<table>
<thead>
<tr>
<th>Topic</th>
<th>Slide</th>
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<td>56</td>
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</table>
The Need for Part L2B

Source: "energy efficiency in new and existing buildings: comparative costs and CO2 savings“, BRE Trust
• Mainly an elemental approach
• Capturing opportunities during other works
  – Whole-building approach
    • Consequential improvements, new regulation 17D
  – Emphasis on practical cost effective measures
    • 15 year simple payback of marginal cost

• Thermal element
  – Regulated when provided, renovated or replaced
Consequential improvements apply to existing buildings over 1,000m² where....

- Includes extension
- New building services
- Increased capacity of existing building services

New buildings

17C. Where a building is erected, it shall not exceed the target CO₂ emission rate for the building that has been approved pursuant to regulation 17B.

Consequential improvements to energy performance

17D.—(1) Paragraph (2) applies to an existing building with a total useful floor area over 1000m² where the proposed building work consists of or includes:
   a. an extension;
   b. the initial provision of any fixed building services; or
   c. an increase to the installed capacity of any fixed building services.

(2) Subject to paragraph (3), where this regulation applies, such work, if any, shall be carried out as is necessary to ensure that the building complies with the requirements of Part L of Schedule 1.

(3) Nothing in paragraph (2) requires work to be carried out if it is not technically, functionally and economically feasible.

Interpretation

17E. In this Part ‘building’ means the building as a whole or parts of it that have been designed or altered to be used separately.
AD L2B applies to

- Provision, extension, alteration or renovation of thermal elements, controlled fittings and services
- Extensions
- Consequential improvements
- Material alterations to existing buildings
- Material changes of use
• Multi-residential buildings
  – AD L1B applies to the individual dwellings
  – AD L2B applies to the common parts

• Mixed use buildings
  – AD L1B applies to domestic parts
  – AD L2B applies to non-domestic parts

• Technical risk
  – The inclusion of energy efficiency measures in works to existing buildings should not introduce increased technical risk
  – Thermal insulation: avoiding risks BR262, BRE 2001
Temporary Buildings

• Relocation of an existing module is treated as a “new building”
• Approach recognises embodied energy benefit
• If the planned life is <2 years BER can be based upon “Type” approval.
  • When speed of erection is the essence (distressed purchases – following a fire etc.)
  • If <500m² pressure test can also be based upon type approval
• If existing modules are being refurbished, AD L2B applies
Buildings with low Heating Demand

• Defined in AD
  • Local Rather than global heating /cooling
  • Heating is to temperatures below that of comfort levels

–In these cases NO TER/BER calculation required but;
  • Services must meet standards in BSCG
  • If heating is provided – all building fabric to have U of < 0.7W/m2K.
  • If partitioned area is heated normally this is treated as separate “building” – normal compliance applies
  • If heating is upgraded, consequential improvement guidelines apply.
Shell and core
• Design stage TER/BER is required on the shell and core
  • If systems are not installed – efficiencies should be assumed and specifications provided to BCB
• At Practical completion TER/BER is required on the shell
  • TER/BER based on as construct
  • An EPC is required if offered for sale or let
  • If systems are not installed – assume areas are conditioned but no energy demand included

– A revised TER/BER is required on the first fit out
  • Creating a new part designed or altered for separate use so a new EPC will be required
  • Confirms final installation meets part L

• Subsequent fit outs
  • Elemental standards as set out in ADL2B
Historic Buildings

Defined
• Listed Buildings
• Buildings in conservation areas
• Designated ancient monuments
• Architectural/historic interest in national parks
• Buildings of traditional construction that need to breathe

Intention
• To improve energy efficiency to a practical extent that does not prejudice the character of the building or increase risk of deterioration

Guidance
• English Heritage publications
• LA conservation officer
The aim is to improve energy efficiency to the extent that is practically possible.
Thermal elements
Controlled fittings
Controlled services
Extensions
  Including conservatories over 30m²
Consequential improvements
Material alterations
Material changes of use
Provision of information
Thermal elements

• Definition
  – A wall, floor or roof (but not including windows, doors or roof-lights) which separate a thermally conditioned space from the external environment, and includes all parts of the element
Thermal elements requirement

