

FUTURESERV

Stocktons, Manchester – Building A

Summertime Internal Environment Report

CIBSE TM59 Overheating Analysis



Stocktons, Manchester – Building A

Summertime Internal Environmental Report

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1. Executive Summary

This report assesses the risk of overheating for the proposed Stocktons, Building A residential development. This report considers a typical residential block to assess the thermal performance of the proposed design.

CIBSE TM59 methodology has been utilised to assess the overheating risk of the apartments within the typical block. The current Manchester weather data set was considered with the possibility of considering future weather files at further stages. The assessment has been conducted following the criteria from the Building Regulations Part O 2021.

It is understood that certain facades are exposed to noise levels which may limit the use of natural ventilation during the evenings which will have an adverse effect on mitigating the risk of overheating. In consideration to this the opening of windows has been restricted to the period of 08:00 – 23:00.

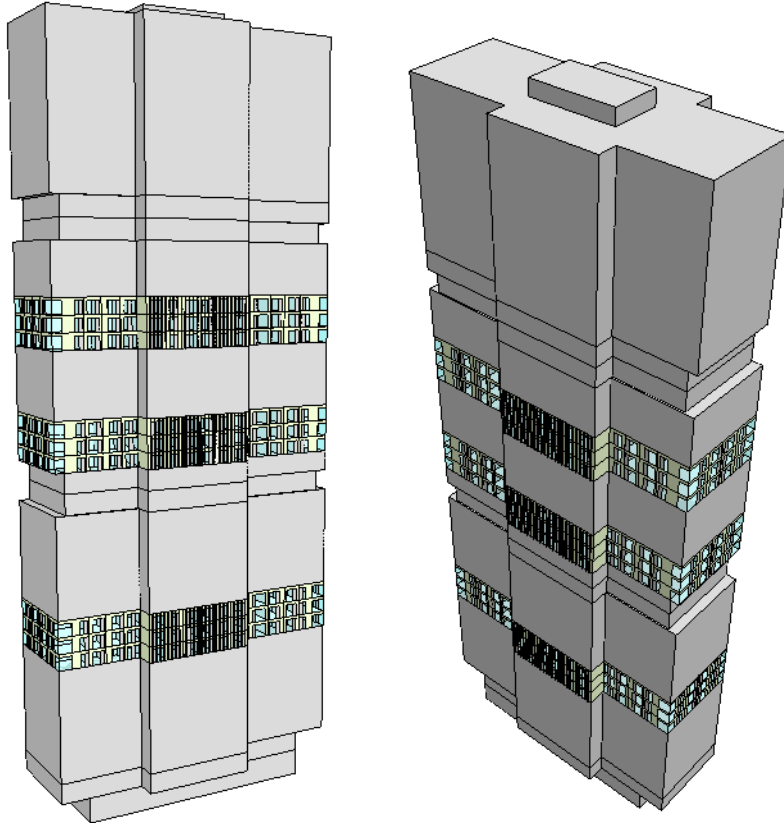
The glazing was modelled with a g value of 0.4 on South and West elevations, and 0.53 on North and East elevations. The opening free areas stated in this report are required for compliance with TM59 overheating only. A separate assessment of the required free area for purge ventilation, in line with Part F of the building regulations, will be required.

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

This report indicates that each of the considered apartments meet with the criterion as set out in the TM59 document.

