Tree Cassyn

Damp. Timber. Moisture Investigations.

TREE CASSYN BUILDING SCIENCE SERIES

TC-04

Understanding Surface Condensation & Mould

The Visible Signs of Moisture Stress

EVIDENCE-LED GUIDANCE FOR TRADITIONAL BUILDINGS ON THE ISLE OF MAN



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Foreword

Almost every building contains moisture

That simple statement often surprises people because we tend to think of buildings as either dry or damp. Buildings are not quite that simple. All buildings continually interact with moisture. Rain falls against them, water vapour passes through them, and the people living inside them generate moisture every day through cooking, showering, breathing and countless other ordinary activities.

The important question is therefore not whether moisture is present, but **how the building manages it**.

This guide has been written to explain one of the most commonly misunderstood aspects of building performance: condensation.

Although most people associate condensation with steamed-up windows on a winter morning, the same physical process can affect cold walls, window reveals, ceilings and areas hidden behind furniture. If those conditions persist, mould may follow. Understanding why this happens is often the first step towards preventing the problem from becoming a recurring feature of the home.

Throughout this guide we deliberately avoid unnecessary technical language wherever possible. Instead, we explain the science in plain English, introducing technical terms only where they genuinely improve understanding.

Our aim is not simply to explain what condensation is, but to help you understand how moisture behaves within buildings. Once that behaviour makes sense, many apparently unrelated defects begin to look rather less mysterious.

Before We Begin…

If, by the time you finish this guide, you find yourself looking at your home differently than you did before you started reading it, then we will have achieved exactly what we set out to achieve.

The purpose of the Tree Cassyn Building Science Series is not simply to explain building defects. It is to help homeowners understand how buildings work, because that understanding leaves us far better equipped to recognise why defects occur, how they should be investigated and, perhaps most importantly, how they can often be prevented.

We hope you find it useful.



Introduction

If you asked a group of homeowners what causes dampness, you would probably receive many different answers: leaking gutters, rising damp and condensation would almost certainly feature among them. Any of those answers can sometimes be correct.

What they have in common is that they begin with the dampness itself. Successful building investigations rarely do. They begin with a more useful question: "How is moisture behaving within this building?"

That is also the question we ask at the beginning of a Tree Cassyn moisture investigation. It reflects the approach encouraged by the 2022 RICS, Historic England and Property Care Association Joint Position Statement: understand the building and the behaviour of the moisture before deciding upon the diagnosis or the treatment.

Once we understand how moisture moves, many apparently unrelated defects begin to make sense.

That is why this guide does not begin with mould, damp patches or expensive repairs. It begins with moisture itself and the way it continually changes.

It changes from liquid water into invisible water vapour. It moves with the air inside our homes. As temperatures change, it can condense onto cooler surfaces before evaporating once again.

Throughout that journey, moisture obeys the laws of physics, and understanding the journey lies at the heart of successful building investigation.

The chapters that follow have been arranged deliberately around questions we frequently hear from homeowners. Taken together, the answers build a picture of how buildings manage moisture and, ultimately, how we investigate dampness.

Chapter 1

What is Condensation?

"Why are my windows covered in water every winter morning?"

It is one of the most common questions homeowners ask. Almost everyone has seen droplets forming on the inside of a window during cold weather, or watched a bathroom mirror mist over after a hot shower; both are familiar examples of condensation.

In simple terms, condensation occurs when invisible water vapour in the air changes back into liquid water. The window, mirror or wall has not created that water. The moisture was already present in the room, invisibly, as water vapour.

This is a completely natural physical process that occurs every day, both inside and outside buildings. The same change is responsible for morning dew on grass, mist over rivers and clouds forming in the atmosphere; buildings are simply another place in which the physics can be observed.

Whenever warm, moisture-laden air cools sufficiently, some of the water vapour it contains changes back into liquid water.

Understanding why this happens is the first step towards understanding condensation itself.

At first sight condensation appears relatively simple, but it represents just one stage in the continual movement of moisture through a building. To understand why it develops, we first need to understand where that moisture comes from.



Chapter 2

Where Does All This Moisture Come From?

"If nobody has spilled any water, where has all this moisture actually come from?"

It is a fair question, because every occupied home produces moisture. Even when nobody has spilled a drop, water vapour is continually being released into the indoor air throughout the day. Most of the time we simply do not notice, because the vapour itself is invisible.

Some everyday activities can release quite large quantities over a relatively short period. Cooking, showering, bathing, boiling kettles and drying clothes indoors all add water vapour to the air, while even breathing contributes moisture continuously, particularly overnight when bedroom doors and windows often remain closed.

Historically, many traditional homes had much higher rates of uncontrolled air change through open chimneys, draughty windows and other gaps. While often uncomfortable and inefficient, this could disperse internally generated water vapour more readily.

Modern homes - and many renovated traditional homes - are generally much better sealed, warmer, more comfortable and more energy efficient. The other side of that improvement is that they rely much more heavily upon planned ventilation to remove the moisture continually produced by everyday living.

At the same time, our lifestyles have changed. Daily showers, additional bathrooms and en-suite shower rooms are commonplace, while utility rooms often contain washing machines and tumble dryers.

Clothes are frequently dried indoors during the winter months - or indeed at almost any time of year when the famously unpredictable Manx weather makes drying washing outdoors rather optimistic.

None of these changes is inherently problematic; modern lifestyles are simply different from those of previous generations. Buildings have changed too, although the way we live in them has arguably changed even more.

Many traditional buildings are therefore expected to manage significantly greater quantities of internally generated moisture than their original builders could ever have anticipated.

Understanding how buildings respond to that additional moisture is one of the keys to understanding condensation.

Which leads to the next question: once moisture enters the air, where does it go?



Chapter 3

Moisture is Always on the Move

"If I boil a kettle in the kitchen, why does the condensation appear on the bedroom window upstairs?"

At first this can seem rather odd. The moisture was produced downstairs, yet the water appears upstairs.

The missing part of the story is that water vapour does not simply stay where it was created. It is continually moving.

Once moisture has entered the air inside a building, it rarely remains where it was first produced. Instead, it becomes part of the air circulating throughout the home.

As we move from room to room, open internal doors, walk up and down the stairs, or simply allow warm air to rise naturally, moisture moves with the surrounding air.

