Net Zero Building Regulation

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The Building Regulations 2010

Approved Document LC

Volume 1- New Residential Buildings in Wales

Approved Document LC: Low Carbon Cooling and Thermal Comfort

2026 edition – for use in Wales*

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0.0 Introduction

As Welsh homes become more insulated and airtight to reduce winter heating demand, summer performance must be considered at design stage (Welsh Government, 2024; LETI, 2020). Poorly balanced fabric-first design can increase overheating risk and lead to reliance on mechanical cooling, increasing operational energy use (Welsh Government, 2022a; CIBSE, 2017).

Approved Document O already addresses overheating risk in new residential buildings, while Approved Document L addresses energy performance and fixed services (Welsh Government, 2022a; Welsh Government, 2024). Approved Document LC therefore does not replace either document. It fills a narrower gap: reducing the carbon impact of cooling demand through a low-carbon cooling hierarchy.

The aim is to achieve summer thermal comfort, where reasonably practicable, through passive and low-energy design before active cooling is considered. Where mechanical cooling is unavoidable, it should be efficient, controlled, commissioned and included in the wider building energy strategy. This supports net zero objectives by reducing cooling-related electricity demand over the building life (UKGBC, 2019; LETI, 2020). In Wales, this also supports decarbonisation, resilience and the long-term prevention principles of the Well-being of Future Generations (Wales) Act 2015 (Welsh Government, 2015).

0.1 Scope

This Approved Document applies primarily to new residential buildings in Wales, including houses, flats, apartments, student accommodation, care accommodation and other dwellings where occupants may be vulnerable to high internal temperatures (Welsh Government, 2022a; CIBSE, 2017). The principles may also inform selected non-domestic buildings, such as schools, offices and community buildings, where similar risks are present (Welsh Government, 2023; CIBSE, 2021).

It applies at design and completion stage and should be read alongside Approved Documents O, L and F. It does not set replacement overheating criteria, ventilation rates or Part L energy targets.

0.2 Purpose

The purpose of Approved Document LC is to provide a clear method for reducing cooling demand and supporting low-carbon thermal comfort in new residential buildings (UKGBC, 2019; LETI, 2020). Its objectives are to reduce cooling-related operational energy, prioritise passive and low-energy cooling, improve summer comfort and wellbeing, and ensure any mechanical cooling is justified, efficient, controlled and evidenced (CIBSE, 2017; BREEAM, 2025).

0.3 Relationship with other Approved Documents

Approved Document LC should be read with the following Approved Documents.

Figure 2: Relationship with Other Approved Documents

Document	Existing focus	Approved Document LC adds
Part O	Overheating risk	Carbon impact of cooling strategy
Part L	Energy performance and services	Cooling demand hierarchy before active cooling
Part F	Ventilation and indoor air quality	Ventilation as summer heat removal without reducing IAQ
Parts B / K / M	Safety and usability	Safe openings, shading and occupant controls

Figure 2: Relationship between Approved Document LC and existing Welsh Approved Documents.

Approved Document O addresses overheating risk. LC does not replace the overheating assessment; it requires the selected cooling strategy to follow a low-carbon hierarchy before active cooling is specified (Welsh Government, 2022a).

Approved Document L addresses energy performance, heat gains and losses, services, controls, commissioning and information. LC adds a requirement to minimise cooling demand and account for any active cooling within the energy strategy (Welsh Government, 2024).

Approved Document F addresses indoor air quality; where ventilation is used for heat removal, it must not compromise ventilation provision, pollutant control or commissioning (Welsh Government, 2022b).

Approved Documents B, K, C and M should also be considered where cooling measures affect fire safety, guarding, moisture, contaminants, accessibility or occupant controls. Where conflict arises, existing safety, health and statutory requirements take priority.

Requirement LC1

Reasonable provision shall be made to limit cooling demand and maintain summer thermal comfort using the lowest-carbon approach that is reasonably practicable (Welsh Government, 2022a; UKGBC, 2019). The building shall be designed so that passive and low-energy measures are considered before mechanical cooling is specified.

