



STAGE 4 | ENERGY PERFORMANCE | EMPLOYER'S REQUIREMENTS

June 2022 | Rev A

# Sections of this document | The parts that form the Energy Performance ERs

The energy performance requirements for Ashley Road are split across three main documents. This document is only one part and should be read alongside the other two parts.

1

## Ashley Road Depot

Energy performance requirements



June 2022

The written **Energy Performance Requirements** document is included within the main ERs for the development. This document summarises the requirements for the development in reference to the Haringey Zero Carbon policies for housing development.

- Sets out the targets for the development.
- Found within the main body of the ERs.

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ASHLEY ROAD DEPOT

STAGE 4 | ENERGY PERFORMANCE | EMPLOYER'S REQUIREMENTS

June 2022 | Rev A



The **Stage 4 Energy Performance Employer's Requirements** reflects the changes in the design and updated energy models since the Stage 3 Energy and Sustainability Statement (document 3 below).

At Stage 4 the team specifically focussed on developing the detail design of the building fabric. These changes are explored in this document. The changes made have been tested against the Passivhaus criteria to demonstrate which buildings are capable of meeting the Passivhaus standard.

- Sets out how the proposed design meets the requirements of the written Energy Performance Requirements.
- This is contained in this report.

3



ASHLEY ROAD DEPOT

ENERGY AND SUSTAINABILITY STATEMENT

April 2022 | Rev G



The **Stage 3 Energy and Sustainability Statement** outlines how the development sought to meet the energy and sustainability requirements (including overheating) of both planning policy and Haringey housing development policies.

Information on the elements of design that achieve these policies is included.

This document is only to be referred to where information is not available in the Stage 4 report.

- Sets out how the proposed design meets the requirements of the written Energy Performance requirements.
- Information in the Stage 4 Energy Performance report supersedes the content of this report.
- In the public domain, available from the planning portal.

# Summary | Stage 4 Contents (and the differences to the Stage 3 report)

A yellow dashed box highlights where Stage 3 information is still relevant and reference to the Stage 3 report should be made

|   |                                          |                                                                                   |
|---|------------------------------------------|-----------------------------------------------------------------------------------|
| 1 | <u>Brief</u>                             |  |
|   | The London Plan and Building Regulations |                                                                                   |
|   | London Borough of Haringey Local Plan    |                                                                                   |
|   | Overheating risk planning policy         |                                                                                   |
|   | Client brief                             |                                                                                   |

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| 2   | <u>Envelope</u>               |  |
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| 2.2 | Junctions and thermal bridges | 8                                                                                 |
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|   |                                   |                                                                                     |
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|     |                                 |                                                                                   |
|-----|---------------------------------|-----------------------------------------------------------------------------------|
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|   |                                              |                                                                                     |
|---|----------------------------------------------|-------------------------------------------------------------------------------------|
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|   | Certification standards for the non-domestic |                                                                                     |

## Appendices

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| 1 Overheating | 2 PHPP | 3 BREEAM | 4 Part L (Domestic) |
|---------------|--------|----------|---------------------|

## 2 | Building envelope

## 2 | Building envelope

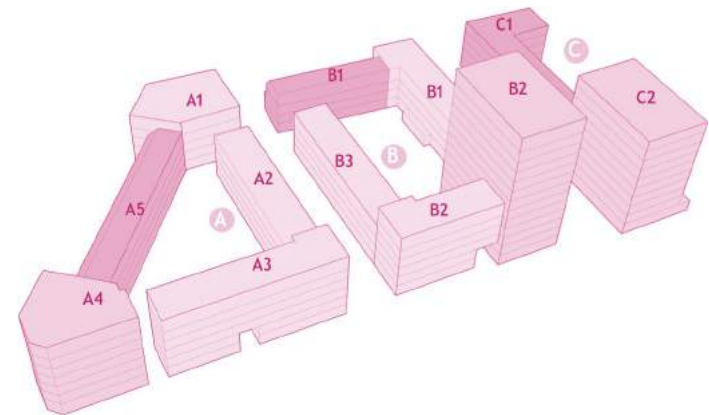
### 2.1 Building form and insulation

### 2.2 Junctions and thermal bridges

### 2.3 Airtightness

### 2.4 Windows and doors

- Form factor
- Thermal envelope
- Insulation requirements



# Envelope | Building insulation line

## Identifying the building insulation line

The three-dimensional surface that encloses the conditioned space is called the thermal envelope. This surface should have a clear insulation and airtightness strategy.

All doors that go through the thermal envelope should be insulated and airtight. Structure going through the thermal envelope should be thermally broken. Exposed floors and soffits must be insulated with significant insulation thickness.

**External areas integrated in the building form** can make the thermal envelope complex, even though the form of the building is simple. Example areas are substations, bin stores, bike stores or non-residential spaces (i.e. shops). These should be outside the thermal envelope and separated from the heated part of the building.

**Plant rooms** often include insulation and could be considered as warm unheated spaces but can breach the airtightness line and are a considerable source of heat loss. Plant rooms should be mechanically ventilated and inside the envelope where possible. Plant rooms or other utilities such as bin stores needing natural ventilation, should be outside of the thermal envelope, even if insulated.

For Ashley Road the thermal envelope for each block has been identified and the above strategies applied. An example thermal envelope markup for the ground and first floor of Block A4 is shown to the right.

### Key – thermal envelope

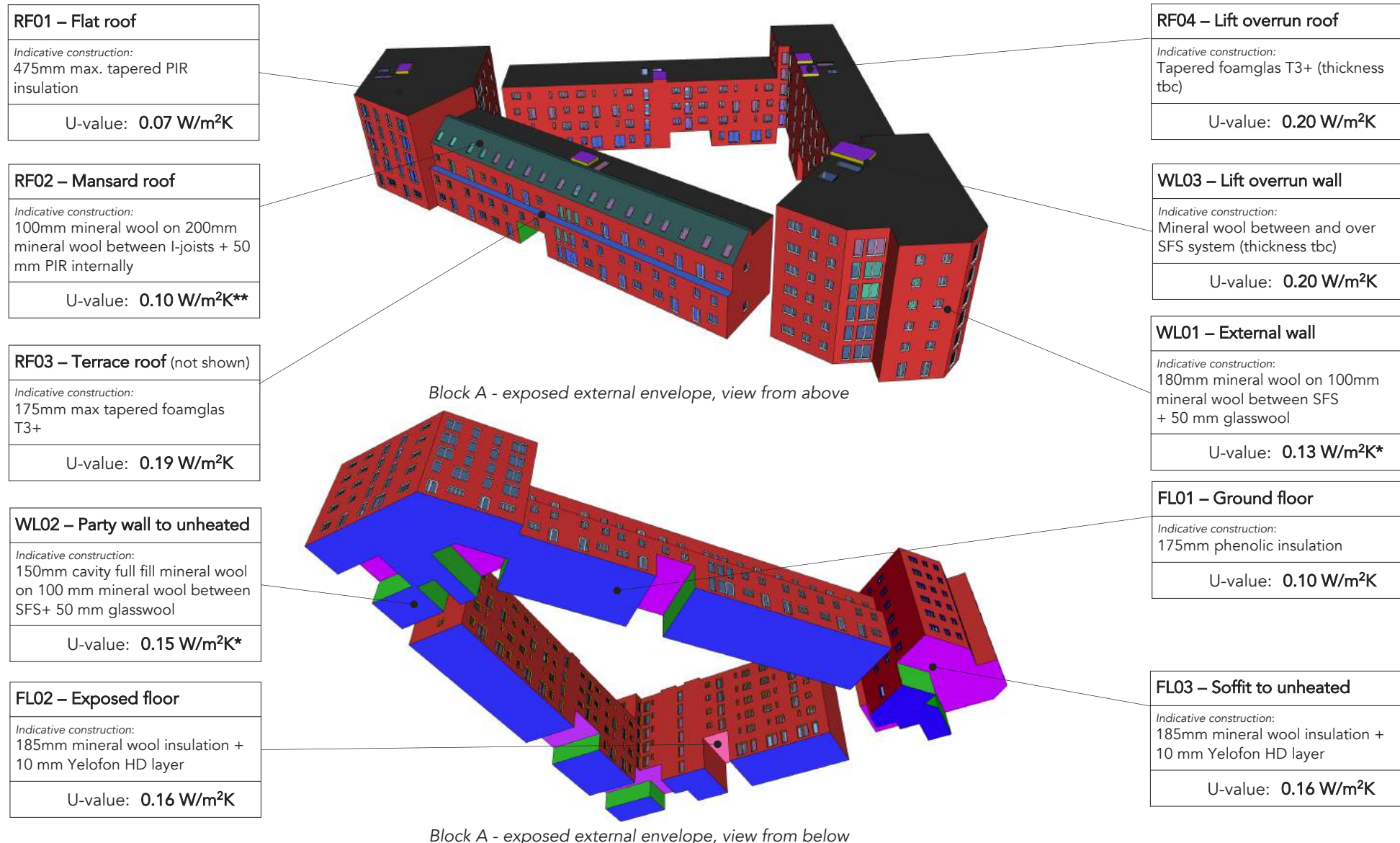
- External wall insulation line
- - - Internal walls requiring insulation and airtightness
- Area within thermal envelope



Block A4 - ground floor and first floor plan, depicting the thermal envelope

# Envelope | Insulation requirements

The recommended U-value and indicative insulation type and thickness for each external construction is shown. These have been tested in Stage 4 PHPP calculations to achieve the required energy targets. Adjustment between the U-value of elements to achieve the same outcome is possible. All blocks at Ashley Road are based on these U-values.



\*Further assessment of thermal transmittance through SFS layer required. U-value excludes heat loss due to structure and some of the repeat thermal bridging.

