Detailed design, airtightness and on-site QA

A presentation for
UKPHC 2015

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Paul Jennings:

- Testing buildings for airtightness since 1987 – started courtesy of Ken Livingston & the GLC!
- Certified PassivHaus consultant
- From the first Passivhaus & EnerPHit projects:

Y Gaol, Machynlleth

DVFP Offices, Machynlleth

Grove Cottage, Hereford

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Getting to now, working at scale:

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QA Issues

- **Every one of these projects had significant quality issues**
- **Not a surprise that most of these were related to airtightness!**
- Horsham: Lots of delays on site, final cost approx. £2500 plus VAT per unit for testing

- Wimbish: poor control on site, e.g. 3 holes cut for a boiler flue; recent retesting showed one flat now at > 1 AC/hr @ 50 Pa
- Lancaster Co-Ho: air moving 4m laterally through porous blockwork; window supplier revoked guarantee due to builder storing windows improperly on site

QA Issues in Refurbishment

- **Parkview Hub in Thamesmead**
  - **Delays due to need to clear balconies before fixing panels;**
  - **Not EnerPHit – new RSL, changed priorities**

- **Erneley Close in Manchester**
  - **Initial survey identified a roof slab – became clear was just a ring beam!**
- **Wilmcote House in Portsmouth**
  - **When steels for EWI arrived on site, didn't fit. Also very poor fire separation**

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Delivering Airtightness

Over a lifetime of testing;

& being involved in the construction and refurbishment of both good and bad buildings;

I have concluded that:

- Good airtightness doesn't happen by chance;
- Achieving a good level of airtightness is a process, and needs a plan;
- For refurbishment, know where you start

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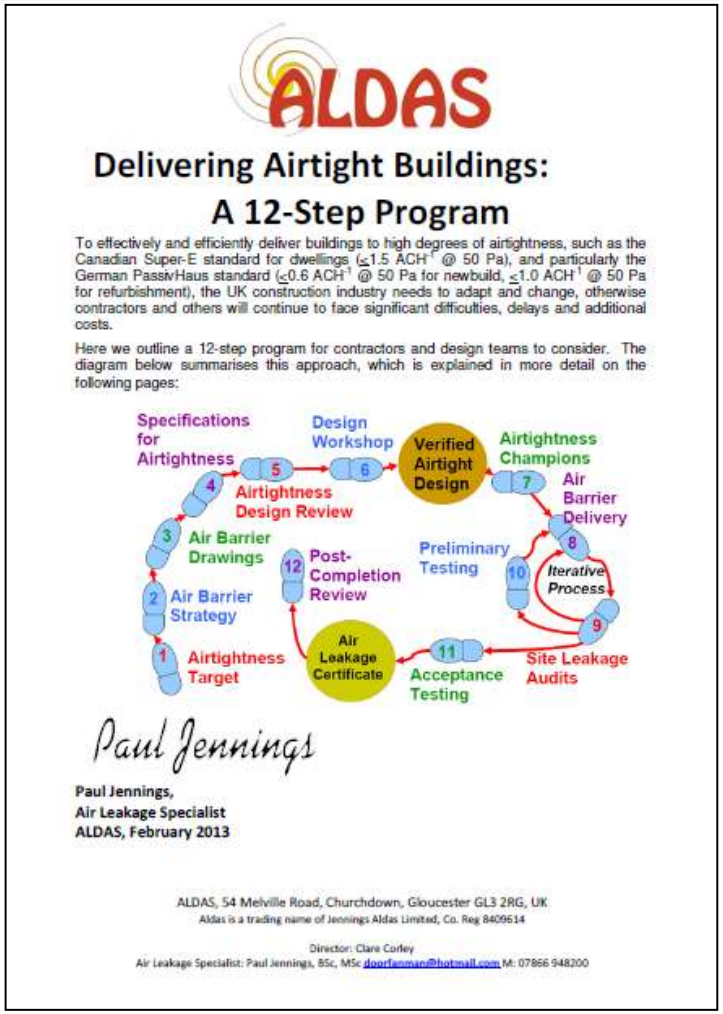
Ensuring Quality in Airtightness

