



BUILDERS' BOOK



An illustrated guide to building energy efficient homes



Pollard
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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.

Central to SIG360 is an easily accessible impartial team of technical specialists, who draw on over 55 years of experience and an extensive range of products in providing the most cost effective build, suited to your preferred building style.

Support and services include:

- 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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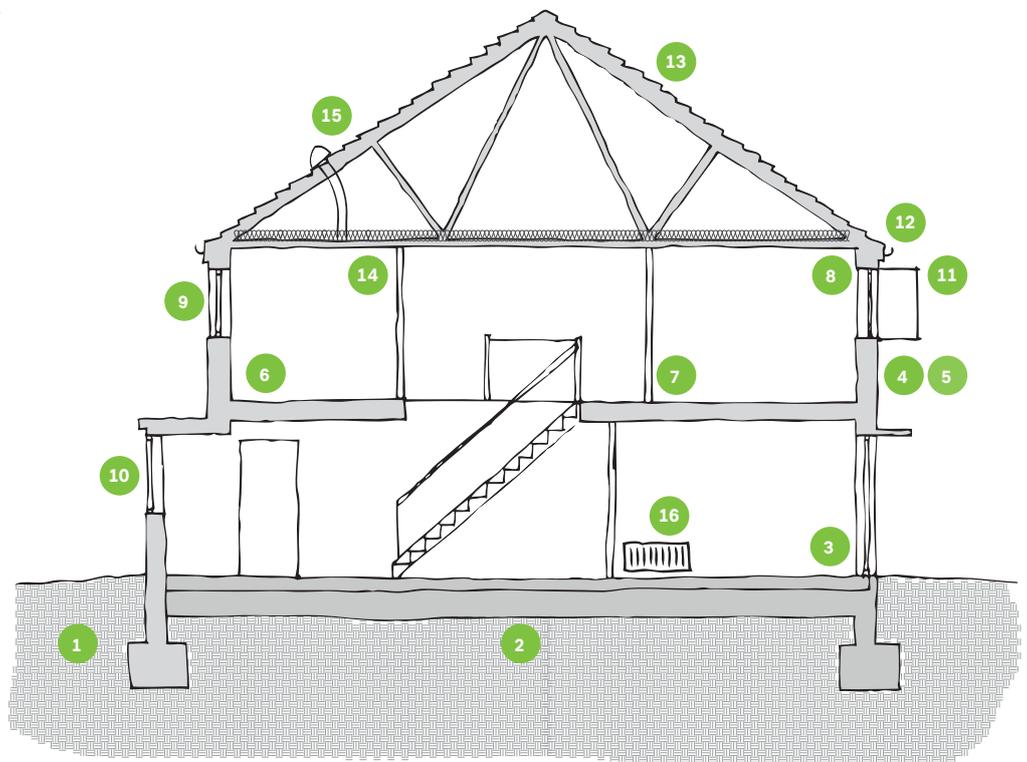
Introduction

How to use this book

Summary - Top Issues Leading to Poor Performance

Site Posters - Fabric and Services

- 1 Groundworks
- 2 Beam and Block Floor
- 3 Door Threshold
- 4 Cavity Wall
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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 house-building 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.

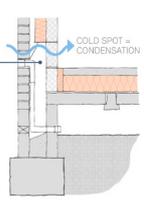
NOTES:

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

ZERO CARBON HUB BUILDERS' BOOK

FOUNDATION / GROUNDWORKS   **1.0**

PROBLEM TO AVOID INSULATION MISSING BELOW DPC

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

GOOD PRACTICE Continuous insulation below floor level

Please print and use in your site office. For further information visit www.zerocarbonhub.org



ICONS FOR DIFFERENT TRADES ON SITE POSTERS



GROUND WORKER



BRICKLAYER



CARPENTER



PLUMBER



ELECTRICIAN



PLASTERER



WINDOW FITTER



ROOFER



DECORATOR

SUMMARY - TOP ISSUES LEADING TO POOR PERFORMANCE



Problems

- Different, lesser performing insulation fitted.
- Insulation not installed correctly – gaps behind insulation around cavity closures. e.g. insulation cut short of reveals.
- 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.
- Air leakage through small gaps in insulation, blockwork and plasterboard can lead to heat losses and condensation issues.
- Ventilation fans not commissioned correctly. Domestic Ventilation Compliance Guide not followed.
- Cold air blowing behind or through insulation. e.g. insulation floating off substrate.
- Cold bridging: steel, concrete or timber structure going through insulation layer.
- Site damage of fragile materials including insulation, blocks and windows. Rain and mud will worsen performance of materials.
- Services: ducting, TV aerial, lights can all disrupt insulation in roof causing heat loss / cold spots.
- Windows installed badly leading to airleakage and heat loss.



Recommendations

- Check insulation against design specification.
- Must be installed to BBA or manufacturer guidelines: no gaps, tight up against blockwork or roof/floor to ensure no air route behind insulation.
- Check materials are same as design specification or discuss with architect/designer and site manager.
- Make sure insulation has no gaps and is sufficiently sealed at joints/ends.
- Check against design specification. Commissioning of fans should be completed by a competent person. e.g. BPEC Certification for Domestic Ventilation.
- Fit insulation close to structure, and ensure it is windtight. Seal accordingly.
- Consult with design team. Designer to reduce cold bridges as Part L Building Regulations.
- Ensure that insulation and other fragile materials are not damaged by rain, wind and mechanical damage.
- 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.
- Ensure correct windows installed with less than 10mm tolerance.

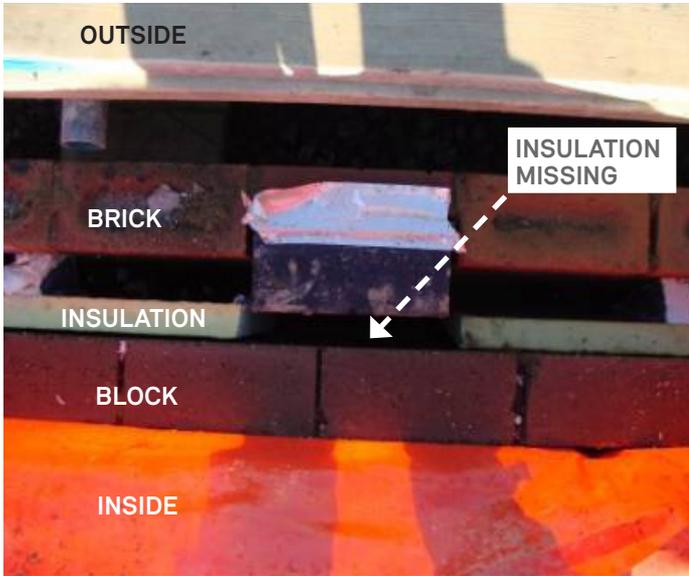
FOUNDATION / GROUNDWORKS



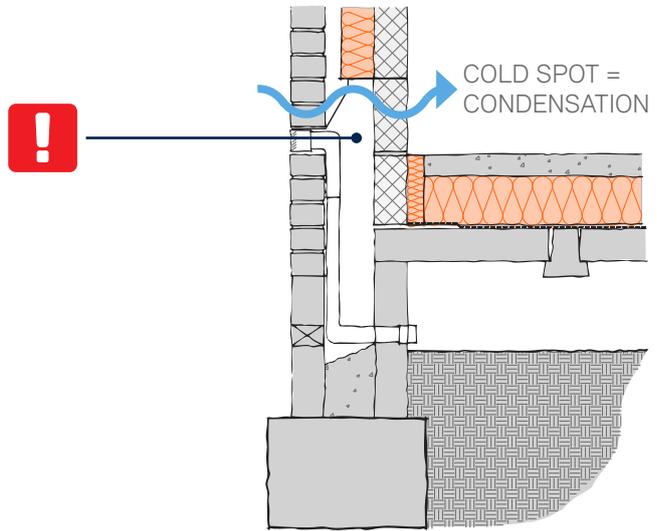
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✗ PROBLEM TO AVOID

