

Pennington Street Residential Development, Levenshulme, Manchester

CIBSE TM59 Overheating Analysis

In accordance with Part O

33502



PREPARED BY:

COMPLETE SUSTAINABILITY SOLUTIONS

76 KING STREET

MANCHESTER

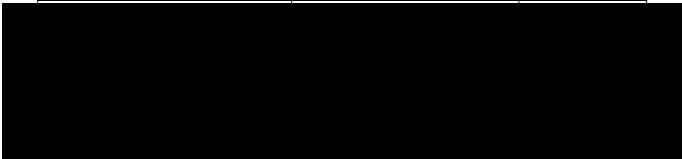
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OVERHEATING REPORT OF PENNINGTON STREET RESIDENTIAL DEVELOPMENT

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Revision Record			
Rev	Date	By	Summary of Changes
-	18.09.25	PY	-

1 EXECUTIVE SUMMARY

This report presents an analytical study of the overheating outcomes for the proposed dwellings at the Pennington Street residential development in Manchester and assesses the units for risks of overheating. The modelling exercise uses design information and relevant industry standards. The results are based on the dynamic modelling outputs from the IES VE software.

The overheating assessment has been carried out with the guidance set out in CIBSE TM59: Design Methodology for the Assessment of Overheating in Homes in accordance with Approved Document Part O. The methodology aims to produce a test that encourages good design that is comfortable within sensible limits while prioritising passive measures to achieving compliance against the overheating assessment criteria.

All of the dwellings have been assessed against the DSY1 weather file to determine the likelihood of overheating to occur, with the modelling assessing each individual dwelling according to the proposed site-plan layout to stress-test the proposed overheating strategy.

The proposed natural ventilation strategy includes openable windows as per the architectural drawings/elevations. Opening schedules are detailed within this report. Additionally, the proposed elevations indicate that the living area windows of house types B and D are fixed, which would result in overheating within these spaces therefore, natural ventilation to the living areas of house types B and D is assumed to be provided by a single openable window to meet Part O compliance (see Section 6.3).

According to the acoustic report by SPRATT+HAMer, a 13 dB sound reduction is expected with windows in a partially open position (assumed 100 mm restrictors in part O analysis). On this basis, there are no acoustic constraints preventing the use of openable windows as part of the overnight overheating mitigation strategy (see section 2.4). However, in line with the security and accessibility provisions of Approved Document O, all ground floor windows are assumed to remain closed during night-time hours.

There are 14 plots being assessed (as part of this study) across the site, containing the following house types:

- Type A (1 plot)
- Type B (8 plots)
- Type C (1 plot)
- Type D (3 plots)
- Type E (1 plot)

The mechanical ventilation strategy for the site included dMEV (system 3), providing continuous extract ventilation to the kitchen and wet rooms at Part F minimum ventilation rates for a continuous extract ventilation system. The double bedroom in house type A (bungalow) to have windows closed overnight for security reasons in accordance with part O; therefore, additional mechanical ventilation will be required to this bedroom to meet the compliance (see section 6.6).



Figure 1: Site plan of the proposed development

A glazing g value of 0.55 (BS EN 410) has been considered to prevent excessive solar gains

Assessment findings

The assessment found all assessed dwellings are able to meet the TM59 overheating criteria and therefore achieve Part O compliance with the building design described in this report. However, a number of key measures that are required are listed below:

- 1) Natural ventilation via window openings as per the architectural drawings.
- 2) Unrestricted window openings to all the openable ground floor windows during daytime only.
- 3) 100 mm restrictors are to be fitted to all upper floor windows where the window cill height is less than 1100 mm above finished floor level in accordance with approved document K.
- 4) Assumed 100 mm restrictors to all upper floor bedroom windows with cill heights above 1100 mm, allowing partial opening and providing an estimated 13 dB noise reduction as stated in acoustic report (See section 2.4).
- 5) Assumed openable windows to Living areas of house type B and D to mitigate overheating (See section 6.3).
- 6) Mechanical ventilation via dMEV to kitchen and wet rooms at Part F minimum ventilation rates (See section 6.4).
- 7) Additional mechanical ventilation to ground floor bedroom to meet the part O compliance (see section 6.6).
- 8) Internal doors to be left open when possible.
- 9) Glazing g value of 0.55 (BS EN 410).

The summary results table below details the overheating assessment findings of the assessed dwelling types:

Table 1: Summary of Results for all house types

#	Unit Type	Quantity	Dwelling description	Overheating Strategy Summary	TM59 / Part O Compliance?	Detailed Results
1	A	1	1B2P Detached Bungalow	• Natural ventilation via opening windows • Ground floor windows to be closed overnight (AD O). • 100mm restrictors to windows below 1100mm (AD K). • Assumed 100mm restrictors to all bedroom windows with cill height above 110mm in line with Acoustic report (Partially open windows) estimated additional 13dB reduction in noise levels (See section 2.4) • dMEV Ventilation (Approved Document F minimum requirements) to kitchen + wet rooms (See section 6.4) • Additional mechanical ventilation to ground floor bedroom of house type A with minimum part F flow rates (See section 6.6) • G value 0.55 (BS EN 410)	☒	Appendix A
2	B	8	2B4P Terrace houses		☒	Appendix B
3	C	1	2B4P Terrace houses		☒	Appendix C
4	D	3	3B6P Terrace houses		☒	Appendix D
5	E	1	3B6P Terrace houses		☒	Appendix E
		14				

2 INTRODUCTION

This report reviews the overheating risk assessment carried out for the proposed dwellings at the Pennington Street residential development in Manchester, using dynamic simulation modelling following the guidance detailed in CIBSE TM59 Design methodology for the assessment of overheating risk in homes (2017).

An analytical study is presented within this report of the potential overheating risks of the residential spaces. The scope of this study is to report upon the likely overheating risk and to assess the periods of the year that the building has the potential to overheat using current CIBSE weather file data, and to present a working solution to any spaces within the assessed dwellings.

This report assesses the overheating risk of all five dwelling house types. The intention is that this study helps inform and verify the design proposals, thereby providing the basis for mitigating overheating risk and producing a building(s) that provides comfortable environmental conditions for occupants.

It is important to note that with any modelling exercise there are assumptions and approximations that have to be made. As far as possible, details of all assumptions and approximations are supplied within the report. These were predominantly informed by information provided by the design team and should be reviewed carefully.

All results are based on the output from computer modelling software and should be taken as an indication of the likely final situation, but these conditions cannot be guaranteed.

Moreover, this Overheating Assessment across the development supports the Planning Application and demonstrate that the proposed development complies with the relevant current guidance CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes (2017) and the requirements of the Dynamic Simulation of the building regulation in England setting standards for overheating in new residential buildings: Overheating: Approved Part O.

14 houses have been assessed in this analysis, which together are a mixture of bungalow and terrace houses. Each unit type has been assessed according to the site-plan to provide a greater understanding of the overheating risks associated with each dwelling type.

