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## The Scottish Building Standards: TECHNICAL HANDBOOK: NON-DOMESTIC

### 3.14 Ventilation

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**standard**  
**3.14**  
**mandatory**

Every *building* must be designed and *constructed* in such a way that the air quality inside the *building* is not a threat to the health of the occupants or the capability of the *building* to resist moisture, decay or infestation.

#### 3.14.0 Introduction

Ventilation of a *building* is required to prevent the accumulation of moisture that could lead to mould growth, and pollutants, originating from within the *building* that could become a risk to the health of the occupants. Ventilation can have a significant affect on energy consumption and a thorough assessment of natural, as against mechanical ventilation, should be made, as the decision could significantly affect the energy efficiency of the *building*. (see Section 6). Where natural ventilation is provided, inside air quality can only be as good as outside air quality.

Ventilation should have the capability of:

- removing excess water vapour from areas where it is produced in significant quantities, such as *kitchens* and bathrooms;
- removing pollutants that are a hazard to health from areas where they are produced in significant quantities, such as *rooms* containing processes that generate harmful contaminants and rest rooms where smoking is permitted;
- rapidly diluting pollutants and water vapour, where necessary, that are produced in habitable *rooms* and *sanitary accommodation*;
- making available over long periods, a minimum supply of outside air for occupants and to disperse, where necessary, residual water vapour.

Ventilation should not significantly affect comfort and where necessary, designers might wish to consider security issues and protection against rain penetration when windows are partially open to provide background ventilation.

Improved insulation and 'tighter' *construction* of *buildings* will reduce the number of natural air changes and can increase the risk of condensation. The guidance recommended for the ventilation of moisture producing areas is the minimum necessary to combat condensation but both design and workmanship will have an affect on the ventilation arrangements and the *building* as a whole.

*Conversions*

In the case of *conversions*, as specified in Regulation 4, the *building as converted* shall meet the requirement of this standard (Regulation 12, Schedule 6).

**3.14.1 Ventilation generally (K1.3, K2.1)**

A *building* should have provision for ventilation by either:

- natural means; or
- mechanical means; or
- a combination of natural and mechanical means.

## Additional ventilation provision

This guidance relates to the provision of air for human respiration and is in addition to, and should be kept separate from, any air supply needed for the smoke ventilation of *escape routes* in the case of fire (Section 2, Fire) and for the safe operation of combustion appliances (see standards 3.21 and 3.22).

There is no need to ventilate:

a. a store room used only for storage requiring a controlled temperature, such as a cold storage room; and

b. a *room* with a floor area of not more than 4 m<sup>2</sup>. This is not intended to include a domestic-sized *kitchen* or utility room where ventilation should be in accordance with the recommendations in table to clause 3.14.5.

Ventilation should be to the external air. However clause 3.14.3 explains where *trickle ventilators* may be installed other than to the external air.

## Calculation of volume

For ventilation purposes, a *storey* should be taken as the total floor area of all floors within that *storey*, including the floor area of any *gallery* or openwork floor. The volume of any space is the internal cubic capacity of the space. Any space, other than for vehicle parking, where the volume is more than 6 m above any floor level in that space may be disregarded. Where the space is for vehicle parking, any volume more than 3 m above any floor level in that space may be disregarded.

**3.14.2 Natural ventilation (K2.1a & b, K4.1, K4.2)**

Natural ventilation of a *room* or *building* should be provided in accordance with the following recommendations:

a. for a *room*, by the provision of a *ventilator* with an opening area of at least 1/30<sup>th</sup> of the floor area of the *room* it serves, and

- a *trickle ventilator* with an opening area of at least 4000 mm<sup>2</sup>, if the area of the *room* is not more than 10 m<sup>2</sup>; or
- a *trickle ventilator* with an opening area of 400 mm<sup>2</sup> for each square metre of *room* area, if the area of the *room* is more than 10 m<sup>2</sup>; or

b. for a *toilet* with an area of not more than 10 m<sup>2</sup>:

- by the provision of a *ventilator* with an opening area of at least 1/30<sup>th</sup> of the floor area of the *room* it serves, and a *trickle ventilator* with an opening area of at least 4000 mm<sup>2</sup>; (see also clause 3.14.6) or
- mechanical extract in accordance with the table to clause 3.14.5;

c. for any *building*, by following the guidance in:

- Section 3 of BS 5925: 1991 (1995); or
- CIBSE Guide A: 1999, Design data, section A4, Air infiltration and natural ventilation.

The options in sub-clause c provide more flexible solutions but may require complex calculations.

#### Wet areas

Where a *building* is naturally ventilated, all moisture producing areas such, as bathrooms and shower rooms, should have the additional facility for removing such moisture before it can damage the *building*. Additional mechanical ventilation to such areas should be provided in accordance with the table to clause 3.14.5.

Where rapid ventilation is provided, such as an opening window or windows, some part of the opening should be at least 1.75 m above floor level. This will reduce the problems of stratification of air.

