INSULATION

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# Making a case for external insulation

**External wall insulation systems look set to take an increasing share of the insulation market. A Hunter Cairns explains the advantages of the various systems**

More than nine million UK homes are unsuitable for cavity wall insulation but half of these can be treated externally. Unfortunately much external insulation on the market was developed for central European climates and there is little experience in the UK of what is required of such systems.

There are several physical factors to be considered in the UK. The system needs to be rainproof and the insulation either non-absorbent or protected from moisture. For example, an inch thick layer of mineral wool has a K-factor of 0.38 when dry but this falls by 30 per cent when it contains just 1 per cent moisture.

In most urban areas the system also needs to be vandal-proof as well as being able to accept a number of decorative finishes. This is not straightforward because putting roughcast on insulation is not the same as applying roughcast to brick, as the insulation causes temperature stresses to build up that would otherwise dissipate into the brickwork. As a result dark colours cannot be used because they would increase the rise in temperature on the surface of the render and add to the risk of thermal movement. The cement mix and reinforcing have to be carefully chosen to match one another to avoid these problems.

At the moment there are four main types of external wall insulation: insulated render, thin coat polymer, mineral fibre and thick coat render. Insulated render consists of polystyrene granules in a cementitous mix which, in a thickness of 50 mm and a density of around 400 kg/m$^3$, has a K-value of about 0.10 W/m. This figure compares badly with conventional insulants that have K-values of 0.034-0.038.

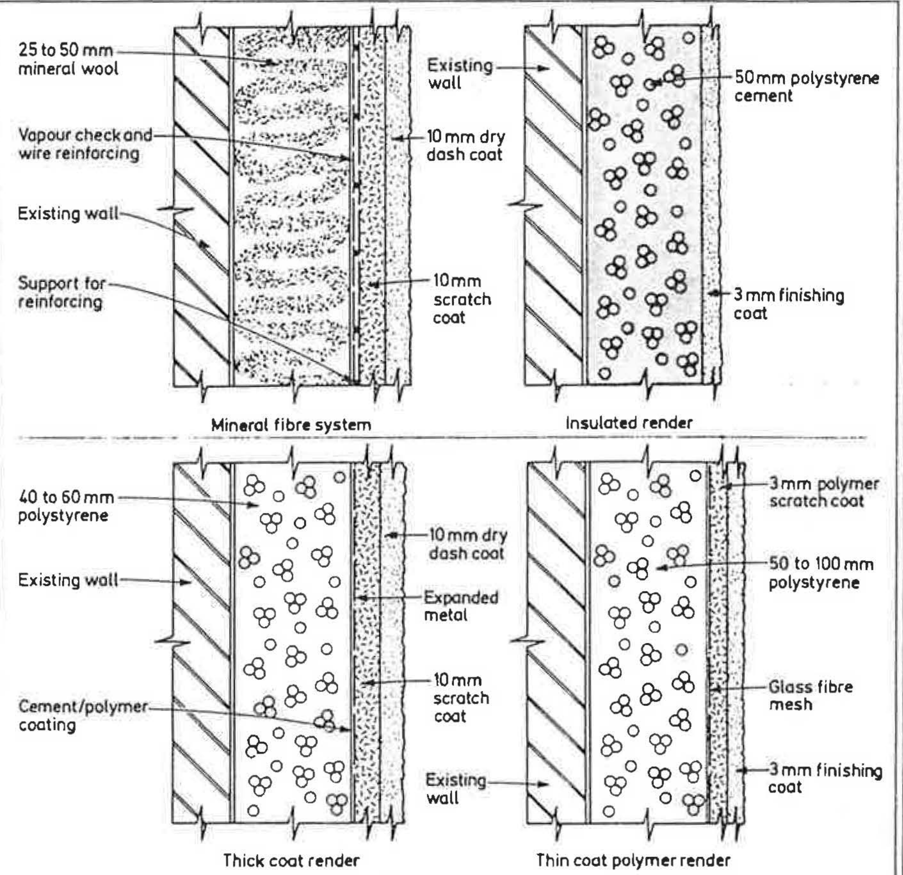
However it is a relatively cheap system, certainly when compared to the German systems, which tend to consist of a series of thin coats of polymer cement reinforced with alkali-resistant glass fibre overlaid on low-density polystyrene bead board 40-100 mm thick. The costs derive from the ingredients. For instance, the polystyrene board is fixed by a cementitious adhesive that is usually a premix containing a polymer and selected grades of sand, all of which are expensive.