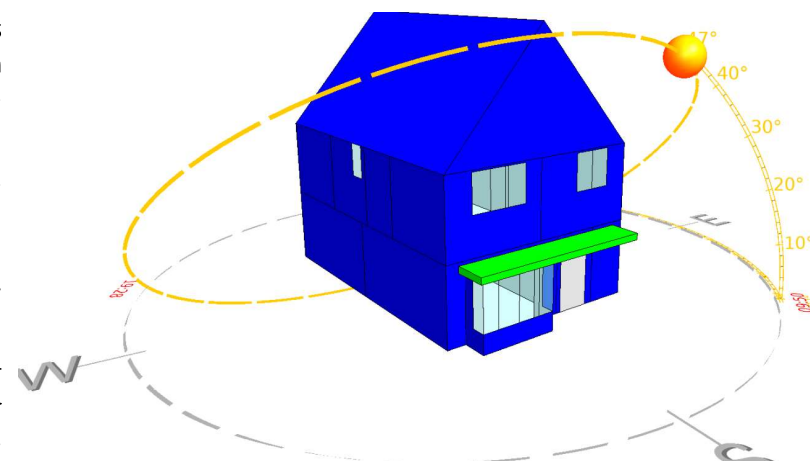


Figure 2: IES VE Model of the assessed plot 34 (House type Bronte)

2.1 SITE PLAN

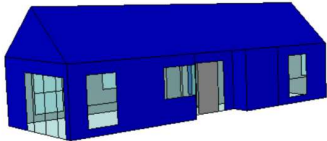
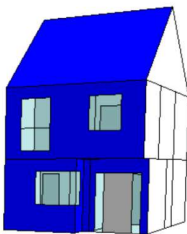
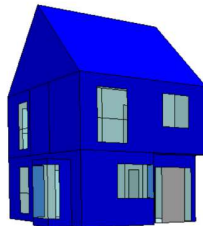


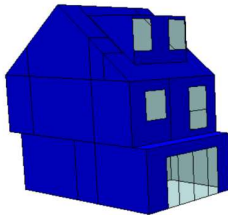
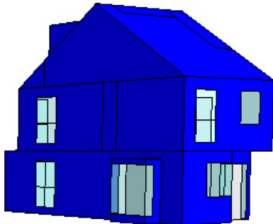
Figure 3: Architectural site plan of proposed residential development

2.2 ASSESSED HOUSE TYPES AND SITE MODEL

The below table summarises the key information for each plot type assessed.

Table 2: Information of assessed unit Types

No. Units	Unit Type	Plot Number Assessed	Model Image	Orientation (Front door facing)	Plots Covered by Calculation	Detailed Results
-	Type A	-		South	-	Appendix A1
-		-		East	-	Appendix A2
01		Plot 1		North	Plot 1	Appendix A3
-		-		West	-	Appendix A4
-	Type B	-		South	-	Appendix B1
-		-		East	-	Appendix B2
-		-		North	-	Appendix B3
08		Plots 3 to 10		West	Plots 3 to 10	Appendix B4
-	Type C	-		South	-	Appendix C1
-		-		East	-	Appendix C2
-		-		North	-	Appendix C3
01		Plot 2		West	Plot 2	Appendix C4

No. Units	Unit Type	Plot Number Assessed	Model Image	Orientation (Front door facing)	Plots Covered by Calculation	Detailed Results
03	Type D	Plots 12 to 14		South	Plots 12 to 14	Appendix D1
-		-		East	-	Appendix D2
-		-		North	-	Appendix D3
-		-		West	-	Appendix D4
01	Type E	Plot 11		South	Plot 11	Appendix E1
-		-		East	-	Appendix E2
-		-		North	-	Appendix E3
-		-		West	-	Appendix E4
14						

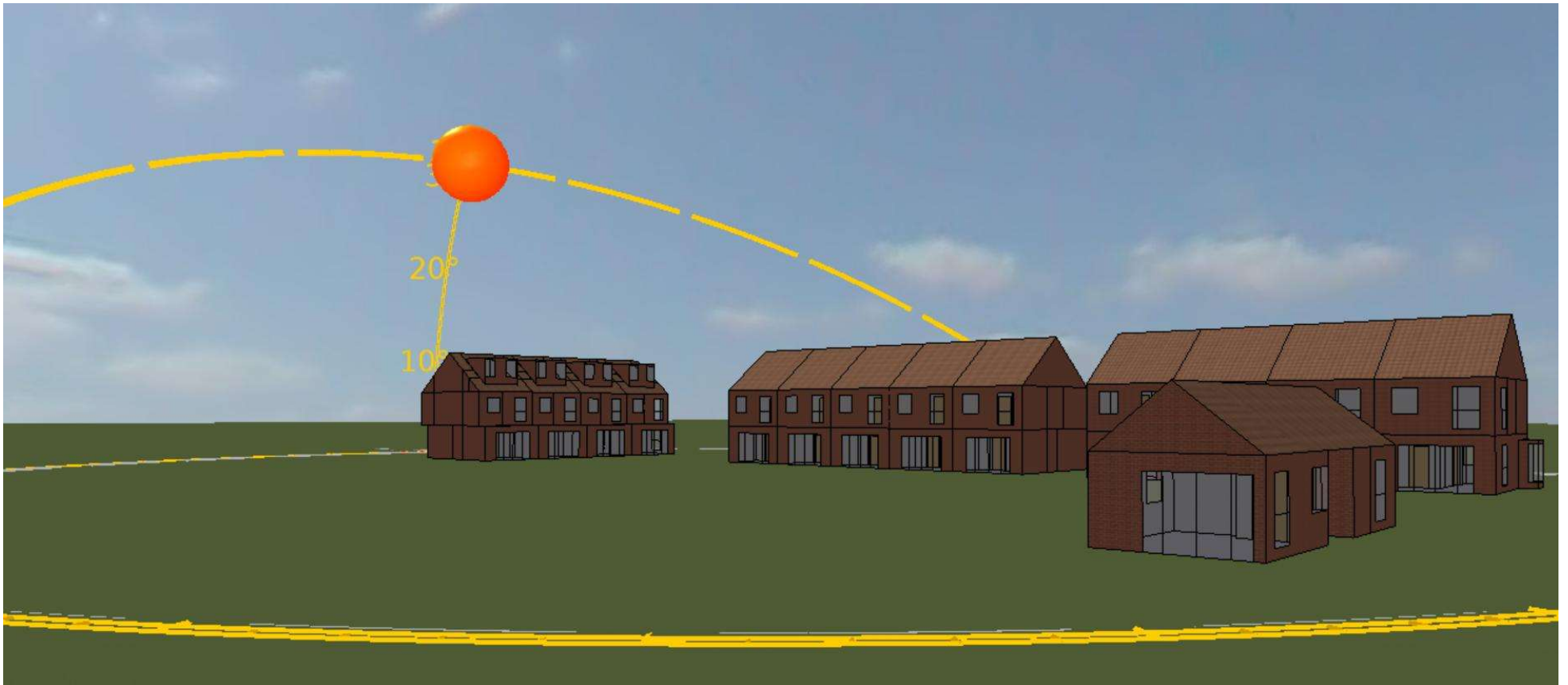


Figure 4: Site Model for proposed residential development

2.3 VULNERABLE TO INTRUSION / EASILY ACCESSIBLE WINDOWS

Part O stipulates in section 3.6 *Security* that openings which may be vulnerable to intrusion by a casual or opportunistic burglar includes the following:

- a) Ground Floor Bedrooms
- b) Easily accessible bedrooms

With 'Easily Accessible' being defined as one of either of the following definitions:

- A window or doorway, any part of which is within 2m vertically of an accessible level surface, such as the ground or basement level, or an access boundary
- A window within 2m vertically of a flat or sloping roof (with a pitch of less than 30 degrees) that is within 3.5m of ground level.

Any windows which can be attributed with any of the above two criteria therefore are required to be closed overnight to ensure compliance with Part O stipulations is adhered to, which has been taken into account during the modelling process, and extended to non-bedroom windows (such as bathrooms and landings which are often used as additional window openings to can aid the removal of excess heat in dwellings) which may act as access points into the dwelling for opportunistic burglars etc.

Analysis has found that across the site, all ground floor windows have been modelled as closed overnight due to security reasons

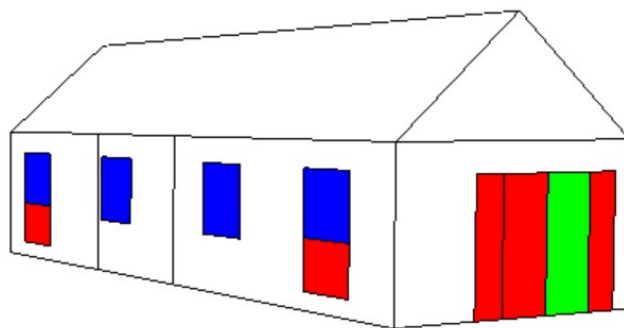


Figure 5: Window Opening Schedule Depiction

Opening Type

- XTRN0000 (Window / Door Closed)
- XTRN0002 (ADO section 2.6a (day) - Glazed Doors)
- XTRN0003 (ADO section 2.6a (day) - Window)
- XTRN0008 (Living Internal Door)
- XTRN0009 (Bedroom Internal Door)

Opening Schedule Description:

- **Window/Door Closed/Fixed: Fixed pane, unopenable**
- **ADO section 2.6a (day) (Patio): closed overnight**
- **ADO section 2.6a (day) Windows: closed overnight**
- **ADO section 2.6a+b (day & night) Windows: Night Open**

2.4 NOISE / ACOUSTICAL IMPACT ASSESSMENT

Part O stipulates in section 3.2 Noise In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits:

- a) 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
- b) 55dB L_{Amax} , more than 10 times a night (between 11pm and 7am).

On Proposed development, according to the acoustic report provided by SPRATT+HAMer, a 13 dB reduction in noise is anticipated with windows in a partially open position. On this basis, there are no acoustic limitations that would prevent the use of openable windows as part of the overheating mitigation strategy. To support this approach, all upper floor windows with a cill height above 1100 mm from finished floor level (FFL) have been modelled with 100 mm restrictors.

The location plan below shows the proposed development and positions of the monitoring equipment.



Figure 1: Indicative Location Map. Image taken from www.google.com/maps

8.4 Open Window Assessment in Accordance with Approved Document O

Approved Document O establishes that in locations where external noise may be an issue (...), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
- b. 55dB L_{Amax} , more than 10 times a night (between 11pm and 7am).

As can be seen in the table below, considering the sound reduction of 13dB of a partially open window, noise levels do not exceed 53dB in all façades. In addition, maximum levels analysis shows that 55dB L_{Amax} has not been exceeded more than 10 times at any of the plots.

Plot	Room	Time period	Measured External $L_{Aeq,T}$ (dB)	ADO criteria*	ADO exceedance
Plot 1	Bedroom	Night time (23:00 – 07:00)	45.6	53.0	-7.4
Plots 2 – 14			41.6	53.0	-11.4

Table 10: ADO Analysis

*with open window R_w of 13dB

Consequently, the overheating mitigation strategy should take account of the likelihood that windows may be open during sleeping hours and therefore the minimum free areas of Approved Document O simplified method can be met.

It should be noted that an Approved Document O assessment is required to be undertaken using the $L_{Aeq,8hour}$ and L_{Amax} criteria over the 23:00–07:00 period. Please note the results may be adjusted once the long-term survey is carried out.

Figure 6: Snippet from Acoustics Report Conclusion (SPRATT+HAMer)

2.5 PROTECTION FROM FALLING (APPROVED DOCUMENT K)

- **3.8)** Openings which are intended to be open for long periods to reduce overheating risk might pose a higher risk of falls from height. Only the proportion of openings which can be opened with a very low risk of occupants falling from height should be considered to form part of the overheating mitigation strategy.
- **3.9)** Openings that can be opened wider than 100mm may form part of the overheating mitigation strategy where they meet all of the following conditions:
 - a) Window handles on windows that open outwards are not more than 650mm from the inside face of the wall when the window is at its maximum openable angle.
 - b) Guarding meets the minimum standards in Table 3.1
 - c) Guarding does not allow children to easily climb it. For example, horizontal bars should generally be avoided.For more information, please refer to *Approved Document K*.

Analysis has found that the upper floor windows across the assessed units are to be placed on 100mm restrictors as the sill heights of the bedroom windows are below the minimum threshold of 1100mm above FFL.

