

BUILDERS' BOOK



An illustrated guide to building energy efficient homes











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Further copies of this guide are available as a PDF download from **www.zerocarbonhub.org**

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SIG360 Technical Centre

is a service offering that focuses on helping customers deliver energy efficient buildings.

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- Design and "As built" SAP
- U-Value Calculations
- Condensation risk analysis
- Guidance on Building Regulation compliance
- Energy Performance Certificates
- Predicted Energy assessments
- Energy statements
- Thermal modelling
- · Impartial product advice

ACKNOWLEDGEMENTS

The Zero Carbon Hub is very grateful to the following contributors/organisations for their involvement in developing this good practice guide.

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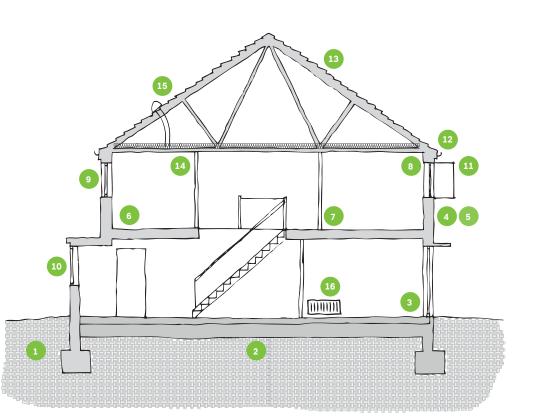
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INTRODUCTION

The builders' book is a good craftsmanship guide that highlights key construction details when building a new home, and good practice for delivering them. During multiple site inspections, these details were most commonly identified as requiring further guidance. The book aims to improve the quality of new homes built, especially with regards to comfort levels and energy bills. It helps builders improve site processes to deliver better performing homes and reduce the risk of condensation and mould growth, excessive heat loss and failure to meet building regulations. This edition of the builders' book is for traditional masonry construction of new homes and extensions. It follows the construction phase of the housebuilding process, and is aimed at helping site personnel and trades improve quality of the end product. It also highlights areas where built environment professionals can improve the design.

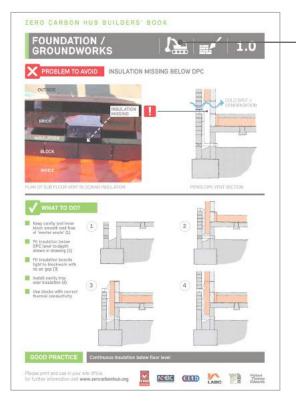
HOW TO USE THIS BOOK

The bulk of the book is made up of site posters that highlight areas of the build in a normal construction sequence.

The site posters can be printed out A4 or A3 size in colour and used as site guidance for site management and trades. They should be used as toolbox talks for trades and at site inductions. The site posters can also be used as design documents and included in specification documentation.

NOTES:

All photographs are taken on building sites. "What to do guidance" is compliant with building regulations and NHBC standards. Diagrams comply with LABC registered construction details www.labc.co.uk/registration-schemes/ construction-details



