



Insulation Handbook

Professional Installation Guide

Version 8

Insulation installation for ceilings,
walls and floors, roof blankets
and pliable building membranes

An independent publication of the
Insulation Council of Australia and New Zealand



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- CSR Bradford Insulation www.bradfordinsulation.com.au
- Pliable Building Membranes Association of Australia

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NOTE: This document will be updated periodically. Check ICANZ website to confirm this is the latest edition.

www.icanz.org.au

Before reading this guide please note

The contents of this document is intended to provide professional installers with practical guidance in the installation of insulation. It should be read in conjunction with technical or safety instructions, product information and guidance material provided by the product manufacturer and any applicable laws and standards. The information provided is general in nature and the user should establish its applicability to any specific circumstances.

Images are provided by way of illustration only.

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Foreword

Insulation Matters!

Climate change and the challenge of reducing carbon emissions and reducing household and business energy costs are now foremost on the agenda of Governments, Councils, Industry and consumers. Improving energy efficiency is one of the cheapest, most accessible and effective ways to cut greenhouse gas emissions from buildings.

By 2005, the Building Code of Australia incorporated minimum energy efficiency requirements for all new habitable buildings and major renovations to pre-existing buildings.

Of all the energy efficiency measures available for buildings, insulation is amongst the most immediate and cost effective. Insulation is not just about reducing greenhouse gas emissions.

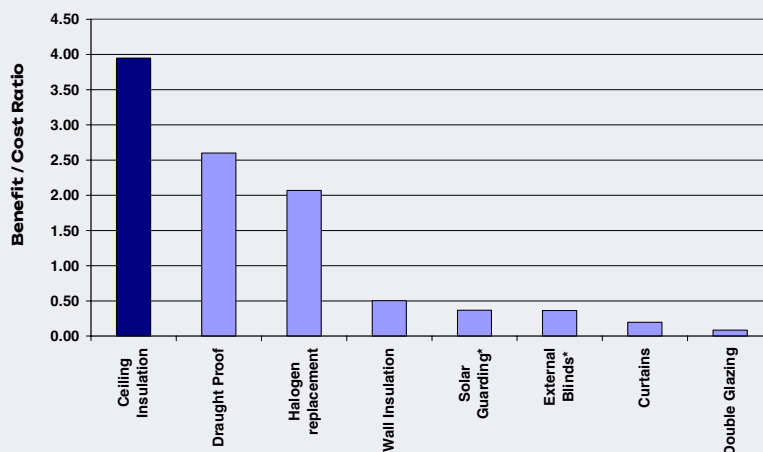
Insulation will:

- reduce costs and save money by reducing energy bills
- provide healthier living conditions and well being for occupants
- reduce sound transmission through buildings
- use less energy and reduce greenhouse gas emissions
- often reduce the size and cost of air conditioning equipment needed for heating and cooling.

Quantified estimates of typical insulation savings (energy savings, reduced greenhouse emissions, reduced peak load) can be found in the ICANZ study "The Value of Insulation Based Residential

Energy Savings Measures In Australia" September 2012. This report is available at www.icanz.org.au.

Comparative National Average Benefit Cost Ratios for Various ESMs



Source: The Value of Insulation Based Residential Energy Savings Measures in Australia - Page 25.

Insulation and solar panels are complimentary

Insulation, correctly installed, reduces the amount of energy needed to heat and cool homes and improves comfort and amenity. So when solar panels are installed, the power solar panels generate will provide a greater proportion of the reduced energy needed from mains power.

Correctly installed insulation provides some of the most cost effective and energy efficient savings investment strategies - particularly for low income households where energy costs are significant and co-benefits such as improved health outcomes are of particular value.

Insulation is the perfect partner to solar PV systems because solar can only produce during the day and mainly in the middle of the day. Insulation will help keep the benefits of day heating or cooling well into the night.

Installing insulation is a once only cost. Choosing the right insulation, correctly installed, will deliver its benefits for the life of the building.



Insulation Handbook Version 8: Professional Installation Guide for ceilings, walls and floors, roof blankets and pliable building membranes.

About this handbook

Selecting the right insulation for the required application is important. Equally important is installing insulation. The full benefits of insulation will be achieved over the life of the building when insulation is correctly installed.

This guide will assist installers to competently install insulation in residential buildings.

This insulation installation handbook is a comprehensive guide providing practical information including:

- principles of energy efficiency, giving an overview of thermal and acoustic products performances and benefits
- the composition of Rockwool and Glasswool products
- reference to Standards, Regulations and Codes relevant to the installation of insulation in ceilings, walls and floors
- Work Health and Safety (Occupational Health and Safety) guidelines covering factors such as storage, handling and, where required, personal protective equipment (PPE)
- common risks which may be present when installing insulation.

Instructions for the safe installation of insulation covering the following:

- Installation of batt insulation for ceilings
- Installation of batt insulation for walls
- Installation of batt insulation for floors
- Installation of pliable building membranes
- Installation of insulation under metal and tiled roofs.

A comprehensive overview of elements of this handbook is available on the Contents page.

The purpose of this handbook is to clearly communicate the message that to achieve the full potential benefits of insulation, the insulation chosen must be fit-for-purpose and installed correctly.

The Right Installation Matters!

How to use this Handbook

This Handbook is designed to provide professional insulation installers with practical guidance on how to install insulation correctly and safely.

It does not replace any technical or safety instructions provided by insulation product manufacturers or regulatory standards. This Handbook must be read in conjunction with all necessary standards and instructional and guidance material provided by insulation product manufacturers.

More information about insulation is available at www.icanz.org.au

A handwritten signature in grey ink that reads "J Strachan".

Janine Strachan
ICANZ CEO

Foreword

Insulation is more than just a product

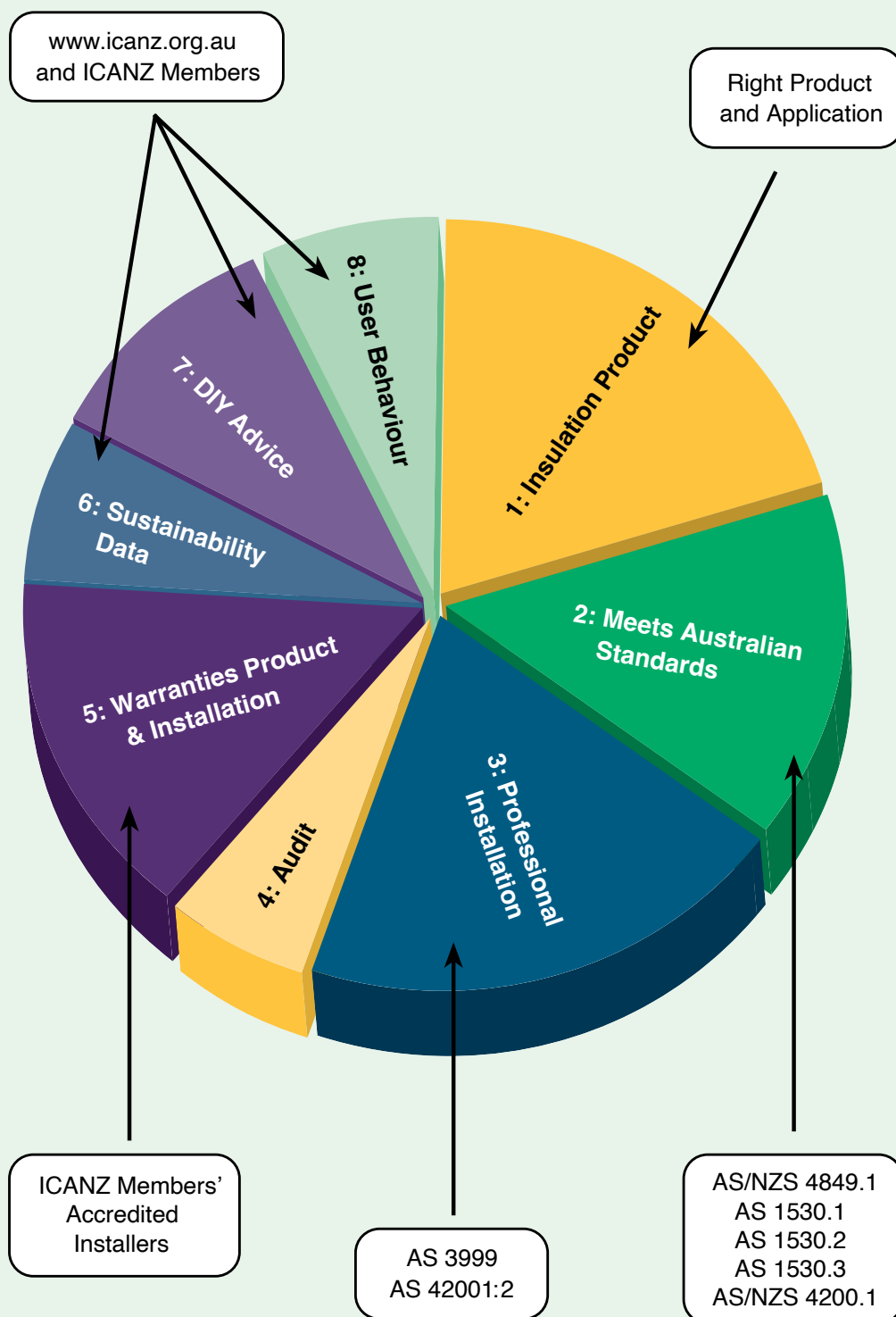
The use of buildings in Australia contributes approximately 23% of Australia's greenhouse gas emissions* and this percentage continues to increase. Measures to reduce greenhouse gas emissions from buildings will include increasing the required minimum energy efficiency stringencies. As these stringencies increase, more attention will need to be directed to 'closing the loop' with regard to ensuring products and services are installed correctly and used effectively to achieve their promised lifetime returns. A well insulated building is fundamental to achieving effective and long-term energy efficiency levels.

Ensure the best performance outcomes (also refer to pie chart).

1. Selecting the right insulation product for the proposed application is the first important step.
2. There are established Australian Standards for independently testing fire, thermal and acoustic performance claims.
3. **Incorrectly installed insulation can substantially reduce its expected life long benefits.** As with other products, there are established Australian Standards for installation.
4. Once installed, insulation is out of sight - and in many cases inaccessible once a building is complete. **Random audits by installation supervisors during construction will ensure the right insulation is being used and correctly installed. Use an established contractor who offers this service.**
5. Correctly installing the right insulation will provide life long benefits. ICANZ members and their approved installation contractors provide warranties and guarantees for product performance and installation to meet all appropriate Australian Standards.
6. Some insulation has high sustainability ratings and a very low impact on the environment. Most insulation types last the lifetime of the building and require no maintenance when correctly installed. Some insulation is made from a high percentage of recycled materials (e.g. glasswool insulation - up to 80% recycled glass content). This information should be available from product manufactures' websites.
7. Some insulation products are available for DIY renovators. ICANZ members provide information on their packaging and websites to assist DIYers to choose the right insulation and install it safely and correctly.
8. **The habits and behaviour of building occupants will have a significant impact on energy use** and on the effectiveness of insulation in controlling the indoor environment of the building.

Adopting good practice will substantially help save energy costs, improve comfort and reduce greenhouse gas emissions. Helpful information is widely available from State and Federal Government websites and from ICANZ and its member companies.

* Australian Sustainable Built Environment Council (ASBEC) (2016). *Low Carbon, High Performance*, p.27.



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BE A LEADER – become a registered, accredited insulation installer

About insulation

Insulation plays a fundamental role in good building design, efficient use of energy, and provides comfort, protection and better health outcomes for building occupants.

Installing insulation should be a once only cost. Selecting the right insulation for the application and installing it correctly will provide significant occupant benefits for the life of the building. However, if the insulation is not fit for purpose or is installed incorrectly up to 50% of the potential life-long benefits could be wasted.

Therefore, the skills of the insulation installer plays an important role in achieving the optimum benefits of installed insulation.

About accredited training

The insulation industry has developed an insulation installer training course that covers new build and retrofit installation, which can be delivered by Registered Training Organisations (RTOs) across Australia. This handbook is a key part of the training material, which has been designed for installers. The course provides details of the latest Australian Standards, Work Health and Safety requirements, duty of care, and identifying, assessing and managing risks.

The insulation industry also works with a Registered Certifying Body, where trained and accredited installers can apply for Insulation Installer Certification.

For further information, visit <https://eeccertified.org.au/certifications/certified-insulation-installer/> or contact the EEC Certifications team at certifications@eec.org.au or 03 9069 6588

Benefits of being an accredited and certified insulation installer

There is a growing requirement within the building industry to have all work done by qualified personnel.

This is already mandatory for government funded building work. No matter how long you have been an installer, you will learn many things from this course and be brought up to date with all relevant standards, regulations and responsibilities you may not realise you have to comply with.



See our Insulation installation videos

ICANZ has been working with the Victorian State Government and Building Industry Associations to create a series of insulation installation videos for installers and other associated trades who regularly handle insulation.

The link <https://youtu.be/jsVWwc8fQeU> will give you a good summary walk through of the content and use of the video series

Please click below to go to ICANZ videos:

MODULE ONE

Insulation & Legislation

MODULE TWO

Hazards & Errors

MODULE THREE

Ceilings, Walls & Floors

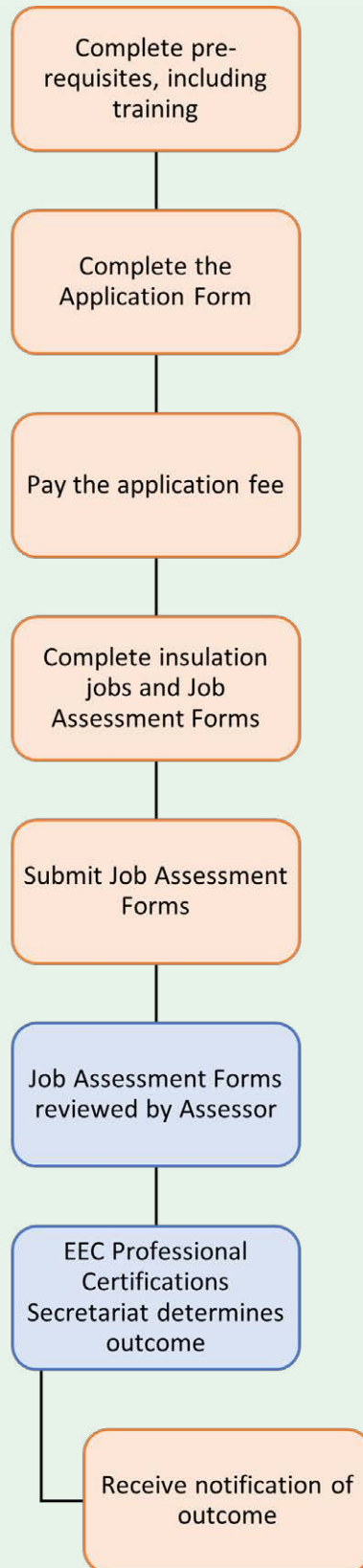
MODULE FOUR

Wraps & Other Trades

MODULE FIVE

Insulating Roofs

INSULATION INSTALLER CERTIFICATION



1. ICANZ Recommended Training Requirements for Persons Employed to Install Insulation

Prerequisites				
Module Name	National Competency	Unit Descriptor	Requirement	Elements
Emergency First Aid (Workplace level 1)	HLTAID002 Promotes basic emergency life support	This unit of competency describes the skills and knowledge required to recognise and respond to life threatening emergencies using basic life support measures only.	Recommend	1 Respond in an emergency situation.
				2 Apply identified first aid procedures.
				3 Communicate details of the incident.
				4 Evaluate own performance.
Construction Industry Safety Induction	CPCWHS1001 Prepare to work safely in the construction industry	This unit of competency specifies the mandatory work health and safety training required prior to undertaking construction work. The unit requires the person to demonstrate personal awareness and knowledge of health and safety legislative requirements in order to work safely and prevent injury or harm to self and others. It covers identifying and orally reporting common construction hazards, understanding basic risk control measures, and identifying procedures for responding to potential incidents and emergencies. It also covers correctly selecting and fitting common personal protective equipment (PPE) used for construction work.	Mandatory	1 Identify health and safety legislative requirements.
				2 Identify construction hazards and risk control measures.
				3 Identify incident and emergency response procedures.

Units of Competency Required for Insulation Installer Certification				
Module Name	National Competency	Unit Descriptor	Requirement	Elements
Install ceiling insulation products	CPCCPB3027A	This unit specifies the outcomes required to safely undertake only ceiling insulation installation work using bulk insulation products. The unit includes identifying legislative, regulatory, and job requirements; planning and preparing to install insulation; installing insulation; and, completing installation, including preparation of a Statement of Insulation Installation.	Mandatory	1 Define job requirements.
				2 Plan and prepare for installing insulation.
				3 Install ceiling insulation.
				4 Complete installation.
Prepare for insulation retrofitting within ceiling spaces	EEC001	This competency specification specifies the outcomes required to safely prepare for retrofitting of insulation in residential ceiling spaces, including removal of existing insulation.	Mandatory	1 Define job requirements.
				2 Plan and prepare for insulation removal.
				3 Remove ceiling insulation.
				4 Clean up site.

Carry out measurements and calculations	CPCCOM1015	This unit of competency specifies the skills and knowledge required to undertake basic measurements and calculations to determine task and material requirements in a construction work environment.	Mandatory	1	Obtain measurements.
				2	Perform basic calculations.
Install bulk insulation and pliable membrane products	CPCCPB3014 + ICANZ supplementary information	<p>This unit specifies the outcomes required to safely undertake floor, wall and ceiling insulation installation work using bulk insulation and pliable membrane products. The unit includes identifying legislative, regulatory, and job requirements; planning and preparing to install insulation; installing insulation; and, completing installation, including preparation of a Statement of Insulation Installation.</p> <p>The unit requires a person undertaking this work to comply with legislative, regulatory, safety and technical, organisational and site requirements while planning and carrying out the work.</p> <p>The unit applies to insulation installers working primarily in residential buildings, although there may be application in some instances in commercial buildings.</p> <p>The work context involves working at heights, working in enclosed areas, dust control and mitigation of risk from asbestos.</p>	Mandatory	1	Define job Requirements
				2	Plan and prepare for installing insulation
				3	Install floor, wall and ceiling insulation
				4	Complete installation
Work Safely at Heights	CPCCM2012	<p>This unit specifies the skills and knowledge required to work safely on construction sites where the worker has the potential to fall from one level to another.</p> <p>This unit of competency does not cover the erection of scaffold or work platforms, but it does include identifying and reporting common faults with scaffold or work platform systems.</p> <p>Work at heights is undertaken in a range of construction work, including new construction, renovation, refurbishment and maintenance.</p> <p>This unit also applies to workers in other industries who need to control the two separate risks associated with people and objects falling from heights.</p>	Mandatory	1	Identify task requirements
				2	Access and assess work area
				3	Conduct work tasks
Apply health and safety requirements, policies & procedures in the construction industry	CPCCWHS2001	<p>This unit specifies the outcomes required to carry out work health and safety (WHS) requirements through safe work practices in all on- or off-site construction workplaces.</p> <p>It requires the performance of work in a safe manner through awareness of risks and work requirements, and the planning and performance of safe work practices with concern for personal safety and the safety of others.</p> <p>The unit covers fundamental WHS requirements necessary to undertake work tasks within any sector in the construction industry. It includes the identification of hazardous materials, including asbestos, and compliance with legislated work safety practices. It does not cover removal of asbestos, which is a licensed activity.</p>	Mandatory	1	Identify and assess risks.
				2	Identify hazardous materials and other hazards on work sites.
				3	Plan and prepare for safe work practices.
				4	Apply safe work practices.
				5	Follow emergency procedures.

2. Glossary of Terms

2.0 Glossary of Terms	
Term	Definition
Sound Insulation	Bulk fibrous insulation, having the ability to absorb various sound frequencies when installed in ceiling, wall and floor cavities.
Added R-value	Thermal resistance added to a construction element by insulation.
Adhesive	A material capable of holding other materials together by surface attachment. Glues, cements, pastes and mucilage are some common adhesives.
Air Tightness	Air Tightness is the fundamental building property that impacts infiltration and exfiltration (the uncontrolled inward and outward leakage of outdoor air through cracks, interstices or other unintentional openings of a building, caused by pressure effects of the wind and/or stack effect).
Australian Standards	Detailed technical documents developed for Standards Australia by expert working parties drawn from industry and government agencies. There are over 400 Australian Standards relevant to work health and safety (WHS). Some of these have been adopted as codes of practice by individual governments.
Batten	Timber or metal support found underneath roof cladding and sometimes found to support ceiling plaster.
Batt Insulation	Flexible, blanket like pieces of a standard size. Usually made from glasswool, batts are used for thermal or sound insulation. As opposed to loose-fill insulation which is blown in place.
BCA/NCC	Building Code of Australia (part of the National Construction Code (NCC)) – a set of national requirements for the use in the design, construction, alteration or demolition of buildings, setting out procedures, acceptable methods or materials and minimum or maximum values. Each state has its own variations to the national document.
Beam	Any major horizontal structural member.
Bearing Partition/Wall	A partition that supports any vertical load in addition to its own weight.
Breathing Zone	A zone described by a hemisphere of 300mm radius, extending in front and measured from the midpoint of an imaginary line joining the ears.
Building Code	Government rules regulating safe building practices and procedures. The codes generally encompass minimum requirements for energy efficiency, structural, electrical, plumbing, and mechanical remodeling and new construction. Inspection may be required to confirm adherence to local codes.
Building Envelope	Is the physical separation between the interior and exterior environments of a building. It serves as the outer shell to maintain the internal environment.
Bulk Insulation	Insulation depending for its performance upon thickness and thermal conductivity to achieve Material R-value.
Ceiling Joist	Structural members providing support and a fixing surface for a ceiling.
Climate Zone	An area defined in the BCA Climate Zone Map of Australia having energy efficiency provisions based on a range of similar climate characteristics.
Code of Practice	Technical document on a health and safety issue approved by a government minister. It provides practical guidance on ways to achieve compliance with WHS legislation.
Competent Person	A person who has acquired through training, qualification or experience – or a combination of these – the know how and skill enabling that person to perform the required task correctly
Conduction	Heat flow transfer by exciting molecules of a solid material.
Conduit	Metal or plastic tubing designed to enclose electrical wires.
Control (i.e. hazard or risk)	Process used after conducting a risk assessment to identify all practicable measures for removing or reducing the likelihood of injury, to implement these measures and review them to ensure their effectiveness.
Convection	Heat flow transferred by movement of a fluid (e.g. air movement).
Dew point	The temperature to which the air must cool for it to become completely saturated with water.
Double Sided	Reflective foil on both faces of reflective foil laminate pliable membrane.
Double Sided Anti Glare	Reflective foil on both faces of reflective pliable membrane with additional ink coating on external face (for WHS antiglare requirements).

2.0 Glossary of Terms

Term	Definition
Duty of Care	A principle of common law that requires each person or company to take care not to cause harm to other persons.
Emergency	An event that will produce or exacerbate injury to people and / or damage to property unless immediate intervention occurs.
Emergency Procedures	Best practice guidelines for reacting to an emergency so that persons at risk respond in a prompt, orderly and appropriate way.
Emittance	Ratio of radiant energy emitted by a surface compared to that of a blackbody (a blackbody emits radiant energy at the maximum rate possible i.e. 100% emittance).
Exposure Standards	An airborne concentration of a particular substance in the worker's breathing zone, exposure to which, over a period of 8 hours followed by a period free of exposure of 16 hours, and according to current knowledge, should not cause adverse health effects nor cause undue discomfort to nearly all workers.
Extruded Polystyrene	(Extruded or expanded polystyrene boards) – used as an insulation and/or external cladding material that is then rendered.
FBS-1™ Glasswool	Insulation composed of bio-soluble glass fibres that comply with test requirements of Note Q (refer SafeWork Australia).
FBS-1™ Rockwool	Insulation composed of bio-soluble rock fibres that comply with test requirements of Note Q (refer SafeWork Australia).
Fibre	A particle with a length to width ratio of at least 3:1.
Fill-Type Insulation	Loose insulating material that is applied by hand or mechanically blown into wall and ceiling spaces.
Floor Plan	A drawing showing the arrangement of rooms, the locations of windows and doors and complete dimensions – A floor plan is actually a horizontal section through the entire building.
Glasswool Batts	Insulation made from up to 80% of recycled glass, non- conductive of electricity, non - combustible and with high sound absorbing qualities.
Guard or Collar	A fire retardant component (AS 1530.3 - Spread of flame 'O') used to provide adequate separation from combustible building elements, insulation and/or debris to reduce the fire risk caused by recessed luminaires (refer AS 3999).
Hazard	An energy or environmental factor that could produce injury or disease.
Hazardous Substance	A substance that has the potential, through being used at work, to harm health and safety in the workplace. The criteria for identifying a hazardous substance are detailed in the NWHSC Approved Criteria for the Classification of Hazardous Substances (1999) as amended occasionally.
Hazmat	An abbreviation for 'hazardous material' used on warning signs.
Heat Transfer	Heat flow from a hot to a cold body (see convection, conduction and radiation).
Heightened Awareness (of Electrical Risks)	An increased level of familiarity and knowledge regarding conditions and circumstances with regard to electrical fittings and cabling that could constitute a safety risk for insulation installers.
Hepa	An air filter that removes 99.97% of all particles greater than .3 microns from the air that passes through it.
Incident	An unplanned, undesirable energy release that may result in injury to people and / or damage to property.
Indoor Air Film	A layer of air adjacent to the internal surface of the building element.
Inspirable Fraction	That fraction of dust which enters the respiratory tract as defined in Australian Standard AS 2640-1989 Workplace Atmospheres: Method for sampling and gravimetric determination of inspirable atmospheric dust.
Insulated Foam Sheathing	A type of sheathing made from compressed foam and covered by a foil or other substance allowing its use as a wall sheathing with increased insulation value.
Insulation	Any material which resists the transfer of electricity, heat or sound. In a home, thermal insulation is any material that slows heat flow. A well-insulated home will provide yearround comfort and costs less to heat and cool. Insulation also helps to reduce noise levels and condensation when in combination with a vapour barrier. Insulation can be made from glasswool batts, Rockwool batts, natural wool, cellulose fibre, extruded polystyrene or expanded polystyrene boards, polyurethane foam, polyester fibres, and reflective foil membranes.
Joist	A series of parallel framing members that supports a floor or ceiling load. Joists are supported by beams and load bearing walls.
Joist Hanger	Metal device, shaped like a "U", used to connect two joists or a joist and beam at right angles to each other.

2.0 Glossary of Terms

Term	Definition
Joist Support	A horizontal beam that supports the floor joists.
JSA	Job Safety Analysis- a method that can be used to identify, analyse and record (1) the steps involved in performing a specific job, (2) the existing or potential safety and health hazards associated with each step (3) the recommended actions(s) or procedure(s) that will eliminate or reduce these hazards and the risk of a workplace injury or illness.
Kneewall	A wall that extends from the floor of a roof space to the underside of the rafters. Kneewalls are short (usually 1200mm high) and often non-load bearing.
Legislation	Law passed by an Act of Parliament.
Lintel	A lintel (or lintel) is a structural horizontal block that spans the space or opening between two vertical supports. It can be a decorative architectural element, or a combined ornamented structural item. It is often found over portals, doors, windows and fireplaces.
Loose-fill Insulation	Small pieces of insulation, made from glasswool or Rockwool that is blown into a home using a machine that contains a blowing machine. Loose-fill is especially effective at filling small and irregularly-shaped spaces.
Luminaire Barrier (down light)	A product complying with AS/NZS 5110.
Manual Handling	Any activity requiring the use of force exerted by a person to lift, push, carry or otherwise move, hold or restrain any object.
Material R-value	<p>The R-value is a measure of thermal heat flow resistance of a material only and referred to in the building and construction industry. A product's thermal heat flow resistance is expressed as the thickness of the material divided by the material's thermal conductivity. The material R-value of a product excludes surface film resistances.</p> <p>Labelled material R-value (R_m) are determined by testing the material to AS/NZS 4859.1 at a mean temperature of 23°C for Australian conditions.</p> <p>Unit of measure expressed as: m²K/W.</p>
Micron	One millionth of a metre, or equivalently one thousandth of a millimetre.
Mineral Wool	Insulation composed of fibres manufactured from glass or rock.
Natural Ventilation	An air space bounded by one or more permeable surfaces allowing a degree of air movement (e.g. a roof space below on un-sarked tiled roof).
Near Miss	An accident that does not produce an injury or disease.
Noggin/Nogging	Horizontal bracing pieces used between wall studs or floor joists to give rigidity to the wall or floor frames of a building. Noggings may be made of timber, steel, or aluminium. If made of timber they are cut slightly longer than the space they fit into, and are driven into place so they fit tightly or are rebated into the wall stud.
Nominal Fibre Diameter	The median diameter to which the fibrous product is manufactured. It may be thought of as the diameter at the mid point of a long fibre created by joining all fibres in a sample together in order to increase thickness.
NWHSC	National Work Health and Safety Commission.
NCC	National Construction Code.
Non-Load Bearing Wall	A wall supporting no load other than its own weight.
Non-Ventilated	Air space enclosed by non air permeable building materials.
Health and safety	Occupational health and safety – prevention of disease and injury caused by workplace influences. Now referred to as Work Health & Safety (WHS).
Outdoor Air Film	A layer of air adjacent to the external surface of the building element.
PBM	Pliable Building Membranes. Flexible, durable rolls of material used to wrap walls or sark roofs. These can be made from material that is reflective or non reflective, permeable or non permeable.
Personal Sample	An air sample taken within the breathing zone of the worker.
PPE	Personal Protective Equipment- equipment worn by workers to reduce risk from WHS hazards.
Quality Assurance	<p>A planned and systematic process of ensuring that the requirements of the assessment system, unit of competency and any other criteria are applied in a consistent manner.</p> <p>Quality assurance mechanisms or procedures are an integral part of an assessment system.</p>
Radiation	Heat flow transfer by electromagnetic radiation (infra red waves).
Radiation Heat	Flow transfer by electromagnetic radiation (infra red waves).

