
151 Dickenson Road, Manchester

Noise Assessment Report

Project: 151 Dickenson Road, Manchester – Plant Noise Assessment

Client: Hayder Rathi

Project Reference: RSA315/2020

Report Date: 01 August 2020

Document History

Version	Date	Comments	Initials
1	30 July 2020	Draft for comment	RS / DS
2	01 August 2020	Issue for planning	RS

Authorised by	Ryan Swales, BSc, MIOA Director & Principal Consultant
---------------	---

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party. Any such party relies on this report at their own risk.

© Report copyright of RS Acoustic Engineering Ltd

RS Acoustic Engineering Ltd
76 Marple Road
Stockport
SK2 5QH
Tel: 0333 577 5152
Web: www.rsacoustic.co.uk
Email: info@rs-acoustic.co.uk

A company registered in England & Wales (No: 07604309)
Corporate Member of the Institute of Acoustics (MIOA)

Contents

Section	Page
1. Introduction	4
2. Assessment Guidance & Criteria	5
Manchester City Council, Planning & Noise (Technical Guidance)	5
British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound	5
3. Environmental Noise Survey	6
Survey methodology	6
Survey equipment	7
Weather conditions	7
Measured indices	7
Results summary	8
4. Assessment & Discussion	9
Sound level targets for new building services plant	9
New building services plant and nearest noise sensitive receptors	9
Predicted fan sound levels at nearest dwellings	11
5. Conclusion	14
 List of Tables, Figures & Appendix	
Table 3.1 – Summary of measured background L_{A90} sound pressure levels	8
Table 4.1 – Sound level targets for the new extract system	9
Table 4.2 – Extract fan octave band sound power levels L_w dBA	9
Table 4.3 – Extract fan sound pressure level at nearest dwellings	11
Table 4.4 – Extract fan sound pressure level with acoustic silencer fitted	12
Figure 3.1 – Site location and survey measurement position	6
Figure 3.2 – Graph showing results of continuous sound level monitoring	8
Figure 4.1 – Existing ground and first floor layout	10
Figure 4.2 – Proposed ground and first floor layout	10
Figure 4.3 – Elevations showing kitchen extract ductwork	11
Appendix A - Extract fan specification and data	15
Appendix B - Assessment terminology	17

1. Introduction

- 1.1 RS Acoustic Engineering Ltd has been appointed by Mr Hayder Rathi to undertake a noise impact assessment with regard to new building services plant for the proposed restaurant/takeaway business at No.151 Dickenson Road, Manchester, M14.
- 1.2 The property was previously used as office accommodation on both the ground and first floors and will therefore undergo a material change of use.
- 1.3 Following the refurbishment, the ground floor layout will consist of a small waiting/dining area to the front of the property and a kitchen area to the rear. The first floor will be used for storage purposes only.
- 1.4 A kitchen extract system (fan and external ductwork) is required as part of the proposals. There is no air-conditioning system proposed.
- 1.5 The proposed operating hours are understood to be 10:00 to 00:00 hours Sunday to Thursday and 10:00 to 01:00 hours on a Friday and Saturday.
- 1.6 There are commercial properties (offices) on either side of the premises at ground floor level and there is a flat at first floor level within the adjacent property (No.153A). There are similar takeaway businesses within the local area.
- 1.7 The dominant source of noise at the site was observed to be road traffic on Dickenson Road (A6010) and Birchfields Road (A34). Other noted sources include high altitude aircraft, intermittent activity from neighbouring commercial premises and passing pedestrians.
- 1.8 An environmental noise survey has been conducted in order to determine the typical background sound level during the daytime and night-time period.
- 1.9 A noise assessment has been undertaken taking into consideration the guidance given within BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*.
- 1.10 Octave band sound power data has been used to determine the extract fan sound pressure levels at adjacent dwellings.
- 1.11 The survey and assessment was conducted by Mr Ryan Swales (BSc(Hons), MIOA), Principal Acoustic Consultant and Corporate Member of the Institute of Acoustics.
- 1.12 This report provides the survey results, details of the proposed building services plant, calculated sound levels at neighbouring dwellings, recommended mitigation and the anticipated impact.

