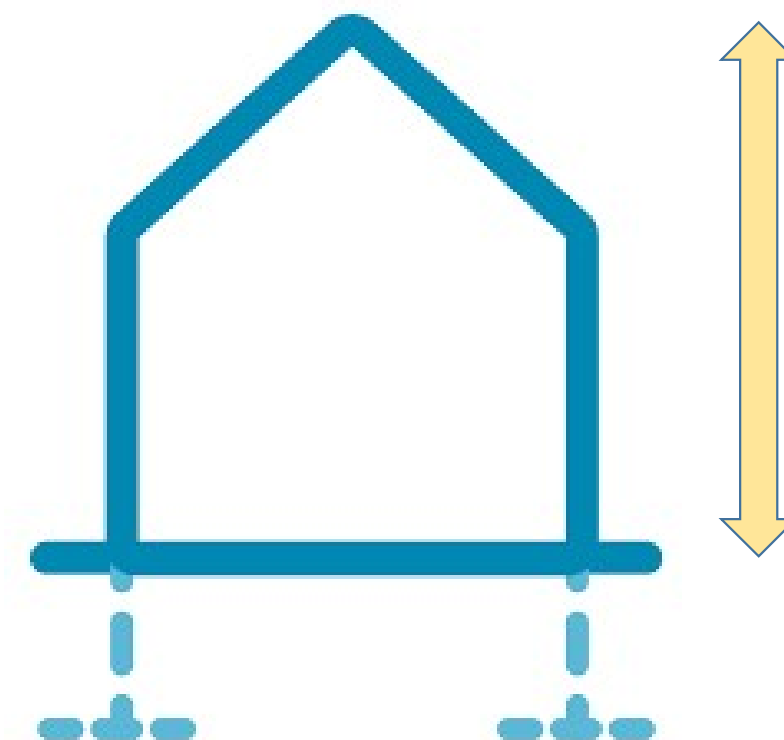
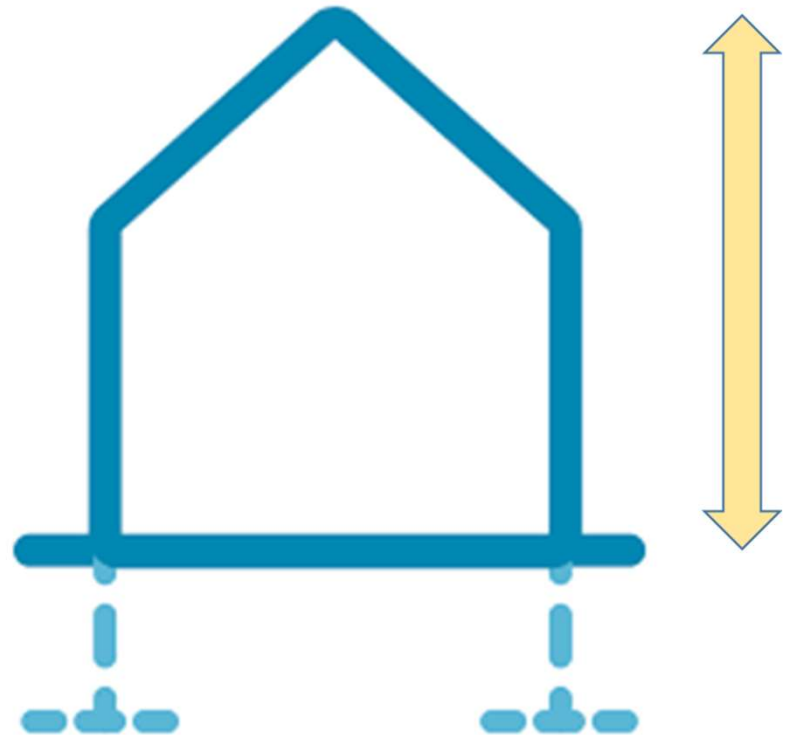


Superstructure : Fundamentals of Construction Technology



Condensation in Buildings





Condensation is intrinsically linked to thermal performance, as the temperature reduction inside to outside through the building **enclosure** is a principal factor in its creation.

