DOCUMENT REFERENCE: EHC/HOL140904/1

REPORT TITLE: NOISE IMPACT ASSESSMENT OF PROPOSED KITCHEN EXTRACTION PLANT

SITE: THE SHIP TAVERN, 12 GATE STREET, HOLBORN, LONDON, WC2A 3HP

Ref	EHC/HOL140904/1
For	EV Inns Ltd
Address	The Ship Tavern, 12 Gate Street, Holborn, London WC2A 3HP
Date of Assessment	Thursday 4th September 2014 – Friday 5th September 2014
Date of Report	Friday 12th September 2014
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1. Introduction

1.1. Healthy Abode have been engaged by EV Inns Ltd of The Ship Tavern, 12 Gate Street, Holborn, London WC2A 3HP

1.2. The Ship Tavern, located by busy Kingsway and High Holborn, is sited on the corner of the pedestrianised road known as 'Gate Street' and the alleyway, known as 'Little Turnstile'. The Ship Tavern (hereinafter known as 'the Tavern' is partly shielded by neighbouring buildings. The premises have traded continuously as a Public House since 1549.

1.3. Following submission of architectural drawings, the client was advised by the Local Planning Authority, London Borough of Camden's Planning Officer (hereinafter termed 'the LPA' and/or 'the Officer') upon the necessity of obtaining an acoustic report to supplement the application.

1.4. The LPA have stated the following:

1.4.1. *With respect to the proposed flue, please submit an acoustic report prepared by qualified noise consultants outlining details of:*

- the existing background noise levels measured over 24hrs;
- proposed noise output;
- the measures proposed to reduce noise, fume emissions and vibration;
- cumulative noise levels including all existing and proposed units and the method used to compile the report including examples of the calculations and assumptions made;
- the system manufacturers specifications.

1.5. A suitable noise criteria and methodology have been agreed in advance, based around the principles of BS4142. The report details the results of a twenty-four hour environmental noise assessment carried out adjacent to the boundary of the nearest neighbouring noise sensitive dwelling, 10 Gate Street.

1.6. The objectives of the survey were to:

1.6.1. establish typical background noise levels over a twenty-four hour period;
1.6.2. determine the new mechanical extraction plant's proposed sound level output;
1.6.3. determine whether specific measures are required to further attenuate noise and vibration;
1.6.4. ensure that the proposed extraction does not cause loss of amenity or a noise nuisance to the occupant's of the neighbouring residential premises.

1.7. Whilst the LPA confirmed the necessity for an acoustic report, no specific advice on the methodology or criteria has been stated. Therefore the report is based upon the principles of BS4142, using a criterion that sound levels emanating from the proposed mechanical extraction shall be at least 10dB below background at 1m from the window of the nearest noise sensitive residence.

2. Site Description

2.1. The site, '12 Gate Street', is a substantial, two-storey, corner terraced Tavern, located in Holborn, London. Located upon the third storey of the Tavern and accessed only from within the Tavern, is the client's residential flat. From the flat, a loft ladder, leads upwards and out onto the flat roof.

2.2. The Tavern is located on the junction of a pedestrianised road and alleyway. The immediate vicinity comprises a mixture of offices, restaurants and shops. The nearest noise sensitive façade is located above 10 Gate Street. Externally, this appears set over the third and fourth storey. The fourth storey window is set into a mansard style roof and is at a distance of 6m from the proposed extract flu aperture. A site survey revealed that there is no direct line of sight from the windows of this residential premises, to the location of the proposed extract flu. Considering the next nearest noise sensitive residence, there is a flat, set to the fourth floor above premises located to the other end of the alleyway, Little Turnstyle. This is approximately 20m distance from the flu aperture. The third residential premises is set on Gate Street, at a distance 35m away from the flu extract. Whilst this premises has a partial view of the Tavern, the location of the proposed flu should not be visible. This is because the line of sight is blocked by the office block, located opposite the Tavern.

2.3. A number of mechanical extraction systems are already in-place, including roof mounted air conditioning units serving the ground floor bar and the first floor restaurant. In addition, the ladies and gentleman's toilets have mechanical extraction, there are also roof mounted cooling units running commercial fridges and chillers, as well as an existing mechanical extraction system serving the pub's kitchen. The operation of these units adds to the background noise levels.

2.4. An application for planning permission to replace the existing kitchen extraction system with a new system, connected to an extract flu, so as to reduce odour and noise, has been made.

2.5. A site survey revealed that the existing kitchen extraction system, for which planning consent exists, is ducted horizontally out of the right hand façade; terminating with an external grille, set at first floor level (See Appendix D). The existing extraction system does not pass through a silencer and therefore when stood in the alleyway, named Little Turnstile, the existing kitchen extraction is audible above daytime background sound levels; though this is not the case at the window of the residential premises.

2.6. The proposed new extract system shall comprise an internally sited Flakt Woods extraction fan, ducted externally into vertical stainless steel flu, terminating above the Tavern's roof line.

3. Noise Criteria

3.1. The National Planning Policy is guided by the National Planning Policy Framework (NPPF). With regard to noise the terms 'significant adverse impact' and 'other adverse impacts' are defined in the explanatory notes of the 'Noise Policy Statement for England (NPSE). These state that there are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are: NOEL – No Observed Effect Level This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise and LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected. Extending these concepts for the purpose of this NPSE leads to the concept of SOAEL - significant observed adverse effect level. This is the level above which significant adverse effects on health and quality of life occur. However, no specific noise limits for LOAEL and SOAEL have been defined. Therefore, guidance from other acoustic standards may be employed to determine suitable levels within the overall principal of the National Planning Policy Framework; such as BS4142.

