



Bulk thermal insulation—Installation



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The following are represented on Committee BD-058:

- Aluminium Foil Insulation Association
 - Australasian Fire and Emergency Service Authorities Council
 - Australian Building Codes Board
 - Australian Cellulose Insulation Manufacturers Association
 - Australian Professional Thermography Association
 - Community Energy Network
 - Consumers Federation of Australia
 - Council of Textile and Fashion Industries of Australia
 - CSIRO Material Science and Engineering
 - Curtin University of Technology
 - Electrical Regulatory Authorities Council
 - Housing Industry Association
 - Insulation Australasia
 - Insulation Council of Australia and New Zealand
 - Master Builders Australia
 - Plastics and Chemicals Industries Association
 - Pliable Membranes Association of Australia
 - Recessed Luminaire Enclosure Association of Australia
 - The Insulation Contractors Association of Australia, NSW
 - Thermal Insulation Contractors Association of Australia
-

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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

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Australian Standard®

Bulk thermal insulation—Installation

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PREFACE

This Standard was prepared by the Standards Australia Committee BD-058, Thermal Insulation, to supersede AS 3999—1992, *Thermal insulation of dwellings—Bulk insulation—Installation requirements*.

This Standard incorporates Amendment No. 1 (June 2020). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

This Standard is an informative secondary reference in the Building Code of Australia by means of a guidance reference within AS/NZS 4859.1:2002, *Materials for the insulation of buildings*, Part 1: *General criteria and technical provisions*.

This Standard is primarily for domestic dwellings but many of the installation methods detailed could be applicable to other forms of construction. This Standard is intended to be used by the installers of bulk thermal insulation. In this edition, a new normative requirement has been introduced for the provision of an installer's statement that details the insulation type and materials used in the completed installation.

The terms 'normative' and 'informative' have been used in this standard to define application of the Appendix to which they apply. A 'normative Appendix is an integral part of a standard, whereas an 'informative' Appendix is only for information and guidance.

This Standard incorporates a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by 'C' preceding the clause number and is printed in italics in a box. The commentary is for information and guidance.

CONTENTS

	<i>Page</i>
FOREWORD.....	5
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE.....	6
1.2 APPLICATION	6
1.3 NORMATIVE REFERENCES	7
1.4 DEFINITIONS.....	8
1.5 ANCILLARY MATERIALS	11
SECTION 2 PRE-INSTALLATION INSPECTION AND PROCEDURES	
2.1 SCOPE OF SECTION	12
2.2 GENERAL.....	12
2.3 SPECIAL FEATURES	12
2.4 TREATMENT REQUIRED FOR SPECIAL FEATURES.....	12
2.5 CONDENSATION ASSESSMENT.....	13
2.6 ELECTRICAL CABLES AND ELECTRICAL EQUIPMENT.....	13
2.7 BUILT-IN APPLIANCES	17
2.8 CONTROL MEMBRANES.....	17
SECTION 3 GENERAL REQUIREMENTS FOR INSULATION INSTALLATION	
3.1 SCOPE OF SECTION	18
3.2 ENERGY EFFICIENCY.....	18
3.3 INSULATION INSTALLATION GUIDANCE AND RULES	21
3.4 GENERAL INSULATION METHOD.....	22
SECTION 4 SAFETY REQUIREMENTS FOR INSULATION INSTALLATION	
4.1 SCOPE OF SECTION	26
4.2 GENERAL SAFETY REQUIREMENTS	26
4.3 ELECTRICAL SAFETY	26
4.4 SAFETY REQUIREMENTS WHEN WORKING WITH INSULATION PRODUCTS	28
4.5 SAFETY REQUIREMENTS FOR CONCEALED STRUCTURAL MEMBERS (CEILINGS)	28
4.6 POLYSTYRENE CONTACT WITH ELECTRICAL CABLES	28
SECTION 5 THERMAL ENVELOPE DETAILED INSTALLATION METHODS	
5.1 SCOPE OF SECTION	29
5.2 INSTALLATION OF ROOF INSULATION.....	29
5.3 INSTALLATION OF CEILING INSULATION.....	39
5.4 INSTALLATION OF WALL INSULATION.....	53
5.5 INSTALLATION OF FLOOR INSULATION	65
SECTION 6 INSTALLATION STATEMENT.....	80

APPENDICES

A	RECESSED LUMINAIRES	81
B	'Text deleted'	88
C	MECHANICAL STRENGTH TEST FOR 'FIXED IN POSITION'	89
D	INSTALLER'S STATEMENT	94
E	CEILING PERIMETER INSULATION	95
F	EDGE INSULATION SOLUTIONS	96
G	CONDENSATION	98
H	INSULATING TRUSSED CEILINGS	101
I	INSULATING UNDER CONCRETE SLAB ROOFS AND FLOORS	105
J	INSULATION RETRO-FIT AND REMEDIATION	107
K	ELECTRICALLY CONDUCTIVE BULK INSULATION.....	112
BIBLIOGRAPHY.....		113

FOREWORD

This Standard specifies the procedures for installing bulk thermal insulation in dwellings. The requirements were compiled from a wide range of procedures used in Australia and considered as consistent with good building practice in the installation of bulk thermal insulation.

The Committee has recognized the risk of certain electrical cables and equipment overheating when operating for extended periods when partially or completely surrounded by thermal insulation. To minimize this possibility a pre-installation inspection has been called for in order to identify whether this potential problem may occur where the thermal insulation is to be placed. The procedure to be adopted as a result of the inspection is set out in this Standard.

The Standard does not attempt to specify requirements for every method of installation of insulation. Rather, it provides general requirements, together with a number of common methods.

The various sub-structures that may be insulated with bulk insulation are dealt with in Section 5 with cross-references where necessary.

It is recommended that users of this Standard read the document as a whole rather than only referring to information on the specific building sub-structure to be insulated.

Installation of bulk thermal insulation, using the requirements and methods given in this Standard, will lead to reduction of heat gain in summer and of heat loss in winter. Bulk insulation and membranes work together to control heat, air and moisture, therefore the properties of membranes should always be considered. This Standard may also be read in conjunction with AS/NZS 4200.2, *Pliable building membranes and underlays*, Part 2: *Installation requirements*.

STANDARDS AUSTRALIA

Australian Standard

Bulk thermal insulation—Installation

S E C T I O N 1 S C O P E A N D G E N E R A L

1.1 SCOPE

The Standard sets out requirements on installing insulation in both new dwellings during construction and the retrofitting of insulation in existing buildings.

This Standard is intended for residential-type construction; however, the methods may be appropriate to other forms of construction.

This Standard includes requirements for electrical safety and guidance on Work Health and Safety.

This Standard is not intended to apply to the insulation of building services and equipment or materials with structural and/or external cladding or internal lining purposes.

This Standard does not deal with insulation that is foamed *in situ* nor the installation of pliable building membranes except when forming part of a bulk insulation product.

Insulation installed for the sole purpose of reverberation control is excluded from this Standard.

For the purposes of this Standard, bulk insulation also includes products which create multiple airspaces with a total installed product thickness greater than 20 mm.

1.2 APPLICATION

1.2.1 General

Bulk thermal insulation installation shall comply with Sections 2, 3 and 4, and the following, as applicable:

- (a) Roofs—Clause 5.2.
- (b) Ceilings—Clause 5.3.
- (c) Walls—Clause 5.4.
- (d) Floors—Clause 5.5.

Additional requirements for electrically conductive bulk insulation are provided in Appendix K.

1.2.2 Relationship with regulations

This Standard is intended to provide technical requirements for implementation by reference in statutory (building) regulations.

This Standard may be read in conjunction with, but does not take precedence over, any statutory regulations that may apply in any area.

NOTE: An installation may come under the jurisdiction of several authorities with differing areas of responsibility, and an approval from one does not necessarily constitute an approval from others.

1.3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard.

NOTE: Documents referenced for information purpose are listed in the bibliography.

The following documents are referred to in this Standard:

AS

A1 | **'Text deleted'**

1530 Methods for fire tests on building materials, components and structures

1530.1 Part 1: Combustibility test for materials

1684 Residential timber-framed construction

1684.1 Part 1: Design criteria

1684.2 Part 2: Non-cyclonic areas

1684.3 Part 3: Cyclonic areas

1684.4 Part 4: Simplified—Non-cyclonic areas

2870 Residential slabs and footings

3660 Termite management

3660.1 Part 1: New building work

3700 Masonry structures

3959 Construction of buildings in bushfire-prone areas

4440 Installation of nailplated timber roof trusses

4654 Waterproofing membranes for external above-ground use

4654.2 Part 2: Design and construction

4773 Masonry in small buildings

4773.1 Part 1: Design

4773.2 Part 2: Construction

AS/NZS

1530 Methods for fire tests on building materials, components and structures

1530.3 Part 3: Simultaneous determination of ignitability, flame propagation, heat release and smoke release

2589 Gypsum linings—Application and finishing

3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)

4200 Pliable building membranes and underlays

4200.1 Part 1: Materials

4200.2 Part 2: Installation requirements

4859 Materials for the thermal insulation of buildings

4859.1 Part 1: General criteria and technical provisions

5110 Recessed luminaire barriers

A1 | 6059 Luminaires

60598.1 Part 1: General requirements and test

60598.2.2 Part 2.2: Particular requirements – Recessed luminaires

ASTM

C411 Standard test method for hot-surface performance of high-temperature thermal insulation

C447 Standard practice for estimating the maximum use temperature of thermal insulations

Australian Building Code Board (ABCB)
National Construction Code (NCC)

NASH Standard

Residential and Low-rise Steel Framing, Part 1: Design Criteria (NASH Standard Part 1)

1.4 DEFINITIONS

For the purpose of this Standard, the definitions given below apply.

1.4.1 Air barrier

A layer that prevents the movement of air under the normal pressure differences found across building elements.

1.4.2 Building membrane, pliable

A material that can be formed into a roll without breaking or cracking, enabling a continuous sheet of underlay material to be applied to act as a sarking, thermal insulation, vapour control membrane, air barrier, ember barrier or any combination of these.

1.4.3 Bulk insulation

Thermal insulation materials in the form of batts, blankets, rigid boards or loose fill and classified in accordance with AS/NZS 4859.1. For the purposes of this Standard, segmented foil products are also considered bulk insulation. Where the term 'insulation' is stated in this Standard, it is referring to bulk insulation only.

1.4.4 Ceiling, flat

Horizontal ceiling.

1.4.5 Ceiling, raked

Sloped ceiling.

1.4.6 Competent person

A person, who has acquired, through training, qualification or experience or a combination of these, the knowledge and skill enabling that person to perform the required task correctly.

1.4.7 Completely surrounded electrical cables

Cables surrounded by, and in contact with, bulk thermal insulation on all sides.

1.4.8 Design specification

A specification in one or more of the following forms:

- (a) Architectural drawings and specifications.
- (b) Contract specifications.
- (c) Manufacturers' specifications.
- (d) Engineers' specifications.

1.4.9 Electrically conductive

A material with capacity to carry electrical current.

1.4.10 Electrically conductive ceiling insulation

A product used, or to be used, as ceiling insulation that is readily able to conduct electricity.

Does not include metal foil batts that are separate, and do not form a continuous membrane.

1.4.11 Guard

A fire retarding component, having a spread of flame index of 0, in accordance with AS/NZS 1530.3 used to provide adequate separation from combustible building elements, insulation, and/or debris to reduce the fire risk caused by recessed luminaires, chimneys and other heat generating equipment. A guard has a minimum long term surface operating temperature of 90°C.

1.4.12 Luminaire barrier

A product complying with AS/NZS 5110.

1.4.13 Partially surrounded electrical cables

Partially surrounded electrical cable is electrical cable that has at least one side not covered with thermal insulation.

1.4.14 Permeability, δ_p

The time rate of water vapour transmission through unit area of a flat material of unit thickness induced by unit vapour pressure difference between two specific surfaces, under specified temperature and humidity conditions. Permeability is a property of a material, but the permeability of a body that performs like a material may be used. Permeability is the arithmetic product of permeance and thickness.

Unit: Microgram per metre second pascal ($\mu\text{g}/\text{m}\cdot\text{s}\cdot\text{Pa}$)

Kilogram per metre second pascal ($\text{kg}/\text{m}\cdot\text{s}\cdot\text{Pa}$)

1.4.15 Protected circuit

A1 | An electrical circuit protected by an approved safety switch (RCD).

1.4.16 Roofs, flat

Roofs having gradients less than 1:5.7 (less than approximately 10°).

1.4.17 Roofs, pitched

Roofs having gradients equal to or greater than 1:5.7 (slope approximately 10° or greater).

1.4.18 Thermal conductance, U

The quotient of the conductivity of a material and its thickness.

Reciprocal of thermal resistance ($1/R$).

Unit: Watts per square metre kelvin ($\text{W}/\text{m}^2\cdot\text{K}$), also called U-value.

1.4.19 Thermal conductivity, k

A measure of the quantity of heat flow under steady state conditions, which passes through a unit area of a homogeneous material with flat and parallel faces and unit thickness (in metres), when a unit temperature difference (in kelvin or degrees Celsius) is maintained between these faces in unit time (J/s or W).

Unit: Watt per metre kelvin ($\text{W}/\text{m}\cdot\text{K}$)

1.4.20 Thermal resistance, R

The quotient of the thickness of the material and its conductivity.

Unit: Square metre kelvin per watt ($\text{m}^2\cdot\text{K}/\text{W}$)

The reciprocal of thermal conductance, also called R-value.

1.4.21 Thermal resistivity

Reciprocal of thermal conductivity ($1/k$).

Unit: Metre kelvin per watt ($\text{m}\cdot\text{K}/\text{W}$)

1.4.22 Unprotected circuit

An electrical circuit that has not been fitted with an approved safety switch.

A1 | 'Text deleted'

1.4.23 Vapour barrier

Layer of material or component intended to almost completely restrict the transmission of water vapour.

1.4.24 Vapour control membrane

A layer of material or component intended to regulate water vapour transfer between each side of the layer.

1.4.25 Vapour permeance, β_p

A measure of the rate of transfer of water vapour through a product of uniform thickness, normal to specified parallel surfaces under unit vapour pressure difference.

Unit: Kilogram per square metre second pascal, $\text{kg/m}^2\cdot\text{s}\cdot\text{Pa}$

Microgram per square metre second pascal, $\mu\text{g/m}^2\cdot\text{s}\cdot\text{Pa}$

Gram per mega-newton second, $\text{g/MN}\cdot\text{s}$

Microgram per newton second, $\mu\text{g/N}\cdot\text{s}$

1.4.26 Vapour resistance

The ability of a material to resist the passage of water vapour. Reciprocal of vapour permeance.

Unit: Square metre second pascal per kilogram, $\text{m}^2\cdot\text{s}\cdot\text{Pa}/\text{kg}$

Square metre second pascal per microgram, $\text{m}^2\cdot\text{s}\cdot\text{Pa}/\mu\text{g}$

Mega-newton second per gram, $\text{MN}\cdot\text{s}/\text{g}$

Newton second per microgram, $\text{N}\cdot\text{s}/\mu\text{g}$

1.4.27 Vapour resistivity

Reciprocal of vapour permeability.

Unit: Metre second pascal per kilogram, $\text{m}\cdot\text{s}\cdot\text{Pa}/\text{kg}$

Metre second pascal per microgram, $\text{m}\cdot\text{s}\cdot\text{Pa}/\mu\text{g}$

A1 | **1.4.28 Residual current device (RCD)**

A device intended to isolate supply to protected circuits, socket-outlets or electrical equipment in the event of a current flow to earth that exceeds a predetermined value.

[SOURCE: AS/NZS 3000]

1.4.29 Non-IC luminaire

A recessed luminaire that cannot be abutted against or covered by normally flammable materials or used in installations where building insulation or debris is, or may be, present in normal use.

NOTE: This classification is not suitable for residential installations.

[SOURCE: AS/NZS 60598.2.2:2016]

A1

1.4.30 CA90 luminaire

A recessed luminaire that can be abutted against normally flammable materials, including building insulation, but cannot be covered in normal use. Building elements, building insulation or debris have limited access to the heated parts of the luminaire.

[SOURCE: AS/NZS 60598.2.2:2016]

1.4.31 IC luminaire

A recessed luminaire that can be abutted against normally flammable materials, including building insulation, and can be covered in normal use. Building elements, building insulation or debris have limited access to the heated parts of the luminaire.

[SOURCE: AS/NZS 60598.2.2:2016]

1.4.32 IC-4 luminaire

A recessed luminaire that can be abutted against normally flammable materials, including building insulation, and can be covered in normal use. Building elements, building insulation or debris have restricted access to the heated parts of the luminaire. This classification of recessed luminaire is effectively a sealed unit that has a restricted flow of air between the habitable room the luminaire emits light into and the void/space where the main body of the luminaire is located.

[SOURCE: AS/NZS 60598.2.2:2016]

1.5 ANCILLARY MATERIALS**1.5.1 General**

All materials referred to in this Clause shall comply with any relevant building regulations.

1.5.2 Support materials

Support materials used to retain in position a pliable building membrane or bulk insulation shall comply with the following (as appropriate):

- (a) *Steel wire or mesh*—shall be rust inhibited by a protective coating such as zinc, plastic material or paint.
- (b) *Cord or non-metallic mesh*—shall be durable and retain its position without sag.
- (c) *Pliable building membrane*—shall comply with AS/NZS 4200.1.
- (d) *Edge-restraint materials*—used to prevent bulk insulation sliding or falling out of place. They may include pliable building membrane or other durable material.
- (e) *Other support materials*—where used, they shall provide support no less effective than that afforded by the materials specified in Items (a), (b), (c) and (d).

SECTION 2 PRE - INSTALLATION INSPECTION AND PROCEDURES

2.1 SCOPE OF SECTION

This Section prescribes requirements for an inspection and procedures to be carried out prior to the installation of bulk insulation. The procedures take account of a number of features and equipment found in dwellings, including electrical cables.

2.2 GENERAL

Prior to installing bulk thermal insulation in a dwelling, there shall be a pre-installation assessment to determine the following:

- (a) Electrical safety requirements, as listed in Section 4.
- (b) Sufficient space shall be available for the insulation to achieve its designed thermal performance.
- (c) The design specification shall clearly state the insulation type and properties that are required in the construction system to enable the system to appropriately control heat and moisture.
- (d) The location of the bulk insulation shall be clearly specified in relation to any sarking or pliable building membranes.

2.3 SPECIAL FEATURES

Treatments (as set out in Clause 2.4) shall be carried out on the following special features:

- (a) Electrical cables that will be completely or partially surrounded by thermal insulation for lengths of cable greater than 400 mm.
- (b) Electrical equipment that will be enclosed by thermal insulation.
- (c) Built-in appliances.
- (d) Hot-gas flues.
- (e) Drop-ceilings.
- (f) Control membranes.
- (g) Recessed luminaires.

2.4 TREATMENT REQUIRED FOR SPECIAL FEATURES

Where the special features described in Clause 2.3, Items (a), (b), (c) and (g) are present, the installation shall comply with Clause 2.6 or Clause 2.7, as appropriate, before installation.

Where the special features described in Clause 2.3, Items (d) and (e) are present, the installation shall comply with Clause 3.4, Items (f) and (g), and Clause 5.3.4.1(d), as appropriate, before installation.

Where the special features described in Clause 2.3, Item (f) are present, the installation shall comply with Clause 2.8, before installation.

Bulk insulation suitable for surrounding an object that produces heat, e.g. recessed luminaires, chimneys and other heat generating equipment, shall have a minimum long term surface operating temperature of 90°C. Where the manufacturer of the heat generating equipment requires insulation to operate at a temperature higher than 90°C, the insulation shall be non-combustible to AS 1530.1 and tested to the required higher surface temperature as per ASTM C411 and ASTM C447 to determine its suitability.

A1

2.5 CONDENSATION ASSESSMENT

The insulation shall be selected and installed in accordance with the design specification, which may include vapour control membranes, air barriers or additional ventilation to reduce the potential for condensation [see Clause 3.4(i) and Note 3 to Clause 5.2.3.2(c)].

Where vapour barriers, vapour permeable membranes or air barrier membranes are already installed or are intended to be installed, the following factors shall be assessed:

- The design specification shall clearly state where the bulk insulation is to be installed in relation to any vapour barriers located within the construction system.
- The type of bulk insulation shall be clearly stated in the design specification with adequate information to enable the installer to select the insulation in accordance with Clause 3.2.3.
- Whether the building designer has considered condensation risk.

NOTES:

- Guidance on condensation is given in Appendix G.
- Types of insulation refers to fibrous batts, extruded polystyrene (XPS), expanded polystyrene (EPS), polyisocyanurate (PIR), loose fill, etc.

2.6 ELECTRICAL CABLES AND ELECTRICAL EQUIPMENT

2.6.1 Electrical cables

2.6.1.1 General

The flow of electric current in cables generates heat that is dissipated to the surroundings. The introduction of bulk insulation around cables will reduce the heat dissipation and in some instances may result in electrical cables overheating and the electrical insulation exceeding its rated temperature, and degrading. It is also possible that electrical equipment may overheat if enclosed by thermal insulation.

For the purpose of this Standard electrical cables are classified according to their degree of proximity to insulation as follows:

- Unsurrounded (see Clause 2.6.1.2).
- Partially surrounded (see Clause 2.6.1.3).
- Completely surrounded (see Clause 2.6.1.4).

2.6.1.2 Unsurrounded electrical cable

Unsurrounded electrical cable is any electrical cable that is completely free of thermal insulation. An electrical cable attached to a building member is also classified as an unsurrounded electrical cable. This means that a building member (e.g. a ceiling joist) is not classified as a thermal insulator. See Figure 2.6.1.2.

A1

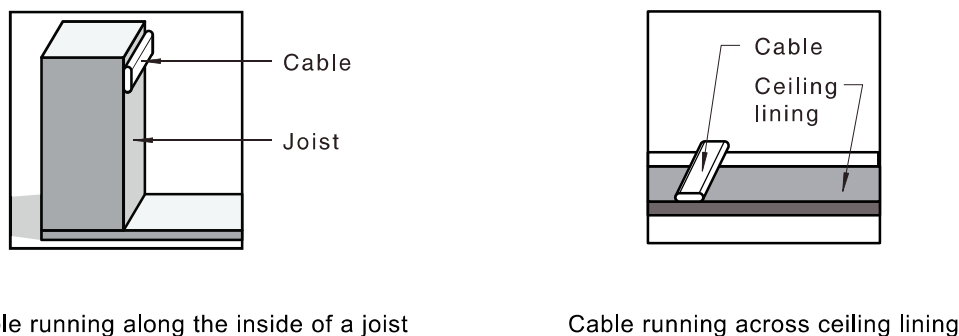


FIGURE 2.6.1.2 UNSURROUNDED ELECTRICAL CABLES

2.6.1.3 *Partially surrounded electrical cable*

The side of the electrical cable not covered with thermal insulation may be open to free air or in contact with a building member that is not classified as thermal insulation such as a timber ceiling joist. See examples in Figure 2.6.1.3.

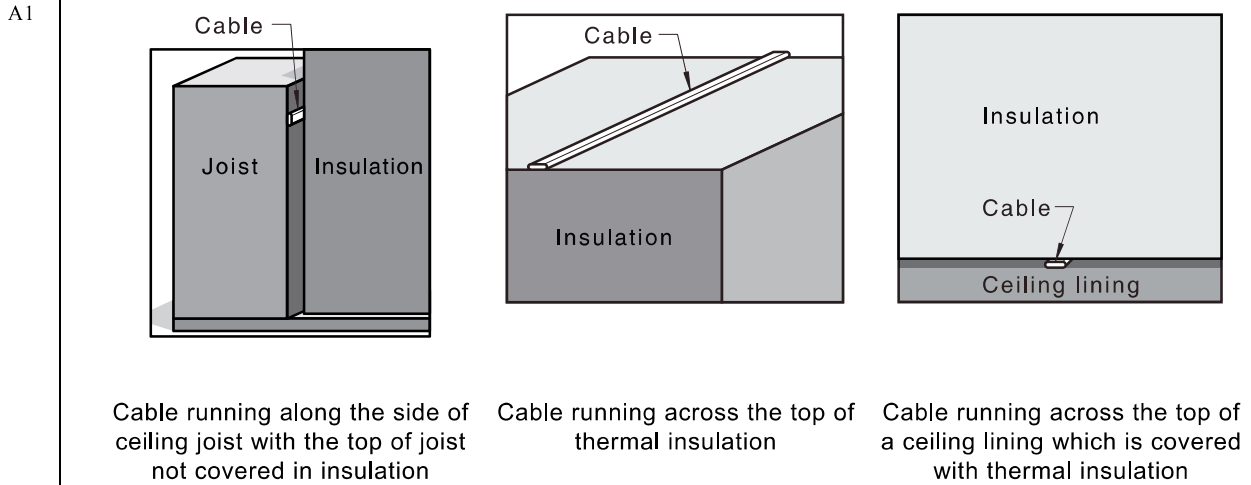
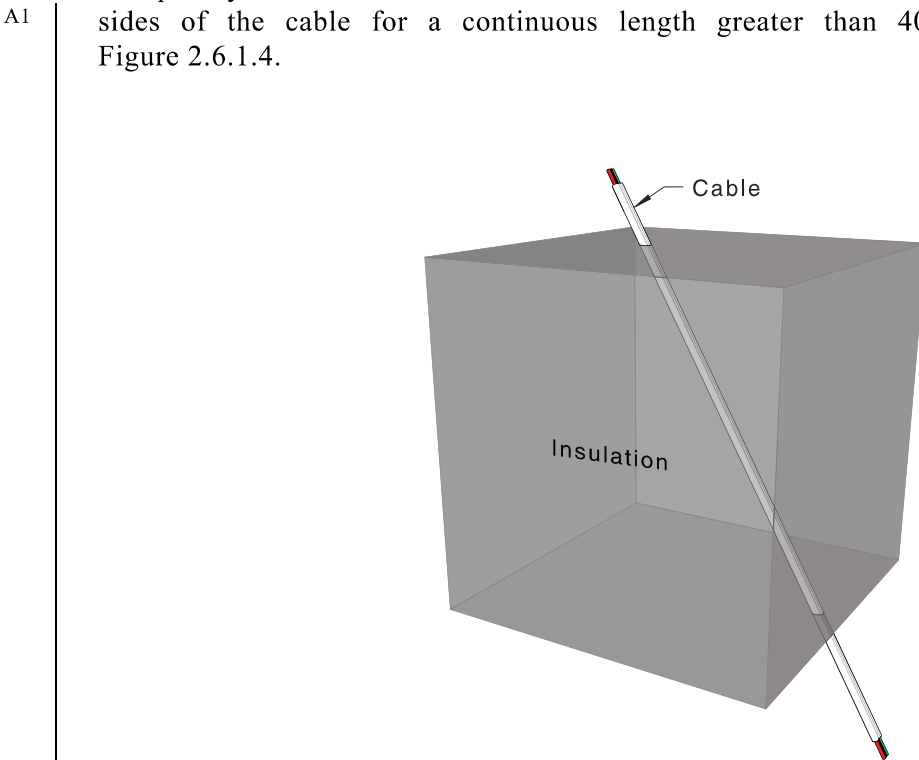


FIGURE 2.6.1.3 PARTIALLY SURROUNDED ELECTRICAL CABLES

2.6.1.4 *Completely surrounded electrical cable*

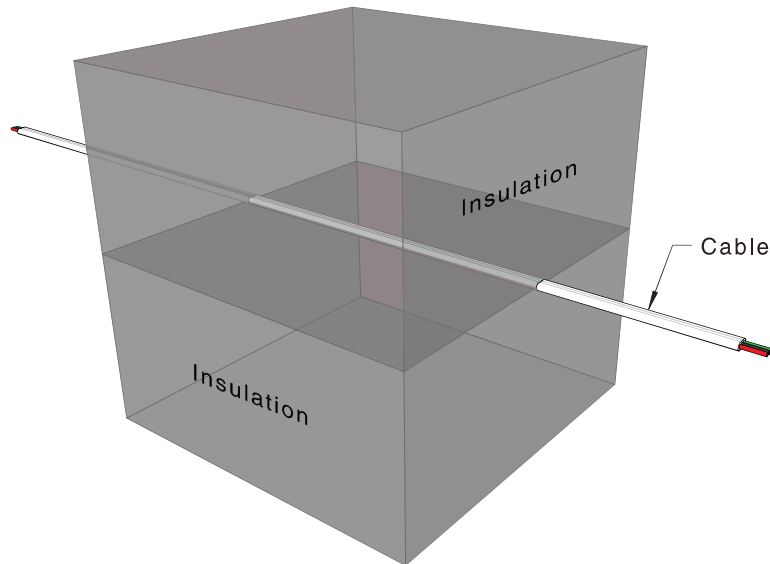
Completely surrounded electrical cable is electrical cable that has thermal insulation on all sides of the cable for a continuous length greater than 400 mm. See examples in Figure 2.6.1.4.



(a) Electrical cable passing through thermal insulation

FIGURE 2.6.1.4 (in part) COMPLETELY SURROUNDED ELECTRICAL CABLES

A1



(b) Electrical cable running in between layers of thermal insulation

FIGURE 2.6.1.4 (in part) COMPLETELY SURROUNDED ELECTRICAL CABLES

A1

2.6.2 Insulation installation and electrical cables

2.6.2.1 General

This Clause (2.6.2) details the requirements for the installation of insulation in ceilings, walls (internal and external) and underfloor of new and existing premises.

NOTE: In the early nineties, the classification of the cables in thermal insulation was introduced into the Wiring Rules. The cables were rated as to how much of the cable was enclosed in thermal insulation; this included the distance that the cable was enclosed in thermal insulation and the number of sides in direct contact with the thermal insulation. Previous editions specified cable to be surrounded by no greater than 300 mm length.

A step change within domestic installation has occurred in line with the publication of the 2018 Wiring Rules.

Electrical cables have been installed within ceilings, walls (internal and external) and underfloor for many years. Originally the cables were installed and sized without the consideration of thermal insulation unless insulation was installed prior to the electrical cables being installed.

2.6.2.2 Dwellings not wired in accordance with AS 3000—1986 or subsequent editions

The installation of bulk insulation in spaces where electrical cables that do not comply with AS 3000—1986, or a subsequent edition, are present and where the bulk insulation would surround the cables for lengths of cable greater than 300 mm, either of the following alternatives shall apply, as appropriate:

- (a) The bulk thermal insulation shall be installed so that it does not surround electrical cables, either completely or partially.
- (b) A written statement from a licensed electrical contractor or electrical engineer qualified in electrical cabling shall be required, confirming the suitability of surrounding the electrical cables with bulk thermal insulation either completely or partially.

If the cables are found unsuitable for surrounding with thermal insulation, the installation of bulk insulation shall comply with the requirement of Item (a) or the relevant areas shall be left uninsulated, or the cables shall be re-routed by a licensed electrical contractor away from the space to be insulated.

A1 **2.6.2.3** *Insulation installations and wiring systems in domestic installations in accordance with AS/NZS 3000:2018*

Wiring systems in domestic installations have been installed on the assumption that thermal insulation in ceilings, walls and under floors, if not currently installed, will be installed in the future. When installing insulation, the following shall apply to cables:

- (a) Only bulk thermal insulation shall be used.

NOTE: Building material that may be used for bulk thermal insulation include—

- (a) glasswool or rockwool batts or loose-fill;
- (b) cellulose fibre, paper, cork, seagrass or similar organic materials that are normally installed in a loose-fill form;
- (c) expanded synthetic foams such as polystyrene, urea formaldehyde or polyurethane, which may be installed by pumping or injection as a wet foam; or
- (d) Electrically conductive bulk insulation (see Appendix K).

- (b) The following shall apply to cables:

- (i) Cables shall be deemed to be unenclosed, where they are installed without further enclosure—

- (A) lying on a horizontal surface;
- (B) lying across ceiling joists;
- (C) supported on perforated or unperforated cable trays, ladders, hangers or racks;
- (D) fixed in place at intervals to a vertical or horizontal surface such as a wall or ceiling joist; or
- (E) surrounded by bulk thermal insulation for a length of less than or equal to 150 mm.

- (ii) Cables shall be deemed to be partially surrounded, where they are installed in such a way that—

- (A) bulk thermal insulation is prevented from completely surrounding unenclosed or enclosed cables over a length of more than 150 mm, such as where an unenclosed or enclosed cable is clipped to a structural member or is lying on a ceiling; or
- (B) cables are completely surrounded by bulk thermal insulation for over a length of more than 150 mm but not more than 400 mm.

- (iii) Cables shall be deemed to be completely surrounded where they are installed in such a way that bulk thermal insulation totally surrounds cables over a length of more than 400 mm.

NOTES:

- 1 This applies to insulation installation in ceilings, walls and floors.
- 2 See Figures 2.6.1.4 for examples of electrical cable passing through up to 400 mm of ceiling insulations to reach a light fitting on the ceiling.

- (c) If an electrical cable is completely surrounded by bulk insulation for a length of 400 mm or greater, a licensed electrician shall be consulted except where Clause 2.6.3 applies.

2.6.3 Electrical accessories and equipment

If electrical equipment is present in the area to be insulated, thermal insulation shall not be placed closer than 50 mm around the equipment unless assurance has been first obtained from the equipment manufacturer that the safe operation of the equipment will not be jeopardized by the proposed placement of thermal insulation. Installation of bulk thermal insulation in conjunction with recessed luminaires shall be in accordance with Appendices A and C.

2.7 BUILT-IN APPLIANCES

If built-in appliances are present in the space to be insulated, thermal insulation shall not be placed closer than 50 mm around the appliance unless assurance has been obtained from the appliance manufacturer that the safe operation of the appliance will not be jeopardized by the proposed placement of thermal insulation. Built-in appliances include heaters, ovens and stoves.

2.8 CONTROL MEMBRANES

Bulk insulation installed on ceilings, under roof cladding, in walls or floors shall comply with the following, as appropriate. This includes where sarking (water barrier membranes), vapour control membranes, radiant barrier membranes (reflective), ember barrier membranes or air barrier membranes are required in the construction:

- (a) The bulk insulation shall be positioned in relation to any currently installed sarking, vapour control membranes, reflective membranes, water barriers, air barriers or ember barriers in accordance with the design specification, manufacturer's specifications or AS/NZS 4200 series.
- (b) The bulk insulation type being installed shall match the design or manufacturer's specifications in conjunction with the type and purpose of membrane (see Clause 3.2.3).
- (c) The insulation shall not inhibit the ability to install any membrane layers specified to be laid after the insulation.
- (d) Any composite blanket products that include a vapour control membrane shall be installed with the membrane in the correct arrangement according to the design specification, manufacturer's specifications, AS/NZS 4200 series and Clause 2.5.
- (e) Any board insulation products shall be in accordance with Clause 2.5, Clause 3.2.2 and Clause 3.2.3 as well as the design specification or manufacturer's specifications.
- (f) Where applicable, bulk insulation shall be installed in accordance with AS 3959.

SECTION 3 GENERAL REQUIREMENTS FOR INSULATION INSTALLATION

3.1 SCOPE OF SECTION

This Section specifies the general requirements for the installation of all types of bulk insulation in order to achieve the designed thermal purpose, for all roofs, ceilings, walls and floors.

3.2 ENERGY EFFICIENCY

3.2.1 General

Insulation shall be installed in accordance with the general requirements in this Section. This will result in the energy efficiency of dwellings being improved.

The following Clause 3.2.2 outlines the fundamental principles of how thermal insulation works and the principles which govern the effectiveness of the insulation once installed. Failure to meet the general requirements and key installation principles may result in thermal non-compliance with the building regulations.

3.2.2 Product description, application and purpose

Bulk insulation installations shall comply with the following:

- (a) The key properties inherent in the thermal insulation materials to be installed shall be identified and shall be suitable for the application.

NOTE: Bulk insulation products may be specially designed for thermal insulation for use in—

- (a) roofs;
- (b) ceilings;
- (c) walls; or
- (d) floors.

- (b) The installation of bulk insulation shall ensure the bulk insulation does not infringe on the designed purpose of the membrane, any damage incurred during the installation to the membrane shall be repaired.

NOTE: Pliable building membranes generally come in rolls and are commonly utilized to sark the dwelling to prevent water ingress. However, they may have additional purposes in the overall design of the building including, preventing unwanted air leakage into cavities, allowing trapped vapour in construction assemblies to dry, reflect radiant heat, and as ember barriers in bushfire prone areas.

- (c) Prior to the installation of bulk insulation, consideration shall be given to the location of any pliable building membranes with a reflective face. These provide a level of thermal resistance when installed with an air space adjacent to the reflective surface. An unventilated air gap shall be left to allow any air spaces adjacent to reflective or semi-reflective surfaces to maintain a minimum of 20 mm to provide a level of heat flow resistance, or as otherwise specified.

NOTES:

- 1 The total system R-values are determined in AS/NZS 4859.1 and are based on still air space. Where the cavity is ventilated, it will affect the total system R-values.
- 2 Some foil surfaces have an ink coating designed to stop discomfort glare which can occur from the reflection of direct sun during installation. These 'anti-glare' coatings are used in both roof and wall applications when an otherwise bright reflective surface would face the exterior of the building causing a possible safety concern. Anti-glare foil/pliable membranes are considered a semi reflective surface and its level of performance is not equal to a reflective shiny surface but still require an air gap of 20 mm to contribute to the overall thermal performance.

3.2.3 Insulation selection

Where a specific insulation manufacturer or product has not been explicitly specified by the designer, an insulation type shall be selected with material properties that meet the design specification or regulatory authority guidelines for all performance parameters. These parameters may include—

- (a) size and dimensions, thickness, width and height of insulation segments or rolls appropriate to the structure and application in which it is being applied;
- (b) thermal resistance tested in accordance with AS/NZS 4859.1;
- (c) density;
- (d) fire hazard properties determined in accordance with AS 1530.1 and/or AS/NZS 1530.3;
- (e) moisture absorptance;
- (f) water vapour permeance in accordance with ASTM E96, Procedure B; and
- (g) product purpose for the specific application and/or purpose in which it was manufactured.

NOTES:

- 1 The comprehensive range of available types and sizes of insulation ensure there is an efficient and effective insulation material suitable for most applications.
- 2 Insulation should be installed based on its stated nominal stabilized thickness.
- 3 Bulk insulation thermal performance is a function of its nominal stabilized thickness.
- 4 The National Construction Code sets out performance targets expressed as total R-values for summer and winter based on climate zone conditions.

3.2.4 Continuity of insulation

The following requirements shall be met as appropriate:

- (a) Bulk insulation shall be installed so that it—
 - (i) abuts or overlaps adjoining insulation other than at structural members such as columns, studs, noggins, joists, furring channels, and the like, where the insulation shall butt against the member;
 - (ii) forms a continuous barrier with ceilings, walls, bulkheads, floors, or the like, that inherently contribute to the thermal envelope (see examples in Figures 3.2.4.1 and 3.2.4.2); and

NOTE: The thermal envelope of a building is the part of a buildings fabric that separates heated or cooled spaces from the exterior of the building or other spaces that are not heated or cooled. A continuous thermal barrier around the envelope is necessary to achieve good performance.
 - (iii) does not affect the safe or effective operation of a service or fitting.
- (b) The settling factors for any loose fill materials being installed shall be confirmed by manufacturer's technical information and extra thickness provided to allow for settling as required to meet the R-value and building regulations.

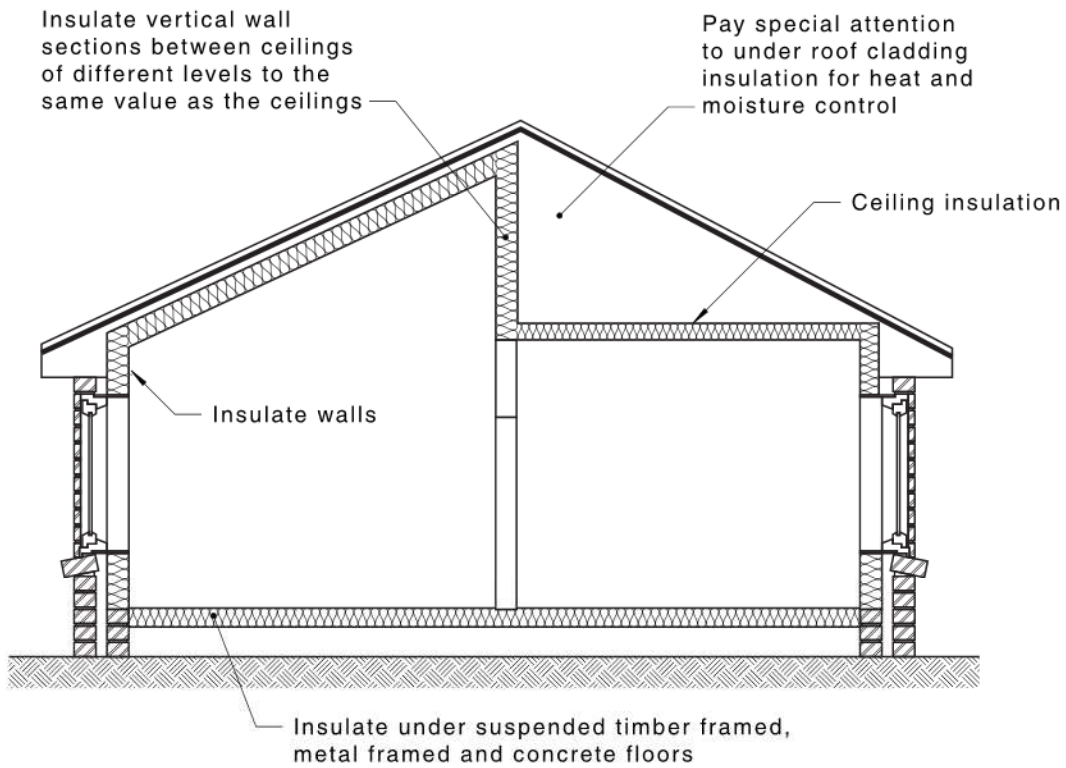


FIGURE 3.2.4.1 EXAMPLE OF THERMAL ENVELOPE WITH SUSPENDED FLOOR

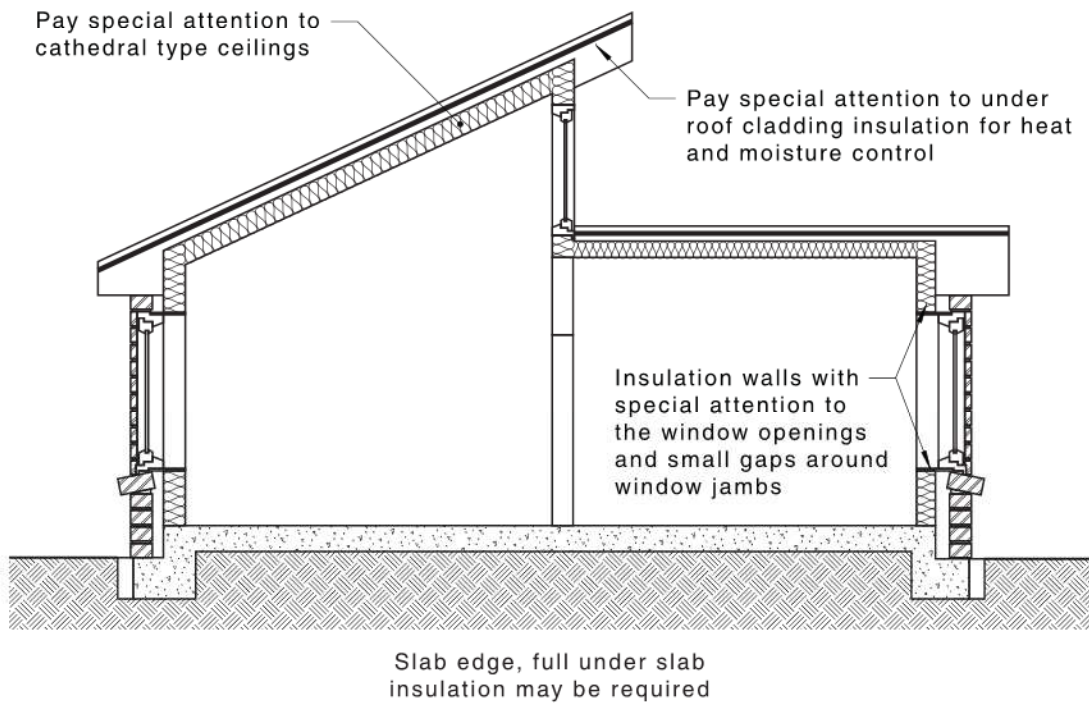


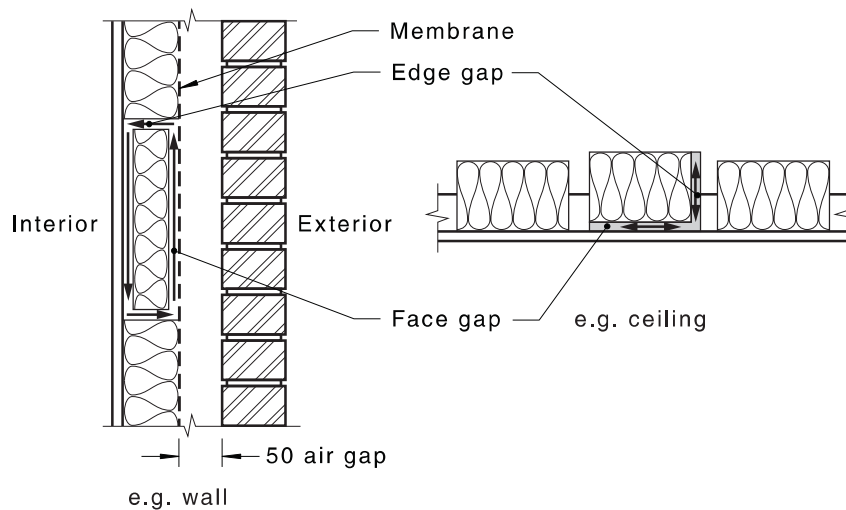
FIGURE 3.2.4.2 EXAMPLE OF THERMAL ENVELOPE WITH SLAB ON GROUND

3.3 INSULATION INSTALLATION GUIDANCE AND RULES

3.3.1 Insulation gaps, joints and thermal bypass

The following requirements apply:

- (a) Gaps around the edges of insulation segments, on all four edges, both sides or gaps at the top and bottom shall be avoided (see Figure 3.3.1).
- (b) Interconnecting cavities shall be avoided (see Note to Figure 3.3.1).



