



Project: J 04421
Mechanical Noise Impact Assessment:
GDK – 14 Oxford Road, Manchester

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Signed:

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1.0 BACKGROUND

1.1 The proposal for 14 Oxford Road, Manchester includes the introduction of new mechanical plant (supply/extract fans and external condenser units).

1.2 The proposed operational times are:

Sunday – Thursday: 11:00 – 23:00 hours

Friday & Saturday: 11:00 – 00:00 hours

1.3 Localised Environment

1.3.1 Oxford Road, Manchester is a busy A road (A34) with high volumes of mixed traffic type.

1.3.2 The localised environment contains a mixture of commercial properties, including NCP car park to the rear, university building (opposite side of Chester Road), KFC, Subway, Gregs and ‘The Dancehouse’ (occupying 1st and 2nd floors of the block).

There is existing mechanical plant associated with local restaurants e.g. KFC, Subway & Gregs

1.3.3 There are residential apartments above NCP Chester Street with Penthouse apartments on the top floors (7th & 8th Floors) with windows overlooking the rear of 14 Oxford Road (although all windows would be screened from any external mechanical plant located on the ground & 1st floor rear elevation).

1.4 Proposed Mechanical Plant:

Equipment/System	Serving
Supply Air System	Course Main Supply
Extract Air System	Kitchen / Toilet / Basement / Pot Wash
External Condensers	(AC)
External Condensers	Cold Rooms



- 1.5 Sound Planning has been retained to evaluate potential noise impact on the nearest noise sensitive receivers using appropriate methodologies and assessment criteria.

1.5.1 Participating Acoustic Consultant

Dan Thomas is a Member of the Institute of Acoustics (M.I.O.A) having attained appropriate qualifications in acoustics and experience within the workplace.

1.5.2 Qualifications

Dan has been working within the noise and vibration industry for fourteen years and has attained the following qualifications within the field of acoustics:

- Institute of Acoustics (IOA) Diploma
- Post Graduate Diploma in Applied Acoustics and Noise Control (University of Surrey)
- Masters Degree in Applied Acoustics and Noise Control (University of Surrey)

2.0 ASSESSMENT CRITERIA

- 2.1 Noise emissions from mechanical plant should be assessed in accordance with the requirements of British Standard 4142: 2014.^{1 2}

2.2 BS 4142: 2014 – Scope

- 2.2.1 This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

- a) sound from industrial and manufacturing processes;
- b) sound from fixed installations which comprise mechanical and electrical plant and equipment;

¹ British Standard 4142: 2014 – Methods for rating and assessing industrial and commercial sound.

² BS 4142: 1997 superseded by BS 4142: 2014.



- c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- d) sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

2.2.2 This standard is applicable to the determination of the following levels at outdoor locations:

- a) rating levels for sources of sound of an industrial and/or commercial nature and
- b) ambient, background and residual sound levels, for the purposes of:
 - investigating complaints;
 - assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and
 - assessing sound at proposed new dwellings or premises used for residential purposes.

2.3 BS 4142: 2014 – Assessment of Impacts

2.3.1 The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

2.3.2 Evaluation of Adverse Impact

- Typically, the greater this difference, the greater the magnitude of the impact.



- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- 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.

2.3.3 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

2.3.4 Objective method for assessing the audibility of tones in sound: One-third octave method

The test for the presence of a prominent, discrete-frequency spectral component (tone) typically compares the $L_{Zeq,T}$ sound pressure level averaged over the time when the tone is present in a one-third-octave band with the time-average linear sound pressure levels in the adjacent one-third-octave bands.

For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the one-third-octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent one-third-octave bands by some constant level difference. The level differences between adjacent one-third-octave bands that identify a tone are:

- 15 dB in the low-frequency one-third-octave bands (25 Hz to 125 Hz);
- 8 dB in the middle-frequency one-third-octave bands (160 Hz to 400 Hz);
- 5 dB in the high-frequency one-third-octave bands (500 Hz to 10 000 Hz).



2.3.5 Rating Level

Subjective Method:

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.

One-third octave method:

Identify tones using the method given in Annex C, then add a correction of 6 dB if a tone is present.

Reference methods

When the one-third octave method is not sufficient, use the reference method for assessing the audibility of tones given in Annex D, which produces a penalty on a sliding scale from 0 dB to 6 dB.

Use the reference method given in Annex E for measuring the prominence of impulsive sounds, which produces penalties in the range 0.0 dB to 9.0 dB.

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 a penalty of 3 dB can be applied.

2.4 Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems (DEFRA January 2005).

2.4.1 Minimum Requirements for Noise Control

For new premises or premises covered by planning conditions restricting the impact of noise the system shall be designed to prevent an acoustic impact on the external environment and therefore harm to the amenity.

For existing premises not covered by planning conditions restricting the impact of noise, the system shall be designed to avoid statutory nuisance and shall comply with the principles of Best Practicable Means.

To achieve these objectives the noise control system shall include:

- Control of noise at source to the greatest extent possible, and
- Control of noise to the environment by taking acoustic considerations into account within duct, grille and termination design.

The control system should meet the requirements laid down in BS 4142: 1997 “*Method for rating industrial noise affecting mixed residential and industrial areas*”.

2.4.2 Types of noise in industrial kitchens

Factors that influence magnitude of noise in a commercial kitchen are:

Size and format of the exhaust: The bulk flow leaving the exhaust diffuser generates broadband aero-acoustic noise. The sound level increases with increase in air speed and decreases with increase in area. The presence of grilles will generate tonal components. The sound levels are inversely proportional to the increase in area and increase with the eighth power of the flow speed.



- Heat release from kitchen: this influences the size of the exhaust system required and the flow rate of air to be handled by the system. Increase in flow rates can increase the pressure perturbations that can generate noise or can excite other parts of the system leading to noise.
- Type of cooking appliances used: this dictates the overall noise level as each individual appliance might contribute significantly to the total noise.
- Position of exhaust fan in the system: this may influence the noise radiated by the fan to the interior or exterior of the building and the transmission of sound energy into the exhaust duct system.
- Fitting and dimensions of the exhaust flow ducts: exhaust duct dimensions, fixings and insulation can all influence the amount of noise these structures will transmit and propagate. Selection of appropriate noise attenuating materials, avoidance of flow restrictions, and vibration isolators between the ducts and the fan are some of the aspects to be considered.
- Fan type and speed: Type of fan used (e.g. centrifugal fan with blades that are backward curved, forward curved or radial, or axial fan) will influence the level and nature of noise emitted. The fan characteristic needs to be chosen so that it is operating at its most efficient duty point as this tends to be the region of minimum noise.

If fan speed is too high it will be operating away from that point which can lead to increases in level of up to 10 dB, as well as inefficient air management. It is often also desirable acoustically to use larger fans operating at low speeds rather than smaller fans operating at higher speeds

2.4.3 Extract System Design

The following points should be taken into account when designing a ventilation system to minimise noise emissions:

- The fan and its installation should be designed as a complete package for a specific task. Fans generally produce less noise if operated at the optimum efficiency relative to their characteristics;



- Fans should be located within buildings at low level, that is, on side walls, rather than in the roofs of buildings, as ground effect and the local topography will far more readily reduce the noise transmission;
- Correct selection of duct size and type;
- Lined or lagged ducts, including bends, elbows or spigots, may be required if additional noise reduction is necessary; and
- The recommended maximum supply and return velocities for grilles and terminals should be applied.
- Silencers may be required where additional attenuation is necessary. A range of silencers is available and it may be necessary to insert in-duct silencers both upstream and downstream to prevent radiation of fan noise through ductwork. These should be fitted as close to the fan as possible (but not so close as to lead to a non-uniform air flow velocity across the face of the silencer). Where this is not possible, the intervening ductwork should be acoustically lagged. It may also be necessary to enclose or lag the fan. Where fans are used to push gases up a stack, silencers containing absorbent material can sometimes be mounted directly on top of the stack. However, where gases are hot, wet or dirty, the infill may need to be protected.
- Acoustic louvres on exhausts and inlets can greatly reduce environmental noise. However, their performance can sometimes increase back-pressure or the velocity of the air flow leading to increased noise.

3.0 METHODOLOGY

3.1 Background Noise Measurements

- 3.1.1 Background noise levels were measured in a position representative of the worst affected noise sensitive receivers (residential apartments above NCP car park) nearest to the proposed mechanical plant.

See APPENDIX 2, 3 & 4



- 3.1.2 Background noise levels were measured during an extended monitoring period from 13:45 hours Wednesday 28th April – 14:30 hours Friday 30th April, 2021.
 - 3.1.3 The measurement periods incorporated time periods which are thought to have the quietest existing background noise levels within the proposed operational times of the proposed mechanical plant.
 - 3.1.4 Measurements were undertaken in accordance with BS 7445³ and BS 4142⁴. The sound level meter was Class 1 and UKAS calibrated.
 - 3.1.5 The microphone was fixed 1.5m above the 1st floor flat roof towards the rear of 14 Oxford Road, in a position representative of the nearest noise sensitive receivers.
 - 3.1.6 The A-weighted L₉₀ parameter was measured using the Fast (F) setting, and logged periodically every 15 minutes.
 - 3.1.7 Meteoric conditions were dry with calm winds, and generally acceptable in accordance with BS 7445.
- 3.2 Equipment Noise Level Calculations (General)
- 3.2.1 All calculations will utilise the manufacturers' sound power level (SWL) or sound pressure level (SPL) data.
 - 3.2.2 Noise calculations will subtract system losses, distance corrections and propagation corrections to the nearest noise sensitive receivers (NSR) based on spherical divergence:

$$SPL_2 = SPL_1 - 20\log_r - 11 + DI^5 \pm MISC$$

Where 'r' = radius; SPL = Sound Pressure Level.

³ British Standard 7445-1: 2003 – *Description and measurement of environmental noise*. © BSI 1997. ISBN 0 580 19736 0.

⁴ British Standard 4142 – *Method for rating industrial noise affecting mixed residential and industrial areas*. © BSI 1997. ISBN 0 580 28300 3.

⁵ DI = Directivity Index.



3.3 Extraction Noise Level Calculations

3.3.1 All calculations will utilise the manufacturers' sound power level (SWL) data or calculated SWL based on the fan type, pressure and air volume⁶.

3.3.2 The fan sound power level (SWL) will be attenuated by internal system (duct) losses and end reflection on reaching the exhaust termination⁷.

3.3.3 Duct Break-Out⁸ calculations will utilise the formula:

$$SWL_{\text{break-out}} = SWL_{\text{duct}} - R + 10\log(S/A)^9$$

<i>Where</i>	<i>SWL</i>	<i>Sound Power Level</i>
	<i>S</i>	<i>Surface Area (Visible Duct)</i>
	<i>A</i>	<i>Cross Section</i>
	<i>R</i>	<i>Sound Reduction Index</i>

The term 'R' cannot give a greater break-out level than there is inside the duct. Therefore at low frequency the effective reduction is taken as 3dB.

3.3.4 The noise level at the nearest external noise sensitive receivers (NSR's) will be calculated using the formula:

$$SPL_2 = SPL_1 - 20\log r - 11 + DI^{10} \text{ [point source]} \text{ and } SPL_2 = SPL_1 - 10\log r - 11 + DI \text{ [line source]}.$$

Where 'r' = radius; SPL = Sound Pressure Level.

3.3.5 The directionality of the duct opening¹¹ relative to the receiver should also be considered; the approximate directivity attenuation can be found by comparing fd/c with the angle to the receiver¹².

⁶ Sound Research Laboratories: *Noise Control in Building Services*. Pergamon Press 1988.

⁷ Sound Research Laboratories: *Noise Control in Building Services*. Pergamon Press 1988.

⁸ See APPENDIX 7 – Plant Noise Calculations.

⁹ Sound Research Laboratories: *Noise Control in Building Services*. Pergamon Press 1988.

¹⁰ DI = Directivity Index.

¹¹ The configuration of the duct termination is currently unknown e.g. cowl etc.

¹² f = frequency; d = duct opening (m); and c = speed of sound 344m/s. Reference: Watson et al. *The Little Red Book of Acoustics*. BTA 2007.



- 3.3.6 Screening attenuation is based on Maekawa's formula (if required), where the expected insertion loss the barrier is the function of the Fresnel number $(2.8/\lambda)^{13}$.

'Line of sight' screening achieves a 5 dB reduction through frequencies.

- 3.3.7 Noise mitigation calculations will utilise sound reduction indices or insertion loss data from the manufacturer's specification data sheets.

3.4 Noise Level Evaluation

3.4.1 Extract Duct - Acoustic Features

Kitchen extract fans (attenuated) sound emissions contain minimal *tonality* (+2 dB penalty) and should not display '*impulsive*' sound characteristics; however they do emit 'other sound characteristics (+3 dB penalty) in operation.

Total sound characteristic penalties are 5 dB.

3.4.2 Target Noise Level

Due to the total sound penalties of 5 dB (for both noise sources), it would seem reasonable to target 10 dB below the lowest background level as required in BS 4142: 1997 (this equates to a Rating level of 5dB below background in the context of BS 4142: 2014).

This target level equates to an evaluation of '*complaints unlikely*' [BS 4142: 1997] and the sound source having '*low impact*' [BS 4142: 2014].

¹³ Attenborough, K. et al. *Predicting Outdoor Sound*. Copyright Taylor & Francis Group 2007.



