BUILDING REGS

Suspended timber ground floors 5

Suspended timber ground floors can conveniently accommodate thermal insulation within the thickness of the structural floor. We look at how it's done

The two commonest methods of insulating timber ground floors use mineral fibre quilt (usually supported on plastic netting) and rigid plastics insulation boards (supported on timber battens, corrosion resistant nails or clips).

The main construction points to consider are accommodating services; preventing water freezing in pipes; avoiding condensation within the construction; providing adequate underfloor ventilation; avoiding cold bridges; and minimising damage from water spillage.

The thicknesses of insulation required to meet the new minimum Building Regulations standard of 0.45 W/m²K are given in the second article in this series (Building Today, January 25). For rigid plastics insulation boards, a thickness of 40 mm will usually be required to meet the 0.45 standard, and 50 mm to comply with the higher standard of 0.35 W/m²K, which is therefore quite easily achieved. For fibre, a 50 mm thick quilt would usually be enough to meet 0.45, and 75 mm to achieve 0.35. However, with 100 mm being the most readily available thickness at present, it may be convenient to use a greater thickness of quilt than the minimum necessary.

The choice of insulation method and its position within the floor are likely to be determined by the depth of the floor joists; the preferred method of strutting; and whether services (particularly electrical) are to be incorporated within the thickness of the structural floor.

Accommodation of services

When services are to be run below ground floor level, the decision needs to be made as to which will run below the insulation, and which above.

Small bore pipework for domestic water supply and central heating is best located above the insulation to keep it warm. Although some builders thread pipework through the centre of the joists, it is more common to run it across the floor in notches cut in the top of the joists (Fig. 1).

To ensure that the structural performance of the floor is unaffected, notches should be cut within the following limits:

- ☐ maximum depth: one-eighth joist depth
- ☐ horizontal position: at a distance from the joist support between 7 and 25 per cent of the span.

Alternatively, complete flexibility of notch position can be achieved by increasing the joist size so that, if one-eighth of the joist depth is cut away, the remaining depth is sufficient for structural purposes.

Although it is more satisfactory for electrical cables to be kept as cool as possible, it is not convenient, for installation and maintenance, to run cables below the insulation. It is common practice, therefore, for cables to pass through joists on their centre line.

Again the rules for drilling holes in joists should be followed, that is confined to the following positions:

- ☐ on the centre line: maximum diameter to be one-quarter joist depth
- ☐ horizontal position: at a distance from the joist support between 25 and 40 per cent of the span.

Cables should be clipped to the sides of the joists, well clear of the insulation. If cable runs are covered along their length by insulation, they are liable to overheat and highly loaded cables may need to be increased in size for the installation to be safe. For example,. cables serving cooker points and electrical showers may need to be upgraded to 6/2.5 mm. For further details, refer to the BRE report Thermal Insulation: Avoiding Risks.

Pvc sheathed cables should be kept clear of expanded polystyrene or passed through suitable conduit, otherwise a chemical reaction can occur which makes the electrical insulation brittle.

The most satisfactory position for the insulation is therefore at the lowest possible level between the joists. Where joists are relatively deep, that is 200 mm or more, any insulation material can be used with plenty of space for services. If, however, joists are less deep, it may be preferable to choose a rigid board material which can achieve the required thermal performance with the least thickness.

Whichever type of insulation is used, it is advisable to plan removable panels at critical maintenance points, such as drain cocks, rodding eyes and so on. If, on the other hand, there are to be no services passing through the floor, no special arrangements are necessary and there is much greater flexibility in the position of the insulation within the depth of the floor.

Large piped services, such as drainage and waste pipes, as well as insulated ducts for heating or ventilation, can be suspended below the joists and therefore below the insulation.

If a small amount of condensation forms in a timber suspended floor, it is easily ventilated away. There is no need, therefore, to introduce a vapour barrier into the construction. Indeed, it may be positively risky to introduce a membrane beneath the floor boarding as it would retain spilt water, rather than allow it to drain through and eventually dry out.

