# Technical Note

| | | | |
|---|---|---|---|
| **Project:** | Wilton LRD | **Title:** | Internal Noise Assessment |
| **Job Number:** | WDA241126 | **Prepared By:** | Arun Kumar |
| **Date:** | 12/12/2024 | **Reviewed By:** | James Cousins |
| **Reference:** | WDA241126TN_A_01 | **Client:** | LDA |

# 1 Introduction

Wave Dynamics was commissioned by the LDA to carry out internal noise assessment from internal plant concerning for a typical apartment for the proposed Wilton LRD development.

This technical note provides a preliminary building acoustics assessment to evaluate internal noise levels associated with heat pump units based on the current planning stage design and drawing details. Noise levels have been assessed for typical living room and bedroom spaces using manufacturer-provided data for the equipment.

# 2 Project Criteria

This section outlines the typical project criteria for a residential development based on industry standards,

## 2.1 Internal Ambient Noise

Table 1 below outlines the recommended internal noise levels from BS 8233:2014 within living accommodation for residential buildings for dining, resting and sleeping. These limits are in line with the ProPG and the World Health Organisation Guidelines.

*Table 1: BS 8233:2014 internal noise criteria –Residential Buildings.*

| Activity | Location | 07:00 to 23:00 Hrs | 23:00 to 07:00 Hrs |
|---|---|---|---|
| Resting | Living Room | 35 dB $L_{Aeq,\ 16\ hour}$ | - |
| Dining | Dining Room/Area | 35 dB $L_{Aeq,\ 16\ hour}$ | - |
| Sleeping (daytime resting) | Bedroom | 35 dB $L_{Aeq,\ 16\ hour}$ | 30 dB $L_{Aeq,\ 8\ hour}$<br>45dB $L_{AFmax}$ (See Note 1) |

1: Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{AFmax}$ more than 10 times a night.

## 2.2 Building Services Noise

The criteria in Table 2 are recommended for the development for the noise generated by building services. The criteria are stated in NR (Noise Rating) which are single value numbers related to numerical curves across the frequency spectrum related to the sensitivity of the human ear. Sound pressure levels measured in octave bands are compared with these curves from which an NR value is obtained. These have been based on the internal ambient noise levels outlined above. For mechanical ventilation and air conditioning the targeted value refers to the unit operating in its normal operating mode.

*Table 2: Mechanical Service Noise Levels*

| Location | Target Mechanical Services Noise Levels NR |
|---|---|
| Resting (Living Room) | 30 |
| Dining (Dining room/area) | 30 |
| Bedroom | 25 |

# 3 Internal Noise Assessment

A desktop model assessment has been carried out to predict the internal ambient noise level based on the typical apartment layout and proposed equipment noise level details. The assessment has been carried out following the recommendations from 2015 ASHRAE Handbook --HVAC Applications, Chapter 48 and CIBSE Guide B.

The proposed ventilation system for apartments features a MVHR unit with two external louvers for the exhaust and intake air. The proposed heating strategy for the development is a centralised system with external heat pumps. An ambient noise level assessment has been carried out using the noise level data of the proposed units and the typical apartment layout. The following section details the assessment inputs, results, and recommended mitigation measures. The duct layout drawings are not available at this stage of the design and subsequently the duct runs have been assumed based on the typical duct runs associated with similar apartment developments.

## 3.1 Noise Model Inputs

Octave band sound power levels have been provided by EDC Engineers and are summarised in Table 3 below.

*Table 3: Noise level data inputs for the MVHR Units.*

| Model | Reference | Octave Band Sound Power Level (Hz) $L_w$ dB | | | | | | | Sound Power Level $L_w$ dBA |
|---|---|---|---|---|---|---|---|---|---|
| | | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| Vent Axia Kinetic Plus | Supply @ 60% | 68 | 73 | 65 | 53 | 48 | 33 | 28 | 69 |
| Vent Axia Kinetic Plus | Extract @ 60% | 62 | 60 | 51 | 39 | 32 | 23 | 25 | 54 |
| Vent Axia Kinetic Plus | Breakout @ 60% | 53 | 58 | 55 | 50 | 44 | 35 | 32 | 53 |

## 3.2 Assessment Assumptions and Considerations

The assumptions and considerations for the noise level assessment are outlined below,