A further disadvantage lies with the resin-based finishing coat — not only does it usually cost half as much again as ordinary dry dash but if the resin content is too high it can stop the moisture escaping from a building in Britain's damp and changeable climate. Furthermore, some of the resin-based finishes become soft when wet which reduces impact resistance, which is only 15 N/m$^2$ for the whole covering anyway.

Wire-reinforced systems are prone to cracking because of different coefficients of linear expansion. When roughcast is applied to wire with air behind excess heat can escape through convection currents but, if there is insulation there instead, the heat is trapped and the wire can expand quite easily by twice as much as the roughcast. The roughcast cannot be depended on to hold this because the wire matrices are derived from systems that span across the face of timber studs between 18 and 24 in. apart. The matrices contain not only the wire mesh itself but heavier gauge rods and metal channels to increase the spanning ability of the lath. And, as if to compound the difficulty, the manufacturers recommend that these be laid close to each other at the laps in the sheets. As a result, when cracks occur they tend to run horizontally along the line of these joints.

Any crack wider than 0.5 mm will admit water so the insulation must either be water repellent or be protected. Polystyrene board will stop water penetration provided it is virgin board and not made from crushed or recovered bead. Mineral wool needs some protection, usually kraft paper, but recent research from the Building Research Establishment indicates that wet paper itself may attract moisture through capillary action.

Another problem with the system is that cracking can be avoided only by avoiding differential expansion — and differential expansion can be avoided only by laying a uniform thickness of roughcast. Any irregularity in the weight of material across the face of the elevation will direct cracks towards the thinnest parts so the lath must be fairly flat when the roughcast is applied — which is difficult when there is no substantial background for the roughcaster to trowel against. Fixings tend to dish the insulation, particularly where the lath is not




Alternative external wall insulation systems

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pre-drilled. Also the insulation is usually lower around the heads of the screws or nails holding it and the lath is often dented on site, two factors which militate against there being an even thickness of roughcast.

The dewpoint of a building must also be considered: because this external coating is dense and hard the structural temperature is markedly lower here so the dew point is going to be between the final coating and the insulant. For this reason, the insulant must be moisture resisting, which rules out urethane foam and mineral quilts because their moisture resistance cannot be guaranteed over the long term.

### Personal experience

As a consultant in the field I have designed systems that take these factors into consideration and developed a thick coat render system.

There is an insulation layer of bead polystyrene (minimum 40 mm thick) at around the 20 kg/m$^3$ density mark with expanded metal lath on top. The polystyrene is precoated in the factory with a cement slurry containing a small amount of polymer. The board and the lath are mechanically fixed to the background with nylon plugs for self draining and the whole matrix is covered over with two coats render. A variety of finishes are available from textured coatings at the lower end of the scale right up through scratch plasters and wet-dashes to the conventional type of dry-dash.

The feature I most prefer in this system is the use of galvanised or stainless steel expanded metal mesh without ribs for reinforcing to the render which will not produce the heavily directional stress concentrations along the building face. I prefer also the bonding of the cement matrix through the mesh and into the polystyrene. This means that the galvanised metal or ferritic stainless steel lies in a totally alkaline environment and the whole system is fused into one solid matrix. Also a very careful balance of ingredients has been chosen for the cement render using limestone as a base aggregate to obtain as close a match as possible between the movement characteristics of the cementitious materials and the metal armature. While I would not pretend that the system is totally idiot proof, it does go a long way to meeting most of the problems which beset this form of building insulation treatment today.

External insulation is not just for upgrading work alone; now that the U-values for domestic properties are being held at 0.6 W/m$^2$ deg. C there is also a case for the application of these systems in new work, say, on the surface of a "solid 8 in. or 10 in. external wall (200 mm or 250 mm thick). After all, if the designer knows at the outset that he has to provide greater overhangs at sills and eaves, etc., the additional cost in that is negligible, so the only "penalty" to be absorbed is the additional cost of the lath (assuming all building systems will now require some insulation).

Concerns in case of fire have largely been exaggerated as has recently been uncovered from extensive testing (and some 10 years' experience of the systems in use). These have shown that the insulation is not the critical factor, as had been supposed by some, but rather that the reinforcing medium and the fixings are the most critical components. Plastic fixing plugs should be hollow and should have a metal pin inserted in their length around windows, doors and other openings. But most important of all, wire reinforcing is preferred to mesh cloth, with secure fixings at soffits and jambs of windows and doors, etc.