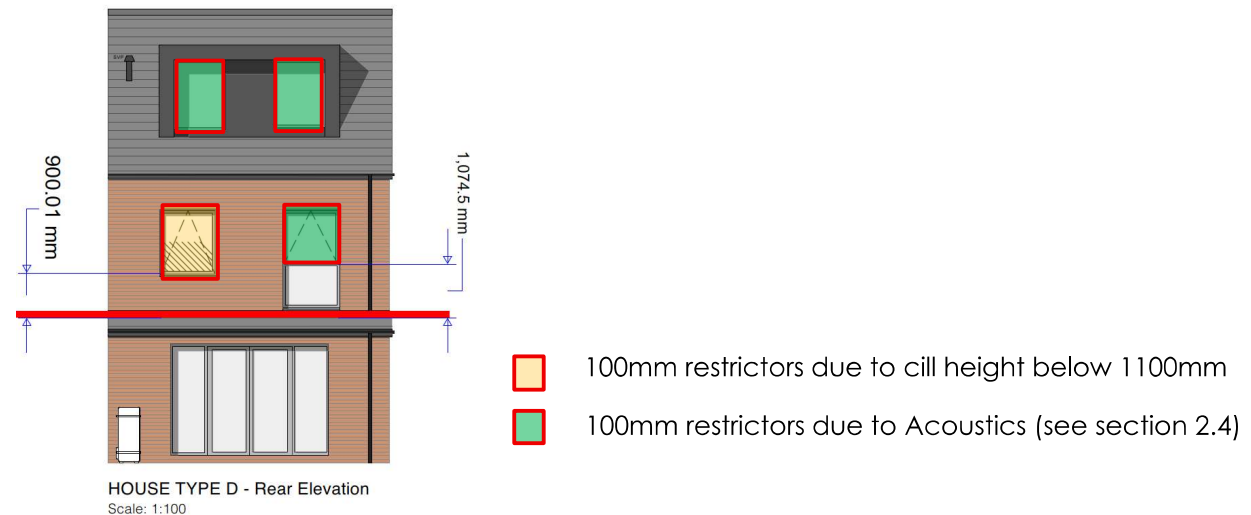


Figure 7: Example of unit showing 100mm restrictors due to cill height and acoustic conditions

3 OVERHEATING ASSESSMENT CRITERIA

TM59 sets different overheating compliance criteria for homes that are predominantly naturally ventilated and for homes that are predominantly mechanically ventilated.

For homes that are predominantly naturally ventilated, the method with two criteria should be used to assess overheating. The first overheating criteria, which applies to both living rooms/kitchens and bedrooms, is an adaptive criterion. The second overheating criterion is a fixed temperature criteria which applies only to bedrooms. Both criteria must be met for all spaces within a home to demonstrate compliance.

For mechanically ventilated homes, the fixed temperature method with a single criterion should be used to assess overheating. This single criterion must be met for all spaces (living rooms/kitchens and bedrooms) within a mechanically ventilated home to demonstrate compliance.

The TM59 criteria for naturally and mechanically ventilated homes are summarised in the following table. The dwellings in this assessment are assessed against 'predominantly naturally ventilated' criteria.

All criteria must be met for all spaces within a home to demonstrate full compliance.

Table 3: Overheating Assessment Categorisation

Assessment Type	Assessment Criteria	Applicable Rooms	Occupied Hours	Naturally Ventilated Homes (open windows)	Mechanically Ventilated Homes (closed windows)
Predominantly Natural Ventilation	Criterion 1	Living rooms, kitchens and bedrooms	Living / Kitchen / Dining rooms – 9am to 10pm (13 hours/day) Bedrooms – 24-hour occupancy	The number of hours during which external and internal temperature difference is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours.	Not Applicable
	Criterion 2	Bedrooms only	Bedrooms – 24-hour occupancy	The operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. 33 or more hours above 26°C will be a fail	Not Applicable
Predominantly Mechanical Ventilation	Criterion 3	Living rooms, kitchens and bedrooms	Living / Kitchen / Dining rooms – 9am to 10pm (13 hours/day) Bedrooms – 24-hour occupancy	Not applicable	The operative temperature in occupied all occupied rooms should not exceed 26°C for more than 3% of the annual occupied annual hours. 143 or more hours above 26°C for living rooms and kitchens will be a fail. 263 or more hours above 26 °C for bedrooms will be a fail

4 DESIGN CRITERIA

The following general criteria have been used throughout the simulation: -

4.1 AIR PERMEABILITY

An air infiltration rate of 0.20ACH has been applied to the dwellings.

4.2 EXTERNAL ENVELOPE

The following U-values have been used: -

Table 4: Building envelope U-values

Element	Modelled U Value (W/m ² K)
External Wall	0.18
Dormer Wall	0.19
Plane Roof	0.09
Slope Roof	0.13
Flat Roof	0.15
Ground Floor	0.11
Exposed Floor	0.15
Glazed Windows	1.20
Doors	1.00

4.3 GLAZING SPECIFICATION

The glazing is based on a G-value of 0.55 (BS EN 410) for windows and glazed doors.

4.4 INTERNAL WINDOW BLINDS

Internal blinds have been not included in the calculations

4.5 WEATHER

Weather file used in the calculation: - **Manchester_DSY1_2020High50_.epw** The peak summer temperature is 34.60°C.

4.6 SITE & ORIENTATION

All plots have been individually modelled to cover all assessed units across the site.

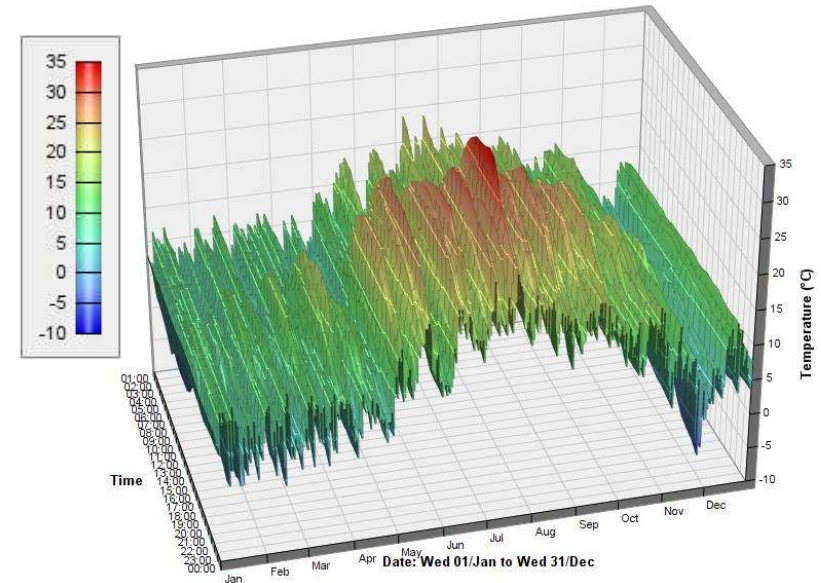


Figure 8: Annual dry-bulb temperature graph of modelled weather file

5 INTERNAL GAINS

The internal gains used throughout the simulations are detailed below. No differences between weekdays and weekends are considered. Bedrooms are set with a 24 hour occupancy profile which means that one person is always considered in each bedroom during the daytime and two people in each double bedroom at night. Kitchen/living rooms are unoccupied during sleeping hours and occupied during the rest of the day. Occupied periods are totalled as 3672 hours per year for bedrooms (24/7 May to September) and 1989 hours for living areas (13 hours per day May to September).

See Appendix I for a detailed CIBSE TM59 internal gain schedule.