The steam you briefly see rising from a saucepan or a cup of tea is only a tiny part of the picture. Most water vapour is completely invisible, quietly mixing with the surrounding air and gradually spreading throughout the building.

This is why condensation often appears in rooms where very little moisture is actually produced.

> **A Moment to Think**
>
> Imagine placing a drop of food colouring into a glass of water. It begins in one place, but gradually spreads until the colour is distributed throughout the glass. Water vapour behaves in a broadly similar way: moisture generated in one room does not remain there indefinitely, but mixes with the air and can travel to other parts of the building.

Moisture Travels with the Air

For visible condensation, this movement of moist air is particularly important.

Warm air leaving a kitchen or bathroom does not remain neatly inside that room. It mixes with the air around it, passes through doorways and stairwells and eventually reaches colder parts of the building.

A small amount of water vapour can also move slowly through porous building materials. That slower journey becomes important when we look inside traditional walls, and we explore it separately in TC-05.

For now, the important point is simpler: the place where moisture is produced and the place where condensation appears are often two different places.

We now know where moisture comes from and that it is continually moving. The next question is perhaps the most important so far: why does invisible water vapour suddenly become liquid water?



Chapter 4

Why Does Condensation Form?

"If water vapour is invisible, why does it suddenly turn back into water?"

We have all seen it happen: a cold drinks bottle taken from the fridge becomes covered in droplets, a bathroom mirror mists over after a shower, or a window streams with water on a cold winter morning. Although the examples look different, exactly the same physical process is taking place.

The important change happens in the thin layer of air beside the cold surface. As that air cools, it can eventually reach saturation. At the dew point, some of the water vapour present can begin to change into liquid water.

Warm Air and Cold Air

One of the easiest ways to picture this is to imagine that air behaves rather like a sponge. It is only an analogy: air does not literally "hold" water in the way a sponge does, but temperature strongly influences how much water vapour can be present before saturation is reached.

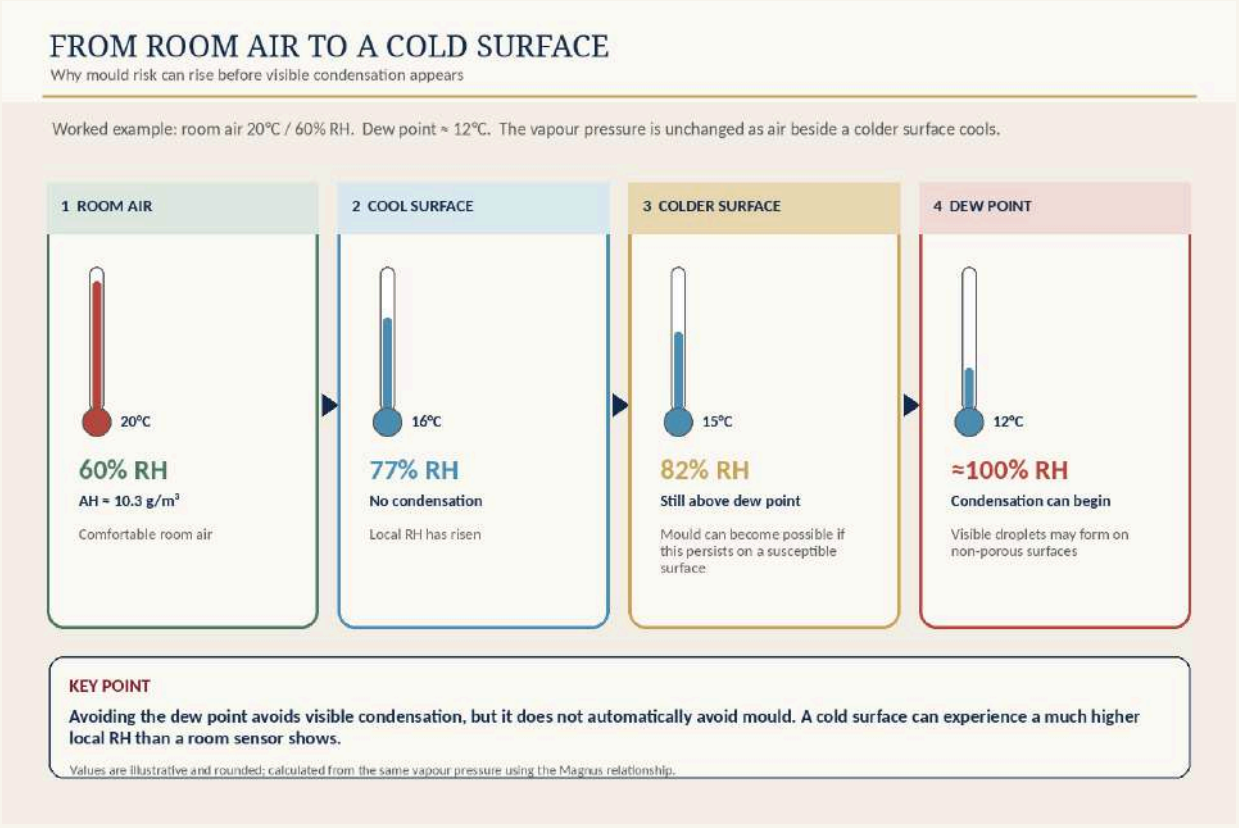
A large sponge can hold more water than a small one. In a similar way, a greater concentration of water vapour can be present in warmer air before saturation is reached. As the air cools, the saturation point falls; if cooling continues far enough, some of the vapour changes into liquid water. That is condensation.

The Dew Point

The temperature at which condensation begins is known as the dew point.

Although the name may sound technical, the idea itself is straightforward. The dew point is the temperature at which the air becomes saturated with its existing moisture load; above that temperature the moisture remains as invisible vapour, while at or below it condensation can begin.

One important point is worth remembering: the dew point is not fixed. It changes according to how much moisture the air already contains, so relatively dry air must cool much further before condensation occurs than air carrying a high moisture load.



This explains why condensation often becomes worse after cooking, showering or drying clothes indoors. The building has not necessarily become colder; the increased moisture load has simply moved the dew point closer to the building's normal internal temperatures.

Condensation therefore does not occur because a wall is simply "cold"; it occurs because that wall has become cold enough for the amount of moisture already present in the air. That leads us to another question: how do we actually measure the amount of moisture in the air?