2. Assessment Guidance & Criteria

Manchester City Council, Planning & Noise (Technical Guidance)

- 2.1 With regard to noise from fixed plant and equipment, Manchester City Council's guidance document states the following:

'Any noise assessment needs to consider not only the overall level of noise emitted but also its particular characteristics. The noise assessment should be based on BS 4142:2014 and any application for fixed plant, equipment or machinery must demonstrate that:

Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5 dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location'.

British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

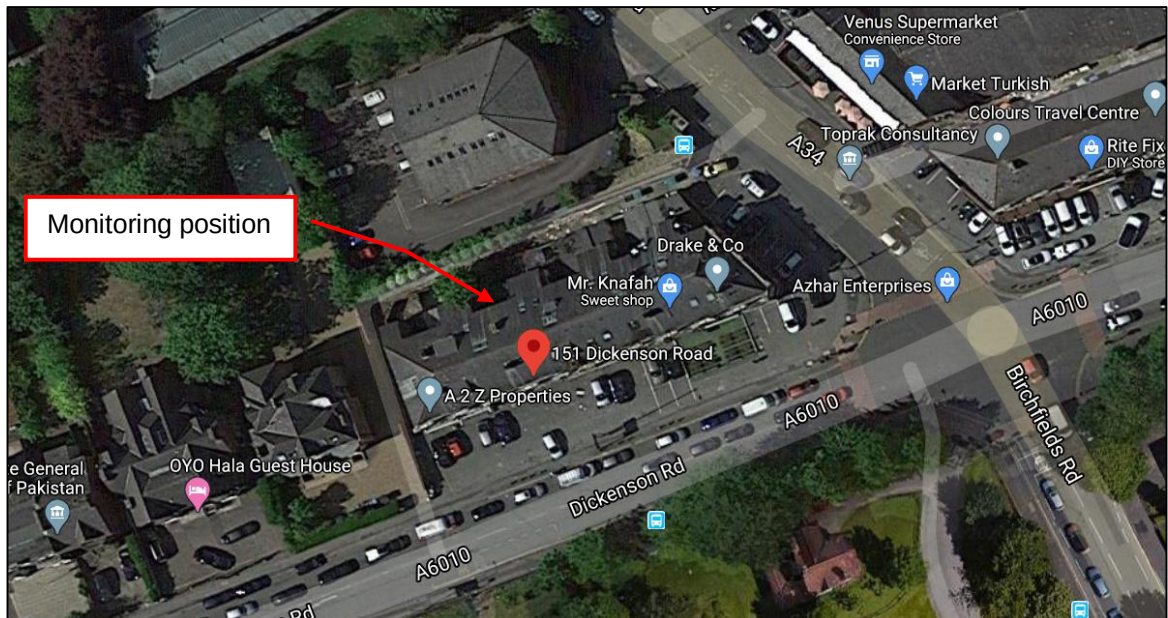
- 2.2 BS 4142 (amended June 2019) describes methods for rating and assessing sound of an industrial and/or commercial nature, such as sound from manufacturing processes and fixed mechanical plant/machinery.
- 2.3 Outdoor sound levels are used to assess the likely effect on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.
- 2.4 BS 4142 is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels.
- 2.5 The standard has three different methods (subjective, objective and reference) of applying a penalty to tonal, impulsive and intermittent noises, as separate entities.
- 2.6 The current standard no longer indicates significance of noise impacts as giving rise to a '*likelihood of complaint*' but rather as an '*indication*' of varying degrees of '*adverse impact*'.
- 2.7 BS 4142:2014 states that a difference of around +10 dB or more (excess of rating level above the background sound level) is likely to be an indication of a significant adverse impact, depending on the context.
- 2.8 A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- 2.9 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.
- 2.10 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.

3. Environmental Noise Survey

Survey methodology

- 3.1 A baseline noise survey has been conducted in order to establish the prevailing acoustic environment during the daytime and night-time period.
- 3.2 Continuous sound level monitoring was conducted over a 46-hour period at the north facing elevation (rear elevation).
- 3.3 Measurements were performed from 11:30 hours on Tuesday 21st through to 09:30 hours on Thursday 23rd July 2020. The microphone was positioned out of a 1st floor window.
- 3.4 A measurement interval of 15 minutes was used throughout the survey and measurements were considered to be subject to reflections from the building elevation (as opposed to free-field).
- 3.5 The site location, surrounding area and survey measurement position are shown in Figure 3.1.