5.1 OCCUPANCY

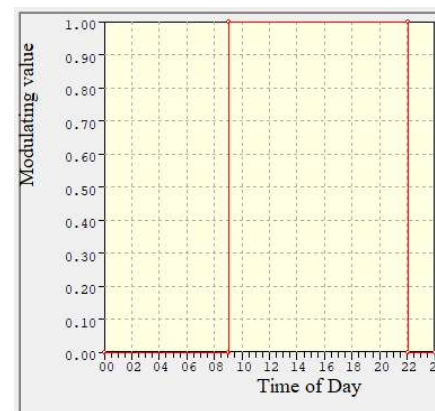
Based on CIBSE Guide A (2015a), a maximum sensible heat gain of 75W/person is assumed in the living spaces. An allowance for 30% reduced gain during sleeping is based on Addendum g to ANSI/ASHRAE Standard 55-2010.

Activity	Sensible heat gain per person (W)
Standard	75
Sleeping	52.5

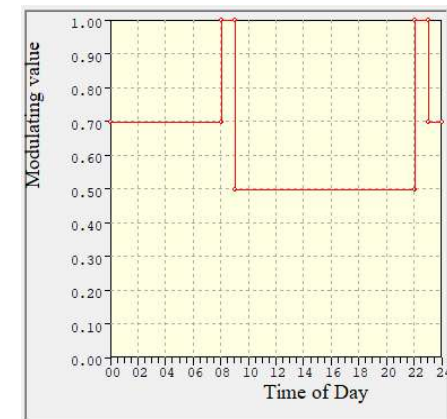
Occupant Gains

Unit/room type	Occupancy
1 bed living/kitchen	1 person from 9am to 10pm room is unoccupied for the rest of the day
2 bed living/kitchen	2 people from 9am to 10pm room is unoccupied for the rest of the day
3 bed living/kitchen	3 people from 9am to 10pm room is unoccupied for the rest of the day
Double bedroom	2 people at 70% gain from 11pm to 8am 2 people at full gain from 8am to 9am and from 10pm to 11pm 1 person at full gain from 9am to 10pm
Single bedroom	1 person at 70% gain from 11pm to 8am 1 person at full gain from 8am to 11pm

Occupancy



Typical living/kitchen occupancy profile



Typical double bedroom occupancy profile

5.2 LIGHTING

Lighting energy is assumed to be proportional to floor area. A default value of 2W/m² is applied to all occupied areas from 6pm to 11 pm.

Zone Type	Gain (W/m ²)
living/kitchen/dining areas, bedrooms	2
	0

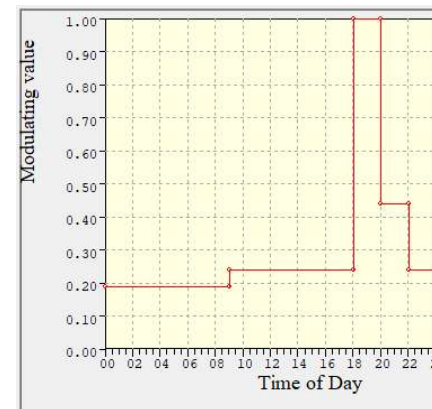
Lighting gains

5.3 EQUIPMENT

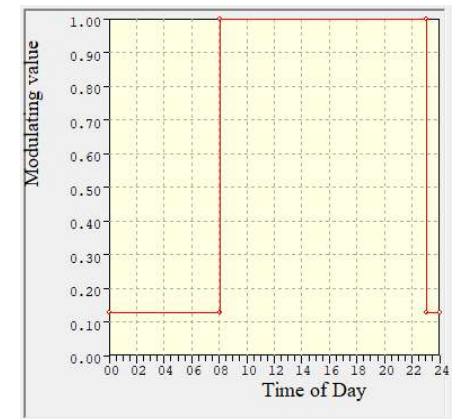
Equipment gains per room type are listed in the table below.

Unit/room type	Load
1 bed living/kitchen	Peak load of 450W from 6pm to 8pm 200W from 8pm to 10pm 110W from 9am to 6pm and 10pm to 12pm Base load of 85W for the rest of the day
2 bed living/kitchen	Peak load of 450W from 6pm to 8pm 200W from 8pm to 10pm 110W from 9am to 6pm and 10pm to 12pm Base load of 85W for the rest of the day
3 bed living/kitchen	Peak load of 450W from 6pm to 8pm 200W from 8pm to 10pm 110W from 9am to 6pm and 10pm to 12pm Base load of 85W for the rest of the day
Double bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during sleeping hours
Single bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during sleeping hours
Communal corridors	Assumed to be zero

Equipment gains



Typical living/kitchen equipment profile



Typical double bedroom equipment profile

6 VENTILATION

6.1 NATURAL VENTILATION

The windows have been modelled using an opening profile that simulates the occupants within the rooms opening the windows when the internal air temperature reaches 22°C, as stipulated by AD Part O. The same procedure operates in reverse as the air temperature cools.

The free area is a way of measuring what the equivalent completely open area is for a glazing assembly. Sufficient free area to the opening windows in a dwelling is vital to the overheating mitigation strategy and can be calculated using the combined areas of $A+B$ (in m^2).

Opening angle is the degree of opening of area **B**. Windows have been modelled to be either top or side hung as shown on the architectural drawings.

Dimension **c** refers to the opening length that windows reach when opened. As referenced in AD Part O section 3.9, if the maximum opening angle (**B**) exceeds 100mm of dimension length **c** then the following three criteria must be met:

- a) Window handles on windows that open outwards are not more than 650mm from the inside face of the wall when the window is at its maximum openable angle.
- b) Guarding meets the minimum standards in Table 3.1
- c) Guarding does not allow children to easily climb it. For example, horizontal bars should generally be avoided.

See section 7 of this report for more information.

6.2 INTERNAL DOORS

It is recommended for dwelling occupants to keep internal doors open at all times where possible so to allow air movement between rooms. Openable windows in non-habitable spaces such as landing/halls and bathrooms have been modelled and can contribute to the overall natural ventilation strategy for the dwelling.

Approved Document Part O stipulates bedroom doors must be modelled to be closed during sleeping hours, however there are no constraints during the day and are therefore modelled as open. All non-bedroom doors are considered open on a 24/7 basis.

