Department for
Business, Energy
& Industrial Strategy

Guide to Best Practice

Retrofit Floor Insulation – Suspended Timber Floors

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Introduction

The UK's ambition to become net zero carbon by 2050 will necessitate the emissions from buildings falling to zero. This will have to be achieved through a combination of insulation measures and low/zero carbon heating. Underfloor insulation (UFI) that is installed well can reduce emissions, increase comfort and reduce bills for the householder.

Whilst there are millions of homes with suspended timber floors suitable for insulation, UFI has been a relatively rare measure in the past. Under the latest iteration of the Energy Company Obligation (ECO), however, it has become one of the most common measures. This is encouraging given that we will have to insulate suitable floors to achieve high levels of efficiency in our homes. On the other hand, some sector organisations have become concerned that, alongside a lack of a systemised approach, there is insufficient guidance on how to install this measure safely and effectively.

Therefore, the aim of this guide is to provide a clear reference document for surveyors and installers considering the suitability for suspended timber floors located above an unheated space, to receive thermal upgrades (insulation), when installed below the floorboards or timber decking. It also applies to timber floors when situated above an unheated integral garage, unheated storeroom or an unheated basement.

The guide does not cover the installation of thermal insulation to solid, concrete (or similar) floors. All possible steps should be taken to assess whether a floor is solid or suspended timber including, where appropriate, lifting the floor covering to evidence the structure. Where it is not possible to assess whether a floor is solid or suspended timber, all available evidence should be retained to demonstrate why this was not possible.

Any drawings or images in this guide are for general use and not prescriptive guidance.

An assessment and design in accordance with the latest version of PAS2035 must be undertaken before any UFI measure is installed. The assessment must be specific to that property and the type of insulation being considered for its suitability; or as a minimum (i.e. before the adoption of PAS2035), an assessment in line with the requirements of the relevant version of PAS2030.

The basic approach to assessment and installation can be summarised as follows:

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Benefits

1. Many older houses with suspended timber floors can suffer from unwanted air infiltration (draughts) and have inadequate floor insulation (typically no insulation when built); and this can lead to higher energy bills as well as poor thermal comfort. Installing underfloor insulation correctly can address both these problems.

2. The main sources of heat loss in relation to timber floors are:

    - conductive heat loss through the floors of a building;
    - convective heat loss from draughts through gaps in between floorboards and the floor perimeter; and
    - floor penetrations e.g. pipework.

3. Insulating a suspended timber floor can eliminate draughts and reduce heat loss through the floor simultaneously.

4. The benefits can be significant for the residents of properties with uninsulated floors as around 10 - 20%[1] of the heat loss from a building can be through the floors if not insulated to a reasonable standard.

5. Correctly insulating suspended timber floors can be beneficial for carbon reduction and alleviation of fuel poverty.

6. Air from the outside can and should flow under suspended timber floors, and this would typically be through air bricks or grilles in the outer walls. Free flowing air can help to maintain a healthy environment for the timber floor construction. However, if there are gaps in the floor covering, or the floor is not insulated, air can penetrate the floor structure and make the internal habitable rooms harder to keep warm.

7. Many suspended floors in older houses will have some damage in places as result of raising floorboards when new central heating pipes were installed or when the house was rewired. For example, damaged tongue and groove floorboards (previously removed to access sub-floor) that can also result in unwanted air infiltration entering the habitable areas. Many traditional timber floors are not tongue and groove construction and exhibit gaps between floorboards, which can significantly increase air infiltration even when in good state of repair.

8. Suspended timber floors that are in good condition can suffer from cold air entering gaps in the skirting boards. This is typically evidenced by tell-tale staining of the carpet around the skirting boards, as air from under the suspended floor continuously flows through the carpet.

[1] See: S. Pelsmakers, B. Croxford & C.A. Elwell (2019) Suspended timber ground floors: measured heat loss compared with models, Building Research & Information, 47:2, 127-140.

Suspended Timber Floor Classification and Identification

9. For the purposes of this guide suspended timber floors are classified as being a timber floor that has an unheated void or unheated room situated beneath the timber.

10. The suspended floors found in most domestic buildings are typically ‘single floors’ consisting of one set of timber joists, called common joists or bridging joists. These can normally be easily identified by lifting the floor finish (carpets or floor covering) in a discreet location to minimise disturbance. Typically, in these types of buildings the joists would have originally spanned the full distance between the bearing walls with the ends supported by wall plates, either bracketed off the wall or built into the supporting masonry. In floors of a wider span, one or more beams or ‘binders’ run from wall to wall to carry the joists, with the beam ends supported by the bearing wall. In the largest floors, heavy beams or ‘girders’ run between supports and carry a series of binders which in turn carry the joists, or they may be supported by additional intermediate walls (sometimes called tassel, sleeper or dwarf walls).

11. When identifying timber suspended floors, it is essential that all floor constructions should be confirmed with no assumptions being made that one floor being timber is indicative of the construction of all other floors. Many buildings may have been built with solid floors under the rear rigger, or may have undergone upgrades or repairs to floors since the time of their original construction.

12. Suspended timber ground floors consist of the finished timber floorboards being attached to floor joists, which are suspended above the sub-floor of the foundation. These floor joists are raised above the sub-floor on small supporting walls called tassel walls (or sleeper walls). A wall plate is then attached to the top of the tassel walls, on which the floor joists rest.

13. A damp-proof course separates the wall plates from the tassel walls, preventing decay from any rising moisture. It is usual to have gaps in the block work of the tassel/sleeper walls, ensuring adequate air circulation. If the installation of UFI results in this cross-ventilation being reduced or restricted, then an equivalent ventilation provision should be provided by (for example) the removal of bricks, provision of an additional external vents, or tapering of the insulation to maintain the original ventilation rate.

14. Vents are installed in the opposing external walls to ensure that adequate cross-ventilation is given to the timbers, ensuring the circulation of fresh air, keeping the timbers dry and preventing decay. Where tassel walls are present, they typically include gaps in the block work to ensure adequate air circulation.

15. These vents should be adequately sized for the property (in line with Part C of the Building Regulations). In addition, they should be free from dirt, dust and other impediments.
There is always the potential for slight alterations to the appearance and material finish of a suspended floor structure, but the principle remains the same.

Health & Safety

16. The surveyor or installer should be mindful of the Health and Safety at Work Act and follow all guidance and specific requirements of this regulation, and in particular the requirements of The Confined Spaces Regulations 1997.

Safe systems of work

17. Safe systems of work, should as a minimum include the following precautions: -

- Appointment of a supervisor (safety person).
- Supervisors (safety person) should be given responsibility to make sure that the necessary precautions are taken, to check safety and wellbeing of the technician inside the confined space. Supervisors will need to remain present on site outside the entrance point while the work is undertaken.
- Only personnel with sufficient experience of this type of work, with the relevant training for the task should carry out the work.
- A risk assessment and method statement detailing the work to be carried out. Where the Construction (Design and Management) (CDM) Regulations (CDM 2015) apply, a CDM construction phase plan should be carried out.
- Where a risk assessment highlights exceptional constraints as a result of the physical layout of the area being insulated, the technicians' personal safety and suitability for working in such confined spaces should be considered.

Isolation of services and mains supply

18. Prior to work starting, the following should be carried out:

- the location of the mains electricity consumer unit, water stop clock, and gas isolation valve should be checked to ensure they are readily accessible;
- electrical cables which could be inadvertently operated or dislodged should be isolated;
- incoming water mains at the stop cock should be turned off; and
- if gas pipework is running under the suspended floor, the pipework should be isolated. The isolation should be checked to avoid the risk of leaking fumes or vapours entering the workspace.

Checking the size of the entrance point

19. The entrance point should be large enough to allow technicians wearing all the necessary personal protection equipment (PPE) and respiratory protection equipment (RPE), to climb in and out easily and provide ready access and exit in an emergency.

