Overheating Assessment

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Site: Ground Floor Flat, 32 South Street, Worthing, Sussex, BN11 3FT.

Client: Roundberry Construction.

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Introduction

The proposed development is a 2no. bedroom flat located at 32 South Street, Worthing, Sussex, BN11 3FT. The intention of this report is to demonstrate compliance against Part O: Overheating Approved Document, which states on Requirement O1: Overheating mitigation that:

a) Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes to:
   - Limit unwanted solar gains in summer.
   - Provide an adequate means to remove heat from the indoor environment.

b) In meeting the obligations in paragraph (1):
   - Account must be taken of the safety of any occupant, and their reasonable enjoyment of residence.
   - Mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.

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

- The simplified method for limiting solar gains and providing a means of removing excess heat.
- The dynamic thermal modelling method.

The dynamic thermal modelling method has been chosen for this development. Therefore, the following standards were followed to achieve compliance:

1. CIBSE's TM59 methodology for predicting overheating risk.
2. CIBSE TM52 – Limits of thermal comfort provides the principles of thermal comfort and should be the main reference for any additional detail.

Acceptable strategies for reducing overheating risk

Limiting solar gains. Solar gains in summer should be limited by any of the following means:

a) Fixed shading devices.
b) Glazing design. (Size, orientation, g-value, depth of the window reveal).
c) Building design.
d) Shading provided by adjacent permanent buildings.

Removing excess heat. Excess heat should be limited by any of the following means:

a) Opening windows.
b) Ventilation louvres in external walls.
c) A mechanical ventilation system.
d) A mechanical cooling system.

The building should be constructed to meet requirement O1 using passive means as far as reasonably practicable. It should be demonstrated to the building control body that all practicable passive means of limiting unwanted solar gains and removing excess heat have been used first before adopting mechanical cooling. Any mechanical cooling is expected to be used only where requirement O1 cannot be met using openings.

Compliance Criteria

Homes that are predominantly naturally ventilated, including homes that have mechanical ventilation with heat recovery (MVHR), with good opportunities for natural ventilation in the summer should assess overheating using the adaptive method based on CIBSE TM52 (2013), as described below.

In order to allow the occupants to 'adapt', each habitable room needs operable windows with a minimum free area that satisfies the purge ventilation criteria set in Part F of the Building Regulations for England (NBS, 2010), and equivalent regulations in other countries, i.e. the window opening area should be at least 1/20th of the floor area of the room.

Compliance is based on passing both of the following two criteria:

(a) For living rooms, kitchens, studios and bedrooms: the number of hours during which DT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).

(b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.

Internal gains profiles.

The following occupancy and equipment gains and profiles have been developed for the purposes of this methodology. They represent a robust test that ensures the key aspects of overheating are captured, namely the hours when risk is highest (i.e. the middle of the day and early afternoon) and night-time hours when, if rooms do not cool down, sleep can be disrupted.

Whilst all homes will be occupied differently, this test is intended to ensure that the units tested will perform reasonably throughout the day and night.

It is important that these profiles are used for all assessments following this methodology.

