Acoustic Consultancy Report

59551/3/1/6
Acoustic Assessment 1

Report Prepared For

C.J. Design Ltd
11-14 Windmill Street
08 November 2012

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i) Executive Summary

New mechanical plant is to be installed at 11-14 Windmill Street, in London.

LCP has been commissioned by C J Design Ltd to carry out a background noise survey and to use the obtained data to assess the noise impact of the plant installation on surrounding noise sensitive receptors.

The design criterion is as follows:

44 dB $L_{Aeq, T}$ at 3m.

The design as proposed and assessed will achieve the required criteria provided the limiting levels detailed in section 4 of this report are implemented; the emissions have been calculated as follows:

44 dB $L_{Aeq, T}$ at 3m.

This report concludes that the design criteria can be achieved.

ii) Document History

Issue	Date	Issue Details	Issued By
1	8th November 2012	Initial Issue	MB

1 Introduction

New mechanical plant is to be installed at 11-14 Windmill Street, in London.

LCP has been commissioned by C J Design Ltd to carry out a background noise survey and to use the obtained data to assess the noise impact of the plant installation on surrounding noise sensitive receptors.

The report details recommendations for necessary noise mitigation where necessary.

The guidance contained in this report is given on the basis that the operational period of the plant may potentially be continuous between 07:00 and 20:00.

2 Survey

2.1 Site Description

The site layout together with the measurement position is shown in the drawing contained within Appendix A.

Photographs are shown in Appendix B.

2.2 Receiver Location

The site was surveyed to determine the location of the most affected receiver.

The nearest receiver with direct line of site to the plant area is 3m to the South of the site. This is shown in both the site plan in Appendix A and the photograph ‘looking south’ in Appendix B.

2.3 Local Noise Climate

The predominant local noise sources were plant on surrounding buildings and local traffic.

2.4 Measurements

The noise monitoring took place from the 22nd to the 23rd October 2012. The measurement period was considered sufficient to establish the lowest background noise levels corresponding to the operational period of the plant.

The weather conditions during the survey were predominantly calm and dry.

2.5 Measurement Results

The measured statistical broad-band sound pressure levels are shown within Appendix C. The lowest representative background noise level(s) obtained being as follows:

Table 1: Lowest measured background noise levels, dB re $2x10^{-5}$ Pa

Measurement Position	**$L_{A90,\ 10\ mins}$ Day***
MP1	49

* For the purpose of this assessment the Day period is defined as between 07:00 - 20.00.

3 Evaluation of Design Criteria

3.1 Residential Design Criterion

3.1.1 Local Authority Requirements

The Local Authority Conditions state that the noise level from any fixed mechanical plant/activity shall not exceed 5 dB below the lowest measured background noise level.

Where mechanical plant is tonal or intermittent, the design criterion must be reduced by a further 5 dB.

3.1.2 Design Rating Level

On the basis of the above the design rating level shall therefore be:

Design Rating Level
Existing lowest $L_{A90,\ 10\ mins}$ - 5 dB

3.2 Commercial Design Criterion (BS8233:1999)

Design criteria for non-residential buildings have been derived from BS8233:1999.

For typical office environments, the rating level is $L_{Aeq,\ T}$ 55 dB at 1m from the façade of the receiver premises.

Design Rating level
$L_{Aeq,\ T}$ 55 dB

3.3 Design Rating Levels

The design levels to be adopted for this project are set out in the table below.

Table 2: Design rating levels, dB re $2x10^{-5}$ Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq,\ 13\ hr}$
Residential at rear of 28 Percy Street	3	44

4 Review of Current Design

4.1 Current Design

The proposed plant shall be located on the second floor roof. Plant includes 1 AHU, 10 Daikin condensers and 5 future tenant condensers. The proposed layout can be seen in Appendix D.

The 10 Daikin condensers will incorporate attenuation to reduce the noise levels from each unit to the levels shown in the table below.

The following limiting levels will be applied to ensure the design criterion is achieved:

Table 3: Limiting Levels

Plant	Type	Octave Band Centre Frequency (Hz)								L_A
		63	125	250	500	1k	2k	4k	8k	
Daikin condensers (10 off)	Lp at 1m	61	58	57	54	52	48	40	37	57
Future Tenant condensers (5 off)	Lp at 1m	57	54	53	50	48	44	36	33	53
AHU intake	Lw	75	62	59	61	65	71	67	65	75
AHU exhaust	Lw	75	62	59	61	65	71	67	65	75

Typically the office will operate between the hours of 7am to 8pm.