\*\*Further assessment of build-up and timber fraction required.

# Envelope | Key requirements regarding installation of insulation

The quality of installed insulation is a key component of a successful low energy building. It is crucial that:

1. The properties of the insulation are as designed
2. The products are delivered and stored securely
3. The products are installed correctly
4. The products are protected during installation
5. The performance is confirmed by testing

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <ul style="list-style-type: none"> <li>All thermal insulation products used on this project shall meet the thermal performance requirements laid out in this document and the architectural and engineering specifications.</li> <li>In particular the <b>declared thermal conductivity (<math>\lambda_d</math> or <math>\lambda_{90/90}</math>)</b> shall be same or lower than the products specified. The thermal conductivity must be quoted to at least 2 significant figures.</li> <li>The same product from different brands or different thicknesses from the same brand can have different thermal conductivities. This should be checked on purchase of the insulation.</li> <li>The product type, moisture permeability and other hygrothermal properties should be similar to the product specified. Where this is critical the properties are quoted in the specification. Other structural and environmental requirements shall also be adhered to.</li> </ul>                                                                                                                          |
| 2 | <ul style="list-style-type: none"> <li>Generally insulation materials shall be delivered as required to limit storage required, they are bulky and vulnerable to damage from impact or moisture.</li> <li>Materials shall be checked on delivery against the performance requirements and properties required, and for damage or manufacturing fault that may affect the performance.</li> <li>Where stored on site materials shall be kept in original packaging, in a dry location of the floor and protected from site vehicle or foot traffic.</li> <li><b>Fibrous, mineral or glass wool and natural insulation are all especially vulnerable to moisture and shall be kept in a dry environment at all times.</b></li> <li><b>Rigid board insulations are particularly vulnerable to damage from impact during transport, delivery, and moving around site. Boards shall be kept in packaging and protection used where lifting or storing to prevent damage.</b></li> <li><b>PIR and PUR foam is vulnerable to UV light, boards shall be kept covered or in original packaging.</b></li> </ul> |
| 3 | <ul style="list-style-type: none"> <li>Insulation shall be installed in accordance with all manufacturer's documentation and guidance. Generally insulation shall be installed with: <ul style="list-style-type: none"> <li>✓ No air gaps behind or between boards or batts and structure. Gaps greater than 3mm will not be accepted on inspection and should be filled.</li> <li>✓ Secure plastic fixings or friction fit between structure</li> <li>✓ Full and whole boards or batts used where possible.</li> </ul> </li> <li>No metal fixings or structure shall penetrate the major insulation layer in the building unless designed and included in the architectural and engineering specification.</li> <li>Damaged panels shall be rejected or damaged parts cut away where part boards or batts are required.</li> </ul>                                                                                                                                                                                                                                                                   |
| 4 | <ul style="list-style-type: none"> <li>Insulation must be covered permanently or with temporarily measures on installation. Insulation shall not be left exposed to weather, site spills, debris, site traffic, etc. during construction.</li> <li>Particular care shall be taken with partially complete works overnight, tops of cavities, door thresholds and exposed insulation edges, and stored materials.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 5 | <ul style="list-style-type: none"> <li>The building thermal continuity will be tested by thermographic survey covering all conditioned spaces. The Contractor will be required to rectify any defects found. Thermography surveys are to be undertaken by suitably qualified professional holding a valid Level 2 certificate in thermography, as defined by the UKTA website <a href="http://www.ukta.org">http://www.ukta.org</a>.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## 2 | Building envelope

2.1 Building form and insulation

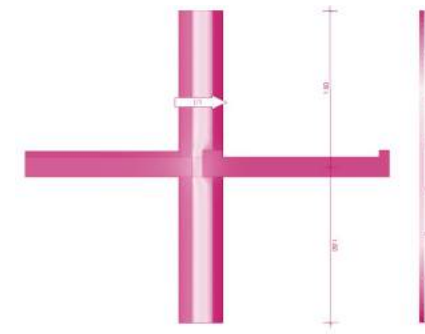
2.2 Junctions and thermal bridges

2.3 Airtightness

2.4 Windows and doors

### 2.2 Junctions and thermal bridges

- Key thermal bridges
- Approach to detailing



# Junctions | Heat loss at junctions

## Maintaining a continuous insulation layer

The additional heat loss through junctions and structural connections in the insulation layer has a significant effect on the total heating energy consumption of the building. This extra heat loss is referred to as **thermal** or **cold bridging**.

The effect on building performance depends on the heat loss rate (Psi-value) and the junction's length or quantity.

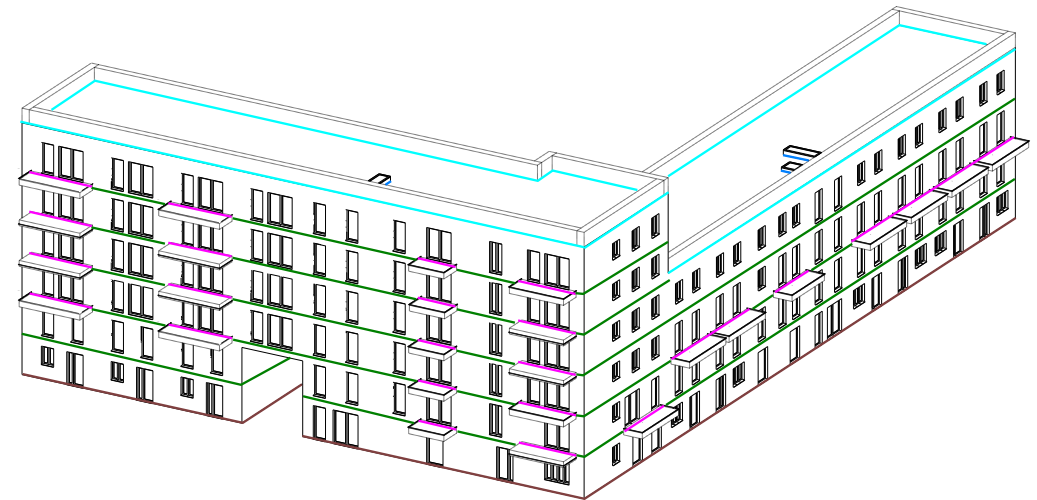
The adjacent image, and table on the following page, highlights the key junctions identified at Stage 3 and their target performance for heat losses. The design for all external junctions will have to be developed and their heat loss minimised during the future design stages.

## Calculating the impacts of thermal bridging

As the design progresses, thermal bridging analysis will be required for the majority of junctions. The results of this analysis will be used as part of the Passivhaus and Part L assessments.

Initially though, values from default assumptions or previous project experience have been used to assess their impact on the PHPP space heating demand and the Part L assessment.

An example building is shown in the image to the right. In Block A2A3 the junctions with the highest potential heat loss are the window and door installation junctions, and the balcony/deck access structural connections.



- Main roof parapet
- Rooflight and AOV upstand
- Balcony
- Slab edge
- Ground perimeter

### ***South-east view of Block A2A3 with key junctions highlighted.***

*A breakdown of thermal bridge categories across all blocks is detailed on the following page.*

*Windows junctions (which represent a significant part of the thermal bridging losses) are not shown in this diagram.*

# Junctions | Schedule of key thermal bridges<sup>1</sup>

| Junction category                    | Type 1                                                      | Type 2                                                          | Type 3                                    | Type 4                                 | Length (m) <sup>2</sup>  | Target $\Psi$ -value (W/mK) | Current <sup>3</sup> $\Psi$ -value assumption (W/mK) | Current H-Value (W/K) <sup>4</sup> |
|--------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------|----------------------------------------|--------------------------|-----------------------------|------------------------------------------------------|------------------------------------|
| <b>Parapet</b>                       | Main & terrace roof parapets                                | Mansard roof parapet                                            | Lift overrun parapet                      | Stair overrun parapet                  | 1556.2                   | 0.02                        | 0.10                                                 | 183.14                             |
| <b>Slab edge at ground</b>           | Basement wall to ground perimeter <sup>5</sup>              | Basement intermediate floor to wall <sup>5</sup>                |                                           |                                        | 37.00                    | 0.10                        | 0.43                                                 | 15.91                              |
| <b>Slab edge above ground</b>        | Slab edge to external wall                                  | Slab edge with masonry support                                  |                                           |                                        | 3205.0                   | 0.08                        | 0.10                                                 | 273.08                             |
| <b>Perimeter</b>                     | Basement perimeter <sup>5</sup>                             | Ground perimeter                                                | Concrete upstands to ground perimeter     | Wall perimeter to uheated basement     | 808.1                    | 0.02                        | 0.04                                                 | 7.22                               |
| <b>Wall to floor inverted corner</b> | Basement wall to heated ground floor <sup>5</sup>           | Block unheated wall to heated floor                             | Concrete unheated wall to heated floor    | Exposed wall to exposed floor          | 372.9                    | 0.10                        | 0.53                                                 | 198.4                              |
| <b>Terrace/balcony Access</b>        | Terrace access                                              | Balcony connection                                              | Access deck connection                    | Stair, Lift overrun walls to main roof | 2919.8                   | 0.10                        | 0.15                                                 | 442.08                             |
| <b>Exposed floor</b>                 | First floor exposed overhangs over passageways              |                                                                 |                                           |                                        | 20.6                     | 0.07                        | 0.10                                                 | 5.01                               |
| <b>Partition</b>                     | Block Partition to ground bearing slab                      | First floor external wall to exposed floor (above passageways)  |                                           |                                        | 167.9                    | 0.08                        | 0.09                                                 | 77.47                              |
| <b>Exposed Partition</b>             | Shear wall to ground & basement bearing slab                | Lift Pit to ground                                              | Concrete Partition to ground bearing slab |                                        | 487.0                    | 0.15                        | 0.20                                                 | 36.29                              |
| <b>Column to slab</b>                | Mid-Column to ground bearing slab (basement & ground floor) | Corner columns to ground bearing slab (basement & ground floor) |                                           |                                        | tbc with final SE design | 0.20                        | 0.33                                                 | 31.85                              |
| <b>Opening installation</b>          | Door thresholds                                             | Window & door heads                                             | Window, door, rooflight & AOV jambs       | Window cill                            | 17122                    | 0.02-0.06                   | 0.04-0.10                                            | 684.88                             |
| <b>Services</b>                      | Soil vent pipe runs                                         |                                                                 |                                           |                                        | tbc                      | 0.25                        | tbc                                                  |                                    |

<sup>1</sup>The schedule above covers the thermal bridges for the project identified at Stage 4a. Further heat loss junctions and thermal bridges may be identified and quantified as the design progresses.

