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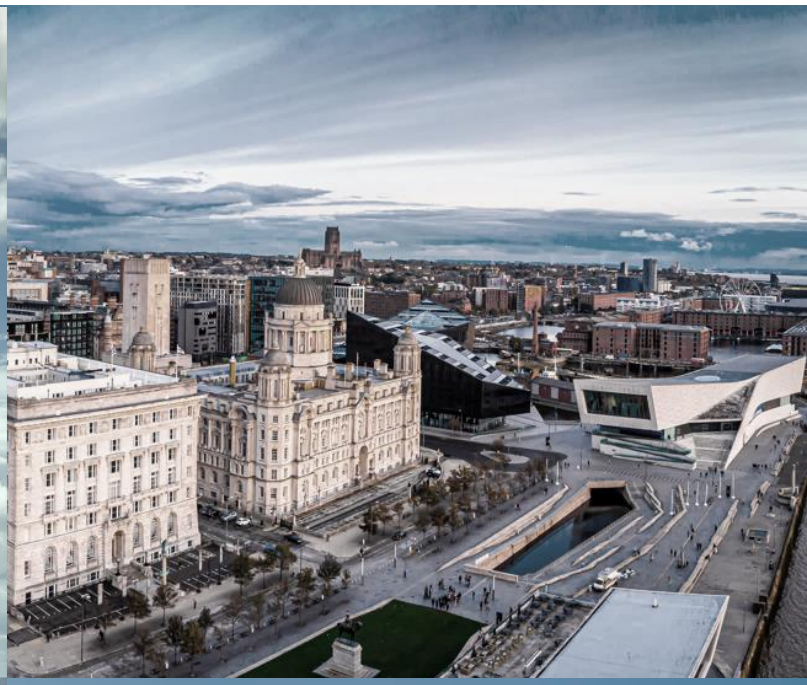
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First St Plot 9B, Manchester

Ventilation Statement







First St Plot 9B

Manchester

Ventilation Statement

Ref: VS9B-FUT-G590-RP-XX-002

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QA – Document History

Ref: VS9B-FUT-G590-RP-XX-002

Issue	**P1**			
Purpose	For Planning			
Date	17/12/2024			
Prepared By	David Carpenter			
Signature	*D. Carpenter*			
Approved By	Gareth Webb			
Signature	*G. Webb*			

Contents

1 Executive Summary 5
2 Introduction 6
3 Design 7
3.1 Design Standards 7
3.2 Statutory Requirements 7
3.3 Ventilation Rates 7
4 Ventilation Strategy 8
4.1 Basis of Design 8
4.2 Studio Ventilation 8
4.3 Amenity Spaces 10
4.4 Smoke Ventilation System 12
5 TM59 Overheating Assessment 13
5.1 Introduction 13
5.2 Assessment Methodology and Criteria 14
5.3 Model Settings 16
5.4 Ventilation 16
5.5 Results 19
6 Conclusion 28
7 Appendix A – CIBSE TM59 Room Heat Gain Profiles 29

1 Executive Summary

Futureserv Ltd has been appointed by Vita Meadow Ltd to provide a Ventilation Statement, including TM59 overheating assessment against both Part O and AVO guidance, for the proposed student residential development at First St Plot 9B, Manchester. The ventilation strategy improves on the fundamental principles of the Building Regulations and will make a contribution to reducing the annual CO_2 emissions of the proposed development.

For the TM59, sample floors have been taken from the top 2 floors of the two different floor plates of the development – floors 10, 11, 30 and 31.

CIBSE TM59 methodology has been utilised to assess the overheating risk within a relevant selection of units. Compliance with TM59 minimum criteria has been analysed using the Manchester weather Centre data. Current scenario weather files were considered. The assessment has been conducted following the criteria from the Building Regulations Part O 2021.

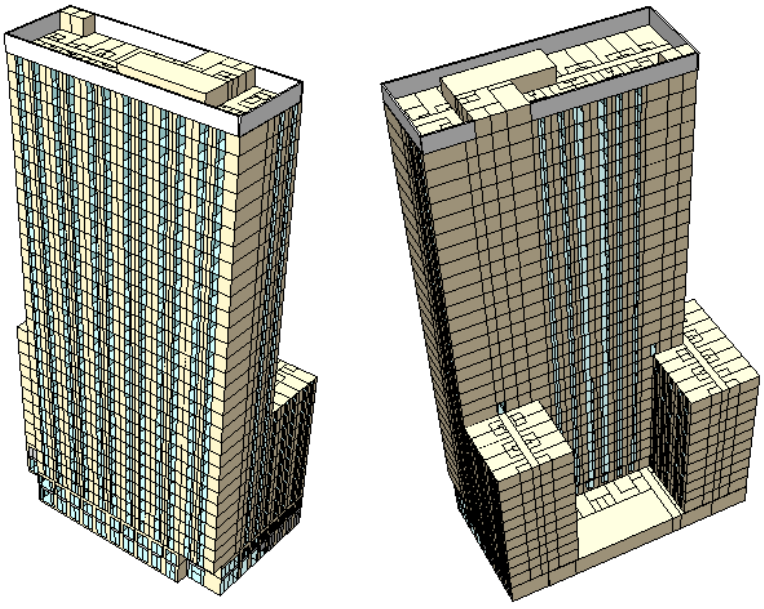
Futureserv understands that certain facades are exposed to high noise levels which will limit the use of natural ventilation for reducing the risk of overheating within the affected dwellings. Windows across different facades can be opened varying between 2 and 10 hours per day, as per the assessment of the Acoustic Consultant against AVO guidance, and detailed within this report.

The residential development was assessed against the requirements of CIBSE TM59. The report outlines the basis of the proposals and the intended overheating mitigation strategy.

The simulation indicated that all assessed Studio Bedrooms passed the TM59 simulation.

The Glazing G values were simulated at 0.55 for all elevations.

The amenity areas at Ground floor level shall be provided with local ceiling void mounted heat recovery mechanical ventilation systems together with heat pump heating and cooling systems to maintain comfort temperatures in these highly occupied spaces.



2 Introduction

This statement has been prepared in support of the planning application for the development of the First St Plot 9B student residential scheme in Manchester. Please note that the Site comprises of the development site and construction compound and this report is only in reference to the development site.

The proposed new development works include a single residential tower which includes:

- Ground and first floor front of house and residential amenity areas
- Staff back of house and refuse areas
- Residential studios

This statement has been produced to detail the supply and extract ventilation strategy for the proposed development and describes how ventilation requirements have been incorporated into the design of the building.

This Ventilation Statement has been prepared to illustrate the proposed ventilation designs. It addresses the building regulation requirements described within Approved Document Part F, 2021 for ventilation to the various facets of the proposed development.

The statement also highlights the need to provide complete, energy efficient, fully working and balanced ventilation systems that can:-

- Deliver sufficient outdoor fresh air to occupants;
- Deliver good indoor air quality;
- Ensure acceptable internal noise levels are not exceeded;
- Assist in the removal of heat gains;
- Remove odours, contaminants and moisture;
- Avoid cold draughts;
- Assist in avoidance of summertime overheating;
- Provide summertime night time cooling of the building fabric when required;
- Provide an easily controlled and maintainable system;
- To prevent cross infection (by full fresh air and negative pressure regime);
- To recover heat from the exhaust air stream for re-use in the fresh air supply.