4.0 RESULTS

4.1 Background Noise Levels¹⁴:

4.1.1 Lowest Background Noise Level for Different Operational Time Periods

Time Period (hours)	Lowest Background Level (dB L _{A90})	Time Occurred (Time Period) Hours
11:00 to 23:00	56.2	22:45 – 23:00
11:00 to 00:00	55.1	23:45 – 00:00
24 hours	43.9	03:15 – 03:30

4.1.2 The quietest background level during the proposed operational period of the supply/extract system/AC is 55 dB L_{A90}; the refrigeration condensers can operate any time in 24 hour period with a quietest background level of 44 dB L_{A90}.

See APPENDIX 6 – Background Noise Measurements

¹⁴ See APPENDIX 6 for full results.

4.2 Noise Sensitive Receivers

External Mechanical Plant	NSR Window Distance (m)	Screened from Nearest NSR ¹⁵
Supply System – Atmosphere Vent	14	Yes
Extract System – Atmosphere Vent	17	Yes
Toilet Exhaust Fan – Atmosphere Vent	15	Yes
Basement Exhaust System – Atmosphere Vent	16	Yes
Pot Wash Exhaust System – Atmosphere Vent	18	Yes
Refrigeration Condenser (RC1)	17	Yes
Refrigeration Condenser (RC2)	18	Yes
AC Condenser (ACC1)	14	Yes
AC Condenser (ACC2)	15	Yes
AC Condenser (ACC3)	16	Yes

See APPENDIX 2 – Site Location and APPENDIX 3 – Site Plans/Elevations

4.3 Levels of Uncertainty

Category	Notes
Complexity of Sound Source	Extract/Supply Atmosphere Vents Directivity/Screening to NSRs Condensers (fan/compressor)
Complexity of Acoustic Environment (Residual)	Site positioned to the rear of busy high street with commercial buildings including restaurants.
Level of Residual Sound (including Specific)	n/a

¹⁵ ‘Line of sight’ screening results in a minimum attenuation level of 5dB.



5.0 NOISE LEVEL CALCULATIONS

5.1 Combined Sound Pressure Level at Nearest Noise Sensitive Façade (before attenuation)

5.1.1 Nearest Noise Sensitive Receiver (window) – Restaurant Opening Hours

System Area	Level @ NSR
(Opening Times)	dB(A)
Supply System - Atmosphere Vent	43
Extract System - Atmosphere Vent	43
Toilet Exhaust Fan - Atmosphere Vent	26
Basement Exhaust System - Atmosphere Vent	39
Pot Wash Exhaust System - Atmosphere Vent	32
Refrigeration Condenser (RC1)	21
Refrigeration Condenser (RC2)	33
AC Condenser (ACC1)	27
AC Condenser (ACC2)	31
AC Condenser (ACC3)	31
Combined	47
Background	55
Excess	-8

5.1.2 Nearest Noise Sensitive Receiver (window) – 24 hrs (refrigeration condensers)

System Area	Level @ NSR
(24 hours)	dB(A)
Refrigeration Condenser (RC1)	21
Refrigeration Condenser (RC2)	33
Combined	33
Background	44
Excess	-11



6.0 NOISE MITIGATION (recommended)

6.1 Nearest Noise Sensitive Receiver (window) – Restaurant Opening Hours

System Area	Attenuation	Level @ NSR
(Opening Times)		dB(A)
Supply System - Atmosphere Vent	MUB Silencer 062	21
Extract System - Atmosphere Vent	MUB Silencer 062	21
Toilet Exhaust Fan - Atmosphere Vent	/	26
Basement Exhaust System - Atmosphere Vent	LDC 315-900 Silencer	29
Pot Wash Exhaust System - Atmosphere Vent	/	32
Refrigeration Condenser (RC1)	/	21
Refrigeration Condenser (RC2)	/	33
AC Condenser (ACC1)	/	27
AC Condenser (ACC2)	/	31
AC Condenser (ACC3)	/	31
Combined		38
Background		55
Excess		-17

See APPENDIX 7 - Plant Noise Calculations for further calculation detail

6.2 Nearest Noise Sensitive Receiver (window) – 24 hrs (refrigeration condensers)

System Area	Attenuation	Level @ NSR
(24 hours)		dB(A)
Refrigeration Condenser (RC1)	/	21
Refrigeration Condenser (RC2)	/	33
Combined		33
Background		44
Excess		-11

See APPENDIX 7 - Plant Noise Calculations for further calculation detail



6.3 Noise Mitigation Notes

6.3.1 Silencers should be fitted as close as possible to the fan (atmosphere side) as specified.

6.3.2 The cross-sectional area of the silencer may have to be larger than the duct in order to restrict pressure drop to permissible levels¹⁶; if this is the case duct transitions may be required before and after the silencer.

6.4 Silencer Suppliers

Systemair (Manchester) TEL: 0161 8737212

7.0 CONCLUSIONS

7.1 Sound Planning has carried out a noise impact assessment in accordance with BS 7445: 2003 and BS 4142: 2014.

See section 3.0 - METHODOLOGY

7.2 Background Noise Levels

7.2.1 Lowest Background Noise Level for Different Operational Time Periods

Time Period (hours)	Lowest Background Level (dB L_{A90})
11:00 to 23:00	56.2
11:00 to 00:00	55.1
24 hours	43.9

¹⁶ The contractor should verify pressure drop with silencer supplier.



7.2.2 The quietest background level during the proposed operational period of the supply/extract system/AC is 55 dB L_{A90} ; the refrigeration condensers can operate any time in 24 hour period with a quietest background level of 44 dB L_{A90} .

7.3 Predicted Sound Levels at Nearest Noise Sensitive Receivers

The introduction of noise mitigation measures (noise control products) results in a combined external mechanical plant noise level at the worst affected noise sensitive window which meets target levels during restaurant opening hours and overnight (refrigeration plant) i.e. 10 dB below background.

The proposed noise mitigation measures result in a *low impact* at the worst affected noise sensitive receiver and meet the requirements of BS 4142: 2014.

See paragraph 6.1 – 6.4

7.4 Noise Mitigation Products

7.4.1 Supply System

Inlet (atmosphere): Systemair 062 MUB Silencer 062

7.4.2 Extract System

Outlet (atmosphere): Systemair 062 MUB Silencer 062

7.4.3 Basement Exhaust System

Outlet (atmosphere): Systemair LDC 315-900

7.5 Levels of Uncertainty

7.5.1 The complexity and screening of the sound sources would lead to the greatest uncertainty. Sound Planning has evaluated each source in detail, its position relative to the nearest noise sensitive receivers and used appropriate calculation methodology in order to accurately predict specific noise (and noise rating level) at the nearest noise sensitive receiver.



- 7.5.2 Sound Planning has taken the lowest background noise levels for equipment operational times from the extended noise measurement period.
- 7.5.2 Sound Planning has designed to a minimum 10 dB below background (assumed), this should allow for any penalties which could be applied for '*Tonality*', '*Impulsivity*', '*Intermittency*' and '*Other Sound Characteristics*'.



APPENDIX 1

Terms & Definitions

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2×10^{-5} pascals) and the threshold of pain is around 120 dB. The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).



BS 4142 - Noise Descriptors

For the purposes of this British Standard, the following terms and definitions apply.

NOTE All the measurements and values used throughout this standard are “A”-weighted. Where “A” weighting is not explicit in the descriptor, it is to be assumed in all cases, except where it is clearly stated that it is not applicable, as in the case of tones.

Acoustic Environment

Sound from all sound sources as modified by the environment [BS ISO 12913-1:2013].

Ambient Sound

Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far .

NOTE The ambient sound comprises the residual sound and the specific sound when present.

Ambient Sound Level, $L_a = L_{Aeq,T}$

Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T .

NOTE The ambient sound level is a measure of the residual sound and the specific sound when present.

Background Sound Level, $L_{A90,T}$

A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T , measured using time weighting F and quoted to the nearest whole number of decibels.

Equivalent Continuous A-weighted Sound Pressure Level, $L_{Aeq,T}$

Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10 \lg_{10} \left\{ (1/T) \int_{t_1}^{t_2} [p_A(t)^2 / p_0^2] dt \right\}$$

where:

p_0 is the reference sound pressure (20 μ Pa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t .

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Measurement Time Interval, T_m

Total time over which measurements are taken.

NOTE This may consist of the sum of a number of non-contiguous, short-term measurement time intervals.

Rating Level, L_{Ar,T_r}

Specific sound level plus any adjustment for the characteristic features of the sound.

Reference Time Interval, T_r

Specified interval over which the specific sound level is determined.

NOTE This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h.

Residual Sound

Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

Residual Sound Level, $L_r = L_{Aeq,T}$

Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T .



Specific Sound Level, $L_s = L_{Aeq,Tr}$

Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr .

Specific Sound Source

Sound source being assessed.

Frequency Analysis

Octave Band	<i>A band of frequencies the upper limit of which is twice the lower limit. They are known by their centre frequency, e.g., 63, 125, 250, 500, 1000, 2000 Hz...</i>
One Third Octave	<i>The logarithmic frequency interval between a lower frequency f_2, when f_2/f_1 equals $2^{1/3}$ apart. Frequencies include: 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1000Hz.</i>

Sound Transmission in the Open Air

Most sources of sound can be characterised as a single point in space. The sound energy radiated is proportional to the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law.

In decibel terms, every time the distance from a point source is doubled, the sound pressure level is reduced by 6 dB. Road traffic noise is a notable exception to this rule, as it approximates to a line source, which is represented by the line of the road. The sound energy radiated is inversely proportional to the area of a cylinder centred on the line. In decibel terms, every time the distance from a line source is doubled, the sound pressure level is reduced by 3 dB.



Factors Affecting Sound Transmission in the Open Air

Reflection

When sound waves encounter a hard surface, such as concrete, brickwork, glass, timber or plasterboard, it is reflected from it. As a result, the sound pressure level measured immediately in front of a building façade is approximately 3 dB higher than it would be in the absence of the façade.

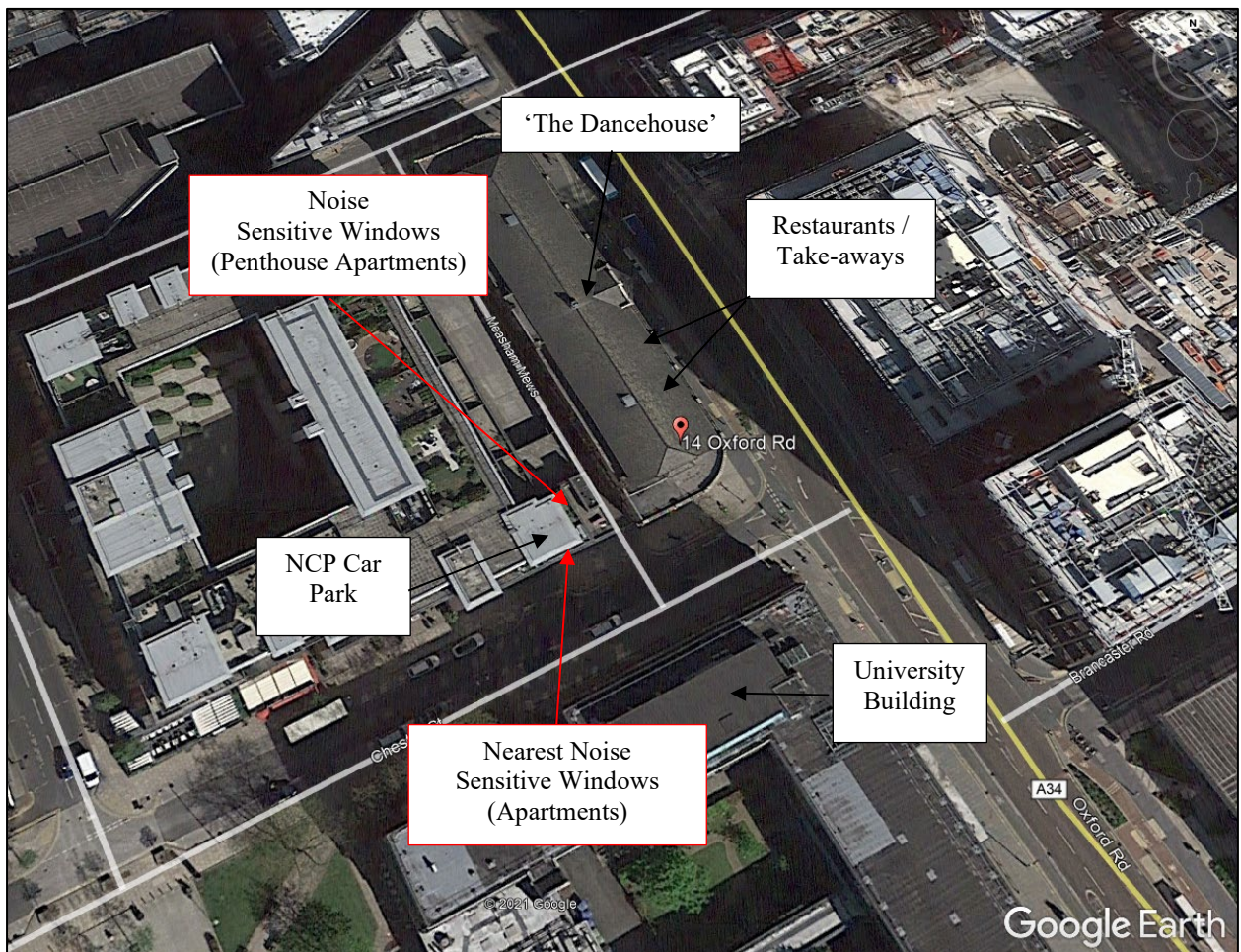
Screening and Diffraction

If a solid screen is introduced between a source and receiver, interrupting the sound path, a reduction in sound level is experienced. This reduction is limited, however, by diffraction of the sound energy at the edges of the screen. Screens can provide valuable noise attenuation however. For example, a timber boarded fence built next to a motorway can reduce noise levels on the land beyond, typically by around 10 dB(A). The best results are obtained when a screen is situated close to the source or close to the receiver.