NOTE: The occurrence of face gaps in conjunction with edge gaps allows air on either side of the insulation to exchange and they can render an insulating layer nearly ineffective. This is known as interconnecting cavities.

FIGURE 3.3.1 EDGE GAPS AND SIDE GAPS

- (c) Where practical folding, tucking in and compression shall be avoided as this will reduce the effectiveness of insulation.

C3.2.1 *In practice, the R-value of a building element will depend to a large extent on the material R-value of the insulation product installed and the quality of the installation itself. R-values for building elements are specified in AS/NZS 4859.1 and the National Construction Code (NCC), so insulation must be installed such that conformance is achieved.*

3.3.2 Thermal bridging

Thermal bridging occurs where more thermally conductive structural elements, fixings, etc. bridge the insulation layer (see Figure 3.3.2) providing a path for heat to flow through the insulation layer. The following requirements apply:

- (a) Structural materials that are very conductive to heat shall be either—
 - (i) fully covered with insulation; or
 - (ii) insulation shall be tightly abutted to structural member.

NOTE: Steel, zinc, copper, lead or aluminium, can transmit significant amounts of heat through the insulation layer, significantly reducing the overall total R-value of the building envelope.

- (b) Thermal bridging shall be kept to a minimum, where possible, and shall be achieved through complying with Item (a) and the use of low conductivity fixings where possible, i.e. nylon anchors or telescopic plastic insulation fasteners.

C3.3.2 *It is very difficult to achieve total coverage of insulation without some amount of thermal bridging through the insulation layer without compromising the structural integrity of the building; therefore, some thermal bridging will always be expected.*

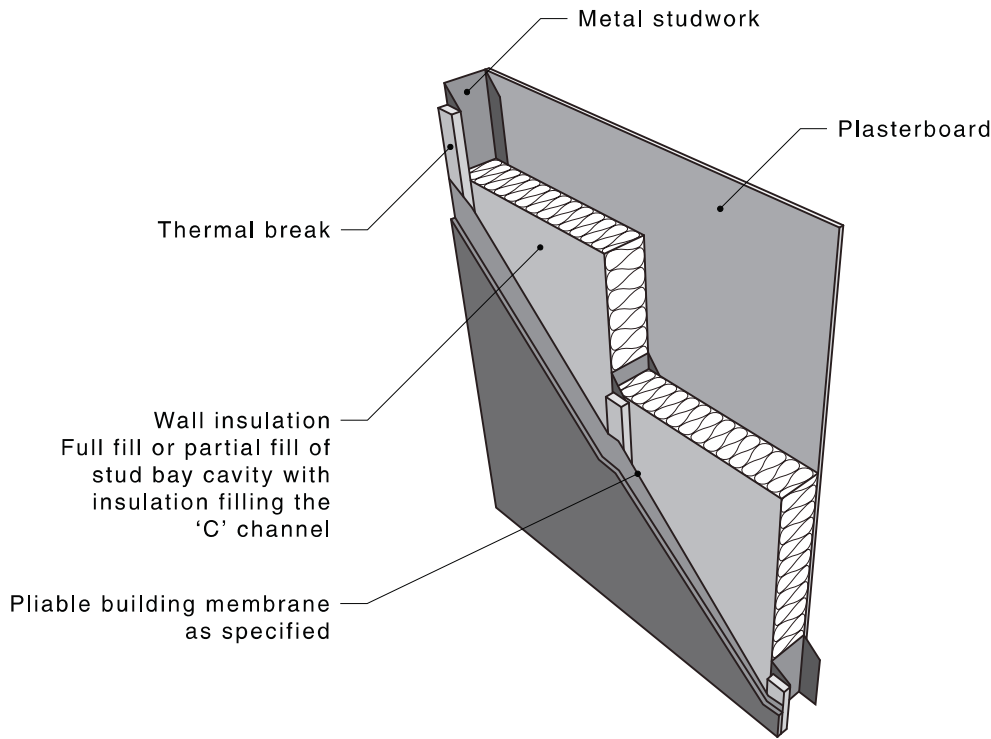


FIGURE 3.3.2 EXAMPLE OF THERMAL BREAKS WITH CLADDING DIRECT FIXED TO METAL STUDWORK

3.4 GENERAL INSULATION METHOD

Bulk insulation installed in all roofs, ceilings, walls and floors shall comply with the following in order to achieve the thermal performance as designed:

- (a) The bulk insulation shall be installed without reduction in thickness to provide the specified R-value over the whole area to be insulated except where special considerations require otherwise. Examples are:
 - (i) Where bulk insulation is placed between ceiling/floor joists, and does not exceed the height of the joists, it is not required to cover the top/bottom of the joists.
 - (ii) The presence of fittings and electrical wiring may necessitate a reduction or complete absence of bulk insulation in some places (see Section 2 and Appendices A and C).
- (b) Bulk insulation shall not be compressed against linings or the roof cover [see Clause 5.3.4.1(h) and Figure 5.3.4.1.7]. Where the structure will not accommodate the thickness required to give the specified R-value, a lesser value shall be used.

NOTES:

- 1 It is desirable to cut insulation and then place around services providing that such compression is limited so that it does not compromise adjacent linings or roof cover.
- 2 The R-value of insulating materials is quoted for a specific nominal stabilized thickness. Reduction of this thickness results in a lowering of the R-value, e.g. where blanket insulation is compressed between roof members and roof sheeting (see Figure 3.4.1).

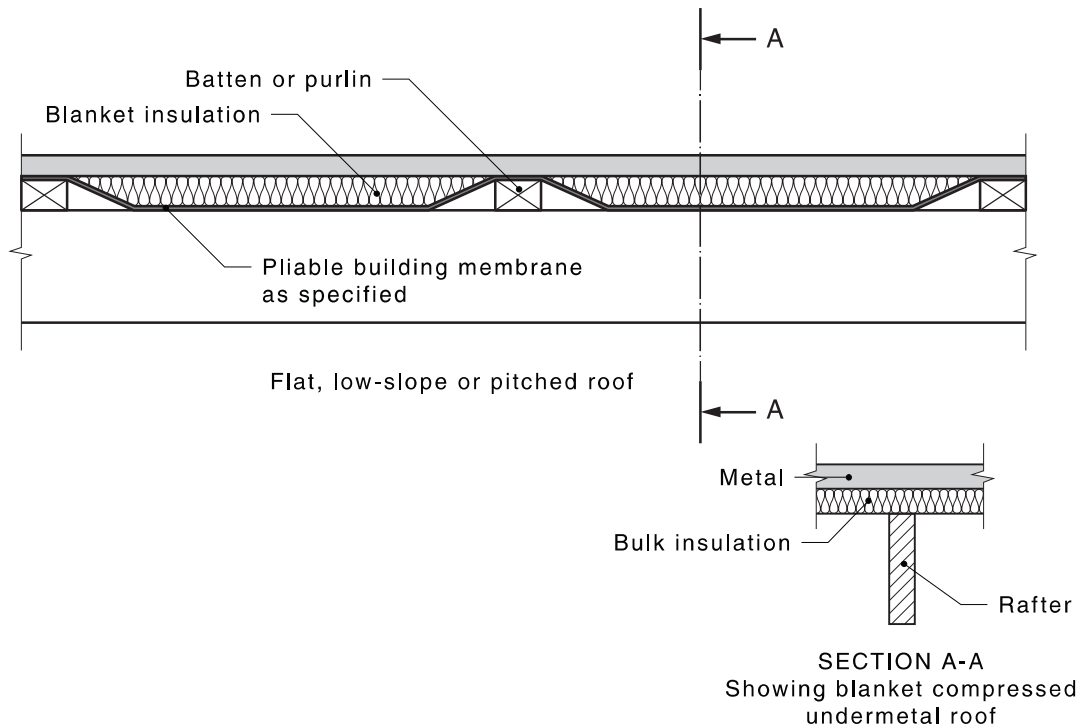


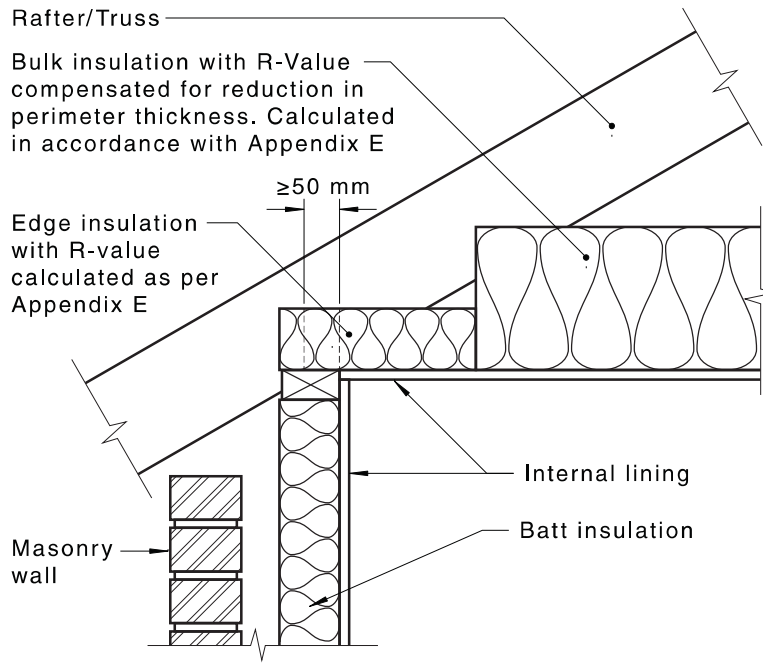
FIGURE 3.4.1 REDUCTION IN THICKNESS OF BLANKET INSULATION WHERE COMPRESSED BETWEEN ROOF SHEETING AND BATTENS

- (c) Bulk insulation shall be dry when installed unless otherwise specified by the manufacturer.
- (d) Batt, blanket and board insulation shall be butted at all joints to avoid gaps or voids as per Clause 3.3.1.
- (e) Bulk insulation shall be restrained where it may fall or slide out of position.

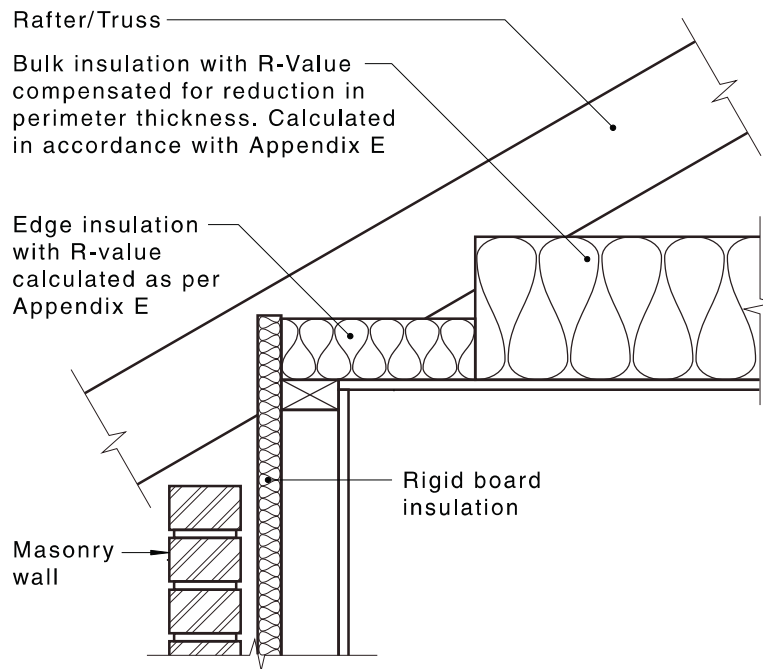
NOTES:

- 1 This situation can apply, for example, to bulk insulation installed between the studs of brick veneer walls or on sloping ceilings.
 - 2 Batt, blanket or rigid board insulation may be secured with cord or mesh. Loose-fill insulation may be restrained by appropriate support materials described in Clause 1.5.2.
- (f) Where bulk insulation is installed in adjacent building elements, e.g. ceilings, walls and bulkheads, provision shall be made, where practicable, to overlap or butt the insulation installation at all the junctions between elements as shown in Figure 3.4.2.
NOTE: Such overlapping or butting of bulk thermal insulation is intended to reduce the potential for thermal bridges.
 - (g) Bulk insulation shall be cut or placed to fit snugly around any penetrations through the insulation, e.g. pipework; except where there is danger of overheating, e.g. flues, electrical cables and equipment, wall furnaces [see Clauses 2.4 and 5.3.4.1(c), and Figure 5.3.4.1.3].
 - (h) A clearance of not less than 50 mm or manufacturer's specifications and which complies with building regulations shall be provided around the outer skin of any flue likely to carry hot gases [see Figure 5.3.4.3].
 - (i) When sarking membranes, vapour control membranes, air barriers, reflective barriers or ember barriers have been specified in conjunction with bulk insulation, refer Clauses 2.5, 3.2.2 and 3.2.3.

NOTE: For classification of pliable building membranes, membrane properties and membrane performance, refer to AS/NZS 4200.1.

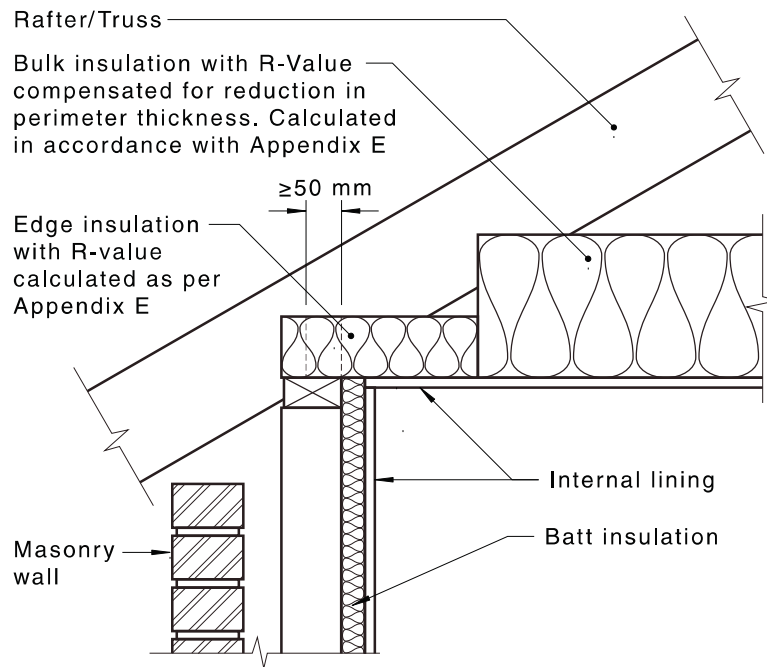


(a) Batt insulation on ceilings and within wall cavity



(b) Batt insulation on ceilings and rigid board insulation externally in framed walls

FIGURE 3.4.2 (in part) PLACEMENT OF THERMAL INSULATION TO ELIMINATE THERMAL BRIDGING



(c) Batt insulation on ceilings and rigid board insulation internally in framed walls

FIGURE 3.4.2 (in part) PLACEMENT OF THERMAL INSULATION TO ELIMINATE THERMAL BRIDGING

- (j) Gaps in the bulk insulation shall be avoided at penetrations and overlaps in vapour control membranes to prevent the passage of air and water vapour. See Clause 2.5.
- Overlaps and sealing of membranes shall be in accordance with AS/NZS 4200.2.
- NOTE: Sealing may require the use of contact adhesive or pressure sensitive tape.
- (k) All packaging materials, other than those used for support purposes, shall be removed from the building upon completion of the installation. The exception being when a product label is required to be left on site for future product identification. The label shall be affixed to the building using an approved method.
- (l) When bulk insulation is faced with a pliable building membrane, the composite product shall be installed as to achieve the membrane purpose (see Clauses 3.2.2 and 3.2.3) within the construction system according to manufacturer's specifications, designer's specifications and AS/NZS 4200.2.
- (m) Reflective bulk insulation products shall be installed—
- (i) over the whole area to be insulated and lap or abut other insulation;
 - (ii) when installed, contact with the reflecting surfaces and other materials shall be avoided maintaining a minimum of 20 mm gap; and
 - (iii) such that air movement in and around the reflective insulation products shall be controlled through sealing, overlapping or tightly fitting where it abuts with other insulation or structural members.

SECTION 4 SAFETY REQUIREMENTS FOR INSULATION INSTALLATION

4.1 SCOPE OF SECTION

This Section sets out requirements for the safe work procedures for the installation of bulk insulation, with particular attention to installations in roofs, ceilings and floors where electrical wiring, equipment or electrically conductive ceiling insulation is present.

4.2 GENERAL SAFETY REQUIREMENTS

Safe practices contained in federal and state WHS legislation shall be followed.

C.4.2 Installation of insulation in existing structures may present a more aggressive environment principally due to elevated temperature, dusty environment and higher risk of electrocution.

There are specific requirements in some state legislation regarding the installation of all types of insulation including electrically conductive insulation, such as the foil faced bulk thermal insulation. Refer to relevant state electrical safety legislation.

An appropriate safe work method statement (SWMS) shall be completed before commencing any work. If the risks are found to be high, then no work should commence until these risks have been managed to a low level.

The appropriate personal protection equipment (PPE) shall be selected to meet any requirements identified in a SWMS (e.g. use of leather gloves, dust masks, rubber soled shoes and safety harnesses).

4.3 ELECTRICAL SAFETY

When insulation is to be installed in an existing building or in a new building after electrical wiring or equipment has already been installed across ceiling joists, the following procedures apply:

- (a) Prior to installation an assessment shall be conducted for input in to the SWMS by a competent person in carrying out an assessment of the electrical risk from the installation of insulation.

NOTES:

- 1 The risk assessment need not be done by a licensed electrician unless required by state regulations.
- 2 It is recommended that a record of the on-site assessment is kept for at least 5 years after the assessment is conducted.

- (b) Prior to entering a ceiling space, how to de-energize circuits located in the roof space shall be identified.

If warning signs on recessed luminaries in accordance with Appendix A are not present, then they shall be installed on each access point to the ceiling.

Before commencing installation:

- (i) Before entering into the ceiling, map the position of downlights and other appliances on a sketch plan of the building as they may be difficult to see once in the ceiling.
- (ii) Check and note the location of electrical cables, electrical equipment and accessories in the area to be insulated.

(iii) Check and note the location of any cabling that cannot be de-energized at switchboard, e.g. mains supply and some solar PV wiring.

NOTE: Unprotected electrical cables should not be positioned in locations where they are vulnerable to damage, such as over the tops of joists.

(c) The power to the work area that can be de-energized shall be switched off and, if required, an alternative safe power supply shall be provided for lighting and other work equipment.

NOTES:

- 1 Based on risk assessment further actions may be required to de-energize circuits located in the work area that cannot be de-energized from the switch board.
- 2 Residual Current Devices (RCDs) provide added protection but should not be relied upon during installation.
- 3 Alternative lighting may include natural lighting or use of batteries.
- 4 The use of lock out arrangements and signage should be provided to avoid inadvertent re-energization of the circuit.

(d) Where it is suspected or ascertained that electrically conductive insulation has been installed across the ceiling joists, the ceiling space shall not be entered. Before any work in the ceiling space commences, an electrical contractor shall make an electrical safety assessment, and issue a written statement stating the contractor has inspected the installation and tested the electrically conductive insulation to establish it is not energized.

(e) Risk assessment outcomes:

- (i) If the cabling or electrical equipment is suspected to be faulty, then the owner shall be advised.
- (ii) If the electrical insulation or equipment appears to be inadequate, the installation shall not proceed until the installation is assessed and if required made safe or rectified by an electrician.
- (iii) If installation is to proceed, all circuits that cannot be de-energized at switchboard, e.g. mains supply and some PV solar wiring, shall be identified.

NOTE: Based on the risk assessment, further actions may be required to de-energize circuits located in the work area that cannot be de-energized from the switchboard.

(f) Equipment and fixings:

- (i) All equipment used for installing insulation shall be designed to minimize the risk of electric shock. Only tools (knives, screwdrivers, etc.) that are non-conductive or have electrically insulated handles shall be used. Clothing or protective equipment that are non-conductive shall be worn.
- (ii) If fasteners are required to be used, non-metallic, non-conductive fasteners shall be used.

(g) During installation:

- (i) When stapling or cutting insulation, ensure that there are no cables or other electrical equipment in the vicinity.

NOTE: Cutting may be done on a kneeling board, not with the insulation in place.

- (ii) When installation is complete, the correct operation of the electrical device shall be checked again. If a fault is detected, that was not present at the start of the work, then an electrician is needed to rectify the situation.

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- (h) Where bulk insulation materials are faced with aluminium foil, which can conduct electricity, the installation process shall ensure that the foil facing does not become energized through contact with electrical wiring and equipment.

NOTE: These requirements, which apply generally to all installations where electrical equipment or cabling is present, are particularly important when installing foil-faced bulk insulation.

- (i) Where pre-existing electrical cables are installed, electrically conductive insulation shall only be installed on top of ceiling surfaces or ceiling joists and under subfloors where—
- (i) permitted by the relevant state regulation; and
 - (ii) installed in accordance with Appendix K.

4.4 SAFETY REQUIREMENTS WHEN WORKING WITH INSULATION PRODUCTS

Instructions contained in the product manufacturer's specifications relevant to the handling, installation and disposal of waste insulation product shall be followed.

4.5 SAFETY REQUIREMENTS FOR CONCEALED STRUCTURAL MEMBERS (CEILINGS)

Where the structural members are concealed, a safe egress pathway shall be created in the roof space as required for maintenance.

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4.6 POLYSTYRENE CONTACT WITH ELECTRICAL CABLES

Electrical cabling shall not be in contact with polystyrene unless the cables and polystyrene are compatible.

NOTE: Plasticizer can migrate out of the electrical insulation of the wiring, making it less flexible, and into the polystyrene insulation, therefore potentially compromising the insulation and wiring.

SECTION 5 THERMAL ENVELOPE DETAILED INSTALLATION METHODS

5.1 SCOPE OF SECTION

This Section sets out the requirements for installation of bulk insulation products in roofs, ceilings, walls and floors.

5.2 INSTALLATION OF ROOF INSULATION

5.2.1 Scope

This Clause (5.2) outlines the installation of insulation located directly on top of roof truss top chords, on top of roof rafters, over roof battens or in close proximity to the roof cladding commonly used in dwellings. This includes bulk insulation below tiled roofs, sheet roofs, metal roofs and concrete roofs.

5.2.2 General

5.2.2.1 Roof framing

Insulation shall be installed to accommodate the following structural elements:

- (a) Timber-framed constructions, as described in AS 1684 series.
- (b) Nail plated trusses and associated bracing members, bracing strapping and spacing members, as described in AS 4440.

NOTE: An example of insulation to accommodate trusses is provided in Appendix H.

- (c) Metal framed trusses, as described in NASH Standard Part 1.

NOTE: Metal framed trusses are designed to minimum load combinations as specified in NASH Standard Part 1, which consider the truss self-weight plus weight of the remaining roof system; roofing, battens, ceiling, ceiling battens, insulation and services.

Commentary: The design would be expected to account for the type and installed thickness of ceiling insulation and that the weight does not exceed the specified load allowance allocated for insulation in the truss or framing design. Loads other than the standard loads on the trusses require approval. The standard loads, i.e. dead load, live load, wind load, and earthquake load, imposed on trusses are specified in AS/NZS 1170.0, AS/NZS 1170.1, AS/NZS 1170.2, AS/NZS 1170.3 and AS 1170.4, as appropriate.

5.2.2.2 Specific installation issues

When installing insulation under roofs it shall be ensured that—

- (a) the ceiling insulation can be installed around the perimeter of the roof where the roof meets the load bearing walls in accordance with the criteria outlined in Clause 5.2.4;
- (b) the insulation shall be installed to meet safety criteria outlined in Section 2 and 4 and Appendices A and C;
- (c) care shall be taken when installing insulation to ensure that it does not interfere with the safety or performance of domestic services and fittings in accordance with Clause 2.4;
- (d) the design specification, where available, shall be checked to ensure the bulk insulation is installed in the correct position in relation to any existing membranes already installed or any future insulation intended to be installed in accordance with Clause 5.3 and the requirements of Clause 2.5 are met;

- (e) any bulk insulation materials (excluding R0.2 thermal breaks), which are compressed between cladding materials and structural members, or to which cladding materials are directly fixed, shall not compromise the structural integrity of the roof construction as required by the National Construction Code (NCC); and
- (f) insulation installed between counter battens or rafters shall maintain a minimum of 10 mm clearance under the battens for drainage between the sarking and the fixing battens unless otherwise specified (see Figure 5.2.2.2).

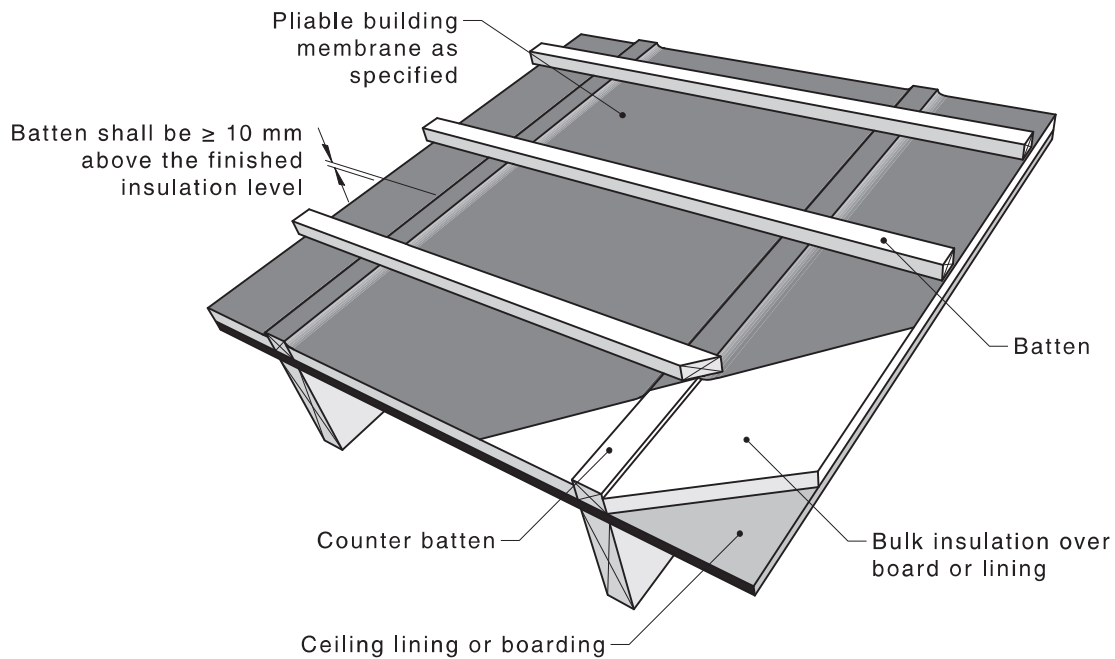


FIGURE 5.2.2.2 FORMING DRAINAGE CHANNELS

5.2.3 Flat roofs

5.2.3.1 Metal clad roofs

Bulk insulation installed in flat metal roofs shall comply with the following, as appropriate:

- (a) Bulk insulation installed between the roof supporting members is shown in Figure 5.2.3.1.2 and above the roof battens is shown in Figure 5.2.3.1.1.

Blanket insulation shall be installed over the roof battens or purlins (see Figure 5.2.3.1.1) and tensioned before fixing to ensure contact between the insulation and the metal roof sheet. Where used as a vapour control membrane, shall comply with AS/NZS 4200.

- (b) Where the roof construction having the roof supporting members above the ceiling lining. The required R-value may be achieved by installing part of the bulk insulation in the form of blanket insulation to comply with Item (a) and with the addition of sufficient bulk insulation applied on the upper surface of the ceiling to achieve the required R-value (see Figures 5.2.3.1.1 and 5.2.3.1.2).

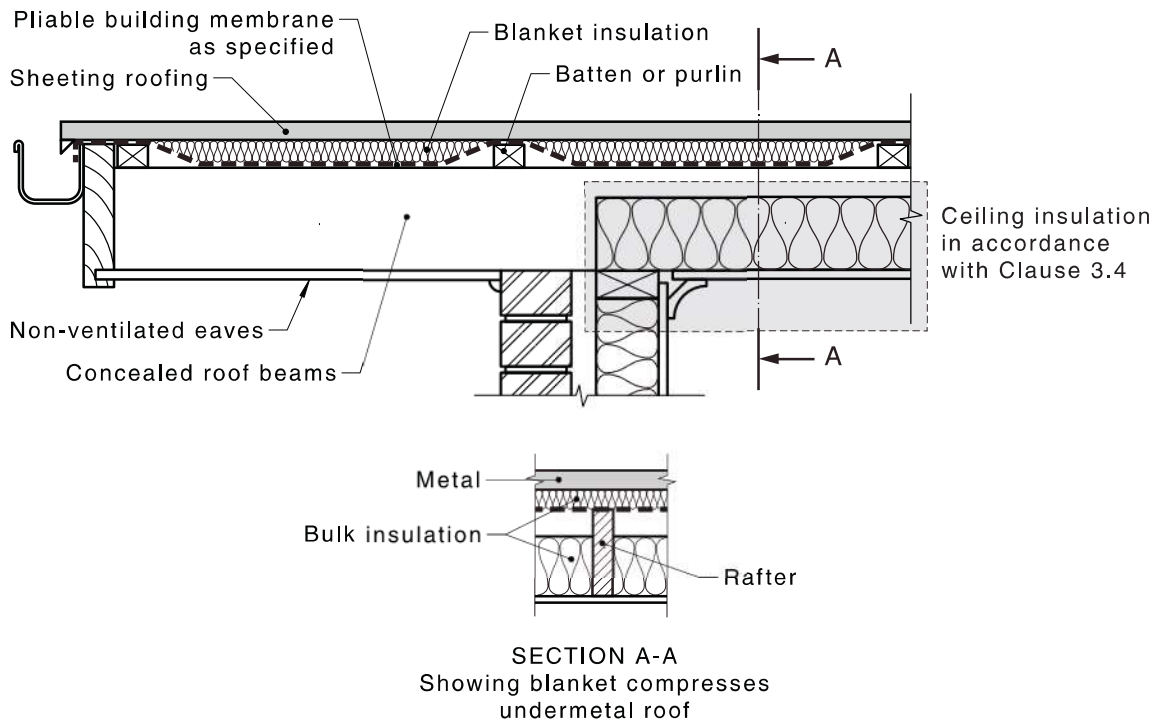


FIGURE 5.2.3.1.1 FLAT METAL ROOF WITH COMPRESSIBLE BLANKET BULK INSULATION

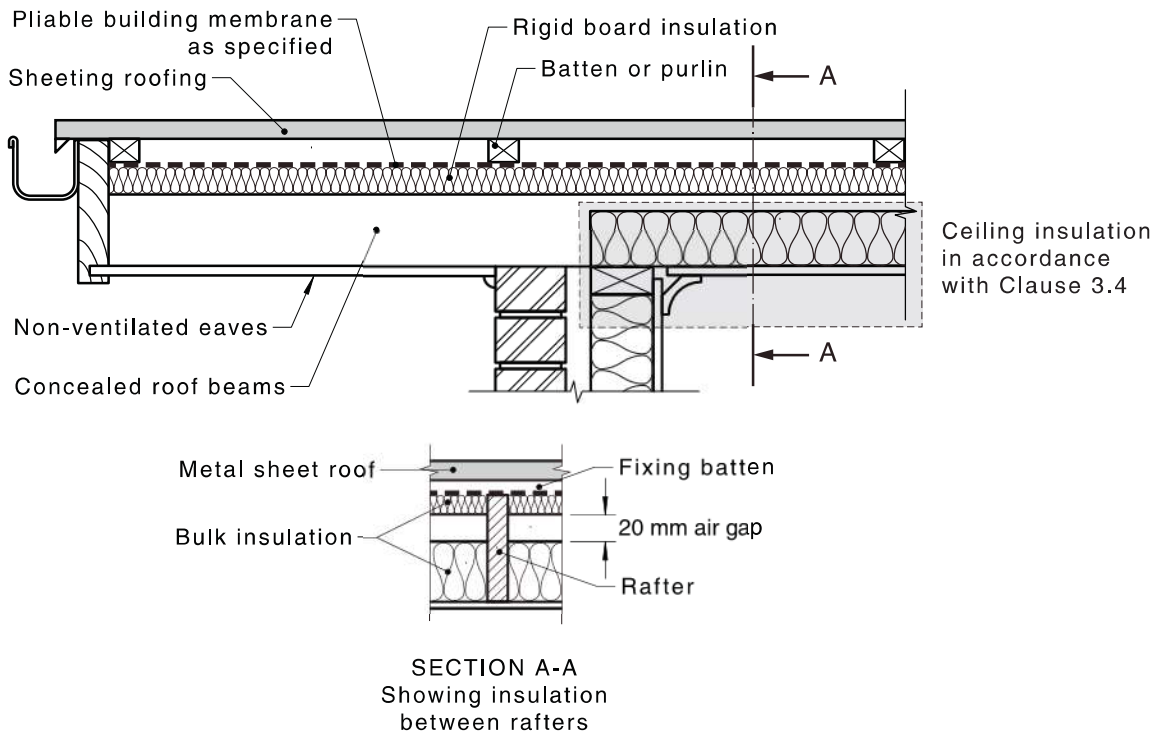


FIGURE 5.2.3.1.2 FLAT METAL ROOF WITH RIGID BOARD BULK INSULATION BETWEEN RAFTERS

- (c) Rigid board insulation shall be laid between the rafters, joists or the purlins. A vapour control sarking above the board and/or a vapour control membrane below the insulation shall be provided with permeability as specified in the design (see Clause 2.5). The installer shall check the design specification to ensure the bulk insulation is in the correct position in relation to the membrane.

5.2.3.2 Concrete roofs

Bulk insulation installed on or below concrete roofs shall comply with the following, as appropriate:

- (a) *Insulation on underside of roof (see Figure 5.2.3.2.1)* Bulk insulation shall be installed as follows:
- (i) The bulk insulation shall be either of the following:
 - (A) Held in contact with the underside of the roof slab by suitable fixing devices, e.g. adhesives or mechanical fasteners. The type and spacing of the fixing device shall follow the manufacturer's specifications and will depend on the insulation type and its dimensions.
 - (B) Installed in a continuous layer beneath the roof slab and be sealed around the perimeter and joints to prevent air flow between any air cavities formed above or below the insulation.
 - (ii) Blanket insulation shall be installed under the concrete roof with a vapour control membrane below complying with AS/NZS 4200. The insulation blanket shall be tensioned before fixing to ensure contact between the insulation and the concrete roof.

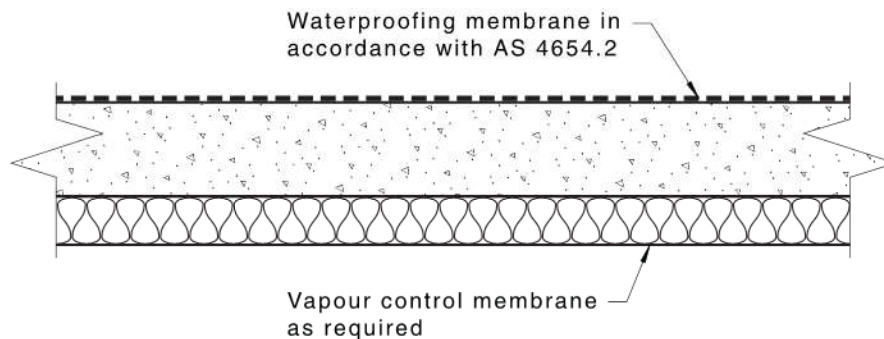


FIGURE 5.2.3.2.1 BULK INSULATION BELOW A CONCRETE ROOF

- (b) *Insulation above the roof and beneath a waterproofing membrane (see Figure 5.2.3.2.2)* Bulk insulation shall be installed as follows:

Rigid board insulation shall be installed on the roof without gaps and secured in accordance with the rigid board insulation manufacturer's specifications. The rigid board insulation shall then be covered with a waterproofing membrane installed in accordance with the membrane manufacturer's instructions.

NOTE: Precise details of fixing the rigid board insulation will depend on the type of membrane used and the exposure conditions expected.

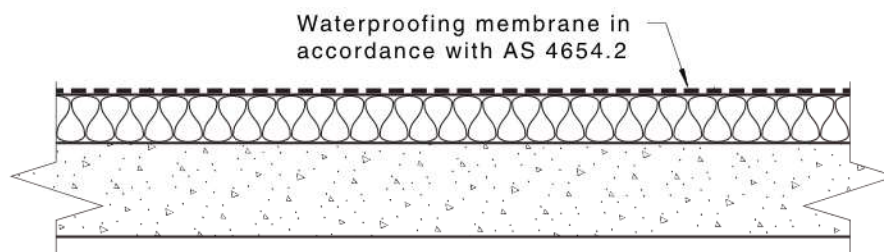


FIGURE 5.2.3.2.2 INSULATION ABOVE A CONCRETE ROOF AND BENEATH A WATERPROOFING MEMBRANE

- (c) *Insulation above the roof and above a waterproofing membrane (see Figure 5.2.3.2.3)* Bulk insulation shall be installed as follows:

The waterproofing membrane shall be laid on the upper surface of the roof slab in accordance with the membrane manufacturer's specifications. Rigid board insulation shall be installed on the membrane with edges butted tightly together but not adhered to the membrane (this is known as loose laying) and covered with a suitable ballast system to prevent wind blow-off in accordance with the rigid board manufacturer's specifications.

NOTES:

- 1 Suitable ballast systems for the method in Clause 5.2.3.2(c) include gravel, paving slabs or a concrete screed laid over the rigid board insulation.
- 2 The method of application described in Clause 5.2.3.2(c) is suitable only with insulation having a high resistance to water absorption and a high compressive strength, e.g. rigid boards. The advantage of this method is that the membrane is protected from mechanical damage, ultraviolet radiation attack and excessive thermal cycling which may cause structural damage.
- 3 Insulation fixed to the underside of a concrete roof will cause an increased condensation risk. Under some circumstances, a vapour barrier may be required beneath the insulation (see Clause 2.5).

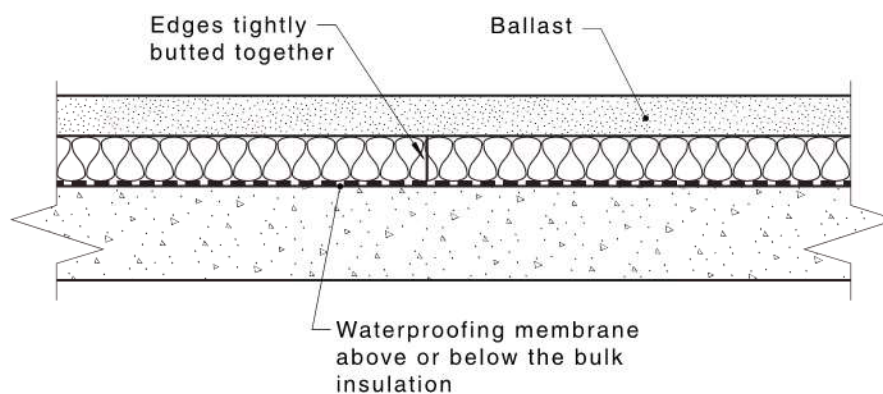


FIGURE 5.2.3.2.3 INSULATION ABOVE A CONCRETE ROOF AND ABOVE A WATERPROOFING MEMBRANE

5.2.4 Pitched roofs

5.2.4.1 Metal clad roofs with horizontal ceilings

Bulk insulation installed in pitched metal roofs shall comply with the following, as appropriate:

- Roof construction having either blanket insulation laid over the roof cladding supporting members (as in Figure 5.2.4.1.1), supported between the roof rafters hard up against the roof battens (as in Figure 5.2.4.1.2) or supported by a rigid board and between counter battens (as in Figure 5.2.4.1.3). In all cases the use of a membrane either above, below, or both above and below the insulation layer may be required.
- The required R-value may be achieved by installing part of the bulk insulation in the form of blanket insulation or otherwise to comply with Item (a) and with the addition of sufficient bulk insulation applied on the upper surface of the ceiling to achieve the required R-value in accordance with Clause 5.3.1.
- Blanket insulation shall be installed over the roof battens or purlins on a vapour control membrane complying with AS/NZS 4200. The vapour control membranes shall be overlapped at all joins as specified in AS/NZS 4200 and tensioned before fixing to ensure contact between the insulation and the metal roof sheet (see Figure 5.2.4.1.1).

NOTE: A sarking material may be required above the upper surface of the insulation.

