



Jonathan Hetreed

The Damp House

*A Guide to
the Causes
and Treatment
of Dampness*

The Damp House

Jonathan Hetreed



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Contents

[Title Page](#)

[Copyright](#)

[Introduction and Acknowledgements](#)

[1 Definitions and Diagnosis](#)

[2 Rising Damp](#)

[3 Penetrating Damp](#)

[4 Condensation](#)

[5 Leaking Services](#)

[6 Remedying the Effects of Damp](#)

[7 Living with Damp](#)

[Further Reading](#)

[Glossary](#)

[Index](#)

Introduction and Acknowledgements

Dampness is the stuff of life: without it our land-world would be dead but, like weeds – often beautiful plants simply growing in the wrong place – dampness becomes an enemy when it invades our interior space, when it persists, spreads and damages the finishes, fittings – and contents – of our homes. In some cases, it can encourage the growth of moulds that threaten our health, as well as stimulating fungus and decay in the structure of a house. It is one of the commonest problems noted by surveyors assessing houses for sale and frequently, its eradication is a condition for buyers obtaining mortgages.

A major industry has developed offering ‘damp treatments’ to home owners, many of them with guarantees – though these are often short-lived and beset with conditions – but specialist contractors often concentrate on a single treatment rather than offering a comprehensive diagnosis. The aim of this book is to provide clear information to general readers and to present them with an overview of the types and causes of dampness, as well as to indicate the range of treatments and remedies.

Since no two individual circumstances are the same, no book can provide all the answers and there is no substitute for experienced, expert diagnosis and advice. However, clear explanations of the symptoms, causes and mechanisms of dampness, as well as descriptions of the methods used to combat it, should help readers to understand and solve simple problems themselves, as well as to evaluate various solutions offered to them by professionals.

ACKNOWLEDGEMENTS

There are so many to thank for a career in architecture that involves constant learning from one's own and others' experience.

Clive Gaynard of Timsbury Preservation has taught me more about the practicalities of damp treatment over 27 years than anyone else, and always with an honesty and wit that has maintained my faith in the industry – even when others sorely tried it!

My former colleagues at Feilden Clegg and my current colleagues at Hetreed Ross, along with many contractors and specialists, building control officers and conservationists, have contributed immensely to the experience from which this book has been gleaned.

Published material used in my research appears in the list of Further Reading at the end of the book. The Building Research Establishment has been an invaluable source of theoretical and practical material.

There have been detailed contributions from many others to my research for the book, and to the photographs included. I would particularly like to thank: Wraxall Builders; Bath and NE Somers Building Control; Aaron Roofing; the Mastic Asphalt Council; Peter Cox Property Services; Timber Decay Treatment; Permagard Products; Cotswold Treatments; Leo Wood, master thatcher; Roofkret; Gledhill Water Storage; Hepworth Building Products; Passivent; Wessex Water.

Thanks are due to The Crowood Press for sound advice, patience and sympathy. I would also thank Shelagh, Lisa and Kelly for putting up with my too frequent neglect of them while I wrote the book.

DEDICATION

To my father, Dr Bill Hetreed, whose lifelong enthusiasm for both the theories and the mess practicalities of making things had much to do with my becoming an architect and enjoyer of building

CHAPTER 1

Definitions and Diagnosis

The causes of dampness are often difficult to diagnose, sometimes because the problems are hidden though the symptoms may be all too visible, and sometimes because there are several causes acting simultaneously. Neglected houses are likely to have suffered from lack of maintenance in many ways, misguided or inexpert attempts to cure dampness often fail and sometimes make matters worse, or, by concealing the symptoms, make diagnosis more difficult. Before discussing diagnosis in more detail, it will be useful to establish some clear definitions.

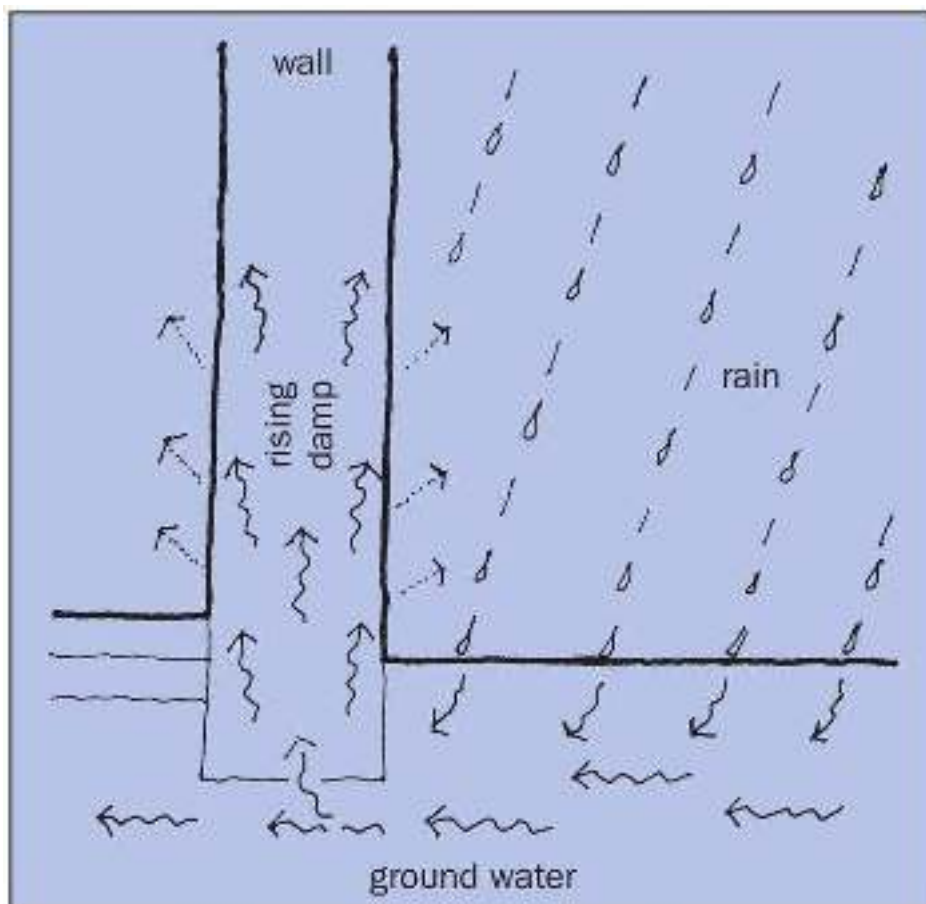


Fig 1 Rising damp – uses walls as wicks.

RISING DAMP

This is the classic form of damp that most people mean when they think of a damp house. As the term implies, it consists of moisture from the ground rising in porous wall construction by means of capillary action, in the same way that oil rises in the wick of an oil lamp, but in buildings the wall is the 'wick' and the moisture in the ground is the 'oil'. Classic visual signs are the 'tide mark' of damp staining or decayed finishes, often reaching to around a metre above local external ground levels.