APPENDIX 2

Site Location

Google Earth - Screenshot



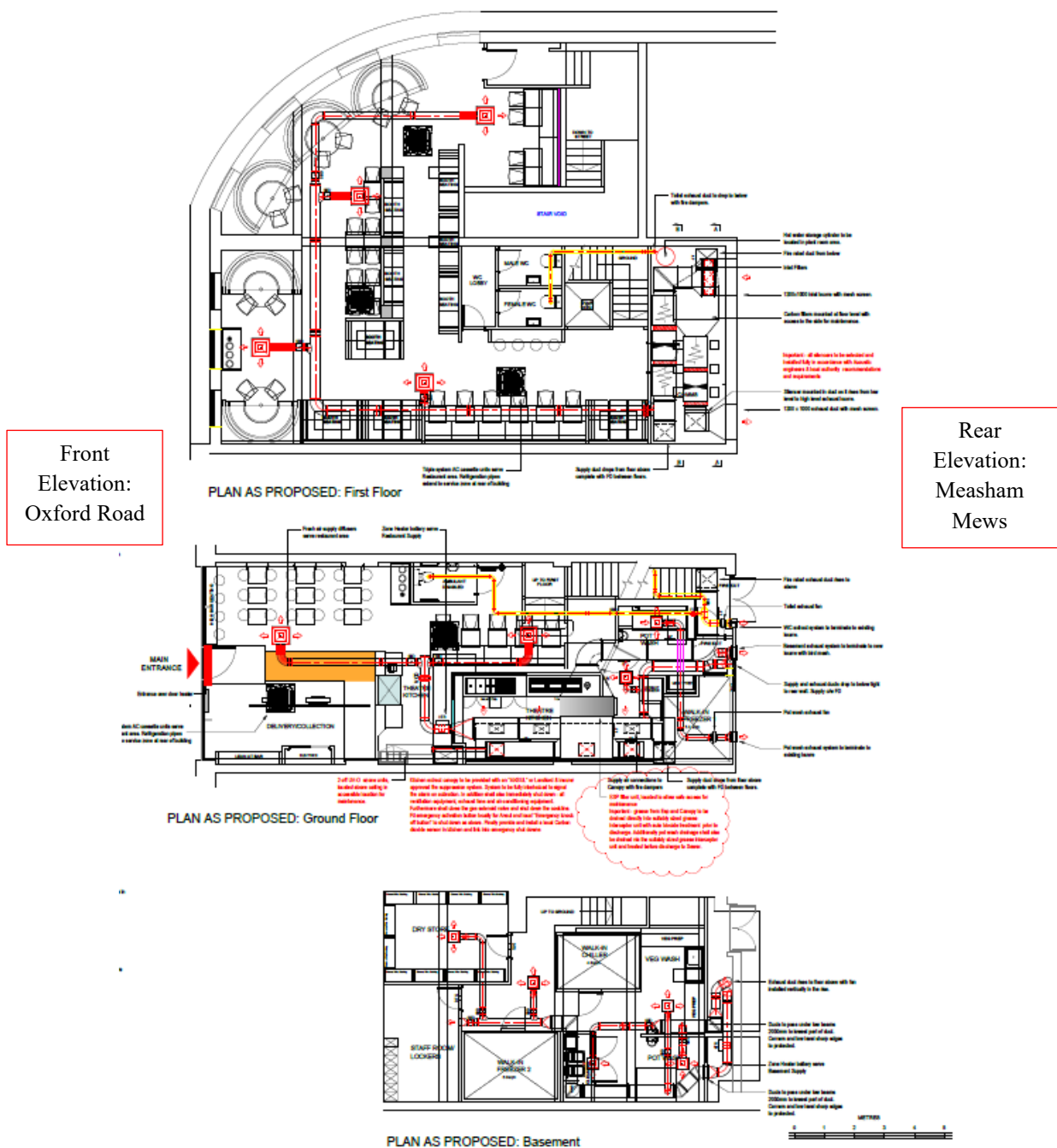
14 Oxford Road, Manchester



APPENDIX 3

Site Plans/Elevations (proposed)

Mechanical Plant Layout



Site Plans/Elevations (proposed)

Mechanical Plant Layout

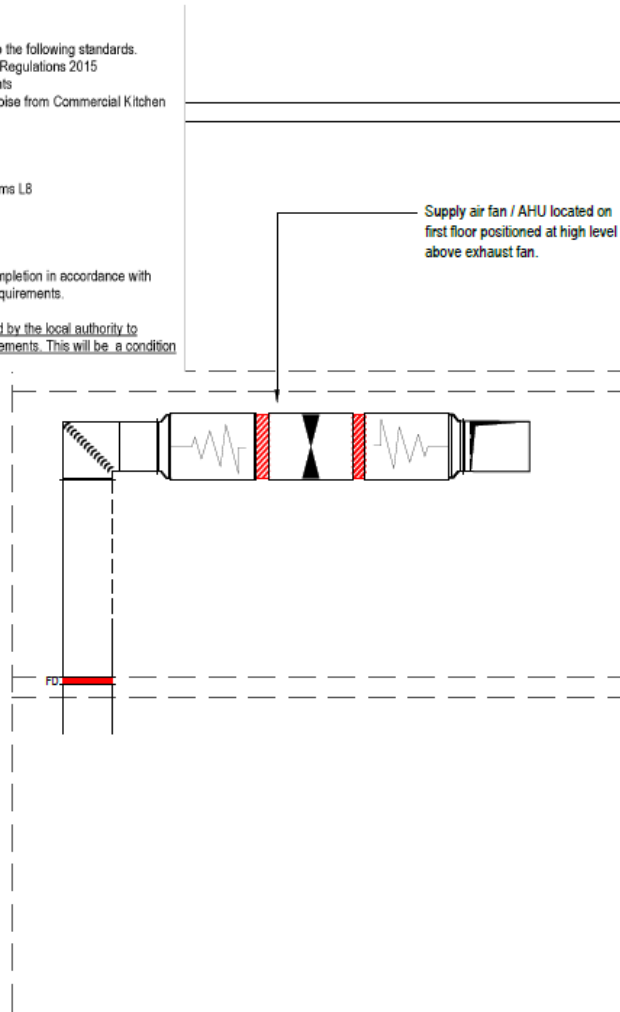
Supply Air System

Important

Contractor to also note adherence required to the following standards.
 The Construction (Design and Management) Regulations 2015
 The Building Regulations Approved Documents
 DEFRA Guidelines – Control of Odour and Noise from Commercial Kitchen
 Exhaust Systems 2018
 CIBSE Guides and Technical Notes
 Water Regulations
 Gas Safety Regulations
 Control of Legionella Bacteria in Water Systems L8
 BS 7671 18th Edition
 BS 5839
 BS 5266

All pipe services to be fully chlorinated on completion in accordance with
 British Standards and local water authority requirements.

An Acoustic survey and report will be required by the local authority to
 demonstrate compliance with planning requirements. This will be a condition
 of the planning consent.

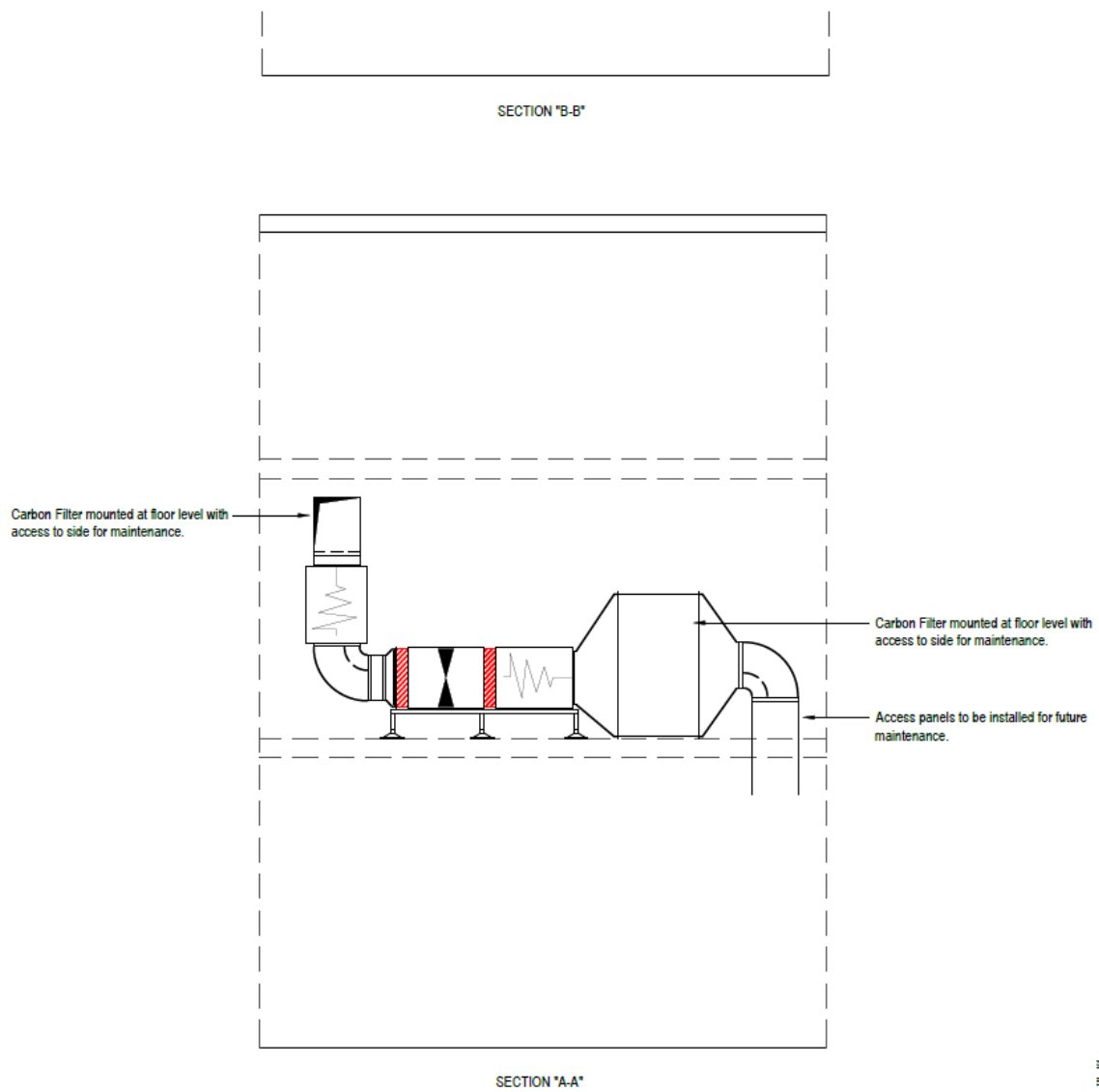


SECTION "B-B"

Site Plans/Elevations (proposed)

Mechanical Plant Layout

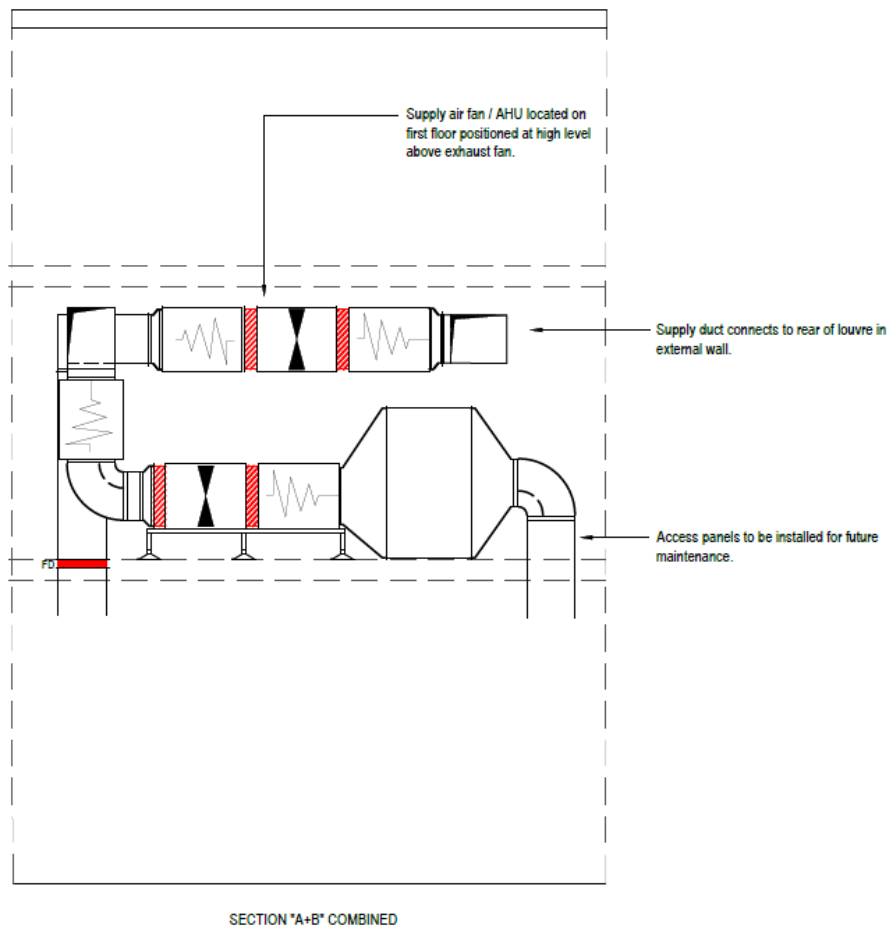
Exhaust Air System



Site Plans/Elevations (proposed)

