REPORT TITLE: ACOUSTIC REPORT IN SUPPORT OF PLANNING APPLICATION FOR AN AIR CONDITIONING UNIT AT 14C PEMBRIDGE CRESCENT, NOTTING HILL, LONDON W11 3DU

REPORT REF: 14163-002 Revision A (replaces report 14163-002 dated August 2014)

ISSUED TO: Mr Michael Metcalfe
14C Pembridge Crescent
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W11 3DU

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DATE: October 2014
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SUMMARY

- Philip Acoustics has been commissioned to assess noise and vibration associated with a proposed new air conditioning unit to be installed at 14C Pembridge Crescent, Notting Hill, London W11 3DU. The assessment considers Royal Borough of Kensington & Chelsea's planning consent acoustic requirements.

- Royal Borough of Kensington & Chelsea's planning consent acoustic requirements are broadly that noise from equipment shall be attenuated as necessary so to not increase the lowest measured existing background noise level to outside nearest residential properties and that equipment be supported on proprietary vibration isolator mountings.

- As the noise requirement is dependent upon existing background noise levels, then a noise survey has been carried out adjacent to nearest residential properties to establish lowest existing background noise levels during the full range of proposed operational times of the new equipment.

- Based on acoustic calculations using equipment manufacturer’s noise data, the overall noise level due the air conditioning unit (without any noise reduction treatment fitted) is calculated to exceed Royal Borough of Kensington & Chelsea’s noise requirement. Noise attenuation treatment is required to the equipment to reduce noise levels to comply with Royal Borough of Kensington & Chelsea’s noise requirement.

- Philip Acoustics recommends the required noise reduction can be achieved by fitting an acoustic louver enclosure around the air conditioning unit. Full specification details of the recommended noise reduction treatment are provided in Section 6 of the report.

- Location of the new equipment is not structurally linked to any adjacent residential properties and therefore there will be no potential for any structure-borne vibration from the equipment to transfer to adjacent residential properties. Nevertheless, it is anticipated the equipment will be installed using vibration isolators as good practice and to anyhow protect residents within the building itself at 14C Pembridge Crescent.
1. INTRODUCTION

A new air conditioning unit is proposed to be installed at 14C Pembridge Crescent, Notting Hill, London W11 3DU.

It is anticipated that as part of the planning process for the new air conditioning unit, the Local Planning Authority (Royal Borough of Kensington & Chelsea) will require information in the form of an acoustic report regarding noise and vibration from the proposed equipment in order to seek to protect the amenity of residents in the vicinity with regard to possible noise and vibration emissions from the equipment.

Philip Acoustics has therefore been commissioned to provide an acoustic assessment for the equipment. This report presents results of the assessment and includes:

- Confirmation of Royal Borough of Kensington & Chelsea’s planning consent acoustic requirements;
- Measurement of existing background noise levels;
- Calculation of equipment noise level;
- Consideration of vibration from the equipment;
- Review of any noise/vibration control treatments necessary to ensure compliance with the planning consent requirements of Royal Borough of Kensington & Chelsea.

Note this Revision A acoustic report replaces Philip Acoustics’ previous report reference 14163-002 dated August 2014 and is required because the proposed location for the new equipment has changed.

2. ROYAL BOROUGH OF KENSINGTON & CHELSEA ACOUSTIC REQUIREMENTS

Supplementary Planning Document (SPD): Noise Adopted May 2009 supporting the Royal Borough of Kensington & Chelsea Local Development Framework (LDF) covers in detail noise issues relating to a wide range of noise and vibration related planning scenarios including of proposed new mechanical services equipment.

Section 6: Noise Generating Development and Section 7: Vibration includes advice and acoustic related planning requirements specifically for new mechanical services equipment (building services plant).

