



AIRTIGHT & NOISECHECK LIMITED

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BS4142 ACOUSTIC TESTING REPORT FOR

**JCB MOTORCYCLE SERVICES
1 PALMERS ROAD INDUSTRIAL ESTATE
EMSWORTH
HAMPSHIRE
PO10 7DH**

SITE ADDRESS

**JCB MOTORCYCLE SERVICES
1 PALMERS ROAD INDUSTRIAL ESTATE
EMSWORTH
HAMPSHIRE
PO10 7DH**



Acoustic Engineer:

Michael Vine

Date: 23rd October 2015

AIRTIGHT & NOISECHECK BUILDING ACOUSTIC TESTING

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Raw data is available upon request



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AIRTIGHT & NOISECHECK LIMITED ACOUSTICS TESTING

Customer Name:

JCB Motorcycle Services
1 Palmers Road Industrial Estate
Emsworth
Hampshire
PO10 7DH

Date: 23rd October 2015

Site Address:

JCB Motorcycle Services
1 Palmers Road Industrial Estate
Emsworth
Hampshire
PO10 7DH

Acoustic Engineer:

Mr. Michael Vine

Equipment used:

Nor121 Environmental Analyser – Serial No 31375, Calibration due February 2016.
Nor118 Integrating-averaging Sound Level Meter - Serial No 31633, Cal due Oct 2016

Analyser complies with the following standards:

IEC 60651 type 1
IEC 60804 type 1
IEC 61260 class 1
IEC 225
ANSI S1.4 – 1985 type 1
ANSI S1.43 – 1997 type 1
ANSI S1.11 – 1986 order 3 type 1D
Norsonic production standard set for the Nor121

Measurement Microphone (Gras 40AF) – Serial No 62522, Cal due Feb 2016, (Nor 1225) - serial No 59993 – Calib due October 2016

Acoustic Calibrator Nor 1251 – Serial No 31652, Cal due August 2016

Measurement Procedure:

The external day-time existing noise levels were measured at the nearest noise sensitive facade on Friday 23rd October 2015 in order to establish the potential adverse impact associated with the use of the unit for motorcycle services. The noise levels were recorded for a period of 1hour at the nearest noise sensitive facade to establish a fair reflection of the day time noise levels in this location. In addition, a variety of specific noise sources were carried out and measured at the same location so a direct comparison can be made between the measured noise levels. This report will use the criteria set out in BS4142: 2014 for the assessment method.



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Executive Summary:

Airtight & Noisecheck Ltd were instructed by JCB Motorcycle Services to undertake a BS4142: 2014 noise impact assessment (NIA) at the nearest noise sensitive location in order to establish if the use of the unit as a motorcycle service centre will have an adverse impact on the residential dwellings located to the West. The microphone locations and services measured were:

- Palmers Road – residential boundary – No Noise
- Palmers Road – residential boundary – 4 stroke v twin with modified exhaust, 750cc @ 6000rpm with doors closed
- Palmers Road – residential boundary – 4 stroke v twin with modified exhaust, 750cc @ 6000rpm with doors open
- Palmers Road – residential boundary – 2 stroke @ 4000rpm with doors closed
- Palmers Road – residential boundary – 2 stroke @ 4000rpm with doors open

For the purpose of this assessment, the motorbikes were being revved constantly at the listed rpm for a 30second duration. In reality it is unlikely that the bikes will be revved like this constantly for a sustained period of time, but to assume worst case scenario these operations were performed.

Based on a log book taken by the owner of the service centre it is understood that the motorbikes will only ever be in operation for approximately 10minutes in any one hour period thus the measured noise levels will have a time period acoustic feature applied to them. In addition to the nature of the noise source other acoustic feature corrections will apply and these are listed within the report.

The results in this report were measured against criteria set out in British Standard BS4142: Method for Rating industrial noise affecting mixed residential and industrial areas 2014. This document states:

- 1- a difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- 2- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
- 3- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific 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.

The results measured and calculated in this report show that without any further mitigation measures the noise associated by the motorcycles will have a significant adverse impact on the neighbouring dwellings. All calculations and results are listed within this report. Without the mitigation measures it would appear that the motorcycle noise ranges from between +9dB to +26dB above the $L_{A90\ 1\text{hour}}$ value

The customer has already installed some heavy duty timber doors to the shutter located at the front of the unit and they are happy to carry out some further mitigation measures to ensure the adverse impact is reduced. There are many other car garages in close proximity to the motorcycle unit and during the background noise measurements it was apparent that the majority of noise emissions were coming from these units.

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1 Objective:

1.1 To determine if the motorcycle service unit will have an adverse impact on the residential dwellings located to the West of the industrial estate. The noise levels associated with different motorcycles were measured, along with the background noise so a direct comparison could be made between the levels.

