



CST Environmental &
Acoustic Consultants

Proposals for Installation of
fixed a/c plant
Acoustic Assessment

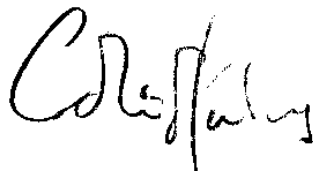
42 & 43 Russell Square
London
WC1B 5BU

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Report Prepared by:.....

Checked by:.....LDS

Date:.....1st August 2018

1.0 Executive Summary

- 1.1 This report has been commissioned by Frankham Consultancy Group Ltd. in support of a forthcoming planning and listed building consent application for the installation of external HVAC plant (6No. external Mitsubishi condensers) to the rear of the subject buildings as part of a renovation and upgrade scheme for existing offices for the Grade II listed buildings at 42 & 43 Russell Square London.
- 1.2 The type and numbers of proposed external plant are listed below. Noise data for the plant have been taken from manufacturers' data sheets, extracts of which are to be found at appendix 3.
- 1.3 Schedule of Proposed External Plant (Total 6 items)

No .42 Russell Square

- 1No. Outdoor Unit – Mitsubishi PURY-EP250YNW-A
- 1No. Outdoor Unit – Mitsubishi PURY-EP200YNW-A
- 1 No. Outdoor Unit– Mitsubishi PUHZ –ZRP50VKA2 (IT Condenser)

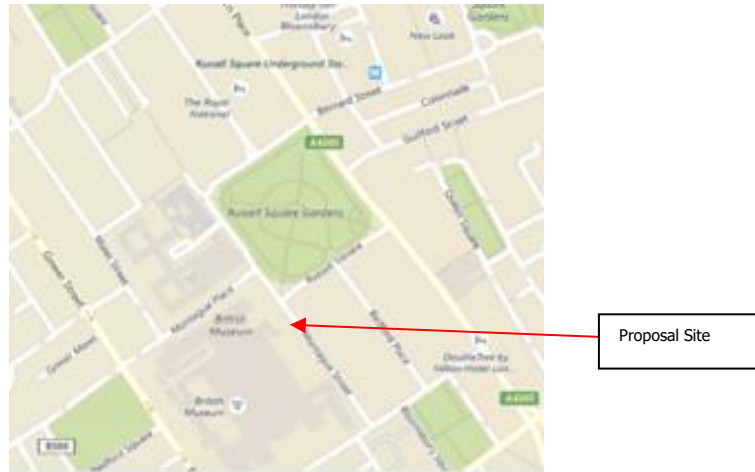
No.43 Russell Square

- 1No. Outdoor Unit – Mitsubishi PURY-EP250YNW-A
- 1No. Outdoor Unit – Mitsubishi PURY-EP200YNM-A
- 1 No. Outdoor Unit– Mitsubishi PUHZ-ZRP50VKA2 (IT Condenser)

