Andrew Walbran

26 WEAVERS WAY

TM59 Overheating Report

UKO0242-R01-P02 26 WEAVERS WAY OVH STRATEGY REPORT
11 OCTOBER 2024

PUBLIC

UK OVERHEATING

Andrew Walbran

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TM59 Overheating Report

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APPENDICES

1. EXECUTIVE SUMMARY

UK Overheating has been appointed by Andrew Walbran to assess the overheating risk for a single dwelling in the 26 Weavers Way, London, NW1 0XE.

Site-specific dynamic thermal modelling has been undertaken based on the proposed architectural and assumed thermal design and the defined environmental constraints.

The dwelling passes the requirements of CIBSE TM59 provided the following mitigation is introduced:

- Mechanical cooling in the Bedroom 1, providing 20 l/s at 0.5 kW cooling capacity
- Mechanical cooling in the Bedroom 2, providing 20 l/s at 0.5 kW cooling capacity

It is proposed to use a Mitsubishi Electric 3-way multi-system model MXZ-3F54V to achieve these requirements. It has been confirmed that this can be delivered with the unit operating on the Super Low setting.

2. INTRODUCTION

2.1. PURPOSE

UK Overheating has been appointed by Andrew Walbran to assess the overheating risk for a single dwelling in the 26 Weavers Way, London, NW1 0XE.

This study has considered the risk of overheating for the proposed dwelling based on the cooling hierarchy of the London Plan.

This report is necessarily technical in nature. To assist the reader, a glossary of technical terms is provided in Appendix A.

2.2. BASIS OF ASSESSMENT

2.2.1. CAMDEN LOCAL PLAN

The Camden Plan (2017) sets out a cooling hierarchy for residential development to follow to manage heat risk, as follows:

1. Minimise internal heat generation through energy efficient design;
2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls;
3. Manage the heat within the building through exposed internal thermal mass and high ceilings;
4. Passive ventilation;
5. Mechanical ventilation; and
6. Active cooling.

The above hierarchy is required to be followed, exhausting all passive means, before opting for cooling systems.

2.2.2. CIBSE TM59

CIBSE TM59 was published in April 2017 and provides a standardised assessment methodology to determine the risk of overheating in residential properties. It includes assumptions for internal heat gains and occupancy profiles and presents criteria which differ depending on whether the home is predominantly naturally ventilated, or it is predominantly mechanically ventilated.

For homes that are predominantly naturally ventilated, including homes that have mechanical ventilation with heat recovery [MVHR], with good opportunities for natural ventilation in the summer, compliance is based on passing *both* of the following two criteria:

Table 1: CIBSE TM59 Predominantly Naturally Ventilated Criteria

Criterion	Requirement
a)	*For living rooms, kitchens and bedrooms*: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.
b)	For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

For homes predominantly mechanically ventilated, because they have either no opportunity or extremely limited opportunities for opening windows (e.g. due to noise levels or air quality), occupied rooms should not exceed an operative temperature of 26 °C for more than 3% of annual occupied hours.

Care homes and accommodation for vulnerable occupants, which are predominantly naturally ventilated, should use criteria (a) and (b), but should assume Type 1 occupancy, as defined in CIBSE TM52. This results in a reduction in the acceptable comfortable temperature range from ±3K to ±2K (and a reduction of predicted mean vote from ±0.5 to ±0.2), reflecting the higher sensitivity of vulnerable occupants to increases in internal temperature.

3. SITE DETAILS

3.1. ORIENTATION

The dwelling is located on site as per the below site plan.