ICONS FOR DIFFERENT TRADES ON SITE POSTERS



GROUND

WORKER





BRICKLAYER CARPENTER



PLUMBER







ELECTRICIAN

ROOFER



PLASTERER

WINDOW FITTER

DECORATOR

SUMMARY - TOP ISSUES LEADING TO POOR PERFORMANCE

Recommendations



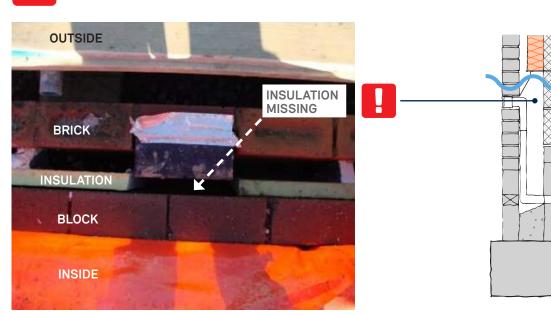
Different, poor performing insulation fitted.	Check insulation against design specification.
Insulation not installed correctly – gaps behind insulation around cavity closures.	Must be installed to BBA or manufacturer guidelines: no gaps, tight up against blockwork or roof/floor to ensure no air route behind insulation.
Product substitution for poorer materials: blocks, insulation, windows, lintels, boiler, controls, fans, windows, doors and lights all affect the energy efficiency of a new home.	Check materials are same as design specification or discuss with architect/designer and site manager.
Air leakage through small gaps in insulation, blockwork and plasterboard can lead to heat losses and condensation issues.	Make sure insulation has no gaps and is sufficiently sealed at joints/ends.
Ventilation fans not commissioned correctly. Domestic Ventilation Compliance Guide not checked.	Check against design specification. Commissioning of fans should be completed by a competent person.
Cold air blowing behind or through insulation.	Fit insulation close to structure, and ensure it is windtight. Seal accordingly.
Cold bridging: steel, concrete or timber structure going through insulation layer.	Consult with design team.
Site damage of fragile materials including insulation, blocks and windows. Rain and mud will worsen performance of materials.	Ensure that insulation and other fragile materials are not damaged by rain, wind and mechanical damage.
Services: ducting, TV aerial, lights can all disrupt insulation in roof causing heat loss / cold spots.	Check insulation in roof is continuous after all services have been installed. Ensure services in service zone to stop this. Label importance of insulation for homeowner.
Windows installed badly leading to airleakage and heat loss.	Ensure correct windows installed with less than 10mm tolerance.

FOUNDATION / GROUNDWORKS

PROBLEM TO AVOID

COLD SPOT = CONDENSATION

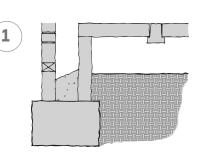
INSULATION MISSING BELOW DPC

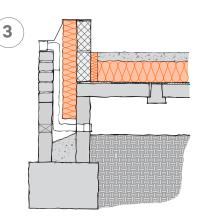


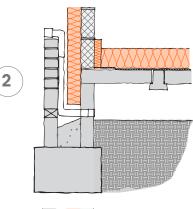
PLAN OF SUB FLOOR VENT BLOCKING INSULATION

WHAT TO DO?

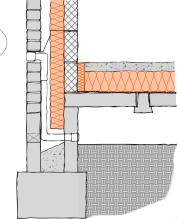
- Keep cavity and inner block smooth and free of 'mortar snots' (1)
- Fit insulation below DPC level to depth shown in drawing (2)
- Fit insulation boards tight to blockwork with no air gap (3)
- Install cavity tray over insulation (4)
- Use blocks with correct thermal conductivity







PERISCOPE VENT SECTION



GOOD PRACTICE

Continuous insulation below floor level

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4



BEAM AND BLOCK FLOOR

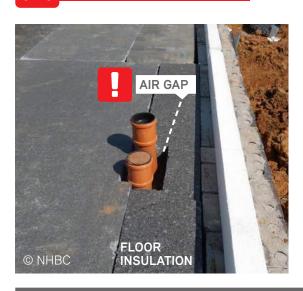
GAPS IN FLOOR INSULATION

2.0

NOT SEALED

INSULATION BOARDS INCOMING SERVICES

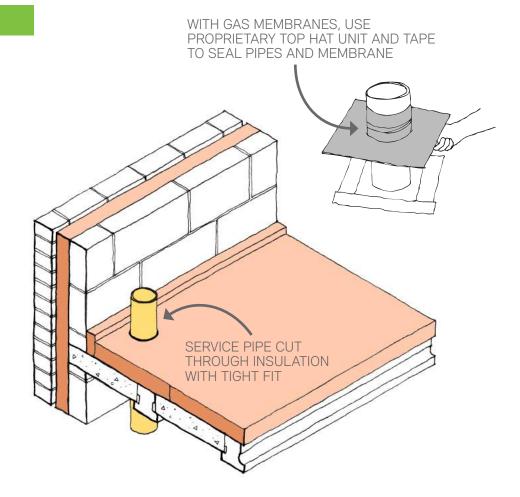
NOT CONTINUOUS



PROBLEM TO AVOID

WHAT TO DO?

