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Code of
Basic data for the
design of buildings:
the control of condensation
in dwellings

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This British Standard Code represents a standard of good practice and therefore takes the form of recommendations. Compliance with it does not confer immunity from relevant statutory and legal requirements.

Foreword

In buildings condensation occurs when moisture produced by the occupants and their activities condenses on the internal surfaces of, or within, building elements. The dampness caused can be distressing to the occupants and can damage building construction as well as contents. The control of condensation is therefore an important feature of building design. The following four aspects of design affect such control.

- (a) *Heating.* Helps to maintain the inside surfaces of the building above the dewpoint of the air. Improves the moisture carrying capacity of the ventilating air.
- (b) *Ventilation.* Assists in the removal of moisture produced within the building to the outside.
- (c) *Thermal insulation.* With any given heat input raises the inside surface temperatures of the building thus increasing the effectiveness of the heat actually put into the building.
- (d) *Permeability of building construction.* Influences the moisture conditions within the thickness of building elements.

In dwellings, with which this code is primarily concerned, thermal insulation is the only measure wholly within the control of building designers, although they can also largely determine permeability. Provision should be made for ventilation and heating suitable to the need of the occupants, but in most cases the designer has no means of ensuring that these facilities will be used. Until recently, in considering the control of condensation, designers have been faced with a dilemma, because the amount of insulation which it has been reasonable to provide has been insufficient, if heating and ventilating facilities were

inadequately used, to obviate the risk of condensation in all cases. Yet condensation occurred only in a minority of dwellings and its occurrence appeared to be largely unpredictable.

Increases in the price of fuel and a growing acceptance of the need to conserve this resource have radically changed this situation. This code therefore, with the object of controlling condensation in buildings, recommends standards of thermal insulation which, taken together with the specified assumptions about ventilation and heating, should prevent surface condensation in all but the most exceptional circumstances.

However, exceptional cases will still occur. The designers can plan for some by considering the provision of higher standards of thermal insulation, heating and ventilation. But beyond this there may still be the occasional unfortunate case where condensation will occur because the occupants by choice, lack of knowledge or force of circumstances do not use the facilities provided to achieve the recommended standards.

Experience shows that changes in the occupants' use of buildings or in building technology, such as may now happen due to major changes in the price of fuel, while solving one set of problems, produce others in their train. In recent years, for example, concern about condensation has been directed towards surface condensation. The less immediately obvious manifestation of interstitial condensation may now be on the increase and is probably in the long term more harmful in its effect on buildings. In future, therefore, designers are recommended to take particular care in detailed constructional design to obviate the possibility of interstitial condensation.

British Standard Code of

Basic data for the design of buildings: the control of condensation in dwellings

Section one. General

1. Scope

This British Standard code gives recommendations relating to the control of condensation and mould growth in blocks of flats and maisonettes and in houses, including those designed for old people. The recommendations are generally applicable to domestic rooms in other buildings such as hotels and hostels. Recommendations for communal rooms or for kitchens used for other than family purposes are not included.

2. References

The titles of the British Standards referred to in this code are listed on the inside back cover.

3. Explanation of terms

For the purposes of this British Standard code the following explanations of terms may be found useful.

3.1 Air volume/mass relationship. One kilogram of air, whether dry or moist, occupies approximately 0.84 m^3 . One cubic metre of air weighs approximately 1.20 kg.

3.2 Cold bridge. Parts of a structure of lower thermal resistance by-passing adjacent parts of higher thermal resistance which may result in localized cool surfaces at which condensation is likely to occur.

3.3 Dewpoint. The temperature at which a sample of moist air becomes saturated and at which condensation begins. Dewpoint depends upon the mass of moisture in the air.

3.4 Interstitial condensation. Condensation which occurs within the thickness of a building element or within its component materials.

3.5 Moisture content of air. The ratio of the mass of moisture present in air to the unit mass of dry air. Expressed as kilograms per kilogram or grams per kilogram of dry air.

3.6 Percentage of saturation. See relative humidity (3.7).

3.7 Relative humidity (r.h.). The ratio (expressed as a percentage) of the actual vapour pressure to the saturation pressure at this same temperature. To the accuracy required for the purposes of this code, this relationship may also be expressed in terms of air moisture content (i.e. percentage saturation). It is essential that a relative humidity is always expressed as a percentage ratio at a particular temperature, i.e. % r.h. at °C.

3.8 Surface condensation. Condensation which occurs at the internal exposed surfaces of building elements or on other exposed surfaces within the building.