Fundamentally, about attention to detail

- during design
- on site

Hence:

12 Steps to Airtightness



ALDAS

Delivering Airtight Buildings:

A 12-Step Program

To effectively and efficiently deliver buildings to high degrees of airtightness, such as the Canadian Super-E standard for dwellings (≤1.5 ACH^{-1} @ 50 Pa), and particularly the German PassivHaus standard (≤0.6 ACH^{-1} @ 50 Pa for newbuild, ≤1.0 ACH^{-1} @ 50 Pa for refurbishment), the UK construction industry needs to adapt and change, otherwise contractors and others will continue to face significant difficulties, delays and additional costs.

Here we outline a 12-step program for contractors and design teams to consider. The diagram below summarises this approach, which is explained in more detail on the following pages:

Paul Jennings

Paul Jennings,
Air Leakage Specialist
ALDAS, February 2013

ALDAS, 54 Melville Road, Churchdown, Gloucester GL3 2RG, UK
Aldas is a trading name of Jennings Aldas Limited, Co. Reg 8409614

Director: Clare Corley
Air Leakage Specialist: Paul Jennings, BSc, MSc doorfanman@hotmail.com M: 07866 948200

12 Steps to Good Airtightness

Developed over a decade of working on leading-edge UK low energy projects;

Because UK construction commonly builds down to a price, not up to a standard;

Conning and misleading the client and Building Control is normal practice

A 12-Step program because many of our builders are

…… addicted to building rubbish!

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12 Steps - Summary

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Fundamentals for airtightness

- Specify the airtightness process
- Check & recheck – design, construction positives & negatives
- Set air leakage maxima for components & building elements
- Don’t assume, don’t trust – check
- Record the process – lots of photographs

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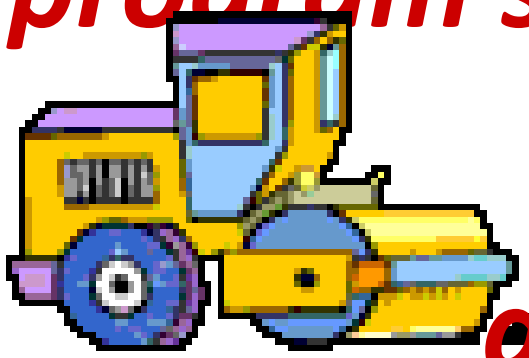
Timings

- Passivhaus takes longer;
- Cannot muddle through;
- Fundamental cause of many problems on major UK Passivhaus projects to date is:

program steamrollers quality, & quality gets broken



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Commenting on the partnership, Matthew Rhodes, Managing Director of Encraft said:

“I’m delighted we’ve been able to extend our existing successful working relationship with Jennings Aldas into this new partnership. The future of the construction sector is all about delivering quality building performance in use, and this means high quality testing that goes well-beyond compliance and adds real value to projects. Working with Jennings Aldas, Encraft now offer clients a one-stop shop that is the simplest and most efficient way to get a building you can trust to perform exactly as it should.”

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"The planning and construction of a Passive house is a demanding task. In order to plan and build functioning Passive Houses which fulfill the requirements for increased comfort and low energy expenditure, the necessary high quality must be ensured. This is the real challenge."

