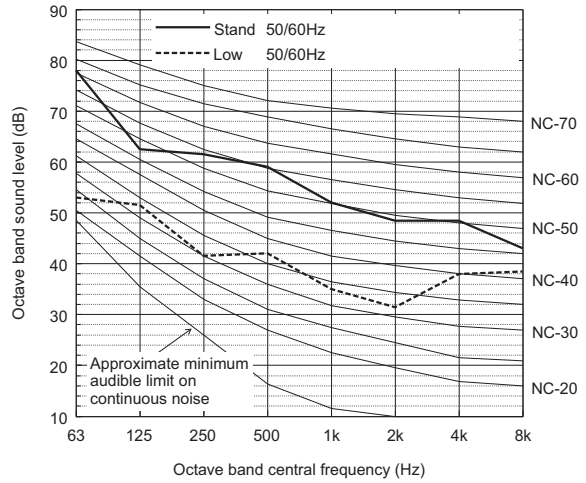
Sound level of PURY-P200YNW-A(-BS)



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard Cooling	50/60Hz	77.0	61.0	60.5	57.5	51.0	46.5	44.0	41.5	59.0
Low noise mode	50/60Hz	51.0	49.5	43.0	39.5	37.5	29.0	33.0	39.0	44.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

Sound level of PURY-P250YNW-A(-BS)

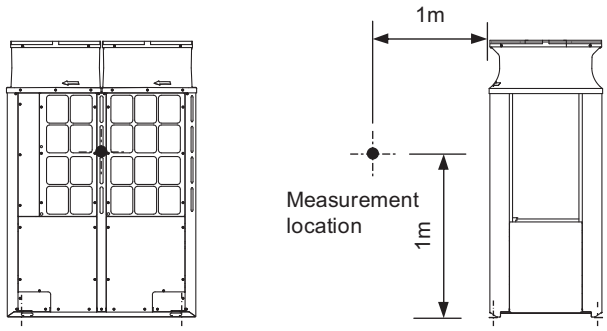


		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard Cooling	50/60Hz	78.0	62.5	61.5	59.0	52.0	48.5	48.5	43.0	60.5
Low noise mode	50/60Hz	53.0	51.5	41.5	42.0	35.0	31.5	38.0	38.5	45.0

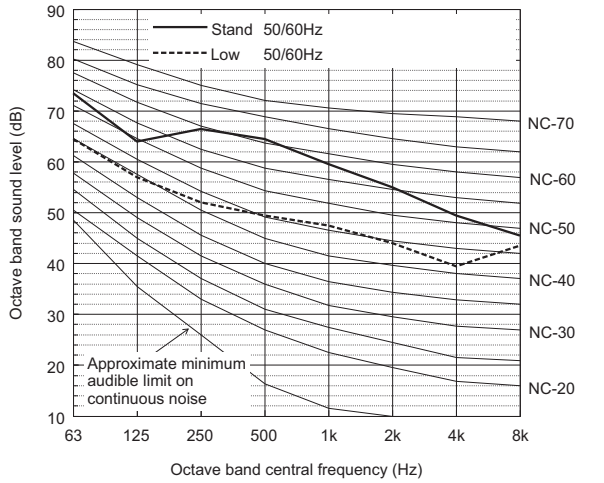
When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

- Depending on the operation conditions, the unit generates noise caused by valve actuation, refrigerant flow, and pressure changes when operating normally. Please consider to avoid location where quietness is required.
  For BC controller, it is recommended to be installed in places such as ceilings of corridor, rest rooms and plant rooms.