2.0 Glossary of Terms

Term	Definition
Reflective Air Space	A still air space between two surfaces - with at least one surface being reflective.
Reflective Insulation / Foils	A reflective foil laminate (RFL) in which one or both surfaces will conduct comparatively little heat. When used with the surfaces facing air spaces of at least 20mm, such material reduces the heat radiation across the air space by use of one or more surfaces of high reflectance and low emittance.
Regulation	Subordinate legislation passed by parliament to amplify or make explicit the requirements of an Act.
Respirable Fibre	A fibre with a diameter less than 3 micrometres and length greater than 5 microns and with a length to width ratio of greater than 3:1. These fibres can reach the deepest part of the lung.
RFL	Reflective foil laminate.
Risk	The chance of the hazard actually causing an injury or disease. Measured in terms of consequences and likelihood.
Risk Assessment	Judgment as to the likelihood of an event producing harm to persons under the circumstances of its use.
Rockwool Batts	Insulation made from basalt or other rock material, with up to 45% recycled material, non conductive of electricity, non combustible with high sound absorption qualities.
R_m	Material R-value.
R_t	Total R-value.
Rsys	System R-value.
R^w	The Weighted Sound Reduction Index (R _w) is a number used to rate the effectiveness of a soundproofing system or material. Increasing the R _w by one translates to a reduction of approximately 1db in noise level. Therefore, the higher the R _w number, the better a sound insulator it will be.
Weighted Sound Reduction Index (R_w).	A single number acoustic rating that takes into account the sound reduction of the system at a number of different frequencies and is used to easily compare different types of construction. The higher the R _w the better the acoustic performance of the system.
Safe Work Method Statement (SWMS)	Statement which describes how work is to be carried out. It identifies the work activities assessed as having a safety risk and outlines the safety risks. It also describes the control measures that will be applied to the work activities. The SWMS includes a description of the equipment used in the work, the standards or codes to be complied with, the qualifications of the personnel and training required to do the work.
Safe Use Instruction Sheet (SUIS)	Summary of relevant properties of product components and chemicals which include safety, health, storage, handling and emergency information.
SDS	Safety Data Sheet – summary of relevant properties of a hazardous- chemical or proprietary product and which includes safety, health, storage, handling and emergency information.
Single Sided (RFL)	Reflective foil on only one face of reflective insulation.
Site Plan	The drawing that shows the boundaries of the building, its location, site utilities.
Specifications	Detailed, precise work instructions that include the kinds of materials to be used and the method of construction.
STC	Sound Transmission Class.
Stringing-in	Fixing some form of string or strap to prevent the batt insulation moving out of cavity stud frame and/or falling prior to plastering.
Structural Member/ Timber	Pieces of wood of relatively large size (with a cross section greater than 100mm X 150mm), the strength of which is the controlling element in their selection and use. Framing for buildings and cross arms for posts are examples of structural timbers.
Stud	A wall stud is a vertical framing member in a building's wall of smaller cross section than a post. They are a fundamental element in frame building.
SDS	Safety Data Sheet – summary of relevant properties or proprietary product and which includes safety, health, storage, handling and emergency information.
Summer	Denotes BCA design heat flow direction into the structure.
System R-value	Thermal resistance of a system, or construction of different materials, excluding surface air film resistances.
Top - up Ceiling Batts	Where insulation batts are installed over existing ceiling insulation.

2.0 Glossary of Terms

Term	Definition
Thermal Bridging	<p>Thermal bridging occurs when there is an interruption of insulation in a house by other materials. Insulation is only effective if it achieves unbroken coverage around the building. If there are any breaks in the insulating material, heat can escape.</p> <p>A common example is steel wall framing which interrupts insulation and acts as a thermal bridge. Heat loss along thermal bridges can be minimized by using thermal breaks.</p> <p>Material that does not conduct heat, for example polystyrene, is placed between the steel framework and the outside building material.</p>
Thermal Conductivity	A measure of the ability of a material to conduct heat.
Thermal Imaging	An advanced, non-invasive technology that identifies details of construction, materials and moisture in buildings that can't be revealed using conventional inspection methods.
Total R-value	The sum of the R-Values of the individual component layers in a composite element including any building material, insulating material, airspace, thermal bridging and associated surface resistances, expressed in m ² .K/W.
Truss	A building truss is a connected combination of framing members (usually in a triangular configuration) used in in roof space to support the roof. By connecting the framing members in this way individual members are not subjected to bending moments and shear forces but are subjected to only axial forces that is either compression or tension.
U - Value	A measure of the heat transmission through a building part (such as a wall or window) or a given thickness of a material (such as insulation) with lower numbers indicating better insulating properties. The units of measurement are W/m ² K.
Ventilated	An air space bounded by surfaces allowing a degree of air movement through opening(s) having a collective area of not less than 1% of the plan surface area that will prevent dead airspaces. In a roof space the definition can be extended to include air movement through opening(s) provided by roof ventilator(s) having a collective opening area of not less than 0.14m ² in conjunction with gable vents, ridge vents, and/or eave vents.
VOC	Volatile organic compounds (VOCs) are organic chemicals that have a high vapor pressure at ordinary room-temperature conditions. Many VOCs are dangerous to human health or cause harm to the environment. VOCs are regulated by law, especially indoors, where concentrations are the highest. VOCs are typically not acutely toxic, but instead have compounding long-term health effects.
Walls (1) Internal	Walls that do not form part of the building envelope.
(2) External	Walls that are part of the building envelope.
WHS	Work health and safety – prevention of disease and injury caused by workplace influences. Previously referred to as OHS.
Winter	Denotes BCA design heat flow direction out of the structure.

3. Principles of Energy Efficiency and Insulation (Thermal and Acoustic)

3.1. What is Insulation?

Insulation provides a level of flow resistance to heat, cold or noise. This level of resistance can be created using any bulk insulation material which slows the flow of heat, cold or noise. Under typical conditions Glasswool and Rockwool batts should last the lifetime of a home.

Glasswool and Rockwool batts are safe to use and provide energy savings that reduce heat entering your home in summer and heat loss in winter.

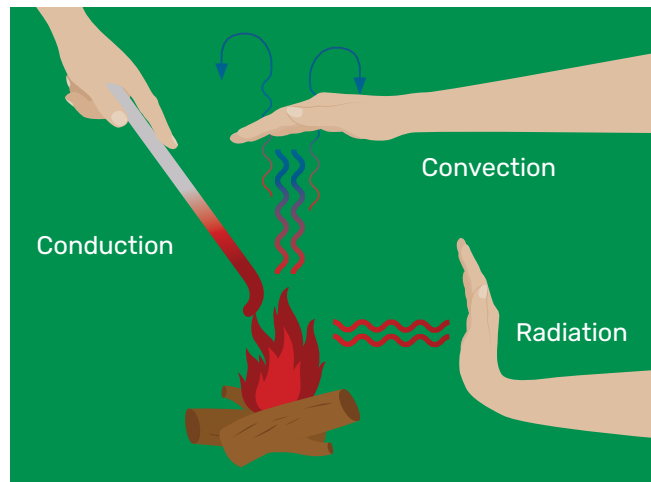
Reflective Foil Laminates provide a level of thermal resistance when installed within an airspace adjacent to the reflective surface. These non ventilated reflective air spaces (minimum 20mm) provide a level of heat flow resistance.

3.2. How is Heat Transferred?

Heat transfer is an important concept in selecting products. There are 3 ways heat is transferred:

- **Conduction** is heat energy transferred between objects that are in physical contact.
- **Convection** is when warm air rises, then cools and falls. Heat energy can be transferred from surface to surface this way.
- **Radiation** is when heat rays come into contact with surfaces, thus heating them.

The number one rule to remember when talking about heat transfer is that heat will always move from a hot place or region to a colder place or region. The greater the temperature difference the faster the rate of heat transfer.



3.3. How Does Insulation Work?

Batts consist of millions of tiny air pockets trapped and separated from each other by very thin strands of fibres. The air is trapped and does not move, which retards heat transfer through the batt by convection.

By installing batt insulation you reduce heat transfer by slowing down the flow of heat into the home, which can reduce summer heat gain by 8 - 12°C. The reduced heat gain will result in savings on energy bills, as well as an increase in human comfort.

Glasswool and Rockwool batts are non-combustible and non-conductive and can be used with confidence around down-lights when installed as per the lighting manufacturer's recommendations.

3.4. Product Description & Applications

Batts are available in varying densities. They are specifically designed for the thermal insulation of ceilings, walls and floors in domestic and commercial buildings. Batts have the added benefits of being an effective sound absorber and so contribute to both the thermal and acoustic comfort of building occupants.

The comprehensive range of sizes and R-values available ensures there is an efficient and effective batt suitable for any application.

Some batts are specifically designed for wall and under floor applications and for installation in both timber and steel framing.

Pliable building membranes are typically applied externally to the wall framing and roof trusses of a dwelling. Pliable building membranes generally come in rolls and are utilised to sark the dwelling and also provide a membrane for weather, dust and draught proofing.

3.5. Environmental and Social Benefits of Insulation

Glasswool and Rockwool batts are used in housing, commercial and industrial buildings, which can save significant amounts of heating and cooling energy through appropriate insulation selection and effective installation.

A sustainable building material is a material that is environmentally responsible and resource-efficient throughout its entire life cycle. This means that the material is harvested, manufactured, transported, used, and disposed of in a way that minimises its environmental impact and maximises its benefits. Insulation is considered sustainable due to:

- reduction of energy use which also reduces air pollution
- manufactured from renewable resources (sand and basalt rock) and recycled content (Up to 80%)
- correctly installed batts should, under typical conditions, last the life of the building
- require no maintenance
- reduce sound transmission through building structure
- low embodied energy used in the manufacturing process especially compared to other building materials
- improve the thermal comfort of occupants.

Pliable building membranes, correctly installed, will:

- reduce greenhouse gas emissions
- has a long life
- require no maintenance
- it is strongly recommended that electrically conductive membranes are not used on top of ceiling joists or attached to underfloor joists.

non permeable building membranes: acts as water and dust barrier

vapour permeable building membranes: allows transmission of water vapour.

3.6. Insulation Advantages for Householders

Insulation
Improves comfort in summer by reducing heat GAIN via walls, ceilings and floors
Improves comfort in winter by reducing heat LOSS via walls, ceilings and floors
Improves comfort by reducing noise transfer through ceilings, walls and floors
Reduces the need for artificial heating
Reduces the need for artificial cooling
Reduces the operating times and settings of heaters
Reduces the operating times and settings of air conditioners
Reduces the size of heating and cooling plant equipment
Glasswool and Rockwool provide superior fire performance – non combustible
Glasswool and Rockwool are safe to use with down-lights (when installed as per manufacturer's instructions) because they are non-conductive.
Safe due to bonded fibres that do not move around in the roof space or enter the house
Safe to use with allergy sufferers due to low volatile organic compound (VOC) content
Easy to cut and install by DIY
Optimum performance for the life of the home
Guaranteed to perform to AS/NZS 4859.1
A sustainable product made from up to 80% recycled materials
Saves on energy bills
Reduces greenhouse gas emissions
Quality Certified Products

Pliable Building Membranes	
General Benefits	
Energy efficiency:	Pliable building membranes can reduce unintended air leakage and airflow around insulation, helping it work more effectively in improving the energy efficiency of the building.
Protection:	Pliable building membranes, can provide protection against the ingress of external moisture both during the construction phase and after completion.
Durability:	Pliable building membranes protect water sensitive materials, such as timber from moisture, helping to improve the durability of the building.
Healthy:	Vapour permeable pliable building membranes allow moisture to escape from the building, helping to reduce the risk of mould and other moisture related damage.
Meet NCC Requirements:	Vapour permeable pliable building membranes can help buildings meet the NCC requirements.
Non-Permeable Membranes	
Designed for use in climates where the prevention of external water entry and restriction of moisture transfer is desirable.	
Vapour impermeable	
Typically, an air and water barrier (although available as a non-water barrier)	
Usually include a reflective foil facing which can contribute an air-gap R-value	
Vapour Permeable Membranes	
Designed for use in climates where the prevention of external water entry and promotion of moisture transfer is desirable.	
<ul style="list-style-type: none"> • Vapour permeable • Typically, an air and water barrier • Non-reflective 	

Bulk Insulation Products to use	
✓	Compliant with the current AS/NZS4859.1 and any other relevant standards in fire, acoustics etc
✓	Made from predominantly recycled materials
✓	Compliance tested against FBS-1 formula
✓	When properly installed, will last for the life of the home

What to look for in selecting insulation products	
✓	Is it fit for purpose?
✓	Does the packaging record it is compliant with Australian Standards?
✓	What is its fire rating performance?
✓	Will it remain in place after it's installed?
✓	Does the manufacturer state that it meets Australian Standards?
✓	Will the insulation increase the fuel load in a fire?
✓	Once it's installed is it easy to handle, move and replace?
✓	Is it guaranteed to maintain a long performance life?

ICANZ Insulation Installation Guide					
	Under Roof Line	Ceilings	Walls	Floors	Air Con Ducts
Bulk Insulation					
Glasswool	✓	✓	✓	✓	✓
Mineral Wool	✗	✓	✓	✓	
Polyester	✓	✓	✓	✓	✓
Sheepswool Batts	✗	✓	✓	✗	✗
Foam Sheets	✓	✓	✓	✓	✗
Loose Fill Insulation					
Mineral Wool	✗	✓	✓	✗	✗
Cellulous Fibre	✗	✓	✗	✗	✗
Sheepswool	✗	✓			
Pliable Building Membranes					
Non - permeable	✓	✗	✓	✓	✓
Permeable	✓	✗	✓	✗	✓

3.7. What is a Thermal 'R-value'?

R is a symbol for the term Thermal Resistance. An R-value is an internationally accepted unit of measure of a material's resistance to heat flow. The higher the R-value, the less thermal (or acoustic) transfer, and the more effective the insulation.

R-values are calculated:

$$R = \frac{t: \text{thickness (m)}}{k: \text{conductivity (W/mK)}}$$

Bulk insulation performance is a function of its nominal thickness. When installing, if the thickness of the insulation does not recover to its claimed value, then the thermal performance will be reduced.

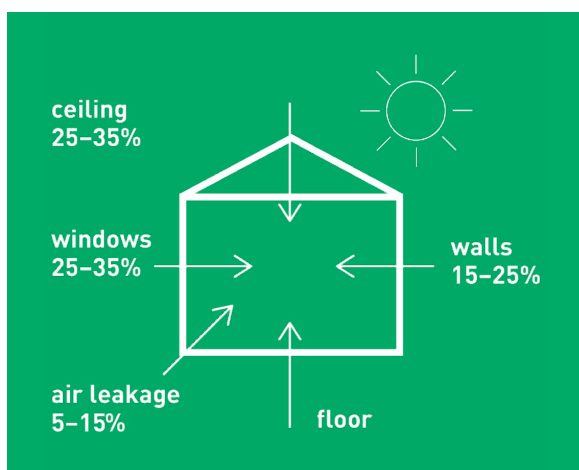
Total R-values (R_t) are based on the sum of all components of the building system including indoor and outdoor air-films, building materials used in the system and air-spaces, and thermal bridging.

Bulk insulation thermal resistance is expressed by **Material R-value**, tested in accordance to AS/NZS4859.1.

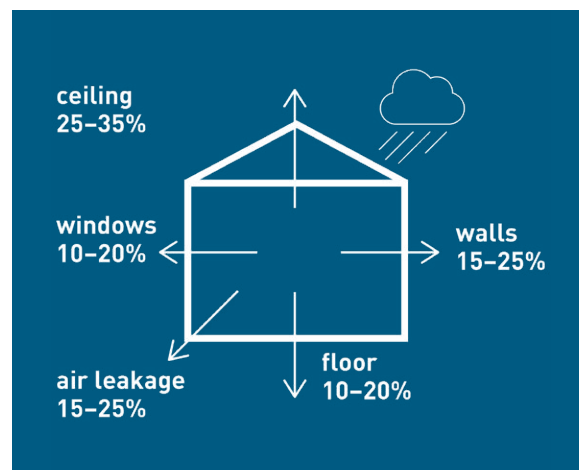
Reflective insulation thermal resistance is expressed in terms of **Total R-value** based on an application. An R_t-value is given for both Summer and Winter performance (as per BCA) www.icanz.org.au. The BCA/NCC sets out performance targets expressed as Total R-values (R_t) for summer and winter based on climate zone conditions.

Some insulation materials may not maintain their installed R-value over the life of the product due to settlement of dust on reflective insulations, outgassing of blowing gases in foam insulations and product movement and settlement of some loosefill insulations.

Summer



Winter



3.8. Sound Insulation (What is an Acoustic 'R' Value (RW).

3.8.1. Soundproofing your home

Doctors and psychologists agree that noise has the ability to raise stress, disrupt sleep and generally reduce quality of life.

These days, there is more external noise – as traffic and housing density increases. Even within our homes, trends such as open plan living, harder surfaces (e.g. timber floors), and more powerful entertainment systems increase the noise levels.

With decreasing block sizes due to urbanisation, there is increasing demand for acoustic insulation to reduce noise within the home from both internal and external noise sources.



3.8.2. How sound is transmitted

Sound is a type of energy made by vibrations. These vibrations create sound waves, which move through mediums such as air, water and wood. When sound waves reach a solid surface they are partially absorbed and reflected.

Some absorbed energy causes vibrations that can transmit sound to the other side of the solid surface.

In this way, external noise is easily transmitted through walls, floors and ceilings to the inside of your home. Additionally, noise generated from within your home can be transmitted through internal walls, and even floors, to adjacent rooms.

3.8.3. How insulation helps

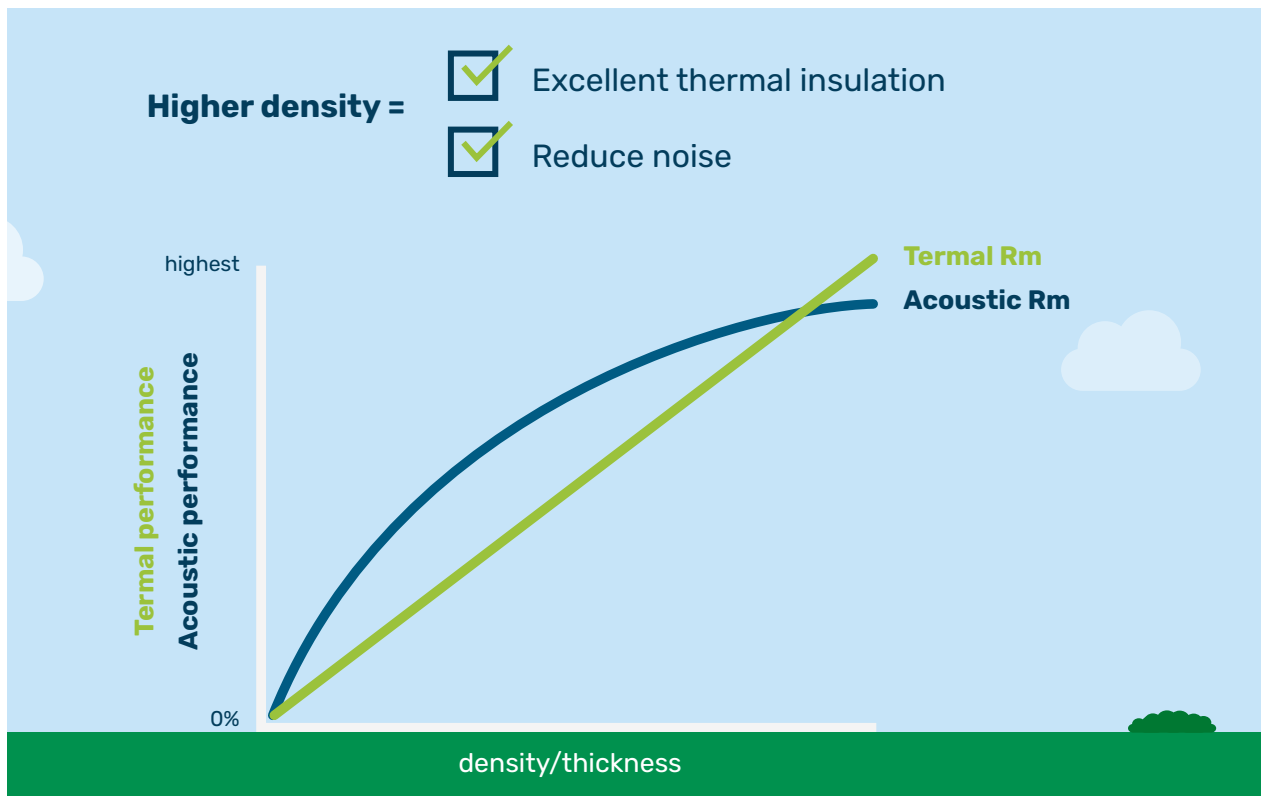
Bulk insulation materials such as glasswool and rockwool act like a sponge to help soak up sound energy and leave less energy to be transmitted. When the sound waves encounter the insulation they are partially deflected by the density of the product and partially absorbed due to the millions of interconnecting air pockets.

As a general rule, insulation products such as reflective foil or foams with hard surfaces are poor noise insulators.

3.8.4. Measuring sound

Sound pressure is measured in decibels (dB), which is a logarithmic scale. A 10dB increase in sound level is heard roughly twice as loud as original sound. Sound levels between 35dB – 45dB are generally considered comfortable.

The acoustic performance of a wall, floor or ceiling system is measured by the Weighted Sound Reduction Index (R_w). It is a single number acoustic rating that takes into account the sound reduction of the system at a number of different frequencies and is used to easily compare different types of constructions. **The higher the R_w the better the acoustic performance of the system.**



3.8.5. Controlling sound in your home

Installing acoustic insulation in external walls, floors and ceilings will not only provide excellent thermal insulation, it will also help reduce noise entering your home from external sources. Combined with door and window seals, it provides an excellent filter for reducing airborne noise.

Traditionally, thermal insulation is applied to the outer building envelope whereas acoustic insulation is installed in the building envelope as well as internal walls, floors and ceilings.

Installing acoustic insulation in interior walls, floors and ceilings can reduce sound transfer creating quiet zones within your home. Installation requirements for acoustic insulation are identical to those specified for thermal insulation.

Quiet Zones

Through effectively installing insulation reduce noise levels to selected areas within the building.



3.8.6. Condensation

What is Condensation?

Air contains invisible water vapour. The higher the temperature the more water vapour it can hold. The lower the air temperature the less water vapour.

Condensation occurs in buildings where the warm air contacts cold below dew point surface. The air cools and produces visible water droplets on the cold surface. The water formed is known as 'condensate' and the process is called 'condensation'. If more water vapour (warm air) is present, further condensation will occur.

The occurrence of condensation in buildings is the result of complex interactions between the environment, construction methods and occupant behaviour. The process of condensation is reversible. Where the material surfaces are warmer or ventilated, condensate may evaporate.

Some facts and figures

- An adult releases up to 3 litres/3kg of water vapour per day into the home environment.
- Normal household activities for a family of 4 (showers/bath, clothes drying, cooking, dish washer) release up to 15 litres/15kg per day of water vapour into the home environment.
- An unflued gas heater can release up to 5 litres/5kg of water vapour in a single night.

Mould, mildew, fungus growth and timber rot

Prolonged condensation in buildings can lead to the development of mould, mildew and fungus growth - the perfect conditions for dust mites and mould spores. These can have detrimental respiratory and other effects on occupants.

Structural decay of building components and fabric can develop as a result of persistent damp conditions.

Insulation and Condensation.

Installing insulation can help reduce the risk of condensation. However if insulation is installed incorrectly it may contribute to creating the conditions needed for condensation.

Building designers have the key role in determining the selection and placement of building materials – including insulation – to ensure conditions such as potential condensation are avoided.

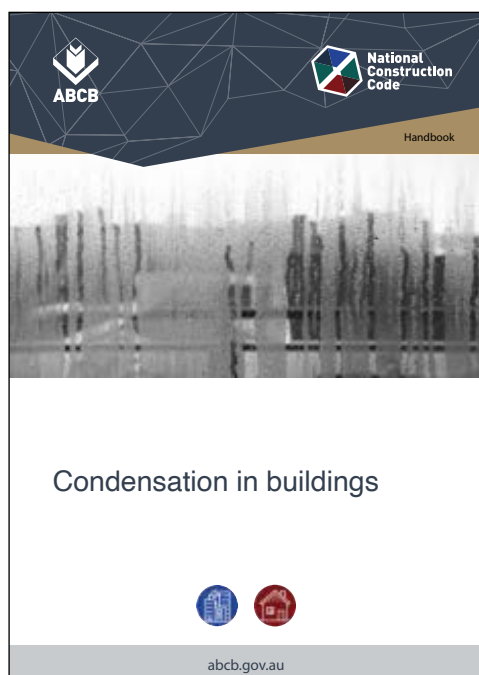
It is most important that insulation installers follow the directions detailed on building plans.

Permeable building membranes are often specified in external wall construction in colder climates (Zone 4-8) to reduce the risk of condensation.

Further references

Australian Building Codes Board www.abcb.gov.au/condensation

Australian Standard AS 3999 Bulk Thermal Insulation - Installation



4. Standards, Regulations and Codes

4.1. Australian Standards

Australian Standards are documents setting out specifications and procedures designed to ensure products, services and systems are safe, reliable and consistently perform the way they are intended to. They give business and consumers' confidence that goods and services they are purchasing and using are safe, reliable and will do the job they were intended for.

Australian Standards protect tradespeople and their clients. If an Australian Standard (or a part of it) is referred to in a regulation (e.g. NCC) it must be complied with. Consequences of non compliance include:

- Client dissatisfaction with products or services – this could lead to claims for compensation
- Reputation as a quality installer and company could be damaged
- People could be harmed or killed because of faulty products/equipment (e.g. through fire)
- Installer (and employer) could be the subject to a fine or legal action
- Breach of Construction Work Code of Practice requirements.

4.2. National Construction Code (NCC)

The National Construction Code (NCC) communicates the minimum necessary requirements for new buildings (and new work in existing buildings) throughout Australia. Where these regulations are adopted by each state or territory, they become enforceable by law.

The NCC includes mandatory minimum energy efficiency performance standards for residential and commercial buildings.

One of the most cost effective ways for buildings to meet those mandatory standards is by installing insulation effectively. The NCC is now available FREE on-line (<https://ncc.abcb.gov.au/>).

Listing of Australian Standards related to Insulation

Here are some important Australian Standards for installers of insulation products. This is not necessarily a complete listing and Australian Standards are updated from time –to–time. You should always check the latest standards relevant to your work by talking to your supervisor, or visiting the Standards Australia website.

Thermal Insulation	
AS/NZS 4859.1 Materials for the thermal insulation of buildings	Provides requirements for labelling of products and methods of test for materials that are added to, or incorporated in, opaque envelopes of buildings designed for human occupancy, to provide thermal insulation by moderating the flow of heat through these elements.
AS 3999 Thermal Insulation of dwellings - Bulk insulation - Installation requirements	Outlines the installation of bulk thermal insulation in all classes of dwellings. It is not intended to apply to the insulation of building services and equipment.
AS4254 part 1&2 Ductwork air handling systems	Includes insulation requirements for flexible and rigid ducting systems.
AS 4426 Thermal Insulation of pipe-work, ductwork and equipment - Selection, installation and finish.	Deals with the selection, installation and finish of thermal insulation for pipework, ductwork, tanks, vessels and equipment in the temperature range of -75°C to +800°C, but excludes manufactured pre-insulated equipment, structural insulation of buildings and cold stores, fireproofing structures, refractory linings of plant, airborne installations and all external underground mains.
AS 4508 Thermal resistance of insulation for ductwork used in building air-conditioning.	Specifies requirements relating to the optimum thermal resistance of insulation for rigid and flexible ductwork and associated fittings used in heating, air-conditioning and evaporative cooling systems of buildings and dwellings.