3.2. British Standard 4142 "Method for Rating Industrial noise affecting mixed residential and industrial areas" is a Standard used primarily for assessing the likelihood of complaints from local residents should a new industrial noise source be introduced to the vicinity.

3.3. The scope of BS4142 states that the Standard describes methods for determining, at the outside of a building:

3.3.1. fixed installations, or sources of an industrial nature in commercial premises; and

3.3.2. background noise level.

3.4. In accordance with BS4142 the background noise level is the A-weighted sound pressure level at the assessment position that is exceeded for 90% of a given time interval (L_{A90}). The specific noise level is the equivalent continuous (L_{Aeq}) sound pressure level at the assessment position produced by the noise source over a given time interval.

3.5. Certain acoustic features can increase the likelihood of complaint over that expected from a simple comparison between the specific noise level and the background level. Where such features are present, these are taken into account by adding 5 dB to the specific noise level this is called the rating level.

3.6. Daytime assessments should be made over a 1-hour reference period. However, measurement periods may be longer or shorter than the full reference period, as long as they are sufficient for correct assessment.

3.7. The rating level is compared to the existing background level.

3.8. According to BS4142 a rating level of:

- 10dB(A) or more above the background is an indication that complaints,

attributable to the operation of the noise source, are likely.

- 5dB(A) above the background is of marginal significance.

- 10dB(A) below the background is a positive indication that complaints attributable to the operation of the noise source are unlikely.

4. Instrumentation, Monitoring Position & Weather

4.1. Measurements were carried out using a Norsonic Nor-140 (s/n 34128) sound level meter (SLM). The SLM was set to record all A-weighted sound pressure levels including L_{Aeq} and L_{A90}. The Nor-140 sound level meter is a Class 1 sound level meter (SLM) capable of operating as integrating sound level meter in compliance with BS EN 60204:1994 (IEC 804). The SLM was set to log measurements every 5 minutes. The SLM was calibrated with a Norsonic 1251 calibrator (s/n 1405219) both before and after the survey; no drift was observed. The microphone was mounted onto a tripod, set at a height of 1.4m above the floor. A weather resistant windshield was fitted to the microphone.

4.2. The SLM was positioned on the roof of the Tavern, to the front left away from all other reflecting façades. Sound levels were monitored over a twenty-four hour period.

4.3. The weather conditions saw partial cloud cover, dry weather with light winds. The weather conditions and wind were therefore satisfactory for assessments to occur throughout the survey period.

5. Environmental Noise Survey – Procedure

5.1. Automated monitoring was conducted over a continuous twenty-four hour period from 17:20 on Thursday 4th September 2014 until 17:15 on – Friday 5th September 2014.

5.2. Data was continuously acquired for each five-minute measurement period with the individual averaging time for statistical noise set to 5 minutes. Whilst a number of statistical parameters were recorded concurrently, the following two are relevant under the assessed noise criteria:

- LA90 – The Sound Pressure Level (SPL) exceeded for 90% of the measurement period. LA90 is considered to represent the “background noise level” during the measurement period and is used for the assessment of noise to determine the likelihood of complaints (BS4142).
- L_{Aeq} – The continuous steady state SPL that has the same acoustic energy, as the real fluctuating level.

5.3. All noise levels recorded were filtered using an industry accepted 'A-weighting' filter.

5.4. The measurement procedure generally complied with BS7445: 1991 'Description and measurement of environmental noise'.

5.5. Given the range of existing mechanical plant, we consider that 10dB(A) below the background level is necessary to ensure that the extract flu does not cause a nuisance to the neighbouring premises.

6. Survey Results

6.1. The test data obtained for each 5-minute period gives a continuous series of daytime and night—time levels. Data is displayed in Appendix A as a line graph.

6.2. Table 2 summaries the L_{Aeq} and L_{A90} parameters, the maximum and minimum sound levels taken for daytime and night-time for the whole of the twenty-four hour time period are displayed in Appendix B.

	Min Level dB(A)	Max Level dB(A)
L_{Aeq} Day (5min)	60 (59.5)	67 (66.7)
L_{Aeq} Night (5min)	57 (57.4)	66 (65.5)
L_{A90} Day (5min)	59 (58.8)	64 (64.2)
L_{A90} Night (5-min)	57 (56.9)	64 (63.9)

Table 1: Summary of Max and Min LAeq & LA90 levels over daytime and night-time periods.

7. Discussion of Results

7.1. The lowest L_{A90} background period recorded was 57dB. Table 3 gives the maximum allowable noise level from the proposed extraction plant. The BS4142 calculation considers a worst-case scenario; assuming that the mechanical extraction plant operates over a continuous twenty-four hour period and at the maximum sound level, specified by the manufacturer. We have considered this worst-case twenty-four hour period on full power scenario even though the reality is that, this shall never actually be necessary. This is because the kitchen does not operate 24-hours a day and the extraction would not need to be run continuously on its maximum permitted fan speed.

7.2. Our client wishes to highlight that the extraction fan is for use when the kitchen is in operation, and that it shall replace an existing older system.