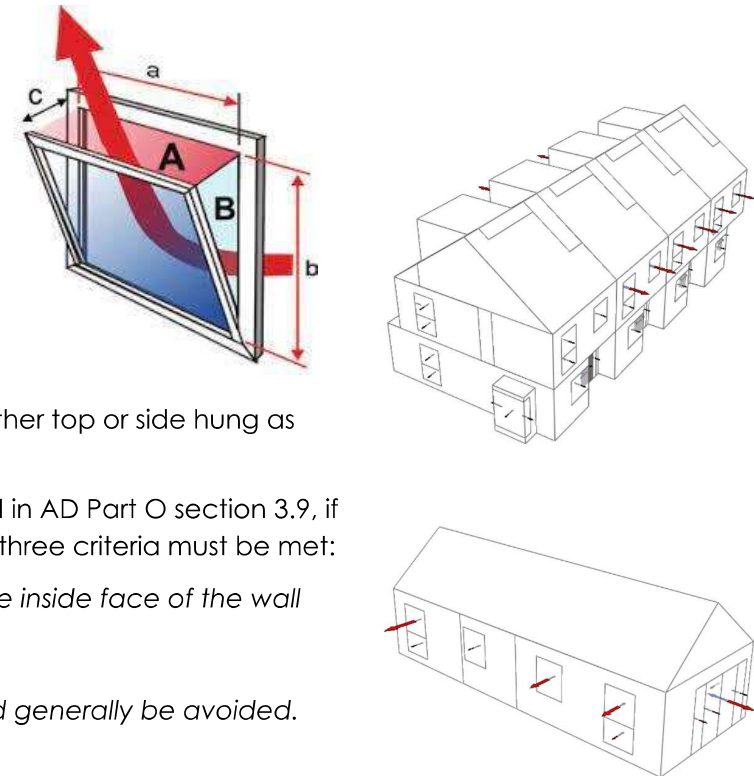


Figure 9: Natural ventilation airflow depiction of example plot

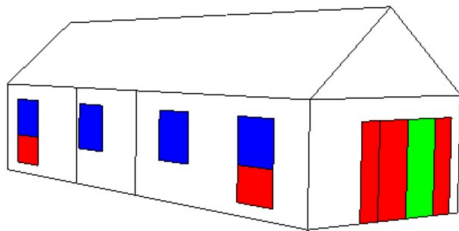
6.3 WINDOW OPENING SCHEDULE

Opening Schedule Description:

2.5 CIBSE's TM59 method requires the modeller to make choices. The **dynamic thermal modelling** method in this section applies limits to these choices, which are detailed in paragraph 2.6. These limits should be applied when following the guidance in CIBSE's TM59.

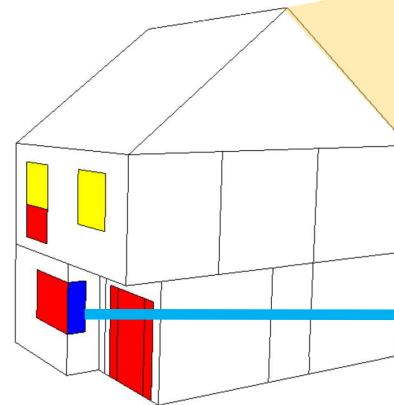
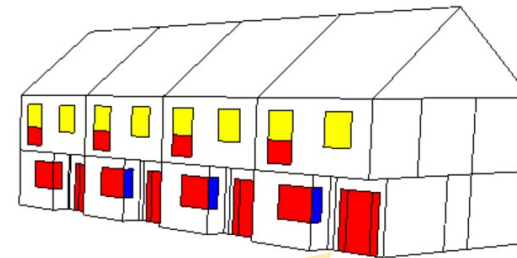
2.6 All of the following limits on CIBSE's TM59, section 3.3, apply.

- a. When a room is occupied during the day (8am to 11pm), openings should be modelled to do all of the following.
 - i. Start to open when the internal temperature exceeds 22°C.
 - ii. Be fully open when the internal temperature exceeds 26°C.
 - iii. Start to close when the internal temperature falls below 26°C.
 - iv. Be fully closed when the internal temperature falls below 22°C.
- b. At night (11pm to 8am), openings should be modelled as fully open if both of the following apply.
 - i. The opening is on the first floor or above and not **easily accessible**.
 - ii. The internal temperature exceeds 23°C at 11pm.
- c. When a ground floor or **easily accessible** room is unoccupied, both of the following apply.
 - i. In the day, windows, patio doors and balcony doors should be modelled as open, if this can be done securely, following the guidance in paragraph 3.7 below.
 - ii. At night, windows, patio doors and balcony doors should be modelled as closed.
- d. An entrance door should be included, which should be shut all the time.



Opening Type
 XTRN0000 (Window / Door Closed)
 XTRN0002 (ADO section 2.6a (day) - Glazed Doors)
 XTRN0003 (ADO section 2.6a (day) - Window)
 XTRN0006 (Living Internal Door)
 XTRN0008 (Bedroom Internal Door)

Opening Type
 XTRN0000 (Window / Door Closed)
 XTRN0002 (ADO section 2.6a (day) - Glazed Doors)
 XTRN0003 (ADO section 2.6a (day) - Window)
 XTRN0006 (ADO section 2.6a + b (day & night) - 100mm Window)
 XTRN0008 (Living Internal Door)
 XTRN0009 (Bedroom Internal Door)



Assumed as openable window in house type **B** and **D** to mitigate overheating and meet part O

Figure 10: Window opening schedule key (plot 34)

6.4 MECHANICAL VENTILATION - dMEV

Mechanical ventilation in the form of centralised and/or decentralised mechanical extract ventilation (cMEV / dMEV, respectively) is proposed for all plots, known as system 3 ventilation system.

This is a low energy, continuous mechanical extract ventilation system designed to replace conventional bathroom fans (such as intermittent systems) and draw moisture laden air out of the kitchen and wet rooms (bathrooms and utility), providing a quiet and efficient ventilation system.

An additional benefit is an air pathway is also formed drawing warm air out of habitable spaces and evacuated from the dwelling, with the makeup air being provided by the windows (when opened) or by the trickle ventilators (see section 7.4 below) which are intended always be open.

The minimum extract ventilation rates (high rate and continuous rates) can be seen in tables 1.2 and 1.3 – these have been taken from *Approved Document F*.

For more information, please refer to *Approved Document F, Volume 1: Dwellings*.

In all dwelling types, the following continuous trickle and boost rates have been modelled.

- Kitchen/Dining: **13l/s**
- Bathroom/Utility/Ensuite's: **8l/s**

6.5 TRICKLE VENTILATORS

As per section 1.64 of *Approved Document F*, where continuous mechanical extract ventilation is present, trickle/background ventilators must be installed and meet the following conditions:

- Not be in wet rooms
- Provide a minimum equivalent area of 4000mm² for each habitable room in the dwelling
- Provide a minimum total number of ventilators that is the same as the number of bedrooms plus two ventilators (i.e. a one-bedroom dwelling should have three background ventilators, a two-bedroom dwelling should have four background ventilators, etc.)