Provision of ventilation

20. The work areas should have an adequate supply of fresh air and technicians should not enter the working area if:

    - there is a lack of fresh air,
    - ventilation is blocked, or
    - the air is stale or stagnant.

Testing the air

21. It may be necessary to test the air on occasions, to check that it is free from both toxic and flammable vapours and that the air is fit to breathe, particularly when insulating underneath old cellars. Testing should be carried out by a competent person using a suitable gas detector which is correctly calibrated.

Tools and equipment

22. Non-sparking tools and specially protected lighting are essential where flammable or potentially explosive atmospheres are likely.

23. Tools and equipment must be used in accordance with the manufacturer's instructions. In confined spaces, suitable precautions to prevent electric shock (including using battery operated tools), and, where necessary, residual current devices (RCD) should be used.

Personal protective equipment

24. Provision of and use of the equipment including personal protective equipment (bump cap, safety glasses, gloves) and respiratory protective equipment (to the relevant filtering face piece (FFP) rating), and lighting (including back up lights) will be required.

Emergency arrangements

25. Emergency arrangements will need to be in place to cover any necessary evacuation. For example, if the technician collapses or becomes overcome with fumes inside the enclosed space. Arrangements will need to include the provision of rescue harnesses attached to the person carrying out the work, with lifelines attached to harnesses that should run back to a point outside the confined space controlled by the supervisor (safety person).

26. The supervisor (safety person) will need to be properly trained and fit to carry out the work and be capable of using any equipment provided for rescue, e.g. lifelines and firefighting equipment. The supervisor (safety person) on site should be a trained first aider, with the ability to properly use any necessary first-aid equipment provided as required.

Communications

27. An adequate communications system will be required to enable communication between the technician working inside the confined space and the supervisor (safety person) outside the confined space. This can be achieved either via a mobile phone if signal allows, or two-way walkie talkies.

28. The supervisor (safety person) should be aware of arrangements for raising the alarm and how to contact local emergency services in the event of an incident.

Customer Care

29. Installing UFI can be disruptive to the residents and the properties involved. It is therefore essential that thorough discussions with the resident and consumer take place before any work commences.

30. All discussions should include, as a minimum:

    a. the extent of any disruption that may be caused by the chosen installation method (removal of fittings and or fixtures, floor covering and/or floorboards);
    b. any additional works that may be required to facilitate the installation of insulation (repair of defects, additional ventilation etc);
    c. the time anticipated to undertake the works, and any deviation from this during the works caused by unforeseen issues; and
    d. the extent of any making good that is included in the work being carried out (redecoration etc).

31. The following general customer care guidelines should also be followed:

- Verify that the address for installation is correct, and the technician identifies their credentials to the customer.
- Do not park vehicles on the customers drive without permission.
- Explain to the customer the purpose of the visit and what they can expect.
- Use shoe protectors/covers when entering the property.
- Advise the customer of any precautions needed e.g. removal of materials or possessions that restrict access to the floor.
- With the customers permission, remove materials and possessions if the customer is unable to do so.
- Put down dust sheets where required, to protect the customer’s property.
- Following completion of the works all packaging/waste materials must be removed from site and properly disposed of.
- Clear up any mess as soon as possible and dispose of waste in the appropriate manner.
- Ask for permission if the customer’s toilet facilities are needed.
- Avoid disputes with the customer or responding negatively to any complaints or criticism.
- Carry out a check of any pre-existing problems or defects and declare them to the customer before starting work and report on the pre-installation check sheet.
- If any damage is caused, however small, the customer should be informed, and the matter subsequently reported to the organisation responsible for carrying out the work. The customer should be informed that the matter will be dealt with appropriately and quickly.

- The customer should be fully informed of the work being carried out, including explanation of any areas that are not accessible (these may be whole rooms if floorboards are lifted). Additionally, any openings or hazards should be appropriately cordoned/barriered.
- Any specific safety considerations as recommended by the manufacturer of the product or system utilised should also be followed.

Materials

Types

32. To improve the thermal performance of a suspended timber floor by adding extra insulation to a floor, it will need to comply with the current relevant national building regulations. Currently, In England[2], Wales[3] and Northern Ireland[4], the floor should achieve a thermal transmittance (U-value) of at least 0.25 W/m2K. In Scotland[5] the floor should achieve a thermal transmittance (U-value) of at least 0.18 W/m2K. To achieve this standard, please refer to the manufacturer's guidance for this level of performance, although this may vary depending on the floor type, shape and size. In all circumstances, the area weighted U-value must be calculated in accordance with the conventions in the current version of BR443 conventions for calculating U-values.

33. If replacing at least half a floor, (according to the building regulations as part of the renovation of a thermal element requirement) the structure would have to be insulated to these standards whether planned or otherwise. However, if such an upgrade is not technically or functionally feasible, the element should be upgraded to the best standard which can be achieved within a simple payback of no greater than 15 years.

34. To achieve this U-value there are a range of materials available on the market that are appropriately certified for use as insulation under timber floors. It is important that manufacturers technical information is checked to see if the materials have been certified, and for details of Technical Approvals such as an Agrément Certificate for specific applications, or refer to manufacturer's specification sheets to ensure the material is suitable for using as UFI. Some materials may be more suitable for insulating suspended timber floors in older traditional buildings (defined in PAS2035:2019 as being a construction consisting of solid brick or stone external walls, or pre-1919 timber-framed external walls).

35. Table 1 below shows a range of materials that are available and their typical lambda values.

Table 1 – Insulation characteristics and lambda values

Material	Lambda Value	Characteristics
Stone Wool	0.032-0.044 W/mK	Vapour open - Rock (Stone) mineral wool is a furnace product of molten rock at a temperature of about 1600°C, through which a stream of air or steam is blown. More advanced production techniques are based on spinning molten rock in high-speed spinning heads somewhat like the process used to produce candy floss. The final product is a mass of fine, intertwined fibres with a typical diameter of 3 to 6 micrometres. Mineral wool may contain a binder, often a terpolymer, and an oil to reduce dusting.

[2] See: Approved Document L 2013 as amended 2016
[3] See: Approved Document L 2014 amended 2016
[4] See: Approved Technical Booklet F2 2012
[5] See: Building Standards Technical Handbook clause 6.0 2019

Sheep's Wool	0.038 W/mK	Vapour open - Sheep's wool is a 100% natural product which is suited for several insulation purposes. The raw wool is felted by means of a special production process. Insulation mats and blankets are made out of these layers of felt. The wool is able to absorb moisture, and the material can bear up to 35% of its own weight without losing its insulation properties.
Wood Fibre	0.038 W/mK	Vapour open - Industrially produced wood fibre insulation was introduced around twenty years ago after engineers from the timber producing areas of Europe devised new ways of transforming timber waste from thinnings and factories into insulation boarding.
Glass Wool	0.032-0.044 W/mK	Vapour open - Made from molten glass, usually with 20% to 30% recycled industrial waste and post-consumer content. The material is formed from fibres of glass arranged using a binder into a texture similar to wool. The process traps many small pockets of air between the glass, and these small air pockets result in high thermal insulation properties. The density of the material can be varied through pressure and binder content.
PUR	0.023–0.028 W/mK	Vapour closed – Polyurethane is a polymer composed of organic units joined by carbamate (urethane) links. Polyurethane can be made in varying density/hardness by varying the isocyanate, polyol or additives.
PIR	0.023–0.028 W/mK	Vapour closed – Polyisocyanurate (PIR), is a thermoset plastic typically produced as a foam and used as rigid thermal insulation. Its chemistry is similar to polyurethane (PUR) except that the proportion of methylene diphenyl diisocyanate (MDI) is higher and a polyester-derived polyol is used in the reaction instead of a polyether polyol.

Material Conformity

36. When assessing any material for use as underfloor insulation, there are a number of factors that should be considered, these are set out in Table 2 below.