INSULATION MISSING BELOW DPC



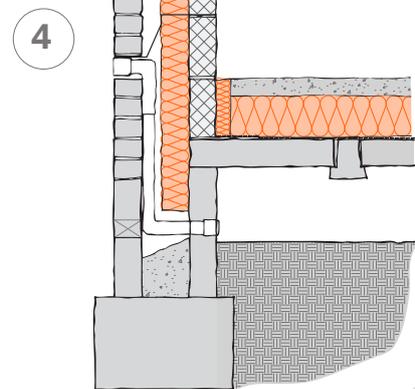
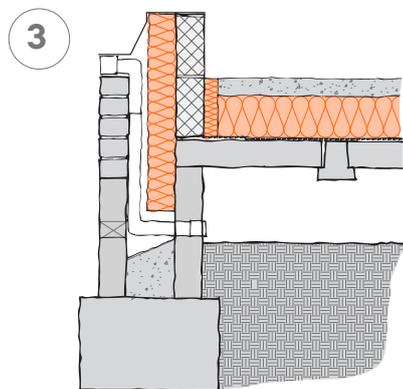
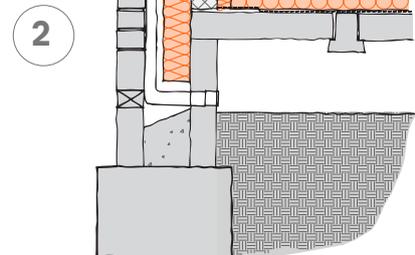
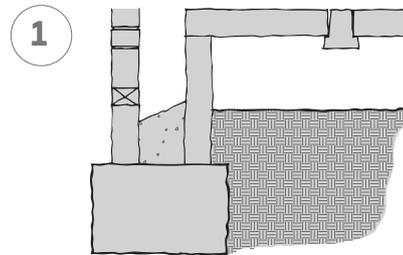
PLAN OF SUB FLOOR VENT BLOCKING INSULATION



PERISCOPE VENT SECTION

✓ 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



GOOD PRACTICE

Continuous insulation below floor level



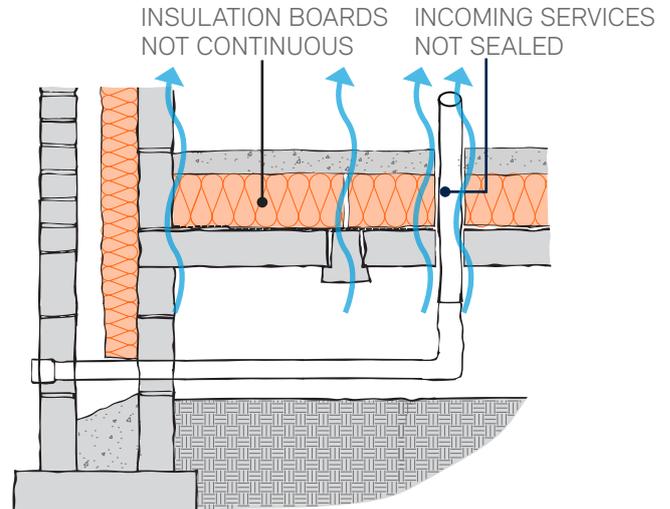
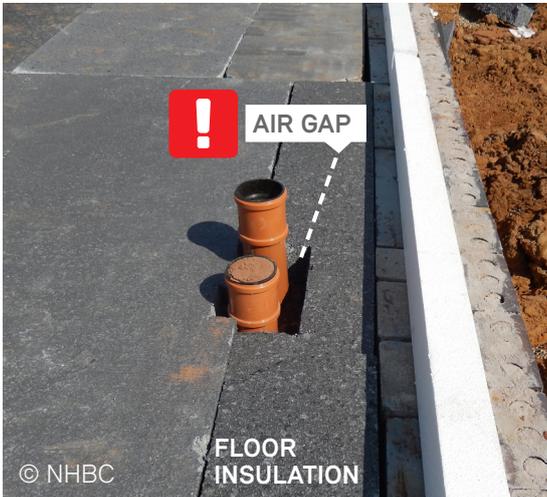
BEAM AND BLOCK FLOOR



2.0

PROBLEM TO AVOID

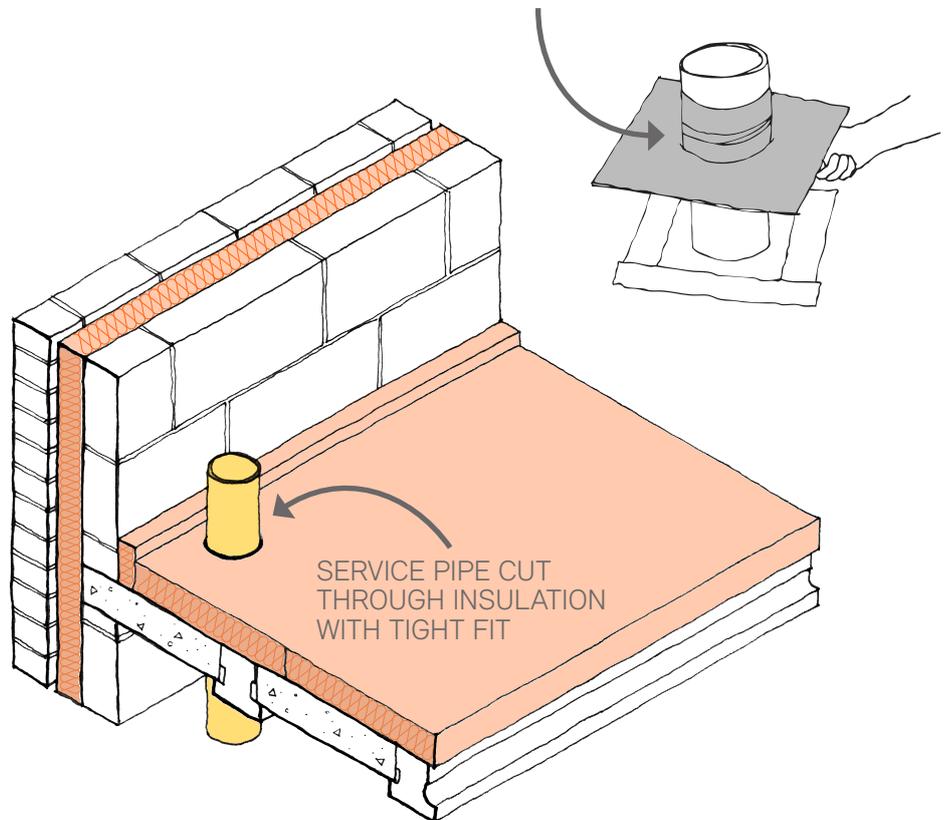
GAPS IN FLOOR INSULATION



WHAT TO DO?