Chapter 5

How Much Moisture Is Actually in the Air?

"People often say the air 'feels damp'... but can we actually measure how much moisture it contains?"

Yes - and this is where condensation becomes slightly counter-intuitive. During a moisture investigation we are often less interested in how a room feels than in how much water vapour is actually present in the air, because those two things are not always the same.

Two Very Different Questions

Before we can understand condensation properly, we need to separate two questions that are often confused: how much water vapour is actually present in the air, and how close is that air to becoming saturated? They sound similar, but they describe two different things, and the distinction makes condensation much easier to understand.

Absolute Humidity

The mass of water vapour present within a given volume of air is known as Absolute Humidity.

It is usually expressed as **grams of water vapour per cubic metre of air (g/m³)**.

Unlike Relative Humidity, Absolute Humidity gives us a practical indication of the actual concentration of water vapour in the air, rather than how close that air is to saturation.

Imagine a sealed sample of air containing a known mass of water vapour.

Warming or cooling that sample, without allowing moisture to enter or leave, does not create or remove water vapour. Its Relative Humidity may change substantially even though the mass of vapour present has not.

In real buildings the picture is slightly more complicated. Air expands, contracts, mixes and is continually exchanged, and because Absolute Humidity is expressed per cubic metre it is not perfectly independent of temperature, pressure or air movement.

Even so, it is much less directly affected by temperature than Relative Humidity, which makes it particularly useful when comparing moisture conditions within a building. For more exact psychrometric work, vapour pressure or humidity ratio may be preferable when following the same air mass through heating or cooling.

Cooking, showering and drying clothes tend to increase the moisture concentration, while ventilation with air containing less water vapour can reduce it. Comparing Absolute Humidity between rooms, outside air



and different times can therefore help us understand where moisture is being produced and how it is moving.

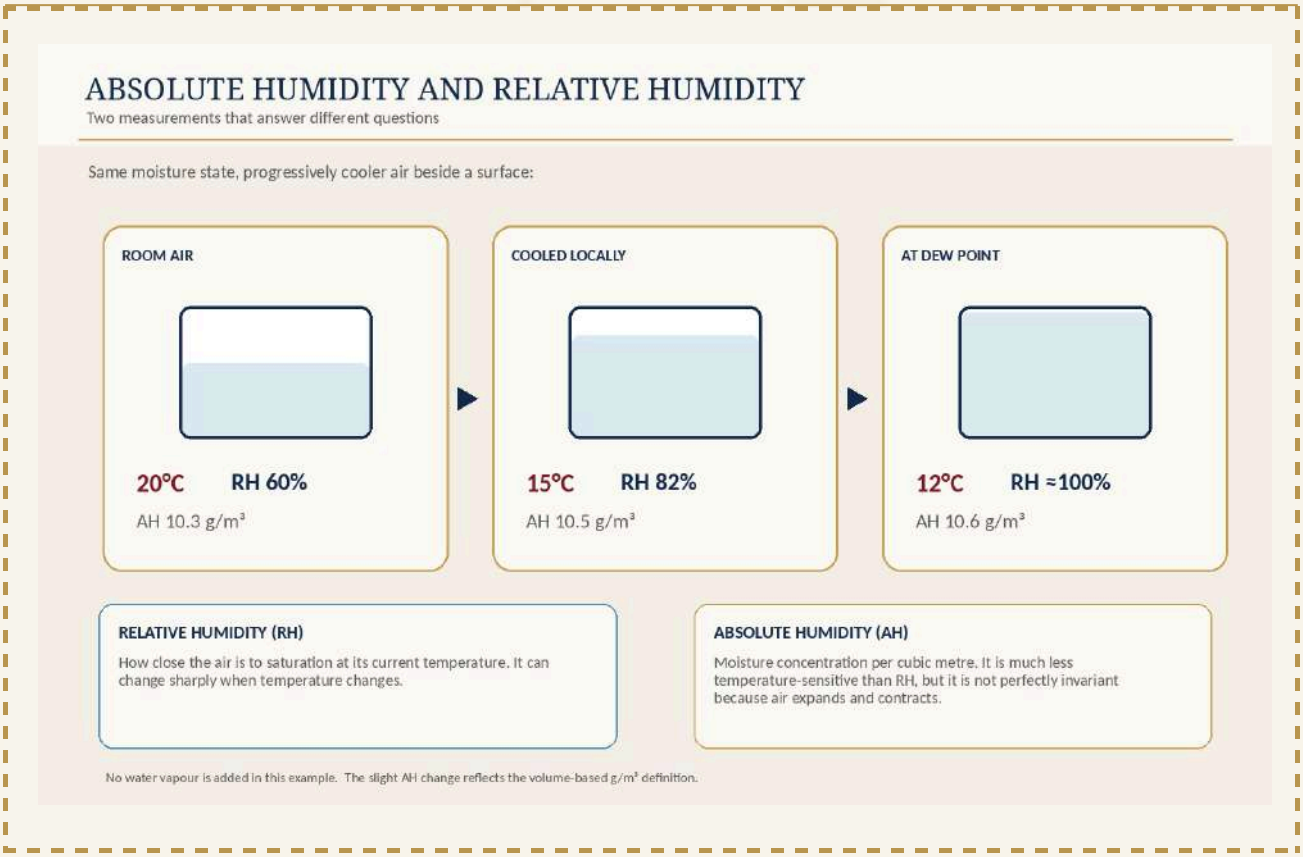
Relative Humidity

This brings us to a measurement that many people have heard of: Relative Humidity, usually shortened to RH. Unlike Absolute Humidity, RH does not tell us how much water vapour is present; it tells us how close the air is to saturation at its current temperature.

The Expanding Bucket

Imagine a bucket containing water, but with one unusual feature: the bucket changes size. As the air becomes warmer the bucket becomes larger; as the air cools it becomes smaller. The amount of water inside has not changed, but the available capacity has. As the bucket shrinks it appears progressively fuller until eventually it reaches the brim. That is essentially what Relative Humidity describes.

It tells us **how full the bucket is**, not how much water it contains.



This is why Relative Humidity often changes throughout the day, even when no additional moisture has been added to the building.

The amount of water may remain exactly the same; only the available capacity has changed.

