

2021 changes to the Building Regulations

December 2021

An Atelier Ten briefing note on the new set of approved documents released by the government on 15 December 2021 and coming into effect 15 June 2022.

Changes to the Building Regulations include updates to the Approved Document L (ADL) on Conservation of fuel and power, ADF on Ventilation, a new ADO on Overheating, and a new ADS on Infrastructure for the charging of electrical vehicles linked to buildings.

Our quick headlines are:

- Meeting primary energy targets is now equally important as carbon emission targets.
- The changes are estimated to reduce the regulated carbon emissions of
 - new dwellings by ~30%
 - new non-domestic buildings by ~27% on average and
 - new offices by ~35%.
- Dwelling fabric efficiency targets will become at least 15% harder to meet.
- No significant increase in ventilation rates in offices in response to the pandemic. Recirculating systems must meet certain new criteria, and air quality sensors are required in a range of spaces.
- The proposal for the reporting of operational energy forecast to the owner has been watered down to allow use of benchmarks instead of analysis based on CIBSE's TM54.
- Overheating will become a hot subject with many developers likely pursuing the dynamic thermal modelling approach using CIBSE's TM59 for regulatory compliance.

Introduction

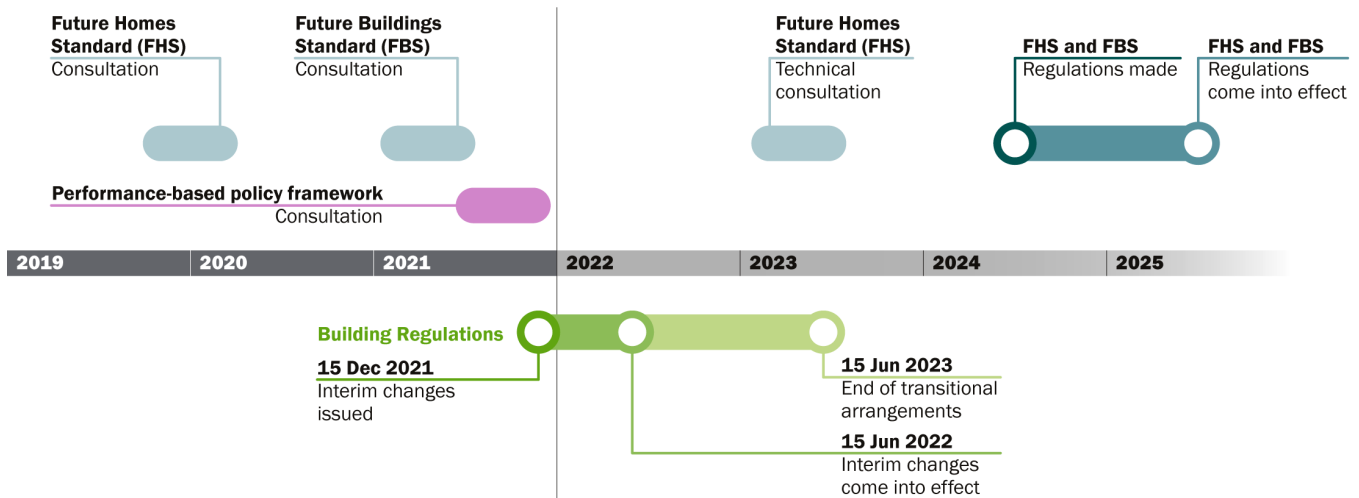


Figure 1 Proposed timeline for ongoing changes to the Building Regulations

On 15 December 2021, the English government officially released the interim changes to the Building Regulations Approved Documents (AD) towards the planned establishment of the Future Homes and Future Buildings Standards (FHS and FBS) by 2025. The release of the updated ADs formally sets in motion the replacement of the previous versions of:

- ADF on Ventilation in Buildings and
- ADL on Conservation of fuel and power in Dwellings (ADL1) and in Buildings other than dwellings (ADL2).