The use of buildings to house people, equipment and processes have resulted in the development of buildings that can control these internal environments with greater accuracy.

As well as protection and **enclosure** we can now consider:

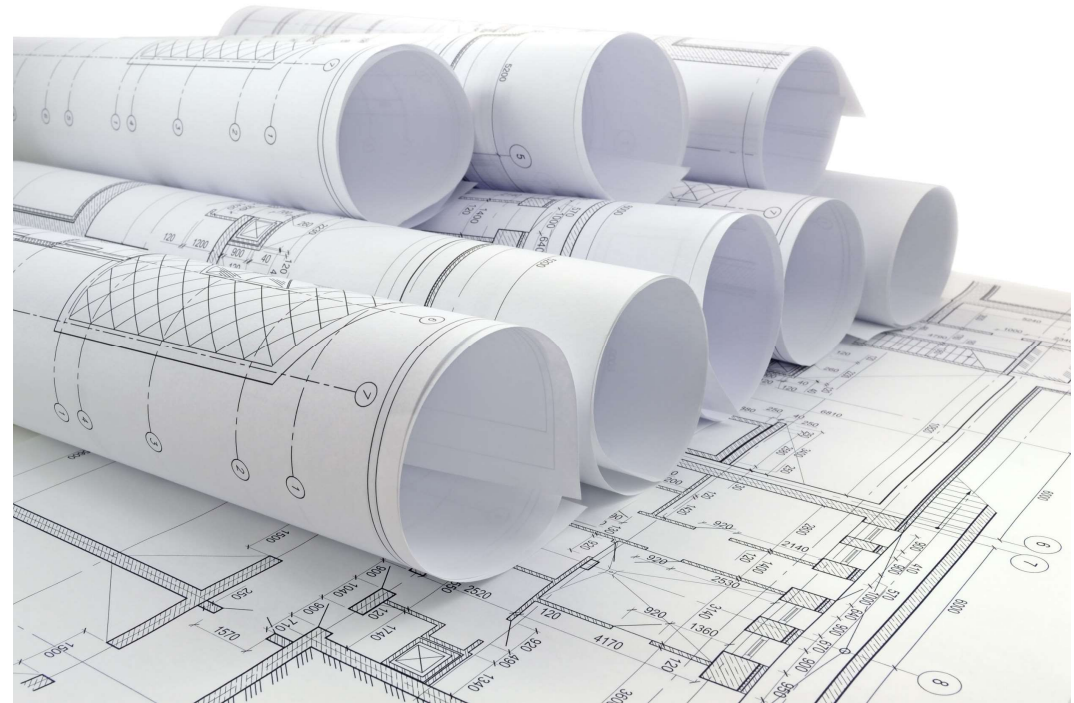
- Thermal Insulation and temperature control
- Acoustic insulation
- Provision of Light (natural and artificial)
- Controls for humidity and ventilation
- Exclusion of contaminants.



Performance Requirements of the Building Fabric

What are the key drivers in providing a building that is suitable for the need?

- Structurally Stable
- Durability
- Thermal insulation
- Protection from weather and exclusion of moisture
- Acoustic performance
- Flexibility to change to changing needs
- Aesthetics
- Buildability
- Sustainability



Key Terms

Types: Surface Condensation and Interstitial Condensation.

Surface Condensation is a familiar problem eg: humid air hitting a cold surface such as bathroom and kitchen windows.

Condensation can be damaging in extreme instances where it leads to residual dampness in plaster and other finishes, and can be the source of mould growth over time.

Interstitial Condensation – most serious type and causes the most problems in lightweight building enclosures where the condensation occurs within the constructional thickness.