Acoustic Insulation	
AS/NZS ISO717.1 Acoustics - Rating of sound insulation in buildings and of buildings elements - Airborne sound insulation	Provides a method whereby the frequency dependent values of airborne sound insulation of building elements and in building can be converted into a single number characterizing the acoustical performance.
AS/NZS 2499 Acoustics - Measurements of sound insulation in buildings and of buildings elements - Laboratory measurement of room-to-room airborne sound insulation of a suspended ceiling.	Provides a laboratory method of measurement the airborne sound insulation of a suspended ceiling with a plenum of defined height mounted above an acoustical barrier which separates two rooms of a specified test facility.

Fire Performance	
AS/NZS 5110 Recessed luminaire barriers	Standard for the required performance of a luminaire barrier. Each barrier must be tested and deemed suitable for covering that particular model luminaire as well as being suitable for that particular type of insulation.
AS 1530.1 Methods for fire tests on building materials, components and structures – Combustibility test for materials	Sets out a test method for determining the combustibility of building materials and is one of a series of test methods for evaluating the potential fire hazard of building products
AS 1530.2 Methods for fire tests on building materials, components and structures – Test for flammability of materials	Specifies the apparatus and test method for determining the flammability index of a material.
AS 1530.3 Methods for fire tests on building materials, components and structures- simultaneous determination of ignitability, flame propagation, heat release and smoke release	Describes a single test method for grading building materials on the basis of ignition tendency, flame spread, heat development and tendency to produce smoke. Apparatus, test procedure, indices for grading and mounting procedures for specimen materials are provided.
AS 3959 Bushfire Safety Requirements	For bushfire prone areas. Includes sarking requirements and installation.

Pliable Building Membranes	
AS/NZS 4200.1 Pliable building membranes and underlays - materials	Specifies the requirements for materials suitable for use as a pliable building membrane (also known as underlay) when it is intended to act as a sarking membrane or thermal insulation, or a vapour barrier in a domestic, commercial or industrial building. It does not specify the thermal insulation requirements, nor does it include materials for use in air handling ducts.
AS 4200.2 Pliable building membranes and underlays - Installation requirements	Specifies the installation procedures for a pliable building membrane (also known as underlay) when it is intended to act as a sarking membrane or thermal insulation, or a vapour barrier in a domestic, commercial or industrial building. It specifies the installation requirements when the membrane is used under sheet roofing, tile roofing or in walls.

Remember that complying with Australian Standards in your installation work, and checking that products comply with relevant Standards, **is your responsibility**.

4.3. Regulations – National Construction Code (NCC) Requirements

The NCC contains the status of building regulations. The NCC aims to achieve and maintain acceptable standards of structural sufficiency, energy efficiency, safety (including safety from fire), health and amenity for the benefit of the community. It contains technical provisions for design and construction of buildings and other structures.

Energy efficiency requirements state insulation products must comply with Australian Standard AS/NZS 4859.1.

Also, the thermal resistance (R-value) shown on all product labelling must be determined by a recognised laboratory, accredited to test the relevant Standards and procedures.

4.3.1. Complying with Electrical Safety Regulations

To ensure that the installation of insulation complies with electrical safety regulations in each state and territory, contact your local regulator.

Details can be found by visiting ERAC (Electrical Regulatory Authorities Council) website at www.erac.gov.au and clicking on 'related links'.

4.3.2. Climate zones

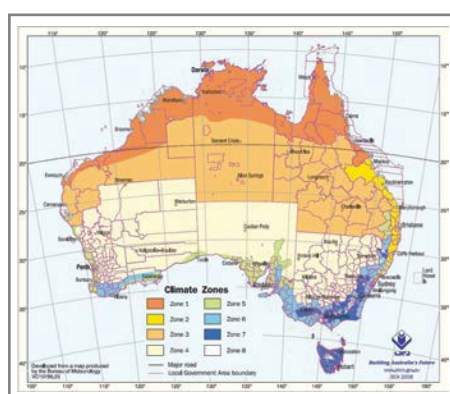
The NCC has established Deemed to Satisfy clauses which specify the total R-value and installation requirements for insulation across 8 climate zones in Australia.

For further information visit www.abcb.gov.au

4.3.3. Legislative requirements for removal of roofing components

When removing roofing components, builders and contractors would need to consider relevant provisions within the NCC and any additional requirements specified by local building authorities. Only a licensed builder can perform this work. This might include aspects such as:

- Ensuring that the removal of roofing components does not compromise the structural stability of the building.
- Avoiding the creation of fire hazards during the removal process and ensuring compliance with fire safety requirements for roofing materials and assemblies.
- Ensuring that any modifications or removals comply with accessibility standards as specified in the NCC and relevant disability discrimination legislation.
- Ensuring that the removal of roofing components does not adversely affect the energy efficiency performance of the building, particularly in terms of insulation and thermal performance.
- Implementing appropriate safety measures to protect workers and occupants during the removal process in accordance with relevant occupational health and safety legislation.



4.4. Industry Codes of Practice

A Code of practice is a set of guidelines and regulations to be followed by members of an industry, organisation or group.

They are developed through consultation. A code is not law (i.e. not mandatory), but may guide compliance with provisions of an Act or regulation.

In some cases, failure to observe an approved code of practice can be used in legal proceedings as evidence of failure to comply with an Act or regulation.

5. Calculations and cutting insulation materials

Carrying out measurements and calculations is an important part of the insulation process. Some organisations have personnel that are dedicated to measuring up the job and providing quotes to the customers. However, it is important that all installers can perform basic measurements and calculations to maintain quality standards.

5.1. Obtaining measurements

A 'take-off' of measurements from plans is the typical method in new construction. Builders typically perform this and provide a Purchase Order details the square metres required of each product type.

If site measurement is required a laser measure or min 5m tape measure is appropriate. When using a laser level, position it on one surface point direction of measurement for length of wall, etc. The level will provide the measure of the length of the wall, floor or ceiling space.

If measuring individual rooms, add them all together and cross-check against the total ceiling or wall area.

Remember always to measure and calculate twice.

Measurements are taken using a ruler or tape measure to obtain linear measurements accurate to 1 mm.



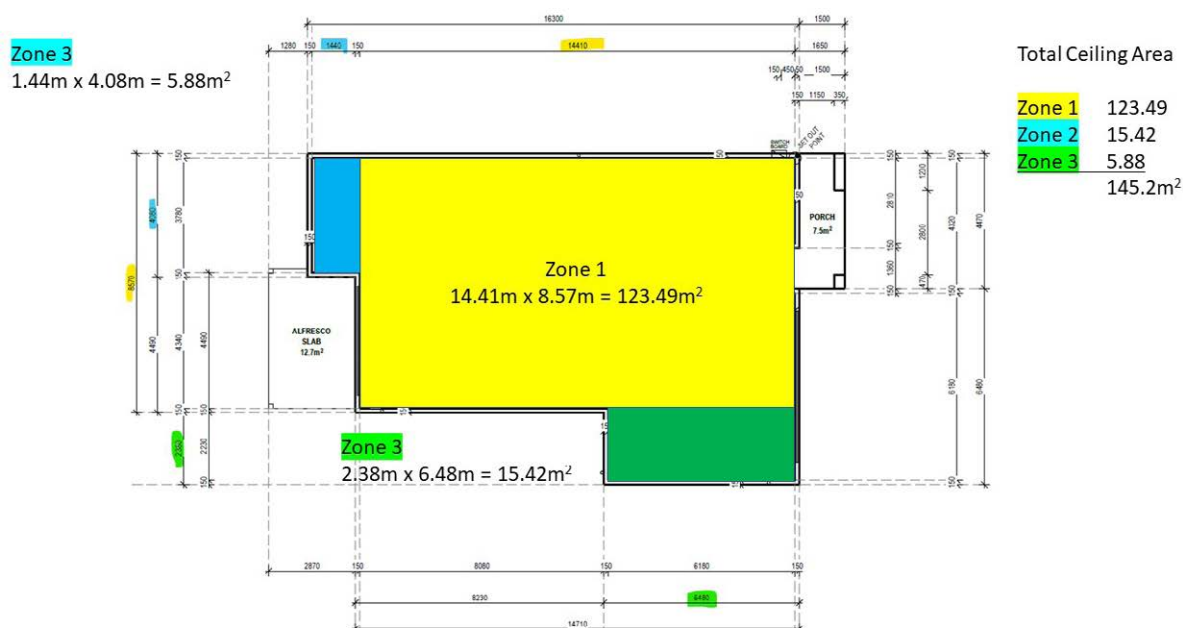
5.2. Calculating area

5.2.1. Area – Ceilings

To calculate the total ceiling area required, multiply the length of the building by the width, i.e. 10m long x 8m wide equals 80m²

However, this only works for basic squares and rectangles. More complicated designs need to be broken down into squares/rectangles, taking care not to miss any zones. Calculate the area of each zone and add them together.

The ceiling area can also be measured by room and added together.



5.2.2. Area – Walls

Calculating the total wall area requires multiplying the width of the wall by the height of the wall. Then, calculate the areas of any window/door openings (width x height) and take these away from the total wall area.

Note: bulk insulation is supplied in bags with 'Content' and 'Coverage'

Content = the area m² of the product if laid out with framing.

Coverage = the estimated area of wall or ceiling that will be covered, including the framing.



Wall Area of insulation = Total Area minus Opening (windows/doors)

Example:-

Total Area	1.4m wide x2.2m high 3.08m ²
Window Area	0.45m wide x0.9m high 0.405m ²
Insulation Area = minus	3.08m ² Total Area -0.405m ² Window Area 2.675m ² Insulation Required

5.2.3. Coverage

Coverage is the estimated area of wall or ceiling that will be covered, including the framing.

When calculating the circumference around an electrical fitting, consider if clearance is required to be 50mm; use a tape measure or ruler to mark 50mm around the fitting.

Light fitting 50mm clearance. Measure min 50mm all round.



The manufacturer's label will also provide the material coverage.

Note the insulation weight on the label. The weight of the insulation needs to be considered, as this will impact the ceiling, wall, or flooring frame and its capacity to weight bare.

For example, measuring the weight of a roll of glasswool insulation used for insulating walls. You have a digital scale measuring up to 20 kilograms (kg).

- Place the roll of insulation on the scale.
- The scale displays a weight of 8.17 kg.
- You record this weight as the weight of the insulation.

Keep in mind that the weight of insulation can vary depending on factors such as the type of material, thickness, and dimensions of the insulation product. If you're measuring loose-fill insulation (such as blown-in insulation), you may need to use a container or bag to hold the material while it's on the scale. It's essential to follow manufacturer guidelines for handling and installation to ensure proper performance and safety.



5.2.4. Using formulas

Use formulas to carry out basic calculations. Not all ceiling, wall and floor spaces are an easy rectangle. Calculating different shapes will ensure wastage is kept at a minimum. You will need a scientific calculator to perform some of these calculations.

Rectangles

Perimeter: $2 \times (\text{length} + \text{width})$

Area: $\text{length} \times \text{width}$



Squares

Perimeter: $4 \times \text{side}$

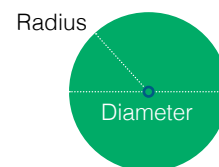
Area: side^2



Circles

Circumference: $2\pi \times \text{radius}$ or $\pi \times \text{diameter}$

Area: $\pi \times \text{radius}^2$



Triangles

Perimeter: Sum of the lengths of the three sides

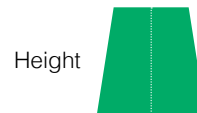
Area: $\frac{1}{2} \times \text{base} \times \text{height}$



Trapeziums

Perimeter: Sum of the lengths of all sides

Area: $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$



Cubes

Surface Area: $6 \times \text{side}^2$

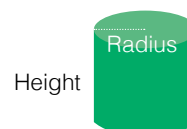
Volume: side^3



Cylinders

Surface Area: $2\pi \times \text{radius} \times (\text{radius} + \text{height})$

Volume: $\pi \times \text{radius}^2 \times \text{height}$



5.2.5. Ratios

A ratio is a comparison of two numbers. It shows how many times one value contains or is contained within another. Ratios can be expressed in various forms, such as

$a : b$

$\frac{a}{b}$

or as a decimal.

For example, installing insulation in a room with dimensions given in meters, but you need to cut the insulation into pieces measured in millimetres for a precise fit. Here's an example:

Assume the room has a length of 5m, a width of 4m, and a height of 3m. You want to install insulation that is 50mm thick.

First, calculate the total surface area of the walls and ceiling that need to be insulated:

1. Calculate the area of the walls:

- Two walls have dimensions 5m (length) by 3m (height), so each wall has an area of $5 \times 3 = 15\text{m}^2$.
- The other two walls have dimensions 4m (width) by 3m (height), so each of these walls also has an area of $4 \times 3 = 12\text{m}^2$
- The total area of the four walls is
 $2 \times 15\text{m}^2 + 2 \times 12\text{m}^2 = 54\text{m}^2$

2. Calculate the area of the ceiling:

- The ceiling has dimensions 5 meters (length) by 4 meters (width), so its area is $5 \times 4 = 20\text{m}^2$

Now, convert the thickness of the insulation from millimetres to meters:

- 50 millimeters is = to $50 \times 10^{-3}\text{ m}$, which is 0.05m.

To find out how much insulation you need in square meters, you can use the ratio of thickness to area:

- For every m^2 of surface area, you need 0.05m of insulation.

Finally, calculate the total amount of insulation needed:

- Total insulation needed = Total area to be insulated x Thickness of insulation
- Total insulation needed = $54\text{m}^2 + 20\text{m}^2$ (walls + ceiling) $\times 0.05\text{m}$
- Total insulation needed $\approx 74\text{m}^2 \times 0.05\text{m}$
- Total insulation needed $\approx 3.7\text{m}^3$

So, you would need approximately 3.7m^3 of insulation to cover the walls and ceiling of the room with a thickness of 50mm.

5.2.6. Percentage

Percentage is often used to calculate the waste amount. Not all pieces of insulation can be used exactly due to cutting errors, irregular shapes, or other factors. Some batts must be cut to ensure they fit into the space. It is common in the industry to allow 10% waste.

Measure the area or volume that needs to be insulated. For example, this could be the floor, walls, or ceiling of a building. Based on your measurements, determine how much insulation material you need.

Use the formula to determine the waste amount.

$$\text{Waste Percentage} = \left(\frac{\text{Waste Amount}}{\text{Total Insulation Amount}} \right) \times 100$$

For example, if you used 1000m² of insulation but only used 900 m² due to waste, the waste amount is 1000 - 900 = 100 m². To find the waste percentage:

$$\text{Waste Percentage} = \left(\frac{100}{1000} \right) \times 100 = 10\%$$

5.2.7. Converting measurements

Converting insulation measurements to millimeters allows for more accurate cost estimation by calculating the quantity of insulation material needed. This helps project planners budget effectively and avoid over- or under-ordering materials.

Building plans and drawings will be in mm which can be divided by 1000 to convert to m.

e.g. 16840mm divided by 1000 = 16.84m

Converting millimetres to metres

mm to m = Divide by 1000 as there are 1000mm in 1 metre.

This can be achieved by moving the decimal point to the left.

e.g. 14410 on a plan

Move decimal to the left x 3 = dividing by 1000



$$14410. = 14.41\text{m}$$

Converting metres to millimetres

m to mm = Multiply by 1000 as there are 1000mm in 1 metre.

This can be achieved by moving the decimal point to the right.

e.g. 18.5m measured with tape

Move decimal to the right x 3 = multiplying by 1000

Remember to add 0 to gaps.

$$18.500.\text{m} = 18500\text{mm}$$

6. Work Health and Safety

Using safe working methods and practices is vital to Work Health and Safety (WHS) in your workplace. To work safely, you need an understanding of the WHS requirements and procedures which cover your work including duty of care, use of Personal Protective Equipment (PPE) etc. You also need to know how to access WHS information.

6.1. Duty of Care

Duty of care requires a person to do everything reasonably practicable to protect themselves and others from harm.

Duty of care is the legal responsibility for **everyone** including:

- employers
- self employed persons
- persons in control of the work site
- construction supervisors
- employees/ workers
- designers
- sub-contractors
- inspectors.

Duty of care responsibilities for **employees** are:

- to cooperate with, or help, your employer on health and safety matters
- to take reasonable care to protect the health and safety of yourself and others who may be affected by your actions at work
- to identify hazards in the workplace and implement control measures to minimise risks.

This means, for example, keeping your work area safe and tidy, and telling other workers about potential hazards that you have noticed (such as the location of electrical cables).

Duty of care responsibilities for **employers**, those in control of the work site and self employed persons are:

- to ensure that, as far as is reasonably practicable, the employee is, while at work, safe from injury and risk to health
- your employer should provide a safe working environment, facilities, systems and equipment. This could be, for example, giving you a hard hat or respirator for personal protection
- your employer should also provide you with health and safety information and training including a proforma or process to enable you to conduct a through risk assessment of the work area.



6.2. Safe Work Methods and Practices

Prior to commencing work a site specific SWMS must be reviewed by all installers. The SWMS will identify any HIGH RISKS on the site and determine the controls to manage the risks.

Using safe work methods and practices will help to protect you, the people around you, and your client's property, free from harm.

6.2.1. When installing insulation, safe work methods and practices can mean:

- not taking any unnecessary risks, particularly when working around electrical cabling
- maintaining vigilance and awareness of potential hazards (e.g. electrical wiring, the dust levels, awareness of asbestos, and stress caused by heat)
- using personal protective equipment and clothing that has been given to you appropriate to the task
- conducting a risk assessment of the work area
- communicating with others about potential hazards and job status
- checking that insulation products labelling and your installation techniques comply with Australian Standards
- if you must smoke, doing so in designated areas
- keeping your work area clean and tidy and proper disposal (or recycling) of waste
- using tools and equipment that are in safe working order and in the way the manufacturer has instructed
- entering and leaving the work site using designated routes
- taking care not to damage client property
- never being under the influence of drugs or alcohol at work, or bringing them to the workplace
- helping to prevent bullying and harassment in the workplace
- check work orders for correct product R values and correct applications.

Asbestos Containing Material

You must be aware of and able to identify a range of asbestos-containing materials. These include the following:

Loose-fill asbestos Insulation: This insulation was commonly used in attics and wall spaces. It appears loose, fluffy, or fibrous, resembling grey or whitish insulation. It may contain visible fibres or pellets that can easily dislodge and become airborne.

Asbestos Insulation Wrappings: Asbestos insulation wrapping typically covers pipes, boilers, ducts, and other heating equipment. It often resembles white or grey cloth or tape wrapping around pipes or equipment. The material may appear frayed, deteriorated, or damaged over time.

Asbestos Block Insulation: Block insulation usually appears as solid blocks or sheets of asbestos-containing material. It's commonly found in older structures as insulation around boilers, furnaces, and other high-temperature equipment. The surface might be smooth or textured, and it could be painted or coated.

Spray-On Asbestos Insulation: This insulation was commonly used to insulate ceilings, walls, and structural steel. It's applied as a spray, creating a textured or popcorn-like surface. Over time, it can become friable, meaning it can easily crumble into powder when disturbed.



6.2.2. What are safe working practices?

Your employer should provide you with information about safe systems of work. This means information about the workplace itself (eg. special client requirements, truck access, entry and exit points, location of any hazards, how to isolate power on the site, how to move about safely, emergency exits, location of first aid equipment, etc).

6.2.3. You will also need to know about:

- procedures for handling and disposing of materials and waste (especially if hazardous)
- how to access amenities such as drinking water and toilets
- other systems, methods and procedures which will help you to work safely (such as removing asbestos, minimizing dust, using respirators, and using tools that are non-conductive or have insulated handles to minimize the risk of electrocution).

6.2.4. Which activities require a licence or permit or accreditation?

There are many common construction activities which require qualifications, licences, tickets, permits and registrations before they can be undertaken. These activities are controlled by building authorities. You should check what special licences or permits are required for activities related to the installation of ceiling insulation, noting in particular:

- removal of asbestos
- scaffolding over 4 metres
- work to move, modify or fix electrical cabling.
- working at heights

6.2.5. Emergency response

It is important that all team members are aware of the organisation's emergency response procedures. When on site, ensure all team members are aware of emergency procedures including evacuation responses.

All workers involved in insulation installation need training and information about emergency procedures, including evacuation routes, assembly points, and actions to take in case of emergencies.

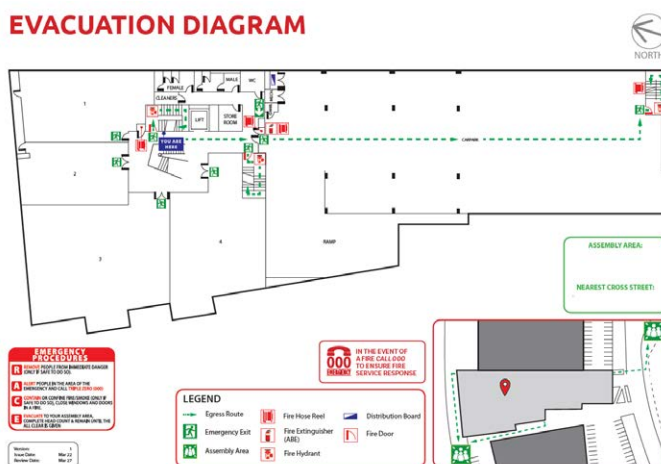
All workers should be trained in the proper use of personal protective equipment (PPE) and emergency equipment such as fire extinguishers.

Ensure all team members are aware of emergency exits, evacuation routes, and assembly points. Check that emergency exits are not blocked by insulation materials or any other obstructions.

Implement fire safety measures such as the provision of fire extinguishers, fire blankets, and smoke detectors at appropriate locations. Conduct regular fire drills to ensure that workers are familiar with evacuation procedures and the location of fire safety equipment.

Provide training on the handling and storage of insulation materials, especially if they are hazardous or pose a risk of respiratory irritation or other health issues. Ensure that Material Safety Data Sheets (MSDS) for insulation materials are readily available and that workers are familiar with their contents. Maintain detailed records of emergency drills, incidents, and near misses, and use this information to continually improve emergency response procedures.

Conduct regular reviews of the emergency response plan to identify any areas for improvement or updates.



Installers are required to keep the building site clean and tidy to reduce trip hazards should there be an Emergency Evacuation.



Emergency Preparedness

There may be events or conditions on a building site that require an emergency response. These situations may include but are not restricted to serious injury or illness requiring urgent medical treatment, fall, fire, flood, collapse of structures or other immediate changes to site conditions. Procedures covering these events and rescue scenarios must be documented, trained, and practiced. On construction sites, the Principal Contractor (i.e. The Builder) typically sets out the site Emergency Procedures as it is The Builder who has overarching control of the worksite.

Incident and injury management procedure

- ➔ Incident causing medical treated injury – Stop work and ensure that the area is safe.
 - Preserve the scene – if notifiable to the regulator or a serious injury, if in doubt do not disturb until advised; unless to provide medical treatment or limit further harm.
 - Provide First Aid and seek medical treatment as required.
 - Contact the CSR Construction Supervisor to help assess the situation and provide further guidance.
- ➔ Serious near hit that could have caused injury – Stop work and ensure that the area is safe.
 - Contact the CSR Construction Supervisor to help assess the situation and provide guidance.
- ➔ Provide the necessary care to an injured person/s
 - First Aid resources (i.e. kits and trained personnel) must be provided by the Primary Contractor
 - Apply First Aid treatment.
 - Seek medical attention if in doubt.
 - Call Ambulance 000 in medical emergency. (e.g. unconscious/breathing difficulty/severe bleeding)
- ➔ Medical treatment
 - Primary Contractor supervisor accompanies the injured employee to seek medical attention. (injured person **MUST NOT** drive themselves to seek medical attention, unless safe to do so)
 - Primary Contractor supervisor communicates to Doctor options to support return to work (e.g. restricted duties)
- ➔ Assess the requirement for Drug & Alcohol testing
 - For serious incidents “for cause” testing may be required in accordance with the CSR Fitness for Work Policy.
 - Primary Contractor Supervisor is to request testing at the nominated doctor (if applicable) with CSR guidance.
- ➔ Report the event immediately to
 - Primary Contractor Supervisor – who reports injury to
 - CSR Construction Supervisor – who reports injury to
 - Principal Contractor representative and CSR Construction Manager – who then follows CSR reporting procedures.
- ➔ Notify the Regulator/Authorities (where required by state or federal legislation)
 - Primary Contractor supervisor to contact relevant state Regulator in line with legislation.
 - Communicate event circumstances as known at the time and injury outcome.
 - Notify Regulator/Authorities of your company details (Not CSR - you are the injured person's employer).
 - **NOTE some incident scenes must not be disturbed or altered until authorised by the WHS Regulator**
- ➔ Consider notifying family
 - Primary Contractor supervisor to contact injured employees family as required.
 - Consider support via an [employee assistance program](#).
- ➔ Incident response
 - Double check and make sure the work area is safe.
 - Secure scene, plant, equipment, and PPE used where incident occurred.
 - Record the scene, take video, photos, sketches and / or measurements.
 - Identify potential witnesses – obtain written or recorded statements.
- ➔ Consider communication
 - Organise a debrief and communication for your team, Principle contractor and CSR.
 - Consider support via an [Employee Assistance Program](#)
- ➔ Conduct the investigation

The purpose of the investigation is to understand the how the incident occurred and why, in an attempt to take action to minimise further harm to people and the environment by applying new or modified controls. The main objective from an investigation is to learn.

Form an investigation team as soon as possible after the incident involving people like:

 - Injured Employee (where possible)
 - Witnesses
 - The responsible Manager or Supervisor
 - CSR Construction Manager or Supervisor
 - Principle Contractor Manager or Supervisor
 - CSR National WHSE Supply and Install Manager

(escalation in circumstances where medical treatment is required or serious near hit event occurred)

Image source: CSR 'Construction WHSE standards'

6.3. Tips for Keeping the Work Site Safe:

6.3.1. Storage of materials and equipment

These should be stored in a safe and systematic manner which allows them to be retrieved again safely. The way materials and equipment are stored should also be in accordance with Material Safety Data Sheets (MSDSs), Safety Data Sheets (SDSs), and/or Safe Use Information Sheets (SIUS) and legislation where this applies.

You should make sure that stored materials and equipment cannot fall on a person, or cause injury through the projection of sharp edges, rough surfaces etc.

6.3.2. Working in an occupied building

Your company may already have some common sense guidelines for working in occupied buildings.

Here are some tips for consideration to help avoid potentially difficult situations:

- park considerately
- present your ID to occupier
- enter property only with permission
- when faced with an angry customer adopt a passive stance
- ask occupier to lock up pets if they present a potential hazard
- do not smoke on site
- work as quietly as is practicable
- keep job site tidy
- remove any job related rubbish and leave site at least as tidy as you found it on arrival

6.3.3. Removal of debris and litter

Debris- (such as insulation off-cuts) should be continually removed from the work area to prevent build up. Build up could affect entry to or exit from the work area or movement around the ceiling space. It can also pose a fire hazard, or other hazards such as tripping.

Litter- includes such things as food scraps and wrappings, waste from packaging, etc. Debris and litter must be disposed of or recycled in approved containers (such as garbage bins or skips). You must ensure that disposal of debris and litter does not create a risk to the environment.

Remember to recycle as much as possible (eg plastic bags can be recycled).

6.3.4. Housekeeping

Good housekeeping is essential to safety. It includes day-to-day cleanliness, tidiness and good order in all parts of your work area, including keeping tools and equipment maintained to ensure they are in safe and efficient working order.

6.3.5. Administering First Aid

If a minor accident or incident occurs on-site that requires first aid, assess the situation before administering any treatment and ensure the safety of yourself and the injured person. If the situation is unsafe, move to a secure location.

For minor burns, immediately remove the source of the burn (heat or chemical) if it's safe to do so. Run cool water over the burn for 10-20 minutes to cool the skin and reduce pain. Avoid ice or ice water, as it can further damage the skin.

Cover the burn loosely with a sterile, non-adhesive bandage or clean cloth to protect it from infection. If blisters form, do not pop them. Seek medical attention if the burn is severe, covers a large area, or affects sensitive areas like the face, hands, feet, or groin.

For minor cuts, clean the wound with mild soap and water to remove dirt and debris. Apply gentle pressure with a clean cloth to stop any bleeding. If bleeding persists, elevate the wound above the heart if possible and continue applying pressure.

Once bleeding has stopped, apply an over-the-counter antibiotic ointment to the wound to prevent infection. Cover the cut with a sterile adhesive bandage or gauze pad to protect it as it heals.