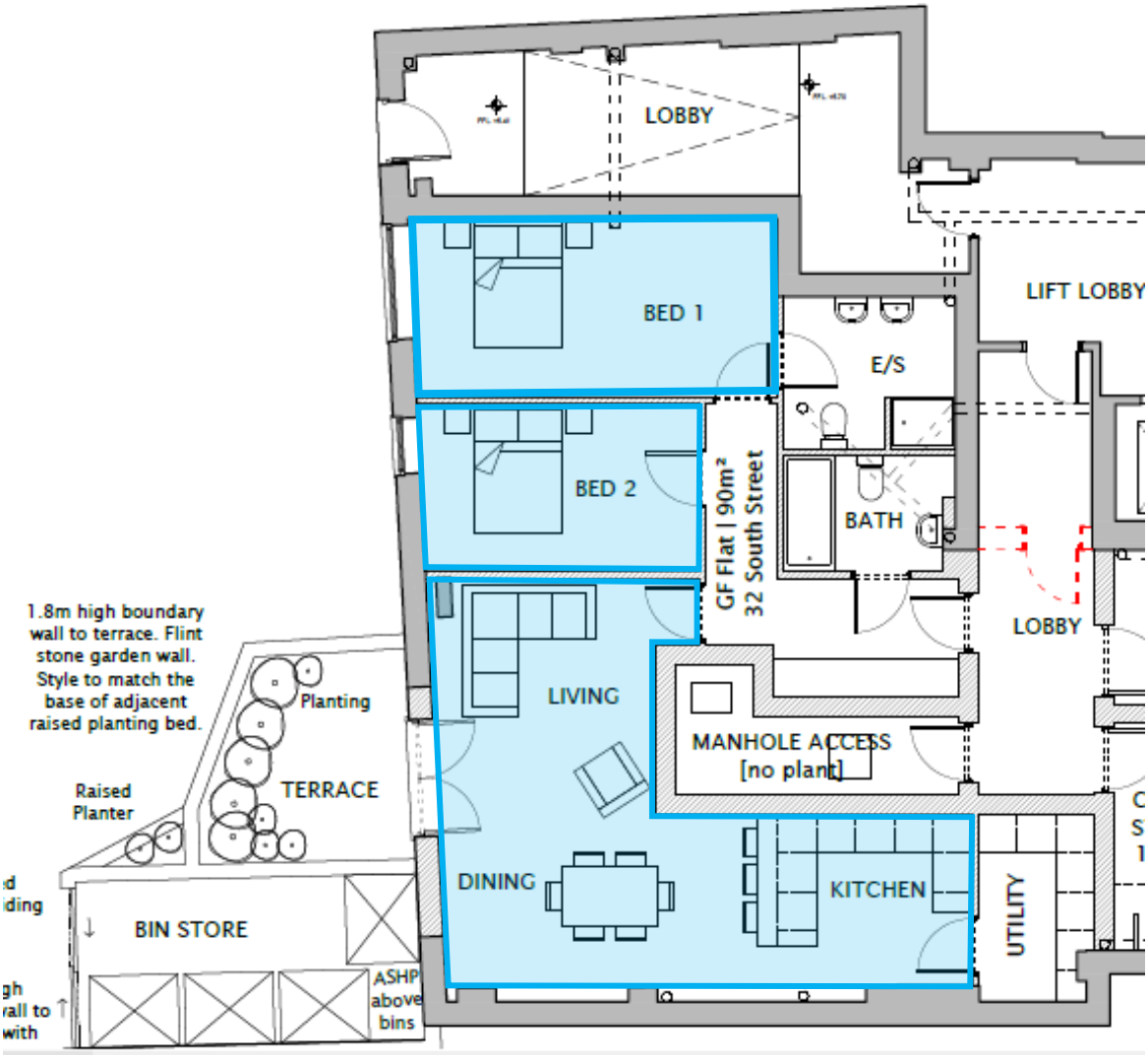
Number of people	Description	Peak load (W) Sensible	Latent	Period 00–01	01–02	02–03	03–04	04–05	05–06	06–07	07–08	08–09	09–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21	21–22	22–23	23–24
				Hour-ending 1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00
1	Single bedroom 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

Thermal Comfort - Inputs

The following methodology has been followed to inform the design against different requirements for this project:

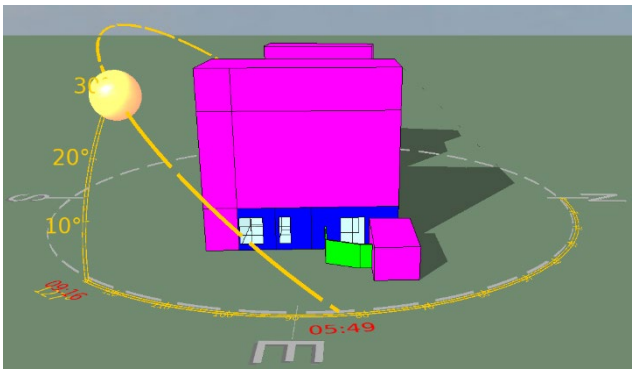
1. First, detailed information of the building was gathered from the Design Team.