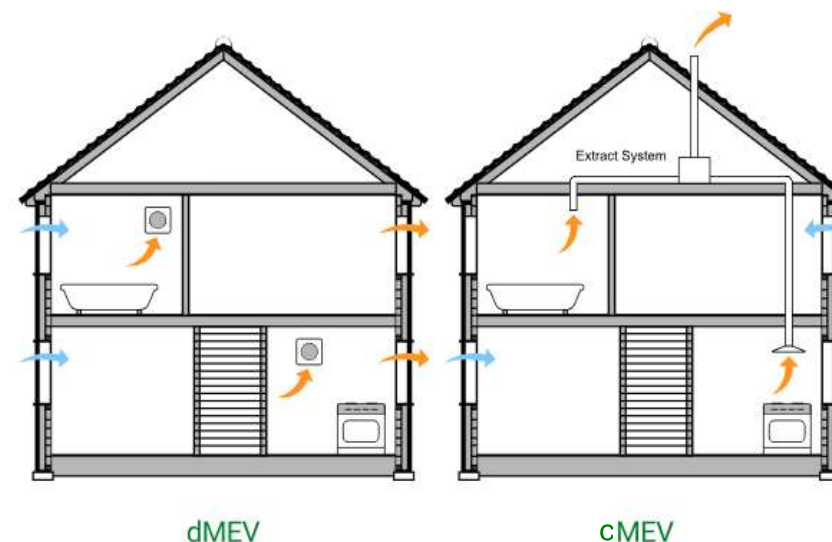


Figure 11: Depiction of dMEV and cMEV systems

Table 1.2 Minimum extract ventilation rates for continuous extract systems ⁽¹⁾		
Room	High rate (l/s)	Continuous rate
Kitchen	13	The sum of all extract ventilation in the dwelling on its continuous rate should be at least the whole dwelling ventilation rate given in Table 1.3
Utility room	8	
Bathroom	8	
Sanitary accommodation	6	
NOTE:		
1. If the continuous rate of ventilation provided in a room is equal to or higher than the minimum high rate specified in the table, no extra ventilation is needed.		

6.6 MECHANICAL VENTILATION – EASILY ACCESSIBLE BEDROOMS

An additional form of ventilation was found to be required to the ground floor bedrooms of house type A (Bungalow) that have their windows closed overnight due to being easily accessible / security reasons (see section 2.3) in accordance with Part O.

As windows are closed overnight it leads to a build-up of warm air which becomes trapped when windows/doors are closed, leading to warm overnight temperatures and a heightened risk of occupant discomfort. Note, this is only applicable to any ground floor bedrooms where the windows are easily accessible.

Modelling has found that the mechanical ventilation system proposed must be capable of 6l/s to ensure Part O compliance is met. In the modelling process, the unit was assumed to become active (i.e. begin to operate at the 6l/s flow rate when internal temperatures exceed 22°C.

During the hottest times of the year, cooler night-time temperatures allow homes / apartments to release heat built up during the day—this system utilises that benefit where natural ventilation is restricted by the Part O requirement to keep external windows closed. The required flow rates could be achieved via the following methods:

- Mechanical extract ventilation (such as the Vent-Axia NBR Coolbox 20)
- Mechanical input ventilation (such as the Sonair 3 MIV unit)
- MVHR system capable of true summer bypass and overheating boosted rates (such as the MRXBOXAB-ECO2 / ECO3)

Whichever of the above systems is used to achieve the required flow rates, they would only apply to the following rooms:

Table 5: Easily Accessible Bedrooms and Flow rates

Unit Type	Plots	Bedrooms Impacted	Required Flow Rate (l/s)
Type A	1	Double Bedroom	6l/s

7 ENSURING THE OVERHEATING STRATEGY IS USABLE

Approved Document O lists a number of measures to ensure the overheating mitigation strategy can be feasibly implemented in reality, as well as complying with overlapping building codes. The full literature can be found in *Section 3: Ensuring the overheating mitigation strategy is usable* of Approved Document O. A summary of these standards has been compiled below:

7.1 NOISE

- **3.2)** In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).
- **3.3)** Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits: A) 40dB LAeq,T, averaged over 8 hours (between 11pm and 7am), & b) 55dB LAFmax, more than 10 times a night (between 11pm and 7am).

7.2 POLLUTION

- **3.5)** Buildings located near to significant local pollution sources should be designed to minimise the intake of external air pollutants. Guidance is given in Section 2 of Approved Document F, Volume 1: Dwellings.

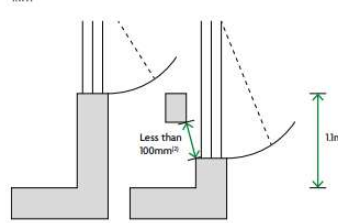
7.3 SECURITY

- **3.6)** When determining the free area available for ventilation during sleeping hours, only the proportion of openings that can be opened securely should be considered to provide useful ventilation. This particularly applies in the following locations, where openings may be vulnerable to intrusion by a casual or opportunistic burglar.
 - a) Ground floor bedrooms
 - b) Easily accessible bedrooms

7.4 PROTECTION FROM FALLING

- **3.8)** Openings which are intended to be open for long periods to reduce overheating risk might pose a higher risk of falls from height. Only the proportion of openings which can be opened with a very low risk of occupants falling from height should be considered to form part of the overheating mitigation strategy.
 - **3.9)** Openings that can be opened wider than 100mm may form part of the overheating mitigation strategy where they meet all of the following conditions:
 - d) Window handles on windows that open outwards are not more than 650mm from the inside face of the wall when the window is at its maximum openable angle.
 - e) Guarding meets the minimum standards in Table 3.1
 - f) Guarding does not allow children to easily climb it. For example, horizontal bars should generally be avoided.
- For more information, please refer to *Approved Document K*.

Table 3.1 Guarding heights	
Change in floor level between inside and outside	Guarding height ⁽¹⁾
Less than 600mm	See Approved Document K
More than 600mm	1.1m



NOTES:

1. This approved document has increased levels of protection from falling compared to Approved Document K. Where applicable, the higher standard applies.
2. Guarding should be sized to prevent the passage of a 100mm sphere.

Figure 12: Guarding heights (from Approved Document K)

8 RESULTS SUMMARY

Table 6: Summary of Results for all house types assessed

#	Unit Type	Quantity	Dwelling description	Overheating Strategy Summary	TM59 / Part O Compliance?	Detailed Results
1	A	1	1B2P Detached Bungalow	- Natural ventilation via opening windows - Ground floor windows to be closed overnight (AD O). 100mm restrictors to windows below 1100mm (AD K). - Assumed 100mm restrictors to all bedroom windows with cill height above 110mm in line with Acoustic report (Partially open windows) estimated additional 13dB reduction in noise levels (See section 2.4) - dMEV Ventilation (Approved Document F minimum requirements) to kitchen + wet rooms (See section 6.4) - Additional mechanical ventilation to ground floor bedroom of house type A with minimum part F flow rates (See section 6.6) - G value 0.52 (BS EN 410)	✓	Appendix A
2	B	8	2B4P Terrace houses		✓	Appendix B
3	C	1	2B4P Terrace houses		✓	Appendix C
4	D	3	3B6P Terrace houses		✓	Appendix D
5	E	1	3B6P Terrace houses		✓	Appendix E
		14				

See Appendix A3, B4, C4, D1, and E1 for full detailed result

9 ASSESSMENT SUMMARY

The assessment has shown that the assessed residential dwellings present a low chance of overheating – with the detailed dynamic thermal modelling showing where the risks are likely to occur.