2.1 Noise

Paragraph 6.1 of Section 6: Noise Generating Development advises that building services plant and equipment will be subject to the imposition of the following condition (shown below), where it is considered appropriate to protect residential amenity:

“Noise emitted by external building services plant and equipment shall not increase the existing concurrent measured lowest $L_{A90(15m)}$ background noise level at any time when the plant is operating. The noise emitted shall be measured or predicted at 1.0m from the façade of the nearest residential window or at 1.2m above any adjacent residential garden, terrace, balcony or patio. The plant and equipment shall be serviced regularly in accordance with manufacturer’s instructions and as necessary to ensure that the requirements of the condition are maintained.”
Paragraph 6.1 also advises that the actual wording of the above condition may change to reflect the specific site circumstances. Notwithstanding this, it is the author’s experience that most sites similar to that at 14C Pembridge Crescent with a proposed new air conditioning unit, and granted planning consent by Royal Borough of Kensington & Chelsea, have the above condition applied without alteration to the wording.

In addition, Paragraph 6.2 of Section 6: Noise Generating Development includes reference to noise assessment procedures and guidance contained within British Standard BS4142:1997 “Method for rating industrial noise affecting mixed residential and industrial areas”.

Paragraph 6.2 advises that when a “…new noise source does not attract the +5dB correction of para 8 of BS4142 the Rating Level shall be 10dBA below the measured background noise level $L_{A90}$, where the new source would attract the +5dB correction the difference shall be -15dBA……”.

The noise assessment procedures and guidance contained within British Standard BS4142 are quite technically complex. However in simple terms by referencing BS4142, Paragraph 6.2 requires that if noise from the equipment does not produce strong tonal elements or have other very noticeable noise characteristics (such as impulses etc.) then noise from the equipment shall be no higher than 10dBA below the background level, whereas if the noise from the equipment is expected to have strong tonal elements or other very noticeable noise characteristics then noise from the equipment shall be no higher than 15dBA below the background level.

It is the author’s experience and professional opinion that the type of relatively small domestic use air conditioning unit as proposed at 14C Pembridge Crescent and subject to this noise assessment (see Section 4), generates a typically broadband type of noise (i.e. without any strong tonal or intermittent characteristics sufficient to attract attention). Therefore in accordance with Paragraph 6.2 it is considered that the proposed new equipment at 14C Pembridge Crescent shall be no higher than 10dBA below the lowest background level in order to comply with the planning consent requirements of Royal Borough of Kensington & Chelsea.

2.2 Vibration

Paragraph 7.8 of Section 7: Vibration advises that building services plant and equipment shall be supported on proprietary anti-vibration mounts and that any permission granted will normally contain a condition necessary to control plant vibration as follows:

“The plant shall be supported on adequate proprietary anti-vibration mounts as necessary to prevent the structural transmission of vibration and regenerated noise within adjacent or adjoining premises and these shall be so maintained thereafter.”
3. **BACKGROUND NOISE SURVEY**

In order to assess noise from the proposed new equipment against Royal Borough of Kensington & Chelsea’s planning consent noise requirement it is necessary to establish lowest background noise levels outside the nearest residential premises. Details of the background noise survey carried out by Philip Acoustics are provided in Sections 3.1 to 3.3.

3.1 **Instrumentation**

Details of the noise survey instrumentation used are provided in Appendix A. The sound level meter was calibrated before and after the survey measurements using the UKAS certified calibrator.

3.2 **Measurement Procedure**

Although the proposed air conditioning unit would likely only tend to operate during the daytime and evening periods, as it will serve a residential property then it will potentially operate at any time over 24 hours. Therefore the survey was carried out over at least a full 24 hour period to obtain background noise levels during the entire range of possible times of operation for the unit.

The noise survey was carried out over a 24 hour period from 29 July 2014 to 30 July 2014; the weather included dry and calm conditions during the survey daytime and night-time periods.

It is noted there is on-going construction activity at the site and associated noise from this could have potentially contaminated part of the daytime noise survey results, however the assessment uses lowest (night-time) background noise levels not affected by any construction works.

The client has proposed to install the new air conditioning unit externally at roof level of the building; unit to be installed behind a C-shape brick enclosure.

Nearest non-associated, noise sensitive (residential) locations to the proposed unit position are:

- **Location 1**: Residential property at 14B Pembridge Crescent approximately 10m from proposed unit position;
- **Location 2**: Residential property at 14 Pembridge Crescent approximately 13m from proposed unit position.

Proposed unit position plus direction to the nearest noise sensitive locations as described above are shown on a marked up drawings in Appendix B.