Figure 3.1 – Site location and survey measurement position (Source: Google Earth)



Survey equipment

- 3.6 The survey was performed using the following Class-1 specification equipment:
- Brüel & Kjaer 2250-Light data logging sound level meter, with microphone type 4189 and pre-amplifier type ZC0032.
 - CEL-120/1 acoustic calibrator.
- 3.7 Calibration of the sound level meter and microphone used for the measurements are traceable to UKAS accredited laboratories.
- 3.8 The calibration of both sound level meter and microphone was checked using a 1 kHz tone at 94 dB prior to and following the survey. The drift in calibration was less than 0.1 dB.

Weather conditions

- 3.9 The weather conditions during the survey were generally dry and fine with clear warm sunny spells.
- 3.10 Temperatures ranged between 12°C and 19°C and wind speed measurements taken on-site were less than 2 m/s⁻¹. The overall weather conditions were considered suitable to obtain representative measurements.

Measured indices

- 3.11 Although a wide range of statistical sound level data was recorded during the survey, the L_{A90} and L_{Aeq} indices are of most interest here:
- $L_{A90,T}$ - The sound pressure level that is exceeded for 90% of the measurement time interval, T. L_{A90} is commonly used to describe the 'background' sound level.
 - $L_{Aeq,T}$ - The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period (commonly used to describe the 'ambient' sound level).
- 3.12 Sound pressure level measurements are taken with an A-weighting (denoted by a subscript 'A', e.g. L_{Aeq}) to approximate the frequency response of the human ear.

Results summary

- 3.13 Table 3.1 presents a summary of the measured background L_{A90} sound pressure levels. Measured values have been rounded to the nearest whole number.

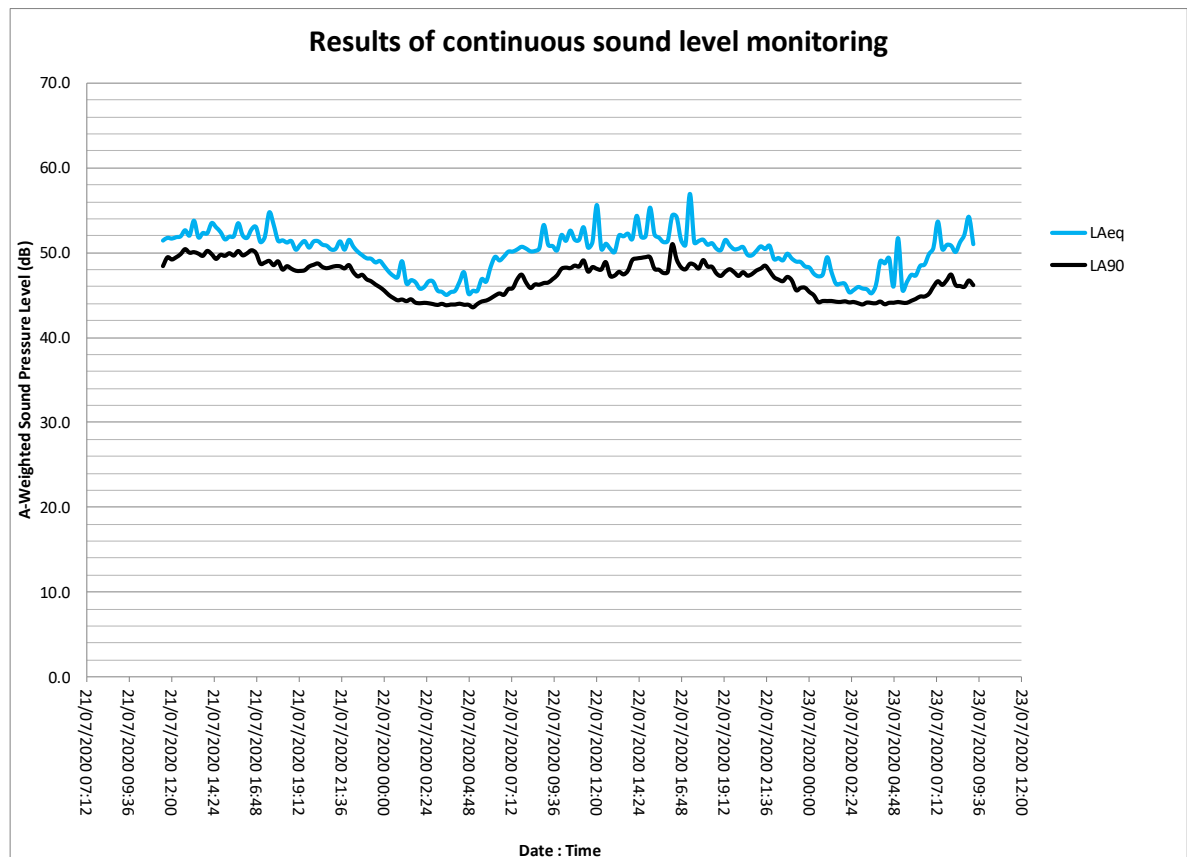
Table 3.1 – Summary of measured background L_{A90} sound pressure levels