As soon as possible after administering first aid, accurately report the treatment details to designated personnel, such as a supervisor or medical professional. Include information such as the cause of the injury, the location and extent of the burn or cut, the treatment administered, and any complications or concerns.

Be prepared to provide additional details if necessary, such as the individual's medical history or any pre-existing conditions that may affect treatment.

6.4. Installation Hazards

6.4.1. What is a hazard?

A hazard is a source or situation with the potential to cause injury or harm.

6.4.2. What is risk?

Risk is the likelihood of a hazard causing injury or harm.

6.4.3. How are hazards identified?

Identifying a hazard means recording that a hazard exists, or **may** exist. This means finding all hazardous activities, situations, tools and equipment, materials and processes.

Everyone should be involved in hazard identification. It mostly requires you to be observant and aware, for example:

- frequently inspecting your workplace
- conducting a risk assessment of the work area (particularly to identify electrical hazards, i.e. have a heightened awareness of electrical hazards.)
- talking to people to find out about hazards, or letting them know about hazards you have found
- checking reports of previous hazards, injuries and accidents to give you an idea about potential hazards.



Remember, if you see a hazard or dangerous situation, you must report it so that all workers can be safe.

6.4.4. Risk management

There are four basic principles of risk management:

- **Identify** hazards – Find or See.
- **Assess** the risks involved – Think About and Check.
- **Control** the hazard – Stop or Prevent.
- **Review** to identify change or improvement – Check and Reflect.

6.4.5. What is a risk assessment?

You will need to be able to assess risks (or potential risks) **before** work starts, as well as each time a hazard is found and a risk control used. This is part of the risk management process. It means gathering information so that you can make a clear and educated decision on what needs to be done to lower the risk as far as possible.

Risk assessments are based on the following three factors:

- the '**likelihood**' that it will do harm (probability)
- the '**severity**' of the harm it could do (consequence)
- the '**number**' of times people could be affected by it (frequency).

It is important to think about and to check:

- whether a hazard is likely to cause harm to a person or property
- how severe the harm could be, or what the consequences would be
- how often people or property could be affected by the hazard

A risk assessment instrument should be provided by your employer.

Importantly, a site risk assessment will help you to locate electrical hazards by identifying and assessing the type, position and condition of electrical cabling in the ceiling/ roof space.

Once you have completed this, you will be able to make an accurate decision about which controls (if any) will be needed. This is an important part of risk management.

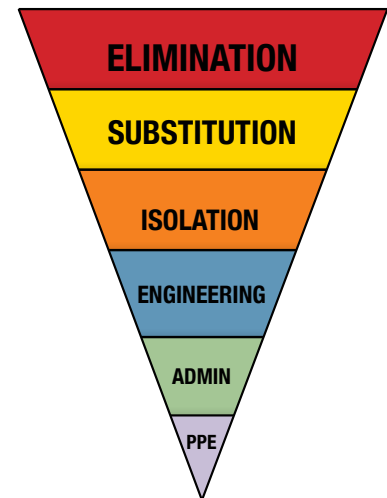
Likelihood ↑ What is the chance it will happen?	Very likely	Acceptable risk Medium 2	Unacceptable risk High 3	Unacceptable risk Extreme 5
	Likely	Acceptable risk Low 1	Acceptable risk Medium 2	Unacceptable risk High 3
	Unlikely	Acceptable risk Low 1	Acceptable risk Low 1	Acceptable risk Medium 2
		Minor	Moderate	Major
		Impact How likely is the risk →		

6.4.6. Controlling hazard

Hazard control means reducing the risk to as low as reasonably practical. It involves implementing measures to reduce the risk of a hazard causing injury using the hierarchy of control.

The hierarchy (order) of control for hazards is:

1. **Elimination:** Removing the hazard completely. This could include removal of a hazardous material or changing work practices to avoid the potential danger or hazard.
2. **Substitution:** Replacing a hazard with something which is less hazardous such as using safer equipment or materials.
3. **Isolation:** minimizing the chance of danger or harm by preventing access such as: erecting physical barriers, or putting a time or distance restriction in place.
4. **Engineering:** Where hazards can't be eliminated substituted or isolated, a safer environment can be created by making equipment and process improvements, for example using a respirator.
5. **Administration:** Where the risk still remains, then administrative measures have to be used and improved to limit the risk. Examples of these are structuring work breaks to avoid heat stress and providing training.
6. **Personal Protective Equipment (PPE):** This is used on top of other measures where extra protection is required. Items might include overalls, gloves and respirators.



6.4.7. How are these controls used?

Elimination – is always the best option!

The rest follow in order (i.e. 1 through to 6). If elimination is not possible, then the hazard needs to be assessed using the risk assessment process described earlier in this booklet. This will help you to describe what else needs to be done to control it.

This process flows down from substitution to using personal protective equipment. The first control (in order) that is able to be achieved should be put in place.

More than one control can be used at any time to reduce exposure to a hazard. For example, exposure can be limited, warning signs installed, training and personal protective clothing provided and used at the same time. It is important that the highest control in the hierarchy is the starting point for safety.

When selecting the most appropriate control method, consider the work activities. Below are some examples of controls used when removing insulation.

Elimination: The most effective way to control hazards is to eliminate them altogether. In the context of ceiling insulation removal and installation, this might involve using alternative insulation materials or methods that pose fewer risks to workers. For example, choosing insulation materials that don't require removal or opting for blown-in insulation that doesn't require handling large rolls or batts. Ensure that edge protection and harnesses are used when working above 2.0m

Substitution: If it's not feasible to eliminate the hazard entirely, substitution involves replacing the hazardous materials or processes with safer alternatives. For instance, insulation removal vacuums must be equipped with HEPA filters, especially if asbestos is a potential hazard.

Engineering Controls: Engineering controls involve modifying the work environment or equipment to minimise exposure to hazards. In the case of insulation removal and installation, engineering controls may include using ventilation systems to remove airborne contaminants, installing barriers to prevent falls or protect workers from falling debris, or using equipment with built-in safety features such as automatic shutoff mechanisms.

Administrative Controls: Administrative controls focus on changing work practices or procedures to reduce exposure to hazards. This might involve implementing safety training programs for workers, establishing work procedures for safe handling and removal of insulation materials, scheduling work during periods of lower occupancy to minimise exposure to building occupants, or rotating tasks to reduce prolonged exposure to hazards.

Personal Protective Equipment (PPE): PPE is the last line of defence and should be used when other control measures are not feasible or sufficient to eliminate or reduce hazards. In the context of insulation removal and installation, PPE may include gloves, goggles, respirators, hard hats, and protective clothing to minimise exposure to insulation fibres, dust, and other airborne contaminants.

A risk assessment should be done every time a control is used. This is done to make sure that the control can, and will work, and that the hazard is eliminated or reduced as far as possible.

Non-Conductive Extension Poles

- External compression locking device provides a secure lock at any extended length
- 1 1/8" diameter smooth fiberglass handle and 7/8" diameter smooth fiberglass slider make this pole extremely rigid
- Rubber hand grip
- Won't conduct electricity (120/240 voltage) if not contaminated with moisture, water or other conductive liquids.



Image: Installers use a wooden or fiber glass non conductive pole

6.4.8. Common installation hazards

The following table lists a number of hazards which may be present when installing insulation.

Hazard	
1: Working at Heights (including scaffolding) Use of Ladders	<p>All governments have introduced laws regarding working at heights. Where installation of insulation requires walking on the roof surface, work practices must ensure safe work conditions are provided as required by these laws. In particular these laws require the provision of safety barriers to protect workers from falling. Falls from heights are one of the most common forms of serious injury or death. All installers, regardless of working height, require appropriate protection.</p> <p>Falls from heights are one of the most common forms of serious injury or death in the construction industry. When working at heights, appropriate protection must be given to you, and used (regardless of the height at which you are working).</p> <p>Where installation requires work at height, or there is a risk of falling e.g. when placing insulation in roofs, working near unprotected open edges or openings in roofs, walls etc, you must always use protection, work safely and comply with Standards.</p> <p>You can't always be sure that a roof is in sound condition, particularly if it is old, or made from cement or fiberglass sheeting. Think about safe use of ladders, use of safety barriers and additional PPE (harnesses etc). Don't forget that weather conditions such as rain and high wind pose additional risks when working at height.</p> <p><u>YOU MUST MAKE SURE THAT:</u></p> <ul style="list-style-type: none"> • an industrial grade ladder is used • ensure the ladder is in good working condition prior to use • passage- ways, corridors and stairs are clear of obstruction • people below are protected from falling objects • ladders are used correctly (e.g. set up at 1:4 base to height ratio, used only to 3 rungs from the top, placed on a solid level surface for support, safe carrying of tools, ascending and descending with both hands etc. • scaffolding or mobile work platforms are used if work is of an extended nature • edge protection is used if a person is likely to fall. Edge protection is used where a person is likely to fall (e.g. externally loading insulation into roof cavity while standing in roof). Check state regulations for details • check for void spaces in the ceiling cavity (e.g. over stairs, air-conditioning shafts, built in robes) • a safety harness, safety net or other system is used if edge protection can't be used • all scaffolding, temporary structures, planks, decking, tools and equipment etc are secured to stop them from falling • you wear non-slip footwear • if you have to work from a ladder, then a platform ladder should be used • Wooden or non-conductive batt sticks (especially for roofs) are used when placing insulation. Batt sticks help support insulation material, such as fiberglass or mineral wool batts, between roof rafters or joists. They keep the insulation in place and ensure it maintains proper alignment, preventing gaps or sagging that could reduce the effectiveness of the insulation. They are particularly helpful when working in confined or hard-to-reach areas where holding the insulation manually may be difficult or impractical. • Loose tiles or cracked tiles need to be checked first when accessing in the roof.

Note: Remember that scaffolding above 4 metres needs to be erected by a licensed scaffolder.

Kick boards, hand railings, barricades and warning signs are required. Check state regulations for details. If extra height is needed, you will need to have a platform re-adjusted. You must not use railings or boards to gain extra height.

Weather conditions may make working on roofs unsafe. Where conditions are too wet or windy to allow safe access onto the roof and no alternative method of access to the roof space can be obtained, installers shall reschedule installation on an alternative date.

Replace second paragraph with: Working in hot and/or humid environments such as on a roof or in a ceiling cavity can be uncomfortable but more importantly lead to a heat related illness which can be fatal. Workplace safety legislation requires employers to assess the risks associated with heat stress and apply adequate controls to safely manage the risk so far is reasonably practicable. Some examples of these are:

- Rest breaks
- Accessible cold drinking water
- Recovery/Rest area available
- Training

Some tasks may expose you to hot or cold working environments. Work outdoors may expose you to the sun's radiation, or to wind chill and the potential for heat-related illness.

Workers in cold areas may be exposed to thermal hazards on the job. It is important that you know the difference between a situation which threatens health and safety and a feeling of discomfort.

Terms like hypothermia and heat stroke refer to serious medical conditions.

Hypothermia: is where a person gets an abnormally low body temperature as a result of exposure to cold environments. It is a serious condition which can lead to death.

Heat stroke: is an uncommon and more severe form of heat illness, which is a medical emergency. It occurs when the body can no longer control the body temperature where mental function is seriously impaired.

Heat exhaustion: is related to lack of fluids or a rapid loss of body fluids. Remain hydrated. Always carry sufficient drinking water.

Heat strain: is more serious and can lead to death. It is more likely to occur in conditions of high humidity.


Heat strain definition: Is how the body responds to heat stress. These responses are focussed on removing heat from the body.

Heat stress definition: is the total heat load on the body from all sources including:

- Ambient air temperature
- Radiant heat from other sources
- Air movement
- Relative humidity
- Individual task requirements

Roof spaces can become very hot in warm weather. This has the potential to cause heat stress especially if you need to wear heavy PPE. Do not discard PPE.

Get relief from the heat by taking breaks and drinking plenty of water to avoid dehydration. Learn to recognize the signs of heat stress such as headaches, dizziness, fainting, irritability, confusion, thirst, nausea and vomiting.

<h2>2: Restricted Access Areas</h2>	<p>Many roof and underfloor spaces pose potential hazards as they are cramped, maybe poorly ventilated, dark, dusty and may restrict movement.</p> <p>All of these potential hazards need to be taken into account when reviewing safe work methods statements and job plans.</p> <p>You will need to:</p> <ul style="list-style-type: none"> • turn off mains power before entering attic or floor spaces <p>Before entering these spaces</p> <ul style="list-style-type: none"> • warm up, loosen up, stretch • wear appropriate and safe footwear <p>When inside spaces</p> <ul style="list-style-type: none"> • do not force your body to conform to uncomfortable positions • keep items needed as close as practicable to your working position • never walk on plasterboard ceilings <p>Have available</p> <ul style="list-style-type: none"> • adequate independent lighting • dust masks • gloves • kneeling board • sufficient drinking water • non conductive tools to help shape and place insulation material correctly • mobile phone with appropriate contact numbers programmed. 
<h2>3: General Dust</h2>	<p>Numerous types of dust are found in ceilings and can cause discomfort. Silica dust is created when bricks are cut by power saws during brick installation. Silica dust is a serious and potentially fatal health threat. Ensure you wear all PPE especially a respirator or mask to prevent dust inhalation.</p> <p>Wearing a P2 dust mask will prevent such discomfort allowing you to proceed with the job.</p>
<h2>4: Asbestos</h2>	<p>Asbestos is found in many areas of buildings in bonded form (located around eaves, ceilings, wet areas, some glues and mastics), and friable form (located around hot water pipes, fire retardant and on structural steel). Use of asbestos in ceiling insulation has long ceased, however loosely bound asbestos (friable) may be found in a few older forms of ceiling insulation. Be sure never to remove asbestos and to always report the presence or suspected presence of it to the householder or supervisor.</p> <p>Asbestos can be found in homes built prior to 1990. It is often found in:</p> <ul style="list-style-type: none"> • Wall sheeting and cladding or roof materials • Old electrical switchboards • Some floor covering.

	<p>STOP WORK if you identify asbestos. Check with your organisation on asbestos removal procedures as in many cases a licensed contractor will be required to remove it.</p> <p>Tools such as power saws, grinders, sanders, and drills can generate significant amounts of dust, which can contain asbestos fibres. These tools should not be used unless they are specifically designed for asbestos abatement and equipped with appropriate dust control measures.</p> <p>Techniques like sandblasting or abrasive blasting should never be used on materials containing asbestos, as they can release large amounts of fibres into the air.</p> <p>Any activity that disturbs asbestos-containing materials should be performed within a controlled environment, such as an enclosure with negative air pressure and proper ventilation, to prevent the spread of asbestos fibres.</p> <p>Tools that are not designed for handling asbestos-containing materials, such as ordinary household vacuums or brooms, should not be used, as they can release fibres into the air or spread contamination. Instead, HEPA-filtered vacuums and wet cleaning methods should be employed.</p>
5: Nails and sharp edges	Be careful of exposed nails or splinters of wood – especially if you are working in ceilings. Wearing the correct PPE will provide you with protection against such hazards.
6: Falling Objects	<p>You must take care to ensure that objects do not fall onto or hit people doing construction work and people in adjoining areas. Adjoining areas could include a private driveway, public footpath, or the yard of a nearby dwelling.</p> <p>Falling objects include anything that can fall or be sent out sideways or upwards, e.g. tools falling off a roof.</p> <p>IT IS IMPORTANT THAT:</p> <ul style="list-style-type: none"> • there are exclusion zones around scaffolding and adjoining areas to stop unauthorized people from accessing the area • perimeter containment screening, scaffolding fans, hoardings or gantries are used to contain falling objects • scaffolding is erected and dismantled during quiet times in built up areas • materials are never dropped from scaffolding- mechanical hoists should be used to move materials • signs are used to warn people of hazards.
7: Electricity	<p>Requirements for installing insulation around or near electrical cabling, heat generating appliances and recessed lighting are addressed in AS 3999 in the following sections:</p> <ul style="list-style-type: none"> • Section 2: Pre-Installation considerations and inspections • Section 4.3: Electrical safety requirements • Appendix A: Recessed Luminaries. <p>Ensure any electrical leads use for portable power equipment are test tagged.</p> <p>Keep leads off the ground.</p> <p>Use a portable RCD where ever an RCD is not present on the electrical circuit.</p>
8: Fire	Recessed Luminaires (downlights) - can generate extremely high levels of heat. Check that no combustible materials (such as dry leaves) is in contact with downlights, or combustible loose insulation.

6.5. Personal Protective Equipment

When working on a new build or retrofit project, you will be working either on a building site or in a private residence. There are hazards associated with these working environments and you need to make sure that you take care of your own health and safety.

The installation is made easier if the right equipment is used, and this should include the recommended clothing. As part of your SWMS, you should review your PPE requirements prior to commencing work.

6.5.1. Why is PPE important?

PPE is important because it can protect your body from injury by blunt impacts, electrical hazards, heat, chemicals and disease or infection.

Using PPE is only one part of a complete safety program that would normally use a range of strategies to maintain a safe and healthy work environment.







PPE does not reduce the hazard itself, nor does it guarantee permanent or total protection. It simply offers a level of protection. You still need to think and act safely at work to identify and control hazards and risks.

Where PPE is considered necessary and if you are feeling hot, don't shed items of PPE. For example, PPE can prevent direct skin contact with hazards such as exposed wiring and can reduce the severity of electrical shock. Instead, take frequent breaks and drink plenty of water.

6.5.2. Who supplies PPE?

Your employer must supply you with PPE appropriate to your job. Your employer must also ensure that the purpose of each PPE item that you are given is explained to you, and that you are trained to fit and use it correctly.

6.5.3. Common examples of PPE

1: Headwear	
	<p>Hard hats need to be carried at all times and should be worn whenever there is any chance of being hit by debris or falling objects.</p> <p>Also, wide brimmed hats or hats with flaps to protect against UV radiation should be worn when required, e.g. when working on a roof.</p> <p>NOTE: brimmed hats can restrict vision when working in a restrictive space.</p>
2: Eye Protection	
	<p>Should be fit for the purpose and job and must be worn where potential discomfort or damage to the eyes could occur e.g. when installing products overhead, or where safety signage specifies that eye protection must be worn.</p>
3: Hearing Protection	
	<p>Ear plugs and muffs are required where noise is a risk to health and safety. Industrial noise is a major factor in partial or permanent hearing loss. The danger can be lessened through the use of appropriate ear protection.</p>
4: Foot Protection	
	<p>Footwear needs must meet Australian Standards and be appropriate for the site and weather conditions. Non-slip footwear should be worn when working at height. Rubber soled shoes can reduce the severity of electric shock.</p>
5: Hand Protection- Gloves	
	<p>Prevent your hands from being damaged by sharp objects. Leather gloves can reduce the severity of electric shock.</p> <p>Gloves can also prevent hazardous substances from entering your body through hand contact. You need to adjust these before using them as they provide a 'different feel'.</p> <p>Consider wearing cut resistant gloves.</p>
6: Respiratory Protection (Lung/Breathing)	
	<p>A respirator is a device designed to protect you from inhaling harmful dusts, fibres, fumes, vapours and/ or gases. Remember that you should only use a respirator which complies with the relevant Australian Standards.</p> <p>There are two main categories:</p> <ul style="list-style-type: none"> • Air-purifying respirators- (half or full face mask) which force contaminated air through a filtering from hazardous dust, mites, fibres or vapours. The mask must fit your face correctly. Sealing is critical to proper use. • Air-supplied respirators- which deliver an alternate supply of fresh air through gas type cartridges or scuba equipment. These are generally required when handling chemicals so you will need to check the relevant MSDS.

7: Body Protection – Clothing



- Overalls or coveralls should be used to keep contaminants from soiling your clothes and from being carried from the workplace. These should completely cover your arms and legs.
- High visibility clothing and vests help you to be seen by others. You need to wear the correct type of vest to suit the lighting conditions (day or night or day/night). This type of clothing may be required for some categories of building sites.
- Long sleeve shirts and pants help to protect against harsh weather elements, UV radiation and also chemicals. They need to fit correctly to help to avoid injury caused by loose clothing which may get caught in machinery or moving objects. Jewellery and chains present similar dangers.

8: Height Safety PPE



In circumstances deemed necessary, working at heights requires you to use some additional PPE for fall prevention. Depending on the job, this can include temporary anchorage points, static lines, shock absorbing lanyards and full body harnesses.

Equipment such as harnesses and safety lines must comply with relevant Standards. Before each use, you should check your equipment is safe and operational by confirming:

- there are no signs of fraying in stitching and webbing
- lanyards and double yokes are not too worn
- no chemicals or paint have spilt on the equipment
- all fixings are tight and secured
- all rings and housing are in good order
- safety clips/ hooks are not bent, cracked or stress-fractured
- the fall arrest section is intact and not disturbed.

Note: PPE will only assist in preventing damage. It is important to use it, and use it properly, but other safety measures must also be followed.

6.6. WHS Documentation

There should be several types of WHS documents at your workplace. They should provide information about:

- WHS, and a method for reporting, e.g. risk assessment instrument (critical step for identifying, assessing, recording and controlling hazards, particularly electrical)
- construction documentation and plans
- Safe Work Method Statement (SWMS)
- accident, incident and injury reports and proformas
- reports of dangerous occurrences or near misses
- Site Safety Plan.

6.7. Electrical Risk Assessment (refer to ‘heightened awareness’)

Requirements for installing insulation around or near electrical cabling, heat generating appliances and recessed lighting are addressed in AS 3999 in the following sections:

- Section 2: Pre-Installation considerations and inspections
- Section 4.3: Electrical safety requirements
- Appendix A: Recessed Luminaires.

6.8. Fixing insulation in position

Insulation or a suitable guard in the ceiling space is required to be fixed in position where located in close proximity to lighting, hot flues or heat generating appliances.

A mechanical strength test for fixing insulation in position and providing appropriate guards has been developed and the details of this test are given in AS 3999 Appendix B.

Manufacturers and suppliers of insulation are required to supply installers with appropriate independent test results certifying the correct procedure for installing insulation up to 50mm from lighting hot flues and heat generating appliances.

6.9. Fall Protection Systems

Anchor Points are fixed points used to secure safety equipment or lines, typically in situations where workers are at height or in hazardous environments. Anchor points are essential for ensuring the safety of individuals working at elevated positions.

Barrier Systems are physical or visual structures designed to prevent access to a particular area or to provide protection from hazards. Barrier systems can include guardrails, fences, or warning signs, among other elements, and are used to keep people safe in various settings such as construction sites, roadways, or industrial facilities.

Static Lines are a safety system used in activities such as rock climbing or working at heights. It consists of a fixed-length rope or cable anchored at one end and attached to a harness worn by a person at the other end. The static line allows the person to move along a predefined path while remaining securely connected, reducing the risk of falls.

Crawl boards are temporary platforms or walkways typically used in construction or maintenance work. They are narrow structures designed to provide safe access in confined spaces or areas where traditional scaffolding or ladders may not be practical or safe to use. Crawl boards allow workers to move horizontally or vertically while performing tasks at elevated levels.

A secured ladder refers to a ladder that is properly stabilised and anchored to prevent it from slipping, tipping over, or shifting while in use. Securing a ladder is crucial for ensuring the safety of individuals climbing or working on it, especially when working at height. Ladder stabilisers, straps, or braces are commonly used to secure ladders in place.

6.10. Clean-up procedures

Cleanup procedures are important to reduce trip hazards, and safe work practices need to be applied to all work activities, including clean-up.

General clean-up activities include waste removal and recycling. Reinstate any moved items like roof tiles etc. The area should be left clean and tidy and free of trip hazards. Segregate waste into categories such as recyclable materials (e.g., cardboard packaging, metal scraps), hazardous materials (e.g., fibreglass insulation waste), and non-recyclable waste (e.g., plastic wrapping). If possible, use onsite waste bins or follow organisational procedures for waste disposal.

Implement safe handling procedures for hazardous waste generated during insulation installation, such as fibreglass scraps. Store hazardous waste in designated containers with appropriate labelling and ensure proper disposal according to regulatory requirements.

If **hazardous waste** is encountered and removed (e.g., asbestos), it needs to be packaged and transported by a licenced person, packaged in accordance with State Worksafe requirements, and disposed of at an appropriate facility licenced to handle such waste.

Clean, check, and maintain tools and equipment to ensure optimal performance, safety, and longevity.

Tools and equipment should be wiped down with a clean cloth to eliminate dust, debris, and insulation materials. Compressed air or vacuum cleaners can be used to clear debris from equipment with small crevices or moving parts.

Washing tools with mild soap and water helps remove residues.

Electrical equipment should be cleaned according to manufacturer guidelines to prevent damage.

Inspect tools for any damage, such as cracks, dents, or wear and tear.

Verify that equipment is functioning correctly by testing each tool or machine. Check for loose or missing parts that require tightening or replacement.

Inspect power cords and hoses for fraying, cuts, or other damage that could pose safety risks.

Lubricate moving parts of machinery and tools ensures smooth operation.

Sharpen cutting tools, such as knives or blades, maintains their effectiveness. Replace worn-out components, such as brushes or filters, as needed.

Calibrate equipment, such as measuring devices or gauges, to ensure accuracy. Store tools and equipment in a clean, dry environment to prevent corrosion or deterioration.

Perform regular maintenance tasks according to manufacturer recommendations.

Ensure that safety features on equipment, such as emergency shut-off switches or guards, are functioning properly. Before using plant and equipment, ensure guards are in place according to the manufacturer's specifications. Check personal protective equipment (PPE), such as gloves, goggles, and respirators, for signs of wear and tear and replace them as needed.

7. Managing Electrical Hazards (having a heightened awareness of electrical hazards)

7.1. Installing insulation in new or existing buildings

When installing insulation in new or existing buildings after wiring or electrical appliances have been installed, a risk assessment shall be carried out prior to work commencing. This assessment is to be performed by a person with heightened awareness of potential electrical risks.

Note: Power to the building should be isolated and if there is any doubt about how to turn the power off, consult a licensed electrician.

7.1.1. Types of electrical and electrical wiring hazards

Hazard	
1: Lead Sheathed Cables	<p>These types of cables were installed up until the late 1940s or early 1950s. They had poor quality insulation around each conductor core, and then covered in a lead casing. Problems arose when the insulation of the inner core broke down and made contact with the outer sheath. The lead sheath then had the potential to become live when the earth continuity of the sheath was lost.</p> <p>If these cables are found in a ceiling space, no work should proceed until the area has been assessed as electrically safe by a licensed electrical contractor.</p>
2: Tough Rubber Sheathed Cables (TRS Cables)	<p>These cables were installed until the mid to late 1950s. They had a short safe service life and where installed in ceiling spaces, deteriorated even more quickly due to the high ambient temperatures under roofs.</p> <p>However, such cables may still be encountered in older buildings. Such cables may appear on contract leaving exposed live parts.</p> <p>If TRS cables are found in a ceiling space, no work should proceed until the area has been assessed as electrically safe by a licensed electrical contractor.</p>
3: Infinity and Olsent electric cables	<p>During 2010 – 2013 a large quantity of Infinity and Olsent branded electric cables were sold into the Australian building industry. These cables have now been assessed as failing to meet minimum performance and safety standards and may present a threat now or in the future. Although remaining unsold stocks have been withdrawn from sale, up to 40,000 buildings may have these cables already installed.</p> <p>If these cables are present on your job, do not continue to work. Inform the occupant and request they arrange an inspection by a licenced electrician or electrical engineer. Do not recommence work until cleared to do so in writing by a licenced electrician or electrical engineer.</p>
4: Split Steel Conduit	<p>These were used up until the late 1940s. The wiring within such conduit is usually of vulcanized India rubber (VIR) insulated cables.</p> <p>The split steel conduit system relied on remaining effectively earthed through the continuity of the grub screw secured joints in the system. These joints often fail electrically with age. With the passage of time, therefore, earthing cannot be guaranteed and with the deterioration of the insulation of the wiring, sections of conduit can become energized at 240 volts.</p> <p>The same VIR cable was sometimes installed in a wooden (pine) duct, often referred to as “cap and casing”. If split steel conduit (or cables in pine ducted wiring systems) are found in a ceiling space, it is recommended no work should proceed until the area has been assessed as electrically safe by a licensed electrical contractor.</p>

Hazard	
5: Thermoplastic Insulated and Sheathed (TPS) Cables	<p>These cables are almost the universal type of electrical cable used in houses today. They have been in use since the late 1950s. Older TPS cables may have a black outer sheath while more modern cables have generally grey or white sheaths. Orange sheathed TPS cables are generally more common in industrial installations.</p> <p>Older TPS cables may have deteriorated to the stage of requiring replacement, although many 50 year old TPS cables remain safe and serviceable. The failure mode of TPS cables is generally from embrittlement and cracking. White Sheathed TPS cables are often more prone to ultra violet radiation.</p> <p>If the following are found, no work should proceed until the area has been assessed as electrically safe by a licensed electrical contractor.</p> <ul style="list-style-type: none"> • cracked or split sheaths of TPS cables • exposed inner cores of TPS cables (usually red, black, white and green) • exposed copper wire is visible at terminations, electrical accessories or equipment.
6: Unenclosed Joints	<p>When TPS cabling was introduced in the late 1970s, some of the wiring joints were not suitably enclosed. These joints were installed in the roof space using exposed connectors. In some instances, Insulation tape was applied. Unenclosed joints (whether enclosed with insulation tape or not), are considered unsafe. It is recommended no work should proceed unless power is isolated and the joint is left undisturbed. A licensed electrical contractor must enclose the joints.</p>
7: Corrosive Effects of Thermal Insulation	<p>Thermoplastic insulated and sheathed cables can suffer degradation of their electrical insulation if it comes into contact with polyurethane or polystyrene types of thermal insulation.</p> <p>If polyurethane or polystyrene insulation is to be installed where it will be in contact with the electrical insulation or sheath of an electrical cable, work must not proceed until the cables have been provided with a protective cover, sleeving or barrier, or other precautions put into place by a licensed electrical contractor.</p>
8: Vermin present or vermin damaged wiring	<p>Check for:</p> <ul style="list-style-type: none"> • presence of vermin (e.g. rodents, bees, spiders, wasps, snakes) • vermin waste <p>Vermin damage to electrical cables in ceiling spaces can result in live bare conductors being exposed. Wiring should be checked for such damage.</p> <p>If wiring is identified that shows signs of vermin damage, no work should proceed until the area has been assessed as electrically safe by a licensed electrical contractor.</p>
9: Derating of Electrical Cables and Wiring Systems	<p>The addition of thermal insulation around or beside a cable can reduce its current carrying capacity because thermal insulation prevents dissipation of the natural heat rise of cables carrying electrical current. As cable operating temperatures rise, their ability to carry electrical current is significantly reduced.</p> <p>This phenomenon is called 'cable derating'. Cables carrying current in excess of their derated capacity can fail catastrophically.</p> <p>Insulation must not be fitted so as to totally enclose a cable for more than 400mm. Insulation must not be arranged where total enclosure may result from a cable sinking into loosefill.</p> <p>The following arrangements are satisfactory:</p> <ul style="list-style-type: none"> • placing insulation over a cable lying on the surface of a ceiling sheet • placing insulation beside a cable fixed to a structural member such as a joist • a cable lying on the top of batt type ceiling insulation.

