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CONDENSATION

Condensation and mould growth — causes and cures

Paul K. Martin

Energy Designs and Surveys

THE PROBLEMS of condensation and mould growth in buildings can manifest itself as anything from an unsightly stain to severe mould on walls, clothes and furnishings, causing a health hazard.

Such conditions have become more prevalent in recent years as a result of higher standards of thermal insulation, draughtproofing and the movement away from open fires and flues in dwellings. These changes have affected many types of building, although the majority of problems occur in housing. It is estimated that 1.5 million dwellings suffer from condensation problems in the United Kingdom.

Health problems caused by mould

Mould growth can cause distress and anxiety for the occupants, being unsightly, implying neglect and a poor standard of hygiene. It can also cause respiratory problems, particularly with asthmatics. This is caused by the release of spores from the mould growth which have a similar effect on some individuals as pollen does on hay fever sufferers. The inhalation of fungal spores in certain concentrations can cause conjunctivitis, itching, sneezing, coughing, fever and swelling of tissues.

In recent years there have been a number of legal cases involving condensation and mould. Provisions are available for private individuals to take actions mainly through Part III Public Health Act 1936.

The cost of condensation

For Local Authorities the cost of curing the condensation and mould can be enormous. Temporary re-location of

families, structural and social surveys, expensive building works, new heating or ventilation appliances are often required.

It is therefore essential that the problem is fully understood and cured. An incorrect diagnosis of the cause can later prove very costly.

What causes dampness?

Dampness in buildings can be caused by various means, although condensation is frequently the source of the problem. Other causes can be rising damp, rain penetration, leaking roofs or faulty gutters. It is important that condensation dampness is not confused with these other causes of dampness, as the remedies are different. The use of moisture meters can be very useful at this stage and expert advice should be sought, if necessary.

Moisture is always present within the air to varying degrees, but surface condensation occurs when warmer air touches a colder surface as this reduces the ability of the air to hold the moisture. If the cold surface is below the dew-point (saturation point) of the air, water will condense out as droplets on the surface resulting in damp patches.

Damp walls provide the nourishment required for mould spores to germinate and grow. Mould can live and grow in the relative humidity levels above 70% RH, which occur frequently in some buildings and often in unheated rooms.

Surface condensation in buildings can result from one or more of the following:-

- insufficient building insulation
- cold bridging
- inadequate or inefficient heating
- poor ventilation
- high moisture generation

Poor insulation levels result in rapid drops in temperature when heating appliances are switched off. The relative humidity increases and can reach levels which can sustain mould growth.

Cold bridging can occur in flats where concrete floors or structural pillars are usually the cause. Door or window reveals are a further common cause.

Poor levels of heating, or heating used intermittently, result in low mean internal air temperatures and high relative humidities as the air loses its ability to hold water.

Lower ventilation levels

Ventilation levels in buildings have decreased through the requirements of energy conservation, draughtproofing and the move away from open fires and flues, all of which prevent the escape of water vapour generated from within. Ventilation rates of 0.5 to 1.0 air changes per hour are usually adequate for domestic dwellings.

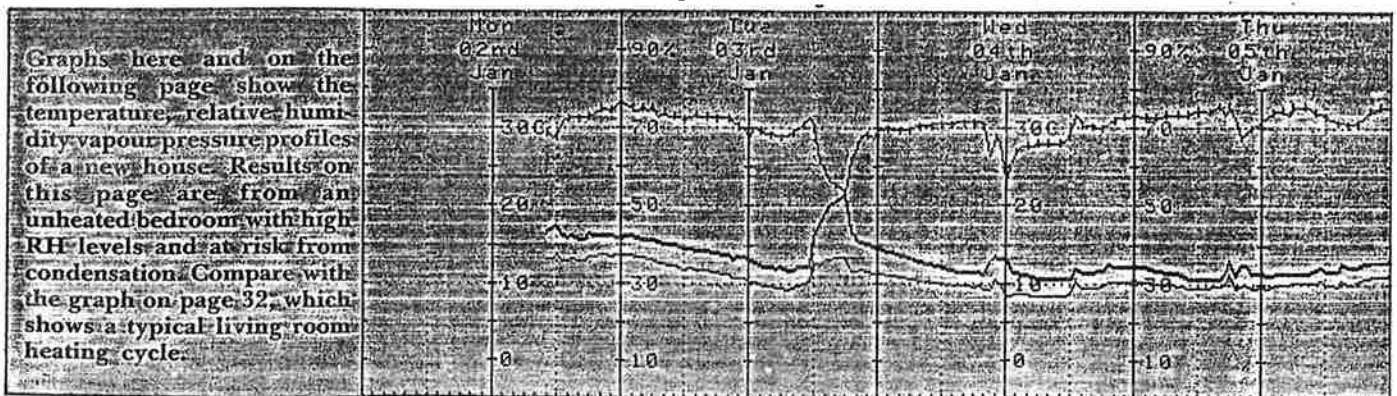
The external vapour pressure during the heating season is usually below the internal vapour pressures. This is caused by tenant generated moisture. A family of four generates between 10 litres and 20 litres of water per day. High levels of moisture generation increase the likelihood of condensation problems.