The plant area will incorporate an acoustic louvre as shown in Appendix F. Performance of louvre is shown in the table below. The louvre will surround the plant on the east and west elevations as well as the south elevation and will extend above the highest piece of plant by at least 500mm.

Table 4: Louvre performance, dB

	Octave Band Centre Frequency (Hz)								R_w
	63	125	250	500	1k	2k	4k	8k	
Gilberts Series 30	6	6	9	14	21	29	27	27	19

4.2 Calculated Results

Calculations of the predicted noise levels have been carried out with the appropriate corrections for geometric attenuation, barrier effect, reflective surfaces, multiple source addition and mitigation.

The design rating levels to be adopted for this project, together with the predicted noise levels, are set out in the table below.

Table 5: Predicted and design noise levels, dB re 2x10^{-5} Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq, 13 hr}$	Predicted Level $L_{Aeq,T}$
Residential at rear of 28 Percy Street	3	44	44

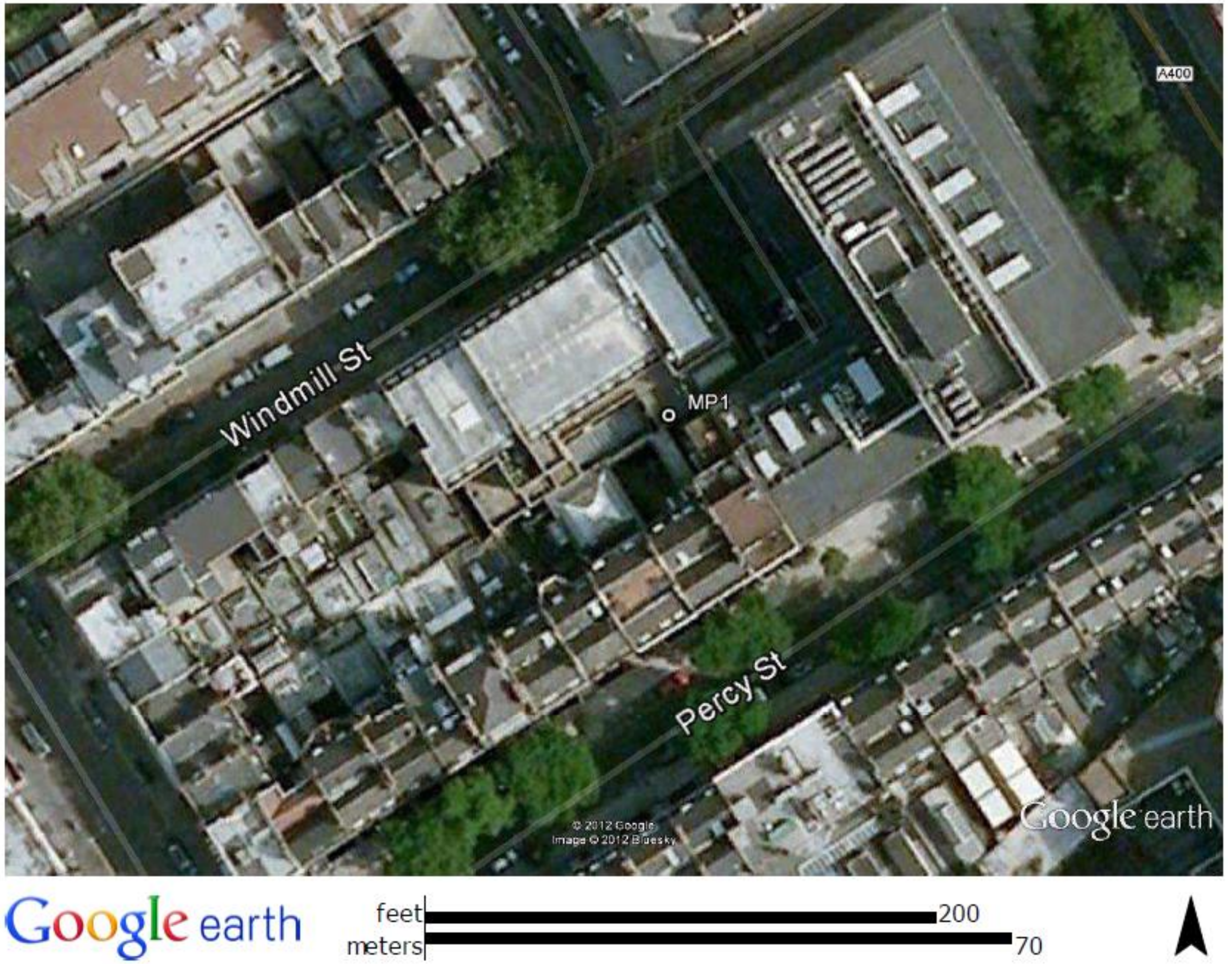
Plant noise level data used in this assessment are contained within Appendix E.