- Overlay floor insulation with a seperating layer to prevent screed bleeding through joints
- Fit horizontal floor insulation tight with no gaps between boards
- Install perimeter floor insulation down to the base of concrete floor and tight to blockwork
- Cut through insulation layer with no gaps
- Restrain perimeter floor insulation to prevent 'floating' during screed pour
- Prevent screed bridging the perimeter insulation



GOOD PRACTICE

Fit insulation boards tightly and seal all penetrations

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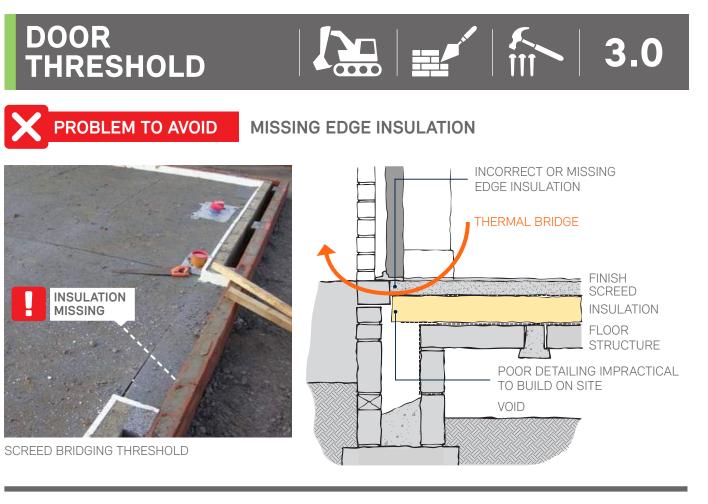


NHBC



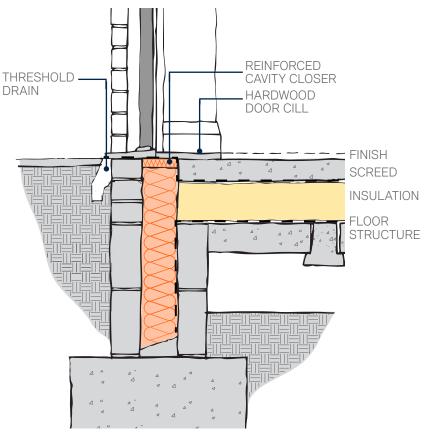
HB





WHAT TO DO?

- Follow the detail drawing or speak with Architect / technical team
- Install a thermal break at the threshold – at least 25mm high performance insulation
- Install damp proof membrane, gas membranes and separating layer as necessary
- Overlap door with cavity by at least 50mm



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GOOD PRACTICE

50mm thick insulation at door threshold or reinforced cavity closer

NHBC

Citb

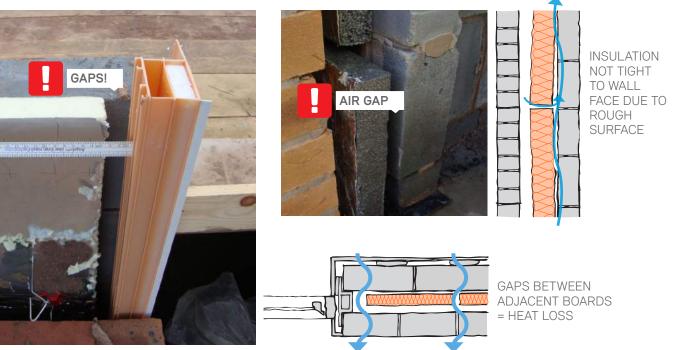
LABC

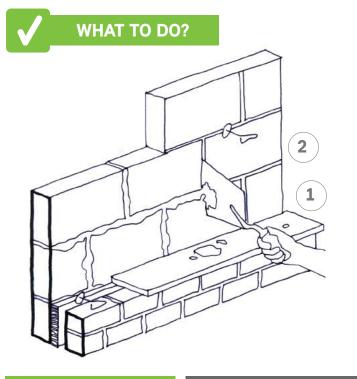
CAVITY WALL

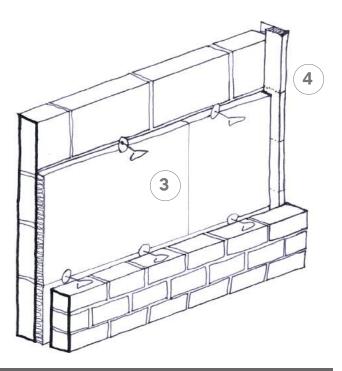


PROBLEM TO AVOID

GAPS IN INSULATION







GOOD PRACTICE

- Protect cavity and insulation from mortar droppings 1
- 2 Smooth mortar joints to allow insulation board tight against block3 Install insulation tightly butted with no gaps
- 4 Cut insulation tight to cavity closers, lintels and cavity trays

NHBC

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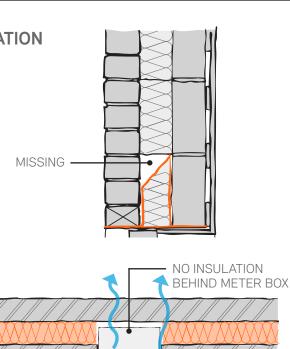


CAVITY WALL



5.0

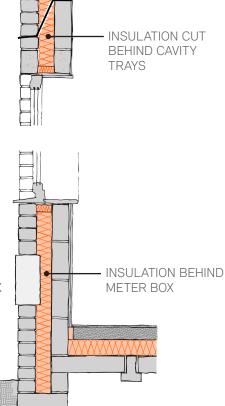




WHAT TO DO?