Mechanical Plant Layout

Supply & Exhaust Air Systems

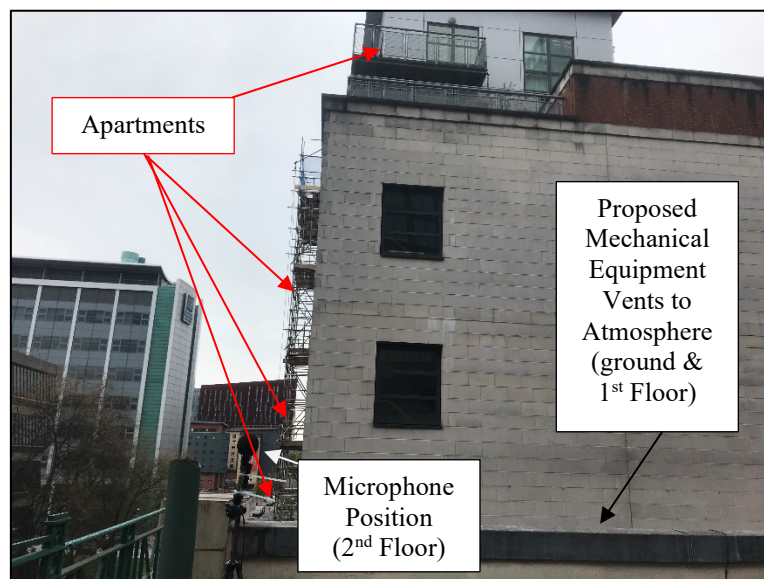


APPENDIX 4

Site Photographs

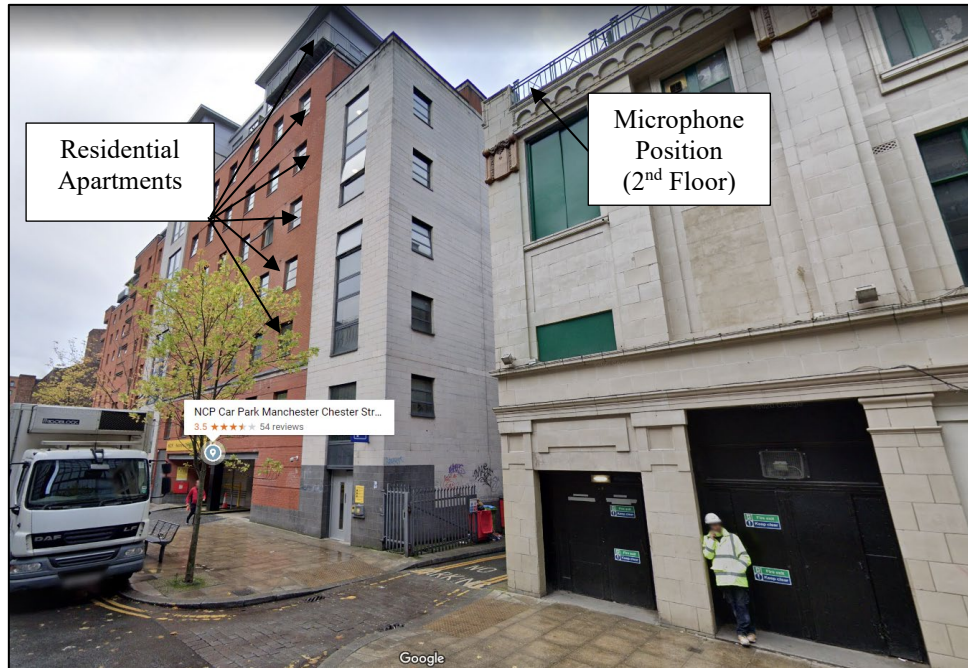


14 Oxford Road, Manchester

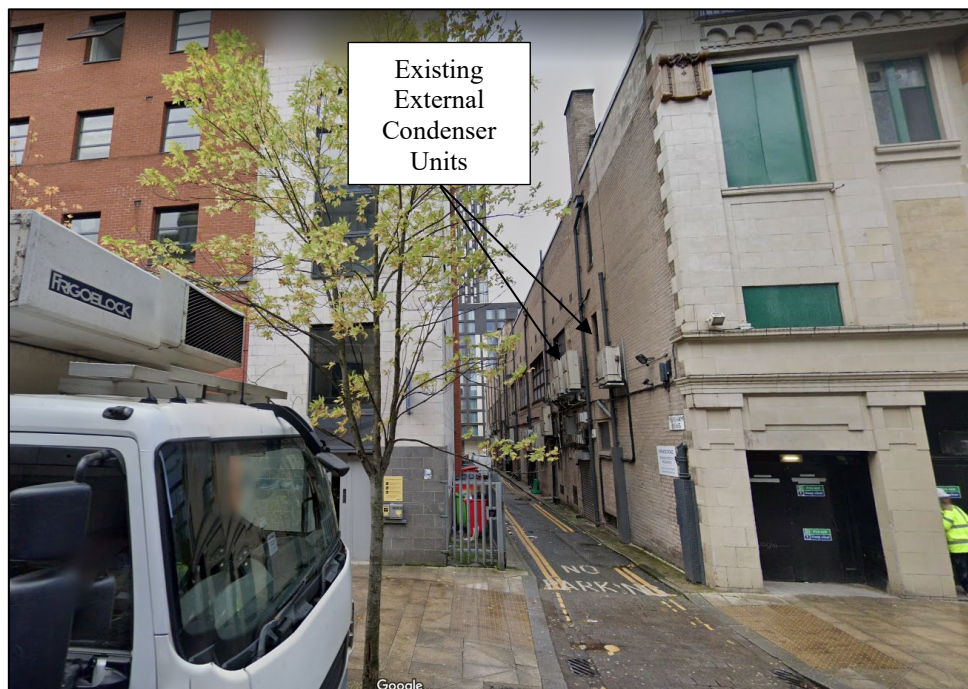


Microphone Position

Site Photographs



14 Oxford Street (view from Chester Street)



14 Oxford Street – Rear Elevation (existing)

Site Photographs



14 Oxford Street – Rear Elevation (existing)

APPENDIX 5

Equipment Noise Data

Extract Fan

MUB-T



MUB/T 100 630D4-K2-L

Centrifugal box fan, 120°C continuous, insulated

Item Number: 229747

Variant: 400V 3~ 50Hz

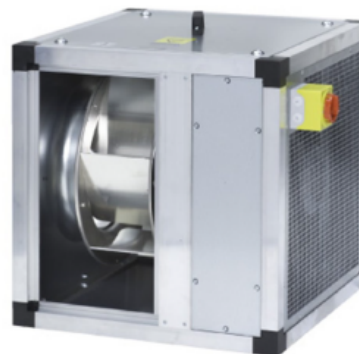
- High efficient motor
- Speed-controllable via frequency converter
- Integral cold conductor (PTC)
- Low sound level
- Max temperature of transported air up to 120°C
- Easy to maintain and reliable

The MUB/T Thermofans size 630D4-K2 are equipped with high efficient motors. The MUB/T fans have impellers with backward curved blades, manufactured from aluminum, and standard motors, which can be speed controlled via frequency converter. Motors are outside the air stream. The casing consists of an aluminum frame with fiberglass reinforced plastic corners and double skin, galvanized steel panels with a 20 mm mineral wool insulation. Panels are removable, allowing flexible ventilation solutions. With quick lock access door. The MUB/T casing is equipped with a condensate tray under the impeller and a protection guard at the motor side. An isolator switch is mounted on the casing.

Motor protection is done by cold conductors (PTC), which have to be connected to an external motor protection device.

The MUB/T fans are delivered to 90° air direction airflow.

MUB with additional modules (filters, heaters etc.) are available as air handling units "K025, K042 or K062" on request!



Technical parameters

Nominal data		
Voltage (Nominal)	400	V
Frequency	50	Hz
Phase(s)	3~	
Motor circuit connection	D	
Input power	5,175	W
Input current	8.38	A
Impeller speed	1,439	r.p.m.
Air flow	max 5.2611	m³/s
Temperature of transported air	max 120	°C
Sound data		
Sound pressure level at 3m (20m² Sabin)	72	dB

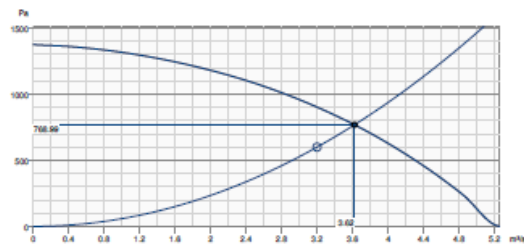
Equipment Noise Data

Extract Fan

MUB-T

Performance

Performance curve



Hydraulic data

Required air flow	3.20 m³/s
Required static pressure	600 Pa
Working air flow	3.62 m³/s
Working static pressure	769 Pa
Air density	1.204 kg/m³
Power	5174.3 W
Fan control - RPM	1439 rpm
Current	8.38 A
SFP	1.428 kW/m³/s
Control voltage	400.0 V
Supply voltage	400 V

Sound power level		63	125	250	500	1k	2k	4k	8k	Total
Inlet	dB(A)	54	74	75	79	80	79	74	68	85
Outlet	dB(A)	55	75	76	81	81	80	76	69	87
Surrounding	dB(A)	52	67	64	63	65	65	67	61	73
Sound pressure level at 3m (20m² Sabine)	dB(A)	-	-	-	-	-	-	-	-	66
Sound pressure level at 3m free field	dB(A)	-	-	-	-	-	-	-	-	52

Equipment Noise Data

Supply Fan

MUB



MUB 062 630EC Coarse 65%

with integrated filter Coarse 65% (G4)
Item Number: 88767
Variant: 400V 3~ 50Hz

With built-in panel-filter, class Coarse 65% (G4)
Revision-panel at side
100% speed-controllable
Integrated electronic motor protection
Low sound level
Installation in any mounting position
Maintenance-free and reliable
Energy-saving

The MUB-EC fans are driven by EC-external rotor motors. These are energy saving motors with high efficiency. The power electronics are integrated in the motor housing. All models have one potential-free terminal for error message. All motors are suitable to be used for 50/60Hz. The input voltage for single phase units can vary between 200 and 277V, for three phase units between 380 and 480V. Speed control by a 0-10V signal. From size 450 the motor has an output voltage of 10V and 20V for an external potentiometer.

All models are equipped with impellers with backward curved blades, manufactured from aluminium. The casing consists of an aluminium frame with fibreglass reinforced plastic corners of PA6; highly shock-resistant. The double skin panels are manufactured from galvanized steel with 20 mm mineralwool insulation. To avoid condensation the profile is provided with a separate chamber to fix the screws. The panels are removable, any outlet side can be chosen, allowing flexible ventilation solutions.

The unit is equipped with a panel-filter, filter-class Coarse 65% (G4) and a revision-panel for replacement of the filter. The maximal airvolume is limited by the filter at maximum of 1800 l/s.

Installation in any mounting position is possible.



Technical parameters

Unit	
Frequency	50 Hz
Voltage (Nominal)	400 V
Phase(s)	3~
Enclosure class	IP55
Speed regulation	None
Air flow	0 to 1.8056 m³/s
Product type	Supply unit
Supply fan	
Voltage	400 V
Phase(s)	3~
Current	4.03 A
Input power (P1), supply fan	2,750 W
Impeller speed	1,656 r.p.m.
Max. Temperature of transported air, when speed controlled	55 °C
Insulation class	F

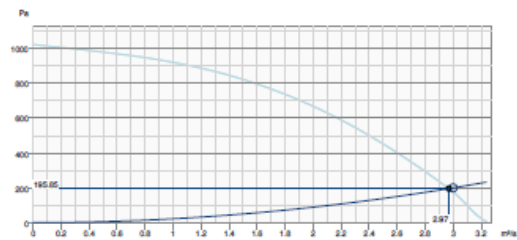
Equipment Noise Data

Supply Fan

MUB

Supply air filter	
Filter class, supply air	G4
Dimensions and weights	
Weight	91.3 kg
Sound data	
Sound pressure level at 3m (20m² Sabin)	67 dB(A)

Performance curve

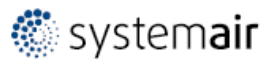


Hydraulic data	
Required air flow	3.00 m³/s
Required static pressure	200 Pa
Working air flow	2.97 m³/s
Working static pressure	196 Pa
Air density	1.204 kg/m³
Power	2878.7 W
Fan control - RPM	1642 rpm
Current	4.23 A
SFP	0.970 kW/m³/s
Control voltage	10.0 V
Supply voltage	400 V

Sound power level		63	125	250	500	1k	2k	4k	8k	Total
Inlet	dB(A)	54	73	73	75	77	74	71	71	82
Outlet	dB(A)	55	74	74	76	78	75	72	72	84

Equipment Noise Data

Toilet Extract Fan



K 100 EC sileo

Systemair Circular duct fan K 100 EC

Item Number: 16955

Variant: 230V 1~ 50/60Hz



EC-motors, high level of efficiency

100% speed controllable

Integrated motor protection

Supplied with mounting bracket

EC technology is intelligent technology; using integral electronic control which eliminates the slip losses in the motor and ensures that the motor always runs at optimal load and guarantees that the proportion of energy utilised effectively is many times higher and the energy usage considerably lower compared with AC motors.

EC fans are notable for their economical use of energy and excellent ease of control. They can be varied in speed to match the airflow demand, and operate at high efficiency levels. For the same air volume, they consume distinctly less energy than AC fan drives.

