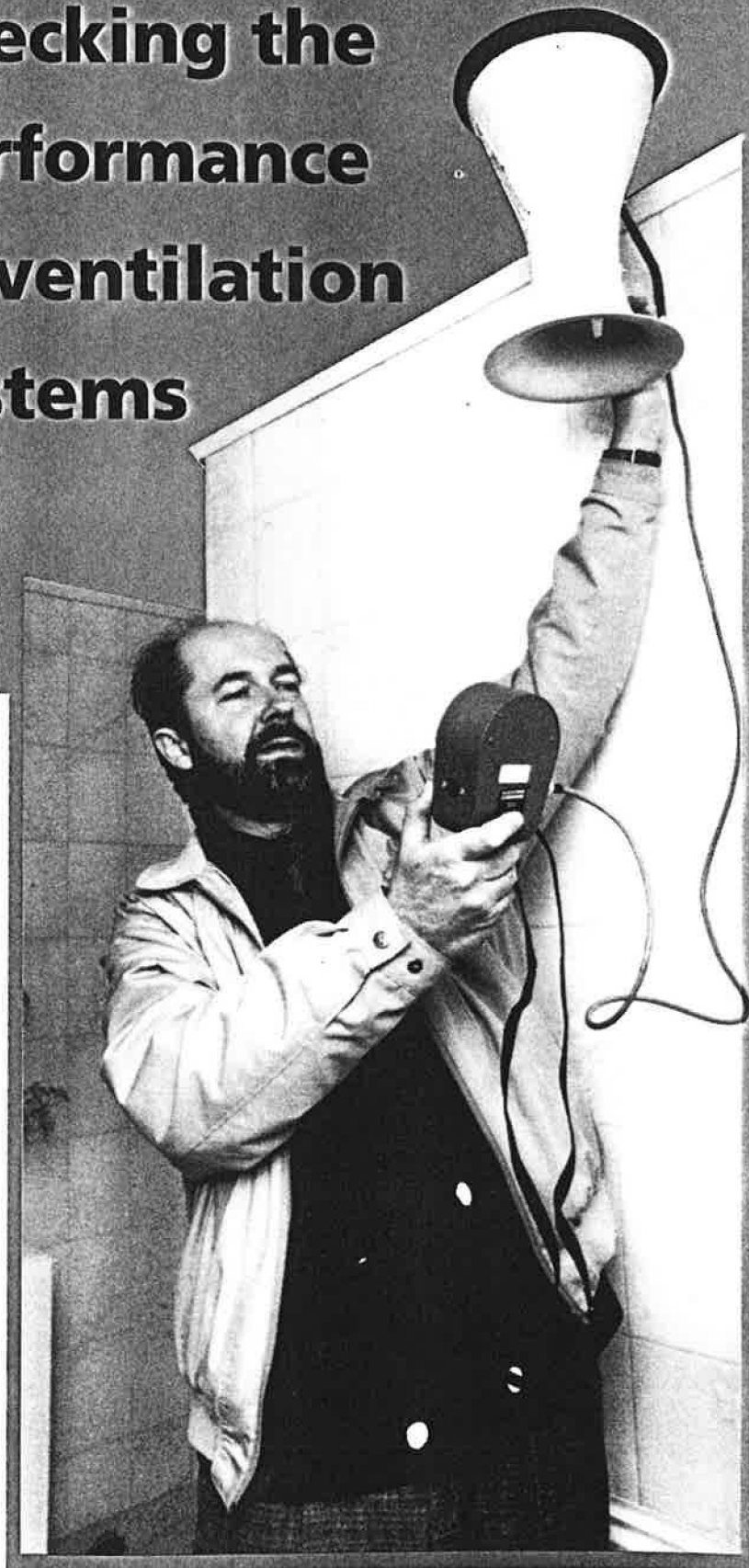


Checking the performance of ventilation systems



**The Swedish National Board of Housing,
Building and Planning.
General Guidelines 1992:3E**

Checking the performance of ventilation systems

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Preface

In recent years, poor indoor climate has caused health problems for building occupants. Sometimes these problems have been so serious that these buildings have, quite rightly, been labelled "sick buildings".

Today, there is good evidence in some areas about why such problems arise. Unhealthy substances given off by various building materials, the existence of mould and general air pollution are the main causes. Another important factor is the high level of humidity in buildings and indoor air.

In general, the most important way to remedy the problem is improved ventilation. Unfortunately many studies have shown that poor upkeep and maintenance have led to a decline in the performance of existing ventilation systems. If, in the future, we do not look after our ventilation systems properly and adapt operation and maintenance to current user habits, then even more buildings will become problem buildings. More people will suffer by health problems unnecessarily.