#### 3.14.3 Trickle ventilators (K4.1b, K4.2)

A *trickle ventilator*, sometimes called background ventilation, is a small ventilation opening, mostly provided in the head of a window frame, but not always, and is normally provided with a controllable shutter. They should be provided in naturally ventilated areas to allow fine control of air movement. A *permanent ventilator* is not recommended since occupants like control over their environment and uncontrollable *ventilators* are usually permanently sealed to prevent draughts.

The *ventilator* should be so positioned that a part of it is at least 1.75 m above floor level. This will allow at least some movement of air within the *building* and reduce stratification.

Although ventilation should normally be to the external air, a *trickle ventilator* serving a bathroom or shower-room may open into an area that does not generate moisture, such as a bedroom or hallway, provided the *room* is fitted with a *trickle ventilator* in accordance with the guidance in clause 3.14.2.

A *trickle ventilator* should be provided in an area containing a mechanical extract to provide replacement air and ensure efficient operation when doors are closed. This will prevent moist air being pulled from other 'wet areas'. The *trickle ventilator* should be independent of the mechanical extract so that replacement air can be provided when the extract fan is operating.

#### 3.14.4 Extensions built over existing windows

*Constructing* an extension over an existing window, or *ventilator*, will effectively result in an internal *room*, will restrict air movement and could significantly reduce natural ventilation to that *room*. Reference should be made to the guidance to standards 3.21 and 3.22 on the ventilation of combustion appliances, as this may be relevant. *There are other recommendations in Section 2: Fire relating to escape from inner rooms.*

A new *ventilator* should be provided to the *room* but, where this is not practicable, e.g. where there is no *external wall*, the new extension should be treated as part of the existing *room* rather than the creation of a separate internal *room*. Because an extension will be relatively airtight, the opening area between the 2 parts of the *room* should be not less than 1/15<sup>th</sup> of the total combined area of the existing *room* and the extension.

If the extension is *constructed* over an area that generates moisture, such as a

*kitchen*, bathroom, shower room or utility room, mechanical extract, via a *duct* if necessary, should be provided direct to the outside air. Any existing system disadvantaged by the *work* may require to be altered to ensure supply and extracted air are still to the outside air.

### 3.14.5 Mechanical ventilation (K2.1d & c, 4.6, 4.7, 4.9, 4.10)

A mechanical ventilation or air conditioning system should be designed, installed and commissioned to perform in a way that is not detrimental to the health of the occupants of a *building* and when necessary should be easily accessible for regular maintenance.

Mechanical extract should be provided in *rooms* where the cubic space per occupant is not more than 3 m<sup>3</sup>, and where the *rooms* have low ceilings and are occupied by large numbers of people.

Mechanical ventilation should be provided in accordance with the following:

- a. compliance with the guidance in BS 5720: 1979; or
- b. compliance with the guidance in CIBSE Guide B: 2001, Installation and equipment data, section B2, Ventilation and air-conditioning (requirements); or
- c. for occupiable *rooms*, where a mechanical air supply is provided at a rate of at least 8 litres/second of fresh air per occupant based on sedentary occupants and the absence of other requirements such as the removal of moisture. This assumes that the provision is for a 'no smoking *room*'. It is generally recognised there is no safe level of protection from tobacco smoke and it is recommended that designers consult current guidelines issued by the Health and Safety Executive. Where smoking is permitted in a *building*, the recommendations in clause 3.2.1.4 of the CIBSE Guide: Section B2: 2001 may be reasonable.
- d. for domestic-sized *rooms* where moisture is produced, such as *kitchens*, bathrooms and *sanitary accommodation*, rapid ventilation and *trickle ventilation* should be provided in accordance with the guidance in the following table:

#### Mechanical ventilation of domestic-sized *kitchens*, bathrooms and *toilets*

Space	Ventilation provision [2]	Trickle Ventilation
<i>Kitchen</i>	either; a. mechanical extraction capable of at least 30 litres/sec (intermittent) above a hob [1]; b. mechanical extraction capable of at least 60 litres/sec (intermittent) if elsewhere [1];	4000 mm <sup>2</sup>
Utility room or washroom	mechanical extraction capable of at least 30 litres/sec (intermittent) [1].	4000 mm <sup>2</sup>
Bathroom or shower-room (with or without a WC)	mechanical extraction capable of at least 15 litres/sec (intermittent).	4000 mm <sup>2</sup>
<i>Toilet</i>	mechanical extraction capable of at least 3 air changes per hour.	4000 mm <sup>2</sup>

Note:

1. Refer to guidance to standard 3.17 and OFTEC Technical Information Sheet TI/112 where an extract fan is fitted in a *building* containing an *open-flued* combustion appliance. Extract rates should be reduced.
2. Long duct runs, flexible ducting and bends can seriously reduce fan performance and should be carefully considered during design.