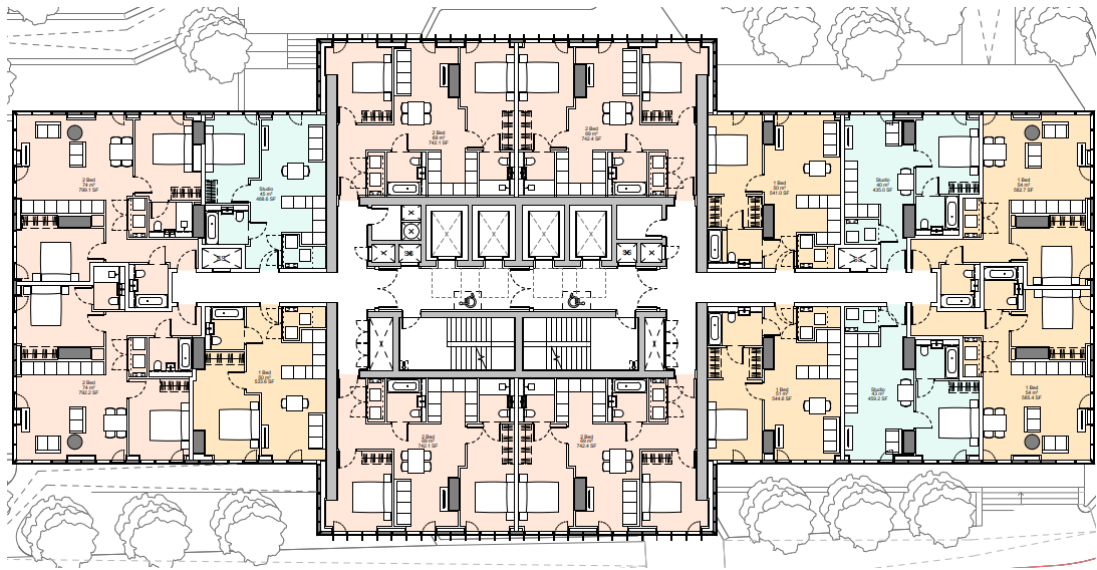
2. Introduction

A thermal modelling exercise has been undertaken to predict the internal temperatures over a typical year for the proposed residential development known as Stocktons, Manchester. The development comprises B2 to roof level 47 and a total of 558 apartments. At this stage the key areas of the development were modelled to represent the various room types, window types and orientations within the building.

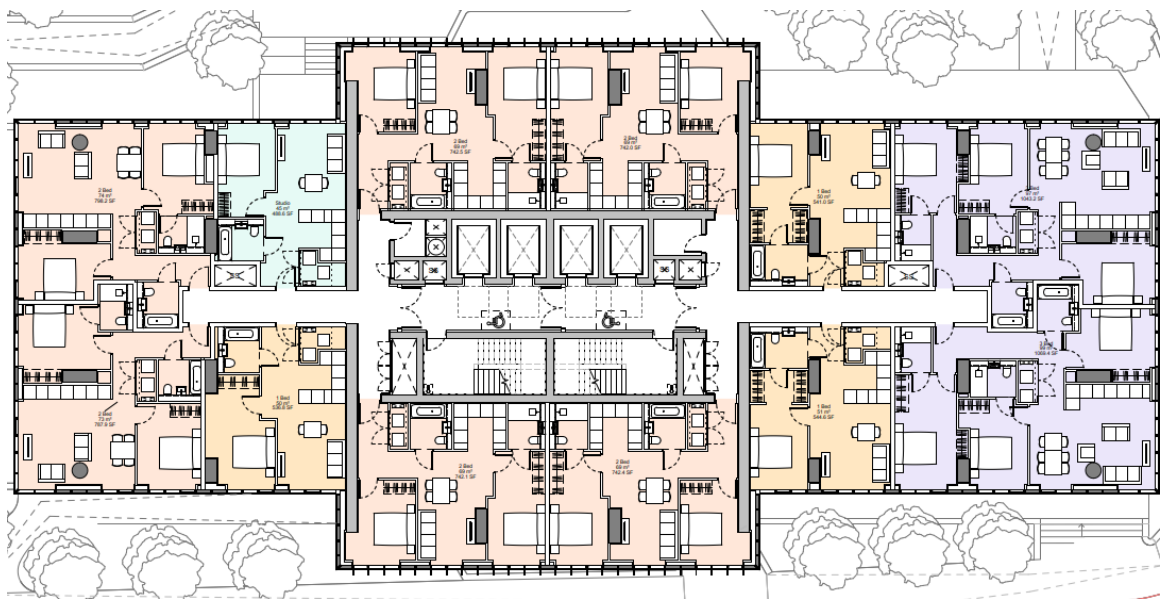


Assessing overheating risk in a residential development is a complex issue. Therefore, the methodology set out in CIBSE TM59 has been utilised to conduct a dynamic analysis of the residential apartments to assess for the risk of overheating. This assessment aims to identify if the proposals meet the requirements of CIBSE TM59 and Part O, including the requirements of acoustics.

