Part O 2021

Where to start

Future Homes Hub

Part O 2021 (England)
Builders Guidance

14.09.2022

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Foreword

We are really pleased to be publishing this guidance for builders on the Approved Documents Part O (2021).

Overheating in homes has been a cause of increasing concern as temperatures rise, with sleepless nights affecting health and well-being; and heat related deaths being forecast to increase significantly. Part O will therefore help mitigate these impacts for new homes. However, with a new regulation comes new challenges; the tools to analyse overheating are unfamiliar to many, there will be implications on the positioning, types and specification of glazing, impacts on energy calculations and quite possibly a need for shading. These implications on design needs to be taken into account, even before planning applications are made.

We are very grateful for the time and input given by those people and organizations who have worked with us to put this guide together.

UK housing design and construction is going through major change. The mitigation of overheating is an important part of the jigsaw and one which will significantly benefit many who will live in the homes we build.

Ed Lockhart
CEO Future Homes Hub

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Overview

Part O requires developers to take steps to reduce overheating in new homes to protect the health and welfare of occupants. Overheating is increasingly widespread in the UK. Excessive temperatures are a particular problem when people are trying to sleep. Heat-related deaths are expected to more than triple to 7,000 a year by the 2050s.

You should normally get overheating and energy advice early in the design process and before submitting designs for planning approval, because it can impact the appearance of façades, especially glazing.

Purpose of this Guide

This 'where to start' guide is intended to help homebuilders, designers, and others involved in the development of new homes to understand the new Approved Document O - Overheating in new dwellings in England (ADO 2021). The guide explains the main implications of the new AD and the interaction with other Building Regulations including Part L - Conservation of fuel and power (ADL 2021), Part K - Protection from falling, collision and impact (ADK 2010) and Part M Access to and use of buildings (ADM 2010). It is intended especially for smaller homebuilders.

The guide is based on the Government's suggested approach to meeting the building regulations. Alternative approaches are possible but they should be discussed and agreed with a building control body before building work starts. You should always check with the Building Control Body that your proposals comply with all the requirements of the Building Regulations. Further information can be found in the Hub's Technical Guide to Part O.

What must you do

The new regulations apply to all new homes from the 15th June 2022, unless the development has a building notice or an initial notice has been given to, or full plans deposited with, a local authority before 15th June 2022 and provided that the building work has started on each plot before 15th June 2023.

You must design and construct your building to:

- limit unwanted solar gains in summer
- provide an adequate means of removing excess heat from the indoor environment

In meeting this requirement:

- you must take account of these safety and wellbeing issues: noise at night, pollution, security, protection from falling and protection from entrapment
- you may only use mechanical cooling where insufficient heat is capable of being removed from the indoor environment without it.

You can achieve compliance by using either:

- the Simplified Method; or,
- the Dynamic Thermal Modelling

The dynamic method allows more flexibility in the techniques that can be used to reduce overheating but requires specialist software and skills.

You must include a section on 'staying cool in hot weather' in the property's Home User Guide including information about the overheating mitigation strategy and its maintenance requirements. You can find more detail on what needs to be included in section 4 of Approved Document O.

What measures you'll need to take

You'll typically need to take these measures to reduce overheating and ensure safety and wellbeing:

- consider noise, security and safety requirements early to design integrated solutions, rather than relying on late design changes or "add-on" features.
- For windows used for overheating mitigation, if the change in floor level between inside and outside is more than 600mm, the guarding height should be at least 1100mm except where the window is used as a means of escape where a tolerance of up to -100mm is allowed (i.e. guard height of at least 1000mm)
- design homes wherever possible to be cross-ventilated (i.e. with openings on opposite sides)
- make all, or the large majority of glazing provided openable, with openings designed to maximise air flow
- incorporate external shading and/or solar control glazing in high risk locations (i.e. most of London and certain areas of Central Manchester)
- review the implications for energy use (e.g. winter solar gains), daylight and views alongside Part O compliance, for example when designing the size and location of glazed areas or incorporating shading: all these need to be considered as a whole.