- Overlay floor insulation with a separating layer (DPM) 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. If possible, 'core drill' hole to tight fit
- Restrain perimeter floor insulation to prevent 'floating' during screed pour
- Prevent screed bridging the perimeter insulation

WITH GAS MEMBRANES, USE PROPRIETARY TOP HAT UNIT AND TAPE TO SEAL PIPES AND MEMBRANE



GOOD PRACTICE

Fit insulation boards tightly and seal all penetrations

DOOR THRESHOLD

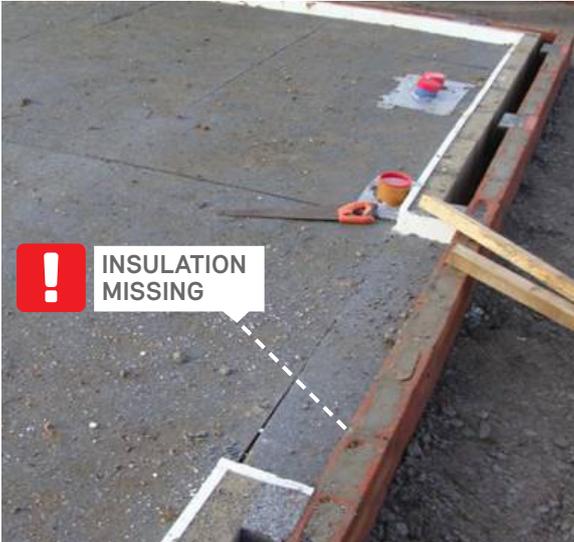


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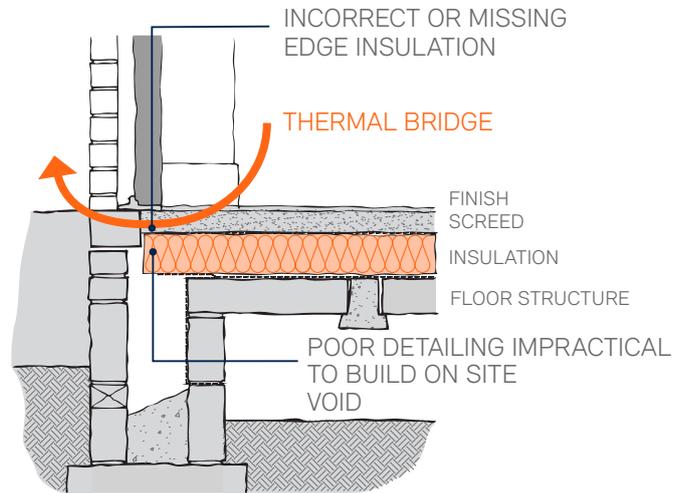


PROBLEM TO AVOID

MISSING EDGE INSULATION



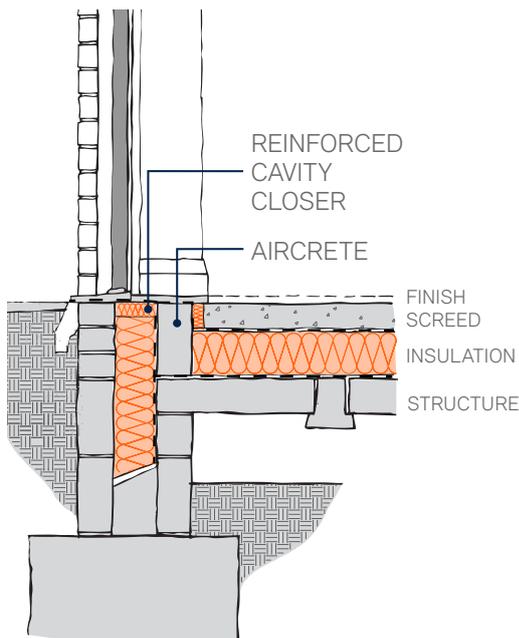
SCREED BRIDGING THRESHOLD



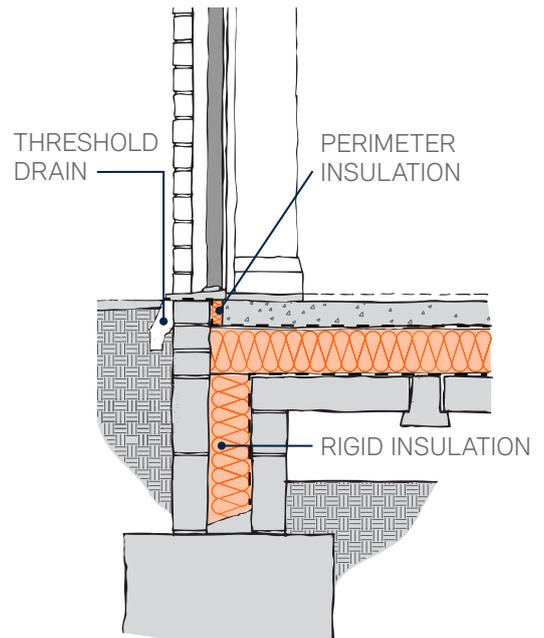
WHAT TO DO?

- 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
- Ensure airtight seal under door

OPTION 1 REINFORCED CAVITY CLOSER



OPTION 2 INSULATION AT DOOR THRESHOLD



GOOD PRACTICE

50mm thick insulation at door threshold or reinforced cavity closer

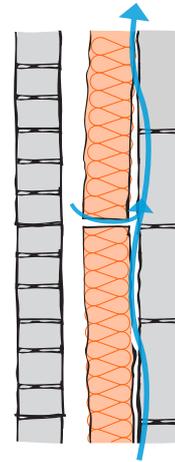
CAVITY WALL



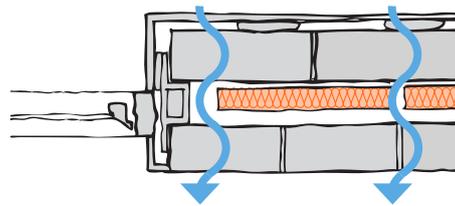
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PROBLEM TO AVOID

GAPS IN INSULATION

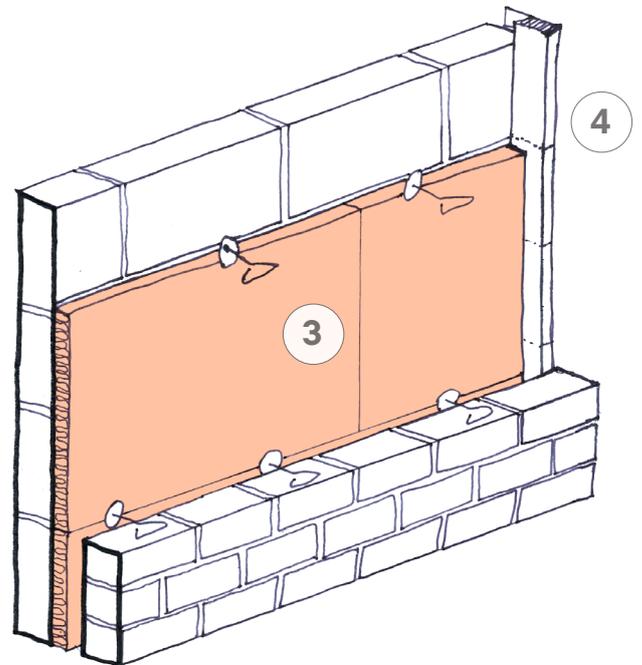
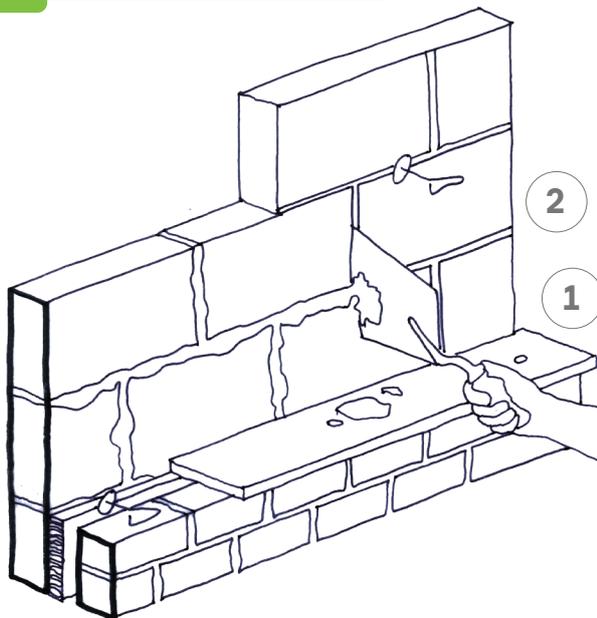