Futureserv Consulting Engineers have collaborated with the design team in order to provide a holistic solution for the building that will provide an efficient envelope and contain intelligent building services reducing the environmental impact of the proposed development whilst providing comfortable living and working accommodation.

A thermal model exercise has been undertaken to predict the internal temperatures over a typical year. The development comprises 32 storeys and a total of 861 student studios. At this stage the key areas of the development were modelled to represent the various room types, window types and orientations within the building.

Assessing overheating risk in residential developments is a complex issue. Therefore, CIBSE TM59 is utilised to conduct a dynamic analysis of the residential apartments to assess overheating. This assessment aims to identify whether the proposals meet the requirements of CIBSE TM59 and Part O, including the requirements of the Acoustics, Ventilation and Overheating (AVO) Guide.

3 Design

The ventilation design shall comply with the following building regulation approved documents and standards:

3.1 Design Standards

The ventilation systems will be designed in accordance with recognised UK and industry best practice.

- Design will be based on standards and guidelines, including:
- British and European Standards (BSI).
- Chartered Institution of Building Services Engineers (CIBSE).
- Building Services Research and Information Association (BSRIA).
- Building Research Establishment (BRE).
- Heating & Ventilating Contractors Association (HVCA).

3.2 Statutory Requirements

Ventilation systems design will also be based on the following Statutory Requirements:

- The Building Regulations
- Clean Air Act
- The Control of Pollution Act
- The Construction (Design and Management) Regulations
- British Standards and Codes of Practice
- Manchester City Council Planning Conditions & Requirements

3.3 Ventilation Rates

Area/Room	Ventilation Criteria
Dwellings	To meet Approved Document Part F of the Building Regulations - "Means of Ventilation" Section 5, New dwellings, System 4 – Continuous mechanical supply and extract with heat recovery (MVHR)
BOH Offices, Amenity/Hub Areas, study rooms, private dining	12 l/s/person
Gym	20 l/s/person
WCs	6 ACH
BOH Kitchen, cleaners stores	10 ACH
Parcel, cycle and general stores	2 ACH
Refuse	12 ACH
Mechanical and electrical plant rooms	To be provided with natural ventilation or mechanical ventilation as appropriate to their use.

4 Ventilation Strategy

4.1 Basis of Design

The ventilation strategy has been designed to comply with the Building Regulations approved document Part F Means of Ventilation 2021, and the Domestic and Non-Domestic Ventilation Compliance guides.

This document describes the basis of the design and outline scope of ventilation works for the various parts of the proposed development.

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.

Table 1.3 Minimum whole dwelling ventilation rates determined by the number of bedrooms

Number of bedrooms[1][2]	Minimum ventilation rate by number of bedrooms (l/s)
1	19
2	25
3	31
4	37
5	43

NOTES:

1. If the dwelling only has one habitable room, a minimum ventilation rate of 13l/s should be used.
2. For each additional bedroom, add 6l/s to the values in Table 1.3.

Extract from Approved Document Part F

4.2 Studio Ventilation

The living space ventilation systems will be designed to operate continuously at low speed air volumes created by energy efficient fans. This will allow the construction of a tightly sealed and correctly ventilated environment reducing thermal heat loss through reduced infiltration, whilst at the same time improving air quality and reducing the occurrence of moisture and mould.

To provide minimum fresh air rates to the living spaces, each habitable space will be provided with a whole dwelling mechanical ventilation heat recovery (MVHR) system. This system comprises of a continuous mechanical supply and extract ventilation unit located in a suitable position based on the space design.

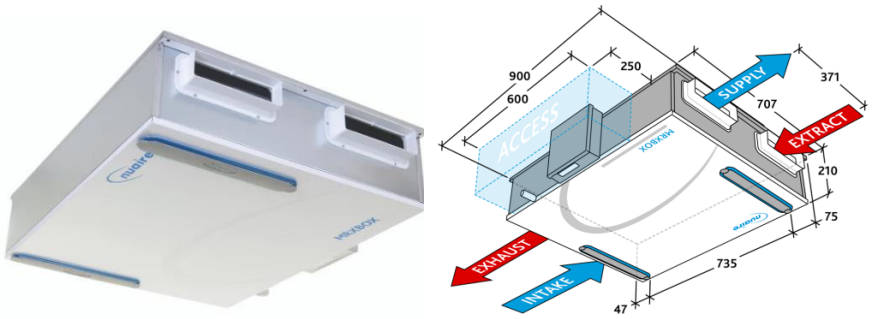


Image of typical ceiling mounted MVHR unit

The units will be provided with a high level of heat recovery efficiency for example an integrated counterflow heat recovery cell designed to aid part L compliance of the Building Regulations as detailed within the energy statement associated with this planning application.

The air volumes will be determined to satisfy the requirements of the Approved Document Part F of the Building Regulations (see abstract from Approved Document Part F).

Each unit will intake fresh air and discharge exhaust air through the façade. The intake and exhaust louvres will be located a suitable distance apart to prevent cross contamination.

An intake supply filter inside the unit will be provided to remove incoming particulate and pollen matter.

The ventilation unit will remove air from the bathrooms and kitchens and provide air to the habitable rooms; in this case the combined living and bedroom space. This will be via a rigid flat ductwork system with supply and extract air grilles located in the ceilings.

These systems shall operate day to day automatically and be controlled to vary ventilation rates via EC/DC motors' as they receive signals from one of the interconnected sensors and controllers such as a humidity sensor. When a signal is received the fans shall vary their speed proportionally or on a trickle and boost principle. The units may also be provided with manual control by means of switch control serving kitchens and ensuites.

Ventilation extract boost will be operated by a switch located in the kitchen. The MVHR will also incorporate summer bypass.

The units shall have the facility to commission the supply and extract fans individually via inbuilt minimum and maximum speed adjustments, or alternative wired remote-control unit. The fans themselves shall have independent, infinitely variable speed control.

The ventilation systems will be designed in rooms to meet the noise levels stated within available Acoustic design specifications. These figures will apply for all supply and extract systems.

Louvres on the façade shall be required for connecting the MVHR ventilation ductwork intake and discharge points to outside.

Attenuators will be installed to reduce external noise intrusion, where required according to the acoustic design specifications.