These are the first substantial changes to the ADL and ADF since 2013. Whilst the necessary step-change in regulations is delayed until at least 2025, the interim changes move slowly in the right direction.

The changes to the ADs also introduce two new compliance documents:

- ADO on Overheating and
- ADS on Infrastructure for the charging of electric vehicles.

The changes to the ADs take effect on 15 June 2022 for use in England. They do not apply to work subject to a building notice, full plans application or initial notice (as defined in Regulation 2 of the Building Regulations) submitted before 15 June 2022, provided the work is started on site before 15 June 2023.

The revised ADLs on conservation of fuel and power in buildings consolidate various documents into single volumes. Notably, ADL1 on dwellings and ADL2 on buildings other than dwellings

now cover both new and existing buildings. In contrast, the previous single volume of ADF on ventilation in buildings is split into two volumes, ADF1 and ADF2 for dwellings and buildings other than dwellings respectively. Requirements on the avoidance of overheating in domestic buildings, which apply to both dwellings and non-dwelling domestic buildings are removed from the scope of the ADLs. This is now covered in the new ADO.

Further technical consultations on the FHS (and presumably on the FBS) are slated for Spring 2023.

These are the first substantial changes to Part L and Part F since 2013. Whilst the necessary step-change in regulations is delayed until at least 2025, the interim changes move slowly in the right direction.

ADL1: Conservation of fuel and power in dwellings

As a key change, ADL1 now requires dwellings to meet primary energy targets in addition to the carbon and fabric efficiency targets. Primary energy is energy from all sources which has not undergone any conversion or transformation process, e.g. total raw energy consumed at the electricity generation plant. This is applicable to all buildings and aligns England's national calculation methods with the rest of Europe as per the Energy Performance of Buildings Directive.

A revised Standard Assessment Procedure 10.2 underpins the compliance procedure for dwellings. It introduces monthly variations to primary energy and carbon intensity of the grid electricity, which as an annual average is 73% lower carbon than the version it replaces (~139g/kWh vs. 519g/kWh). This drop reflects the ongoing grid decarbonisation and it will accelerate electrification of heating and hot water generation, often the largest energy end uses in dwellings. With up to 50% higher emission rate and 15% higher primary energy factor in the winter months compared to the summer months, electricity use reduction and solar electricity generation in winter months will yield more favourable outcomes than in summer.

Fabric energy efficiency standards are retained and tightened by over 15% compared to the outgoing standards through improvements to the elemental thermal performance and removal of the headline adjustment factor of 15%.

Other consolidated improvements to performance standards expected to reduce regulated carbon emissions of dwellings by ~30% compared to outgoing ADL1 include

- lighting and building service system performance and control improvements, some of which also apply to extensions and new and replacement elements in existing dwellings
- stricter fabric and MEP equipment requirements,
- inclusion of new technologies such as photovoltaic panels and wastewater heat recovery in the definition of the notional dwelling.

ADL2: Conservation of fuel and power in buildings other than dwellings

The new ADL2 combines the previous ADL2A and ADL2B to align and streamline the requirements for new and existing buildings. The methodology to assess compliance with ADL2 remains broadly unchanged, with three key exceptions:

- Limiting of primary energy use in addition to carbon emission rate for new buildings.
- Required forecasting of the actual building energy use to be recorded in the building log book, including all metered energy uses and unregulated loads and using an energy forecasting methodology such as CIBSE's TM54, design calculations or energy benchmarks.
- Separation of the requirements to mitigate overheating in residential buildings, including dorms, care homes etc.

With the introduction of the new primary energy use metric, a building compliant with the Building Regulations will have to perform better than the corresponding notional building in terms of both carbon emissions and primary energy use.