- Reasonable provision to improve energy efficiency
- On provision of new thermal elements (extensions)
  - minimum standards (maximum U values) apply
- On replacement of existing thermal elements
  - minimum standards (maximum U values) apply
- On retention of existing thermal elements
  - on material change of use or material alteration
  - where forming part of the thermal envelope
  - improvement required above ‘threshold’ U values
- On renovation of existing thermal elements
  - if more than 50% of surface area of individual or 25% of whole building envelope is treated improve to ‘Threshold’ value
### Table 4 Standards for new thermal elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Standard (W/m².K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall</td>
<td>0.28²</td>
</tr>
<tr>
<td>Pitched roof – insulation at ceiling level</td>
<td>0.16</td>
</tr>
<tr>
<td>Pitched roof – insulation at rafter level</td>
<td>0.18</td>
</tr>
<tr>
<td>Flat roof or roof with integral insulation</td>
<td>0.18</td>
</tr>
<tr>
<td>Floors⁸</td>
<td>0.22⁴</td>
</tr>
<tr>
<td>Swimming pool basin</td>
<td>0.25³</td>
</tr>
</tbody>
</table>

**Notes:**

1. ‘Roof’ includes the roof parts of dormer windows, and ‘wall’ includes the wall parts (cheeks) of dormer windows.
2. A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.
3. The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.
4. A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.
If the U value of the retained element is worse than the Threshold U value it must be improved towards the Improved U value, to the best technically and functionally achievable standard with a simple payback ≤ 15 years.
Renovation of thermal elements

- Renovation is stripping back to basic structural component
- Applicable where > 50% of the surface area of individual element or >25% of total building envelope
- Renovate the whole element to the standard suggested for replacement (Table 4)
- If not achievable, renovate to the best standard that is technically and functionally feasible with a simple payback of 15 years
• Definition
  – Windows, roof windows, roof lights and external doors

• Requirement
  – On provision (extensions) or replacement
    • use draught-proofed fittings that achieve minimum standards (maximum area-weighted average U values)
  – Special considerations apply to historic buildings
<table>
<thead>
<tr>
<th>Fitting</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows, roof windows and glazed rooflights(^4)</td>
<td>1.8 W/m(^2).K for the whole unit</td>
</tr>
<tr>
<td>Alternative option for windows in buildings that are essentially</td>
<td>A window energy rating(^4) of Band C</td>
</tr>
<tr>
<td>domestic in character(^4)</td>
<td></td>
</tr>
<tr>
<td>Plastic rooflight(^4)</td>
<td>1.8 W/m(^2).K</td>
</tr>
<tr>
<td>Curtain walling</td>
<td>See paragraph 4.28</td>
</tr>
<tr>
<td>Pedestrian doors where the door has more than 50% of its internal</td>
<td>1.8 W/m(^2).K for the whole unit</td>
</tr>
<tr>
<td>face area glazed</td>
<td></td>
</tr>
<tr>
<td>High-usage entrance doors for people</td>
<td>3.5 W/m(^2).K</td>
</tr>
<tr>
<td>Vehicle access and similar large doors</td>
<td>1.5 W/m(^2).K</td>
</tr>
<tr>
<td>Other doors</td>
<td>1.8 W/m(^2).K</td>
</tr>
<tr>
<td>Roof ventilators (including smoke extract ventilators)</td>
<td>3.5 W/m(^2).K</td>
</tr>
</tbody>
</table>

**Notes:**
1. Display windows are not required to meet the standard given in this table.
2. For example, student accommodation, care homes and similar uses where the occupancy levels and internal gains are essentially domestic in character.
3. See Approved Document L1B for more detail on window energy rating.
4. The relevant rooflight U-value for checking against these limits is that based on the developed area of the rooflight, not the area of the roof aperture.
Display Window... means an area of glazing, (including glazed doors), intended for the display of products or services on sale within the building; positioned at the external perimeter of the building at an access level immediately adjacent to a public thoroughfare. There should be no permanent workspace within one glazing height of the perimeter. Glazing that extends to a height of more than 3m above such an access level will not be considered as part of the display window, except:

- Where the products on display require a greater height of glazing;

- In existing buildings when replacing windows that already extend to a greater height;

- In cases of building work involving changes to the façade and glazing which require planning consent, where planners should have the discretion to require a greater height of glazing. (eg: to fit in with surrounding buildings or match the character of the existing façade).
Controlled Services include:
- Heating and hot water systems
- Cooling plant
- Air handling plant including ducts
- Insulation to pipes, ducts and vessels
- Fixed internal lighting
- Renewable energy systems
- Metering
Controlled Services

