SHARPS REDMORE

ACOUSTIC CONSULTANTS

Report

Air Handling and Environmental Control Plant at 36 Avenue Road, Primrose Hill

Environmental Noise Assessment

Prepared by

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1.0 Introduction

1.1 Sharps Redmore have been commissioned to provide an acoustic assessment relating to a proposed development at 36 Avenue Road, Primrose Hill. This sets out requirements for the control of plant noise to adjacent critical areas and contains an assessment of noise emissions from proposed plant (including recommended mitigation measures).

1.2 The site is currently occupied by a residential property. The planning application relates to the demolition of the existing building and replacement with a new family dwelling, including leisure facilities, with requirements for associated plant and machinery. The development would have plant rooms in the basement, and would include internal plant which vents to atmosphere. Additional heat rejection plant would be located at ground level in the rear garden.

1.3 Camden Council have requirements in their UDP relating to external plant noise (namely Policy DP 28 relating to noise).

1.4 This report details the environmental noise survey undertaken to assess the existing noise climate at the site, over a 24-hour period.

1.5 This data forms the basis of assessing the acoustic requirements and limitations for plant noise emissions, based on the Camden DP28 requirements.

1.6 Calculations of noise emissions from the proposed plant are contained in the report, and an assessment is made against the Camden DP28 requirements. Where necessary, mitigation measures are included in the calculations.

2.0 Assessment Criteria

2.1 Plant noise is covered by Table E of Camden Policy DP28, as follows.

Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	$55dB_{LAeq}$

2.2 The measured site noise levels need to be compared to the above values to determine the specific criteria for the plant noise, which are covered in Section 5.

3.0 Noise Survey and derived noise limits

3.1 An environmental noise survey was carried out from 25th to 26th February 2015 to determine the existing noise levels at the site.

3.2 Continuous measurements were made at ground floor level in the rear garden of 36 Avenue Road (see location plan at Appendix A). These measurements were taken continuously over a 24-hour period. The microphones were fitted with an integrated wet weather microphone and wind shield.

3.3 All measurements were made in 5 minute periods.

3.4 The measurements were made using a Norsonic 140 sound level meter. The meter used is of Class 1 type.

3.5 The meter was field checked for calibration before and after the measurements. No drift was noted.

3.6 The weather was cool and dry with low wind speeds.

3.7 Construction work was occurring in close proximity to the site (at adjacent premises) during the surveys. This work only took place during normal construction hours and not during the evening, night and early morning periods where background noise levels (used in determining plant noise limits) are at their lowest. The construction noise did not, therefore, affect the survey data upon which this subsequent assessment is based and has been excluded from the background noise level assessment.

3.8 The meter allows simultaneous measurements of noise levels both in overall dBA values and frequency selective octave bands over predetermined time periods, using various measurement parameters. The L_{eq}, $L_{min,}$ L_{90} and L_{max} noise levels were recorded in overall dBA values together with octave band levels.

3.9 For information purposes it can be noted:

- dBA is the sound level in decibels (dB) measured by the sound level meter with the A-weighting. The A-weighting is a filter applied to the sound level meter to simulate the frequency response of the human ear, which is more sensitive to high frequency sound than low.
- L_{eq} is the equivalent continuous noise level which is a method of averaging the varying noise level over the time period into a single figure value. The L_{eq} has the same sound energy as the fluctuating level over that period.
- L_{MAX} is the highest level within the measurement period.
- L_{90} is the noise level exceeded for 90% of the time and is referred to as the background noise level.

3.10 The full results are included in Appendix A, and are summarised in Table 1, as follows:

Table 1

	Background Noise $L_{A90, 5mins}$ dB		
	0700 -1900 hours	1900 – 2300 hours	2300 – 0700 hours
Minimum	43	40	35
Median (Typical)	51	43	40

3.11 The external noise level to be achieved by the plant is determined from the procedure in Policy DP28. Where the background level is below 60 dB L_{A90} (as is the case here), the plant noise is to be controlled to 5 dB below background. If the plant has tonal qualities or is sufficiently intermittent to attract attention, the criterion has to be reduced by a further 5 dB.

3.12 Discounting the daytime levels affected by construction noise, the median background L_{A90} data recorded give the following plant noise criteria:

Table 2

Rating Level 1m from sensitive window	
0700 – 2300 hours	2300 – 0700 hours
38	35

3.13 The design and noise mitigation for the plant will be progressed in relation to the criteria in Table 2.

4.0 Noise emissions

4.1 Calculations have been carried out to assess the noise levels, at the nearby sensitive properties from the air handling system louvres and external VRF units, as shown in Appendix B. The property would be approximately 10 metres distance from the plant room louvres.

4.2 The calculations take into account the following systems:

- Building Ventilation Air Handling Unit - Fresh Air Supply and Exhaust.

  This unit would have two fans which drive the fresh air supply and exhaust to atmosphere from the unit itself. The unit would be located in the plant room in the basement and it has been assumed that the only path for noise breakout is via duct-borne noise to the louvres.

- Pool Ventilation Air Handling Unit – Fresh Air Supply and Exhaust

  This unit would have two fans which drive the fresh air supply and exhaust to atmosphere from the unit itself. The unit would be located in the plant room in the basement and it has been assumed that the only path for noise breakout is via duct-borne noise to the louvres.