Similar to dwellings, the carbon factor for grid electricity is weighted on a monthly basis and revised down by over 70% compared to the outgoing annual emission intensity. This means that a direct electric heater will emit less carbon than the most efficient natural gas boiler in the market. However, it will use more primary energy. Deterrence from direct electric heating is therefore a likely consequence of the newly introduced primary energy metric. At the detail level, further adjustments to the calculations also penalise use of direct electric systems for space heating in favour of heat pumps. Conversely, the assessments will likely favour point-of-use direct electric systems for domestic hot water generation particularly in buildings with low hot water demand.

These and other changes to the way limiting emission and primary energy rates are calculated will make use of fossil fuels other than natural gas likely untenable. Whilst they do not fully shut the door to the use of natural gas for heating, they pave the way to a full switch that requires low-carbon or all-electric heating in all buildings by 2025.

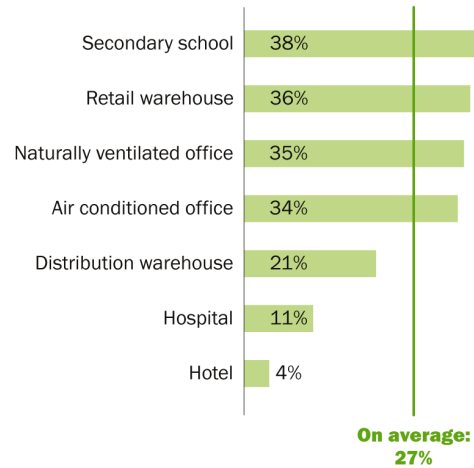


Figure 2 Preliminary estimates on reduction in carbon emissions compared to Part L2013 for different building types.

The changes to ADL2 also enhance the performance requirements for compliance. On this, ADL2 adopts the higher of the two previously consulted options estimated to yield up to 27% headline carbon reduction over the outgoing current Part L compliant buildings. To contrast the scale of this change, the switch from Part L2010 to Part L2013 was estimated to yield a 9% reduction in regulated carbon emissions.

The headline reduction figure aggregates different building types covered by ADL2. For offices, the targeted reduction in emissions under the government's preferred scenario is ~35% (Figure 2). This levels compliance for offices with the GLA requirements in London. However, for regulations this reduction will have to be achieved without the implicit reward for fuel switching allowed under GLA's three-step energy hierarchy that defaults to natural gas boilers for heating as the baseline. Therefore, the new regulatory framework may force office buildings towards higher performance than the recently adopted version of the London Plan. At the time of writing, it is unclear how GLA's recently updated carbon reduction policy will respond to these changes.

Such reduction in carbon emissions results primarily from the tightening of the performance parameters, starting with the limiting factors for building fabric and services. The first major change to the building envelope limiting parameters since 2002 sets the properties of the notional building under Part L2013 as the regulatory minimum for each fabric element. Infiltration limit is reduced from 10 to 8m³/m²/s at 50Pa (see Appendix A for further details).

ADL2: Conservation of fuel and power in buildings other than dwellings

ADL2-2021 also tightens the summer solar heat gain budget into occupied or air-conditioned spaces by ~30% compared to the outgoing limits. This is now only applicable to new “non-domestic” buildings (see section on overheating in residences below). In addition, most building services will be subject to increased efficiency requirements. Notably, revised lighting requirements will likely necessitate LED lights in most ambient and display lighting applications.

Where applicable, the new ADL2 broadly aligns the minimum performance requirements for the regulated building fabric and service elements between new buildings, extensions and refurbishments included within its scope.

Looking beyond construction, the new ADL2 requires development larger than 1000m² to report to the building owners a forecast of operational energy use following CIBSE’s TM54 methodology, design calculations or energy benchmarks. It also requires more extensive commissioning, automated building management, and metering to facilitate direct comparisons with such forecasts and to bridge the all-too-common performance gap in use. Whilst this is a welcome change, it lacks teeth and dilutes the proposals advanced during the consultation phase by allowing benchmark values to be used. If adopted, another recently consulted policy on the introduction of a performance-based policy framework that mandate operational energy use disclosure in operation may address this gap by leveraging reputational liability of consultants and developers.