• General requirements where the work involves the provision of a controlled service
  – Reasonable standards of energy efficiency

• For replacement controlled services
  – Not less than efficiency of service being replaced
  – Reasonable standards of energy efficiency
Boilers in existing buildings

- Assess seasonal boiler(s) efficiency as new buildings
- Reasonable provision is to show that the system achieves the minimum effective heat generating seasonal efficiency
- If boiler seasonal efficiency less than min. effective requirement, use efficiency credits to demonstrate compliance
- Controls to meet the minimum standards
  - Zone control (> 150 m²)
  - Demand temperature
  - Timing
For efficiencies of other heating system types refer to Non Domestic Services Compliance Guide

<table>
<thead>
<tr>
<th>Gas, oil and biomass-fired boilers (b) Existing buildings</th>
<th>Effective boiler seasonal efficiency (gross)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas</td>
<td>84%</td>
</tr>
<tr>
<td>LPG</td>
<td>85%</td>
</tr>
<tr>
<td>Oil</td>
<td>86%</td>
</tr>
<tr>
<td>Biomass – independent automatic pellet/woodchip</td>
<td>75%</td>
</tr>
</tbody>
</table>
Extensive range of controls credits;

- Boiler oversize <20%, multiple boilers, sequential controllers, M&T, TRV’s, zone control, weather compensation, room thermostat, optimised stop/start, BMS, de-centralised systems

<table>
<thead>
<tr>
<th>Plant description</th>
<th>Heating efficiency credits (% points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler efficiency 82%</td>
<td></td>
</tr>
<tr>
<td>Boiler oversizing is less than 20%</td>
<td>2</td>
</tr>
<tr>
<td>System controlled by room thermostat which controls boiler water temperature</td>
<td>0.5</td>
</tr>
<tr>
<td>System uses TRVs to ensure full building temperature control</td>
<td>1</td>
</tr>
<tr>
<td>Multiple boilers</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total credits</strong></td>
<td><strong>4.5</strong></td>
</tr>
</tbody>
</table>

For control credits of other heating system types refer to Non Domestic Services Compliance Guide
Cooling plant

– Where it is practical and cost effective reduce cooling loads
– Achieve efficiency and provide controls recommended in *Non-domestic Services Compliance Guide*
  - *Meet minimum full load EER (system type dependant)*
  - *Meet minimum controls requirement*
– demonstrate that reasonable provision has been made.
Air handling plant

– On provision or replacement

• Meet minimum specific fan power requirements
• Limit air leakage from ventilation ductwork
• Meet minimum controls requirement (system type dependant)
• For supply/extract systems heat recovery should be used
<table>
<thead>
<tr>
<th>Air distribution systems (b) Existing buildings</th>
<th>Specific fan power (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central balanced mechanical ventilation system including heating and cooling</td>
<td>2.2 W/(V·s)</td>
</tr>
<tr>
<td>Central balanced mechanical ventilation system including heating only</td>
<td>1.6 W/(V·s)</td>
</tr>
<tr>
<td>All other central balanced mechanical ventilation systems</td>
<td>1.8 W/(V·s)</td>
</tr>
<tr>
<td>Zonal supply system where the fan is remote from the zone, such as ceiling void or roof mounted units</td>
<td>1.5 W/(V·s)</td>
</tr>
<tr>
<td>Zonal extract system where the fan is remote from the zone</td>
<td>0.6 W/(V·s)</td>
</tr>
<tr>
<td>Zonal supply and extract ventilation units such as ceiling void or roof units serving a single room or zone with heating and heat recovery</td>
<td>2.0 W/(V·s)</td>
</tr>
<tr>
<td>Local balanced supply and extract ventilation system such as wall/roof units serving a single area with heating and heat recovery</td>
<td>1.8 W/(V·s)</td>
</tr>
<tr>
<td>Local supply or extract ventilation units such as window/wall/roof units serving a single area (e.g. toilet extract)</td>
<td>0.5 W/(V·s)</td>
</tr>
<tr>
<td>Other local ventilation supply and/or extract units</td>
<td>0.6 W/(V·s)</td>
</tr>
<tr>
<td>Fan-assisted terminal VAV unit</td>
<td>1.2 W/(V·s)</td>
</tr>
<tr>
<td>Fan coil units (rating weighted average)</td>
<td>0.6 W/(V·s)</td>
</tr>
</tbody>
</table>
SPF Additional Components