3.9 Thermal capacity. Thermal capacity is the property of a material or element of construction which determines its ability to store heat and the rate at which the temperature of the material or construction will alter with change in temperature of adjacent air. Thermal capacity increases with increase in density of material and mass of construction.

3.10 Thermal conductance (C). Thermal conductance is the thermal transmittance between the inner and outer surfaces of a construction depending on the thickness and thermal properties of the materials-making up that construction but ignoring the resistance of the inner and outer surfaces. It is expressed in $\text{W}/(\text{m}^2 \text{ K})$. For a construction of one material only, thermal conductance = k/L where L is the thickness of the component.

3.11 Thermal conductivity (k). Thermal conductivity is a property of a single material independent of thickness and is a measure of the rate at which heat will flow through a material when a difference exists between the temperatures of its surfaces. It differs from the C value (described above) inasmuch as it is a measure of the rate of heat transfer per unit thickness. It is expressed in $\text{W}/(\text{m K})$.

3.12 Thermal resistance (R). Thermal resistance is the reciprocal of thermal conductance and is the measure of the overall thermal resistance of a material or combination of materials to heat flow. The total thermal resistance of an element of structure, including the resistance of the inner and outer surfaces and of any enclosed cavities, is the reciprocal of the total transmittance, i.e. $1/U$. It is expressed in $(\text{m}^2 \text{ K})/\text{W}$.

3.13 Thermal resistivity ($1/k$). Thermal resistivity is also a property of a material regardless of size or thickness; it is the reciprocal of conductivity and is expressed in $(\text{m K})/\text{W}$.

3.14 Thermal transmittance (U value). Thermal transmittance of construction or an element of structure (e.g. wall, floor, roof), the U value, is defined as the quantity of heat that flows through unit area in unit time, per unit difference of temperature between the internal and external environments, and is expressed in $\text{W}/(\text{m}^2 \text{ K})$. The thermal transmittances can be calculated from data on the thermal resistances of the various components making up the structural element, including the thermal resistances of the internal and external surfaces exposed to the air and the thermal resistances of any cavities. Further guidance is given in the CIBS Guide: Section A3* and BRE Digest 108†.

3.15 Vapour barrier. Part of a constructional element through which water vapour cannot pass. In practice this is nearly impossible to achieve and in the text of this code 'vapour barrier' refers to a constructional element which approximates well to the theoretical definition.

3.16 Vapour check. A material or part of a constructional element which offers a high resistance to the passage of water vapour.

3.17 Vapour diffusivity (d_v). A property of a material independent of thickness and a measure of the rate at which vapour will pass through a material when a difference of pressure exists between the air on opposite sides. Expressed as $(\text{g m})/(\text{MN s})$ (gram metre per meganewton second).

3.18 Vapour pressure. The moisture in air contributes to the total atmospheric pressure. It is this water vapour pressure (expressed in millibars‡) which causes water vapour to move through building elements to regions of lower vapour pressure.

3.19 Vapour resistance (R_v). The measure of the overall resistance of a material or combination of materials to vapour diffusion. Expressed as $(\text{MN s})/\text{g}$. (For materials applied as thin membranes their value is expressed as vapour resistance. The vapour resistance of other materials is their vapour resistivity multiplied by thickness.)

3.20 Vapour resistivity (r_v). The reciprocal of vapour diffusivity and expressed as $(\text{MN s})/(\text{g m})$.

3.21 Ventilation rate (air change). Ventilation rate in this code is expressed in two ways:

- (a) the volumes of room air changed in one hour;
- (b) the rate of air change expressed as litres per second.

Section two. The occurrence of condensation and mould growth

4. General

4.1 Basic causes of condensation. Warm air can hold more water vapour than cold air. If warm air is cooled to its dewpoint it gives up some of its moisture as condensate. The water vapour in air exerts a pressure (vapour pressure). Air containing a large mass of water vapour has a higher vapour pressure than drier air. Water vapour will therefore move from places of high vapour pressure to places of lower vapour pressure.

4.2 Surface condensation. Surfaces which are at or below dewpoint of the air immediately adjacent to them will suffer surface condensation. Often this occurs on cool internal surfaces of external elements of a building; cold pipes and cisterns within a building also present areas of risk.

4.3 Interstitial condensation. Vapour pressure drives water vapour through all except completely impermeable materials in passing from the inside to the outside of external structural elements. Water vapour may be cooled to dewpoint causing condensation to occur within the thickness of the constructional element. This may be either within the materials themselves or the spaces between component parts of the element. Interstitial condensation may occur within any constructional element in which dewpoint conditions occur but is likely to be especially serious if water vapour is unable to escape outwards.