7.3. We are advised that in this instance, the LPA have not set a specific requirement for the proposed noise output in relation to the background. Therefore, we have considered that that any noise emanating from the new mechanical plant shall need to be 10dB below background at 1m from the nearest noise sensitive façade's window.

Hours of Operation	Lowest Recorded L_{A90} Background Noise Level	Maximum Allowable L_{Aeq} Noise Level
24 hours	57	47

Table 3: Maximum plant levels

7.4. The client wishes to apply for planning permission to utilise a Flakt Woods 50/JM/20/4/6/32 Aerofoil mechanical extraction fan (Appendix C), installed internally within the kitchen. The installer confirms that this is connected to an external stainless steel flu, comprising 3 x 90° elbows, with a proposed ductwork length of 5 metres, so as to extract 1.4m3/s airflow, with an extract ductwork size 450mm x 450mm. The extractor fans manufacturer's stated maximum sound power level of 56dB(A).

7.5. The positioning and height of the current extraction system and the proposed new extraction flu are shown on the associated Mino Architect site plans, Appendix D and E.

7.6. In considering sound propagation, the distance from the flu outlet to the nearest neighboring external façade has been measured at 5m, with an additional 1m to the residential window. The calculations are shown in Table 4.

Existing Unit Arrangement Right hand Façade	Sound Pressure Levels dB(A)
Minimum background noise level (L_{A90})	57dB(A)
Specific Noise Level: Flakt Woods 50 JM/20/4/6 Aerofoil, sited internally	56dB(A)
Nil feature correction, as broadband	+0dB(A)
5m length of extract flu, reduction of 0.5dB per metre = -2.5dB	53.5dB(A)
Three 90° bends in extract flu, cautious reduction of just 6dB	47.5dB(A)
Attenuation due to end reflection of duct dimension 0.45m x 0.45m in 250Hz band = -1.5dB	46(A)
Correction for distance to 1m from nearest residential window = 20log(5) = 14dB	32dB(A)
Cautiously, nil correction for line of site screening	32dB(A)
Correction for acoustic directivity, cautiously only allowed 6dB for	26dB(A)
Specific noise level below background by 31dB	
The specific noise level is 21dB(A) below the criteria to be -10dB below background	

Table 4: BS4142 noise impact calculation from mechanical plant

7.7. The proposed output at the flu aperture shall be 46dB(A).

7.8. The sound pressure level from the extraction system at the nearest residential window shall be 26dB. The monitored background is 57dB.

7.9. Table 4 shows that by siting the extraction unit internally within the kitchen and externally ducted to the stainless steel flu terminating above roof line, out of line of sight with the residential dwelling's window, the rating sound pressure level is 31dB below the obtained background level, at 1m from the nearest residential window.

7.10. The BS4142 calculation confirms that there is no requirement for additional physical sound attenuation, in order to ensure that the proposed extraction system does not cause loss of amenity to the neighbouring residence.

8. Noise from Mechanical Services Equipment

8.1. The kitchen extract ventilation system proposed for the restaurant and which has been assessed in this acoustic report consists of the following components:

8.1.1. 1 kitchen ventilation extraction fan Flakt Woods JM Aerofoil: 50JM/20/4/6/32

8.1.2. external stainless steel ducting 5m in length, with three 90° right angle bends terminating at roof level aperture.

8.2. The client advised that the kitchen extraction fan shall be located internally, with external vertical ducting. A copy of the Mino Architects proposed plan is shown in Appendix E.

8.3. A copy of manufacturers noise datasheet for the extraction fan is shown in Appendix C and in Table 1.

2.08m3/s @ 125Pa	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz	Lw	LpA
Inlet Spectrum	76dB	78dB	75dB	74dB	72dB	68dB	65dB	59dB	83dB	56dB
Outlet Spectrum	78dB	80dB	76dB	74dB	72dB	68dB	66dB	60dB	84dB	56dB
Sound Breakout	68dB	62dB	54dB	51dB	47dB	40dB	44dB	36dB	69dB	33dB

Table 5: Manufacturer's Data for Flakt Woods JM Aerofoil: 50JM/20/4/6/32

8.4. A BS4142 calculation has been undertaken to calculate the noise contrition from the equipment to outside the nearest residential windows.

8.5. The calculation uses outlet sound power level (SPL) source data and takes account of the following:

8.5.1. Length of extract flu is 5m. A reduction of 0.5dB per meter has been calculated.

8.5.2. There are three 90° bends. Cautiously, we have calculated a reduction of just 6dB for all three bends.

8.5.3. Attenuation due to end reflection of duct dimension 0.45m x 0.45m in the 250Hz band is -1.5dB

8.5.4. Distance from extract flu aperture to outside the nearest residential windows, as 6m.

8.5.5. Cautiously a +3dB correction has been included to allow for any noise reflections back from the surrounding structures.

8.5.6. Cautiously, any noise reduction benefit from line of sight screening, as the residential window is not in a direct line of site to the extract flu or to the flu aperture is not allowed for in the calculation.

8.5.7. Acoustic directivity, this takes account that the residential window is off axis to the extract aperture. The angle of directivity from the aperture outlet is at least 90°. Cautiously, we have only applied a -6dB correction.