- Professional Kitchen Extract System

  This would consist of a single high-velocity hood-mounted extract fan ducted to atmosphere either at the side elevation adjacent to the staff entrance or within the light well to the front of the building.

- Domestic Kitchen extract System

  This would be a hood system expected to have light use and will discharge through the side elevation adjacent to the staff entrance. This system has not been included in the calculations on the basis that it is unlikely to be any more than a normal domestic extract hood used sporadically. Noise control can be incorporated into the duct work/discharge louvre if necessary but the noise from this system is unlikely to contribute to the overall level of noise from the other plant assessed.

- External VRF Units

  Heating and cooling for the building would be provided by systems operating from external air-source heat pumps. These would be Mitsubishi PURY-P800YSJM-A external VRF units (2no.), to be located at ground level in the rear garden. They have a noise level of 64 dBA at 1-metre during daytime operation and 55 dBA at 1-metre when on night mode. It is assumed that night mode would be operational between 2300 and 0700 hours.

4.3 The calculations at Appendix C show a cumulative noise level of 41 dBA outside the adjacent property, without any attenuation.

4.4 Allowing for an attenuator in each system (the details of which are contained in the calculation sheets), the noise level reduces to 36 dBA outside the property, i.e. within the 38 dBA criterion during the day. With the attenuators installed, and the VRF units on night mode, the cumulative noise levels outside the property would be 29 dBA – well within the 35 dBA criterion at night.

5.0 Conclusions

5.1 Cumulative noise levels from all of the proposed plant at the development would comply with the Local Authority criterion at all times, with attenuators in the ducted systems where appropriate, and the external VRF units on “night mode” between 2300 and 0700 hours.

APPENDIX A

SITE LOCATION PLAN


Measurement Location
Radlett Pl
Avenue Rd
Image © 2015 The GeoInformation Group
© 2015 Google
Google earth
1945
Imagery Date: 7/19/2013 51°32'18.38" N 0°10'05.42" W elev 46 m eye alt 228 m

APPENDIX B

NOISE SURVEY RESULTS

Date	LAEQ	LAMAX	LAMIN	LA10	LA90
(2015/02/25 12:20:00.00)	58.5	75	47.7	61.8	49.8
(2015/02/25 12:25:00.00)	59.2	77.9	48.1	62.9	49.7
(2015/02/25 12:30:00.00)	58.9	77.6	47.4	61.4	49.3
(2015/02/25 12:35:00.00)	62.4	79.5	48.1	65.8	49.6
(2015/02/25 12:40:00.00)	57.5	75.4	47.7	59.7	49.7
(2015/02/25 12:45:00.00)	63.9	87	48.6	64.7	50.2
(2015/02/25 12:50:00.00)	57.6	74.3	49	59	50.6
(2015/02/25 12:55:00.00)	56.1	74.9	49.4	59	51
(2015/02/25 13:00:00.00)	56.3	73.7	49.6	58.7	51.4
(2015/02/25 13:05:00.00)	56.7	71.6	49.6	58.7	50.9
(2015/02/25 13:10:00.00)	56.2	75.5	49	57.8	50.8
(2015/02/25 13:15:00.00)	56.1	72.5	49.5	56.5	51.5
(2015/02/25 13:20:00.00)	59.2	76.4	50.7	61.4	52.1
(2015/02/25 13:25:00.00)	57.6	74.7	49.6	60.7	51.2
(2015/02/25 13:30:00.00)	56.5	76	49.2	58.2	51.1
(2015/02/25 13:35:00.00)	59.2	74.6	50.8	63.2	52.7
(2015/02/25 13:40:00.00)	63	82.7	50.3	64.1	52.1
(2015/02/25 13:45:00.00)	56.1	74.7	50.1	57.5	51.5
(2015/02/25 13:50:00.00)	60.3	79.8	49.5	63.2	51.1
(2015/02/25 13:55:00.00)	59.8	79.1	49.9	63.1	51.9
(2015/02/25 14:00:00.00)	58.6	78.3	48.4	61.1	50.2
(2015/02/25 14:05:00.00)	54.8	72.1	47.4	57.2	49.2
(2015/02/25 14:10:00.00)	56.5	72	48.3	59.4	50.9
(2015/02/25 14:15:00.00)	57.4	72.7	50.3	60.6	52.2
(2015/02/25 14:20:00.00)	54.4	68.4	49.4	56.3	50.8
(2015/02/25 14:25:00.00)	59	78.7	49	61.5	51
(2015/02/25 14:30:00.00)	59.4	77.7	49.7	62.9	51.2
(2015/02/25 14:35:00.00)	57.2	74.5	50.1	59	51.2
(2015/02/25 14:40:00.00)	60.9	76.4	50.2	63.7	51.7
(2015/02/25 14:45:00.00)	56.5	76	49.4	58.1	51.3
(2015/02/25 14:50:00.00)	58.9	72.9	52.8	60.5	55.4
(2015/02/25 14:55:00.00)	63.2	78.6	49.9	66.2	53.2
(2015/02/25 15:00:00.00)	56.8	70.2	49.9	59	52.2
(2015/02/25 15:05:00.00)	57.4	74.1	49.9	60.4	51.5
(2015/02/25 15:10:00.00)	57.5	73.2	48.6	60.9	50.3
(2015/02/25 15:15:00.00)	67.8	76.7	49.6	74.3	51.5
(2015/02/25 15:20:00.00)	77.2	80.7	66	78.3	76.2
(2015/02/25 15:25:00.00)	64.5	79.1	50.9	58.8	52.2
(2015/02/25 15:30:00.00)	60.5	80.9	49.5	62.5	51.3
(2015/02/25 15:35:00.00)	68.2	79.3	49.9	70.6	53.7
(2015/02/25 15:40:00.00)	68.7	75.3	51	70.1	64.6
(2015/02/25 15:45:00.00)	67.6	74.9	50.2	70.2	52.7
(2015/02/25 15:50:00.00)	68.5	74.5	52.1	70.2	64.7
(2015/02/25 15:55:00.00)	68.2	75.8	48.8	69.8	58.2
(2015/02/25 16:00:00.00)	68.6	78	51.8	70.2	63
(2015/02/25 16:05:00.00)	68.7	76.1	61.2	70.2	63.8
(2015/02/25 16:10:00.00)	66.7	80.5	47.9	70.3	50.4