2. Once it was analysed and verified complete, all the room types and areas of the building were "zoned" to input those into the interface.



1 Ground floor assessed rooms highlighted in blue.

3. Then a 3D model was carried out with the relevant envelope, internal gain loads, services specifications, and opening details following CIBSE TM59.



2 East axonometric view of the IES model.

Element	U-Value (W/m2k)	Further Information
External walls	0.55 W/m2k	15mm Silicone render system, 100mm blockwork, 50mm cavity space, 50mm Rockwool rainscreen insulation, 140mm blockwork.
Ground Floor	0.14 W/m2k	175mm concrete suspended slab, 150mm Recticel Eurthane GP insulation, 30mm Recticel Eurothane GP insulation, 75mm sand and cement screed.
Windows / Glazed Doors	1.40 W/m2k	Double glazing for windows, glazed doors. (Refer to Table 4 for further detail)

3 Building fabric specifications.

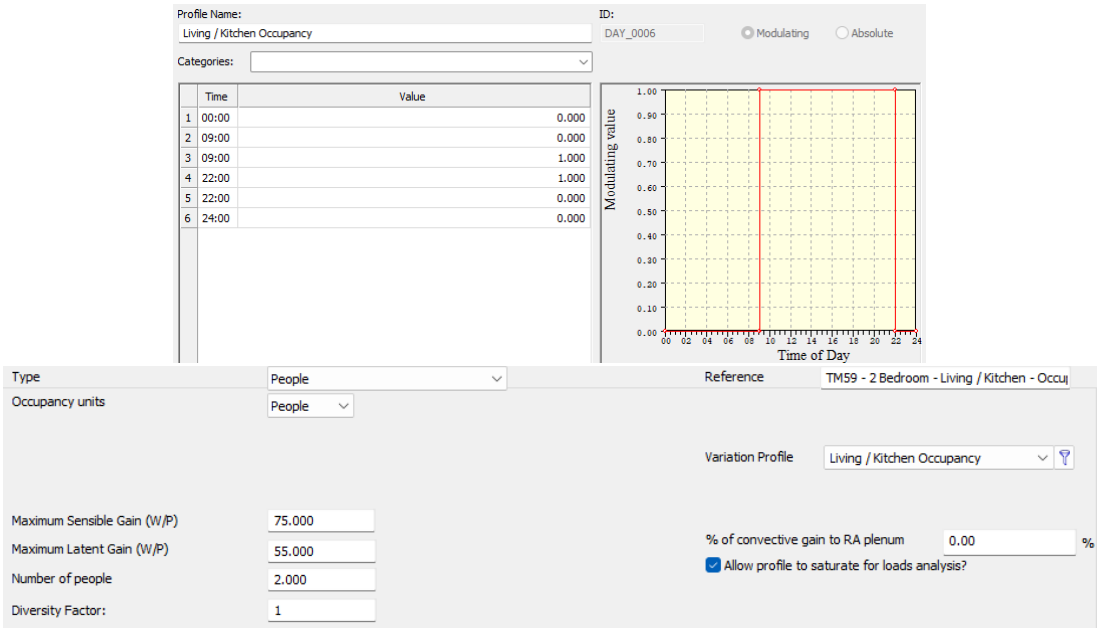
Room	Glazing	G-value	LT-value	Shading device.
All rooms	Double glazed windows.	<0.65	>71%	None.