Quality control in Passivhaus is delivered in 5 ways:

1. Planning tools: PHPP
2. Attention to detail throughout planning, design and construction
3. Passivhaus Certified products
4. Passivhaus Certified architects and engineers
5. Final certification of the building on confirmation of the air tightness test result and MVHR commissioning

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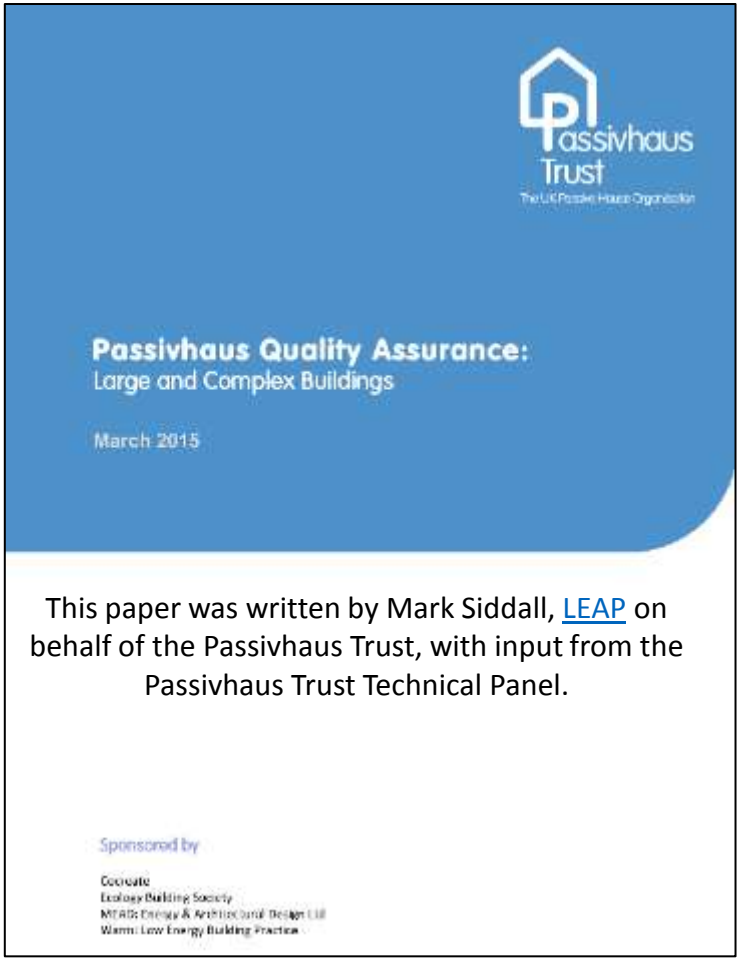
Purpose of the guide

- To illustrate the need for formalised quality assurance tools and methods
- To demonstrate examples of tools and techniques
- To confirm and clarify the requirements of the Passivhaus standard with regard to workmanship and liability as they relate to site teams and managers

http://www.passivhaustrust.org.uk/guidance.php



Services we provide

- Risk register
- Design stage assessment
- Project management checklists
- Desktop buildability reviews
- Buildability workshops
- Quality / air tightness champion training
- Tool box talks to provide basic training for site trades
- Change management sign off
- Site inspections and snagging lists