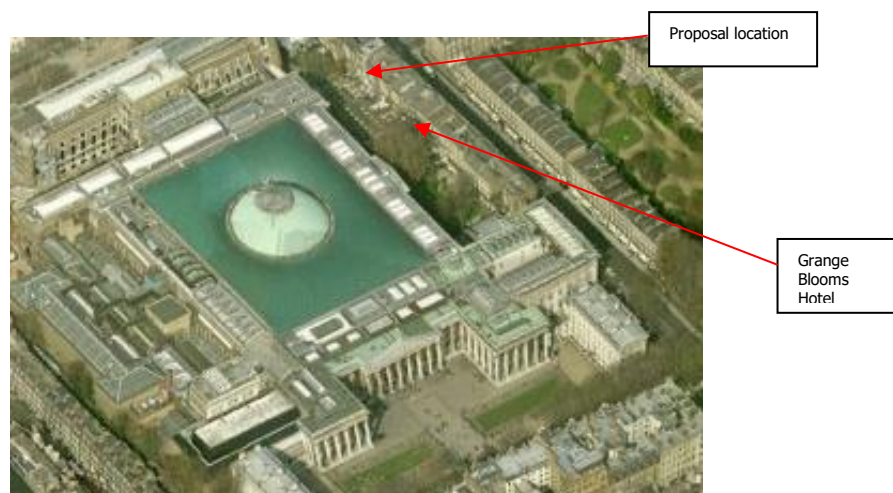
- 1.4 The proposed location of all 3 items of plant is within the rear open space at ground floor level as shown on a plan extract at appendix 2.
- 1.5 An evaluation of the impact of the proposed plant based upon manufacturers published sound data is provided against the latest noise guidance criteria issued by the LB Camden, who are the local planning authority in this case.
- 1.6 The base line local sound environment was established in November 2017 by way of a 24-hour measurement survey and report. The data obtained from our November 2017 survey have been used to inform the proposals and the 2107 survey report forms a companion document to this assessment.
- 1.7 The results of the evaluation show that it is predicted that the proposals will meet the local planning authority's requirements to operate 24/7 without the need for any additional sound mitigation measures such as acoustic enclosures (attenuator boxes). It is however proposed to mitigate the visual impact of the proposed units by way of a 2.2m architectural screen to be constructed around the units. No adverse implications for the local sound environment are expected.

2.0 Description of Site

- 2.1 The proposal site is to be found at approximate grid reference 530076(E): 181823(N). It is further identified by an extract of the location plan below:



- 2.2 The subject (adjoining) properties form part of a substantial terrace of similar properties constructed in the 18th and 19th Century. Although originally built for residential use the subject building along with all of the rest of the terrace is now part of the British Museum office and research department. The nearest potentially sensitive residential receptor was identified as the rear facade of The Grange Blooms Hotel located between 37m to 47m south of the proposal locations.
- 2.3 The aerial photograph below shows the proposal location in relation to its surroundings.

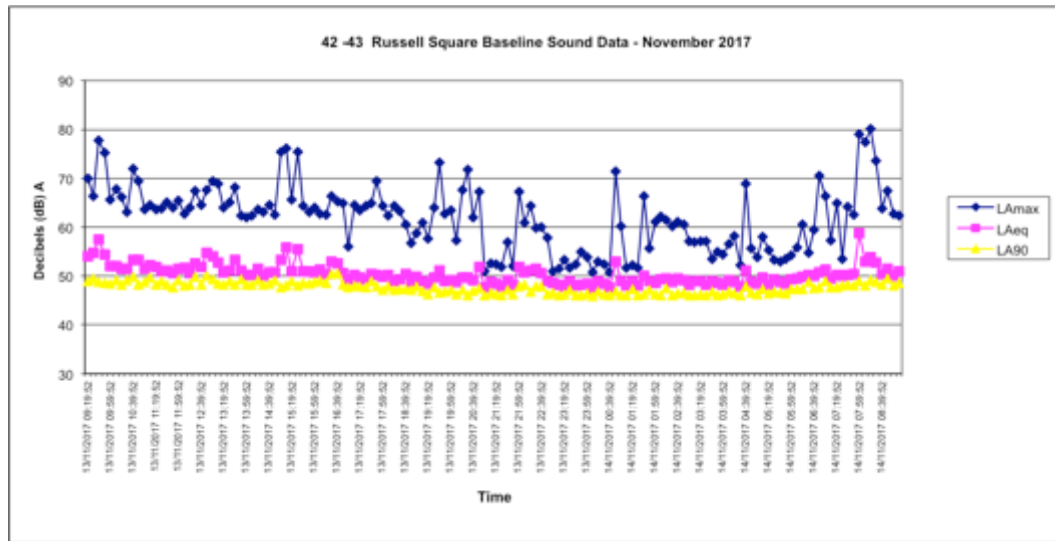


- 2.4 A number of technical terms are referred to in this main report. A glossary of acoustic terms is to be found at appendix 1.