Why This Matters

This explains something that often feels contradictory.

A room may feel perfectly comfortable during the afternoon and yet develop condensation on the windows later that evening. Often the amount of moisture has hardly changed at all; the temperature has. As the air cools, its capacity reduces, the Relative Humidity rises and eventually the dew point may be reached.

And actually...

Cooling a room does not create moisture.

If no moisture is added or removed, the Absolute Humidity can remain unchanged while the Relative Humidity rises.

What has changed is the air's proximity to saturation - not the amount of water vapour already present.

We are now beginning to understand why condensation occurs, but another question naturally follows: if the air outside also contains moisture, why does opening a window often reduce condensation instead of making it worse?

Chapter 6

When Does Ventilation Help?

"If it's cold and raining outside, surely opening a window just lets damp air into the house?"

It is one of the most common questions we are asked and, at first glance, the logic seems impeccable: if the weather outside is wet, surely the air outside must also be "wetter"? Not necessarily.

A Building Is Not a Closed Box

Every occupied building continually produces moisture. Cooking, bathing, breathing and drying clothes all add water vapour to the indoor air, and without some means of removal that concentration can build day after day.

Outside, things are rather different. The atmosphere is enormous, the air is continually mixing and wind disperses moisture over huge distances, so moisture released from one building is diluted into a vastly greater volume of air.

Inside a building, however, the same moisture is being released into a comparatively small volume. Unless some of it is removed, the concentration gradually increases.

Cold Air Can Still Contain Less Moisture

This is where the difference between **Relative Humidity** and **Absolute Humidity**, which we explored in the previous chapter, becomes particularly useful.

Cold outdoor air may have a very high Relative Humidity - it might even be raining - yet that does not necessarily mean it contains a large quantity of water vapour. At lower temperatures, saturation is reached with less vapour present.

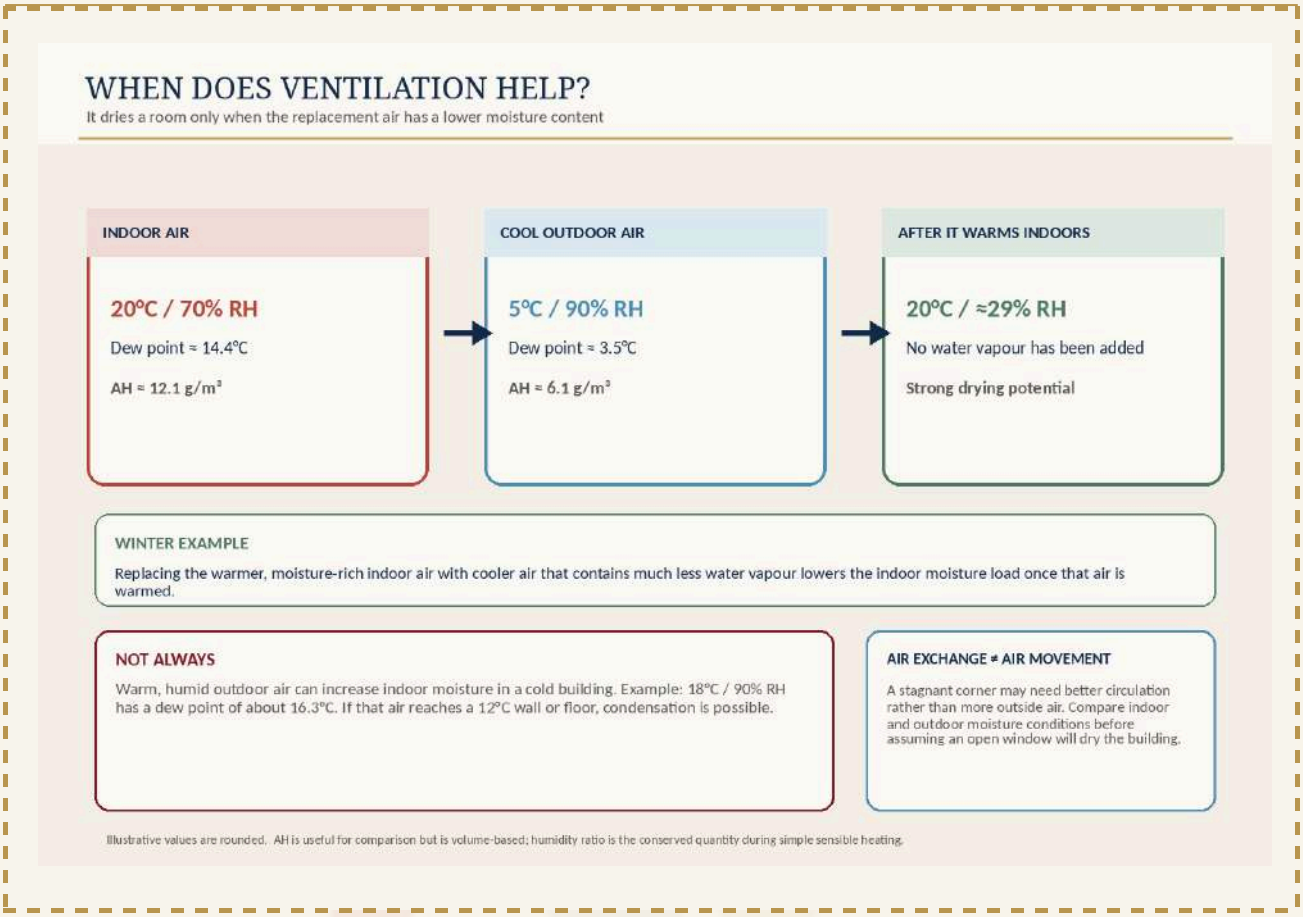
So during much of the cooler part of the year — precisely when condensation is most likely to cause problems — outdoor air can have a high Relative Humidity while still containing **less actual water vapour** than the warmer air inside the building.

That distinction is important. When cooler outside air enters the building and warms up, warming it does not add water vapour. Its Relative Humidity falls as its temperature rises. Because Absolute Humidity is expressed per cubic metre, the numerical g/m³ value can change slightly as the air expands; the important point is that the incoming air may still carry a much lower moisture load than the indoor air it replaces.

This is one of the reasons ventilation can reduce condensation even when the weather outside feels cold and damp.