*Chartered Institution of Building Services Guide. Section A3:

Thermal properties of building structures. 1980.

† Standardized 'U' values. BRE Digest 108.

‡ 1 mbar = 10^2 N/m^2 = 100 Pa.

4.4 Basic cause of mould growth. Sources of infection and nourishment for mould are widespread in buildings. Germination depends upon a damp environment. Although often associated with surface condensation, mould germination depends not only upon the presence of surface moisture but also upon the length of time during which the humid conditions persist.

5. Factors affecting condensation and mould growth

Many aspects of building design affect the occurrence of condensation and mould growth, as do variations in temperature and moisture conditions. The difference in environmental conditions between situations proving satisfactory and those where condensation and mould growth occur is often small. External environment, building shape and internal planning all have some effect. For surface condensation and mould growth major controlling factors are moisture production within a building, heating, ventilation and the thermal properties of external elements of the structure. For interstitial condensation similar factors apply but the permeability to water vapour of the external elements, and the ventilation of air spaces within the construction, may be decisive.

The effects of the various factors are interrelated. A high rate of moisture production within a dwelling may be countered by a high ventilation rate, but this may inhibit good heating. The effectiveness of heating is also related to the thermal resistance of external structure. The type and use of heating is also important, especially in the relationship between continuous or intermittent heating and high or low thermal capacity buildings.

The structure and the method of heating are largely determined at the design stage. Moisture production and the adequacy of heating and ventilation depend upon occupational use of a dwelling. It is therefore important that occupants should be aware that these factors may determine whether condensation occurs.

6. Variation in conditions

Factors affecting temperature on the inside face and within the thickness of a constructional element include:

- (a) external exposure;
- (b) internal air temperature;
- (c) thermal properties;
- (d) moisture content of the construction.

At the inside surface of a constructional element the dewpoint of the air varies with changes in its moisture content. In practice, the moisture content of internal air fluctuates because it is

dependent upon moisture created by the occupational use of the building and upon the effect of ventilation.

Moisture conditions, and therefore dewpoint, within the thickness of an external constructional element depend upon fluctuations in internal and external air vapour pressures and upon the resistance of the structure to the transfer of water vapour.

Relative humidity of internal air, which affects mould growth, depends upon air moisture content and temperature, both of which fluctuate. The local lowering of air temperature adjacent to a cold surface may cause condensation to form on the surface, resulting in conditions suitable for mould germination, even though the room air generally is at a considerably lower relative humidity.

Section three. Basis of design for the control of condensation

7. Design objectives

The objectives should be:

- (a) to minimize surface condensation;
- (b) to prevent any interstitial condensation which would result in damage to structure or finishes;
- (c) to prevent mould growth.

8. Design procedure

8.1 General. Designing for the control of condensation depends upon obtaining a satisfactory relationship between air conditions (internal and external air temperature and humidity) and the properties of external elements of construction (thermal resistance and water vapour resistance). Ideally, the design procedure would be as follows.

- (a) To determine internal and external air conditions.
- (b) To design external constructional elements to have sufficient thermal resistance to control internal surface condensation.
- (c) To design external constructional elements having a combination of thermal resistance and water vapour resistance to prevent dewpoint conditions leading to harmful interstitial condensation. In practice this involves suitable positioning, as well as choice, of materials. In some forms of construction it is also necessary to ventilate air spaces within the construction.

It will also be necessary to check, during construction, that materials and details comply with design and specification.

8.2 Design standards. For economic reasons and because theoretical steady state air conditions rarely apply, a reasonable assessment of design conditions depends upon judgement and experience as well as upon a full understanding of the interrelationship of all factors. For general use recommendations for design standards are therefore made (see section four). These recommendations provide a design basis for the control of condensation and mould growth in dwellings such as mid-terrace houses of normal design. Higher standards may be necessary, or economically desirable, for other dwellings, e.g. where site exposure is severe or where plan arrangement results in large areas of roof or external walling or where exceptional occupancy conditions appear probable.

The recommendations assume that, subject to precautions (see section five), some intermittent condensation on single glazed windows and in bathrooms is tolerable.

8.3 Calculations. In designing constructional elements some calculations are necessary and data and examples are given in appendix A.

8.4 Design details. Section five refers to practical aspects of design to ensure, so far as possible, that necessary standards are achieved by suitable methods of heating and ventilation and appropriate details of construction.