Date	Period, Hours	Typical ¹ $L_{A90,15min}$ dB	Lowest $L_{A90,15min}$ dB	Highest $L_{A90,15min}$ dB
Tuesday 21/07/2020 - Wednesday 22/07/2020	Daytime (11:30-23:00)	50	47	50
	Night-time (23:00-07:00)	44	44	47
Wednesday 22/07/2020 - Thursday 23/07/2020	Daytime (07:00-23:00)	48	46	51
	Night-time (23:00-07:00)	44	44	47
Thursday 23/07/2020	Daytime (07:00-09:30)	46	46	47

¹Considered to be the representative background sound level (from a statistical analysis)

- 3.14 The results of the sound level monitoring are presented graphically in Figure 3.2. The background L_{A90} sound levels are presented, along with the ambient L_{Aeq} sound levels.

Figure 3.2 – Graph showing results of continuous sound level monitoring



4. Assessment & Discussion

Sound level targets for new building services plant

- 4.1 Taking into account MCC's requirements, the sound rating level (L_{Aeq}) from all new building services plant should be at least 5 dB below the typical background sound level ($L_{A90,T}$).
- 4.2 BS 4142 states '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'.
- 4.3 Taking into consideration the proximity of existing dwellings/flats, it is considered prudent to use the lowest measured background sound level during the proposed operating hours when determining appropriate noise limits/targets.
- 4.4 Table 4.1 presents the applicable sound level targets for the new extract fan. The sound level targets should be achieved at approximately 1 metre from the nearest noise sensitive window (dwelling).

Table 4.1 – Sound level targets for the new extract system

Period, Hours	Typical Background Sound Level $L_{A90,15min}$ dB	Target Rating Level $L_{Aeq,15min}$ dB
Daytime (07:00-23:00)	46	41
Night-time (23:00-07:00)	44	39

- 4.5 Since the extract fan will operate during the late evening and early night-time period, the appropriate sound rating level at adjacent windows is 39 dB $L_{Aeq,15min}$.

New building services plant and nearest noise sensitive receptors

- 4.6 The proposed extraction fan is understood to be a direct duct-mounted S&P centrifugal fan (fan ref: CBM-9/9 4P 3V). The fan will be attached to a length of 315 mm diameter circular ductwork that will be routed vertically up the rear elevation, with a total length of approximately 3 to 4 metres.
- 4.7 The extraction ductwork will be terminated via a meshed beak cowl.
- 4.8 The separation distance between the discharge (ductwork termination) point and the nearest bedroom window is approximately 6 metres. The distance from the ductwork termination to the apartment windows to the north is approximately 16 metres.
- 4.9 The manufacturer's octave-band sound power levels for the extract fan are presented in Table 4.2. The sound power spectrum is presented graphically in Appendix A.

Table 4.2 – Extract fan octave band sound power levels L_w dBA

Octave Band Centre Frequency (Hz)								Overall L_w dBA
63	125	250	500	1000	2000	4000	8000	
51	61	70	73	78	77	74	65	82

- 4.10 Figure 4.1 to 4.3 overleaf show the existing and proposed floor layouts and also the proposed ductwork on the rear elevation.