Noise, security and safety

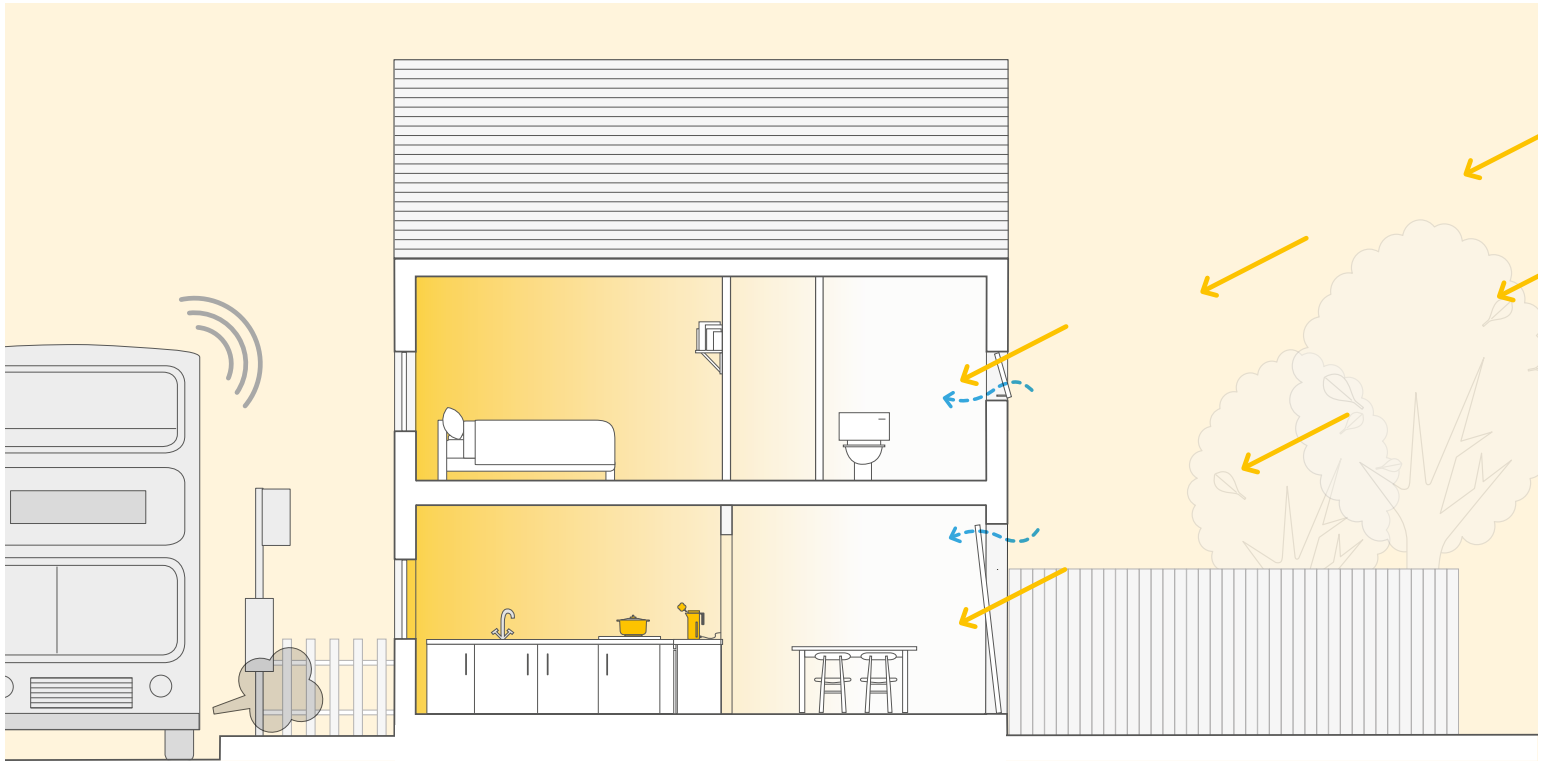
Design

Noise, security and safety requirements must be considered early to design integrated solutions, rather than relying on late design changes or “add-on” features.

Close proximity to airborne noise or pollution from busy roads, railways and industrial uses may prevent an occupant from opening and using the windows as they were intended.

Part O requires each home to be considered individually and sets out different requirements for each situation, for instance whether the home has cross-ventilation or not.

A house design that complies in a rural setting may need to be re-designed for Part O in a more urban setting.



Key

Part O sets out the requirements for good ventilation to remove unwanted heat through bedrooms particularly.

Direct sunlight (solar gains) will contribute to overheating and Part O reduces unwanted gains by limiting window areas and requiring shading in high risk locations.

Figure 1: **Site context**

Noise and pollution

Where it is noisy overnight (for example in many urban settings or near main roads) the Approved Document assumes bedroom windows will be closed and not available for ventilation.

> 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).

Measurements should be in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings.

Planning may make additional requirements for noise.

Where noise levels are only just above the limits at the pre-development stage, then it may still be possible to avoid mechanical cooling, if noise abatement measures are taken. This will require specialist advice.

With regard to pollution the Approved Document states:

> "Buildings located near to significant local pollution sources should be designed to minimise the intake of external air pollutants".

Developers may need to liaise with the local authority at the planning stage who may recommend or require, mechanical ventilation with filters (for overheating and background ventilation OR background alone).

Often high pollution sites will also be noisy sites; so noise mitigation will be an important factor for managing overheating risk.

Figure 2: **Noise mitigation measures through landscaping, site and building layout**

Noise from rail and road is buffered by the taller buildings, protecting the dwellings and landscaped areas on the other side (provided by Studio Partington).

Window design: security and protection from falls and entrapment

To be used for overheating mitigation windows need to be safe and secure.

Windows used for ventilation during sleeping hours can only be considered if they are secure from intrusion by a casual or opportunistic burglar. One way of achieving security and ventilation would be through using louvred shutters.

Figure 3: **Illustration of secure side openings**

Note that windows with external shading will usually be inward opening. (61 Warwall, Architects: Penoyre & Prasad Photography: David von Sternberg)

To protect from falling there can be requirements for windows that are in addition to Part K (Protection from Falling Collision and Impact). If windows are going to be opened as part of an overheating mitigation strategy then:

- For the compliance calculations only, it must be assumed that handles on windows that open outwards are not more than 650mm from the inside face of the wall when opened (although in practice they may be able to be opened by more).
- For windows that are not restricted to 100mm opening AND where the change in floor level between inside and out is greater than 600mm, the guarding height must be 1100mm.
- If the window is used as a means of escape the tolerance on this is +0/-100mm (to avoid a conflict with Part B).
- For Part M4(2) and M4(3) compliance options would include external guarding or top hung windows.
- Guarding can use horizontal bars provided these start at a minimum 600mm above the inside floor level.

For clarifications and further guidance the government has a FAQ page:

gov.uk/guidance/approved-document-o-overheating-frequently-asked-questions

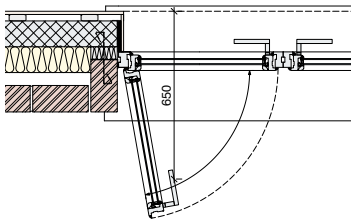
Louvered shutters, windows railings, and ventilations grills should also comply with all of the following:

(a) Not allow the passage of a 100mm diameter sphere.

(b) Any hole which allows the passage of an 8mm diameter rod should also allow the passage of a 25mm diameter rod. Such holes should not taper in a way that allows finger entrapment

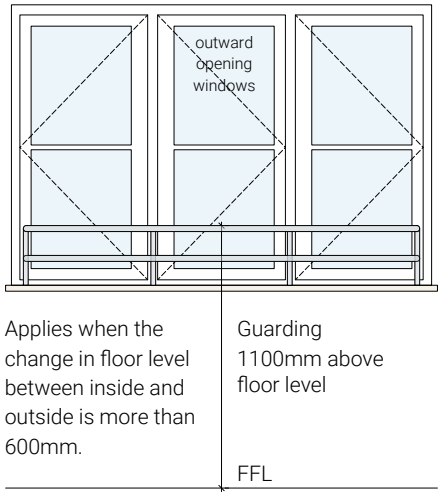
(c) Any looped cords must be fitted with child safety devices

Side hung Window - Plan



The maximum opening angle is not a physical limit of 650mm but only used for determining the open area for Part O compliance.