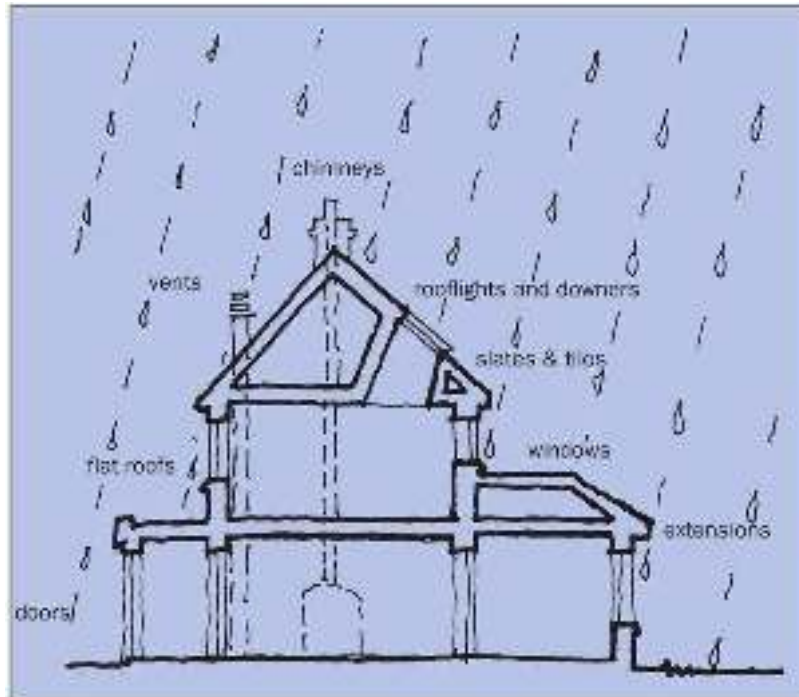


Fig 2 Penetrating damp – every external component is vulnerable.

PENETRATING DAMP

This consists of moisture – usually rain, occasionally floods – penetrating the interior of the house from the outside, under wind or gravity. There are many parts to the ‘envelope’ or external skin of a house – roofs, walls, windows, doors, chimneys and so on – each of which has their own sets of components (for example, in the tiles, slates, flashings, copings, ridges of roofs) and each of the components has its own role to play in keeping out the weather. Consequently, damage, deterioration or dislodging of even individual components can lead to damp penetration or a full-scale leak, though such is the complexity of construction, particularly modern or modernized construction with its multiple layers, that the symptoms may not necessarily appear where they are expected.

The visual signs of penetrating damp may well seem similar to those of rising damp but they usually relate more specifically to local sources and will, therefore, vary markedly around the house. For example, a sheltered wall may appear dry, whereas one fully exposed to driving rain from the prevailing westerly wind may be seriously affected, or even more specifically, a spreading vertical damp patch that is worst at the top of a wall may relate to a leaking rainwater pipe or broken gutter.

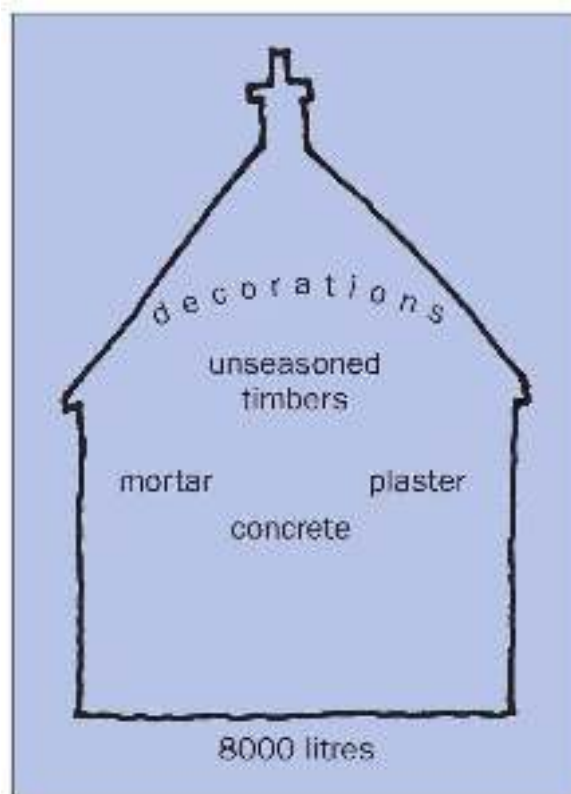


Fig 3 Construction moisture – 8t of water built into a three-bedroom masonry house.

CONSTRUCTION MOISTURE

For most domestic construction in the UK, wet materials and processes are used both for new homes and in alterations, principally in concrete, masonry, plastering, screeding and decorating. For a typical masonry-built semi-detached house, around 8t or 8,000ltr of water are embodied in its construction although around half of this water will usually have evaporated by the time the house is complete. The drying-out process will continue for at least six months and sometimes much longer if it is delayed by damp weather or if built-in dampness has been exacerbated by poor construction management. The same process happens with extensions, improvements and alterations, though usually to a lesser extent.

Although there are many good reasons to speed up construction and get projects completed as quickly as possible, drying-out is not one of them, at least in traditional construction. Where sufficient time has not been allowed for drying-out before finishes are applied – a common rule of thumb is that a month of ‘good drying conditions’ (i.e. dry air and lots of ventilation) should be allowed for every 25 mm (1in) of ‘wet construction’ such as a concrete slab – symptoms of damp may well appear and can give the impression of serious faults: these should be relatively short-lived but may cause minor damage to decorations, for example, and may need minor treatment if salts are brought to the surface (see below). The obvious clues to construction moisture are its association with new (wet) work and its diminishing over time.