3.0 Local Sound Environment - Base Condition

3.1 Although well shielded from road traffic noise, the sound environment in the rear garden of Nos. 42 & 43 Russell Square are impacted to a material degree by existing HVAC plant located along the rear elevation of the terrace as well as that specifically serving the Hirayama Studio plant located to the south. This plant appears to run 24/7. Reference to the above graph shows there is very little diurnal variation in either the ambient (L_{Aeq}) or background (L_{A90}) noise levels.

3.2 The following graph, compiled from the raw survey data shows the time / sound level history recorded at the survey point.



3.3 For town planning purposes the baseline sound levels can be summarised in table 1 below:

| Time | Measured L_{Aeq} 16/8 hr | Measured L_{A90} 16/8 hr |
|-------------------|----------------------------|----------------------------|
| 07:00 – 23:00 hrs | 55 | 49 |
| 23:00 – 07:00 hrs | 50 | 47 |

Table 1

3.4 The lowest day and night time background noise recorded during the survey over a 10 minute average was 46.0 dB_{LA90} .

4.0 Assessment Framework

4.1 Assessment Framework - National Guidance

4.2 The adoption of a National Planning Policy Framework (NPPF) in May 2012¹ coincided with the withdrawal PPG 24 "Planning and Noise". The PPG formerly provided detailed guidance in relation to what sort of developments were acceptable in areas subject to transportation and commercial noise.

4.3 At the heart of the NPPF there is now a presumption in favour of sustainable development, the planning system now being required to contribute to the achievement of "sustainable development".

4.4 Noise Policy Statement England (NPSE)

4.5 The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010. The vision of the NPSE is to "Promote good health and good quality of life through the effective management of noise within the context of government policy on sustainable development".

4.6 The NPSE aims to "through the effective management and control of environmental, neighbour and neighbourhood noise within the context of government policy on sustainable development".

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.

4.7 The NPSE embraces three key concepts:

(i) No Observed Effect Level (NOEL) - 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 noise.

(ii) Lowest Observed Adverse Effect Level (LOAEL) - This is the level above which adverse effects on health and quality of life can be detected.

(iii) Significant Observed Adverse Effect Level (SOAEL) - This is the level above which significant adverse effects on health and quality of life occur.

4.8 Planning Practice Guidance - Noise

4.9 The Government's Planning Practice Guidance (PPG) provides guidance on the effects of noise exposure, relating these to people's perception of noise, and linking them to the NOEL and, as exposure increases, the LOAEL and SOAEL.

4.10 As exposure increases above the LOAEL, the noise begins to have an adverse effect and consideration should be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. As the noise exposure increases, it will then at some point cross the SOAEL boundary.

¹ The NPPF was updated July 2018

- 4.11 The LOAEL is described in PPG as the level above which "noise starts to cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise potential for sleep disturbance. It is also the level at which noise starts to affect the acoustic character of the area such that there is a perceived change in the quality of life".
- 4.12 The PPG identifies "SOAEL" as the level above which "noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Sleep disturbance, resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life is diminished due to change in acoustic character of the area."
- 4.13 Local Authority – Noise Policy
- 4.14 L.B Camden has published a number of local noise policies which are contained within its Local Plan. The Local Plan contains a number of documents which set out The Council's planning policies. The Council's decisions on planning applications should be taken in line with its development plan unless there are significant matters (material considerations) that indicate otherwise.
- 4.15 Local Plan - Policy A4 Noise & Vibration: sets out The Council's overall policy in relation to planning and noise.
- 4.16 For ease of Reference policy A4 (Noise and Vibration) is reproduced below:

The Council will seek to ensure that noise and vibration is controlled and managed.
Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3).
We will not grant planning permission for:

a. Developments likely to generate unacceptable noise and vibration impacts; or

b. Developments sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation can be provided and will not harm the continued operation of existing uses.

We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity.

We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development

- 4.17 In respect of Commercial Noise Sources, the local plan has specific requirements. These are set out at Appendix 3 of the plan. These are:
- 4.18 A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion.