9. Vibration from Mechanical Services Equipment

9.1. The location for the extract flu is structurally linked to the Tavern's restaurant and second floor flat. Therefore it is recommended that vibration isolators be fitted to the equipment.

10. Olfactory Comment

10.1. The LPA have requested information on the measures proposed to reduce fume emissions. There is no standard olfactory test. At the time of site inspection, a build-up of grease particulates was noted. Our consultant confirmed that there were no particular cooking odours evident in the alleyway and none on the boundary with the nearest residence. We advise that by installing the proposed baffle filters, vertical flu and having in place an annual service/cleaning contract, the local environment shall be improved.

11. Optional Amelioration Measures

11.1. The predicted noise output at the flu aperture is over 10dB below background. Therefore the following optional works are recommendations only in order to improve comfort within the Tavern kitchen and restaurant, in the alleyway outside the Tavern and in the second floor flat.

11.1.1. Ensure an annual mechanical extract fan service plan and flu cleaning regime is agreed with the installer.

11.1.2. Fit an acoustic enclosure around the fan body to reduce noise breakout from the fan casing. This will improve sound levels within the kitchen.

11.1.3. It is recommended that a silencer is fitted after the fan and either immediately before or immediately after the ducting passes through the external brick façade. This will further reduce sound levels, improving sound levels within the alleyway.

11.1.4. It is recommended that the flu should be mounted using vibration isolators. We recommend that the fan is mounted using high definition proprietary rubber or neoprene turret mountings. The mountings should have a static deflection under weight of the fan and associated ducting of not less than 5mm.

11.1.5. We recommend that the fan has flexible connections fitted to the duct connections either side of the fan. To be effective the connections need to be loose when installed, not taut. This will ensure that vibration is not transmitted. Such fittings are formed of rubber or neoprene sheet material; standard size flexible connectors are available from most suppliers.

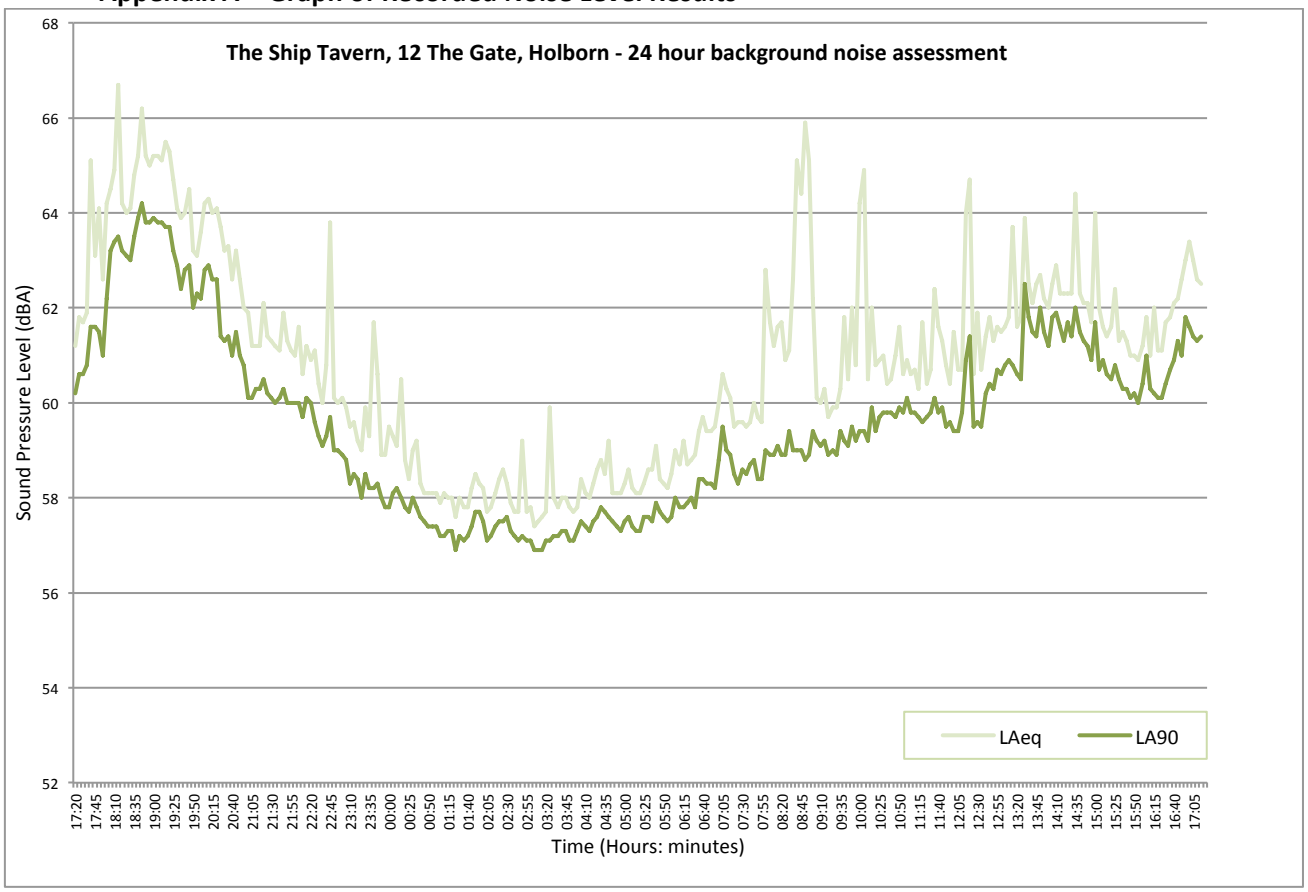
11.1.6. It is recommended that the external flu is connected to the façade upto roof level using proprietary rubber or neoprene turret mountings on brackets to take the weight vertically. The mountings should have a static deflection under weight of the ducting of not less than 3mm.