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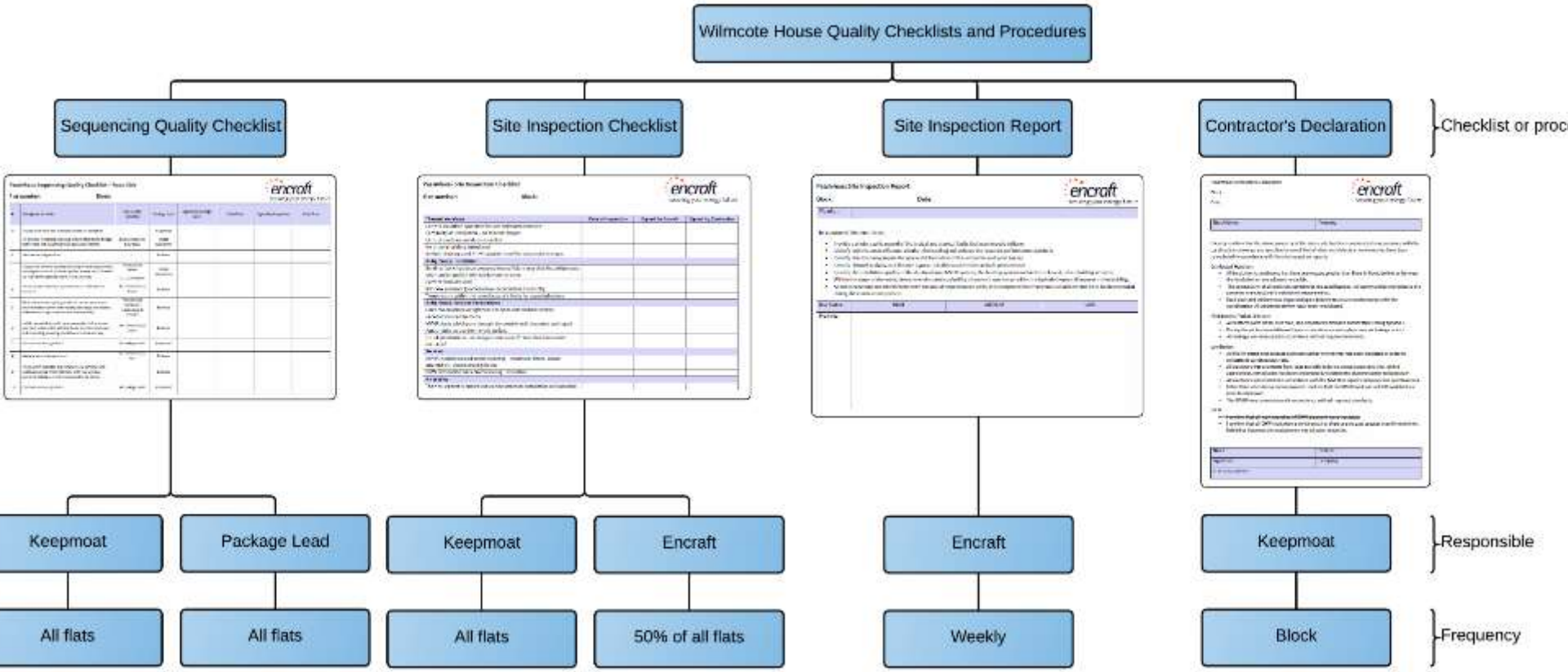

The Passivhaus standard requires that the construction supervisor makes a declaration of conformance

"Execution according to the reviewed PHPP project planning must be documented and confirmed with the construction manager's declaration. Any variation in construction should be mentioned; if any of the products used deviate from those included in the project planning, evidence of compliance with criteria must be provided."

Example Contractors Declaration

Site Address:
Property:
Date:
I hereby confirm that the above property at the above site has been constructed in accordance with the construction drawings and specifications and that all observed defects in workmanship have been remediated in accordance with the site inspection reports.

Conducted Heat Loss
All insulation is continuous i.e. there are no gaps greater than 3mm in front, behind or between the insulation or any adjacent materials.
The conductivity of all materials conform to the specifications.
All workmanship conforms to the specified manufacturer's installation requirements.
Each door and window was inspected upon delivery to ensure conformance with the specification.
All observed defects have been remediated.

Airtightness / Wind tightness
All surfaces were clean, dust free, and dry prior to air/wind barrier tapes being applied.)
During the air test no additional tapes or membranes were place over air leakage points.
Air leakage was measured in accordance with all required standards.

Ventilation
All MVHR intake and exhaust ductwork within the thermal has been insulated in order to mitigate all condensation risks.
All ductwork was protected from dust and debris during construction and that, where appropriate, remediation has been undertake by cleaning the ductwork prior to hand over.
All ductwork was installed in accordance with the MVHR designer's drawings and specifications.
Other than when being commissioned I confirm that the MVHR unit was not left switched on prior to hand over.
The MVHR was commissioned in accordance with all required standards.