5 Conclusion

An environmental noise survey has been undertaken in order to establish the existing background noise levels local to the site generally in accordance with the method contained within BS4142: 1997.

Calculations have been carried out to determine the noise levels at the nearest receiver premises. The calculations show that with the implementation of the acoustic louvre enclosure screen and the noise mitigation measures to the proposed plant detailed in section 4 of this report the design criteria of 44 dB $L_{Aeq, 13 hr}$ will be met.

Appendix A: Site Plan



Approximate measurement position (Latitude & Longitude) 51.518648,-0.133577.

Appendix B: Photographs

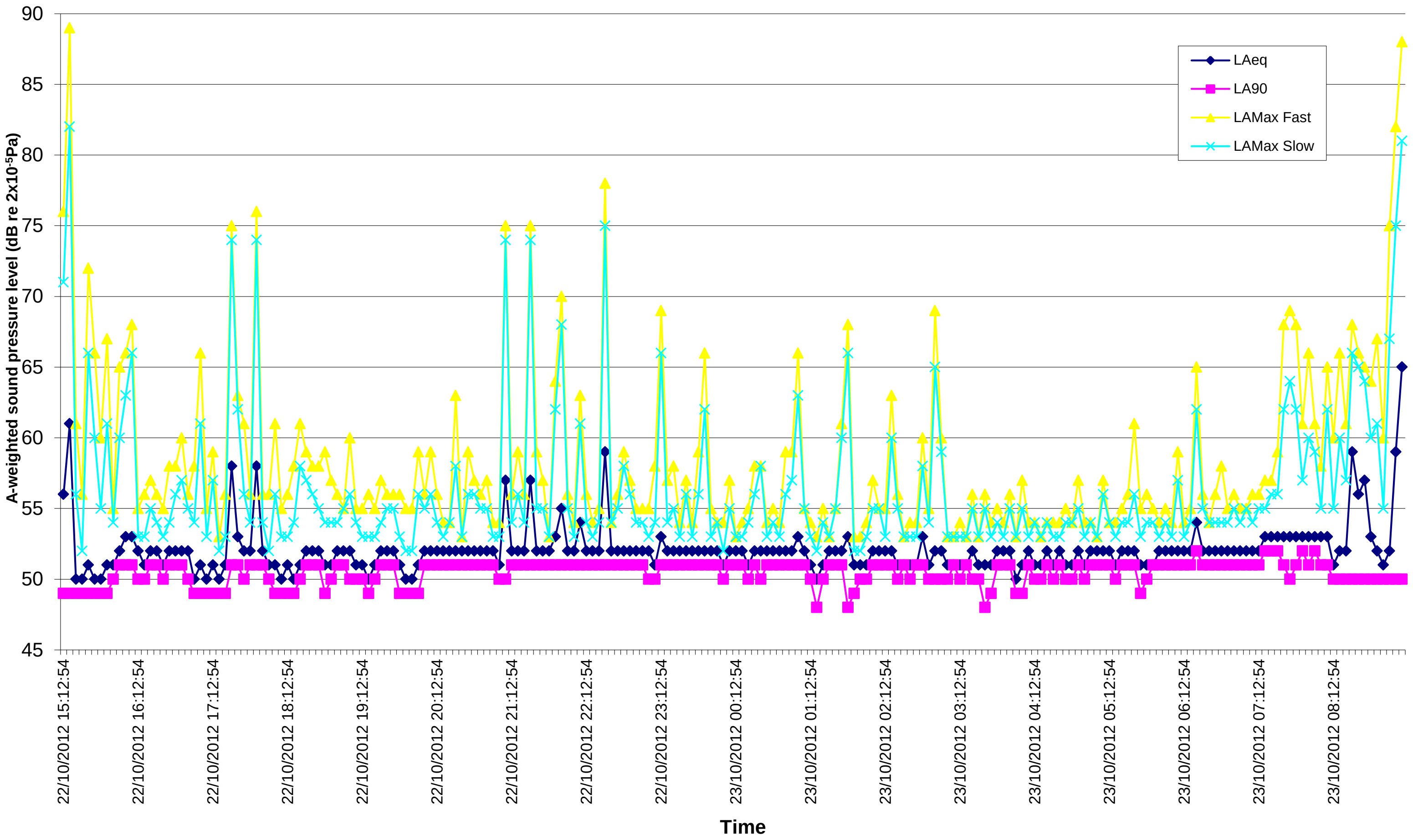
Looking North

Looking East

Looking South

Looking West

Appendix C: Measurement Data

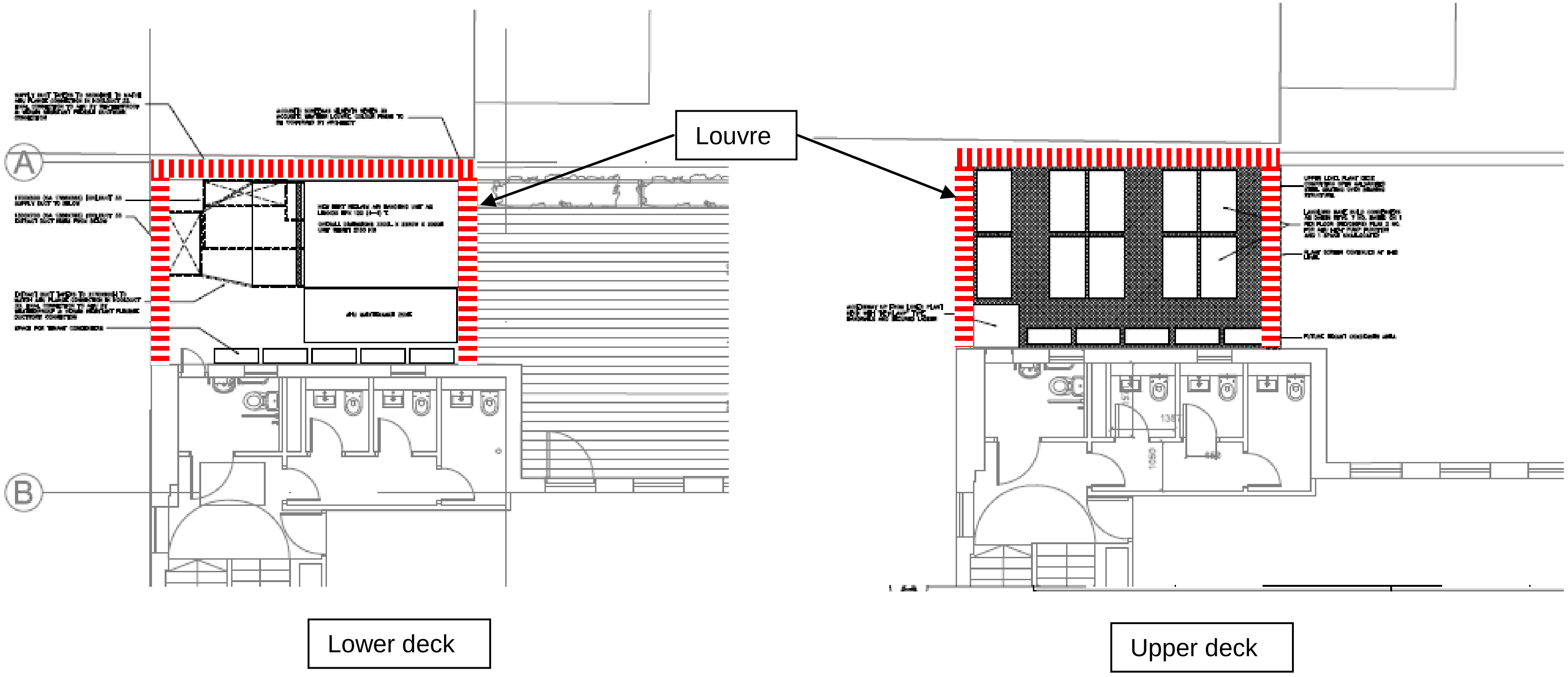


Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003

- Svantek 959 Sound Level Meter S/N: 11258
- Svantek pre-amplifier SV12L S/N: 13111 with GRAS microphone capsule 40AE S/N: 96548

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10890 complying with Class 1 specification of BS EN 60942:2003, calibration level 94.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

Appendix D: Proposed Plant Layout



Appendix E: Plant Data

Plant noise data used in the preceding assessment follow.