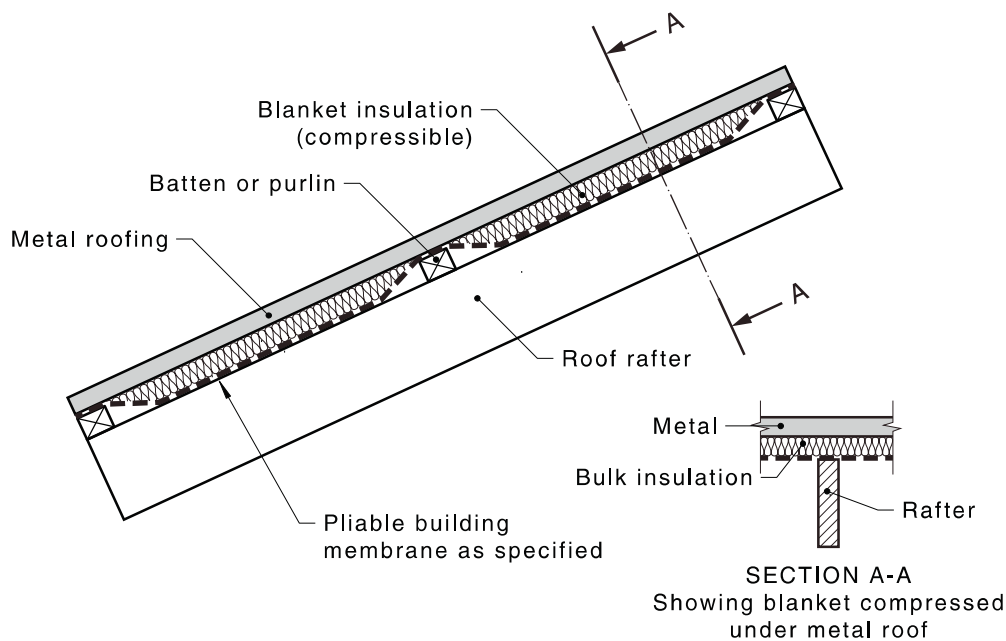


FIGURE 5.2.4.1.1 METAL SHEET ROOF WITH COMPRESSIBLE BLANKET BULK INSULATION

- Board bulk insulation shall be installed between the rafters.

NOTE: A sarking material may be required above the upper surface of the insulation (Figure 5.2.4.1.2).

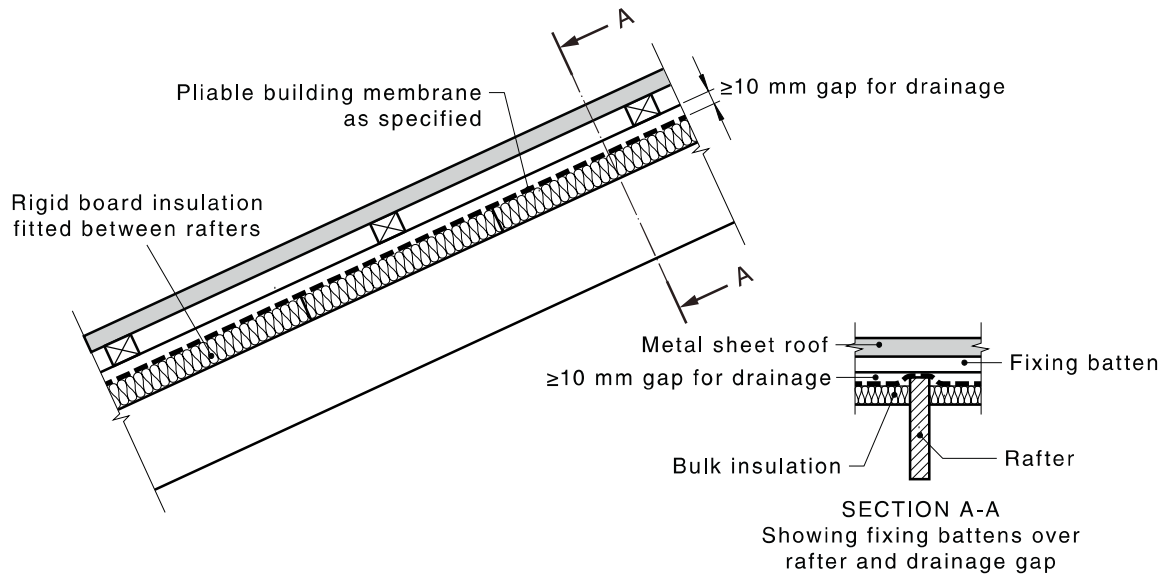


FIGURE 5.2.4.1.2 EXAMPLE OF METAL SHEET ROOF WITH RIGID BOARD INSULATION SHOWING POSSIBLE MEMBRANE LOCATIONS

- (e) When roof supporting members (rafters or joists) are below a bracing board, bulk insulation shall be installed between counter battens, maintaining a clearance of not less than 20 mm between the insulation and the metal or sheet roofing unless otherwise specified. Where this clearance is not maintained, a sarking material shall be installed above the upper surface of the insulation. A vapour control membrane above or beneath the bracing board shall be provided unless the board itself has a vapour control function and joints between boards and where the boards abut the rafters include a suitable seal to prevent air and vapour transmission between joins (see Figure 5.2.4.1.3).

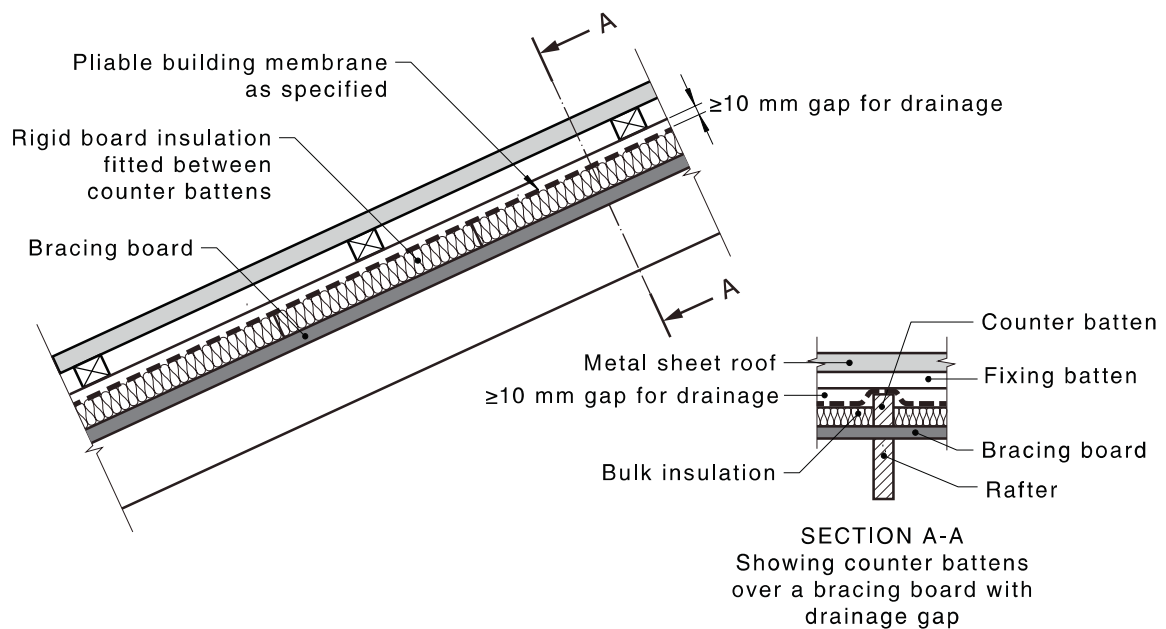


FIGURE 5.2.4.1.3 METAL SHEET ROOF WITH RIGID BOARD INSULATION ABOVE A BRACING BOARD

5.2.4.2 Tiled roofs with horizontal ceilings

Bulk insulation installed in pitched tiled roofs shall comply with the following as appropriate:

- (a) For roof construction having insulation supported between the roof rafters shall be as shown in Figure 5.2.4.2.1.
- (b) For roof construction having insulation supported by a rigid board and between counter battens shall be as shown in Figure 5.2.4.2.2.

NOTES:

- 1 In both cases the use of a membrane either above or below the insulation layer may be required.
 - 2 The required R-value may be achieved by installing part of the bulk insulation to comply with Item (a) and with the addition of sufficient bulk insulation applied on the upper surface of the ceiling (see Clause 5.3.1).
- (c) Bulk insulation shall be installed between rafters, maintaining a clearance of not less than 20 mm between the insulation and the tiles. Where this clearance cannot be maintained a sarking material shall be installed above the upper surface of the insulation (Figure 5.2.4.2.1).

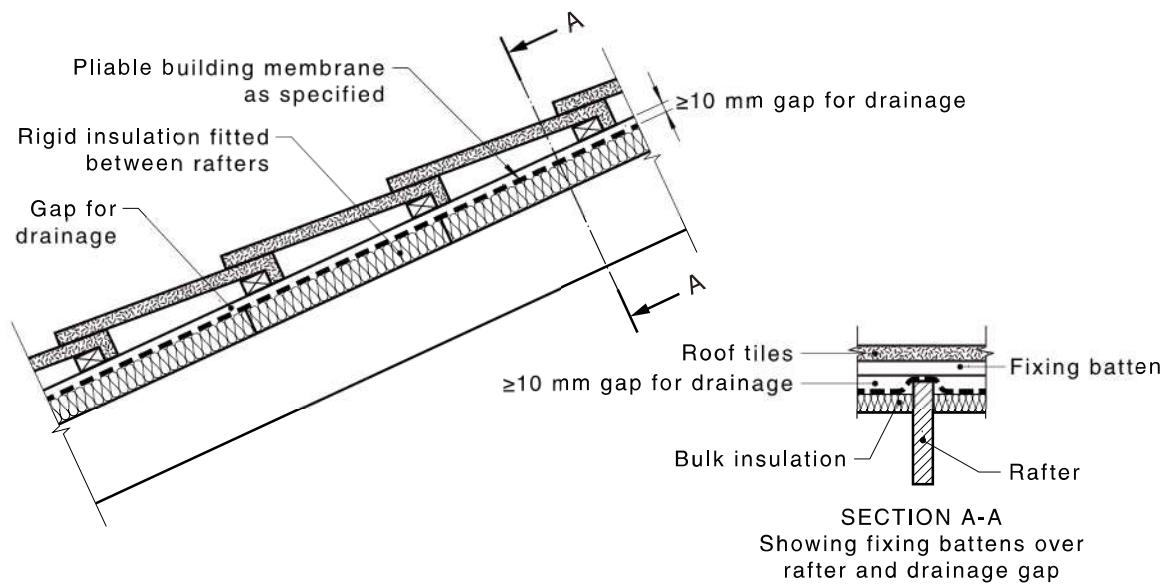


FIGURE 5.2.4.2.1 TILED ROOF WITH RIGID BOARD INSULATION

- (d) Bulk insulation shall be installed between counter battens, maintaining a clearance of not less than 20 mm between the insulation and the tiles. Where this clearance cannot be maintained a sarking material shall be installed above the upper surface of the insulation (Figure 5.1.4.2.2).

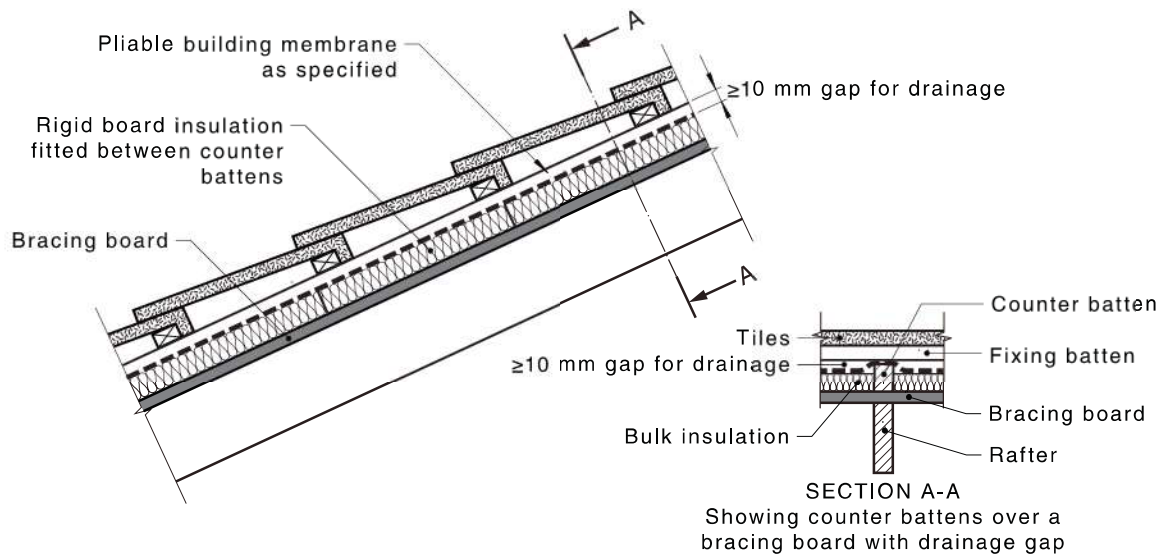


FIGURE 5.2.4.2.2 TILED ROOF WITH RIGID BOARD INSULATION ABOVE A BRACING BOARD

5.2.4.3 Sheeted roofs with sloped ceilings

Bulk insulation installed on sloped ceilings under sheeted roofs shall be installed with members (rafters or joists) above ceiling lining as in Figures 5.2.4.3.1, 5.2.4.3.2 and 5.2.4.3.3. Bulk insulation shall be installed to comply, as appropriate, with—

- Clause 2.5;
- Clause 5.2.4.1(a) to (e); and
- a minimum 20 mm air gap adjacent to the vapour control membrane layer.

NOTE: Insulation will impact for temperature profile, this may affect the risk of condensation, refer to Appendix G.

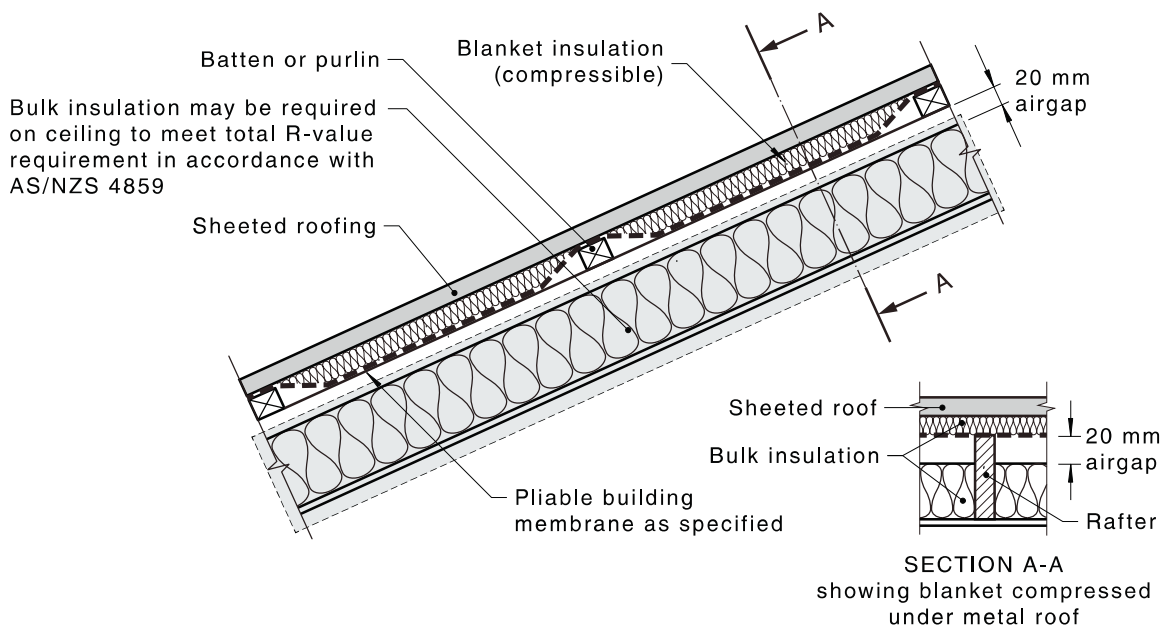


FIGURE 5.2.4.3.1 SHEETED ROOFS WITH COMPRESSIBLE INSULATION

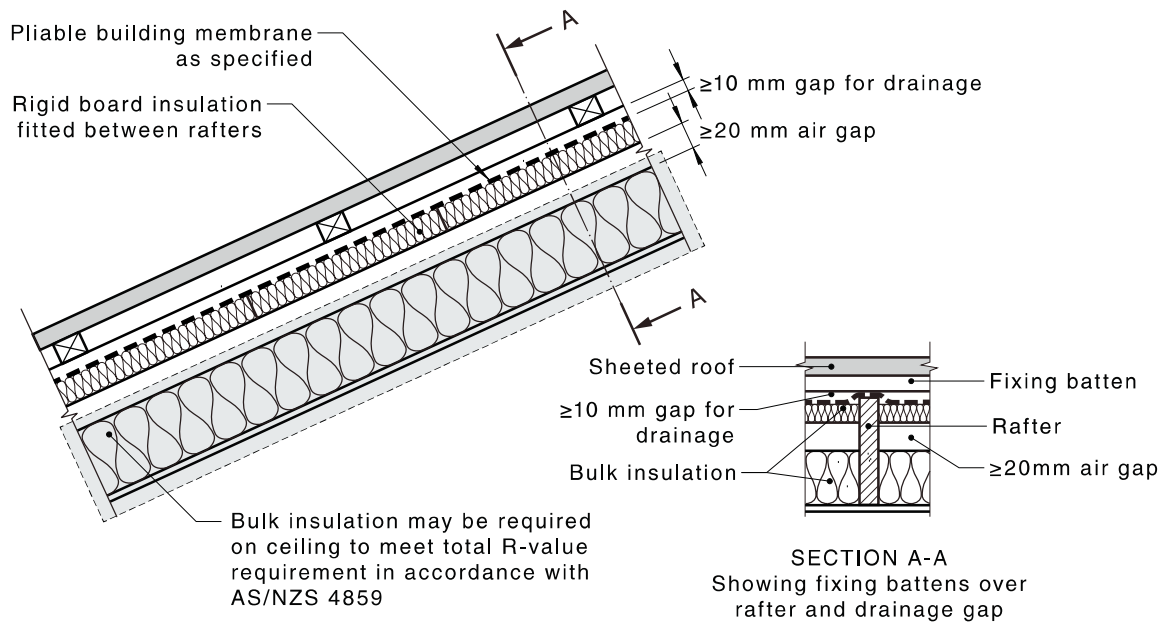


FIGURE 5.2.4.3.2 SHEETED ROOFS WITH RIGID BOARD INSULATION

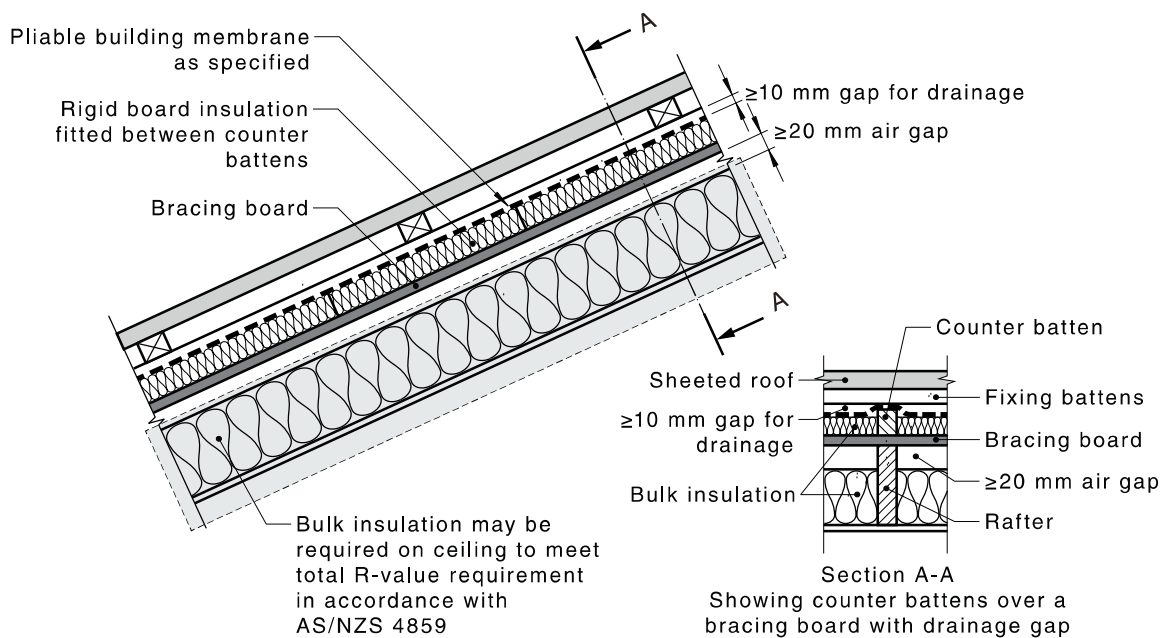


FIGURE 5.2.4.3.3 SHEETED ROOFS WITH RIGID BOARD INSULATION ABOVE A BRACING BOARD

5.2.4.4 Tiled roofs with sloped ceilings

Bulk insulation installed under tiled roofs with roof-supporting members (rafters or joists) above ceiling lining as in Figures 5.2.4.4.1 and 5.2.4.4.2. Bulk insulation shall be installed to comply, as appropriate, with—

- (a) Clause 2.5;
- (b) Clause 5.2.4.2(a) to (d); and
- (c) a minimum 20 mm air gap adjacent to the vapour control membrane layer.

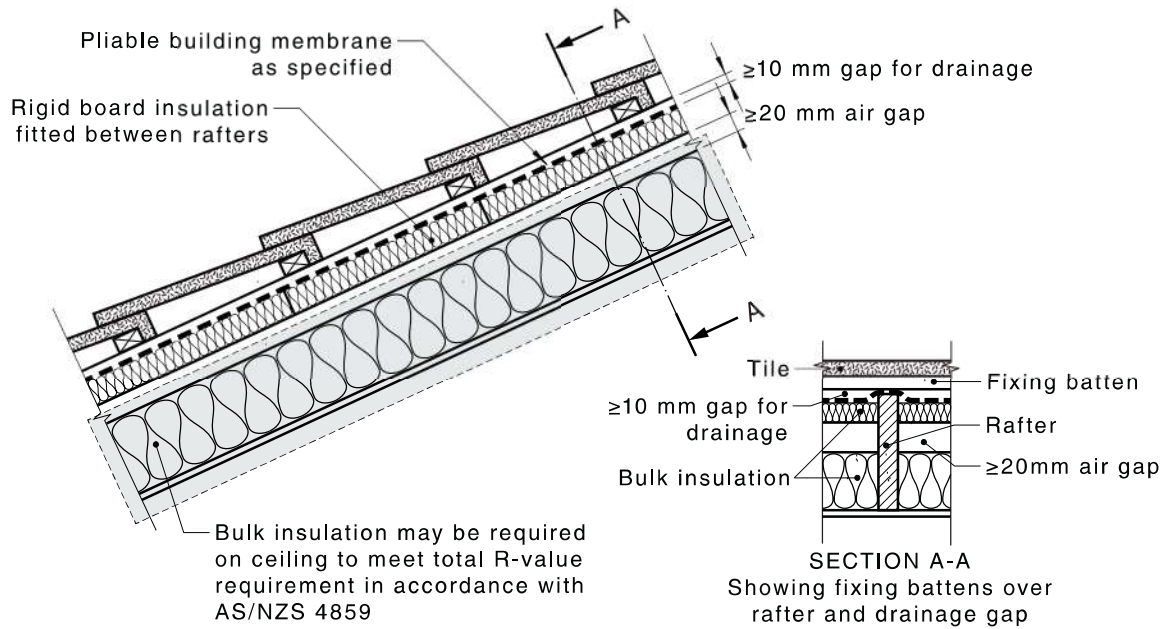


FIGURE 5.2.4.4.1 TILED CATHEDRAL ROOF WITH RIGID BOARD INSULATION

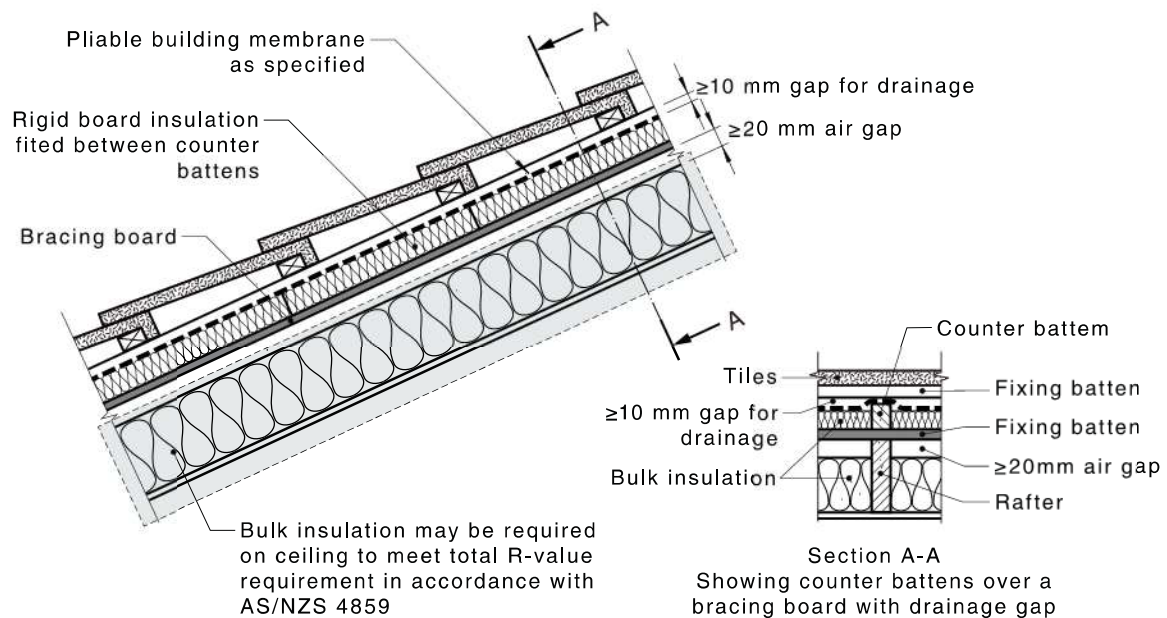


FIGURE 5.2.4.4.2 TILED CATHEDRAL ROOF WITH RIGID BOARD INSULATION ABOVE A BRACING BOARD

5.3 INSTALLATION OF CEILING INSULATION

5.3.1 Scope

This Clause (5.3) outlines the installation of insulation located directly on top of ceiling linings commonly used in dwellings and directly on top of joists or bottom chord of trusses when used in dwellings.

5.3.2 General

5.3.2.1 Ceiling framing

Insulation shall be installed to accommodate the following structural elements:

- (a) Timber-framed constructions as described in AS 1684, Part 1 to 4.
NOTE: For installation of insulation to accommodate common structural elements in trussed roofs refer to Appendix H.
- (b) Nail plated trusses and associated bracing members, bracing strapping and spacing members of as described in AS 4440.
NOTE: An example of insulation to accommodate trusses is provided in Appendix H.
- (c) Metal framed trusses as described in NASH Standard Part 1.
NOTE: Roof trusses are designed to minimum load combinations, as specified in NASH Standard Part 1, which consider the truss self-weight plus weight of the remaining roof system; roofing, roofing, battens, ceiling, ceiling battens, insulation and services.

5.3.2.2 Specific installation issues

In roof spaces with pitched roofs with flat ceilings it shall be ensured that—

- (a) the ceiling insulation can be installed at the perimeter to meet the criteria outlined in Clause 5.3.4;
- (b) the insulation shall be installed to meet safety criteria outlined in Sections 2 and 4 and Appendix A;
- (c) areas adjacent to hot surfaces, such as recessed luminaires, hot fluids, built-in appliances and areas of high air movement, such as exhaust fans shall be fitted with guards unless the insulation product is certified for compliance with the resistance to movement test specified in Appendix C;
- (d) care shall be taken when installing insulation to ensure that it does not interfere with the safety or performance of domestic services and fittings in accordance with Clause 2.4;
- (e) care shall be taken to ensure that the ceiling insulation does not interfere with the safety or performance of internal linings installed according to AS/NZS 2589;
- (f) the ceiling lining fixing method and strength characteristics have been accounted for in the design specification to enable the ceiling to hold the weight of insulation; and
- (g) the insulation is not electrically conductive when intended to be laid on top of ceiling surfaces or ceiling joists.

For the installation of ceiling insulation in existing ceilings refer to Appendix J.

The design specification shall be checked to ensure the bulk insulation is installed in the correct position in relation to any existing membranes already installed or insulation installed in accordance with Clause 5.2 and the requirements of Clause 2.5 are met.

5.3.3 Ceilings below flat roofs

5.3.3.1 Ceilings below metal clad roofs

Bulk insulation on ceilings below flat metal roof with compressed blanket shall be installed as shown in Figure 5.3.3.1.1 and the insulation board between rafters shall be installed as shown in Figure 5.3.3.1.2.

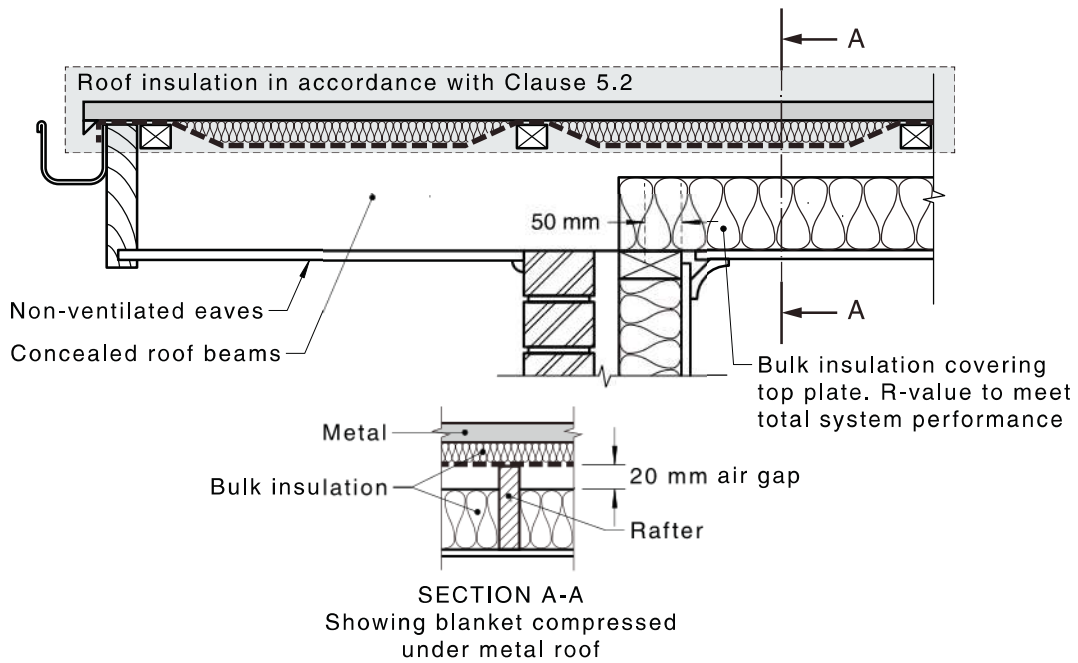


FIGURE 5.3.3.1.1 CEILING BELOW FLAT METAL ROOF WITH COMPRESSED BLANKET

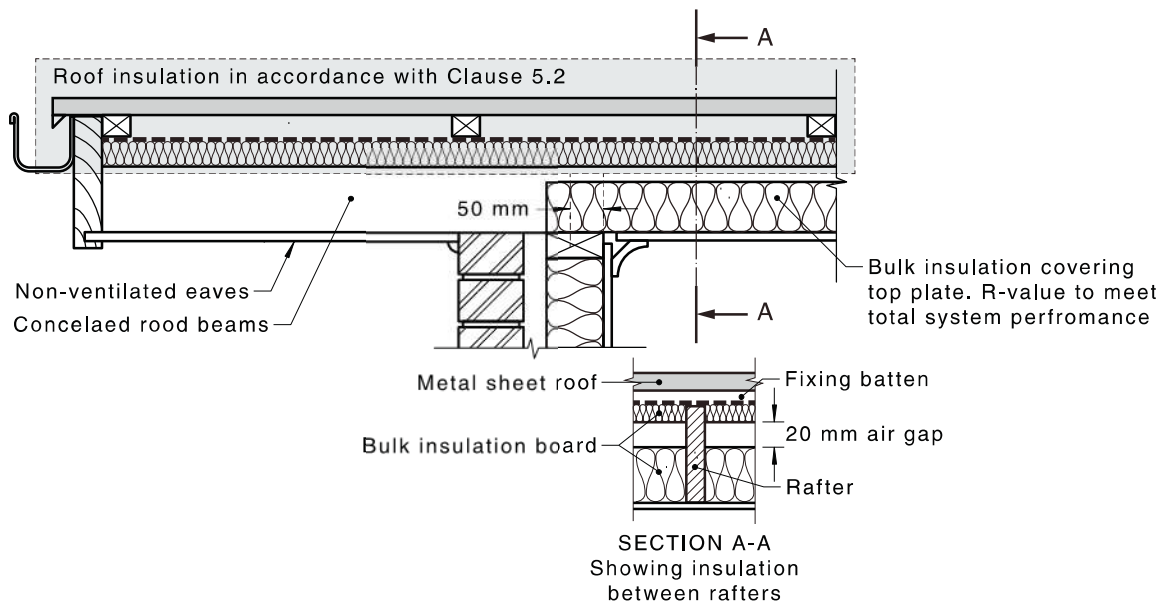


FIGURE 5.3.3.1.2 CEILING BELOW FLAT METAL ROOF WITH INSULATION BOARD BETWEEN RAFTERS

5.3.3.2 Ceilings below concrete roofs

Bulk insulation installed on ceilings below concrete roofs shall comply with the following:

- Bulk insulation on ceilings below concrete roofs shall meet the requirements in Clause 5.2.3.2.
- Insulation of suspended ceiling—bulk insulation shall be installed directly on top of the ceiling lining as in Figure 5.3.3.2.
- Clause 2.5 shall be satisfied.

NOTE: The typical example of this type of system is where a modular suspended ceiling system is to be insulated.

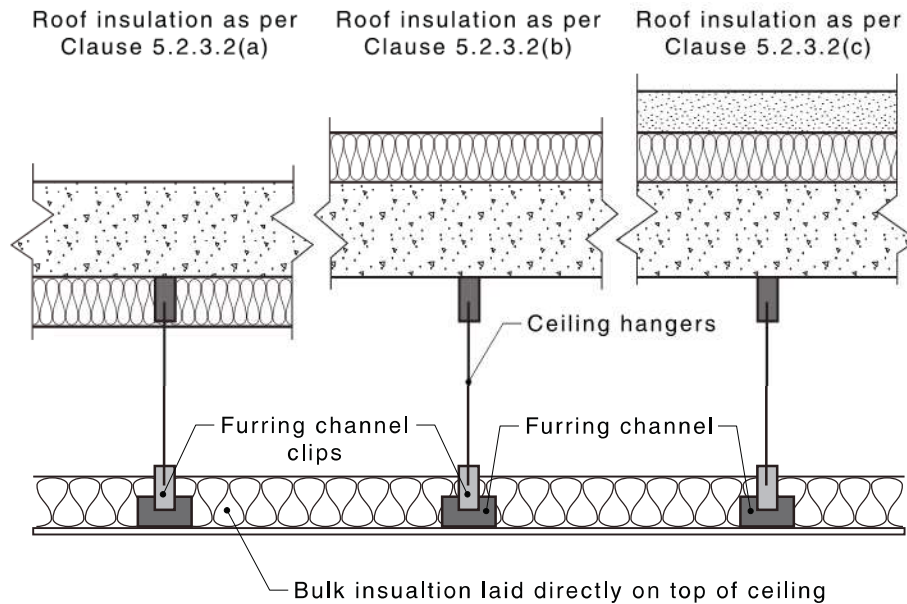


FIGURE 5.3.3.2 CEILING BELOW FLAT CONCRETE ROOFS

5.3.4 Horizontal ceilings below pitched roofs

5.3.4.1 General

Bulk insulation installed on horizontal ceilings under pitched roofs shall comply with the following, as appropriate:

- (a) Where loose-fill insulation is to be placed adjacent to ventilated or open eaves care shall be taken to avoid significant loss of insulation either during or after installation. However, eaves that have been designed to be ventilated shall not be completely blocked and the insulation shall be protected from wind disturbance by a suitable restraint material.

NOTE: Eaves are considered ventilated if they are open eaves, have eave vents or have slotted or perforated eave linings.

- (b) Bulk insulation in ceilings shall extend not less than 50 mm beyond the inside face of the walls enclosing the space to be insulated (see Figures 5.3.4.1.1 and 5.3.4.1.2 and Clause 3.2.2).
- (c) Where bulk insulation is placed on top of ceiling joists, air exchange between the spaces above and below the insulation shall be prevented with particular attention at eaves, flues and any other penetrations through the insulation (see Figures 5.3.4.1.3 and 5.3.4.1.4).
- (d) Where a drop ceiling or a cavity is to be insulated, e.g. above a cupboard, one of the following methods shall be used:
- (i) All horizontal and vertical surfaces shall be insulated with bulk insulation having the same R-value as that specified for the ceiling. Where necessary, the bulk insulation shall be retained in position by a support material as specified in Clause 1.5.2 [see Figure 5.3.4.1.6(a)].
 - (ii) A support material shall be provided to maintain the bulk insulation in the plane of the main ceiling as specified in Clause 1.5.2 [see Figure 5.3.4.1.6(b)]. Where bulk insulation is suspended over a void, air exchange between the spaces above and below the insulation shall be prevented except in cases where heat flow is down only.
- (e) For installing insulation around recessed luminaires, see Appendices A and C.

- (f) For installing insulation around electrical wiring or equipment, see Section 2.
- (g) Where the structure will not accommodate the thickness required to give the specified R-value, a lesser value may have to be specified. The equation in Appendix E shall be used to determine the resulting total R-value when areas of less R-value are used. For correct installation refer to Figure 5.3.4.1.7.

NOTE: For installation of insulation to accommodate common structural elements in trussed roofs refer to Appendix H.

- (h) A clearance of not less than 20 mm shall be maintained between the bulk ceiling insulation and the underside of roof cladding materials or the underside of sarking membranes on completion of installation (see Figure 5.3.4.1.5).

NOTE: However, it is desirable to cut insulation and then place around services providing that such compression is limited so that it does not compromise adjacent linings or roof cover [see Clause 3.4(f)].

- (i) Where an existing installation is to be upgraded any insulation not meeting Items (a) to (h) above the insulation shall be removed or rectified.