Internal elevation



Cross-ventilation

Design

Wherever possible, homes should be designed so they can be cross-ventilated (i.e. with openings on opposite sides). Part O doesn't count windows on adjoining façades (i.e. a front and a side) as giving cross-ventilation.

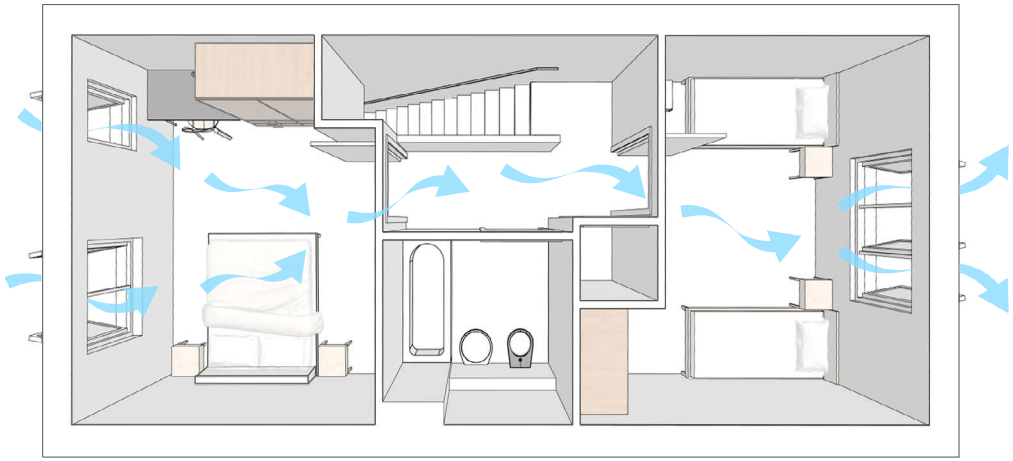


Figure 4: **Cross ventilation trough a terrace house.**

Several standard house types have been assessed in the work that the Future Homes Hub has done for both Part L and Part O guides. Looking at current designs we found that mid terrace houses are more likely to fail the ventilation requirements and would need more opening windows.

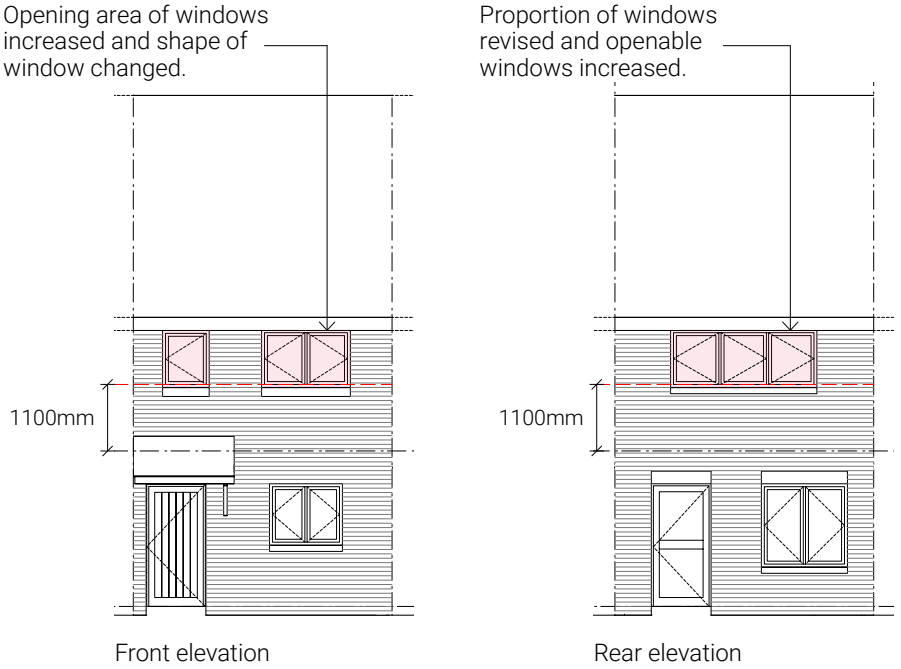


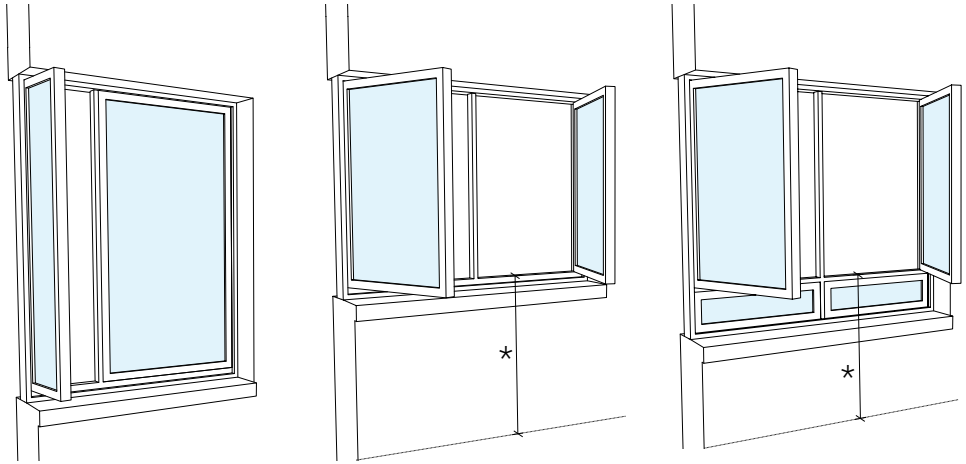
Figure 5: **Mid terrace revised window proportions to increase ventilation.**

Detached houses would be more likely to exceed (fail) the glazing requirements. There are case studies in the full technical guide to Part O that illustrate the likely design changes.

Openings to maximise air flow

Glazing

All, or the large majority of glazing provided should be openable, and openings should be designed to maximise air flow.



A large fixed pane with a small opening pane may not give sufficient ventilation in bedrooms.

All panes openable. Introduce guard rail at 1100mm

Omit guarding with fixed pane at 1100mm. Increased width of window opening to retain ventilation.