2 Calibration:

2.1 The microphones were calibrated before and after the testing procedure and no drift was recorded on either microphone.

3 Site Layout & Microphone Position:

3.1 Palmers Road Industrial Estate is a relatively small industrial estate located to the North of Emsworth. There is a number of industrial units located to the East of Palmers Road, with a large derelict industrial unit located to the North with the residential dwellings located to the West. The immediate area is a mixture of residential dwellings and light industrial units. The industrial units are made up of vehicle MOT stations, workshops and garages with a supermarket located to the South and an antiques warehouse located to the North.

3.2 The unit in question is a traditional light industrial unit, with a corrugated roof and large roller shutter door located on the Western façade, which directly faces the residential dwellings. The road is fairly busy with vehicular traffic using the local roads and visiting the industrial estate, although it is anticipated that the industrial estate is quiet at night time as the industrial units are not in operation during these times.

3.3 The nearest noise sensitive facades are located to the West of the unit, at a distance of approximately 12metres from the doors. All measurements were taken at the façade of the dwellings, although the microphones were in excess of 3.5metres from the façade. The microphone was in excess of 1.5metres from the ground.

3.4 The dwellings are in direct line of sight from the unit thus the roller shutter doors directly face the front of the residential dwellings. There is no screening between the unit and residential dwellings.

3.5 The microphones were placed on the Western side of Palmers road, approximately 3.5metres from the residential façade and in excess of 1.5metres from ground level.

4 Weather Conditions:

4.1 The weather was dry for the duration of testing, approximately 12degrees Celsius, there was no wind or rain during the measurement procedure.

5 Hours of Operation:

5.1 The hours of operation of the motorcycle unit is:

- 0830-1800 Monday to Friday
- 0900-1300 on Saturday
- Closed on Sunday



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AIRTIGHT & NOISECHECK LIMITED ACOUSTICS TESTING**6 Results: Background Noise Levels**

Measurement Location	LAeq Value 1hr	LA90 Value 1hr
Residential Facade	57dB(A)	51dB(A)

(Results obtained using the environmental sound level meter and where needed taking a logarithmic average of different values)

6.1 The $L_{A90\ 1\text{hour}}$ values listed above are the target values for the residential dwellings in the various locations. The rating tables are listed below for each location.

6.2 The table listed below shows the applied corrections for varying acoustic features, these apply to the receptor location and not the source location.

Activity	Measured Sound Pressure Level	Correction for intermittency	Correction for Tonality	Correction for impulsiveness	Correction for reduced time in operation	Specific Level
4 stroke v twin with modified exhaust – doors closed	70dB(A)	+3	+2	+6	-8	73dBA
4 stroke v twin with modified exhaust – doors open	74dBA	+3	+2	+6	-8	77dBA
2 Stroke – doors closed	60dBA	+3	+2	+6	-8	63dBA but 60dB due to residual equation
2 stroke – doors open	69dBA	+3	+2	+6	-8	72dBA

6.3 Due to the nature of the noise, the frequency values and the intermittent use of their motorbike engines the above acoustic feature corrections would appear fair.

The mitigation measures that will be applied by the customer will be shown later in the report after the results tables.

6.5 Results for 4 stroke v twin with modified exhaust bikes – doors closed:

Results		Commentary
Ambient Sound Level	70dBA	Calculated from measured level
Residual Sound Level	57dBA	Measured at receptor
Specific Sound Level	70dBA	
Acoustic Feature Correction	+11dB -8dB	Intermittent, tonality & impulsiveness Only in use for 10mins in any one hour
Reductions due to facade & distance	0dB	Measured at facade – distance mitigation measures to be implemented
Rating Level	73dBA	
Background Sound level	51dBA	
Excess of rating over background	(73-51) = +22dB	
Assessment indicates no impact at receptor		The noise produced will have an adverse impact on the dwellings. Mitigation measures required



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AIRTIGHT & NOISECHECK LIMITED ACOUSTICS TESTING**6.6 Results for 4 stroke v twin with modified exhaust– doors open:**

Results		Commentary
Ambient Sound Level	74dBA	Calculated from measured level
Residual Sound Level	57dBA	Measured at receptor
Specific Sound Level	74dBA	
Acoustic Feature Correction	+11dB -8dB	Intermittent, tonality & impulsiveness Only in use for 10mins in any one hour
Reductions due to facade & distance	0dB	Measured at facade – distance mitigation measures to be implemented
Rating Level	77dBA	
Background Sound level	51dBA	
Excess of rating over background	(77-51) = +26dB	
Assessment indicates no impact at receptor		The noise produced will have an adverse impact on the dwellings. Mitigation measures required