Table 2 – Material conformity

Assessment	Requirement	Evidence
Are the materials suitable as UFI?	Consider if the material has been certified for use as a floor insulation for existing buildings of the type being considered for the installation.	Technical Approval such as Certificate of Agrément from the BBA or Kiwa covering usage and limitations. CE Marking or manufacturers' data sheet.
Are the works to be undertaken considered as "Building Works" under the Building Regulations?	Consider if the materials certified are appropriately fire rated for the location of the works being undertaken.	Reference to the Certificate of Agrément and assessment of the characteristics and location of the insulation to be used.
Is the building classified under the latest version of PAS2035 as being "traditional"?	Consider if the building is of a vapour open[6] construction, then vapour open may provide a solution that is more compatible with this type of construction.[7]	Technical Approval such as Certificate of Agrément or Manufacturers' technical specification including moisture transfer and build up characteristics for the material undertaking a condensation risk analysis as set out by the current version of BS5250. Surface condensation risk can be undertaken using software that calculates thermal bridging and temperature factors.

[6] Traditional buildings constructed prior to approximately 1930, which were erected using natural materials, such as stone and timber. Natural materials are generally porous and permeable, which means that they have open-pore pore structures, thereby allowing moisture transport

[7] See: https://historicengland.org.uk/images-books/publications/eehb-insulation-suspended-timber-floors/

Building Regulations

37. It is the responsibility of the installer to consider whether the works being undertaken would be considered “Building Works” as defined by the Building Regulations.

38. For clarity, a floor suspended over a heated basement or cellar would **not** be suitable for insulation since it would not be considered a heat loss perimeter. Any such type of construction is excluded from this guidance.

39. In England and Wales, the Building Regulations apply to most buildings and alterations to existing buildings. They contain a range of requirements in respect of how a building is designed or constructed. Analogous regulations apply in the devolved administrations. PAS2030 requires that, where relevant, the Building Regulations are required to be complied with.

40. In Scotland, reference should be made to Schedule 3 Descriptions of Building of the Scottish Building Standards, and work including the provision of services, fittings and equipment, not requiring a warrant. Unless the work is more extensive and may require an application for a Building Warrant to be made to the Local Authority.

41. In Northern Ireland reference should be made to the Building Regulations and specifically Part F (Conservation of Fuel and Power).

42. The Building Regulations in England 2010 provide that “building work” shall be carried out so that it complies with the requirements contained in Schedule 1. The definition of “building work” includes, but is not limited to:

    - the erection or extension of a building (which would cover new builds);
    - the material alteration of a building, which is either;
        - where the work would result in the building no longer complying with a previous requirement when it once did; or
        - a building, which before the work did not comply with a relevant requirement, being more unsatisfactory in relation to such requirements.
    - the insertion of insulation into the cavity wall of a building; and
    - certain other specific work which relates to energy efficiency requirements, including the renovation of individual thermal elements or change in the energy status of the building.

43. The installer should determine whether the installation of the UFI on a particular project constitutes “building work” as defined under the Building Regulations 2010. Whether this is the case will depend on the nature of the specific project being undertaken. In the event that the project is being deemed to be building work, then the requirements contained in Schedule 1 of the Building Regulations will need to be complied with.

44. Schedule 1 Part B of the Buildings Regulations 2010 contains requirements for fire safety, which includes requirement B3, relating to internal fire spread (structure). This provides that the building shall be designed and constructed so that, in the event of fire, its stability will be maintained for a reasonable period, as referenced in Schedule 1 Part B of the Building Regulations 2010. In other words, if the project is considered to be “building work” for the

purposes of the Building Regulations, the fire resistance requirements apply. Specific fire requirements also apply where the floor is above an unheated garage.

45. If there is any doubt over the compliance and handover (as specified in the latest version of PAS2030) of the installation, or whether Building Regulations apply, an independent report from Building Control confirming that they are content with the approach taken should be obtained, and this must be undertaken on a property specific basis.

46. If it is considered that the sub-floor ventilation will have supplied an element of the ventilation requirement of the property through infiltration, an assessment of the ventilation requirement for the property must be undertaken in accordance with the requirements set out in the latest version of PAS2035. Part F of the Building Regulations requires that the building works (when completed) should not demonstrate a worse level of compliance with other applicable requirements of Schedule 1 than before the work commenced. I.e. “make it no worse”.

Building Suitability Assessment & Risks

47. When assessing the suitability of a timber suspended floor to receive UFI, table 3 below identifies the main elements that should be considered. Many of the items indicated below result in UFI not being suitable for the property, unless satisfactorily resolved. Those with the greatest associated risks have been highlighted in red to indicate that the works must not proceed.

Table 3 – Pre-installation suitability and risks

Action	Assessing	Methodology	Risk
Are the works to be undertaken defined as "Building Works" according to the current Building Regulations?	The Building Regulations 2010 provide that "building work" shall be carried out so that it complies with the requirements contained in Schedule 1.	Consider if the works entail: 1. the erection or extension of a building (which would cover new builds); 2. the material alteration of a building. This is either: a. Where the work would result in the building no longer complying with a previous requirement when it once did; or b. In a building which before the work did not comply with a relevant requirement, being more unsatisfactory in relation to such requirement. 3. the insertion of insulation into the cavity wall of a building; and 4. certain other specific work which relates to energy efficiency requirements, including the renovation of individual thermal elements or change in the energy status of the building.	Works being undertaken without correct permissions or approvals in place.
Are the works captured under the Party Wall Act 1996?	If the installation will require notice under the Party Wall Act 1996.	Consider if the work involves excavation near a party or boundary wall	Works being undertaken without the necessary permissions.

Action	Assessing	Methodology	Risk
Is the property located in a high radon area?	Reference to the Radon Maps.	Consider: https://www.ukradon.org/information/ukmaps	The property may require a gas membrane to be installed at the same time as the insulation. Refer to the Addendum for more information on risks.
Has an assessment been undertaken for compliance with the Building Regulations?	If the installation to be undertaken will result in non-compliance with the Building Regulations.	Review of the scope of works to assess suitability in relation to: • workmanship, • materials, • structural stability, • fire safety, • resistance to moisture, and • ventilation.	Installation of the measure contravenes or results in the building no longer complying with the Building Regulations.
Has an assessment been undertaken of how the measure may affect the significance of the building after installation, particularly if the building is defined as “Traditional” in the latest version of PAS2035?	Impact of the measure that may have a detrimental effect on the significance of the building.	Completing the BS7913 Significance Checklist as per the latest version of PAS2035	Non-compliance with latest version of PAS2035, and negative impact on the significance of the building.
Is the external ground level higher than the internal finish floor level?	Relationship of the internal floor to the potential risk of water penetration.	Visual inspection and measurement of internal and external finish floor level.	Water penetration to any timber joists built into the wall, or wall plates.

Action	Assessing	Methodology	Risk
Is there a functioning damp proof course (DPC)?	Rising damp in walls.	Visual inspection, or by measurement if property is rendered to the ground.	Rot or decay of joist ends.
Is there external evidence of air bricks being present, or sub- floor ventilation grilles?	Potential for sub-floor ventilation, and evidence of cross-flow of air.	Visual inspection of the presence of vents or grilles that are free from obstruction either internally or externally. Adequate openings in tassel walls (if present) to allow for air flow.	Lack of adequate ventilation, increasing the risk of premature rot and decay.
Is the timber floor covered by the definition in this guidance?	Suitability to use this guide and methodology.	Verification that the timber floor is not located above a heated space, and meets the definition used in this guide for a suspended timber floor.	Works should not be covered by this guidance.
Is the whole of the timber floor to be insulated?	Extent of the whole ground floor, or floor above unheated space to be insulated.	Visually assess the type of construction of all ground floors.	Floors that may have already been replaced with concrete or similar can result in suspended timber floors no longer receiving adequate ventilation, which can lead to premature decay and rot.
Are the floorboards in good condition and firmly fixed, and are there any significant cracks, splits and missing fixings?	Deflection in timbers caused by rot or decay.	Visual inspection, which may involve the lifting of floor finishes or furniture.	Increased risk of UFI not being suitable or accelerating any decay to the timbers.
Are the joist ends built into the opposing walls or hung from brackets?	Construction.	Visual inspection.	Greater risk of rising damp causing rot of joist ends if built into walls.