Reasonable provision is demonstrated by submitting a Low Carbon Cooling Strategy showing that heat gains have been limited, passive heat removal considered, low-energy cooling assessed, and any mechanical cooling justified, controlled and included in the energy strategy. This recognises that overheating risk and cooling demand are related but not identical issues: Part O considers overheating risk, while LC tests whether the cooling response limits operational energy and carbon (Welsh Government, 2022a; LETI, 2020).

1.0 Application of the Requirements

This document applies where cooling demand or summer comfort may be affected by building form, orientation, glazing, insulation, airtightness, ventilation, internal heat gains or mechanical cooling. Additional consideration is required for higher-risk spaces, including single-aspect or top-floor flats, heavily glazed dwellings, homes affected by noise or pollution, dwellings where windows cannot be safely opened, care accommodation and buildings with high internal gains (Welsh Government, 2022a; CIBSE, 2017).

For extensions, material alterations and changes of use, the principles should be applied where the work significantly affects glazing, ventilation or cooling demand. Compliance should be demonstrated through a Low Carbon Cooling Strategy at design stage and updated at completion.

2.0 Definitions

Low carbon cooling: the design, control and operation of a building to maintain acceptable internal temperatures while minimising energy use and carbon emissions. Passive cooling: reducing temperatures without primary reliance on mechanical cooling, using measures such as shading, controlled glazing, ventilation, night cooling, thermal mass and reduced internal heat gains.

Active or mechanical cooling: fixed mechanical or electrically powered systems used to reduce internal temperature, including air conditioning, comfort cooling, reversible heat pumps in cooling mode or chilled water systems. Cooling demand: the cooling required to maintain acceptable thermal comfort during warmer periods. Cooling hierarchy: the order in which measures should be considered: avoid heat gains; remove heat passively; use low-energy cooling; justify mechanical cooling; and make any cooling efficient and low carbon.

Purge ventilation means rapid removal of excess heat, pollutants or moisture through larger openings. Night cooling means removing heat during cooler night-time periods. MVHR summer bypass allows incoming air to bypass heat recovery during warmer periods. These terms should be read with Approved Documents O, F and L and recognised overheating guidance (Welsh Government, 2022a; Welsh Government, 2022b; Welsh Government, 2024; CIBSE, 2017).

3.0 General Principles

Cooling demand should be avoided and reduced through design before mechanical cooling is specified (LETI, 2020; UKGBC, 2019). Building form, orientation, glazing, shading, ventilation, airtightness, insulation, thermal mass and internal gains should be considered together from the earliest design stage.

Measures should be practical for occupants to use and provide reasonable control over ventilation, shading and comfort (CIBSE, 2021; BREEAM, 2025). Designs should not rely on unrealistic assumptions, such as windows being left open where noise, pollution, security, falling risk or weather exposure make this unlikely. Low-carbon cooling measures must also maintain compliance with fire safety, moisture control, accessibility, acoustics, security and protection from falling.

Designers should consider future climate conditions because new buildings have long service lives. This guidance cannot remove all overheating risk or guarantee identical comfort in every dwelling; outcomes will also depend on behaviour, maintenance, internal gains and system operation. Its purpose is to require an evidence-based process that reduces avoidable cooling demand and operational carbon (CIBSE, 2017; Passivhaus Trust, n.d.).

4.0 Low Carbon Cooling Hierarchy

New buildings should be designed in accordance with the low-carbon cooling hierarchy. The Low Carbon Cooling Strategy should explain how each stage has been considered (LETI, 2020; UKGBC, 2019; CIBSE, 2017).