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

This information is primarily addressed to property owners, the people responsible for ensuring that performance checks are carried out, but residents and users are also important target groups. As building users we all have a joint interest in good indoor climate. With the help of property owners and managers we can all enjoy an improved indoor climate. Performance checks are a first step in this direction.

Karlskrona, May 1992

Gösta Blücher, Director General.

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CHAPTER ONE

Why check ventilation?

For good indoor climate

One condition for a good indoor climate is ventilation that works properly. The link between poor air exchange and air pollution is self-evident.

The actual performance of ventilation systems, their quality and maintenance, adequate demands on airchange and the use of recirculated air are central issues with regard to a good indoor climate.

Defects in ventilation systems 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.

Ensuring that mistakes and defects are discovered and dealt with in time, requires a properly run operation and maintenance organization which makes regular inspections. Users need readily available and easily understandable information explaining how they can contribute to a better indoor climate.

For a good return on 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.

In modern buildings with many installations, the electricity used by ventilation systems accounts for a large proportion of total electricity consumption.

With regular checks of ventilation installations it is possible to not only achieve a good indoor climate but also to reduce electricity costs.

For property owners interested in good operational economy and satisfied users, the need for proper working ventilation is obvious. However, the alarming reports in recent years, concerning poor indoor climate, highlights the general frequency of ventilation problems.

What does the legislation say?

According to the Swedish Planning and Building Act (PBA 1987:10), buildings are to provide opportunities for good hygiene, a good working environment and a satisfactory indoor climate. From the legislation

follows in addition that the ventilation systems must be looked after and maintained.

The demand for maintenance means that the function of a building may not manifestly deteriorate in relation to what was originally intended.

The Swedish Work Environment Act (1977:1160) also applies to indoor climate. Amongst other things it states that air, noise and lighting conditions as well as other work hygiene aspects shall be satisfactory.

Introduction of compulsory ventilation performance checks

The PBA has now been supplemented with a special regulation which states how checks of ventilation installations are to be carried out.

According to the regulation (1991:1273) about checks on the performance of a ventilation system, the owner of a building shall be responsible for ensuring all checks are carried out, both before a ventilation system is brought into use for the first time as well as at regular 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.

National authorization is divided into two classes according to qualifications. These are described in the section entitled "Inspector qualifications". For local authorization a municipality is free to choose other qualifications.

If the owner of a building does not follow the regulation about checks on the performance of ventilation systems or fails to remedy stated defects, the municipality can, with the aid of the regulations under section 10 of the PBA, order the owner to carry out the required measures and, where necessary, link this to a fine. It should also be noted that a municipality can also take action on the basis of the Swedish Health Protection Act (1982:1080) if unhygienic conditions are shown to exist.

CHAPTER TWO

Compulsory ventilation checks

Statutory Requirements

Basic regulations concerning the purpose and extent of these checks are to be found in the *Ordinance on performance checks of ventilation systems*. The Swedish National Board of Housing, Building and Planning has, on the basis of this ordinance, issued regulations concerning

- systems and buildings which are exempt from compulsory checks, inspection intervals and repeat inspections, and the latest date for the first inspection of an existing building (BFS 1992:15).
- fees for issuing a national authorization (BFS 1992:26)

Extent

For a ventilation system already in use before 1 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 system. Performance checks shall be carried out not only when a new installation is brought into use but also at regular intervals during the installation's lifetime.

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 developer 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 operating 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 measurements in combination with random checks of representative dwellings or premises. It would be appropriate, in such cases, to have access to earlier inspection reports and measurements. This would simplify performance checks and reduce costs.

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 Total Defence purposes and are secret.

It should be noted that office and personnel areas in industry's are not exempted from checks.

With regard to dwellings and premises which are expected to be unused for a limited period, it may be appropriate for the municipality, on the basis of the last paragraph of The National Board of Housing, Building and Planning's regulations, to permit inspection at a later date.

These regulations also provide a municipality with the opportunity of adapting the dates of prescribed checks and co-ordinating them with checks by other bodies. This can refer to e.g. premises for production purposes, for foodstuffs and laboratories.

Dates and intervals for regular inspections

The following table indicates:

- the latest date for the first inspection of an installation brought into use before 1 January 1992
- intervals for regular checks
- approved authorization level of the inspector (commented in greater detail in the following section).

Buildings	Last date for first inspections 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, office buildings, etc. Mechanical exhaust ventilation.	31 Dec 1995	6 years	N
4. Blocks of flats, 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

Comments on the table

The category day care centres, schools and health care centres should also include pre-school premises, secondary schools, leisure centres and old peoples' homes. The category does not include institutions for higher education (e.g. universities). These are included in the category office buildings.

The category blocks of flats and office buildings includes meeting rooms, shops, theatres, cinemas, sport halls, terminals, museums, exhibition halls, hotels and garages.