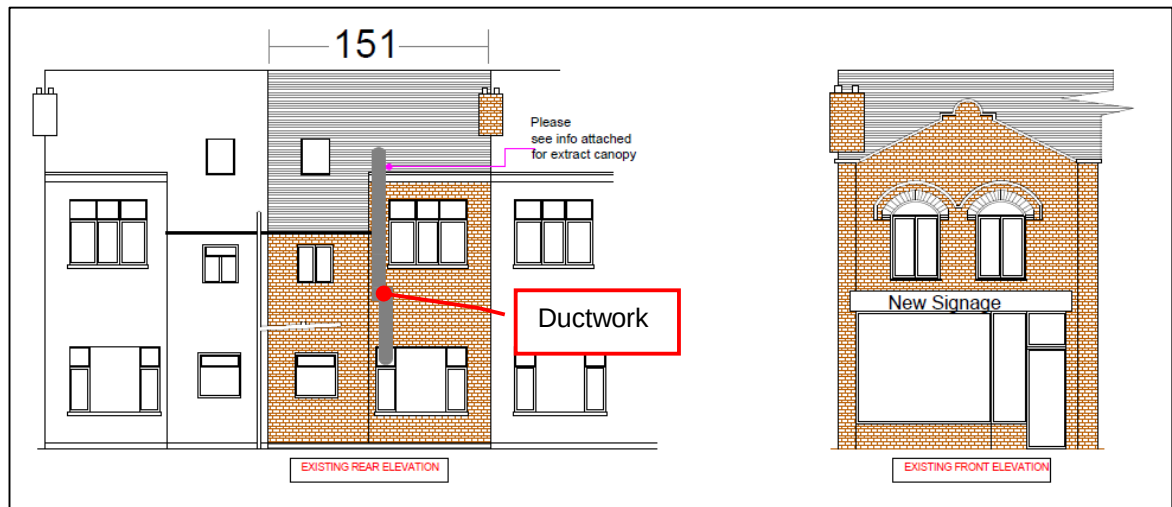
Figure 4.1 – Existing ground and first floor layout



Figure 4.2 – Proposed ground and first floor layout



Figure 4.3 – Elevations showing kitchen extract ductwork



Predicted fan sound levels at nearest dwellings

- 4.11 Table 4.3 presents a calculation summary for the proposed extract fan taking into consideration the sound power spectrum, the system's natural attenuation (duct bend and end reflection loss), surface directivity factor (reflection) and distance separation. Tabulated values have been rounded to the nearest whole number.

Table 4.3 – Extract fan sound pressure level at nearest dwellings

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Extract fan L_w dBA	51	61	70	73	78	77	74	65
Bend attenuation dB	0	0	0	-1	-2	-3	-3	-3
Duct attenuation dB	0	0	0	0	-1	-1	-1	-1
End reflection loss dB	-12	-8	-4	-1	0	0	0	0
Directivity factor dB	+3	+3	+3	+3	+3	+3	+3	+3
Spherical radiation dB	-28	-28	-28	-28	-28	-28	-28	-28
Resulting L_{Aeq} dB	14	28	41	46	50	48	45	36
Specific sound level $L_{Aeq} = 54$ dB								

- 4.12 The calculation results indicate a specific sound pressure level of approximately 54 dB $L_{Aeq,T}$ at the nearest dwelling.
- 4.13 The resulting fan sound level is therefore approximately 10 dB above the night-time background sound level and 15 dB above the night-time noise limit.
- 4.14 The extraction system therefore requires an appropriate in-duct acoustic silencer in order to sufficiently reduce the noise level emitted from the system.
- 4.15 Taking into consideration the level of noise attenuation required, it is recommended that a circular (cylindrical) type silencer with a central 'pod' is installed within the system.
- 4.16 A circular 'pod' silencer typically provides a greater level of attenuation than a standard straight-through circular silencer.

- 4.17 Table 4.4 presents the calculation results for the extract fan with the inclusion of a 450 mm long circular 'pod' type silencer. A slighter longer silencer will also be suitable (e.g. 600 mm long), however the acoustic performance should equal that used within this assessment.