Cooker hoods will be provided extracting directly to outside, to most effectively remove contaminants and odour from cooking. The cooker hoods will be retrofitted with more efficient

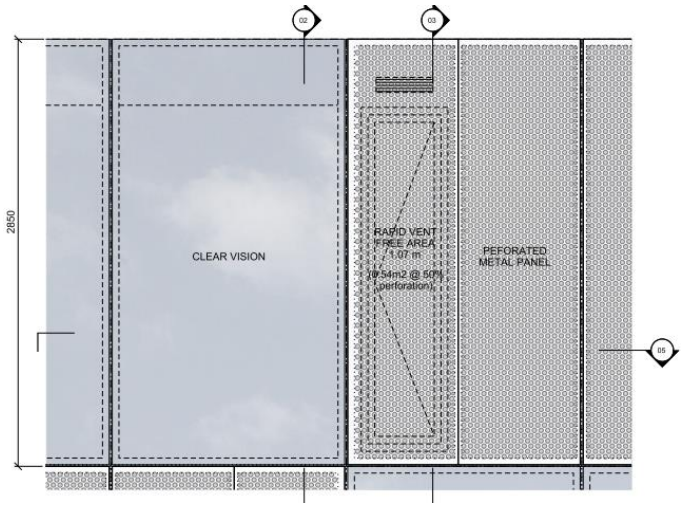
and quieter inline fans, so that they can also be used to combat overheating heating and meet the acoustic design specifications during the nighttime.

The MVHR units will be fitted with G3 filters as standard. During occupation the tenants have the option to replace these filters in line with the MVHR installation and user guide replacement with G3 filters or enhanced filtration of M5 or F7. Heat Recovery units require regular maintenance. The unit shall be designed to facilitate access to facilitate enable maintenance to be carried out easily. The MVHR unit shall display a warning symbol, code, light or similar to confirm cleaning or replacement filters is overdue.

Part F Purge Ventilation & Part O Overheating

Purge ventilation, giving the occupant final control over their environment, will be provided by free area natural ventilation openings in the building façade. These openings shall only be used for purge and overheating comfort, with day-to-day ventilation being provided by the mechanical MVHR systems.

Purge Ventilation shall be provided to each studio via rapid/purge panel vents installed in the façade. These openings are to be provided alongside an MVHR summer/purge boost mode (as required) which shall be operated locally via a manual switch within each apartment.



Typical Purge Ventilation Panel Detail

It should be noted that the purge panels are purely for user comfort and shall satisfy the building regulations compliance for purge ventilation for odour control and to offset summertime overheating.

Effective ventilation area openings shall be in line with the minimum requirements set out in Approved Document Part F of the Building Regulations including Appendix B.

4.3 Amenity Spaces

Local Heat Recovery units shall be provided to supply tempered fresh air to each of these spaces. The units shall be located locally within the ceiling voids of the area served discharging to atmosphere via local louvres within the facade. The units shall be of the heat recovery type as per Mitsubishi Lossnay units or equal and approved. The units shall generally comprise of the following sections: -

- Return air fan

- Air intake louvre
- Motorised shut off damper
- Fresh air filter (F7 Grade Filter)
- Extract filter (M5 Grade Filter)
- Counter flow heat exchanger (providing heat recovery)
- Supply fan
- Local controllers provided in each area

The systems shall be controlled to supply a variable air volume in line with occupancy of each area, controlled with CO_2 sensors. This will meet minimum fresh air requirements and be provided with manufacturer's controls package to ensure fresh air rates and temperatures are maintained at comfortable levels and allow connection to the central building management system.

The spaces shall be ventilated to provide 12l/s per person.

Heat recovery units shall be mounted within the ceiling void and these will be routed via rigid ductwork to supply and extract grilles located in the ceiling.

Intake and exhaust ductwork will be insulated to prevent condensation.

Louvres on the façade shall be required for connecting the ventilation ductwork intake and discharge points to outside.

Attenuators will be installed to reduce external noise intrusion where required.

4.3.1 Entrance and Reception

The entrance and reception areas will be provided with a dedicated ventilation system. Outside air will be provided at 12 l/s per person as per the CIBSE guide recommendation. These areas will be served by filtered heat recovery supply and extract units located within ceiling voids of each space.

Outdoor air intake and exhaust louvres will be formed at high level in the ground floor façade. These shall be separate at a distance from each other to minimise recirculation of intake and exhaust air flows.

4.3.2 General Occupied Amenity Areas

These areas will be provided with a dedicated ventilation system. Outside air will be provided at 12 l/s per person as per the CIBSE guide recommendation. These areas will be served by filtered heat recovery supply and extract units located within ceiling voids of each space.

Outdoor air intake and exhaust louvres will be formed at high level in the façade. These shall be separate at a distance from each other to minimise recirculation of intake and exhaust air flows.

4.3.3 Toilets, Cleaners Store Ventilation

Toilet and cleaner's stores will be ventilated by means of mechanical extract systems with the fan units located locally to the space they are serving. Make up air shall be provided naturally via one of the following methods: undercut doors, door transfer grilles, transfer ducts or make-up air drawn directly from outside via a louvred façade. Subject to the extent of air volumes required.

The local WC extract fans shall be complete with the following.

- Time clock controller
- Electronic fan speed controller
- Fan auto changeover facility
- Duty/share facility which changes the lead fan every 12 hours
- AV mounts
- Back draught shutters
- Ductwork distribution system rising vertically through the building

4.3.4 Mechanical and Electrical Plantrooms

All plant rooms shall be provided with ventilation as appropriate to their use, which will be generally natural ventilated via louvred openings to achieve a minimum of 2 ACH.

4.3.5 Refuse Stores

All proposed refuse areas are to be provided with appropriate dedicated extract ventilation. Refuse store extract ventilation shall be provided via an extract fan and ducting system that shall exhaust foul air to atmosphere at ground floor level, away from public spaces and air intakes.

A refuse holding area and refuse store is located at the Ground Level. This will use mechanical extract ventilation which will be provided in line with current industry standard practice levels as set out in BS 5906:2005 - Waste management in buildings - Code of practice. A localised extract air fan will be located at high level (soffit mounted), within each refuse store, to provide 12 ACH of mechanical extract ventilation.

This is in accordance with ASHRAE, Ventilation for Acceptable Indoor Air Quality, 62.1-2004, TABLE 6-4 Minimum Exhaust Rates. This extract ventilation will be ducted to the louvred façade. Supply air make-up will be drawn from the adjacent areas and via infiltration through intake louvres along the elevation to external.

The refuse store extract fan will be fire rated, along with the ductwork connecting it to the façade.

4.4 Smoke Ventilation System

A smoke clearance system shall be installed that shall operate automatically in the event of a fire within the residential sections of the development.

The contractor shall provide an automatic opening vent (AOV) at the head of each of the stair cores. This shall open automatically at the dictates of the fire control panel to provide make up air for the smoke clearance system. Air shall be transferred to the protected evacuation lift lobby through the door opening onto the affected floor from the stair core.

A grille complete with fire damper (Lobby Ventilator) located at high level within the protected evacuation lift lobby shall open automatically at the dictates of the fire control panel to allow the passage of smoke from the affected lobby, into the mechanical smoke shaft formed within the core area. A dedicated corridor smoke detector located at each level shall be used to actuate the fire damper at the affected floor.

Residential corridors shall also be protected by a smoke ventilation system, with mechanical extract shafts at one end of the corridor and associated natural inlet shafts at the other end.

Smoke fans at roof level, controlled automatically by the fire control panel, once energised shall extract smoke from the building through the automatic opening vents. The fans shall be run in duty / standby mode to ensure operation in the event of a fan failure.

The system shall be designed to operate on only one level at a time, on first activation.