Another special feature of EC fans is their energy-saving potential not only at full load, but especially at part-load. When operating at part-load, the energy used is much lower than with an asynchronous motor of equivalent output.

Reduced energy usage guarantees a drop in operating costs.

The K EC series is designed for installation in ducts. All the K-fans have minimum 25 mm long spigot connections. The fans have backward-curved blades and external rotor motors (EC). The FK mounting clamp facilitates easy installation and removal, and prevents the transfer of vibration to the duct. The fans are delivered with a pre-wired potentiometer (0-10V) that allows you to easily find the desired working point.

Motor protection is integrated in the electronics of the motor. The casing is manufactured from galvanised sheet steel with the seams folded to give the fan a close to air tight casing.



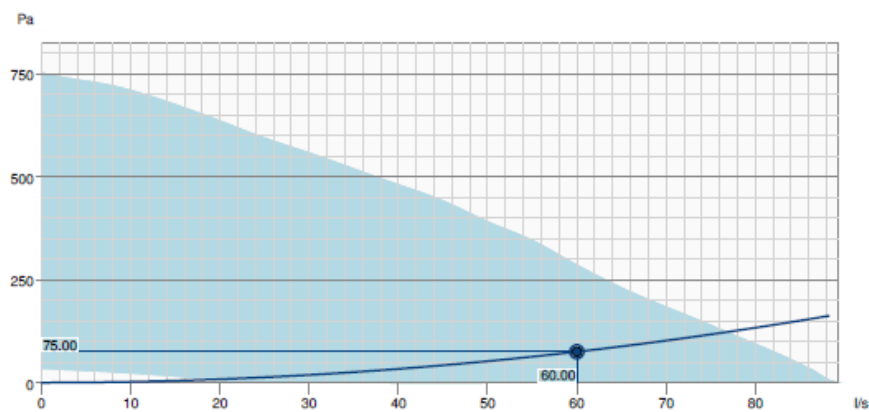
Technical parameters

Nominal data	
Voltage (nominal)	230 V
Frequency	50; 60 Hz
Phase(s)	1~
Input power	83 W
Input current	0.69 A
Impeller speed	3,479 r.p.m.
Air flow	max 321 m³/h
Temperature of transported air	max 60 °C

Equipment Noise Data

Toilet Extract Fan

Performance curve



Hydraulic data	
Required air flow	60.00 l/s
Required static pressure	75 Pa
Working air flow	60.00 l/s
Working static pressure	75 Pa
Air density	1.204 kg/m³
Power	37.7 W
Fan control - RPM	2442 rpm
Current	0.31 A
SFP	0.628 kW/m³/s
Control voltage	6.9 V
Supply voltage	230 V

Sound power level		63	125	250	500	1k	2k	4k	8k	Total
Inlet	dB(A)	52	61	66	66	63	59	50	38	71
Outlet	dB(A)	53	63	63	61	63	59	51	38	69
Surrounding	dB(A)	12	11	25	43	44	42	37	22	48
Sound pressure level at 3m (20m² Sabine)	dB(A)	-	-	-	-	-	-	-	-	41
Sound pressure level at 3m free field	dB(A)	-	-	-	-	-	-	-	-	27

Equipment Noise Data

Basement Exhaust System – Fan



K 315L EC Circular duct fan

Centrifugal circular duct fan
Item Number: 2585
Variant: 230V 1~ 50/60Hz



EC-motors, high level of efficiency
100% speed controllable
Integrated motor protection
Supplied with mounting bracket
EC technology is intelligent technology; using integral electronic control which eliminates the slip losses in the motor and ensures that the motor always runs at optimal load and guarantees that the proportion of energy utilised effectively is many times higher and the energy usage considerably lower compared with AC motors. EC fans are notable for their economical use of energy and excellent ease of control. They can be varied in speed to match the airflow demand, and operate at high efficiency levels. For the same air volume, they consume distinctly less energy than AC fan drives. Another special feature of EC fans is their energy-saving potential not only at full load, but especially at part-load. When operating at part-load, the energy used is much lower than with an asynchronous motor of equivalent output.

Reduced energy usage guarantees a drop in operating costs.

The K EC series is designed for installation in ducts. All the K-fans have minimum 25 mm long spigot connections. The fans have backward-curved blades and external rotor motors (EC). The FK mounting clamp facilitates easy installation and removal, and prevents the transfer of vibration to the duct. The fans are delivered with a pre-wired potentiometer(0-10V) that allows you to easily find the desired working point.

Motor protection is integrated in the electronics of the motor. The casing is manufactured from galvanised sheet steel with the seams folded to give the fan a close to air tight casing. Outdoor mounting and wet room applications are possible due to the fans air tight casing and the IP 55 rated terminal box with a IP 68 rated M20 cable gland.



Technical parameters

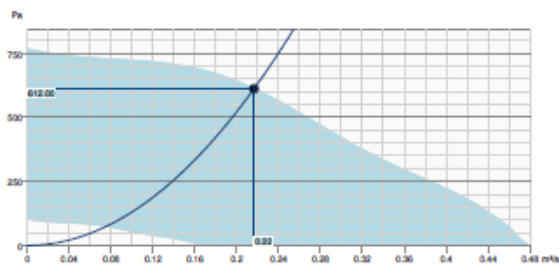
Nominal data	
Voltage (Nominal)	230 V
Frequency	50; 60 Hz
Phase(s)	1~
Input power	340 W
Input current	2.08 A
Impeller speed	2,719 r.p.m.
Air flow	max 0.481 m³/s
Temperature of transported air	max 55 °C
Max temperature of transported air, when speed controlled	55 °C

Equipment Noise Data

Basement Exhaust System – Fan

Performance

Performance curve

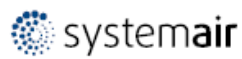


Hydraulic data	
Required air flow	0.22 m³/s
Required static pressure	612 Pa
Working air flow	0.22 m³/s
Working static pressure	612 Pa
Air density	1.204 kg/m³
Power	324.2 W
Fan control - RPM	2786 rpm
Current	1.98 A
SFP	1.497 kW/m³/s
Control voltage	10.0 V
Supply voltage	230 V

Sound power level		63	125	250	500	1k	2k	4k	8k	Total
Inlet	dB(A)	66	74	74	78	75	71	69	67	83
Outlet	dB(A)	64	72	76	75	75	75	72	65	82
Surrounding	dB(A)	44	46	57	62	54	54	52	43	64
Sound pressure level at 3m (20m² Sabine)	dB(A)	-	-	-	-	-	-	-	-	57
Sound pressure level at 3m free field	dB(A)	-	-	-	-	-	-	-	-	43

Equipment Noise Data

Pot Wash Exhaust System – Fan



KVK Silent 355 EC

Centrifugal circular duct fan

Item Number: 92173

Variant: 230V 1~ 50/60Hz



Technical parameters

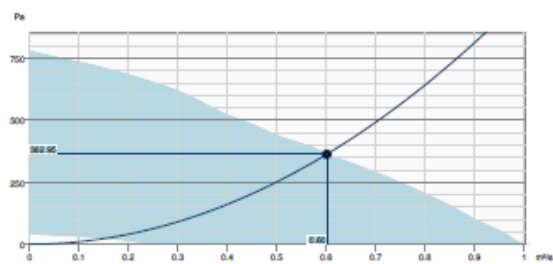
Nominal data	
Voltage (Nominal)	230 V
Frequency	50; 60 Hz
Phase(s)	1~
Input power	533 W
Input current	2.36 A
Impeller speed	1,803 r.p.m.
Air flow	max 1.002 m³/s
Temperature of transported air	max 60 °C
Max temperature of transported air, when speed controlled	60 °C
Sound data	
Sound pressure level at 3m (20m² Sabin)	53 dB(A)
Protection/Classification	
Enclosure class, motor	IP55
Insulation class	F

Equipment Noise Data

Pot Wash Exhaust System – Fan

Performance

Performance curve



Hydraulic data	
Required air flow	0.60 m³/s
Required static pressure	363 Pa
Working air flow	0.60 m³/s
Working static pressure	363 Pa
Air density	1.204 kg/m³
Power	519.8 W
Fan control - RPM	1833 rpm
Current	2.27 A
SFP	0.864 kW/m³/s
Control voltage	10.0 V
Supply voltage	230 V

Sound power level		63	125	250	500	1k	2k	4k	8k	Total
Inlet	dB(A)	61	68	71	57	56	55	52	44	73
Outlet	dB(A)	55	67	72	66	68	63	57	48	75
Surrounding	dB(A)	40	50	60	49	42	39	31	32	61
Sound pressure level at 3m (20m² Sabine)	dB(A)	-	-	-	-	-	-	-	-	54
Sound pressure level at 3m free field	dB(A)	-	-	-	-	-	-	-	-	40



Equipment Noise Data

Coldroom Condensers

Tecumseh WINAJ9510Z-TZ



Tecumseh

Condensing unit
Voltage Code : TZ

High Temp. Commercial (MHP)

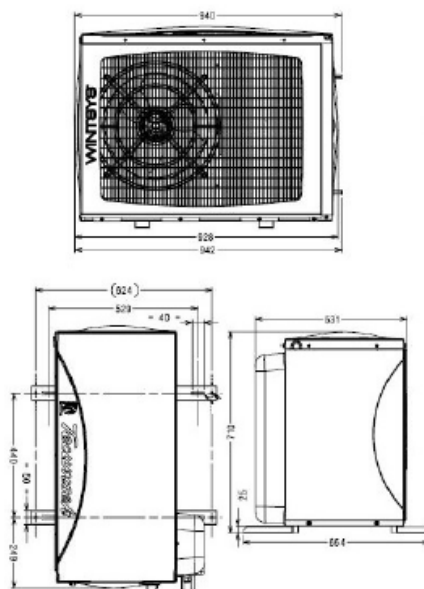
WINAJ9510Z-TZ

400V 3~ 50Hz / 440V 3~ 60 Hz

R452A / R404A / R448A / R449A

WINAJ9510Z-TZ

Conditions	Frequency	Nominal Cooling Capacity		Sound Power ISO 3745 / ISO 3743-1
		Watts	BTU/h	
EN13215 / R452A	50 Hz / 60 Hz	1617 / 1943	5513 / 6626	59 dBA
EN13215 / R404A	50 Hz / 60 Hz	1664 / 2037	5776 / 6945	59 dBA
EN13215 / R448A	50 Hz / 60 Hz	1478 / 1775	5039 / 6052	59 dBA
EN13215 / R449A	50 Hz / 60 Hz	1478 / 1776	5041 / 6055	59 dBA



* EN13215 : T*Ambient 32.0°C / T*Evap. -10.0°C / T*Return gas temp.. 20.0°C
T*Subcooling: 3.0K

Net Weight (Kg)	63.0
Expansion device	Expansion_Valve
Air Flow (m³/h)	1650 / 1650
Compo Data Sheet	224EU-TZ
Elec Comp Type	TRI
Current (Amp)	
Load Rated Amp	2.4 2.5
Max Cont Current	4.1 4.3
Lock Rotor Amp	15 15
Fan	
Speed (rpm)	546 / 546
Power (W)	65.0
Diameter (mm)	360
Protection	Overload
IP Level	IP44
Condenser	360/11500
Liquid Receiver	
Capacity (L)	1.5
Maximum Pressure (Bars)	32.0
Suction Line	
Suction Type	Tube / Tube
For Tubing Out Diam	15.9 (5/8")
Suction Connection Type	Brased
Liquid Line	
Liquid Line Type	Tube
For Tubing Out Diam	9.5 (3/8")
Liquid Connecton Type	Brased
Connection Type	TT
Fan Guard	maille < a 8mm

Note : Tecumseh reserves the right to change Information contained in this document without notification.

Selection program - V4.6_2021028 - 08/02/2021



Equipment Noise Data

Coldroom Condensers

Tecumseh WINFH2511Z-FZ



Condensing unit
Voltage Code : FZ

WINFH2511Z-FZ

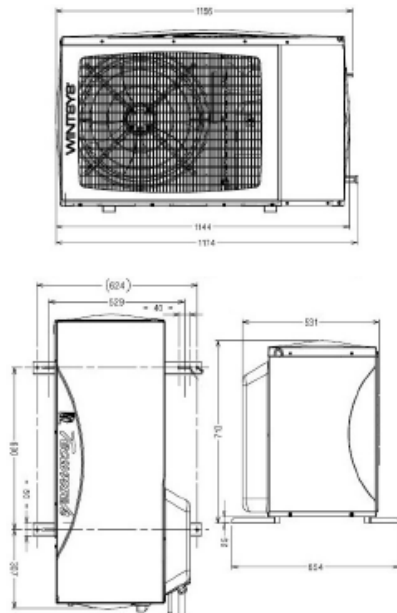
Low Temp. Commercial (BP)

220 - 240V 1~ 50 Hz

R452A / R404A / R448A / R449A

WINFH2511Z-FZ

Conditions	Frequency	Nominal Cooling Capacity		Sound Power ISO3745 / ISO 3743-1
		Watts	BTU/h	
EN13215 / R452A	50 Hz	1515	5165	71 dBA
EN13215 / R404A	50 Hz	1683	5739	71 dBA
EN13215 / R448A	50 Hz	1221	4164	71 dBA
EN13215 / R449A	50 Hz	1222	4166	71 dBA



* EN13215 : T'Ambient 32.0°C / T'Evap. -35.0°C / T'Return gas temp.. 20.0°C
T'Subcooling. 3.0K

Net Weight (Kg)	82.0
Expansion device	Expansion_Valve
Air Flow (m³/h)	2750
Compo Data Sheet	126LT-F
Elec Comp Type	CSR
Current (Amp)	
Load Rated Amp	12.1
Max Cont Current	24.7
Lock Rotor Amp	82
Fan	
Speed (rpm)	830
Power (W)	125.0
Diameter (mm)	450
Protection	Overload
IP Level	IP44
Condenser	450/11500
Liquid Receiver	
Capacity (L)	2.35
Maximum Pressure (Bars)	32.0
Suction Line	
Suction Type	Tube / Tube
For Tubing Out Diam	15.9 (5/8")
Suction Connection Type	Brased
Liquid Line	
Liquid Line Type	Tube
For Tubing Out Diam	12.7 (1/2")
Liquid Connection Type	Brased
Connection Type	TT
Fan Guard	maille < à 8mm

Note : Tecumseh reserves the right to change information contained in this document without notification.