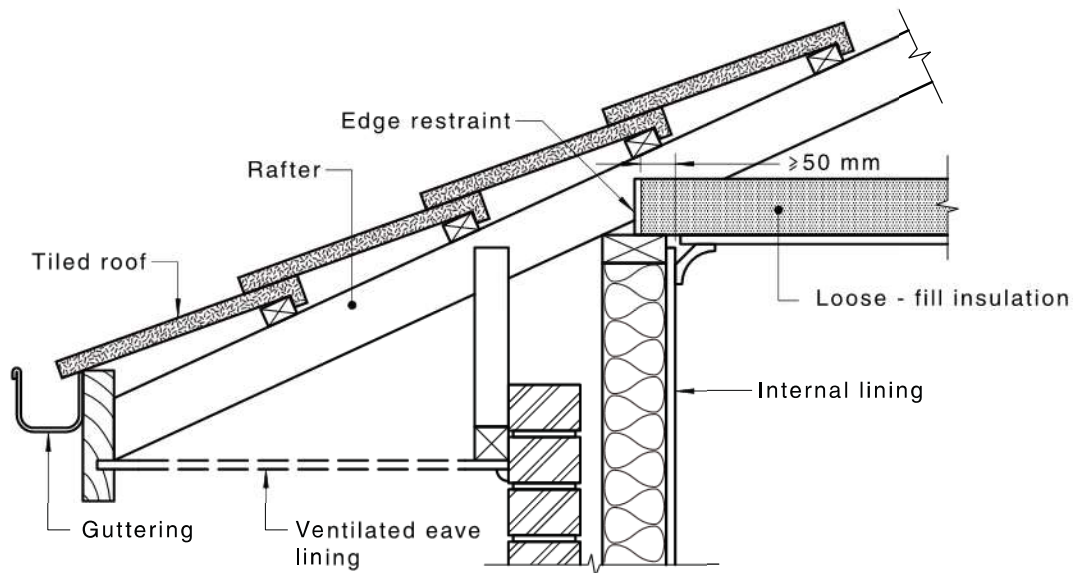


FIGURE 5.3.4.1.1 EDGE RESTRAINT FOR LOOSE-FILL INSULATION WHERE EAVES ARE VENTILATED

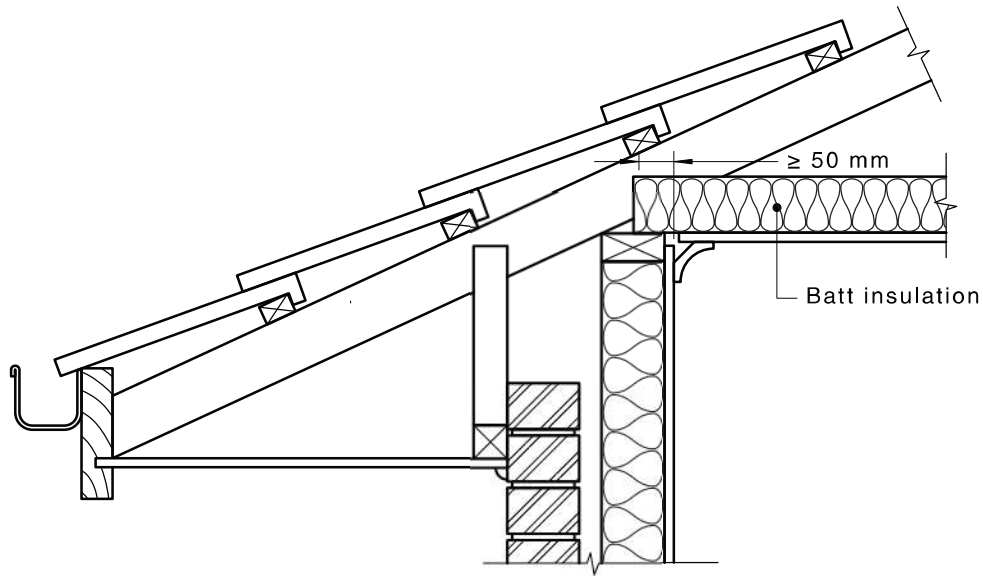


FIGURE 5.3.4.1.2 EXTENSION OF CEILING INSULATION BEYOND INSIDE FACE OF WALL

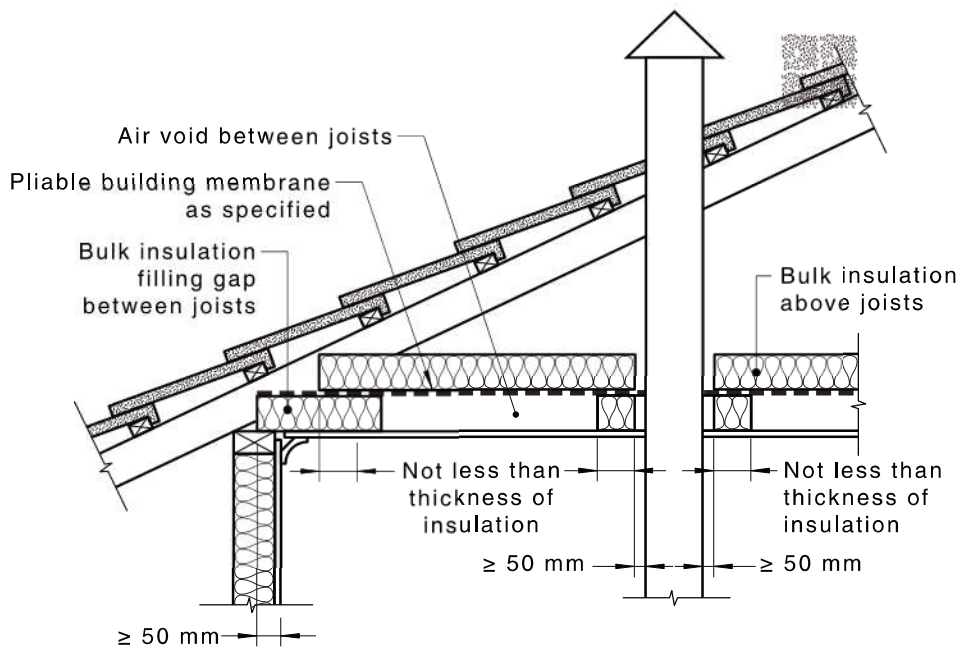
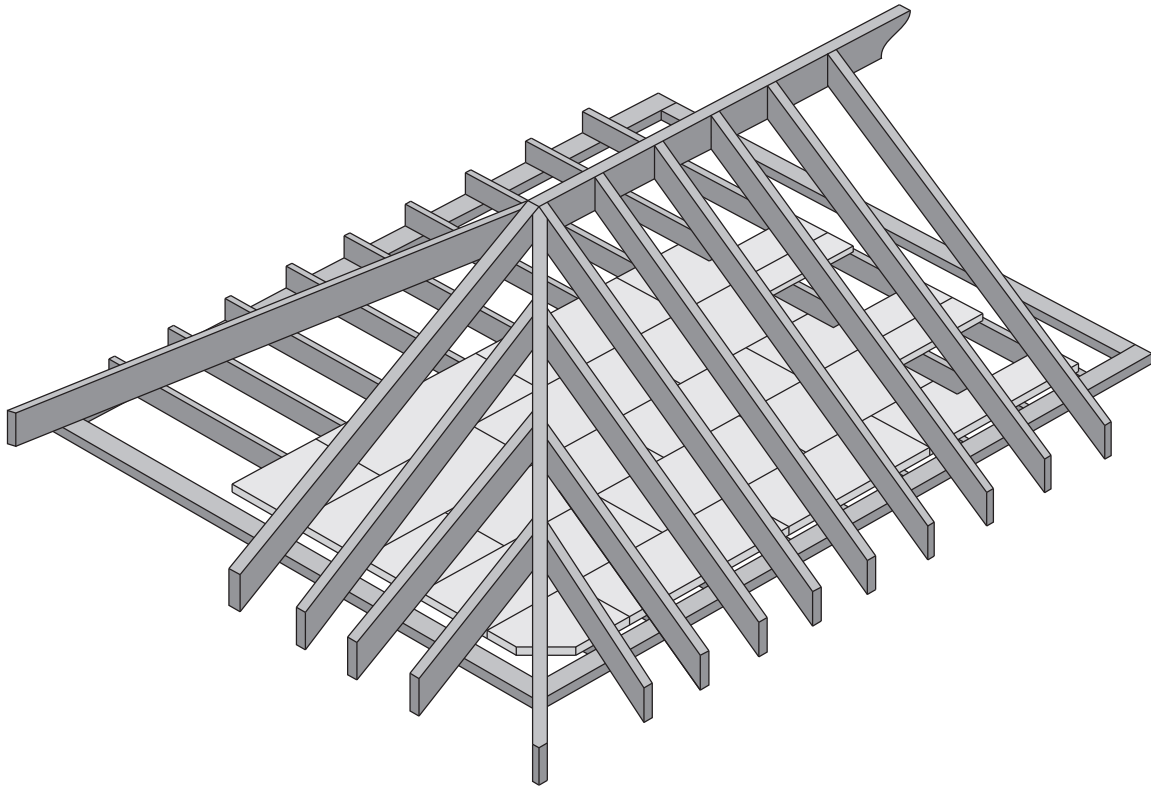
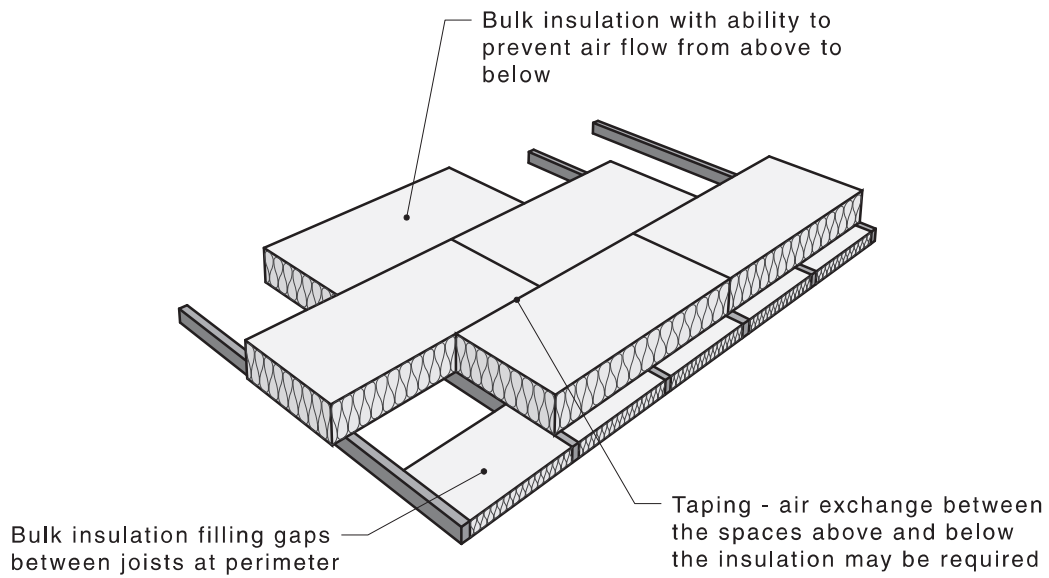


FIGURE 5.3.4.1.3 PREVENTION OF AIR FLOW BELOW INSULATION INSTALLED ON TOP OF CEILING JOISTS



(a) General layout



(b) Method to prevent of air exchange

FIGURE 5.3.4.1.4 BULK INSULATION INSTALLED ACROSS CEILING JOISTS

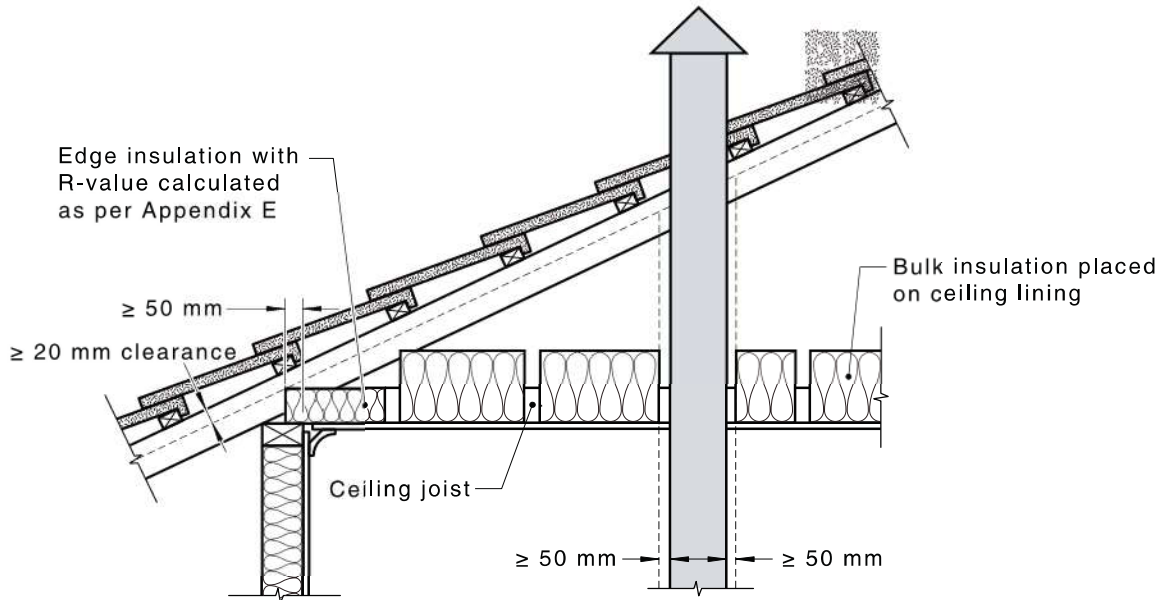
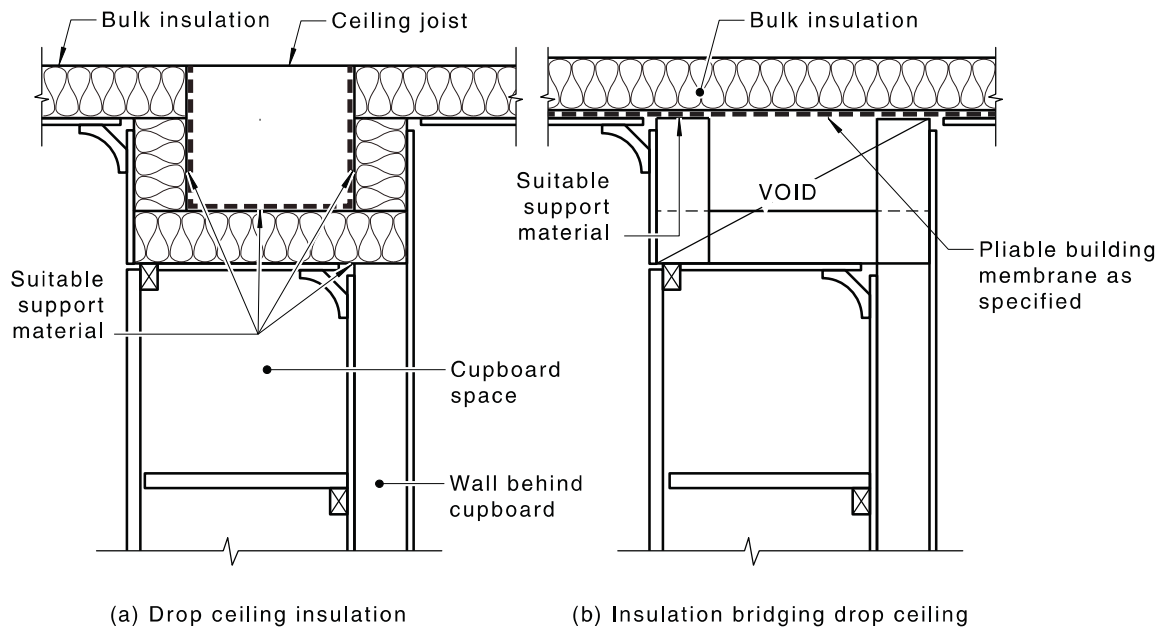


FIGURE 5.3.4.1.5 BULK INSULATION INSTALLED BETWEEN CEILING JOISTS



(a) Drop ceiling insulation

(b) Insulation bridging drop ceiling

FIGURE 5.3.4.1.6 ALTERNATIVE TREATMENTS FOR DROP CEILINGS OR CAVITIES BELOW CEILING LINE

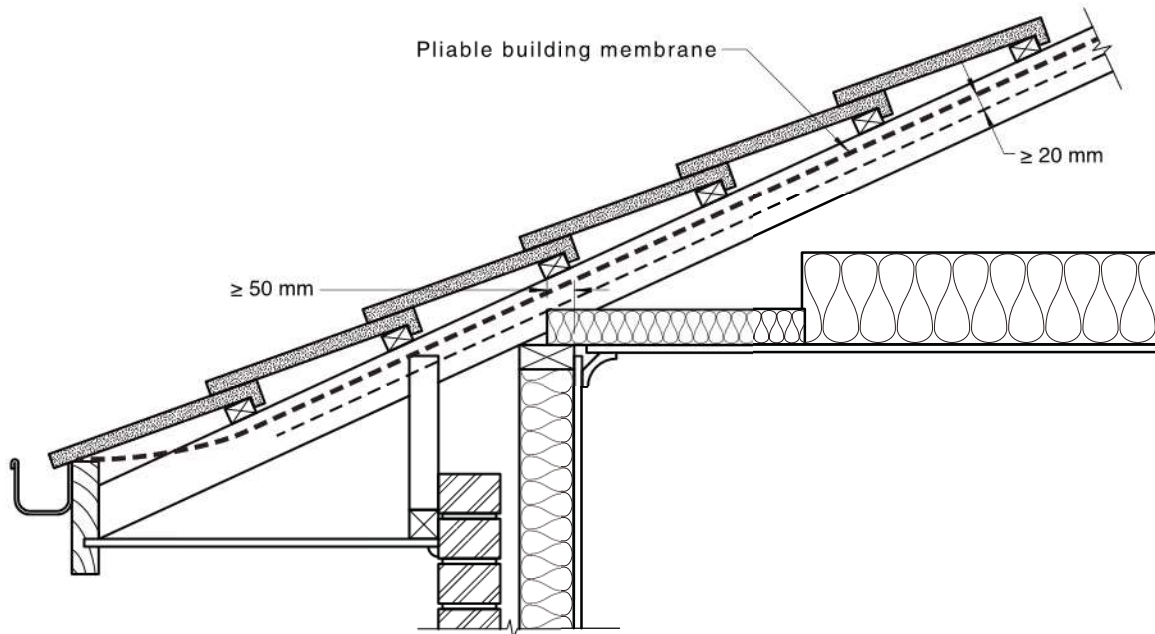


FIGURE 5.3.4.1.7 CLEARANCE OF INSULATION UNDER ROOF SARKING OR CLADDING, ALLOWABLE INSULATION SPACE IN ATTIC ROOF SPACES

5.3.4.2 Horizontal ceilings under pitched roofs

Bulk insulation installed on horizontal ceilings under tiled, metal or sheeted roofs shall comply with the following:

- (a) The bulk insulation shall maintain a minimum of 20 mm air gap between the bulk insulation and sarking membranes or underside of the tiles, metal, other roof sheets or battens (see Figure 5.3.4.1.7).

NOTE: Alternative solutions for other edge insulation methods are shown in Appendix F.

- (b) Bulk insulation installed on horizontal ceilings under pitched metal roofs shall comply with the following, as appropriate:
 - (i) *Ceiling supporting members (joists) above the ceiling lining* The bulk insulation shall be installed either on top of the ceiling lining between the ceiling joists (see Figure 5.3.4.1.5) or across the ceiling joists [see Clause 5.3.4.1(c), and Figures 5.3.4.1.3 and 5.3.4.1.4].
 - (ii) *Ceiling supporting members (joists) below the ceiling lining* The bulk insulation shall be installed directly on the ceiling lining.

5.3.5 Sloped ceiling below pitched roofs

5.3.5.1 General

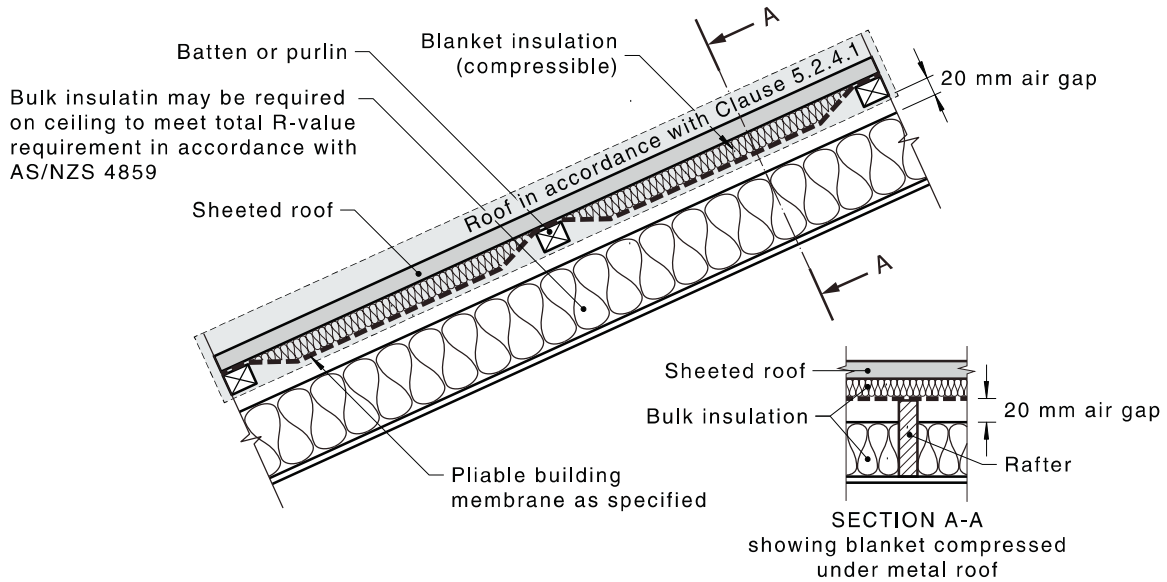
The bulk insulation shall be installed on the ceiling lining between the rafters or joists. Bulk insulation installed on sloped ceilings under pitched roofs shall comply with Clause 5.3.5.2 or Clause 5.3.5.3, as appropriate:

5.3.5.2 Sloped ceilings under pitched sheeted roofs

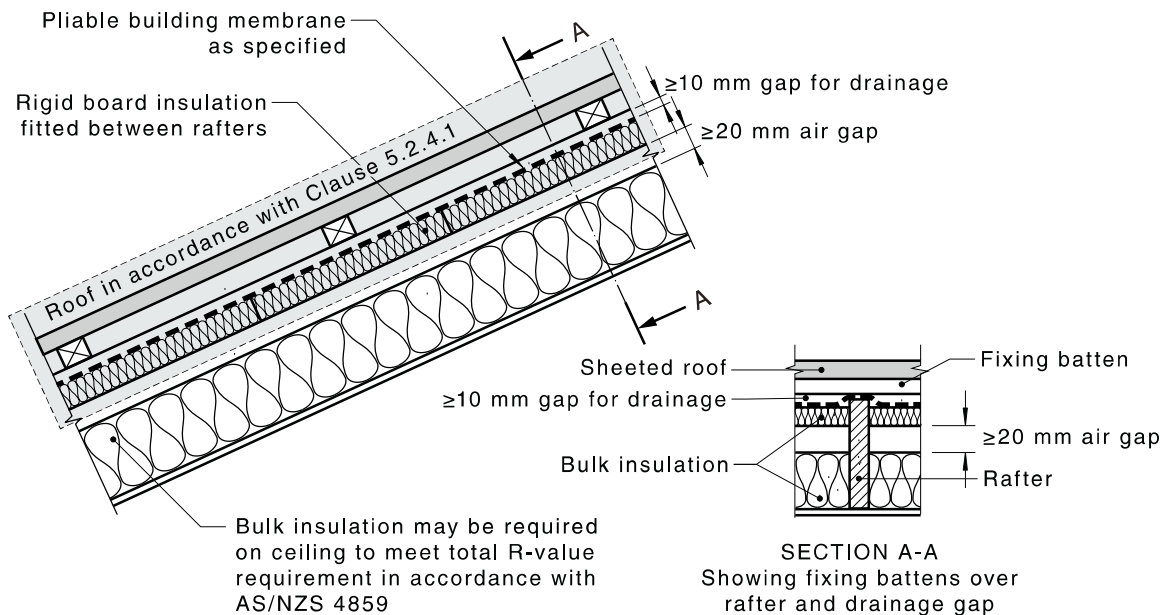
Bulk insulation installed on sloped ceilings under sheeted roofs shall comply with the following:

- (a) Bulk ceiling insulation shall be installed on the ceiling lining between the rafters or joists.
- (b) Bulk ceiling insulation shall be installed under a sheeted roof with insulation in accordance with Figure 5.3.5.2(a), (b) or (c).

- (c) Bulk ceiling insulation shall meet the wall junctions in accordance with Figure 5.3.5.3.2(a), (b), (c) or (d), as appropriate.
- (d) Any other insulation methods not covered in Items (a) or (c) above may be used as long as the requirements in Clause 2.5 are satisfied.

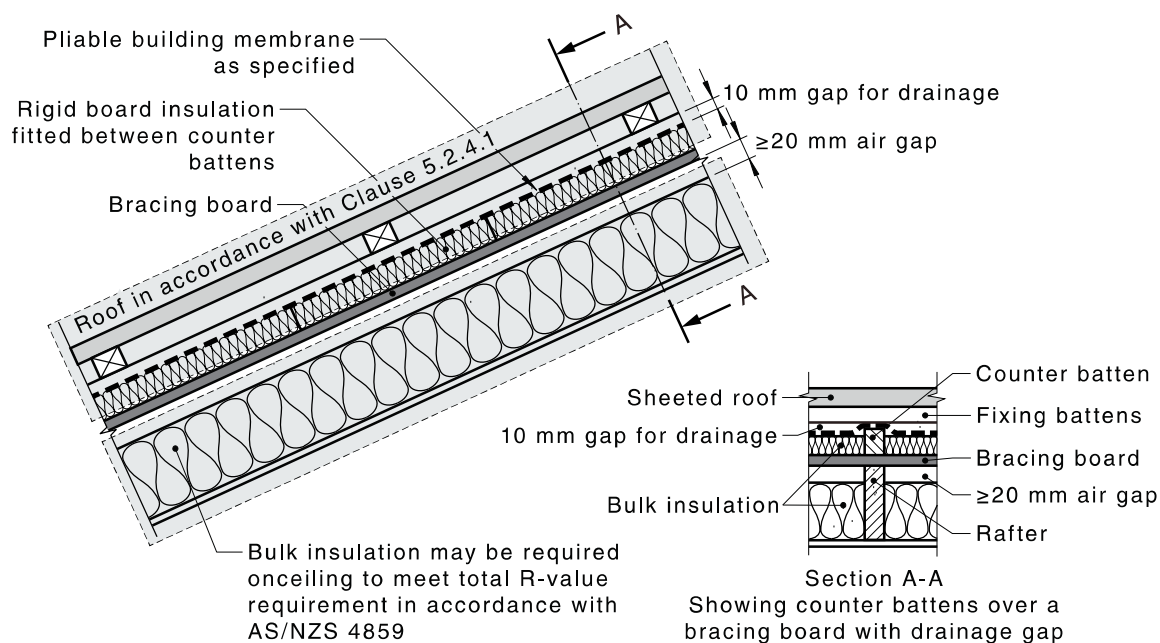


(a) Sloped ceiling below a sheeted roof with compressible bulk insulation



(b) Sloped ceiling below a sheeted roof with rigid board insulation

FIGURE 5.3.5.2 (in part) INSULATING CATHEDRAL CEILINGS UNDER INSULATED METAL ROOF CLADDING



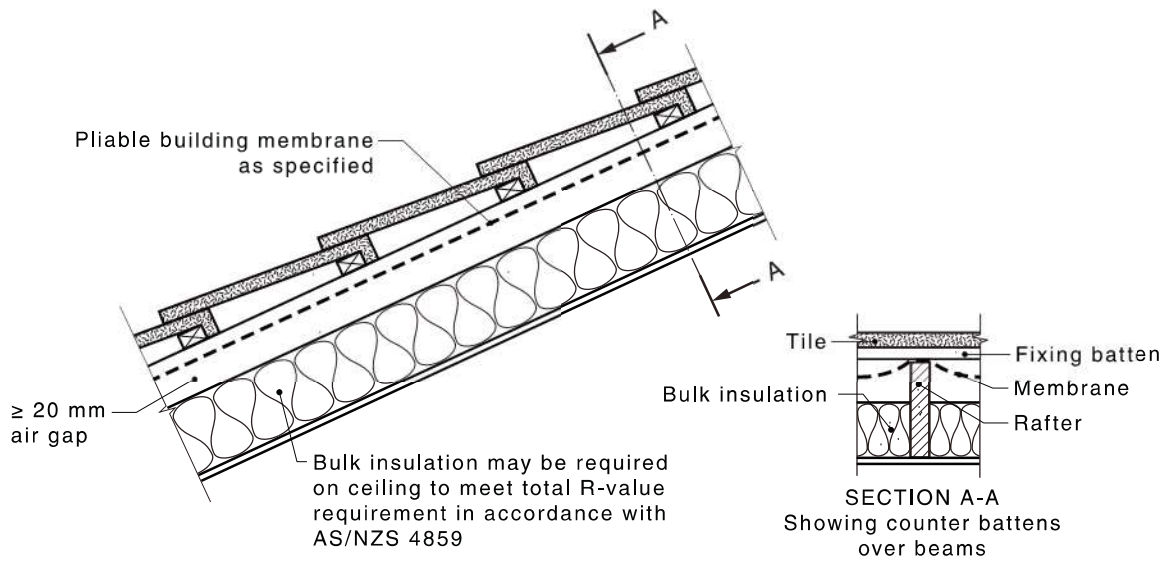
(c) Sloped ceiling below a sheeted roof with bracing board

FIGURE 5.3.5.2 (in part) INSULATING CATHEDRAL CEILINGS UNDER INSULATED METAL ROOF CLADDING

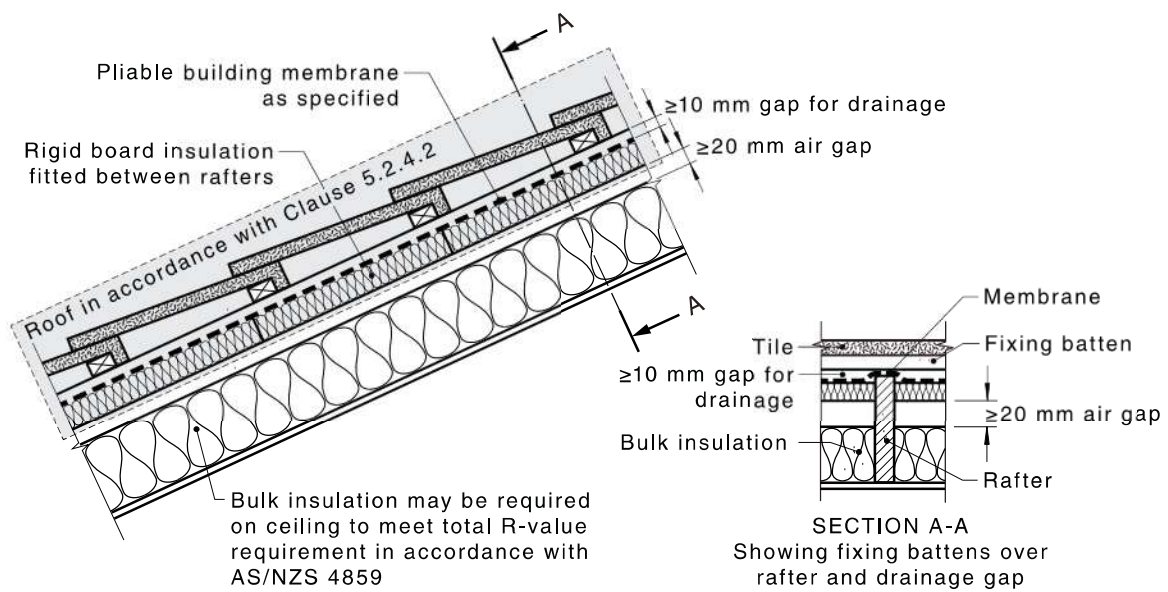
5.3.5.3 Sloped ceilings under pitched tiled roofs (Cathedral)

Bulk insulation installed on sloped ceilings under tiled roofs shall comply with the following:

- Bulk insulation shall be installed on the ceiling lining between the rafters or joists maintaining a clearance of not less than 20 mm between the top of the ceiling insulation and any sarking membranes as in Figure 5.3.5.3.1(a).
- Insulation system in Figure 5.3.5.3.1(b) and (c) shall not need any air clearance between the roof insulation and the ceiling insulation.
- Bulk insulation shall meet the wall junctions in accordance with Figure 5.3.5.3.2(a), (b), (c) or (d), as appropriate.
- Any other insulation methods not covered in Figure 5.3.5.3.1(a), (b) or (c) may be used as long as the requirements in Clause 2.5 are satisfied.

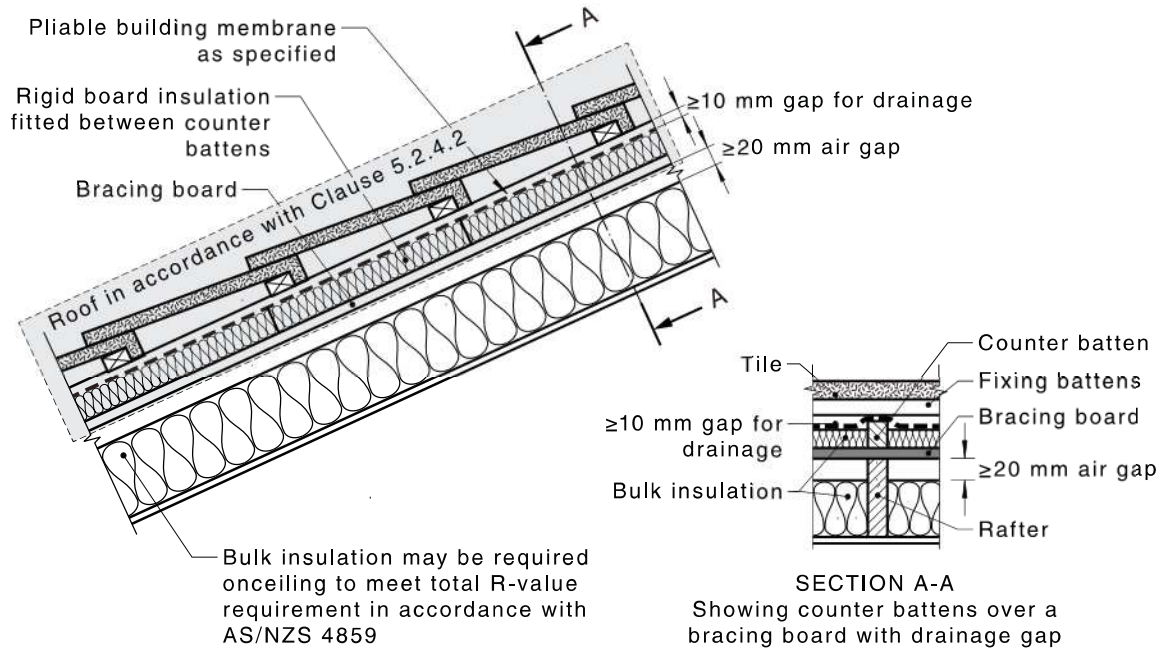


(a) Sloped ceiling below a tiled roof with sarking



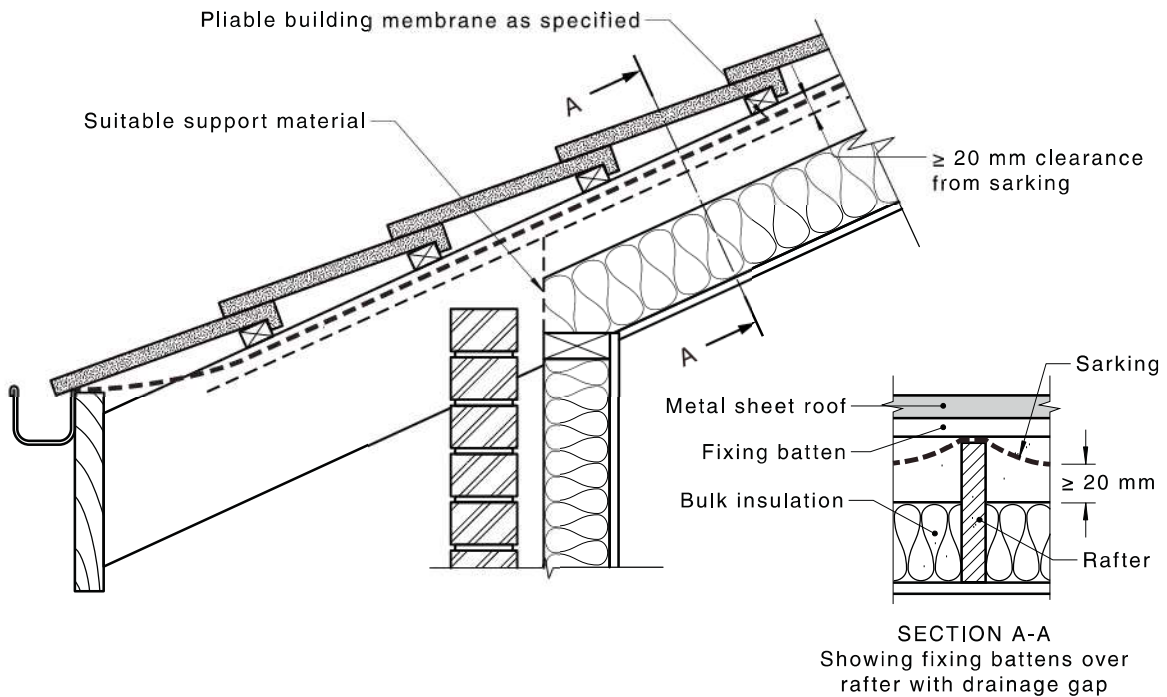
(b) Sloped ceiling below a tiled roof with rigid board insulation

FIGURE 5.3.5.3.1 (in part) INSULATING SLOPED CEILINGS UNDER INSULATED TILED ROOF CLADDING



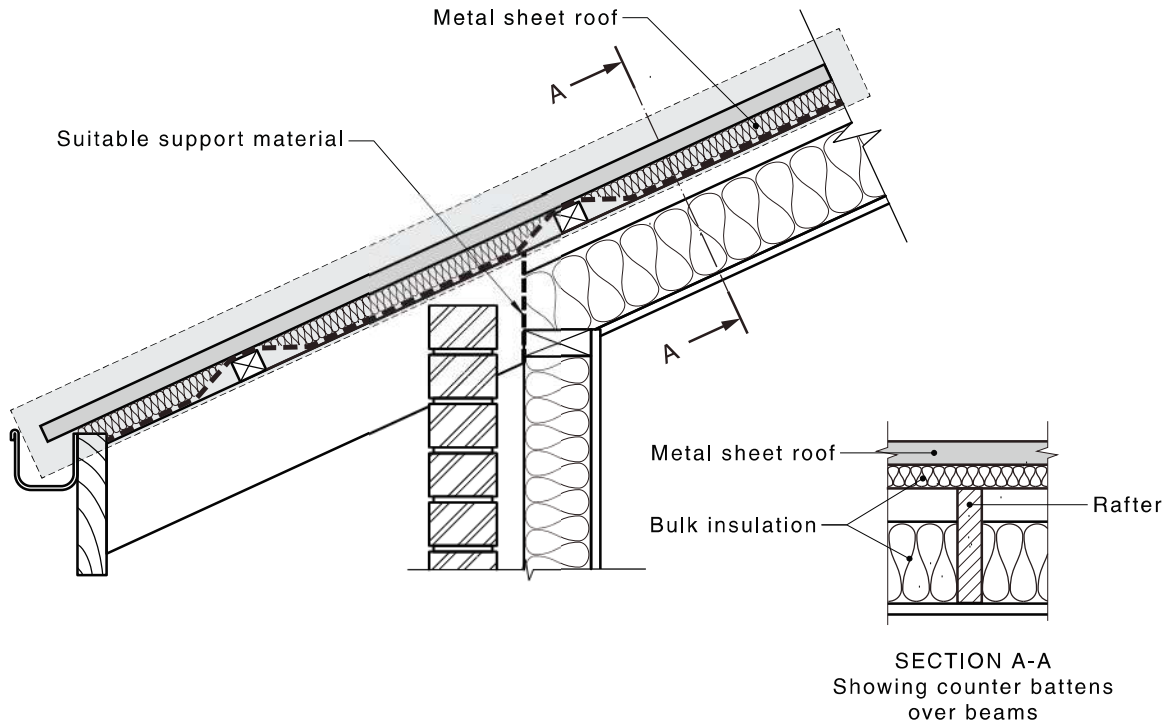
(c) Sloped ceiling below a tiled roof with bracing board

FIGURE 5.3.5.3.1 (in part) INSULATING SLOPED CEILINGS UNDER INSULATED TILED ROOF CLADDING

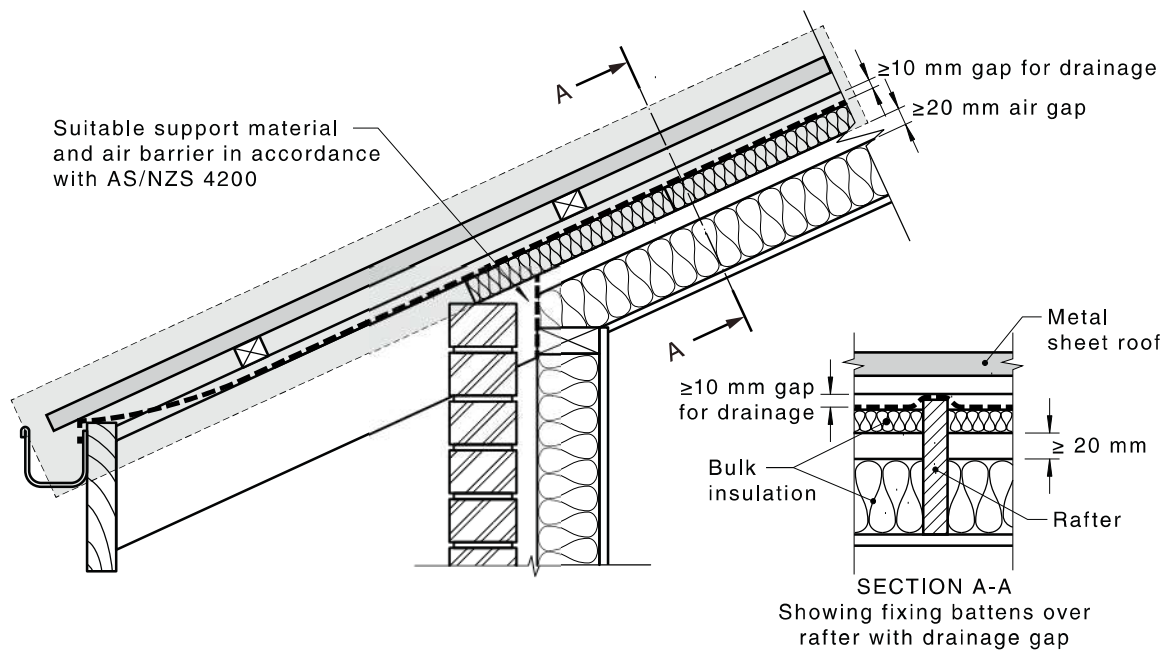


(a) Sloped ceiling below a tiled roof with sarking

FIGURE 5.3.5.3.2 (in part) FORMING A CONTINUOUS INSULATION LAYER BETWEEN CEILING AND WALL JUNCTIONS

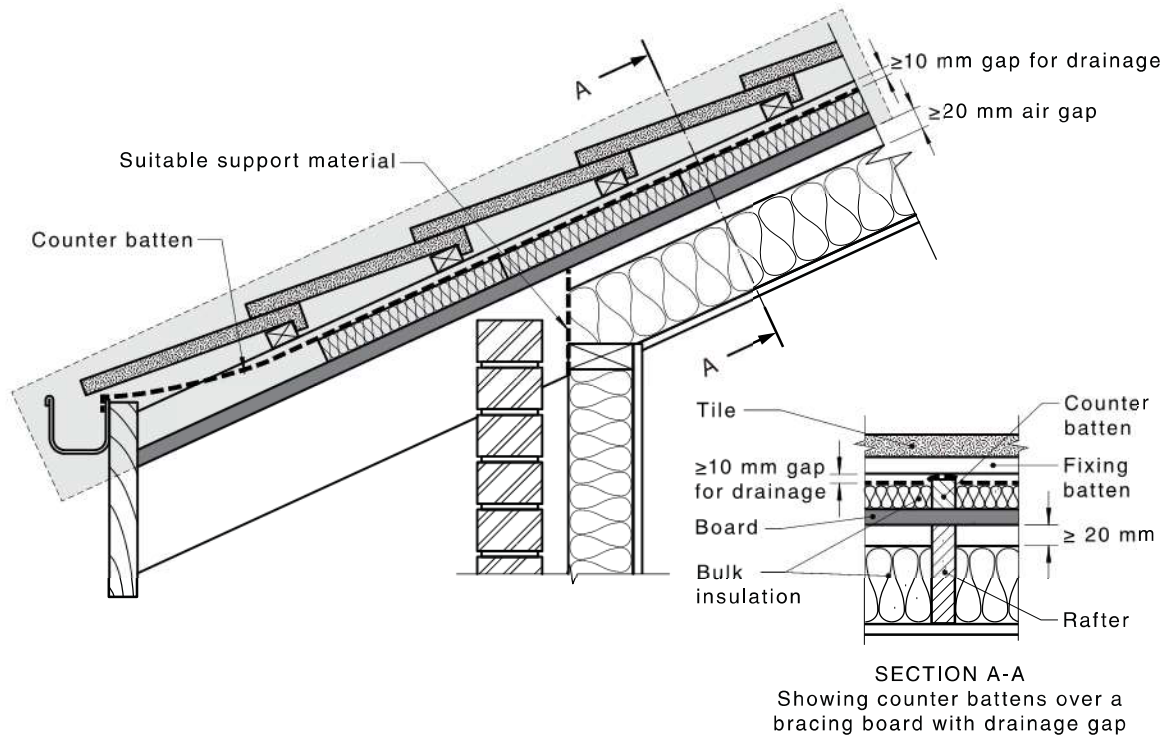


(b) Sloped ceiling below a metal roof with compressible blanket insulation



(c) Sloped ceiling below a roof with rigid board insulation

FIGURE 5.3.5.3.2 (in part) FORMING A CONTINUOUS INSULATION LAYER BETWEEN CEILING AND WALL JUNCTIONS



(d) Sloped ceiling below a roof with insulated bracing board

FIGURE 5.3.5.3.2 (in part) FORMING A CONTINUOUS INSULATION LAYER BETWEEN CEILING AND WALL JUNCTIONS

5.4 INSTALLATION OF WALL INSULATION

5.4.1 Scope

This Clause (5.4) prescribes requirements for the installation of bulk insulation that is common for all walls, in any of the following constructions:

- (a) Framed walls having sheet, board or brick veneer cladding.
- (b) Masonry walls.
- (c) Concrete walls.

5.4.2 General

Bulk insulation installed in walls shall comply with the following, as appropriate:

- (a) The specified R-value and thickness is achieved throughout the insulated wall area. The insulation shall not be compressed below its nominal thickness. Where the specified R-value and nominal thickness is physically not achievable, then the insulation shall be trimmed accordingly so the material is not compressed, folded or tucked.

NOTE: Trimming or a reduction in insulation thickness may be required where a structural member such as a timber lintel or services such as plumbing, cables, ducts, flues and the like obstruct the insulation layer (see Figures 5.4.3.1.3 and 5.4.3.2.2 for lintel). This will in turn affect the thermal performance but is unavoidable in some circumstances.

- (b) In multi-storey construction, the wall space between ceilings and adjacent floors shall be insulated (see Figure 5.4.2).

NOTE: Such installation of bulk insulation will minimize the formation of thermal bridges (energy leakage paths).

- (c) Batt insulation shall be compressed or cut to size where necessary to fit between any pipework or cable in the wall cavity and the wall lining. See Clause 2.6 for details on electrical cables and equipment.
- (d) Insulation shall be installed around electrical cables or equipment in accordance with determination made during the pre-installation consideration and inspection process (refer to Section 2) in accordance with Clause 2.6.
- (e) Before proceeding with the installation, the requirements of Clause 2.5 shall be met.