Balanced ventilation refers to the fan ventilation of supply and exhaust air. **Mechanical ventilation** refers only to fan-controlled exhaust air ventilation. **Natural ventilation** refers to the ventilation created by thermal forces.

If the inspection identifies faults these should be remedied within 6 months so that a repeat 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.

CHAPTER THREE

The inspector's qualifications

Performance checks of ventilation systems are to be carried out by an inspector who is authorized either nationally by the Swedish National Board of Housing, Building and Planning or locally by the municipal committee(s) responsible for planning and building matters. Only those persons having the necessary training and experience and who are suitable for the task will be approved.

National authorization

Upon approval of the application, The National Board of Housing, Building and Planning issues an inspector with a national authorization certificate. An inspector with national authorization is entitled to work as an inspector throughout Sweden. For persons meeting the qualification requirements, the National Board of Housing, Building and Planning issues an authorization certificate which is normally valid for five years. The application to the National Board of Housing, Building and Planning shall be accompanied by a curriculum vitae and attested copies of certificates and testimonials. For the National Board of Housing, Building and Planning's evaluation, charges are levied in accordance with special fees (BFS 1992:26).

The following evaluation guidelines should not be regarded as the only means of documenting an applicant's qualification for national authorization.

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 blocks of flats and offices, etc.

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

Demand for general technical qualifications.....

The applicant should exhibit general technical competence documented through examinations from

- 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.

.....and practical experience.

The demand for experience in the case of the N authorization is met if the applicant, after examination, has worked in a professional capacity for three years in some of the following fields. These are projecting, production management, the inspection or checking of ventilation systems of the natural ventilation type, mechanical exhaust ventilation type for blocks of flats or offices and balanced ventilation systems for detached or semi-detached dwellings.

In the case of the K authorization the applicant shall, after examination, have five years professional experience in some of the following fields: projecting, production management, adjustment, inspection and checking of balanced ventilation (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

In addition to knowledge about the regulations concerning performance checks for ventilation systems, the applicant should also know about the Swedish administrative procedures concerning building permits and contacts with the authorities. This should involve overall familiarity with

- The Planning and Building Act
- The National Board of Housing, Building and Planning's Regulations for New Construction
- Earlier acts and ordinances concerning construction
- The National Rescue Service Board's regulations for new air-raid shelters and the former National Board of Civil Defence's regulations for older types of air-raid shelters¹
- The National Board of Industrial Safety's regulations AFS 1986:22 concerning asbestos
- The ordinance (1985:997) about the obligation to report the occurrence of asbestos in ventilation installations.

Local authorization

The municipality determines whether a qualified inspector is to receive local authorization. The guidelines noted above regarding national authorization can help the municipality in its deliberations. However, personal knowledge which the municipality may possess offers the possibility of a more flexible assessment of an applicant's qualifications and extent of authorization than in the case of a central assessment.

¹The Civil Defence Board ceased to exist on 1 July 1986 when the National Rescue Service Board was established. New technical regulations for air-raid shelters were issued by the NRSB.

Responsibility and consequences of negligence

If the owner of a building does not fulfil his/her responsibilities according to the regulations about checking the performance of ventilation systems, the municipality can intervene on the basis of section 10 in the Planning and Building Act.

In decisions reached by the National Board of Housing, Building and Planning or a municipality concerning the authorization of an inspector, it should also be noted that the authorization can be withdrawn if the inspector neglects his/her responsibilities.

CHAPTER FOUR

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

An operation and maintenance instruction manual for a ventilation system shall always exist. The instructions should include comprehensive drawings as well as a description of the ventilation system. The descriptive material can include e.g. a schematic diagram with explanatory text. Inspection panels and fire valves should be indicated on the drawings.

Operating instructions should also include a description of the installation as well as instructions about how to use it. A simple fault-localization schedule should also be included.

The instructions should also include directions about the replacement of filters, the intervals at which ducts should be cleaned, cleansing and lubricating. Directions for operation and maintenance are available in VVS AMA and in "Advice and directions to VVS AMA".

Measurement methods

When checking the performance of different parts of a ventilation system, the measurement methods employed shall facilitate subsequent follow-ups. To make this possible, the instructions for each measurement method must be followed and, if necessary, instruments for measurement must be calibrated. The inspector should therefore be well-informed about these methods.

In buildings with balanced ventilation, both supply and exhaust air flows shall be measured so that all components in the ventilation system are covered. Appropriate measurement methods are described in the National Council of Building Research publication T32:1982. It is up to the inspector to select dwellings and premises. The method of selection shall be documented.

The same method for air flow measurements shall be applied to buildings with mechanical ventilation. The inspector's report should indicate how the outdoor air supply is designed to work and how actual performance has been measured and assessed.