The background noise measurement location was selected to the rear of the site boundary, directly adjacent to neighbouring residential properties, selected as being representative of both nearest residential locations. The survey was carried out using an extension pole and microphone extension lead arrangement to obtain levels representative of outside windows of the neighbouring properties.
3.3 Measurement Results

Existing background noise levels in the vicinity are relatively low principally due to noise from occasional traffic along Pembridge Crescent.

A graph showing full raw data background noise level measurements over the entire survey period is provided in Appendix C. The lowest measured background noise level and corresponding noise requirement are shown in Table 1.

<table>
<thead>
<tr>
<th>Description</th>
<th>Lowest Background Noise LA90 (15 minutes)</th>
<th>Equipment Noise Limit Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest background level at position representative of outside neighbouring residential windows (occurs at night between about 2am and 3am)</td>
<td>33dB</td>
<td>≤23dBA</td>
</tr>
</tbody>
</table>

Table 1: Lowest measured background noise level and corresponding noise limit requirement

4. NOISE FROM MECHANICAL SERVICES EQUIPMENT

Note that whilst this report is based on the specific proposed make and model of Daikin air conditioning unit as detailed below, if during later design stages or during construction or as part of routine equipment maintenance or equipment replacement, an alternative make and model of equipment is selected then it is important that noise levels for the alternative equipment be checked by Philip Acoustics or another Acoustic Consultant to ensure that noise emissions will remain compliant with Royal Borough of Kensington & Chelsea’s planning consent noise requirement.

The proposed air conditioning unit is a Daikin model 2MXS50H.

A copy of available manufacturer’s noise data for the proposed unit is provided in Appendix D. The proposed air conditioning unit is a relatively small modern domestic type unit with only modest noise output. Summary of noise data for the unit in terms of overall free-field dBA sound pressure level at 1m is shown in Table 2.

The client has advised that during the night-time period the unit will be operating in ‘setback’ mode which (as advised by Daikin) has slightly lower noise output of approximately 2-3dB, however for the purpose of this noise assessment it is cautiously taken that the unit operates in ‘normal’ mode all of the time and therefore is “worse case”.

<table>
<thead>
<tr>
<th>Description</th>
<th>Equipment Overall Free-Field Sound Pressure Level at 1m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daikin air conditioning condenser unit model 2MXS50H</td>
<td>48dBA</td>
</tr>
</tbody>
</table>

Table 2: Equipment noise level (based on manufacturer’s noise data – ‘normal’ mode)

To calculate noise contributions from the air conditioning unit to outside nearest non-associated residential windows a spreadsheet noise model has been used. The model takes account of distance between the unit location and residential windows, acoustic directivity, acoustic reflections and any natural acoustic screening.
The noise model also takes account of noise reduction due to a proposed acoustic enclosure to the Daikin air conditioning unit as specified in Section 6 of the report. Acoustic calculation details are provided in Appendix E.

Summary overall calculated noise levels from the proposed equipment to outside the nearest non-associated windows at both locations: 14B Pembridge Crescent (Location 1) and 14 Pembridge Crescent (Location 2) compared with Royal Borough of Kensington & Chelsea’s planning consent noise requirement (based on 24 hour equipment operation) are shown in Table 3. The acoustic calculations are considered extremely cautious for the following reasons:

- The calculation assumes the unit is operating in ‘normal’ mode all of the time (when operating in night ‘setback’ mode levels will be 2 to 3 dB lower);
- The calculation assumes the unit is operating constantly all of the time. In practice this type of air conditioning unit operates “on demand” and even when providing significant cooling during the middle of a hot day / night tend to operate only 60 to 70% of the time. It is extremely unlikely that the air conditioning unit would operate constantly for a full 60 minute period;
- The noise limit used for the assessment is cautiously based on the lowest measured background noise level over the complete noise survey period which occurs during the very middle of the night. Background noise levels for most of the time are much higher and correspondingly for these times any equipment noise would be significantly lower than noise limits applicable to these times based on the background noise during these times.

