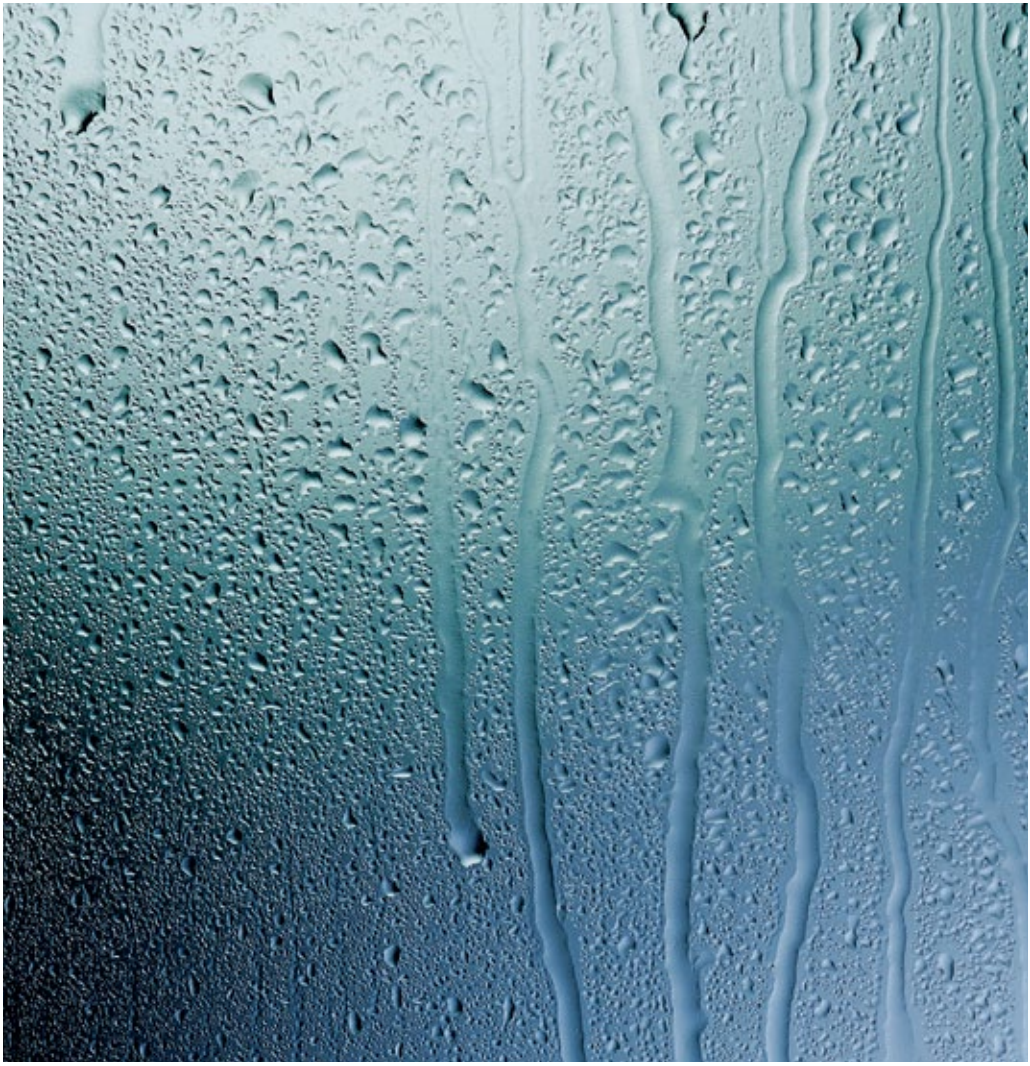
ADVICE TO CONSUMER
REFERENCE 50.1
MAY 2013

Glass and Glazing Federation

Condensation

Some causes, some advice.



Contents

The issue

This leaflet explains why condensation occurs on internal and external surfaces and offers some advice about control.

Internal condensation

Condensation on windows and in conservatories, and the damage it can do to paintwork, curtains, wall coverings and window fittings, are problems sometimes encountered in all types of building.

Modern aids to home comfort have created rooms which are warmer but which often have less ventilation and fewer air changes. The result is that the water vapour produced by normal living activities is no longer able to escape up the chimney or through door jambs, window joints and other outlets.

In certain circumstances, all these aids to comfort combine to create ideal conditions for the formation of condensation, which could form on the coldest surface within the room. This may not necessarily be on the glazing.