Table 4.4 – Extract fan sound pressure level with acoustic silencer fitted

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Extract fan L_w dBA	51	61	70	73	78	77	74	65
Silencer insertion loss dB	-4	-6	-10	-18	-25	-28	-26	-21
Bend attenuation dB	0	0	0	-1	-2	-3	-3	-3
Duct attenuation dB	0	0	0	0	-1	-1	-1	-1
End reflection loss dB	-12	-8	-4	-1	0	0	0	0
Directivity factor dB	+3	+3	+3	+3	+3	+3	+3	+3
Spherical radiation dB	-28	-28	-28	-28	-28	-28	-28	-28
Resulting L_{Aeq} dB	10	22	31	28	25	20	19	15
Specific sound level $L_{Aeq} = 34$ dB								

- 4.18 The calculation results indicate a specific sound pressure level of approximately 34 dB $L_{Aeq,T}$ at the nearest dwelling with an appropriate acoustic silencer.
- 4.19 Taking into consideration the tonal characteristics of the unit, it is considered appropriate to apply a correction (penalty) of +2 dB with regard to the tonality or characteristics of the noise as experienced at the nearest dwelling.
- 4.20 On this basis, the corresponding sound 'rating' level of the extract fan is 36 dB $L_{Ar,15min}$.
- Specific sound level of 34 dB $L_{Aeq,15min}$ + 2 dB correction = 36 dB $L_{Ar,15min}$
- 4.21 The fan rating level is therefore approximately 8 dB below the night-time background sound level and 3 dB below the night-time noise limit.
- 4.22 The sound rating level of the extract fan therefore satisfies the daytime and night-time noise limit.
- 4.23 With regard to the anticipated noise impact, BS 4142 states:
- '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'.*
- 4.24 On this basis, noise from the attenuated extract fan is expected to have a low to negligible impact at adjacent dwellings.

Noise transmission through the separating walls

- 4.25 The separating party wall appears to be a double-leaf masonry construction with a plaster finish.
- 4.26 The airborne sound insulation performance of the party wall is expected to be in the region of 45 to 50 dB $D_{nT,w}+C_{tr}$.
- 4.27 Sample measurements conducted within similar sized restaurants and food takeaways indicate typical ambient sound levels in the region of 60 to 70 dB $L_{Aeq,60sec}$.

- 4.28 Taking into consideration the anticipated sound insulation of the party wall, the corresponding sound level within the adjacent office accommodation is expected to be in the region of 20 to 25 dB $L_{Aeq,60sec}$.
- $70 \text{ dB } L_{Aeq,60sec} - 45 \text{ dB } D_{nT,w} + C_{tr} = 25 \text{ dB } L_{Aeq,60sec}$
- 4.29 The resulting sound level is therefore expected to be significantly below the recommended internal sound level limit of 35 to 40 dB $L_{Aeq,T}$ for offices and similar accommodation (recommendation from BS 8233:2014).