<sup>2</sup>The stated length includes all modelled blocks (A1-A5, B1-B3, C1-C2)

<sup>3</sup>The current assumptions are based on existing Etude calculations of similar junctions and point thermal bridges.

<sup>4</sup>PSI-values are quoted on an external dimension basis for input to PHPP. H-Values have been calculated for all blocks to indicate which junctions are likely to present the biggest heat loss; these values are based on the target PSI value and will differ in practice.

<sup>5</sup>Identified only in Block C1, which is the only block to include a small basement section.



# Junctions | Approach to detailing across the site

Reducing the losses from the thermal bridging will require specialist products or construction details.

## Balconies and access decks

Several strategies have been used to minimise the thermal impact of balconies and access decks across the development. In Blocks B2 and C2, which have extensive south facing balconies, a degree of external structural support is provided, reducing thermal bridging from steel rebar passing through the insulation layer. Where used, inset balconies are located predominantly at corners to reduce junction length. Cantilevered balconies are to be connected via a thermal break product, such as the Schöck Isokorb XT system.

## Walls/columns to slab

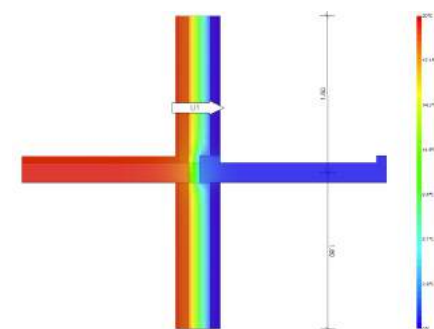
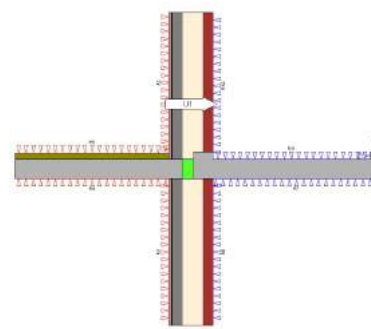
Ground floor insulation will be above the slab. This means that the core and party walls to the slab could present significant heat loss junctions. The use of load-bearing insulation (i.e. Marmox Thermoblock) will reduce this heat loss. Another option is the Schöck Alphadock. There are no existing products on the market to thermally separate reinforced concrete columns and slabs, however Schöck have stated that they will be releasing a new product imminently called Sconnex which will be considered at the next stage of design.

## Continuous podium slab

Buildings C1 and C2 have an adjacent podium at first floor level. This will typically be formed of a continuous slab running from external areas to inside flats. Thermally separating these spaces could be achieved by using a heavy duty dowel, similar to the Schöck Dorn.

## Parapets

Parapet heights are to be minimised and where possible the parapet will be thermally broken at the base. This can be achieved by a course of low-conductivity thermal blocks (i.e. Foamglas' Perinsul HL) or the Schöck Isokorb XT system.



Example - model assessing the heat flow across a thermally broken cantilevered balcony.



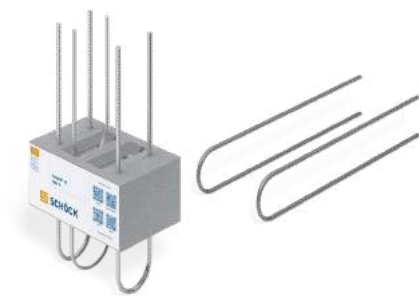
Schöck Isokorb XT thermal break used to separate balconies and access decks (© Schöck)



Schöck Dorn dowel could be used to separate the podium slab between internal and external space (© Schöck)



Schöck Alphadock can be used to separate walls and slabs (© Schöck)



Schöck Isokorb A can be used to separate parapet walls from the structure below (© Schöck)

# Junctions | Window installation thermal bridges

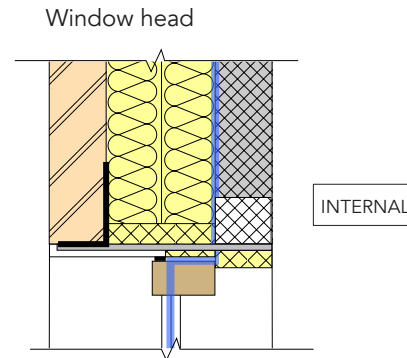
## The importance of installation junctions around doors and windows

The thermal performance of window and door installation junctions have a big impact on energy efficiency.

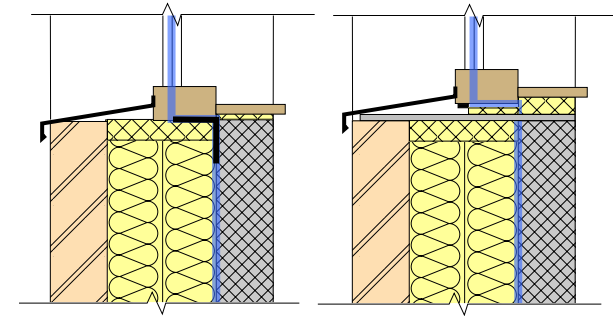
An installation thermal bridge of 0.04 W/mK has been assumed for windows and doors generally, and 0.10 W/mK for door thresholds. These values should be achieved or bettered. Key considerations for reducing heat loss are:

- ✓ The window glass pane should be as close to the centre line of the insulation as feasible.
- ✓ Maintain the full depth of wall insulation as close as possible to the edge of the window frame
- ✓ Wrapping window frames internally (or externally) with an additional piece of insulation reduces heat loss.
- ✓ Steel connections to the windows have a very high impact on the performance of the detail. Windows and doors should be supported by small straps or fixings through the frame. Angle brackets at the sill should be minimised and should only be specified on larger openings. These should be hit and miss or replaced with a structural block, e.g. Compacfoam or ArmathermPET.
- ✓ Use split or thermally broken lintels.
- ✓ Full fill any air gaps surrounding windows with insulation, using expanding foam where required and an EPDM gasket, with particular attention around brick returns and other details.

## Example indicative details

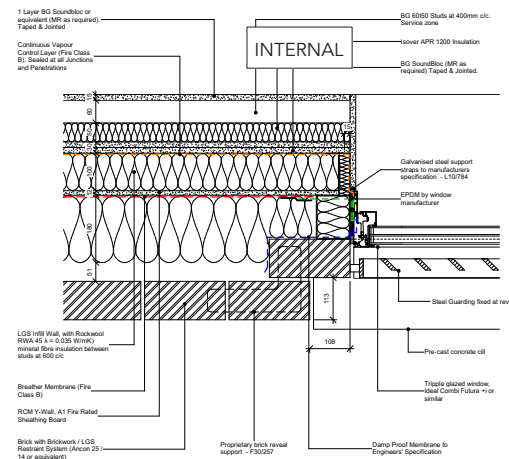


## Window cill



## Proposed details

### Window jambs



## Important characteristics of the proposed detail

- ✓ The position of the window frame overlaps with cavity insulation by more than 2/3 of the total frame thickness.
- ✓ The cavities behind the recessed brickwork are fully packed with insulation.
- ✓ Steel supporting brackets for the recessed brick are fully outside the insulation and airtightness line.
- ✓ The air barrier (in this diagram labelled as the VCL) needs to be kept to the internal side of the insulation (i.e. on the inside of the plasterboard) before being then taped onto the EPDM.

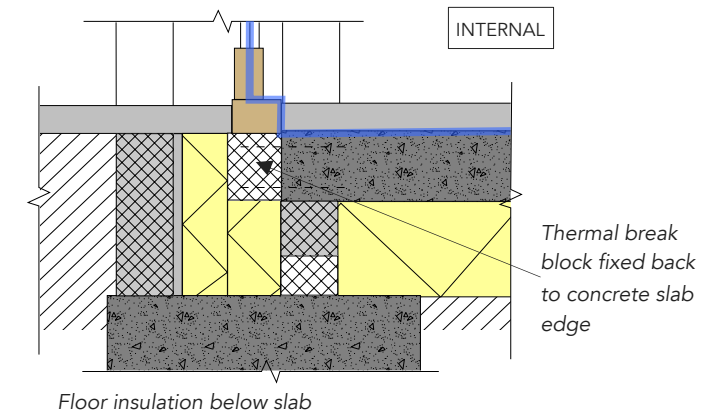
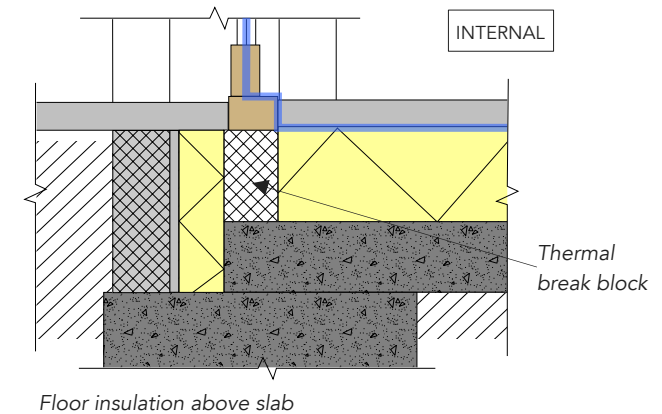
## Junctions | Door threshold junctions

### Robust and thermally efficient structural support

Door thresholds can be one of the largest thermal bridges in a project. The door and threshold need to be well supported which can bridge the insulation layer.