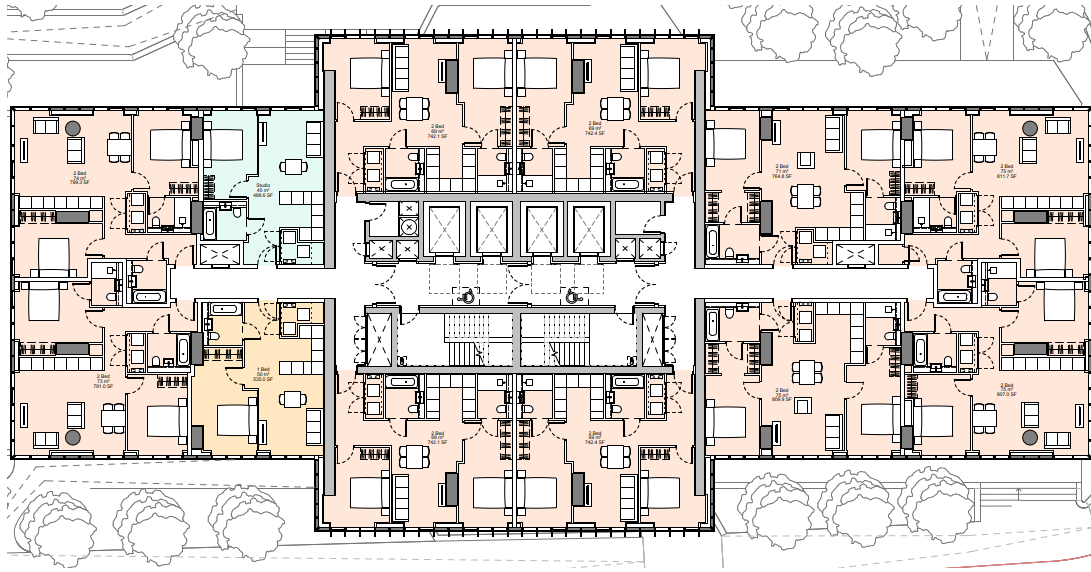
3. Floor Plans



Residential Typical Floor Type A (02-15th floors)



Residential Typical Floor Type B (16-17th & 20-22nd floors)



Residential Typical Floor Type C (23-31st & 35-44th floors)

4. Assessment Methodology and Criteria

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 during the summer months.
- 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 as detailed in section 3.0 of this report, no blinds to be incorporated, any ground floor or easily accessible room to have daytime ventilation only via window/door openings.

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

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 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 can 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.

TM 59 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.

This analysis will consider the building with the windows open. As such, the assessment will consider the building as being 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 ($^{\circ}\text{K}$) 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 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.

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.

Futureserv have created a banding category for risk of overheating, which helps to illustrate more clearly which rooms might be at a higher risk of overheating, despite potentially complying with the TM59 criteria. The banding values can be seen below.

COLOUR KEY	LOW RISK	MED RISK	HIGH RISK	OVERHEATING
Living Areas Criterion, A	<2.4%	2.4% - 2.7%	2.7% - 3.0%	>3.0%
Bedroom Areas Criterion A	<2.4%	2.4% - 2.7%	2.7% - 3.0%	>3.0%
Bedroom Areas Criterion B	<25 hrs	25-27 hrs	28-32 hrs	>32 hrs

5. Model Settings

5.1 Software

The model was created using IES VE 2025.2.0.0 software suite. The software is confirmed to be in-line with the requirements of CIBSE AM11: Building Performance Modelling (2015b) and is capable of full dynamic analysis. The 'SunCast' solar shading module has been used to model the sun path and shading for the proposed building. The 'Macroflo' module has been used to simulate the natural ventilation openings using a selection of appropriate control profiles.

5.2 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.

5.3 Ventilation

5.3.1 Natural ventilation

Each of the bedrooms and living spaces have access to natural ventilation via openable panels. Measurements for both the fixed glazing and purge panels have been taken from the structural openings.

The free areas have been provided by SimpsonHaugh. Any reduction in the free areas provided may affect compliance with the overheating criteria.

Opening Element	Height	Width	Free Area (m ²)
Opening Panel - Block A N/S	2.38	0.75	0.7
Opening Panel - Block A E/W	2.38	0.82	0.7

The Architect is responsible for ensuring that the window opening areas are sufficiently sized to achieve the building regulations Part F requirements for purge ventilation. An infiltration rate of 0.1 ach/hr has been applied to all areas as based on a targeted air permeability of 2.5m³.m².hr@50Pa based on CIBSE guide A table 4.16.

5.3.2 Windows and Openings

The opening of the panels was deemed a manual operation. They are modelled to begin opening when the internal temperature exceeds 22°C and to be fully open when the internal temperature exceeds 26°C. The opening profile has been set to operate for Bedrooms and KLDs during the daytime hours of 08:00-23:00 to meet Part O and TM59 requirements.