Date	LAEQ	LAMAX	LAMIN	LA10	LA90
(2015/02/25 16:15:00.00)	69.6	74.6	56.8	71.2	65.1
(2015/02/25 16:20:00.00)	70	78.5	60.1	71.7	64.8
(2015/02/25 16:25:00.00)	68.6	76.2	49.7	70.4	60.2
(2015/02/25 16:30:00.00)	69.6	75.5	50.1	71.3	65.3
(2015/02/25 16:35:00.00)	70	77.1	49.1	72.2	64.3
(2015/02/25 16:40:00.00)	71.5	80	50.2	73.1	68.2
(2015/02/25 16:45:00.00)	72.3	77.3	64	73.8	69.6
(2015/02/25 16:50:00.00)	72.5	76.9	65.6	73.9	70.4
(2015/02/25 16:55:00.00)	68.2	75.3	47.8	72.5	50.1
(2015/02/25 17:00:00.00)	57.3	73.6	47.9	60.4	49.5
(2015/02/25 17:05:00.00)	55.9	75.6	48.2	57.8	49.6
(2015/02/25 17:10:00.00)	57.4	75.5	48.3	58.9	50.5
(2015/02/25 17:15:00.00)	58.6	75	46.6	62.7	48.3
(2015/02/25 17:20:00.00)	54.6	70.5	47.2	56.3	48.5
(2015/02/25 17:25:00.00)	60	77.4	47.3	64.2	48.6
(2015/02/25 17:30:00.00)	51.4	63.9	47	53.5	48.7
(2015/02/25 17:35:00.00)	56	75.1	47.1	55.2	49.1
(2015/02/25 17:40:00.00)	60.1	76.3	44.9	64.3	47.1
(2015/02/25 17:45:00.00)	56.7	73.9	45	58	46.9
(2015/02/25 17:50:00.00)	57.9	75.5	44	61.6	47.2
(2015/02/25 17:55:00.00)	56.6	71.7	42.4	59.8	45.8
(2015/02/25 18:00:00.00)	59.2	79.9	43.4	59.3	45.3
(2015/02/25 18:05:00.00)	59.6	77.7	42.4	63.8	45.3
(2015/02/25 18:10:00.00)	56.3	74.4	43.2	54.4	45
(2015/02/25 18:15:00.00)	55.8	73.2	42	59.1	45.1
(2015/02/25 18:20:00.00)	55.1	70.7	40	59.9	42.7
(2015/02/25 18:25:00.00)	53.2	70.3	41.3	57	43.5
(2015/02/25 18:30:00.00)	53.8	68	40.9	58.4	43.9
(2015/02/25 18:35:00.00)	53.2	68.9	42.9	57.2	45.1
(2015/02/25 18:40:00.00)	54.8	73.4	42.4	56.1	44.2
(2015/02/25 18:45:00.00)	55.5	70.4	41.6	59.5	44.9
(2015/02/25 18:50:00.00)	53.4	69.5	41.1	56.9	44.6
(2015/02/25 18:55:00.00)	48.2	55.3	43	49.7	46.2
(2015/02/25 19:00:00.00)	52.5	68.6	43	55.5	45.3
(2015/02/25 19:05:00.00)	54.3	69.8	41.8	58.6	44.6
(2015/02/25 19:10:00.00)	53.1	69.2	41.8	55.7	43.9
(2015/02/25 19:15:00.00)	47.2	57.8	41.1	49	44.7
(2015/02/25 19:20:00.00)	59.4	77.9	43	59.7	45.7
(2015/02/25 19:25:00.00)	51.6	64.7	39	55.1	44.2
(2015/02/25 19:30:00.00)	47.9	56.5	41.7	50	45
(2015/02/25 19:35:00.00)	51.7	70	40.5	54.3	44.2
(2015/02/25 19:40:00.00)	47.7	66.4	39.9	48.6	43.4
(2015/02/25 19:45:00.00)	46.3	60.7	39.6	48.2	42.6
(2015/02/25 19:50:00.00)	46.1	53.6	40.5	48	43.6
(2015/02/25 19:55:00.00)	46.5	56.9	39.7	48.3	43.5
(2015/02/25 20:00:00.00)	46.9	58.2	41.9	48.4	44.4
(2015/02/25 20:05:00.00)	46.3	58	40.4	48.2	43