DHW
In confirm that all main branches of DHW pipework were insulated.
I confirm that all DHW insulation is continuous i.e. there are no gaps greater than 3mm in front, behind or between the insulation or any adjacent materials.

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Changes that should be tracked include:

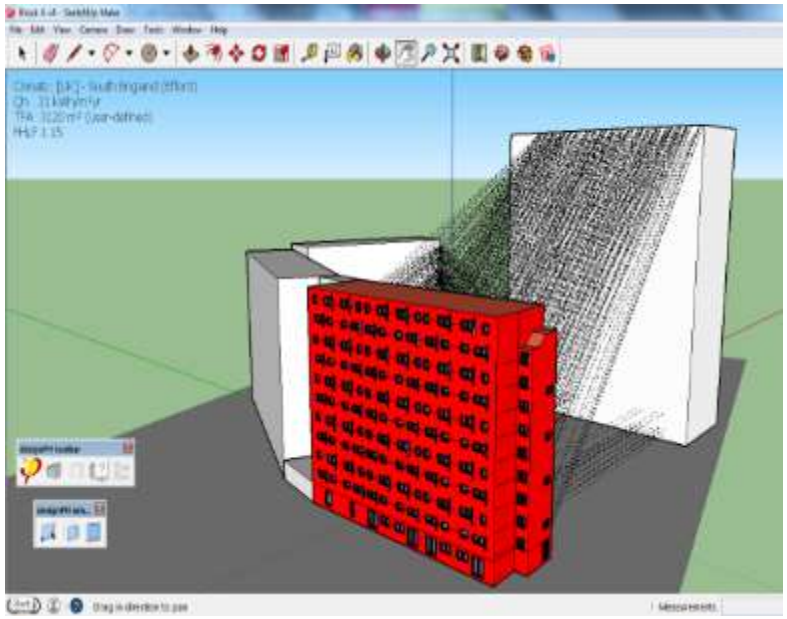
- Designs
- Products & materials
- Sequencing
- Staff/personnel changes

Site inspections should address:

- Below-ground and above-ground fabric
- Installation of insulation - including thermal bypass etc.
- Poor application of insulation at junctions
- Airtightness of service penetrations
- Poor application of air & wind barriers at junctions
- MVHR & ductwork installation
- MVHR commissioning
- Site storage

The Certified Passivhaus Consultant should be present at:

- Air tightness test
- MVHR commissioning
- Commissioning of other services
- Operator/occupant training



Wilmcote House, Portsmouth
111 dwellings

42 site inspections planned

Saffron Acres / Heathcott Road, Leicester
68 dwellings

30 site inspections planned

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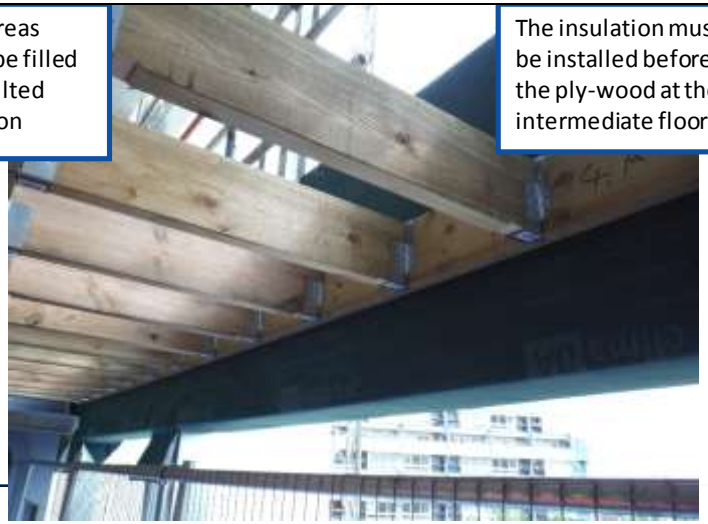
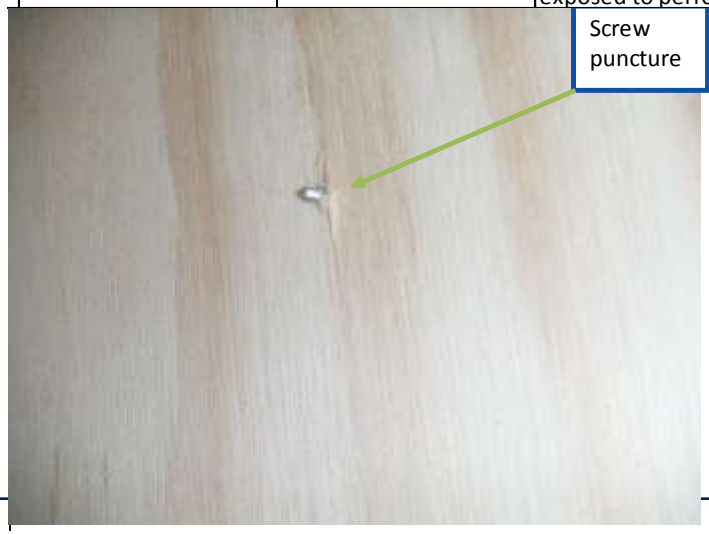
Passivhaus snagging list