Measurement condition
PURY-P350, 400, 450YNW-A(-BS)



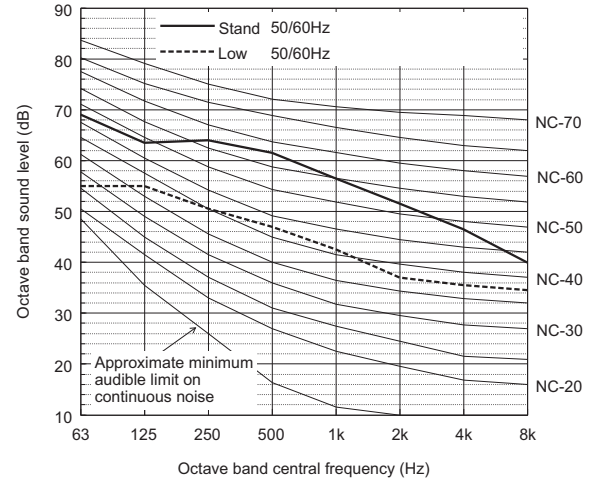
Sound level of PURY-P450YNW-A(-BS)



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	73.5	64.0	66.5	64.5	59.5	55.0	49.5	45.5	65.5
Low noise mode	50/60Hz	64.5	57.0	52.0	49.5	47.5	44.0	39.5	43.5	53.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

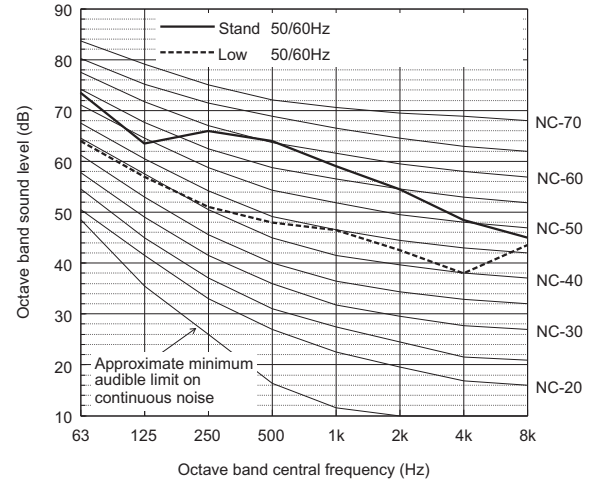
Sound level of PURY-P350YNW-A(-BS)



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	69.0	63.5	64.0	61.5	56.5	51.5	46.5	40.0	62.5
Low noise mode	50/60Hz	55.0	55.0	50.5	47.0	42.5	37.0	35.5	34.5	49.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

Sound level of PURY-P400YNW-A(-BS)



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	73.5	63.5	66.0	64.0	59.0	54.5	48.5	45.0	65.0
Low noise mode	50/60Hz	64.0	57.0	51.0	48.0	46.5	42.5	38.0	43.5	52.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

♦Depending on the operation conditions, the unit generates noise caused by valve actuation, refrigerant flow, and pressure changes when operating normally. Please consider to avoid location where quietness is required.
For BC controller, it is recommended to be installed in places such as ceilings of corridor, rest rooms and plant rooms.

APPENDIX C

Mechanical Plant Noise Prediction Model

Equipment List Sound Power Levels

Revision	Date	Comment

Equipment or Source	Octave Band Sound Power Level, Lw (Linear)								Overall LwA (dB)	Frequency shaping (L/M/H)	% On-time	No. off	Corrected overall LwA (dB)	Comments
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz						
Mitsubishi PURY-P250YNW-A (Low Noise)	72	70.5	60.5	61	54	50.5	57	57.5	**64**					LwA values from data sheet.
Mitsubishi PURY-P450YNW-A (Low Noise)	84	76	71	69	67	63	59	63	**72**					LwA values from data sheet.
Mitsubishi PUZ-ZM71VHA	74	73	74	65	64	59	54	48	**70**					LwA values from data sheet.
HRU G.1 - LGH-150RVXT-E	75	74	70	65	57	45	47	41	**66**					LwA values from data sheet.
HRU G.2 - LGH-200RVXT-E	75	76	71	67	59	48	46	34	**68**					LwA values from data sheet.
HRU B.1 - LGH-200RVXT-E	75	76	71	67	59	48	46	34	**68**					LwA values from data sheet.
EF B.1 - TD-500/150 SILENT 3V	38	43	43	40	40	38	35	33	**45**	M				Overall LwA from data sheet. Mid frequency source assumed.
EF G.1 - TD-1300/250 SILENT 3V	47	52	52	49	49	47	44	42	**54**	M				Overall LwA from data sheet. Mid frequency source assumed.