Determining the correct cure

Monitoring the existing environmental conditions within a building suffering from condensation, coupled with a structural and tenant survey (with dwellings) will help to determine the correct cure. Subsequent monitoring after measures have been taken will determine the effectiveness of the measures.

A tenant/structural survey should not the following:- location of heating appliances, fans, airbricks, mould, condensation, moisture emitting heaters, insulation levels, physical building dimensions and fabric moisture levels.

The tenants help should be sought for family size, use of heating appliances, use of moisture producing equipment and activity. This information is useful when interpreting subsequent monitoring results.



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The following questions are then frequently asked.

- what measurements do I take?
- what equipment do I need?
- how many instruments do I need?
- how much is it to set up a good monitoring system?

As condensation depends upon air temperature, relative humidity and surface temperature it is advisable that your instruments can record these. Spot checks can only give a general guide and a continuous recording device is recommended.

Thermohydrograph chart recorders have been popular in the past, but are not as sophisticated as the new portable data loggers, which enable temperature, relative humidity and surface temperatures to be taken all from the one robust device. The recordings can be taken as frequently as required. The instrument can be left in the property over a number of weeks and debriefed onto tape when convenient for detailed computer analysis at base.

Detailed analysis can then give graphical displays and printouts of the dynamic conditions within the rooms from which the incidence of condensation can then be determined, either through referring to psychrometric charts or with the aid of computer software.

The results will help point toward the possible cure, ie high vapour pressures - improved ventilation; low air temperature - improved heating; low air and surface temperatures - improved heating and increased insulation.

It is advisable to place a recorder in each room. One recorder placed in a room with visible problems will be useful although it will not reveal the full picture, as each room may show completely different conditions. In a house one will be able to detect where excessive moisture is generated, i.e. kitchen, bathroom, heating appliances etc. With the source located excessive moisture generation can be resolved at source through, say, extract fans or removal of the offending appliance.

In the past one of the reasons for the lack of monitoring by Local Authorities has been the high cost of temperature and humidity recorders. Chart thermohydro-

graphs can cost about £250 each whereas digital logging temperature and humidity recorders cost about £600 each. However, digital temperature and humidity recorders are becoming available for about £350 each.

A basic kit of six recorders, portable computer with tape storage and sensors will cost approximately £3,000. Detailed analysis could be carried out on personal computers often readily accessible in most modern offices.

Energy Designs & Surveys provides a monitoring and advisory service, using such instruments to help indicate a solution.

Looking at solutions

There is no 'magical' solution to surface condensation and mould growth and it is not possible to predict whether the measure taken to counteract this will be 100% successful.

There are a number of ways currently practised to solve or ease the problem. The best cure depends very much on the cause, consequently prior knowledge of environmental conditions through monitoring is an advantage.

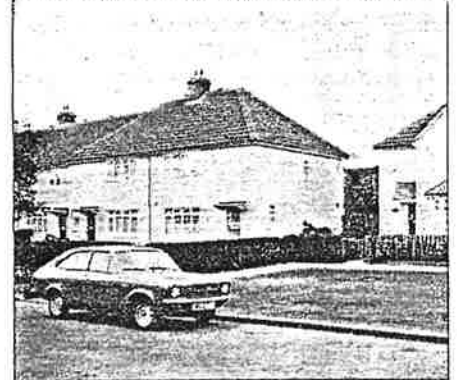
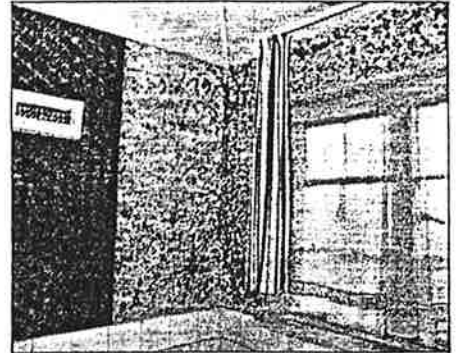
One or more of the following measures could be the solution.