4.19 The table below² sets out the local planning authority requirements for noise from fixed plant:

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

| Existing Noise sensitive receptor | Assessment Location | Design Period | LOAEL (Green) | LOAEL to SOAEL (Amber) | SOAL (Red) |
|-----------------------------------|---|---------------|--|---|---|
| Dwellings** | Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade) | Day | 'Rating level' 10dB* below background | 'Rating level' between 9dB below and 5dB above background | 'Rating level' greater than 5dB above background |
| Dwellings** | Outside bedroom window (façade) | Night | 'Rating level' 10dB* below background and no events exceeding 57dB _{L_{Amax}} | 'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB _{L_{Amax}} | 'Rating level' greater than 5dB above background and/or events exceeding 88dB _{L_{Amax}} |

*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

Table 2 – LB Camden Local Noise Standards (Fixed Plant)

4.20 By reference to the above local requirements, BS 4142:2014 is considered to be an appropriate reference standard for this project. It will be necessary to demonstrate that:

- The combined effects of all the proposed units (rating level) will not exceed the measured background level by 10dB_{L_{A90}} (no tonal elements present).

4.21 Having established the baseline background noise environment it is possible to calculate the noise impact at specified distances from the proposed installation and compare these levels with the baseline L_{A90}. This process is set out in the following table (Table 3). Standard acoustic prediction techniques and formulae for a point sound source have been used in the calculations.

² Source: appendix 3 Camden Local Plan 2017

5.0 Calculations - BS 4142:2014 Assessment

- 5.1 BS 4142:2014 describes a method for rating and assessing:
- Sound from industrial and manufacturing processes;
 - Sound from fixed installations which comprise mechanical and electrical plant and equipment;
 - Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
 - Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.
- 5.2 If appropriate, the specific sound level of the source ($L_{Aeq,T}$) is corrected, by the application of one or more corrections for acoustic features such as tonal qualities and/or distinct impulses, to give a 'rating' level ($L_{Ar,Tr}$). The Standard effectively compares and rates the difference between the rating level of the specific sound and the typical background sound level ($L_{A90,T}$) in the absence of the specific sound.
- 5.3 The BS advises that the time interval ('T') of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) the source in question operates or is proposed to operate in the future.
- 5.4 Comparing the rating level with the background sound level, BS 4142 states:
- Typically, the greater this difference, the greater the magnitude of impact.
 - A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
 - A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.
 - Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.
- 5.5 This assessment considers the combined effects of all the proposed units operating together full power. In practice during the evening and night periods overall sound emission levels will reduce by software control as shown on the manufacturer's data sheet extracts that form appendix 3.

5.6 Table 3 - Calculation of Noise Impact – Ground & First Floor (rear) receptors Grange (Blooms) Hotel

| Receptor | Design Criteria & Calculations |
|---|---|
| <p>G/F windows Rear of Grange Blooms Hotel</p> | <p><u>Background Sound Levels recorded:</u></p> <p>Night Time Background Levels = 46.0dB_{LA90/10min}</p> <p><u>Proposed Plant – 42 Russell Square</u></p> <p>1 No. Mitsubishi PURY EP250YNW-A - Sound Pressure Level @1m = 61.0dB(A)</p> <p>1 No. Mitsubishi PURY EP200YNW-A - Sound Pressure Level @1m = 59.0 dB(A)</p> <p>1 No. Mitsubishi PUHZ-ZRP50VKA2 - Sound Pressure Level @1m = 43.0 dB(A)</p> <p>Combined Source Sound Pressure Level (Lp) = 61+ 59 + 46= 63dB(A) [full power] @1m</p> <p><u>Proposed Plant – 43 Russell Square</u></p> <p>1 No. Mitsubishi PURY EP250YNW-A - Sound Pressure Level @1m = 61.0dB(A)</p> <p>1 No. Mitsubishi PURY EP200YNW-A - Sound Pressure Level @1m = 59.0 dB(A)</p> <p>1 No. Mitsubishi PUHZ-ZRP50VKA2 - Sound Pressure Level @1m = 46.0 dB(A)</p> <p>Combined Source Sound Pressure Level (Lp) = 61+ 59 + 46= 63dB(A) [full power] @1m</p> <p><u>Mitigation Proposals: NIL (No acoustic attenuators proposed)</u></p> <p><u>For 42 Russell Square</u> - Distance to Receptor = 47 metres. Distance Attenuation – 33dB(A)* Resultant emission level at nearest receptor = 63 -33= 30dB(A)</p> <p><u>For 43 Russell Square</u> - Distance to Receptor = 37 metres. Distance Attenuation – 31dB(A)* Resultant emission level at nearest receptor = 63 -31= 32dB(A)</p> <p><u>Combined Emission level at nearest receptor = 30 + 33dB = 35dB(A)</u></p> <p>BS 4142:2014 Assessment - Night Time</p> <p>Measured Ambient = 50 dB(A)</p> <p>Residual Sound (Measured) = 50 dB(A)</p> <p>Acoustic feature correction = 0dB(A)</p> <p>Rating Level = 35 dBL_{AeqTr}</p> <p>Background Sound Level (LA90 – measured) = 47dB(A)</p> <p>Excess of Rating over Background = minus 12dB</p> <p>Result – The proposals comply with LBC noise thresholds</p> |
| <p>* Attenuation for a point source given by formula $Attn = 20 \cdot \log d1/d$</p> | |