Spectrum
ACOUSTIC CONSULTANTS

CLIENT: Thirdway
JOB NO: 19443
PROJECT: Centric Close
ENCLOSURE DESCRIPTION: Quiet Box VE

Rev. No.	Date	Details

1. ENCLOSURE DIMENSIONS AND SOURCES

EAST - WEST LENGTH (m) = 4.8
NORTH - SOUTH LENGTH (m) = 1.6
HEIGHT (m) = 2.99

WEST AND EAST FACADES AREAS, EACH (m^2) = 4.784
NORTH AND SOUTH FACADES AREAS, EACH (m^2) = 14.35
ROOF AREA (m^2) = 7.68
TOTAL SURFACE AREA INCLUDING FLOOR (m^2) = 54

DOORS AND GRILLS	Area(m^2) of each door or grille	Details

Octaves Band Sound Power Level

SOURCE	LwA	31	63	125	250	500	1k	2k	4k	8k	No. off
Mitsubishi PURY-P250YNW-A	64		72	71	61	61	54	51	57	58	1
Mitsubishi PURY-P450YNW-A	72		84	76	71	69	67	63	59	63	1
Mitsubishi PUZ-ZM71VHA	70		74	73	74	65	64	59	54	48	1
	7										
	7										
	7										
	7										
	7										
	7										
	7										
	7										
	7										
	7										
	7										
	7										
TOTAL	74	5	84	79	76	71	69	65	62	64	