Key strategies to minimise thermal bridging include:

- ✓ Supporting the door frame outside of the main building slab edge. In this example the slab has been extended underneath the door.
- ✓ Supporting the threshold on a thermal break block material that can take fixings. For example Compacfoam or ArmathermPET.
- ✓ Fully filling any air gaps surrounding windows with insulation, with particular attention around brick returns and other details.



## 2 | Building envelope

2.1 Building form and insulation

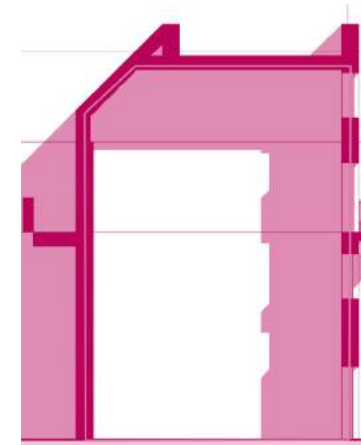
2.2 Junctions and thermal bridges

2.3 Airtightness

2.4 Windows and doors

### 2.3 Airtightness

- Targets for the scheme
- Airtightness strategy and materials



# Airtightness | Delivering an exemplar level of energy efficiency

## A low airtightness target for high quality buildings

The building airtightness target is an air permeability of less than  $0.6\text{m}^3/\text{m}^2/\text{h}$  @ 50Pa.

This is for the whole building envelope and follows the Passivhaus test methodology documented in ATTMA TSL4 and EN 13829 (Method A). Where flats are onto a shared corridor the individual flats may have a relaxed airtightness of less than  $1.5\text{m}^3/\text{m}^2/\text{h}$  @ 50Pa as long as the whole building meets the primary target of  $0.6\text{m}^3/\text{m}^2/\text{h}$  @ 50Pa. This number ( $1.5\text{m}^3/\text{m}^2/\text{h}$  @ 50Pa) has been used in SAP calculations.

## Benefits of low airtightness

Airtightness is about more than reducing energy consumption. Low air permeability is good for all buildings, as it:

- Improves comfort by eliminating cold air movement, allowing reduced air temperature for a comfortable operative temperature.
- Reduces heating energy consumption by reducing cold air infiltration. This leads to reduced heating bills and can also lead to reduced heating plant size.
- Reduces noise transmission between inside and outside.
- Reduces uncontrolled ingress of external odours and pollutants, such as traffic fumes.
- Protects the building fabric from internal humidity, leading to more robust construction with no long-term moisture build up.
- Is a reliable indication of the construction quality, measuring how well different elements of the building have been connected.

## A measure of construction quality

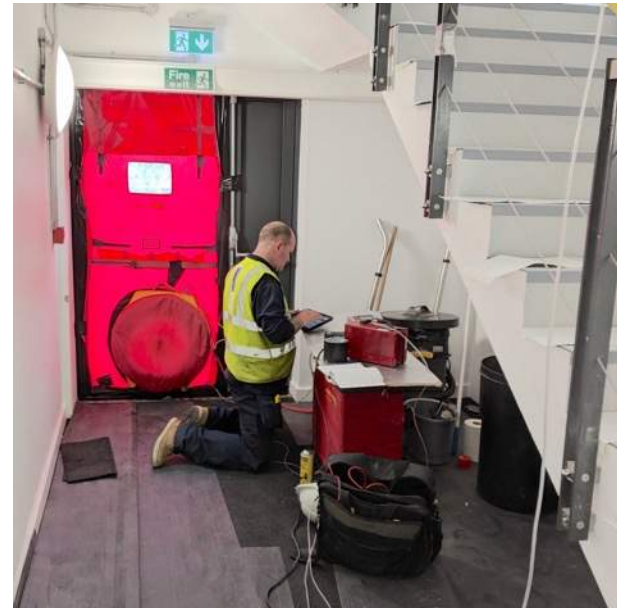
Airtightness is one of the few indicators that can be reliably tested to verify a building's performance on completion. It is an indicator of construction quality. Contractors who can commit to and achieve a low air test result on completion are demonstrating that the building is constructed to a very high standard.

$<0.6$   
 $\text{m}^3/\text{m}^2/\text{h}$

*Air permeability target for all buildings at Ashley Road*

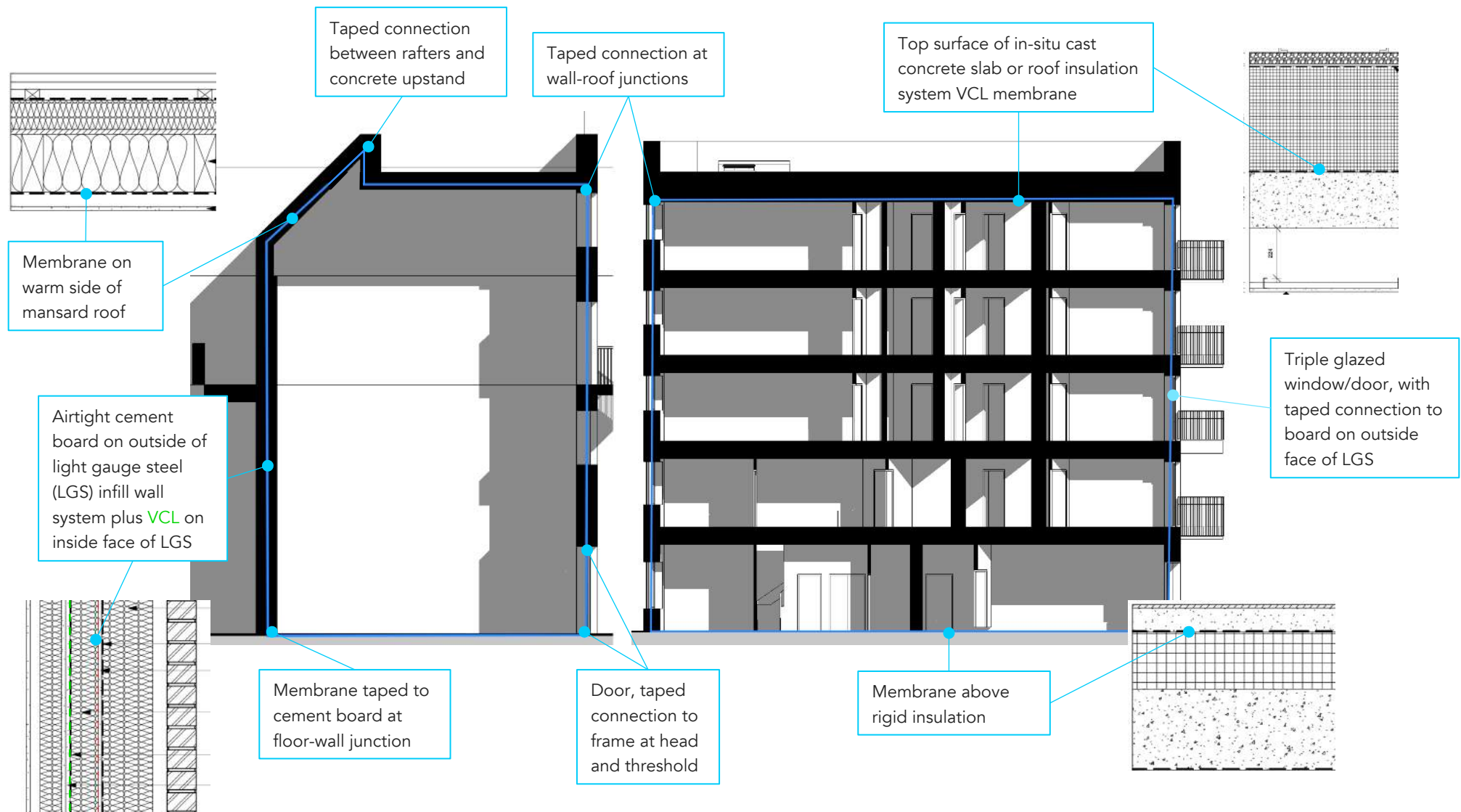
$<0.6$   
ach

*Equivalent air change rate*



*Airtightness testing showing the fan blower door installed in a fire escape access door. The fan blows or sucks air from the building maintaining a constant pressure to give the air flow through the external fabric.*

## Airtightness | Strategy showing material and connections



Etude section mark-up of Block A1A5 indicating the airtightness layer in **blue** for the major building constructions. For some elements this is the same as the vapour control layer (VCL). There is one airtightness layer completely wrapping the insulated space and made up of a range of materials. The diagram shown here is an indicative airtightness line markup, appropriate given the design stage. The airtightness line should be continually revisited and updated with increasing detail as the project approaches construction. A similar strategy is assumed for all blocks.

# Airtightness | Design for low airtightness

To achieve a low external envelope air permeability a clear design strategy and quality process is required. As the design progresses the contractor led team should create (and build upon, where they already exist) the following documents to record the strategy and help all design team members develop a joined up approach:

1. **Airtightness strategy drawing.** A section markup showing the material and construction junction recommended for achieving airtightness.
2. **Airtightness risk tracker.** A live list of risks to achieving the airtightness target.
3. **Airtightness test requirements.** Setting out the purpose and potential options for interim air testing, and the requirements for the final building air test.
4. **Service penetration schedule.** A live tracker for external penetrations to the building fabric, how they will be sealed and checked on site.