8.5 Recommendations to occupants. Because the sensible use of heating and ventilation is important in the control of condensation, appendix B makes suggestions for recommendations to be made to occupants.

Section four. Recommended design assumptions

9. General

9.1 Surface condensation and mould growth.

Unless extreme conditions are known to exist, the assumptions and recommendations contained in clauses 10 to 15 should be used as the basis for design to control surface condensation and to prevent mould growth.

9.2 Interstitial condensation. Unless extreme conditions are known to exist, the assumptions and recommendations contained in clause 22 should be used as the general basis for design, to prevent harmful interstitial condensation in roofs, external walls and exposed floors.

10. External air temperature

10.1 Roofs. For calculations relating to roofs an external air temperature of -5°C should be assumed, because on clear nights the effect of radiant heat loss to a cold night sky can cause external roof temperatures to drop 5°C or more below adjacent air temperature.

10.2 Walls. For calculations relating to external walls an external air temperature of 0°C should be assumed except where they are particularly liable to be affected by radiant heat loss to a clear night sky when the external air temperature taken as -3°C .

10.3 Externally exposed floors. For calculations relating to externally exposed floors, an external air temperature of 0°C should be assumed.

11. External air humidity

The relative humidity of external air should be assumed to be 90 %. At the temperatures recommended in clause 10 the external air moisture content and vapour pressure would then be as detailed in table 1.

Table 1. Moisture content and vapour pressure of air at 90% r.h.

Air temperature	Air moisture content	Vapour pressure
$^{\circ}\text{C}$	kg/kg	mbar*
0	0.0034	5.3
-3	0.0027	4.3
-5	0.0022	3.6

* 1 mbar = 10^2 N/m^2 = 100 Pa.

12. Internal air temperature

It is recommended that the air temperature throughout a dwelling, day and night, should be taken as not less than 10°C and, in addition, the temperature of living rooms when occupied should be not less than 20°C when the external air temperature is as given in 10.1, 10.2 and 10.3. (For heating design see section five.)

13. Internal air humidity

For normal occupancy conditions, including ventilation at rates not less than those listed in 14.1, the internal air conditions, except in kitchens and bathrooms, should be assumed as:

moisture content: 0.0068 kg/kg;

vapour pressure: 10.7 mbar.

If occupancy conditions or the size or plan arrangement of a dwelling are likely to result in some rooms having higher than normal moisture content the above values should be increased. Table 2 in appendix A provides an indication of



the relative importance of sources of moisture arising from occupancy.

14. Ventilation

14.1 Living rooms and bedrooms. Although natural ventilation is dependent upon the use occupants make of facilities, rates for main rooms are assumed to be not less than:

- 1.0 air change per hour in occupied living rooms;
- 0.5 air change per hour in bedrooms and unoccupied living rooms.

Recommendations on the provision of facilities for natural ventilation are contained in clause 21.

14.2 Kitchens. Kitchens are a source of high moisture production for limited periods of time. It is therefore recommended that all kitchens be provided with an electrically operated fan to extract to outside air. For most self-contained kitchens in normal dwellings a fan providing an extraction rate of 80 litres/s should be adequate. For large kitchens or where kitchens are in, or open to, living areas, a fan providing a greater extraction rate may be necessary. Precautions to be taken in the installation of kitchen fans are described in 21.3.

14.3 Bathrooms and W.C.s. It is essential that internal bathrooms and W.C.s be provided with mechanical extraction. With the other measures recommended in this code the ventilation requirements of building regulations will normally be adequate to prevent harmful condensation. Additional requirements for the use of mechanical extraction where bathrooms are likely to be used for clothes drying are given in 21.5. The ventilation of bathrooms by natural means is referred to in 21.4. Although the addition of an extract fan would be advantageous it is not considered essential.

15. Thermal insulation

The maximum thermal transmittance (*U* value) for roofs, (including any air space and ceiling beneath), external walls and other enclosing walls, and exposed floors is specified in the relevant building regulations. This represents a minimum insulation standard; there may be advantages in designing to higher standards but in such cases due consideration needs to be given to the possible problems which can arise, for example, interstitial condensation. Thermal insulation of suspended and solid ground floors is not required by building regulations except where floors are exposed to outside conditions, but it may be necessary to reduce risk of condensation on floor surfaces, especially at building perimeters.

16. Windows

Some intermittent condensation on windows is assumed to be tolerable (see 8.2). Large areas of north-facing single glazing (between north-east and north-west) are undesirable. When south-facing, advantage can be taken of solar heat gains.