12. Conclusions

12.1. Our calculations based upon BS4142 demonstrate that the proposed internal position of the mechanical extraction fan and the location of the external stainless steel flu, terminating above roofline, shall not cause a loss of amenity or noise nuisance to the nearest residential dwelling.

12.2. For greater comfort within the Tavern kitchen, restaurant, and Tavern's dwelling, additional amelioration measures have been stated, though these are recommendations only.

Appendix A – Graph of Recorded Noise Level Results



Appendix B – 5-min L_{Aeq} & L_{A90} data for 24-hour period

Date	LAeq	LA90
17:20	61.2	60.2
17:25	61.8	60.6
17:30	61.7	60.6
17:35	61.9	60.8
17:40	65.1	61.6
17:45	63.1	61.6
17:50	64.1	61.5
17:55	62.6	61
18:00	64.2	62.2
18:05	64.5	63.2
18:10	64.9	63.4
18:15	66.7	63.5
18:30	64.2	63.2
18:25	64	63.1
18:30	64.1	63
18:35	64.8	63.5
18:40	65.2	63.9
18:45	66.2	64.2
18:50	65.2	63.8
18:55	65	63.8
19:00	65.2	63.9
19:05	65.2	63.8
19:10	65.1	63.8
19:15	65.5	63.7
19:20	65.3	63.7
19:25	64.7	63.2
19:30	64.1	62.9
19:35	63.9	62.4
19:40	64	62.8
19:45	64.5	62.9
19:50	63.2	62
19:55	63.1	62.3
20:00	63.6	62.2
20:05	64.2	62.8
20:10	64.3	62.9
20:15	64	62.6
20:20	64.1	62.6
20:25	63.7	61.4
20:30	63.2	61.3
20:35	63.3	61.4
20:40	62.6	61

20:45	63.2	61.5
20:50	62.6	61
20:55	62	60.8
21:00	61.9	60.1
21:05	61.2	60.1
21:10	61.2	60.3
21:15	61.2	60.3
21:20	62.1	60.5
21:25	61.4	60.2
21:30	61.3	60.1
21:35	61.2	60
21:40	61.1	60.1
21:45	61.9	60.3
21:50	61.3	60
21:55	61.1	60
22:00	61	60
22:05	61.6	60
22:10	60.6	59.7
22:15	61.2	60.1
22:20	60.9	60
22:25	61.1	59.6
22:30	60.4	59.3
22:35	60	59.1
22:40	60.8	59.3
22:45	63.8	59.7
22:50	60.1	59
22:55	60	59
23:00	60.1	58.9
23:05	59.9	58.8
23:10	59.5	58.3
23:15	59.6	58.5
23:20	59.2	58.4
23:25	59	58
23:30	59.9	58.5
23:35	59.3	58.2
23:40	61.7	58.2
23:45	60.6	58.3
23:50	58.9	58
23:55	58.9	57.8
00:00	59.5	57.8
00:05	59.3	58.1
00:10	59.1	58.2
00:15	60.5	58
00:20	58.8	57.8
00:25	58.4	57.7
00:30	59	58
00:35	59.2	57.8
00:40	58.3	57.6

00:45	58.1	57.5
00:50	58.1	57.4
00:55	58.1	57.4
01:00	58.1	57.4
01:05	57.9	57.2
01:10	58.1	57.2
01:15	58	57.3
01:20	58	57.3
01:25	57.6	56.9
01:30	58	57.2
01:35	57.8	57.1
01:40	57.8	57.2
01:45	58.2	57.4
01:50	58.5	57.7
01:55	58.3	57.7
02:00	58.2	57.5
02:05	57.7	57.1
02:10	57.8	57.2
02:15	58.1	57.4
02:20	58.4	57.5
02:25	58.6	57.5
02:30	58.3	57.6
02:35	57.9	57.3
02:40	57.7	57.2
02:45	57.7	57.1
02:50	59.2	57.2
02:55	57.7	57.1
03:00	57.8	57.1
03:05	57.4	56.9
03:10	57.5	56.9
03:15	57.6	56.9
03:20	57.7	57.1
03:25	59.9	57.1
03:30	58	57.2
03:35	57.8	57.2
03:40	58	57.3
03:45	58	57.3
03:50	57.8	57.1
03:55	57.7	57.1
04:00	57.8	57.3
04:05	58.4	57.5
04:10	58.1	57.4
04:15	58	57.3
04:20	58.3	57.5
04:25	58.6	57.6
04:30	58.8	57.8
04:35	58.5	57.7
04:40	59.2	57.6