All plant items associated with the system shall also be fed by the Generator to ensure operation when the electricity supply is interrupted.

The control panel for each system shall be located at the foot of the stair core adjacent to the fire personnel entry point.

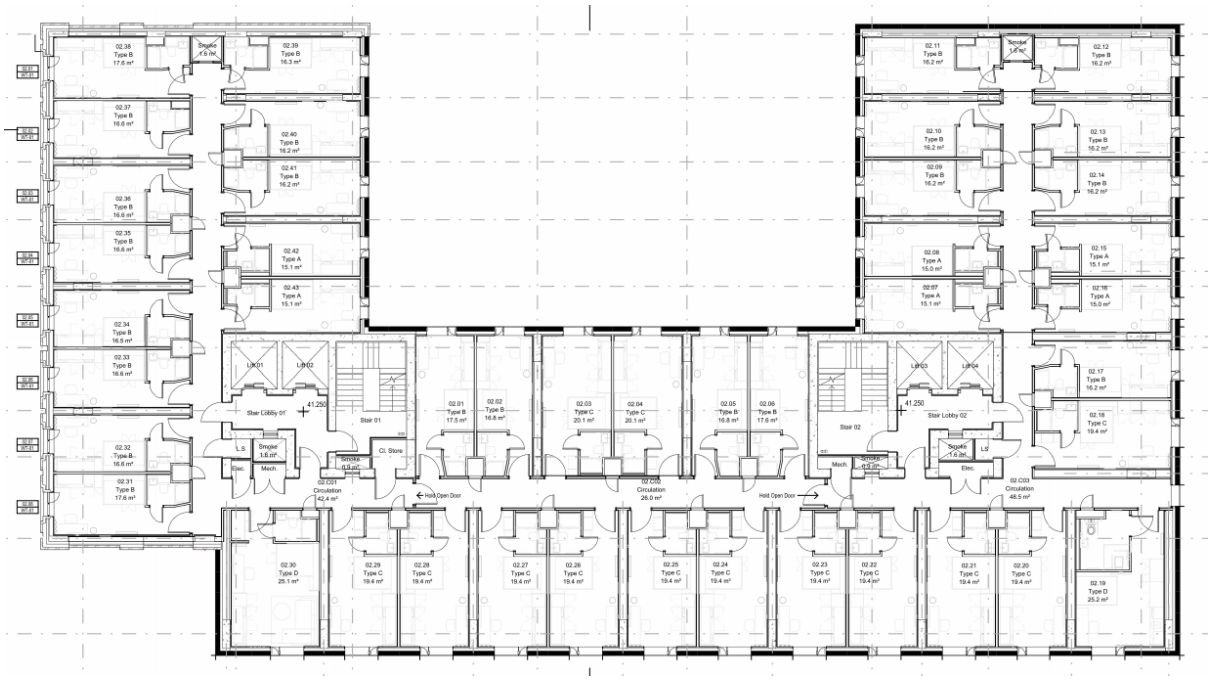
The corridor smoke extract systems shall also operate as day-to-day environmental ventilation, to prevent overheating in the corridor, based on temperature sensors at each level.

5 TM59 Overheating Assessment

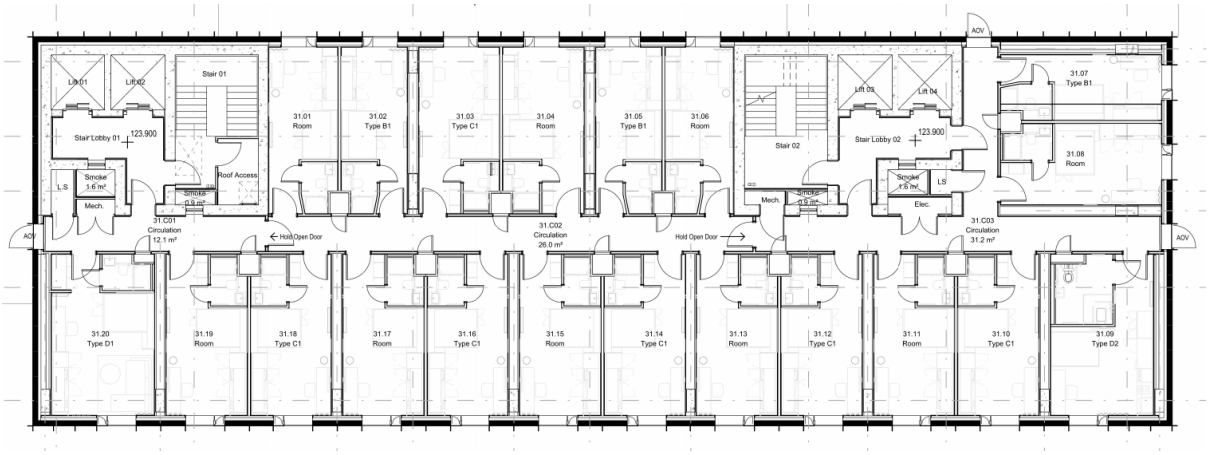
5.1 Introduction

A thermal model exercise has been undertaken to predict the internal temperatures over a typical year. The development comprises 32 storeys and a total of 861 student studios. At this stage the key areas of the development were modelled to represent the various room types, window types and orientations within the building. Drawings below show the levels that have been assessed.

Assessing overheating risk in residential developments is a complex issue. Therefore, CIBSE TM59 is utilised to conduct a dynamic analysis of the residential apartments to assess overheating. This assessment aims to identify whether the proposals meet the requirements of CIBSE TM59 and Part O, including the requirements of the Acoustics, Ventilation and Overheating (AVO) Guide.



Typical Levels 2 to 11



Typical Levels 12 to 31

5.2 Assessment Methodology and Criteria

5.2.1 Part O Building Regulations 2021

The aim of requirement O1 is to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures.

In the Secretary of State's view, requirement O1 is met by designing and constructing the building to achieve both of the following:

- Limiting unwanted solar gains in summer.
- Providing an adequate means of removing excess heat from the indoor environment.

The guidance and regulations are written for the purposes of protecting health and welfare. Following this guidance does not guarantee the comfort of building occupants.

In the Secretary of State's view, compliance with requirement O1 can be demonstrated by using one of the following methods.

a. The simplified method for limiting solar gains and providing a means of removing excess heat.
b. The dynamic thermal modelling method, in line with the TM59 methodology, but incorporating additional elements from the guide O 2021.

These additional elements include a specific window opening formula, no blinds to be incorporated, any GF or easily accessible rooms to have daytime ventilation only via window/door openings.

This project will use the dynamic thermal modelling method of compliance.

5.2.2 TM59 Methodology

The TM59 methodology is a standardised approach to predicting overheating risk for residential building designs using dynamic thermal analysis. The aim is to produce a test that encourages good design that is comfortable within sensible limits, without being so stringent that it over promotes the use of mechanical cooling.

CIBSE TM59 also sets out profiles that represent reasonable usage patterns for a home suitable for evaluating overheating risk. The profiles are developed to test a design and do not cover all usage models.

The Methodology is intended for use by designers in order to influence building design for the better. It could be used at planning stage to assess risk, as well as at later design stages.