Selection program - V4.6_2021026 - 08/02/2021

Equipment Noise Data

External Condenser Units

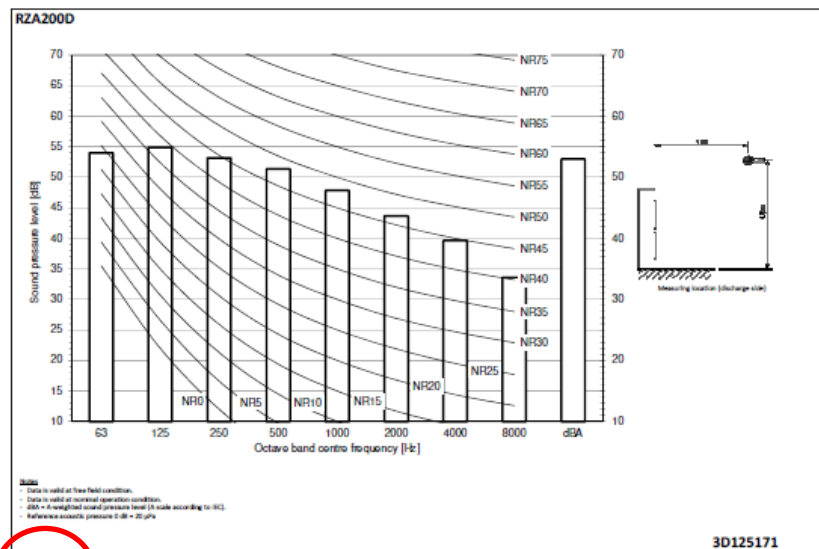
Daikin RZA-D 250 (2)



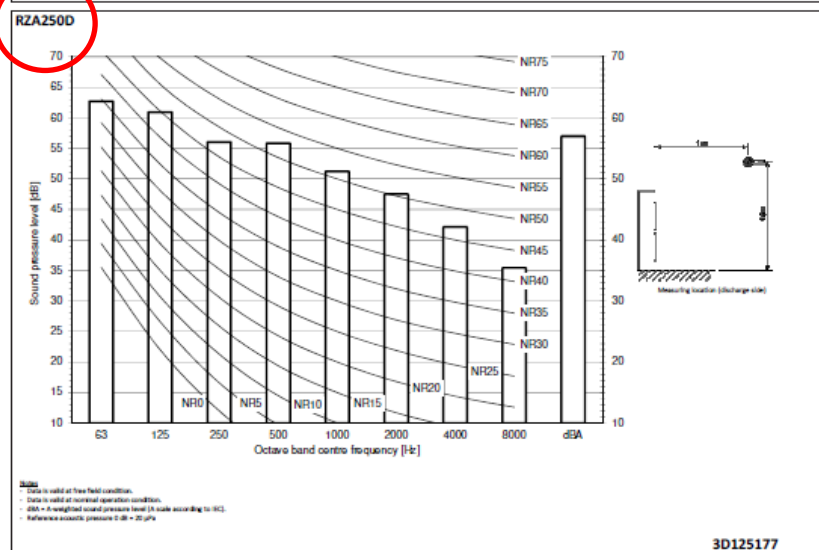
Sky Air Advance-series • RZA-D

11 Sound data

11 - 2 Sound Pressure Spectrum - Cooling



11



Sky Air Advance-series • RZA-D

23

Equipment Noise Data

External Condenser Units

Daikin RZAG125 (1)



SkyAir Alpha-series **SkyAir** Advance-series

BLUEEVOLUTION

FDA-A / RZAG+RZASG-M

ESP up to 200Pa,
ideal for large sized spaces

- › High external static pressure up to 200Pa facilitates extensive duct and grille network
- › Possibility to change ESP via wired remote control allows optimisation of the supply air volume
- › Discretely concealed in the ceiling: only the suction and discharge grilles are visible
- › Reduced energy consumption thanks to specially developed DC fan motor
- › No optional adapter needed for Dill-connection, link your unit directly into the wider building management system
- › Flexible installation, as the air suction direction can be altered from rear to bottom suction
- › Standard built-in drain pump with 625mm lift increases flexibility and installation speed



FDA-A



RZAG125



BRCE53A

BRCE53S
(optional)

BRP060ABT
(optional)

WI-FI ADAPTOR

AVAILABLE AS AN OPTION





Equipment Noise Data

External Condenser Units

Daikin RZAG125 (1)



FDA-A / RZAG+RZASG-M



Indoor Units			Single Phase		3 Phase	
			FDA125A	FDA125A	FDA125A	FDA125A
Capacity	UK Total Cooling	kW	13.60	13.60	13.60	13.60
	UK Sensible Cooling	kW	9.30	9.30	9.30	9.30
	Nominal Cooling	kW	12.1	12.1	12.1	12.1
	Nominal Heating	kW	13.5	13.5	13.5	13.5
Seasonal Efficiency (EN14825)	Energy Label		-	-	-	-
	Pdesign	kW	12.1	12.1	12.1	12.1
	SEER		6.59	5.03	6.59	5.03
	Annual Energy Consumption	kWh	1102	1444	1102	1444
Seasonal Efficiency (EN14825)	Energy Label		-	-	-	-
	Pdesign	kW	9.52	6.00	9.52	6.00
	SCOP		4.08	3.58	4.08	3.58
	Annual Energy Consumption	kWh	3267	2346	3267	2346
Nominal Efficiency	EER/COP		3.81/4.43	2.56/4.08	3.81/4.43	2.56/4.08
Air Flow Rate (Cooling)	High / Low	m ³ /sec	0.650/0.466	0.650/0.466	0.650/0.466	0.650/0.466
External Static Pressure	High / Nom	Pa	200/50	200/50	200/50	200/50
Dimensions	Height	mm	300	300	300	300
	Width	mm	1400	1400	1400	1400
	Depth	mm	700	700	700	700
Weight		kg	45	45	45	45
Sound Pressure (Cooling)	High / Low	dBA	40/33	40/33	40/33	40/33
Sound Pressure (Heating)	High / Low	dBA	40/33	40/33	40/33	40/33
Sound Power (Cooling)		dBA	66	66	66	66

Outdoor Units			RZAG125MV1	RZASG125MV1	RZAG125MY1	RZASG125MY1
Dimensions	Height x Width x Depth	mm	1430 x 940 x 320	990 x 940 x 320	1430 x 940 x 320	990 x 940 x 320
Weight		kg	92	70	92	70
Electrical Details	Power Supply		1ph	1ph	3ph	3ph
	Running Current	A	28.2	28.9	15.7	15.7
	Starting Current	A	-	-	-	-
	Max Fuse Size	A	32	32	16	16
Interconnection Wiring	Core / Cable Size		3+E / 1.5			
Piping Connections	Liquid / Gas	inches (mm)	3/8 (9.5) / 5/8 (15.9)			
Pipework	Maximum Length	m	85	50	85	50
	Maximum Vertical Rise	m	30	30	30	30
	Precharged to	m	40	30	40	30
	Additional charge	g/m	Refer to Installation Manual			
	Holding charge	kg	3.75	2.60	3.75	2.60
Sound Pressure (Cooling)	Nom / Night Quiet	dBA	50/44	53/44	50/44	53/44
Sound Pressure (Heating)	Nom / Night Quiet	dBA	52/44	57/44	52/44	57/44
Sound Power (Cooling)		dBA	69	71	69	71
Operating Range (Cooling)	Min / Max	°CDB	-20/52	-15/46	-20/52	-15/46
Operating Range (Heating)	Min / Max	°CWB	-20/18	-15/15.5	-20/18	-15/15.5
Air Flow Rate (Cooling)	Nominal	m ³ /sec	1.383	1.183	1.383	1.183

Accessory Ref	Description	Accessory Ref	Description
BRC1E33A	Premium wired remote controller (Included as standard)	KLIC-DI	KNX Interface for Sky Air and VRV systems
BRP069A81	WiFi adaptor for connection to on-line controller	KRC501-4	Remote room mounted temperature sensor
BRC4C65	Wireless remote controller	KRP4A53 and UKFB2	Unit/group adaptor PCB for remote on/off, status indication and temperature setting
DTA111B51	Adaptor PCB for interface to Daikin centralised control systems	RTD-10 and UKFB2	Enhanced function PCB for Sky Air and VRV. Duty rotation, Lead Lag control and heating interlock
EXR090S	Remote on/off control interface kit	RTD-20 and UKFB2	Energy control PCB for Sky Air and VRV
K-CGL	Condensing unit guard size 100-140 including RXY5Q	RTD-NET and UKFB2	Modbus interface PCB for Sky Air and VRV
K-CWB140-2	Condensing unit bracket - size 100 to 140		
K-DT2	Condensate drip tray for use with K-CWB140-2		

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FSC

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08/01/2017 - 04/04/2018 (08/17) (04/18) / Copyright © 2017 Daikin

APPENDIX 6

Background Noise Measurements

Table

Record	Date	Time	L _{Aeq}	L _{AFmin}	L _{AFmax}	L _{AF50}	L _{AF90}
	(yyyy-mm-dd)	(hrs:mins)	(dB)	(dB)	(dB)	(dB)	(dB)
2	2021-04-28	13:45:00	64.9	59.9	84.7	63.2	61.7
3	2021-04-28	14:00:00	64.1	59.4	83.0	63.5	61.8
4	2021-04-28	14:15:00	64.4	59.6	84.2	63.3	61.6
5	2021-04-28	14:30:00	65.8	59.6	84.6	63.7	61.9
6	2021-04-28	14:45:00	65.9	60.0	83.2	64.0	62.1
7	2021-04-28	15:00:00	65.1	60.5	80.7	63.8	62.2
8	2021-04-28	15:15:00	65.4	59.5	86.6	63.8	62.3
9	2021-04-28	15:30:00	65.2	60.5	83.0	63.8	62.2
10	2021-04-28	15:45:00	63.5	60.2	73.4	63.1	61.8
11	2021-04-28	16:00:00	64.6	60.8	80.7	63.6	62.3
12	2021-04-28	16:15:00	65.8	59.9	87.8	63.4	62.1
13	2021-04-28	16:30:00	67.2	59.9	87.0	64.1	62.0
14	2021-04-28	16:45:00	64.6	58.9	84.8	62.5	60.9
15	2021-04-28	17:00:00	63.6	59.1	76.9	62.8	61.5
16	2021-04-28	17:15:00	62.2	57.5	73.1	61.7	59.8
17	2021-04-28	17:30:00	62.5	58.5	72.5	61.7	60.4
18	2021-04-28	17:45:00	62.4	58.5	76.1	61.9	60.5
19	2021-04-28	18:00:00	62.7	59.6	71.6	62.3	60.9
20	2021-04-28	18:15:00	63.7	59.6	76.4	62.7	61.3
21	2021-04-28	18:30:00	62.8	58.9	71.6	62.3	60.9
22	2021-04-28	18:45:00	67.2	59.7	91.8	62.6	61.1
23	2021-04-28	19:00:00	66.4	59.5	88.2	63.6	61.7
24	2021-04-28	19:15:00	63.0	59.1	77.2	62.1	60.7
25	2021-04-28	19:30:00	62.9	58.4	78.8	61.9	60.6
26	2021-04-28	19:45:00	63.6	59.2	73.7	62.7	60.8
27	2021-04-28	20:00:00	63.0	58.4	84.6	62.1	60.6
28	2021-04-28	20:15:00	62.4	58.1	73.7	61.8	60.3
29	2021-04-28	20:30:00	61.6	57.1	76.1	61.1	59.7
30	2021-04-28	20:45:00	61.1	57.3	71.8	60.4	59.2
31	2021-04-28	21:00:00	61.8	58.0	74.2	61.2	59.6
32	2021-04-28	21:15:00	62.6	57.4	79.7	61.2	59.6
33	2021-04-28	21:30:00	63.5	54.5	83.1	62.8	58.5