## Principles

**1. A single, simple airtightness line (AVCL - Air & Vapour Control Layer).** The layer should be a flat plane with accessible connections and construction junctions.

**2. Airtight line on the warm side of construction.** The airtightness test should test the vapour control layer. External airtightness could lead to interstitial condensation issues.

**3. Show AVCL on detail drawings.** Include connections and strategy on details from early stages. Include airtightness in BIM model strategy.

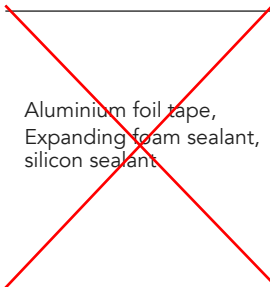
**4. Specify suitable openings and façade systems.** Windows, doors and curtain walling should achieve Class 4 air permeability to EN ISO 12207.

**5. Schedule service penetrations.** List service penetrations through the building fabric and aim to reduce the number as far as possible. Identify a strategy for sealing.

**6. Design testing regime.** Develop a strategy for interim leak tests and the final building airtightness test.

**7. Design site quality assurance process.** Construction quality management integrated with site team.

# Airtightness | Suitable materials for achieving airtight connections

| Material                                                                                                                                              | Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Example specification                                                                                                                                                                        |                                                                                       |                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Air-tightness tape<br/>Multi purpose</b>                                                                                                           | Flexible tape for junctions, corners, and services not using a rubber gland                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Isover</b> Multitape SL, <b>Isocell</b> Airstop Flex, <b>SIGA</b> Rissan, <b>Partel</b> Conexo, <b>Proclima</b> Tescon<br>Single sided flexible adhesive tape with a split release strip. |    |    |
| <b>Air-tightness tape<br/>Joints</b>                                                                                                                  | Butt joints between flat boards or membranes.<br>Flexible tapes can be used here instead                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Proclima Vana, Isover Vario KB1, SIGA Sicrall, Isocell Airstop or equal. Single sided adhesive tape for sealing overlap seams in membranes and rigid boards.                                 |    |    |
| <b>Air-tightness tape<br/>Below ground</b>                                                                                                            | Concrete slab edge to fibre cement board or membrane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Proclima Extoseal, alternatively multi-purpose tapes with primer may be used.                                                                                                                |    |                                                                                       |
| <b>Flexible sealant</b>                                                                                                                               | As an adhesive for tape or membrane connecting to a rough or porous substrate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Isover Vario DS, Proclima Orcon F, SIGA Meltell or equal.<br>Durable elastic air tight sealant                                                                                               |    |    |
| <b>EPDM services seal or gland</b>                                                                                                                    | A rubber gland that seals mid size ducts and pipes passing through the air-barrier that need further adjustment. E.g. SVPs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Isover Vario Stos, Proclima Roflex, (or equal)<br>Self-adhesive flexible membrane profile for durable airtightness junction around service penetrations                                      |    |    |
| <b>Concrete sealant</b>                                                                                                                               | A durable and permanent primer or sealant that provides a robust surface to take an adhesive tape                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Pro Clima Tescon Primer RP, SIGA Docksill, or equal. Priming coat suitable for use blockwork, brick, concrete                                                                                |   |   |
| <b>Liquid applied airtightness products</b>                                                                                                           | A latex based paint or spray applied liquid. Suited to masonry connections and complex joints. Can not span large gaps.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Blowerproof, Passive Purple, Soudal                                                                                                                                                          |  |                                                                                       |
|  Aluminium foil tape,<br>Expanding foam sealant,<br>silicon sealant | Foil tapes do not have the flexibility or durability of specialist products and should not be used.<br><br>Site applied expanding foam is not suitable for achieving Passivhaus levels of air-tightness. The foam is rigid and cracks away from surfaces as the building settles. Air passages are often formed that are near impossible to trace and repair. Foam is a good solution for filling construction junctions and ensuring insulation continuity for example around windows, but must be taped over to create an air-tight seal.<br><br>Silicon sealant is not a suitable airtightness connection unless installed between a butt joint. 90deg beads will pull away from one surface. |                                                                                                                                                                                              |  |  |

# Airtightness | Airtightness for building services

## Services

Service penetrations are one of the most common causes of failing the airtightness test. Key services penetrations through the airtightness barrier of the building must be identified, minimised where possible, and effectively sealed.

There are specialist airtight products particularly designed for services' penetrations such as rubber grommets.

## Electrical services

There will be multiple cable penetrations through the building fabric. The number of connection cables should be minimised and each of the remaining cables will need to be individually sealed to ensure a completely airtight building.

Etude recommend that taped connections to each cable should be used.

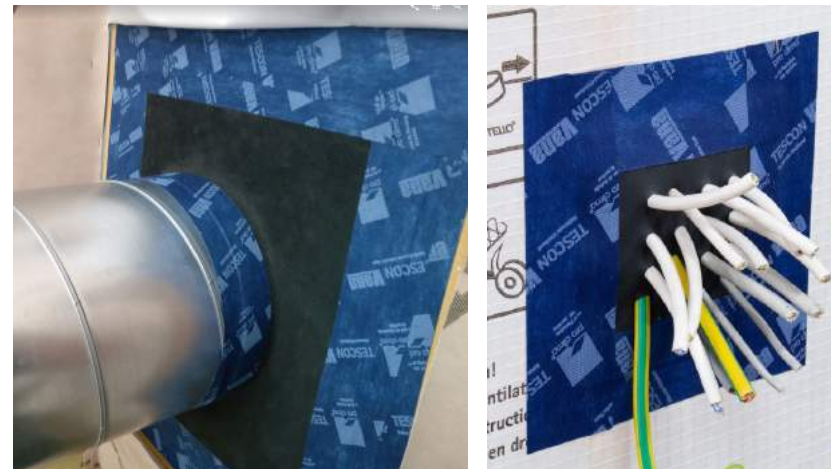
Bunching cables together through an air tight seal is not acceptable, each cable must be individually sealed.

## Mechanical services

Incoming services through the ground floor concrete slabs that can be cast in situ will be airtight with no further treatment.

Utilities running through a duct or penetrating a wall will require secondary sealing either with tape or with a dedicated rubber seal.

| Service | Examples                                                                                                                                                                                         | Recommendations                                                                                                                                                                                                         |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cables  | <ul style="list-style-type: none"><li>Incoming data cables</li><li>Fire alarm connections</li><li>Solar PV connections</li><li>Connections to roof plant rooms</li><li>External lights</li></ul> | <ol style="list-style-type: none"><li>Incoming connections at the same location.</li><li>Taped or rubber gland joint to individual cables.</li><li>Each cable must be separate and have 50mm clear all round.</li></ol> |
| Ducts   | Plant room duct connections                                                                                                                                                                      | Taped joint connection to duct and insulation.                                                                                                                                                                          |
| Pipes   | <ul style="list-style-type: none"><li>Water mains to the building</li><li>Roof top chiller</li><li>Sump pump and access hatches</li></ul>                                                        | <ol style="list-style-type: none"><li>Taped or rubber gland joint to individual pipes.</li><li>Each pipe must be separate and have 100mm clear all round.</li></ol>                                                     |
| Drains  | Drainage rodding access points                                                                                                                                                                   | Cast in and drain covers should be self sealing.                                                                                                                                                                        |



Example service penetrations with best practice air sealing.

## 2 | Building envelope

2.1 Building form and insulation

2.2 Junctions and thermal bridges

2.3 Airtightness

2.4 Windows and doors

- Environmental context
- Elevation design
- Glazing proportions
- Thermal performance of openings



# Windows and doors | Proposed thermal performance

All windows should be triple-glazed.

The main parameters that impact window performance are:

1. **Area of frame proportional to glass area** - the window frame has higher heat loss than the glass and reduces the transmission of solar gain and light. Less frame improves the window performance, and a thin frame is a requirement for Ashley Road.
2. **Thickness of glazing unit** - the thermal performance of the glass is mainly dependent on the thickness of the entire glazing unit. The optimum cavity width in triple glazing is 16-20 mm, giving an ideal glazing thickness range of 44-52 mm. Warm edge plastic spacers further reduce heat loss and are recommended.
3. **Gas and coatings in glazing unit** - the gas used between the glass panes affects heat transmission. Argon gas is standard practice.. All options should include low emissivity coatings.
4. **Frame material and thermal performance** - less conductive materials such as timber reduce heat loss and are preferred, however, solutions available include thermally broken aluminium frames which can also suit a variety of designs as their profiles are much thinner than their timber equivalents.
5. **Thermal and light transmission of glass** - improved transparency of the glass means more daylight and solar energy is transmitted into the room. Special glass types are available that are clear but limit the solar gain (to control overheating).
6. **Careful installation** - the quality of installation of windows (and doors) is very important from an energy point of view. The window glass pane should be as close to the centre line of the wall insulation as feasible. Any connection between the frame and supporting structure should be a low conductivity material and used intermittently (e.g. split or thermally broken lintels)



Glass U-value



Glass g-value



Frame thickness



Window frame  
U-value



Area-weighted  
window U-value\*



Entrance / access  
door U-value

\*The U-value of windows refers to the whole system (e.g. including frame).  
This U-value should also be met for glazed doors in the building insulation line.



All windows are to be high performance triple glazing - e.g. Idealcombi futura+ or equivalent – this product has a narrow frame, something that is very important to the scheme to ensure that windows exploit the maximum solar gain.

# Windows and doors | Passivhaus thermal requirements

## Evidence provided by the window manufacturer

The project is seeking Passivhaus certification, therefore all windows and doors must meet further thermal performance requirements.