6.7 Results for 2 stroke – doors closed:

Results		Commentary
Ambient Sound Level	60dBA	Calculated from measured level
Residual Sound Level	57dBA	Measured at receptor
Specific Sound Level	57dBA	
Acoustic Feature Correction	+11dB -8dB	Intermittent, tonality & impulsiveness Only in use for 10mins in any one hour
Reductions due to facade & distance	0dB	Measured at facade – distance mitigation measures to be implemented
Rating Level	60dBA	
Background Sound level	51dBA	
Excess of rating over background	(60-51) = +9dB	
Assessment indicates no impact at receptor		The noise produced will have an adverse impact on the dwellings. Mitigation measures required

6.8 Results for 2 stroke – doors open:

Results		Commentary
Ambient Sound Level	69dBA	Calculated from measured level
Residual Sound Level	57dBA	Measured at receptor
Specific Sound Level	69dBA	
Acoustic Feature Correction	+11dB -8dB	Intermittent, tonality & impulsiveness Only in use for 10mins in any one hour
Reductions due to facade & distance	0dB	Measured at facade – distance mitigation measures to be implemented
Rating Level	72dBA	
Background Sound level	51dBA	
Excess of rating over background	(72-51) = +21dB	
Assessment indicates no impact at receptor		The noise produced will have an adverse impact on the dwellings. Mitigation measures required

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AIRTIGHT & NOISECHECK LIMITED ACOUSTICS TESTING**7 Rating Sound Levels:**

7.1 The table below shows the overall rating levels for the motorbike noise in relation to the background noise levels.

Noise Source	Rating Level	Background Noise Level	Difference	Assessment Indicates
4 stroke v twin with modified exhaust – doors closed	73dBA	51dBA	+22dB	Adverse Impact
4 stroke v twin with modified exhaust– doors open	77dBA	51dBA	+26dB	Adverse Impact
2 stroke – doors closed	60dBA	51dBA	+9dB	Adverse Impact
2 stroke – doors open	72dBA	51dBA	+21dB	Adverse Impact

7.2 The above table clearly indicates that the current acoustic environment associated with the motorcycles would have an adverse impact on the residential dwellings. The noise is intermittent, tonal and impulsive so the necessary acoustic feature corrections have been applied. The calculation has also been applied to the levels based on the noise only being in operation for 10minutes in any one hour. This duration has been confirmed as the worst-case scenario by the client, the equation below shows how the -8dB correction was sought

- 10log (duration of event/duration of reference period) in seconds.

8 Conclusion:

8.1 With no mitigation measures being implemented it is apparent that the potential noise from the motorbikes will have an adverse impact on the residential dwellings located to the West. It would however appear that the acoustic feature corrections applied to the values seem excessive based on the actual measured levels being lower than the predicted ones, however these corrections need to be added to the overall noise levels to determine the impact.

8.2 There are many other light industrial units in the vicinity of the industrial estate, which also produce higher than background noise levels but this report is only concerned with the noise emissions produced from the motorcycle unit. JCB will have to carry out some mitigation measures in order to reduce the noise break out for the residential dwellings. A list of recommended measures is listed below with the approximate sound reduction expected.

9 Recommended Mitigation Measures:

1. Perform all works to motorcycles at rear of unit, this is an extra 10meters from the dwellings and as a result will reduce the noise by a further 4dB.

$$L_2 = L_1 - 20 \log (r_2/r_1)$$

Where L2 is level at façade

L1 = Noise produced by bike

r2 – final distance to dwellings (26m approx)

r1 – distance from source (16m approx)



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2. Install an acoustic enclosure/room at the rear of the unit that can house motorcycles and all noisy works to be performed within this room. It can be located in the South East corner of the unit, with a set of double doors installed to the Southern façade so they do not directly face the front of the unit. The walls of the enclosure should comprise of something similar to:

- 2 x 15mm acoustic plasterboard
- 50mm Metal/timber stud
- acoustic mineral wool slab insulation between studs
- Cavity
- 50mm Metal/Timber Studs
- Acoustic mineral wool slab insulation between studs
- 2 x 15mm acoustic plasterboard

The room could be adequately ventilated through the rear facade using an acoustic vent cover to reduce noise break out through the vent. An acoustic ceiling could also be installed, comprising of:

- MF suspended ceiling within the room
- Acoustic mineral wool slab insulation laid on top
- 2 x 15mm acoustic plasterboard fixed to underside of ceiling

The high density double doors (fire rated) could be installed to the Southern partition to ensure the room can remain closed for the duration of works.

10 Possible Further works/Alternative approach:

10.1 The client has also stated that the roller shutter doors could be enclosed to reduce the noise breaking out through these, if these works are performed then they could be done in conjunction with a lobby area created at the front of the unit, and separated from the rest of the unit using the same partition make up as listed above.