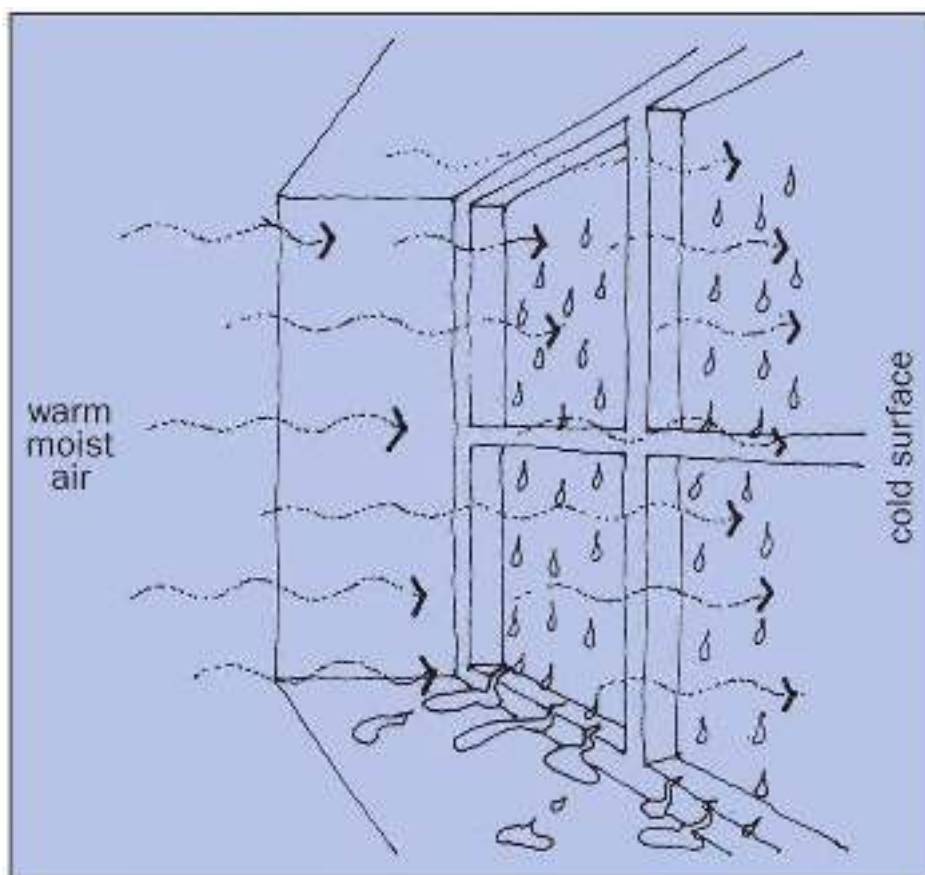


Fig 4 Condensation – warm moist air meets a cold surface.

CONDENSATION

This is probably the most complicated form of dampness, often difficult to diagnose and sometimes occurring as 'interstitial condensation' between the layers of a building's structure, where it can remain invisible to the occupants for years, while it contributes to problems such as timber decay.

Put most simply, condensation occurs when warm moisture-laden air (water vapour) meets a cold surface, with the most familiar and conspicuous example probably being the water droplets forming on the inside of a window in a steamy shower room. It occurs most often in winter when houses are least ventilated and when uninsulated external walls, windows, and so on, are at their coldest; but it can also occur in summer, often on interior walls or chimney breasts that are cool in relation to warm humid external air. It is particularly affected by people's management of their homes; for example, the extent of ventilation and control of moisture sources such as cooking and washing.

Signs of condensation, less obvious than water droplets on windows, are often grey or black-spotted mould growth on walls and ceilings, particularly in areas with least air movement, such as corners, recesses, and colder areas of construction around windows and doors, or below uninsulated roofs.

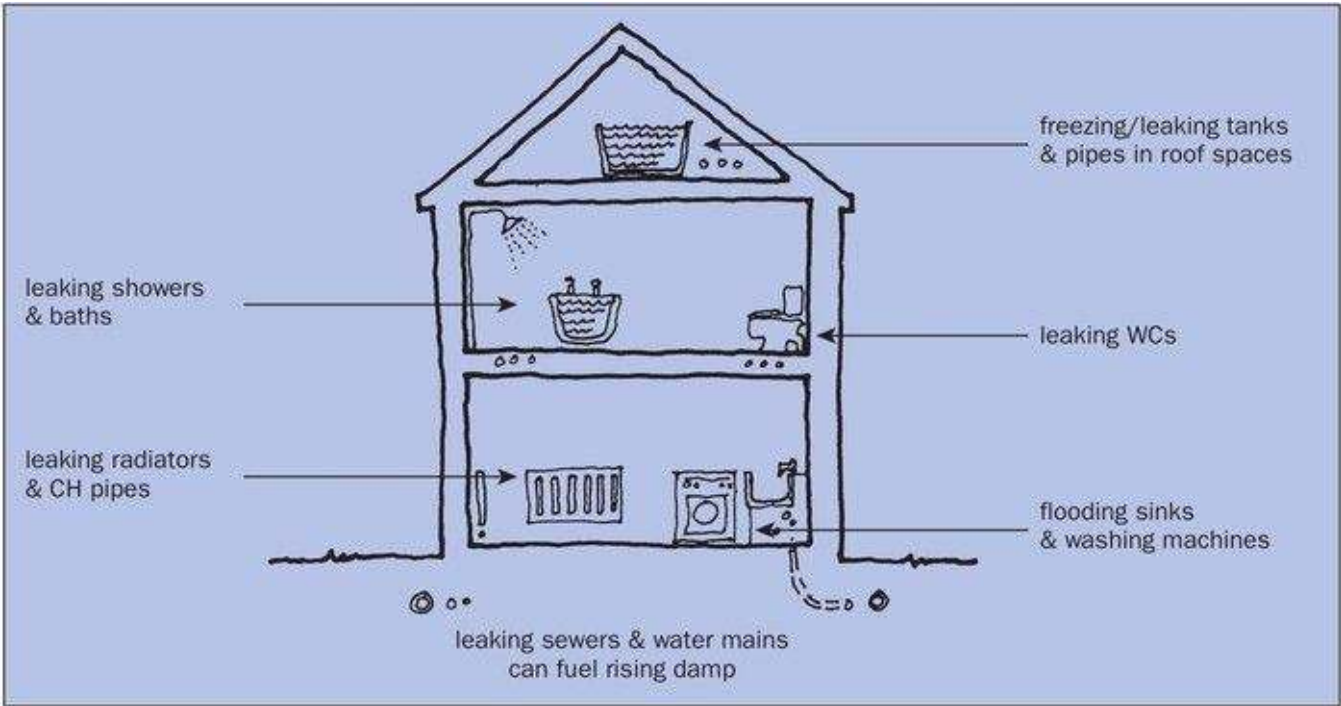


Fig 5 Leaking sewers and appliances.

LEAKING SERVICES AND APPLIANCES

Major improvements to the convenience and comfort of houses have included bringing water supply and drainage inside the 'building envelope', which naturally brings the attendant risk of failure of these 'services' – usually in the form of leaking pipes or tanks – causing dampness. Leaking external pipes and drains, whether above or below ground, can also cause damp problems by supplying the water that leads to penetrating or rising damp. Leaking water-supply pipes can be particularly troublesome in this respect because the supply of water is continuous, rather than intermittent, as from rain or drainage. Some of the wet appliances we use – principally washing machines and dishwashers – tend to have a much shorter life than our piped services; even relatively minor faults such as failure of seals can lead to damaging internal flooding, particularly if left undetected. Most of our 'sanitary ware' – baths, basins, sinks, showers and lavatories – is reliable and long-lasting but small leaks can go undetected for long periods, especially from shower cubicles and trays, where the advent of the 'power shower' has strained the performance of finishes and seals, and this can lead to cumulative damp problems, often hidden, initially, in floor structures.