INSULATION NOT TIGHT TO WALL FACE DUE TO ROUGH SURFACE CREATED BY EXCESS MORTAR



GAPS BETWEEN ADJACENT BOARDS = HEAT LOSS

WHAT TO DO?



GOOD PRACTICE

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

CAVITY WALL

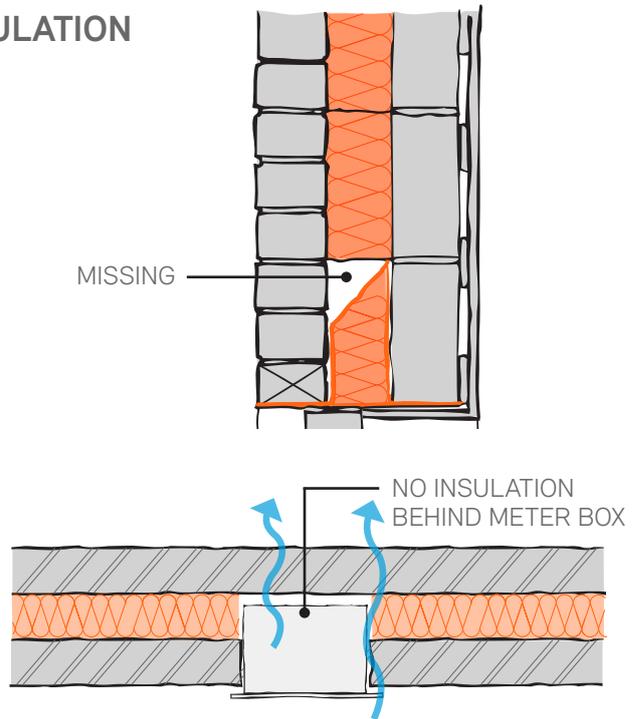


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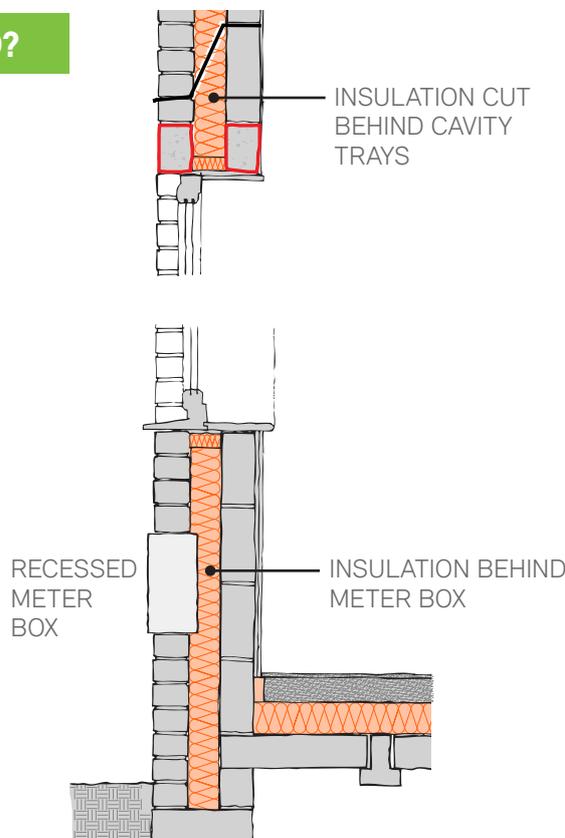
PROBLEM TO AVOID

MISSING INSULATION



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
- Install cavity trays where needed



CUT INSULATION AROUND CAVITY TRAY

GOOD PRACTICE

Use preformed tray around complex junctions



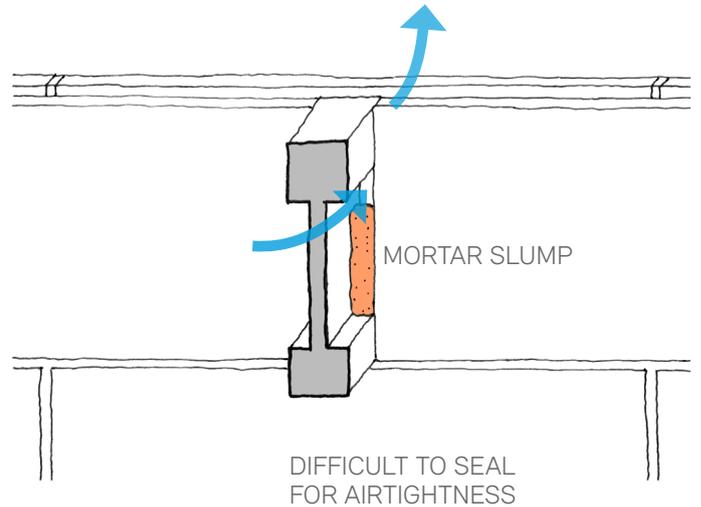
FLOOR JOISTS



6.0

PROBLEM TO AVOID

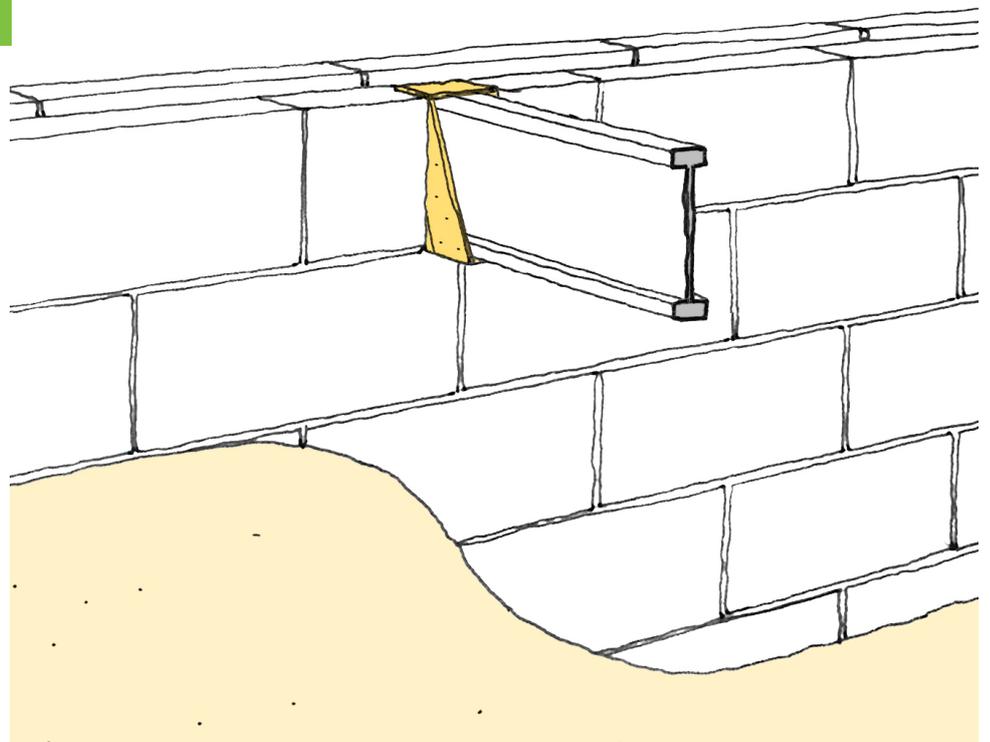
AIR-LEAKAGE AROUND JOISTS



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, joints fully mortared and then sealed using proprietary sealant