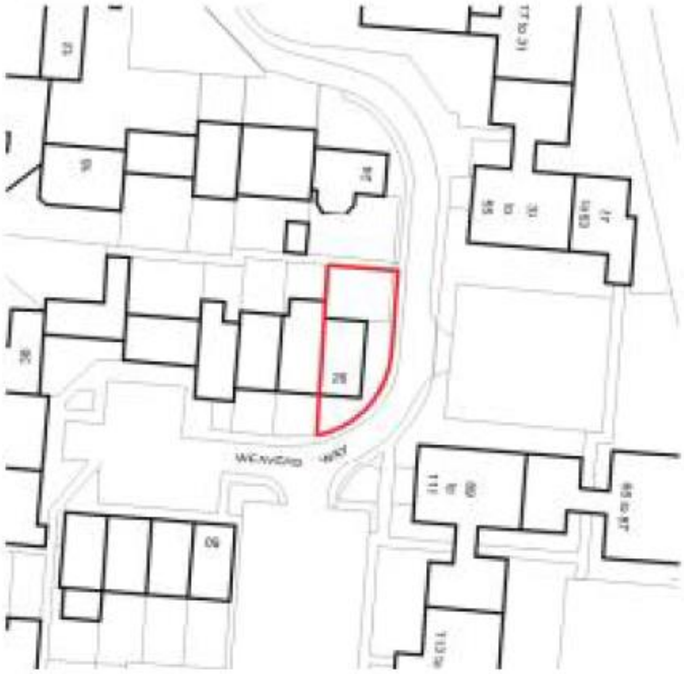


Figure 1: Site Plan

3.2. DESIGN

The dwelling comprises a ground floor Kitchen, a Living room, a Hall, a W.C. and two no. bedroom, bathroom and a study room at first floor.

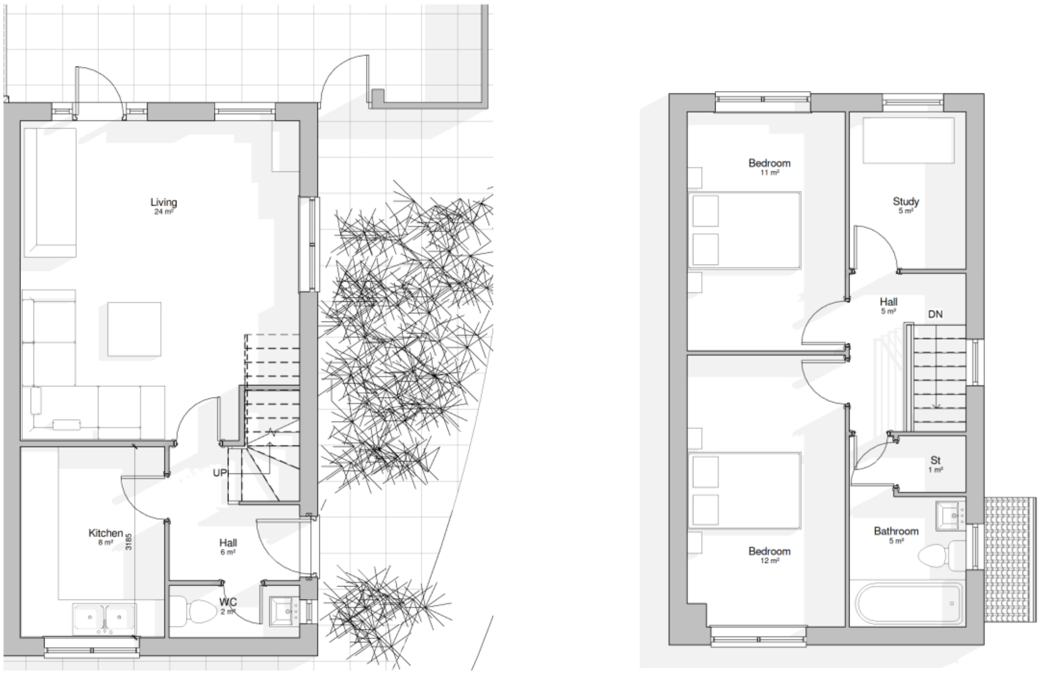


Figure 2: Ground & First Floor Layout

Figure 3: Elevations

4. ASSESSMENT METHODOLOGY

4.1.1. MODELLING ASSUMPTIONS

4.1.1.1. Dynamic Thermal Modelling Software

Dynamic thermal modelling has been undertaken utilising 10-minute sample periods using IES Virtual Environment (version 2024.0.0.0).

4.1.1.2. Building Fabric

The building fabric for all variants assumes the following thermal parameters.