- improved heating
- cavity, external or internal wall insulation
- extraction fans
- ventilation bricks or trickle ventilators
- dehumidifiers
- anti-mould paints and washes
- absorbent plasters
- reducing moisture generation

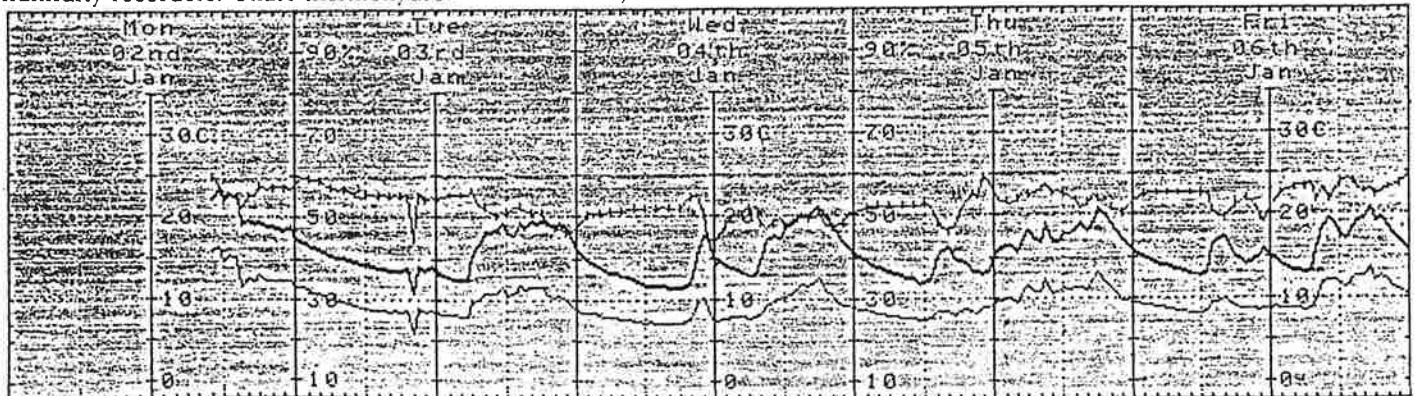
The Building Research Establishment at Garston, and Princes Risborough have monitored many of the above solutions in great details through site measurements and monitoring. Some of the results are described in reports and digests available from BRE Publications.

Demonstration Projects

External wall insulation and dry lining of dwelling can be expensive. The London Borough of Harrow successfully used external wall insulation and anti-condensation measures in houses on the Eastcote Lane Estate, Harrow. This was monitored



Figures above show houses in Harrow which suffered badly from condensation and mould growth (top). Under the EEO's Energy Efficiency Demonstration Project Scheme, the houses were renovated using external wall insulation (middle) to both cure the condensation problem and improve appearance (bottom).



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in detail by The Building Research Establishment, Garston, under the Department of Energy's Demonstration Scheme and details of this along with other external and internal wall insulation projects are described in Project Profiles 110, 88 and 209 which are available from the Energy Efficiency Office.

Flats often suffer from low temperatures in bedrooms coupled with cold bridging resulting in condensation. A number of London Local Authorities have tried dry lining and central heating.

Extraction fans are often fitted to bathrooms and kitchens to remove the moisture generated close to the source. Humidistat sensors can be used to control their operation when the relative humidity rises above a pre-determined level. These are more useful than manually operated types. If choosing fans, consideration should be given to their maintenance and occupants acceptance of them. Not all tenants use them effectively.

Dehumidifiers remove moisture from the air. These can be portable and located in rooms with high relative humidities to reduce the room vapour pressure. Their use will also increase the room air temperature slightly. Some types of dehumidifiers can be noisy in operation although attempts are being made to reduce noise levels. This certainly affects their positioning and ultimate use. It also

needs to be decided who pays for their running cost.

Trickle ventilators have been used at Edward's Terrace, Abertridwr. These are adjustable slots which allow limited amounts of local ventilation and are usually positioned above windows.

Drip trays collect condensation from windows which is diverted outside through small channels. It is important that these channels do not get blocked as this would result in the trays overflowing and damp patches or mould occurring in the reveals.

Central heating, of course, will raise the air temperature, reduce relative humidity to below 70% R.H. and will improve comfort levels. This measure is often considered together with improved insulation levels.

Educating tenants

Tenants life style can initiate conditions suitable for mould growth. Condensation and mould have occurred in flats for no apparent reason other than a change of tenant. Occupants can help themselves through simple practices aimed at reducing the levels of moisture in the air. Avoid drying clothes on radiators, using lids on saucepans, avoid using paraffin or liquid gas heaters, opening windows and closing internal doors after bathing or cooking.

Internal door use is significant. After

one has a bath, resulting in high vapour pressures, why leave the bathroom door open? This serves to help the moisture circulate to the colder bedrooms or hall where it condenses on walls. Leaflets can be circulated outlining these measures.

Conclusions

In summary, there are a number of different solutions to the problem of condensation and mould growth. The correct course of action depends upon the building and conditions found. Basic monitoring using temperature and humidity recorders, moisture meters etc. before a solution is considered can save money by indicating the correct solution. Subsequent monitoring after a measure is implemented will show whether you have got it right.

Acknowledgements

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