Hazard	
10: Cables Subject to Damage from Insulation Fixing Methods	<p>Lead sheathed cables, TRS cables and thermoplastic sheathed (TPS) cables are not designed to withstand mechanical damage such as would be occasioned from thermal insulation fixing nails, pins or cleats.</p> <p>Under no circumstances must fixing devices in ceiling spaces, or in proximity to electrical wiring, be of metal or other conductive material. Control measures that ensure that a fixing device cannot be at risk of puncturing or otherwise damaging a cable must be used. Controlled measures should also ensure that cables are not trodden on, punctured, abraded, cut, crushed or placed under tension.</p>
11: When installing Insulation	<ul style="list-style-type: none"> ✓ Never use metal or conductive tools ✓ Never use metal or conductive tools ✓ Don't tread on, abrade, cut or crush cables ✓ Don't put cables under tension ✓ If damaged, contact electrician immediately
12: Recessed Luminaires/Downlights	<p>Recessed luminaires (or downlights) are common in houses today. There are detailed requirements in AS 3999 and AS/NZS 3000:2018 (wiring rules) for the precautions that must be in place to ensure that the installation arrangements for these, and their auxiliary equipment, ensure that the risk of fire is prevented.</p> <p>Thermal insulation on or near recessed luminaires can cause excessive temperature rise and has the potential to cause fires</p> <p>Note: an increasing number of available recessed luminaires are now manufactured to allow insulation to abut or cover them. This will be clearly shown on the packaging and also on the light fitting. If there is no clear instructions to this effect, or any doubt, refer back to the default clearances given in AS 3000 2018 wiring rules (repeated in AS 3999 2015)</p> <p>If a ceiling has a recessed luminaire, one of the following precautions derived from AS /NZS 3000:2018 Wiring rules must be used before thermal insulation is installed:</p> <ul style="list-style-type: none"> • it must be verified that the luminaire has been specifically designed and certified by the manufacturer to permit contact with combustible materials or enclosure or covering by thermal insulation, or • the luminaire must be installed within a suitable fireproof enclosure or • there must be provision of required clearances from combustible and thermal insulation materials as specified by the manufacturer of the luminaire or • there must be provision of the default clearances from combustible and thermal insulation materials as specified in AS 3999 and AS/NZS 3000:2018 (wiring rules).
13: Electrical Conductive Insulation and Conductive Fasteners	<p>Aluminium foil insulation products and metal fasteners conduct electricity. Aluminium foil insulation is commonly supplied in long rolls and would become energised if contact was made with the aluminium sheet and 240V ac.</p> <p>To avoid risk of electricution care should be taken to ensure these items do not come in contact with electrical wiring during installation.</p>
14: Other Electrical Appliances	<p>Electrical appliances other than recessed luminaires in ceiling spaces may include air conditioning equipment, exhaust fans, combination bathroom fan/ light/heaters and luminaries installed specifically to illuminate the roof space. You must ensure that installation of thermal insulation does not impede the safe operation of the equipment.</p> <p>The equipment manufacturer's installation instructions/ advice in this regard must not be contravened. Statutory clearances between the equipment and thermal insulation must be maintained in accordance with relevant current Standards including AS 3999 and AS/NZS 3000:2018 (wiring rules). Some equipment such as bathroom combination fan/light/heater units must not have a cover placed over them as this will create an immediate fire hazard.</p>

Hazard	
15: Other Electrical Equipment	<p>Recessed luminaries (or downlights) are common in houses today. There are detailed requirements in AS/NZS 3000:2018.</p> <p>Additional risks relate to using any electrical tools or equipment in the installation process, for example power drills and vacuum cleaners. You must report all electric shocks and short circuits. Australian Standards and WHS legislation demand regular inspections of electrical equipment.</p> <p>All electrical equipment must be tested and tagged. Extension leads and portable tools should be checked for defects and correct tags. In work areas, all electrical leads should be suspended off the ground.</p> <p>If you suspect the wiring in the ceiling does not confirm to AS/NZS 3000:2018, or the building was constructed prior to 1989, you should seek advice from a licensed electrical contractor or electrical inspecting authority to determine whether the cables are suitable for surrounding in thermal insulation.</p>
16: Tools and Machinery	<p>Tools used in the installation of insulation (e.g. knives, cutters etc) pose hazards, particularly when used in confined spaces and around electrical equipment and cabling. Use only tools and equipment that are safe to use.</p> <p>Make sure the equipment you use has been correctly serviced and checked. Also, keep tools in good repair and check to make sure they are fit for use. Knife blades must be covered when not in use and be able to be locked in place when in use.</p> <p>Treat tools with respect.</p> <p>Tools and Equipment used in insulation removal</p> <p>Vacuum Insulation Removal System (VIRS)</p> <p>Safety: Ensure proper ventilation to prevent inhalation of dust and particles. Wear appropriate personal protective equipment (PPE) such as goggles, gloves, and respirators.</p> <p>Characteristics: VIRS typically consists of a powerful vacuum attached to a long hose with specialised nozzles designed to suck up insulation materials.</p> <p>Uses: Ideal for removing loose-fill insulation materials such as fibreglass, cellulose, or mineral wool from attics or ceilings.</p> <p>Limitations: It may not be suitable for removing insulation that has become wet or compacted. It may also struggle with removing insulation in hard-to-reach areas or tight spaces.</p> <p>Insulation Blowing Machines</p> <p>Safety: Operators should be trained in machine operation and safety procedures. PPE such as goggles, gloves, and a respirator should be worn.</p> <p>Characteristics: These machines use air pressure to blow loose-fill insulation into cavities or spaces. They can also be reversed to remove insulation.</p> <p>Uses: Commonly used for installing or removing loose-fill insulation in ceilings, attics, and walls.</p> <p>Limitations: Not suitable for removing insulation that has become wet or compacted. The effectiveness may depend on the type and condition of the insulation material.</p> <p>Insulation Removal Bags</p> <p>Safety: Ensure proper lifting techniques to prevent strain or injury. Wear gloves and a respirator to protect against dust and particles.</p> <p>Characteristics: Heavy-duty bags designed to hold insulation materials safely during removal. They often have reinforced seams and handles for easy transportation.</p> <p>Uses: Used in conjunction with hand tools or vacuum systems to collect and contain removed insulation for disposal.</p> <p>Limitations: Limited to manual removal methods and may require significant physical effort, especially for large amounts of insulation.</p>

Hazard

Hand Tools (e.g., Shovels, Rakes, Scoops)

Safety: Wear gloves to protect hands from sharp edges or protruding nails. Use caution when working on elevated surfaces to prevent falls.

Characteristics: Manual tools designed for scooping, scraping, or lifting insulation materials.

Uses: Effective for removing insulation from tight spaces, corners, or areas where machinery cannot reach.

Limitations: It can be time-consuming and labour-intensive, especially for large-scale removal projects. Not suitable for removing insulation in hard-to-reach areas without proper safety precautions.

Protective Enclosures

Safety: Ensure proper ventilation and access for workers inside the enclosure. Monitor air quality to prevent exposure to hazardous materials.

Characteristics: Temporary structures or barriers erected to contain insulation removal activities and prevent contamination of surrounding areas.

Uses: Used in conjunction with other removal tools to create a controlled environment for safe and efficient work.

Limitations: Requires setup time and may not be practical for small or confined spaces.

When using any insulation removal tools and equipment, it's crucial to prioritise safety, follow manufacturer instructions, and consider the specific requirements of the project and insulation materials involved. Regular maintenance and equipment inspection are also essential to ensure optimal performance and minimise risks.

Power Tools:

Safety: Inspect power tools before each use to ensure they are in good working condition. Check for any damaged cords, guards, or blades. Handle power tools with care and follow manufacturer instructions for safe operation. Avoid using tools in wet or damp conditions.

Characteristics: Power tools are designed to provide efficient and fast performance, allowing for quicker installation of insulation compared to manual methods.

Uses: Power saws such as circular saws or reciprocating saws can be used to cut insulation materials such as fiberglass or foam board to the desired size and shape. Power drills equipped with hole saw attachments are useful for creating openings in walls or ceilings for installing insulation around pipes, wires, and other obstacles.

Limitations: Power tools can pose safety hazards if not used properly, such as the risk of cuts, lacerations, or electrical shocks. Some power tools generate high levels of noise and vibration, which can cause discomfort or potential long-term health issues with prolonged use.

NEVER place insulation using tools that can conduct electricity (eg metal sticks or poles). Always use tools that are nonconductive or have insulated handles to minimize the risk of electrocution.

7.2. Performing the Electrical Isolation

Electrical isolation must always be carried out when retrofitting insulation to an existing building. However, with construction of new buildings insulation is mostly fitted prior to power being energised to the building. In this circumstance, electrical isolation is not required.

Always check if power is connected and energised.

7.2.1. Before performing the Electrical Isolation procedure:

- Inform the client and any other trades on site that it is necessary to isolate the power to remove the risk of electrocution
- Before proceeding, complete a SWMS (Refer to ICANZ SWMS example - page 99)
- If the power can not be isolated, do not proceed. Contact your employer/site manager for further advice
- Request the client to set the alarm in maintenance mode (if applicable)
- Activate some ceiling lights and appliances so, when the power goes off, it is confirmed that the correct switch has isolated for both lighting and power
- Ensure any gas ducted heaters are switched from 'Auto' to 'Off' mode prior to isolation being carried out.



Circuit board



Tagged circuit board

7.2.2. Review meter box

- Locate and review the meter box
- Mains power isolators are located in the meter box
- Identify if there are ceramic fuses (see 6.2.7 Ceramic Fuses) or a model circuit breaker (see 6.2.4 Model Circuit Breaker)
- Ensure you understand what the main isolator is and what individual isolators are
- Ensure you understand the direction of the 'On' and 'Off' position of the switch
- The 'Off' position is not always as it seems.



Fuse and circuit breaker

7.2.3. Isolate Mains Power

- Switch off mains power isolator – Labelled MAIN SWITCH
- Make sure switch is in the OFF Position
- If there are signs of burnt or exposed wiring, do not continue - report the hazard.



Voltage detector

7.2.4. Lock out Switches

- Attach an electrical isolation device to the main switch.



Note: The Safe Work Australia - Model Code of Practice for Managing Electrical Risks in the Workplace 2018 pg 36 states “if more than one person is working on the same de-energised electrical installation, individuals should ensure their own personal lock is applied to the isolation point, otherwise the principles of tagging apply”



7.2.5. Attach danger tag

- Attach Danger Do Not Operate tag to locked out switches
- Insert padlock tie through hole in lockout and tag
- Record your name and contact number on the tag.



7.2.6. Check power is off

To check power is not still running, these checks may be used:

- check if lights are operational
- check if power points are still active
- check cables and power points with voltage detector.

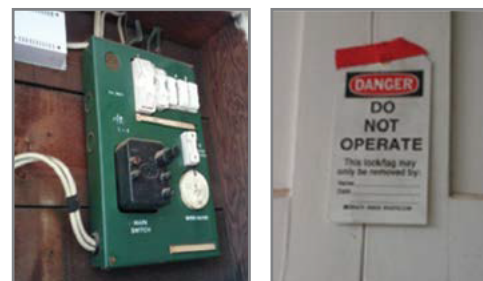


7.2.7. Ceramic fuses

- Ceramic fuses are typically found in older style homes
- Identify if any fuse is deactivated
- If no isolator switch **DO NOT** proceed
- **DO NOT** remove ceramic fuses - unless by a Licenced Electrician
- Check if there are any fuses currently in the 'Off' position, take note of them
- **Fit lock-out device to main isolator switch and ensure it is locked in the 'Off' position**
- Toggle main switch and place a strip of electrical tape over main switch isolator
- Apply additional strips of electrical tape over the deactivated fuse and any individual isolator in the 'Off' position as a reminder to leaving it in the 'Off' position once the re-activation procedure has been completed
- If you find a fuse plug out of its socket, whilst the main isolator is in the 'Off' position, place electrical tape over its respective switch and one over the fuse socket opening
- **DO NOT** touch the internal metal fittings
- Place an isolation tag on the main isolator switch or meter box enclosure to advise the power is off and **WORK IN PROGRESS** is occurring
- Check to ensure the light and appliance, within the home, previously left on are no longer operating to confirm the mains power is now isolated
- **The original person who placed the isolation tag is the only one who can re-activate the power. Advise client of this requirement.**



Example: The switch on the left with the blue mechanism is positioned in the 'On' position. The grey switch looks the same but is actually in the 'Off' position.



Ceramic fuses

7.2.8. Electrical Current

- There are two types of electrical current: direct and alternating. In a direct current, abbreviated DC, the electrons move in one direction whilst alternating current is a type of electrical current, in which the direction of the flow of electrons switches back and forth at regular intervals or cycles.. The unit of current is the ampere, which is defined as one coulomb of charge passing a given point in one second.

7.2.9. Circuit board

- Circuit boards are typically found in modern homes
- Check if there are any circuit breakers currently in the 'Off' position, take note of them
- Toggle main switch and place a strip of electrical tape over main switch isolator
- Apply additional strips of electrical tape over the deactivated fuse and any individual isolator in the 'Off' position after isolating the mains power as a reminder to leave it in the 'Off' position once the re-activation procedure has been completed
- Place an isolation tag on the switches or meter box enclosure to advise the power is off and work in progress is occurring
- Check to ensure the light and appliances within the home previously left on are no longer operating to confirm the mains power is now isolated
- **The originator that placed the electrical isolation tag and lock is the only one who can re-activate the power. Advise client of this requirement.**

7.3. Solar Isolations

7.3.1. Solar Power

- Solar cables running through the roof space from solar panels to the inverter are live. If cables are exposed (not enclosed in conduit) do not touch when installing insulation.
- The process of working in close proximity to solar cables must be covered in work methods statement and job plan.



Exposed cables - not compliant

7.3.2. Solar Installations prior to 16th October 2012

- Installations that took place prior to October 2012 may have white or black TPS cable used for DC supply from the solar array.
- The DC cable should be identified as "Solar DC".

7.3.3. Solar Installations after 16th October 2012

- After 16th October 2012 DC Cable within the roof cavity should be enclosed in HD conduit and marked "Solar".
- The HD conduit may be orange, grey or even black in colour.



Solar Installations after 16th October 2012 using conduit to enclose wires.

7.3.4. Insulation proximity to cables in conduit

- Requirements for insulation and cabling AS/NZS 3000: 2018 equally apply to cables in conduit.

Note: Requirements for insulation in proximity to electrical cabling equally apply to cable running through conduit.

7.3.5. To Shut Down a rooftop solar installation, prior to entering the ceiling:

When returning Mains power the installer is required to:

- Switch off the AC electricity in the switch box with the breaker marked "Solar Supply Main Switch".
- Switch off the DC isolation breaker. This is usually a separate small box next to the inverter and will be marked "PV array DC Isolator". The inverter should shut down and the LED panel is left blank.
- Continue with normal shutdown procedure and lockout of the standard AC power as you would in your everyday work. (Refer to 6.2.3 Isolate Mains Power).

7.3.6. To restart the system on completion in the roof:

- Switch the DC "PV array DC Isolator" back on. It may need some force as it is a mechanical isolator.
- Switch on the AC breaker marked "Solar Supply Main Switch".
- The startup process can take around 120 seconds. The system needs to do a number of checks before it re-connects to the grid.
- Lights and a LED display will indicate the system is working.



Solar Power Board

7.4. Reactivating the Power

7.4.1. Old style ceramic fuses

When returning Mains power, the installer is required to:

- Before reactivating power be sure to advise the client and all trades on site that power will now be reactivated
- request the client and any other trades on site permission to turn off electrical items at the power point
- return mains power; toggle switch to the 'On' position
- any isolator fuse taped in the 'Off' position noted earlier is to remain as is and leave taped over
- advise the client and any other trades on site that power has been restored and of any issues related to the meter box.

7.4.2. Modern circuit board

When returning Mains power the installer is required to:

- Before reactivating power be sure to advise the client and all trades on site that power will now be reactivated
- request the homeowner's any other trades on site permission to turn off electrical items at the power point
- remove Danger tag and lockout
- switch each of the individual circuit boards to the 'Off' position
- turn on main power isolator
- reactivate individual power isolators, one at a time
- reactivate individual lighting power isolators, one at a time
- reactivate remaining isolators i.e. spa, stove, air conditioning, etc, one at a time
- any circuit breaker fuse electrically taped in the 'Off' position noted earlier is to remain as is and leave taped over
- Check all switches are on and power is working
- advise the client and any other trades on site that power has been restored and of any issues related to the meter box.

WARNING: If you cannot re-install power (eg. circuit board won't turn on) installers are required to report the incident to the client as it may require: assistance from a qualified electrician.

7.4.3. Electrical Safety Check

When returning Mains power the installer is required to:

- Before reactivating power be sure to advise the client and all trades on site that power will now be reactivated
- request the homeowner's permission to turn off electrical items at the power point.

8. Health and Safety of Glasswool and Rockwool Insulation Material

Glasswool and rockwool insulation batts have been classified as **NON HAZARDOUS SUBSTANCES – NON DANGEROUS GOODS**.

Safety Data Sheet for both glasswool and rockwool can be accessed from the ICANZ Members websites

Glasswool and rockwool insulation products are excellent and versatile insulation materials and are safe to use under all conditions.

Both insulation materials have been used worldwide for over 80 years and during that time their manufacture and use has been extensively monitored and researched.

It is clear from comprehensive site and plant monitoring and extensive medical research that no serious health effects have occurred in those manufacturing, using or otherwise exposed to glasswool or rockwool insulation.

FBS-1TM glasswool and rockwool insulation products manufactured in Australia and New Zealand by member companies of ICANZ are classified as NON-HAZARDOUS and NON-DANGEROUS GOODS .

This means that an SDS (GHS-format) or Material Safety Data Sheet (MSDS) is not required under Australian regulations, however ICANZ members have produced product information in the SDS format, even though the products are Non Hazardous Substances.

The handling of glasswool and rockwool insulation may result in temporary itching.

Often installation sites are dusty and dust can be released from the installation sites. Adhere to sensible work practices to minimise exposure to dust.

Advice on safe product handling can be found at the following web sites:

- **Fletcher Insulation at www.insulation.com.au**
- **CSR Bradford Insulation at www.bradfordinsulation.com.au**
- **ROCKWOOL Malaysia at www.rockwool.com/asia/.**



TM



TM

9. Installation of Ceiling Batts

9.1. Application

Batts for thermal efficiency and acoustic performance.

9.2. Planning before the job

9.2.1. Safety (WHS)

Installers are required to carry out their duties in accordance with their employer safety management plans and policies. The installer may also need to accommodate specific builder safety policies on site. It is a requirement that you review the Safe Work Method Statement (SWMS) prior to commencing installation and ensure all risks are identified and controlled.

Refer to ICANZ SWMS example included in this training document & duty of care responsibility. (Refer section 15).

9.2.2. Confirm the scope of work

Relevant instructions and operational details are obtained using work information, such as:

- a purchase order
- job sheet instructions
- energy rating reports
- architect drawings and their respective notes
- client specific instructions
- builder specific installations.

Basic information required is as follows:

- material R-value of batts required
- batt width to match joist centres
- number of packs required for the job
- locations of the ceilings to be insulated including any special areas
- ceiling batts to be applied to a short wall within the ceiling void adjacent to a living area i.e. a roof space.

While preparing the work area, ensure that it will not damage or distort the surrounding environment, electrical and other services, and maximise safety for yourself and others. If the installation involves working around electrical wiring or other services, consult with relevant professionals such as electricians or plumbers to ensure that the insulation process will not interfere with these systems and communicate with them accordingly.

The Lead Installer will plan the installation before commencing work. A toolbox talk will outline each installer's role and work activities. Lead Installers will set the pace to ensure work is completed efficiently and safely.

Familiarise yourself with building codes and regulations and your organisation's SWMS and policies that specifically pertain to ceiling insulation materials and installation methods.

Implement procedures for safely accessing ceiling spaces, including the use of ladders, scaffolding, or other equipment. Ensure you are familiar with the safe handling of insulation materials and the proper use of equipment to prevent injuries or accidents.

Develop a systematic approach to planning the installation process, considering factors such as the type of insulation material, ceiling structure, and accessibility.

- Assess the condition of existing insulation (if any) and plan for its removal or replacement as needed.
- Coordinate with other trades involved in ceiling-related work, such as electricians or HVAC technicians, to ensure compatibility with insulation installation.
- Determine the appropriate insulation R-value and thickness for the ceiling space based on local climate conditions and energy efficiency requirements.

Conduct inspections during and after installation to verify that insulation is installed according to manufacturer recommendations and building codes. Address any issues or deficiencies promptly to maintain the effectiveness of the insulation system.

Example of a Job Sheet

Company name Supervisor details	Company address	308161397/110	G.CEILBATT, R2.5X16PCE,,1160X580 L.SERVICE,STRINGING CEILING	FL	4647	129.18	12	PAC	L.INSTALL,FLOORS Mid-floor TO MIDFLOOR All downlights are IC-4 rated and to be covered with ceiling insulation	D	03.04.2024
Company name Supervisor details	Company address	308161397/60	LOAD G.CEILBATT, R3.5X10PCE,,1160X580X185 G.WALLBATT, R2.0X22PCE,,1160X430X90 G.WALLBATT, R2.0X18PCE,,1160X580X90 G.WALLBATT, R2.0X18PCE,,1160X580X90 L.SERVICE,INSTALL POLYESTER FRAME INFILL		4647	137	20	PAC	L.INSTALL,WALLS External wall	D	05.04.2024
				FL	4647	131.3	131.3	M2			
					4647	98.766	9	PAC			
					4647	96.88	8	PAC			
				FJ	4647	12.11	1	PAC			
					4647	27	27	EA			

9.2.3. Material type and quantity required

Material selection is based on the scope of work. The installer needs to confirm that the material R-value (Rm) of the batts on hand, are those that meet the material R-value target set by the scope of work. The quantity of batts required is based on the project's ceiling surface area in m² (inclusive of the wall top plate dimension) divided by the manufacturers nominal coverage quoted on the batt packaging. The manufacturer's advice normally allows for ceiling timbers. This is a rough calculation and an allowance of surplus stock should also be on hand.

The Total R-value is determined by the product thickness and density at manufacturing stages. Before installing check the R value matches the work order.

CSR Bradford and Fletcher Insulation provide thermal calculators online.

ThermalCalculator ([csr.com.au](https://apps.csr.com.au))

<https://apps.csr.com.au/thermalcalculator>

Fletcher Spec Pro

<https://insulation.com.au/tools/fletcherspecpro>

EXAMPLE ONLY: CEILING and FLOOR area calculations and requirements

1. Using the house design plans take off the total ceiling area from top plate to top plate. Do not include eaves. This calculation can be used for both ceiling and floor insulation requirements OR where no plans are available
2. - Sketch the outline of the house perimeter
- measure and plot perimeter dimensions
- calculate the total area inside the perimeter (see example)
3. Check the ceiling joist spacings. This will determine the correct batt width required.
4. Check the R value on the packaging to ensure the correct thermal value is being installed
5. Refer to the labelling on the insulation packaging for 'nominal pack coverage'
6. To determine the number of packs needed, divide the total ceiling area by the nominal pack coverage.
7. Where this calculation results in a whole and part pack requirement, round up to the next whole pack
8. Where a perimeter insulation batt is required due to the roof pitch, consider the perimeter area in your calculation.

Example Calculation of ceiling or floor area

Area A: $3.0 \times 4.5 = 13.5 \text{ m}^2$

Area B: $10.5 \times 6.0 = 63.0 \text{ m}^2$

Area C: $8.5 \times 9.0 = 76.5 \text{ m}^2$

Area D: $6.0 \times 5.5 = 33.0 \text{ m}^2$

Total 186 m²

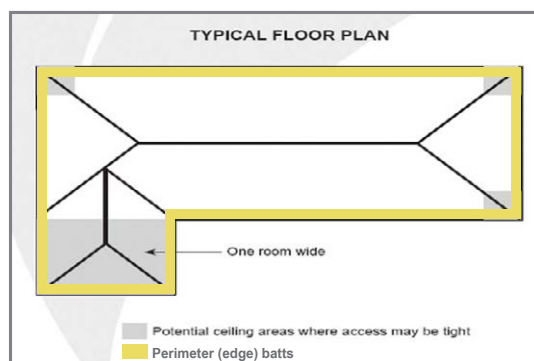
Joist Spacing - 600mm: batt width 580mm

Required R Value – R3.5

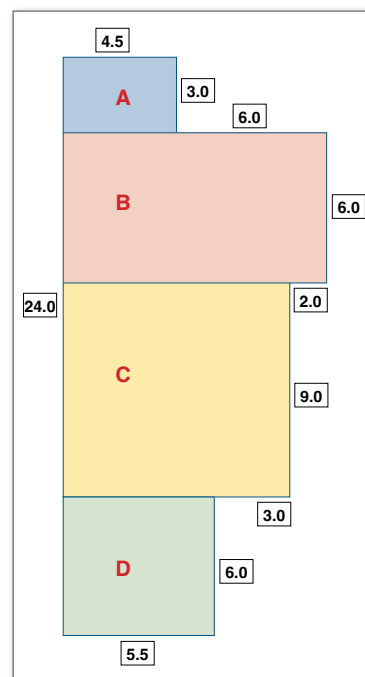
Nominal pack coverage – 7.6 m²

Packs - $186 \text{ m}^2 / 7.6 \text{ m}^2 = 24.5 \text{ packs}$.

Require 25 packs of R5.0 (580mm)



Example of calculation for ceiling and floor insulation



* All measurements are in metres.

PLEASE NOTE: Insulation manufacturers may also provide a Ready Reckoner as a guide to assist installers calculate packs required. For steel frame applications with one open side, refer to the manufacturer's advice for available insulation sizes.

9.2.4. Batt Width Requirements

Measure the joist spacing and check that the supplied batt width (430mm or 580mm) is suited to the joist spacing. This will minimise the cutting of batts. For the examples below, it is assumed that the timber frame joist is 45mm thick*.

Timber frame joist centres	Batt width
450mm	430mm
600mm	580mm
900mm*	2x430mm side by side
1200mm*	2x580mm side by side

Steel frame joist centres	Batt width
450mm	450mm
600mm	600mm
900mm*	2x450mm side by side

- Check any areas in the ceiling that may restrict the ceiling batt from recovering to its nominal thickness. If this is the case, a lower profile batt may need to be used.
- Insulation batts must not be in direct contact with roofing material (clearance \geq 20mm).
- Check to see whether there is an internal wall surface in the ceiling space that creates a separation between a roof space and any conditioned living space. The wall separating these two zones must be insulated using the same R-Value batts as the ceiling. The roof space wall insulation may require: stringing-in to hold the insulation vertically in place.
- Check that the R-value on the material delivered corresponds with the work order instructions.
- Discuss with the customer any particular requirements they may have with the work order prior to commencing installation.
- Confirm the suitability of the roof access point.