Building Fabric	Construction	U-value (W/m^2K)	Centre-pane G-value	Thermal Mass (kJ/m^2K)
External wall	103mm External Brick, 10mm Cavity, 50mm Glass wool, 100mm Concrete Block (Medium), 12.5mm Plasterboard	0.37	n/a	128
Ground floor	750mm London Clay, 100mm Cast Concrete, 100mm Polyurethane Board, 100mm Screed	0.20	n/a	98
Roof	Tiles on battens, Asphalt, 160mm Glass-fibre quilt, 20mm cavity, 12.5mm Plasterboard	0.20	n/a	50
Glazing Windows	4mm inner Pane, 20mm cavity, 4mm outer Pane	2.00	0.76	0

Table 2: Thermal and Solar Performance of Building Fabric Elements

4.1.1.3. Internal Gains

Solar Gain

Solar gains are calculated automatically by the modelling software based on the orientation of the building, the transmission coefficients of the glazing and the solar angles.

The following weather file has been used:

- London City 2020 DSY1 50th percentile high emissions

Occupancy, Equipment and Lighting Gains

Occupancy, equipment lighting gains for the residential spaces are based on the guidance in CIBSE TM59 Design methodology for the assessment of overheating risk in homes. The following table lists rooms and the associated TM59 profiles.

Room	TM59 Type
Bedroom	Double Bedroom
Kitchen	2 Bed Kitchen
Living Room	2 Bed Living
Study	1 Bed Living
Bathroom	Bathroom

Table 3: Room TM59 Assignment

Ventilation

Infiltration

The dwelling is assumed to have an air permeability of 10.0 m³/hr/m² @ 50 Pa related to its construction year. This has been taken to correspond to an average infiltration rate of 0.50 ach.

Background Ventilation (Approved Document F)

Year-round background ventilation for the dwelling has been assumed to provide 0.32 l/(s*m2) background ventilation as per Approved Document F:

Natural Ventilation

Openable windows are provided within all the units for ventilation and are assumed to be able to be opened by occupants in warm weather unless there is a constraint to opening the windows.

Window openings are assumed to provide the openings as set out in the below table.

Window Ref.	No. Panes Openable	Opening Angle per Pane (degrees)		Total Equivalent Area (m^2)	
		Day	Night	Day	Night
GW01	1	58	0	0.88	0
GW02	1	90	0	0.33	0
GW03	1	58	0	0.68	0
GW04	1	42	0	1.00	0
GW05	1	90	0	1.26	0
FW01	1	36	36	0.56	0.56
FW02	1	36	36	0.56	0.56
FW03	1	35	35	0.73	0.73
FW04	1	27	27	0.81	0.81
FW05	1	35	35	0.73	0.73

Table 4: Window Opening Specifications

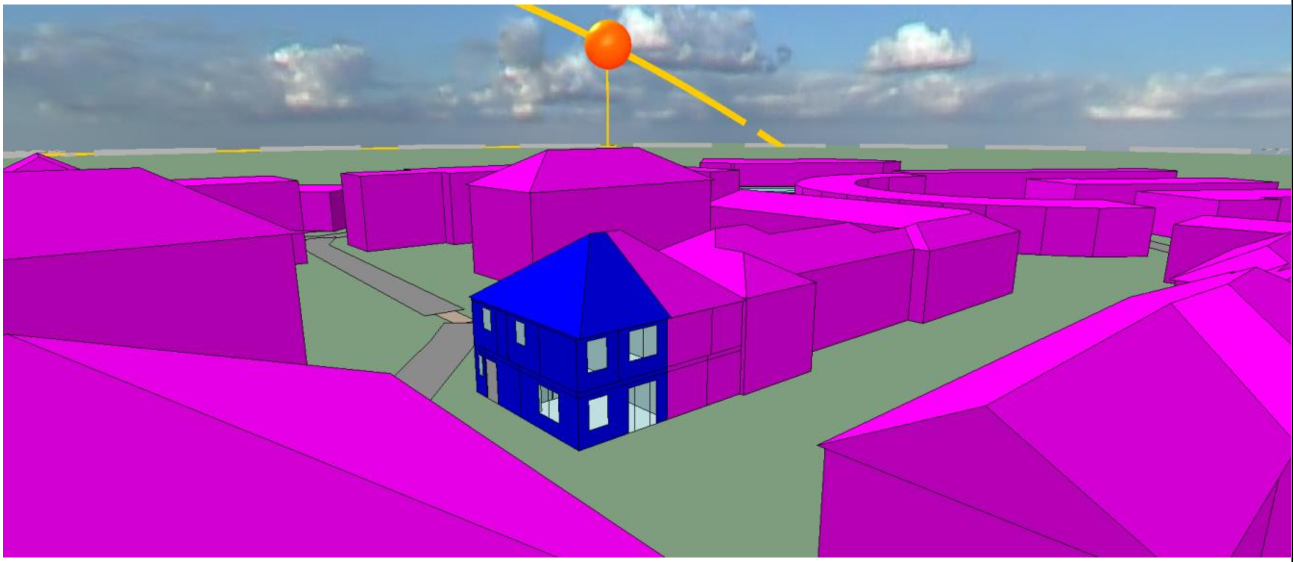
All internal doors are assumed to be open during the day to allow cross ventilation between rooms and closed at night when people are sleeping.