Figure 6: **Window configurations to maximise air flow and retain safety height.**

Part O will influence the design of windows, particularly bedroom windows.

Guarding

For windows that are not restricted to 100mm opening AND where the change in floor level between inside and out is greater than 600mm, the guarding height must be 1100mm (see the section on windows for more detail).

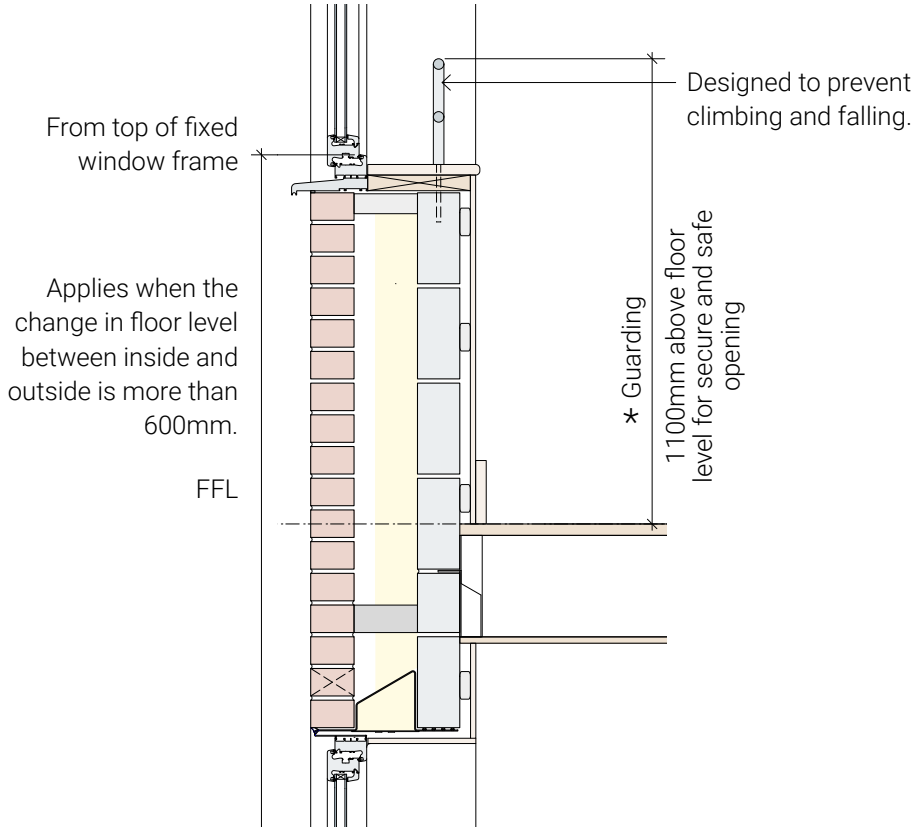


Figure 7: **Window guarding arrangement.**

Shading

Design

The implications for energy use (e.g. winter solar gains or the introduction of mechanical cooling), daylight and views must be reviewed alongside Part O compliance, for example when designing the size and location of glazed areas or incorporating shading: all these need to be considered as a whole.

Shading with Winter and Summer sun

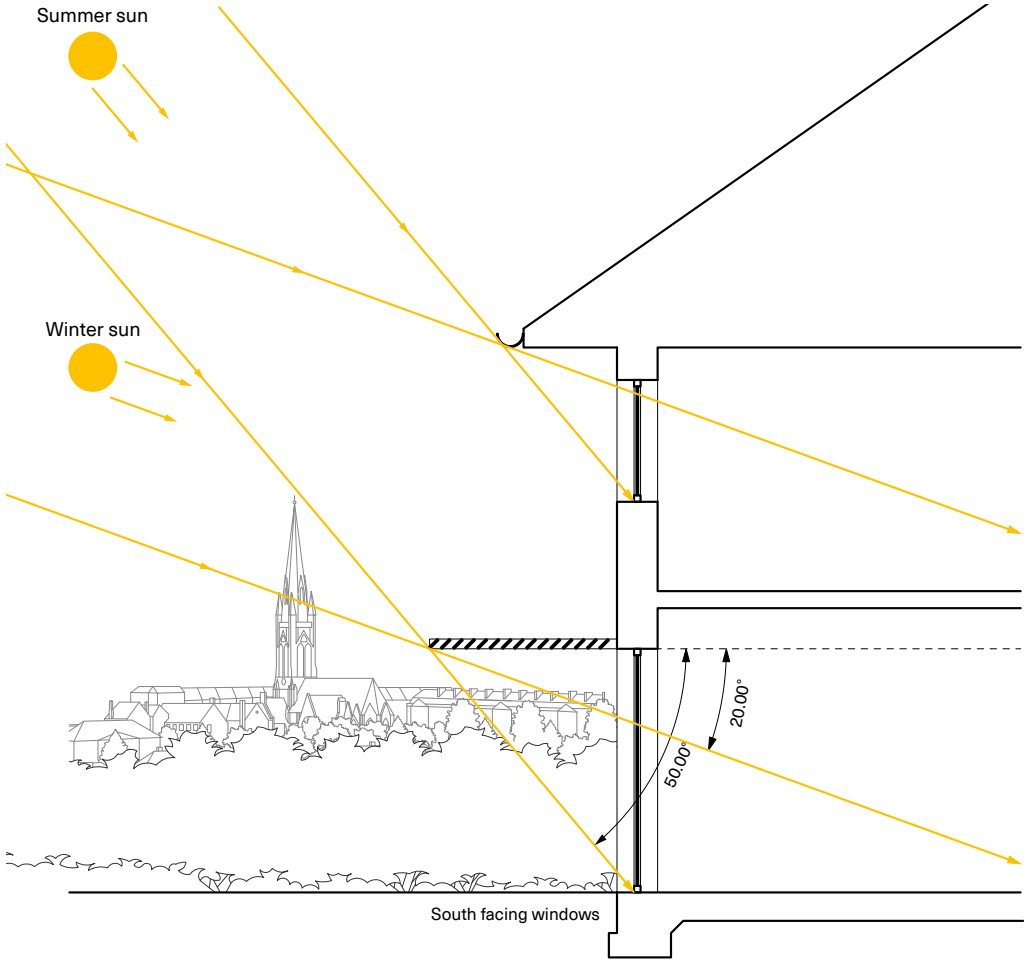


Figure 8: **Horizontal shading.**

Compliance method

- Overheating risk will need to be modelled early in the design stage, before planning and before energy modelling as it will impact the appearance of façades and especially glazing.
- There are two modelling methods which can be used to show compliance: The Simplified Method and Dynamic Thermal Modelling. The Simplified Method has limitations and does not offer the design flexibility of Dynamic Thermal Modelling.
- Dynamic Thermal Modelling requires specialist software and skills.