Hint: When attending an older home, check if the house has undergone an extension. There may be different joist centres in different parts of the house.

9.2.5. Removing insulation in the roof space

If old insulation needs to be removed prepare the roof area for removal. Identify the entry point on the roof where the insulation removal hose will be inserted. This is usually a roof vent or access point near the attic.

Insert one end of the insulation removal hose into the entry point on the roof. Ensure that the hose is securely attached and sealed to prevent any insulation or debris from escaping. Use duct tape or cable ties to secure the insulation removal hose to the roof surface. Ensure the hose is positioned properly and does not obstruct vents or other roof components. Secure with tape to rafter or other fixed connection point with enough length inside the roof to cover the extraction space.

Extend the insulation removal hose to reach all areas of the attic or roof space where insulation needs to be removed. Connect additional hose sections securely using appropriate connectors.

Check for gaps or openings around the hose entry point and seal them using duct tape or sealant to prevent air leaks. Before starting the insulation removal process, test the setup to ensure that the hose is properly attached and secured and that there are no leaks or obstructions.

Once everything is set up and secured, you can remove the insulation using a vacuum or other appropriate equipment. Follow proper safety guidelines and procedures during the removal process.

Take care as removal should not be done blindly in case it hits someone on the way out.

9.3. Access to the Ceiling Space from within the home

9.3.1. Preload of Insulation

Pitched roofs with flat ceilings provide suitable crawl access for the installer. However, some ceilings have obstructions that limit movement

of the packs in the ceiling space. In new construction, a preload is undertaken during the wall batt installation. In new construction it is recommended that a preload of insulation is undertaken during the wall installation and prior the ceiling being installed.

Hint: For homes that are not secure (e.g. from theft), cut the external plastic packaging at either end. This will cause the batts to fan out making it difficult to move out of the ceiling space.

9.3.2. Stringing-in Insulation

Stringing-in is used on pitched roofs with raked ceilings and/or where complex obstructions are present such as:

- air-conditioning ducting
- truss timber work
- cabling for TV aerials
- plumbing and electrical services
- platforms for service equipment located in ceilings

These can limit the access of transferring batt packs and installer crawl space across the ceiling area. In these cases, stringing-in the ceiling area using strapping may be required. The stringing-in method requires a staple gun to fix the strap onto the base of the timber frame. Any staple fixed onto the joist surface that is in contact with the plaster must be fully embedded into the frame. Any miss-fired staple must be flattened using a hammer or removed to provide a flat surface to fix the plaster lining. It is recommended to secure the strapping at every 450mm spacing. Complex timber framing may require odd shaped batts to be cut and additional straps to support the batt.



Installing ceiling batts after ceiling linings are fitted.



Installing ceiling batts with stringing in method.

9.3.3. Inaccessible areas

Low pitch corners inaccessible

The floor plan below illustrates grey areas highlighting tight access zones. These zones are best treated at the time of installing the wall batts. String in ceiling batts during the wall batt installation. External access will require the roof capping and repairs to the capping when finished, and is not typically an option.

9.3.4. Part of a roof space is inaccessible

The floor plan below presents an 18° pitched roof that is 5 metres wide having an apex of about 800mm from the ceiling material. It could be further complicated due to services and/or structural members. Assessment of access to the ceiling void should be conducted at the wall installation stage of the project (if applicable). For existing homes, external access will be required.

9.3.5. External roof entry

External access into the roof may be required for various reasons including but not limited to:

- the inability to transfer insulation material through the internal access point into the ceiling
- when an internal access point is located near the external wall of the home thus restricting access
- obstruction near the internal access point
- restrictive internal access point dimensions
- if using roof as access point, recommend using roof edge protection
- refer Working at Heights Risks – see 5.4.8.



New build - Installing ceiling insulation with limited access due to ducting.



Roof edge fall protection.



New build - perimeter batts installed.

9.4. Access to the Ceiling Space via the Roof

9.4.1. Tiled roofs

Each operator should be aware of and comply with the safety requirements in their State. This will involve having a Safe Work Method Statement (SWMS) for the activities to be undertaken.

WARNING: Never attempt an external roof entry when tiles are wet.

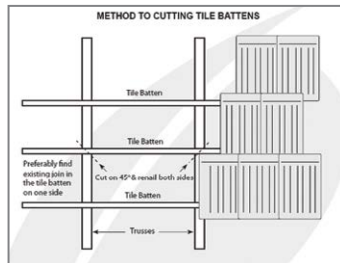
- Open up one or more access points.
- The opening in the tiles should be approximately 1200mm above ceiling height where possible.
- For a roof with a 22° pitch with no eaves, measure an approximate distance of 3400mm from the gutter fascia towards the ridge. The first and second row of tiles from the ridge should not be disturbed. The third row of tiles can be removed if required with a careful approach not to damage ridge capping.
- Some roofs have every second row of tiles fixed onto the batten or a group of tiles are fixed. Where possible, avoid these tiles by moving up one row or attempt the neighbouring tile. If a fixed down tile is held in position by a nail method, remove the nail using a claw hammer and timber block.
- To create the required access, it may be required to cut one tile batten. If possible find a join in the tile battens and cut the batten on a 45° angle. Cut the batten over the adjoining truss/rafter. Refer to **Method to, Cutting Tile Batten diagram.*** At the end of the job, make sure you nail the tile batten using a flat head nail with a length twice the thickness of the timber batten.
- Some roofs will have sarking beneath roof tiles. Installers are required to cut the sarking on three edges only and peel back the sarking. **Repair using suitable foil tape and additional sarking material.**
- Only support your weight on a ceiling rafter or roof truss. **Never support your weight on a plasterboard batten or plaster surface.**

Hint: Whether gaining access through the tiles or loading the roof through the internal access point, it is recommended that you install approximately half a dozen packs at a time. This gives an installer a break from the heat and cramped conditions of the roof as the installer is then required to come down and reload the next batch of packs.

9.4.2. Metal clad roofs

Access is gained by removing a length of steel sheet cladding. This may include disconnecting part of the ridge capping to allow the sheet cladding to be removed. An installer will be required to refer to local state plumbing codes as some state authorities require a licensed roof plumber to carry out work pertaining to roof sheeting removal/replacement.

Batten spacing and truss/rafter spacing on metal roofs are typically generous and will not require cutting of the batten. However, if required, follow the procedure outlined above in 8.4.1 Tiled Roofs.



Tiled roof



Metal roof

9.5. Tools and Equipment required

Ensure the tools and equipment selected to carry out the tasks are consistent with the requirements of the job. Check for tool defects, rectifying any faults and report findings to your supervisor prior to commencement.

May Require:

- wear High Vis clothing
- industrial box cutter with retractable blade and non-conductive handle.
- industrial strength ladder
- non-conductive batt poker: a batt poker is an essential item of equipment. This allows you to position batts into inaccessible ceiling locations. Ensure that the batt poker handle is made from non-conductive material such as wood or plastic.
- claw hammer
- P2 dust mask
- hammer Tacker
- knee pads
- hand saw
- tape measure
- safety eye wear
- standard duty gloves
- independent lighting – e.g. torch and spare batteries, LED head lamp
- suitable safety shoes (walking across joists etc)
- sufficient drinking water
- accessible first aid kit
- mobile phone (fully charged, programmed contact numbers)
- portable fire extinguisher.



9.6. Before you commence work:

- identify yourself to the client if present
- review your safe work method statement (SWMS)
- plan the install route and access, ensure it is unobstructed
- before entering the ceiling, map the position of downlights and other appliances on a sketch plan of the building as they may be difficult to see when in the ceiling
- **isolate and tag power.** Refer to steps outlined 6.2 - Performing Electrical Isolation.

9.7. Installation of Ceiling Batts

WARNING: If the electrical wiring is connected to the meter box, before entering the roof, ensure the power is isolated and tagged. Refer to WHS – Electrical Safety Wiring

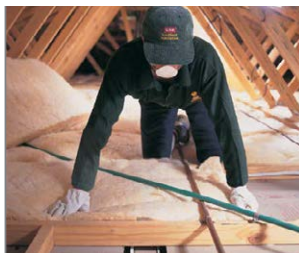
9.7.1. Installing Batts in pitched roof – flat ceiling

WARNING: Never walk on a plasterboard ceilings. When required to be in a kneeling position the use of a kneeling board will allow you to keep balance whilst in the ceiling.

- Check to ensure you have correct batts (correct R value and fit for proposed application)
- Load and distribute the packs into the ceiling space.
- Cut the bags open along the seam.
- Place the ladder so that you can safely climb and install the batts in the ceiling .
- Start installing insulation at the far corners and work back towards the roof exit.
- Measure the batts against the ceiling to find the best fit around ceiling penetrations.
- Cut the batts against a firm straight surface where no electrical or services exist.
- Gently push the cut batts between the joists. Butt batts closely together to ensure there are no gaps left at joints. Continue cutting and fitting the batts working along the ceiling until all of the ceiling area is covered and extending a minimum 50mm onto the external wall top plate.
- Batts must maintain a minimum of 20mm air gap between the insulation and sarking membranes or underside of the tiles, metal, other roof sheets or battens.
- Cut a label from the batt installed in the ceiling and fix it to a joist near the internal access point in the ceiling. This is to provide information in the future to anyone wishing to know which product has been installed.
- Ensure the access point is completely covered with a cut to size batt.
- When you have fitted all of the ceiling, tidy away all of the empty bags and any remaining off cuts.
- When you have completed the installation, all materials should be removed and the job should be inspected to ensure it is complete and correct.

Hint: Do not load all the packs of batts into the ceiling. As you get towards the end of the job, estimate how many more packs are needed and only load these into the ceiling.

Hint: At the end of the job it is easier to load another pack into the ceiling than it is to take a full pack out of the ceiling.



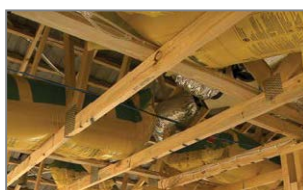
Install batts under services



Safety: use joists for footing support



Fitting insulation snugly around ducting



Preload packs and distribute in ceiling space



Measure - right sized batts



Snug fit

9.7.2. Perimeter Batts (edge batts)

- For bulk insulation to deliver its stated R-value it must not be compressed (e.g. at eaves).
- The thickness of many specified ceiling batts will not fit freely out to the eaves and over the top plate unless forced and compressed between the ceiling and roofing material. This is bad installation practice and could lead to issues such as restricted ventilation and moisture build-up.
- **Where the roofing structure will not accommodate the thickness of the batt at the eaves, it is recommended a thinner batt (perimeter batt) be used where necessary**
- The overall ceiling R value can still be maintained by using a higher R-value batt across the majority of the ceiling.
Refer AS 3999 2015 Appendix F – Edge Batts

9.7.3. Installing batts in raked ceilings with a tiled roof

WARNING: For installing batts in raked ceilings with a metal roof, an installer will be required to refer to local state plumbing codes as some state authorities require a licensed roof plumber to carry out work pertaining to roof sheeting removal/replacement. Before commencing work advise client and all on site power is to be deactivated.

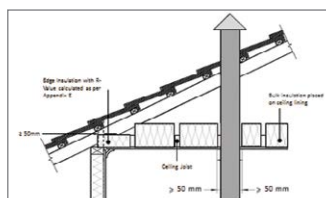
Raked Ceilings with enclosed rafters

- Install batts prior to plaster being installed
- Refer to 5.4.8 – working at heights. Consider using mobile scaffold at heights over 3m to install insulation at apex of the roof apex
- Confirm the depth of the ceiling void and what R-rating batt is to be installed. The batts' nominal thickness must be less than the clearance measured at the base of the roof batten and above ceiling lining or ceiling batten; whichever ever is the lesser of the two.
- If the ceiling lining is below the rafters, there will generally only be a shallow depth to install an insulation batt between the tile batten and the ceiling lining. In this instance, the insulation is to be installed by pushing back every third row of tiles and sliding half a batt up and half a batt down between the rafters. It is recommended to select a batt product having a density of 14kg/m³ or greater so to provide adequate stiffness.
- If sarking is present beneath the tiles, the sarking will need to be slit at these rows parallel to the batten at mid span.
- Start and finish the slit at the mid point of a rafter. Presence of dust can make it difficult to tape sarking unless it is cleaned.
- The installer will need to insert a piece of sarking to seal the opening. The installer must place the repair piece of sarking so that its top runs under the existing sarking and above and over the sarking below.
- Slide a 300mm wide trimmer piece of sarking within the slit to create the cascading effect.
- Tape the upper original sarking onto the trimmer piece surface.
- Ensure the start and end points of the slit are taped to form a water tight seal.
- Inform the customer that the sarking repaired continues to work as a radiant barrier and water proof barrier.
- **If the sarking is laid down after installation without taping of the slit opening, it will not be an effective water barrier and will act as a radiation barrier only.**

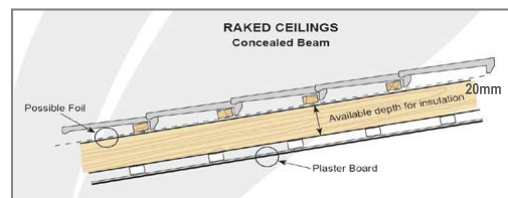
WARNING: Where a tiled roof pitch is 18 degrees or less refer to the NCC or Guidance notes for the minimum treatments for waterproofing.



Installing perimeter batts over top plate



Schematic - keep space between insulation and roofing



Raked ceiling - maintain 20mm air gap between insulation and roofing

9.7.4. Bulkheads or split ceiling levels

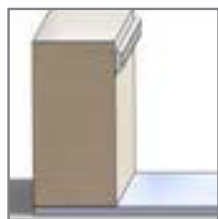
If the ceiling is split in any way, this will generally result in a bulkhead. A bulkhead is a vertical section of wall in the ceiling void that is a division between the internal living space and the ceiling void. It is important that this surface be installed in conjunction with the ceiling. This can be installed with batts with the same R-value as used in the ceiling. Ensure install batts prior to installation of plaster linings. These batts will generally need to be held in place using the stringing-in method.

9.7.5. Electrical cabling and equipment

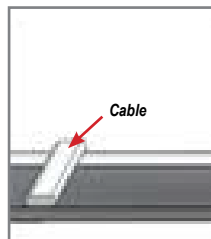
When in operation, the flow of electricity through cabling generates heat. Unobstructed, this heat is released. However in some circumstances where insulation and electric cabling are in contact, the heat generated cannot be dissipated quickly enough and can cause cables to overheat and exceed its rated specification. For the purposes of installing insulation, there are three categories to consider:

1. Cabling installed after AS/NZS 3000:2018 – can only be fully surrounded by bulk insulation for up to 400mm.

1. unsurrounded electrical cable.

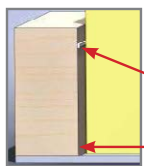


Cable running along the inside of a joist



Cable running across plaster board ceiling

2. Partially surrounded electrical cable.



Cable running along the side of ceiling joist with the top of joist not covered in insulation

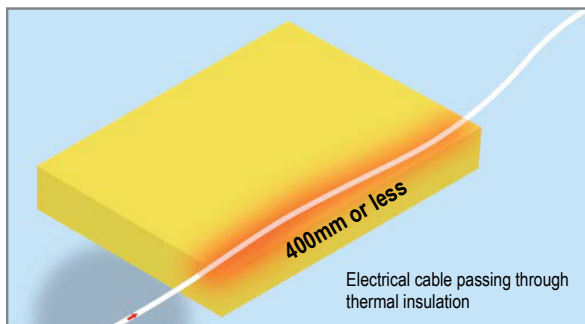


Cable running across the top of a plasterboard ceiling which is covered with thermal insulation



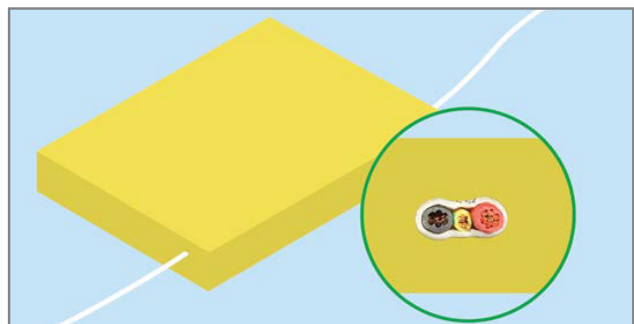
Cable running across the top of insulation

2. Completely surrounded by insulation on all sides.


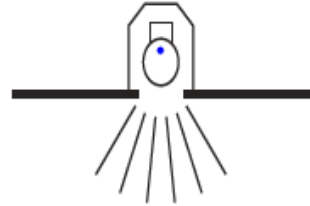

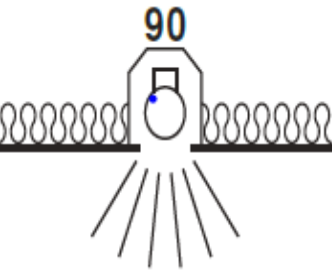

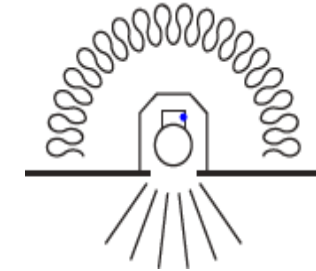


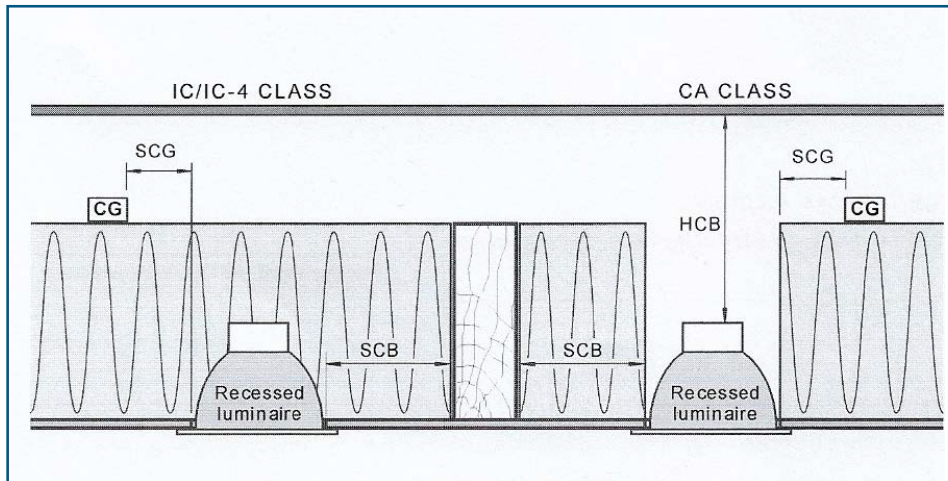
Electrical cable passing through thermal insulation

Electrical cable running between layers of thermal insulation

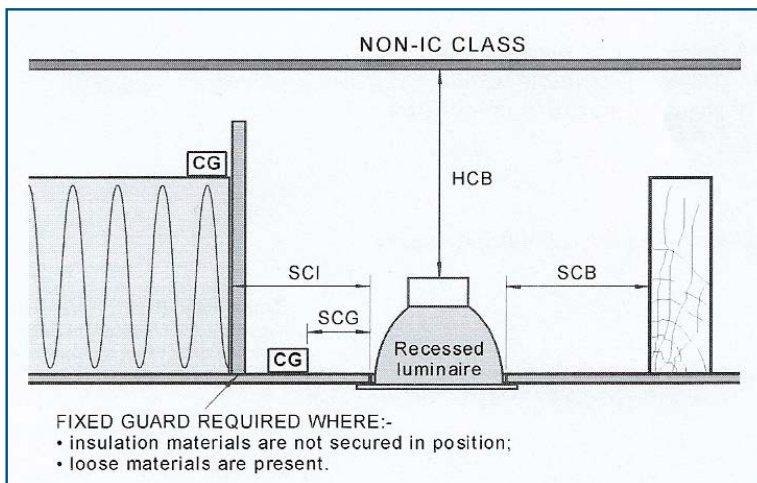


MARKINGS AND CLASSISICATIONS OF RECESSED LUMINAIRES

		<ul style="list-style-type: none">• No marking on light• Not classified• Do not abut or cover with insulation• Use default clearances
		<ul style="list-style-type: none">• Light fitting is CA-90 rated• Abut insulation but do not cover
		<ul style="list-style-type: none">• Light fitting is IC rated (IC, IC-4, IC-F)• Insulation can abut and cover light fitting



If in any doubt regarding classification of light fittings - use default clearances.



DEFAULT MINIMUM CLEARANCES FOR RECESSED LUMINAIRES

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

*These diagrams have been reproduced from pages 231 and 232 of AS/NZS 3000 (2018) with the permission of Standards Australia.

9.7.6. Recessed luminaires (Downlights)

Downlights and their equipment can only be installed by licenced electricians. This does not include barriers and restraints that can also be installed by insulation contractors. The application of these rd to be considered in the context that insulation may already be (or may not be) present when downlights are installed.

Downlights and their accompanying equipment (e.g. transformers) must be installed in a manner to prevent:

- excessive operating temperature
- risk of fire from ignition of combustible materials.

This requirement will be met if:

- the downlight and installation is certified to meet the intended location by the downlight manufacturer as suited to be
 - a. in contact with combustible materials
 - b. in contact with or enclosed by thermal insulation
- the installed clearances from combustible materials and thermal insulation are as specified by the downlight manufacturer
- insulation is fixed in place as determined by AS 3999 appendix B
- insulation is installed to the default clearances for combustible materials and thermal insulation - as set out in Appendix A of AS 3999.

9.7.7. Luminaire (down light) Barriers Standard (AS/NZS 5110)

This standard sets out specific performance criteria required by barriers. Barriers must be installed to the instructions as tested by AS/NZS 5110 and deemed specifically suitable for:

- covering the particular model of luminaire
- being in the presence of a particular type and thickness of insulation.

Combustible materials need to be prevented from contacting hot surfaces of the luminaires. This includes structural timber which 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, the precautions should comprise the use of a suitably designed and certified luminaire (Refer AS/NZS 5110).

A warning sign is required where the installed recessed luminaires are not classified as CA-90 or IC fittings

Installation of recessed luminaires (downlights)



Recessed lights have been installed in this roof space. To reduce the risk of fire DO NOT COVER the light fittings with thermal insulation or any other material unless in accordance with instructions provided by the light fittings or barrier manufacturer.

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 words shown in AS/NZS 3999:2015 A2 Fig 2' with minimum sized lettering of 10mm.

***This diagram has been reproduced from pages 231 and 232 of AS/NZS 3000 (2018) with the permission of Standards Australia.**

9.7.8. Insulating around downlights or where recessed ceiling fixtures are present

When using glasswool and rockwool ceiling batts:

- if the light fitting is not classified as IC or CA-90, leave default clearance of 100mm from the body of heat emitting fixtures such as downlights and flues
- cut a hole in the batt to suit the location of the fixture
- resistance to movement – do not use small pieces of batts to form part of the barrier around a fixture as these pieces could dislodge and cover the fixture potentially overheating/faulting the device (as determined by AS 3999 appendix C)
- locate transformers on the ceiling plaster with a minimum gap of 50mm around the device; alternatively place the transformer onto the glasswool or rockwool batt
- exhaust fans typically vent vertically to the roof space. Insulate around the perimeter of the fixture and ensure a piece of insulation batt does not stop a fan blade from turning as this can overheat and burn out the device
- exhaust fans with a closed body housing and outlet port can have the insulation in contact with the body of the fan casing
- ensure the outlet port has an adequate clearance from insulation to the exhaust air (i.e. $\geq 150\text{mm}$).

Hint: Downlights or fans near the external wall can be difficult to see and it is easy to foul the blade of a fan with a piece of batt. These devices may be best finished from an external roof access approach.

9.7.9. Installing insulation in tight areas

- Tight areas include over top plate, bulkheads, underneath piping and services, underneath appliance platforms in the ceiling space, underneath ductwork.
- Where possible install insulation in these areas before ceiling are applied
- Start installing insulation at the far corners of the home and work back towards the tile opening or internal access point.
- Lay batts from the perimeter towards the centre of the ceiling from either side of the external walls.
- Ensure the insulation does not touch the underside of the roofing material and a nominal gap of 20mm should be maintained to allow ventilation. This may require: the use of lower R_m -value batts around the perimeter (see perimeter batts page 62). No less than R_m 2.0 should be used. This strip of lower R_m -value batts may be no longer than 600mm or the minimum required to achieve a clearance of equal or greater than 20mm from the underside of the roofing material, for the original batt to be used.
- If there is a central catwalk, insulate beneath the catwalk using a wall batt minimum of R_m 2.0 or equal of less than the clearance of beneath the walk way (typical 90mm). Tuck a batt under the catwalk.



Using non conductive Batt Poker for inaccessible areas.



Check table minimum clearances for recessed lumen.



Ensure electrical cables are left on top of insulation along the roof edge. If the tension in the cable does not permit the cable to rest on the top of the ceiling joist if needed use a lesser R-value batt for edge trim.

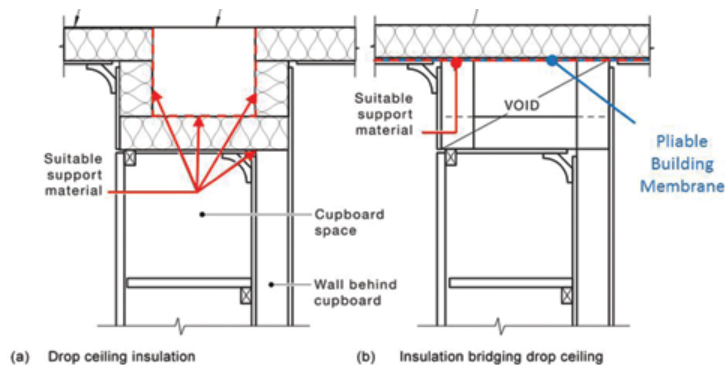


- **Using a non conductive batt poker**, (usually wooden handle) stab a batt about a quarter from its length, pushing it out to the external wall plate
- If there is no insulation material in or on the wall studs, make sure the batt extends at least 50mm onto the top wall plate. If there is insulation material in or on the stud, push the batt to cover the top plate.

Hint: If possible, it is a good idea every now and then to push back a tile over the external wall plate to check if the batts are 50mm onto the wall plate.

Hint: If insulation is being installed into an old roof ceiling it maybe necessary to quite forcefully push the batt out past the sloping rafter to ensure that it reaches the outer wall plate. Ensure 20mm clearance above tha batt is maintained.

- Ceiling voids can occur over stairwells, atriums, ducting channels and wardrobes. String-in is used to install insulation
- Falls through these areas could be fatal. When covered with insulation these areas are not visible from above.



9.7.10. Topping-up ceiling insulation

- Assess that the condition of roof space and the pre-existing insulation are in adequate condition and have suitable space to receive additional insulation
- If there is evidence of moisture damage or wood rot – do not proceed.
- Notify home owner of initial inspection concerns and recommend they arrange to have the ceiling condition inspected by a building engineer.
- Only proceed with work if the ceiling is assessed by the building engineer as suitable to do so
- Some of what needs to be determined for current insulation
 - * Condition of insulation
 - * Is there any leaves, dust debris needing to be removed
 - * Thickness and evenness of spread across the ceiling
 - * Is the insulation in contact with downlights, ceiling exhaust fans, vents, hot flues etc.
 - * Will topping up cover electrical cabling
 - * Will the ceiling cope with the weight of topping up.

Although it costs more, we advise consumers to vacuum out the ceiling space and install batts in accordance to Australian Standard AS 3999 to current energy efficiency levels.

- **Before proceeding with adding new insulation to old insulation, assess if old insulation is in a suitable condition. In many cases completely replacing the existing insulation may prove the better option.**
- The method of installing top-up insulation is the same as that for installing original ceiling insulation as described throughout Section 8.0. There are however additional issues to be addressed when installing top-up batts.
 - » achieving 'R' values: it is not possible to guarantee a total 'R' value when combining new insulation with old insulation. For example by adding R 3.0 batts to an original layer of R 2.5 Batts is more likely to achieve a total 'R' value of between R 4.5 to R 5.0 depending on the condition of the original insulation.
 - » existing loose-fill: if the original insulation is loose-fill it is recommended to entirely remove the loose-fill insulation and re-insulate with batts.
 - » additional weight: check that the additional weight of top-up insulation does not exceed the recommended ceiling load for ceiling linings.
 - » electrical wiring: electrical wiring must not be sandwiched between old and new insulation (refer to 8.7.5). Electrical wiring must run either on top of the new insulation, below the original insulation and along the ceiling sheeting or fastened to the side of the joists.