4 Glazing specifications to achieve compliance with Part O.

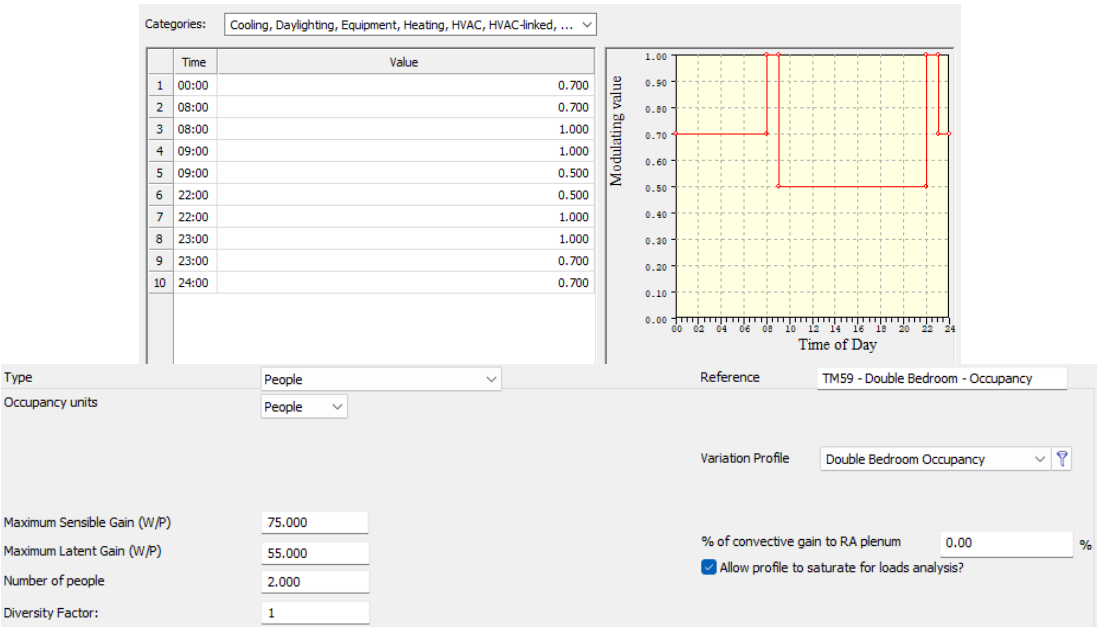
Internal gains.

Occupancy.

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



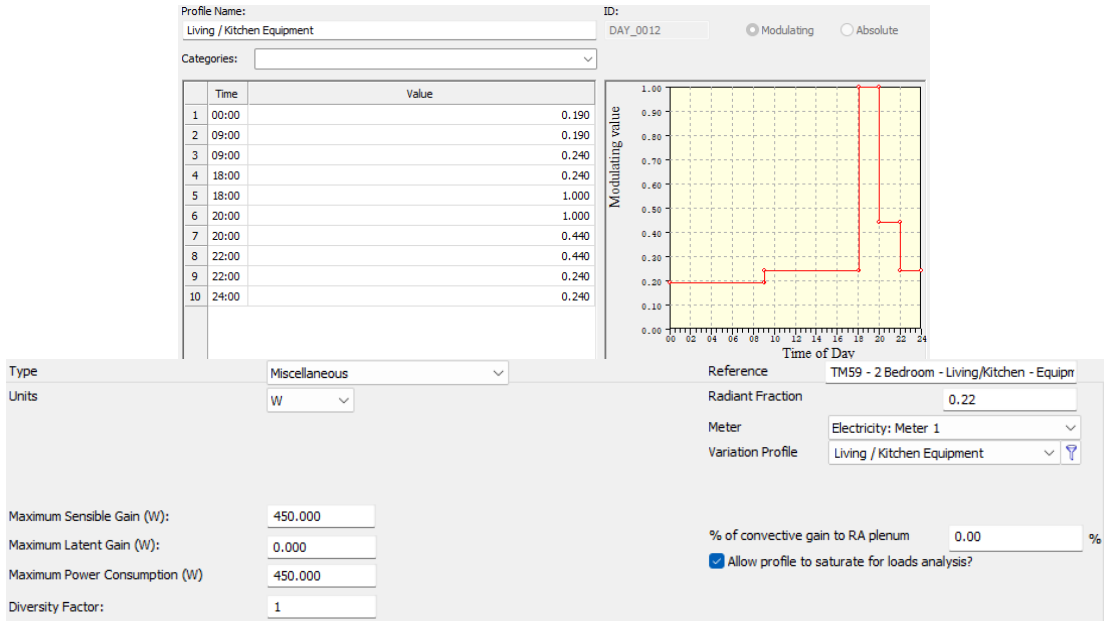
5 Living/kitchen/dining occupancy profile as per CIBSE TM59 (IES VE inputs)