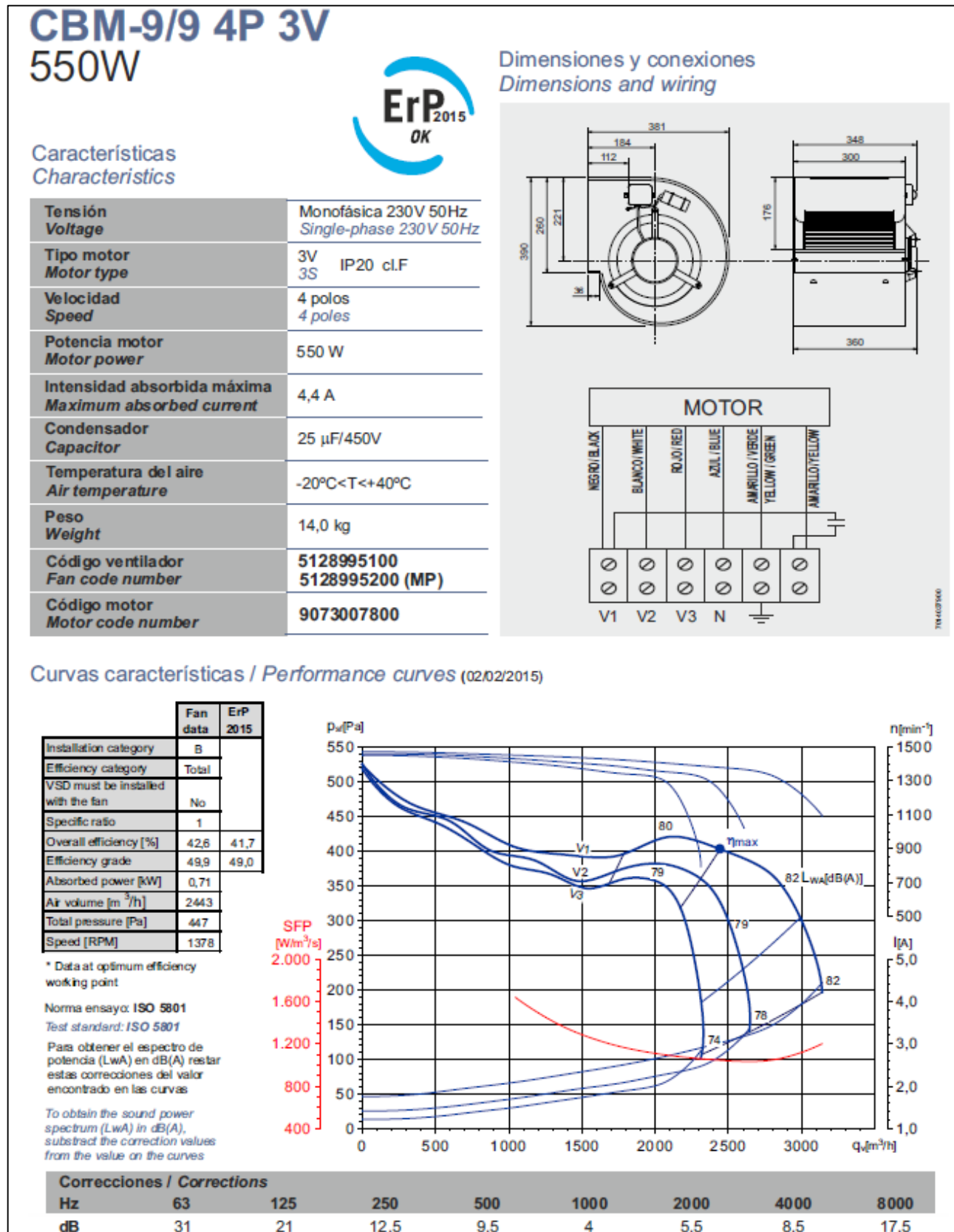
5. Conclusion

- 5.1 The typical background sound level has been determined by continuous sound level monitoring to the rear of the property.
- 5.2 Appropriate noise limits have been determined for the daytime and night-time period.
- 5.3 The extract fan sound level is approximately 10 dB above the night-time background sound level and 15 dB above the night-time noise limit without an acoustic silencer/attenuator in the system.
- 5.4 With an appropriate acoustic silencer, the fan rating level is approximately 8 dB below the night-time background sound level and 3 dB below the night-time noise limit.
- 5.5 It is anticipated that a 450 to 600 mm long, circular 'pod' type silencer will be suitable.
- 5.6 On the basis of this assessment and BS 4142 guidance, the operation of the attenuated extract system is expected to have a low to negligible impact at the adjacent dwellings.
- 5.7 It is anticipated that the party wall will provide sufficient sound insulation with regard to noise transmission to the adjacent offices.

Appendix A

Extract fan specification and data

Figure A.1 – Extract fan specification and data



Appendix B

Assessment terminology

Assessment terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2 \times 10^{-5} \text{Pa}$).
dB(A)	The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc, according to the parameter being measured.
Acoustic environment	Sound from all sources as modified by the environment.
Ambient sound level	The totally encompassing sound in a given situation at a given time; it is usually composed of sound from many sources, near and far.
Background sound level	The sound level in the absence of a specific noise source under consideration (e.g. plant/machinery), measured as $L_{A90,T}$.
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.
Specific sound source	Sound source being assessed.
Specific sound level	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T.
Rating level $L_{Ar,T}$	Specific sound level plus any adjustment for the characteristic features of the sound.