- » downlights: old insulation immediately around downlights should be replaced completely with one full batt of thicker insulation.
- » eave-edge insulation: ensure insulation has a least 20mm clearance from overhead roofing material. Insulation of a lower 'R' value may be required at the eaves (see AS 3999).
- Where top-up insulation is used, it is recommended installers should work closely with their materials supplier and obtain specific installation instructions and warranties before proceeding.

9.8. After Completion

Finishing off.

- Ensuring there are no gaps between the batts, or between the batts and rafters.
- Confirm batts extend to at least 50mm over external top wall plate.
- Ensure Batts are kept 50mm away from exhaust fans and hot gas flues.
- Recessed downlights – check classification of downlights. If no classification instructions are printed on downlights, the default clearance of 100mm must apply (refer 8.7.8).
- Ensuring batts are cut to fit snugly where there are no ceiling penetrations.
- Confirming no insulation has been installed over the oven or refrigerator ceiling vent voids.
- Where there is a drop ceiling or a cavity in the ceiling, ensure batts are placed such that the vertical walls and the dropped flat ceiling are insulated. Alternatively, place the insulation continuously over the top of the cavity. This method is only suitable if there are no open sides to the cavity and may need to be supported.
- Ensuring insulation on top of the internal access point is added and does not restrict future access.
- Ensuring insulation batts installed before the plasterboard is installed will need to be supported and held in place by stringing-in.
- Ensuring the work area is cleaned and off-cut materials are placed back into the original package (when possible) and taped closed. Dispose of in accordance with local authority guidelines.
- Ensuring tools and equipment are cleaned, checked, maintained and stored in accordance with the manufacturer's recommendations and standard work practices.
- Advise client and all on site power is about to be reactivated.
- Confirming power is reactivated and isolation tags are removed.
- Notifying relevant people that the installation is finalised (i.e. supervisors, the client etc).
- Completing necessary documents and forms.
- Evaluating your work quality and process to identify improvements.
- Following up, reporting and resolving any outstanding issues or problems such as non-conformances, client complaints, damage to property, faulty materials etc.



Typical Installer working kit



Fully installed ceiling insulation batts
- no gaps

Examples of Installed Ceiling Insulation

Good Installs



- Neatly fitted
- Strung into position
- No gaps
- Recommend 3 strings per batt

Bad Installs



- Poorly fitted between ceiling joists
- Hanging below and incorrectly fitted above ceiling joists
- Inadequate stringing to hold insulation in place
- No insulation above windows and gaps above ceiling batts



- Neatly fitted between joists
- No protrusions between joists or stubs
- Fitted over top plate
- No gaps in stud or joist spacings



- Inadequate number of batts for ceiling insulation
- Batts in very poor condition - uneven thickness - inconsistent or no R-value
- Would appear insulation has been displaced to install wiring and insulation not reinstalled correctly



- Cut neatly to fit around flexible ducting
- No gaps



- Poorly fitted batts - compressed and bulging below joists
- Batts incorrectly installed above joists leaving gaps
- Would impede the installation of ceiling linings

10. Installation of Wall Batts

10.1. Application

Batts for thermal efficiency and acoustic performance.

10.2. Planning before the job

10.2.1. Safety (WHS)

Installers are required to carry out their duties in accordance with their employer safety management plans and policies. The installer may also need to accommodate specific builder safety policies on site. It is a requirement that you review the Safe Work Method Statement (SWMS) prior to commencing installation and ensure all risks are identified and controlled.

Refer to ICANZ SWMS example included in Section 15.

10.2.2. Confirm the scope of work

Relevant instructions and operational details are obtained using work information, such as:

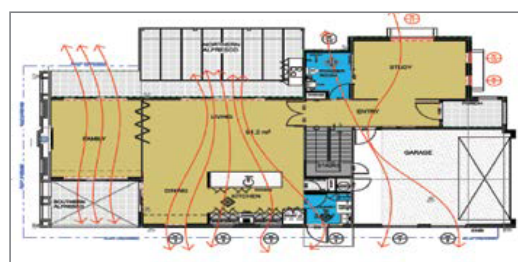
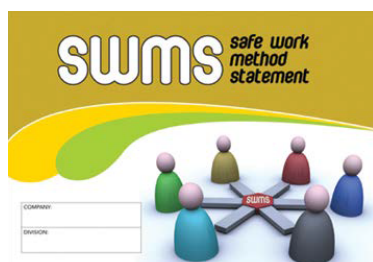
- a purchase order
- job sheet instructions
- energy rating reports
- architect drawings and their respective notes
- client specific instructions
- builder specific installations.

Basic information required includes:

- material R-value of batts required
- batt width to match stud centres
- number of packs required for the job
- locations of the walls to be insulated including any special areas
- for claims of thermal performance from a reflective wall wrap, you must provide a physical restraint between the batt and foil surface to maintain a still air gap of at least 20mm.

10.2.3. Material type and quantity required

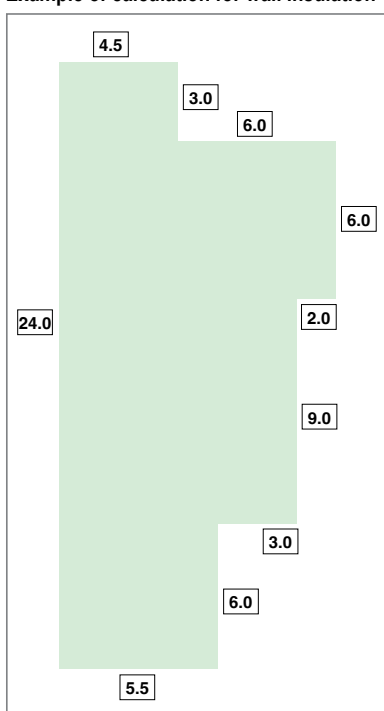
The installer needs to confirm that the material R-value (R_m) of the batts on hand, are those that meet the material R-value target set by the scope of work. The quantity of batts required is based on the projects wall surface area in m^2 divided by the manufacturers nominal coverage quoted on the batt packaging. The manufacturer's advice normally allows for wall timbers. This is a rough calculation and an allowance of surplus stock should also be on hand.



EXAMPLE ONLY: Wall area calculations and insulation requirements

1. Using the house design plans, take off the exterior wall perimeter for living areas
OR where no plan is available, measure and sketch these perimeter dimensions (see example).
Note all measurements of wall openings (doors and glazing)
2. Calculate the gross wall area of this perimeter
Perimeter of living area (lineal metres) X wall height (1m) = Gross wall area (m²)
3. Calculate the total area of all wall openings (doors + glazing)
4. To determine the INSULATABLE wall area (m²) - deduct the total of all wall openings (m²) from the Gross wall area (m²).
5. Check the stud spacings and stud thickness to ensure the width and thickness of batt is supplied
6. Check the R value on the packaging to ensure the correct thermal value and thickness is supplied.
7. Check the labelling for the 'nominal pack coverage'.
8. To determine the number of packs needed, divide the INSULATABLE wall area by the nominal pack coverage
9. Where this calculation results in a whole and part pack requirement, round up to the next whole pack.

Example of calculation for wall insulation



* All measurements are in metres.

Perimeter: 69 lineal metres

Wall Height: 2.55m

Gross wall area: 69m X 2.55m = 176m²

Openings in the walls (doors and glazing)

- 3 external doors : 5.02m²

- 15 windows and glass doors 45.9m²

TOTAL wall openings 50.92m²

Insulatable wall area calculation:

- Gross wall area 176.0 m²

- Minus wall openings 50.92 m²

INSULATABLE wall area 125.04 m²

* Stud spacings: 580mm, depth 90mm

* R value: R2.5, thickness: 90mm

* Nominal pack coverage: 4.5m²

* Pack calculation: 125.04m²/4.5m² = 27.8 packs

*** Required packs: 28 R2.5 (580mm) packs of wall batts**

Calculating wall openings

Doors		m ²
3	2.04 X 0.82	5.02
Glazing		
2	83 X 2.20	8.05
1	2.70 X 2.20	5.94
2	1.8 X 2.20	3.96
2	1.75 X 0.55	1.93
1	0.83 X 0.77	0.64
1	0.68 X 0.94	0.64
1	3.50 X 2.20	7.70
1	2.73 X 2.20	6.00
3	1.83 X 1.200	6.59
1	1.80 X 2.10	3.78
1	1.25 X 0.57	0.71
Total Glazing		45.90
Total wall openings		50.96

PLEASE NOTE: Insulation manufacturers may also provide a Ready Reckoner as a guide to assist installers calculate packs required. For steel frame applications with one open side, refer to the manufacturer's advice for available insulation sizes.

10.2.4. Batt width requirements

- ensure the width of batt (430mm or 580mm) matches the measured common stud frame centre. Two storey projects may require: a portion of batts in both width sizes
- check the stud depth and ensure that the specified material R-value of the batt will fit snugly in the cavity.

Standard Stud centre	Batt width
450mm	430mm
600mm	580mm

Hint: This is particularly important in stud walls clad on both sides, e.g. any internal wall such as a plaster bedroom wall or a plaster skin wall separating an attached garage from the condition zone of a home.

- If there is a step down between floor levels, (as shown in the elevation diagram below) the wall separating this step is to be considered an external wall and must be insulated. Check if this specialty area is nominated in the scope of work instructions.

10.2.5. Homes under construction having ceiling voids with poor access

When scheduling the installation of wall insulation, review the ceiling void for any access issues. Examples could include:

- ducting/plumbing/wiring
- crossbeams resulting from roof pitch
- void/cavity restrictions or space too small

If any of the above are noted, consider sending out the ceiling insulation at the time of wall installation to install or preload the ceiling insulation. This will prevent future access complications. Alternatively, the stringing-in method could be used.



Example of ceiling insulation in progress using stringing



Examples of well installed wall batts



Example of fitting edge batts

10.3. Tools and Equipment required

Ensure the tools and equipment selected to carry out the tasks are consistent with the requirements of the job. Check for tool defects, rectifying any faults and report findings to your supervisor prior to commencement.

May Require:

- wear High Vis clothing
- industrial box cutter with retractable blade and non-conductive handle.
- industrial strength ladder
- non-conductive batt poker: a batt poker is an essential item of equipment. This allows you to position batts into inaccessible ceiling locations. Ensure that the batt poker handle is made from non-conductive material such as wood or plastic.
- claw hammer
- P2 dust mask
- hammer Tacker
- knee pads
- hand saw
- tape measure
- safety eye wear
- standard duty gloves
- independent lighting – e.g. torch and spare batteries, LED head lamp
- suitable safety shoes (walking across joists etc)
- sufficient drinking water
- accessible first aid kit
- mobile phone (fully charged, programmed contact numbers)
- portable fire extinguisher.



10.4. Before you commence work:

- identify yourself to the client if present.
- review your safe work method statement (SWMS)
- plan the install route and access, ensure it is unobstructed
- **isolate and tag power.**

10.5. Installation of Wall Batts

WARNING: If the electrical wiring is connected to the meter box, before commencing installation, ensure the power is isolated and tagged. Refer to WHS – Electrical Safety Wiring.

10.5.1. Placement and opening of packs

When distributing and opening packs of insulation it is recommended to:

- distribute packs of batts around the building's floor area without obstructing walkways
- cut packaging to allow compressed batts to expand to their nominal thickness prior to installation.

10.5.2. Cutting batts to size

One of the most common causes of poor installation is the failure to use a knife for trimming batts. You must trim batts to ensure they are not:

- overly compressed
- bulging in a space
- too small for the area.

There are two methods for cutting batts. Refer to manufacturers' advice regarding **Density of Batts** for dimensions applicable.

Method 1: Using a cutting board as a base, measure the stud opening and cut the batts width to suit. This method is recommended when installing batts in steel frame construction because you could damage the cutting blade edge if cutting on the steel frame.

Method 2: Using the wall timber stud as a cutting base: Hold batt against the timber stud where the cut needs to be made.

WARNING: When using a stud edge as a cutting base, be aware of nearby services (pipes, wires etc.) ensuring you do not damage them. If services are located on the same stud, it is recommended that an installer need only 'mark' a cut dimension point on the top of the batt and move to a neighbour stud so to avoid potential damage to the services.



Examples of fitting wall batts

Density of Batts	
Density of batt (Kg/m ³)	Additional batt length or width versus required stud opening dimension
<11	15mm
>11 and <24	10mm
1200mm*	5mm

10.5.3. External wall stud cavity restraint

Timber framing

All wall batt insulation (either rockwool or glasswool batts) must be physically restrained in brick veneer stud walls. The restraint could be from the external stud wall wrap or using the stringing-in method.

Stringing-in

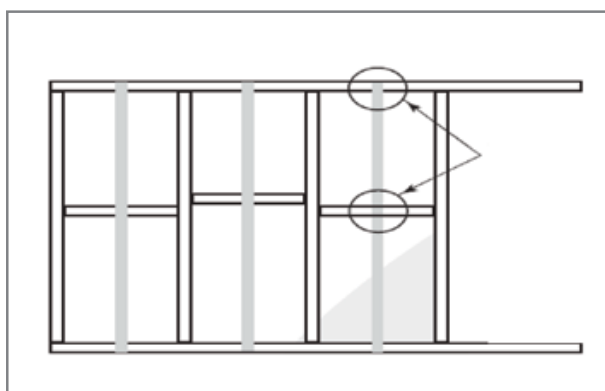
This is done by fixing strapping support to prevent the wall batt insulation moving forward and/or falling into the brick veneer cavity. The stringing-in material can be either nylon brick layer string or polypropylene strapping. The stringing-in method requires a staple gun to fix the strap onto the timber frame. Any staple fixed onto the stud surface that will come into contact with the internal plaster lining must be embedded into the frame. Any miss-fired staple must be flattened or removed. If there is external support material such as wall wrap or speedbracing, holding the insulation in place, it is not required to stringing-in these areas.

There are two methods for stringing-in support for external walls:

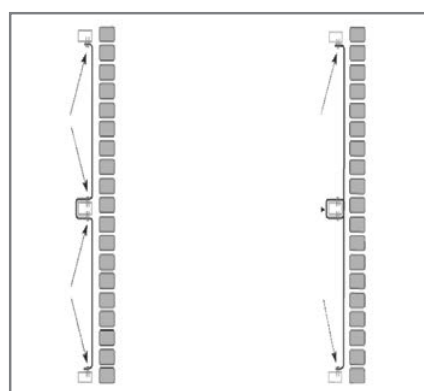
Method 1: Minimum one (1) vertical strap per stud opening

Method 2: Minimum two (2) horizontal straps per noggin opening.

- At the beginning of the wall strap run (either horizontally or vertically) staple the wall tape towards the back of the stud and extend to the next stud or noggin.
- Wrap the tape around the timber, pulling tightly.
- Alternatively, staple the tape at the back of the cavity, bring the tape around the timber to the other side and staple again at the back of the cavity in the next opening.
- Proceed in this way until the entire wall is strapped.



Method 1



Method 2

Steel framing

In steel frame homes metal studs that require stringing-in are more difficult as the fixing method is typically a cordless drill with wafer head tec screws. The horizontal stringing-in method can be used as per the timber frame section.

Hint: Ensure that you do not over-pull on the strap as this may twist some steel stud framing members.

10.5.4. Internal wall stud restraint

Internal walls (e.g. the wall between the garage and the media room and other living spaces) can have a stringing-in method applied to both sides to prevent winds moving the batt.

10.5.5. Batt installation

The timing of installation of wall batts is critical in a project. Once the internal lining is applied, there is no access to the wall cavity. Any error may be costly to amend once the cavity is sealed. Ensure all services to be installed in the wall are completed prior to commencing wall batt installation.

If plumbing or electrical services are yet to be installed it is recommended the installer take picture evidence of the finished insulation installation as proof the work has been completed satisfactorily.

Install the wall batts into the frame. **The insulation must be kept within the frame and must not be pushed into any wall cavity.** Batt's must not touch the brickwork or mortar surface. Ensure the batts do not bow inwards towards the plaster lining. Where batts need to be cut to fit into a non-standard opening, cut the batt as per procedure **9.5.2 Cutting Batt's to Size**.

Wall heights in today's home designs will often vary. This will require an additional piece of insulation to extend the batt length. Smaller pieces may be required in both the upper and/or lower stud bays. Always install a piece of batt on the upper position of each bay using one width piece. To reach upper wall heights, you can use a low height step ladder or a batt poker.

It is not acceptable to use damaged or use a large number of small off cut pieces to fill a stud bay of an external wall (no more than four offcuts should be used in one space. Where four offcuts are used the smaller offcuts should be positioned at the top of the space being insulated). Ensure you achieve full and snug coverage of the external wall including obstructed areas (e.g. behind a bath located against external wall). There should be no remaining gaps visible.

To improve thermal performance of the building envelope at the external wall junction you could consider cutting batts into strips and placing them into the wall junction just prior to wrapping the house.

Hint: Left overs and off cuts may be placed in internal walls with the biggest pieces at the base and smaller pieces at the top.

10.5.6. Windows and door lintels

Insulation is required in areas above lintels. However the lintel surface area itself does not require insulation unless specific instructions are provided. Lintel thickness occupies part of the stud depth and if insulation of this area is specified a batt with the correct nominal thickness will be needed to fill this limited depth of remaining stud depth.

10.5.7. Penetrations

Any object penetration through a wall requires the insulation to be neatly cut around the object. Align the batt near the object and cut batt the edge to approx the centre of the object to suit the area required.

Glasswool and rockwool batts can make contact with the object. The exception is any object having a hot surfaces >90°C requiring an air space for cooling or similar. In this situation, always follow the manufacturers instructions.



Installing insulation from underneath - note batts cut to fit above windows and over top plate



Installing insulation behind services

10.5.8. Non electrical services and obstructions

Obstructions such as:

- natural gas lines
- water lines
- air-conditioning gas lines
- PVC vent lines
- cross bracing
- bracing adjustment bolts.

These non-electrical services could be located inside the stud walls and will determine how the batts are installed. This includes:

- stopping the batt at the obstruction and restarting after the obstruction
- removing a portion of the batt so to limit contact with object
- cutting and chasing the obstruction into the batt.

10.5.9. Electrical outlets and recessed wall mounted objects

Any object in the wall that may compress bulk insulation will require the insulation in contact with the object to be removed. General Purpose Outlets (GPO's) require a portion of the insulation, behind the GPO, to be removed. This provides the electrical tradesman a cavity within the insulation for the flex cabling to rest and ensures there is no pressure on the GPO or the external wall wrap (if present). When required, cut the insulation to be removed neatly around the object. In most cases the removal of the full thickness depth of the insulation is not necessary.

Continuous electrical cabling (240 volts) travelling along the wall cannot be fully surrounded by the insulation for a length greater than 400mm. In runs greater than 400mm, the electrical wiring must be touching a timber stud or the plaster lining.

Hint: Not all objects protruding into the wall cavity need the insulation's full thickness to be removed. Recess mounted speakers may benefit having a small thickness of insulation behind the speaker body.

Hint: Generally the use of Glasswool and Rockwool batts will allow the insulation to make contact with object as they are electrically non conductive.

10.5.10. Narrow gaps within stud cavities and around windows and door frames

Narrow openings are insulated with a small section of insulation pushed into the full depth of the cavity with some compression.

The loss of thickness due to compression is out weighed by having some form of material R-value in lieu of a cavity absent of insulation. Alternatively, narrow openings (typically less than 15mm) can be sealed using polyurethane insulation foam to cork the gap.



Insulation cut-outs for power points



Inadequate number of batts for ceiling insulation. Insulation has been displaced to install wiring and not reinstalled correctly



Batts squashed into rafters compromise thermal benefits

10.6. After completion

Finishing off

- Ensuring that there are no gaps in the insulation batts or between the batts and studs or noggins.
- If the batts are being installed in a brick veneer wall, confirm they have been mechanically held in the stud frame by the stringing-in method.
- Generally ensure that the batts do not protrude past of the stud surface area and fit snugly.
- Where insulation batts are around water pipes or other rigid obstructions in the wall, ensure that the insulation batt doesn't protrude past the stud.
- Stringing-in any inaccessible ceiling areas that will not be accessible from the ceiling void, during the wall batt installation process.
- Returning functioning work areas to a clean and tidy state. This may require: wet mopping of loose fibre or alternatively vacuum the area using a vacuum cleaner with a High Efficiency Particulate Air (HEPA) filter.
- Ensuring the work area is cleaned and off-cut materials are placed back into the original package (when possible) and taped closed. Dispose of in accordance with local authority guidelines.
- Ensuring tools and equipment are cleaned, checked, maintained and stored in accordance with the manufacturer's recommendations and standard work practices.
- Advise client and all on site power is about to be reactivated.
- **Confirming power is reactivated and isolation tags are removed.**
- Notifying relevant people that the installation is finalised (i.e. supervisors, the client etc).
- Completing necessary documents and forms.
- Evaluating your work quality and process to identify improvements.
- Following up, reporting and resolving any outstanding issues or problems such as non-conformances, client complaints, damage to property, faulty materials etc.



Typical Installer working kit

Examples of Installed Wall Insulation

Good Installs



- Well installed around windows
- Snug fit to top and bottom plate



- Snug fit to wall studs - no bulges that would impede fitting of wall linings
- Well installed batts will conceal and wall wrap from view

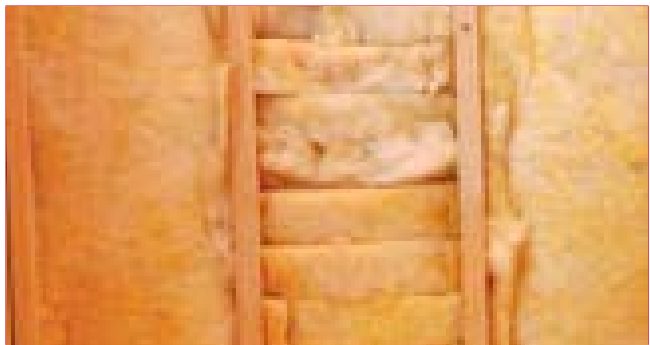


- Example of stringing in wall batts to ensure no protrusions or barriers to fitting wall linings
- Bracing and stringing of wall batts prevents batts being dislodged on windy days

Bad Installs



- Oversized batts compressed into stud space
- Gaps left above and below noggings



- Over-use of off-cuts for filling wall stud space recommend maximum of four pieces with the smallest piece at the top and smallest piece at the bottom



- Insulation gaps left above and below noggings

11. Installation of Underfloor Batt/blankets

11.1. Application

Batts for thermal efficiency and acoustic performance.

11.2. Planning before the job

11.2.1. Safety (WHS)

Installers are required to carry out their duties in accordance with their employer safety management plans and policies. The installer may also need to accommodate specific builder safety policies on site. It is a requirement that you review the Safe Work Method Statement (SWMS) prior to commencing installation and ensure all risks are identified and controlled.

Refer to ICANZ SWMS example included in this training document & duty of care responsibility.

11.2.2. Confirm the scope of work

Relevant instructions and operational details are obtained using work information, such as:

- a purchase order
- job sheet instructions
- energy rater reports
- architect drawings and their respective notes, client specific instructions
- builder specific installations
- refer to manufacturer's installation requirements for their preferred methods for fixing.

Basic information required includes:

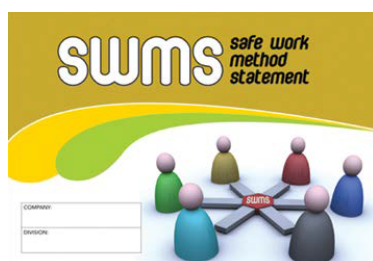
- material R-value of batt/blankets needed
- batt/blanket width to match joist centres
- number of packs required for the job
- location of underfloors to be insulated including any special areas.

11.2.3. Material type and quantity required

The installer needs to confirm that the material R-value (R_m) of the batts on hand, are those that meet the material R-value target set by the scope of work. The quantity of batts required is based on the projects underfloor surface area in m^2 divided by the manufacturers nominal coverage quoted on the batt packaging. The manufacturer's advice normally allows for underfloor joists. This is a rough calculation and an allowance of surplus stock should also be on hand.

As an example of how to calculate area coverage and the number of packs required refer to 8.2.3 Material Types and quantity required.

PLEASE NOTE: Insulation manufacturers may also provide a Ready Reckoner as a guide to assist installers calculate packs required. For steel frame applications with one open side, refer to the manufacturer's advice for available insulation sizes.



11.3. Tools and Equipment required

Ensure the tools and equipment selected to carry out the tasks are consistent with the requirements of the job. Check for tool defects, rectifying any faults and report findings to your supervisor prior to commencement.

May Require:

- wear High Vis clothing
- industrial box cutter with retractable blade and non-conductive handle.
- industrial strength ladder
- non-conductive batt poker: a batt poker is an essential item of equipment. This allows you to position batts into inaccessible ceiling locations. Ensure that the batt poker handle is made from non-conductive material such as wood or plastic.
- claw hammer
- P2 dust mask
- hammer Tacker
- knee pads
- hand saw
- tape measure
- safety eye wear
- standard duty gloves
- independent lighting – e.g. torch and spare batteries, LED head lamp
- suitable safety shoes (walking across joists etc)
- sufficient drinking water
- accessible first aid kit
- mobile phone (fully charged, programmed contact numbers)
- portable fire extinguisher.



11.4. Before you commence work:

- identify yourself to the client if present
- review your safe work method statement (SWMS)
- plan the install route and access, ensure it is unobstructed
- **isolate and tag power.**

11.5. Installation of Underfloor Insulation

WARNING: If the electrical wiring is connected to the meter box, before commencing installation, ensure the power is isolated and tagged.

WARNING: Prior to commencing work, check clearances for access points and crawl spaces in the sub floor.

11.5.1. Installing the insulation from underneath.

- Start at the furthest position from the access point.
- Friction fit the insulation batt/blanket between the floor joists.
- Ensure insulation is **positioned up against the floor**.
- Use designed support fixings and/or strapping (strapping by stapling to the floor joist maintaining the position of batt/blanket).
- Provide support (e.g. cross-strapping) when in accordance with manufacturers instructions.
- Remove any off cuts and rubbish as you progress throughout the underfloor.
- If the insulation is being installed from on top before the sheet flooring is installed, fixings and strapping can be installed from above.

Hint: When installing insulation under an existing floor, install a few packs at a time. This gives you a break from the cramped conditions underfloor.



Cutting insulation around under floor services



Butterfly clip holding insulation in place



Stringing under floor insulation in place



Elevated floor- installing insulation between floor joists

11.5.2. Cantilevered Floors

- Installers can often overlook insulating under cantilevered floors.
- Check this has also been installed correctly before leaving job.

11.5.3. Non electrical services and obstructions

Obstructions such as:

- natural gas lines
- water lines
- air-conditioning gas lines
- PVC vent lines
- cross bracing
- bracing adjustment bolts.

These non-electrical services could be located inside the stud walls and will determine how the batts are installed.

This includes:

- stopping the batt at the obstruction and restarting after the obstruction
- removing a portion of the batt
- cutting and chasing the obstruction into the batt.

11.6. After Completion

Finishing off.

- Ensuring there are no gaps between the batts, or between the batts and joists.
- Ensuring batts are kept 50mm away from heat emitting devices.
- Ensuring batts are cut to fit snugly around any underfloor penetrations.
- Ensuring the work area is cleaned and off-cut materials are placed back into the original package (when possible) and taped closed. Dispose of in accordance with local authority guidelines.
- Ensuring tools and equipment are cleaned, checked, maintained and stored in accordance with the manufacturer's recommendations and standard work practices.
- Advise client and all on site power is about to be reactivated.
- **Confirming power is reactivated and isolation tags are removed.**
- Notifying relevant people that the installation is finalised (i.e. supervisors, the client etc).
- Completing necessary documents and forms.
- Evaluating your work quality and process to identify improvements.
- Following up, reporting and resolving any outstanding issues or problems such as non-conformances, client complaints, damage to property, faulty materials etc.
- Inspecting, cleaning and maintaining tools and equipment used during the installation to ensure they are in safe working.



Cutting insulation to install around plumbing services



Typical Installer working kit



Examples of Installed Floor Insulation

Good Installs



- Stringing in insulation between floor joists



- Batts cut to fit snugly between floor joists
- Batts cut around plumbing pipes



- Butterfly fixing to hold insulation between floor joists

Bad Installs



- Poorly fitted insulation between floor joists
- Risk of batts falling out of place over time
- No stringing or fixing clips appear to be installed



- Gaps left
- Batts sagging - need stringing



- Gaps left
- Uneven install
- Batts sagging
- need stringing or fixing clamps support

12. Installation of Pliable Building Membranes

12.1. Application

Wall membranes for weather protection moisture control and thermal efficiency.

12.2. Types of wall wraps commonly specified

12.2.1. Selecting the correct wall wrap.

The selection and provision of the wall wrap material to be installed is mostly pre-determined by the designer, builder or client. Where this is not specified the following should be noted. For assistance selecting the correct wall wrap for the climate conditions and application consult your cladding or wall wrap product manufacture for advice.