This methodology will:

- Allow different designs to be compared based on reasonable assumptions.
- Support design decisions that improve comfort without cooling
- Provide consistency across the industry for overheating risk prediction.

This methodology will not:

- Guarantee that people will always be comfortable in compliant spaces, however they act.
- Take into account unusual use.

The Basis of the design comfort criteria for CIBSE TM59 is:

- CIBSE TM52: Limits of thermal comfort: avoiding overheating – Provides the principles of thermal comfort.
- CIBSE Guide A: Environmental design – Includes advice regarding sleep quality.

The methodology is prescriptive so as to be consistently applied. It uses thermal modelling tools, defined internal gains profiles and specific weather files with a clearly defined thresholds to provide a clear pass/ fail result.

It is vital that the mitigation options selected as a result of the assessment are fully incorporated into the design or the assessment will have no value.

5.2.3 TM59 Criteria – Homes

CIBSE TM59 sets out two different overheating criteria for different design strategies. The two strategies are:

- Buildings that are predominantly naturally ventilated
- Buildings that are predominantly mechanically ventilated

For homes that are predominantly naturally ventilated:

For homes that are predominantly naturally ventilated, two criteria apply. These are:

1. **Living Rooms, Kitchens and Bedrooms – Hours of exceedance**

   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% of occupied hours. ΔT is defined as operative temperature less the maximum acceptable temperature. ΔT is rounded to the nearest whole degree (CIBSE TM52, criteria 1).

   This has been determined as being 110.2 hours a year or less for Bedrooms and 59.6=7 hours or less for Living/Kitchen areas.

2. **Bedrooms Only – Sleeping Conditions**

   During the sleeping hours the operative temperature in the bedroom from 11pm to 8am shall not exceed 26°C for more than 1% of annual hours. This has been determined as being 32 hours a year.

For homes that are predominantly mechanically ventilated:

1. For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26°c for more than 3% of the annual occupied annual hours (CIBSE Guide A (2015a)).

The TM59 criteria set out above provides a basis for assessing the risk of perceived overheating. The criteria above and results contained within this report are estimates of the temperatures that may be experienced in a typical year based on the CIBSE DSY1 (Design Summer Year), weather file for the 2020's, high emissions, 50% percentile scenarios.

5.3 Model Settings

5.3.1 Software

The model was created using IES VE 2023 software. The 'Suncast' solar shading shading software has been used to model the sun path and solar shading effect for the proposed building.

5.3.2 Drawings

The model is based on the following drawings by Tim Groom Architects:

- 1207-TGA-XX-00-DR-A-03100 – GA Plan – Level 00
- 1207-TGA-XX-01-DR-A-03101 – GA Plan – Level 01
- 1207-TGA-XX-02-DR-A-03102 – GA Plan – Level 02
- 1207-TGA-XX-12-DR-A-03114 – GA Plan – Level 12
- 1207-TGA-XX-13-DR-A-03115 – GA Plan – Level 13
- 1207-TGA-XX-32-DR-A-03124 – GA Plan – Level 32
- 1207-TGA-XX-ZZ-DR-A-05000 – General Arrangement – South Elevation
- 1207-TGA-XX-ZZ-DR-A-05001 – General Arrangement – West Elevations
- 1207-TGA-XX-ZZ-DR-A-05002 – General Arrangement – North Elevation
- 1207-TGA-XX-ZZ-DR-A-05003 – General Arrangement – East Elevations
- 1207-TGA-XX-ZZ-DR-A-04000 – General Arrangement – Section AA
- 1207-TGA-XX-ZZ-DR-A-04001 – General Arrangement – Section BB

5.3.3 Weather file and weather file characteristics

The Manchester DSY1 2020High50 (Design Summer Year) weather file was used as directed by TM59 methodology, as it is the closest DSY weather file to the site.

5.4 Ventilation

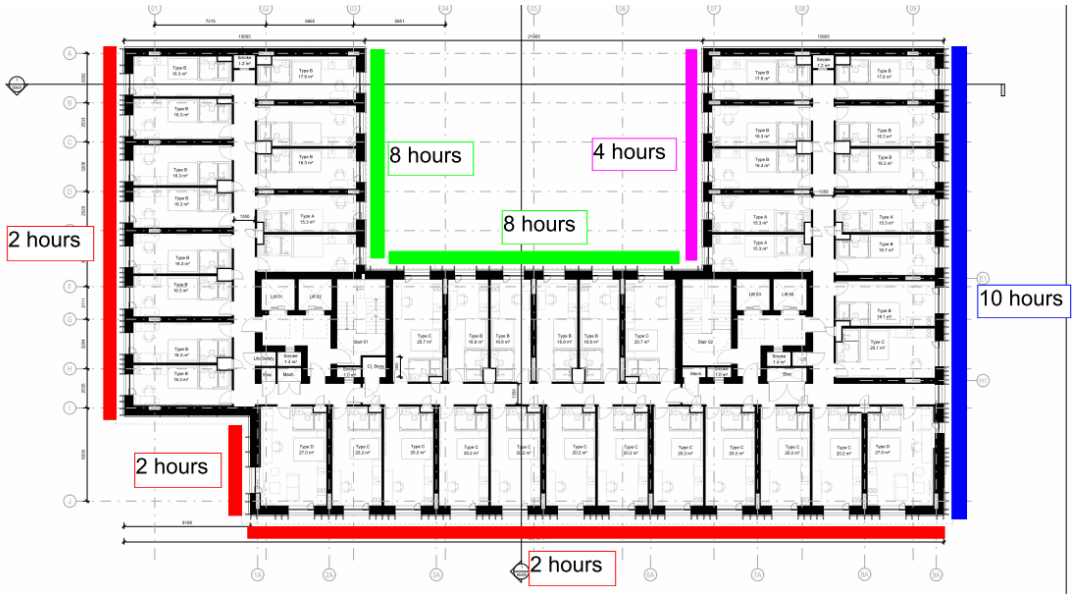
5.4.1 Natural Ventilation

All apartments have access to natural ventilation as windows have opening restrictions due to acoustic reasons. An infiltration rate of 0.1 ach/hr has been applied to all areas as based on a targeted air permeability of 2.5 m3/m2/hr@50Pa based on CIBSE guide A table 4.16.

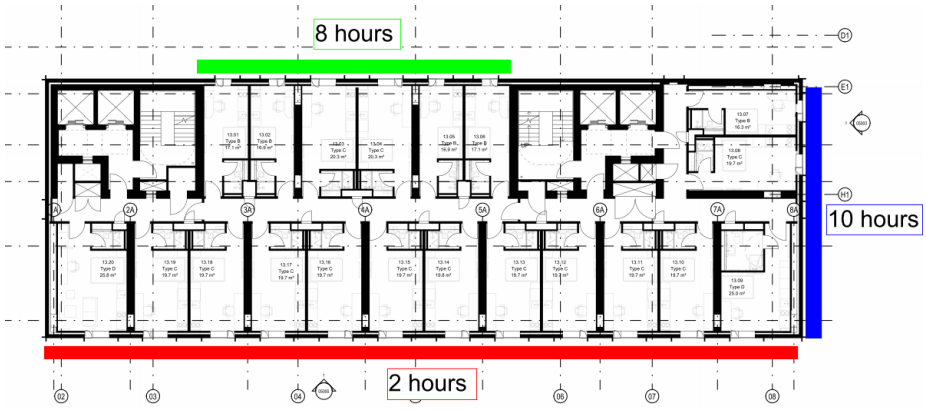
Window opening is manual and has the following restrictions:

- Part O compliance, window openings are restricted to during the daytime hours of 0700 to 2300 hours each day.