Date	LAEQ	LAMAX	LAMIN	LA10	LA90
(2015/02/25 20:10:00.00)	45.7	58.8	40.3	47.5	42.6
(2015/02/25 20:15:00.00)	47	58.2	40.1	49	42.8
(2015/02/25 20:20:00.00)	50.3	67.9	40	52	42.7
(2015/02/25 20:25:00.00)	54.5	71.9	40.7	57.3	43.4
(2015/02/25 20:30:00.00)	56.2	71.9	40.4	60.1	43.7
(2015/02/25 20:35:00.00)	57.7	77.3	45.1	56.3	48.3
(2015/02/25 20:40:00.00)	55.9	68.2	54.2	55.9	54.6
(2015/02/25 20:45:00.00)	57.2	72.3	53.8	59.7	54.2
(2015/02/25 20:50:00.00)	57.8	73.3	54	60.4	54.5
(2015/02/25 20:55:00.00)	55.9	73.1	54.2	55.6	54.6
(2015/02/25 21:00:00.00)	55	57.6	54.3	55.3	54.6
(2015/02/25 21:05:00.00)	55	56.4	54.4	55.3	54.7
(2015/02/25 21:10:00.00)	55.1	57.8	54.3	55.5	54.7
(2015/02/25 21:15:00.00)	55	57.3	54.3	55.3	54.6
(2015/02/25 21:20:00.00)	55	58	54.2	55.5	54.6
(2015/02/25 21:25:00.00)	55	57	54.3	55.4	54.7
(2015/02/25 21:30:00.00)	47.7	61	37.7	53	41.1
(2015/02/25 21:35:00.00)	48.6	67.3	38.5	47.8	40.9
(2015/02/25 21:40:00.00)	51.4	67.7	40	52.8	43
(2015/02/25 21:45:00.00)	50.9	76.6	38.7	47.5	41.2
(2015/02/25 21:50:00.00)	46.5	69	39.1	48.5	41.5
(2015/02/25 21:55:00.00)	47.9	67.4	40	48.8	41.7
(2015/02/25 22:00:00.00)	45.8	63.7	38.5	47.9	41.1
(2015/02/25 22:05:00.00)	48	59.9	37.5	51.9	39.6
(2015/02/25 22:10:00.00)	45.8	58.7	38.9	48.2	41.5
(2015/02/25 22:15:00.00)	45.8	55.4	40.8	47.9	42.5
(2015/02/25 22:20:00.00)	45.9	60.6	40.4	47.6	43
(2015/02/25 22:25:00.00)	44.9	55	38.3	47.6	39.8
(2015/02/25 22:30:00.00)	44.8	56.1	38.7	47.4	40.7
(2015/02/25 22:35:00.00)	46.6	56.2	40.3	48.7	43.1
(2015/02/25 22:40:00.00)	44.1	53.8	37.7	46.7	39.8
(2015/02/25 22:45:00.00)	46.9	61.1	40.6	48.4	43
(2015/02/25 22:50:00.00)	44.3	54.8	38.4	47	40.2
(2015/02/25 22:55:00.00)	44.2	51.3	39.1	46.8	40.6
(2015/02/25 23:00:00.00)	44.5	53.9	38.9	46.8	40.6
(2015/02/25 23:05:00.00)	53	56.9	39.3	55.6	40.9
(2015/02/25 23:10:00.00)	55.5	57.5	54.5	55.8	55
(2015/02/25 23:15:00.00)	54.7	55.9	53.9	55	54.3
(2015/02/25 23:20:00.00)	52.6	59.1	38.9	55	40.4
(2015/02/25 23:25:00.00)	43	53.7	37.8	45.5	38.8
(2015/02/25 23:30:00.00)	44.2	50.9	37.7	46.8	39.6
(2015/02/25 23:35:00.00)	42.6	49.7	36.6	45.5	38.1
(2015/02/25 23:40:00.00)	43.8	63.3	37.6	45.9	39.2
(2015/02/25 23:45:00.00)	43.5	51.6	38.3	46.4	39.6
(2015/02/25 23:50:00.00)	42.7	50.2	36.1	45.8	38.1
(2015/02/25 23:55:00.00)	42.8	52	36.8	45.6	38.4
(2015/02/26 00:00:00.00)	42.5	49.3	37.2	45.1	38.9