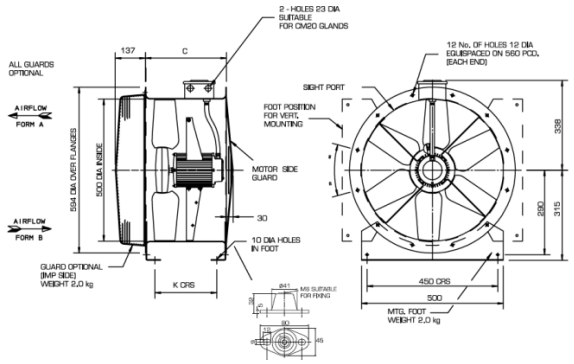
04:45	58.1	57.5
04:50	58.1	57.4
04:55	58.1	57.3
05:00	58.3	57.5
05:05	58.6	57.6
05:10	58.2	57.4
05:15	58.1	57.3
05:20	58.1	57.3
05:25	58.3	57.6
05:30	58.6	57.6
05:35	58.6	57.5
05:40	59.1	57.9
05:45	58.4	57.7
05:50	58.3	57.6
05:55	58.2	57.5
06:00	58.5	57.6
06:05	59	58
06:10	58.7	57.8
06:15	59.2	57.8
06:20	58.7	57.9
06:25	58.8	58
06:30	58.9	57.8
06:35	59.4	58.4
06:40	59.7	58.4
06:45	59.4	58.3
06:50	59.4	58.3
06:55	59.5	58.2
07:00	60	58.8
07:05	60.6	59.5
07:10	60.3	59
07:15	60.1	58.9
07:20	59.5	58.5
07:25	59.6	58.3
07:30	59.6	58.6
07:35	59.5	58.5
07:40	59.6	58.7
07:45	60	58.8
07:50	59.7	58.4
07:55	59.6	58.4
08:00	62.8	59
08:05	61.7	58.9
08:10	61.2	58.9
08:15	61.6	59.1
08:20	61.7	58.9
08:25	60.9	58.9
08:30	61.1	59.4
08:35	62.6	59
08:40	65.1	59
08:45	64.4	59
08:50	65.9	58.8
08:55	65.1	58.9
09:00	62.2	59.4
09:05	60.1	59.2
09:10	60	59.1
09:15	60.3	59.2
09:20	59.7	58.9
09:25	59.9	59
09:30	59.9	58.9
09:35	60.3	59.4
09:40	61.8	59.2
09:45	60.5	59.1
09:50	62	59.5
09:55	60.8	59.2
10:00	64.2	59.4
10:05	64.9	59.4
10:10	60.5	59.2
10:15	62	59.9
10:20	60.8	59.4
10:25	60.9	59.7
10:30	61	59.8
10:35	60.4	59.8
10:40	60.5	59.8
10:45	61	59.7
10:50	61.6	59.9
10:55	60.6	59.8
11:00	60.9	60.1
11:05	60.6	59.8
11:10	60.7	59.8
11:15	60.3	59.7
11:20	61.7	59.6
11:25	60.4	59.7
11:30	60.7	59.8
11:35	62.4	60.1
11:40	61.6	59.8
11:45	61.3	59.9
11:50	60.8	59.5
11:55	60.4	59.6
12:00	61.5	59.4
12:05	60.7	59.4
12:10	60.7	59.8
12:15	64	60.9
12:20	64.7	61.4
12:25	60.6	59.5
12:30	61.9	59.6
12:35	60.7	59.5
12:40	61.4	60.2

12:45	61.8	60.4
12:50	61.3	60.3
12:55	61.6	60.7
13:00	61.5	60.6
13:05	61.6	60.8
13:10	61.8	60.9
13:15	63.7	60.8
13:20	61.6	60.6
13:25	61.8	60.5
13:30	63.9	62.5
13:35	62.5	61.8
13:40	62.1	61.5
13:45	62.5	61.4
13:50	62.7	62
13:55	62.2	61.5
14:00	62	61.2
14:05	62.5	61.8
14:10	62.9	61.9
14:15	62.3	61.6
14:20	62.3	61.3
14:25	62.3	61.7
14:30	62.3	61.4
14:35	64.4	62
14:40	62.3	61.5
14:45	62.1	61.3
14:50	62.1	61.2
14:55	61.7	60.9
15:00	64	61.7
15:05	62	60.7
15:10	61.6	60.9
15:15	61.4	60.6
15:20	61.6	60.5
15:25	62.4	60.8
15:30	61.3	60.5
15:35	61.5	60.3
15:40	61.3	60.3
15:45	61	60.1
15:50	61	60.2
15:55	60.9	60
16:00	61.2	60.4
16:05	61.8	61
16:10	61	60.3
16:15	62	60.2
16:20	61.1	60.1
16:25	61.1	60.1
16:30	61.7	60.4
16:35	61.8	60.7
16:40	62.1	60.9
16:45	62.2	61.3
16:50	62.6	61
16:55	63	61.8
17:00	63.4	61.6
17:05	63	61.4
17:10	62.6	61.3
17:15	62.5	61.4