Where standard house types are available, it is useful to test them in different locations and orientations, incorporate changes as required, and build a library of approved products (including windows, shading, and opening details).

When to use the simplified method or dynamic thermal modelling

Overheating risk will need to be modelled early in the design stage, before planning and before energy modelling as it will impact the appearance of façades and especially glazing.

There are two ways in which overheating can be modelled within Part O; the Simplified Method and Dynamic Thermal Modelling. Dynamic Thermal Modelling requires specialist software and training.

Buildings that need to be dynamically modelled are ones which:

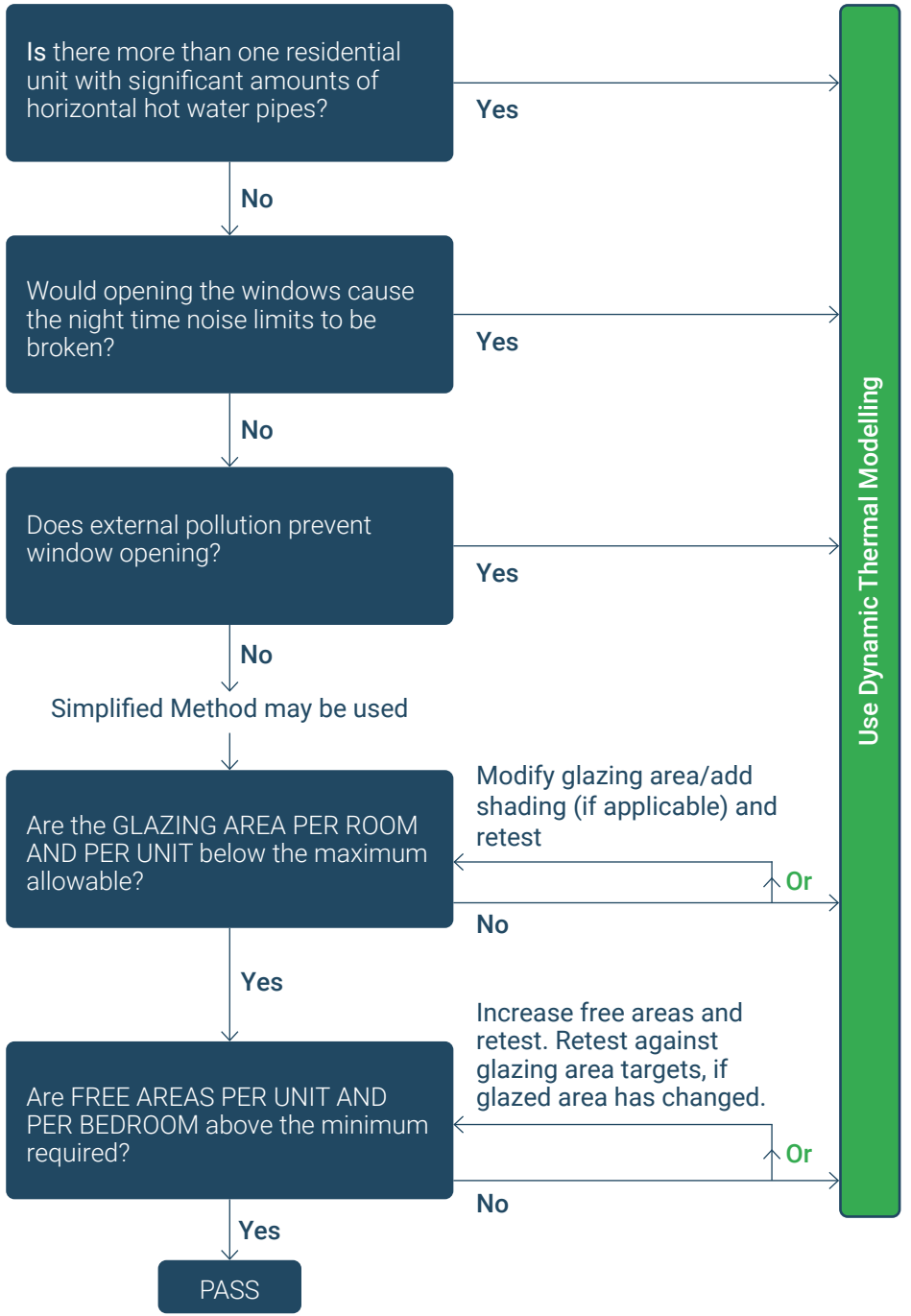
- contain more than one residential unit with significant amounts of horizontal hot water pipes (e.g. communal heating pipes in corridors)
- occupants cannot open the window because either:
    - Part O's night-time noise limits will be exceeded and/or
    - there is external pollution.

Dynamic Thermal Modelling may also be appropriate where home designers wish to make use of mitigation options that are not available within the Simplified Method.

The Simplified Method considers two aspects; limiting solar gains and removing excess heat. It is a manual process that requires glazing areas and openable areas to be calculated before comparing to the targets set out in ADO. It divides England into two zones "high risk" which includes most of London and "moderate risk".

Despite its name it is not entirely simple:

- every space/room in every home must be tested to show compliance (Dynamic Thermal Modelling can be used on a sample of homes).
- it restricts glazing proportions, shading and the design of openings; especially on the South or West facing façades. It therefore limits design flexibility.
- it only has two zones: "high risk" and "medium risk" and designers may not feel that this is representative of all areas.



How to apply the simplified method

Whilst it is possible to manually carry out the calculations required, commercial tools are being developed and a spreadsheet tool is available from the Future Homes Hub website. These calculators make the process of determining compliance much easier.