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34	2021-04-28	21:45:00	60.6	54.5	79.0	59.7	57.3
35	2021-04-28	22:00:00	60.7	55.1	72.3	59.7	57.5
36	2021-04-28	22:15:00	60.8	54.6	76.0	59.8	57.6
37	2021-04-28	22:30:00	60.4	53.8	76.0	59.4	56.7
38	2021-04-28	22:45:00	59.7	53.3	70.6	58.6	56.2
39	2021-04-28	23:00:00	60.6	53.1	75.1	59.4	56.3
40	2021-04-28	23:15:00	59.5	51.8	74.0	58.4	55.9
41	2021-04-28	23:30:00	61.1	51.6	73.4	59.6	55.5
42	2021-04-28	23:45:00	61.2	50.3	82.3	58.6	55.1
43	2021-04-29	00:00:00	60.3	51.6	77.5	58.7	55.5
44	2021-04-29	00:15:00	59.7	48.6	79.9	57.4	53.8
45	2021-04-29	00:30:00	62.5	47.0	89.5	57.8	52.7
46	2021-04-29	00:45:00	64.6	46.6	76.4	58.6	53.1
47	2021-04-29	01:00:00	57.6	44.0	80.3	54.5	49.9
48	2021-04-29	01:15:00	57.3	44.6	76.3	54.4	49.7
49	2021-04-29	01:30:00	56.4	43.0	69.9	53.4	47.5
50	2021-04-29	01:45:00	55.1	43.7	67.8	52.2	47.3
51	2021-04-29	02:00:00	55.1	42.3	69.9	52.4	46.2
52	2021-04-29	02:15:00	54.9	42.2	71.0	51.4	45.5
53	2021-04-29	02:30:00	56.9	44.0	72.6	52.4	47.8
54	2021-04-29	02:45:00	53.8	42.0	68.0	50.9	45.6
55	2021-04-29	03:00:00	57.1	42.5	73.4	52.4	46.5
56	2021-04-29	03:15:00	52.4	41.0	65.0	49.6	44.4
57	2021-04-29	03:30:00	53.2	41.1	67.3	51.0	44.7
58	2021-04-29	03:45:00	60.6	44.3	82.0	57.1	51.2
59	2021-04-29	04:00:00	55.6	42.2	69.2	53.9	45.9
60	2021-04-29	04:15:00	53.3	43.1	69.1	50.8	46.4
61	2021-04-29	04:30:00	57.1	44.0	66.2	56.7	51.5
62	2021-04-29	04:45:00	57.7	54.3	69.0	56.9	55.8
63	2021-04-29	05:00:00	58.2	54.3	68.6	57.6	56.2
64	2021-04-29	05:15:00	58.9	55.4	67.8	58.2	56.7
65	2021-04-29	05:30:00	60.0	55.7	69.5	59.5	57.8
66	2021-04-29	05:45:00	60.3	56.2	68.5	59.9	58.5
67	2021-04-29	06:00:00	60.8	56.9	68.4	60.4	58.8
68	2021-04-29	06:15:00	61.9	57.0	69.0	61.5	59.8
69	2021-04-29	06:30:00	62.4	58.0	69.9	62.1	60.3
70	2021-04-29	06:45:00	62.7	58.3	73.7	62.1	60.9
71	2021-04-29	07:00:00	63.0	59.5	73.7	62.6	61.1
72	2021-04-29	07:15:00	63.2	59.1	71.9	62.8	61.5
73	2021-04-29	07:30:00	63.2	60.2	70.6	62.9	61.8
74	2021-04-29	07:45:00	63.6	59.9	73.0	63.2	61.8
75	2021-04-29	08:00:00	63.8	60.6	74.1	63.6	62.2



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76	2021-04-29	08:15:00	64.1	60.0	79.0	63.7	62.4
77	2021-04-29	08:30:00	63.9	60.3	78.0	63.1	61.8
78	2021-04-29	08:45:00	64.0	59.7	81.1	63.4	62.0
79	2021-04-29	09:00:00	63.7	59.9	72.1	62.9	61.5
80	2021-04-29	09:15:00	63.4	59.9	73.0	63.0	61.5
81	2021-04-29	09:30:00	64.3	59.8	74.6	63.6	61.9
82	2021-04-29	09:45:00	64.0	60.0	74.8	63.3	61.6
83	2021-04-29	10:00:00	62.7	58.7	74.0	62.1	60.7
84	2021-04-29	10:15:00	62.6	59.2	74.4	62.0	60.6
85	2021-04-29	10:30:00	62.4	59.1	69.8	61.8	60.6
86	2021-04-29	10:45:00	62.5	59.1	71.0	61.8	60.8
87	2021-04-29	11:00:00	63.1	59.2	77.9	62.2	60.9
88	2021-04-29	11:15:00	63.0	58.7	69.8	62.6	61.2
89	2021-04-29	11:30:00	62.6	59.1	72.6	62.2	60.9
90	2021-04-29	11:45:00	62.7	58.8	70.2	62.3	60.9
91	2021-04-29	12:00:00	62.5	59.1	72.8	62.1	60.8
92	2021-04-29	12:15:00	63.0	59.3	75.0	62.4	61.1
93	2021-04-29	12:30:00	62.9	59.3	76.0	62.3	61.0
94	2021-04-29	12:45:00	62.9	59.6	73.4	62.3	61.0
95	2021-04-29	13:00:00	62.6	59.4	72.4	62.1	60.7
96	2021-04-29	13:15:00	62.8	59.3	71.6	62.4	61.0
97	2021-04-29	13:30:00	63.2	58.9	78.6	62.4	61.2
98	2021-04-29	13:45:00	62.9	59.3	70.0	62.4	61.1
99	2021-04-29	14:00:00	62.4	59.4	72.5	62.0	60.9
100	2021-04-29	14:15:00	63.1	59.8	72.1	62.6	61.3
101	2021-04-29	14:30:00	63.4	59.5	73.9	62.6	61.1
102	2021-04-29	14:45:00	63.6	59.2	75.8	62.7	61.2
103	2021-04-29	15:00:00	63.9	60.3	71.5	63.1	61.6
104	2021-04-29	15:15:00	63.1	58.7	75.0	62.7	61.2
105	2021-04-29	15:30:00	63.2	58.7	72.0	62.3	61.0
106	2021-04-29	15:45:00	63.6	59.5	83.6	62.5	61.1
107	2021-04-29	16:00:00	63.1	58.9	72.5	62.5	61.3
108	2021-04-29	16:15:00	62.6	58.7	76.3	61.9	60.3
109	2021-04-29	16:30:00	62.0	58.1	75.0	61.2	59.7
110	2021-04-29	16:45:00	62.0	57.6	73.3	61.1	59.5
111	2021-04-29	17:00:00	62.8	59.5	69.4	62.5	61.2
112	2021-04-29	17:15:00	62.7	59.5	69.8	62.2	61.0
113	2021-04-29	17:30:00	62.1	57.6	75.3	61.3	60.0
114	2021-04-29	17:45:00	63.0	58.0	74.1	62.2	60.3
115	2021-04-29	18:00:00	64.6	60.1	87.1	63.6	61.8
116	2021-04-29	18:15:00	63.5	58.9	73.0	63.0	61.4
117	2021-04-29	18:30:00	63.3	60.0	69.7	62.8	61.5



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118	2021-04-29	18:45:00	63.1	59.8	72.3	62.7	61.3
119	2021-04-29	19:00:00	63.1	59.3	76.5	62.4	61.1
120	2021-04-29	19:15:00	63.0	59.2	71.6	62.3	61.1
121	2021-04-29	19:30:00	62.8	58.8	73.0	62.2	60.8
122	2021-04-29	19:45:00	63.3	59.3	71.6	62.8	61.1
123	2021-04-29	20:00:00	63.1	59.4	70.0	62.5	61.0
124	2021-04-29	20:15:00	63.7	58.7	75.2	62.6	60.7
125	2021-04-29	20:30:00	62.7	58.2	77.6	61.9	60.3
126	2021-04-29	20:45:00	62.6	57.6	82.7	61.5	59.9
127	2021-04-29	21:00:00	61.9	58.1	72.1	61.2	59.8
128	2021-04-29	21:15:00	64.5	58.2	89.7	61.6	59.9
129	2021-04-29	21:30:00	61.8	56.4	76.8	60.9	58.5
130	2021-04-29	21:45:00	62.1	56.0	78.6	60.4	58.3
131	2021-04-29	22:00:00	62.1	54.1	75.7	60.7	58.5
132	2021-04-29	22:15:00	61.2	54.7	71.0	60.4	58.1
133	2021-04-29	22:30:00	59.9	54.3	72.3	58.9	56.7
134	2021-04-29	22:45:00	61.4	52.9	80.9	60.1	56.9
135	2021-04-29	23:00:00	61.1	53.6	79.4	59.7	56.7
136	2021-04-29	23:15:00	62.0	52.5	76.5	59.5	56.5
137	2021-04-29	23:30:00	62.0	53.6	80.5	59.6	56.4
138	2021-04-29	23:45:00	60.8	53.5	73.0	59.3	56.3
139	2021-04-30	00:00:00	61.2	53.2	86.4	59.0	55.9
140	2021-04-30	00:15:00	61.0	50.5	76.1	58.8	55.3
141	2021-04-30	00:30:00	65.7	52.7	81.9	62.7	57.4
142	2021-04-30	00:45:00	64.1	46.4	78.4	56.3	51.8
143	2021-04-30	01:00:00	58.0	45.0	68.6	56.4	51.8
144	2021-04-30	01:15:00	56.4	41.9	69.3	54.3	49.2
145	2021-04-30	01:30:00	55.8	42.2	69.4	53.7	47.7
146	2021-04-30	01:45:00	56.4	43.3	69.3	53.2	47.7
147	2021-04-30	02:00:00	54.9	42.3	67.6	52.4	46.7
148	2021-04-30	02:15:00	60.6	43.0	85.7	52.4	48.1
149	2021-04-30	02:30:00	61.0	43.9	76.3	56.2	49.4
150	2021-04-30	02:45:00	55.6	41.4	68.4	52.7	46.6
151	2021-04-30	03:00:00	55.6	41.0	80.4	52.5	46.4
152	2021-04-30	03:15:00	52.9	40.8	65.9	50.3	43.9
153	2021-04-30	03:30:00	57.2	43.8	71.8	53.5	48.1
154	2021-04-30	03:45:00	60.7	43.5	81.6	56.7	53.9
155	2021-04-30	04:00:00	56.9	43.1	67.8	55.0	48.4
156	2021-04-30	04:15:00	53.8	43.5	67.4	52.2	47.0
157	2021-04-30	04:30:00	57.2	46.6	67.3	56.9	51.1
158	2021-04-30	04:45:00	58.5	55.3	69.2	58.0	56.9
159	2021-04-30	05:00:00	58.8	55.1	68.7	58.0	56.6