- Install rigid insulation behind steel beams, cavity trays, meter boxes and subfloor vents or any other elements bridging cavity
- Blown or injected insulation, ensure this reaches the whole wall with no gaps
- Adjust drill pattern for tight spots, cavity trays and inject below DPC

RECESSED METER BOX





CUT INSULATION AROUND CAVITY TRAY

GOOD PRACTICE

Use preformed tray around complex junctions



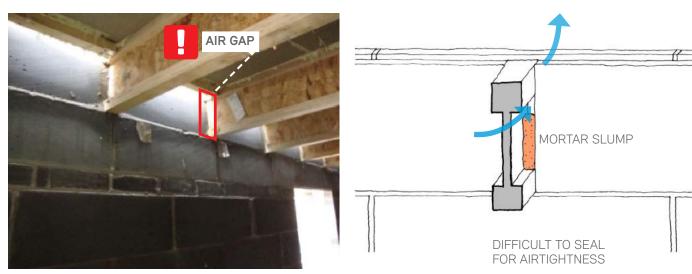


FLOOR JOISTS





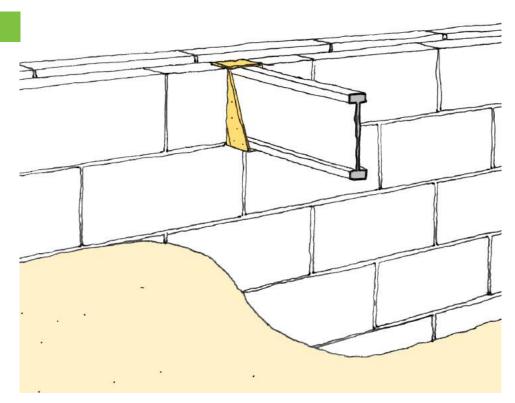
AIR-LEAKAGE AROUND JOISTS



MORTAR WILL NOT BE AIRTIGHT AROUND JOISTS

WHAT TO DO?

- Joists on hangers will reduce air leakage and heat loss
- Fully seal hangers with plaster to retain airtightness
- If joists need to be built in, then end caps should be used and sealed using propriety sealant



GOOD PRACTICE

Apply parge coat to party wall to ensure continuous airtightness line

NHBC

Citb

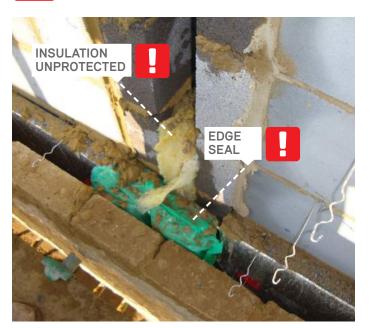
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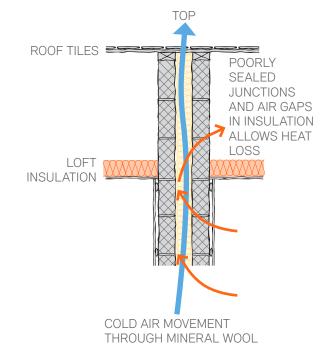
Pollard Thomas Edwards



PROBLEM TO AVOID



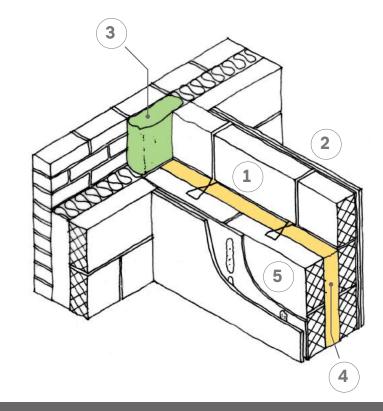




EDGE SEAL NOT UNDER COMPRESSION

WHAT TO DO?