5.3.3 Auxiliary ventilation

The apartments also benefit from MVHR units which supply and extract air to the apartments whilst simultaneously 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.

The overheating boost rate has been modelled to activate from 00:00 to 24:00 when the temperature exceeds 22°C. 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.

Apartment Type	Capacity (l/s)	Trickle (l/s)	Additional Boost (l/s)
1 Bed – KLD	45	13	12
1 Bed – Bed		8	12
2 Bed – KLD	79	13	16
2 Bed - Bed		8	17
3 Bed – KLD	79	13	12
3 Bed - Bed		8	10

5.4 Internal Gains TM59

The internal gains and profiles applied to each space in the apartment have been taken from CIBSE TM59 document and are listed in Appendix A.

5.5 Building Fabric Specification

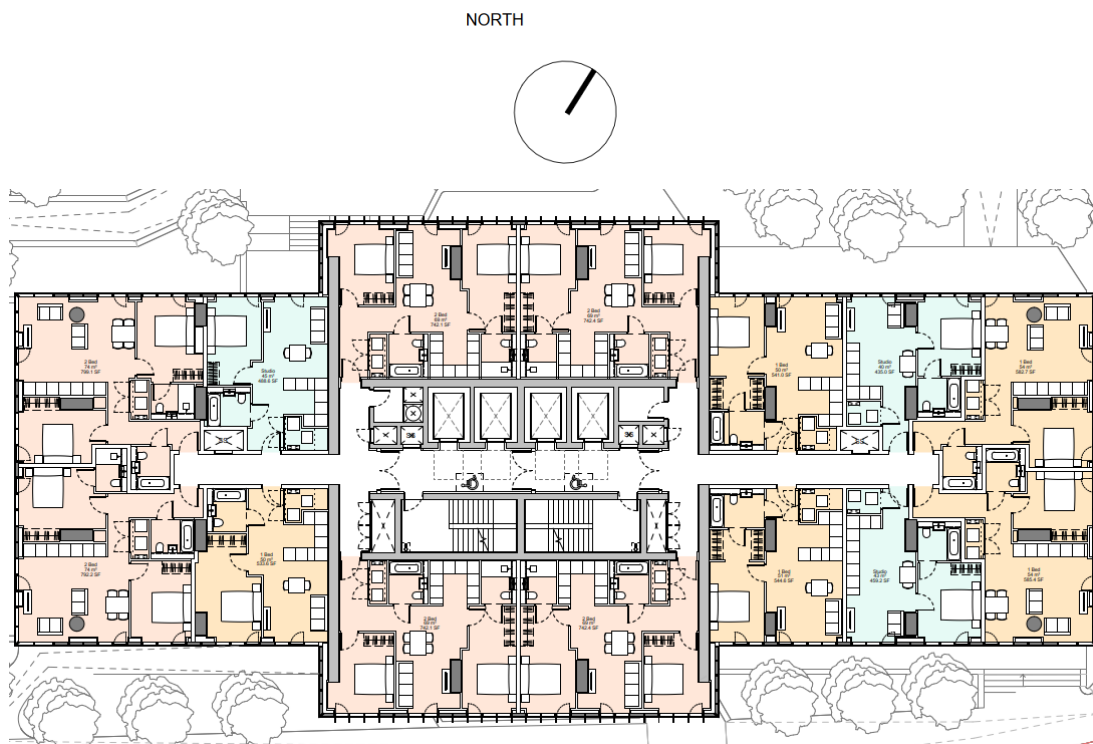
The building specification for the building fabric is as follows:

Construction Element	Development Specification
Ground	0.11 W/m ² K
External Wall	0.72 W/m ² K
Roof	0.11 W/m ² K
Glazing	SW - 0.72 W/m ² K, g value 0.40 NE – 0.72 W/m ² K, g value 0.53
Purge Panels	0.72 W/m ² K

Thermal mass is automatically accounted for within the IESve software.

5.6 Building Orientation

The image below indicates the orientation of the building.



6. Results

6.1 Summary of TM59 / Part O Overheating assessment results

The results from the TM59 / Part O assessment indicate that each of the assessed bedrooms and Kitchen/ Living/Dining (KLD) areas comply with the TM59 overheating criteria:

Criterion 1: None of the assessed areas exceed 3% for the assessment of ΔT ($T_{\max} - T_{\text{operative}}$) $\geq 1K$.