<table>
<thead>
<tr>
<th>Description</th>
<th>Noise From Daikin 2MXS52H</th>
<th>Equipment Noise Limit Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 1: Outside windows of adjacent residential property at 14B Pembridge Crescent</td>
<td>≤21.1dBA</td>
<td>≤23dB</td>
</tr>
<tr>
<td>Location 2: Outside windows of adjacent residential property at 14 Pembridge Crescent</td>
<td>≤18.9dBA</td>
<td>≤23dB</td>
</tr>
</tbody>
</table>

Table 3: Equipment noise at nearest residential locations compared with noise limit

Table 3 shows that noise from the proposed unit with the specified noise reduction treatment applied (see Section 6) complies with Royal Borough of Kensington & Chelsea’s planning consent noise requirement. At this level, any noise from the air conditioning unit will be significantly below lowest existing background levels and be subjectively very low such that it would not be expected to give rise to any audible noise or complaint from adjacent residential occupiers.

5. VIBRATION FROM MECHANICAL SERVICES EQUIPMENT

Location of the new equipment is not structurally linked to any adjacent residential properties and therefore there will be no potential for any structure-borne vibration from the equipment to transfer to adjacent residential properties. Nevertheless, it is anticipated the equipment will be installed using vibration isolators as good practice and to anyhow protect residents within the building itself at 14C Pembridge Crescent.
6. SPECIFICATIONS FOR NOISE REDUCTION TREATMENT

Note that Philip Acoustics Ltd can only advise on acoustic issues and therefore it is recommended that professional advice from others may need to be sought to confirm suitability of noise reduction treatment including acoustic louvers etc. with regard to non-acoustic issues such as airflow ventilation to the air conditioning condenser, access for maintenance, structural and any visual requirements (e.g. colour of louvers).

In order to comply with Royal Borough of Kensington & Chelsea’s noise requirement it is recommended that the proposed C-shape brick wall screening around the unit is upgraded incorporating an acoustic louver front panel and solid roof to form a full “acoustic” enclosure.

A concept detail for the recommended acoustic enclosure is indicated on a marked up section drawing and sketch in Appendix F.

Calculation of noise levels with the recommended acoustic enclosure is provided in Appendix E and confirms that with the acoustic treatment applied, noise from the equipment complies with Royal Borough of Kensington & Chelsea’s noise requirement.

It is anticipated that the proposed C-shape brick wall screen is to be at least as high as the air conditioning unit, therefore the louvered front panel should be of the same height. The louver would typically be secured in place by brackets/channels fixed to the proposed screen walls and/or supported by suitably designed frame/support.

The recommended minimum performance requirement for the acoustic louver is shown in Table 4.

<table>
<thead>
<tr>
<th>Description</th>
<th>Octave Band Centre Frequency (Hz)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>125</td>
<td>250</td>
</tr>
<tr>
<td>Acoustic Louver Insertion Loss dB</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 4: Acoustic louver performance specification

The acoustic louver in Table 4 is based on a proprietary 150mm deep type acoustic louver available from Allaway Acoustics. A technical data sheet for the acoustic louver and details of possible acoustic hardware companies who could supply the specified types of acoustic louver are provided in Appendix G.

It is anticipated the acoustic louver forming the enclosure may need to be demountable to enable maintenance access to the condenser unit. This would be achieved typically by using easy release acoustic louvered access panels (as opposed to acoustic louver doors which are much more costly).

Top of the unit acoustic enclosure need not be acoustic louvers; this could be formed by a normal “lean to” pitched timber lid or roof with felt covering or similar, constructed from minimum 18mm ply or similar thickness/density material.
APPENDIX A

Noise Survey Instrumentation
NOISE SURVEY INSTRUMENTATION

- Rion sound level meter type NL-31 Class 1 serial number 00903983 plus Rion microphone type UC-53A serial number 317502 complete with weatherproof and lockable outdoor environmental kit, microphone extension lead and extension boom arrangement;
- Bruel & Kjaer calibrator type 4231 serial number 2642929 (UKAS certified).
APPENDIX B

Drawings Showing Equipment Locations & Direction To Nearest Residential Locations
APPENDIX C

Background Noise Levels
BACKGROUND NOISE SURVEY RESULTS

NOISE SURVEY RESULTS OVER A 24 HOUR MEASUREMENT PERIOD
AT REAR OF 14C PEMBRIDGE CRESCENT, NOTTING HILL, LONDON W11 3DU

29 July 2014
30 July 2014

Date / Time

Signal Pressure Level (Lw) [dB A]