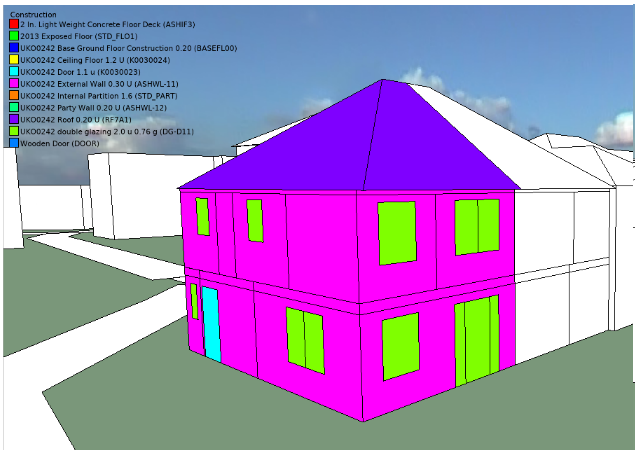
4.1.2. MODELLING APPROACH

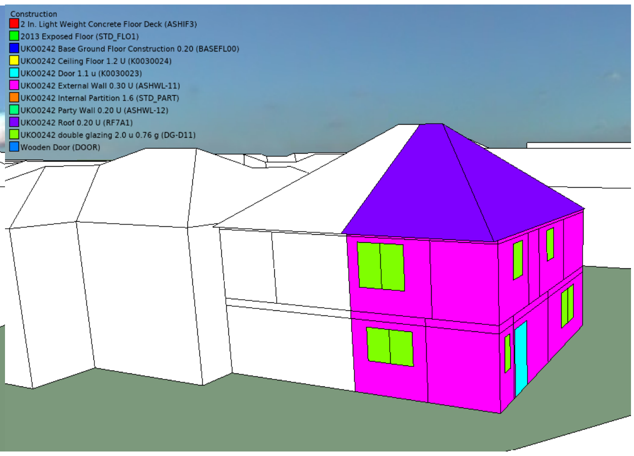
The modelling has taken the following approach:

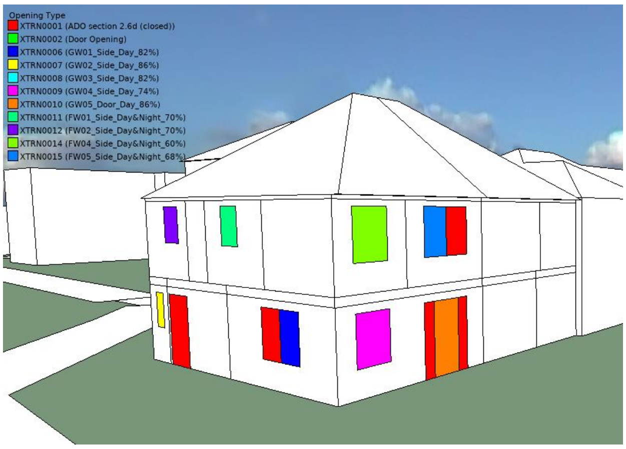
- Receive the floor plans and elevations
- Develop a geometric model of the house
- Apply the TM59 gain profiles to the rooms
- Apply the Approved Document F ventilation rate and the assumed air permeability
- Apply the assumed thermal performance to the building elements and standard solar performance of the glass
- For any rooms that do not pass the TM59 criteria, adopt the cooling hierarchy approach depicted in Camden Local Plan (2017):
    - Minimise internal heat generation through energy efficient design;
    - Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
    - Manage the heat within the building through exposed internal thermal mass and high ceilings
    - Passive ventilation;
    - Mechanical ventilation
    - Active cooling