6.0 Conclusions

- 6.1 A baseline assessment of the local sound environment has been carried out (November 2017).
- 6.2 By reference to manufacturers' sound data the combined effects of all the proposed plant are predicted to meet the LPA requirements.
- 6.3 Although the external units will be provided with a visual screen, as per the architect's drawings, no additional noise mitigation measures e.g. acoustic enclosures are considered necessary to meet the L.B. Camden local noise standards.

7.0 Appendix 1 - Glossary of Acoustic Terms

Sound is measured in decibels (dB). To establish a reference framework it is useful to consider two noise levels which are at the extreme ends of the range to be considered. At the low end, 35 to 40 dB (A) is the normal noise level in a quiet living room, 35 dB (A) is the noise level given as a target for suburban bedrooms by the Wilson Report; a government report on noise published in 1963. At the high end is the noise level experienced at the pavement edge of a busy city centre street, a level of 75 to 80 dB (A).

The sensitivity of the human ear varies with pitch or frequency. The designation "A" used in this assessment simply means that the noise level was measured using a meter which is able electronically to respond very closely to the performance of the human ear.

Decibels are measured using a logarithmic scale, and therefore two numerically equal values cannot be added together arithmetically. Two equal noise levels occurring together form a new level which is 3 dB (A) higher than either alone. Thus two identical vehicles each producing 65 dB (A) outside someone's window will produce, not 130 dB (A), but 68 dB (A) if both engines are running together at the same distance from the microphone.

If one sound source is 10 dB (A) below an adjacent louder source, then the combined effect will be virtually no different to the louder one alone.

Experiments have shown that most people will indicate that a sound has become twice as loud, when on a measuring meter it has risen by about 10 dB (A). Also it is generally accepted that a difference in 3 dB (doubling in energy terms) is the smallest incremental step that can be distinguished by the average human ear.

Some additional acoustic terms are also referred to in this report. These are:

LA10: is the noise level just exceeded for 10% of the measurement period, and calculated by statistical analysis.

LA90. This is the sound level exceeded for 90% of a time interval T. LA90 and it is termed background sound or noise level. It is effectively a measure of the minimum noise level which is experienced in the absence of specific noisy events such as brake squeal or engine backfire.