Ventilation is therefore not simply about bringing "dry air" into a building. It is about managed air exchange when the replacement air contains less moisture, and useful air movement where local circulation is poor.



When Ventilation Can Make Things Worse

The reverse can also happen. If outside air contains more water vapour than the indoor air, ventilation can increase the moisture load rather than reduce it.

This can matter particularly in spring or early summer when warm, humid outside air enters a thermally massive building that is still cold after winter. If the incoming air meets a surface below its dew point, condensation can occur even though opening the windows felt like the natural way to "air the building".

The useful comparison is therefore not outdoor Relative Humidity alone. Internal and external moisture content, dew point, surface temperature and the purpose of the ventilation all matter.

Air Exchange and Air Movement

People often use the word ventilation to describe two different things. Air exchange replaces one body of air with another, usually by bringing outside air in and allowing indoor air to leave. Air movement simply circulates air within the room and does not necessarily change its overall moisture content.

That distinction is diagnostically useful. A stagnant cold corner behind furniture may benefit from better circulation even when importing more outside air would offer little drying advantage.

Seeking Balance

Moisture is continually being added to the indoor air. A shower, a cooked meal or a load of washing dried indoors all push that balance in one direction; effective extraction and appropriate air exchange move it back in the other.

Ventilation is not intended to eliminate moisture - that would be impossible - but to prevent it from continually accumulating while maintaining acceptable comfort and indoor air quality.

Chapter 7

Why Is It Always the Same Wall?

"Why does condensation always seem to come back to exactly the same place?"

It may be the corner of a bedroom, the space behind a wardrobe, a window reveal or one particular external wall. It is natural to assume there must be something wrong with that exact spot - and sometimes there is. But very often the explanation is simpler: not every part of a building is the same temperature.

Every Building Has Cold Spots

Although we often think of a room as having one temperature, the building fabric itself is far from uniform. Some parts of a room warm up quickly while others remain noticeably cooler. Window glass, for example, is usually colder than the surrounding wall, while external corners often lose heat more quickly than large flat wall surfaces.

Ceilings immediately below an uninsulated roof may remain cooler than those beneath a heated room. Walls adjoining unheated garages, stairwells or roof spaces often behave differently from walls separating two heated rooms.

These cooler areas are commonly referred to as **cold spots**.

They are simply parts of the building where condensation is more likely to occur because they reach the dew point before warmer surrounding surfaces.

Some cold spots are also thermal bridges: parts of the construction through which heat is conducted more readily, for example at certain junctions, lintels or where insulation is interrupted. The terms are not interchangeable, however. A surface can be colder because of orientation, exposure, reduced heating or restricted air circulation without there being a thermal bridge at all.

The Building Doesn't Know It's a Bedroom

The building itself does not know how we use a room.

To the building, a spare bedroom is simply another room.

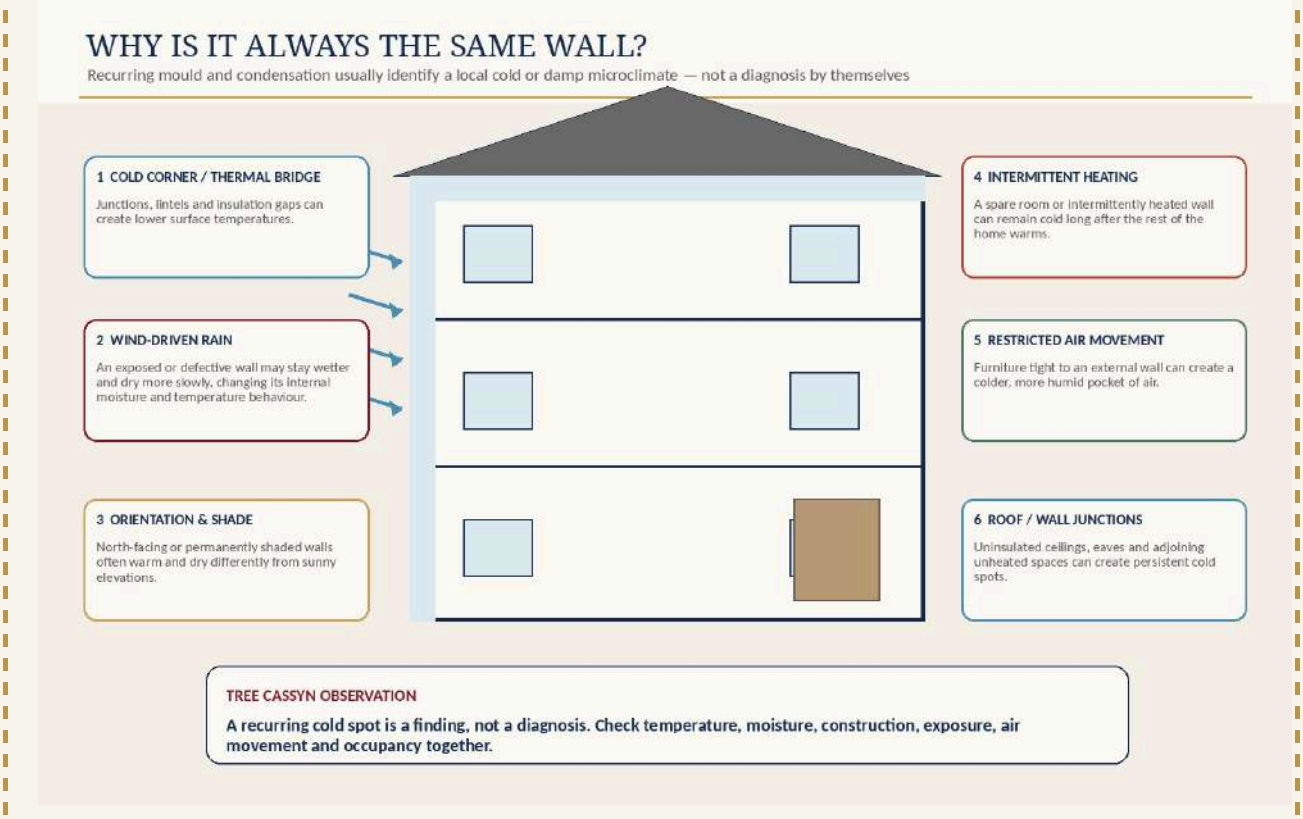
But to us, that room may remain unheated for much of the winter.