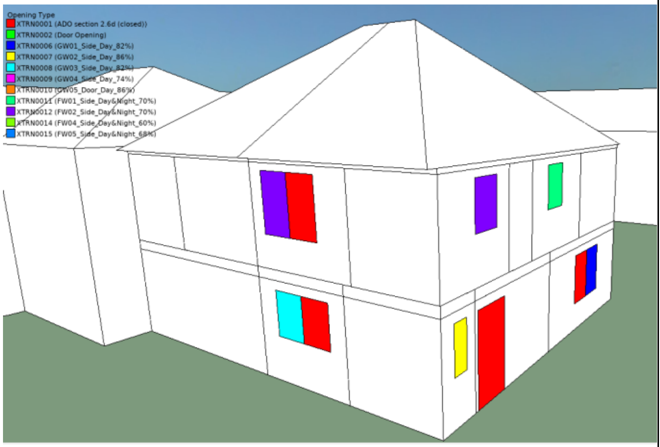
4.1.3. MODEL IMAGES











Front Elevation

Rear Elevation

5. OVERHEATING STRATEGY

5.1. RESULTS

The base case consists of no mitigation other than opening windows.

Results of base case model is set out below, evaluated for TM52 occupant category Type 2.

Room	Room Type	Occupied Summer Hours	Max. Daytime Hours	Max. Night-time Hours	Criterion a (≤3%) Pass/Fail	Criterion b (≤32) Pass/Fail
Bedroom 1	Double Bedroom	3672	110	32	0.7	46
Bedroom 2	Double Bedroom	3672	110	32	0.8	46
Living	2 Bedroom Living	1989	59	N/A	1.5	
Kitchen	2 Bedroom Kitchen	1989	59	N/A	1.5	
Study	1 Bedroom Living	1989	59	N/A	1.3	

Table 5: Base Case Results

The full results of the dynamic thermal modelling, along with the applied mitigation recommendations, are provided in Table 6.

5.2. COOLING HIERARCHY

Changing construction layers or thermal performance is not feasible for this case, as it is an existing building. The Cooling Hierarchy has been implemented without altering the building fabric.

Minimising internal heat generation through energy efficient design:

- Incandescent lighting replaced with Energy efficient lighting to reduce internal heat.
- All the equipment used at home is assumed to have a high efficiency rate.

Reducing the amount of heat entering a building in summer:

- Internal blinds have been adopted into the model.
- Shading from natural vegetation and adjacent buildings has been considered.

Increasing passive ventilation:

- Window openings have been maximised
- To enable cross-ventilation, internal doors are modelled as fully open when the rooms are occupied in the daytime.

After exhausting all passive means, mechanical ventilation was modelled up to an air exchange rate of 50l/s.

The following rooms still exceeded the required limits:

- Bedroom 1 TM59 Criterion a: 35 hours (vs. ≤32 hours requirement)
- Bedroom 2 TM59 Criterion a: 35 hours (vs. ≤32 hours requirement)

Consequently, mechanical cooling has been adopted for the above rooms.