2. SOUND ABSORPTION AND NOISE LEVEL IN ENCLOSURE

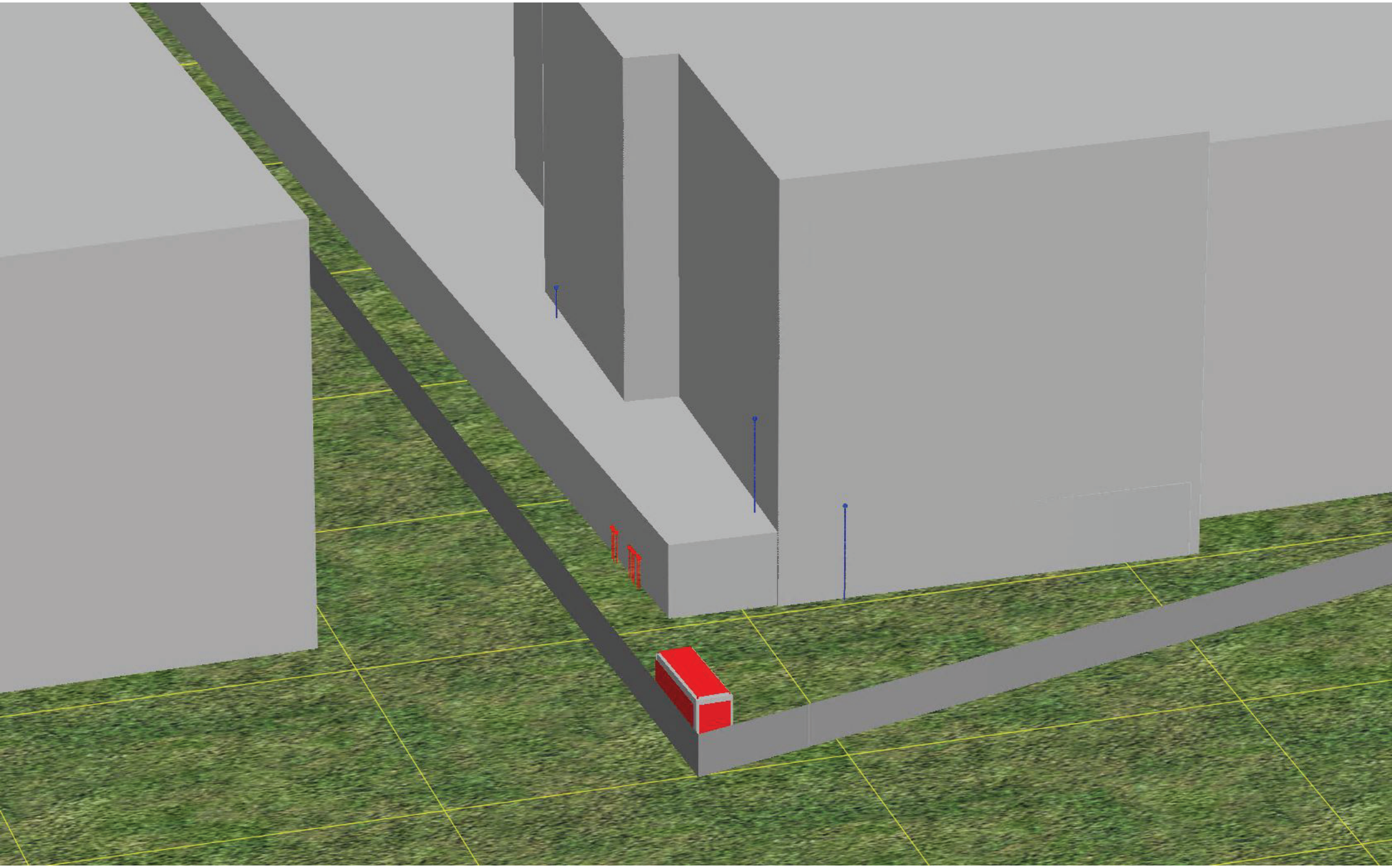
Sound Absorption Coefficient

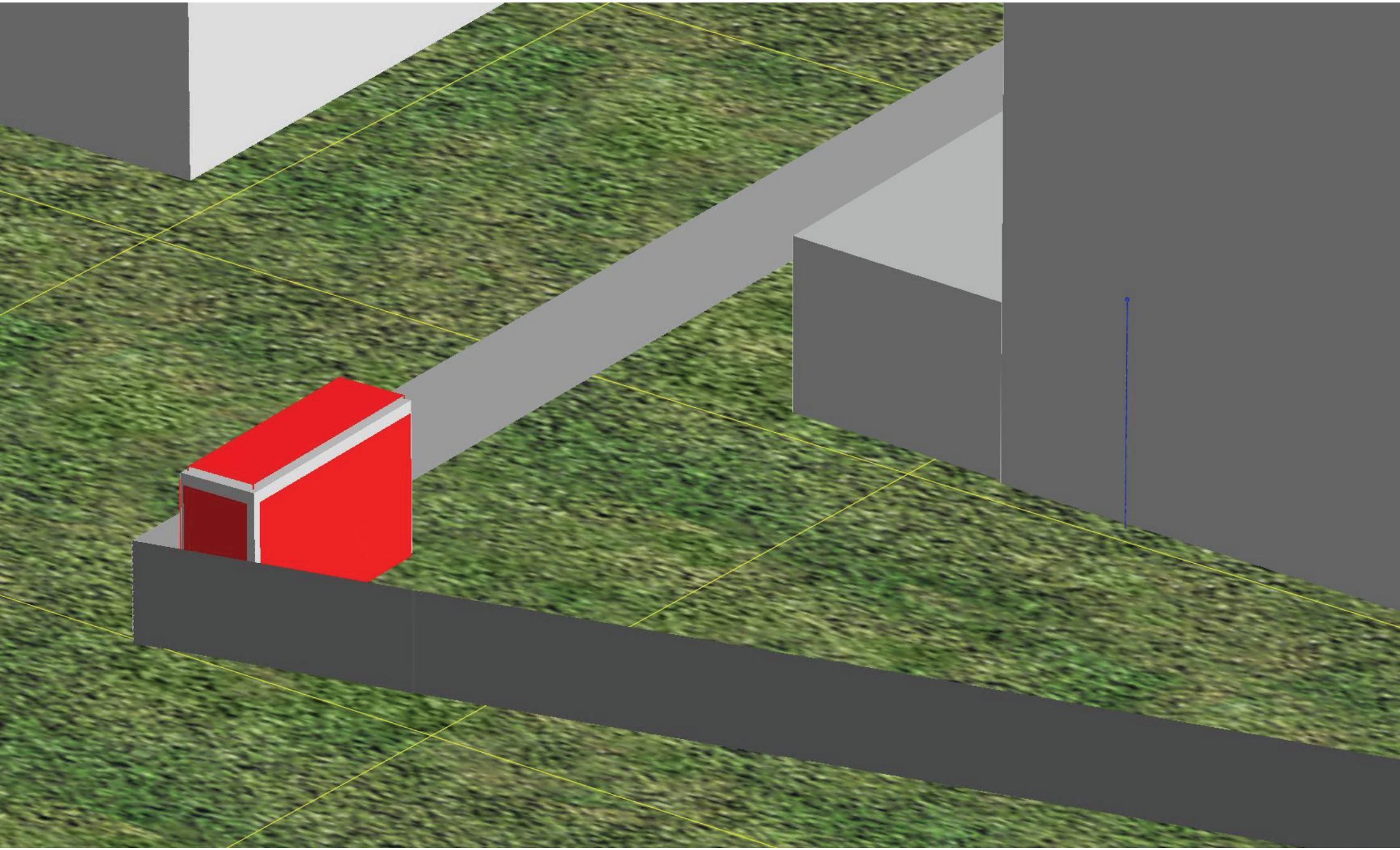
	Octave Band								
Enclosure Surface	31	63	125	250	500	1k	2k	4k	8k
Walls	0.12	0.12	0.12	0.28	0.55	0.71	0.74	0.83	0.90
Ceiling	0.12	0.12	0.12	0.28	0.55	0.71	0.74	0.83	0.90
Floor including equipment	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
MEAN	0.13	0.13	0.13	0.27	0.50	0.64	0.66	0.74	0.80

Ignores the internal absorption of wall louvres

Sound Pressure Level (reverberant)

		Octave Band								
	dB(A)	31	63	125	250	500	1k	2k	4k	8k
10Log(4/Rc)		-3	-3	-3	-7	-11	-14	-14	-16	-17
T60 (Norris Eyring) (s)		0.5	0.5	0.5	0.2	0.1	0.1	0.1	0.1	0.0
Lp rev	65	2	81	75	69	59	55	50	46	47