Similarly, a wardrobe pushed tightly against an external wall may seem completely harmless.

Yet by restricting the circulation of warmer room air, it creates a small pocket of cooler air behind it.



The wall behind the wardrobe therefore remains colder and condensation becomes more likely. Any mould that eventually develops there is not caused by the wardrobe itself, but by the colder, less well-ventilated conditions it has unintentionally created.



Every Building Has Its Own Microclimate

It is easy to think of a house as an isolated object.

In reality, every building sits within its own unique environment.

Its orientation, prevailing wind, exposure to sunshine, nearby buildings, mature trees, hillsides and shelter from neighbouring properties all influence how the building gains heat, loses heat and dries after becoming wet.

Two apparently identical houses standing opposite one another can behave quite differently simply because they experience different environmental conditions.

Orientation Matters

A south-facing wall may receive several hours of warming sunshine during the day while a north-facing wall receives almost none during winter. East- and west-facing elevations also warm at different times, so



otherwise similar walls can follow quite different temperature cycles. The differences may be subtle on any one day, but over an entire winter they can influence where condensation is most likely to occur.

Trees and Shade

Natural surroundings also play an important part.

Dense tree cover may reduce the amount of sunshine reaching a building throughout much of the day.

Walls that remain permanently shaded often dry more slowly after becoming wet.

On the Isle of Man, where mature trees, steep valleys and rapidly changing weather are all common features of the landscape, these local conditions frequently influence how traditional buildings behave.

Rain Exposure and Wet Walls

On exposed elevations, wind-driven rain can materially change the conditions within a wall. Masonry that becomes wetter may dry more slowly, contribute moisture to the internal environment as it dries and behave differently thermally from the same wall in a sheltered, drier condition.

A cold, mould-prone internal surface therefore does not prove that the original moisture source is internal humidity. Orientation, rain exposure, defects, wall construction and drying conditions remain part of the investigation, particularly in the exposed marine climate of the Isle of Man.

The Occupants Become Part of the Building

The people living in a building are part of the equation too.

Two houses can have identical construction and heating systems yet develop very different moisture behaviour.

One family may produce relatively little moisture. Another may cook more frequently, take longer showers and dry washing indoors throughout the winter. Neither household is necessarily doing anything wrong; they are simply living differently, and the building responds accordingly.

Cold spots explain why condensation often returns to the same places. But when those conditions persist, another familiar problem can follow: mould.



Chapter 8

Why Condensation and Mould Often Occur Together

"Why does the same black mould keep coming back, even after I clean it away?"

Condensation and mould often appear together, but one does not simply turn into the other. Condensation is liquid water; mould is a living fungus. More importantly, mould can develop on a surface that remains sufficiently humid for long enough even when liquid condensation has never been visible.

Mould Spores Are Already Around Us

Moulds are fungi. Their microscopic spores are a normal part of the environment and are present in outdoor and indoor air. Trying to remove every mould spore from a home would be neither realistic nor necessary. Most of the time those spores simply remain dormant or pass through the building without causing a visible problem.

For mould to establish itself and grow, it needs suitable conditions. Moisture is one of the most important. That moisture may come from a leak or penetrating dampness. But in many homes it is provided by persistently humid air, cold surfaces and repeated episodes of condensation.

Why Surface Humidity Matters

There is no single Relative Humidity at which every type of mould suddenly begins to grow. Temperature, the material at the surface, the length of time it remains humid and the particular fungus all influence what happens.

As an investigative guide rather than a universal mould-growth threshold, sustained room RH around or above 60% deserves attention. Its significance depends on temperature, duration and the surfaces within the room. More importantly, the air immediately beside a cold wall or corner can reach a much higher Relative Humidity than a sensor positioned in the middle of the room.

That is why mould so often appears first in external corners, around window reveals, behind wardrobes and at other cold spots - sometimes before visible condensation has ever appeared.

And actually...

A room at 20°C and 60% RH has a dew point of about 12°C.

If that air reaches a 15°C wall surface, the local air beside the surface rises to about 82% RH. The wall is still around 3°C above dew point, so visible condensation need not occur.

If those conditions persist on a susceptible surface, mould can become possible. Avoiding the dew point is therefore not the same as avoiding mould.

And actually...

A room can have an apparently reasonable RH reading while a cold corner is experiencing very different conditions.

The colder the surface becomes, the closer the air immediately beside it moves towards saturation.

This is another reason why a single room reading never tells the whole story.

Not All Mould Looks the Same

Different moulds can colonise damp building surfaces. Common indoor genera include Aspergillus, Penicillium and Cladosporium, and several different fungi may sometimes be present in the same building. Their appearance varies. Mould may look black, green, grey, brown or white. Colour alone does not reliably identify the species, nor does it tell us how significant the health risk may be.

What About "Toxic Black Mould"?

The phrase "toxic black mould" has received considerable public attention, but it is not a precise scientific description and should not be treated as a diagnosis.

Stachybotrys chartarum is one mould commonly associated with the phrase, but many different fungi can appear dark or black. Colour alone cannot reliably identify the species.

Some mould fungi can produce mycotoxins under suitable growing conditions, but visual inspection cannot establish whether toxins are present or what health significance a particular patch of mould may have.

From a building-investigation perspective, the priority is therefore to identify and correct the moisture conditions allowing significant mould growth to persist rather than attempting to judge species or risk from colour alone.

Mould and Health

Not everyone exposed to damp and mould develops symptoms, but exposure can affect health and some people are at greater risk because of age, respiratory disease, allergy, immune status or other factors.

The established health concerns associated with damp and mould relate particularly to respiratory symptoms, allergic responses and the development or worsening of conditions such as asthma and rhinitis.

Children, people with existing respiratory disease and people with weakened immune systems can be more susceptible.

Mould growth can release spores, fragments, allergens and irritants into the indoor air. Some species can also produce mycotoxins under particular conditions.

That does not mean that every small area of household mould represents a medical emergency. It does mean that persistent or extensive mould should not simply be ignored.

Where an occupant has persistent respiratory symptoms, a known mould sensitivity or another relevant health condition, medical advice should come from an appropriate healthcare professional.