Table 6: Plant sound power data, dB re 10^{-12} W

Plant	Octave Band Centre Frequency (Hz)								L_{WA}
	63	125	250	500	1k	2k	4k	8k	
AHU intake*	75	62	59	61	65	71	67	65	75
AHU exhaust*	75	62	59	61	65	71	67	65	75

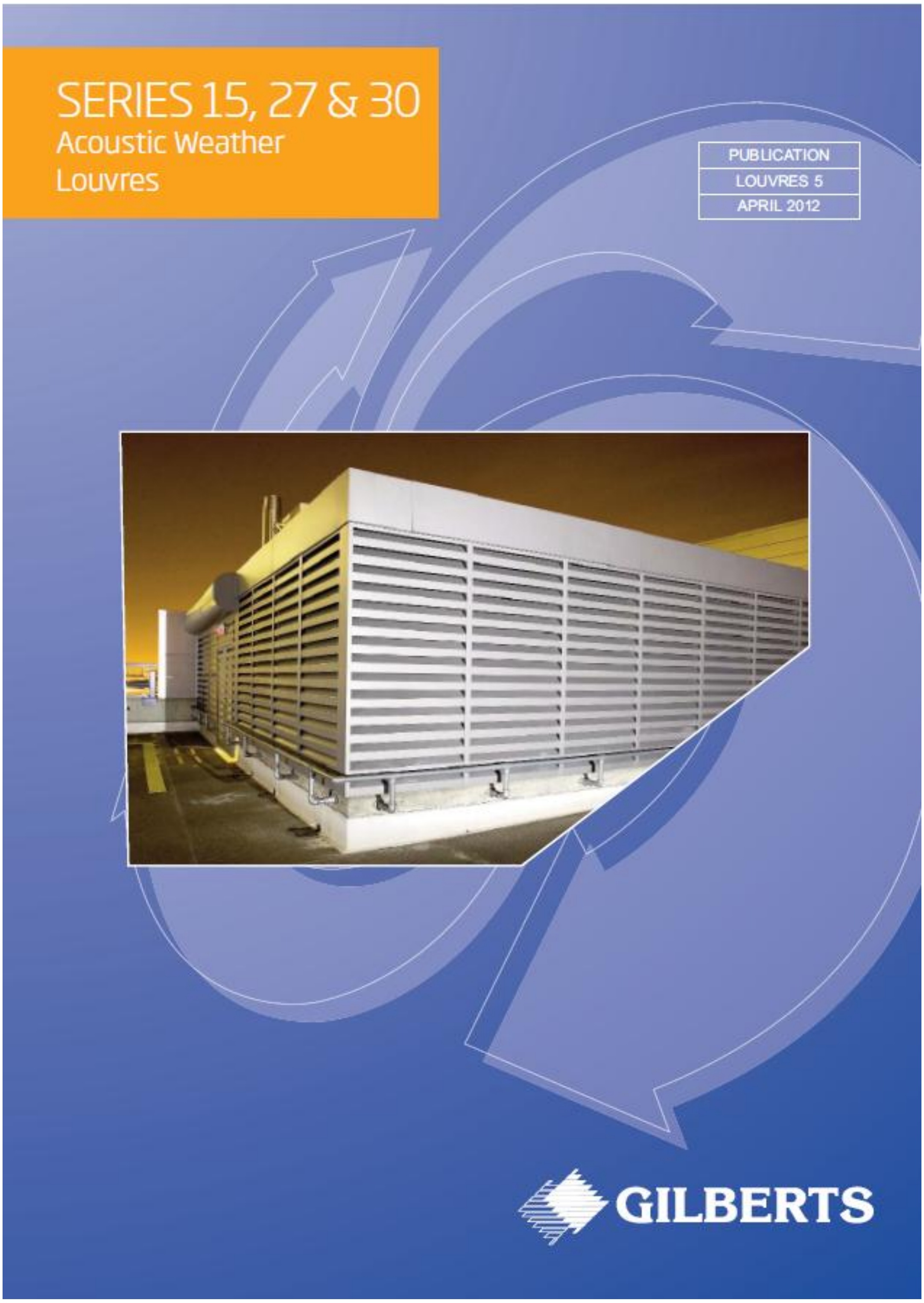
* Limiting levels.