GOOD PRACTICE

Apply parge coat to party wall to ensure continuous airtightness line

SEPARATING WALL

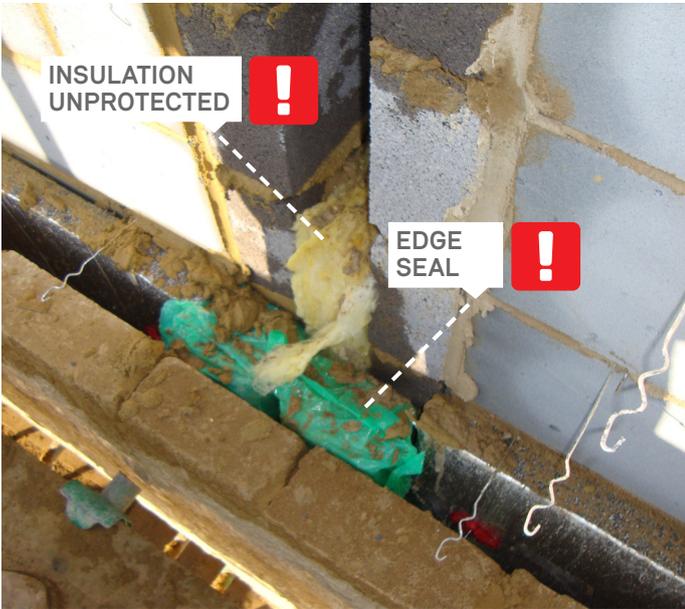


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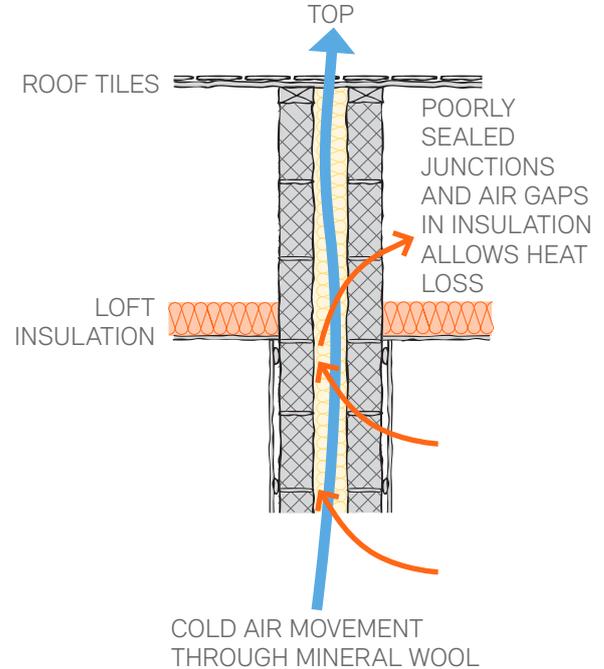


PROBLEM TO AVOID

INCORRECTLY SEALED PARTY WALL

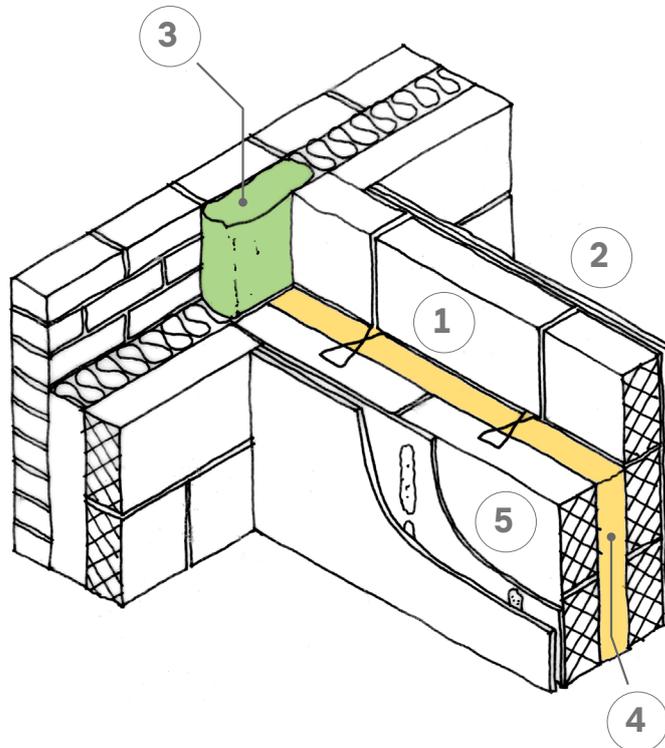


EDGE SEAL NOT UNDER COMPRESSION



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



GOOD PRACTICE

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



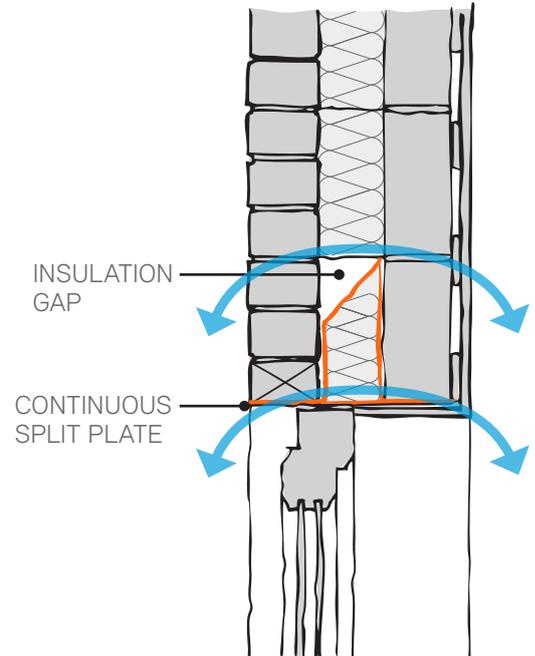
LINTELS



8.0

PROBLEM TO AVOID

COLD BRIDGING & MISSING INSULATION

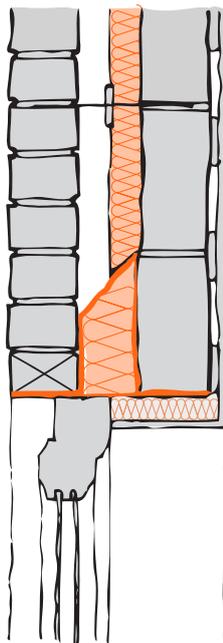


CONTINUOUS SPLIT PLATE CREATES COLD SPOT

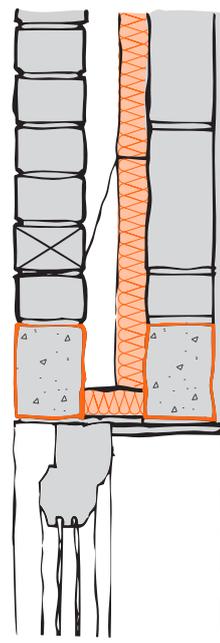
WHAT TO DO?