- Ensure fully filled mortar joints (1)
- Keep insulation and cavity protected from weather and mortar snots (2)
- Install party wall edge seal under 15mm compression (3)
- Install mineral wool to fully fill cavity (4)
- Parge coat for improved airtightness may be required (5)
- Refer to robust details for acoustic requirements www.robustdetails.com



INCORRECTLY SEALED PARTY WALL

GOOD PRACTICE

Cavity should be fully filled with edge seal at wall end and roof junctions





LINTELS

PROBLEM TO AVOID



8.0



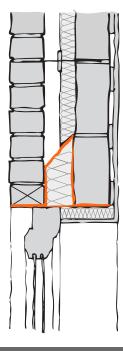


CONTINUOUS BASEPLATE CREATES COLD SPOT

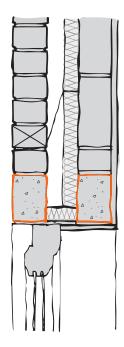


- Install fully insulated cavity closers tight with cavity and insulation
- Cut insulation tight around lintel and cavity tray
- Install lintels that minimise heat loss with non continuous baseplates or thermal breaks
- Improve energy performance by using separate lintels or thermally broken lintels

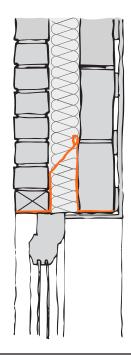
OPTION 1 CONTINUOUS LINTEL & INSULATED PLASTERBOARD



OPTION 2 SEPARATE LINTELS







GOOD PRACTICE

Fully insulated cavity closers to be used

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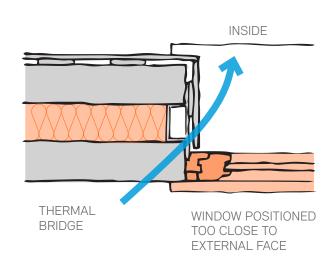


WINDOW INSTALLATION

PROBLEM TO AVOID

WINDOWS INSTALLED FORWARD OF DESIGN POSITION



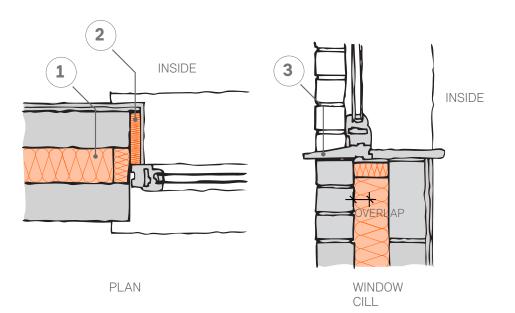


9.0

NO OVERLAP OF WINDOW AND CAVITY

WHAT TO DO?

- Close the cavity with tightly packed insulation (1)
- Insulation to window reveal (2)
- Window fitter to provide non standard large cill (3)
- Overlap frame with cavity as much as possible minimum 30mm
- Check trickle vent sizes as design
- Less than 10mm tolerance around window frame and structural opening



GOOD PRACTICE

A large overlap with cavity will improve thermal performance. For improved airtightness, use air barrier tapes between the window/door and structure



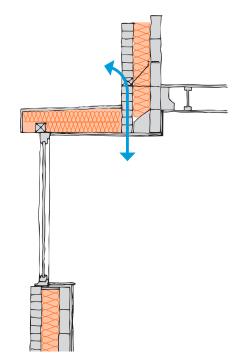
BAY WINDOWS





COLD BRIDGING

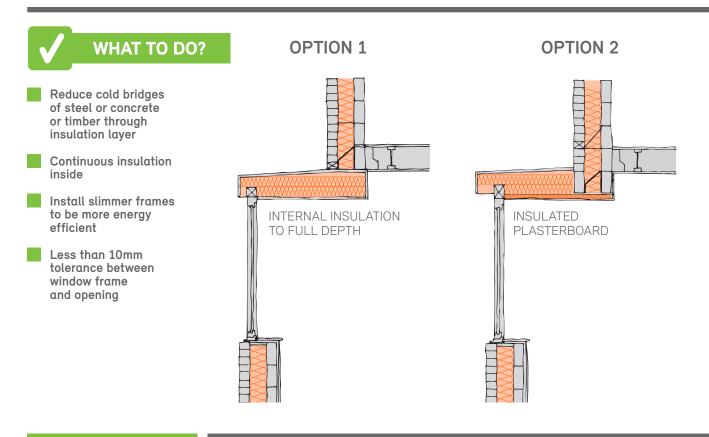




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THICK FRAME AND POSTS INCREASES HEAT LOSS