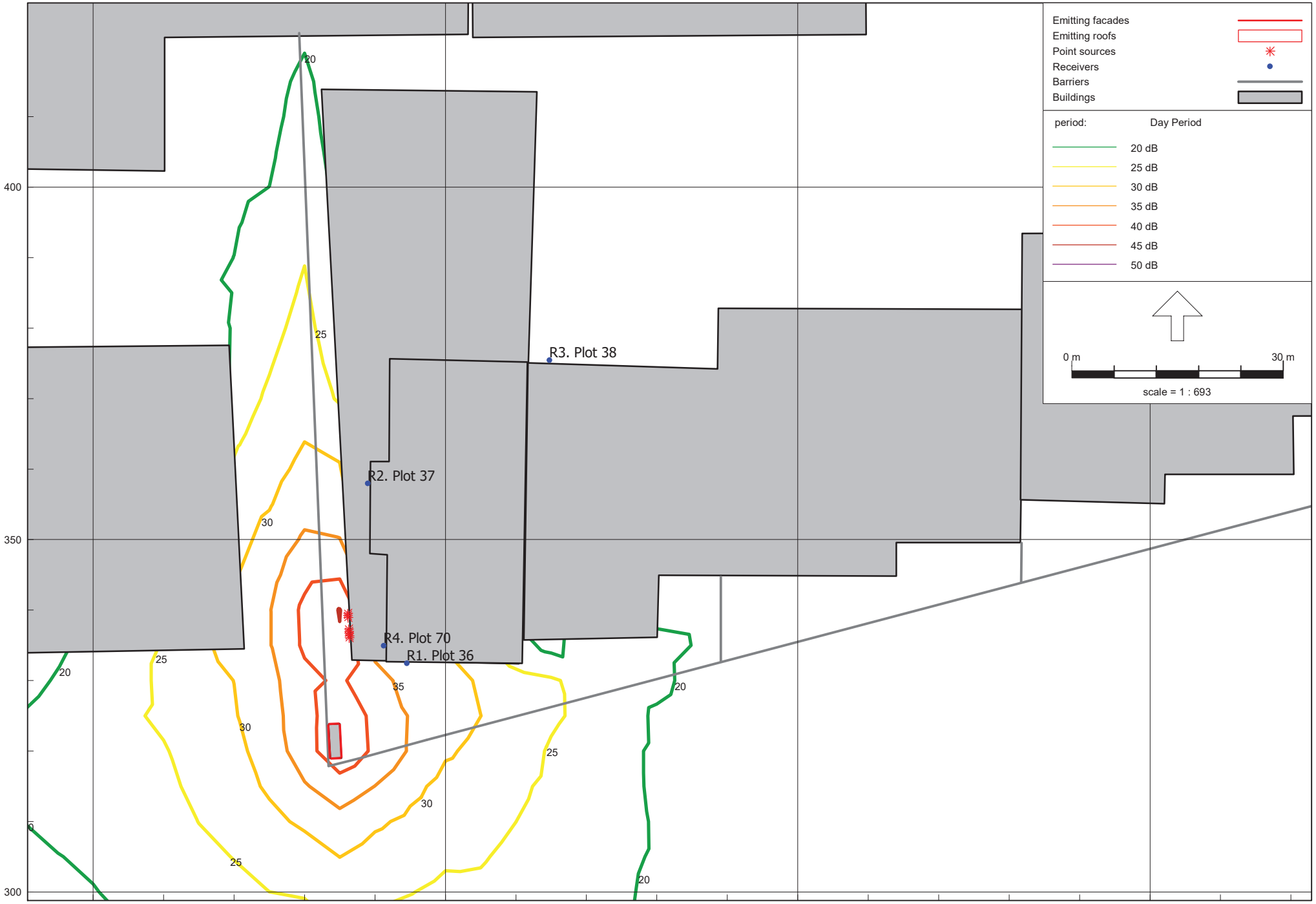




Report: Table of Results
Model: Rev 2 - August 2020 Scheme
LAeq per octave: total results for receivers
Group: (main group)
Group Reduction: No

Name			Day								
Receiver	Description	Height	Total	63	125	250	500	1000	2000	4000	8000
_A	R1. Plot 36	4.50	32	27	27	24	19	21	15	8	3
_A	R2. Plot 37	5.00	24	19	20	16	10	9	1	--	--
_A	R3. Plot 38	5.00	--	--	--	--	--	--	--	--	--
_A	R4. Plot 70	8.00	33	28	30	26	20	21	15	8	1

All shown dB values are A-weighted



Centric Close, Camden
Predicted Plant Noise Levels - Rev 2

Spectrum Acoustic Consultants Ltd

Industrial noise - LimA - ISO 9613.1/2, [version of 19443 - Centric Close, Camden - Rev 2 - August 2020 Scheme] , Predictor V2019.3

Head Office
Spectrum Acoustic Consultants Ltd
27-29 High Street
Biggleswade
Bedfordshire
SG18 0JE
UNITED KINGDOM

+44 (0)1767 318871
enquiries@spectrumacoustic.com
www.spectrumacoustic.com