The question of how to reduce condensation without sacrificing the benefit of increased comfort is covered within this leaflet.

External condensation

Due to recent innovations in the efficiency of double and triple glazing, along with updated requirements of building regulations and the lowering of carbon emissions, certain weather conditions may allow the formation of external condensation on energy efficient windows and doors. This is a natural phenomenon and a clear indication that the window or door is preventing heat loss from your house. Further explanation can be found within this leaflet.

What is condensation?

Condensation is the point at which water vapour turns to liquid.

Technical definition of condensation

Condensation is defined as the physical process by which a gas or vapour changes into a liquid. If the temperature of an object (e.g. grass, metal, glass) falls below what is known as the 'Dew Point' temperature for a given relative humidity of the surrounding air, water vapour from the atmosphere condenses into water droplets on its surface.

This 'Dew Point' varies according to the amount of water in the atmosphere and air temperature (known as relative humidity). In humid conditions condensation occurs at higher temperatures.

In cold conditions condensation occurs despite relatively low humidity.

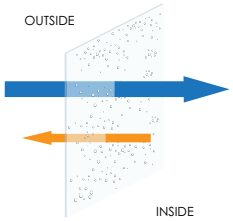
With regard to windows and doors, it is the difference in temperature between the internal and external environment, and the glass, that causes condensation to form.

What this means to the Householder

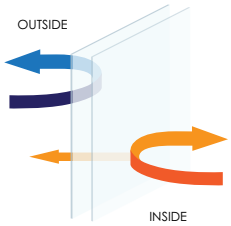
The air surrounding us in our homes always contains water vapour, which is invisible. A typical example is the steam cloud from a kettle, which rapidly becomes invisible – it has in fact been absorbed into the atmosphere.

The warmer the air, the more water vapour it can hold – but there is a limit to the amount it can hold for a given temperature. When that limit is reached, the air is said to be 'saturated'. When saturated air comes into contact with a surface which is at a lower temperature than itself, the air is chilled at the point of contact and sheds its surplus water vapour on that surface – initially in the form of a mist and, if excessive, eventually in the form of droplets of moisture.

An example of this is when a person breathes onto a mirror: condensation occurs because the exhaled air is saturated and its temperature is higher than that of the mirror (which is at room temperature).



A single glazed window cannot retain the heat within the room and the lower temperature of the glass allows the moisture in the air to condense on the cold surface. This is often more evident in rooms in which there is a lack of ventilation.



Although a double glazed window is capable of retaining far more internal heat, the less efficient types allow a certain amount to pass through the air space and thus warm up the outer pane. This would not therefore allow condensation to form on either pane. This assumes the room is heated and ventilated.

Some examples of where the water vapour comes from internally:

Breathing: two sleeping adults produce approximately 1 litre of moisture in 8 hours, which is absorbed as water vapour into the atmosphere.

Cooking: steam clouds can be seen near saucepans and kettles, and then seem to disappear. The clouds have been absorbed into the atmosphere. The heat source itself may be a source of water vapour; e.g. an average gas cooker could produce approximately 1 litre of moisture per hour.

Washing up: the vapour clouds given off by the hot water are rapidly absorbed into the atmosphere.

Bathing, laundry, and wet outer clothing: these are often major sources of water vapour in the home.

Heaters: a flueless gas heater can produce up to 350cc of moisture per hour. Paraffin heaters produce 4 litres of moisture for every 3.5 litres of fuel burned.

Indoor plants: a frequently unrecognised but nevertheless significant source of water vapour.

New property: the bricks, timber, concrete and other materials in an average 3-bedroomed house absorb about 7000 litres of water during construction. Much of this is dissipated into the indoor atmosphere during the drying out period.

Where the water vapour comes from externally:

It is always present and the levels are dependent upon atmospheric conditions (temperature and humidity).

A typical example is the formation of condensation on the entire surface of a car, including the glazing, when left in an exposed area. This condensation would typically be removed using both the wipers blades and a squeegee.

The factors governing condensation

The four main factors governing condensation are:

1. **Water vapour content of the air**
2. **Inside room temperature**
3. **Outside temperature**
4. **Variation between inside room temperature, outside temperature and the glazing**

The first two factors are normally controllable.

1. Water vapour content of the air

This is produced by normal living activities such as washing, cooking, bathing, etc., and can be controlled by the use of extractor fans, cowlings, and ventilation at appropriate places.

2. Inside room temperature

This can be controlled to some extent by replacing single glazing with double or triple glazing, thereby maintaining a higher surface temperature of the glass on the room side, and by increasing the air temperature to enable it to hold more water vapour without condensing.