GOOD PRACTICE

Continuous insulation throughout bay window

NHBC

Citb

LABC

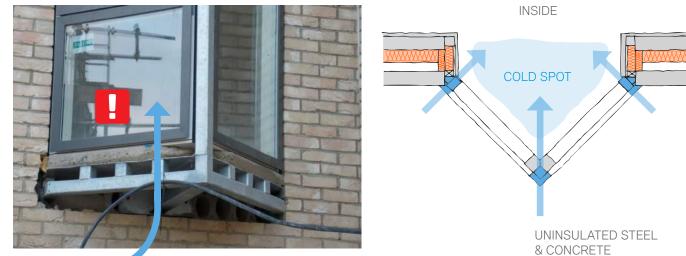
PROJECTING WINDOWS

COLD BRIDGING

11.0

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CONTINUOUS STEEL CREATES COLD BRIDGE

WHAT TO DO? STEEL AND TIMBER Reduce thermal bridges STRUCTURE of steel, concrete or timber through insulation layer If timber structure, ensure less than 15% 1 timber content or AL AL AB continuous insulation outside structure If GRP structure, ensure sufficient thickness of continuous insulation as design Wrap insulation around FULLY steelwork INSULATE STEEL TO KEEP 'WARM' 2

GOOD PRACTICE

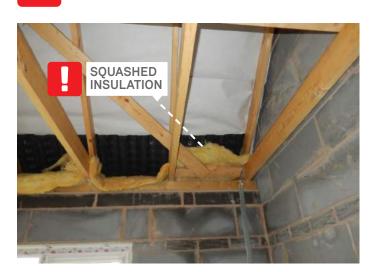
Design to wrap structure with insulation

NHBC

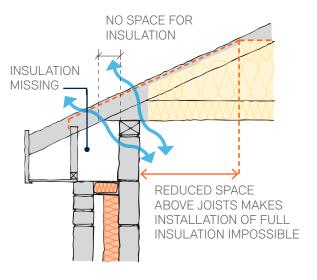
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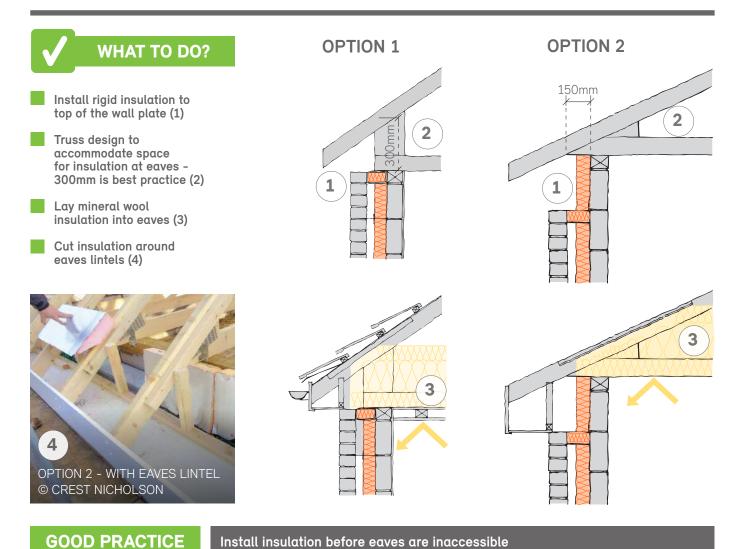
EAVES





PROBLEM TO AVOID





NO INSULATION AT EAVES

Install insulation before eaves are inaccessible

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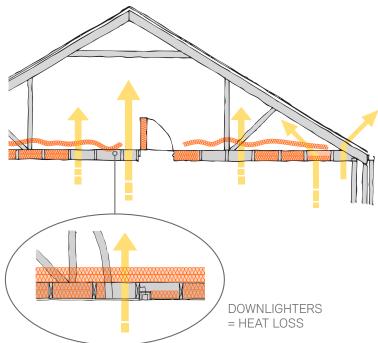
ROOF

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MISSING ROOF INSULATION



PROBLEM TO AVOID



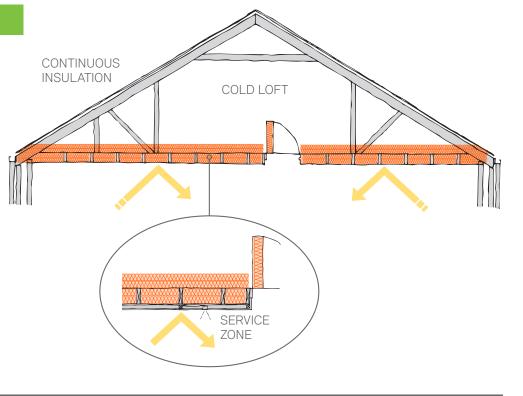
WHAT TO DO?