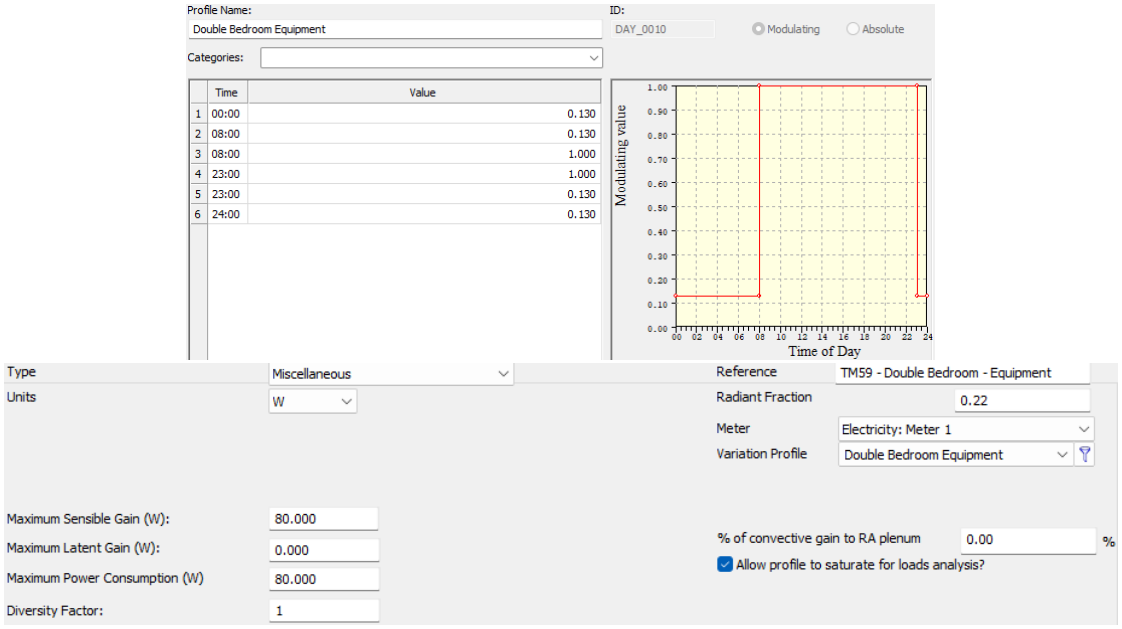
6 Double Bedroom occupancy profile as per CIBSE TM59 (IES VE inputs)

Equipment.

It is assumed that apartments with the same number of occupants and bedrooms are usually provided with the same appliances, therefore the heat loads given by them should be assumed to be independent of floor area for the purpose of overheating risk assessment. Therefore, the equipment loads are defined in watts (not W/m²).