10.2 This lobby area could be implemented with a suspended ceiling running from above the shutters to the partition, whereby enclosing the shutters from the outside area

It is also recommended that all noisy works are performed with the timber doors closed, however it is expected that if the enclosure is built the works could be in operation whilst the doors are open – however this may not be the case in reality. The tables below relate to the 4 measurements taken.

Table 1 = 4 stroke v twin with modified exhaust– doors closed

Table 2 = 4 stroke v twin with modified exhaust– doors open

Table 3 = 2 stroke – doors closed

Table 4 = 2 stroke – doors open



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Table 1

Works	Description	Sound Reduction Offered	Total Reduction	Overall Level
Relocate works	Relocated works to rear of building. An increase of 10m	-4dB		
Acoustic Enclosure	Erect an acoustic enclosure at the rear of the unit to house all noisy activity. Use the specifications listed on previous page	45-49dB (BS8233: 2014 but if -30dB is assumed because of the doors but in reality it will be higher than this		
			-34dB	39dBA

Table 2

Works	Description	Sound Reduction Offered	Total Reduction	Overall Level
Relocate works	Relocated works to rear of building. An increase of 10m	-4dB		
Acoustic Enclosure	Erect an acoustic enclosure at the rear of the unit to house all noisy activity. Use the specifications listed on previous page	45-49dB (BS8233: 2014 but if -30dB is assumed because of the doors but in reality it will be higher than this		
			-34dB	43dBA

Table 3

Works	Description	Sound Reduction Offered	Total Reduction	Overall Level
Relocate works	Relocated works to rear of building. An increase of 10m	-4dB		
Acoustic Enclosure	Erect an acoustic enclosure at the rear of the unit to house all noisy activity. Use the specifications listed on previous page	45-49dB (BS8233: 2014 but if -30dB is assumed because of the doors but in reality it will be higher than this		
			-34dB	26dBA

Table 1

Works	Description	Sound Reduction Offered	Total Reduction	Overall Level
Relocate works	Relocated works to rear of building. An increase of 10m	-4dB		
Acoustic Enclosure	Erect an acoustic enclosure at the rear of the unit to house all noisy activity. Use the specifications listed on previous page	45-49dB (BS8233: 2014 but if -30dB is assumed because of the doors but in reality it will be higher than this		
			-34dB	38dBA

Calculated Rating Levels after Mitigation Measures

Noise Source	Rating Level	Background Noise Level	Difference	Assessment Indicates
4 stroke v twin with modified exhaust– doors closed	39dBA	51dBA	-12dB	No Impact
4 stroke v twin with modified exhaust– doors open	43dBA	51dBA	-8dB	No Impact
2 stroke – doors closed	26dBA	51dBA	-25dB	No Impact
2 stroke – doors open	38dBA	51dBA	-13dB	No Impact



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11 Google Earth:



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12 Appendix:

Continuous equivalent noise level, LAeq — The steady noise level (usually in dBA) which, over the period of time under consideration, contains the same amount of sound energy as the time varying noise.

L_{Amax} - The maximum value that the A-weighted sound pressure level reaches during a measurement period.

dB (A) — The A-weighted sound pressure level.

Decibel (dB) — A unit used for many acoustic qualities to indicate the level of sound with respect to a reference level.

A-weighting — A frequency weighting that relates to the response of the human ear.

Background noise level — Prevailing noise level in a specified environment measured in the absence of the noise being studied.

Habitable Room – A room used for sleeping or recreation/relaxation

D_{nc,w} Weighted element normalised level difference – A single-number quantity which characterises the airborne sound insulation of a small building elements.

R_w Weighted sound reduction index – A single-number quantity which characterises the airborne sound insulation of a material or building element measured in the laboratory.

LA₁₀ – The A-weighted noise level exceeded for 10% of the measurement duration.

LA₉₀ - The A-weighted noise level exceeded for 90% of the measurement duration.

British Standards & associated documents:

- **BS4142: Rating industrial noise affecting mixed residential and industrial areas - 2014**

- **Code of Practice: BS8233: 2014 - Sound Insulation and noise reduction for buildings.**

Table E.1B – Field Airborne sound insulation of walls & partitions specifies that the following partition should achieve a sound reduction of 45-49dB

Metal stud partition of overall nominal width of 200 mm. Two frames of 48 mm metal “C” studs at 600 mm centres, cross-braced at 1200 mm centres. Cavity width of 140 mm. 50 mm mineral wool insulation positioned between the frames. Double layer of 15 mm plasterboard each side (minimum plasterboard density 25 kg/m² each side).

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