Date	LAEQ	LAMAX	LAMIN	LA10	LA90
(2015/02/26 00:05:00.00)	42.1	50.2	36.6	44.6	38.2
(2015/02/26 00:10:00.00)	42.2	48.3	37.7	44.9	39.1
(2015/02/26 00:15:00.00)	41.6	48.1	35.9	44.2	38
(2015/02/26 00:20:00.00)	42.8	57	36.1	45.8	37.4
(2015/02/26 00:25:00.00)	41.8	51.1	36.5	44.9	37.9
(2015/02/26 00:30:00.00)	40.7	52.9	35.5	43.3	37.4
(2015/02/26 00:35:00.00)	40.7	49.4	34.6	43.5	36.7
(2015/02/26 00:40:00.00)	39.6	47.5	35.3	42.4	36.6
(2015/02/26 00:45:00.00)	41.5	50.7	35.6	45.1	36.9
(2015/02/26 00:50:00.00)	41	48.5	36.1	44.1	37.6
(2015/02/26 00:55:00.00)	40.3	48.4	36.1	43.1	37
(2015/02/26 01:00:00.00)	39.9	47	35	42.9	35.9
(2015/02/26 01:05:00.00)	54	56.7	34.9	55.3	38.2
(2015/02/26 01:10:00.00)	54.9	56.1	54	55.3	54.4
(2015/02/26 01:15:00.00)	54.3	55.3	53.8	54.5	54.1
(2015/02/26 01:20:00.00)	54.3	56.1	53.6	54.6	54.1
(2015/02/26 01:25:00.00)	54.2	55.5	53.8	54.5	54
(2015/02/26 01:30:00.00)	54.2	55.5	53.8	54.5	54
(2015/02/26 01:35:00.00)	54.3	63.7	53.8	54.5	54
(2015/02/26 01:40:00.00)	54.2	55.1	53.8	54.4	54
(2015/02/26 01:45:00.00)	54.3	55.2	53.9	54.4	54.1
(2015/02/26 01:50:00.00)	54.3	55.2	53.9	54.6	54.1
(2015/02/26 01:55:00.00)	54.3	55.7	53.9	54.5	54.1
(2015/02/26 02:00:00.00)	48.1	55.4	33	54.3	35.2
(2015/02/26 02:05:00.00)	38.2	46.9	32.6	41.2	35.5
(2015/02/26 02:10:00.00)	37.8	48	31.7	40.5	35.3
(2015/02/26 02:15:00.00)	41.8	52.2	33	45.4	35.3
(2015/02/26 02:20:00.00)	45.6	71.9	33.9	40.7	34.9
(2015/02/26 02:25:00.00)	55.2	72.6	34.8	58.2	36.8
(2015/02/26 02:30:00.00)	53.2	70.9	35.6	57.5	37.9
(2015/02/26 02:35:00.00)	54.5	71.7	33.7	58.7	35.5
(2015/02/26 02:40:00.00)	55.2	71.3	33.2	60.1	34.8
(2015/02/26 02:45:00.00)	55.2	71.2	33.6	60	35.8
(2015/02/26 02:50:00.00)	54.8	70.3	33.7	59.5	35.6
(2015/02/26 02:55:00.00)	54.7	74.3	32	59.5	35
(2015/02/26 03:00:00.00)	54.2	72.1	32.5	58.3	35.6
(2015/02/26 03:05:00.00)	56	72.5	32.5	60.8	35.2
(2015/02/26 03:10:00.00)	52.9	70.1	34	57.1	35.7
(2015/02/26 03:15:00.00)	53.6	72.8	33.1	56.7	36.2
(2015/02/26 03:20:00.00)	57.5	74.2	34.1	62	37.1
(2015/02/26 03:25:00.00)	57.1	73.5	34.5	62.3	37.1
(2015/02/26 03:30:00.00)	55.9	72.5	34.4	60.2	37.2
(2015/02/26 03:35:00.00)	58.5	73.6	34.3	62.1	40.6
(2015/02/26 03:40:00.00)	58.7	74.8	53.6	61.7	54.2
(2015/02/26 03:45:00.00)	56.9	70.8	53.4	59.7	53.7
(2015/02/26 03:50:00.00)	57.8	70.2	53.3	61.6	53.7
(2015/02/26 03:55:00.00)	57.1	71.5	53.3	60.3	53.6