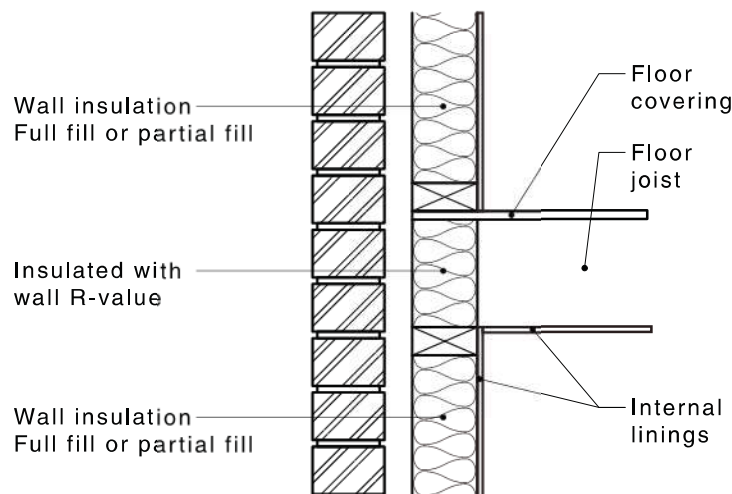


FIGURE 5.4.2 INTERMEDIATE FLOOR/WALL JUNCTION

5.4.3 Metal and timber-framed walls

5.4.3.1 Insulation installed within the frame

When installing insulation to fit between wall framing members:

- (a) Bulk insulation when installed between wall studs shall be in contact with and fit tightly between studs, top and bottom plates and noggins. See Figure 5.4.3.1.1(a) and (b), as appropriate.
- (b) Bulk insulation fitted between studs shall be installed to make contact with the internal wall lining unless otherwise specified.
NOTE: Failure to comply with both the requirements given in Items (a) and (b) may allow the movement of air in the stud space to impair the thermal performance of the installation.
- (c) The total wall area shall be insulated with the specified R-value except where obstructed by structural members (see Figure 5.4.3.1.3) or services.
- (d) The correct width and depth of insulation shall be installed to suit the frame dimensions.
- (e) Insulation shall not be compressed below its nominal stabilized thickness except in accordance with Clause 5.4.2(c).
- (f) There shall be no gaps between the insulation material and the frame or any abutments with adjacent material.

(g) Insulation material shall be of suitable integrity to be self-supporting so that no settling or slumping in the cavity will occur. Where there is an external drainage or ventilation cavity between the cladding and the insulation, the insulation shall be restrained within the frame cavity so that the insulation does not bridge or block the external cavity. In the absence of membranes or sheet bracing, a restraint shall be at least as effective as stringing or strapping spaced at 300 mm spacing, and with maximum 300 mm distance from a structural a stud or noggin (see Clause 1.5.2).

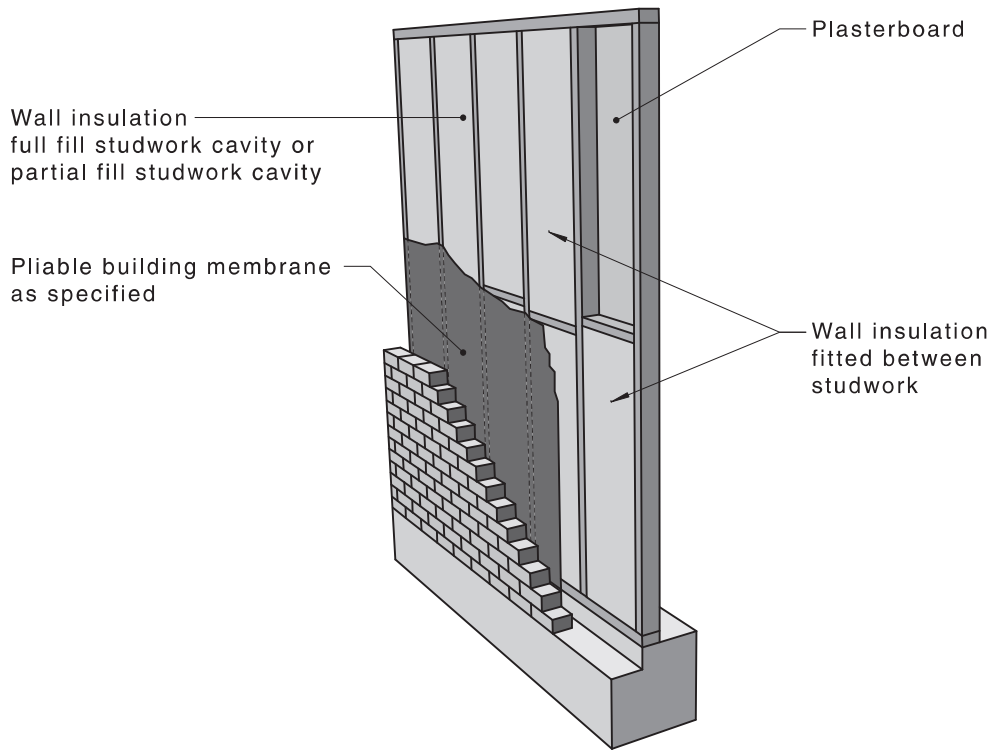
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(h) **‘Text deleted’**

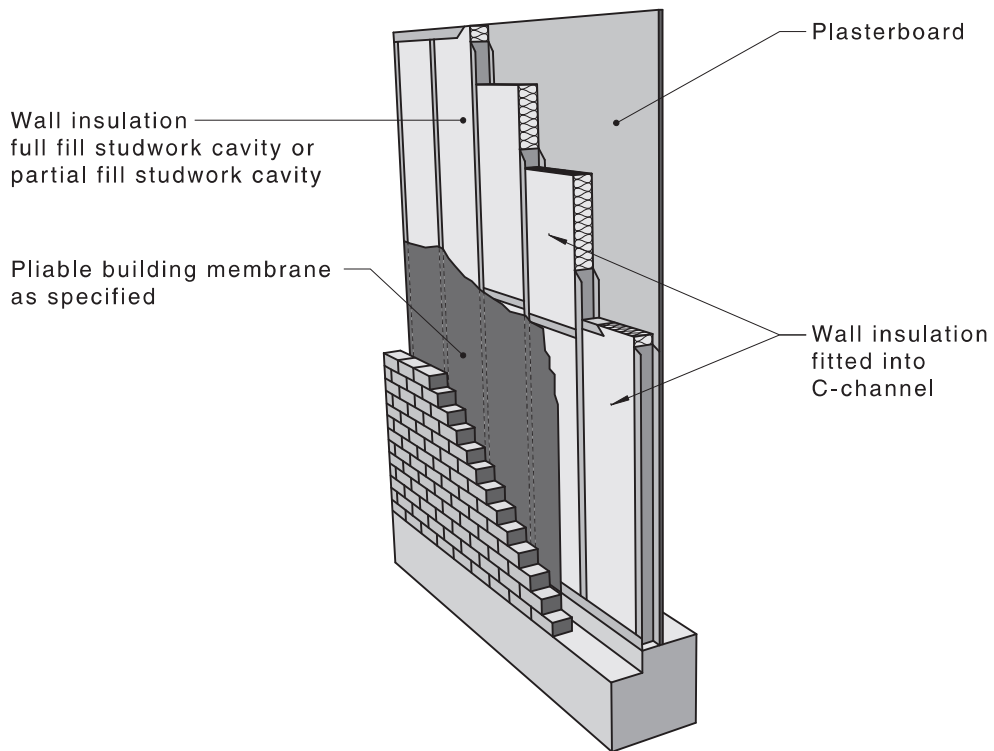
(i) Where there is a narrow gap between non-standard stud spacing’s this shall be filled with the specified insulation thickness as shown in Figure 5.4.3.1.2 where clearances and access permits.

(j) Methods for insulation installed within the frame may be used in conjunction with the method outlined in Clause 5.4.3.2 and Clause 5.4.3.3.

(k) The requirements of Clause 2.5 shall be checked to have been satisfied before proceeding with installation.

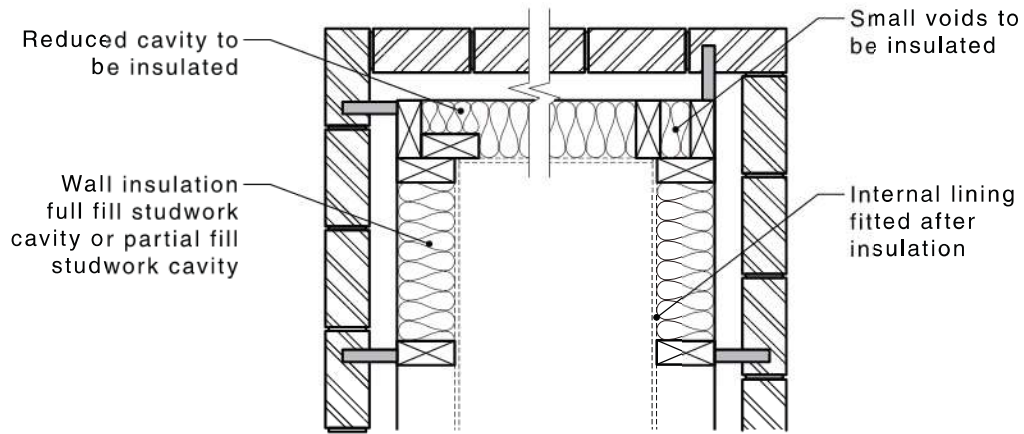


(a) Timber frame

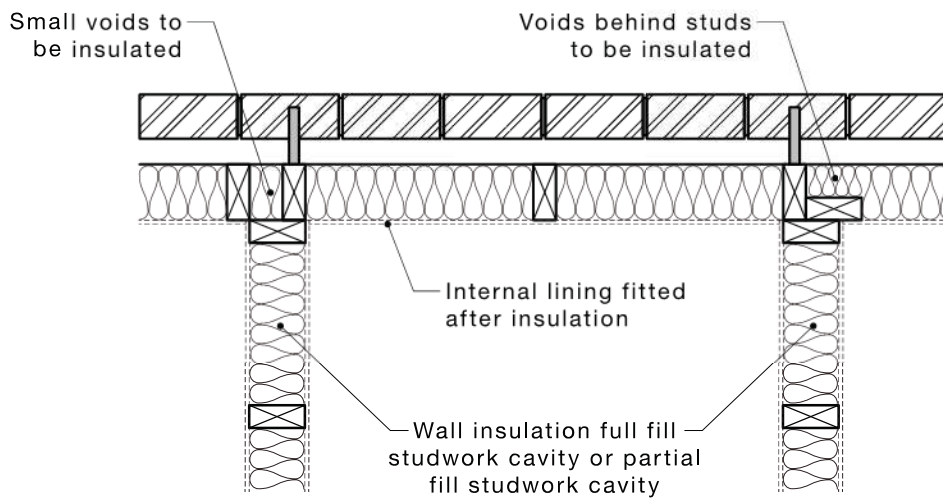


(b) Metal frame and stud channels

FIGURE 5.4.3.1.1 INSULATING WITHIN FRAMES



(a) At corners



(b) At wall junctions

FIGURE 5.4.3.1.2 INSULATING VOID BETWEEN CLOSELY SPACED STUDS

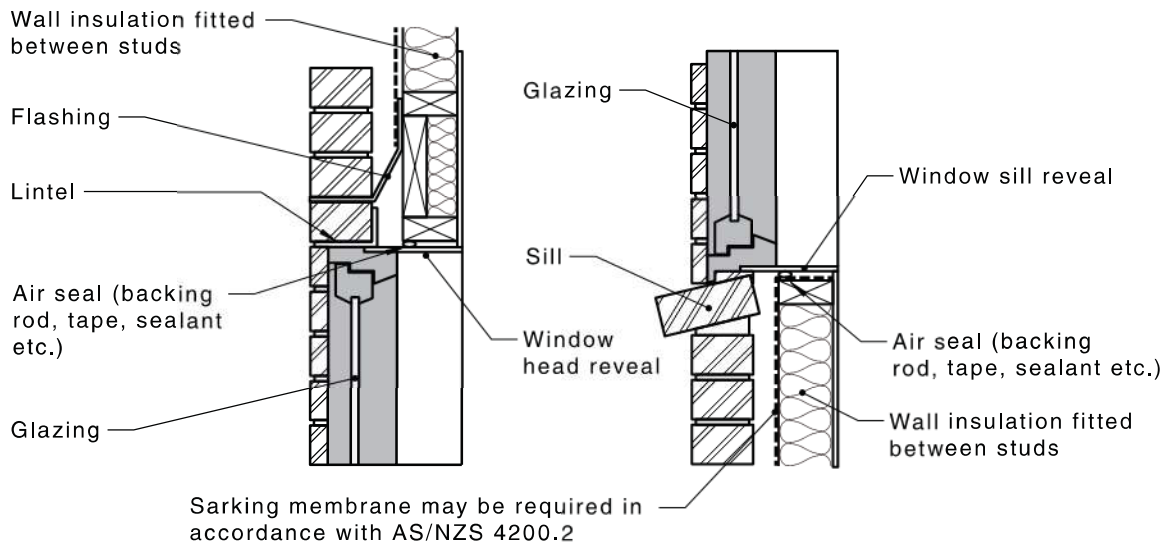


FIGURE 5.4.3.1.3 INSULATING AT WINDOW REVEALS WITH INSULATION WITHIN THE FRAME

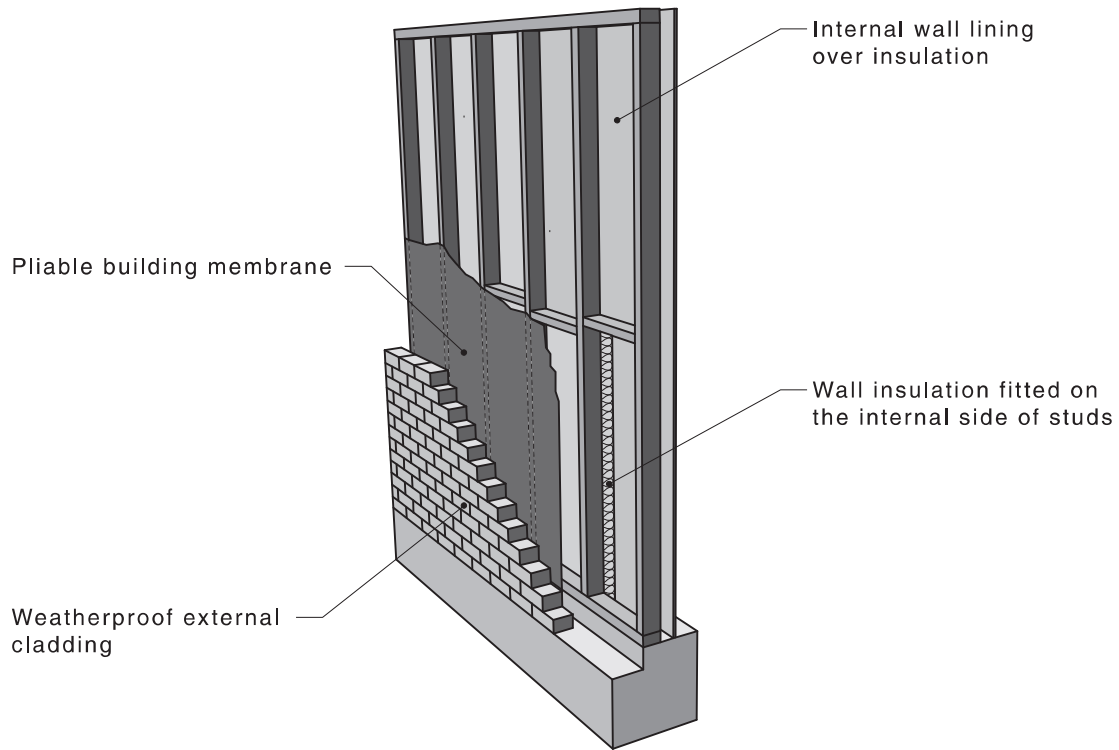
5.4.3.2 Internally insulated

Internal insulation may be installed on the internal surface of walls over which a suitable lining material is installed, as in Figures 5.4.3.2.1 and 5.4.3.2.2. Bulk insulation installed on the internal side of framed walls shall comply with the following, as appropriate:

- (a) The insulation shall be installed such that there are no gaps between segments of insulation or at abutments with other materials.
- (b) Reveals at windows (see Figure 5.4.3.2.2) and doors shall be insulated with a suitable insulation material to achieve maximum thickness possible, up to the design R-value for the wall.
- (c) This method may be used in conjunction with the method outlined in Clause 5.4.3.1 and Clause 5.4.3.3.
- (d) The requirements of Clause 2.5 shall be checked to have been satisfied before proceeding with installation.

NOTES:

- 1 At window and door reveals there is likely to be inadequate space for the design R-value, especially in retrofits to existing buildings therefore the maximum possible R-value should be used.
- 2 Where metal fixings are used to install insulation, i.e. rigid insulation inside a wall, they should be kept to a minimum structural requirement and least thermally conductive fixings should be used to minimize thermal bridging through the fixings.



NOTES:

- 1 This is commonly a composite product and commonly installed by plasterboard installers, and should be installed as per manufacturer's specifications.
- 2 If the insulation component is installed prior to the internal lining the insulation should not compromise the requirements of the wall lining.

FIGURE 5.4.3.2.1 INSULATING INTERNALLY TO THE FRAME

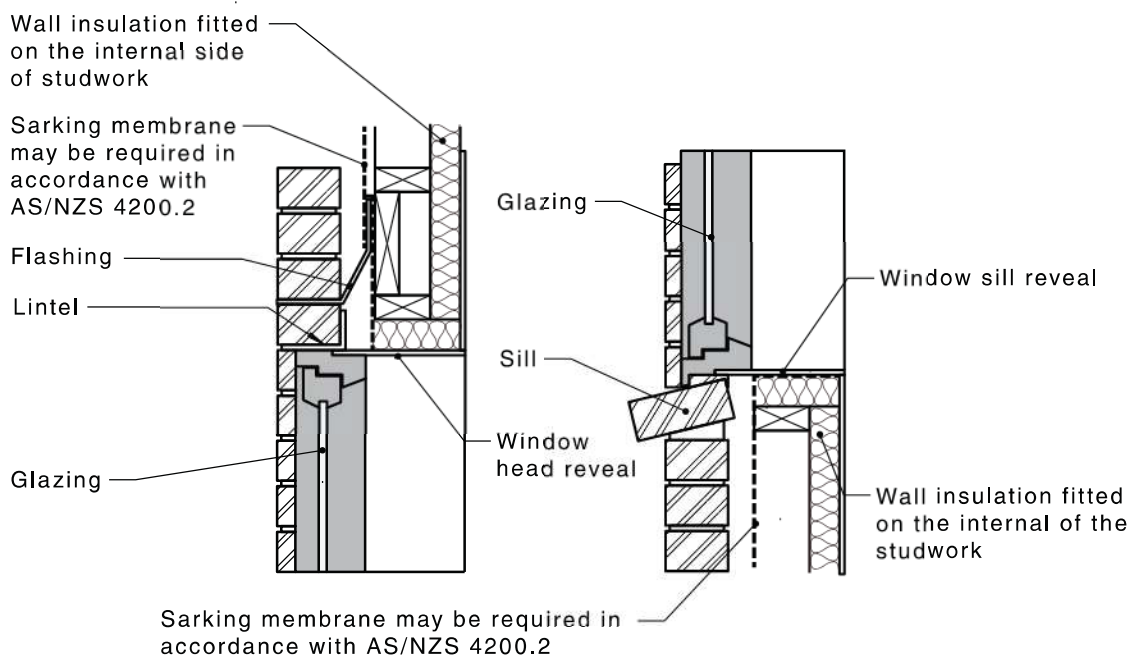


FIGURE 5.4.3.2.2 INSULATING AT WINDOW REVEALS WITH INSULATION

5.4.3.3 Externally insulated frame

External insulation systems are those that can be protected by a weatherproof external cladding (see Figure 5.4.3.3.1). These systems can be used on all wall types including brick, block or concrete, and steel or timber framing.

When externally insulating frame, the following requirements shall apply:

- The chosen insulation material shall be selected with consideration for its suitability for use under the environmental and thermal conditions behind the chosen cladding system (see Clauses 3.2.2 and 3.2.3).
- Where the special features listed in Clause 2.3, Items (a), (b) and (c) are present, the installation shall comply with Clause 2.6 or Clause 2.7, as appropriate.
- Where the special features listed in Clause 2.3, Items (d) and (e) are present, the installation shall comply with Clause 3.4, Items (f) and (g), and shall have a maximum service temperature of not less than 90°C.

NOTE: Dark claddings can generate significant heat if in direct sunlight, therefore, the insulation needs adequate dimensional stability and physical integrity under these conditions.

- Bulk insulation fixed on the outer face of the frame shall be fitted so that the air space between the insulation and the internal lining is sealed as well as is practicable.

NOTE: The thermal effectiveness of bulk insulation installed on the outer face of the frame is seriously affected if outdoor air can move into and out of the stud space.

- In non-masonry veneer construction, bulk insulation shall not contact the inner face of the cladding material.
- In masonry veneer construction, bulk insulation shall maintain a clearance from the inner face of the brick as specified in AS 3700 or AS 4773.

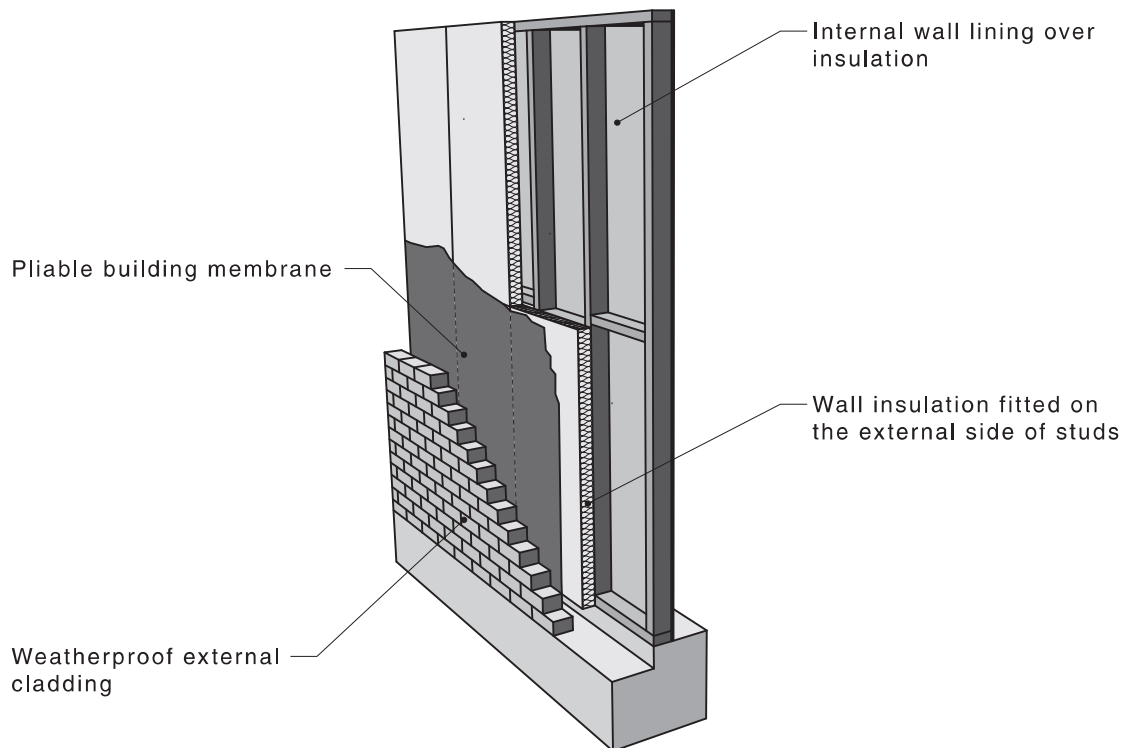


FIGURE 5.4.3.3.1 INSULATING OUTSIDE TO THE FRAME

- (g) The insulation system shall be installed to manufacturer's instructions or design specification.

NOTE: Insulation may play a critical role in the mechanical strength of the external weatherproof layer. Insulation with incorrect properties can compromise the structural integrity and wind loading capacity of the chosen cladding system.

- (h) The insulation shall be continuous over the area to be insulated, i.e. no gaps between segments or at abutments with other materials unless the insulation layer is obstructed by structural elements or services.

Reveals at windows and doors shall be insulated with the maximum thickness possible, up to the design R-value for the wall (see Figure 5.4.3.3.2).

NOTE: At window and door reveals there is likely to be inadequate space for the design R-value, especially in retrofits to existing buildings therefore the maximum possible R-value should be used.

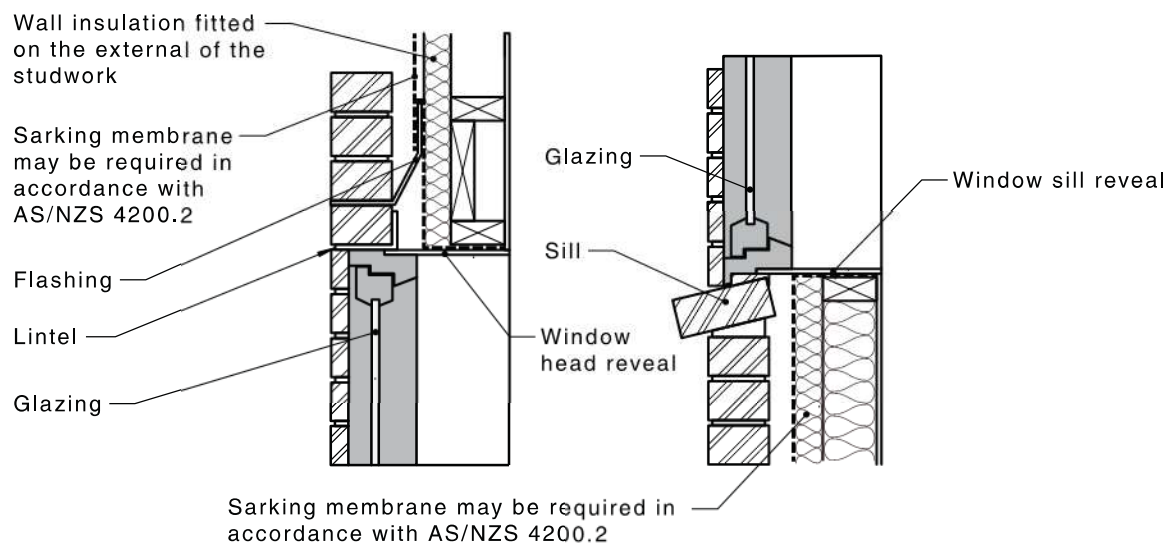


FIGURE 5.4.3.3.2 INSULATING AT WINDOW REVEALS WITH INSULATION EXTERNALLY TO THE FRAME

- (i) The insulation shall be neatly abutted to penetrations so that there are no gaps.
- (j) The insulation shall cover the entire area of the wall from at least 50 mm below internal floor level up to ceiling height.

NOTES:

- 1 Where metal fixings are used to install insulation, i.e. rigid insulation outside a frame, they should be kept to a minimum while still meeting structural requirement and least thermally conductive fixings should be used to minimize thermal bridging through the fixings.
- 2 External insulation method may be used in conjunction with the method outlined in Clause 5.4.3.1 and Clause 5.4.3.2.

5.4.3.4 Condensation

The requirements of Clause 2.5 shall be satisfied before proceeding with installation of wall insulation.

5.4.4 Cavity masonry insulation

When insulation is installed in a brick wall cavity the following applies:

- (a) The insulation shall be installed against the inner leaf of the wall and a gap not less than specified in AS 3700 or AS 4773 between the bulk insulation and the outer leaf of the wall (see Figure 5.4.4).

Where it is not practicable to maintain a gap of not less than 25 mm between the bulk insulation and the outer leaf of the wall, the procedure of complete cavity fill as described in Clause 5.4.2(c) shall be followed. Mortar extrusions shall be cleaned off the inner leaf to give a smooth surface against which the insulation shall be permanently fixed (see Figure 5.4.4).

NOTE: Partial cavity fill is most readily achieved by the inner leaf being constructed ahead of the outer leaf.

- (b) The insulation shall be continuous over the area to be insulated, i.e. no gaps between segments or at abutments with other materials.
- (c) The insulation shall be restrained against the internal leaf so that it cannot obstruct or bridge the designed cavity width.

NOTE: Where cavities are designed in walls it is often to provide weatherproofing by limiting the potential for moisture ingress into the building. This requirement is intended to ensure that this function is not compromised by the insulation system.

- (d) The insulation shall cover the entire area of the wall from at least 50 mm below internal floor level up to wall plate level in height, and the insulation shall abut where it meets at corners.
- (e) Cavity wall insulation installation shall not interfere with requirements laid out in AS 3660.1 on termite management, AS 3700 on masonry structures and AS 4773 on masonry in small buildings.

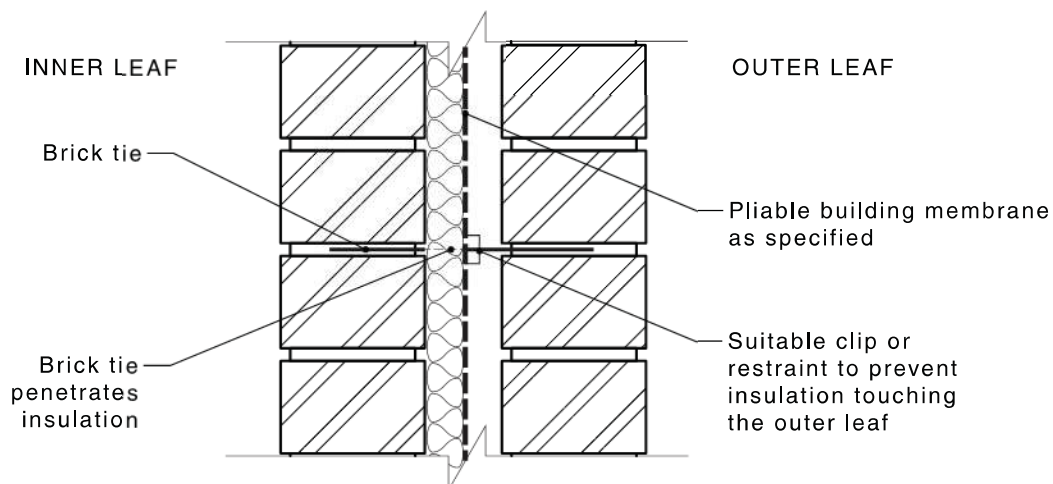


FIGURE 5.4.4 MASONRY CAVITY WALLS—PARTIAL FILL CAVITY INSULATION

5.4.5 Solid masonry, stone and concrete

Where solid masonry walls are to be insulated the insulation installation shall meet the same requirements as externally insulated and internally insulated timber and metal framed walls as well as the following requirements for rigid and compressible insulation types:

- (a) *Insulation on the inside of the wall* Bulk insulation shall be installed on the inner face of the masonry wall by suitable fixing devices, the type and spacing of which shall comply with the insulation manufacturer's specifications.

Alternatively, it shall be held in place by a suitable support material or internal lining, fixed on the inside of battens or furring channels between which the insulation shall be located.

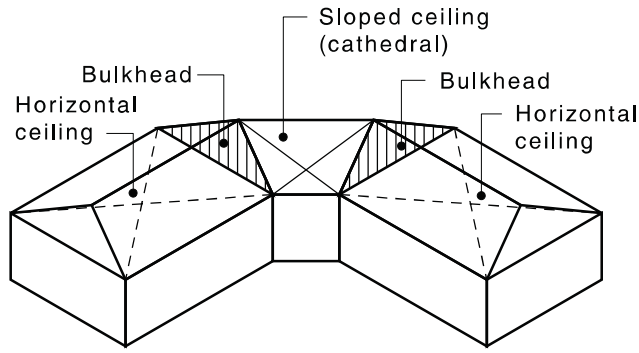
- (b) *Rigid board bulk insulation* Rigid board insulation shall be installed on the outside of the masonry wall using mechanical fixing devices, the type and spacing of which shall comply with the insulation manufacturer's specifications. The rigid board insulation shall be covered with a wall cladding material fastened to the masonry wall to comply with the insulation manufacturer's specifications.
- (c) *Compressible insulation types* Suitable mounting, framing, channels, battens or the like shall be in place prior to insulation installation to prevent compression of insulation and fixing of linings or claddings to be installed in accordance with AS/NZS 2589.

5.4.6 Bulkheads

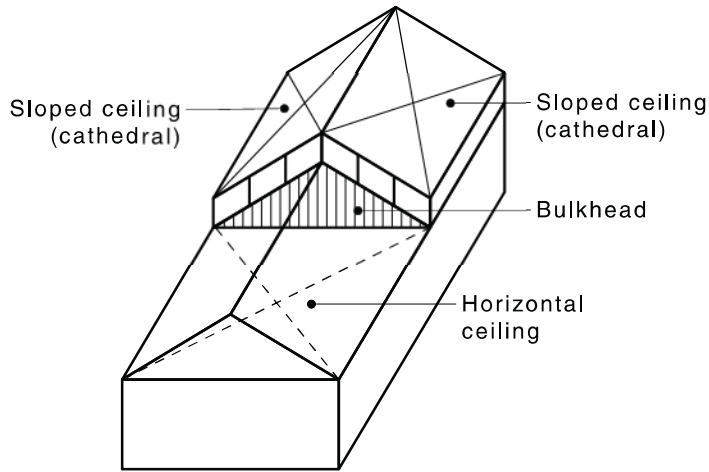
Bulkheads separating spaces to be insulated from those uninsulated shall have bulk insulation installed to comply with Clause 5.4.2.

NOTES:

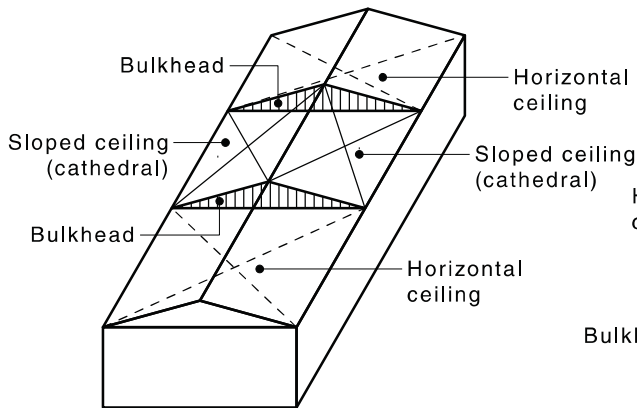
- 1 The installation of bulk insulation in bulkheads minimizes the formation of thermal bridges.
- 2 Examples of building configurations in which bulkheads may require bulk insulation are shown in Figure 5.4.6.



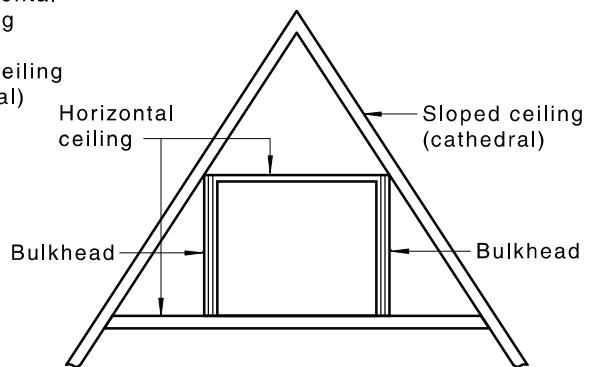
(a) Multi-angled construction



(b) Split level construction

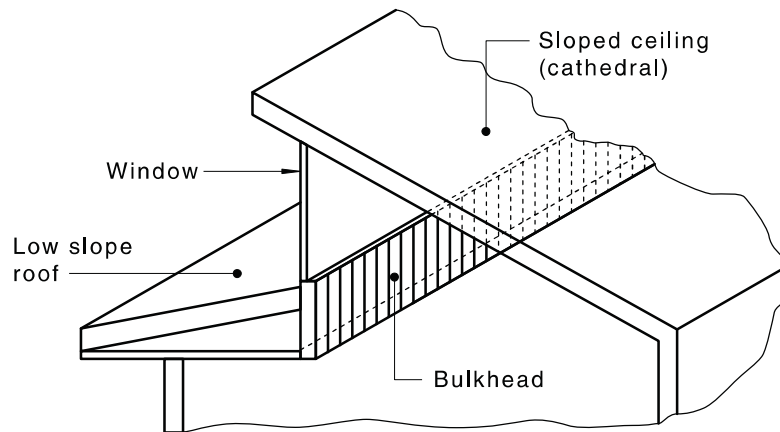


(c) Terrace construction



(d) Cape Cod construction

FIGURE 5.4.6 (in part) EXAMPLES OF BULK HEADS



(e) Saw-tooth roof construction

FIGURE 5.4.6 (in part) EXAMPLES OF BULK HEADS

5.5 INSTALLATION OF FLOOR INSULATION

5.5.1 Scope

This Clause (5.5) prescribes requirements for the installation of bulk insulation in suspended framed floors concrete slab on ground, elevated concrete slabs or floating floors.

5.5.2 General

5.5.2.1 Suspended floors

The insulation of the suspended flooring systems framed with either timber or metal with sheet or panel flooring (including aerated concrete) fixed to the floor structure, shall comply with the following:

- Bulk insulation shall be installed in suspended floors to form a thermal barrier between conditioned and unconditioned spaces.
- Aerated autoclaved concrete is commonly supported with framed support systems and shall be insulated in the same manner as Item (a).
- The installed insulation shall comply with Clause 5.5.3.1.

5.5.2.2 Suspended concrete slabs

Under suspended concrete slabs insulation shall comply with the following:

- Be installed to form a continuous thermal barrier between conditioned and unconditioned spaces including subfloors and external air.
- Aerated autoclaved concrete can also be used as structural precast panels spanning between supporting members and will be insulated in the same way as a suspended concrete slab.
- The details of the installed insulation shall comply with Clause 5.5.3.2.

5.5.2.3 Concrete slab on ground

Concrete slabs are commonly used in direct contact with the ground and bulk insulation installation shall comply with the following, as appropriate:

- Bulk insulation shall be installed either under the entire slab forming a continuous barrier, under a designated perimeter area or on the slab edge.
- The bulk insulation shall be rigid board insulation of sufficient compressive strength and stiffness to carry the loads of the structure as outlined in AS 2870, or where the structure is outside the scope of AS 2870, loads as determined by the structural engineer.
- The details of the installed insulation shall comply with Clause 5.5.5.

5.5.2.4 *Floating floors*

Floating floors are commonly used to provide insulation against the transmission of heat, sound, vibration or all three and shall comply with the following:

- (a) Provide a discontinuous construction for full thermal isolation from the building structure.
- (b) The floor finish (facing) in which the upper layer(s) floor shall be supported on a resilient insulation layer.

5.5.2.5 *Termite management*

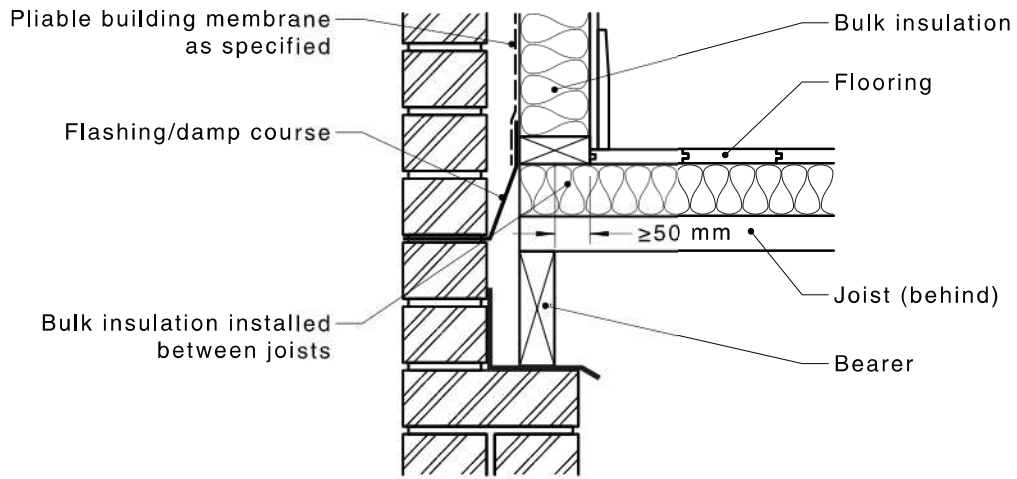
All floor insulation installation shall not interfere with termite management requirements set out in AS 3660.1.

5.5.3 **Suspended floors**

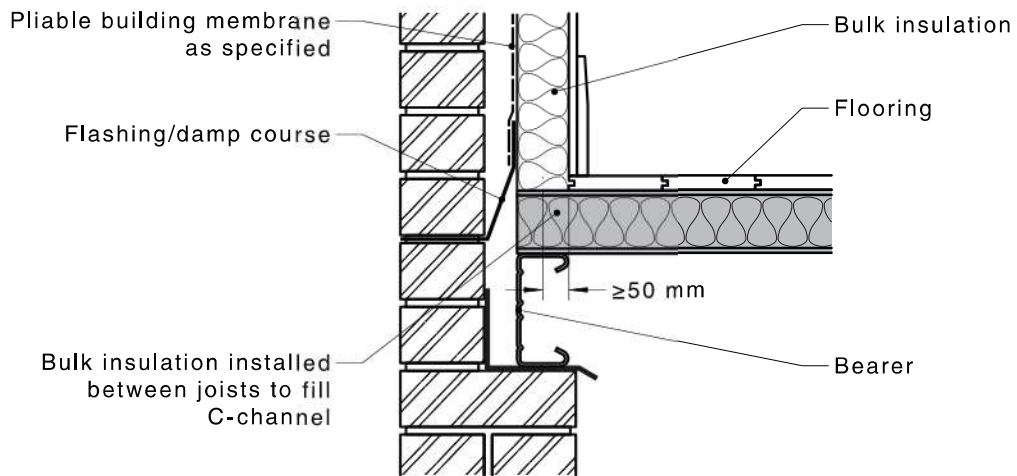
5.5.3.1 *Metal and timber-framed floors*

Installation of bulk insulation to suspended floors shall comply with either of the following:

- (a) Where bulk insulation is installed directly against the underside of the floor and held in place by a suitable support material, adhesive or fixing device, it shall be arranged to fit tightly between the floor joists and extend not less than 50 mm beyond the inside face of walls enclosing the space to be insulated (see Figures 5.5.3.1.1 and 5.5.3.1.2).
- (b) Where bulk insulation is not installed directly against the underside of the floor, it shall be installed beneath the floor and held in place by a suitable support material or fixing device. Air exchange between the spaces above and below the insulation shall be prevented with particular attention at the perimeter of the installation and where structural members or other constructions interrupt the continuity of the bulk insulation (see Figure 5.5.3.1.3).