- Flow velocity as per the CIBSE Guide B recommendations.
- Noise levels resulting from sound transmission paths listed in 2015 ASHRAE Handbook – HVAC Applications chapter 48.
- Assessment based on the provided noise data for the units.
- Typical room dimensions based on architect's drawings.
- Assumed duct and diffuser heights.
- Assessment is for ventilation services noise and does not take into consideration other internal sources of noise or break in noise from external noise sources.
- Extract and supply ducts are unlined.
- It is assumed the MVHR unit will be running at 60% setting during normal operation.
- Assumed duct size of 204mm x 60mm.
- Where a circulation pump is required in the utility room it should be designed to have lower breakout noise levels than the MVHR unit outlined in *Table* 3.

- Assumed duct layout as per Figure 1 below.

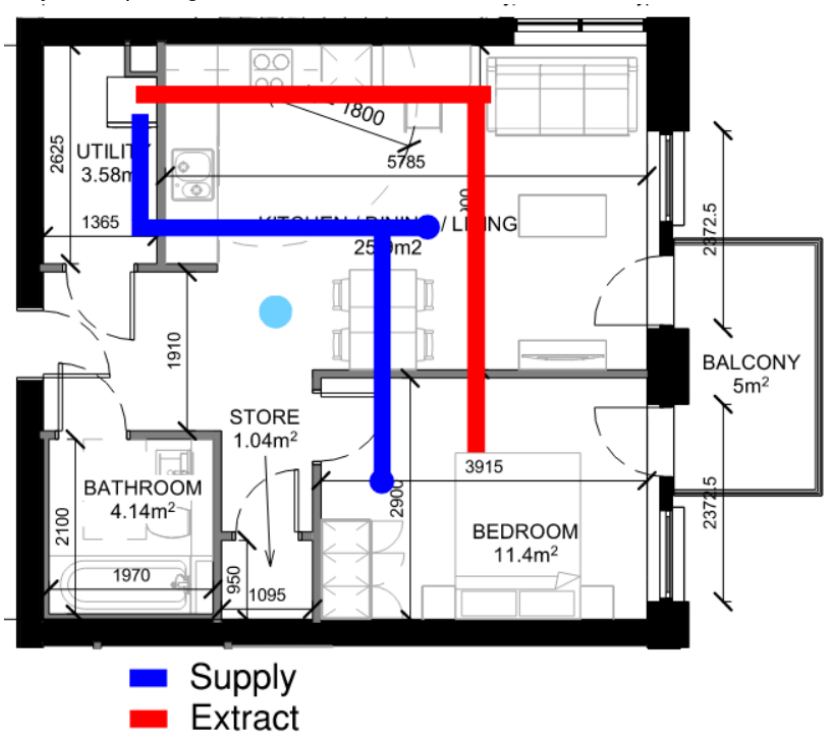


*Figure 1: Assumed duct dimensions.*

## 3.3 Assessment Results

The assessment has been conducted using the provided data and typical apartment layout to evaluate noise levels in the apartment under the worst-case scenario. The assessment indicates that the noise levels at the supply opening exceed the project criteria for both the living room and bedroom. Mitigation measures have been outlined in Section 3.4 to meet the ambient noise level criteria. The radiated noise from the unit was also assessed, taking into account that the units will be located within a closed utility room. It was determined that this noise does not contribute to the internal noise levels of the habitable spaces based on typical internal partition constructions. The assessment is based on the information available at planning stage, the final duct layouts, ventilation units and attenuators should be reviewed by the acoustic consultant during design development stage.

### 3.3.1 Predicted Noise Levels

The predicted ambient noise levels with ventilation units during normal operation at 60% setting are shown in the Table 4 below.