A series of window, door and room measurements are required as is the dwelling location, whether there is cross ventilation and whether shading is provided. The tools undertake the necessary calculations and display whether the dwelling passes or fails the Part O criteria.

For each home you will need to measure (see Glossary for definitions):

- ***Floor area*** (GIA)
- The ***floor area of each room*** containing a window, rooflight or external door. Where rooms are dual activity (e.g. kitchen/living rooms) the depth of room is limited to 4.5m.

For each window pane, rooflight and door the orientation is required and the following measured:

- ***Glazing area*** (m²)
- Window opening height and width (m)
- Opening angle (taking into account the 650mm maximum reach criteria for windows) or the position of window frame within the wall
- Orientation.

An example of the output from the free Future Homes Hub Part O Calculator tool (an Excel spreadsheet) is shown in Figure 9.

Building Regulations Part O 2021 (England), Simplified Method - Results

Is dwelling in a location where external noise may be an issue?	**No**
Is dwelling located near to significant local pollution sources?	**No**
Direction of clock face 6 on site wide plan:	**East**

A **Site data**					
Company	Test				
Site	Somewhere				
House type	FHH RinR Semi				
Plot number	82				
B **Home data**					
Location risk category	**Moderate**				
Shading provided?	**None**				
Cross ventilation?	**Yes**				
Total GIA of home (m^2)	**112.97**				
Largest glazed façade orientation	**West**				
C **Results**	**Value**	**Percentage**	**Target**	**Result**	✓×
Limiting solar gains:					
Total glazing area for home	9.31 m^2	8.24 %	11 %	< target	✓
Glazing area for most glazed room: **Lounge/Dining**	3.50 m^2	15.12 %	22 %	< target	✓
Shading	None		Not required		✓
Removal of excess heat:					
Total equivalent area (% of floor area)	8.30 m^2	7.35 %	9 %	> target	×
Total equivalent area (% of glazed area)	8.30 m^2	89.20 %	55 %	> target	✓
Bedroom 1 equivalent area	1.07 m^2	7.19 %	4 %	> target	✓
Bedroom 2 equivalent area	0.53 m^2	4.64 %	4 %	> target	✓
Bedroom 3 equivalent area	0.53 m^2	6.48 %	4 %	> target	✓
Bedroom 4 equivalent area	0.39 m^2	5.15 %	4 %	> target	✓
Bedroom 5 equivalent area	m^2	%	%		

Figure 9: **Example Results output from the Future Homes Hub Part O Simplified Method Excel spreadsheet.**

Note: this shows non-compliance with the removal of excess heat.

Additional measures for high risk locations under the simplified method

All homes in high risk locations (i.e. most of London and parts of central Manchester) should incorporate external shading and/or solar control glazing. See Appendix C of Approved Document O for the list of postcodes.