Underfloor ventilation

If the floor structure is to be kept dry, it must be adequately ventilated. The underfloor space should be cross-ventilated by openings with a free area which is the greater of the following alternatives given in BS 5250:

- ☐ 1500 mm² per metre run of external wall, or
- ☐ 500 mm² per square metre of floor area.

For terraced housing, the larger free area requirement will often be based on the floor area criterion, rather than linear run of external wall. Generally, 225 by 150 mm clay or concrete air bricks will be acceptable for most circumstances but, where a large ventilation area is required, proprietary plastics units can often provide a greater free area without increasing the nominal size of the air brick.

Air bricks should be located on at least two opposite walls, with one unit within 450 mm of the end of each of the external walls enclosing the underfloor space, and at a maximum of 2 m centres. Intermediate sleeper walls should have the same free area as the external walls, evenly distributed along their length.

The ventilation should not be restricted by floor joists, strutting or blocking and, while it

may appear possible to locate air bricks within the thickness of the floor joists (when joists run at right angles to the external wall), this makes it impossible to incorporate the full thickness of insulation within the floor near the air brick, where there is the greatest risk of a cold bridge.

In practice, this means that the ventilation opening should emerge into the underfloor space below the level of the floor joists.

If the floor level of the building is high in relation to the surrounding ground, there is often enough space for an air brick with a horizontal sleeve to be fitted, giving straight-through ventilation to the underfloor space. If, however, the floor void is kept to the minimum permitted dimensions (125 mm in England, Wales and Northern Ireland, 150 mm in Scotland), a proprietary stepped ventilator will need to be used. Since all sleeved and stepped ventilators are a potential route for dampness to reach the inner leaf, they should be protected by a cavity tray (Fig. 2).

Prevention of water freezing

According to BS 6700, the main cold water supply pipe beneath the suspended floor must be insulated as if it is outside the building, irrespective of its distance from the external wall (Fig. 2). Table 9 of the Standard indicates that, for pipes with an outside diameter up to 42 mm, insulation with a thermal conductivity of not more than 0.035 W/mK (such as foamed plastics) would need to be 27 mm thick to give worthwhile protection during normal occupation of a building. For thicknesses of other insulation materials and further details, refer to BS 6700 or Table 2 of the Appendix to the BRE report Thermal Insulation: Avoiding Risks.

Avoidance of cold bridges

To ensure insulation continuity and, therefore, minimise the risk of a cold bridge occurring at the junction of the floor and the external wall, the space between the last parallel joist and the wall should be filled with insulation.

Continuity should also be provided by the use of a high insulation block for the inner leaf, in conjunction with cavity fill or an insulated inner lining (Fig. 3). To prevent cold spots due to air leakage between the floor and the wall, seal the skirting to both wall and floor with tape or a ribbon of flexible sealant.

For floors insulated with fibrous quilt, the insulation should be supported so that the full thickness of insulation is provided between the joists. This is usually done by draping plastics netting over the joists, stapling it to the sides of the joists and stretching it horizontally between them. This, however, is not an easy operation. A better alternative might be to fix strips of netting to the underside of the first joist and stretch each strip across the complete floor, fixing the netting as necessary to the underside of the intermediate joists.

The quilt should not be draped across the joists with the boarding fixed through it, since this causes a cold bridge where the insulation is compressed close to the joists, and also the possibility of an uneven, squeaky floor.

To ensure full insulation performance and to prevent cold spots, rigid insulation boards should be cut to fit accurately between the joists and supported on timber battens, corrosion resistant nails or proprietary clips. If supported on continuous timber battens, nails can be used to hold the insulation tightly against the support battens.

When rigid insulation boards are used, solid rather than herringbone strutting should be used to avoid gaps in the insulation layer. Both types of strutting may be used for floors insulated with fibrous quilt, but when herringbone strutting is used, care should be taken to ensure continuity of insulation where it wraps around the strutting.