Windows with Passivhaus product certification satisfy all requirements. However it is possible to use non-certified products, and Passivhaus certified windows may not be available for all openings. Each product type will be evaluated based on manufacturer data.

The window manufacturer or supplier will need to provide information for each type of glass, insulated panel and frame.

## Typical product features

Windows and doors meeting the requirements typically have the following characteristics:

- Insulated frames or large thermal break section to frame
- Insulating 'warm edge' glazing spacers
- Triple glazing with 48-54mm bead, low-e coatings and Argon fill



*Certified Passivhaus window products are not required to achieve Passivhaus or similar performance. However, they give assurance that the performance has been met and make useful design values readily available.*

|                     | Passivhaus criteria                                                                                                                                                                                         | Evidence required                                                                                                                     |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Heat transfer       | PHPP heating energy balance<br>Calculated for each opening within PHPP.                                                                                                                                     | PHPP calculation.                                                                                                                     |
|                     | Frame U-value for each element and product type<br>Typical value $U_{\text{frame}} < 1.0 \text{ W/m}^2\text{K}$<br>Best possible required.                                                                  | Calculation report to EN ISO 10077 for each frame element.<br>Glazing spacer Psi-value.<br>Frame thickness marked on section drawing. |
|                     | Glass U-value for each glass type<br>Typical value $U_{\text{glass}} < 0.6 \text{ W/m}^2\text{K}$                                                                                                           | Calculation report to EN ISO 673 and given to <b>2 decimal places</b> .                                                               |
|                     | Glass g-value for each glass type                                                                                                                                                                           | Calculation report EN ISO 410 and given to <b>2 decimal places</b> .                                                                  |
| Surface temperature | Installed window U-value for occupied rooms $< 0.85 \text{ W/m}^2\text{K}$ .<br>Surface temperature may not be less than 4.2K below internal air temperature.<br>Triple glazing needed.                     | PHPP calculation.                                                                                                                     |
| Condensation risk   | Minimum temperature permitted on internal frame surface.<br>$f_{\text{Rsi}} > 0.8$ . Report $f_{\text{Rsi}}$ where this is not achieved.                                                                    | Calculation report to EN ISO 10077 for each frame element marking temperature isotherms and $f_{\text{Rsi}}$ .                        |
| Airtightness        | Meets whole building air permeability test.<br>Generally products should be Class 4 air permeability. Some (<5%) openings can be Class 3 where other characteristics are required, but this is higher risk. | Stated air permeability class to EN ISO 12207.<br>Stated tested air permeability in $\text{m}^3/\text{m}^2/\text{h}$ @ 600Pa.         |
| Ventilation opening | Occupied rooms have opening windows.                                                                                                                                                                        | Floor plan and elevation showing window openings.                                                                                     |

## 3 | Building services

## 3 | Services

### 3.1 Ventilation

### 3.2 Heating and hot water

### 3.3 Appliances, white goods and lighting

### 3.4 Energy metering (Be Seen)

- Mechanical ventilation with heat recovery
- Targeted comfort cooling for at risk homes



# Ventilation | Heat recovery ventilation throughout

## Location of MVHR units

Mechanical Ventilation with Heat Recovery (MVHR) is required for low energy buildings. The location of the MVHR unit is critical to the performance of the system. Internal intake and exhaust ducts, which carry air at or near to the external temperature, must be insulated and should be less than 2m in length. This means the unit should ideally be located against an outside wall.

Best practice  
intake and  
exhaust duct  
length



All intake and exhaust ducts are assumed to be insulated with at least 25 mm of vapour sealed insulation with a design thermal conductivity of  $<0.04 \text{ W/mK}$ .

Ideally the MVHR units should also be installed close to the 'noisiest' part of the flat (i.e. within a kitchen/bathroom or in a dedicated service cupboard). Service cupboards within living areas should be provided with sufficient sound-proofing. MVHR units should not be located in bedrooms.

A MVHR for a single dwelling has a typical footprint of 800 x 600mm. With attenuators and ducts units often take up half of a service cupboard height. Sufficient clearance should be provided to change the MVHR filters. A condensate drain connection to the unit is also required.

Current locations for the MVHR units are shown on the following page. These are predominantly in service cupboards with some units being located in kitchens. All MVHR locations have been selected to reduce the length of intake and exhaust ductwork at Ashley Road.

## A Passivhaus certified MVHR

Specifying Passivhaus Institute Certified MVHR units guarantees best practice heat recovery efficiency and acoustic performance. Due to the wide range of domestic MVHR units available, this is recommended as a simple approach to ensuring quality, even if the building is not certified Passivhaus.

Database of certified units:

<http://www.passiv.de/komponentendatenbank/en-EN>



Example unit: Zehnder Comfoair 350 MVHR

For dwellings where access to the external wall is constrained combined grilles can be used to allow colocation of the intake and exhaust terminal, helping to minimise the 'cold' duct length.



Example of combined terminal (MAICO)

## Ventilation | Locations of the MVHR units to minimise heat losses



### Key

■ MVHR location

### Horizontal duct length to external wall:

- poor for thermal performance
- acceptable for thermal performance
- good for thermal performance

Target average intake and exhaust duct lengths for all buildings at Ashley Road

2.0 m

Stair cores and circulation spaces within the thermal envelope require ventilating and should have an air flow rate to achieve 0.1ach. This can be from an inline duct mounted fan.

Ground floor for Building A showing location of the MVHR units and lengths of intake and exhaust ductwork to external wall. Lengths have been calculated based on the position of the MVHR unit and account for connections in and out of the MVHR unit.

# Ventilation | MVHR installation requirements

## Design – General

- MVHR should be designed as a complete system, including ducting, attenuators, frost protection, supply/extract and intake/exhaust valves and any auxiliary components.
- Sufficient room should be provided to carry out routine maintenance on the MVHR unit; typically 1m of clear space is required in front of the unit to change the filters or heat exchange core.
- Control systems should be simple and conveniently located for building occupants to access. Ideally near the ventilation unit.
- Filters must be accessible to building occupants and easily replaceable without tools.
- The kitchen extract terminal must have a separate terminal filter.
- Visual indicators are recommended to display the MVHR system status, including any maintenance requirements. Ideally a control panel should be visible on the face of the MVHR unit.
- Any fire stops should clearly indicate their status (tripped or stand-by) and be easy to reset by hand without special tools.
- Any boost function should be timed and system set to return to standard ventilation rate automatically.
- External intake terminals should be located to minimise exposure to air pollutants and the extract air. e.g. away from bin storage.
- Ducting layout should ensure any condensation does not reach the MVHR unit or accumulate in the ducts.
- It is essential that MVHR ducting is treated as a key component of the system, as it has a significant effect on overall system performance and energy efficiency.

## Design – Air flow rates, ducting & comfort

- Intake and exhaust duct lengths should be as short as possible. Less than 1.5m per duct is good practice.
- Intake/exhaust ducts should have 25mm minimum thickness of vapour sealed insulation with a minimum design thermal conductivity of 0.04 W/(m.K)
- Supply air terminals should be located away from internal doors, transfer grilles and at least 1m from walls to ensure proper air flow across rooms.
- Ducts should be sized to achieve <2m/s and air speeds associated with supply air terminals should be low enough to avoid excessive noise and thermal discomfort:
  - ✓ Rigid or semi-rigid ducting should be used. Never flexible ducting.
  - ✓ Extract terminals should not be located above cooking appliances in kitchens, and grease filters used if necessary.
  - ✓ Acoustic attenuators should be positioned to reduce noise from the unit, and between rooms.

## Installation

- The system designer, or a suitably experienced representative, should meet with the installation team to confirm system layout before installation, or visit site while ducting is still exposed to identify any issues.
- No flexible ductwork is permitted. This includes final connections to terminals.
- Kinks or crushing ductwork must be avoided.
- Ducts should be kept clean and ends covered during installation to prevent dust entering the system.
- A method statement for installing duct insulation highlighting key risk areas is required before start on site. This will summarise the key areas that require insulating before installation, and the installation order.
- Insulation must have no air gaps larger than 2mm between or behind the insulation layer. The vapour barrier shall be a robust and weatherproof (where required) complete sealed jacket to the duct.
- Any design changes should be approved by the system designer.

## Commissioning

- Ensure ductwork is clean at terminals.
- Ensure all filters are clean so system is balanced with clear air flow.
- Set fan speed according to dwelling-specific design specification.
- Balance total supply and extract flow rates within at most 10% of one another, and within 5% of design values (or better if required by mechanical spec).
- Individual rooms supply and extract terminals to be measured at standard/commissioning operating flow, these should be within 5% or better of the design air flow.
- Lock air valves in position once balanced.
- Investigate and resolve deviations from the design specification when they occur.
- Submit commissioning reports for each MVHR system/unit to the client.
- Transfer grills, low level floor supply grills, and door undercuts should have supply air speed not exceeding 1m/s. Door undercuts must have more than 10mm clear opening after finishes are installed.

# Ventilation | Supplementary cooling to homes with particular acoustic constraints

There are 13 homes within the Ashley Road development that are at a greater risk of overheating, due to higher levels of external noise preventing occupants from opening windows. The Anderson Acoustic report identifies which flats these are (more info is given in the TM59 overheating section of the Stage 3 report, although the number of units has been revised to the list presented in this report).

The incorporated solution for these homes is to add a pre-tempering system to the ventilation unit. This is not a full cooling system but enables pre-tempering of supply air on hot days. There are no complicated controls, the system activates and deactivates automatically to maintain a comfortable, healthy and energy efficient indoor climate.