Surface Condensation

Two people active for one day



= 3 pints

Cooking and boiling a kettle



= 6 pints

Having a bath or shower



= 2 pints

Washing clothes



= 1 pint

Drying clothes



= 9 pints

Using a paraffin or bottled-gas heater



= 3 pints

**Total amount of moisture
produced in your home
in one day**

= 24 pints



Key Terms

Dew Point

The temperature at which saturation and condensation occurs.

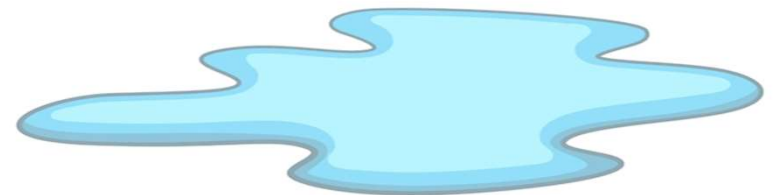
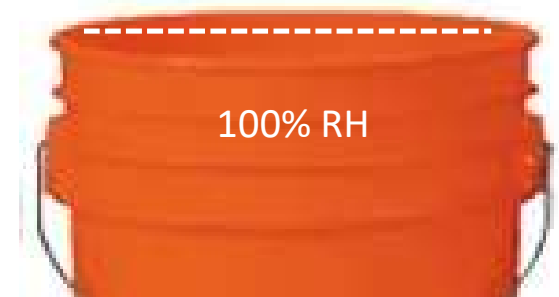
When water vapour in the humid air is cooled it eventually reaches a saturation temperature where the water vapour condenses into water droplets.

Relative Humidity

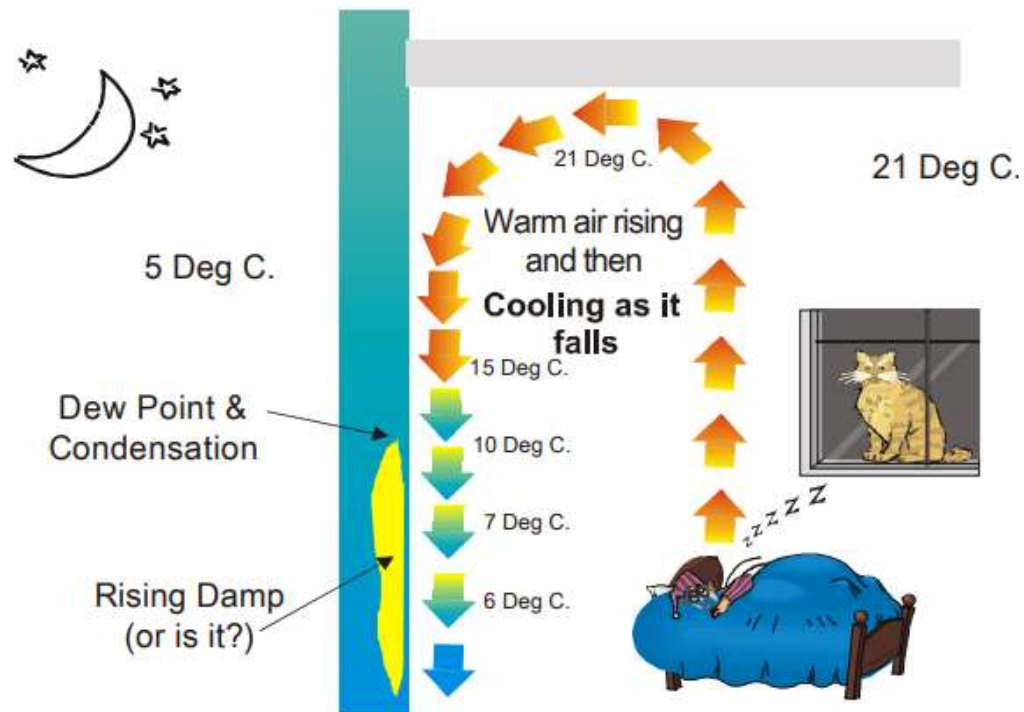
This is the relative wetness of a given volume of air. This is expressed as a % based on the amount of water vapour in the air relative to the amount of water vapour the air *could* carry.

e.g if the RH is 50% then the air's carrying capacity is at half.
If the air temperature is reduced to a where the RH is 100%
- Dew point.