3. Outside temperature

This cannot be controlled, but its effect on the inside room temperature can be countered by the installation of double or triple glazing.

4. Internal and external temperature variation

This cannot be controlled as the main variant is the outside temperature. However, this variation may also be affected by building orientation, localised atmospheric conditions, shelter from nearby trees or buildings, air currents, wind speeds and nearby vegetation.

NOTE: It is often the case that external condensation will appear on some windows but not on others due to variable micro-climates in differing locations.

How double or triple glazing helps

Double or triple glazing is an insulator, designed to reduce the loss of heat by conduction from the inside to the outside of a building.

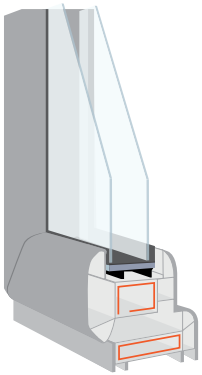
Current Building Regulations, (Approved Document L: Conservation of Fuel and Power), specify that all new or replacement windows must meet a minimum performance criteria. This requirement can only be met by the installation of energy efficient windows and doors.

Under average exposure conditions, and provided the room is heated, the room side surface temperature of the inner glass will be higher than would be the case with single glazing. The likelihood of condensation occurring when warm moist air in the room comes into contact with the surface of the glass is thereby reduced.

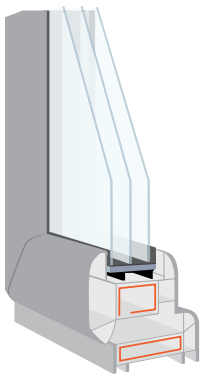
It must be remembered, however, that double or triple glazing is an insulator and not a source of heat; it does not control the amount of water vapour in the air. When rooms are inadequately heated and there is little heat to retain, double glazing cannot fulfil the purpose for which it was installed.

One reason why condensation forms in a room not normally occupied is that many householders, for reasons of economy, do not heat such rooms. Consequently the surface temperature of the inner glass gets very close to the outside temperature.

In addition, the windows in such rooms are generally kept closed, but water vapour, generated elsewhere in the house, will find its way in and then not escape. Thus the two conditions necessary to produce condensation – a low glass surface temperature, and high water vapour content in the atmosphere – are present.



Double Glazed



Triple Glazed

The location of condensation on the glass

When attempting to reduce the degree of condensation it is important to note on which surface of the glass it forms; its location indicates the cause, and so points to the solution.

Internally

Condensation on the room side surface of the inner glass means that the temperature of the glass surface is too low given the water vapour content of the atmosphere in the room. This is most likely to occur on the surface of single glazed windows but can happen on double or triple glazed windows if the room isn't heated.

Within the cavity

Condensation within the cavity of a hermetically sealed double glazed unit or Insulating Glass Unit (IGU) denotes a failure of the seal.

Where the double glazing is achieved by the installation of secondary glazing, condensation on the cavity surface of the outer glass generally (but not invariably) indicates leakage from moist air from the room into the cavity. However, the reader should note that it is not possible to hermetically seal secondary windows; therefore some migration of air from the room into the cavity is to be expected. Condensation can occur occasionally on the cavity surface of the inner glass when the sun is shining on the window. This means that something in the air space itself, such as an unsealed wooden separator or desiccant, contains moisture. It should be noted, however, that this source can also be responsible for condensation on the cavity surface of the outer glass.

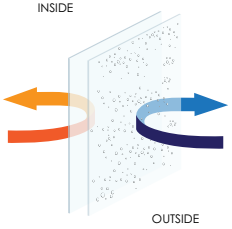
Externally

Condensation forms on the outside surface of glass when its temperature drops below the outdoor dew point temperature.

Windows manufactured with a double or triple glazed unit containing energy efficient low-emissivity glass have enhanced thermal insulation properties thanks to a high performance transparent coating that reflects heat from radiators or fires back into the room.

As a result the outer pane of glass does not get warmed by heat escaping from inside the building through the glass and remains cooler in comparison to less thermally efficient windows.

External condensation only occurs in certain climatic conditions – a variable combination of high relative humidity and clear cold conditions normally experienced in spring and autumn.



The new generation of thermally efficient double and triple glazed windows allow little or no heat through to warm up the outer pane. This creates the condition which allows condensation to form on the outside surface of the outer pane under certain weather conditions. This is strong evidence that heat is not escaping from your house through the window.