Where components in Table 37 are fitted SPF Credits may be claimed:

<table>
<thead>
<tr>
<th>Component</th>
<th>SFP, W/l/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional return filter for heat recovery</td>
<td>+0.1</td>
</tr>
<tr>
<td>HEPA filter</td>
<td>+1.0</td>
</tr>
<tr>
<td>Heat recovery – thermal wheel system</td>
<td>+0.15</td>
</tr>
<tr>
<td>Heat recovery – other systems</td>
<td>+0.3</td>
</tr>
<tr>
<td>Humidifier/dehumidifier (air conditioning system)</td>
<td>+0.1</td>
</tr>
</tbody>
</table>
Insulation

- Scope covers pipework and ductwork
- Insulate pipework when; outside heated envelope, in voids
- *Un-insulated pipes only when heat can be demonstrated as useful*
- Cooling pipework insulated along whole length
- Ductwork (hot or cold) insulated along whole length
- Must meet maximum permissible heat loss and gain standards
• Fixed internal lighting
  – General lighting efficacy in office, industrial and storage areas
    • Provide lighting with an average efficacy of not less than 55 luminaire-lumens per circuit-watt averaged over the whole area
  – General lighting efficacy in all other types of space
    • Provide lighting with an average efficacy of not less than 55 luminaire-lumens per circuit-watt averaged over the whole area
  – Display lighting efficacy
    • Provide lighting with an average efficacy of not less than 22 luminaire-lumens per circuit-watt averaged over the whole area
  – Lighting controls
    • Avoid unnecessary lighting when daylight levels are sufficient
    • Local switches in easily accessible positions
Energy metering

- Reasonable provision for energy meters would be install energy metering systems that enable:
  - a. at least 90% of the estimated annual energy consumption of each fuel to be assigned to the various end-use categories (heating, lighting etc.). Detailed guidance on how this can be achieved is given in CIBSE TM 39; and
  - b. the output of any renewable energy system to be separately monitored; and
  - c. in buildings with a total useful floor area greater than 1000 m², automatic meter reading and data collection facilities.
Extensions

• Conventional extension, except where;
  – Total floor area of proposed extension is both > 100 m² AND > than 25% of existing total floor area
  – ADL2A applies to extension

• Enclosing existing structures
  – Enclosing an extended roof
  – Covering over a courtyard

• Conservatories
Table 4  Standards for new thermal elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Standard (W/m².K)</th>
</tr>
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<tbody>
<tr>
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<td>Flat roof or roof with integral insulation</td>
<td>0.18</td>
</tr>
<tr>
<td>Floors¹</td>
<td>0.22¹</td>
</tr>
<tr>
<td>Swimming pool basin</td>
<td>0.25⁵</td>
</tr>
</tbody>
</table>

Notes:
1  ‘Roof’ includes the roof parts of dormer windows, and ‘wall’ includes the wall parts (cheeks) of dormer windows.
2  A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.
3  The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.
4  A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.
<table>
<thead>
<tr>
<th>Building type</th>
<th>Windows &amp; personnel doors (as a % of wall area)</th>
<th>Rooflights (as a % of roof area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential buildings where people temporarily or permanently reside</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Places of assembly, offices and shops</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Industrial and storage buildings</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Vehicle access doors and display windows, and similar glazing</td>
<td>As required</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Alternatively, if a greater proportion of glazing is present in the part of the building being extended, use the existing glazing percentage.
Extensions

- Incorporation of existing elements
  - Any existing elements that become part of the thermal envelope should be upgraded in accordance with the guidance for retained thermal elements

- Thermal bridging
  - Use approved construction details

- Air permeability
  - Reduce air infiltration through the new envelope

- Provide a report on design details and construction by a suitable qualified person

- Where fixed building services are provided or extended, follow the guidance for controlled services
Extensions – approaches with more design flexibility