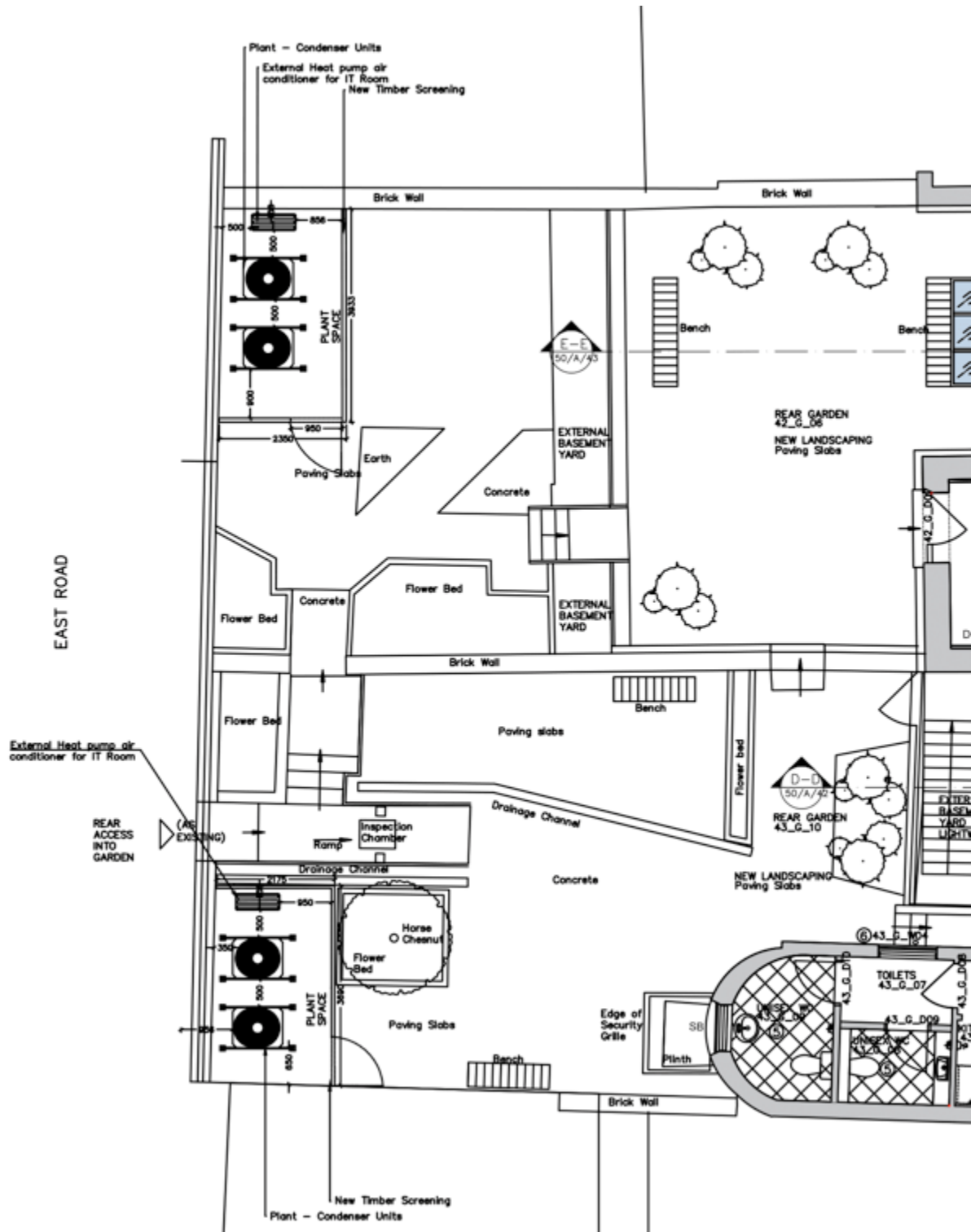
LA_{eq(T)} is the equivalent continuous sound level over a time T, which can be described as the "energy - average" noise level.

LA max is the highest noise level recorded by the measuring meter during a single event e.g. overlying aircraft. In this assessment the meter was set to "fast" response.

Ambient Sound - This is the all encompassing sound at a given location at a within a specified time frame and comprises the sound from all near and distant sources.

Noise - Noise was defined in the Wilson Report on 1964 as "unwanted sound". Noise excluded vibration, except where indicated otherwise.

