

Air Infiltration Review

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Checking The Performance Of Ventilation Systems: The Swedish Approach

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In recent years, poor indoor climate has increasingly been seen as the cause of health problems for building occupants. Today, there is good evidence in some areas why such problems arise. Unhealthy substances given off by various building materials, the existence of mould and general air pollution are the main causes. In general, the most important way to remedy the problem is improved ventilation. Poor upkeep and maintenance have led to a decline in the performance of existing ventilation systems.

Briefly this is why the Swedish Parliament and Government decided, in complete political unanimity, to introduce regulations on compulsory inspection of ventilation systems. The National Board of Housing, Building and Planning has issued the general guidelines about performance checks on ventilation systems which are presented briefly in this article.

Why check ventilation?

For a good indoor climate

One basic condition for a good indoor climate is ventilation that works properly. Defects are often

simple to remedy. Sometimes it is only a matter of changing a filter or a fan belt or cleaning a dirty ventilation unit. Good ventilation performance requires a properly run operation and maintenance organization which makes regular inspections.

For a good return of investments

Installations in modern buildings account for a large proportion of building costs. To ensure these investments are not wasted, adjustments must be carried out properly when the building is brought into use. These adjustments require regular follow-up inspections so that performance does not decline over time.

For lower operation and maintenance costs

Well-managed installations result in lower operation and maintenance costs. The life-span of equipment and components is lengthened and this also helps to keep total costs down. With well-managed installations it is furthermore possible to reduce the electricity needed for running the systems.

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The legal side of compulsory ventilation performance checks

The compulsory ventilation performance checks are based mainly on two Swedish law acts; the Swedish Planning and Building Act (PBA 1987:10) and the Swedish Work Environment Act (1977:1160). They both apply to a good indoor climate and the owner of a building is responsible for ensuring this.

Hence, it was possible to introduce compulsory ventilation performance checks and the owner of a building shall be responsible for ensuring that all checks are carried out, both before a ventilation system is brought into use for the first time as well as at repeated intervals during the building's lifetime. Checks are to be carried out by an inspector who has either received national authorization from the Swedish National Board of Housing, Building and Planning or has been approved by a municipality i.e. local authorization.

If the owner of a building does not follow the regulation about the compulsory ventilation performance checks or fails to remedy stated defects, the municipality can (according to PBA) order the owner to carry out required measures and, where necessary, link this to a fine.

Compulsory ventilation checks

Extent

For a ventilation system already in use before 1st January 1992, the first inspection shall be carried out before the end of 1993, 1994 or 1995, depending on the type of building and ventilation systems.

When inspecting a new installation, not only shall the current regulations be observed, but checks shall also be made that drawings and design documents have been followed, that the ventilation system is correctly adjusted and that it works in a satisfactory manner. If the designer has specified higher ventilation requirements than required by the regulations, then the inspection shall also check that these requirements are met. The inspector shall also check that the system does not include any contamination which can spread throughout the building and that instruction and operation manuals are readily accessible.

When inspecting an existing installation the inspector shall check that its performance and other aspects conform to the regulations that were in force when the system was brought into operation and that the system, in general, operates in the way intended. The existence of contamination as well as the availability of instruction and operating manuals shall be checked in the same way as for the inspection of new installations.

The inspection shall primarily involve the carrying out of total flow rate measurements in combination with random checks of representative dwellings or premises.

Exemptions

Performance checks shall be carried out in all buildings with the exception of

- detached and semi-detached dwellings with natural ventilation
- detached and semi-detached dwellings with only mechanical exhaust air ventilation
- buildings for agriculture, forestry or similar activities
- industrial buildings
- buildings which are for the Total Defence purposes and are secret.

Dates and intervals for regular inspections

Prescribed dates and intervals for regular inspections and approved authorization level of the inspector are shown in table 1.

Table 1

Buildings	Last date for first inspection of existing building	Inspection intervals	Inspector qualifications class
1. Day-care centres, schools, health care centres etc.	31 Dec 1993	2 years	K
2. Blocks of flats and office buildings etc. Balanced ventilation.	31 Dec 1994	3 years	K
3. Blocks of flats and office buildings etc. Mechanical exhaust ventilation.	31 Dec 1995	6 years	N

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Air Infiltration Review has a quarterly circulation of 3,500 copies and is currently distributed to organisations in 40 countries. Short articles or correspondence of a general technical nature related to the subject of air infiltration and ventilation are welcome for possible inclusion in AIR. Articles intended for publication must be written in English and should not exceed 1,500 words in length. If you wish to contribute to AIR, please contact the Air Infiltration and Ventilation Centre. Please note that all submitted papers should use SI units.

4. Blocks of flats and office buildings etc. Natural ventilation.	31 Dec 1995	9 years	N
5. One and two-dwelling houses. Balanced ventilation.	31 Dec 1995	9 years	N

If the inspection identifies faults, these should be remedied within 6 months, so that a repeated inspection gives a satisfactory report. If a property owner does not fulfil his/her responsibilities, the municipality can order the property owner to carry out the necessary measures.

The inspectors' qualifications

Authorization is issued for two different levels: authorization N is for simple installations and authorization K for more complicated installations.

Authorization N entitles the holder to check the ventilation systems in one- or two-dwelling houses as well as natural and mechanical ventilation systems in block of flats and offices etc.

Authorization K entitles the holder to check all types of ventilation systems.