- AVO compliance, window openings are restricted to a certain number of hours during the daytime, which differs for each façade, as per the mark ups below.



Typical Level 2 to 11



Typical Level 12 to 31

5.4.2 Auxiliary Ventilation

The studios are ventilated with MVHR's, which supply and extract air, along with recovering heat from the extract air. The ventilation rates have been applied as per Part F 2021 in terms of trickle and standard boost rates.

In addition to the boosted air flow rate from the MVHR, due to limited openings for windows as per the acoustic report, additional ventilation is required in the form of an extra purge fan. This will utilise the cooker hood as an extract position, so will double up as overheating ventilation and cooker hood extract. This will be suitably acoustically rated to be able to be utilised during the day and nighttime, with the added benefit of operating as a much quieter cooker hood.

Boosted ventilation rates have then been applied to the overheating simulations to go beyond the standard Part F rates and are based on a boosted rates referenced below.

- Part F trickle rate – 13 l/s

- Part F boost rate – 21 l/s
- Cooker hood overheating air volume – 30 l/s
- Total overheating boost rate – 51 l/s

The overheating boost rate of 51 l/s has been modelled to activate when internal temperature is above 22°C during the daytime. At nighttime, it will activate when temperature is above 25°C at 11pm and will remain active for 4 hours, to simulate a run on timer, and then will revert back to trickle at 3am.

5.4.3 Internal Gains TM59

The internal gains and profiles that have been used for the internal temperature analysis model have been taken from CIBSE TM59 and are listed in appendix B.

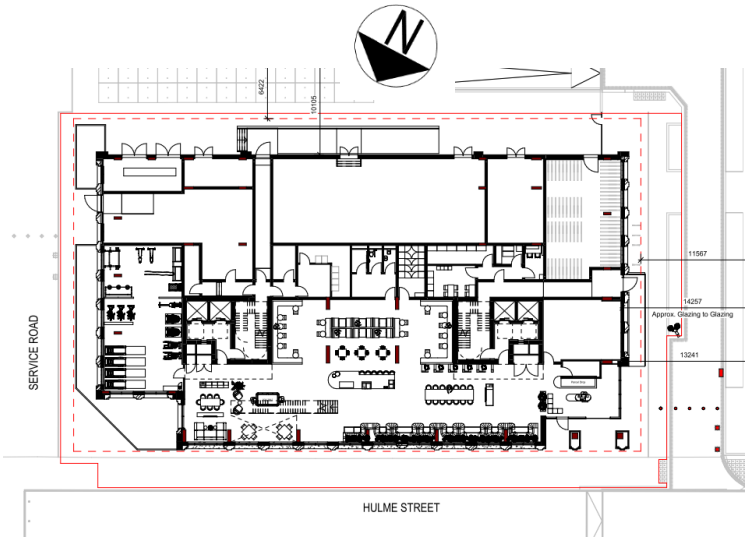
5.4.4 Building Fabric Specification

The building specification used in the model is as follows:
G values - 0.55

Blinds/curtains have been added for the AVO assessment, with a shading coefficient of 0.6.

Construction Element	Part L Specification	Development Specification	Improvement over Part L Building Regulations
Floor	0.18 W/m^{2}K	0.1 W/m^{2}K	**44%**
External Wall	0.26 W/m^{2}K	0.16 W/m^{2}K 0.14 W/m^{2}K	**38%** **46%**
Curtain Walling	1.6 W/m^{2}K	0.58 W/m^{2}K	**64%**
Roof	0.16 W/m^{2}K	0.1 W/m^{2}K	**38%**
Glazing U Value	1.6 W/m^{2}K	0.89 W/m^{2}K	**44%**
Air Permeability	8 m^3/h/m^2	2.5 m^3/h/m^2	**69%**

5.4.5 Building Orientation



5.5 Results

5.5.1 Summary of Part O Overheating Assessment Results – No blinds

COLOUR KEY	LOW RISK	MED RISK	HIGH RISK	OVERHEATING
Criteria 1	< 2.4 %	2.4 - 2.7 %	2.7 - 3.0 %	> 3.0 %
Criteria 2	< 25 hrs	25 - 27 hrs	28 - 32 hrs	> 32 hrs

The results for the final overheating simulation can be seen in the table below.

The results from the final overheating simulation showed that all of the assessed bedrooms and Kitchen/Living/Dining Areas comply with the TM59 overheating criteria.

None of the assessed living/Kitchen/bedroom areas failed criterion 1, whereby the ΔT (T_{max}-$T_{operative}$) is ≥1K for more than 3% of Occupied Summer Hours. None of the assessed bedrooms failed criterion 2, whereby the $T_{operative}$ exceeds 26ºC for more than 1% of the sleeping hours (11pm till 7am).

Room Name	Criteria 1	Criteria 2	Compliance
10_Bedroom_38	2	22	Pass
10_Bedroom_37	2.4	22	Pass
10_Bedroom_36	2.5	22	Pass
10_Bedroom_35	2.5	22	Pass
10_Bedroom_34	2.5	22	Pass
10_Bedroom_33	2.5	23	Pass
10_Bedroom_32	2.8	21	Pass
10_Bedroom_31	2	23	Pass
10_Bedroom_39	0	0	Pass
10_Bedroom_42	0.1	0	Pass
10_Bedroom_43	0	0	Pass
10_Bedroom_02	0.1	0	Pass
10_Bedroom_01	0	0	Pass
10_Bedroom_03	0.1	0	Pass
10_Bedroom_04	0.1	0	Pass
10_Bedroom_05	0.1	0	Pass
10_Bedroom_06	0.1	0	Pass
10_Bedroom_11	0.5	0	Pass
10_Bedroom_10	0.5	0	Pass
10_Bedroom_09	0.5	0	Pass