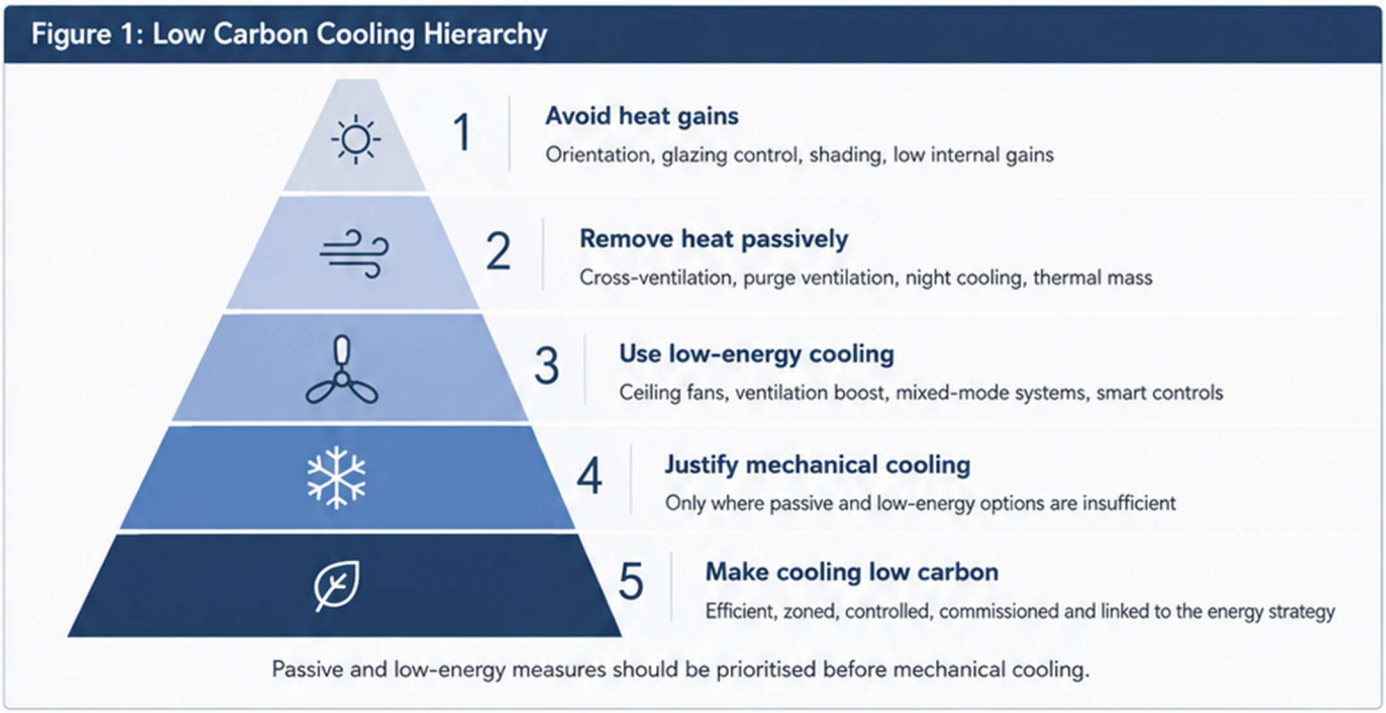

Figure 1: Low Carbon Cooling Hierarchy. Passive and low-energy measures should be prioritised before mechanical cooling.

4.1 Stage 1: Avoid unwanted heat gains

The first stage is to reduce heat entering or being generated within the building. Measures include appropriate orientation, limiting excessive glazing, external shading, solar control glazing, insulation continuity, low-energy lighting, efficient appliances and reducing unnecessary gains from pipework, plant and communal services. Solar and internal gains should be reduced without unacceptable impacts on daylight, ventilation, safety or wellbeing (Welsh Government, 2024; LETI, 2020).

4.2 Stage 2: Remove heat passively

Where gains cannot be fully avoided, the design should remove excess heat passively through natural or cross-ventilation, purge ventilation, secure night cooling, useful thermal mass, effective air flow paths and MVHR summer bypass. These measures must be safe, secure and practical for occupants (Welsh Government, 2022b; CIBSE, 2017).

4.3 Stage 3: Use low-energy cooling

Where passive measures are insufficient, low-energy cooling should be considered before refrigeration or air conditioning. Measures may include ceiling fans, low-energy circulation fans, ventilation boost, mixed-mode operation, smart controls and zoning. Systems should be simple to use, commissioned and capable of limiting energy use (CIBSE, 2021; LETI, 2020).