Table 7: Plant sound pressure data, dB re $2x10^{-5}$ Pa

Plant	Distance (m)	Octave Band Centre Frequency (Hz)								L_{PA}
		63	125	250	500	1k	2k	4k	8k	
Proposed Daikin REYQ16P8 (10 off)	1	67	64	63	60	58	54	46	43	63
Attenuated Levels for Daikin condensers* (10 off)	1	61	58	57	54	52	48	40	37	57
Future Tenant condensers* (5 off)	1	57	54	53	50	48	44	36	33	53

* Limiting levels.

Appendix F: Louvre Data



SERIES 15,27 & 30

Accoustic Weather Louvres

Introduction

Gilberts acoustic weather louvre ranges interface directly with the exterior fabric of a building in either steelwork frames and cladding or brickwork.
Primarily utilised where a combination of good weathering protection and accurate noise emission control are required, the louvre can be manufactured to accommodate the various dimensional and aesthetic requirements a project may demand. With size ranges from 300 x 300 to 1500-2000 in single assemblies, larger formats can be accommodated by the use of a modular approach to assist on site handling and installation. The louvre is available with a channel frame housing for side or rear fixing and 50mm flange for front face fixing.

Construction

Standard construction comprises of outer casings of not less than 1.2mm galvanised mild steel with outer faces at the top and bottom support sections not less than 0.7mm. Inner absorptive faces will not be less than 0.7mm galvanised perforated mild steel sheet.
Materials and finishes available include stainless steel, anodised aluminium and aluminium with a polyester powder or synthapulvin paint finish to the BS/RAL colour range. The mineral wool acoustic infill is organic, flame, moisture and vermin proof with a minimum density of 48 Kg/m3. It is packed under compression to prevent voids due to settlement. Bird guards or insect screens can be fitted if required.

Performance Data

	Octave bands								
	63	125	250	500	1k	2k	4k	8k	Hz
Series 15 Transmission Loss	4	4	6	9	12	17	11	10	dB
Series 27 Transmission Loss	6	7	10	13	17	19	13	11	dB
Series 30 Transmission Loss	6	6	9	14	21	29	27	27	dB

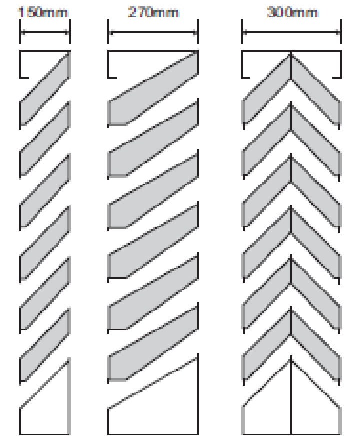
Performance test in accordance with BS 2750:1980

Transmission Loss

This is the acoustic performance (dB) of an acoustic louvre to BS 2750:1980 and is defined as the ratio, in decibels, of acoustic energy transmitted through the louvre sample to that which is incident upon it. Also expressed as Sound Reduction Index SRI.

The aerodynamic performance of single acoustic louvres is as follows:-

Face Velocity (m/s)	Series 15 (N/m^2)(Pa)	Series 27 (N/m^2)(Pa)	Series 30 (N/m^2)(Pa)
1.0	10	10	20
1.5	15	17	27
2.0	20	24	34
2.5	28	35	45
3.0	40	50	56
Weight per m^2(kg)	30	55	60



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Appendix G: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