The TM59 model was not set-up to accurately predict cooling consumption, so any results will likely be very inaccurate. However, based on a set-point of 26 degrees, windows openable during the day, but closed at night, the model estimates an annual cooling consumption of around 0.8kWh/m<sup>2</sup>/yr.



It is anticipated that the following units will require an MVHR pre-tempering unit to be provided:

|          |          |
|----------|----------|
| C2.03.01 | C2.08.01 |
| C2.04.01 | C2.08.05 |
| C2.04.05 | C2.09.01 |
| C2.05.01 | C2.09.05 |
| C2.05.05 |          |
| C2.06.01 |          |
| C2.06.05 |          |
| C2.07.01 |          |
| C2.07.05 |          |

Total number of units with pre-cooling: **13**

## 5 | Calculations

## 5 | Calculations

## 5.2 Space heating demand (PHPP)

- Space heating demand target
- PHPP results block by block

| Passive House Verification                                                                         |      |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
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|                 |      |                                                                                                                                                           | <table><tr><td colspan="2"><b>Building:</b> C3</td><td colspan="2"><b>Street:</b> Ashley Road Depot</td><td colspan="2"><b>City:</b> London</td><td colspan="2"></td></tr><tr><td colspan="2"><b>Postcode:</b> City</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr><tr><td colspan="2"><b>Province/Country:</b> England</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"><a href="#">GB United Kingdom Entry</a></td></tr><tr><td colspan="2"><b>Building type:</b> Mid-residential</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr><tr><td colspan="2"><b>Climate zone:</b> 3, Continental</td><td colspan="2"></td><td colspan="2"><b>Altitude of location:</b> 10 m</td><td colspan="2"></td></tr><tr><td colspan="4"><b>Home center (City, Street)</b></td><td colspan="4"><b>Home Borough of Hierarchy</b></td></tr><tr><td colspan="2"><b>Province/Country:</b></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr></table> |                                   |  |                                         |  |                                        |  | <b>Building:</b> C3            |      | <b>Street:</b> Ashley Road Depot |      | <b>City:</b> London             |      |                                |     | <b>Postcode:</b> City                  |     |                           |  |  |  |  |  | <b>Province/Country:</b> England |  |  |  |  |  | <a href="#">GB United Kingdom Entry</a> |  | <b>Building type:</b> Mid-residential |  |  |  |  |  |  |  | <b>Climate zone:</b> 3, Continental |  |  |  | <b>Altitude of location:</b> 10 m |  |  |  | <b>Home center (City, Street)</b> |  |  |  | <b>Home Borough of Hierarchy</b> |  |  |  | <b>Province/Country:</b> |  |  |  |  |  |  |  |
| <b>Building:</b> C3                                                                                |      | <b>Street:</b> Ashley Road Depot                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>City:</b> London               |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Postcode:</b> City                                                                              |      |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Province/Country:</b> England                                                                   |      |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |  | <a href="#">GB United Kingdom Entry</a> |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Building type:</b> Mid-residential                                                              |      |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Climate zone:</b> 3, Continental                                                                |      |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Altitude of location:</b> 10 m |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Home center (City, Street)</b>                                                                  |      |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Home Borough of Hierarchy</b>  |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Province/Country:</b>                                                                           |      |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Architecture</b><br>Architect: Lucetti Bernabini<br>Postcode: City<br>Province/Country: England |      |                                                                                                                                                           | <b>Mechanical engineer:</b> Rex Farnham<br>Street: 14-16, Riverside Greenway<br>Postcode: City<br>Province/Country: England                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Energy engineer:</b> Steve J. Barlow<br>Postcode: City<br>Province/Country: England             |      |                                                                                                                                                           | <b>Geotechnical engineer:</b> Carl Smith<br>Postcode: City<br>Province/Country: England                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Structure:</b> J. Barlow<br>Postcode: City<br>Province/Country: England                         |      |                                                                                                                                                           | <b>Structural engineer:</b> Alex Farnham<br>Street: 14-16, Riverside Greenway<br>Postcode: City<br>Province/Country: England                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Year of construction:</b> 2013<br>No. of building units: 44<br>No. of occupants: 115            |      |                                                                                                                                                           | <table><tr><td><b>Indoor temperature (°C)</b></td><td>20.0</td><td><b>Indoor temp. summer (°C)</b></td><td>25.0</td></tr><tr><td><b>Indoor heat gains (W/m²)</b></td><td>12.0</td><td><b>PHI ceiling case (W/m²)</b></td><td>2.0</td></tr><tr><td><b>Specific capacity (W/m² per °K)</b></td><td>138</td><td><b>Mechanical cooling</b></td><td></td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                   |  |                                         |  |                                        |  | <b>Indoor temperature (°C)</b> | 20.0 | <b>Indoor temp. summer (°C)</b>  | 25.0 | <b>Indoor heat gains (W/m²)</b> | 12.0 | <b>PHI ceiling case (W/m²)</b> | 2.0 | <b>Specific capacity (W/m² per °K)</b> | 138 | <b>Mechanical cooling</b> |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Indoor temperature (°C)</b>                                                                     | 20.0 | <b>Indoor temp. summer (°C)</b>                                                                                                                           | 25.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Indoor heat gains (W/m²)</b>                                                                    | 12.0 | <b>PHI ceiling case (W/m²)</b>                                                                                                                            | 2.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Specific capacity (W/m² per °K)</b>                                                             | 138  | <b>Mechanical cooling</b>                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Specific building characteristics with reference to the treated floor area</b>                  |      |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |  |                                         |  |                                        |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Space heating</b>                                                                               |      | Treated floor area (m²)<br><b>1319.0</b><br>Heating demand (W/m²) <b>13.3</b><br>Heating heat (W/m²) <b>9.8</b>                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Criteria<br>a<br>13<br>-          |  | Alternative criteria<br>-<br>10         |  | Fulfillment<br><b>yes</b>              |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Space cooling</b>                                                                               |      | Cooling & dehum. demand (W/m²) <b>0</b><br>Frequency of overheating (> 25 °C) <b>0.2</b><br>Frequency of excessively high humidity (> 12 g/m³) <b>0.3</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | a<br>-<br>0<br>10<br>20           |  | -<br>-<br>-                             |  | <b>yes</b><br><b>yes</b><br><b>yes</b> |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |
| <b>Airtightness</b>                                                                                |      | Pressurization test result (n <sub>50</sub> ) <b>0.6</b>                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | a<br>0.6                          |  | 0.6                                     |  | <b>yes</b>                             |  |                                |      |                                  |      |                                 |      |                                |     |                                        |     |                           |  |  |  |  |  |                                  |  |  |  |  |  |                                         |  |                                       |  |  |  |  |  |  |  |                                     |  |  |  |                                   |  |  |  |                                   |  |  |  |                                  |  |  |  |                          |  |  |  |  |  |  |  |

# Predicted energy use modelling (PHPP) | Results for Block A4

The PHPP modelling completed for Block A4 demonstrates that the design is...