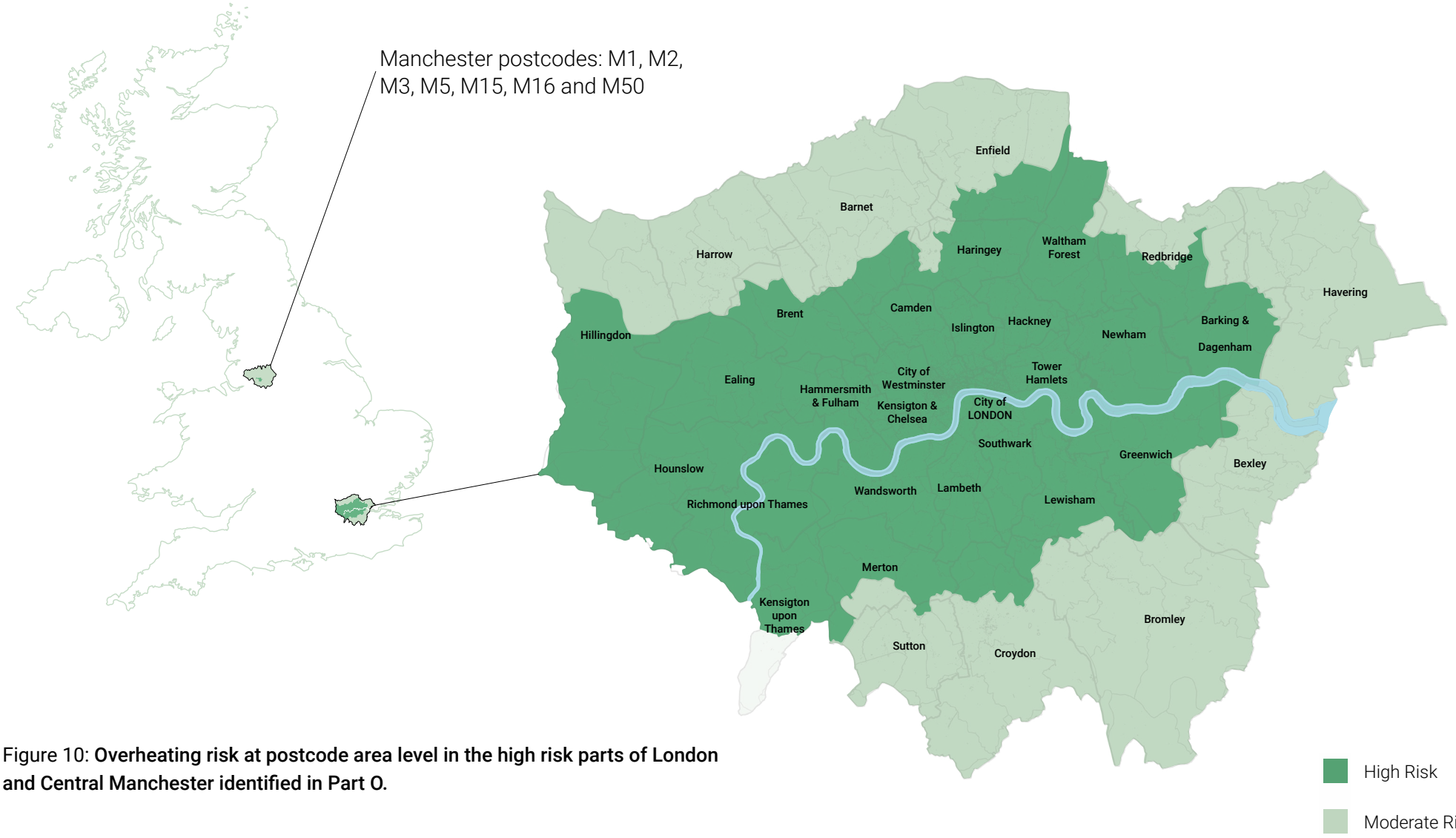
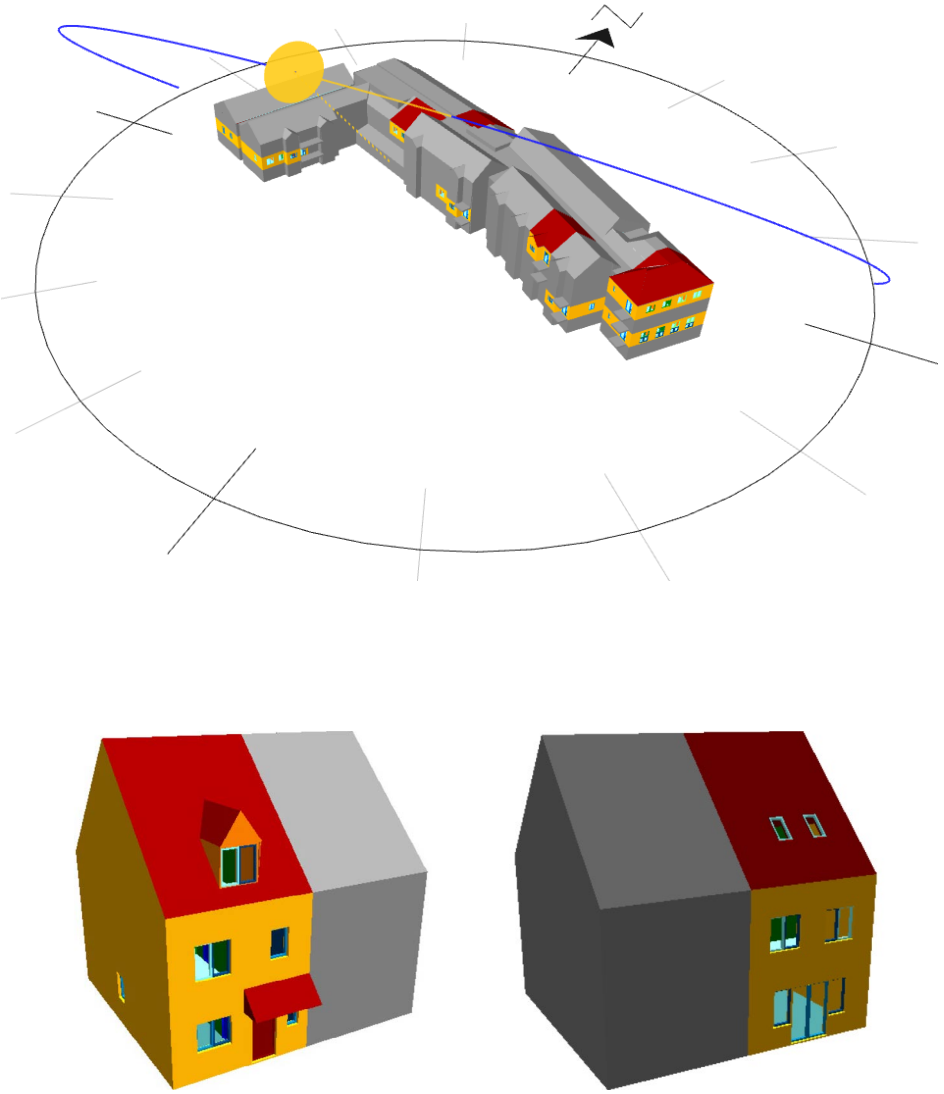


Figure 10: **Overheating risk at postcode area level in the high risk parts of London and Central Manchester identified in Part O.**

What you need to know about Dynamic Thermal Modeling

- Dynamic thermal modelling is largely based on the CIBSE TM59 methodology. It requires specialist software and the input of an experienced modeller, who should be appointed early in the design stage. They will be able to advise on the best approaches to modelling and any relevant design changes to the homes
- Rather than setting design limits, it is based on comfort criteria, and the modelling can take account of a wider range of parameters than the Simplified Method. It therefore offers more design flexibility.
- In addition, compliance may be achieved using mechanical ventilation, for those sites where windows cannot be opened.
- Unlike the Simplified Method, it can be used on a sample of homes, to be approved with the Building Control Body, rather than every single home.
- Dynamic modelling is only as good as the inputs used. Design teams should provide the modeller with as much detail about the building as possible e.g. window reveal depths, which window panes open, and how much of the thermal mass is exposed. Teams should never assume the model matches the building just because it is complete: they should discuss the inputs as the design develops, and review modelling reports carefully.
- Shading from trees and other foliage, and from internal shading (e.g. blinds) cannot be taken into account in the model for Part O compliance purposes.
- Night-time window opening profiles are different from those in the “standard” CIBSE TM59. Software manufacturers are expected to release updates that will provide this functionality.