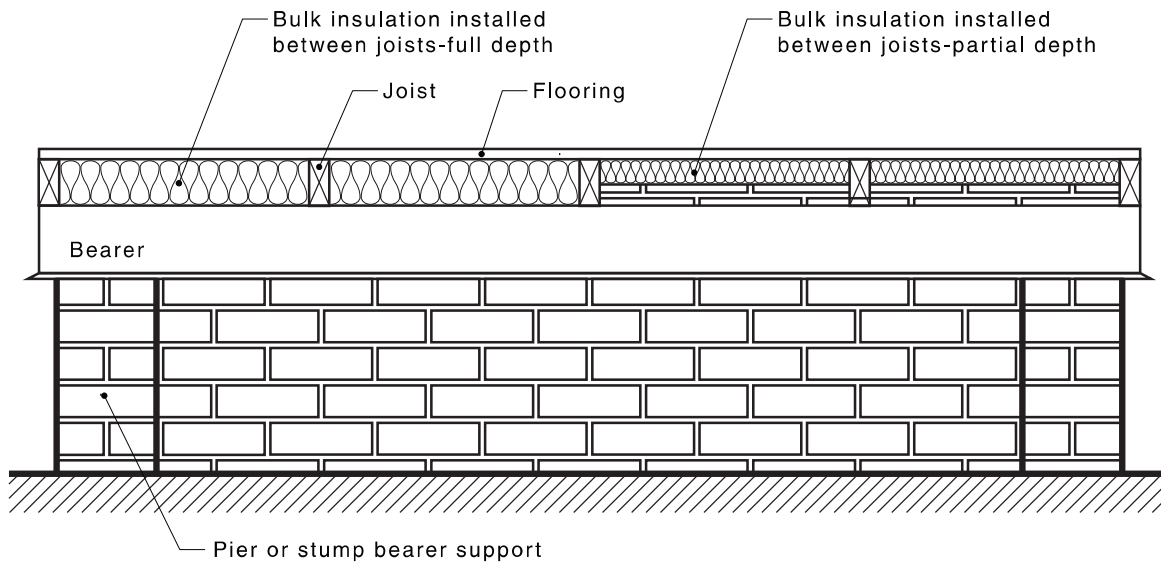


(a) Timber-framed construction

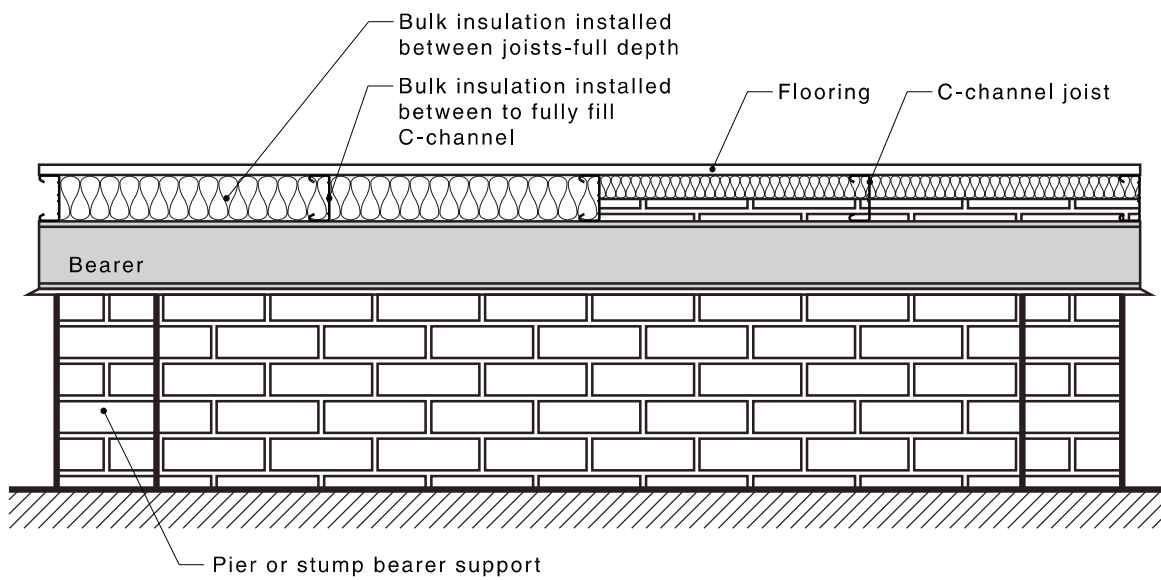


(b) Metal framed construction

FIGURE 5.5.3.1.1 INSULATION UNDERLAPPING A STUD WALL

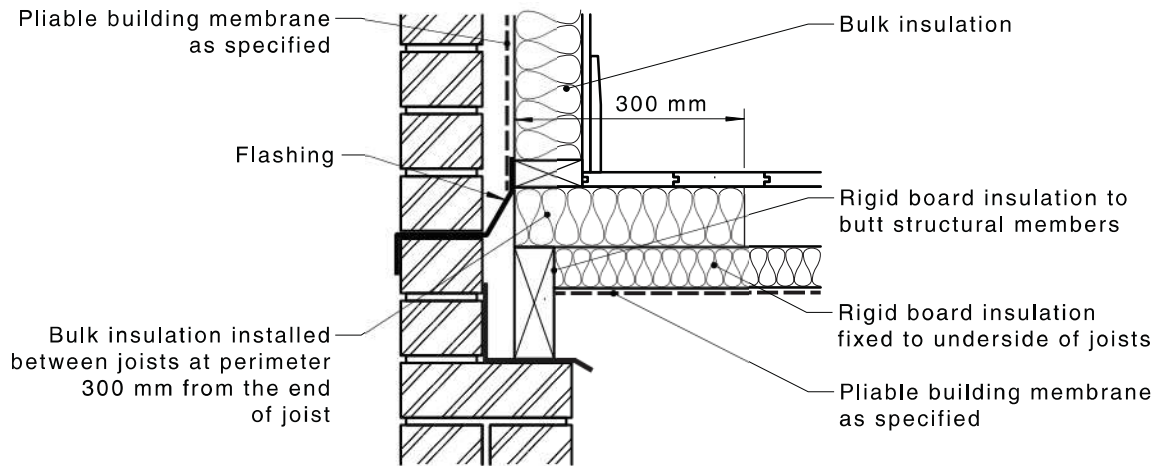


(a) Insulation fixing between timber-framed joist construction



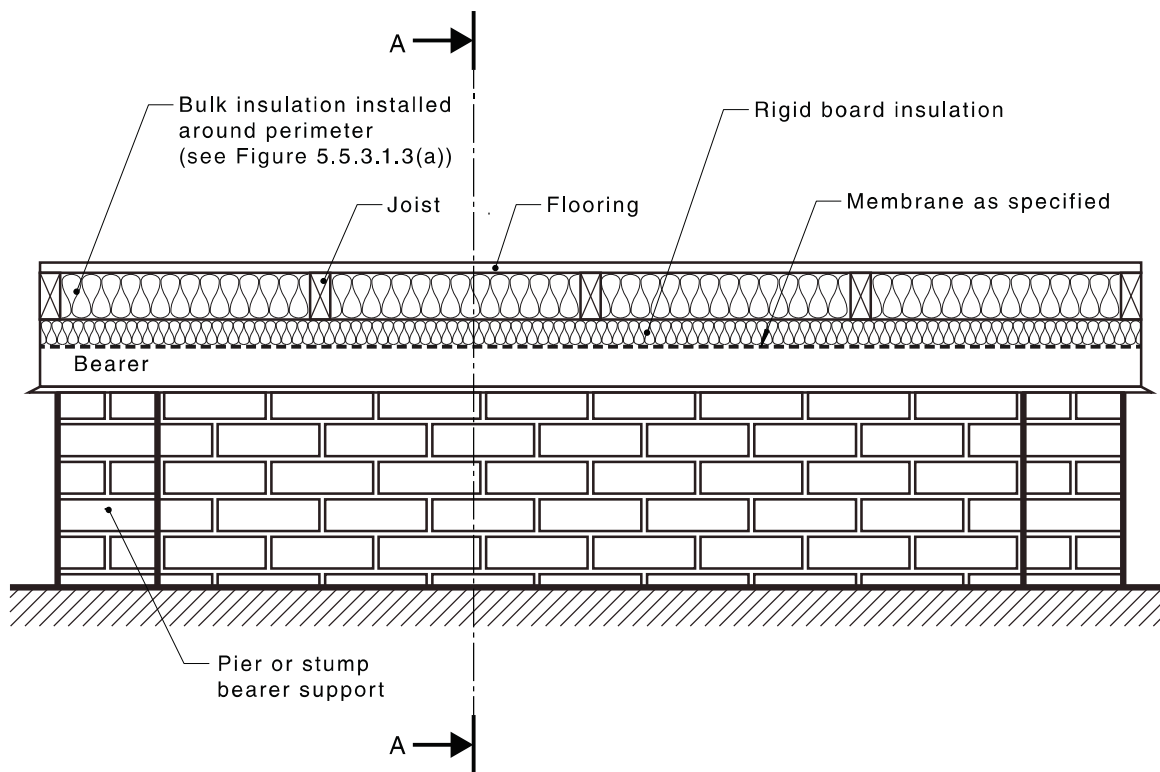
(b) Insulation fixing between metal framed joist construction

FIGURE 5.5.3.1.2 INSTALLATION OF SUSPENDED TIMBER FLOOR INSULATION—EXAMPLES OF ACCEPTABLE PRACTICE



SECTION A-A
for Figure 5.5.3.1.3(b)

(a) Edge treatment for framed construction with rigid or semi-rigid board fixed under joists
(Section A-A)



(b) Rigid or semi-rigid board fixed under joists (with perimeter treatment)

FIGURE 5.5.3.1.3 RIGID OR SEMI-RIGID INSULATION FIXING
UNDER TIMBER OR METAL FRAMED CONSTRUCTION

5.5.3.2 Suspended concrete floors

When required insulation installed under suspended concrete floors shall comply with the following:

- (a) The bulk insulation shall be either—
 - (i) held in contact with the underside of the floor slab by suitable fixing devices, e.g. adhesives or mechanical fasteners. The type and spacing of the fixing device shall follow the manufacturer's specifications and will depend on the insulation type and its dimensions; or
 - (ii) installed in a continuous layer beneath the floor slab and be sealed around the perimeter and joints to prevent air flow between any air cavities formed above or below the insulation.
- (b) Sections of bulk insulation shall be fixed with edges butted closely to avoid gaps.
- (c) The bulk insulation shall be arranged to abut supporting members of the slab (see Figure 5.5.3.2).
- (d) Bulk insulation composite products incorporating a vapour control membrane or with an unfaced bulk insulating component having a similar purpose, shall meet the following:
 - (i) Have a smooth flat surface on the underside of the insulation, and shall be fixed with edges butted closely to avoid gaps and sealed with a pressure sensitive tape or contact adhesive.
 - (ii) Bulk insulation faced with pliable membranes in accordance with AS/NZS 4200.1 shall have at minimum the full length of all joints sealed with a pressure-sensitive tape or a contact adhesive.
 - (iii) Where a vapour control membrane is required, non-fibrous closed cell insulation with equivalent vapour control membrane properties shall have the full length of all joints sealed with a pressure-sensitive tape.
- (e) Bulk insulation shall form a continuous barrier of uniform thickness around structural slab beams and thickened slab sections (see Appendix I).

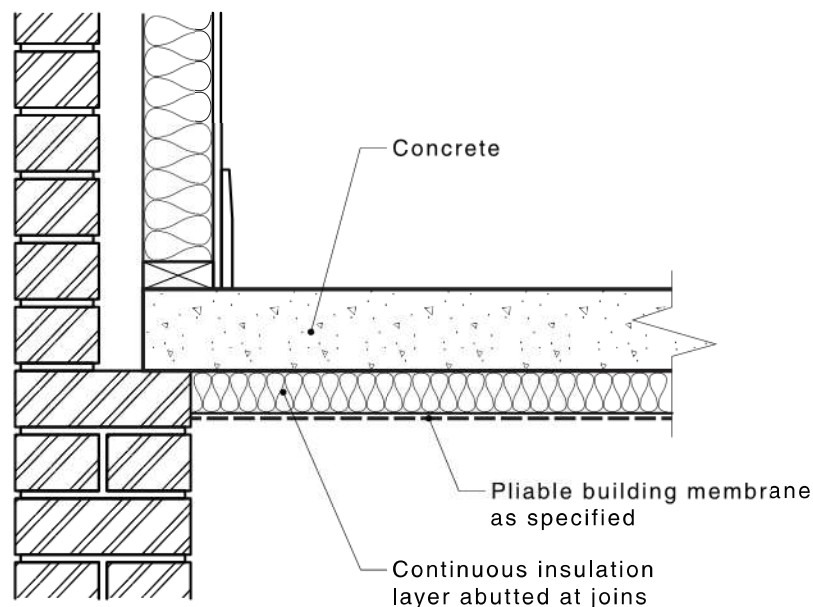


FIGURE 5.5.3.2 SUSPENDED CONCRETE FLOOR INSULATION

5.5.4 Concrete slab on ground

5.5.4.1 Insulation of stiffened raft slabs and footing slabs

Bulk insulation installed under stiffened raft slabs shall comply with the following:

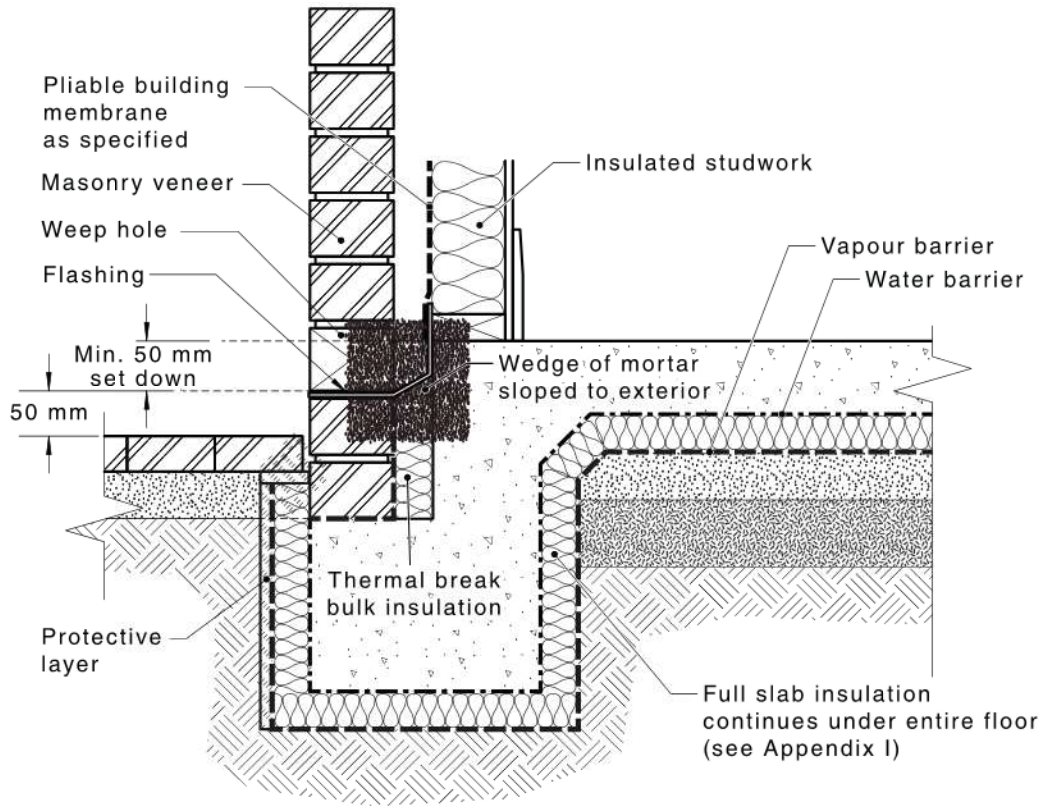
- (a) The bulk insulation shall be rigid board insulation of sufficient compressive strength and stiffness to carry the loads of the structure to comply with AS 2870.1 and local building regulations.

NOTE: Should there be any doubts regarding the practicality of the design of the floor slab and the type of insulation provided, work should not commence or be ceased immediately.

- (b) A vapour barrier shall be placed between the bulk insulation and the ground, which shall have been prepared to have a smooth flat surface. The bulk insulation shall then be laid on the vapour barrier with edges butted closely to avoid gaps. A water barrier to protect the bulk insulation from water penetration during construction shall then be laid over the bulk insulation material and the full length of all joints shall be lapped not less than 200 mm, and sealed with a pressure-sensitive tape or a contact adhesive (see Figure 5.5.4.1.1).
- (c) Where it can be shown that the thermal performance of the bulk insulation is virtually unaffected by water, the water barrier may be omitted and the vapour barrier installed above the insulation rather than below it.
- (d) Bar chairs for the support of reinforcing mesh/rods shall be positioned on pads of a size sufficient to prevent damage to the bulk insulation material, the water moisture barrier and the vapour barrier. Any damage to the water barrier or the vapour barrier shall be repaired prior to pouring the concrete.
- (e) Bulk insulation installed beneath slab-on-ground floors shall comply with the following, as appropriate:
- (i) *Full under-slab insulation* The rigid board insulation shall completely cover the underneath area of the slab and the vertical faces of the outside edge for the whole depth of the slab, including edge beams, internal beams and slab thickening (see Figure 5.5.4.1.1 and Appendix I).
- (ii) *Waffle raft slab with full under-slab insulation* The rigid board insulation shall be laid directly on the ground with the void forming waffle pods laid over the thermal insulation layer. The thermal insulation layer shall completely cover the underneath area of the waffle pods and internal beams, the vertical faces of the outside edge for the whole depth of the slab including the edge beams (see Figure 5.5.4.1.2).
- (iii) *Perimeter slab insulation* The rigid board insulation shall cover and extend 1.2 m beneath the slab, around the perimeter and vertically against the outside edge for the depth of the slab (see Figure 5.5.4.1.1).
- (iv) *Slab-edge insulation* The rigid board insulation shall be fitted vertically against the outside edge of the slab and for a specified distance from the top of the slab into the ground (see Figure 5.4.4.2).

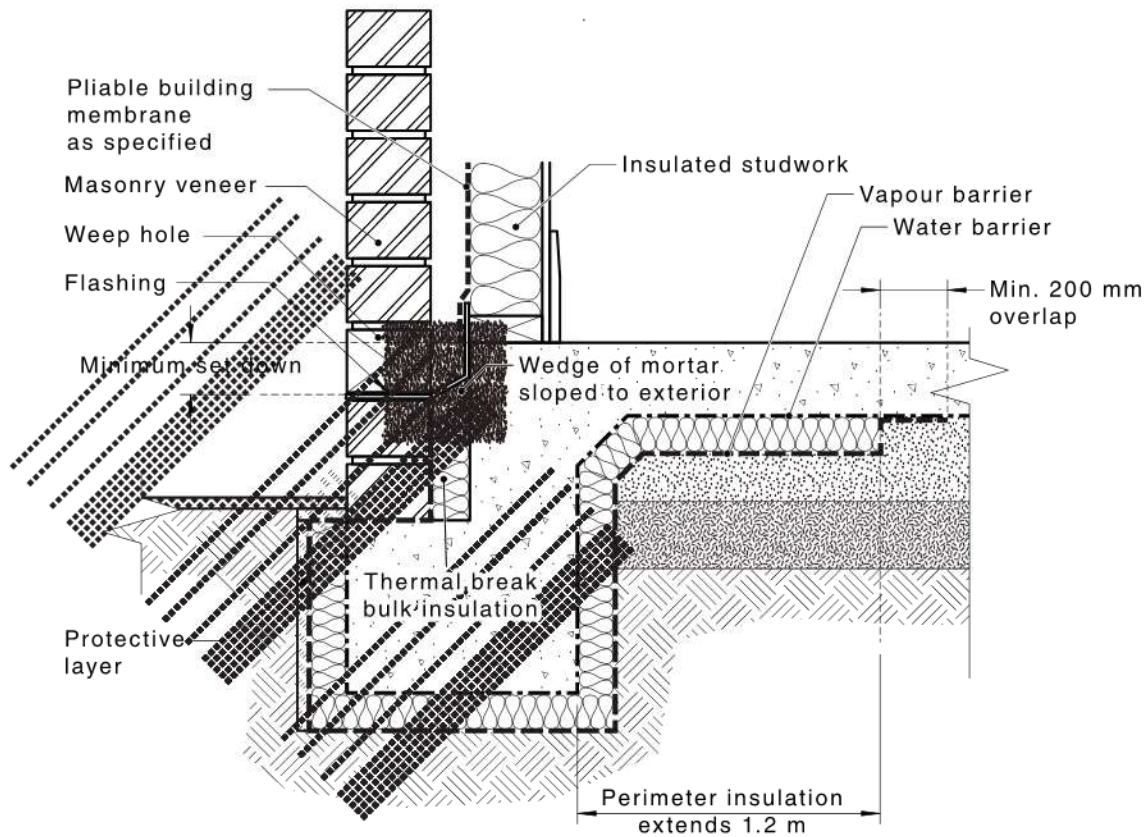
NOTES:

- 1 To maximize the thermal performance of the building envelope, thermal insulation is provided to the underside of the concrete floor slab. The insulation is laid over the damp-proof membrane and installed immediately before placing of steel reinforcement.
- 2 Consideration should be given to ensure the compressive strength of insulation meets the requirements of this application.



(a) Full under slab insulation

FIGURE 5.5.4.1.1 (in part) FULL UNDERSLAB AND PERIMETER INSULATION



(b) Perimeter insulation

NOTE: In the case of larger floor slab areas, it is considered sufficient to provide under slab insulation to the first 1.2 m from the perimeter. Although the thermal performance is not greatly enhanced in the case of smaller residential floor slab areas, builders are likely to find it more practical to extend the under-slab insulation material to the whole of the area so that the compacted hard fill can be graded to a uniform level.

FIGURE 5.5.4.1.1 (in part) FULL UNDERSLAB AND PERIMETER INSULATION

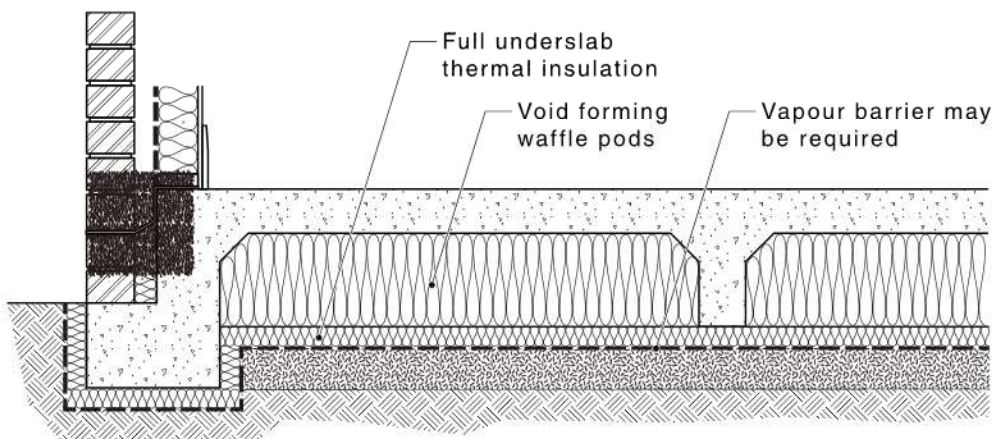


FIGURE 5.5.4.1.2 UNDERSLAB WAFFLE RAFT INSULATION

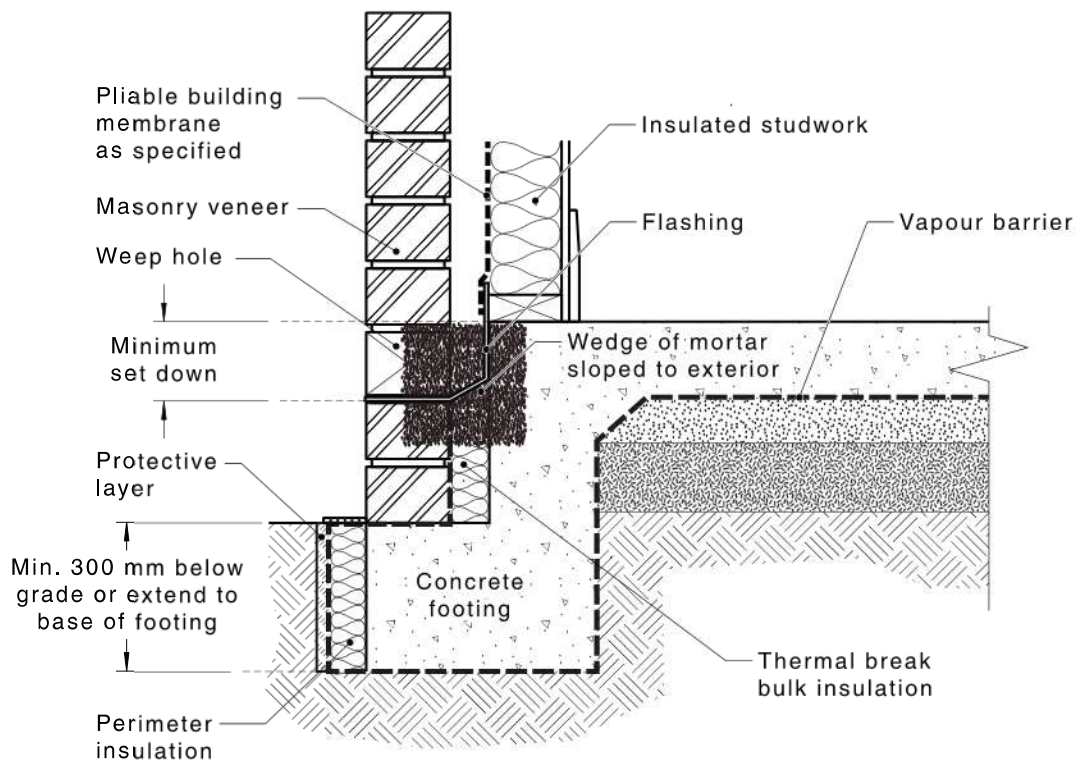
5.5.4.2 Slab edge insulation

Slab edge insulation shall be installed to comply with the following:

- (a) Insulation shall be water resistant rigid board insulation of sufficient compressive strength as to not be severely adversely affected by ground water or adjacent earth works.
- (b) The rigid board insulation shall be fitted vertically against the outside edge of the slab and extend no less than 300 mm below the finished ground level or extend to base of footing (see Figure 5.5.4.2).
- (c) The insulation shall be protected from the weather (water and UV light) and from physical damage (see Figure 5.5.4.2).

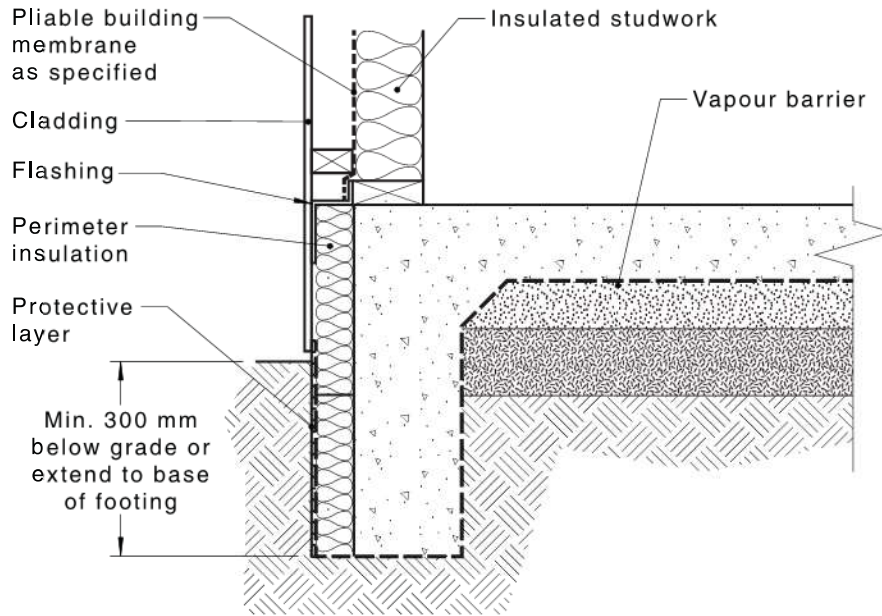
NOTES:

- 1 Insulating the edge of the slab is likely to be required where a floor is heated with embedded reticulated hot water or electric cabling and is recommended for any on-ground concrete floor slab, particularly where the water table is high (within 1 m of the surface) or for houses with a polished concrete floor designed to take advantage of passive solar heating.
- 2 Maintaining durability and performance of any externally applied insulation should be resolved in the design.

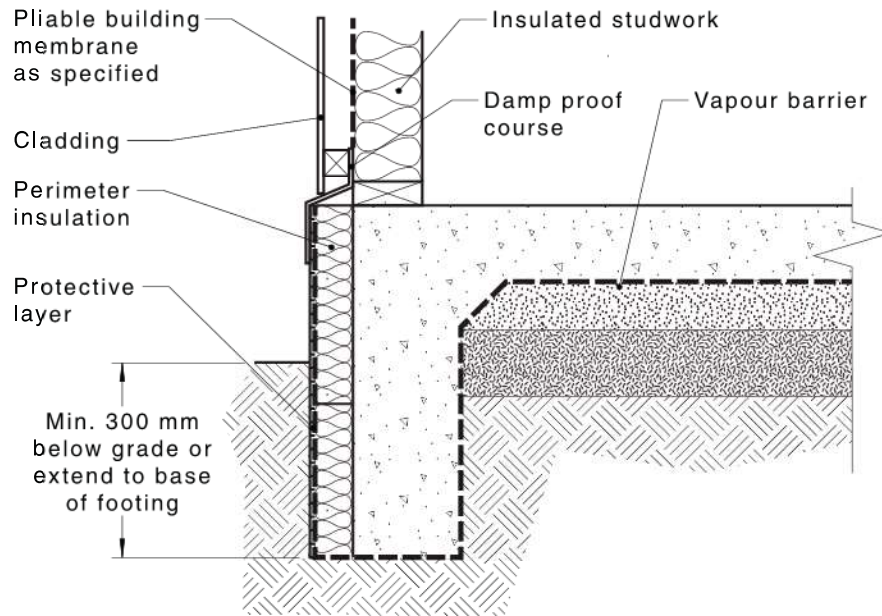


(a) Brick veneer with slab edge insulation

FIGURE 5.5.4.2 (in part) SLAB EDGE INSULATION SOLUTIONS



(b) Lightweight clad timber-framed construction with slab edge insulation—Option 1



(c) Lightweight clad timber-framed construction with slab edge insulation—Option 2

FIGURE 5.5.4.2 (in part) SLAB EDGE INSULATION SOLUTIONS

5.5.4.3 *Insulation of stiffened slab with deep edge beams*

When installing insulation in stiffened slabs with deep edge beam the bulk insulation the following apply:

- (a) The rigid board insulation is of sufficient compressive strength and stiffness as to not compromise the integrity of the slab which shall maintain compliance with AS 2870 and local building regulations.

The vertical and horizontal sections shall be insulated as follows:

- (i) A water barrier shall be placed between the vertical edge beam and the bulk insulation. It shall be fitted to the inside face of the edge beam and extend no less than 300 mm downwards or to the top of the footing. A vapour barrier shall separate the insulation from any sand back-fill to hold the insulation in position (see Figure 5.5.4.3).
 - (ii) The vapour barrier shall continue between the horizontal bulk insulation and the ground fill, which shall have been prepared to have a smooth flat surface. The bulk insulation shall then be laid on the vapour barrier with edges butted closely to avoid gaps. The water barrier shall continue over the insulation to protect the bulk insulation from water penetration during construction shall then be laid over the bulk insulation material and the full length of all joints shall be lapped not less than 200 mm, and sealed with a pressure-sensitive tape or a contact adhesive.
- (b) Where it can be shown that the thermal performance of the bulk insulation is virtually unaffected by water, the water barrier may be omitted and the vapour barrier installed above the insulation rather than below it.
 - (c) Bar chairs for the support of reinforcing mesh/rods shall be positioned on pads of a size sufficient to prevent damage to the bulk insulation material, the water moisture barrier and the vapour barrier.
 - (d) Any damage to the water barrier or the vapour barrier shall be repaired prior to pouring the concrete.

When slab edge insulation is required the installer shall comply with the following as appropriate:

- (A) Rigid board insulation shall be fitted vertically between the edge beam and the bricks up to the level of the weep holes and down to the footing (see Figure 5.5.4.3).
- (B) If the insulation in Item (A) amounts to less than 300 mm, then the outside edge of the footing will need to be insulated in accordance with Clause 5.5.4.2.

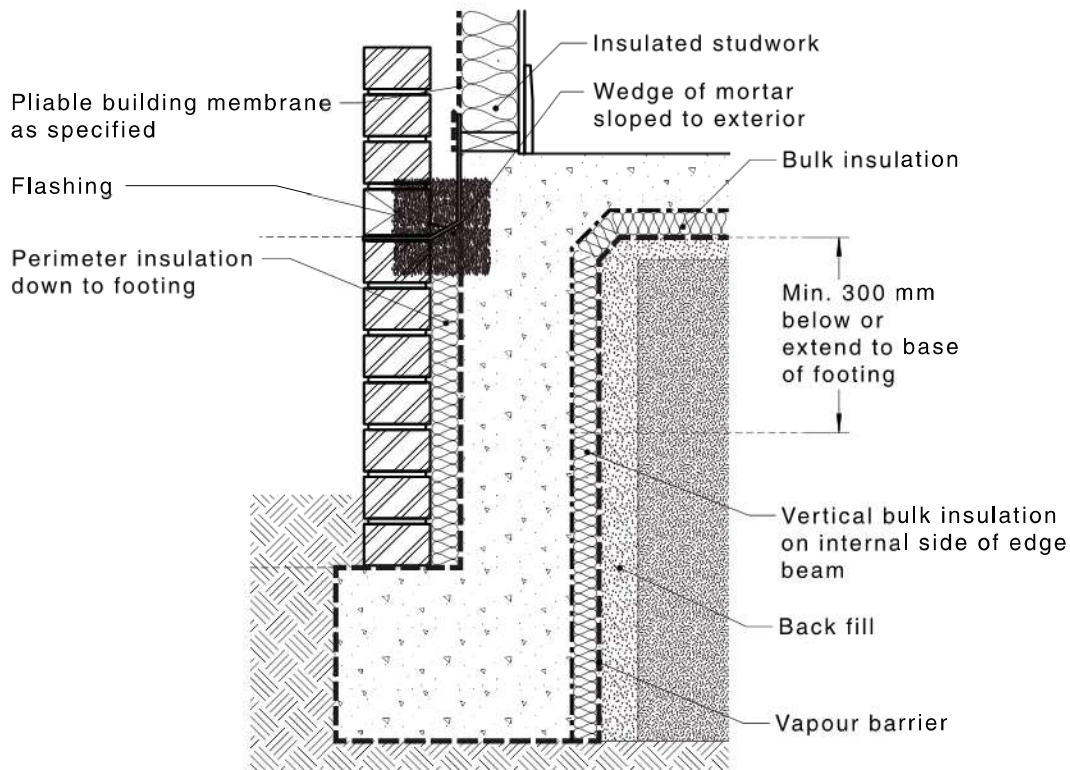
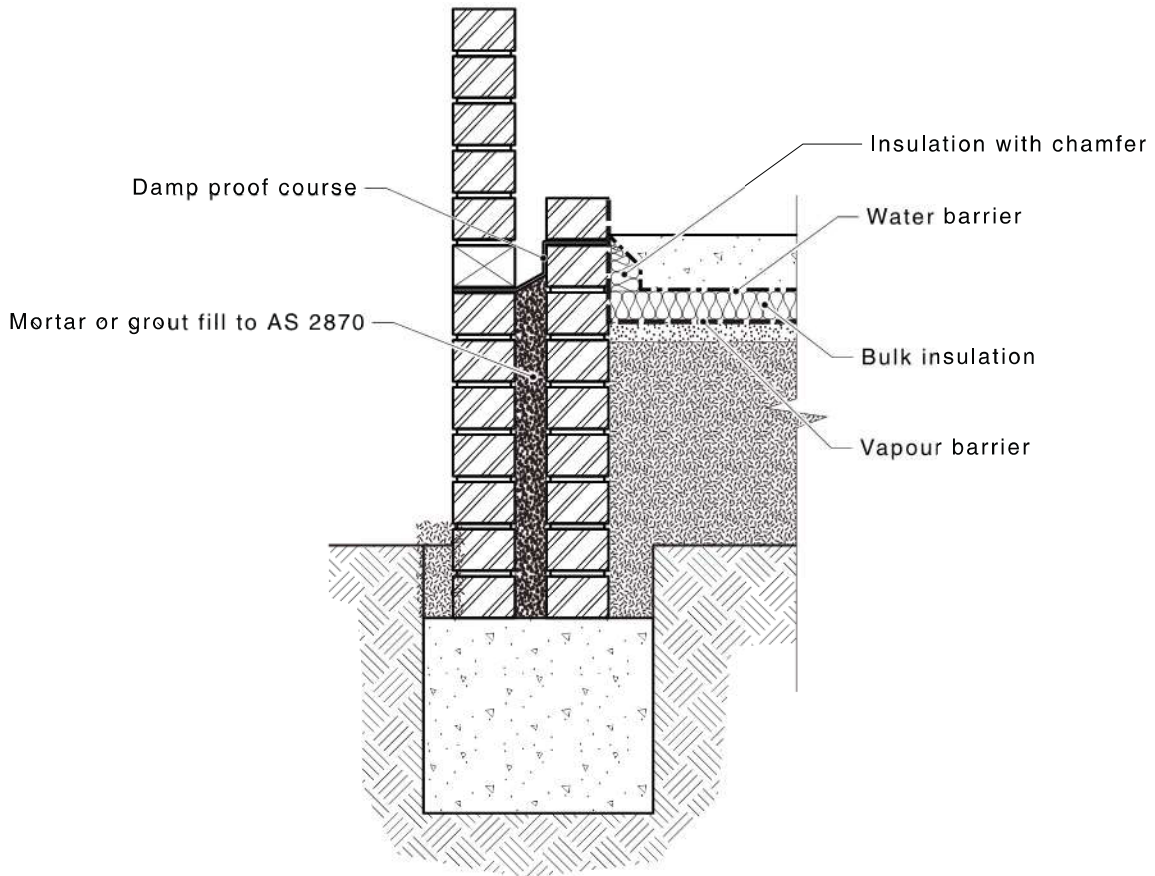


FIGURE 5.5.4.3 INSULATION OF SLABS WITH DEEP EDGE BEAMS

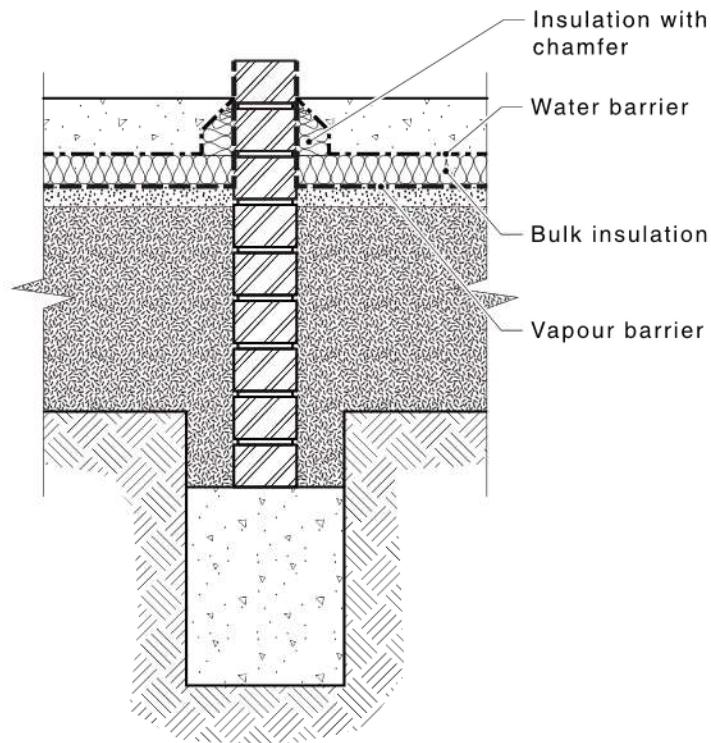
5.5.4.4 Strip footing systems

When installing insulation in stiffened slabs with strip footing systems, the following apply:

- (a) The bulk insulation shall be rigid board insulation of sufficient compressive strength and stiffness as to not compromise the integrity of the slab, which shall maintain compliance with AS 2870 and local building regulations.
- (b) Impervious strips shall separate the masonry wall from the edge of the slab and shall comply with AS 2870 and have a thermal resistance of not less than $0.2 \text{ m}^2 \cdot \text{K}/\text{W}$.
- (c) A vapour barrier shall be placed between the bulk insulation and the ground fill, which shall have been prepared to have a smooth flat surface. The vapour barrier shall return upwards to the level of the FFL of the slab creating a continuous impervious membrane. The bulk insulation shall then be laid on the vapour barrier with edges butted closely to avoid gaps. A water barrier to protect the bulk insulation from water penetration during construction shall then be laid over the bulk insulation material and the full length of all joints shall be lapped not less than 200 mm, and sealed with a pressure-sensitive tape or a contact adhesive (see Figure 5.5.4.4).
- (d) Where it can be shown that the thermal performance of the bulk insulation is virtually unaffected by water, the water barrier may be omitted and the vapour barrier installed above the insulation rather than below it.
- (e) Bar chairs for the support of reinforcing mesh/rods shall be positioned on pads of a size sufficient to prevent damage to the bulk insulation material, the water moisture barrier and the vapour barrier.
- (f) Any damage to the water barrier or the vapour barrier shall be repaired prior to pouring the concrete.



(a) Perimeter footings



(b) Internal footings

FIGURE 5.5.4.4 INSULATION OF STRIP FOOTING SYSTEMS

5.5.5 Floor discontinuities

To accommodate obstacles such as protruding pipes and plumbing, cut the panel and notch around the difficult areas. A gap of approximately 100 mm shall be maintained between sheets and the plumbing pipe work in case of water leaks. This gap will ensure there is adequate service access to repair damaged pipes and fittings.

SECTION 6 INSTALLATION STATEMENT

On completion of the installation, when required by the relevant authority, a statement containing the information shown in Appendix D shall be provided.

NOTE: A copy of this statement is normally provided to the client.

APPENDIX A
RECESSED LUMINAIRES
(Normative)

A1 REQUIREMENTS

Regulations require that luminaires and their equipment only be installed by licensed electricians. This may not include guards and restraints.