Reducing the size of the bucket (air temperature) whilst keeping the contents the same means puddles!



Rising Damp?

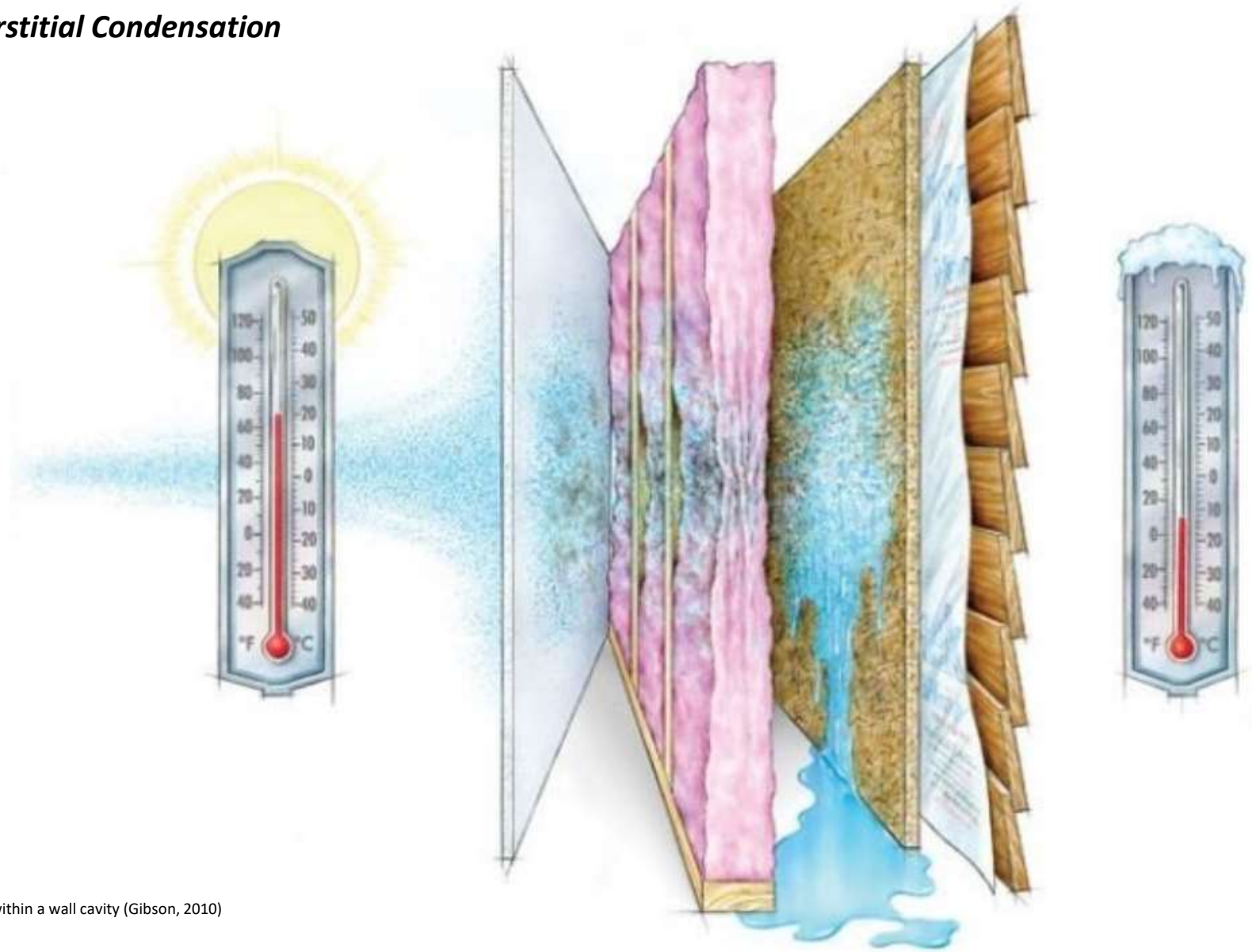
What might be happening here?