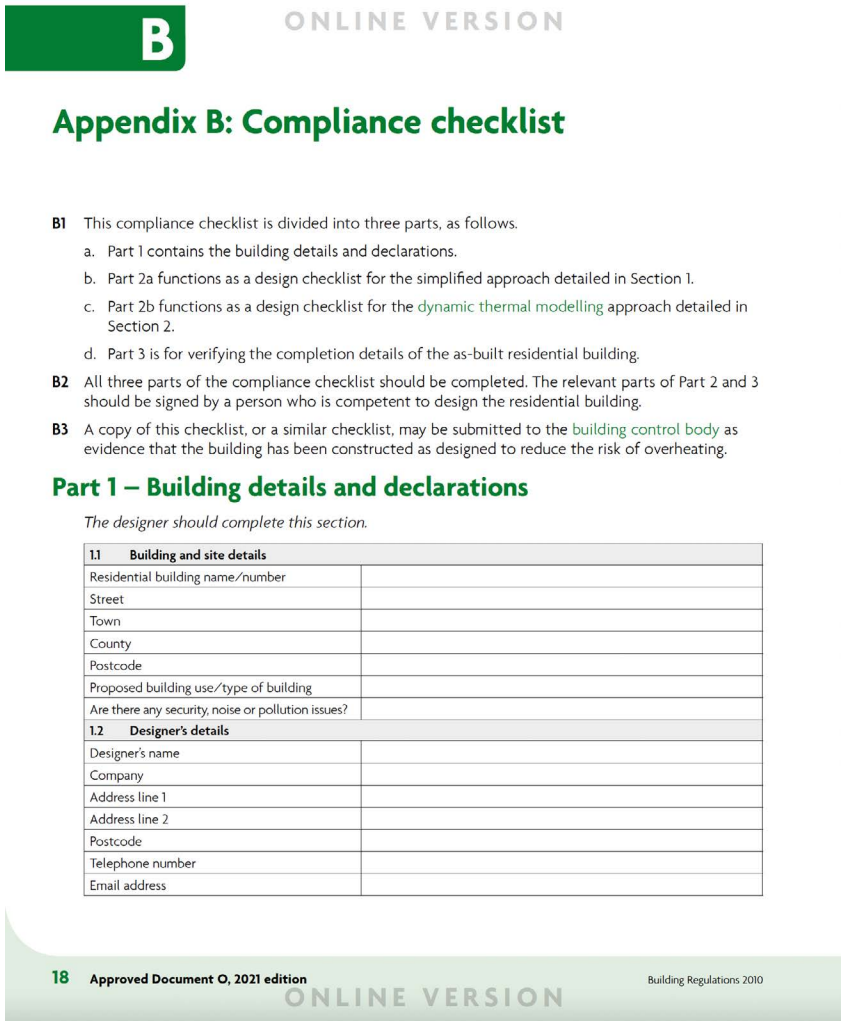
Worked examples can be found in the Future Homes Hub Part O Technical Guidance.



Figures 11: **Example houses and apartments modelled in the Dynamic Thermal Modelling package.**

Show that you have complied

To show that you have complied, the checklist in Appendix B of Approved Document O is used.



B

ONLINE VERSION

Appendix B: 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 detailed in Section 1.

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

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

B2 All three parts of the compliance checklist should be completed. The relevant parts of Part 2 and 3 should be signed by a person who is competent to design the residential building.

B3 A copy of this checklist, or a similar checklist, may be submitted to the building control body as evidence that the building has been constructed as designed to reduce the risk of overheating.

Part 1 – Building details and declarations

The designer should complete this section.

1.1 Building and site details	
Residential building name/number	
Street	
Town	
County	
Postcode	
Proposed building use/type of building	
Are there any security, noise or pollution issues?	
1.2 Designer's details	
Designer's name	
Company	
Address line 1	
Address line 2	
Postcode	
Telephone number	
Email address	

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Figure 12: **Extract page from AD-O Appendix B.**

Appendix B compliance checklist continues to Parts 2 and 3.

Where to go for further help

Help can be found at

Future Homes Hub guidance

- The Technical Guide to Part O by the Future Homes Hub
- The Future Homes Hub has developed a spreadsheet for the Simplified Method.
- Provide homeowners with information about their new homes
- Improve ventilation under the new building regulations
- Improve fabric, airtightness and thermal bridging performance
- Provide information for SAP assessors and building control
- Keep up to do with changes to the building regulations and the introduction of the Future Home Standard

Find all new regulations in the official Approved Documents on GOV.UK:

- The government FAQ page to support the new Part O: Approved Document O: Overheating, frequently asked questions
- Conservation of fuel and power: Approved Document L - 'Part L'
- Overheating: Approved Document O - 'Part O'
- Ventilation: Approved Document F - 'Part F'

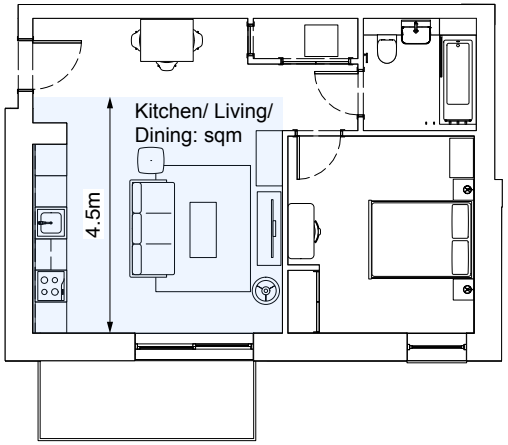
Glossary

Equivalent area: A measure of the aerodynamic performance of an opening. It is the area of a sharp-edged circular orifice through which air would pass at the same volume flow rate, under an identical applied pressure difference, as through the opening under consideration.

Free area: The geometric open area of a ventilation opening. This area assumes a clear sharp-edged orifice that would have a coefficient of discharge (Cd) of 0.62.

Floor area: The area of the residential unit, measured to the internal face of the perimeter walls at each floor level. NOTE: This area is the gross internal area as measured in accordance with the Code of Measuring Practice by the Royal Institution of Chartered Surveyors (RICS).

Floor area of the room: The area of the room, measured to the internal face of the perimeter walls. Where a room serves more than one activity, e.g. open-plan kitchen and living room, the area with the largest glazing area should be assessed and the room area calculated based on a room depth no greater than 4.5m from the glazed façade.



g-value: total solar heat gain / incident solar radiation. NOTE that the maximum g-value referred in Part O is a centre-pane value for the glass itself. This is different to the whole window g-value quoted in BFRC data ("solar factor"), which takes account of the effect of the window frames and is therefore significantly lower

Most glazed room: The room with the highest (m²) area of glazing. Where a home has equal areas of glazing in two or more rooms then the glazing:floor area ratio for each room should be calculated and the room with the highest ratio selected as the "most glazed".

SAP: Standard Assessment Procedure; the Government's approved method for calculating energy efficiency and carbon emissions primary energy, energy cost and SAP rating from homes to demonstrate compliance with Building Regulations.