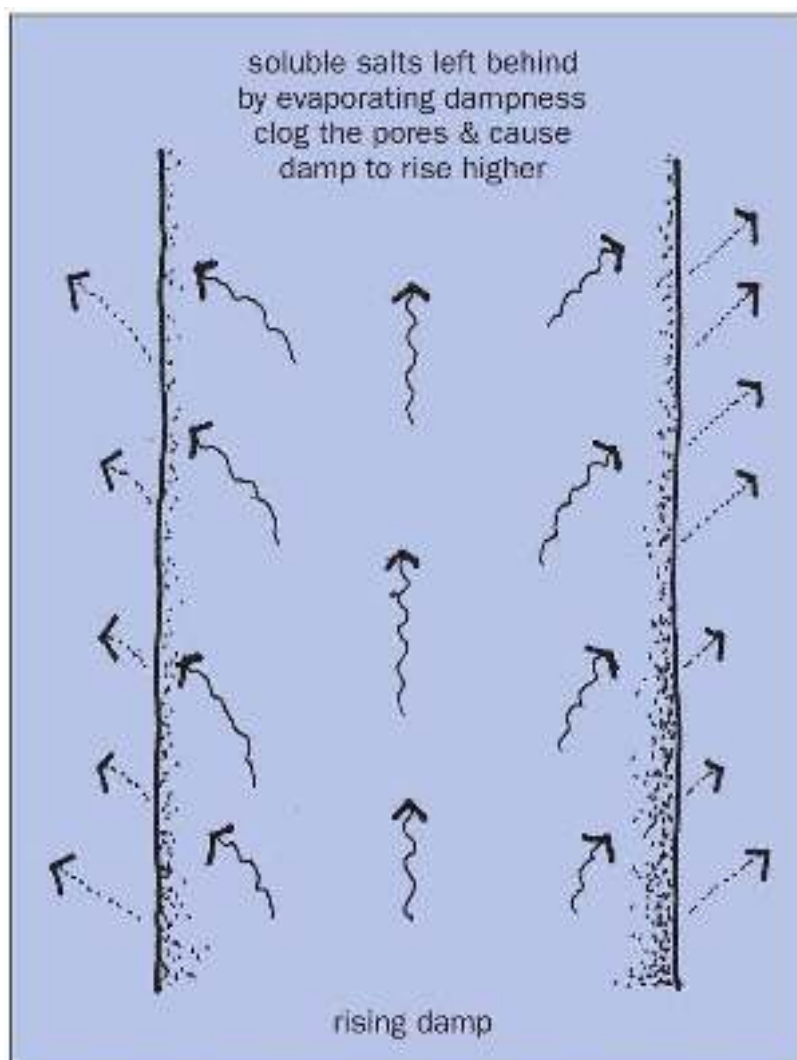


Fig 6 Salt contamination from evaporating moisture.

SALT CONTAMINATION

As moisture migrates through walls, whether from driving rain or from rising damp or any other cause, it tends to evaporate from inside surfaces to leave increasing mineral salt concentration in the inner face of the wall, for example. Some of these salts may appear as fine crystals on the surface of the wall, and some of them may be hygroscopic, meaning that they tend to absorb moisture from the air, which then tends to prolong the effects of dampness after the original source has dried up. The fact and the long periods needed to dry out damp walls after a damp course has been formed, lead damp-proofing specialists insisting on removal of plaster (often salt contaminated) and its replacement with proprietary salt-inhibiting render mixes as part of their specification.

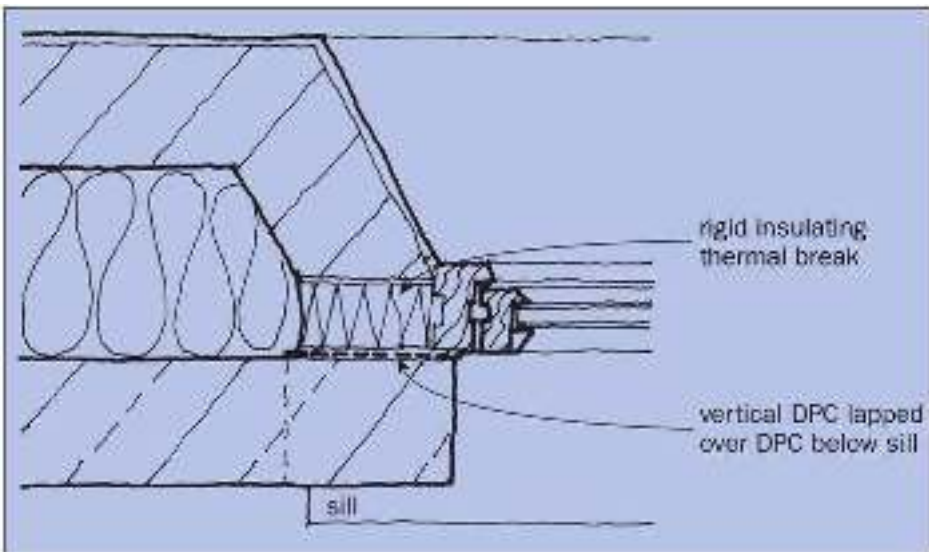


Fig 7 Detail plan of vertical DPC at a window in a cavity wall.

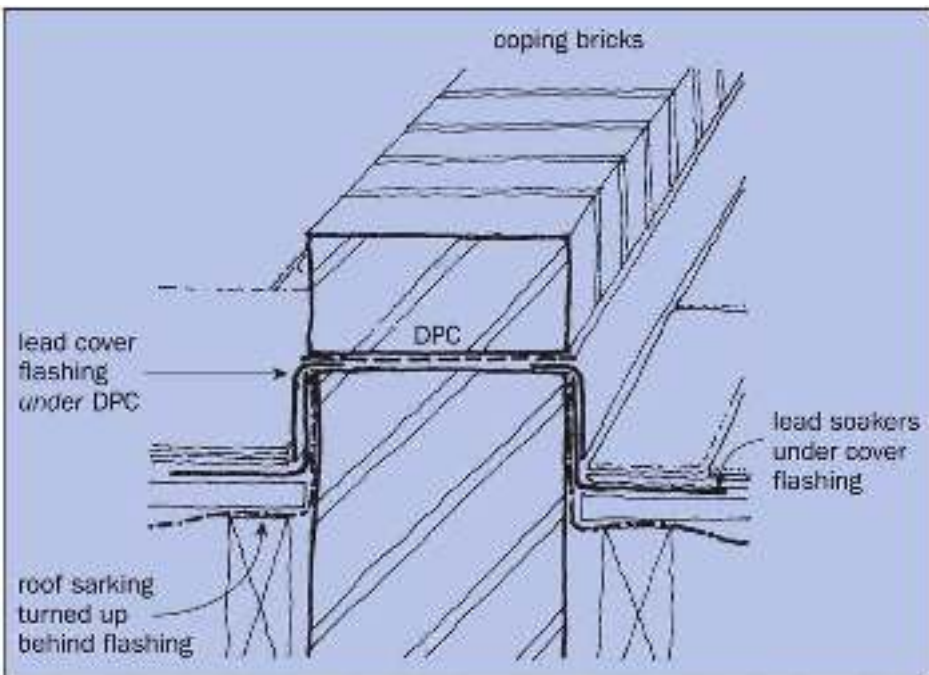


Fig 8 Detail of DPC to copings above roofs.