Date	LAEQ	LAMAX	LAMIN	LA10	LA90
(2015/02/26 04:00:00.00)	53.2	67.5	35.5	56	38.4
(2015/02/26 04:05:00.00)	56.6	71.9	36	61.3	39.2
(2015/02/26 04:10:00.00)	56.6	72.8	35	61	39.7
(2015/02/26 04:15:00.00)	56.2	72.2	34.4	60.9	38.4
(2015/02/26 04:20:00.00)	56.1	72.7	35.6	61	39.5
(2015/02/26 04:25:00.00)	50.8	69	34.9	53	39
(2015/02/26 04:30:00.00)	54.5	70.8	35.8	58.5	40.3
(2015/02/26 04:35:00.00)	56.3	70.9	35.3	61	39.8
(2015/02/26 04:40:00.00)	53.5	70.5	34.3	57.4	37.6
(2015/02/26 04:45:00.00)	57	71.5	35	62.1	40.2
(2015/02/26 04:50:00.00)	57	71.9	37	61.9	40.6
(2015/02/26 04:55:00.00)	56.3	70.6	35.5	61	39.7
(2015/02/26 05:00:00.00)	56.4	71	36.1	61.3	40
(2015/02/26 05:05:00.00)	56.3	71.6	36.3	58.9	44.1
(2015/02/26 05:10:00.00)	58.8	72.2	53.9	62.5	54.5
(2015/02/26 05:15:00.00)	59	71.3	53.5	62.9	54.1
(2015/02/26 05:20:00.00)	59.1	72.9	53.5	63	54
(2015/02/26 05:25:00.00)	59	72.2	53.5	62.9	53.9
(2015/02/26 05:30:00.00)	57.7	72.9	37.5	62.6	42.3
(2015/02/26 05:35:00.00)	55.1	72.1	37.4	58.2	40.4
(2015/02/26 05:40:00.00)	53.8	68.6	37.8	58.1	41.9
(2015/02/26 05:45:00.00)	56.4	73.8	37	60.1	41.2
(2015/02/26 05:50:00.00)	57	75	38.2	61.2	41.2
(2015/02/26 05:55:00.00)	58.6	75.7	38.6	63.5	42.7
(2015/02/26 06:00:00.00)	56.2	73.9	39.6	59.3	42.5
(2015/02/26 06:05:00.00)	51.8	65.2	39.2	55.4	43.7
(2015/02/26 06:10:00.00)	51.6	63.7	39.8	55.5	43.3
(2015/02/26 06:15:00.00)	57.8	82.2	40.3	59.8	42.9
(2015/02/26 06:20:00.00)	60.5	78.9	41.3	64.7	45.2
(2015/02/26 06:25:00.00)	62.4	78.9	40.1	67.1	43.8
(2015/02/26 06:30:00.00)	59.6	78.2	41.2	63.5	45.5
(2015/02/26 06:35:00.00)	56.2	73.9	40.8	59.5	44.8
(2015/02/26 06:40:00.00)	55.2	70.6	47	58.8	48.3
(2015/02/26 06:45:00.00)	54.7	69.6	46.3	59.2	48.2
(2015/02/26 06:50:00.00)	59.3	77.7	46.5	62.9	48.2
(2015/02/26 06:55:00.00)	56.2	72.2	46.6	58.7	48.3
(2015/02/26 07:00:00.00)	56.5	74.2	46.8	59	48.4
(2015/02/26 07:05:00.00)	56.3	73.4	46.4	60	48.1
(2015/02/26 07:10:00.00)	55.3	74.7	46.9	56.1	48.1
(2015/02/26 07:15:00.00)	57.2	76.8	46.8	59	48.6
(2015/02/26 07:20:00.00)	56.1	74	47.2	55.9	48.5
(2015/02/26 07:25:00.00)	52.6	70	47.2	52.8	48.4
(2015/02/26 07:30:00.00)	53.4	70.2	47.6	56.7	48.8
(2015/02/26 07:35:00.00)	55.5	71.6	47.3	57.8	48.6
(2015/02/26 07:40:00.00)	54.5	69.5	46.7	56.4	48.7
(2015/02/26 07:45:00.00)	55.3	71.9	47.1	56.5	48.4
(2015/02/26 07:50:00.00)	55.6	71.9	48.1	58.7	49.1

Date	LAEQ	LAMAX	LAMIN	LA10	LA90
(2015/02/26 07:55:00.00)	53.2	70.8	47.4	55.2	48.7
(2015/02/26 08:00:00.00)	55.4	72.3	48.2	57.5	49.6
(2015/02/26 08:05:00.00)	55.3	76.4	48.4	55.2	49.6
(2015/02/26 08:10:00.00)	57.5	78.6	48.2	57.6	49.5
(2015/02/26 08:15:00.00)	59.3	80.7	48.9	60.1	50.7
(2015/02/26 08:20:00.00)	59	76.6	50.9	61.5	52
(2015/02/26 08:25:00.00)	60.7	77	51	62.2	52.2
(2015/02/26 08:30:00.00)	60.8	78.8	50.5	63.3	52.2
(2015/02/26 08:35:00.00)	61.2	83.5	51	62.2	52.5
(2015/02/26 08:40:00.00)	57.2	74.1	50.1	58.5	51.7
(2015/02/26 08:45:00.00)	59.9	77.2	49.9	62.4	51.1
(2015/02/26 08:50:00.00)	57.1	81.9	50.6	57.1	52
(2015/02/26 08:55:00.00)	54.9	70.7	48.9	57.5	51.2
(2015/02/26 09:00:00.00)	63.7	81.2	50.9	66.6	52.1
(2015/02/26 09:05:00.00)	57.3	74.6	51.4	57.1	52.8
(2015/02/26 09:10:00.00)	55.8	72.7	50	56.7	51.4
(2015/02/26 09:15:00.00)	58	75.1	50.1	60.2	51.5
(2015/02/26 09:20:00.00)	60.6	80.8	50.5	57.9	51.6
(2015/02/26 09:25:00.00)	60.6	79.9	49.7	63.2	51.4
(2015/02/26 09:30:00.00)	59	82	49.4	59.6	50.9
(2015/02/26 09:35:00.00)	58.9	78.7	49.4	60.1	50.6
(2015/02/26 09:40:00.00)	53.5	68.9	49.6	54.9	50.5
(2015/02/26 09:45:00.00)	53.8	69	49.3	55.8	50.6
(2015/02/26 09:50:00.00)	56	73.5	50.5	56.9	51.5
(2015/02/26 09:55:00.00)	59.3	77.8	48.9	60.5	51
(2015/02/26 10:00:00.00)	57.2	74.4	49.4	57.8	51.6
(2015/02/26 10:05:00.00)	55	69.7	50.7	56.1	52.3
(2015/02/26 10:10:00.00)	55.9	70.2	50.1	57.1	51.8
(2015/02/26 10:15:00.00)	58.6	77	49.2	59.6	52
(2015/02/26 10:20:00.00)	59	79.3	49.8	58.4	51.1
(2015/02/26 10:25:00.00)	54.4	72.1	48.8	55.7	50.1
(2015/02/26 10:30:00.00)	53.9	73.1	49	55.6	50
(2015/02/26 10:35:00.00)	55.3	71.3	48.5	58.1	50.2
(2015/02/26 10:40:00.00)	56.6	71	50.9	59.2	52.9
(2015/02/26 10:45:00.00)	57.2	71.1	51.4	58.1	53.9
(2015/02/26 10:50:00.00)	57	75.4	51.5	57.9	52.6
(2015/02/26 10:55:00.00)	63.6	83.7	53.4	62.7	54.6
(2015/02/26 11:00:00.00)	57.1	73.5	53.3	57.2	54.6
(2015/02/26 11:05:00.00)	61.1	83.7	53.9	60.5	55.1
(2015/02/26 11:10:00.00)	61.9	80.5	53	62.1	54.8
(2015/02/26 11:15:00.00)	64.1	82.6	52.5	66.3	54.2
(2015/02/26 11:20:00.00)	61	84.8	52.4	59.6	53.7
(2015/02/26 11:25:00.00)	59.1	75.2	51.5	62	52.5
(2015/02/26 11:30:00.00)	58.7	78	51.3	60.2	52.6
(2015/02/26 11:35:00.00)	54	66.4	50.4	55.1	52.1
(2015/02/26 11:40:00.00)	62.7	90.5	50.4	58.2	52.8
(2015/02/26 11:45:00.00)	66.4	91.7	53.2	61.3	54.3