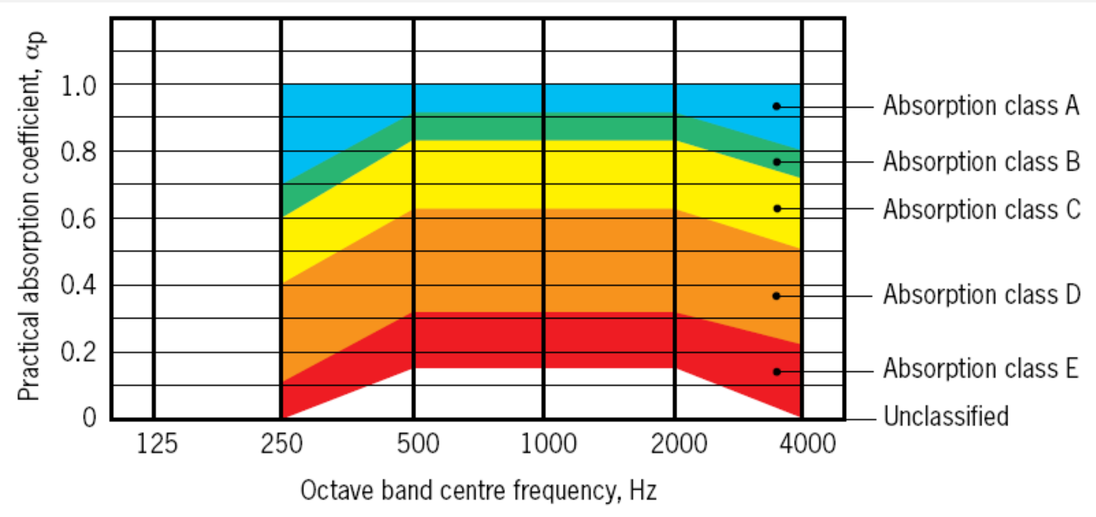
'A' Weighting

Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).

Absorption Class

In order to categorise the absorptive effects of different elements (such as ceiling tiles), classes from A to E were derived, as per BS EN ISO 11654:1997. A class 'A' absorber would be very acoustically absorptive, a Class 'E' absorber would be less absorptive and more reflective. A product that is highly reflective may not be classified.

The chart shown below has been extracted from BB93, and demonstrates the characteristics of each class according to BS EN ISO 11654:1997.



Absorption Coefficient (α)

A value usually between 0 and 1 assigned to a material to indicate how acoustically absorptive it is. 0 indicates a material is entirely reflective (and therefore not absorptive), and 1 indicates a material is entirely absorptive (and therefore not reflective). Absorption coefficients are usually given for each octave band between 125Hz and 4kHz, or as an overall 'practical' coefficient.

Airborne Noise

Noise transmitted through air.

Ambient Noise	
The total noise level including all ‘normally experienced’ noise sources.	
dB or Decibel	
Literally meaning ‘a tenth of a bel’, the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:	
30 dB + 30 dB ≠ 60 dB	30 dB + 30 dB = 33 dB
D_{nTw}+C_{tr}	
The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.	
D	Is simply L1 – L2.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.
C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.
Frequency (Hz)	
Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.	
Impact Noise	
Re-radiated noise as a result of impact(s) on a solid medium, such as footfalls on floors. Measured in L'_{nTw}.	
Insertion Loss, dB	
The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.	

$L_{A90, T}$

The ‘A’ weighted noise level exceeded for 90% of the time period T, described or measured. The ‘90’ can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The ‘A’ weighted ‘equivalent’ noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The ‘A’ weighted maximum measured noise level. Can be measured with a ‘slow’ (1 sec) or ‘fast’ (0.125 sec) time weighting.

L_{Amin}

The ‘A’ weighted minimum measured noise level.

L'_{nTw}

The weighted, normalised impact sound pressure level measured in a receive room below a source room.

L	Is the spatially averaged impact sound pressure level measured in a receive room.
L'_{nT}	Is the normalisation of the measured impact sound pressure level to the expected (in comparison to the measured) reverberation time in the receiving room.
L'_{nTw}	Is the weighted and normalised impact sound pressure level. This value is the result of applying a known octave band weighting curve to the measured result.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf}, RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to $2x10^{-5}$ Pa.

Speech Intelligibility, Speech Transmission Index (STI)

Speech intelligibility is the measure of how well a speaker's voice can be heard within a given space. Speech intelligibility within a room depends on a number of factors, including reverberation time and background noise.

The Speech Transmission Index or STI has emerged as the favoured method of describing speech intelligibility.

Subjective Effect of Changes in Sound Pressure Level

The table below details the subjective effects of variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	Increase in ambient noise level in 'real terms'	Change in apparent loudness
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.