Mould Is a Symptom

From a building-investigation perspective, this is the most important point: mould tells us that the local environment has been suitable for fungal growth, but it does not tell us why.

Condensation may be responsible. So may a leak, penetrating moisture, external wetting, a thermal bridge, inadequate extraction, restricted air movement - or several mechanisms acting together.

Cleaning the surface may remove visible mould for a time. Unless the moisture conditions are changed, however, it is likely to return.

The real task is therefore not simply to remove the mould, but to understand why the surface became suitable for fungal growth in the first place.



Chapter 9

So What Should We Actually Do About Condensation?

"If condensation is about moisture, temperature and ventilation... which one do I actually need to change?"

By this point we have followed the process from everyday moisture production to visible condensation and, in some cases, mould growth. The tempting question now is: which single thing do we change?

There is rarely one condensation switch to turn off. Opening the windows, turning the heating up, buying a dehumidifier or adding insulation may each help in the right circumstances, but the better answer usually comes from understanding the balance between several factors.

Four Things Usually Matter

For surface condensation, four factors are especially useful to consider: the amount of moisture being produced, how effectively it is being removed, the temperature of the vulnerable surfaces and the length of time those conditions persist. That gives us a much better framework than simply asking whether a room is "damp".

Reduce Moisture at Source

The most efficient moisture to remove is often the moisture that has only just been produced.

Effective extraction in kitchens and bathrooms matters because it captures moisture before it spreads through the rest of the building. Using lids when cooking, venting tumble dryers correctly and avoiding unnecessary indoor drying of clothes can all reduce the moisture load.

None of this is about blaming occupants for living normally. It is about recognising that everyday activities form part of the moisture balance inside every occupied building.

Provide Useful Ventilation

Ventilation should remove moisture without making the home needlessly cold or uncomfortable.

Background or whole-dwelling ventilation, appropriately used windows and effective mechanical extract can all play a part. The right arrangement depends upon the building, its occupancy and the rooms in which moisture is being generated.



Ventilation Has Different Jobs

In practice, ventilation can mean local extraction at the source, background or whole-dwelling air exchange, short periods of purge ventilation through windows, and transfer paths that allow air to move towards extract points. These functions are complementary rather than interchangeable.

An Extract Fan Must Actually Extract

Having an extract fan is not the same as having effective extraction. During investigation it can be useful to consider actual airflow, whether the fan operates when required, duct length and restriction, the external discharge point, overrun or humidity controls and whether replacement air can reach the room.

What About a Dehumidifier?

A dehumidifier can be useful for temporary moisture control or in particular managed situations, but it does not repair a leak, restore inadequate extraction or correct a persistently cold surface.

In a wet traditional building, aggressive dehumidification can also accelerate evaporation and salt activity. It should therefore be used for a defined purpose and with an understanding of the underlying moisture source rather than as a substitute for diagnosis.

Keep Vulnerable Surfaces Warmer

Reducing the moisture load is only half of the equation.

A surface that remains warmer is less likely to reach the dew point. More consistent heating, improved insulation in appropriate locations, attention to genuine thermal bridges and allowing room air to circulate behind furniture can all influence surface temperature.

The aim is not to heat every building excessively. It is to avoid creating persistently cold surfaces while moisture levels remain high.

When a Snapshot Is Not Enough

Some condensation problems are obvious during a single inspection. Others are highly dependent upon time of day, heating cycles, weather and patterns of occupation.

In those cases, data logging can be extremely useful. Recording temperature and Relative Humidity over days or weeks allows us to see how conditions change rather than relying on one reading taken at one moment.



Where possible, the strongest monitoring compares indoor and outdoor conditions over the same period. From those measurements we can consider Absolute Humidity, dew point and drying potential, and compare them with surface temperatures, thermal-imaging observations, heating cycles and known moisture-producing events.

The purpose of collecting more data is not to produce more numbers; it is to test whether the explanation fits the way the building actually behaves.

Tree Cassyn Observation

Mould and condensation are symptoms to be explained, not labels to be applied.

A useful investigation looks at moisture production, ventilation, heating, surface temperature, construction and occupancy together.

The best remedy is the one that addresses the mechanism actually operating in that building.

Beyond the Surface

Everything in this guide has deliberately concentrated on condensation that becomes visible on surfaces. A wall, of course, does not stop getting colder simply because we can no longer see inside it.

In many traditional buildings, water vapour can also move slowly through the building fabric. If the right combination of moisture and temperature occurs somewhere within that construction, the same change from vapour to liquid can happen out of sight.

That hidden process is interstitial condensation, and it is where the next guide in this series, TC-05, begins.



Closing Thoughts

Surface condensation is one of the most familiar moisture problems in buildings, but familiarity can make it deceptively easy to oversimplify.

At its simplest, the physics is straightforward. Air contains water vapour. When moisture-laden air encounters a sufficiently cold surface, the air immediately next to that surface cools. If it reaches its dew-point temperature, condensation can occur. Mould, however, does not require visible condensation: a surface can remain above dew point while still experiencing a sufficiently high local Relative Humidity for long enough to support growth.

The physics can be straightforward. The building is usually more complicated.

Internal moisture production matters. Ventilation matters. Heating matters. So do insulation, thermal bridges, rain exposure, surface temperatures, occupancy, room layout and the way the building has been constructed or altered. Usually, it is the interaction between several of these factors that produces the conditions we eventually see as condensation or mould.

This is why condensation should not automatically be treated as evidence that a building is being used incorrectly.

Advice to produce less moisture, ventilate more and maintain more consistent heating can be entirely reasonable. In many homes, relatively modest changes can make a substantial difference. But those recommendations also have limits.

The building itself is part of the equation.

Poor insulation, thermal bridging, cold walls and ceilings, inadequate extract ventilation or an inefficient heating system can make condensation much more difficult to avoid. These conditions are not confined to any particular age or type of property. They may be found in poorly insulated modern construction, traditional buildings, converted flats, HMOs, social housing and buildings that have been altered or subdivided without sufficient consideration of heat, moisture and ventilation.

Nor does an occupant necessarily have control over all of those conditions.