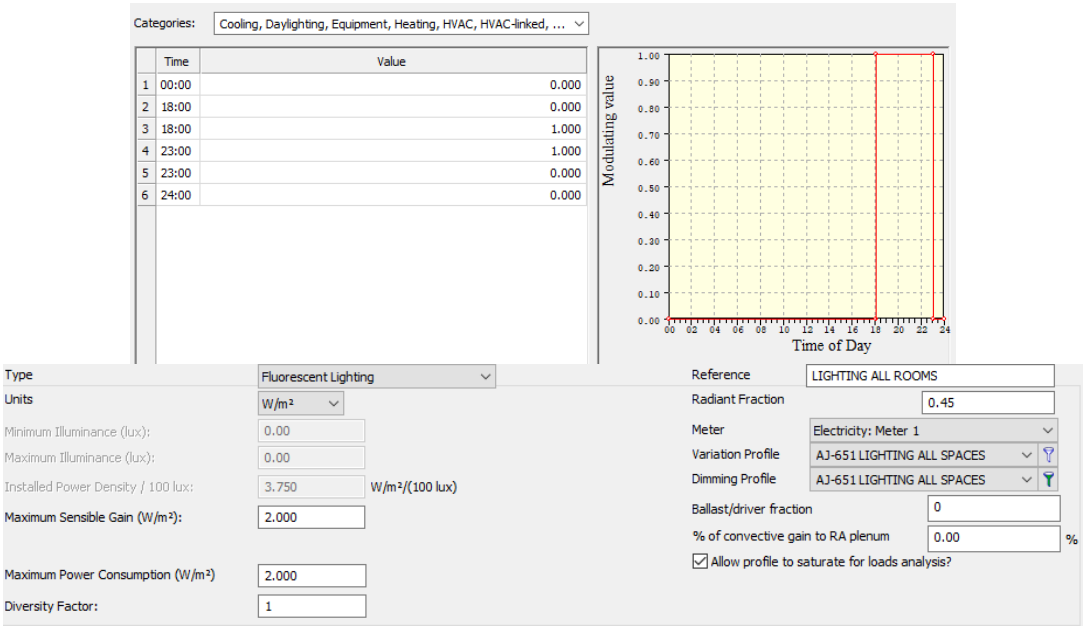
7 Living/kitchen/dining equipment profile as per CIBSE TM59 (IES VE inputs)



8 Double bedroom equipment profile as per CIBSE TM59 (IES VE inputs)

Lighting.

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).



13 All Rooms lighting profile as per CIBSE TM59 (IES VE inputs)

Window and doors openings.

Windows in each room should be controlled separately and modelled as open when both the internal dry bulb temperature exceeds 22 °C and the room is occupied. If additional security and rain protection details are included in the design, then the opening hours during the night could be extended.

Open areas should be based on the architecturally designed windows including any restrictors that are required. The guidance in CIBSE Guide A (2015a) and CIBSE AM10: Natural ventilation in non-domestic buildings (2005) should be followed for calculation of free areas. The window opening area should be at least 1/20th of the floor area of the room.

Opening areas assumed should take into account any security, acoustic or air quality issues that limit opening area (e.g. on ground floors). The compliance report should explain the basis of all assumptions.

Ventilation criteria set in Part F of the Building Regulations for England (NBS, 2010)				
Room	**Room area**	**Minimum free area 1/20th of room area**	**Designed free area**	**Complies with Part F?**
Living/kitchen/dining	37.44 m2	1.87 m2	4.50 m2	Yes
Bedroom 1	15.86 m2	0.79 m2	1.70 m2	Yes
Bedroom 2	11.73 m2	0.58 m2	0.83 m2	Yes

Openings profile.

For this project, all operable windows and glazed doors of habitable rooms (lounge, kitchen/dining and bedrooms 1 and 2) were considered to be open during day hours as follows:

- For lounge, kitchen/dining, study and bedrooms: fully open from 9:00 to 20:00 hrs.

No pollution or noise issues were found. Therefore, night ventilation is recommended in bedrooms to comply with CIBSE TM59 criteria 'b'. Schedule as follows:

- For all bedrooms: Top hung windows slightly open from 20:00 hrs to 07:00 hrs to allow night ventilation.

4. A series of simulations were done using dynamic thermal simulation software IES VE, including the specialist modules: SunCast, MacroFlo and Apache.

5. The simulations followed the criteria stated in Part O Approved Document, CIBSE TM59 and CIBSE TM52.

Thermal Comfort – Results.

Criteria for homes predominantly naturally ventilated.

Compliance is based on passing both of the following two criteria:

(a) For living rooms, kitchens, study and bedrooms: the number of hours during which DT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).

(b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.

Room	Criteria (a)			Criteria (b) *Only bedrooms		
	Maximum hours of exceedance (%)	**Design hours of exceedance (%)**	**Complies with CIBSE TM52 Criterion 1 ?**	**Maximum annual hours above 26°C (10pm to 7am)**	**Design annual hours above 26°C (10pm to 7am)**	**Complies with CIBSE TM59 ?**
Living/kitchen/dining	3 %	0 %	Yes	N/A	N/A	N/A
Bedroom 1	3 %	1.5 %	Yes	32	0	Yes
Bedroom 2	3 %	0 %	Yes	32	1	Yes

Conclusion

The proposed development is a 2no. bedroom house located at 32 South Street, Worthing, Sussex, BN11 3FT. The intention of this report is to demonstrate compliance against Part O: Overheating Approved Document, Requirement O1: Overheating mitigation.