- 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
- Cavity trays to be installed as needed
- Check correct lintel is installed and value

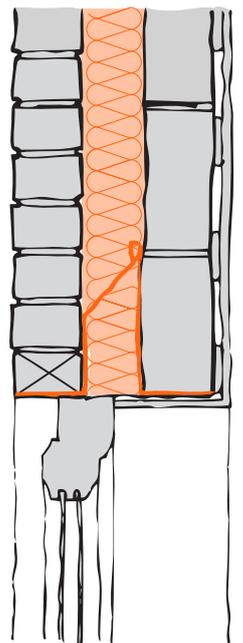
OPTION 1 CONTINUOUS LINTEL & INSULATED PLASTERBOARD



OPTION 2 SEPARATE LINTELS



OPTION 3 THERMALLY BROKEN LINTEL



GOOD PRACTICE

Fully insulated cavity closers to be used

WINDOW INSTALLATION

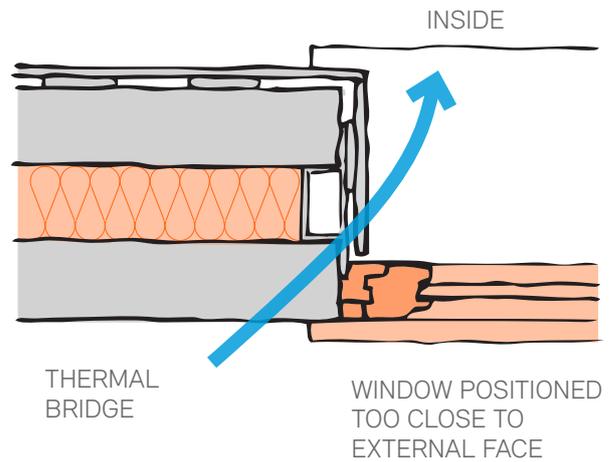
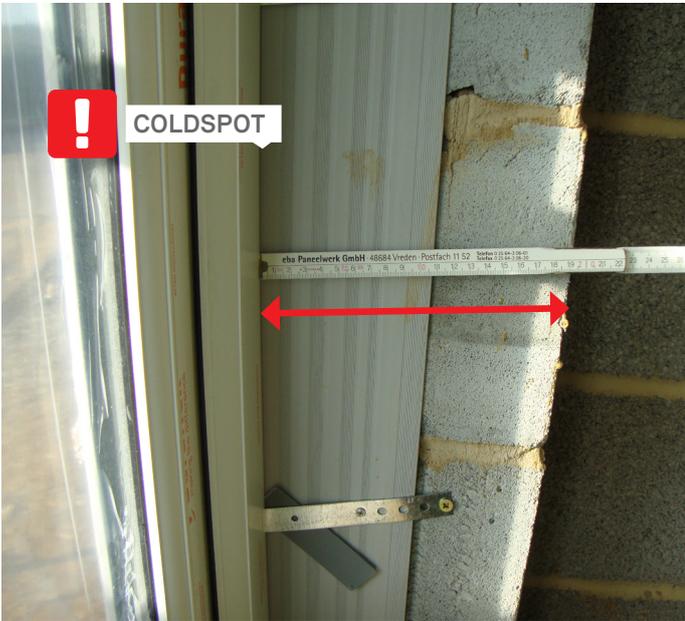


9.0



PROBLEM TO AVOID

WINDOWS INSTALLED FORWARD OF DESIGN POSITION

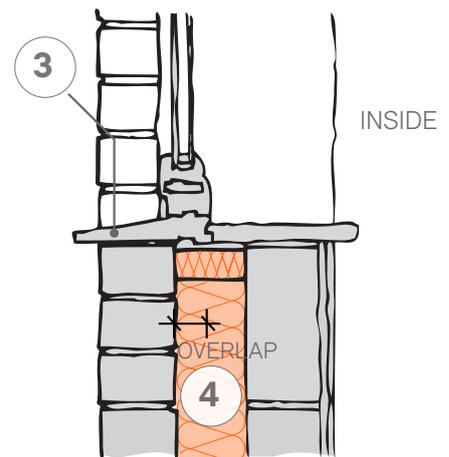
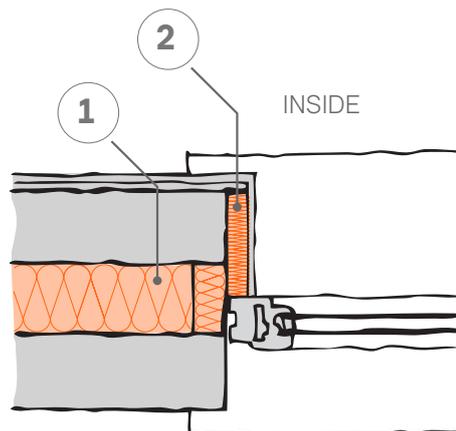


NO OVERLAP OF WINDOW AND CAVITY



WHAT TO DO?

- Close the cavity with tightly packed insulation (1)
- Insulation to window reveal (2)
- Window fitter to provide cill to suit set back of frame (3)
- Less than 10mm tolerance between window frame and structural opening
- Overlap frame with cavity as much as possible - minimum 30mm (4)
- Check trickle vent sizes as design
- Use continuous cavity closer



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



10.0

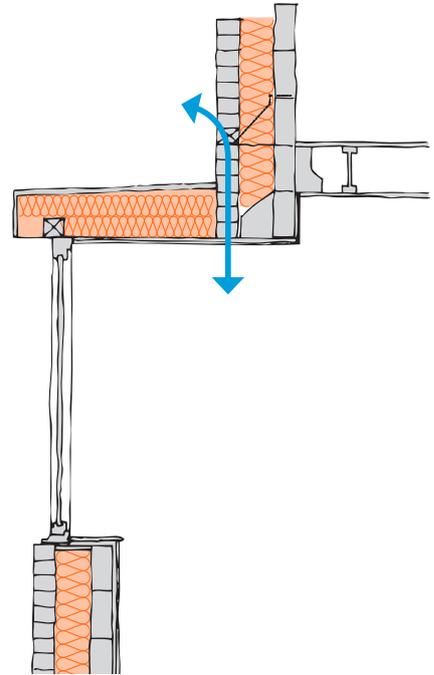


PROBLEM TO AVOID

COLD BRIDGING



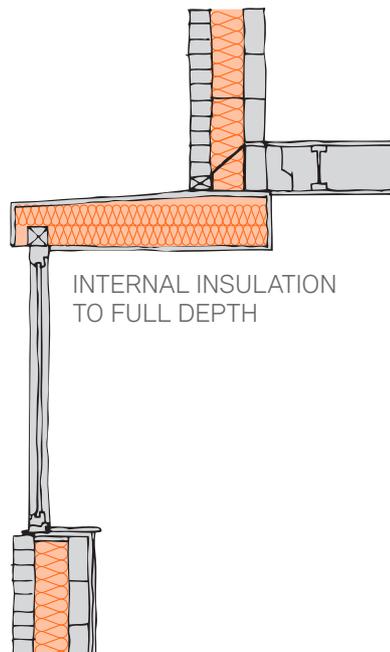
THICK FRAME AND POSTS INCREASES HEAT LOSS