A tenant cannot readily improve the insulation of an external wall, correct a significant thermal bridge or install a better ventilation system. Increasing ventilation may reduce internal humidity while also increasing heat loss. Additional heating may raise internal temperatures and warm surfaces, but the energy required to maintain those conditions may not always be affordable. **Fuel poverty can therefore become part of the condensation problem: the building may require a level of heating to maintain sufficiently warm internal surfaces that the household cannot realistically afford to provide.**

Sometimes, therefore, there may be no simple or wholly satisfactory answer.

The physics may be relatively easy to understand while changing the conditions responsible for the problem is much more difficult. Smaller measures may reduce the frequency or severity of condensation without eliminating it. In other cases, meaningful improvement may ultimately require changes to the building itself. That does not make investigation pointless. Quite the opposite: it makes understanding the real constraints even more important.

Good diagnosis does not guarantee an easy solution. Its value lies in establishing what is actually happening, understanding the factors contributing to it, identifying what can realistically be changed and recognising where the limitations of the building itself remain.

Perhaps the most useful question is therefore not simply:

“How do we stop the condensation?”

but:

“Why is condensation occurring here, in these conditions, and which of those conditions can realistically be changed?”

Once we start asking that question, condensation becomes less about blame and more about understanding the building.



Glossary of Key Terms

A quick reference to the technical terms introduced throughout TC-04.

Absolute Humidity (AH) The mass concentration of water vapour in a given volume of air, usually expressed in grams per cubic metre (g/m^3). It is useful for practical comparison but can vary slightly with temperature and pressure because the air volume changes.	**Relative Humidity (RH)** A percentage describing how close the air is to saturation at its current temperature. RH can rise as air cools even when no moisture has been added.
Dew Point The temperature at which air becomes saturated with its existing moisture load and condensation can begin.	**Saturation** The condition in which air has reached 100% RH at its current temperature.
Surface Condensation Condensation that forms on a visible surface, such as glazing, a cold wall, a window reveal or a ceiling.	**Water Vapour** Water in its gaseous, invisible form. In occupied homes it moves readily with the surrounding air.
Cold Spot A part of the building surface that remains colder than its surroundings and therefore reaches the dew point sooner.	**Mould** A group of fungi that can grow on building surfaces when moisture, temperature, time and available nutrients provide suitable conditions.
Mycotoxin A substance that some mould fungi can produce under particular growing conditions. Its presence or significance cannot be judged simply from mould colour.	**Interstitial Condensation** Condensation occurring within the construction rather than on a visible surface. This is explored in TC-05.
Surface Relative Humidity The Relative Humidity of the air immediately beside a surface. It can be much higher than the RH measured in the centre of the room when the surface is cold.	**Air Exchange** The replacement of one body of air with another, usually indoor air with outside air. Its drying effect depends on the moisture content of the replacement air.
Air Movement Circulation or mixing of air within a space without necessarily replacing it with outside air. It can reduce stagnant, humid pockets at cold surfaces.	**Wind-Driven Rain** Rain driven against a wall by wind. Exposure, orientation, defects and drying conditions can all affect the moisture behaviour of an external wall.

Quick reminder: AH = moisture concentration per unit volume | RH = closeness to saturation | Surface RH = conditions immediately beside the surface | Dew point = the temperature at which saturation is reached.



Further Reading & Technical References

This guide is intended to make a complex subject understandable rather than reproduce the much larger body of technical and medical guidance that exists around condensation, indoor moisture and mould.

For readers who would like to explore the subject in greater depth, the following publications provide useful further reading. Some are written primarily for building professionals; others are intended for a wider audience.

Moisture, condensation and building investigation

BS 5250:2021 - Management of moisture in buildings. Code of practice. The principal British Standard covering moisture management in buildings, including surface and interstitial condensation and whole-building moisture risk. Read online

RICS / Historic England / Property Care Association - Investigation of Moisture and its Effects on Traditional Buildings: Principles and Competencies, **Joint Position Statement**, 1st edition (September 2022). Particularly useful on evidence-led investigation and avoiding conclusions based on isolated measurements. Read online

Historic England - Assessing Damp in Historic Buildings: A Practical Guide to Investigation and Diagnosis (2026). A detailed practical guide to moisture behaviour, investigation and monitoring, including the strengths and limitations of moisture-measurement techniques in historic building fabric. Read online

Historic England - Understanding the Environmental Performance of Historic Buildings for Conservation (HEAG329, 2025). Whole-building guidance on internal microclimates, ventilation, air exchange, air movement, heating, monitoring and moisture control. Read online

ISO 13788:2012 - Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods. Particularly relevant to the distinction between mould risk at a surface and visible condensation. Read online

BS 8104:1992 - Code of practice for assessing exposure of walls to wind-driven rain. Relevant when orientation and rain exposure may be contributing to the moisture and temperature behaviour of an external wall. Read online

Isle of Man Government - Building Control (Approved Documents) Order 2020. The Manx approved-document framework adopts Approved Document F - Ventilation (2010 edition incorporating the 2010 and 2013 amendments). Read online



Damp, mould and health

UK Government / UK Health Security Agency - Understanding and addressing the health risks of damp and mould in the home. Current UK guidance on respiratory and other health effects, groups at increased risk and the importance of addressing the underlying cause. Read online

World Health Organization - WHO Guidelines for Indoor Air Quality: Dampness and Mould (2009). A comprehensive review of the evidence linking persistent dampness and microbial growth with respiratory symptoms, allergies and asthma. Read online

A useful principle runs through all of these sources: visible condensation or mould is evidence of a moisture problem, not a complete diagnosis. The aim is to understand why the conditions developed and which changes will correct them.



ABOUT THE TREE CASSYN BUILDING SCIENCE SERIES

The Tree Cassyn Building Science Series provides practical, evidence-led guidance on the behaviour, maintenance and repair of traditional buildings on the Isle of Man.

Tree Cassyn is an independent Isle of Man firm specialising in damp, timber and moisture investigations, using a diagnostic, evidence-led approach informed by established professional guidance and relevant British Standards.

Each guide introduces one aspect of building performance in accessible terms, drawing upon the recurring construction details and moisture patterns encountered during Tree Cassyn investigations.

IMPORTANT NOTE

This publication provides general educational guidance. Traditional buildings vary considerably, and similar-looking symptoms may arise from different causes. Repairs should be based upon an investigation of the individual building rather than upon general descriptions alone.

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DAMP · TIMBER · MOISTURE INVESTIGATIONS

ISLE OF MAN

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