Minimising damage from water spillage

For suspended timber floors, damage from water spillage will be minimised if:

☐ water can drain through (rigid plastics insulation will tend to hold water within the floor for longer than fibrous quilt insulation)

☐ the insulation is not in contact with the flooring (this is more important for rigid plastics board since water can be retained on the surface)

☐ chipboard flooring is moisture resistant, Type II/III to BS 5669 (see the fourth article in this series, Building Today, February 8). ○

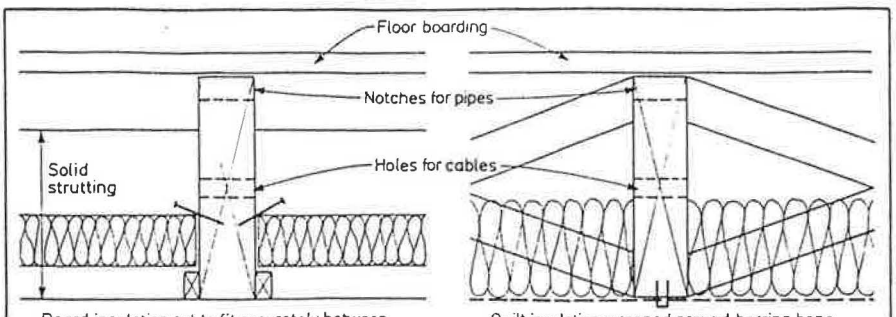

Fig.1. Insulation methods and position of services

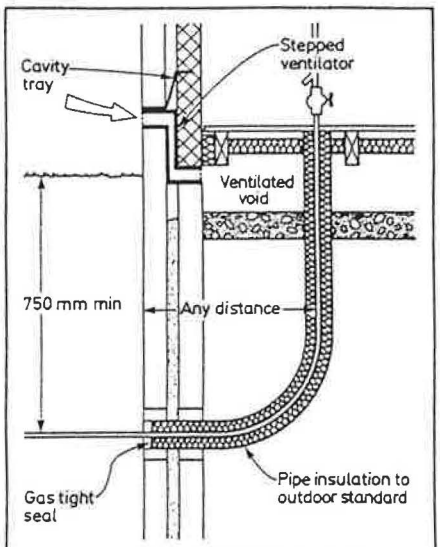

Fig. 2. Providing ventilation and frost protection to pipes

Further information on all aspects of energy efficiency in buildings is available from the Enquiries Bureau, BRECSU, BRE, Garston, Watford, WD2 7JR. Tel: (0923) 664258. More detailed advice on building to higher insulation standards can be found in the BRE report, BR 143, **Thermal Insulation: Avoiding Risks**, obtainable, price £10, from BRE Publications Sales, BRE, Garston, Watford, WD2 7JR Tel: (0923) 664444.

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Timber Suspended Ground Floors, September 1988, available from TRADA.

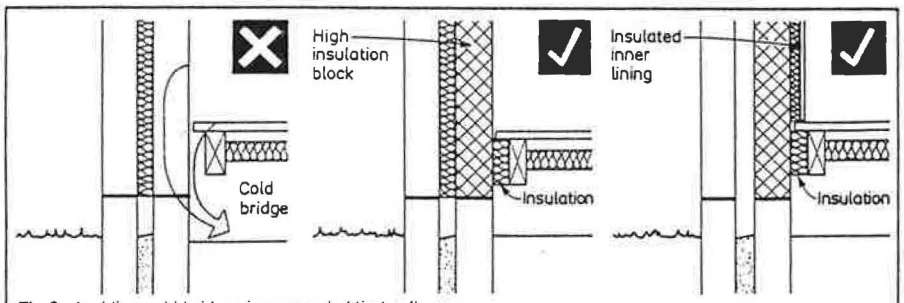

Fig.3. Avoiding cold bridges in suspended timber floors