*Table 4: Predicted ambient noise level.*

| Location | Predicted Noise levels | |
|---|---|---|
| | 07:00 to 23:00 Hrs $L_{Aeq,\ 16\ hour}$ dB | 23:00 to 07:00 Hrs $L_{Aeq,\ 8\ hour}$ dB |
| Resting (Living Room) | 45 | 45 |
| Dining (Dining room/area) | 45 | 45 |
| Bedroom | 44 | 44 |

*Note: The predicted noise levels are only for ventilation services noise and does not take into consideration other internal sources of noise or break in noise from external noise sources.*

## 3.4 Recommended Mitigation Measures

Based on the assessment, the following mitigation measures are recommended to ensure the internal ambient noise levels are achieved for the bedroom and living space in a typical apartment:

- Provide an inline attenuator for the supply duct having insertion loss of $D_{n,e,w}$ 23 dB for supply duct and of $D_{n,e,w}$ 18 dB for extract duct or;
    - Select lower noise units, to have a maximum sound power level at the inlet/outlet opening of Lw 50 dBA.
- Units should be placed on anti-vibration mounts and should not be located on a separating walls to habitable spaces.
- The MVHR units should be placed in a closed room (utility) to eliminate breakout noise. The utility room should not open directly to a bedroom.
- The separating wall between utility room and living room/bedroom should be made up of a partition construction to achieve minimum 40dB Rw. It is recommended that the partition includes mineral wool insulation.

### 3.4.1 Silencer Insertion Loss

The table below outlines the insertion loss considered for the silencer/attenuator in the assessment.

*Table 5 Insertion loss for the recommended attenuator/silencer.*

| Model | Octave band Insertion loss (Hz) dB | | | | | | | | $D_{n,e,w}$ dB |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| Vent Axia Wholehouse Attenuators 204x60mm 620mm | 3 | 4 | 7 | 13 | 21 | 38 | 45 | 33 | 18 |
| Vent Axia Wholehouse Attenuators 204x60mm 920mm | 1 | 3 | 12 | 24 | 38 | 49 | 50 | 36 | 23 |

### 3.4.2 Predicted Noise Level with Mitigation

Based on the recommended mitigation measures in place, the predicted noise levels will achieve the recommended internal noise level criteria. Table 6 summarises the predicted noise levels following the implementation of these measures.

*Table 6: Predicted ambient noise level with mitigation.*

| Location | Predicted Noise levels | |
|---|---|---|
| | 07:00 to 23:00 Hrs $L_{Aeq,\ 16\ hour}$ dB | 23:00 to 07:00 Hrs $L_{Aeq,\ 8\ hour}$ dB |
| Resting (Living Room) | 24 | 24 |
| Dining (Dining room/area) | 24 | 24 |
| Bedroom | 24 | 24 |

*Note: The predicted noise levels are only for ventilation services noise and does not take into consideration other internal sources of noise or break in noise from external noise sources.*

# 4 Conclusion

Wave Dynamics was commissioned by The LDA to carry out internal noise assessment concerning for a typical apartment for the proposed Wilton LRD development. The assessment was based on a typical apartment layout, and available M&E information at this stage of the design. The internal duct layout has been assumed as this is not yet available.

**Based on the recommended mitigation measures outlined in this report, the internal noise level criteria within bedrooms and living rooms are predicted to be achieved. The assessment is based on the information available at planning stage, the final duct layouts, ventilation units and attenuators should be reviewed during the design development stage to confirm compliance.**

# Appendix A- Glossary of Terms

| | |
|---|---|
| Decibel (dB) | The standard unit for defining sound pressure levels. |
| $L_{Aeq}$ | A-weighted, equivalent continuous sound level. |
| $L_{AFmax}$ | A-weighted, maximum, sound level measured with a fast time-constant - maximum is not peak |
| $L_{den}$ | day-evening-night noise level, the A-weighted, Leq (equivalent noise level) over a whole day, but with a penalty of 10 dB(A) for night-time noise (23:00-07:00) and 5 dB(A) for evening noise (19:00-23:00), also known as the day evening night noise indicator. |
| $L_{Aeq,16hour}$ | The equivalent continuous sound level in dB(A) that, over the period 07:00-23:00 hours, contains the same sound energy as the actual fluctuating sound that occurred in that period. |
| $L_{Aeq,8hour}$ | The equivalent continuous sound level in dB(A) that, over the period 23:00-07:00 hours, contains the same sound energy as the actual fluctuating sound that occurred in that period. |
| $D_{n,e,w}$ | A single-number quantity that describes the sound insulation of ventilators/attenuators. |
| Octave Frequency Bands | Octave bands divide the audio spectrum into 10 equal parts. The centre frequencies of these bands are defined by ISO as 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz and 16 kHz. Sound levels that have passed through an octave band pass filter are termed octave band sound levels. |