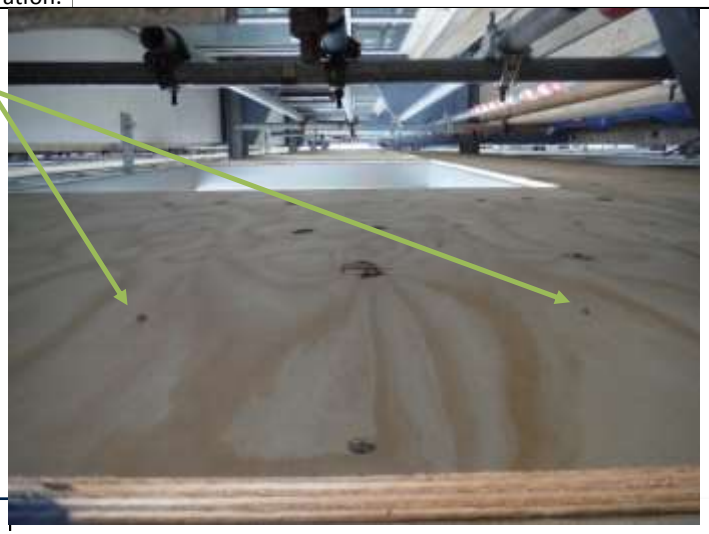
3.8	Insulation has not been incororpated into the horizontal steel c-section on the garden side at the level of the new intermediate floor	All voids within this zone must be filled with insulation. This work must be done as and when the timber packers are being placed and before the installation of the ply-wood sheathing.	Block A – United Insulations should inject mineral wool fibre insulation into these voids using a blowing agent. Blocks B&C – United Insulations should insulate these areas before they are covered with ply	There should be no gaps left in the insulation layer.



Passivhaus snagging list

1.2	The ply-wood is being installed with screw fixing through from the outside. This approach is necessary, however the 34mm screws which have been used are too long as they can be seen puncturing through to the other side of the board.	The ply-wood should be installed with screws no longer than 24mm so as to avoid puncturing the board.	United Insulations should trial shorter screws in order to determine the best length of screw to be used going forwards. They should check all screw fixings by hand to ensure that none puncture the board.	Any sharp object on the surface of the ply-wood, such as a puncture from a screw or nail is at risk of causing a tear in the air tight membrane as it is installed and stretched tight across the board. While the DA membrane is fairly robust it is not worth the risk to leave it exposed to perforation.





Key Quality Indicators

- Continuity of the insulation layer
- Thermal conductivity of insulation materials
- Using the right products in the specified locations
- Continuity of the air barrier
- Sequencing of work
- Air leakage testing
- MVHR commissioning

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