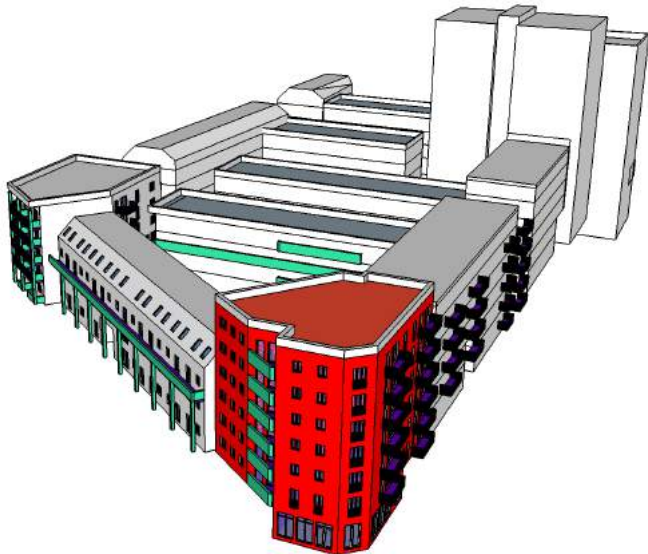
| Passive House Verification                                                          |  |                                                  |  |                                                |  |                            |  |                                   |  |            |  |
|-------------------------------------------------------------------------------------|--|--------------------------------------------------|--|------------------------------------------------|--|----------------------------|--|-----------------------------------|--|------------|--|
|  |  |                                                  |  | Building:                                      |  | A4                         |  |                                   |  |            |  |
|                                                                                     |  |                                                  |  | Street:                                        |  | Ashley Road Depot          |  |                                   |  |            |  |
|                                                                                     |  |                                                  |  | Postcode/City:                                 |  | London                     |  |                                   |  |            |  |
|                                                                                     |  |                                                  |  | Province/Country:                              |  | England                    |  | GB-United Kingdom/Britain         |  |            |  |
|                                                                                     |  |                                                  |  | Building type:                                 |  | Multi-residential          |  |                                   |  |            |  |
|                                                                                     |  |                                                  |  | Climate data set:                              |  | GB0002a-Silkeborg          |  |                                   |  |            |  |
|                                                                                     |  |                                                  |  | Climate zone:                                  |  | 3: Cool-temperate          |  | Altitude of location:             |  | 10 m       |  |
|                                                                                     |  |                                                  |  | Home owner / Client:                           |  | London Borough of Haringey |  |                                   |  |            |  |
|                                                                                     |  |                                                  |  | Street:                                        |  |                            |  |                                   |  |            |  |
|                                                                                     |  |                                                  |  | Postcode/City:                                 |  |                            |  |                                   |  |            |  |
|                                                                                     |  |                                                  |  | Province/Country:                              |  |                            |  |                                   |  |            |  |
| Architecture:                                                                       |  | Levitt Bernstein                                 |  |                                                |  | Mechanical engineer:       |  | Max Fordham                       |  |            |  |
| Street:                                                                             |  | 2-4 Thane Villas                                 |  |                                                |  | Street:                    |  | 42/43 Gloucester Crescent         |  |            |  |
| Postcode/City:                                                                      |  | N7 7PA London                                    |  |                                                |  | Postcode/City:             |  | NW1 7PE London                    |  |            |  |
| Province/Country:                                                                   |  | England GB-United Kingdom/Britain                |  |                                                |  | Province/Country:          |  | England GB-United Kingdom/Britain |  |            |  |
| Energy consultancy:                                                                 |  | Elude                                            |  |                                                |  | Location:                  |  |                                   |  |            |  |
| Street:                                                                             |  | 5 Baldwin Terrace                                |  |                                                |  | Street:                    |  |                                   |  |            |  |
| Postcode/City:                                                                      |  | N1 7BU London                                    |  |                                                |  | Postcode/City:             |  |                                   |  |            |  |
| Province/Country:                                                                   |  | England GB-United Kingdom/Britain                |  |                                                |  | Province/Country:          |  |                                   |  |            |  |
| Year of construction:                                                               |  | 2023                                             |  | Interior temperature winter [°C]:              |  | 20.5                       |  | Interior temp. summer [°C]:       |  | 25.0       |  |
| No. of dwelling units:                                                              |  | 15                                               |  | Internal heat gains (IHG) heating case [W/m²]: |  | 2.6                        |  | IHG cooling case [W/m²]:          |  | 2.6        |  |
| No. of occupants:                                                                   |  | 41.1                                             |  | Specific capacity [Wh/K per m² TFA]:           |  | 132                        |  | Mechanical cooling:               |  |            |  |
| Specific building characteristics with reference to the treated floor area          |  |                                                  |  |                                                |  |                            |  |                                   |  |            |  |
| Treated floor area [m²]                                                             |  |                                                  |  | 1692.0                                         |  | Criteria                   |  | Alternative criteria              |  | Fulfilled? |  |
| Space heating                                                                       |  | Heating demand [kWh/m²/a]                        |  | 10.2                                           |  | ≤                          |  | 15                                |  | -          |  |
|                                                                                     |  | Heating load [W/m²]                              |  | 9.1                                            |  | ≤                          |  | -                                 |  | 10         |  |
| Space cooling                                                                       |  | Cooling & dehum. demand [kWh/m²/a]               |  | -                                              |  | ≤                          |  | -                                 |  | -          |  |
|                                                                                     |  | Cooling load [W/m²]                              |  | -                                              |  | ≤                          |  | -                                 |  | -          |  |
| Frequency of overheating (> 25 °C) [%]                                              |  |                                                  |  | 12.5                                           |  | ≤                          |  | 10                                |  | no         |  |
| Frequency of excessively high humidity (> 12 g/kg) [%]                              |  |                                                  |  | 0.3                                            |  | ≤                          |  | 20                                |  | yes        |  |
| Airtightness                                                                        |  | Pressurization test result n <sub>50</sub> [1/h] |  | 0.6                                            |  | ≤                          |  | 0.6                               |  | yes        |  |

To be updated

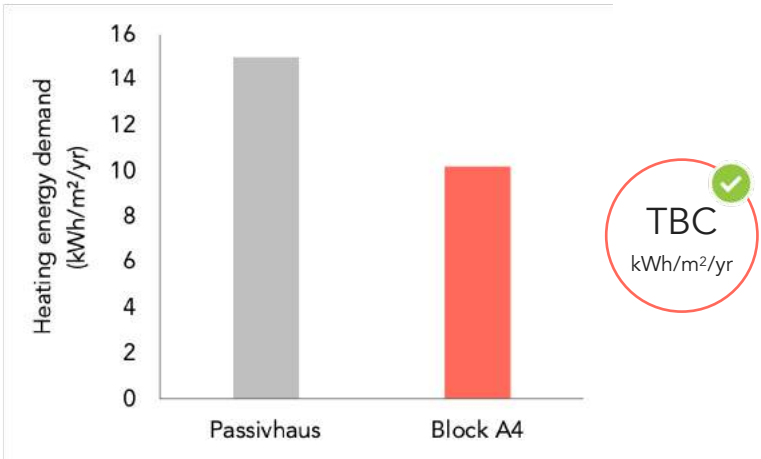
Annual space heating demand calculation carried out in PHPP

Form Factor

TBC



DesignPH model used to create PHPP calculation looking north east



Annual space heating demand calculation for the building

Ashley Road Depot

Energy and Sustainability Statement

Appendices

# Appendix 3

*PHPP*



- Model assumptions

## Appendix 3 | PHPP model assumptions

| Assumption                | PHPP calculation                                      | Notes                                                                      |
|---------------------------|-------------------------------------------------------|----------------------------------------------------------------------------|
| <b>General</b>            |                                                       |                                                                            |
| Weather file              | BRE GB0002a-Silsoe                                    | Passivhaus climate file                                                    |
| Occupancy                 | Standard residential occupancy pattern<br>72.4 people |                                                                            |
| Floor area (TFA)          | A1 & A5: 2902m <sup>2</sup><br>A4: 1692m <sup>2</sup> | Space heating demand is calculated using<br>Passivhaus treated floor area. |
| Winter design temperature | 20°C                                                  |                                                                            |

### Building Fabric

|                   |                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                            |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Air permeability  | 1.0 m <sup>3</sup> /m <sup>2</sup> .hr @ 50 Pa (0.6 ACH)                                                                                                                                                                                                                                                                                                                             | Equivalent to Passivhaus. Building should target <0.6m <sup>3</sup> /m <sup>2</sup> .hr @ 50 Pa. Margin provided for contractor risk.                      |
| Average U-values  | Ground floor: 0.10 W/m <sup>2</sup> .K (SAP 0.085)<br>Exposed floor: 0.175 W/m <sup>2</sup> .K<br>External wall: 0.13 W/m <sup>2</sup> .K (0.14)<br>Flat Roof: 0.08 W/m <sup>2</sup> .K<br>Mansard Roof: 0.13 W/m <sup>2</sup> .K<br><br>Soffit to unheated: 0.17 W/m <sup>2</sup> .K<br>Party wall to unheated: 0.15 W/m <sup>2</sup> .K<br>Terrace roof: 0.166 W/m <sup>2</sup> .K | Ground floor U-value does not include affect of ground<br>External wall U-value does not include affect of structure (e.g. slab edges and masonry shelves) |
| Thermal bridging  | Additional 4kWh/m <sup>2</sup> /yr budget included                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                            |
| Window U-value    | Area weighted building average<br>U <sub>window</sub> 0.8 W/m <sup>2</sup> .K<br>Window frame 1.0 W/m <sup>2</sup> .K<br>Glass 0.60W/m <sup>2</sup> .K                                                                                                                                                                                                                               | Triple glazing, frame thickness 80mm<br>Glazing assumed as 21% of external wall<br>U <sub>window</sub> includes installation thermal bridging              |
| Door U-value      | <1.2 W/m <sup>2</sup> .K                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                            |
| Rooflight U-value | Rooflights <1.2W/m <sup>2</sup> .K                                                                                                                                                                                                                                                                                                                                                   | Triple glazing                                                                                                                                             |
| Glazing g-value   | Generally 0.50                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                            |
| Fixed shading     | Calculated from 3D model including surrounding buildings.                                                                                                                                                                                                                                                                                                                            | Assumes average of 190mm reveal and overhang shading from face of glass.                                                                                   |

### Heat gains

|                    |                     |                                                                     |
|--------------------|---------------------|---------------------------------------------------------------------|
| Internal heat gain | 2.8W/m <sup>2</sup> | Standard assumptions used at this stage.<br>Average gains to space. |
|--------------------|---------------------|---------------------------------------------------------------------|

Estimates of heating energy demand at this stage are based on assumed use, and performance of products, materials, systems and construction quality in the building. There is a substantial margin for error. It is very important that these specification items are maintained through technical design and construction. Small changes in specification could have a disproportionate effect on the performance of the building.

| Assumption        | PHPP calculation                                         | Notes |
|-------------------|----------------------------------------------------------|-------|
| <b>Lighting</b>   |                                                          |       |
| Lighting efficacy | LED fixed lighting throughout<br>Efficacy 80 lumens/Watt |       |
| Lighting controls | Manual switching                                         |       |

### Electrical equipment

|                        |                                                                                                                                                     |                                                                                                                                                                 |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment & appliances | Washing machine, dishwasher and fridge / integrated fridge-freezer, electric oven. No tumble drier.<br>Allowance for consumer electronics and lifts | Appliances chosen by owner / tenant can have a big impact on the overall electricity demand. White goods should have an energy efficiency rating of C or better |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Ventilation Systems

|                          |                                                                                               |                                                                                                            |
|--------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| System                   | To MEP design. Balanced mechanical ventilation with heat recovery                             | Unit should be Passivhaus certified                                                                        |
| AHU system efficiency    | Heat recovery efficiency = 90%<br>SFP <1.5W/l.s<br>Ducts to/from atmosphere insulated to 25mm | SFP includes both fans and controller                                                                      |
| Ducts to/from atmosphere | Average duct length of 2m.<br>Pre-insulated, or Insulated to at least 25mm                    | Intake / exhaust ducts, and ducts external to the thermal envelope must be insulated and minimal in length |

### Space Heating & Domestic Hot Water

|                   |                                                                  |  |
|-------------------|------------------------------------------------------------------|--|
| Source            | Communal heat pump providing hot water and space heating via HIU |  |
| Distribution loss | Not used at this stage                                           |  |