Appendix C – JM 50 Woods Extraction Fan Unit Manufacturers Datasheet

500 Woods Data Sheet

Dimensions - 50 JM Aerofoil



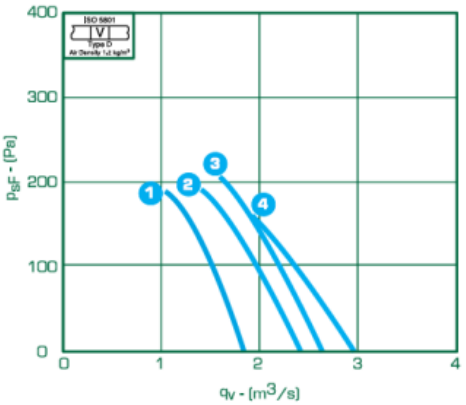
Performance Data

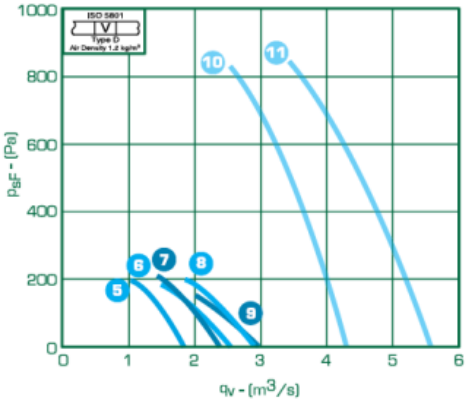
1 Phase

1 - 50JM/20/4/6/20	**3** - 50JM/20/4/6/32		
2 - 50JM/16/4/5/28	**4** - 50JM/16/4/5/38		

3 Phase

5 - 50JM/20/4/6/20	**7** - 50JM/20/4/6/28	**9** - 50JM/16/4/5/40	**11** - 50JM/20/2/6/34
6 - 50JM/16/4/5/30	**8** - 50JM/20/4/6/38	**10** - 50JM/20/2/6/24	



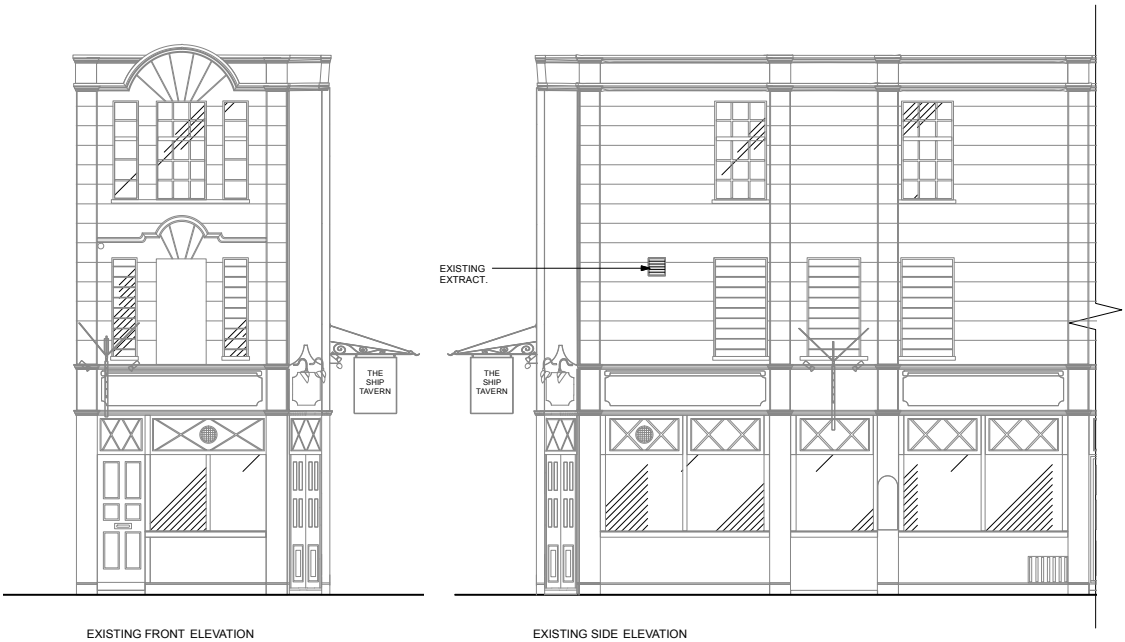


Ref	Product Code	m³/s at Ps (Static)									
		0	50	100	150	200	250	300	400	500	600
2	50JM/16/4/5/...	2.42	2.19	1.95	1.66						
4	50JM/16/4/5/...	2.93	2.66	2.36	1.99						
1	50JM/20/4/6/...	1.84	1.68	1.52	1.30						
3	**50JM/20/4/6/...**	2.61	2.42	2.20	1.94	1.62					
6	**50JM/16/4/5/...**	2.54	2.30	2.04	1.75						
9	50JM/16/4/5/...	3.02	2.75	2.43							
5	50JM/20/4/6/...	1.84	1.68	1.52	1.30						
7	**50JM/20/4/6/...**	2.37	2.19	1.98	1.75	1.42					
8	50JM/20/4/6/...	2.88	2.69	2.45	2.16						
10	50JM/20/2/6/...	4.32	4.23	4.16	4.08	4.00	3.91	3.83	3.65	3.43	3.20
11	50JM/20/2/6/...	5.56	5.46	5.37	5.27	5.16	5.05	4.96	4.73	4.49	4.23