The dynamic thermal modelling method has been chosen for this development. Therefore, the following standards were followed to achieve compliance:

1. CIBSE's TM59 methodology for predicting overheating risk.
2. CIBSE TM52 - Limits of thermal comfort provides the principles of thermal comfort and should be the main reference for any additional detail.

A 3d model was carried out using IES VE 2022 software following the methodology above. After a series of simulations, **it was determined that all habitable rooms within the proposed dwelling achieve compliance** with CIBSE TM59 Criteria (a) and (b). **This applies as long as all the measures within this report are fully implemented.**

Appendix A

Compliance checklist

B1 This compliance checklist is divided into three parts, as follows.

a. Part 1 contains the building details and declarations.

b. Part 2a functions as a design checklist for the simplified approach.

c. Part 2b functions as a design checklist for the dynamic thermal modelling approach.

d. Part 3 is for verifying the completion details of the as-built residential building.

Part 1.- Building details and declaration.

The designer should complete this section.

1.1 Building and site details.	
Residential building name / number	32
Street	South Street.
Town	Worthing
County	Sussex
Postcode	BN11 3FT
Proposed building use / type of building	Dwelling (Flat)
Are there any security, noise or pollution issues?	No
1.2 Designer's details	
Designer's name	Illustrate Architects
Company	Illustrate Architects
Address line 1	4 Prince Street
Address line 2	Earls Barton, Northamptonshire
Postcode	NN6 0LL
Telephone number	01604 979730
Email address	admin@illustratearchitects.co.uk

Part 2. – Design details.

The designer should complete either Part 2a or 2b, depending on the method used.

2b.1 Modelling details		
Dynamic software name and version	IES VE 2022	
Weather file location used, including any additional, more extreme weather files.	SouthamptonDSY05.fwt	
Number of samples units modelled, including and explanation of why the size/selection has been chosen.	One, this is a single dwelling.	
2b.2 Modelled occupancy		
Has the project passed the assessment described in CIBSE's TM59, taking into account	Yes **X**	No

the limits detailed in paragraphs 2.5 and 2.6?		
Details of the occupancy profiles used	*For Living/Kitchen/dining – 2 people from 9am to 10pm *For double bed -2 people at 70% from 11pm to 8am / 2 people at 100% from 8am to 9am and 10pm to 11pm.	
Details of the equipment profiles used	*For Living/kitchen/dining – Peak load of 300W from 6pm to 8pm / 200W from 8pm to 10pm/ 110W from 9am to 6pm and 10pm to 12pm / 35W for the rest of the day. *For Bedrooms - Peak load of 80 W from 8 am to 11 pm / 10 W during the sleeping hours.	
Details of the openings profiles used	*For all habitable rooms: operable windows/glazed doors are open from 9 to 20hrs *Allow for night ventilation for bedrooms.	
2b.3 Modelled overheating mitigation strategy		
Free areas	Operable window areas greater than the required by Part F for most of rooms: *Living/kitchen/dining – 4.50 m2 *Bedroom 1 – 1.70 m2 *Bedroom 2 – 0.91 m2	
Infiltration and mechanical flow rates	No mechanical ventilation heat recovery unit, only extract fans. Flows as per MEP design.	
Window g-value	G=0.65 – All rooms windows and glazed doors.	
Shading strategy	None.	
Mechanical cooling	None.	
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?	Yes **X**	No
What is the overall overheating strategy (i.e. what design features are key to the project passing?)	Operable windows during day hours + night ventilation on bedrooms.	
2b.5 Designer's declaration		
Has the building construction proposal been modelled accurately?	Yes **X**	No
Designer's name	TBC	
Designer's organisation	TBC	
Designer's signature		
Registration number (if applicable)		
Date of design		