ADF1 and ADF2: Ventilation in buildings

Key changes introduced to the ADF include the following:

- separation of the Approved Document F into ADF1 for dwellings and ADF2 for buildings other than dwellings
- alignment of compliance requirements with the latest industry guidance and consultation responses to the FHS
- introduction of measures to improve indoor air quality and reduce the transmission of airborne infectious agents.

ADF1: Ventilation in dwellings

Other than recasting few of the existing obligations and introducing new reporting and commissioning requirements, ADF1 does not include very significant changes to the ventilation requirements for new dwellings.

However, there is greater emphasis on ensuring that new energy efficiency upgrades do not deteriorate the indoor air quality of existing dwellings and sufficient ventilation is maintained through new measures. Supported by a checklist, a newly introduced method ranks common energy efficiency measures based on their likely impact on ventilation and requires steps to be taken based on the likely severity of their combined impact.

ADF2: Ventilation in buildings other than dwellings

Overall, the changes incorporated into ADF2 are typically less onerous than those that were advanced during the consultation prior to the release of the final document.

In offices the requirement to provide at least 10l/s/person of outdoor air remains as before. However, this requirement is combined with a minimum outdoor air provision of 1l/s/m² of floor area. In common spaces, now redefined to also include circulation areas and lobbies, suitable natural ventilation, or mechanical ventilation providing at least 0.51l/s/m² is required. These new floor area-based requirements aim to deliver adequate outdoor air to all areas independent of occupancy.

Consultation proposals to increase the outdoor air delivery rate under certain conditions to reduce exposure to airborne contaminants are not incorporated into the adopted version of new ADF2. However, new specific provisions are stipulated for recirculating ventilation systems in offices. For these systems, one or more of the following will be required:

- changeover to 100% outdoor air mode (no recirculation)
- incorporation of UV-C germicidal irradiation systems
- ability to incorporate HEPA filters, if required.

Otherwise, the changes to the ADF2 include provisions to:

- improve the quality of ventilation system installation
- mitigate noise in operation, and
- enhance indoor air quality through requirements for indoor air quality monitoring in large occupiable rooms and outdoor air quality assessment, based on which measures to limit ingress of pollutants are triggered.

ADO: Overheating

Energy efficiency measures can increase the overheating risk in buildings, which can be further exacerbated by climate change. In response to the health and welfare implications of this risk, the government is introducing the new Approved Document O aiming to limit the overheating risk in new residential buildings.

The residential buildings covered by the new ADO include dwellings and “non-domestic residential buildings” such as dorms, care homes, and other institutional buildings where people sleep on the premises.

The Approved Document O on overheating expands the weak provisions to counter overheating risk previously covered under ADL1 and expects buildings to meet the requirements for avoidance of overheating using passive means, i.e. without the need for mechanical ventilation or cooling system, as far as reasonably practicable. It expects mechanical cooling to be used only where the requirements cannot be met using openings. To demonstrate compliance, developments can choose between a simplified (prescriptive) and a thermal simulation-based compliance path.

Simplified method

The simplified method splits England into two regions: large parts of Greater London with significant risk of overheating and the rest of England with moderate risk of overheating. It also distinguishes between residential units that can have cross-ventilation through openings on two opposing sides of the individual unit and those that cannot.

Based on these groupings, prescribed requirements for the size, shading and the solar factor of the windows and openings aim to limit excess solar heat gain and enhance natural ventilation. For a non-cross-ventilated flat in London, this corresponds to glazing area of maximum 11% (15% if facing north), and operable facade area of at least 10% of the floor area. This is further supported by minimum shading and glass specification requirements for southerly exposures and additional room specific requirements, such as orientation-based glazing area limits for the most glazed rooms, and bedroom opening free area requirement of at least 13% of the room floor area.