Electrical Data

Ref	Product Code	Speed rev/min	Motor	Product Number	Pitch Angle (°)	Rating (kW)	Full Load Current (A)	Starting Current (A)	Wiring Diagram Ref	Speed Controller		Sound Level dBA
										Electronic	Transformer	
	220-240V/50Hz/1 Ph											
2	50JM/16/4/5/...	1420	CT5	DX511464	24-28	0.52	3.9	7.8	CD1705	**ME1.6**	**MT1.5**	57
4	50JM/16/4/5/...	1420	CT9	JL511460	32-38	0.68	4.8	11	CD1705	**ME1.6**	**MT1.5**	59
1	50JM/20/4/6/...	1420	BT9	DX511455	16-20	0.32	2.2	5	CD1705	**ME1.3**	**MT1.5**	53
3	**50JM/20/4/6/...**	**1420**	**CT5**	**DX511466**	**32**	**0.52**	**3.9**	**7.8**	CD1705	**ME1.6**	**MT1.5**	56
	380-420V/50Hz/3 Ph									Transformer	Inverter	
6	**50JM/16/4/5/...**	**1420**	**CT5**	**DX531460**	**30**	**0.54**	**1.8**	**4.9**	CD2420	**MT3.2**	FWX1	57
9	50JM/16/4/5/...	1385	80	EE531474	8-40	0.9	1.92	9.78	CD2416	N/A	FWX1	60
5	50JM/20/4/6/...	1420	BT9	JL531456	8-20	0.39	1.3	3.9	CD2420	N/A	FWX1	53
7	**50JM/20/4/6/...**	**1420**	**CT5**	**DX531462**	**28**	**0.54**	**1.8**	**4.8**	CD2420	**MT3.2**	FWX1	56
8	50JM/20/4/6/...	1385	80	EE531478	8-40	0.9	1.92	9.78	CD2416		FWX1	59
10	50JM/20/2/6/...	2850	100L	EE531273	8-28	4.6	8.88	61.27	CD2416		FWX4	72
11	50JM/20/2/6/...	2865	112M	EE531274	8-34	6.05	11.6	76.65	CD2417		FWX5	75

Appendix D – Mino Architect Site Plan Existing

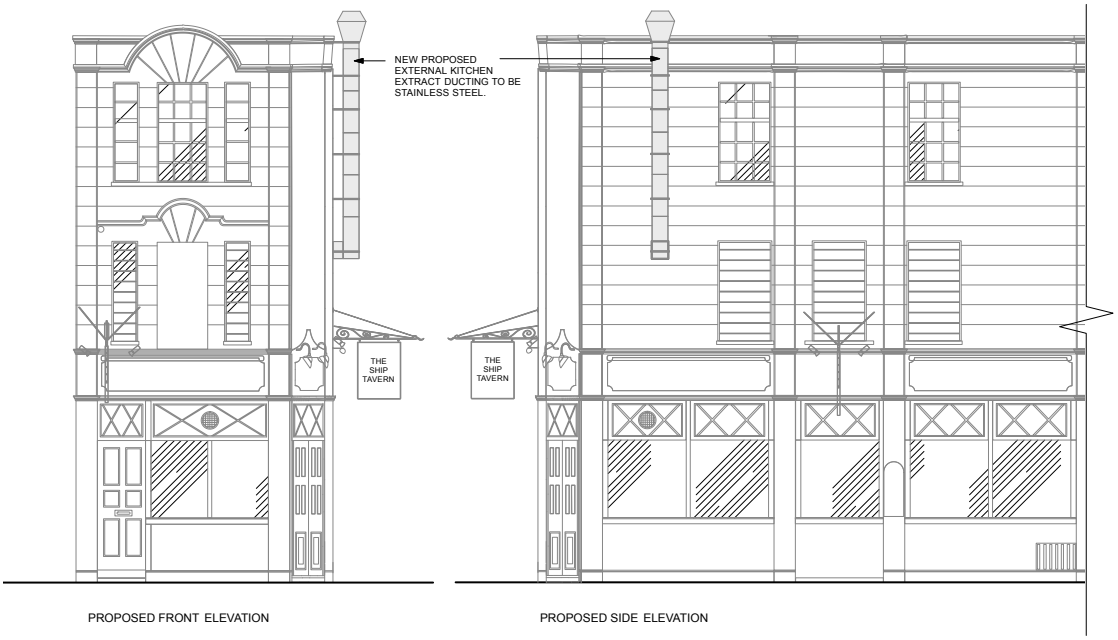


EXISTING FRONT ELEVATION

EXISTING SIDE ELEVATION

MINO ARCHITECTS	DRAWN BY	SCALE	DRAWING TITLE	PROJECT TITLE	DRAWING NUMBER
19 HIGH STREET LEIGH ON SEA ESSEX SS9 2EN Tel: +44(0)1702 546564 Email: info@minoarchitects.com Web: www.minoarchitects.com	DDP	1:50 @A3	EXISTING ELEVATIONS	12 GATE STREET HOLBORN LONDON WC2A 3HP	MA040-002
	CHECKED BY				DRAWING DATE: 1.08.2014 / REV: -

Appendix E – Mino Architect Site Plan Proposed



PROPOSED FRONT ELEVATION

PROPOSED SIDE ELEVATION

MINO ARCHITECTS	DRAWN BY	SCALE	DRAWING TITLE	PROJECT TITLE	DRAWING NUMBER
19 HIGH STREET LEIGH ON SEA ESSEX SS9 2EN Tel: +44(0)1702 546564 Email: info@minoarchitects.com Web: www.minoarchitects.com	DDP	1:50 @A3	PROPOSED ELEVATIONS	12 GATE STREET HOLBORN LONDON WC2A 3HP	MA040-001
	CHECKED BY				DRAWING DATE: 1.08.2014 / REV: -