How could we tell the difference?

In this example shown above; if the Relative Humidity is only 50% (and with two people breathing in a bedroom it could easily be higher), and the inside room temperature is 21 deg C., then the dewpoint temperature is 10 deg C. Many outside walls have lower temperatures than this during the winter!

[condensation-booklet](#)

Interstitial Condensation



Condensation within a wall cavity (Gibson, 2010)

Examples:

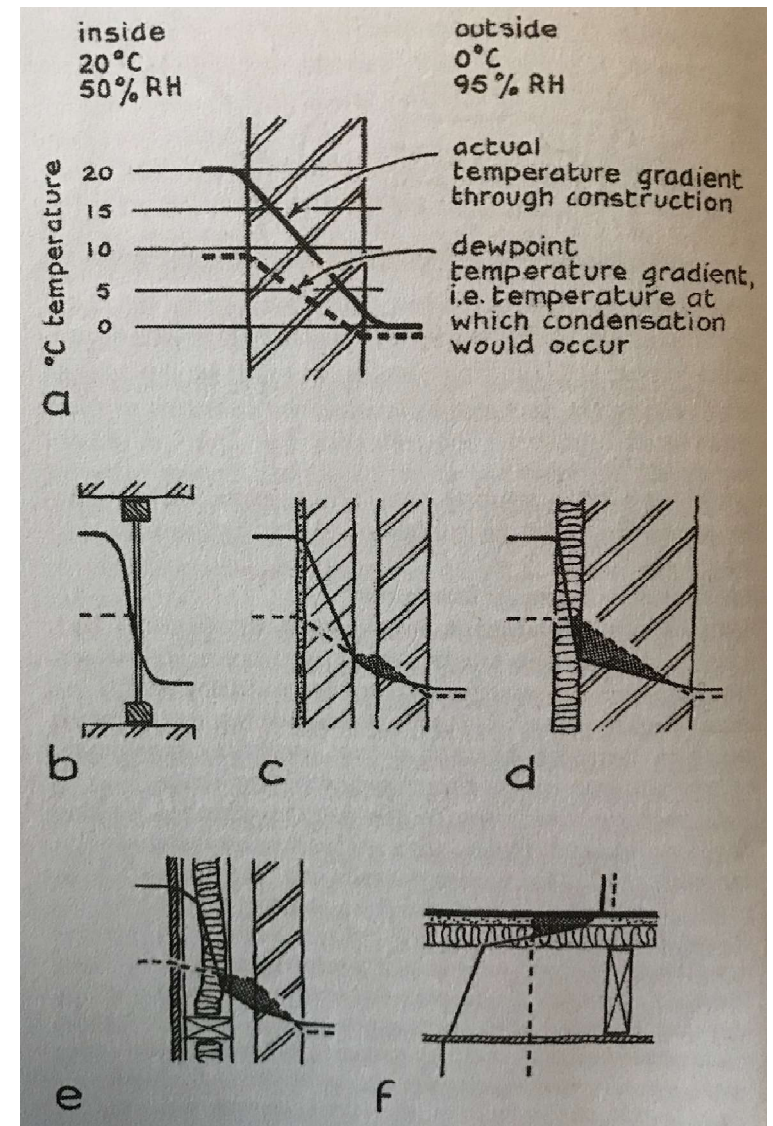
Domestic Internal temp 20 degs C and 50% RH

External Cold Winter 0 degs C and 95% RH

Note: The air outside has a higher RH than the inside only because it is colder – although it actually contains less water vapour.

Actual Temperature Gradient and Dew point Temperature Gradient Basic Principles and Examples (a – f)

Interstitial Condensation occurs where the two gradients cross.