- Install roof membrane in line with the design i.e. breathable or standard with ventilator
- Install continuous insulation across the roof and into the eaves
- Insulate eaves before roof is closed up
- Use insulation support box above down-lighters to maintain insulation thickness and prevent burn
- Install loft hatch with appropriate insulation thickness

GOOD PRACTICE

Cross lapped insulation checked at final inspection before handover

NHBC













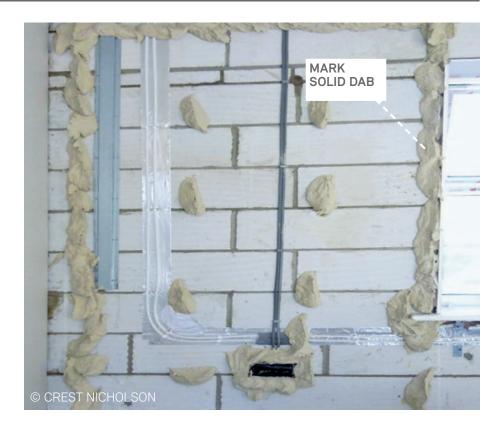
AIR-LEAKAGE



NOT SEALING SERVICES

WHAT TO DO?

- Foam fill all penetrations/ gaps before drylining
- Stagger ceiling boards and over door openings to minimise future cracking
- Mark continuous ribbon of adhesive to be applied around all openings, along the top and bottom and at internal and external corners of walls, and over service chasers



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GOOD PRACTICE

Use a parge coat or plaster on block work to improve airtightness

NHBC

Citb

LABC



VENTILATION

POORLY SPECIFIED AND INSTALLED DUCTWORK



FLEXI DUCT TOO LONG AND NOT SUPPORTED = FANS WILL BE NOISY / INEFFICIENT VENTILATION COMMISSIONING NOT DONE CORRECTLY



- Install rigid ductwork for extract fans, and minimise use of flexi ductwork
 - Installer to commission fans to part F domestic ventilation compliance guide
 - Commissioning sheets to be provided to site manager
- Check noise of fan is not excessive
- Check ducts to outside are fully insulated
- Clearly label the ventilation controls





MEASURE AIRFLOW WITH APPROPRIATE DEVICE

GOOD PRACTICE

Specialist or manufacturer to commission fans





PROBLEM TO AVOID







HEAT LOSS THROUGH UNINSULATED PIPES

PRIMARY PIPEWORK NOT INSULATED

BOILER FLUE NOT SEALED



- Insulate all pipework to site specification and DHCG – minimum 25mm insulation to all primary pipework
- Fully seal all holes and gaps under/behind kitchen units
- Fully seal all holes and gaps in wet rooms (under/ behind bathroom units, bath and shower)
- All control valves are clearly labelled, providing information about the valve function
- Refer to Domestic Heating Compliance Guide from www.planningportal.gov.uk





GOOD PRACTICE

Pipe insulation continuous around the full length and secured in place

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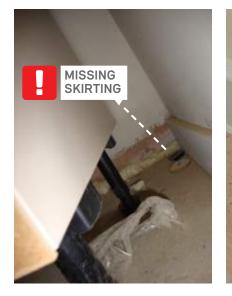




FINALS

***** 17.0

AIR LEAKAGE AS SEALANT DOES NOT LAST





WHAT TO DO?

- Check insulation in roof is continuous and installed correctly at eaves
- Do not rely on sealant as an air barrier – build tight and parge coat or plaster instead
- Trim all doors to achieve a clear gap between finish and door of 10mm; 25mm where no floor covering provided
- Inform SAP assessor of sales extras fitted that were not included in the design or specification e.g. fireplace, downlights, electric radiator





GOOD PRACTICE

Final inspection to use eyeball test to pick up on missing insulation Notify SAP Assessor of changes to original design



NOTE:

This guide is not a legal document and does not form part of a Building Regulations approved specification. It is for information and good practice purposes only. Consult your Building Control Officer for details on approved specification's and policy.

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