4.4 Stage 4: Justify mechanical cooling

Mechanical cooling should only be specified where previous stages are insufficient. The strategy should state why cooling is needed, what alternatives were considered, the predicted demand, rooms served, sizing, controls, zoning, commissioning and how it is included in the energy assessment. It should not compensate for avoidable poor design (Welsh Government, 2022a; CIBSE, 2017).

4.5 Stage 5: Efficient low-carbon cooling

Where mechanical cooling is unavoidable, it should be appropriately sized, zoned, controllable, commissioned and explained to the user. It should minimise operational energy, avoid cooling unoccupied spaces, prevent simultaneous heating and cooling, consider refrigerant impacts, and use low-carbon electricity or on-site generation where reasonably practicable (Welsh Government, 2024; UKGBC, 2019).

5.0 Design Standards

Designers should use a combined strategy. Glazing should limit unwanted solar gain while maintaining daylight and outlook, and large areas of unshaded glazing or rooflights should be justified by assessment (Welsh Government, 2022a; LETI, 2020). External shading should be prioritised because it reduces heat before it enters the building; suitable options include overhangs, balconies, shutters, external blinds, brise soleil, deep reveals and reliable landscape shading (CIBSE, 2017).

Ventilation strategies should support indoor air quality and summer heat removal. Natural ventilation, cross-ventilation, purge ventilation, secure night ventilation, mechanical boost and MVHR summer bypass should be considered, with attention to noise, security, pollution, weather exposure, fire safety and falling risk (Welsh Government, 2022b; CIBSE, 2017). Thermal mass may reduce peaks where heat can later be released through night cooling, but it is not a substitute for controlling solar gain (CIBSE, 2021; Passivhaus Trust, n.d.).

Internal heat gains should be reduced through efficient lighting, appliances, insulated hot water pipework and sensible location of heat-generating equipment (Welsh Government, 2024; CIBSE, 2021). Controls should be accessible, simple and clearly labelled. Buildings for vulnerable occupants should not depend on actions that may be difficult or unsafe (BREEAM, 2025; Welsh Government, 2015).

6.0 Mechanical Cooling Restrictions

Mechanical cooling should not be the default method for summer comfort. It may be acceptable for health, wellbeing or site constraints, but must be justified through the Low Carbon Cooling Strategy. The justification should identify rooms served, assessment method, expected demand, passive measures included, low-energy alternatives considered and the effect on operational energy and carbon (Welsh Government, 2022a; LETI, 2020).

Systems should be sized using realistic assumptions for occupancy, internal gains, glazing, shading, ventilation, orientation and future summer conditions (CIBSE, 2021). Where installed, cooling should include time,

temperature and occupancy controls, zoning, user-friendly interfaces, commissioning and user information. Poorly controlled, inefficient or oversized cooling should not be reasonable provision (Welsh Government, 2024; UKGBC, 2019).

7.0 Compliance Criteria

Compliance should be demonstrated by a Low Carbon Cooling Strategy prepared at design stage and updated at completion (Welsh Government, 2022a; Passivhaus Trust, n.d.). The strategy should show how heat gains have been reduced, how heat will be removed passively, what low-energy measures were considered, why mechanical cooling is necessary if proposed, and how any system will be efficient, controlled and commissioned.