Criterion 2: None of the assessed bedrooms exceeds 26°C for more than 1% of the sleeping hours (11pm till 7am).

Table 6.1 Part O Assessment Results Table

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

Room Name	Criteria 1	Criteria 2	Compliance
21_APT01_2B_Bed_01	0.7	2	Pass
21_APT01_2B_Bed_02	0.2	0	Pass
21_APT02_1B_Bed	0	0	Pass
21_APT03_2B_Bed_01	0	0	Pass
21_APT03_2B_Bed_02	0.1	0	Pass
21_APT04_2B_Bed_01	0	0	Pass
21_APT04_2B_Bed_02	0	0	Pass
21_APT05_1B_Bed	0	0	Pass
21_APT06_3B_Bed_01	0.1	0	Pass
21_APT06_3B_Bed_02	0.4	3	Pass
21_APT06_3B_Bed_03	0	0	Pass
21_APT07_3B_Bed_01	0	2	Pass
21_APT07_3B_Bed_02	0.4	7	Pass
21_APT07_3B_Bed_03	0	0	Pass
21_APT08_1B_Bed	0	0	Pass
21_APT09_2B_Bed_01	0	0	Pass
21_APT09_2B_Bed_02	0	0	Pass
21_APT10_2B_Bed_01	0	0	Pass

21_APT10_2B_Bed_02	0	0	Pass
21_APT11_1B_Bed	0	0	Pass
21_APT12_2B_Bed_01	0.7	0	Pass
21_APT12_2B_Bed_02	0	0	Pass
28_APT01_2B_Bed_01	0.7	2	Pass
28_APT01_2B_Bed_02	0.2	0	Pass
28_APT02_1B_Bed	0	0	Pass
28_APT03_2B_Bed_01	0	0	Pass
28_APT03_2B_Bed_02	0	0	Pass
28_APT04_2B_Bed_01	0	0	Pass
28_APT04_2B_Bed_02	0	0	Pass
28_APT05_2B_Bed_01	0	0	Pass
28_APT05_2B_Bed_01	0	0	Pass
28_APT06_2B_Bed_01	0	0	Pass
28_APT06_2B_Bed_02	0	0	Pass
28_APT07_2B_Bed_01	0	0	Pass
28_APT07_2B_Bed_02	0	0	Pass
28_APT08_2B_Bed_01	0	0	Pass
28_APT08_2B_Bed_02	0	0	Pass
28_APT09_2B_Bed_01	0	0	Pass
28_APT09_2B_Bed_02	0	0	Pass
28_APT10_2B_Bed_01	0	0	Pass
28_APT10_2B_Bed_02	0	0	Pass
28_APT11_1B_Bed	0	0	Pass
28_APT12_2B_Bed_01	0.7	0	Pass
28_APT12_2B_Bed_02	0	0	Pass
10_APT01_2B_Bed_01	1.6	8	Pass
10_APT01_2B_Bed_02	0.7	3	Pass
10_APT02_1B_Bed	0.5	3	Pass

10_APT03_2B_Bed_01	0	0	Pass
10_APT03_2B_Bed_02	0.2	0	Pass
10_APT04_2B_Bed_01	0	0	Pass
10_APT04_2B_Bed_02	0	0	Pass
10_APT05_1B_Bed	0	0	Pass
10_APT06_1B_Bed	0.6	6	Pass
10_APT07_1B_Bed	0.3	2	Pass
10_APT08_1B_Bed	0.2	3	Pass
10_APT09_1B_Bed	0.5	8	Pass
10_APT10_1B_Bed	0	5	Pass
10_APT11_2B_Bed_01	0	0	Pass
10_APT11_2B_Bed_02	0	0	Pass
10_APT12_2B_Bed_01	0	0	Pass
10_APT12_2B_Bed_02	0.1	0	Pass
10_APT13_1B_Bed	0.1	5	Pass
10_APT14_2B_Bed_01	1.5	8	Pass
10_APT14_2B_Bed_02	0.6	4	Pass
21_APT01_2B_KLD	2.6	N/A	Pass
21_APT02_1B_KLD	0	N/A	Pass
21_APT03_2B_KLD	0	N/A	Pass
21_APT04_2B_KLD	0	N/A	Pass
21_APT05_1B_KLD	0	N/A	Pass
21_APT06_3B_KLD	0.8	N/A	Pass
21_APT07_3B_KLD	0.4	N/A	Pass
21_APT08_1B_KLD	0	N/A	Pass
21_APT09_2B_KLD	0	N/A	Pass
21_APT10_2B_KLD	0	N/A	Pass
21_APT11_1B_KLD	0	N/A	Pass
21_APT12_2B_KLD	1.7	N/A	Pass