General technical qualifications

Examination from (either of):

- a) an institute of technology
- b) engineering training at a former three and four-year technical college
- c) present technical college four and five-year technical training
- d) professional technical training at a university college or
- e) other training which the National Board of Housing, Building and Planning regards as of equivalent value.

In all cases it is assumed that the training has been acquired as part of studies in appropriate technical subjects, such as building or installation technology.

Practical experience

N authorization: Professional work for at least three years in some of the following fields; design, production management, inspection or checking of ventilation systems except balanced systems in larger buildings.

K authorization: As above, but professional work for at least five years and inspection and checking of all kinds of systems (with or without heat recovery).

Supplementary training

If the applicant lacks professional experience of adjustment and/or inspection and checking, then the

applicant shall undergo supplementary training in these fields.

Knowledge about administrative regulations

Knowledge about the Swedish administrative procedures concerning building permits and contacts with the authorities.

Inspection implementation

There are considerable variations in how installations and buildings are designed and constructed. Each ventilation performance check should therefore be adapted as far as possible to the individual building. However, the following points shall always be included in a ventilation performance check:

- Operation and maintenance instructions
- Air change
- Humidity
- Fans and air handling units
- Recirculated air
- Deposits in ventilation ductwork
- Radon
- User viewpoints

Reports

A report on the results of checking the performance of a ventilation system shall be drawn up and signed by the inspector. The report shall be sent to the property owner and the municipality.

Certificate

A special certificate will be issued after an inspection has been carried out and include the date of the inspection. The property owner shall place the certificate in a clearly visible position in the building.

Present status of the work

At the present time the Swedish National Board of Housing, Building and Planning is not able to present a nation-wide review on the results of the ventilation performance checkings carried out during 1993. A questionnaire will be sent out to all municipalities (287) in order to get back information on how the checkings have been performed in practise. The frequencies of passed / unpassed systems, number of exemptions (if any) and number of applicants who have been given local authorization by the municipality will be reported.

In spite of a strong resistance against this authoritarian control - initially - now almost all building owners admit that this really was necessary by no means less seen in the perspective of appr. 30 % of the Swedish population suffering from hypersensitivity in one form or another.

Operation and maintenance instructions are often found to be lacking. The ducts are in many cases

very dirty, giving rise to strongly reduced flow rates and imbalance in the ventilation systems.

A more detailed report on the results of the ventilation performance checking will be presented later this year. Finally, it could be mentioned that there has been shown a particular interest in the Swedish performance checking from many other countries around the world. The problems of badly performing ventilation systems are not unique to Sweden...

References

Checking the performance of ventilation systems, General Guidelines 1992:3 (In English, to be published soon). The book could be ordered from The Swedish National Board of Housing, Building and Planning, P.O.Box 534, S-371 23 KARLSKRONA, Sweden.

ASHRAE Winter Meeting New Orleans, January 1994

Martin W Liddament

A considerable proportion of building energy use is often needed to heat or cool indoor air. From an energy aspect it is therefore desirable to minimise the amount of incoming air that needs to be treated. Unfortunately, this can impact on air quality and thus the subject of indoor air quality has become inextricably linked to ventilation energy use in buildings. Essentially, the quality of air is improved either by ventilation (which is energy intensive) or by controlling the sources of avoidable pollutant emissions. As a consequence, the subject of air quality attracts much interest and this was particularly evident at the ASHRAE Winter meeting held in New Orleans. Symposia, Seminars, Technical Committee and Standards meetings related to ventilation and air quality were all well attended.

ASHRAE Seminars

An increasing number of seminars are finding their way into the ASHRAE programme. Unfortunately, papers or proceedings of these seminars are not published, yet, much interesting material is often presented. The wide use of parallel sessions also inhibits the opportunity to follow all the relevant sessions. Of those attended, the following were of particular interest:

Outdoor Air

An essential prerequisite of good indoor air quality is that the outdoor air itself should be pollutant free. A seminar entitled "Complying with the clean air act amendments of 1990" concentrated on this particular issue. The Act applies to the United States and has been introduced to limit and reduce harmful pollutant emissions into the atmosphere. It addresses the following topics:

(i) Attainment and maintenance of ambient air quality Standards

- (ii) Motor Sources
- (iii) Hazardous air pollutants
- (iv) Acid Deposition (from power utilities)
- (v) Permits
- (vi) Stratospheric Ozone Pollution

The Seminar specifically focused on issues (i), (iii) and (v). Attainment and Maintenance is directed at locations where major pollutants exceed specified concentration criteria. Included in this list are CFC's, oxides of nitrogen, ozone, lead and volatile organic compounds. The degree to which concentration is exceeded is categorised into five bands, varying from marginal to extreme. Target dates have been set for when the concentration criteria must be met; these range from between 1997 for the marginal band to 2010 for the extreme band. Control measures include emission caps, permits and other restrictions. Emissions from new sources are only permitted if they are offset by reducing emissions from existing sources by a greater amount, i.e. an 'offset' ratio of greater than one must be applied. Emission caps prevent a company from increasing the rate of pollutant emission as its business expands.

Indoor Air Quality

A seminar on indoor air risk assessment reviewed the difficulties often experienced in establishing the risk to health associated with the presence of contaminants in a building. Typically, health risk assessment is based on a linear extrapolation of data from a known risk condition. The presence of radon gas and volatile organic compounds (VOC's) were cited as good examples of pollutants which have unresolved and seemingly unresolvable health risks. This, it is argued, is because the predicted number of occupants likely to be seriously affected is minute in relation to the total size of population that develop cancers.