8.0 Appendix 2 - Design Scheme Extract



9.0 Appendix 3 - Manufacturer's Sound Data

Air Conditioning

Product Information

R2 Series High Efficiency (22.4-45kW)
Simultaneous Heating and Cooling
with Heat Recovery Outdoor Unit

Making a
World of
Difference

CITYMULTI



Throughout the year, many buildings require cooling in some areas and heating in others - even in adjacent rooms. The outstanding City Multi R2 system meets these requirements by distributing surplus heat from cooling operations (and vice versa) to rooms where it is needed. This efficiency can result in energy savings up to 30% over conventional systems.

Key Features

- Highest specification, highest efficiency heat recovery system available
- Delivers the highest levels of comfort, both thermally and acoustically
- Flexible design, installation and maintenance

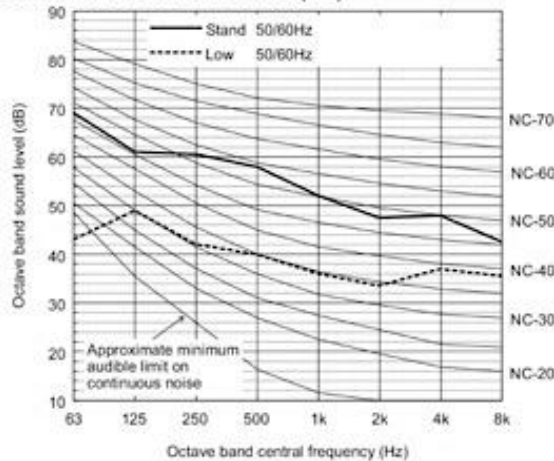


Cooling | Heating | Ventilation | Controls



| OUTDOOR UNITS | | PURY-EP200YNW-A | PURY-EP250YNW-A |
|-------------------------------------|-------------------------------|---------------------|---------------------|
| CAPACITY (kW) | Heating (nominal) | 25.0 | 31.5 |
| | Cooling (nominal) | 22.4 | 28.0 |
| | High Performance Heating (UK) | 25.0 | 31.5 |
| | COP Priority Heating (UK) | 22.8 | 28.7 |
| | Cooling (UK) | 20.0 | 25.1 |
| POWER INPUT (kW) | Heating (nominal) | 4.57 | 5.98 |
| | Cooling (nominal) | 4.23 | 5.62 |
| | High Performance Heating (UK) | 5.76 | 7.53 |
| | COP Priority Heating (UK) | 4.57 | 5.98 |
| | Cooling (UK) | 2.45 | 3.26 |
| COP / EER (nominal) | | 5.47 / 5.29 | 5.26 / 4.98 |
| SCOP / SEER' | | - | - |
| MAX No. OF CONNECTABLE INDOOR UNITS | | 20 | 25 |
| MAX CONNECTABLE CAPACITY | | 50~150% OU Capacity | 50~150% OU Capacity |
| AIRFLOW (m ³ /min) | High | 170 | 185 |
| PIPE SIZE mm (in) | Gas | 19.05 (3/4") | 22.2 (7/8") |
| | Liquid | 15.88 (5/8") | 19.05 (3/4") |
| SOUND PRESSURE LEVEL (dBA) | | 59.0 | 61.0 |
| SOUND POWER LEVEL (dBA) | | 78.0 | 80.0 |

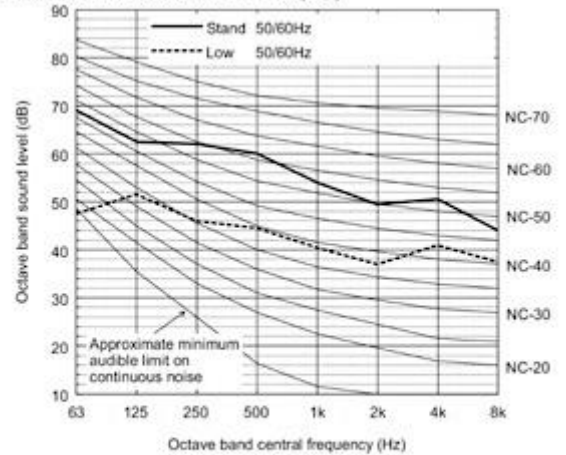
Sound level of PURY-EP200YNW-A(-BS)



| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | dB(A) |
|------------------|---------|------|------|------|------|------|------|------|------|-------|
| Standard Heating | 50/60Hz | 69.0 | 61.0 | 60.5 | 58.0 | 52.0 | 47.5 | 48.0 | 42.5 | 59.0 |
| Low noise mode | 50/60Hz | 43.0 | 49.0 | 42.0 | 40.0 | 36.0 | 33.5 | 37.0 | 35.5 | 44.0 |