DAMP-PROOF COURSES (DPCs)

The term is self-explanatory, though a little confusing if you are reading a label on a roll of polythene strip – how can this be a ‘course’? When first widely introduced in the late nineteenth century – the Public Health Act of 1875 made them compulsory in new dwellings – damp-proof courses consisted of a course or, preferably, several courses of impervious bricks or of slates, which are more susceptible to cracking so tend to be less reliable than brick courses. Single courses of any material are weakest at the joints, since mortars are seldom reliably waterproof, particularly the weaker, more flexible mortars that are least likely to crack. Cracks in mortar joints are a further cause of failure in rigid damp courses.

Flexible damp-course materials have followed the development of the chemical industry in the changing materials and increasing toughness and flexibility; relatively costly metal DPCs, particularly lead and occasionally copper, were used in high-specification buildings, while cheaper flexible DPCs were made from hessian-reinforced bitumen, until the adoption of plastics from the 1950s onwards rendered them increasingly obsolete. Hybrid ‘pitch-polymer’ materials were popular in the 1970s and 80s but have been criticized for health reasons, leaving the market dominated by ‘pure plastics’ from plain black polythene to more sophisticated polymers.

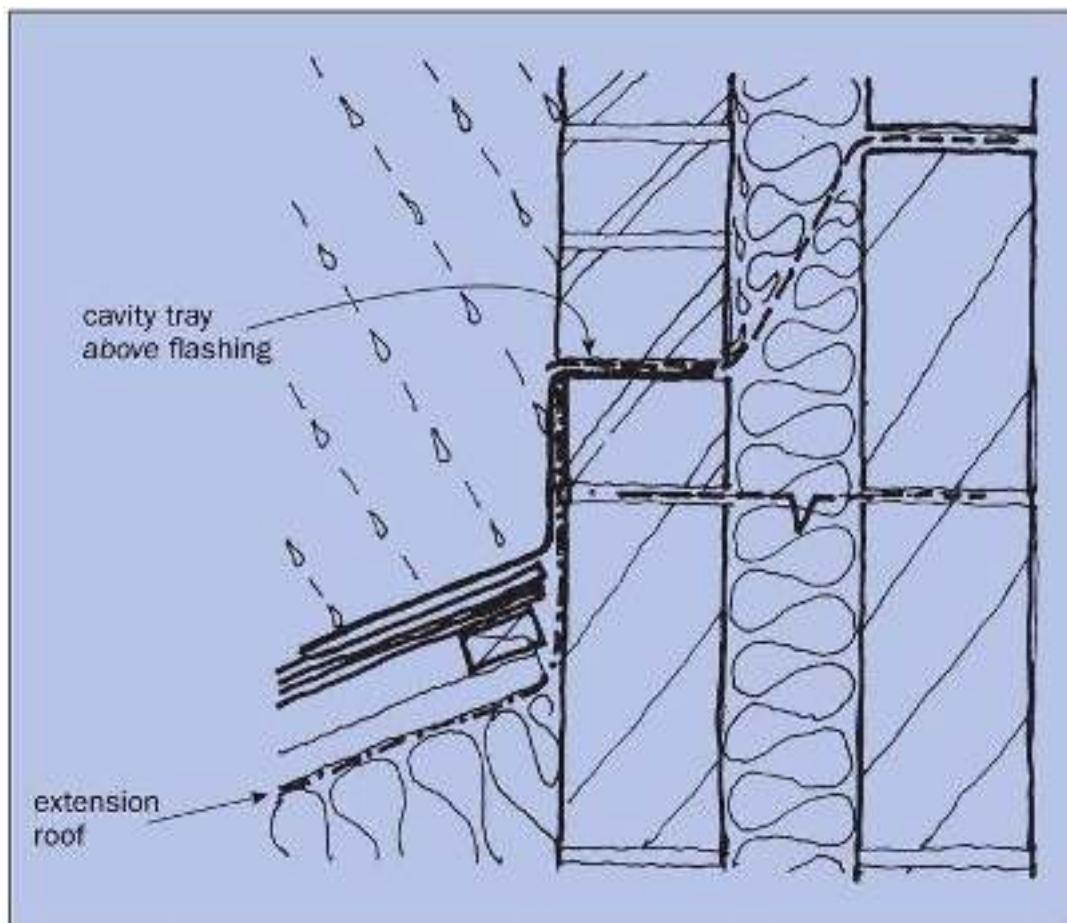


Fig 9 DPC cavity tray at roof abutment.

Although flexible DPCs have major advantages of relative freedom from joints, flexibility to withstand movement in masonry, ease of use and low cost, they do have limitations, particularly their poor adhesion to themselves for sealing joints at corners, roll-ends and stepped details (where the need for specific adhesives and clean conditions make site management and workmanship critical), and

mortar where their very flexibility causes them to form a slip plane, which effectively ‘detaches’ wall from its foundation.

In substantial buildings, stability is maintained by the sheer weight of masonry, but free-standing walls, particularly smaller garden walls, can be vulnerable to high winds or modest impacts due to flexible DPCs, so are still often built with brick, tile or slate DPCs at the base and the coping, or else have DPCs omitted entirely.

DPCs are fitted in modern construction – and in alterations – to protect against penetrating damp, as well as rising damp, particularly around openings in cavity walls where the window or door ‘reveals’ the cavity and would otherwise provide a route for moisture to enter the house. DPCs at coping level, where walls project above roofs, for example, are especially important in preventing the downward entry of moisture. Another critical point, equally applicable in alterations and extensions, is where roofs adjoin higher external walls, particularly cavity walls: the DPC in this location is called a cavity tray and will be discussed in more detail in [Chapter 3](#).

Retro-fitted or remedial DPCs are occasionally physical sheet barriers inserted into slots cut through walls but more often proprietary systems of chemical injection, electronic treatment or evaporation devices. These are dealt with fully in [Chapter 2](#).

DAMP-PROOF MEMBRANES (DPMs)

Serving the same purpose as DPCs – preventing rising damp – but across ground floors, DPMs have followed a similar but later evolution. Although the model by-laws of 1937 required damp-proofing usually of pitch or bitumen – between solid floors and timber finishes, it was not until the 1950s that they were increasingly adopted beneath solid concrete floors, and they were not mandatory under the Building Regulations until 1967. Prior to the reliable and cheap production of polythene sheeting, DPMs were formed either from liquid bitumen or trowelled asphalt, or from waterproof building papers laminated with bitumen. Good quality concrete floor slabs, particularly of at least 150mm (6in) thickness, are generally waterproof and their performance can be improved by additives; but thinner slabs, such as the 100mm (4in) slabs generally used in housing, are less reliable and the addition of a DPM is a simple and effective measure, which has the beneficial side-effect of improving the quality of the concrete by retaining water and fine aggregate ('fines') within the mix.