Action	Assessing	Methodology	Risk
Are the timber joists free from infestation and rot?	Moisture content of the timbers, and signs of decay and infestation.	Timber moisture content should not exceed 20%. Timbers are generally understood to be free from the risk of decay below 20% moisture content. Measured with a moisture meter with electromagnetic capability which allows greater accuracy and depth of assessment. The symptoms of severe decay in exposed timbers are usually obvious. However, some decayed timbers retain a surface veneer of sound wood, so thoroughly investigate all suspect timbers near to actual or potential sources of dampness, and any showing evidence of fungal growths. Investigate by probing with a sharp implement, like a bradawl: the presence of internal decay in large-section timbers can often be detected by 'sounding' with a large hammer. Probe especially carefully where timbers, such as purlins and joist ends, enter walls, because decay can be localised in the portions of timber embedded in the masonry.	Insulating timber with high levels of moisture/rot or decay can lead to adding additional stress to the timbers and accelerating their decay or covering up an existing problem (inadequate ventilation, weather ingress, leaks, etc).
Are there pipes in the floor voids?	Water or condensate pipes present in the sub-floor void will need to be considered in the design or installation of insulation.	Visual inspection of all of the floor voids for the presence of, pipes or services.	Water or condensate pipes in the sub-floor void will have an increased risk of freezing should the floor be insulated, and the pipe left exposed to the colder void environment after the works.
Are any cables in the sub-floor area free from damage or obvious defects? i.e. trailing cables,	Repairs required and hazards for installation and or potential issues in the future.	Visual inspection of any cables, pipes or services in the sub-floor void.	Cables if insulated run a higher risk of overheating, and if using inflammable materials may pose an additional hazard to the resident.

Action	Assessing	Methodology	Risk
damaged cables or exposed conductors?			
Are there any signs of water accumulation visible leakage from any underfloor pipes in the underfloor area?	Potential leaks or water ingress that may cause long term issues.	Visual inspection of all sub-floor voids.	Water in the void can cause long term issues for the property and should be correctly diagnosed and rectified before insulation is undertaken.
Are there any signs of materials that may contain asbestos in the sub-floor area?	Presence of hazardous materials that would require specialist removal or encapsulation.	Visual inspection. Ensure staff are appropriately trained in asbestos awareness.	Hazard to resident and installation operatives. Would need specialist removal or encapsulation.
Are there any metal structural floor supports?	Signs of corrosion or fatigue (deflection).	Visual inspection of any metal supports in the floor void, identifying any signs of corrosion or deflection.	Once covered over repairing would be more difficult, and any reduction in sub-floor ventilation may increase the rate of atmospheric corrosion.
Are lighting or electrical fittings in the floor void?	Potential for electrical fittings to be covered up during installation.	Identify and mark up any light fittings of electrical connections that will need protecting during the installation phase. Ensure that a suitable design has incorporated the safe operation of any such features, such as hoods, protective barriers etc.	Overheating of fitting and fire risk.
Do any appliances use combustion?	Any appliance that uses combustion needs ventilation either	Consider if the insulation potentially affects the adequate ventilation for any appliance that requires ventilation for combustion,	Carbon monoxide risk or failure of the appliance to operate effectively.

Action	Assessing	Methodology	Risk
	through a balanced flue or room.	for example, because combustion air is drawn from the floor void.	
Is the steel support condition free from corrosion?	Corrosion that may exist in any steel structural supports for the building in the sub-floor void.	Visual inspection of any structural steel in the sub-floor void, for signs of: • corrosion, • deflection, and • rotted fixings.	Installing insulation may increase the risk of atmospheric corrosion in steel.
Are there any risks to joist ends in relation to the penetration of warm, moist air after installation of UFI?	Suitability of existing conditions and detailing to protect the joist ends from condensation within the joist pockets. This may require the planning of additional enabling or detailing works associated with the install such as draughtproofing the joist ends from below, adding airtightness measures above the floorboards, chemically protecting the joist ends, adding airtightness measures inside the dwelling, at the perimeter, tapering the	Visual inspection of the joist ends and joist pockets as well as the structural and finishes detailing between the walls above, and the basement/ground floor walls and the suspended timber floor of any existing airtightness measures. Review of the insulation specification and detailing (BBA or Kiwa Certificate or other technical document) to understand the manufacturer's preferred method of protecting the joist ends (if any). Examination of materials and any dimensional constraints within the joist pockets to determine suitability of various options for applying protection as part of the works.	Installing insulation may increase the risk of warm moist air condensing on the joist ends, within the joist pockets, unless they are specifically protected from air infiltration from inside the dwelling and/or from the risk of rot/mould growing within the timbers.

Action	Assessing	Methodology	Risk
	insulation away at the joist ends to allow air circulation, or some combination thereof.		
Has there been an assessment of any internal or external wall insulation, (existing or planned) which may impact the junction between the floor insulation and the wall insulation?	Potential for cold bridging at the plinth level between the floor insulation and any existing wall insulation (or planned wall insulation).	Review of the Whole House Retrofit Plan as required under the latest version of PAS2035. Visual and potential invasive inspection (if appropriate) of the existing wall conditions. Including any CWI, EWI or IWI that has been installed anywhere in the property to assess how the junction between the floor insulation and wall insulation will/can be resolved. Production of appropriate details and specifications to resolve any potential thermal bridge at the junction level. Simulate any thermal bridge potential and ensure that the Whole House Retrofit Plan includes any detail for the junction between the floor and any potential planned wall insulation that may be carried out in the future.	The creation of a significant thermal bridge at the perimeter of the building if the wall and floor insulation are not properly resolved and detailed with respect of one another.
Is the installation acceptable and appropriate?	Suitability of design and appropriateness to ascertain if the installation is suitable.	Consider whether the installation would: • be non-compliant with any requirements stated by the designer/specifier; • compromise the functionality of existing air supply/extract ventilation ducts/systems; and • result in unsafe operation of a combustion appliances (floor vents, etc). • Consider if the site layout or conditions will impair the	Lack of air supply to the habitable spaces. Risk to safe combustion of appliances. Risk to safe working practices. Risk to the appropriateness to the building. Proximity of stored items that may result in damage.

Action	Assessing	Methodology	Risk
		execution of the works in relation to: a. appropriate access to the property and to the floor to be insulated; and b. the room being free from stored items, floor coverings, etc.	

48. The following flow diagram outlines the key considerations in determining whether a floor can be safely treated or whether remediation is required to correct defects prior to re-assessment:

Suitability Flow Diagram

Installation Considerations

49. Before installing UFI, it is essential that the condition of the void and floor structure is thoroughly assessed, covering the risks identified in table 3 above, with particular emphasis on the following areas:

    - the condition of the floor structure, ensuring it is free from rot (dry rot and wet rot), especially at the abutment to any external walls, tassel or dwarf walls;
    - ensuring there is no existing evidence of dampness, staining or condensation on the faces of the floor;
    - ensuring there is no evidence of infestation (bore holes or active infestation);
    - the type, suitability and condition of floor timbers, substrates and any openings;
    - the type and condition of floorboards or breather membrane present; and
    - room space ventilation requirements.

50. The resulting height of the void allows for sufficient air movement post-installation (150mm minimum) between the lowest level of either the insulation or the floor joist. It is essential to check the condition and power rating of existing cabling beneath the ground and underside of floor which may need to be repositioned/replaced or extended beneath the insulation or timbers.

51. If any of the above defects or issues are identified they should be either rectified before work commences or as part of the agreed works with the customer. Any remediation work must be carried out before the installation of the UFI.