When Low noise mode is set, the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

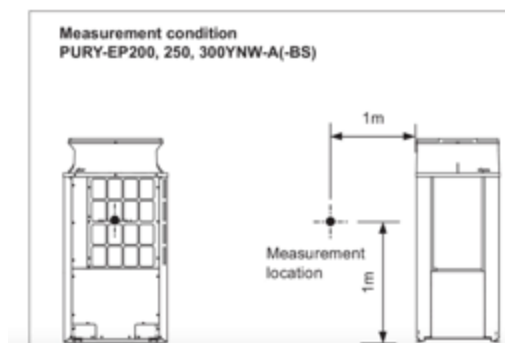
Sound level of PURY-EP250YNW-A(-BS)



| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | dB(A) |
|------------------|---------|------|------|------|------|------|------|------|------|-------|
| Standard Heating | 50/60Hz | 69.0 | 62.5 | 62.0 | 60.0 | 54.0 | 49.5 | 50.5 | 44.0 | 61.0 |
| Low noise mode | 50/60Hz | 47.5 | 51.5 | 46.0 | 44.5 | 40.5 | 37.0 | 41.0 | 37.5 | 48.0 |

When Low noise mode is set, the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

5-1. Sound levels in cooling mode



| Service Ref. | | PUHZ-ZRP35VKA2 PUHZ-ZRP35VKA2-ER PUHZ-ZRP35VKA2-ET | | PUHZ-ZRP50VKA2 PUHZ-ZRP50VKA2-ER PUHZ-ZRP50VKA2-ET | |
|--------------------------------------|--|--|---------|--|---------|
| Mode | | Cooling | Heating | Cooling | Heating |
| Power supply (phase, cycle, voltage) | | Single, 50Hz, 230V | | | |
| Max. current | | 13 | | | |
| External finish | | A | | | |
| Refrigerant control | | Munsell 3Y 7.8/1.1 | | | |
| Compressor | | Linear Expansion Valve Hermetic | | | |
| Model | | SNB092FGCM | | | |
| Motor output | | kW | | | |
| Starter type | | 0.6 | | | |
| Protection devices | | SNB130FGCM2 1.1 Inverter | | | |
| Crankcase heater | | HP switch | | | |
| Heat exchanger | | Comp.shell thermo | | | |
| Fan | | Plate fin coil | | | |
| Fan(drive) x No. | | Propeller fan x 1 | | | |
| Fan motor output | | 0.046 | | | |
| Airflow | | 45 (1,590) | | | |
| Defrost method | | Reverse cycle | | | |
| Sound pressure level | | 44 | | | |
| Cooling | | dB | | | |
| Heating | | 46 | | | |
| Dimensions | | 809 (31-13/16) | | | |
| W | | 300 (11-3/16) | | | |
| D | | 630 (24-13/16) | | | |
| H | | | | | |
| Weight | | 43 (95) | | | |
| Refrigerant | | R410A | | | |
| Charge | | 2.2 (4.8) | | | |
| Oil (Model) | | 0.35 (FV50S) | | | |
| Pipe size O.D. | | 6.35 (1/4) | | | |
| Liquid | | 12.7 (1/2) | | | |
| Gas | | Flared | | | |
| Connection method | | Flared | | | |
| Indoor side | | Maximum 30m | | | |
| Outdoor side | | Maximum 50m | | | |
| Between the indoor & outdoor unit | | Piping length | | | |
| OUTDOOR UNIT | | | | | |
| REFRIGERANT PIPING | | | | | |