Ground floor spaces are limited to a 'daytime only' window opening schedule which limits the amount of hours which natural ventilation can take place. Secondly, these spaces cannot take advantage of cooler night temperatures to purge the room of the warm air from internal and solar gains accumulated throughout the day. The ground floor assessed spaces in the houses however were able to sufficiently mitigate the warm temperature build up provided there is additional mechanical ventilation to the room (see section 6.6).

The windows on the upper floor which are below the cill height of 1100mm from FFL are modelled with 100mm restrictor in accordance with approved document k. Additionally in line with the acoustic report provided by SPRATT+HAMer, a 13 dB reduction in noise is anticipated with windows in a partially open position. On this basis, there are no acoustic limitations that would prevent the use of openable windows as part of the overheating mitigation strategy. To support this approach, first-floor windows with a cill height above 1100 mm from finished floor level (FFL) have been modelled with 100 mm restrictors.

A solar controlled window glazing g value of 0.55 (BS EN 410) has been considered to prevent excessive solar gains during summer months.

A summary of the overheating mitigation strategy is listed below:

- Natural ventilation via window openings as per the architectural drawings.
- Unrestricted window openings to all the openable ground floor windows during daytime only.
- 100 mm restrictors are to be fitted to all upper floor windows where the window cill height is less than 1100 mm above finished floor level in accordance with approved document K (see section 2.5).
- Assumed 100 mm restrictors to all upper floor bedroom windows with cill heights above 1100 mm, allowing partial opening and providing an estimated 13 dB noise reduction as stated in acoustic report (See section 2.4).
- Assumed openable windows to Living areas of house type B and D to mitigate overheating (See section 6.3).
- Mechanical ventilation via dMEV to kitchen and wet rooms at Part F minimum ventilation rates (See section 6.4).
- Additional mechanical ventilation to ground floor bedroom to meet the part O compliance (see section 6.6).
- Internal doors to be left open when possible.
- Glazing g value of 0.55 (BS EN 410).

With the above measures implemented, the modelling found all spaces in the assessed dwellings to pass the overheating criteria and comply with Part O building regulations.

Though the regulations do not permit the use of blinds and curtains in the calculations, if the sun shines directly into a living space, the occupant should consider closing the curtains or blinds to limit solar gains and try and keep rooms as cool as possible.

Mitigating overheating will rely on the end user operation and understanding of overheating. Heat comes into the house in two ways: solar radiation from the sun, and hot air. We need to limit both to prevent overheating, which may require closing both the windows and curtains on the warmest days.

If it's cooler inside than outside, it is advised that occupants should keep their windows closed, to prevent bringing warm air in. If it reaches a point where the temperature inside the house is equal to that outside, then you should open the windows, keeping the curtains closed.

10 MODELLING DISCLAIMER

The calculations produced by Complete Sustainability have been carried out with the information provided by others to determine whether the thermal model of the proposed building can achieve compliance, at design stage, with the stated criteria within this report.

It should be noted that the data generated by this work is obtained using computer simulations. These simulations are the best means of predicting the performance of the building at this stage. Full certainty can only be achieved by measuring the performance of the building and associated systems after a period of use.

The actual operative temperatures within the building once occupied may vary from the calculated values within this report. These differences will occur due to a number of variable parameters between the modelled building and the actual building. Such differences will include the hours, levels of occupancy, equipment, how the windows are used etc.

Whilst the simulations have been undertaken in good faith using reasonable skill and care, Complete Sustainability can take no responsibility for differences between the computer simulations and the actual performance of the completed development due to the inherent complexity and variability of the physics in a building and its environment.

On the Approved Document O detailed report appendices, although Complete Sustainability Solutions Ltd. is listed in the Approved Document O detailed report appendices under designer details, including organisation and address, we hold no responsibility for the design of the building, houses, or dwellings referenced. The term "designer" in this context refers solely to our role as a consultant interpreting drawings and details provided by the architect, client, or contractor. Our responsibility is limited to constructing and simulating the Part O overheating model within the IES software based on this information.

11 APPENDIX F - DETAILED OCCUPANCY SCHEDULES – CIBSE TM 59 HEAT GAIN PROFILE

Number of People	Description /Occupancy	Period																							
		00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
		Hour ending																							
		1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00
1	Single Bedroom	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
2	Double Bedroom	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7
2	Studio	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
1	1-bedroom /living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1	1 - bedroom /living	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
1	1 - bedroom Kitchen	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
2	2-bedroom /living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
2	2 - bedroom /living	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
2	2 - bedroom Kitchen	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
3	3 - bedroom/living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
3	3 - bedroom /living	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
3	3 - bedroom Kitchen	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0

12 APPENDIX G – COMPLIANCE CHECKLIST (APPROVED DOCUMENT O – APPENDIX B – PART 2B)

2b.1 Modelling details		
Dynamic software name and version	IES Virtual Environment 2024 (Version 2024.1.0.0)	
Weather file location used, including any additional, more extreme weather files	Manchester_DSY1_2020High50_.epw	
Number of sample units modelled, including an explanation of why the size/selection has been chosen	All Units are assessed in their correct orientation	
2b.2 Modelled occupancy		
Has the project passed the assessment described in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6? ⁽¹⁾	Yes	No
Details of the occupancy profiles used	As per imported ADO dataset profiles	
Details of the equipment profiles used	As per imported ADO dataset profiles	
Details of the opening profiles used	As per imported ADO dataset profiles	
2b.3 Modelled overheating mitigation strategy		
Free areas	Fully openable but handles within 650mm limit of inside wall face as per section 3.9 of ADO	
Infiltration and mechanical flow rates	Based on Table 4.24 of CIBSE Guide A for an air permeability target of 3m ² /(h.m ²). Continuous extract fans to kitchen + wet rooms as per Approved Document F minimum requirements (see section 6.4) A form of mechanical ventilation to the easily accessible first floor bedrooms (see section 6.6)	
Window g-value	Windows (0.55) (BS EN 410)	
Shading strategy	N/A	
Mechanical cooling	N/A	
2b.4 Modelling results		
Has the project passed the assessment described in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6? ⁽¹⁾	Yes	No
What is the overall overheating strategy (i.e. what design features are key to the project passing)?	Natural ventilation Openable windows (100mm restrictors on upper floor windows) Continuous extract fans to all kitchen + wet rooms to all houses (Part F minimum rates) g value 0.55 (BS EN 410) A form of mechanical ventilation to the easily accessible ground floor bedroom of house type A (see report for details)	
2b.5 Designer's declaration		
Has the building construction proposal been modelled accurately?	Yes	No
Designer's name	Pratik Yenpure	
Designer's organisation	Complete Sustainability Solutions Ltd	
Designer's signature		
Registration number (if applicable)	N/A	
Date of design	18/09/25	