Figure 3: Compliance Process

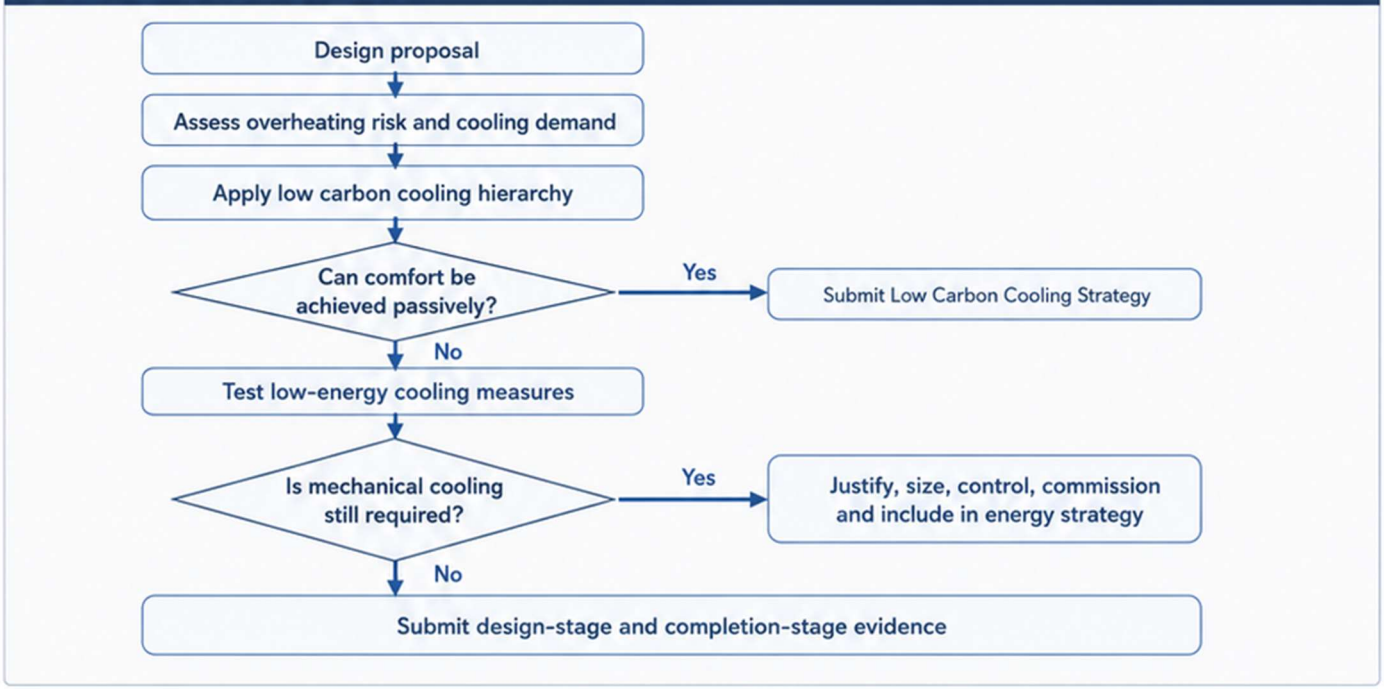

Figure 3: Low Carbon Cooling Strategy compliance process. The process demonstrates how designers should assess cooling demand, apply the cooling hierarchy and justify mechanical cooling only where passive and low-energy measures are insufficient.

Design-stage evidence should include the cooling strategy, drawings showing orientation, glazing and shading, ventilation routes, secure night cooling where relevant, internal heat gain considerations, thermal mass or low-energy cooling details, any overheating or thermal comfort assessment, and mechanical cooling justification (Welsh Government, 2022a; CIBSE, 2017). Where an assessment identifies excessive risk, the design should be amended or additional low-carbon measures introduced (BREEAM, 2025).

8.0 Documentation and Verification

At completion, the applicant should confirm that the approved strategy has been delivered. Evidence should include final drawings or schedules, confirmation of installed glazing, shading and ventilation measures, commissioning certificates for ventilation or cooling systems, final energy assessment information where active cooling is installed, and records of significant changes from design stage (Welsh Government, 2022a; Welsh Government, 2024; Welsh Government, 2022b).

Building users should receive clear information on using windows, purge ventilation, shading, fans, ventilation boost, summer bypass and mechanical cooling while minimising energy use. For higher-risk buildings or buildings with active cooling, owners should be encouraged to review summer comfort and cooling energy after occupation (UKGBC, 2019; BREEAM, 2025).

9.0 Competence and Certification

The Low Carbon Cooling Strategy should be prepared by a competent person with suitable knowledge of building design, energy performance, ventilation, overheating risk and thermal comfort. Depending on complexity, suitable persons may include architects, building services engineers, energy assessors, overheating assessors, Passivhaus designers, sustainability consultants or ventilation and cooling specialists (Welsh Government, 2023; CIBSE, 2021). Where mechanical cooling is proposed, design, installation and commissioning should be undertaken by competent persons with appropriate system sizing, controls and energy efficiency knowledge (Welsh Government, 2024).