Preventing Condensation

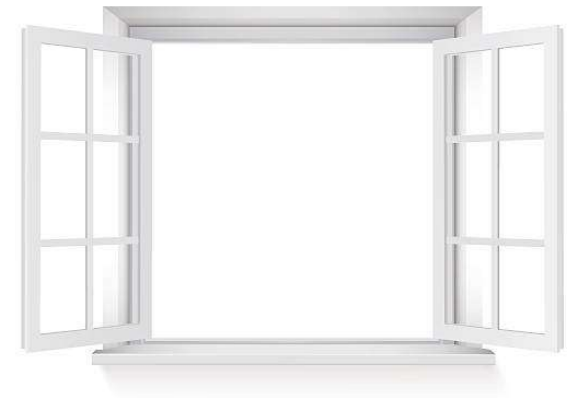
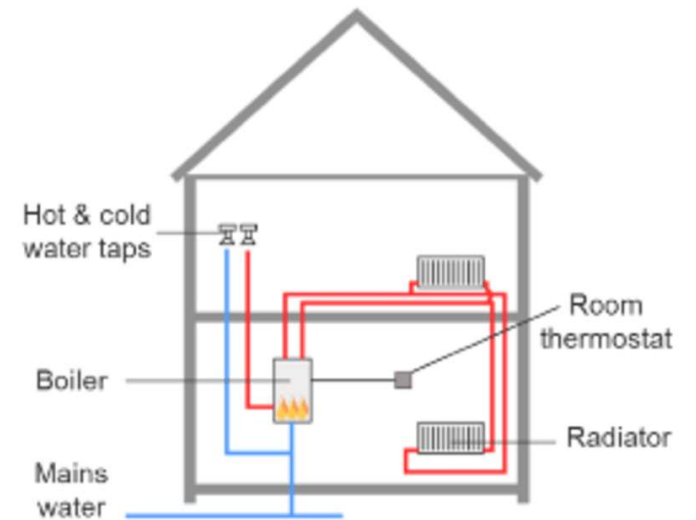
Heating and Ventilation.

Improve the heating of the building and increase the ventilation.

Does that mean - Heating on full with all the windows open?

Ventilation is limited, but additional fans in kitchens and bathrooms will reduce the vapour content in the air.

This may provide solutions for surface condensation but this will do little for the interstitial condensation.



Preventing Condensation

Placing Insulation towards the Outside

This has the effect of making the gradient distortion a safer one, but is not always a practical solution. **(a)**