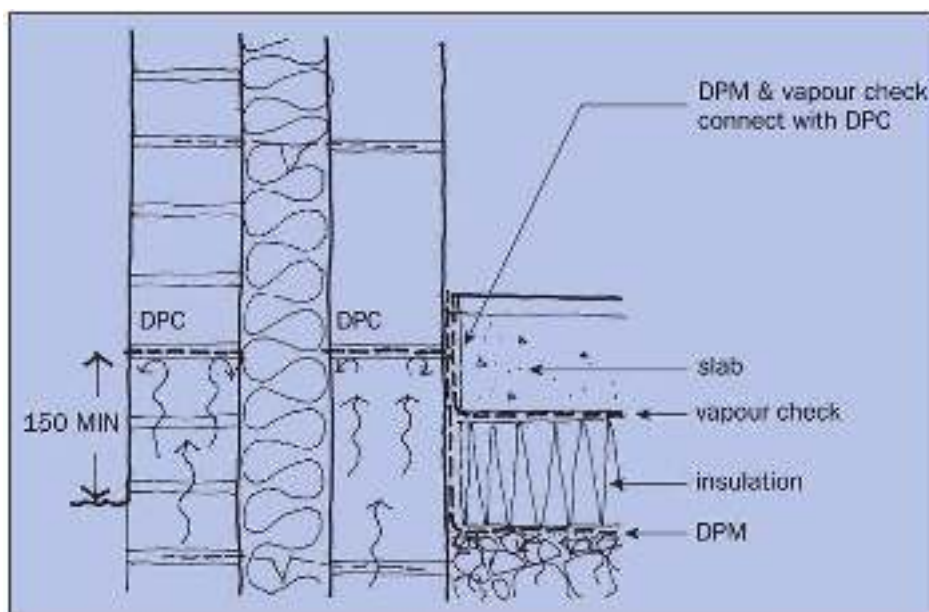


Fig 10 DPCs and DPM for a solid ground floor.

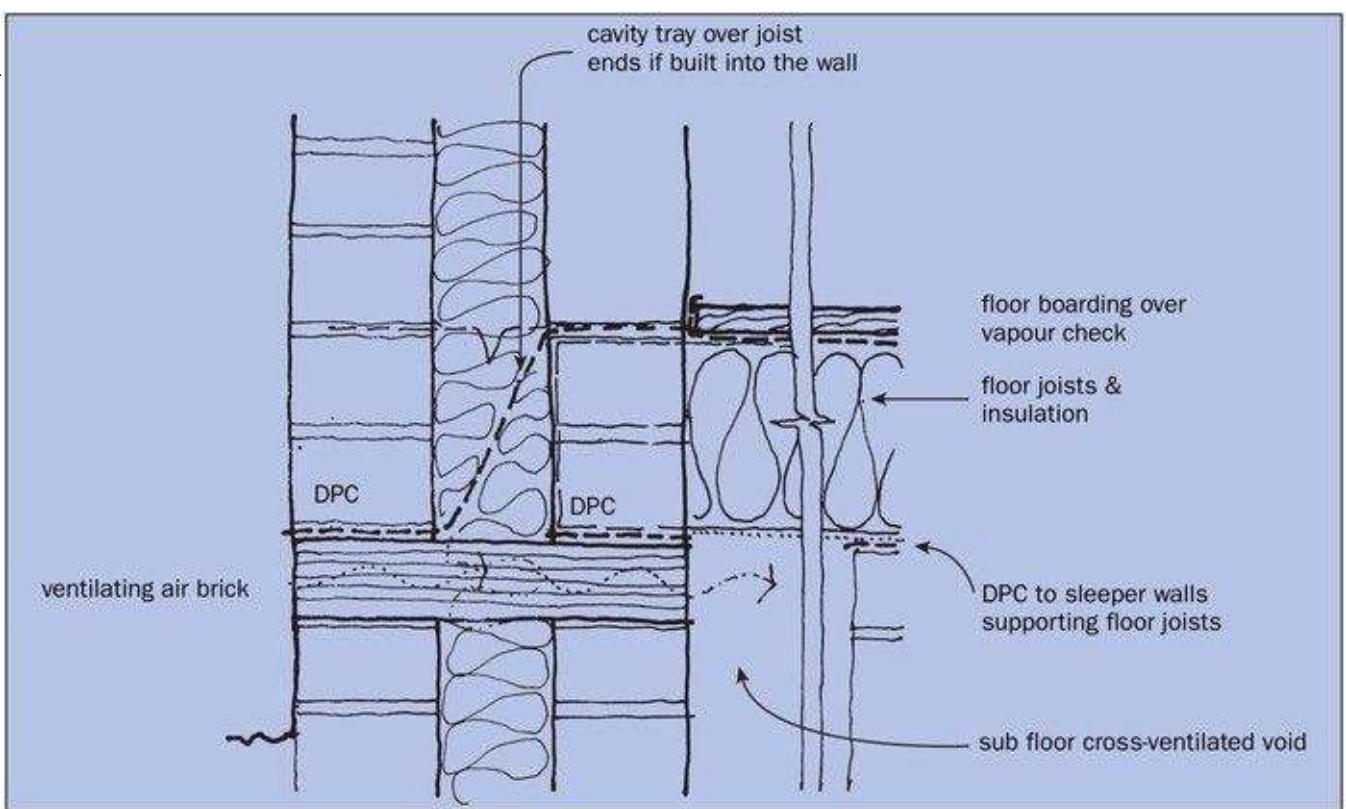


Fig 11 DPCs and ventilation for timber ground floor.

The weak points of DPMs are at their joints and where they join wall DPCs; although most details are straightforward, good workmanship is critical, particularly for floors below adjacent ground levels. Traditional timber, suspended ground floors include no DPMs but rely on cross ventilation to prevent dampness accumulating and causing decay; accidental or sometimes deliberate blocking of such sub-floor vents (to prevent draughts entering the house) is one of the commonest causes of decay and failure of timber ground floors in houses.

Once cheap, flexible DPCs were introduced, they began to be used – though inconsistently – to protect timber joists from rising damp in supporting walls. In older timber floors, slate was sometimes used under joists for the same reason.