Date	LAEQ	LAMAX	LAMIN	LA10	LA90
(2015/02/26 11:50:00.00)	55.5	72.3	51.9	56.1	53.2
(2015/02/26 11:55:00.00)	57.9	79.1	52.3	58.8	53.6
(2015/02/26 12:00:00.00)	58.7	75.2	53.1	59.7	54.6
(2015/02/26 12:05:00.00)	56.6	70.7	54.4	57.3	55.4
(2015/02/26 12:10:00.00)	65.6	82.9	55	68.3	56.8
(2015/02/26 12:15:00.00)	57.4	74.4	54.8	58	55.7
(2015/02/26 12:20:00.00)	57.2	67.1	54.6	58.4	55.6
(2015/02/26 12:25:00.00)	60.4	78.4	53.7	60.5	55.1
(2015/02/26 12:30:00.00)	61.9	79.7	53.2	64.5	54.5
(2015/02/26 12:35:00.00)	68.1	88.3	57.5	70.7	59.6

Text in red indicates periods where measured data may have been influenced by adjacent construction noise.

APPENDIX C

PLANT NOISE CALCULATIONS

Customer	IAL
Project	36 Avenue Road
System	All Systems Cumulative Level Summary

Without Attenuators

		63	125	250	500	1K	2K	4K	8K	dBA
System	1	32	36	34	34	25	24	21	13	34.1
System	2	35	38	35	34	26	24	22	13	34.6
System	3	40	43	37	29	27	21	15	10	33.8
System	4									36
						Cumulative Level (All Systems)				**41**

With Attenuators

		63	125	250	500	1K	2K	4K	8K	dBA
System	1	27	31	24	19	7	9	10	6	21.4
System	2	30	33	25	19	8	9	11	6	22.7
System	3	31	31	16	-3	-15	-17	-15	-11	16.5
System	4									36
						Cumulative Level (All Systems)				**36**

VRF on Night Mode, All Systems With Attenuators

		63	125	250	500	1K	2K	4K	8K	dBA
System	1	0	0	0	0	0	0	0	0	21.4
System	2	0	0	0	0	0	0	0	0	22.7
System	3	0	0	0	0	0	0	0	0	16.5
System	4									27
						Cumulative Level (All Systems)				**29**

Customer	IAL
Project	36 Avenue Road
System 1	Pool AHU Supply & Exhaust

ITEM	INPUT		OCTAVE BANDS							
			63	125	250	500	1K	2K	4K	8K
FAN SWL			**75**	**76**	**74**	**75**	**72**	**74**	**71**	**63**
Fan Airflow	1	m3/s								
	size	length								
duct losses	mm	m								
D1	600	5	1	1	1	1	1	1	1	1
D2	0	0								
D3	0	0								
D4	0	0								
	size	No.								
bends	mm	off								
B1	600	1			1	2	3	3	3	3
B2	0	0								
B3	0	0								
B4	0	0								
Other losses 1		(optional)								
Other losses 2		(optional)								
Outlet size:										
B x H (mm)	400	600								
End reflection	2400	cm2	8	4	1					
Total losses			9	5	3	3	4	4	4	4
			66	71	71	72	68	70	67	59
Air to outlet	1	m3/s	0	0	0	0	0	0	0	0
Distance	10	m	-36	-36	-36	-36	-36	-36	-36	-36
Directivity Angle (0º,45º,or90º)	90	º	2	1	-1	-2	-7	-10	-10	-10

For Barrier Losses insert data, otherwise set source-to-barrier distance to zero:

Source to barrier 0 m — Barrier to receiver 0 m

Source height 0 m — Barrier ht. 0 m — Receiver ht 0 m

Barrier Losses			0	0	0	0	0	0	0	0	
	SPL		32	36	34	34	25	24	21	13	dBA 34.1
CRITERION											
input the	**NC**	**or NR**									
appropriate level :		**25**	55	44	35	29	25	22	20	18	
	REQUIRED I.L.		**0**	**0**	**0**	**5**	**0**	**2**	**2**	**0**	
Insertion Loss (600mm 50% Free Area)			5	5	10	15	18	15	11	7	dBA
Resultant Noise Level			27	31	24	19	7	9	10	6	21.4