30
40
50
60
70
80

Construction Noise
APPENDIX D

Manufacturers Noise Data For Equipment
## Multi Series Inverters
### MXS-E/F/G/H/K

<table>
<thead>
<tr>
<th>Outdoor Units</th>
<th>(2\text{MXS550H})</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity</strong></td>
<td></td>
</tr>
<tr>
<td>Nominal Cooling</td>
<td>kW 5.00</td>
</tr>
<tr>
<td>Nominal Heating</td>
<td>kW 5.70</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>mm 550</td>
</tr>
<tr>
<td>Width</td>
<td>mm 765</td>
</tr>
<tr>
<td>Depth</td>
<td>mm 285</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
</tr>
<tr>
<td>kg 42</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical Details</strong></td>
<td></td>
</tr>
<tr>
<td>Power Supply</td>
<td>Phase 1ph</td>
</tr>
<tr>
<td>Hz 50</td>
<td></td>
</tr>
<tr>
<td>V 230</td>
<td></td>
</tr>
<tr>
<td>Running Current</td>
<td>amps Refer to Multi Table</td>
</tr>
<tr>
<td>Starting Current</td>
<td>amps 4</td>
</tr>
<tr>
<td>Fuse Rating</td>
<td>amps 16</td>
</tr>
<tr>
<td><strong>Refrigerant Circuit</strong></td>
<td></td>
</tr>
<tr>
<td>Refrigerant Type</td>
<td>R410a</td>
</tr>
<tr>
<td>Refrigerant Charge</td>
<td>kg 1.6</td>
</tr>
<tr>
<td><strong>Sound Pressure</strong></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>dBA 48</td>
</tr>
<tr>
<td>Sound Power</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td></td>
</tr>
<tr>
<td><strong>Piping Limits</strong></td>
<td></td>
</tr>
<tr>
<td>Maximum Length</td>
<td>m 30</td>
</tr>
<tr>
<td>Maximum Vertical Rise</td>
<td>m 15</td>
</tr>
<tr>
<td><strong>Piping Connections</strong></td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td>inches 2x 1/4</td>
</tr>
<tr>
<td>Gas</td>
<td>inches 3/8 1/2</td>
</tr>
<tr>
<td>Number of Connected Indoor Units</td>
<td>2</td>
</tr>
</tbody>
</table>
APPENDIX E

Acoustic Calculations
ACOUSTIC CALCULATION SHEET

ASSESSMENT POSITION: Location 1 - To outside nearest residential windows at 14B Pembridge Crescent.

NOISE CONDITION: 1 x Daikin 2MXS50H Air Conditioning Unit

NOISE MITIGATION: With acoustic enclosure fitted to the proposed unit location (as per Section 6 of report 14163-002 Revision A)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Sound Pressure Level at 1m (Lp dBA)</th>
<th>Attenuation for noise directivity (dB)</th>
<th>Correction for distance to assessment position (m)</th>
<th>Correction for line of sight screening (db)</th>
<th>Correction for acoustic reflections (db)</th>
<th>Individual Contributions dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Daikin 2MXS50H</td>
<td>48</td>
<td>-11</td>
<td>0</td>
<td>-20</td>
<td>-5</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall SPL from sources at assessment position:</td>
<td>21.1 dBA (A)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Note 1: Free-field overall dBA sound pressure level at 1m based on manufacturer noise data.

Note 2: Specified acoustic louvre reduces equipment noise by differing amounts at different frequencies; the equivalent overall dBA noise level reduction for the specified acoustic enclosure is -11dB.

Note 3: Cautiously no directivity benefit allowed for.

Note 4: Distance is from center of sound source (Air Conditioning Unit location) to outside center of nearest residential windows.

Note 5: Distance correction for point source sound radiation within hemispherical flat reflecting plane.

Note 6: Line of sight acoustic screening between unit location and nearest residential windows due to location of the unit plus orientation and elevations of the building, cautiously only allowed maximum -5dB screening loss.

Note 7: Air Conditioning unit is located in non free-field conditions, cautiously allow +9dB correction to account for noise reflections off surrounding vertical surfaces.
ACOUSTIC CALCULATION SHEET

ASSESSMENT POSITION: Location 2 - To outside nearest residential windows at 14 Pembridge Crescent.