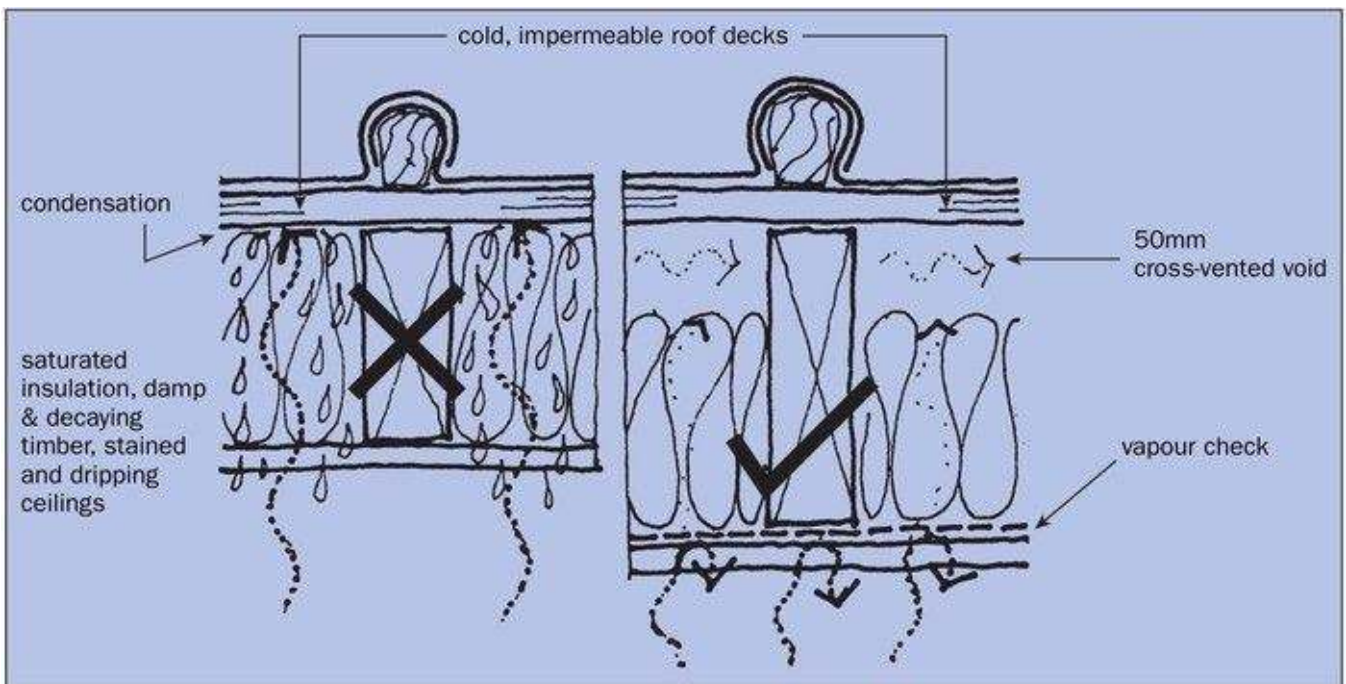


Fig 12 Vapour check and ventilation to minimize condensation below impermeable roofs.

VAPOUR CHECKS

The commonest form of vapour check in construction is clear polythene sheet, usually thinner at 125 (1000-gauge) than the 250 or 300 μ (500-gauge) sheet used for DPMs, and transparent (instead of black or blue) because it is usually needed internally, so is less exposed to sunlight (and its destructive ultraviolet rays), and because seeing through it makes fixing and checking easier. In most construction, 'barrier' is a misnomer since mere fixing perforates it, and the idea of a barrier to vapour can be a dangerous illusion – it is important that construction details outside the vapour check allow for the inevitable leaks of vapour and for its dispersal. Only in special circumstances, with great care on site, can a true vapour barrier be formed, which then has to be protected against future damage; for example, in the insertion of wiring or light fittings.

The role of the vapour check is to hold back water vapour on the inside of construction, so as to reduce the amount reaching cold external materials and condensing. Its importance is in direct proportion to the susceptibility of the construction to damp and to the impermeability of the construction to the exterior: to take a worst example, an insulated timber-framed roof closely covered in metal sheeting but without an effective vapour check, may appear to be leaking due to the quantity of condensation dripping back through the ceiling – and probably rotting the timbers. The same construction with a clear polythene sheet vapour check on the inside of the insulation, and a ventilated cavity under the metal sheet, should be trouble-free.

As floors have been increasingly insulated – particularly if the floor is heated – vapour checks have become more widely used, always on the warm side of the insulation, below the flooring and over the joists in timber floors, and over the insulation in concrete floors; in contrast to the DPM, which is usually next to the ground or hardcore.

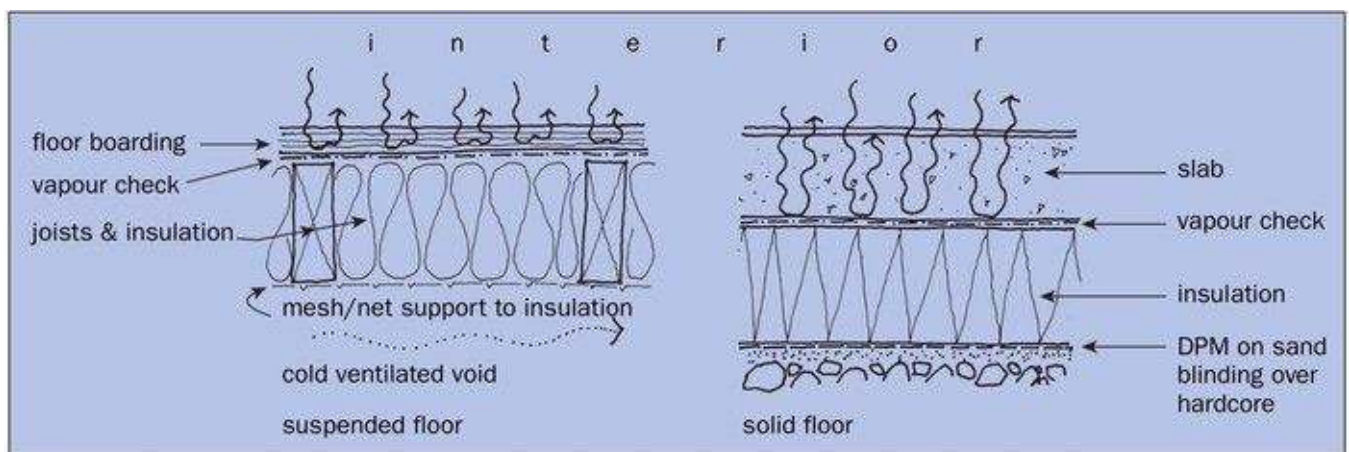


Fig 13 Vapour checks in solid and suspended ground floors.