How to reduce the condensation

It is important to remove excess moisture by ventilating rooms. A room can be ventilated without making draughts or causing it to become cold. One way to do this is to open the window slightly or use the trickle vent if fitted. By opening windows or ventilating your home it may appear that you are losing some heat, but what you are actually doing is allowing warm moisture laden air to escape and permitting cool dry air to enter your home. Dry cool air is actually cheaper to heat than warm moist air.

A) When formed on the room side surface of the inner glass

I. Provide natural ventilation through an opening section of the window, through a proprietary ventilating unit, or through an airbrick.

II. Where there is no open fire, or where existing flues have been blocked off (and cannot be unblocked), ensure that wall vents are fitted and kept clear.

III. Open at least one window in each room for some part of the day to permit a change of air.

IV. Ensure permanent ventilation of all rooms where gas and oil heaters are used.

NOTE: This is a statutory requirement which will be monitored by the heating engineer.

V. Fix hoods over cookers and other equipment producing steam, and ventilate them to the outside air.

VI. Ensure that bathrooms and kitchens are ventilated in accordance with National Standards.

VII. Draught proof internal doors and keep them closed, to prevent transfer of air with high water vapour content from the main moisture producing rooms – kitchens, bathrooms, and drying rooms. It should be borne in mind that water vapour does not remain in the room where it is first generated, but tends to migrate all over the house because:

a. The air pressure in the original room may be higher than elsewhere, and so the moist air will be forced out into rooms with a lower pressure, and

b. Air movement will carry it through the house.

VIII. Increase slightly the air temperature within the house.

IX. In cold weather, keep some form of heating on permanently in the house.

X. Wherever practicable, fix radiators under windows to maintain the temperature of the inner glass at a reasonable level.

Secondary glazing only

XI. Condensation can be caused by isolating the inner glass from the warm room air with heavy curtains when drawn. To allow free passage of warm air to the glass, position curtains 15cm to 20cm away from the window, and ensure there are sufficient gaps at the top and bottom to permit continuous circulation.

B) When formed on the outer surface

As this is caused by external atmospheric conditions, little can be done to prevent this condition at certain times of the year. In many cases the condensation is not present for long periods and the sun often warms the outer glass enough to evaporate the moisture. Should you require its removal sooner than would naturally occur, the use of a squeegee is recommended.

NOTE: The presence of external condensation is an indication that the glazing is thermally efficient and should not be considered detrimental. The more thermally efficient the glazing, the higher the likelihood of condensation.

C) When formed inside the cavity

Condensation will not form on the inside of a correctly functioning Insulating Glass Unit. However this phenomenon could occur within secondary glazing.

D) When formed on the frame

There are circumstances which will allow condensation to form on the inner surface of the window frame. This is more common on steel or aluminium frames.

There are aluminium frames which can combat this by having a thermal break however; this is only effective if the window is fitted correctly into the opening.

Secondary glazing only

E) When formed on the cavity side surface of the outer glass

Make the seal of the secondary frame and the sealing of the secondary glass to this frame, as near airtight as possible. Particular attention should be paid to all joints.

Summary

Internal condensation

This is usually a ventilation problem and cannot be caused purely by the installation of double or triple glazing. By acting as a heat barrier and providing an inner pane which is considerably warmer than the outer pane, condensation may be reduced.

Modern buildings are designed to eliminate draughts and do not have the natural ventilation that some older houses have with their chimneys and ill-fitting windows and doors. Houses which have been completely sealed by the installation of cavity wall insulation, loft insulation, double or triple glazing, and draught proofing throughout are likely to become moisture traps. In such cases, condensation is a ventilation problem. Provided the rooms are heated normally, the solution will probably by found by providing controlled ventilation.

When a lack of ventilation is suspected, the householder should consult a heating and ventilation engineer.

In the case of the older, "unsealed" buildings, the dominant factor is likely to be the indoor temperature, and additional heat, or the introduction of localised heat near the windows, will probably provide the answer.

External condensation

Our industry is aware of this climatic phenomenon and is investigating processes to help the home owner manage it.