10.0 References and Standards

The following documents, standards and guidance may be used to support compliance with this Approved Document.

Welsh Approved Documents

- Welsh Government (2022a) *Approved Document O: Overheating*. 2022 edition. For use in Wales. Accessed at - https://www.gov.wales/approved-document-o-overheating
- Welsh Government (2022b) *Approved Document F: Ventilation, Volume 1 – Dwellings*. 2022 edition. For use in Wales. Accessed at - https://www.gov.wales/approved-document-f-ventilation
- Welsh Government (2023) *Approved Document L, Volume 2: Buildings other than dwellings – Conservation of fuel and power*. 2022 edition. For use in Wales. Accessed at- https://www.gov.wales/approved-document-l-conservation-fuel-and-power
- Welsh Government (2024) *Approved Document L, Volume 1: Dwellings – Conservation of fuel and power*. 2022 edition incorporating 2024 amendments. For use in Wales. Accessed at- https://www.gov.wales/approved-document-l-conservation-fuel-and-power
- Welsh Government. Approved Document B: Fire Safety. Current edition for use in Wales. Accessed at- https://www.gov.wales/approved-document-b-fire-safety
- Welsh Government. Approved Document C: Site preparation and resistance to contaminants and moisture. Current edition for use in Wales. Accessed at- https://www.gov.wales/approved-document-c-site-preparation-and-resistance-contaminants-and-moisture
- Welsh Government. Approved Document K: Protection from falling, collision and impact. Current edition for use in Wales. Accessed at- https://www.gov.wales/approved-document-k-protection-falling-collision-and-impact
- Welsh Government. Approved Document M: Access to and use of buildings. Current edition for use in Wales. Accessed at- https://www.gov.wales/approved-document-m-access-and-use-buildings

Technical standards and industry guidance

- Chartered Institution of Building Services Engineers. CIBSE TM59: Design methodology for the assessment of overheating risk in homes. 2017. Accessed at- https://www.cibse.org/knowledge-research/knowledge-portal/technical-memorandum-59-design-methodology-for-the-assessment-of-overheating-risk-in-homes
- Chartered Institution of Building Services Engineers. CIBSE Guide A: Environmental Design. Current edition. Accessed at- https://www.cibse.org/knowledge-research/knowledge-portal/guide-a-environmental-design-2015-updated-2021-pdf/
- London Energy Transformation Initiative. LETI Climate Emergency Design Guide: How new buildings can meet UK climate change targets. 2020. Accessed at- https://www.leti.uk/cedg
- UK Green Building Council. Net Zero Carbon Buildings: A Framework Definition. 2019. Accessed at- https://ukgbc.org/resources/net-zero-carbon-buildings-a-framework-definition/
- Passivhaus Trust (n.d.) *Avoiding Summer Overheating*. Available at: Passivhaus Trust website. Accessed 30 June 2026. Accessed at- https://passivhaus.uk/keeping-cool-avoiding-overheating-risks/

- BREEAM (2025) *Hea 04 – Thermal Comfort: Assessing thermal comfort – Residential buildings, KBCN1408*. BREEAM Knowledge Base. Updated 26 January 2025. Accessed at- https://kb.breeam.com/wp-content/plugins/breeamkb-pdf/pdf/?c=6035

Supporting Welsh and net zero policy

- Welsh Government. Net Zero Wales Carbon Budget 2, 2021–2025.
- Welsh Government. Well-being of Future Generations (Wales) Act 2015.
- Welsh Government. Prosperity for All: A Low Carbon Wales.
- Future Homes Hub. Embodied and Whole Life Carbon: 2023–2025 Implementation Plan for the Homebuilding Industry.
- Deliver Net Zero Pattern Book. Seeing is Believing. Welsh Government supported project guidance.

Use of alternative guidance

Alternative standards or guidance may be used where the applicant can demonstrate that they provide an equivalent or higher level of performance in relation to reducing cooling demand, maintaining summer thermal comfort and minimising operational carbon emissions.

Where a standard or guidance document has been updated, the latest version may be used where it remains relevant to the requirements of this Approved Document.