This Appendix specifies requirements on the installation of bulk thermal insulation in relation to recessed luminaires and is intended to prevent—

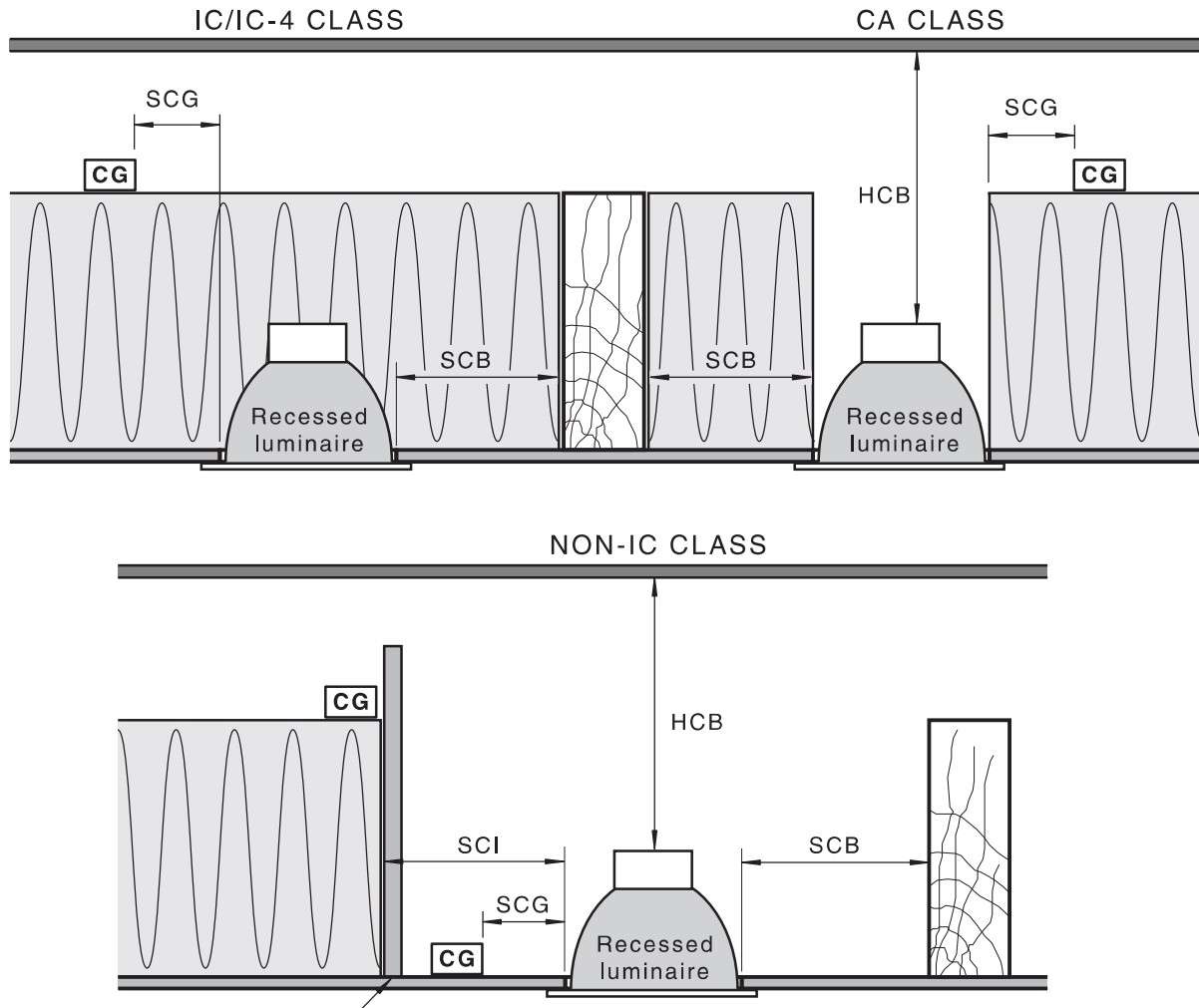
- (a) excessive temperature rise of the luminaire and equipment; and
- (b) the risk of fire from ignition of combustible materials.

Where it is determined that light fittings or barriers are permitted to be covered, the following compliance methods shall be used:

- (i) The installation of thermal insulation material in conjunction with luminaires designed and certified by the manufacturer, as appropriate to the location, as being suitable for operation—
 - (A) in contact with combustible materials; or
 - (B) in contact with, or covered by, thermal insulation material.
- (ii) The installation of thermal insulation material in conjunction with luminaires in combination with barriers tested and classified as being compliant with AS/NZS 5110, and as being suitable for the installation conditions and the particular insulation being used.
- (iii) The installation of thermal insulation material shall provide—
 - (A) the minimum clearance specified by the manufacturer of the luminaire, which may require a barrier or guard constructed of fire-resistant material; or
 - (B) the default clearances as specified in Figure A1, which may require a barrier or guard constructed of fire-resistant material.

NOTE: Further guidance and information is provided in Appendix B.

A1



- FIXED GUARD REQUIRED WHERE:-
- insulation materials are not secured in position;
 - loose materials are present.

Dimension	Any lamp up to 100 W
HCB – height clearance to building element	100 mm
SCB – side clearance to building element	100 mm
SCI – side clearance to insulation	100 mm
SCG – side clearance to auxiliary equipment [control gear (CG)]	50 mm

FIGURE A1 DEFAULT MINIMUM CLEARANCE FOR RECESSED LUMINAIRES [SOURCE: AS/NZS 3000:2018]

A2 WARNING SIGN

Where recessed luminaires are installed in an accessible roof space, a permanent and legible warning sign shall be installed in the roof space adjacent to the access panel in a position that is visible to a person entering the space. The sign shall contain the words shown in Figure A2 with a minimum lettering size of 10 mm.

Where all recessed luminaires installed in an accessible roof space are of either IC or IC-4 classification, a warning sign is not required.

A1



FIGURE A2 WARNING SIGN TO BE INSTALLED IN ACCESSIBLE ROOF SPACES CONTAINING RECESSED LUMINAIRES

A1

A3 PRECAUTIONS AROUND RECESSED LUMINAIRES

Where recessed luminaires have been installed, the following shall apply:

- (a) The heat generated from lamps shall be dissipated to prevent over-temperature damage to the luminaire or to adjacent materials. Cooling air circulation through or around the equipment shall be required for the typical range of downlights. The maximum surface temperature around recessed luminaires shall be as specified in AS/NZS 60598.2.2. The maximum temperature of adjacent materials shall be not more than 90°C.
- (b) For luminaires designed and certified by the manufacturer as in compliance with the method specified in Paragraph A1(i), where the manufacturer's specification may restrict installation including warnings on covering with insulation, the symbol depicted in Figure A4(A), as specified in AS/NZS 60598.1, shall be used.

For typical fittings, the installation method shall accommodate barriers, as specified in Paragraph A1(ii), or clearances, as specified in Paragraph A1(iii), shall be included during installation so as to prevent contact with materials that may impede air flow (e.g. thermal insulation) or which may be affected by the high temperature (e.g. combustible building elements). In the absence of manufacturer's specifications, the default clearances shall apply and the fitting shall not be covered.

NOTE: Under NCC requirements, bulk thermal insulation is prevalent in modern building construction within roofs, ceilings, walls and floors depending on the type of building and its climate zone. Bulk thermal insulation may also be retrofitted, added or altered, in which case precautions should be applied by the insulation installer where recessed downlights are present, or the luminaire installer where insulation is present.

- (c) The presence of bulk thermal insulation, particularly over the rear of a ceiling-mounted downlight, can readily impair cooling air circulation. Unless the luminaire is in compliance with the method specified in Paragraph A1(i) or the barrier is classified to permit insulation coverage, as specified in Paragraph A1(ii), the space above the luminaire, shown as dimension A in Figure A1, shall remain clear and a warning sign as shown in Figure A2 shall be installed.

- A1
- (d) Where clearances are to be applied as specified in Paragraph A1(iii) and bulk thermal insulation is not fixed in position (see Appendix C) one of the following means shall be provided and secured in position to maintain the clearances:
 - (i) A barrier complying with AS/NZS 5110.
 - (ii) A guard or collar constructed of fire-resistant material.
 - (e) Combustible materials require protection from contacting the hot surfaces of the luminaires. This includes structural timber that may be affected by pyrolysis, which over a long exposure can result in increased susceptibility to ignition.

Where extraneous material, such as leaves, vermin debris, or combustible materials stored in a roof space, is present in proximity to the downlight, a luminaire signed and certified as specified in Paragraph A1(i) or a barrier as specified in Paragraph A1(ii) shall be used.
 - (f) Unless the auxiliary equipment specifications permit otherwise, any auxiliary equipment operating at a high temperature shall be positioned above any insulation as illustrated in Figure A1. Where this is not practicable, insulation shall be cut away to provide clearance.

A4 CLASSIFICATION AND MARKING OF RECESSED LUMINAIRES

Recessed luminaires are classified and marked as follows in AS/NZS 60598.2.2:2016, Appendix ZZ:

- (a) *Non-IC luminaire* Non-IC luminaires complying with AS/NZS 60598.2.2 are marked with the symbol shown in Figure A4(A).

NOTE: An alternative symbol to Figure A4(A) as seen in Figure A4(B) is permissible for the period of 24 months from the date of publication of AS/NZS 60598.2.2:2016.
- (b) *Do-not-cover luminaire* Do-not-cover luminaires complying with AS/NZS 60598.2.2 are marked with the symbol shown in Figure A4(C).
- (c) *CA90 luminaire* CA90 luminaires complying with AS/NZS 60598.2.2 are marked with the symbol shown in Figure A4(D).

NOTE: An alternative symbol to Figure A4(D) as seen in Figure A4(E) is permissible for the period of 24 months from the date of publication of AS/NZS 60598.2.2:2016.
- (d) *IC luminaire* IC luminaires complying with AS/NZS 60598.2.2 are marked with the symbol shown in Figure A4(F).

NOTE: An alternative symbol to Figure A4(F) as seen in Figure A4(G) is permissible for the period of 24 months from the date of publication of AS/NZS 60598.2.2:2016.
- (e) *IC-4 luminaire* IC-4 luminaires complying with AS/NZS 60598.2.2 are marked with the symbol shown in Figure A4(H).

NOTE: An alternative symbol to Figure A4(H) as seen in Figure A4(I) is permissible for the period of 24 months from the date of publication of AS/NZS 60598.2.2:2016.

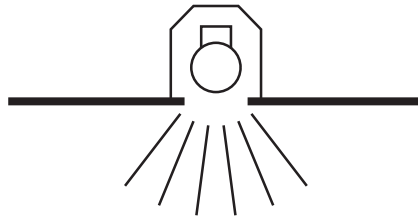


FIGURE A4(A) NON-IC SYMBOL
[SOURCE: AS/NZS 60598.2.2:2016]



NOTE: See Note to Paragraph A4(a).

FIGURE A4(B) ALTERNATIVE NON-IC SYMBOL
[SOURCE: AS/NZS 60598.2.2:2016]

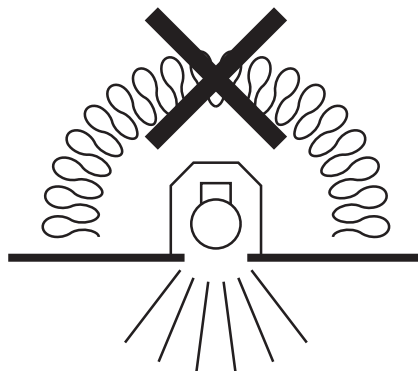


FIGURE A4(C) DO-NOT-COVER SYMBOL
[SOURCE: AS/NZS 60598.2.2:2016]

A1

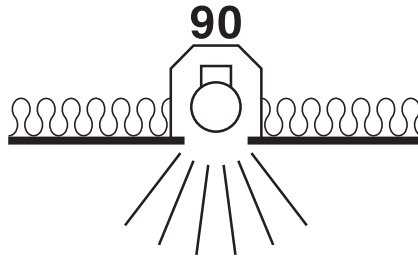


FIGURE A4(D) C90 SYMBOL
[SOURCE: AS/NZS 60598.2.2:2016]



NOTE: See Note to Paragraph A4(c).

FIGURE A4(E) ALTERNATIVE C90 SYMBOL
[SOURCE: AS/NZS 60598.2.2:2016]

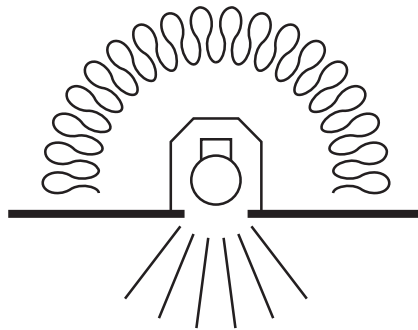


FIGURE A4(F) IC SYMBOLS
[SOURCE: AS/NZS 60598.2.2:2016]

A1



NOTE: See Note to Paragraph A4(d).

FIGURE A4(G) ALTERNATIVE IC SYMBOL
[SOURCE: AS/NZS 60598.2.2:2016]

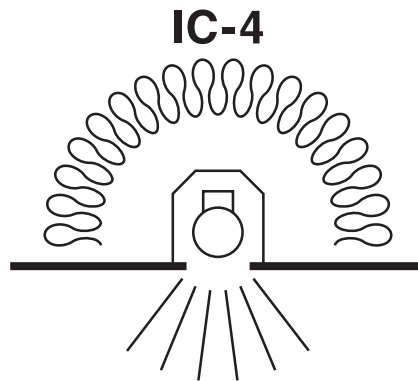


FIGURE A4(H) IC-4 or IC-F SYMBOLS
[SOURCE: AS/NZS 60598.2.2:2016]



NOTE: See Note to Paragraph A4(e).

FIGURE A4(I) ALTERNATIVE IC-4 or IC-F SYMBOL
[SOURCE: AS/NZS 60598.2.2:2016]

APPENDIX B

A1 | **'Text deleted'**

APPENDIX C

MECHANICAL STRENGTH TEST FOR 'FIXED IN POSITION'

(Normative)

C1 CRITERION

The insulation shall not move permanently to close the gap to the light fitting by more than 10 mm.

C2 PREPARATION AND PRECONDITIONING

The insulation to be tested shall be mounted in accordance with the manufacturer's specifications with all parts and accessories in place to a horizontally positioned 12 mm wooden mounting board. A 190 mm circle shall be cut into the insulation 150 mm from a ceiling support member, see Figure C1.

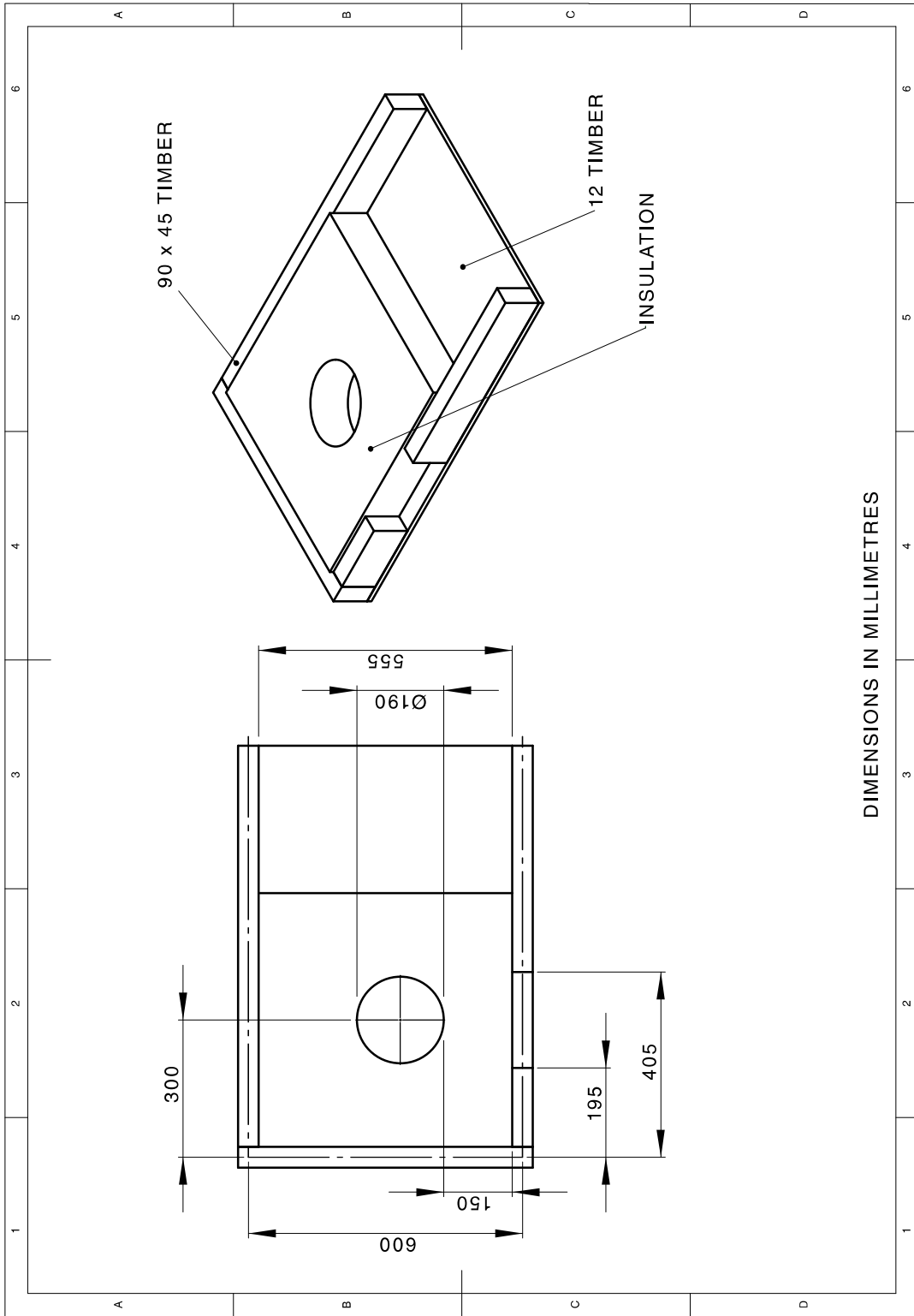
Insulation or guard secured only with adhesive requiring a curing period shall be mounted in position and allowed 48 h minimum drying prior to preconditioning.

A sample shall be preconditioned for no less than 168 h in a vented oven at 90°C followed by 48 h in a humidity cabinet containing air with a relative humidity maintained between 91% and 95%. The temperature of the air at all places where samples can be located shall be maintained within 1°C of any convenient value 'T' between 20°C and 30°C.

C3 PROCEDURE

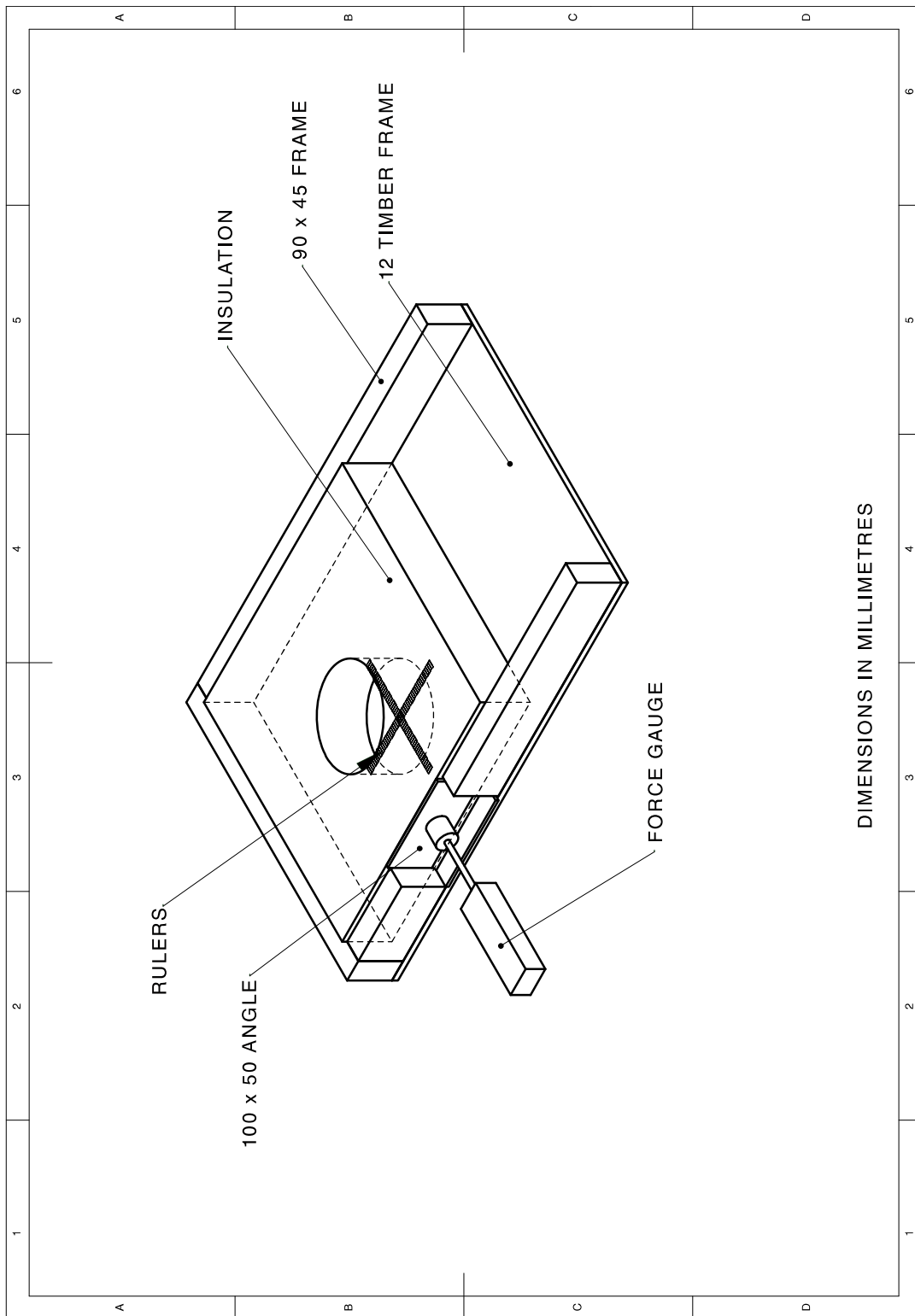
The resistance to movement test shall be applied as follows:

- (a) The insulation shall be installed as per the manufacturer's specifications, see Figure C2.
- (b) A 5 N force shall be applied horizontally via an intermediate steel angle 100 mm × 50 mm × 0.55 mm. The force shall be applied in the general direction of the 190 mm circle as shown in Figure C1 from two points, see Figure C3.
- (c) A third 5 N force shall be applied via a 250 mm × 250 mm × 2 mm thick steel plate with a mass of 0.5 kg being placed directly over the 190 mm hole, see Figure C4.
- (d) The force shall be removed and the permanent distance moved recorded.



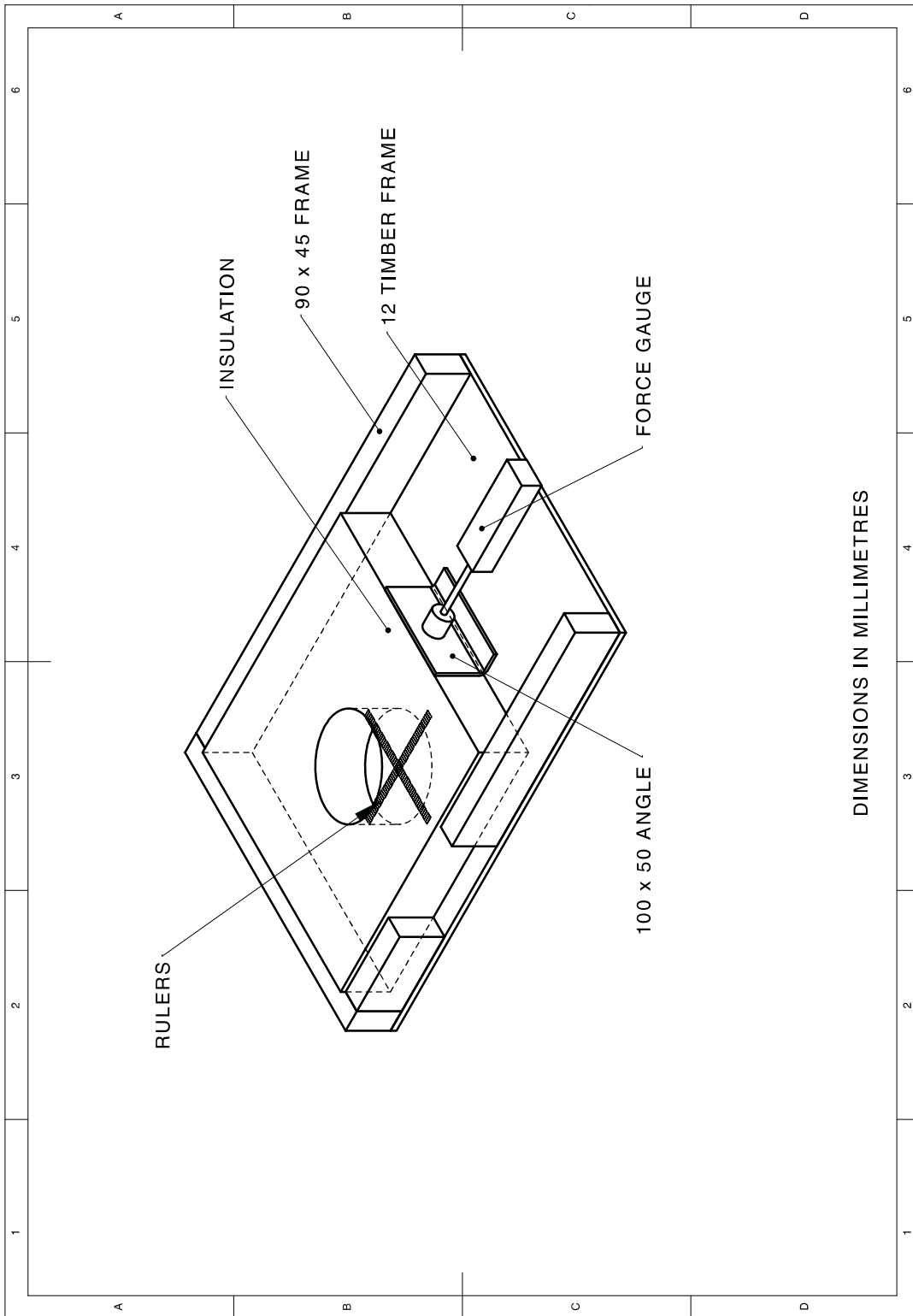
DIMENSIONS IN MILLIMETRES

FIGURE C1 FRAME AND INSULATION DIMENSIONS



DIMENSIONS IN MILLIMETRES

FIGURE C2 TEST CONDITION A



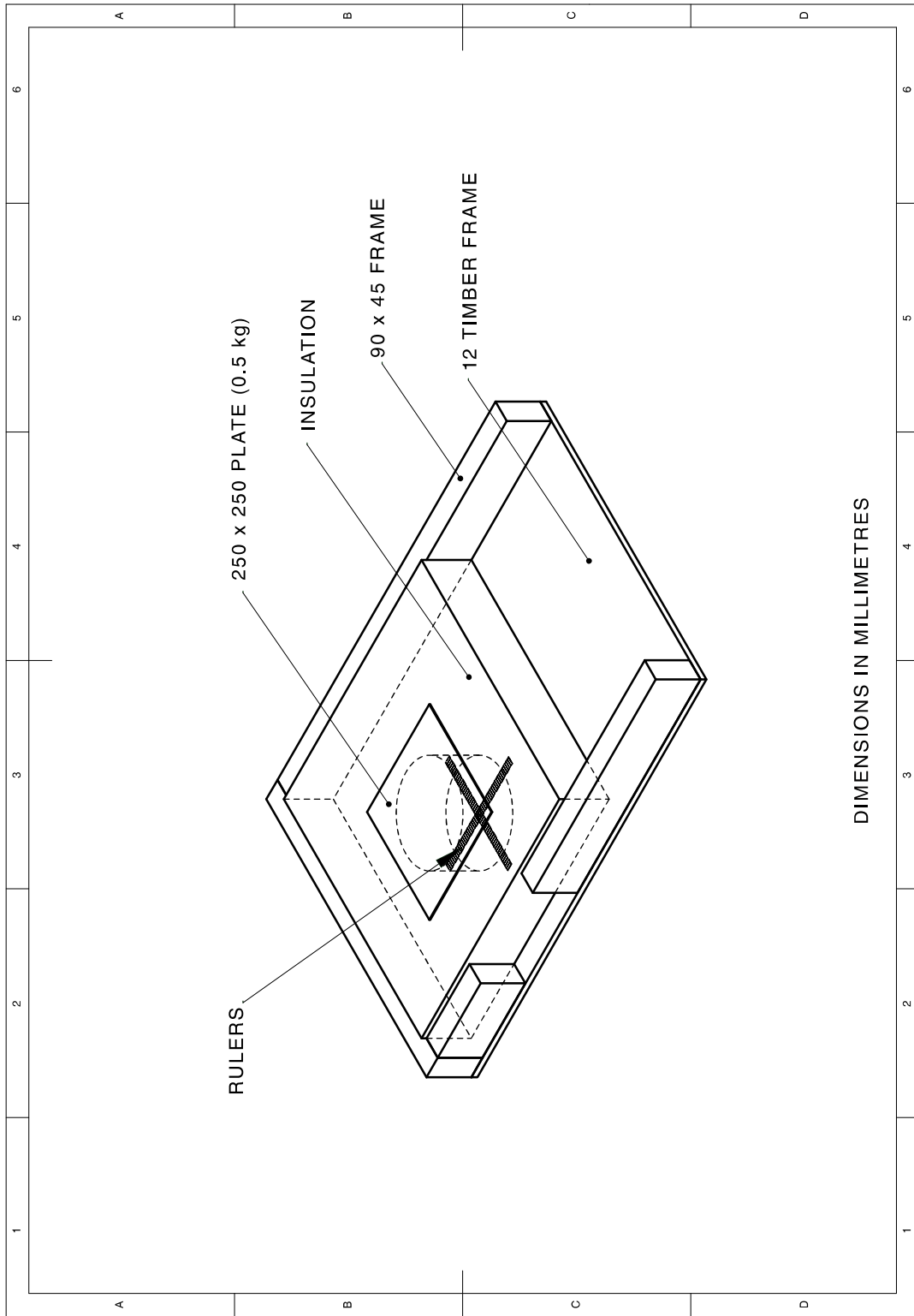


FIGURE C4 TEST CONDITION C

APPENDIX D
INSTALLER’S STATEMENT
(Normative)

This Appendix indicates the information to be provided by the installer with respect to a job on completion of the installation (see Section 6). The layout of the form is an example of how the information may be presented.

STATEMENT OF INSULATION INSTALLATION	
Contractor	
Installing company:	ABN/ACN:
Address:	
Contact person:	Telephone:
Email:	
Installer	
Name:	Qualifications (if applicable):
Site:	Address:
Type of building:	
Product	
Insulation type:	Insulation manufacturer:
Trade name:	Batch identification:
Existing installation	
Existing insulation (type and thickness, expressed in millimetres)	
Estimated R-value	
New installation	
R-value required	Stabilized thickness, expressed in millimetres.....
Installed thickness, expressed in millimetres.....	
Net area insulated, expressed in square metres	
Install location:	Floor: Wall: Ceiling: Roof:
Date of installation	
Affirmation	
I declare that the new product installed at the above site was installed in accordance with the current version of AS 3999 in effect at this date.	
Installer’s signature:	

APPENDIX E
CEILING PERIMETER INSULATION
(Normative)

In cases where a lower R-value is used due to space limitations the remainder of the ceiling insulation shall be increased to maintain the overall total R-value required.

For an example of ceiling perimeter insulation see Figure E1.

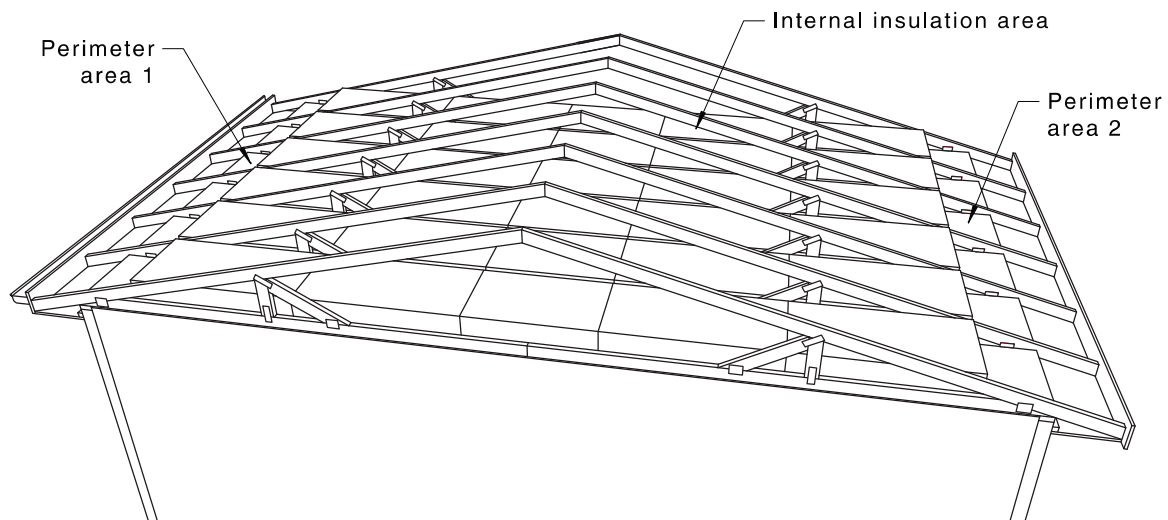
The overall total R-value can be calculated using the following calculation:

$$R_T = \frac{A_T}{\frac{A_1}{R_1} + \frac{A_2}{R_2} + \dots + \frac{A_x}{R_x}}$$

where

- A_T = total area of ceiling
- A_1 = area of insulation with value R_1
- A_2 = area of insulation with value R_2
- A_x = area of insulation with value R_x
- R_T = overall total thermal value of entire ceiling
- R_1 = thermal value for insulation covering area A_1
- R_2 = thermal value for insulation covering area A_2
- R_x = thermal value for insulation covering area A_x

An example of the areas of insulation is shown in Figure E1.



LEGEND:

- A1 = Internal insulation area
- A2 = Perimeter area 1 + Perimeter area 2

FIGURE E1 EXAMPLE OF CEILING PERIMETER INSULATION AREAS

APPENDIX F
EDGE INSULATION SOLUTIONS
(Informative)

F1 GENERAL

The following options may be used as deemed to comply installation methods for the perimeter of ceilings with limited height.

F2 PERIMETER EDGE BATTS OR SEMI RIGID BOARD

Higher density batts or semi rigid board insulation around the perimeter of the ceiling may allow for easier installation in confined spaces with a higher performance with a thinner product nominal thickness (see Figure F1). The main ceiling area insulation may need to compensate for any reduction in R-value around the perimeter (as calculated in accordance with Appendix E).

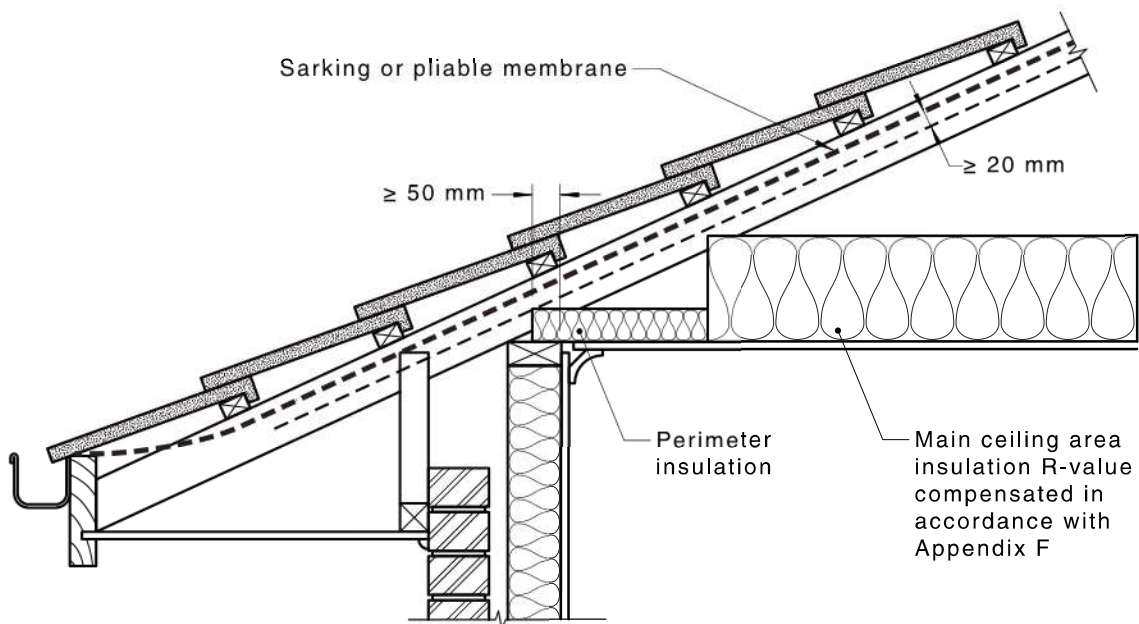


FIGURE F1 PERIMETER BATTS

F3 LOOSE FILL WITH STEPPED RESTRAINTS

Loose fill insulation products may be pumped in around the perimeter of the ceiling at a lesser thickness and R-value (see Figure F2). The main ceiling area insulation may need to compensate for any reduction in R-value around the perimeter (as calculated in accordance with Appendix E).

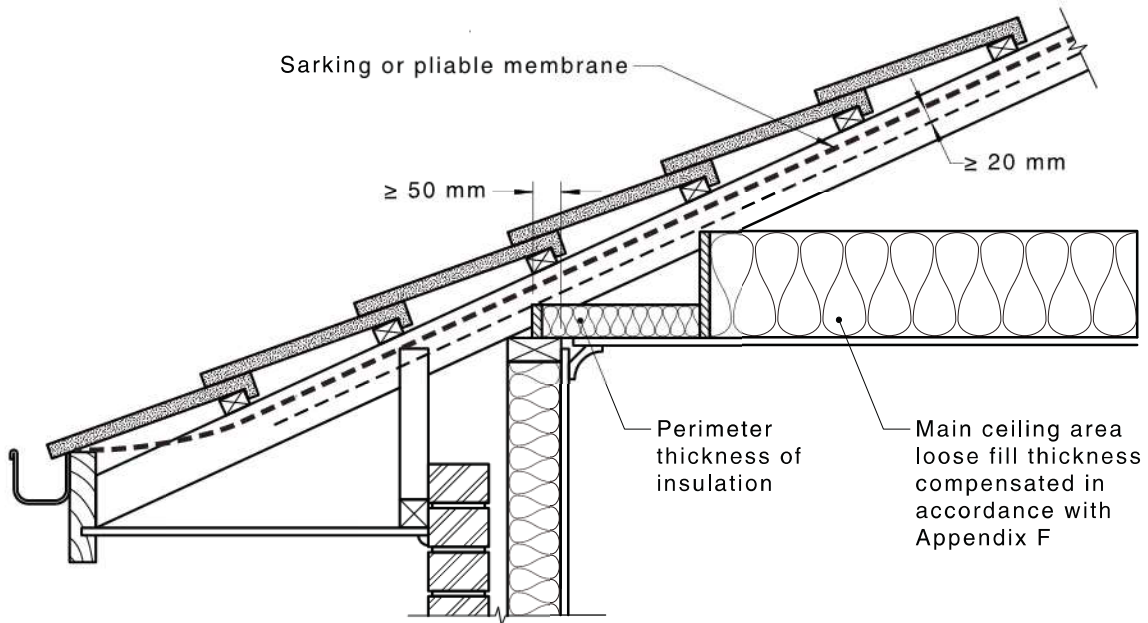


FIGURE F2 LOOSE FILL WITH STEPPED RESTRAINTS

F4 LOOSE FILL WITH RETAINING BOARD

A retaining board may be used to maintain a 20 mm air gap between the roof cladding or sarking membrane. Loose fill insulation products may be pumped in around the perimeter of the ceiling at a lesser thickness and R-value (see Figure F3). The main ceiling area insulation may need to compensate for any reduction in R-value around the perimeter (as calculated in accordance with Appendix E).

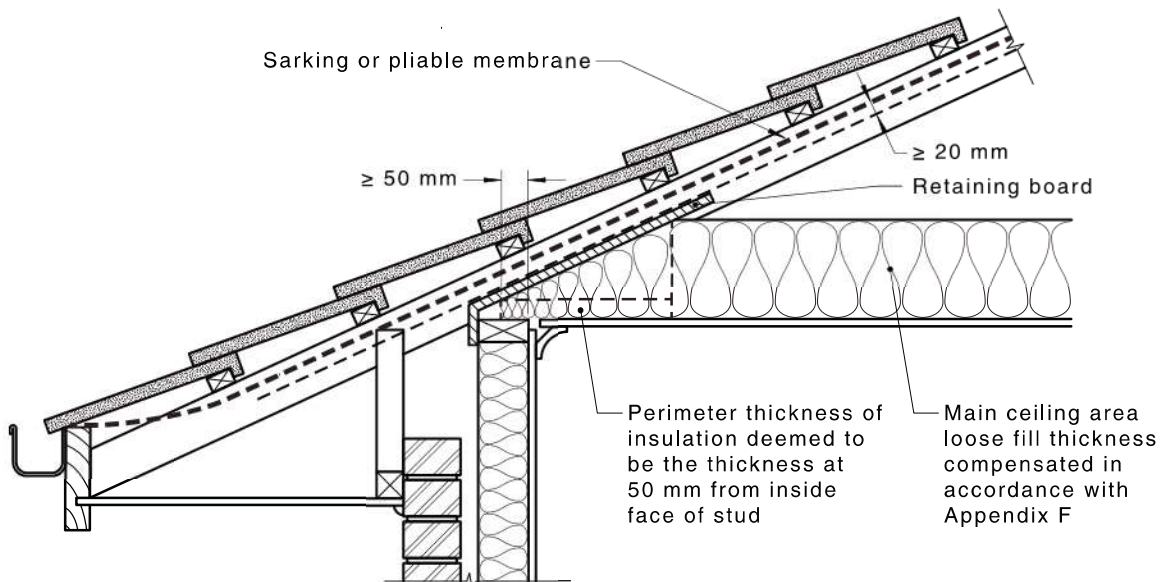


FIGURE F3 LOOSE FILL WITH RETAINING BOARD

APPENDIX G

CONDENSATION

(Informative)

G1 GENERAL

Insulation should be installed with due consideration of condensation and associated interaction with adjoining building materials. As an example, reflective insulation or sarking installed on the cold side of the building envelope should have an adequate degree of vapour permeance.

Consideration should be given to the need to include vapour control membranes, ventilation or additional ventilation to reduce the potential for condensation.

‘Hygrothermics’ is the term for the study of the interaction of both humidity and temperature in buildings.

G2 MOISTURE ISSUES

Moisture gives rise to the following problems:

- (a) Surface condensation occurs when the temperature of a surface is at or below dew point temperature of water vapour in the air adjacent to the surface.
- (b) Mould growth on internal surfaces—moulds and their spores are one of the most significant causes of respiratory problems.
- (c) Interstitial condensation occurs within building cavities such as roof spaces and wall cavities, this can give rise to—
 - (i) corrosion of metal components;
 - (ii) decay of timber based components;
 - (iii) nail plate pull-out;
 - (iv) reduction of the performance of insulations; and
 - (v) concealed mould growth.

Minimization of these problems depends on—

- (i) appropriate thermal design of the building fabric for the given climate;
- (ii) consideration of moisture production and ventilation within the building use of combinations of materials that allow for the possibility of storage and movement of moisture within the structure; and
- (iii) use of materials and detailing appropriate to the location and use of the building.

G3 INTERNAL AND EXTERNAL MOISTURE

In order to design for condensation management, it is necessary to have an understanding of the building use, the local climate, construction type and ventilation.

The level of internal moisture generated is determined by building use which is characterized by:

- (a) Number of occupants.
- (b) Cooking activity.
- (c) Showers.

(d) Washing and drying.

This can be managed through the introduction of suitable natural air and mechanical ventilation/extraction. The moisture content of the external air should be considered when using natural ventilation.

External moisture is determined by the climate. Historical data can be obtained through the Australian Bureau of Meteorology or weather conditions consistent with approved energy rating software may be suitable for design purposes.

G4 MECHANISMS OF MOISTURE MOVEMENT

G4.1 General

Moisture is transferred through a building element by a number of mechanisms. The relative importance of those mechanisms will be determined by the materials of which an element is composed and their configuration.

G4.2 Surface moisture transfer

Surface moisture transfer where airborne water vapour condenses onto a surface or where liquid water surface condensation is evaporated.