### Real scope for new work

Far from being a retrofit system only, then, I would hope that external insulation will also have an application in new work where it will help restore some of the competitiveness of wet-trade based building systems and enable the traditional contractors to regain some of the ground lost recently to the timber trade. ○

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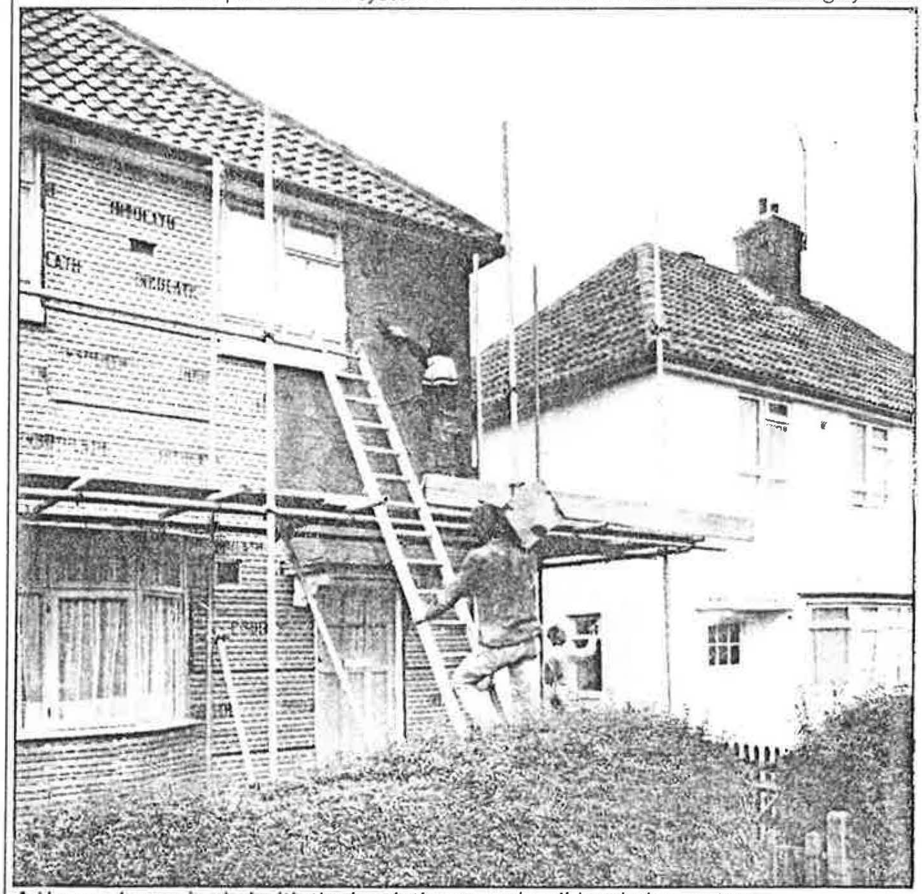

***A Harrow house is clad with the Insolath external wall insulation system***

### Checklist

1 Go for the systems which offer the best levels of real insulation and therefore better value for money.

2 Fit only non-absorbent insulation materials because they maintain their performance in bad weather.

3 The insulation boards should interlock at the edges (break bonded).

4 Avoid high-stress systems with the heavier metal concentrations.

5 Metal reinforced systems usually perform best in a fire.

6 Avoid systems which are liable to lead to differential thickness of render and therefore set up crack concentrations.

7 Roughcast systems are to be preferred to polymer coatings because the British workforce are familiar with the former and will price them sensibly.

8 Look for the coatings which offer the highest impact resistance and resistance to vandalism. (About 20 Nm or Joules as a minimum).

9 Remember that in the unlikely event of damage being done, a system which can be more readily patched and won't show the patching will be less of a heauache to maintain.

10 Avoid the use of fixings which are untested in time but remember that too high a concentration of metal may well show up as spots on the finished elevation. This is a particular problem with "thin coat" applications.

11 Mechanical fixings also allow better drainage at the rear of the insulation in case of accidental moisture ingress.

12 Ensure the best match possible between aggregate and reinforcing, i.e. ferritic stainless steel is better than austenitic.