- Use an approved calculation tool
  - Show that the CO₂ emissions from the proposed extension is no greater than for the building plus a notional extension complying with the maximum U values etc.
  - If required, consequential improvements apply to both notional and actual design
  - If trading ‘poorer’ performance in extension with improvements to the existing building, notional calculation must include improvements, but to standard recommended in AD
Conservatories (Extensions)

• Definition

  – Conservatory, exempt provided:
    • At ground level and < 30m²
    • thermally separated from the building by walls, windows and doors with the same U values and draught-stripping as provided elsewhere in the building
    • Independently operable building services
CONSEQUENTIAL IMPROVEMENTS
Consequential Improvements

- Applies to buildings with a total useful floor area over 1,000 m² where the proposed building works includes:
  - An extension; or
  - The initial provision of any fixed services; or
  - An increase to the installed capacity of any fixed building service

- Consequential improvements should be made to improve the energy efficiency of the whole building

- Energy efficient buildings (the thermal envelope and fixed building services meet the suggested standards) no consequential improvement is required
Consequential Improvements

- Regulation does not require anything to be done that is not technically, functionally and economically feasible
  - The value of consequential improvements should not be less than 10% of the value of the principal works
  - The value of the principal works and the consequential improvements should be based on prices current at the time proposals are made known to BCB
  - Values should be confirmed by a suitably qualified person, such as a chartered quantity surveyor
Consequential Improvements on extending a building

Plant improvements

- Heating system > 15 years, upgrade or provide new plant or improved controls
- Cooling system > 15 years, upgrade or provide new plant or improved controls
- Air handling system > 15 years, upgrade or provide new plant or improved controls
- Any general lighting system serving an area > 100 m² and has an average lamp efficacy of < 40 lamp-lumens per circuit watt provide new luminaries or improved controls
Consequential Improvements on extending a building

• Plant improvements
  – Install energy metering
  – Upgrade thermal elements in line with guidance for retained thermal elements
  – Replace windows, roof windows or roof lights or doors which have a U-value worse than 3.30 W/m\(^2\)K
  – Implement recommendations from EPC
  – Increase the on-site LZC provision
    • Simple pay back of 7 years or less
Consequential Improvements on installing building services

• Reasonable provision where there is an initial provision of a service or an increase in the installed capacity (per unit area) of the heating or cooling plant
  – Upgrade any thermal element within the area served by the plant in accordance with the guidance for retained thermal elements, AND
  – Any existing window or door with a U-value worse than 3.30 W/m2K should be replaced (excluding display windows and high usage entrance doors)

• This requirement is NOT limited by the 10% rule

Additionally for any area being provided with cooling for the first time or capacity increased (per unit area) then lighting should be upgraded to be not less than 45 lamp-lumens
Material Alterations

• Definition
  – An alteration is material if the work or any part of it would result in a building or a controlled service or fitting
    • not complying with a relevant requirement where previously it did, or
    • being more unsatisfactory in relation to such a requirement

• Requirement
  – Make reasonable provision for energy efficiency by following the guidance for thermal elements and controlled services and controlled fittings, for those elements that are provided or replaced
MATERIAL CHANGE OF USE
Material Changes of Use

• Definition
  – A material change of use occurs when
    • The building is used as an hotel or boarding house, where previously it was not;
    • The building is used as an institution, where previously it was not;
    • The building is used as a public building, where previously it was not;
    • The building is not a building describing in Classes I to VI in Schedule 2, where previously it was.
Material Changes of Use

Requirements

- Incorporate all practical and cost effective energy efficiency improvement measures
  - by following the guidance for thermal elements that are provided, renovated or retained
  - and by following the guidance for controlled services and controlled fittings that are provided or extended
  - and by replacing any existing windows, roof windows or doors with U values > 3.3 W/m²K with new units that meet the requirements for new or replacement controlled fittings
Material Changes of Use

Requirements

– Where more design flexibility is required, use an approved calculation tool to demonstrate that the carbon dioxide emissions from the building as it will be are no greater than if the building had been improved to comply with all the practical and cost effective energy efficiency improvement measures
Logbook

– On completion of the work, provide or update a logbook

– Logbook should provide details of
  • Any newly provided, renovated or upgraded thermal elements
  • Any newly provided fixed building services, their method of operation and maintenance
  • Any newly installed energy meters
  • Any other details that collectively enable energy use to be monitored and controlled

– Information should be provided in a summary form suitable for day-to-day use

– CIBSE TM31 provides guidance