Without Attenuator

63	125	250	500	1K	2K	4K	8K	dBA
32	36	34	34	25	24	21	13	34.1

With Attenuator

63	125	250	500	1K	2K	4K	8K	dBA
27	31	24	19	7	9	10	6	21.4

Customer	IAL
Project	36 Avenue Road
System 2	Building AHU Supply & Exhaust

ITEM	INPUT		OCTAVE BANDS							
			63	125	250	500	1K	2K	4K	8K
FAN SWL			**75**	**76**	**74**	**75**	**73**	**74**	**72**	**63**
Fan Airflow	1	m3/s								
	size	length								
duct losses	mm	m								
D1	800	5	1	1	1	1	1	1	1	1
D2	0	0								
D3	0	0								
D4	0	0								
	size	No.								
bends	mm	off								
B1	900	1			1	2	3	3	3	3
B2	0	0								
B3	0	0								
B4	0	0								
Other losses 1		(optional)								
Other losses 2		(optional)								
Outlet size:										
B x H (mm)	800	1000								
End reflection	8000	cm2	5	2						
Total losses			6	3	2	3	4	4	4	4
			69	73	72	72	69	70	68	59
Air to outlet	1	m3/s	0	0	0	0	0	0	0	0
Distance	10	m	-36	-36	-36	-36	-36	-36	-36	-36
Directivity Angle (0º,45º,or90º)	90	º	2	1	-1	-2	-7	-10	-10	-10

For Barrier Losses insert data, otherwise set source-to-barrier distance to zero:

Source to barrier 0 m — Barrier to receiver 0 m

Source height 0 m — Barrier ht. 0 m — Receiver ht 0 m

Barrier Losses			0	0	0	0	0	0	0	0	
	SPL		35	38	35	34	26	24	22	13	dBA 34.6
CRITERION											
input the	**NC**	**or NR**									
appropriate level :		**20**	51	39	31	24	20	17	14	13	
	REQUIRED I.L.		**0**	**0**	**4**	**10**	**6**	**7**	**8**	**1**	
Insertion Loss (600mm 50% Free Area)			5	5	10	15	18	15	11	7	dBA
Resultant Noise Level			30	33	25	19	8	9	11	6	22.7

Without Attenuator

63	125	250	500	1K	2K	4K	8K	dBA
35	38	35	34	26	24	22	13	34.6

With Attenuator

63	125	250	500	1K	2K	4K	8K	dBA
30	33	25	19	8	9	11	6	22.7

Customer	IAL
Project	36 Avenue Road
System 3	Kitchen Extract

ITEM	INPUT		OCTAVE BANDS							
			63	125	250	500	1K	2K	4K	8K
FAN SWL			**80**	**82**	**77**	**75**	**76**	**70**	**64**	**59**
Fan Airflow	1.15	m3/s								
	size	length								
duct losses	mm	m								
D1	900	5	1	1	1	1				
D2	0	0								
D3	0	0								
D4	0	0								
	size	No.								
bends	mm	off								
B1	900	1			1	2	3	3	3	3
B2	0	0								
B3	0	0								
B4	0	0								
Other losses 1		(optional)								
Other losses 2		(optional)								
Outlet size:										
B x H (mm)	1000	1200								
End reflection	12000	cm2	4	1						
Total losses			5	2	2	3	3	3	3	3
			75	80	75	72	73	67	61	56
Air to outlet	1.15	m3/s	0	0	0	0	0	0	0	0
Distance	10	m	-36	-36	-36	-36	-36	-36	-36	-36
Directivity Angle (0º,45º,or90º)	90	º	1	-1	-2	-7	-10	-10	-10	-10

For Barrier Losses insert data, otherwise set source-to-barrier distance to zero:

Source to barrier 0 m — Barrier to receiver 0 m

Source height 0 m — Barrier ht. 0 m — Receiver ht 0 m

Barrier Losses			0	0	0	0	0	0	0	0	
	SPL		40	43	37	29	27	21	15	10	dBA 33.8
CRITERION input the	**NC**	**or NR**									
appropriate level :		**20**	51	39	31	24	20	17	14	13	
	REQUIRED I.L.		**0**	**4**	**6**	**5**	**7**	**4**	**1**	**0**	

Insertion Loss (900mm 33% Free Area)	9	12	21	32	42	38	30	21	dBA
Resultant Noise Level	31	31	16	-3	-15	-17	-15	-11	16.5

Without Attenuator

63	125	250	500	1K	2K	4K	8K	dBA
40	43	37	29	27	21	15	10	33.8

With Attenuator

63	125	250	500	1K	2K	4K	8K	dBA
31	31	16	-3	-15	-17	-15	-11	16.5

Customer	IAL
Project	36 Avenue Road
System 4	VRF Units

ITEM	**INPUT**	
		dBA
SPL at 1m		**64**
No. of units	2	**67**
Distance	10 m	-20
Barrier Losses		-5
Directivity		-6
		dBA
Resultant Noise Level		36
Night Mode		27