Continuous mechanical ventilation For smaller, domestic sized developments, a mechanical ventilation system complying with BRE Digest 398, 'Continuous mechanical ventilation in dwellings: design, installation and operation' may be appropriate.

Input air Mechanical input air ventilation is another option for supplementing the ventilation to a *building*. However it may only be suitable for small domestic sized *buildings* as the system has been principally developed for the domestic market. Further information should be obtained from the manufacturer.

Where a mechanical ventilation system gathers extracts into a common *duct* for discharge to an outlet, no connection to the system should be made between any exhaust fan and the outlet.

Mechanical ventilation should be to the outside air. However it may be via a *duct* or heat exchanger.

Care should be taken when installing mechanical extract systems where there is an *open-flued combustion appliance* in the same *room* or close by. Guidance is given in clause 3.17.9, extract fans.

Cross contamination An inlet to, and an outlet from, a mechanical ventilation system should be installed so as to avoid contamination of the air supply to the system. The inlet to, and the outlet from, the mechanical ventilation system should be installed in accordance with the recommendations in Clause 2.3.3 of BS 5720: 1979.

A mechanical ventilation system should be *constructed* to ensure, as far as is *reasonably practicable*, the avoidance of contamination by legionella. The ventilation system should be *constructed* in accordance with the recommendations of Paragraphs 70 to 84 of The Control of Legionellosis including Legionnaires' Disease.

Control of Legionellosis There are additional recommendations in Section 2: Fire where mechanical ventilation systems pass through *compartment* and *separating walls* and *separating floors*.

### 3.14.6 Ventilation of *sanitary accommodation*

Any *room* containing *sanitary facilities* should be well ventilated, so that offensive odours do not linger. Measures should be taken to prevent odours entering other *rooms*. This may be achieved by, for example, providing a ventilated area between the *sanitary accommodation* and the other *room*. Alternatively it may be possible to achieve it by mechanical ventilation or, if the *sanitary accommodation* is well sealed from a workroom and has a door with an automatic closer, by good natural ventilation.

However, no *room* containing *sanitary facilities* should communicate directly with a *room* for the preparation or consumption of food. This does not apply to places of lawful detention, such as integral sanitation in prison cells.

### 3.14.7 Ventilation of small garages (K3.2)

The principal reason for ventilating garages is to protect the *building* users from the harmful effects of toxic emissions from vehicle exhausts. Where a garage is attached

to a *building*, designers may wish to consider making the separating *construction* as air tight as possible. Where there is a communicating door, a lobby arrangement could be considered.

Garages of less than 30 m<sup>2</sup> do not require the ventilation to be designed. It is expected that a degree of fortuitous ventilation is created by the imperfect fit of 'up and over' doors or pass doors. With such garages, it is inadvisable for designers to attempt to achieve an airtight *construction*.

A garage with a floor area of at least 30 m<sup>2</sup> but not more than 60 m<sup>2</sup> used for the parking of motor vehicles should have provision for natural or mechanical ventilation. Ventilation should be in accordance with the following guidance:

- a. where the garage is naturally ventilated, by providing at least 2 permanent *ventilators*, each with an open area of at least 1/3000<sup>th</sup> of the floor area they serve, positioned to encourage through ventilation with one of the permanent *ventilators* being not more than 600 mm above floor level; or
- b. where the garage is mechanically ventilated, by providing a system:
  - capable of continuous operation, designed to provide at least 2 air changes per hour; and
  - independent of any other ventilation system; and
  - *constructed* so that two-thirds of the exhaust air is extracted from outlets not more than 600 mm above floor level.

### 3.14.8 Ventilation of large garages (K3.1)

A garage with a floor area more than 60 m<sup>2</sup> for the parking of motor vehicles should have provision for natural or mechanical ventilation on every *storey*. Ventilation should be in accordance with the following guidance:

- a. section B2 of the CIBSE Guide 2001:
  - to give carbon monoxide concentrations of not more than 50 parts per million averaged over an eight hour period; and
  - to restrict peak concentrations of carbon monoxide at areas of traffic concentration such as ramps and *exits* to not more than 100 parts per million for periods not exceeding 15 minutes; or
- b. section 4 of the Association for Petroleum and Explosive Administration's "Code of practice for ground floor, multi-*storey* and underground car parks" and CIBSE Guide B, 1986, Section B2; or
- c. by providing openings in the walls on every *storey* of at least 1/20<sup>th</sup> of the floor area of that *storey* with at least half of such area in opposite walls to promote extract ventilation, if the garage is naturally ventilated; or
- d. by providing mechanical ventilation system capable of at least 6 air changes per hour and at least 10 air changes per hour where traffic concentrations occur; or
- e. where it is a combined natural/mechanical ventilation system, by providing:
  - openings in the walls on every *storey* of at least 1/40<sup>th</sup> of the floor area of that *storey* with at least half of such area in opposite walls; and
  - a mechanical system capable of at least 3 air changes per hour.

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