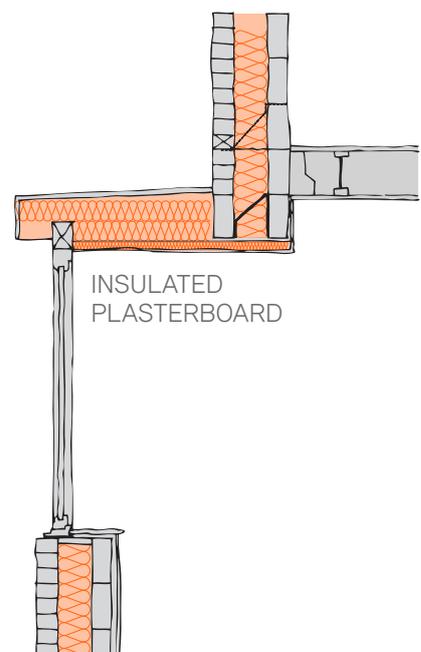
WHAT TO DO?

- Reduce cold bridges of steel or concrete or timber through insulation layer
- Continuous insulation inside
- Less than 10mm tolerance between window frame and opening

OPTION 1



OPTION 2



GOOD PRACTICE

Continuous insulation throughout bay window



PROJECTING WINDOWS



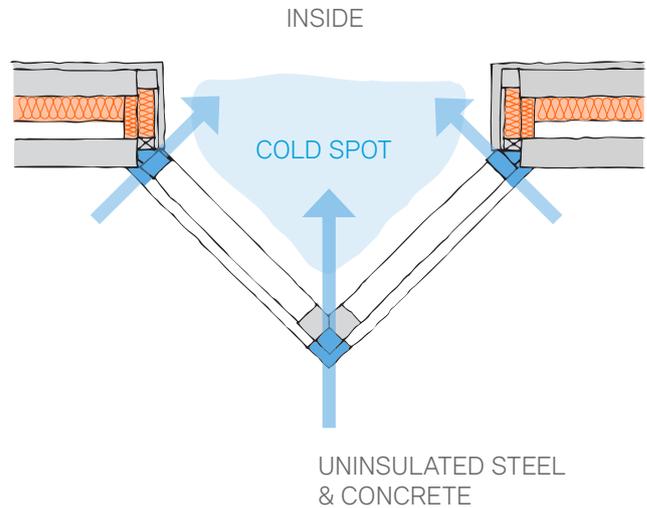
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PROBLEM TO AVOID

COLD BRIDGING



CONTINUOUS STEEL CREATES COLD BRIDGE

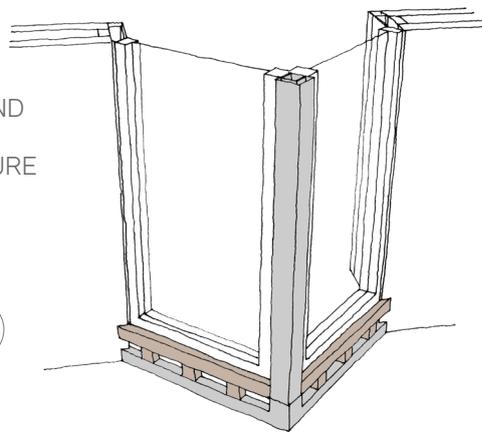


WHAT TO DO?

- Reduce thermal bridges of steel, concrete or timber through insulation layer
- Install continuous insulation outside structure
- If GRP structure, ensure sufficient thickness of continuous insulation as design
- Wrap insulation around steelwork
- Install thermal laminate plasterboard to inside face

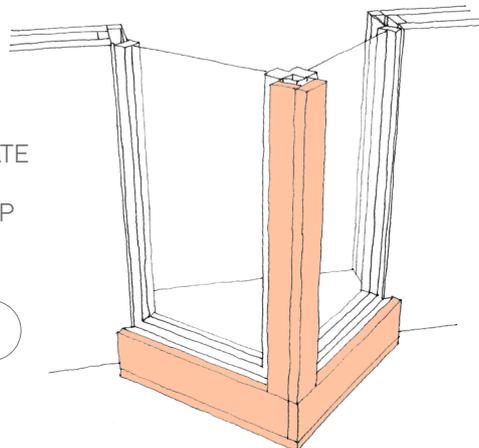
STEEL AND TIMBER STRUCTURE

1



FULLY INSULATE STEEL TO KEEP 'WARM'

2



GOOD PRACTICE

Design to wrap structure with insulation



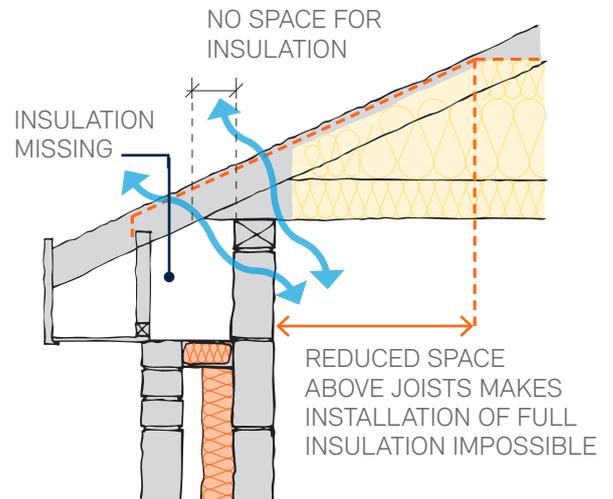
EAVES



12.0

PROBLEM TO AVOID

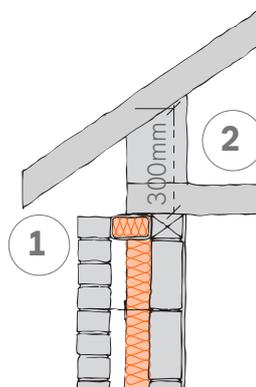
NO INSULATION AT EAVES



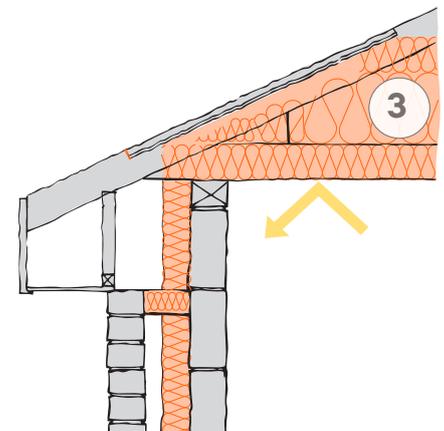
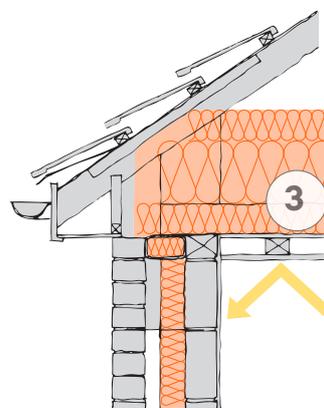
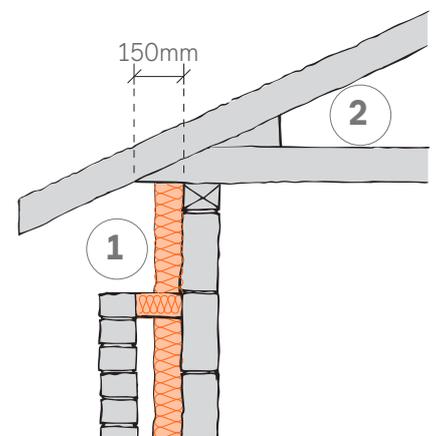
WHAT TO DO?