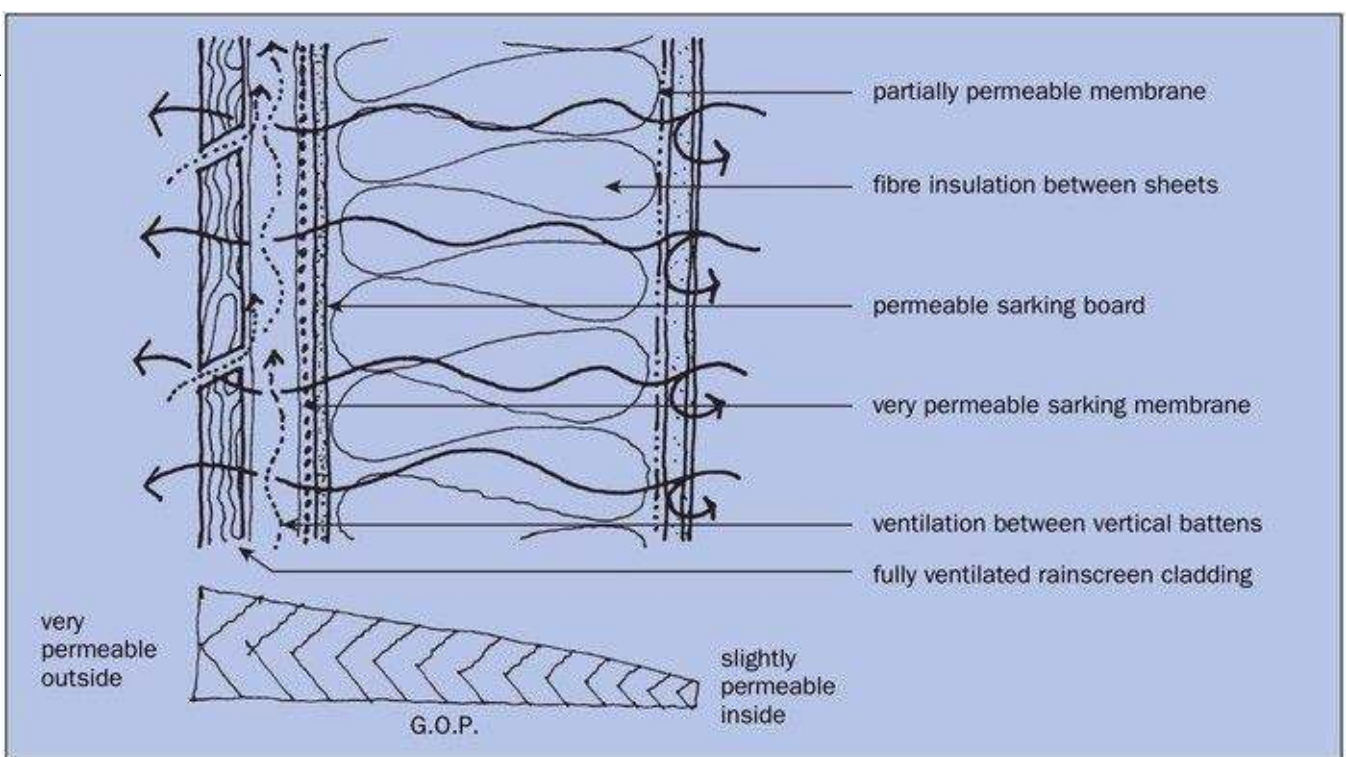


Fig 14 'Breathing wall': the gradient of permeability.

There has been some negative reaction to the 'sealed-house approach' and, particularly, to vapour checks, which suggests that more natural internal conditions in houses and better air quality are achieved by 'breathing construction', which allows air and vapour to pass slowly through it in either direction. So as to avoid or to minimize condensation, it is then critical that there is a gradient of permeability through the construction from the less permeable inside to the most permeable outside, which allows the condensation occurring in the outer layers of insulation to evaporate harmlessly through well-ventilated cladding (over timber or steel framing) or vapour-tolerant construction (usually masonry). Manufacturers have developed special 'vapour-control' sheetings for the inside and 'vapour-permeable' sheetings for the outside.

SYMPTOMS AND DIAGNOSIS

The most blatant symptom of dampness is water itself, common enough from condensation and from leaks, whether from rain or faulty pipework, easy to see and sometimes to hear; it is also relatively easy to trace, though significant dismantling may be needed to track its path. Subtler symptoms, such as damp patches, peeling paint or wallpaper, and a whole range of moulds and fungi, from the slight mottling of incipient grey or black moulds, due to intermittent condensation, to the full glories of the fruiting bodies of 'dry rot' (a confusing name for the fungus *Serpula lacrymans*, that thrives in damp but not wet conditions), can be caused by many different kinds of dampness or by a combination of them. As a result, diagnosis can be much more difficult; a process of elimination may be required over a considerable period to be sure of a correct result. The complexity of diagnosis is further increased by the human factor: different occupants and lifestyles in otherwise similar houses can generate quite different problems or, in some cases, no problems at all; whereas a neighbour may suffer seriously from the symptoms of damp.



Fig 15 Fruiting bodies of dry rot fungus. (Peter Cox)

Similarly, people's attitudes to damp vary enormously. Historically, buildings were expected to be damp if they were built in damp places, and most people lived a generally weather- and damp-tolerant existence. They relied on ventilation, damp-tolerant materials and careful placing of their possessions to avoid or mitigate the problems of living in damp houses. During the twentieth century, the people of industrial societies have experienced steadily 'rising standards of living' and changing attitudes to public health and housing conditions, which mean that a damp house is now considered somewhat disgraceful, as well as unhealthy and damaging to itself, its finishes and contents, as well as its occupants.

As the costs and awareness of the environmental effects of profligate energy use have grown, we have been encouraged to 'seal up' our houses with draft-stripping and insulation. Both measures tend to increase comfort and reduce energy use but can exacerbate some of the symptoms of dampness, particularly if the improvements are partial or piecemeal; for example, in draft-stripping windows that remain single glazed, which will tend to increase condensation since there will be much less

ventilation across the glass.

MULTIPLE DIAGNOSIS

Similar symptoms may derive from different causes and, particularly in derelict or poorly maintained houses, there may be several sources of damp-producing symptoms simultaneously. Unlike a human patient discussing their symptoms with their doctor, the damp house is mute and can sometimes represent a serious challenge even to experts. Rapid diagnosis is particularly risky, since both time and climate tend to affect symptoms; as well as a thorough survey, potentially including taking material samples from walls and floors for analysis, it may prove necessary to assess the building over a period of time, including different weather conditions.

It may be clear initially that penetrating damp is a problem – for example, from the holes in the roof – but the extent to which rising damp is also present may not become clear until some time after the roof is repaired and drying-out has begun. Similarly, condensation may not show up as a problem until winter, or until new occupants dramatically increase the amount of hot water and steam in the house, while reducing ventilation rates.

The Building Research Establishment (BRE)'s guidance on damp assessment suggests an 8-point process for thorough diagnosis:

1. Check for recent construction changes in the affected areas (for example, new openings made, ground levels altered, or cavity walls altered or insulated), that may not have been correctly detailed.
2. Record visually, by photographs or sketches, the exact location of penetrating moisture.
3. Record in the same way any staining or mould growth.
4. Record local context, such as neighbouring buildings, trees, and so on, particularly noting any recent changes that may have affected the building's exposure to weather.
5. Record timing of moisture appearing and drying-out, in relation to weather conditions, including any time-lags between changes in weather and changes in damp symptoms.
6. Measure the moisture content of the affected construction, initially by meter testing and then by sampling and laboratory analysis; take samples from the full thickness of construction rather than just from surfaces.
7. Measure and record the weather externally and conditions internally: temperature, humidity, wind and rain or snow.
8. Open up the affected construction to check exactly how it is built, taking care not to obscure the 'track' of moisture from its source.

Clearly, some of these checks are easier than others and it is seldom necessary to go as far as laboratory analysis of samples to diagnose straightforward problems, even with multiple causes; but too rapid an assessment can easily lead to simplistic solutions and thereby to unnecessary costs. The scale of diagnosis – and of remedies – should also match both the scale of the problem and the level of need: many people live quite happily in slightly damp, traditionally built houses, so the fact that a local damp problem appears, or gets worse, may require an appropriate local solution but does not mean that the whole house suddenly 'needs treatment'.

Conversely, more modern houses typically incorporate damp-resistant details and materials, s

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