Ventilation to the main dwelling

52. The ventilation provision to the main dwelling should be assessed to ensure that the building will not become less compliant than before the measure was considered for installation. This assessment should be undertaken in line with the requirements of the latest version of PAS2035 for fabric improvement measures (also see previous comments regarding PAS2030 requirements).

Sub-floor ventilation

53. The durability of suspended timber floors is in most circumstances totally dependent on there being adequate and suitable cross-flow ventilation to the void below. It is essential that the ventilation is effective and unobstructed by any new materials, debris, or other detritus material.

54. When assessing the effectiveness of any sub-floor ventilation it is paramount that an inspection takes place of the floor levels externally in relation to the internal finished floor level. External works may have been undertaken since the property was originally constructed, such as new pavements, decking, soft landscaping or disabled access ramps. These may result in the air bricks and other vents becoming obstructed. Raised external ground levels if caused by soil or soft landscaping should be carefully reduced to restore full cross-flow. Where this is not possible, the use of telescope vents may provide a technical solution to maintaining the required ventilation.

55. For the purposes of this guide, and without robust research having been undertaken in this area, the default requirement for ventilation for sub-floor voids will be the requirements set out in Part C 2013 of the Approved Documents for England and Wales, and its equivalent in Scotland and Northern Ireland. This requires that a ventilated air space measuring at least 75mm from the ground covering to the underside of any wall plates and at least 150mm to the underside of the suspended timber floor (or insulation if provided).

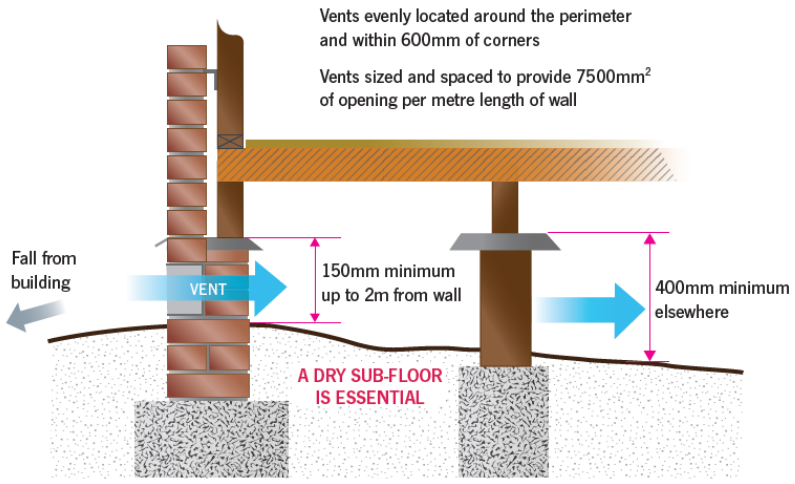
56. In the case of a floor being considered for a thermal upgrade, it should be assumed that any measurement should be taken to where it is anticipated any insulation would finish, in relation to the ground covering. Two opposing external walls should have ventilation openings placed so that the ventilating air will have a free path between opposite sides and to all parts. The openings should not be less than either 1,500mm² or 500mm²/m² of a given floor area, (whichever gives the greater opening area). Any pipes needed to carry ventilating air should have a diameter of at least 100mm, and all ventilation openings should incorporate suitable grilles which prevent the entry of vermin to the sub-floor (but do not resist the air unduly).

57. If floor levels need to be nearer to the ground due to the construction or alterations to external ground levels, then ventilation can be provided through the use of offset (periscope) ventilators that are rated to meet the requirements set out above. This requirement may require the addition of new airbricks or vents to meet the standard or if a more serious blockage, such as a house extension, has obstructed the cross-ventilation paths.

58. It should be noted that suspended ground floors were occasionally constructed without ventilation paths below, although not common practice. If it is noted during any inspection that the timbers and support walls are relatively dry, this may indicate that conditions are stable and therefore careful thought must be given to the effectiveness of adding insulation in these circumstances.

59. It is not unreasonable to assume that these stable conditions may have been helped by ventilation through board gaps to the room above. Under these circumstances, the addition of insulation may significantly obstruct this ventilation, and the addition of new ventilation paths below the floor may therefore be necessary, including through tassel walls (where present).

Image 1: Building section



Moisture control barriers

60. If a moisture control barrier/vapour control layer (VCL) is to be introduced into the floor structure when thermal insulation is applied between the joists, it should not be supported on a material which offers a vapour resistance higher than that of the thermal insulation. It is therefore

essential that if a VCL is introduced then reference should be made to the manufacturer's guidance for the material being used as to its vapour resistance characteristics.

61. Normally a VCL would only be introduced if condensation risk modelling using EN13788 had indicated that the structure would be at risk of interstitial condensation. Additional guidance can be found in Annexe F of the BS5250:2011 code of practice for control of condensation in buildings.

Cold Bridging

62. The suitability of a floor structure to be insulated should be considered, to ensure that the introduction of cold bridging does not increase the risk of the floor structure becoming stressed. For example, if the length of the joist is not insulated, as part of the work to insulate between floor joists, the exposed/uninsulated length of the floor joist could increase the risk of heat loss and result in condensation build up/mould growth. PAS2030 requires installers to minimise thermal bridges.

63. The exposed length of the floor joists are repeating thermal bridges by definition. However, Building Regulations 2013 Approved Document C states that if a ground floor is designed and constructed so that the thermal transmittance (U-value) does not exceed 0.7W/m2K at any point then building regulations will be satisfied with regard to the risk of condensation and mould growth. The "at any point" will only be achieved by insulating the perimeter edge of the floor as well as the joists.

64. Generally, the following provides an indication of the floor configurations that may be more at risk from cold bridging:

- 8-inch joist (200mm) the U-value will not exceed 0.7 and is therefore highly unlikely to be an issue.
- 6-inch joist (150mm) is also unlikely to create an issue (other than in extreme situations where original hardwood joists and floorboards remain).
- 4-inch joist the U-value is likely to exceed 0.7W/m2k, and therefore Building Regulations will not be satisfied.

Protected Species

65. Although unlikely, species which are protected may be found nesting, or located in a sub-floor void or basement, in these circumstances further guidance should be taken from Natural England's published standing advice on protected species[8].

[8] See: https://www.gov.uk/guidance/protected-species-how-to-review-planning-applications#where-species-are-likely-to-be-found

66. For clarity purposes, the protected species in the UK are listed in Table 4 below.

Table 4: Protected species and their likely location

Habitat Building or Land	Species to look for
Veteran (historical or important) trees, cellars, ice houses, old mines and caves	Bats or breeding birds
Buildings with features suitable for bats, or large gardens in suburban or rural locations	Bats, breeding birds, badgers, reptiles and great crested newts
Traditional timber-framed building (such as a barn or oast house)	Bats, barn owls and breeding birds
Normally in gardens or under debris but may be found in basements.	Slow worms

Installation Methods

Options for insulating a suspended timber floor

67. To insulate a floor correctly, it is important that the whole floor area is improved to the same level, and floors are not insulated in isolation of other floor areas, this helps to alleviate issues of cold bridging and unwanted moisture movement in voids.

68. In some instances, it may be preferable to insulate the floor from above, by removing the floorboards. This may be appropriate when:

    - the room is going to be refurbished anyway; and,
    - the existing floorboards can easily be removed without being damaged excessively; or,
    - the existing floorboards are in poor condition and they are going to be replaced anyway.

69. Alternatively, it may be possible to insulate from under the floor, which may be appropriate when:

    - using a BBA or Kiwa certified remote floor insulation method such as Q-Bot (certificate no: 175440),
    - there is an unheated basement or cellar which allows easy access to the underfloor area;
    - there is a sufficient gap under the joists to use the crawl space to work. In practice that means there are about 5 or 6 bricks below the bottom of the joists (38-45 cm or 15 "-18 of space). It is, however the responsibility of the installer to undertake a comprehensive risk assessment before any works are undertaken in line with the regulatory requirements;
    - an access hole is already in existence or can easily be created; or
    - when the crawl space allows access to most of the house.