NOISE CONDITION: 1 x Daikin 2MXS50H Air Conditioning Unit

NOISE MITIGATION: With acoustic enclosure fitted to the proposed unit location (as per Section 6 of report 14163-002 Revision A)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Sound Pressure Level at 1m</th>
<th>Attenuation</th>
<th>Correction for noise directivity</th>
<th>Distance to assessment position m</th>
<th>Correction for distance to assessment position dB</th>
<th>Correction for line of sight screening dB</th>
<th>Correction for acoustic reflections dB</th>
<th>Individual Contributions dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Daikin 2MXS50H</td>
<td>48</td>
<td>-11</td>
<td>0</td>
<td>13</td>
<td>-22</td>
<td>-5</td>
<td>+9</td>
<td>19</td>
</tr>
</tbody>
</table>

Overall SPL from sources at assessment position: 18.9 dBA

Notes:

Note 1: Free-field overall dBA sound pressure level at 1m based on manufacturer noise data.

Note 2: Specified acoustic louvre reduces equipment noise by differing amounts at different frequencies; the equivalent overall dBA noise level reduction for the specified acoustic enclosure is -11dB.

Note 3: Cautiously no directivity benefit allowed for.

Note 4: Distance is from center of sound source (Air Conditioning Unit location) to outside center of nearest residential windows.

Note 5: Distance correction for point source sound radiation within hemispherical flat reflecting plane.

Note 6: Line of sight acoustic screening between unit location and nearest residential windows due to location of the unit plus orientation and elevations of the building, cautiously only allowed maximum -5dB screening loss.

Note 7: Air Conditioning unit is located in non free-field conditions, cautiously allow +9dB correction to account for noise reflections off surrounding vertical surfaces.
Marked Up Drawing Showing Noise Reduction Treatment Applied To Equipment
APPENDIX G

Supplier Details For Noise Reduction Treatment
DETAILS OF POSSIBLE ACOUSTIC HARDWARE SUPPLIERS

NOISE REDUCTION TREATMENTS

Not listed in any order of recommendation or preference

- Allaway Acoustics: 01992 550825, www.allawayacoustics.co.uk
- AG Fabrications Ltd: 01268 785365, www.agfabrications.co.uk
- Environmental Equipment Corporation Ltd: 01932 230940, www.eecnoisecontrol.co.uk
- EMTEC: 020 8848 3031, www.emtecproducts.co.uk
DATA SHEET L60
ACOUSTIC LOUVRE
MODEL AL1515

DIMENSIONS

WEIGHT

LOUVRE WEIGHTS ARE GIVEN ON THE EQUIPMENT SCHEDULE. APPROXIMATELY:
28kg/M² GALVANISED CONSTRUCTION
20kg/M² ALUMINIUM CONSTRUCTION

ACOUSTIC PERFORMANCE

SOUND REDUCTION INDEX B.S. 2750/3-1980 (ISO 140/3-1978)

<table>
<thead>
<tr>
<th>HZ</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
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</thead>
<tbody>
<tr>
<td>dB</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>

PRESSURE LOSS

NOTES

THIS DATA SHEET IS TO BE READ IN CONJUNCTION WITH THE EQUIPMENT SCHEDULE.

WIDTH (W) AND HEIGHT (H) DIMENSIONS GIVEN ON THE EQUIPMENT SCHEDULE ARE AS MANUFACTURED. ADEQUATE CLEARANCE MUST BE ALLOWED WHEN CONSTRUCTING THE BUILDERSWORK OPENING, A MINIMUM OF 10 mm IS RECOMMENDED.

LOUVRES WILL BE SUPPLIED WITHOUT SUPPORT STEELWORK, CLEATS, BRACKETS, FIXINGS, FLASHING, MASTIC, OR OTHER SUCH ITEMS, UNLESS OTHERWISE STATED.

EXCESSIVELY LARGE OR HEAVY LOUVRES MAY BE MANUFACTURED IN MATING SECTIONS FOR EASE OF HANDLING.

LOUVRES ARE MANUFACTURED TO STANDARD SHEET METAL TOLERANCES OF +/- 3 mm.

STANDARD SIZES

THERE ARE NO STANDARD SIZES. ALL LOUVRES ARE MADE TO ORDER.