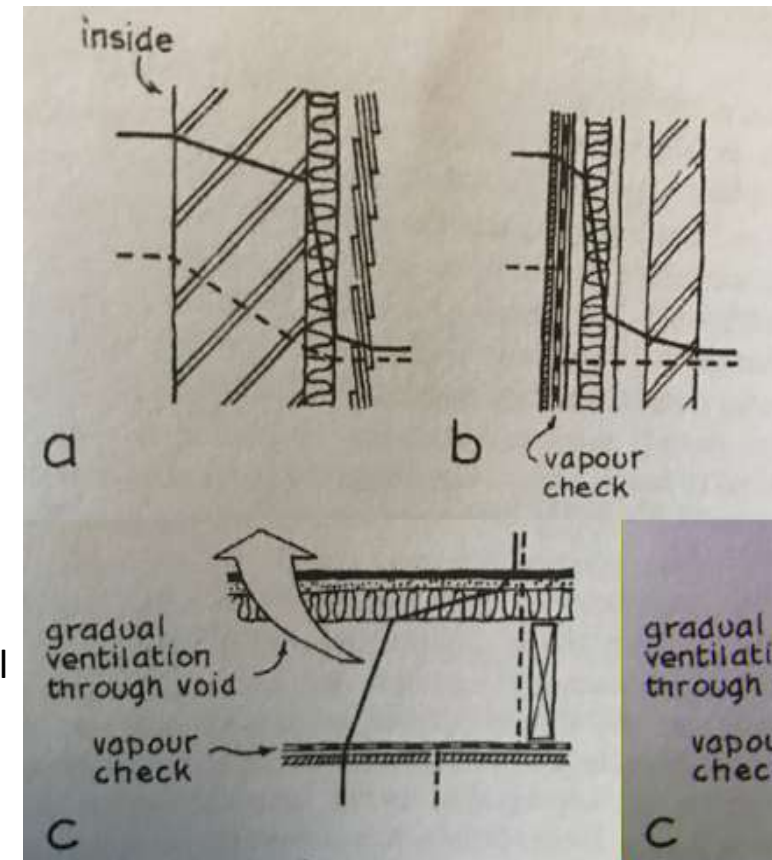
Vapour Checking

An effective vapour check can reduce the dew point gradient and makes the dew point in the enclosure the lower outside level. **(b)** Typically the positive vapour check can be a thin layer of plastic sheeting or metal foil.

Vapour Checking and Construction Ventilation

In an extreme case - flat roof timber construction **(c)** a vapour check is not enough. They cannot be relied on 100% due to fixings etc.

The answer is to allow the construction some ventilation to the outside. Gradual through ventilation, (Soffit vents / eaves vents / airbricks) will carry any residual ventilation away. Vapour checking and gentle ventilation avoid condensation without significant heat loss.



Summary

Condensation is caused by warm moist air reaching cold places.

Precautions are:

- Improving heating and ventilation generally
- Possibly putting insulation to the outside
- Vapour checking **ON THE WARM SIDE** of the insulation
- Ventilating the Construction to the fresh air if there happens to be a vapour trapping membrane on the outside.

Further Reading:

Esmond Reid: 'Understanding Buildings'

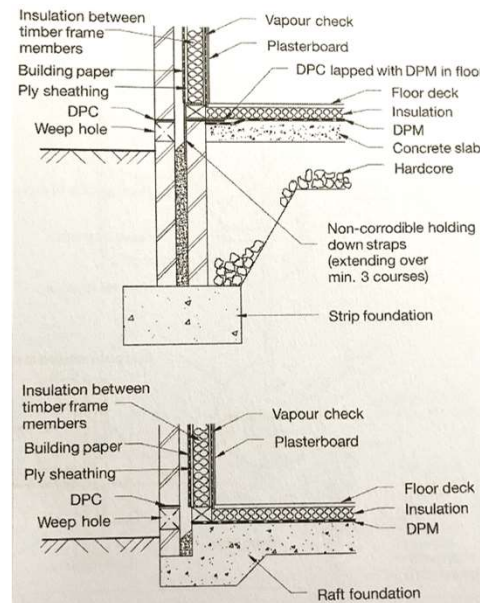
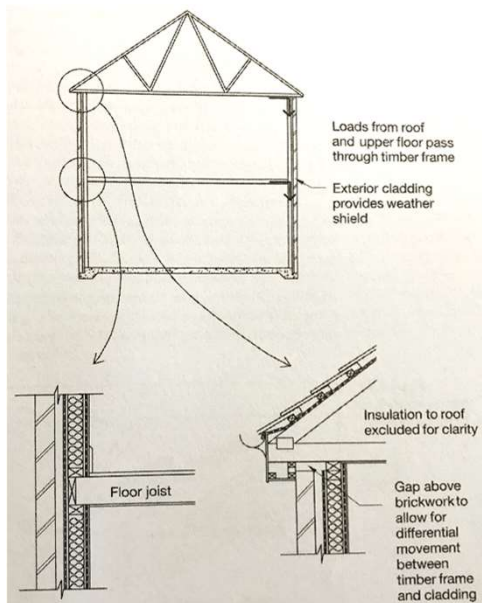
Mike Riley: Alison Cotgrave: 'Construction Technology 1'

McMullans: 'Environmental Science in Building'