70. It is not recommended to fully fill the void with blown insulation material (such as EPS beads) under any circumstances as Building Regulations require a minimum of a 150mm clear ventilated gap between the floor and ground below.

71. In all cases, compliance with health and safety requirements and access to confined spaces should take priority over any proposed installation approach and an appropriate risk assessment and method statement produced and followed.

Guidance from BR262 Thermal Insulation Avoiding Risk

72. The BRE document “BR262 Thermal Insulation Avoiding Risk” provides guidance of reducing risk when installing insulation in suspended timber floors, and where possible should always be followed.

73. There may be circumstances where the floor joists are less than 125mm (5”). Therefore, to meet the required floor U value, the underside of the joists may need to be insulated. This should only be undertaken with careful consideration of the condition of the timbers and where points a-g are followed:

a. Use full depth strutting between the joists at the perimeter of the floor to provide a fixing for the flooring and to limit the size of gaps which need to be sealed at the edge of the floor.
b. Seal the skirting to the wall with a sealant or airtightness tape, and to the floor with a flexible sealant, airtightness tape, or an extruded draughtproofing section. Also seal the gaps at services penetrations and access panels in the flooring with airtight gromets (if possible) or flexible sealants.
c. Pack the space between the wall and the joist or solid strutting with mineral wool insulation.
d. Apply a continuous seal in the space between plasterboard dry lining and masonry walling. This can be undertaken using tapes and other physical barriers or use of tapes and membranes if the substrate can be clean, dry and free from debris, particularly at skirting level.
e. Position the insulation level with the top of the joists to avoid any air movement between the insulation and the flooring. This may be less critical where the movement of cold air from the sub-floor space through or around the insulation, is restricted, e.g. by using support boards for quilt installation, or tightly butted plastic insulation boards.
f. Do not drape insulation over the joists as its thickness will be reduced substantially either side of each joist, and the uneven support may lead to loose fixings and a squeaky floor.
g. Choose a support method which ensures that the full thickness of insulation is maintained for the full width between the joists. Support quilt insulation to reduce air movement through and above the insulation, by either supporting the insulation:

    - on a board; or
    - fixed to battens nailed to the sides of the joists.

    In some circumstances, a substantial mesh such as scaffold debris netting may be appropriate. The use of inferior garden netting or mesh not specifically designed for the purpose of supporting insulation should not be used under any circumstances. Strips of vapour permeable membrane flooring panels which create an airtight layer can be used if required. Consider laying a vapour permeable membrane with sealed joints below the flooring where additional airtightness is required

74. Additionally, points h-j should be followed where the chosen insulation is a rigid PIR board or similar:

h. Support rigid plastics boards on battens fixed to the sides of the joists, and hold the boards down against the battens with nails driven into the joists.
i. Do not support insulation boards on nails or clips, unless the insulation is tight to the underside of the flooring, as any gap due to the inaccurate cutting of the boards will allow cold air to by-pass the insulation.
j. Consider laying a vapour permeable membrane, with sealed joints, below the flooring where additional airtightness is required.

Methods of applying roll or batt insulation:

75. The first main method of applying roll or batt insulation is to insulate from above. In these instances, existing floorboards and/or decking should be removed, and the insulation should be applied using a method stipulated and approved by the manufacturer, in terms of using materials not capable of supporting themselves (mineral wool, glass wool, sheep’s wool, woodfibre etc.). This would normally involve some form of substantial scaffolding mesh or a

netting designed for the specific use of supporting insulation. Garden netting or other non-specific netting must not be used. The floorboards may then be re-laid.

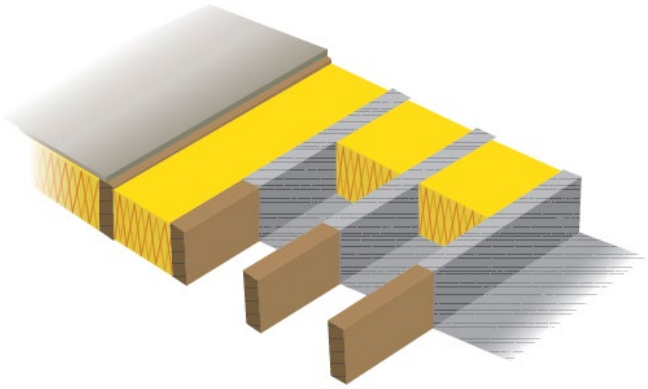
76. The second main method of applying roll or batt insulation is to insulate from under the floor. In these instances, a sufficient and safe working space must be available, either by using the crawl space underneath the insulation, or where access can be gained to fit the insulation into place and then secured using battens, netting, membranes, or mesh. The health and safety of the installers should be carefully considered to ensure a safe working space, given that they may be working in enclosed spaces, with potential exposure to toxic materials or substances in the ground. The suitability of PPE should also be considered.

77. Removing existing floorboards can be difficult, disruptive and increases the risk of damaging the boards. If the floorboards are tongue and groove, then they will need to be removed in order (and numbered). This may require specialist intervention where boards are more firmly nailed down.

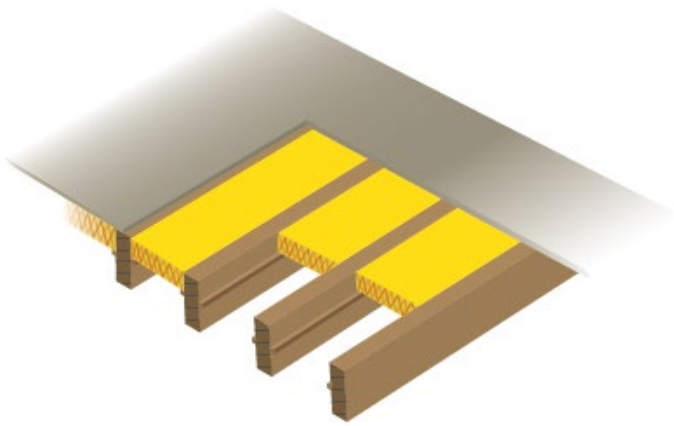
78. Alternatively, an installer may wish to saw between each floorboard to cut through the tongue and groove before levering them up (please note that unless new tongue and groove boards or additional airtightness is required, then a breathable membrane should be used or this may lead to detrimental effects on airtightness even with additional insulation).

79. The floor should be scanned using appropriate equipment to identify the location of electric cables and pipework. Where the boards run the width of the room, it may be necessary to either cut the boards in half, or remove the skirting to allow the boards to be lifted. This level of disruption must be communicated to the resident and customer beforehand.

Image 2: Floor sections



Quilted insulation supported by netting stapled to joist



Rigid insulation supported by battens

Insulating using spray foam

80. An insulating spray foam product should be applied between timber joists of a suspended ground floor construction. This can be done from a crawl space between the underside of a floor and the ground surface below.

81. The product should be sprayed to the underside of an existing floor with any excess material cut to suit the specification.

82. Alternatively, the product can be installed from above a floor where a floor covering has been removed. It is critical that a breathable membrane or Insupanel (Expanded Polystyrene Panel) rafter system is installed between floor joists to receive the product and ensure that the product does not contact the ground surface below with any excess material cut flush with joist tops. In both applications, the ventilation of a void between the timber joists structure and the ground surface below must be maintained in accordance with the guidance set out in BS5250.

83. The product should not be applied over electrical cables, recessed lighting, existing vents or ventilation gaps. Instead, installers should consider re-routing, re-laying in conduit/trunking or de-rating electrical cables. Existing recessed lighting (if applicable) should be replaced with ventilated fittings which incorporate a protective fire hood. Care is needed for design detailing of joints at service/flue pipe openings and should be in accordance with BS6093.

84. For suspended upper floors, adequate fire resistance and fire stopping should be provided by floors between homes and at penetrations. Upper floors should be constructed to ensure structural timber is located away from heat sources.