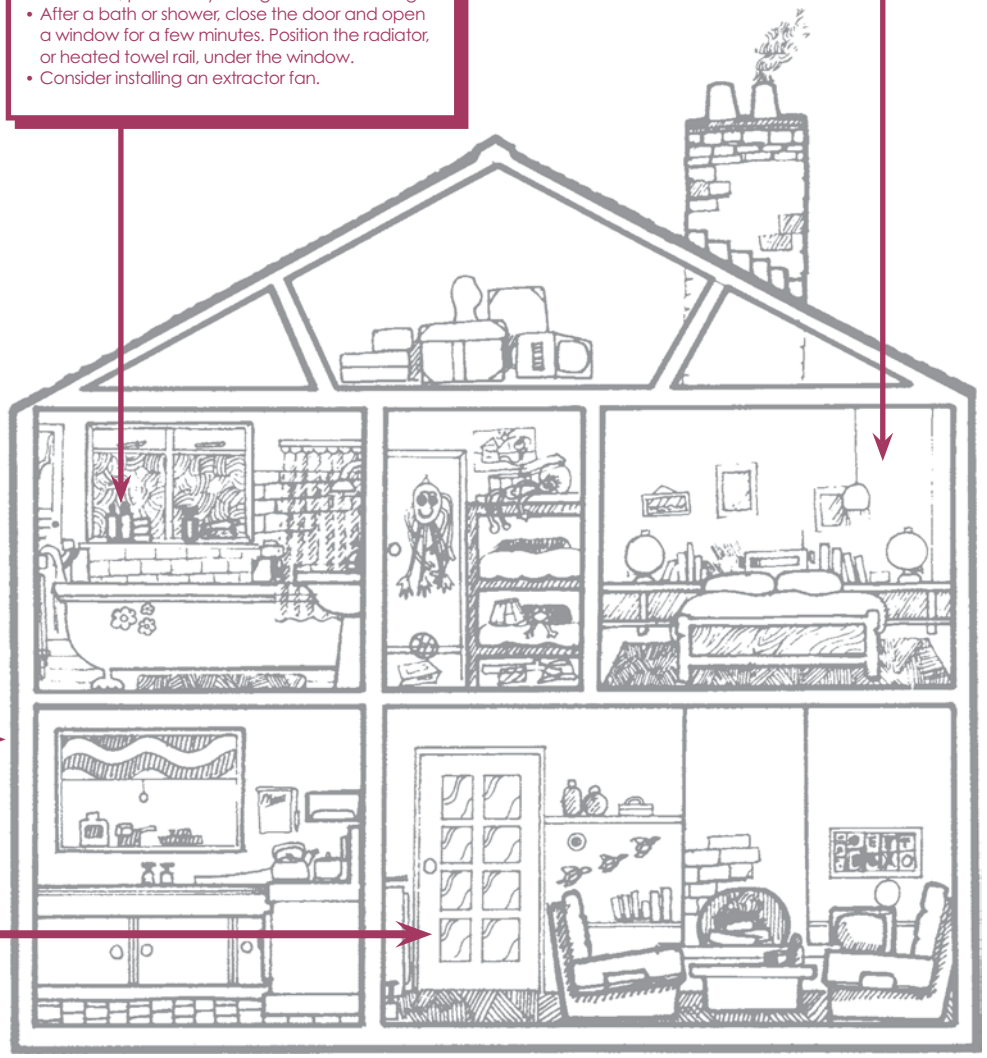
Conservatories
- Consider crossflow ventilations with the use of vents in walls and roofs especially if the conservatory is south facing.
- Trickle ventilation in the wall, eaves and ridge zone can also help.

Kitchens & Laundries
- Close internal doors and keep a windows open. Alternatively, install extractor fans or cooker hoods, ventilated to the outside air.

Living room
- Allow the room's warmth to reach the windows. Position heaters under the windows, and use firing which holds the curtains at least 15cm to 20cm away from the glass to allow free movement of warm air.
- Open windows for at least a few minutes each day to permit air changes.
- Where open fires are not provided, or existing flues are blocks off, see that wall vents are fitted and kept clear, When a gas fire has been installed in an open fire aperture, the back plate should have vent holes below the fire, unless this is provided for in the fire design.
- Where possible, avoid glazed or non-absorbent wall coating, as these can promote condensation on walls.

Bedrooms
- Check points under "Living Rooms" particularly with respect to the position of curtains and the providing of vents.
- If possible extend the central heating programme to compensate for the night time drop in external temperature, and the increase in water vapour caused by the occupants' breathing.
- Bedroom windows should be opened during the day to allow at least one complete air change.

Bathroom
- Stop water vapour finding its way into the rest of the house, particularly during and after bathing.
- After a bath or shower, close the door and open a window for a few minutes. Position the radiator, or heated towel rail, under the window.
- Consider installing an extractor fan.



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