- Install rigid insulation to top of the wall plate (1)
- Truss design to accommodate space for insulation at eaves - 300mm is best practice (2)
- Lay mineral wool insulation into eaves (3)
- Cut insulation around eaves lintels (4)

OPTION 1



OPTION 2



GOOD PRACTICE

Install insulation before eaves are inaccessible

ROOF

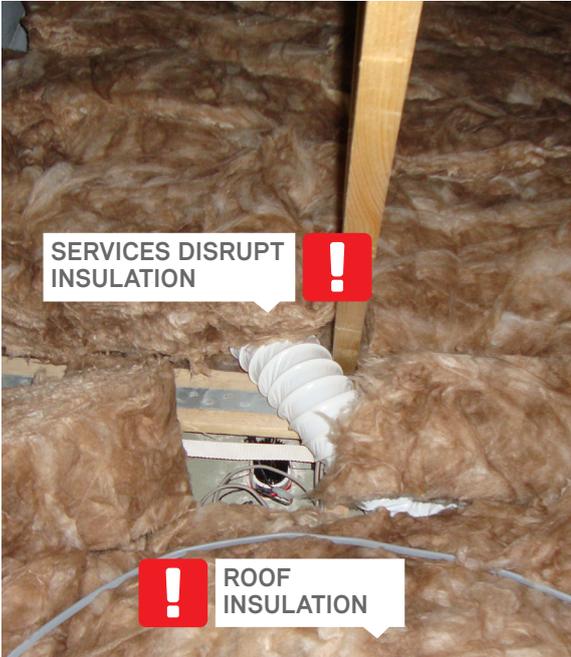


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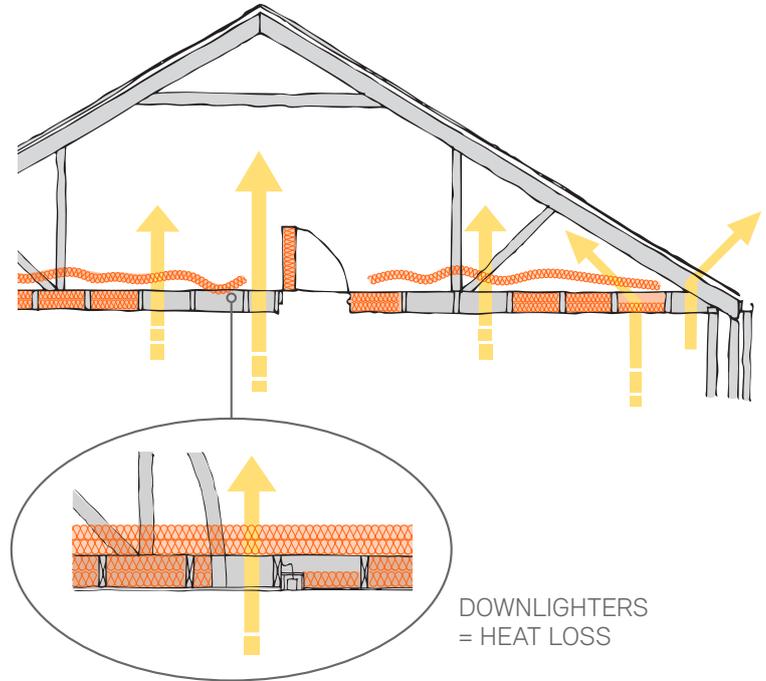


PROBLEM TO AVOID

MISSING ROOF INSULATION



INSULATION DISTURBED BY SERVICES

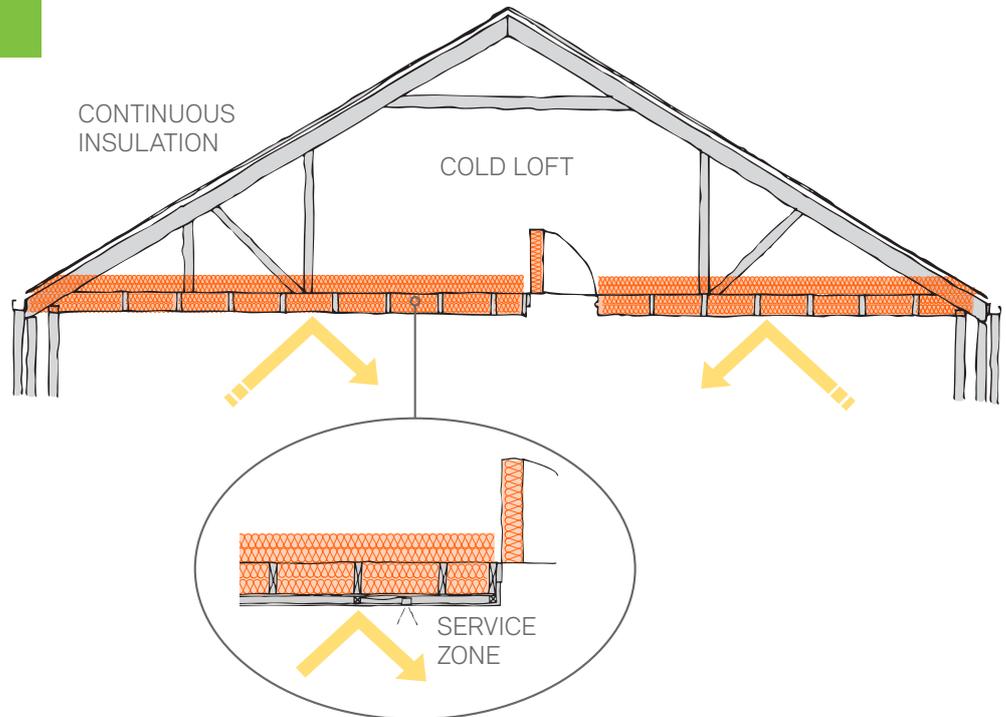


DOWNLIGHTERS = HEAT LOSS



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



CONTINUOUS INSULATION

COLD LOFT

SERVICE ZONE

GOOD PRACTICE

Cross lapped insulation checked at final inspection before handover



DRYLINE/ PLASTER



14.0



PROBLEM TO AVOID

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

VENTILATION



15.0



PROBLEM TO AVOID

POORLY SPECIFIED AND INSTALLED DUCTWORK



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



WHAT TO DO?

- Install rigid ductwork for extract fans, and minimise use of flexi ductwork at final connection to 0.5m max
- 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



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MEASURE AIRFLOW WITH APPROPRIATE DEVICE

GOOD PRACTICE

Specialist or manufacturer to commission fans

Please print and use in your site office,
for further information www.zerocarbonhub.org



HEATING / HOT WATER



16.0



PROBLEM TO AVOID

HEAT LOSS THROUGH UNINSULATED PIPES



PRIMARY PIPEWORK NOT INSULATED



BOILER FLUE NOT SEALED



WHAT TO DO?

- Insulate all pipework to site specification and DHCG - minimum 25mm insulation to all primary pipework including valves and junctions
- 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

FINALS



17.0



PROBLEM TO AVOID

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 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.

Published June 2015

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