17. Condensation on internal fittings

The design criteria in clauses 9 to 16 of this section refer to external constructional elements. Care should also be taken to prevent harmful condensation on fittings within dwellings, e.g. cisterns and cold pipes. Further reference is made to this in 22.17.

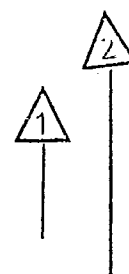
Section five: Design and construction details

18. General

This section gives details of how to implement section four and provides guidance for some atypical situations.

19. Building shape and internal arrangement of rooms

19.1 External structure. For an individual room of any given size heat loss may vary considerably according to its location in a building. Centre dwellings are less exposed than similar ones at the ends of terraces. Top floor flats have roof heat loss to contend with. Single storey houses expose more structure than similar sized houses planned on several floors. Patio type plans tend to increase exposed wall areas. Internal temperature conditions may be the same for all types if sufficient heating is provided for the exposure condition. In practice the exposed rooms tend to be cold. For rooms or dwellings with high exposure, consideration should be given to providing higher standards of thermal insulation than those recommended in section four as applicable to 'normal' conditions. This is especially necessary where occupancy conditions are likely



to inhibit the use of heating as a means of overcoming high heat loss. Particular consideration should also be given to kitchens and bathrooms where exposure is high, e.g. in positions such as top floor external corner rooms. The effect of glazing should also be considered. Large areas of north-facing single glazed windows (between north-east and north-west) are undesirable.

19.2 Internal plan arrangement. Some transfer of heat will take place from warm to cool rooms. Bedrooms above heated living rooms frequently benefit in this way, by upward transmission through the dividing floor structure. This benefit does not occur in single storey buildings and may not apply in flats. Stairs form a route for warm air to rise by convection, which may benefit bedrooms in conventional houses. In maisonettes the relative position of living rooms and bedrooms will affect heat transfer, with bedrooms sited at the lower level being least likely to benefit from casual heat transfer.

Disposition of rooms can also affect the transfer of water vapour from room to room. Humid air from kitchens readily rises with air convection up stairways. Kitchens open to living areas, e.g. in open plan or bed-sitting rooms, may result in higher than normal moisture conditions in living areas. Bedrooms with doors close to kitchen or bathroom doors may have a higher than normal risk of condensation. Whereas heat will most readily transfer upwards and less readily horizontally, water vapour will disperse easily in any direction provided there is a difference in water vapour pressure.

It is noticeable that mould growth often starts, and becomes most severe, in room corners. This may be due to the additional rate of heat loss which occurs on external corners but is frequently due to stagnant air pockets resulting from insufficient air circulation in the room. The shape of rooms and the disposition of windows and doors affect air circulation.

Clothes drying, which produces large quantities of water vapour, is referred to in 21.5. Where clothes drying cupboards are provided they should be located to permit ventilation to outside air.

20. Heating installations

20.1 General. Provided that the system does not produce additional moisture any method of heating can be satisfactory. In practice, however, there is a risk that occupants may fail to maintain the recommended air temperatures. This is most likely to occur in the form of insufficient heating of bedrooms or under-heating of the whole dwelling,

by allowing temperatures to fall for long periods, e.g. if dwellings are unoccupied during daytime. The following subclause refers to the characteristics of various methods of heating.

20.2 Heating methods. In some circumstances the only means of ensuring the recommended standards may be to provide some degree of heating which is not solely under the control of the occupant.

As a general rule long period background heating plus topping up during periods of room occupation is more likely to prevent condensation than the same total amount of heat introduced over relatively short periods.

There is a time lag before structural temperature reacts to change in air temperature. High thermal capacity structures react slowly. A combination of intermittent heating with heavy type external structure therefore tends to be unsatisfactory. Low thermal capacity internal finishes to heavy external constructional elements can reduce the risk of surface condensation in such conditions, but it is then necessary to ensure that interstitial condensation will not occur on heavy structure behind the low thermal capacity linings (see 22.1 to 22.5).

Wholly convective heat, from forced warm air systems, very rapidly heats room air and is therefore liable to be operated to provide only the heat required for acceptable comfort of the occupants. Heat provided mainly by small, high temperature, radiant sources provides easy control and an almost immediate feeling of local warmth. Both forms are liable to be used insufficiently to warm a heavy structure adequately.