With mechanical cooling applied to Bedroom 1 and Bedroom 2 in place of mechanical ventilation, at a duty of 0.5kW cooling capacity and at an air exchange rate of 20l/s, the following results were achieved:

Orientation	Room	Room Type	Occupied Summer Hours	Max. Daytime Hours	Max. Night-time Hours	Criterion 1 (≤3%) Pass/Fail	Criterion 2 (≤32) Pass/Fail
East	Bedroom 1	Double Bedroom	3672	110	32	1	28
East	Bedroom 2	Double Bedroom	3672	110	32	0.9	26
East	Living	2 Bedroom Living	1989	59	N/A	0.2	13
East	Kitchen	2 Bedroom Kitchen	1989	59	N/A	0.8	13
East	Study	1 Bedroom Living	1989	59	N/A	0.7	10

Table 6: Outcomes of Applied Mitigation Strategy

All air exchanges referenced relate to the movement of air out the referred space. Any ventilation or cooling system shall be designed to enable sufficient air movement without causing excessive pressure on the system and without creating turbulent noise from the movement of air.

5.3. COOLING PROVISION

It is proposed to install a Mitsubishi Electric 3-way multi system model MXZ-3F54V which can provide 6.8kW of cooling capacity with a Mitsubishi MSZ-AP20VGK wall mounted indoor unit.

Air Conditioning | Product Information

MSZ AY / MSZ-AP R32
Elegance Wall Mounted System
Inverter Heat Pump

R32

MSZ-AP / MSZ-AY INDOOR UNITS		MSZ-AP15VGK	MSZ-AP20VGK	MSZ-AY25VGK	MSZ-AY35VGK	MSZ-AY42VGK	MSZ-AY50VGK	MSZ-AP60VGK	MSZ-AP71VGK
CAPACITY (kW)	Heating (nominal)	1.7 (1.2-3.0)	2.5 (0.5-3.5)	3.2 (1.0-4.1)	4.0 (1.3-4.6)	5.2 (1.3-6.0)	5.5 (1.4-7.3)	6.8 (2.0-8.6)	8.0 (2.2-10.3)
	Cooling (nominal)	1.5 (0.9-2.7)	2.0 (0.6-2.7)	2.5 (0.9-3.4)	3.5 (1.1-3.8)	4.2 (0.9-4.5)	5.0 (1.4-5.4)	6.1 (1.4-7.3)	7.1 (2.0-8.7)
	Heating (UK)	-	2.06 (0.4-2.9)	2.64 (0.8-3.4)	3.3 (1.1-3.8)	4.45 (1.1-4.9)	4.78 (1.2-6.0)	5.6 (1.6-7.1)	6.68 (1.8-8.6)
	Cooling (UK)	-	1.98 (0.6-2.7)	2.48 (0.9-3.4)	3.47 (1.1-3.8)	4.17 (0.9-4.5)	4.95 (1.4-5.3)	6.05 (1.4-7.2)	7.04 (2.0-8.6)
SHF (nominal)		-	0.80	0.92	0.88	0.77	0.74	0.83	0.77
COP / EER (nominal)		-	4.17 / 4.35	4.10 / 4.17	3.88 / 3.54	3.74 / 3.23	3.74 / 3.24	4.07 / 3.84	3.82 / 3.53
SCOP / SEER (BS EN14825)		-	4.10 / 8.60	4.80 / 8.70	4.70 / 8.70	4.70 / 7.90	4.70 / 7.50	4.60 / 7.40	4.40 / 7.20
ErP ENERGY EFFICIENCY CLASS	Heating/Cooling	-	A+ / A+++	A++ / A+++	A++ / A+++	A++ / A++	A++ / A++	A++ / A++	A+ / A++
AIRFLOW (l/s)	Heating - SLo-Lo-Mid-Hi-SHi	62-73-83-100-113	62-73-83-100-122	67-83-110-133-197	67-83-110-133-197	73-90-116-143-215	80-95-121-151-215	180-223-257-290-338	170-192-220-255-320
	Cooling - SLo-Lo-Mid-Hi-SHi	58-65-77-92-107	58-65-77-92-115	60-83-105-130-175	60-83-105-130-185	75-95-116-140-175	86-106-125-151-195	157-183-220-267-315	160-192-220-255-310
PIPE SIZE mm (in)	Gas	9.52 (3/8")	9.52 (3/8")	9.52 (3/8")	9.52 (3/8")	9.52 (3/8")	9.52 (3/8")	12.7 (1/2")	12.7 (1/2")
	Liquid	6.35 (1/4")	6.35 (1/4")	6.35 (1/4")	6.35 (1/4")	6.35 (1/4")	6.35 (1/4")	6.35 (1/4")	6.35 (1/4")
SOUND PRESSURE LEVEL (dBA)	Heating - SLo-Lo-Mid-Hi-SHi	21-26-30-35-40	21-26-30-35-42	18-24-34-39-45	18-24-31-38-45	21-29-35-40-45	28-33-38-43-48	30-37-41-45-48	30-37-41-45-51
	Cooling - SLo-Lo-Mid-Hi-SHi	21-26-30-35-40	21-26-30-35-42	18-24-30-36-42	18-24-30-36-42	21-29-34-38-42	28-33-36-40-44	30-37-41-45-48	30-37-41-45-49
SOUND POWER LEVEL (dBA)		59	60	57	57	57	58	65	65
DIMENSIONS (mm)	Width x Depth x Height	760 x 178 x 250	760 x 178 x 250	798 x 245 x 299	798 x 245 x 299	798 x 245 x 299	798 x 245 x 299	1100 x 257 x 325	1100 x 257 x 325
WEIGHT (kg)		8.2	8.2	10.5	10.5	10.5	10.5	16	17
ELECTRICAL SUPPLY		Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit
FUSE RATING (BS88) - HRC (A)		6	6	6	6	6	6	6	6
INTERCONNECTING CABLE No. CORES		4	4	4	4	4	4	4	4