85. The product should not be applied over junctions with external walls required to provide a minimum period of fire resistance. Care should be taken to ensure continuity of fire resistance at junctions with fire-resisting elements, in accordance with the national Building Regulations.

86. The installed product should be separated or shielded from any heat-emitting appliance, fire place, chimney or flue pipes passing through a suspended floor and any potential source of ignition where the temperature is in excess of 70 °C, by non-combustible insulation in accordance with the provisions of the national Building Regulations. The product should also be 8 cm from any heat emitting devices and potential source of ignition, where the temperature is > 82° C.

87. When installing with joists that run parallel to the external wall, the spray insulation should be tapered away from the wall in line with the manufacturer’s specification.

Services & Damp-Proof Courses

89. Care is needed for design detailing of joints at service/flue pipe openings and should be in accordance with BS6093. The British Standard sets a requirement for joints to be constructed to obstruct the passage of any or all of the following:

    - insects and vermin;
    - plants, leaves, roots, seeds and pollen;
    - dust and inorganic particles;
    - heat, light, sound, radiation;
    - air, gases and odours;
    - water, snow, ice and water vapour; and
    - to avoid the generation of sound and odours.

90. In terms of safety, the functions of sealed joints in this context are:

    - to obstruct the passage of fire, smoke, gases, radiation and radioactive materials;
    - to resist sudden positive or negative pressures due to explosion or atmospheric factors;
    - to avoid the generation of toxic gases and fumes in case of fire; and
    - to avoid harbouring or proliferation of dangerous micro-organisms.

91. It is therefore essential that any joints are designed and installed in strict adherence to this standard.

Water pipes

92. All pipework carrying water that is located in the sub-floor void should be insulated appropriately, as this may help to minimise the risk of freezing and subsequent leakage or damage. This includes incoming water pipe, heating distribution pipes, and condensate pipes. The pipes should be insulated with new foam pipe insulation such as Tubolit or similar.

Gas pipes

93. Gas pipes should not be insulated and must remain in a ventilated space.

Electrical wiring

94. All electrical high amperage cables that are located in the sub-floor void, and/or pass through the floor structure to be insulated, must not be covered with insulation and should be safeguarded by an appropriate shield or restrictor.

Flues

95. Any flues that are located, pass through or access the sub-floor void must be safeguarded and insulation must not restrict their ability to allow their functional operation as designed by the manufacturer.

Underfloor heating

96. If undertaking the installation of UFI to a building that has underfloor heating already installed, the installer must refer to the manufacturer's guidance on its suitability and performance. Additional guidance can be found in the latest version of PAS2030 on the installation of underfloor heating.

Damp-proof courses

97. When dealing with the connection between damp proof courses and insulation, care should be taken with the placement of any insulation that is susceptible to moisture (hydrophobic) being in direct contact with the walls. This can be alleviated by using a different more moisture resistant material at these connections and junctions or if technically suitable, the introduction of a damp proof membrane.

98. Care should be taken when insulation is placed against external walls that have damp proof courses. It is essential that the insulating material does not bridge the damp proof course and allow moisture damage to the main wall structure, particularly if the wall is of solid construction or cavity wall that has previously been filled with retrofit insulation.

Condensation

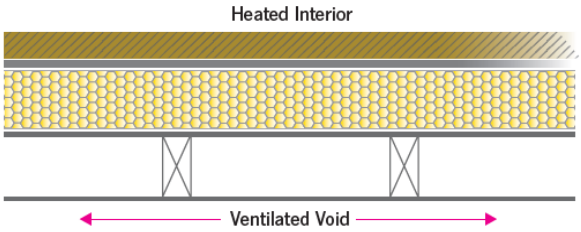
99. When considering the risk of condensation, BS5250:2016 'the Control of Condensation in Buildings' should be referred to. The risks depend on whether the suspended timber floor is insulated by applying insulation above, between or beneath the joists, separately or in any combination.

100. When thermal insulation is applied above the joists, there is no risk of surface condensation, although interstitial condensation can occur on the timber. To avoid such condensation, air and vapour control layers (AVCL) should be laid between the thermal insulation and the floor finish.

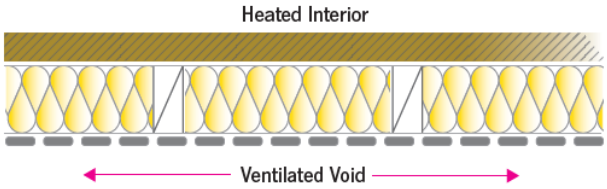
101. When thermal insulation is applied between the joists, it should not be supported on a material which offers a vapour resistance higher than that of the thermal insulation.

Image 3: Suspended floors

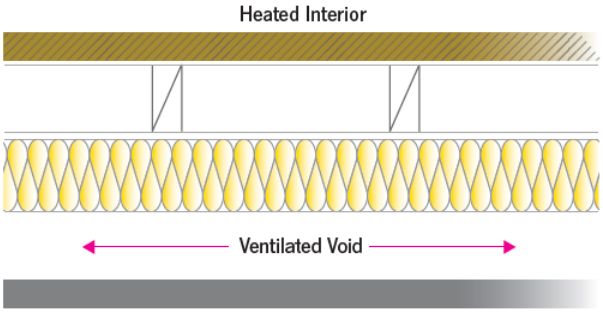
Suspended timber floor with insulation above the joists



Suspended timber floor with insulation between the joists



Suspended timber floor with a soffit of high vapour resistance



Making Good

102. Before any work commences, it is essential that the expectations and outcomes of the work and any subsequent making good (redecoration) are clearly communicated to the customer, to reduce the risk of complaints and unsatisfactory outcomes.

103. It is always advisable that prior to any works being undertaken, the condition of any floor coverings including floorboards or decking, fittings or fixtures that may be removed by the installers, or adjacent areas (walls) that could potentially sustain damage during the installation, are evidenced using photographs.

Post-Installation Checks

104. It is essential that any issues or special considerations that were identified at the assessment stage are carefully considered and appropriately addressed in accordance with the relevant standard.

105. All post-installation checks should be evidenced by survey notes and photographic evidence at mid and post-installation stage. Such evidence must include suitable referencing to identify the precise spatial area of the work that it relates to.

106. It may be worth noting that where access cannot be gained at a later stage by anyone monitoring the measure, the photographs provided should evidence the following:

- adequate sub-floor cross-flow ventilation as defined by this guide has been provided;
- air bricks that are free from dust, vegetation and other impediments;
- any small gaps between the last joists and the external walls are fully insulated;
- water pipework in the newly formed "cold space" is appropriately insulated and image of thickness used, located on the lagging;
- the structure of the existing floor is suitable for the insulation i.e. no evidence of damp, rot etc;
- the underfloor area is free from insects and vermin;
- there are no existing leaks from pipework;
- any combustion appliances in the space to be insulated have appropriate combustion ventilation in line with the Insulation Assurance Authority (IAA) guidance[9] ;
- any pre-existing combustion vents that are due to be insulated are safeguarded in line with the IAA guidance;
- any recessed floor lighting is safeguarded;
- any high amperage cables (electric shower/cooker etc) that may be clipped to the underside of the floor joist are not covered by insulation;
- any other in-situ equipment will not be compromised by the work undertaken;
- the insulation is applied in a manner which ensures that there are no exposed joists acting as thermal bridges, this is dependant on joist thickness;
- the insulation has been secured in position in line with system designer requirements;
- measurement of joist depth;
- insulation thickness;
- measurement of gap from joist bottom to ground level in several areas;
- the overall installation area below the insulation showing 100% of available area insulated;

[9] See: www.theiaa.co.uk available to registered installers

- the overall installation area below the insulation showing that the insulation is not sagging;
- cellar install images of fire rated sealants and plasterboards installed;
- compliance with the requirements of the latest version of PAS2030; and
- Building Regulation compliance notification.