12.2.2. Some of the product requirements to consider are:

- strength (duty classification)
- weather resistance (water barrier classification)
- condensation control (vapour barrier or vapour permeable classification)
- contribution to thermal energy efficiency (reflective or non-reflective)
- contribution to draft proofing (air tightness)
- durability to direct sunlight (UV stability)
- fire resistance (flammability).

12.2.3. Types of wall wraps now commonly specified.

1. Vapour Barrier Wall Wraps

Commonly specified for use in warmer climates where more moisture (humidity) is part of the outside climate conditions and cooling predominately used for building comfort (Northern Australia).

2. Vapour Permeable Wall Wraps

Often specified for use in cooler climates where more moisture (humidity) is part of the internal climate conditions due to heating the building comfort (climate zones 6, 7 & 8).

12.3. Planning before the job

12.3.1. Safety (WHS)

Installers are required to carry out their duties in accordance with their employer safety management plans and policies. The installer may also need to accommodate specific builder safety policies on site. It is a requirement that you review the Safe Work Method Statement (SWMS) prior to commencing installation and ensure all risks are identified and controlled.

Always be mindful of electrical hazards. Isolate power, and ensure lockout and tagging prior to installation, as per Australian Standards (AS) AS 4200.2 and AS 3999, which apply to pliable membrane insulation.

Refer to ICANZ SWMS example included in this training document & duty of care responsibility



Suitable for
timber frame



Suitable for
metal frame

Foil tape

12.3.2. Confirm the scope of work

Relevant instructions and operational details are obtained using work information, such as:

- a purchase order
- job sheet instructions
- energy rater reports
- architect drawings and their respective notes
- client specific instructions
- builder specific installations.

The timing of the wall wrap installation is critical in a project. Once the external lining is applied, there is no access to the wall cavity to apply wall membrane. Where brace board is installed and bulk insulation is specified, the bulk insulation must be installed prior to fixing the membrane. Any error may be costly to amend once the cavity is sealed.

Basic information required prior to installing wall wrap includes:

- roll width
- number of rolls required for the job
- location of walls to be wrapped including any special areas e.g. a gable end.

12.3.3. Material type and quantity required

Material selection is based on the scope of work details. The installer needs to confirm that the material grade and type supplied matches the scope of the work. The quantity of material required is based on the projects wall surface area in m2 (inclusive of overlaps and openings) divided by the manufacturers nominal coverage quoted on the roll packaging. This is a rough calculation and an allowance of surplus stock should also be on hand.

In addition to the wall wrap material, you may require:

- TEC screws
- Staples
- UV stable, non shrink tapes e.g. foil tape for reflective foil wall wraps
- wall wrap fasteners and/or staples.

12.4. Safety advice when installing electrically conductive insulation material

Ensure the tools and equipment selected to carry out the tasks are consistent with the requirements of the job. Check for tool defects, rectifying any faults and report findings to your supervisor prior to commencement.

May Require:

- Retractable knife with non conductive handle.



Using Hammer tacker to fix pliable building membrane to frame



Wall wrap fixing fastener



Fixing wall wrap neatly around windows

12.5. Tools and Equipment required

Ensure the tools and equipment selected to carry out the tasks are consistent with the requirements of the job. Check for tool defects, rectifying any faults and report findings to your supervisor prior to commencement.

May Require:

- wear High Vis clothing
- industrial box cutter with retractable blade and non-conductive handle.
- industrial strength ladder
- non-conductive batt poker: a batt poker is an essential item of equipment. This allows you to position batts into inaccessible ceiling locations. Ensure that the batt poker handle is made from non-conductive material such as wood or plastic.
- claw hammer
- P2 dust mask
- hammer Tacker
- knee pads
- hand saw
- tape measure
- safety eye wear
- standard duty gloves
- independent lighting – e.g. torch and spare batteries, LED head lamp
- suitable safety shoes (walking across joists etc)
- sufficient drinking water
- accessible first aid kit
- mobile phone (fully charged, programmed contact numbers)
- portable fire extinguisher.



12.6. Before you commence work:

- identify yourself to the client if present
- review your safe work method statement (SWMS)
- plan the install route and access, ensure it is unobstructed
- check if power is activated to site
- if activated - advise client and all on site that power is about to be deactivated
- **isolate and tag power.**

12.7. Installation of Pliable Building Membrane

WARNING: If the electrical wiring is connected to the meter box, before commencing installation, ensure the power is isolated and locked and tagged with installer contact mobile number.

Refer to WHS – Electrical Safety Requirements

12.7.1. General Requirements and Timber Framing

- Face the antiglare side of the wall wrap outwards ensuring the print or logo is visible and matches the order.
- Starting at a corner location, line up the bottom of the wall wrap with the base of the timber bottom plate, cut at a height so that the wall wrap slightly overlaps the window terminated by edge of timber window
- Roll the wall wrap out to the far end of the subsequent window and affix. Ensure the wall wrap is cut slightly oversized
- Cut wall wrap larger than the window size to allow the wrap to fold into the frame and taped.

Hint: If the damp course is not installed, the wall wrap should not be fastened within 100mm of the bottom. This allows the damp course to be later slipped behind the wall wrap.

Hint: If the damp course is installed, fasten the bottom of the wall wrap over the damp course.

- When stapling, leave the overlap of 150mm from the top unfastened as this will be fastened once the next layer of wall wrap is applied. Once this run has been fastened, trim neatly around window and door frames.
- Initially fasten the wall wrap at one point, roll the wall wrap along ensuring it is level before fastening.
- Smooth the wall wrap down to the bottom edge at the corners to minimize creases in the wall wrap.
- Affix staples at approximately 150mm per stud including the top plate.
- Install the next run of wall wrap leaving 150mm overlap on the layer of wall wrap below.
- If an overlap of 150 mm cannot be achieved, provide a minimal overlap. This must be taped and sealed using UV stable, non-shrink tape.
- When wall wrap does not reach the top plate, cut a strip of wall wrap inclusive of the 150mm overlap to ensure the top plate is covered.
- When stapling wrap to structure with hammer tacker, be careful not to pierce services, piping or cables.
- When a service penetrates the wall wrap, use UV stable, non-shrink tape to create a weather tight seal.



Taping and sealing membrane overlaps



Wall wrap installed prior to windows being fitted



12.7.2. Special Requirements for Metal Framing

If the wall wrap is being installed onto a steel frame:

- If the wall wrap is being installed onto a steel frame, use double sided tape and button head screw to fix wall wrap to metal studs.
- Install the double-sided tape or button head screws over/down each stud.
- Do not peel the protective paper from the double-sided tape until you apply the wall wrap.
- Where a pliable building membrane is installed onto a steel frame it shall be fixed to the steel studs using -
(a) adhesive when cladding is directly fixed to the stud work; or
(b) mechanical fixings with broad headed washer at 300mm centres for cavity walls, prior to cladding.
- For paper-based wraps, where longer term exposure to weather is expected, a combination of Masonite strips and TEC screws are required every 300mm centres.

Hint: To provide additional strength, metal wafer tec screws can be affixed every 600mm. If weather conditions are such that damage may occur to the wall wrap install prior to external linings being applied, additional fixings may be required.

12.8. After Completion

Finishing off.

- Ensuring full coverage of the frame in wall wrap.
- Ensuring overlap of wall wrap at all windows.
- If fastened with staples, wall wrap should be fixed at 150mm to 200mm centres per stud.
- If fastened with fasteners, wall wrap should be fixed at 300mm to 400mm centres per stud.
- If the bottom damp course is not in place, do not fix the wall wrap within 100mm of the bottom plate.
- Ensuring that penetrations through the wall wrap by services have been taped to provide a weather tight seal.
- Ensuring the work area is cleaned and off-cut materials are placed back into the original package (when possible) and taped closed.
- Dispose of in accordance with local authority guidelines.
- Ensuring tools and equipment are cleaned, checked, maintained and stored in accordance with the manufacturer's commendations and standard work practices.
- **Confirming power is reactivated and isolation tags are removed.**
- Notifying relevant people that the installation is finalised (i.e. supervisors, the client etc).
- Completing necessary documents and forms.
- Evaluating your work quality and process to identify improvements.
- Following up, reporting and resolving any outstanding issues or problems such as non-conformances, client complaints, damage to property, faulty materials etc.



Safety rails fitted for working at heights



Typical Installer working kit



Examples of Installed Wall Wrap

Good Installs



- Example of full membrane wall installation
- Correct overlapping of top sheet to bottom sheet
- Taping and smoothing out joins



- Correct overlapping of top sheet to bottom sheet
- Taping and smoothing out joins



- Taping around penetrations

Bad Installs



- Membrane not continuous to stud
- Large gaps left between membrane and stud
- Seriously undermines the purpose and effectiveness of the membrane



- Gaps and tears significantly decrease membrane performance



- No taping around penetrations

13. Installing Insulation Under Roofing Material

13.1. Application

Installing faced insulation under metal roofs.

13.2. Before you commence work:

13.2.1. Work safety

If the electrical wiring is connected to the meter box, make sure you inform other trades and then isolate the power sign onto your SWMS and carry out a site risk assessment, paying special attention to working safely on a roof.

13.2.2. Planning the job

Before starting work, make sure you check the following:

- Check the job plans to make sure you follow their insulation installation instructions.
- Confirm that the insulation material that has been delivered (both insulation and facing material) matches those specified for the job, making sure that the B.A.L. classification is appropriate.

13.2.3. Tools and equipment required

Check that you have all the appropriate tools for the job ready, which may include:

- roof railing restraint
- wear High Viz clothing
- sun glasses
- tape measure
- a hammer
- clips
- a retractable knife with a non-conductive handle, and
- cut resistant gloves
- knee pads
- suitable safety shoes
- UV stabilized non-stick tape
- accessible first aid kit
- mobile phone (fully charged, programmed contact numbers).



Fixing power sign to meter box



Check that you have all the appropriate tools for the job



13.3. Installation

13.3.1. Installing faced building blanket under a metal roof on a domestic dwelling

There are 3 methods for installing faced building blanket onto a domestic roof:

1. Vertical roll out over the battens
2. Horizontal roll out over battens, and
3. Horizontal roll out under battens.

Whichever method you use, always make sure the blanket faces up and the facing material faces down. These instructions cover Method 1 because it's the most common method used by roofing installers

13.3.2. Cutting preparation

Measure the main roof plan rafter length, and then mark and pre-cut lengths in quantities as needed.

Position the start of the blanket roll nearest the roof ridge batten with the facing side lap pointed in the direction of the uninsulated roof area.

Roll the faced blanket away from the ridge batten towards the fascia or gutter and use clips to temporarily hold the blanket in position.

13.3.3. Position

Position the start of the blanket roll nearest the roof ridge batten with the facing side lap pointed in the direction of the uninsulated roof area.

Roll the faced blanket away from the ridge batten towards the fascia or gutter and use clips to temporarily hold the blanket in position.

13.3.4. Allow for sag

Adjust the length and width at each crossing of the batten or rafter to allow sufficient blanket to recover to its advertised thickness and for the blanket to remain in touch with the underside of the metal roof.

13.3.5. Roll out the next blanket

Repeat until you reach the end of roof, then repeat, once again, from the other side of the roof.

- begin from the opposite starting end of the roof
- start the roll out from the end lap, over the ridge and down to the fascia
- make sure that the earlier exposed facing lap (150mm or less) is below the adjacent roll, and that the bulk insulation of both rolls abut, leaving no gaps.

NOTE: For high risk condensation zones, or where a vapour control layer (or VCL) is required, use a foil facing that has a vapour barrier classification as HIGH under the Australian Standard.

13.3.6. End Joins

The end and start of a new blanket must overlap by 1 batten crossing.

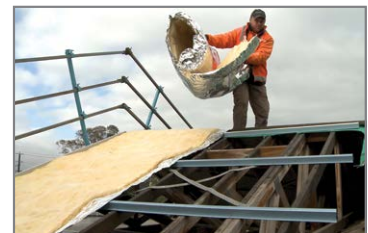
- remove bulk insulation from the lower portion of the roll width to expose the facing
- trim and peel away the bulk insulation where it crosses the batten to expose the facing from the blanket roll that is being positioned
- abut the ends of both blankets over their respective exposed facing laps to make sure there are no exposed gaps between the insulation blankets



Vertical roll out over horizontal battens



Cutting Preparation



Rolling out next blanket

13.3.7. Ridge / hip line join

When starting to lay faced blanket from the other side of the ridge, extend the faced blanket over the ridge and make sure it abuts an existing installed faced blanket on the other side.

- check that the facing portion of the blanket extends at least 150mm crossing over a batten
- peel and trim off 150mm of blanket, and
- then make sure that the facing edges are lapped in a cascading manner while abutting the blanket insulation, leaving no gaps.

Note: If ventilation is specified in the design, allow for a gap at the ridge or hip join.

13.3.8. Fascia, valleys and gutters

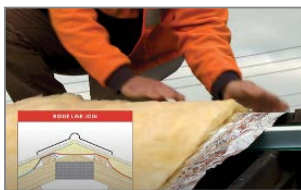
- The roofing material faced building blanket and fascia should all meet at the gutter line.
- Often an anti-ponding board is installed between the last roofing batten and the fascia to help drain any water that may have been captured on the facing material.
- It's important to strip back the building blanket to the top edge of the fascia and leave approximately 25mm of facing material draped into the gutter.
- Do not leave bulk insulation attached to this section of facing as it can wick moisture back through the insulation to the under-side of the roofing material.
- Similarly, in valleys, make sure that the excess bulk insulation blanket abutting a valley flashing is trimmed back to exclude the risk of the bulk insulation edge coming into contact with the valley water path. You could also peel back the bulk insulation away from the facing material and the water path, and fold back any exposed facing material at the flashing edge, to make sure that it's not in the water way.

13.3.9. Hot Flue penetrations

Tapes should not be stuck around hot flues, so always leave at least 50 mm clearance between faced building blanket and any hot surface such as a hot flue chimney pipe.

The roofing material faced building blanket and fascia should all meet at the gutter line.

- Often an anti-ponding board is installed between the last roofing batten and the fascia to help drain any water that may have been captured on the facing material.
- It's important to strip back the building blanket to the top edge of the fascia and leave approximately 25mm of facing material draped into the gutter.
- Do not leave bulk insulation attached to this section of facing as it can wick moisture back through the insulation to the under-side of the roofing material.
- Similarly, in valleys, make sure that the excess bulk insulation blanket abutting a valley flashing is trimmed back to exclude the risk of the bulk insulation edge coming into contact with the valley water path. You could also peel back the bulk insulation away from the facing material and the water path, and fold back any exposed facing material at the flashing edge, to make sure that it's not in the water way.



Overlap insulation at ridge line



Fixing anti-ponding board



Trim back bulk insulation.
Only overlap sarking into gutter



Minimum 50mm clearance of
insulation/sarking from hot flues

13.4. Common mistakes seen:

- Forgetting to make sure that facing material and blanket are laid square and overlap by at least 150mm.
- Not abutting building blanket so no gaps are left.
- Forgetting to make sure that faced blanket is installed correctly over the ridge.
- Not properly taping gaps, cuts and unsealed penetrations in the facing material leaving an entry point for water, and - leaving building blanket exposed in gutters and valleys that could cause moisture to wick back under the roof.

13.5. After completion

- Ensure the entire roof has been insulated– no gaps.
- Ensure all penetrations are sealed appropriately.
- Check all overlaps are 150mm or taped with long life UV resistant sealing tape.
- Take and store photos of completed work.
- Clear all off cut material and disused packaging to site rubbish collection or if not available remove these items from site.
- Check tools and equipment are located, cleaned and taken from site.
- If power has been de-activated, notify all on site power is to be activated. And remove isolation tags from switchboard.
- Notify relevant people (site supervisor, client etc) that job is completed.
- Complete all necessary documents and forms.
- Evaluate your work quality and processes to identify any improvements for future work.
- Follow up, report and resolve outstanding issues such as non-compliance, client complaints, property damage, faulty material and material returns.



Don't leave gaps - abut blankets together so no facing is visible



Do not let insulation blanket overhang into gutter



14. Installing Pliable Building Membrane Under Tiled Roofs

14.1. Application

Installing pliable building membrane under tiled Roofs.

The main benefits of installing sarking under tiled roofs are for one or a combination of the following

- Water control
- Thermal control
- Vapour control
- Air Control

The building design specification will have already determined the benefit needed and accordingly the type of sarking to be used.

But in all cases of using pliable building membrane the correct installation is equally as important as the specified product.

14.2. Before you commence work:

14.2.1. Work safety

- If the electrical wiring is connected to the meter box, sign onto your SWMS and carry out a site risk assessment, paying special attention to working safely on a roof. Also,
- If the pliable building membrane is electrically conductive, ensure SWMS and work assessments.
- If the electrical wiring is connected to the meter box, make sure it's been isolated.

14.2.2. Planning the job

Before starting work, make sure you check the following:

- Confirm that the specified sarking material that has been delivered matches those specified for the job, making sure that the B.A.L. classification is appropriate.
- Check the job plans to make sure you follow the manufacturer installation instructions.

14.2.3. Tools and equipment required

Check that you have all the appropriate tools for the job ready, which may include:

- roof railing restraint
- wear High Viz clothing
- sun glasses
- tape measure
- a hammer
- clips
- a retractable knife with a non-conductive handle, and
- cut resistant gloves
- knee pads
- suitable safety shoes
- UV stabilized non-stick tape
- accessible first aid kit
- mobile phone (fully charged, programmed contact numbers)



Tiled roof - lay membrane over rafters then apply tile battens



Start apply membrane from gutter line and work up to ridge



Typical tools for sarking tied roofs



Examples of aids to have when working in a roof

14.3. Installation

14.3.1. Valleys

The pliable building membrane is to be carried beyond the inside vertical face of the valley raking batten and turned down into the edge of the valley gutter drip so as it does not impede water running down the valley gutter.

Whichever method you use, always make sure the blanket faces up and the facing material faces down.

These instructions cover Method 1 because it's the most common method used by roofing installers

14.3.2. Ridge / hip line join

In all cases pliable building membranes are to be installed over the ridge by not less than 150mm unless specific ventilation requirements have been specified.

14.3.3. Penetration, cuts, tears to sarking

Penetrations are needed for chimneys, flues, vents, pipes cables and other services. The role of pliable building membranes is to preserve a barrier control. Therefore, penetrations need to be fixed and resealed with long-life UV stable tape.

Tapes should not be stuck around hot flues, so always leave at least 50mm clearance between faced building blanket and any hot surface.

14.3.4. Down lights and electrical cabling and equipment

In rare cases where the construction has already installed cathedral or raked ceilings - recessed downlights and other electrical equipment and cabling could come into close contact with electrically conductive pliable building membrane. In these circumstances:

- Maintain safety distances in accordance with AS/NZS 3000
- Consult a licensed electrician

14.4. Common mistakes seen:

Environmental conditions should form part of the pre-start check and hazard identification. High winds can make installing the pliable building membrane difficult and or high risk. Additional workers or methods may be required.

14.5. After completion

- Ensure the entire roof has been sarked – no gaps.
- Ensure all penetrations are sealed appropriately.
- Check all overlaps are 150mm or taped with long life UV resistant sealing tape.
- Take and store photos of completed work.
- Clear all off cut material and disused packaging to site rubbish collection or if not available remove these items from site.
- Check tools and equipment are located, cleaned and taken from site.
- If power has been de-activated, notify all on site power is to be activated. And remove isolation tags from switchboard.
- Notify relevant people (site supervisor, client etc) that job is completed.
- Complete all necessary documents and forms.
- Evaluate your work quality and processes to identify any improvements for future work.
- Follow up, report and resolve outstanding issues such as non-compliance, client complaints, property damage, faulty material and material returns.



Overlap roof sarking into gutter by up to 25mm



Apply UV stabilized sealing tap if overlap less than 150mm



Install sarking from gutter to ridge

15. Manufacturer's Specifications

Products and their applications vary from manufacturer to manufacturer. It is important for installers to familiarise themselves with their manufacturer's product range and to understand which products are best suited for various applications.

Interpreting the manufacturer's instructions includes reading and understanding the manufacturer's instructions provided with the insulation material. These instructions will outline specific requirements, recommendations, and safety precautions.

Below are some examples of how you can interpret the manufacturers' instructions.

- Clean the roof surface to ensure it's free from debris, dirt, and any moisture that could compromise the insulation's effectiveness. Repair any damaged areas as per the manufacturer's recommendations.
- Measure the dimensions of the roof space accurately to determine the amount of insulation material needed. Follow the manufacturer's guidelines for properly cutting the insulation to fit the space, ensuring a snug and effective installation.
- Secure the insulation in place using appropriate fasteners (such as nails or staples) as specified by the manufacturer.
- Seal any gaps or seams in the insulation material using approved sealing methods recommended by the manufacturer. Apply tape or sealant to ensure a tight seal and maximum insulation efficiency.



A full understanding of products and their applications can be achieved through the study of product literature developed by the manufacturer.

Such literature can be accessed via the following links:

Manufacturer's Name	Website
Fletcher Insulation Building Better. Together	www.insulation.com.au
CSR Bradford™	www.bradfordinsulation.com.au
ROCKWOOL®	www.rockwool.com/asia

15.1. Statement of Insulation

The Statement of Insulation Installation (SII) incorporating the requirements of the AS 3999 needs to include fields such as project details, insulation materials used, installation methods, compliance statements, and any other relevant information specified by the standard.

Obtain approval from authorised personnel, such as project managers or supervisors, confirming the accuracy and completeness of the SII. Ensure that the appropriate parties sign and date the document to certify its validity.

Distribute copies of the approved SII to relevant stakeholders, including building owners, contractors, architects, and regulatory authorities as required by AS 3999.

16.Safe Work Method Statement



APPENDIX A - HIGH RISK CONSTRUCTION WORK SAFE WORK METHOD STATEMENT TEMPLATE

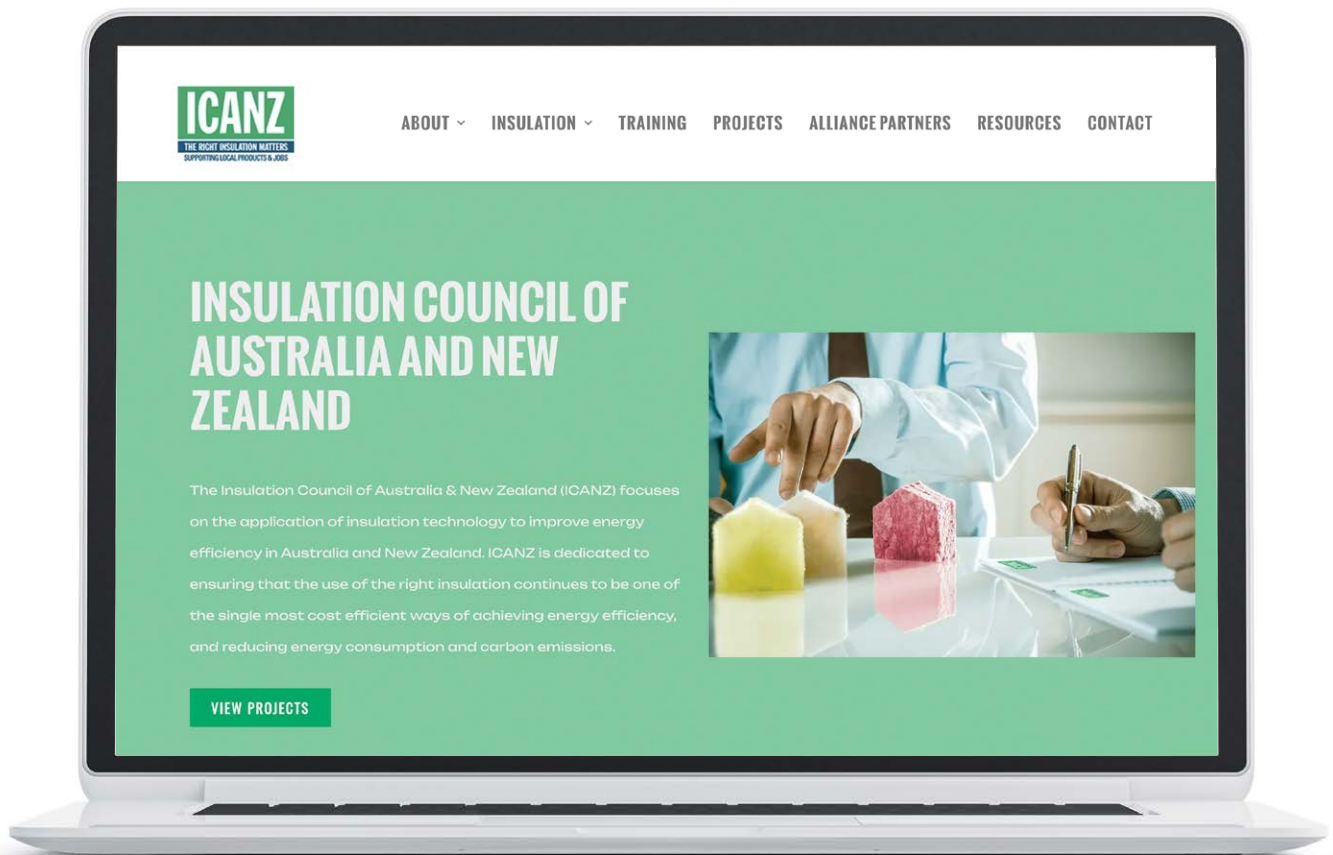
NOTE: Work must be performed in accordance with this SWMS.
This SWMS must be kept and be available for inspection until the high risk construction work to which this SWMS relates is completed. If the SWMS is revised, all versions should be kept.
If a notifiable incident occurs in relation to the high risk construction work in this SWMS, the SWMS must be kept for at least 2 years from the date of the notifiable incident.

[PCBU Name, contact details]		Principal Contractor (PC) [Name, contact details]	
Works Manager: Contact phone:		Date SWMS provided to PC:	
Work activity: [Job description]		Workplace location:	
High risk construction work:	<input type="checkbox"/> Risk of a person falling more than 2 metres (Note: in some jurisdictions this is 3 metres)	<input type="checkbox"/> Work on a telecommunication tower	<input type="checkbox"/> Demolition of load-bearing structure
	<input type="checkbox"/> Likely to involve disturbing asbestos	<input type="checkbox"/> Temporary load-bearing support for structural alterations or repairs	<input type="checkbox"/> Work in or near a confined space
	<input type="checkbox"/> Work in or near a shaft or trench deeper than 1.5 m or a tunnel	<input type="checkbox"/> Use of explosives	<input type="checkbox"/> Work on or near pressurised gas mains or piping
	<input type="checkbox"/> Work on or near chemical, fuel or refrigerant lines	<input type="checkbox"/> Work on or near energised electrical installations or services	<input type="checkbox"/> Work in an area that may have a contaminated or flammable atmosphere
	<input type="checkbox"/> Tilt-up or precast concrete elements	<input type="checkbox"/> Work on, in or adjacent to a road, railway, shipping lane or other traffic corridor in use by traffic other than pedestrians	<input type="checkbox"/> Work in an area with movement of powered mobile plant
	<input type="checkbox"/> Work in areas with artificial extremes of temperature	<input type="checkbox"/> Work in or near water or other liquid that involves a risk of drowning	<input type="checkbox"/> Diving work
Person responsible for ensuring compliance with SWMS:		Date SWMS received:	
What measures are in place to ensure compliance with the SWMS?			
Person responsible for reviewing SWMS control measures:		Date SWMS received by reviewer:	
How will the SWMS control measures be reviewed?			
Review date:		Reviewer's signature:	



Information sheet: Safe Work Statement
High Risk Construction Work

ICANZ PURPOSE:



ICANZ is the peak body of Australian and New Zealand insulation providers.

ICANZ member companies include leading Australian manufacturers and international manufacturers that manufacture insulation in accordance with internationally accredited standards and are involved with leading energy efficiency trade associations. Some member companies have been manufacturing insulation for over 80 years and together account for more than more than 70 per cent of the insulation sold and installed in Australia.

ICANZ works with all levels of government in Australia to advocate the significant benefits that flow from improving the energy efficiency of buildings:

- lower energy costs;
- more jobs in the construction sector;
- improved health and comfort for building occupants;
- reduced carbon emissions; and
- greater competitiveness for the Australian economy.

ICANZ recognises that insulation is the most fundamental step in improving the energy efficiency of Australian buildings and is committed to working with other organisations to identify the most effective regulatory pathways for delivering better buildings which will help protect Australian households and businesses from rising energy costs.

ICANZ seeks to increase public awareness of the role that insulation can play in an energy efficient future by publishing research and contributing to the development of better standards for the industry.

Visit **ICANZ** website:

www.icanz.org.au

Insulation Council of Australia and New Zealand



For more information visit our website at:
www.icanz.org.au