10_Bedroom_08	0.5	0	Pass
10_Bedroom_07	0.4	0	Pass
10_Bedroom_12	0.1	0	Pass
10_Bedroom_13	0.1	0	Pass
10_Bedroom_14	0.1	0	Pass
10_Bedroom_15	0.1	0	Pass
10_Bedroom_16	0.1	0	Pass
10_Bedroom_17	0.1	0	Pass
10_Bedroom_18	0	0	Pass
10_Bedroom_30	0.1	0	Pass
10_Bedroom_19	0	0	Pass
10_Bedroom_20	0.1	0	Pass
10_Bedroom_21	0.1	0	Pass
10_Bedroom_22	0.1	0	Pass
10_Bedroom_23	0.1	0	Pass
10_Bedroom_24	0.1	0	Pass
10_Bedroom_25	0.1	0	Pass
10_Bedroom_26	0.1	0	Pass
10_Bedroom_27	0.1	0	Pass
10_Bedroom_28	0.1	0	Pass
10_Bedroom_29	0.2	0	Pass
10_Bedroom_40	0.1	0	Pass
10_Bedroom_41	0.1	0	Pass
11_Bedroom_38	1.7	22	Pass
11_Bedroom_37	2.1	20	Pass
11_Bedroom_36	2.2	18	Pass
11_Bedroom_35	2.2	20	Pass
11_Bedroom_34	2.3	18	Pass
11_Bedroom_33	2.1	20	Pass
11_Bedroom_32	2.2	18	Pass
11_Bedroom_31	1.9	22	Pass
11_Bedroom_39	0	0	Pass

11_Bedroom_42	0.1	0	Pass
11_Bedroom_43	0	0	Pass
11_Bedroom_02	0.1	0	Pass
11_Bedroom_01	0.1	0	Pass
11_Bedroom_03	0.2	0	Pass
11_Bedroom_04	0.2	0	Pass
11_Bedroom_05	0.2	0	Pass
11_Bedroom_06	0.1	0	Pass
11_Bedroom_11	0.3	0	Pass
11_Bedroom_10	0.4	0	Pass
11_Bedroom_09	0.5	0	Pass
11_Bedroom_08	0.5	0	Pass
11_Bedroom_07	0.4	0	Pass
11_Bedroom_12	0.1	0	Pass
11_Bedroom_13	0.1	0	Pass
11_Bedroom_14	0.1	0	Pass
11_Bedroom_15	0.1	0	Pass
11_Bedroom_16	0.1	0	Pass
11_Bedroom_17	0.1	0	Pass
11_Bedroom_18	0.1	0	Pass
11_Bedroom_30	0.1	0	Pass
11_Bedroom_19	0	0	Pass
11_Bedroom_20	0.1	0	Pass
11_Bedroom_21	0.1	0	Pass
11_Bedroom_22	0.1	0	Pass
11_Bedroom_23	0.1	0	Pass
11_Bedroom_24	0.1	0	Pass
11_Bedroom_25	0.1	0	Pass
11_Bedroom_26	0.1	0	Pass
11_Bedroom_27	0.1	0	Pass
11_Bedroom_28	0.1	0	Pass
11_Bedroom_29	0.2	0	Pass

11_Bedroom_40	0.1	0	Pass
11_Bedroom_41	0.1	0	Pass
30_Bedroom_01	0.1	0	Pass
30_Bedroom_02	0.2	0	Pass
30_Bedroom_03	0.2	0	Pass
30_Bedroom_04	0.2	0	Pass
30_Bedroom_05	0.2	0	Pass
30_Bedroom_06	0.1	0	Pass
30_Bedroom_07	0.1	0	Pass
30_Bedroom_08	0	0	Pass
30_Bedroom_09	0	0	Pass
30_Bedroom_20	0.1	0	Pass
30_Bedroom_19	0.1	0	Pass
30_Bedroom_18	0.1	0	Pass
30_Bedroom_17	0.1	0	Pass
30_Bedroom_16	0.1	0	Pass
30_Bedroom_15	0.1	0	Pass
30_Bedroom_14	0.1	0	Pass
30_Bedroom_13	0.1	0	Pass
30_Bedroom_12	0.1	0	Pass
30_Bedroom_11	0.1	0	Pass
30_Bedroom_10	0.1	0	Pass
31_Bedroom_01	0.1	0	Pass
31_Bedroom_02	0.1	0	Pass
31_Bedroom_03	0.2	0	Pass
31_Bedroom_04	0.2	0	Pass
31_Bedroom_05	0.1	0	Pass
31_Bedroom_06	0.1	0	Pass
31_Bedroom_07	0.1	0	Pass
31_Bedroom_08	0	0	Pass
31_Bedroom_09	0	0	Pass
31_Bedroom_20	0.1	0	Pass

31_Bedroom_19	0.1	0	Pass
31_Bedroom_18	0.1	0	Pass
31_Bedroom_17	0.1	0	Pass
31_Bedroom_16	0.1	0	Pass
31_Bedroom_15	0.1	0	Pass
31_Bedroom_14	0.1	0	Pass
31_Bedroom_13	0.1	0	Pass
31_Bedroom_12	0.1	0	Pass
31_Bedroom_11	0.1	0	Pass
31_Bedroom_10	0.1	0	Pass

5.5.2 Summary of AVO Overheating Assessment Results – blinds applied

For AVO compliance, we have applied blinds to the analysis. This approach has been successfully adopted on other high rise residential projects in Manchester.

All apartments were tested using the using the Part O modelling inputs detailed above, and with blinds applied only to fixed windows.

All of the rooms on the typical floors comply with the overheating criteria when purge panels are only open according to the AVO restrictions and blinds are closed – applied as per the mark ups earlier in this report.

Room Name	**Criteria 1**	**Criteria 2**	**Compliance**
10_Bedroom_38	17	17	Pass
10_Bedroom_37	16	16	Pass
10_Bedroom_36	16	16	Pass
10_Bedroom_35	16	16	Pass
10_Bedroom_34	16	16	Pass
10_Bedroom_33	16	16	Pass
10_Bedroom_32	16	16	Pass
10_Bedroom_31	18	18	Pass
10_Bedroom_39	0	0	Pass
10_Bedroom_42	0	0	Pass
10_Bedroom_43	0	0	Pass
10_Bedroom_02	0	0	Pass
10_Bedroom_01	0	0	Pass
10_Bedroom_03	0	0	Pass

10_Bedroom_04	0	0	Pass
10_Bedroom_05	0	0	Pass
10_Bedroom_06	0	0	Pass
10_Bedroom_11	0	0	Pass
10_Bedroom_10	0	0	Pass
10_Bedroom_09	0	0	Pass
10_Bedroom_08	0	0	Pass
10_Bedroom_07	0	0	Pass
10_Bedroom_12	0	0	Pass
10_Bedroom_13	0	0	Pass
10_Bedroom_14	0	0	Pass
10_Bedroom_15	0	0	Pass
10_Bedroom_16	0	0	Pass
10_Bedroom_17	0	0	Pass
10_Bedroom_18	0	0	Pass
10_Bedroom_30	3	3	Pass
10_Bedroom_19	0	0	Pass
10_Bedroom_20	0	0	Pass
10_Bedroom_21	0	0	Pass
10_Bedroom_22	0	0	Pass
10_Bedroom_23	1	1	Pass
10_Bedroom_24	2	2	Pass
10_Bedroom_25	2	2	Pass
10_Bedroom_26	1	1	Pass
10_Bedroom_27	2	2	Pass
10_Bedroom_28	2	2	Pass
10_Bedroom_29	4	4	Pass
10_Bedroom_40	0	0	Pass
10_Bedroom_41	0	0	Pass
11_Bedroom_38	13	13	Pass
11_Bedroom_37	14	14	Pass
11_Bedroom_36	14	14	Pass