107. The following photographs illustrate some examples of poor practice that would not be acceptable:

Image 5: Unlagged pipework.

Image 6: Poorly secured insulation and covered electrical wiring

Training and Vocational Competence

108. All competency requirements for the surveying, assessment, installation and checking should be in strict compliance with the relevant Building Regulations, and/or latest versions of PAS2030 and PAS2035 for the measure to be undertaken.

Addendum

Health & safety

The Health and Safety at Work Act is the overriding legislation in terms of working practices. However the surveyor or installer should also be mindful to the following specific requirements:

- The Confined Spaces Regulations 1997
- The Provision and use of Work Equipment Regulations 1998 (PUWER).
- Workplace (Health, Safety and Welfare) Regulations 1992.
- The Personal Protective Equipment Regulations 2002 and the Personal Protective
- Equipment at Work Regulations 1992 (as amended).

Underfloor insulation and radon gas

Radon is a colourless, odourless radioactive gas formed by the radioactive decay of the small amounts of uranium that occur naturally in all rocks and soils. It can enter buildings from the ground and exposure to high concentrations increases the risk of lung cancer.

Public Health England (PHE) recommends that radon levels should be reduced in homes where the annual average is at or above 200 becquerels per cubic metre (200 Bq m-3). This level is termed the Action Level.

Public Health England defines radon Affected Areas as those with 1% chance or more of a house having a radon concentration at or above the Action Level of 200 Bq m-3.

The link below can be utilised to check the interactive map to see if the property is likely to be at risk of greater than 1%.

https://www.ukradon.org/information/ukmaps

Presence of radon makes the requirement for ventilation in sub-floor areas even more vital to prevent its build up.

Where radon is a serious issue, the installation of any underfloor insulation may need to incorporate a membrane capable of preventing the gas from leaking into the property (regardless of whether this was in situ prior to the installation) or other remedial measures such as sumps and positive ventilation as outlined in the link below:

https://www.ukradon.org/information/reducelevels

Prior to UFI installation, property addresses should be checked against the interactive map and postcode checker to assess whether sealing the floor could exacerbate any build up of radon gas due to reduction in air infiltration through the flooring, which can lead to a higher radon concentration under the floor post-installation. Further information can be accessed at:

https://www.ukradon.org/services/address_search

In some circumstances, a test maybe required to determine the actual levels of radon prior to proceeding (This test is provided by Public Health England free of charge but can take up to 3 months).

Technicians should ensure that all of the ventilation underfloor is at least to the minimum requirements.

ANNEX A: Underfloor Insulation Checklists

Pre-Assessment process: This checklist should be used before any works are undertaken

Stage	Element to be checked	Response	Evidence Requirements
Stage 1 Assess	1.Is any of the work defined as Building Works according to the current Building Regulations?	Y/N	Scope of works described.
	2.Is the property located in a high radon area?	Y/N	Confirmation of location.
	3.If the building is traditionally constructed as per the definition in the latest version of PAS2035 has a Significance Survey Checklist been completed or if protected, has a full BS7913 assessment been carried out?	Y/N	Checklist to be supplied.
	4.Has the customer been made aware of the level of disruption during works (including timescales and any furniture or disturbances that may occur)?	Y/N	Signed agreement in plain language that explains the level of disruption and time scale for works.
	5.Are all surfaces of the sub-floor/solid floor construction which is to receive the installation suitable to receive insulation, and has the construction been detailed?	Y/N	Photographic evidence of all areas of the floor to be insulated.

Stage	Element to be checked	Response	Evidence Requirements
	6.Have all features/services and risks been considered (including cables, services and pipes in the sub-floor void)?	Y/N	Photographic of any cables, services or pipes in the sub-floor void. Clearly marked and dated to identify their location, where possible, however justification for no photographic evidence must be maintained.
	7. Has the ventilation provision been assessed for combustion (if the insulation is to be installed in a room with equipment that has combustion)?	Y/N/NA	Calculations or photographic evidence that the ventilation for combustion will not be affected.
	8.Is the existing ventilation within the sub-floor space adequate unrestricted, and capable of delivering the cross-flow requirements in this guide? If not, does the design address additional ventilation requirements? Has combustion floor ventilation been identified for safe operation?	Y/N	Calculation according to the requirements of this guide submitted.
	9. Are any areas not being insulated? Has the condition of the sub-floor and requirements to achieve cross-flow ventilation in all circumstances been considered?	Y/N	Explanation of why these areas are not being considered for insulation.
	10. Is there any evidence of high moisture readings in any timbers (in excess of 20% Moisture Content (MC)), dampness, mould or water ingress?	Y/N	Photographic evidence of meter readings taken, and the exact location noted on the survey form.
	11. If installing insulation above a garage or other storage space, have any downlighters or fixed electrical fittings been protected from coverage?	Y/N/NA	Photographic evidence of electrical fittings to be protected.

Stage	Element to be checked	Response	Evidence Requirements
	12. If a traditional building, is the insulation to be used compatible with the breathable nature of the structure?	Y/N	Vapour open materials are more suitable for breathable buildings. Rationale for material selection.
	13. Is the external ground level higher than the internal finish floor level	Y/N	Photographic evidence and any ground level measurements or observations taken during the survey.
	14. Are there any signs of water accumulation, visible leakage from any underfloor pipes in the underfloor area?	Y/N	Photographic evidence of the condition of the sub-floor void, location of images marked up on the survey form.
	15. Are there any signs of materials that may contain asbestos in the sub-floor area?	Y/N	Noted on the survey form the location and possible materials identified.
	16. Are there any metal structural floor supports?	Y/N	Photographic evidence of the condition of any metal structural supports in the sub-floor void.

Post insulation checklist process

	Elements to be checked	Response	Evidence
Stage 2 Install	1. Are all component manufacturer guidance and best practice guidance being followed throughout the installation? e.g. Correct depth, installation and coverage. Water pipes and cold/hot water tanks insulated. Un-restricted ventilation or extraction. High-power cables safeguarded. Gas pipes not insulated. Sub-floor hatches insulated to requirement. Access points, fixtures and fittings re-instated as required. Any down lighters situated in the floor void above a garage or storage space been protected from coverage.	Y/N	Photographic evidence of all measures undertaken at mid stage installation and post installation stages.

	2. Has cold bridging been addressed on interface details such as joist ends and floor between and walls, in accordance with BR262 Thermal Insulation “Avoiding Risks”?	Y/N	Photographic evidence provided of any areas when significant cold bridging may affect the performance of the building, and how they have been treated at mid stage installation and post installation stages.
	3. Is the property located in a high radon zone?	Y/N	If a gas membrane was required, photographic evidence of the membrane correctly installed and sealed.
	3. Have all ventilation points been safeguarded, or additional vents installed if required, and calculations provided to meet the guidelines in this document?	Y/N	Photographic evidence of ventilation provision installed at mid stage and post completion stages. Any calculations if new ventilation was identified as being required at the assessment stage.
	4. Have all high voltage cables, junction boxes or other electrical equipment been safeguarded from being covered by insulation?	Y/N/NA	Photographic evidence of any cables, junction boxes or other electrical equipment and ventilation provision installed at mid stage and post completion stages.
	5. If any materials were identified as containing asbestos, have they been appropriately collected and disposed of?	Y/N/NA	Collection certificate from a specialist hazardous waste collection and disposal organisation.

	6. If any structural metal was identified as being present at the survey stage that required remedial works, have these been completed?	Y/N/NA	Photographic evidence of remedial works at mid stage and completion stage before installation of insulation.
	7.Have post-installation measures taken place, including evidencing post-installation insulation depth, tanks and pipes are insulated and access points, fixtures and fittings have been re-instated, as required.	Y/N	Photographic evidence of all measures installed, and any services, cables or pipes safeguarded or insulated.
	8. Has the customer been issued with-post installation documentation?	Y/N	Signed receipt from the customer of documentation being received and understood including any ongoing maintenance requirements or considerations.

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