Timber Frame Construction

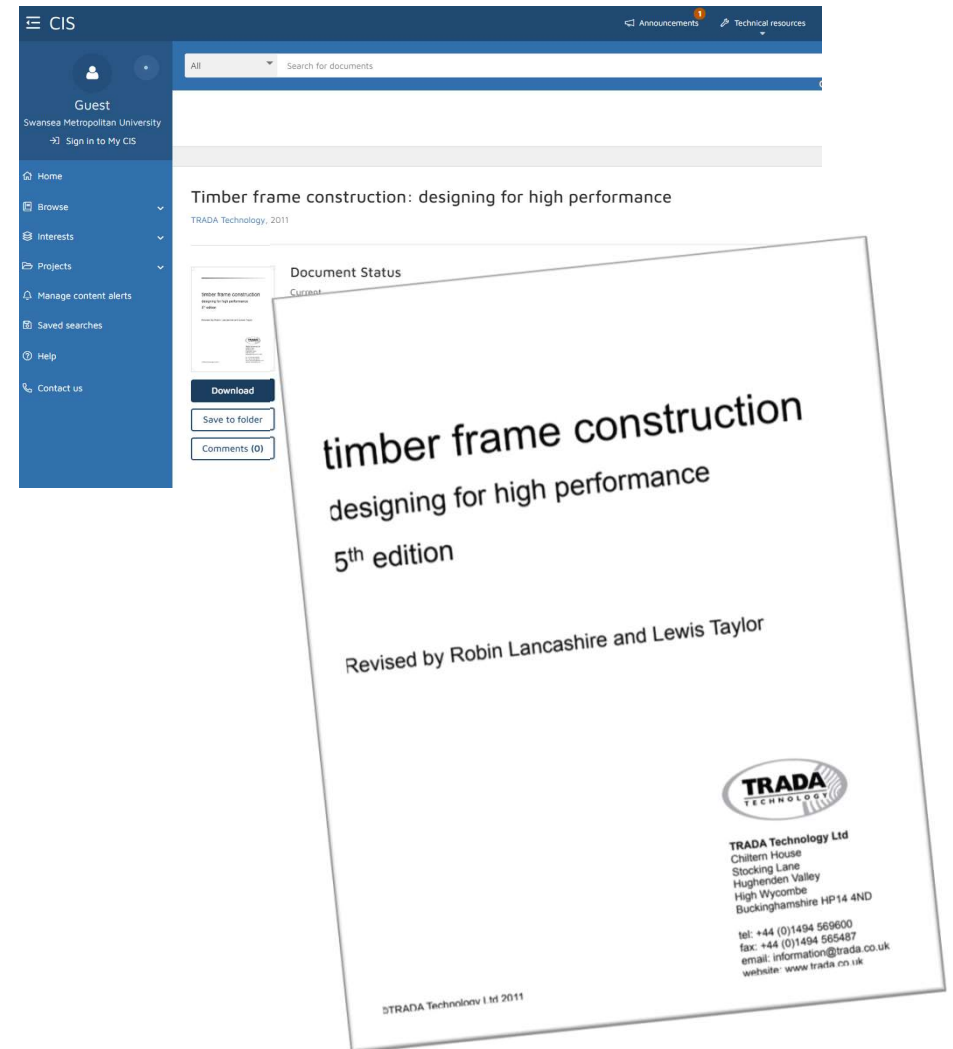
Sources for Timber construction

<https://www.macmillanihe.com/companion/Riley-Construction-Technology-1/resources-zone/Chapter-07-Case-Study-2/>



BOOK Construction technology. 1, House construction

Riley, Mike., Cotgrave, Alison., Third edition., Basingstoke, Hampshire : Palgrave Macmillan, 2013., Total Pages vii, 382 pages, 8 pages of unnumbered plates :



EXERCISE

In the following two scenarios consider the implications for insulation and the prevention of condensation in the structure.

New Build:

Draw a cross section for a typical 280mm twin timber frame construction with the brick finish.

Retrofit:

Draw a cross section of an existing 400mm solid stone wall and indicate proposals for increased energy performance.

Explain what limitations you may have if the structure is listed.

Superstructure

Condensation in Buildings