With warm air systems it is important to ensure that secondary air circulation does not pick up moisture from inlets located in or adjacent to the kitchen and then transfer the moisture to other rooms.

Low temperature radiant heating in the form of embedded underfloor systems usually has a low rate of heat output which, because of the thermal capacity of the floor, generally operates for long periods. This system is likely to be advantageous in controlling condensation and mould growth. Low temperature radiant heat from ceilings can have similar characteristics but if the heat is from a lightweight ceiling the thermal capacity advantage does not apply. Electrical storage heating generally tends to have a slow build-up of heat output which needs to be understood by the designer and user. The charging period should be related both to the need for comfort of the occupants and to the need for an adequate reserve for heating the house fabric. Block storage heaters without fans emit heat almost continuously for

assisted heaters have some characteristics rather similar to other forms of forced warm air heating but may provide some continuous background warming by heat leakage.

Many modern hot water radiator systems heat quickly but their effect on room air temperature is slower than that of forced warm air heating. Although operation controlled by a programmer and heat control by a thermostat may result in intermittent heating, the thermal storage capacity of the radiators ensures some heat output for a limited time after the input ceases. Background heating is therefore likely to be provided for longer periods than with heating by high temperature radiant or forced warm air methods.

Whether operating as a direct radiant heat source or as a method of supplying heat to other means of heat transfer, solid fuel heating appliances are less easily started and stopped than those using oil, gas or electricity, and thus tend to be used for longer periods. By providing steadier background heating they therefore tend to be useful in combatting condensation.

Design for heating by means of oil or gas fired appliances unconnected to flues should be avoided because these appliances, when in use, liberate large quantities of water vapour.

Though less important than the duration factor, the way in which heat is distributed is of some importance. The value of siting radiators beneath windows is generally recognized. An advantage of forced warm air heating can be that it causes sufficient room air movement to reduce the risk of stagnant air pockets, for example in corners of rooms. High temperature radiant heaters, on the other hand, may leave some parts of a room relatively unheated, in spite of providing adequate local warmth for the occupants.

21. Room ventilation

21.1 General. There is no practical method by which occupants can measure ventilation rate, but because they are sensitive to discomfort from draughts and are aware of the effect of ventilation upon the cost of heating there is usually a tendency to reduce ventilation in cold weather. The effect of modern building design, without flues, with solid ground floors and with well fitting windows, is to reduce ventilation rates.

21.2 Natural ventilation of living rooms and bedrooms. Where room ventilation depends upon windows or wall ventilators, satisfactory operation by occupants can be expected only if the following requirements are met.

- (a) Location of the ventilation openings to obviate unpleasant draughts: generally this

means at high level. Main opening lights of side hung, horizontal sliding or pivot hung windows are unlikely to be used satisfactorily for cold weather ventilation, especially in exposed situations.

- (b) Location of ventilator opening control within easy reach of occupants.
- (c) Design of ventilator and its control to allow fine adjustment.
- (d) Design of ventilator to permit some opening without allowing rain or snow to enter.
- (e) The location or the design of ventilators to provide for security against unauthorized access, so that they can be left open when the premises are unoccupied.

Where a living room provides combustion air to a heating appliance connected to a vertical flue, the room ventilation is almost certain to exceed the minimum rates assumed in section four. Provision of close control wall or window ventilators is then of less importance.

21.3 Ventilation of kitchens. Where possible a mechanical extract fan should be located above or nearly above the cooking position and preferably also near the sink. Generally a position higher than the top of doors is advantageous. Where cooking appliances are sited away from external walls a high level duct may be required, with the inlet preferably in the underside of the duct.

When fitting an extract fan it is necessary to ensure that sufficient air inlet is also provided. Without this the room air pressure can be reduced to a point where the fan does not operate properly. Any air inlet should be located to avoid short circuiting of air to the extract fan or the recirculation of fumes. It is essential that an extract fan should not adversely affect the safe operation of any fuel burning appliance in the room. Specialist advice may be needed to ensure safety.

Although reliance may be placed upon the use of an extract fan during periods of high moisture production in kitchens, some natural ventilation should be readily obtainable at other times. The principles set out for living rooms (see 21.2) apply but with a need for particular care to ensure that ventilator controls will be within easy reach after allowing for obstruction by kitchen fittings.

21.4 Ventilation of bathrooms and W.C.s. Where bathrooms are dependent upon natural ventilation some intermittent condensation is unavoidable. Occupants should be advised to ventilate a bathroom after use to outside while the door is kept shut to reduce spread of moisture to other parts of the dwelling.