Dynamic thermal simulation method

The simplified method restricts design flexibility and is unlikely to be suitable for all residences. Greater flexibility can be achieved by adopting the thermal simulation method following CIBSE's TM59. ADO standardises this approach further by imposing additional requirements, for example on how the windows are expected to be used, and limitations, for example on the use of internal shades while conducting assessment in accordance with CIBSE's TM59.

Compliance with TM59 is challenging in London, unless a robust combination of high-performance fabric with external shading, access to cross ventilation, and thermal mass is built into the design. This route is therefore likely to require additional measures, even if it may allow greater flexibility in façade design.

In addition to prescribing compliance methodologies, ADO also requires consideration of noise, pollution, safety and security. When window openings are used for heat removal in bedrooms, specific noise level targets must be considered. Openings must also be designed for security and protection against fall and entrapment, with some of the ADO requirements overriding the acceptable standards defined under the Part K of the Building Regulations.

For dwellings, the new ADO replaces the overheating requirements under ADL1 and the Standard Assessment Procedure (SAP). ADL2 will maintain the requirements for limiting solar gains, yet these will apply only to building types other than those covered by the new ADO on overheating.

Appendix A: Changes to building fabric performance

Table 1 Comparison of the limiting performance properties for the new thermal elements in dwellings, and the notional building definition. Note that for existing buildings, same limiting values apply to both replacements and new elements.

Fabric element in [W/K/m ²]	Outgoing limit New / existing	New limit in 2021 New / existing	Outgoing notional properties	New notional properties in 2021
Roof	0.20 / 0.18	0.16 / 0.15	0.13	0.11
Pitched cold roof	0.20 / 0.16			
External wall	0.30 / 0.28	0.26 / 0.18	0.18	0.18
Floor	0.25 / 0.22	0.18 / 0.18	0.13	0.13
Party wall	0.20 / -	0.20 / -	0	0
Swimming pool basin	0.25 / 0.25	0.25 / 0.25	-	-
Windows [g-value]	2.00 / 1.60	1.60 / 1.40	1.40 [0.63]	1.20 [0.63]
Skylights*	2.00 / 1.60	2.20 / 2.20	1.40 [0.63]	1.20 when vertical [0.63] (1.70 when horizontal)
Entrance doors	2.00 / 1.80	1.60 / 1.40	1.00 - 1.20	1.00 (not or partly glazed)
Air tightness	10m ³ /h.m ² @50Pa	New only 8.00m ³ /h.m ² @50Pa 1.57m ³ /h.m ² @4Pa	5m ³ /h.m ² @50Pa	5m ³ /h.m ² @50Pa

Table 2 Comparison of the limiting performance properties for the new thermal elements in buildings other than dwellings, and the notional building definition. Note that for existing buildings, same limiting values apply to both replacements and new elements.

Fabric element in [W/K/m ²]	Outgoing limit	New limit in 2021	Outgoing notional properties	Proposed notional properties Side lit / top lit space
Flat roof	0.25	0.18	0.18	0.15 / 0.18
Pitched roof		0.16		
External wall	0.35	0.26	0.26	0.18 / 0.26
Floor	0.25	0.18	0.22	0.15 / 0.22
Swimming pool basin	0.25	0.25	-	-
Window [g-value/Tvis]	2.2	1.6	1.60 [40%/71%]	1.40 [29%/60%]
Rooflight* [g-value/Tvis]	2.2	2.2	1.80 [55%/60%]	2.10 [40%/71%]
Pedestrian door	2.2	1.6	2.2	1.9
Vehicle access and similar large door	1.5	1.3	1.5	1.3
High usage entrance door	3.5	3	2.2	1.9
Roof ventilator	3.5	3	-	-
Air permeability (for new buildings)	10m ³ /h.m ² @50Pa	8.00m ³ /h.m ² @50Pa	3.00 to 7.00 m ³ /h.m ² @50Pa	3.00 / 5.00 m ³ /h.m ² @50Pa

*In ADL2-2021, rooflights and skylights are to be rated in horizontal position. This is a change from the current version of Part L, which rates rooflights in vertical position.