The indoor unit has the capability, even on Super Low setting, to deliver the required air flow at the minimum cooling capacity needed.

6. CONCLUSIONS

This dynamic thermal modelling report provides overheating analysis for the dwelling located in 26 Weavers Way, London, NW1 0XE.

Due to the age of the existing building, thermal insulation is assumed to be low. However, the NW1 postcode location is defined as a high overheating risk area by Approved Document O. Despite the low thermal performance of the building fabric, overheating is a significant risk for the dwelling.

Base model simulation results show that Bedroom 1 and Bedroom 2 require an overheating mitigation strategy. The Cooling Hierarchy scheme has been implemented without changing the building fabric and thermal performance, but mechanical cooling is still required in Bedroom 1 and Bedroom 2.

The proposed mechanical cooling unit can provide the necessary cooling demand as modelled, to satisfy CIBSE TM59.

Appendix A

TECHNICAL TERMINOLOGY

Overheating Strategy Overheating Condition	The situation where measures are in place to mitigate overheating to meet agreed compliance criteria.
Dynamic thermal modelling	A technique that can be used to simulate internal temperatures in dwellings before they are built
Ventilative cooling	Cooling by means of introducing external ambient temperature air at a high ventilation rate. Can be either passive (no fans) or mechanical (with fans).
Purge ventilation	Ventilation to aid removal of high concentrations of pollutants and water vapour released from occasional activities such as painting and decorating or accidental releases such as smoke from burnt food or spillage of water.
Mechanical cooling	Cooling by means of a refrigerant cycle. This would include ‘air conditioning’ systems and the use of fan coil units (FCUs).
Equivalent area, A_{eq} **a.k.a. EA**	The area of a sharp-edged, circular orifice that gives the same flow rate as the actual opening at a given pressure-difference. In other words, the free-area of a notional circular hole made in an infinitely thin, infinite extent baffle that gives the same air-flow performance as the real opening. Used to describe the area of trickle vents in Approved Document F. Not to be confused with Effective area.

Appendix B

REPORT LIMITATIONS

This report has been prepared for the titled project or named part thereof and should not be used in whole or part and relied upon for any other project without the written authorisation of UK Overheating Limited. UK Overheating Limited accept no responsibility or liability for the consequences of this document if it is used for a purpose other than that for which it was commissioned. Persons wishing to use or rely upon this report for other purposes must seek written authority to do so from the owner of this report and/ or UK Overheating Limited and agree to indemnify UK Overheating Limited for any and all loss or damage resulting therefrom. UK Overheating Limited accepts no responsibility or liability for this document to any other party other than the person by whom it was commissioned.

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