28_APT01_2B_KLD	2.5	N/A	Pass
28_APT02_1B_KLD	0	N/A	Pass
28_APT03_2B_KLD	0	N/A	Pass
28_APT04_2B_KLD	0	N/A	Pass
28_APT05_2B_KLD	0	N/A	Pass
28_APT06_2B_KLD	0.6	N/A	Pass
28_APT07_2B_KLD	0.2	N/A	Pass
28_APT08_2B_KLD	0	N/A	Pass
28_APT09_2B_KLD	0	N/A	Pass
28_APT10_2B_KLD	0	N/A	Pass
28_APT11_1B_KLD	0	N/A	Pass
28_APT12_2B_KLD	1.6	N/A	Pass
10_APT02_1B_KLD	0.6	N/A	Pass
10_APT03_2B_KLD	0.1	N/A	Pass
10_APT04_2B_KLD	0	N/A	Pass
10_APT05_1B_KLD	0.7	N/A	Pass
10_APT06_1B_KLD	0.8	N/A	Pass
10_APT07_1B_KLD	1.4	N/A	Pass
10_APT08_1B_KLD	0.8	N/A	Pass
10_APT09_1B_KLD	0.4	N/A	Pass
10_APT10_1B_KLD	0.7	N/A	Pass
10_APT11_2B_KLD	0	N/A	Pass
10_APT12_2B_KLD	0	N/A	Pass
10_APT13_1B_KLD	0	N/A	Pass
10_APT14_2B_KLD	2	N/A	Pass

The table above shows each of the considered spaces to meet the criteria as set out in the CIBSE TM59 document and so are deemed not at risk of overheating.

8. Assumptions

Occupancy and equipment gains are specified by the TM59 guidance. For clarity, the following assumptions have been used and the proposals for purge vent openings are also detailed below:

Assumptions	Target performance
Glazing G-value	0.40 South – West 0.53 North - East
Façade layout	As per floor plan
Weather data	Manchester_DSY1_2020High50.epw
MVHR rate	Capacity 45 l/s
1 Bed - KLD	Trickle 13 l/s Additional Boost 12 l/s
1 Bed - Bed	Trickle 8 l/s Additional boost 12 l/s
MVHR rate	Capacity 79 l/s
2 Bed - KLD	Trickle 13 l/s Additional Boost 16 l/s
2 Bed – Bed	Trickle 8 l/s Additional boost 17 l/s
MVHR rate	Capacity 79 l/s
3 Bed - KLD	Trickle 13 l/s Additional Boost 12 l/s
3 Bed – Bed	Trickle 8 l/s Additional boost 10 l/s
Blinds	None for the TM59 assessment as per Part O
Ventilation opening hours profile TM59 / Part O	Open 08:00–23:00 when temperature exceeds 22c

9. Appendix A : TM59 Occupancy and Equipment Gains Guidance

Unit/Room Type	Occupancy	Equipment Load
1 Bed Apartment : Living room/Kitchen	1 person from 9am to 10pm ; room is unoccupied for the rest of the day	Peak load of 450 W from 6pm to 8pm 200 W from 8pm to 10pm 110 W from 9am to 6pm and 10pm to 12pm Base load of 85 W for the rest of the day
2 Bed Apartment : Living room/Kitchen	2 people from 9am to 10pm ; room is unoccupied for the rest of the day	Peak load of 450 W from 6pm to 8pm 200 W from 8pm to 10pm 110 W from 9am to 6pm and 10pm to 12pm Base load of 85 W for the rest of the day
2 Bed Apartment : Living room/Kitchen	3 people from 9am to 10pm ; room is unoccupied for the rest of the day	Peak load of 450 W from 6pm to 8pm 200 W from 8pm to 10pm 110 W from 9am to 6pm and 10pm to 12pm Base load of 85 W for the rest of the day
Double Bedroom	2 people at 70% gains from 11pm to 8am 2 people at full gains from 8am to 9am and from 10pm to 11pm 1 person at full gains in the bedroom from 9am to 10pm	Peak load of 80 W from 8am to 11pm Base load of 10 W during the sleeping hours
Communal Corridors	Assumed to be zero	