11_Bedroom_35	14	14	Pass
11_Bedroom_34	14	14	Pass
11_Bedroom_33	14	14	Pass
11_Bedroom_32	13	13	Pass
11_Bedroom_31	15	15	Pass
11_Bedroom_39	0	0	Pass
11_Bedroom_42	0	0	Pass
11_Bedroom_43	0	0	Pass
11_Bedroom_02	0	0	Pass
11_Bedroom_01	0	0	Pass
11_Bedroom_03	0	0	Pass
11_Bedroom_04	0	0	Pass
11_Bedroom_05	0	0	Pass
11_Bedroom_06	0	0	Pass
11_Bedroom_11	0	0	Pass
11_Bedroom_10	0	0	Pass
11_Bedroom_09	0	0	Pass
11_Bedroom_08	0	0	Pass
11_Bedroom_07	0	0	Pass
11_Bedroom_12	0	0	Pass
11_Bedroom_13	0	0	Pass
11_Bedroom_14	0	0	Pass
11_Bedroom_15	0	0	Pass
11_Bedroom_16	0	0	Pass
11_Bedroom_17	0	0	Pass
11_Bedroom_18	0	0	Pass
11_Bedroom_30	3	3	Pass
11_Bedroom_19	0	0	Pass
11_Bedroom_20	0	0	Pass
11_Bedroom_21	0	0	Pass
11_Bedroom_22	0	0	Pass
11_Bedroom_23	1	1	Pass

11_Bedroom_24	1	1	Pass
11_Bedroom_25	1	1	Pass
11_Bedroom_26	1	1	Pass
11_Bedroom_27	2	2	Pass
11_Bedroom_28	2	2	Pass
11_Bedroom_29	4	4	Pass
11_Bedroom_40	0	0	Pass
11_Bedroom_41	0	0	Pass
30_Bedroom_01	0	0	Pass
30_Bedroom_02	0	0	Pass
30_Bedroom_03	0	0	Pass
30_Bedroom_04	0	0	Pass
30_Bedroom_05	0	0	Pass
30_Bedroom_06	0	0	Pass
30_Bedroom_07	0	0	Pass
30_Bedroom_08	0	0	Pass
30_Bedroom_09	0	0	Pass
30_Bedroom_20	4	4	Pass
30_Bedroom_19	3	3	Pass
30_Bedroom_18	1	1	Pass
30_Bedroom_17	1	1	Pass
30_Bedroom_16	1	1	Pass
30_Bedroom_15	0	0	Pass
30_Bedroom_14	1	1	Pass
30_Bedroom_13	0	0	Pass
30_Bedroom_12	0	0	Pass
30_Bedroom_11	0	0	Pass
30_Bedroom_10	0	0	Pass
31_Bedroom_01	0	0	Pass
31_Bedroom_02	0	0	Pass
31_Bedroom_03	0	0	Pass
31_Bedroom_04	0	0	Pass

31_Bedroom_05	0	0	Pass
31_Bedroom_06	0	0	Pass
31_Bedroom_07	0	0	Pass
31_Bedroom_08	0	0	Pass
31_Bedroom_09	0	0	Pass
31_Bedroom_20	1	1	Pass
31_Bedroom_19	0	0	Pass
31_Bedroom_18	0	0	Pass
31_Bedroom_17	0	0	Pass
31_Bedroom_16	0	0	Pass
31_Bedroom_15	0	0	Pass
31_Bedroom_14	0	0	Pass
31_Bedroom_13	0	0	Pass
31_Bedroom_12	0	0	Pass
31_Bedroom_11	0	0	Pass
31_Bedroom_10	0	0	Pass

6 Conclusion

The ventilation strategy improves on the fundamental principles of the Building Regulations and will make a contribution to reducing the annual CO_2 emissions of the proposed development.

The proposed development will incorporate energy reduction measures in the ventilation systems to reduce the carbon footprint of the site using heat recovery devices and energy efficient fan selections.

Waste heat will be recovered by the mechanical ventilation heat recovery (MVHR) systems. This type of ventilation will help to reduce heat demand and provide filtered air to the studios and amenity areas, thus promoting healthy living conditions for the occupants. All fans and motors shall be specified to incorporate accredited technology and appropriate controls.

This statement also demonstrates compliance with Building Regulations Part O, as well as the AVO Guide, with respect to reduced allowable window opening hours. Compliance is achieved while giving the room occupants full control over natural and mechanical ventilation to their space.

7 Appendix A – CIBSE TM59 Room Heat Gain Profiles

Extract from TM59: 2017 Section 6

Please note for student studios the occupancy has been reduced to 1 person per studio.

Table 2 Occupancy and equipment gain descriptions

Unit/ room type	Occupancy	Equipment load
Studio	2 people at 70% gains from 11 pm to 8 am 2 people at 100% gains from 8 am to 11 pm	Peak load of 450 W from 6 pm to 8 pm*. 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room/kitchen	1 person from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room	1 person at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
1-bedroom apartment: kitchen	1 person at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
2-bedroom apartment: living room/kitchen	2 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
2-bedroom apartment: living room	2 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
2-bedroom apartment: kitchen	2 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
3-bedroom apartment: living room/kitchen	3 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
3-bedroom apartment: living room	3 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
3-bedroom apartment: kitchen	3 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm base load of 50 W for the rest of the day
Double bedroom	2 people at 70% gains from 11 pm to 8 am 2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm 1 person at full gains in the bedroom from 9 am to 10 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during the sleeping hours
Single bedroom (too small to accommodate double bed)	1 person at 70% gains from 11 pm to 8 am 1 person at full gains from 8 am to 11 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during sleeping hours
Communal corridors	Assumed to be zero	Pipework heat loss only; see section 3.1 above

* All times in GMT

Figure 1 Heat gain profile

Number of people	Description	Peak load (W)		Period																							
		Sensible	Latent	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 occupancy	75	55	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 occupancy	150	110	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	1	0.7
2	Studio occupancy	150	110	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1-bed: living/kitchen occupancy	75	55	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-bed: living occupancy	75	55	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-bed: kitchen occupancy	75	55	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-bed: living/kitchen occupancy	150	110	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-bed: living occupancy	150	110	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-bed: kitchen occupancy	150	110	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-bed: living/kitchen occupancy	225	165	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-bed: living occupancy	225	165	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-bed: kitchen occupancy	225	165	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
	Single bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13
	Double bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13
	Studio equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living/kitchen equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living equipment	150		0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1	1	1	1	0.4	0.4
	Kitchen equipment	300		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	1	1	0.17	0.17	0.17	0.17
	Lighting profile	2 (W/m2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0

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Extract from TM59: 2017 Section 5.2

For the purposes of the assessment, lighting energy is assumed to be proportional to floor area, and lighting loads are measured in W/m². From 6 pm to 11 pm, 2 W/m² should be assumed as the default for an efficient new-build home. This assumes that good daylight levels are available (also noting that only May to September is assessed within CIBSE TM52).

For existing buildings, or specialist lighting designs, a calculated higher value should be used. For communal corridors, use 2 W/m²; this may be assumed as zero if passive infrared (PIR) sensors are present.