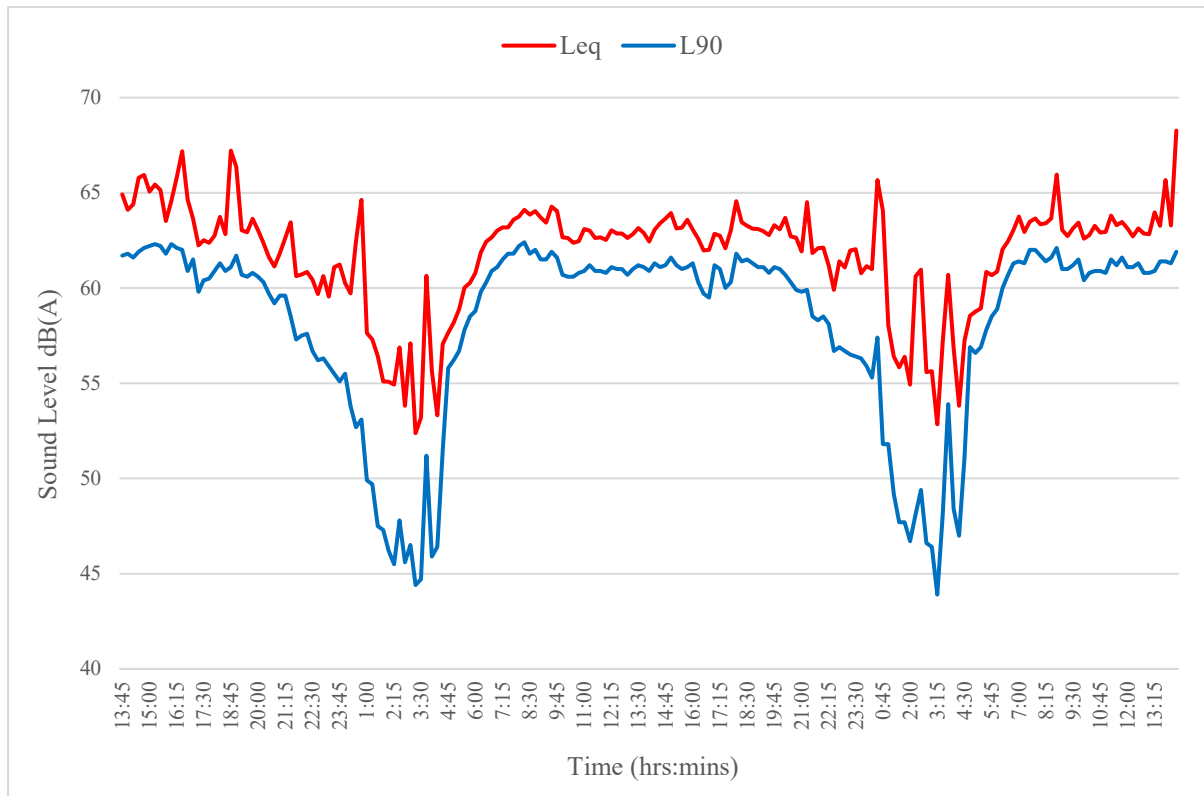


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160	2021-04-30	05:15:00	58.9	55.2	69.5	58.4	56.9
161	2021-04-30	05:30:00	60.8	55.6	71.9	60.3	57.8
162	2021-04-30	05:45:00	60.7	56.2	69.3	60.2	58.5
163	2021-04-30	06:00:00	60.9	56.9	71.4	60.5	58.9
164	2021-04-30	06:15:00	62.0	57.5	71.3	61.5	60.0
165	2021-04-30	06:30:00	62.5	59.0	70.5	62.1	60.7
166	2021-04-30	06:45:00	63.1	59.5	71.6	62.5	61.3
167	2021-04-30	07:00:00	63.8	59.2	74.7	62.9	61.4
168	2021-04-30	07:15:00	62.9	59.5	69.7	62.6	61.3
169	2021-04-30	07:30:00	63.5	60.2	73.4	63.1	62.0
170	2021-04-30	07:45:00	63.6	60.1	74.7	63.2	62.0
171	2021-04-30	08:00:00	63.3	60.1	70.3	62.9	61.7
172	2021-04-30	08:15:00	63.4	59.9	73.2	62.8	61.4
173	2021-04-30	08:30:00	63.7	59.7	74.0	62.9	61.6
174	2021-04-30	08:45:00	66.0	60.0	75.5	64.0	62.1
175	2021-04-30	09:00:00	63.0	59.3	74.8	62.6	61.0
176	2021-04-30	09:15:00	62.7	59.5	70.9	62.2	61.0
177	2021-04-30	09:30:00	63.1	58.9	74.7	62.6	61.2
178	2021-04-30	09:45:00	63.4	59.3	70.5	63.0	61.5
179	2021-04-30	10:00:00	62.6	58.4	81.2	61.8	60.4
180	2021-04-30	10:15:00	62.8	59.1	71.0	62.0	60.8
181	2021-04-30	10:30:00	63.3	58.7	75.3	62.4	60.9
182	2021-04-30	10:45:00	62.9	59.1	70.2	62.4	60.9
183	2021-04-30	11:00:00	62.9	59.0	74.4	62.1	60.8
184	2021-04-30	11:15:00	63.8	59.9	78.3	62.9	61.5
185	2021-04-30	11:30:00	63.3	59.7	78.8	62.6	61.2
186	2021-04-30	11:45:00	63.5	60.4	74.5	63.0	61.6
187	2021-04-30	12:00:00	63.1	59.3	73.5	62.3	61.1
188	2021-04-30	12:15:00	62.7	59.8	75.8	62.2	61.1
189	2021-04-30	12:30:00	63.1	59.4	74.0	62.5	61.3
190	2021-04-30	12:45:00	62.9	59.0	69.5	62.4	60.8
191	2021-04-30	13:00:00	62.8	59.4	79.7	62.1	60.8
192	2021-04-30	13:15:00	64.0	59.3	84.6	62.3	60.9
193	2021-04-30	13:30:00	63.3	59.4	76.3	62.5	61.4
194	2021-04-30	13:45:00	65.7	59.4	89.0	62.8	61.4
195	2021-04-30	14:00:00	63.3	59.4	73.4	62.6	61.3
196	2021-04-30	14:15:00	68.3	60.5	86.1	63.9	61.9

Background Noise Measurements

Graph



APPENDIX 7

Plant Noise Calculations

Supply System – Atmosphere Vent

Atmospheric Vent	Frequency (Hz)								Overall	
	63	125	250	500	1000	2000	4000	8000		
MUB	54	73	73	75	77	74	71	71	82	dB(A)
MUB Silencer 062	-8	-12	-20	-30	-36	-31	-24	-18		
Corrected L _{WA}	46.0	61.0	53.0	45.0	41.0	43.0	47.0	53.0	63	dB(A)
Duct Length (m)	1	1	1	1	1	1	1	1		
Duct Loss per m	0.82	0.66	0.33	0.16	0.16	0.16	0.16	0.16		
Duct Attenuation	-0.8	-0.7	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2		Ref SRL
90° Duct Bend										
End Reflection 0.4m ²	-7	-3	-1	0	0	0	0	0		
Screening	-5	-5	-5	-5	-5	-5	-5	-5		
Distance (m)	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0		DI
Point Source Attenuation	-34	-34	-34	-34	-34	-34	-34	-34		
Attenuated Level	-0.7	18.4	12.7	5.9	1.9	3.9	7.9	13.9	21	dB(A)

Plant Noise Calculations

Extract System – Atmosphere Vent

Atmospheric Vent	Frequency (Hz)								Overall	
	63	125	250	500	1000	2000	4000	8000		
MUB-T	55	75	76	81	81	80	76	69	87	dB(A)
MUB Silencer 062	-8	-12	-20	-30	-36	-31	-24	-18		
Corrected L _{WA}	47.0	63.0	56.0	51.0	45.0	49.0	52.0	51.0	65	dB(A)
Duct Length (m)	1	1	1	1	1	1	1	1		
Duct Loss per m	0.82	0.66	0.33	0.16	0.16	0.16	0.16	0.16		
Duct Attenuation	-0.8	-0.7	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2		Ref SRL
Radius 90° Duct Bend			-1.0	-2.0	-3.0	-3.0	-3.0	-3.0		
End Reflection 0.4m ²	-7	-3	-1	0	0	0	0	0		
Screening	-5	-5	-5	-5	-5	-5	-5	-5		
Distance (m)	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0		DI
Point Source Attenuation	-36	-36	-36	-36	-36	-36	-36	-36		
Attenuated Level	-1.4	18.7	13.1	8.2	1.2	5.2	8.2	7.2	21	dB(A)

Plant Noise Calculations

Toilet Exhaust Fan – Atmosphere Vent

Atmospheric Vent	Frequency (Hz)								Overall	
	63	125	250	500	1000	2000	4000	8000		
K100	53	63	63	61	63	59	51	38	69	dB(A)
Corrected L _{WA}	53.0	63.0	63.0	61.0	63.0	59.0	51.0	38.0	69	dB(A)
Duct Length (m)	1	1	1	1	1	1	1	1		
Duct Loss per m	0.07	0.1	0.1	0.16	0.33	0.33	0.33	0.33		
Duct Attenuation	-0.1	-0.1	-0.1	-0.2	-0.3	-0.3	-0.3	-0.3		Ref SRL
Radius 90° Duct Bend										
End Reflection 0.1mØ	-16	-12	-8	-3	-1	0	0	0		
Screening	-5	-5	-5	-5	-5	-5	-5	-5		
Distance (m)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0		DI
Point Source Attenuation	-35	-35	-35	-35	-35	-35	-35	-35		
Attenuated Level	-2.6	11.4	15.4	18.3	22.1	19.1	11.1	-1.9	26	dB(A)



Plant Noise Calculations

Basement Exhaust System – Atmosphere Vent

Atmospheric Vent	Frequency (Hz)								Overall	
	63	125	250	500	1000	2000	4000	8000		
K315	64	72	76	75	75	75	72	65	82	dB(A)
LDC 315-900 Silencer	-1	-3	-7	-16	-22	-12	-6	-7		
Corrected L _{WA}	63.0	69.0	69.0	59.0	53.0	63.0	66.0	58.0	74	dB(A)
Duct Length (m)	1	1	1	1	1	1	1	1		
Duct Loss per m	0.07	0.1	0.1	0.16	0.23	0.23	0.23	0.23		
Duct Attenuation	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2		Ref SRL
Radius 90° Duct Bend				-1.0	-2.0	-3.0	-3.0	-3.0		
End Reflection 0.315mØ	-13	-8	-4	-1	0	0	0	0		
Screening	-5	-5	-5	-5	-5	-5	-5	-5		
Distance (m)	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0		DI
Point Source Attenuation	-35	-35	-35	-35	-35	-35	-35	-35		
Attenuated Level	9.8	20.8	24.8	16.8	10.7	19.7	22.7	14.7	29	dB(A)

Plant Noise Calculations

Pot Wash Exhaust System – Atmosphere Vent

Atmospheric Vent	Frequency (Hz)								Overall	
	63	125	250	500	1000	2000	4000	8000		
K355	55	67	72	66	68	63	57	48	75	dB(A)
Corrected L _{WA}	55.0	67.0	72.0	66.0	68.0	63.0	57.0	48.0	75	dB(A)
Duct Length (m)	1	1	1	1	1	1	1	1		
Duct Loss per m	0.07	0.1	0.1	0.16	0.23	0.23	0.23	0.23		
Duct Attenuation	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2		Ref SRL
Radius 90° Duct Bend										
End Reflection 0.355mØ	-12	-8	-4	-1	0	0	0	0		
Screening	-5	-5	-5	-5	-5	-5	-5	-5		
Distance (m)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0		DI
Point Source Attenuation	-36	-36	-36	-36	-36	-36	-36	-36		
Attenuated Level	1.8	17.8	26.8	23.7	26.7	21.7	15.7	6.7	32	dB(A)



Plant Noise Calculations

Condenser Units

Serving	Equipment				
	RC1	RC2	AC1	AC2	AC3
Manufacturer	/	/	Daikin	Daikin	Daikin
Model	WINA9510Z-TZ	WINFH2511Z-TZ	RZAG125	RZA-D250	RZA-D250
SPL @ 1m dB(A)	48	60	52	57	57
DI	3	3	3	3	3
NSR Distance (m)	17	18	14	15	16
Screening	-5	-5	-5	-5	-5
NSR SPL dB(A)	21.4	32.9	27.1	31.5	30.9

APPENDIX 8

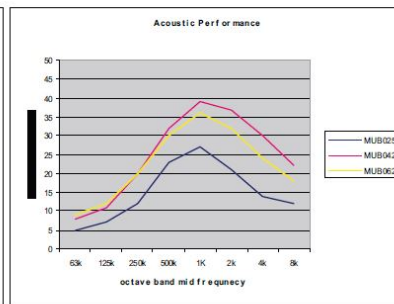
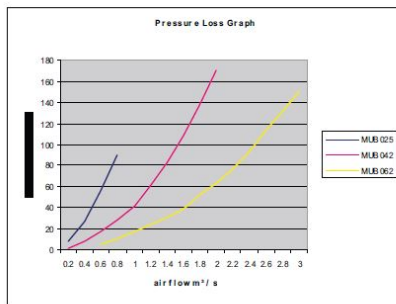
Noise Mitigation Products

Systemair Silencers

MUB SIL Multibox Silencer



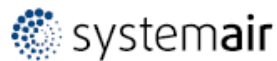
Inlet- outlet silencer
Suitable for MUB-fans – all 1200 mm
long inc 300 mm plenum.



MUB	b	B	L	kg
025	378	418	1200	19
042	548	588	1200	39
062	678	718	1200	57
100	878	918	1200	enq

Noise Mitigation Products

Systemair Silencers



LDC 315-600 Silencer

Round, for air handling units

Item Number: 5949

Silencer

Easily-fitted silencer for circular ducts, fitted with a connection that complies with the spiral duct standard. The LDC effectively reduces noise in the duct. Two silencers can be used together in installations where noise reduction is a particularly strong requirement. This is very effective. For the most effective noise reduction, the silencer should be fitted immediately behind a fan or bend. The silencer should be used together with an insulated fan where there is a requirement for noise reduction both in the duct and in the surroundings as a whole. Insulation thickness 50 mm.



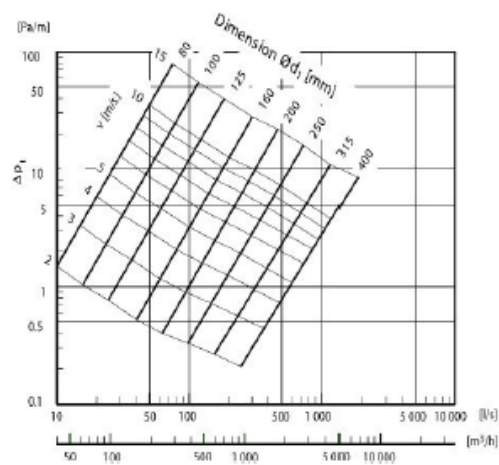
Technical parameters

Dimensions and weights		
Duct dimension; Circular, inlet	315	mm
Duct dimension; Circular, outlet	315	mm
Weight	10.8	kg
Others		
Duct connection type	Circular	

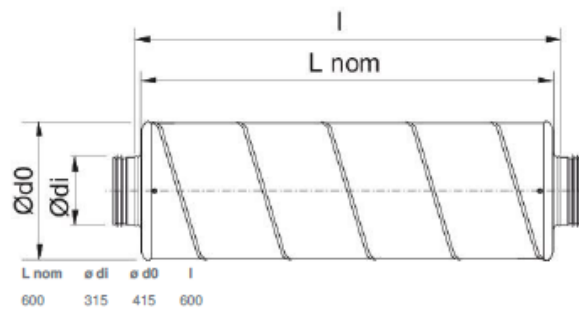
Noise Mitigation Products

Systemair Silencers

Performances



Dimension



Noise Mitigation Products

Systemair Silencers

Acoustic

Noise suppression dB (mid-frequency Hz)

	63	125	250	500	1k	2k	4k	8k
LDC 100-300	2	2	6	14	21	25	20	11
LDC 100-600	4	3	11	24	36	49	34	17
LDC 100-900	5	4	15	34	50	50	48	23
LDC 100-1200	6	5	19	45	50	50	50	29
LDC 125-300	2	2	6	13	16	20	15	10
LDC 125-600	3	3	9	23	30	40	22	14
LDC 125-900	4	4	12	33	45	50	30	17
LDC 125-1200	5	5	15	43	50	50	38	21
LDC 150-300	1	2	4	10	12	15	8	8
LDC 150-600	-	3	7	20	27	31	16	11
LDC 160-300	1	2	4	10	12	15	8	8
LDC 160-600	2	3	7	19	27	29	14	11
LDC 160-900	2	4	10	28	42	43	20	15
LDC 200-300	1	2	5	8	10	11	5	5
LDC 200-600	2	3	7	16	21	23	9	8
LDC 200-900	2	4	8	24	32	34	13	10
LDC 250-600	3	2	7	13	17	16	8	6
LDC 250-900	3	4	8	20	26	23	10	8
LDC 315-600	0	2	6	11	14	9	4	5
LDC 315-900	1	3	7	16	22	12	6	7
LDC 355-900	-	3	6	13	18	10	6	7
LDC 400-900	1	3	5	10	13	7	5	6