Most materials will take up water when exposed to moist air, the equilibrium quantity depending on the nature of the material, its pore structure and the relative humidity of the air. This phenomenon is important for the thermal conductivity of building and insulating materials. Very low porosity materials such as glass and metals may cause surface condensation at 60% relative humidity as opposed to high porosity materials such as bricks which will take high humidity close to 100% to cause surface condensation.

When managing moisture transfer in buildings, a system approach should be taken to ensure adequate control of moisture movement.

G4.3 Diffusion

Most solid materials permit the diffusion of water vapour to some extent and, whenever there is a difference in the temperature and/or relative humidity across the material, a movement of water vapour takes place. This is analogous to the flow of heat through a material when subjected to a temperature difference.

ISO 13788 is the International Standard for condensation calculations based on vapour resistivity of building materials. Manufacturers' specifications commonly quote vapour resistivity.

Australian product permeability may in some cases vary from international products depending on the manufacturing process, composition of raw materials and specialized coatings.

Vapour control layers as specified in AS/NZS 4200 series are usually thin materials and it is more convenient to classify them by their vapour resistance than by their thickness and vapour resistivity.

Product manufacturers commonly state values for vapour resistances of membranes in specifications. It should be noted that these values apply to undamaged membranes and the presence of any perforations may reduce the vapour resistance considerably.

G4.4 Air transfer

Moisture is transferred by air movement through gaps at the junctions between elements of the construction and through cracks within the elements. In a typical masonry wall with windows or other openings, the mass flow of moisture due to air movement through gaps can be as much as an order of magnitude greater than that produced by diffusion. This is especially true in the case of pitched roofs, where the moisture transfers are dominated by wind and stack driven air flows from the house into the roof space, through gaps in the ceiling and from the roof space to outside via installed ventilators and laps in the under tiling membrane.

G5 CONDENSATION RISK ASSESSMENTS

Condensation risk assessments are designed to assess the risk of interstitial condensation occurring within the building elements. The design should minimize or eliminate these risks so the materials performance specified in the design should not be varied.

In well-sealed buildings, for energy efficiency, acoustics or bush fire resistance, a condensation risk assessment calculation is important.

Condensation risk analysis can be carried out according to ISO 13788 or conducted using an hourly analysis software program using weather conditions consistent with approved energy rating software. This assesses the risk of condensation within any configuration of cladding, air cavities, membranes, insulation, internal linings or any other additional construction layers.

APPENDIX H
INSULATING TRUSSED CEILINGS
(Informative)

H1 TRUSS TYPES

In order to correctly insulate a ceiling under a trussed roof requires proper attention to treatment around the perimeter, at eaves and at gable ends. Figures H1 to H5 indicate good practice for insulating ceilings below trussed roofs.

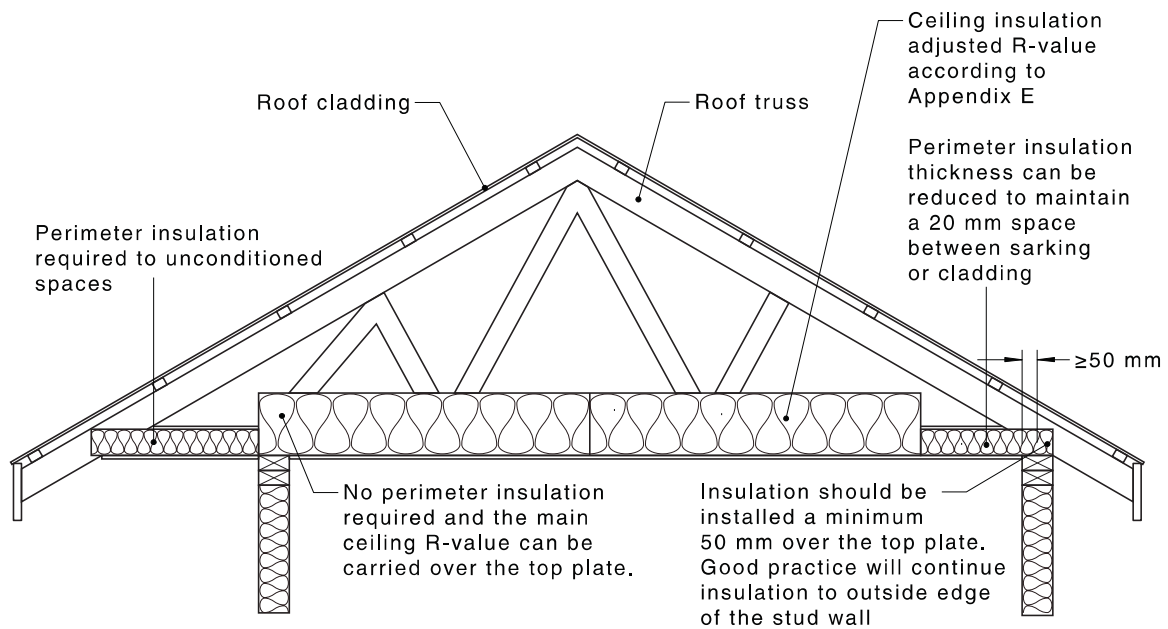


FIGURE H1 BULK CEILING INSULATION—A CANTILEVERED EXTERNAL TRUSS OVERHANG

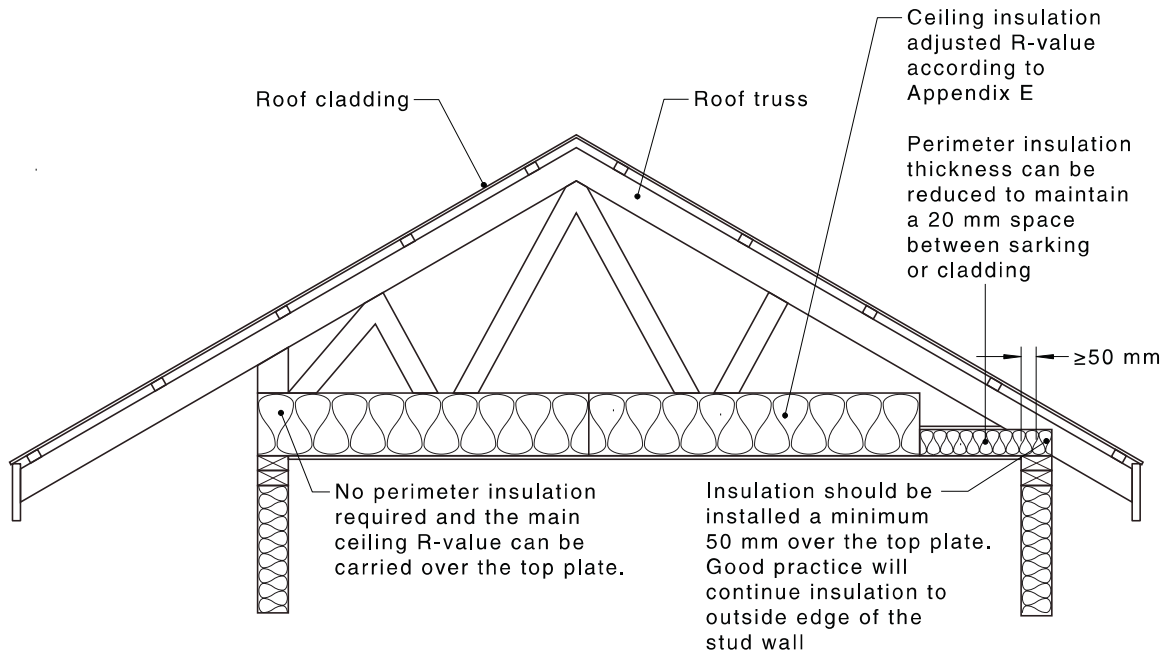


FIGURE H2 BULK CEILING INSULATION—A CUT-OFF TRUSS

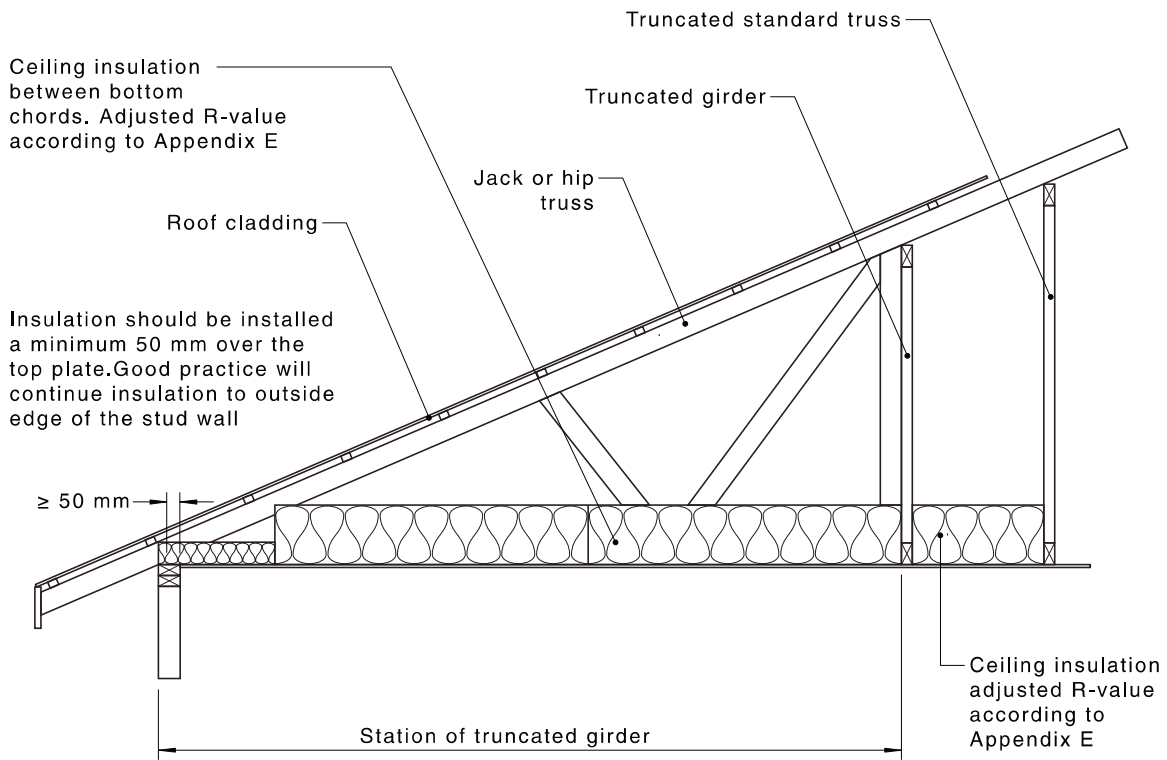


FIGURE H3 BULK CEILING INSULATION—A TRUSS STATION

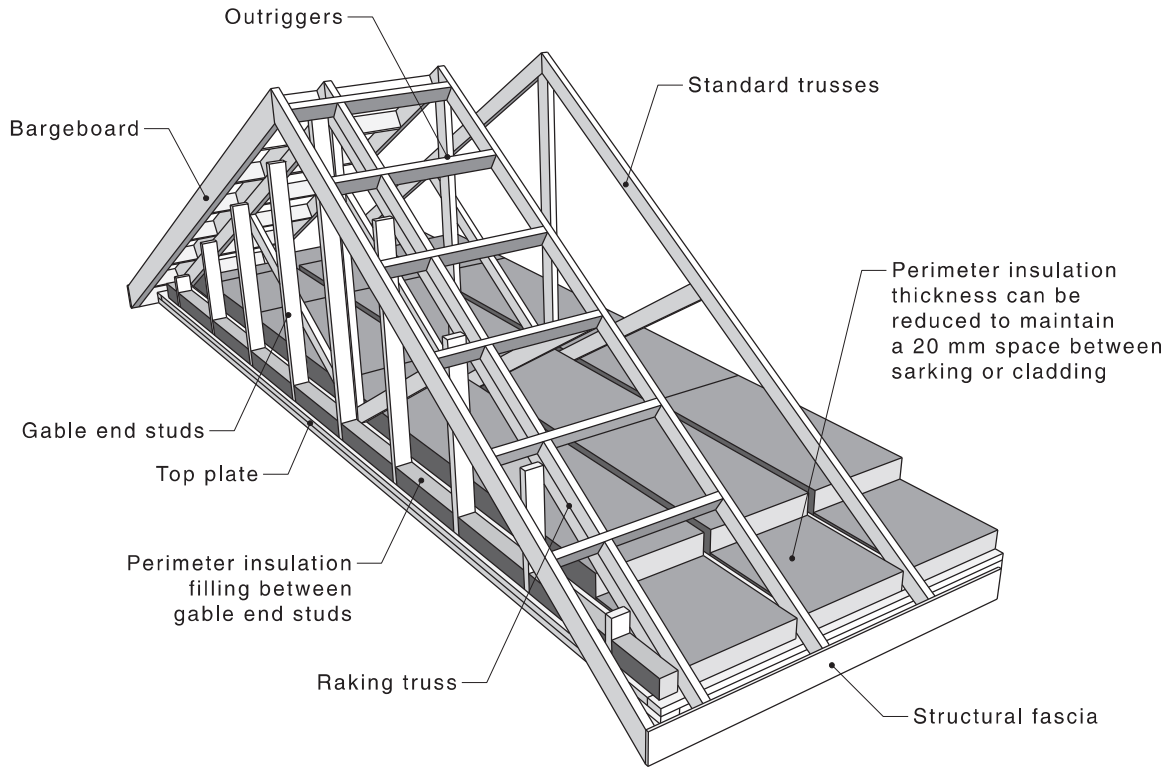


FIGURE H4 BULK CEILING INSULATION—BETWEEN GABLE END STUDS

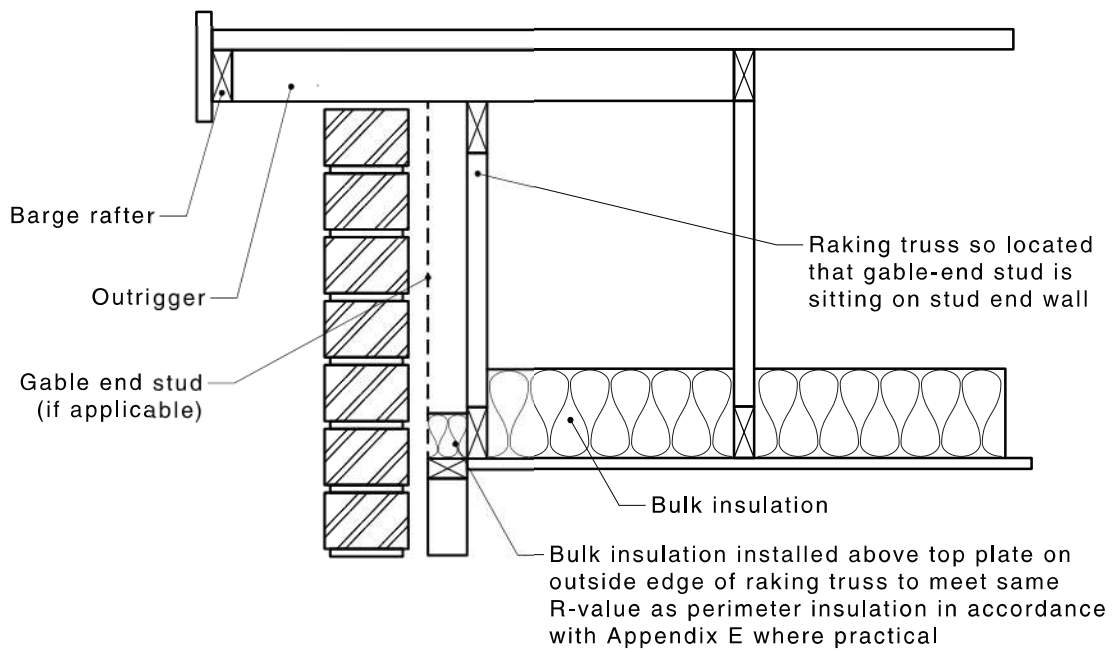


FIGURE H5 BULK CEILING INSULATION—BETWEEN GABLE END STUDS SECTION

H2 SUPPLEMENTARY NOGGINS AND STRAPPING

In order to correctly insulate a ceiling under a trussed roof requires proper attention around blocking and where interrupted by roof bracing straps.

Where plasterboard is fixed directly to the bottom chord of trusses, supplementary noggins may be fitted with the roof trusses. The supplementary noggins are specified in AS 4440 on edge, and are commonly fitted in the following situations:

- (a) *At hip ends* The supplementary noggins may be fitted where the bottom chords of the hip-end system do not continue to run parallel to the main run of trusses.
- (b) *Elsewhere* The supplementary noggins may be fitted between trusses where internal walls run parallel to the common trusses. They are fixed at a spacing not exceeding that for the common trusses.

Figure H6 indicates good practice for insulating around supplementary noggins and strapping.

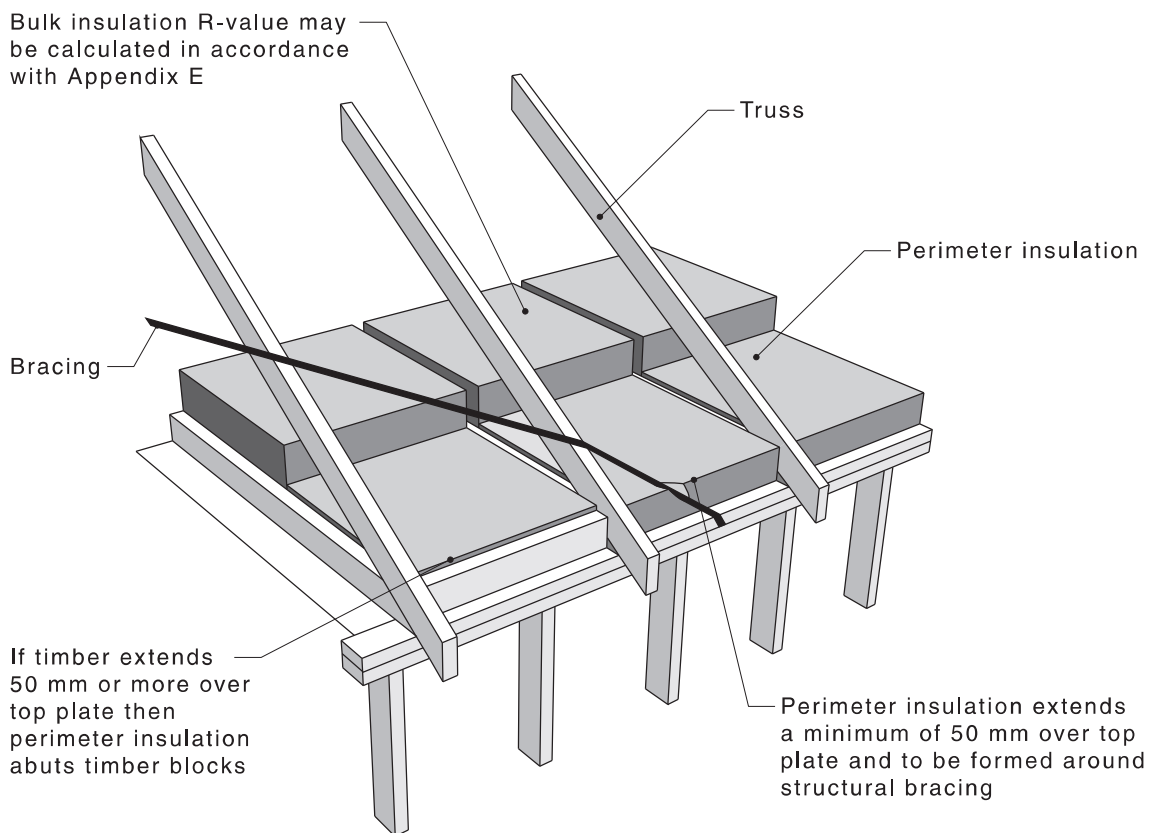


FIGURE H6 INSULATING AROUND BLOCKING AND BRACING

APPENDIX I
INSULATING UNDER CONCRETE SLAB ROOFS AND FLOORS
(Normative)

Where insulation for suspended floor slabs is specified the insulation shall extend under formed beams and thickened slab sections (see Figures I1 and I2).

Where insulation for concrete slabs on ground is specified as full under-slab insulation, ensure the insulation has been selected to meet the compressive load requirements as outlined in Clause 5.5.4. The insulation shall extend under formed beams and thickened slab sections, unless otherwise stated in the design specification (see Figures I3 and I4).

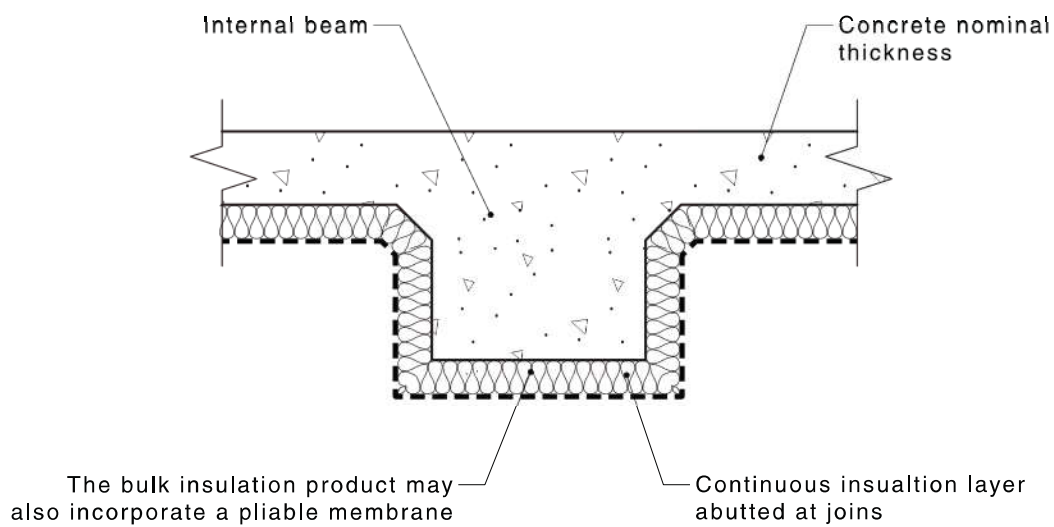


FIGURE I1 ELEVATED SLAB WITH INSULATION
UNDER FORMED SLAB BEAMS

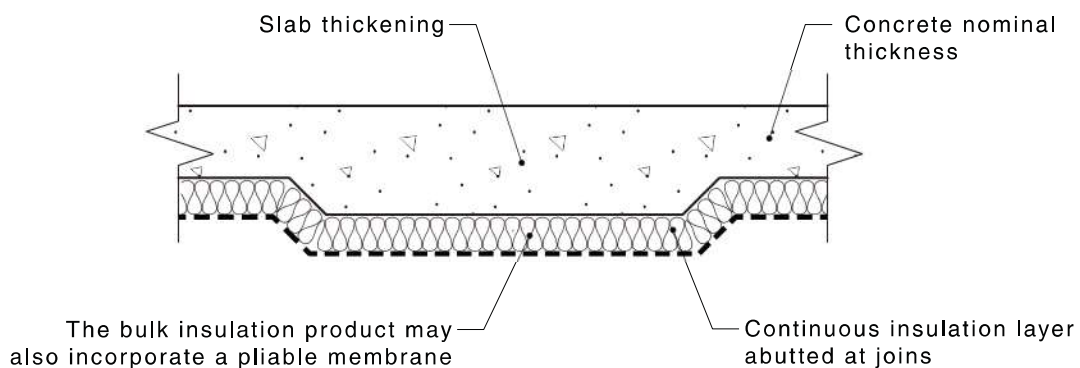


FIGURE I2 ELEVATED SLAB WITH INSULATION
UNDER THICKENED SLAB SECTIONS

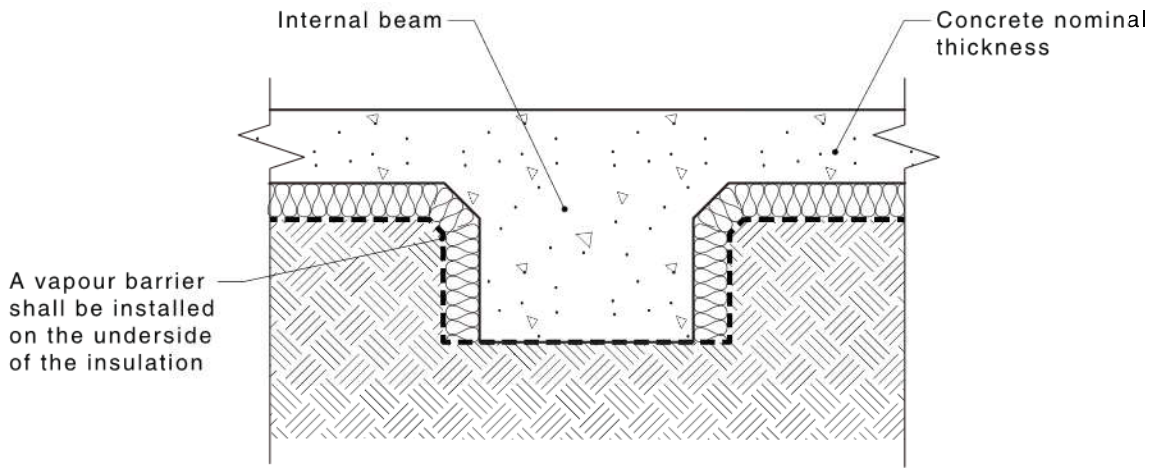


FIGURE 13 SLAB ON GROUND WITH INSULATION UNDER FORMED SLAB BEAMS

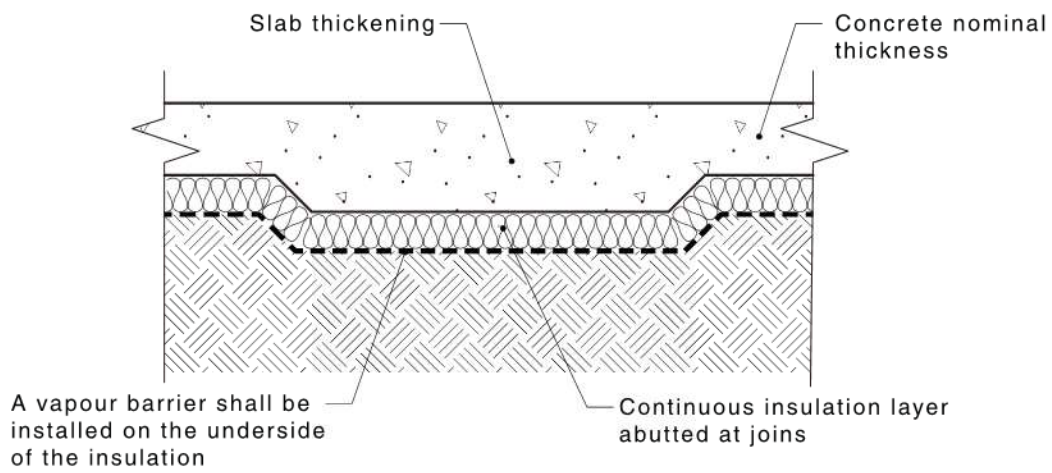


FIGURE 14 SLAB ON GROUND WITH INSULATION UNDER THICKENED SLAB SECTIONS

APPENDIX J
INSULATION RETRO-FIT AND REMEDIATION
 (Normative)

J1 SCOPE

This Appendix specifies requirements for the installation of bulk insulation where existing insulation may or may not be present and the necessary procedures required to assess the compatibility of top-up insulation and/or necessary procedures for removal.

J2 GENERAL

Prior to installing bulk thermal insulation in an established dwelling, the installer shall first be satisfied that there is sufficient space available for the insulation to achieve its designed thermal performance, and the structure is capable to support the additional loads.

Guidance on the selection of R-value of the insulation to be used in the roof/ceiling element of a dwelling which requires heating or cooling and can be obtained from the methods set out in AS/NZS 4859.1, based upon economic considerations using current costs which include—

- (a) installed cost of the thermal insulation; and
- (b) cost of energy for heating and cooling.

The economic R-value will not necessarily be the same for different insulation materials or for different climate regions, nor may it be achievable in practice because of space limitations or structural considerations.

Undertaking any retrofit or, remediation of insulation the insulation installer shall comply with fire and electrical safety procedures outlined in Section 2 and Section 4.

J3 MOISTURE

Where signs of moisture damage, mould or rot are present in the existing building structure the following precautions shall be taken, as appropriate:

- (a) Cease work and notify the owner or client.
- (b) Advise the owner/client to—
 - (i) seek engineering advice to rectify the damage; and
 - (ii) seek engineering advice to design an adequate thermal insulation system to control heat, air and moisture specific to the application.

NOTE: The type of water damage may be critical to the longevity and performance of the insulation. Contamination may occur from non-potable water such as, sediment, saltwater and sewage which may need to be treated differently from damage by rainwater or freshwater.

J4 CEILING RETROFIT DETAILS

When adding insulation to existing ceilings it shall comply with the following as appropriate:

- (a) Where existing ceiling insulation is present check the insulation and determine if it complies with Sections 2, 3, 4 and Clause 5.3, and proceed with either of the following, as appropriate:
 - (i) Rectify the insulation to comply with Sections 2, 3, 4 and Clause 5.3.
 - (ii) Remove the insulation.
- (b) For fibrous batt insulation to be laid over existing loose fill insulation ensure that—
 - (i) the existing loose fill insulation installation is compliant with Clauses 2.4, 2.6, 2.7, 5.3 and Sections 3 and 4;
 - (ii) loose fill shall be removed 600 mm either side of downlights along the joist bay and replaced with a localized thicker batt insulation, which meets the requirements of Appendix C for ‘resistance to movement’, and shall be of equal thickness and thermal value to the existing insulation plus the new insulation layer;
 - (iii) where joists, bottom chords or blocking are less than 600 mm from a downlight, and the loose fill layer does not sit higher than the joists or blocking, then 600 mm requirement in Item (ii) above may be reduced to the point at which the joist, bottom chord or blocking is located; and
 NOTE: Structural timbers are deemed satisfactory to hold loose fill insulation in place provided the loose fill is not higher than the top edge of the joists.
 - (iv) the new insulation system is compliant with Sections 2, 3, 4 and Clause 5.3.
- (c) For fibrous batt insulation to be laid over existing fibrous batt insulation, the installer shall ensure—
 - (i) the existing fibrous batt insulation installation is compliant with Clauses 2.4, 2.6, 2.7, 5.3 and Sections 3 and 4;
 - (ii) the existing fibrous batt shall be removed 600 mm either side of downlights and replaced with a higher performance batt insulation, which meets the requirements of Appendix C for ‘resistance to movement’, and shall be of equal thermal value to the existing insulation plus the new insulation layer; and
 - (iii) the new insulation system is compliant with Sections 2, 3, 4 and Clause 5.3.
- (d) For loose fill insulation to be laid over existing fibrous batt insulation, the installer shall ensure—
 - (i) the existing fibrous batt insulation installation is compliant with Clauses 2.4, 2.6, 2.7, 5.3 and Sections 3 and 4;
 - (ii) barriers of sufficient height and mechanical strength are added to restrain the new insulation layer in accordance with Clauses 2.4, 2.6 and 2.7; and
 - (iii) the new insulation system is compliant with Sections 2, 3, 4 and Clause 5.3.
- (e) For foil batt products to be laid over existing fibrous batt insulation of loose fill, the installer shall ensure—
 - (i) the existing fibrous batt or loose fill insulation installation is compliant with Clauses 2.4, 2.6, 2.7, 5.3 and Sections 3 and 4;
 - (ii) all requirements in Section 4 and Clause 5.3 are met for the installation of the foil batt product; and
 - (iii) the new insulation system is compliant with Section 2, 3, 4 and Clause 5.3.

J5 ROOF RETROFIT DETAILS

Insulation to be added under uninsulated roofs with ceiling lining above the structural members shall comply with the following:

- Fire safety and moisture tolerance in accordance with Section 2.
- Insulation procedures in accordance with Section 3.
- Electrical safety provisions in accordance with Section 4.
- Detailed roof insulation requirements in Clause 5.2.
- Detailed ceiling insulation requirements in Clause 5.3.
- General layout in Figures J1 or J2.

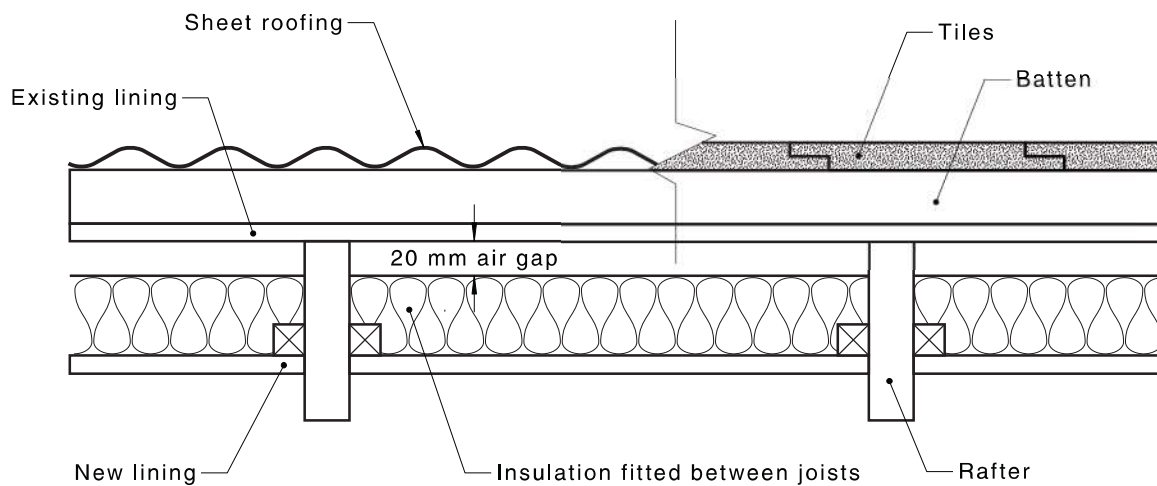


FIGURE J1 RETROFIT OF INSULATION BETWEEN ROOF RAFTERS WITH A FALSE CEILING

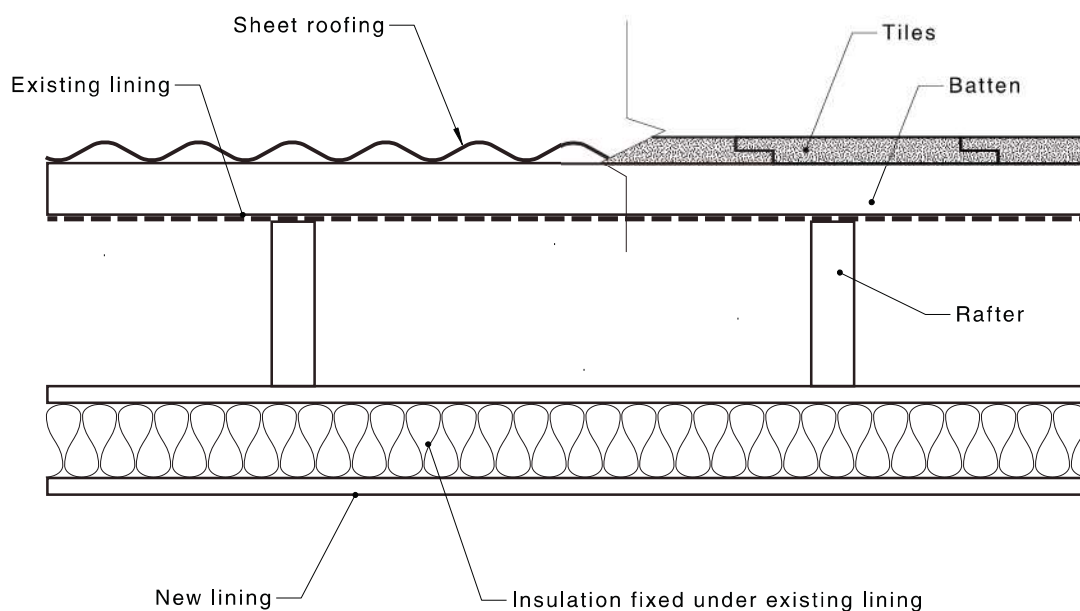


FIGURE J2 RETROFIT OF INSULATION UNDER ROOF RAFTERS WITH A FALSE CEILING

J6 WALL RETROFIT DETAILS

J6.1 General

Walls can be retrofitted with an additional insulation layer on the internal linings, or other methods described in Clause 5.4 may also be used.

NOTE: The use of loose fill should be assessed to ensure that the insulation does not compromise the required weather proofing or electrical safety.

J6.2 Retrofitting timber-framed walls

Insulation to be added to the face of existing internal wall linings shall comply with the following:

- (a) Fire safety and moisture tolerance in accordance with Section 2.
- (b) Insulation procedures in accordance with Section 3.
- (c) Electrical safety provisions in accordance with Section 4.
- (d) Detailed requirements in Clause 5.4.3.2.
- (e) General layout in Figure J3.

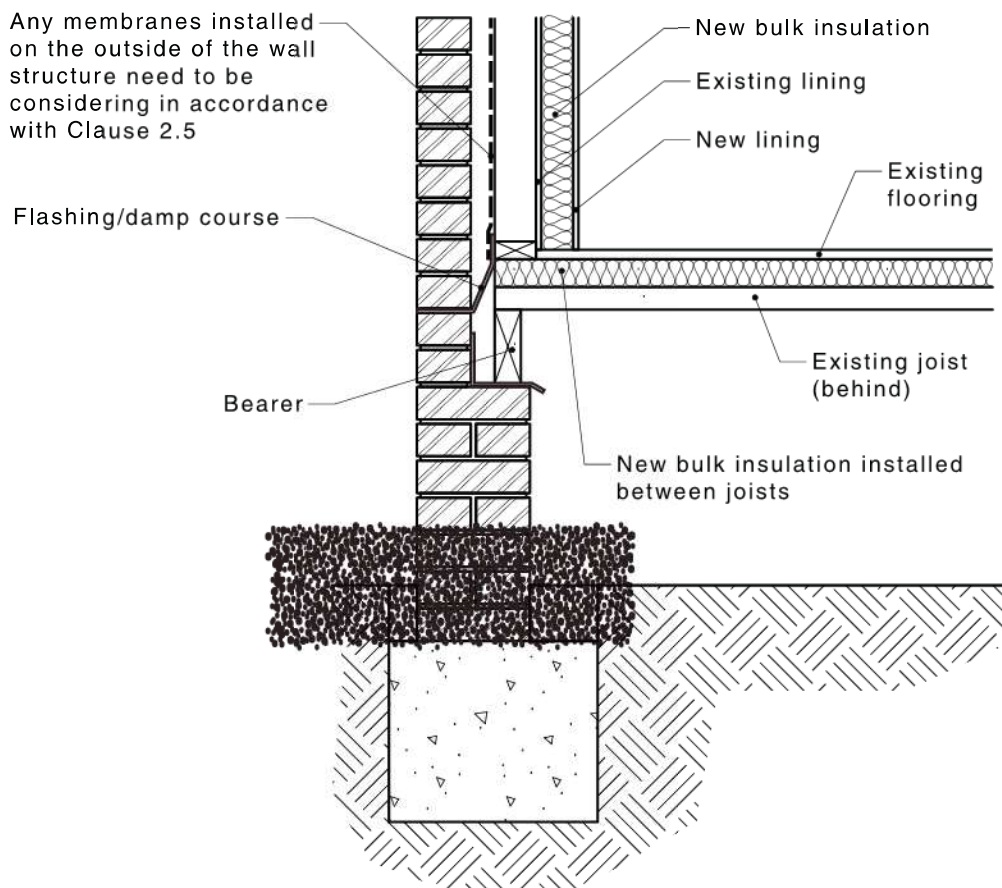


FIGURE J3 RETROFIT OF INSULATION TO INTERNAL WALL LININGS

J7 FLOORS

Insulation to be added to existing floor structures shall comply with the following:

- (a) As appropriate—
 - (i) underfloor insulation shall be installed in accordance with Clause 5.5.3; and
 - (ii) slab edge insulation shall be installed in accordance with Clause 5.5.4.
- (b) Fire safety and moisture tolerance in accordance with Section 2.
- (c) Insulation procedures in accordance with Section 3.
- (d) Electrical safety provisions in accordance with Section 4.
- (e) Detailed requirements for internally insulated materials as set out in Clause 5.4.3.2.

APPENDIX K
ELECTRICALLY CONDUCTIVE BULK INSULATION
(Normative)

K1 GENERAL

Electrically conductive bulk insulation proposed for location on top of ceiling surfaces or ceiling joists, and under subfloors, where pre-existing electrical cabling is installed, shall meet the following additional requirements before installation commences.

K2 ELECTRICAL SAFETY INSPECTION AND ASSESSMENT

Before the start of the installation in a building of electrically conductive ceiling and subfloor insulation, a written statement shall be obtained confirming that—

- (a) the existing electrical installation in the ceiling structure and/or subfloor of the building has been inspected and assessed in accordance with the requirements of this Standard; and
- (b) the existing electrical installation in the ceiling and/or subfloor structure of the building is electrically safe.

NOTE: It is recommended that this written statement is kept by all parties for at least 5 years after it is given to the employer or self-employed person is given the written statement.

K3 FOR APPROVED SAFETY SWITCH OR PERMANENT MARKING FOR ELECTRICAL CIRCUITS

Before the start of the installation in a building of electrically conductive ceiling or subfloor insulation, a written statement shall be obtained confirming that each unprotected circuit located in the area to be insulated is identified and clearly marked. An unprotected circuit is clearly marked only if the unprotected circuit is permanently marked—

- (a) in a way that distinguishes the unprotected circuit from protected circuits located in the area to be insulated; and
- (b) at intervals of not more than 1 m, to the extent that it is reasonably practicable.

This written statement shall explain the way in which unprotected circuits have been permanently marked to distinguish them from protected circuits.

If a protected circuit has been marked with durable high visibility tags, the certificate shall explain this.

NOTE: It is recommended the written statement (or a copy thereof) is kept by all parties for at least 5 years after it is given to the employer or self-employed person.

K4 INSTALLATION REQUIREMENTS FOR UNPROTECTED CIRCUITS

Electrically conductive ceiling and subfloor insulation installed in a dwelling shall—

- (a) not cover, in whole or in part, any unprotected circuit; and
- (b) be installed at least 25 mm away from any unprotected circuit.

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AS/NZS

- 1170 Structural design actions
 - 1170.0 Part 0: General principles
 - 1170.1 Part 1: Permanent, imposed and other actions
 - 1170.2 Part 2: Wind actions
 - 1170.3 Part 3: Snow and ice actions
- 60598 Luminaires
 - 60598.1 Part 1: General requirements and tests (IEC 60598-1, Ed.7.0 (2008) MOD)
 - 60598.2.2 Part 2.2: Particular requirements—Recessed luminaires (IEC 60598-2-2:1996, MOD)

ASTM

- E96 Standard test methods for water vapour transmission of materials

ISO

- 13788 Hygrothermal performance of building components and building elements—Internal surface temperature to avoid critical surface humidity and interstitial condensation—Calculation methods

AMENDMENT CONTROL SHEET

AS 3999:2015

Amendment No. 1 (2020)

REVISED TEXT

SUMMARY: This Amendment applies to the Preface, Clauses 1.3, 1.4.15, 1.4.22, 1.4.28 (new), 1.4.29 (new), 1.4.30 (new), 1.4.31 (new) and 1.4.32 (new), 2.3, 2.6.1.4, 2.6.2, 4.3(c), 4.6 (new) and 5.4.3.1, Figures 2.6.1.3 and 2.6.1.4, and Appendices A, B and C.

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NOTES

NOTES

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