Air change

In natural ventilation systems the flow of air varies considerably in relation to temperature and wind conditions. It is therefore often of

little or no interest to measure the flow of air in a building with a natural ventilation system. It should be sufficient to find out about the system's design and whether alterations have been made which may have resulted in impaired air change. The inspector shall also check that ducts and exhaust air terminal units are not clogged. In the same way as for exhaust air systems, it is also important to discover how the outside air supply works.

If activity inside the building has changed after it was first brought into use, demands on the ventilation system should be adapted to the current use. This shall be noted in the inspector's report.

Humidity

Humidity results in the spreading of bacteria, mould and mould fungus. These break down organic material as well as creating smells which have a negative impact on the indoor environment.

Living and hygienic habits are of great importance with regard to the amount of humidity in indoor air. This also affects the need for ventilation. Particular attention shall therefore be given to the ventilation of areas with high moisture load.

Fans and air handling units

A ventilation performance check should start by ensuring that the performance and operation of all components of the air handling unit accord with inspection details. These details can refer e.g. to fans, pumps, filters and dampers. Visual checks of airtightness and cleanliness should also be made.

Recirculated air

When checking a ventilation system with recirculated air, it is especially important to assess that

- air quality in premises, supply air quality and outdoor air flows are satisfactory
- air quality in each room can be held at a level to eliminate health risks and prevent unhygienic conditions, and
- the movement of foul smelling gases or substances (especially those with a health risk) from one room to another does not occur.

Deposits in ventilation ductwork

Deposits in ventilation ducts can, in addition to being a hygienic risk, reduce air flow capacity, affect fan performance and reduce heat recovery. Efficient filtration and maintenance of filters protects the ducts and components from deposits. This can lengthen the intervals between system cleanings.

Through the regular measurement of air flow at specific reference points in combination with a visual check of the duct system, ongoing information about the state of uncleanliness can be acquired.

Cleaning should be based on a dry method in order to avoid introducing chemicals and solvents into the ventilation system. The selected cleaning method should not cause any discomfort to those in the premises. Checks of the degree of cleanliness achieved should be

determined by the quantification of e.g. the number of particles in the ventilation system. A good hygienic standard is achieved with a median value of 1g dust per m² duct area.

It may also be necessary to require higher demands when activities are of such a nature that an individual's health is to be safeguarded, e.g. schools, daycare centres and district health centres.

The cleaning of both exhaust and supply systems should be carried out to also ensure good recirculated air quality.

Radon

Ventilation systems which have been installed for the reduction of radon gas concentrations are also included in the compulsory performance checks.

User viewpoints

In order to get an idea about how a ventilation system works, it can often be useful to listen to the views of operating staff, residents and other users. This information can be acquired through a questionnaire survey. The result of such a survey can form the basis for the selection of measuring points and checking methods.

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 should include the official designation of the property, the owner of the building, the date of the performance checks, the measurements carried out, comments on what faults are to be rectified before re-inspection, advice to the property owner concerning alternative solutions and a final comment about the acceptability or otherwise of the ventilation system's performance. The report shall be sent to the property owner and to 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.

More detailed inspection

In many cases there may be good financial reasons for a property owner to permit a more detailed inspection in conjunction with the compulsory ventilation system inspection.

A more detailed inspection can demonstrate specific opportunities e.g. for improved heat exchange, for the more efficient use of electricity and for the more precise adjustment of the ventilation installation.

Noise

In the cases where the ventilation system is regarded as creating discomforting noise or exhibits very poor insulation against air noise, the system should be checked against the same documents as used for inspection purposes.

CHAPTER FIVE

Older regulations about ventilation

Regulations for new buildings

Over the years increasing demands have been placed on ventilation systems. From a natural ventilation system, development then moved towards balanced ventilation with heat recovery.

The following text reviews what has been basically included in the different regulations that have appeared during the past forty years.

Natural ventilation

In the municipal regulations, which preceded the national ones, there has been a requirement, as early as 1916 in Stockholm, that there should be an outdoor air duct leading to a windowless bathroom. This led to the description "Stockholm ventilation" for this solution.

Included in the regulations was also the requirement for a natural ventilation duct from each room and from the kitchen and bathroom.

Exhaust air systems

Right from the beginning there has been, in the regulations for exhaust air systems, demands for definite exhaust air flows from units e.g. in kitchens and bathrooms, as well as the type of unit and area of the outdoor air intake and the transfer air mechanism.

In 1931, complete regulations for exhaust air ventilation systems were published in the technical journal "The Builder" (*Byggmästaren*). Shortly afterwards the Building Committee of the City of Stockholm issued regulations for fan ventilation. An expanded version of these regulations, including a description of a low pressure system using propeller fans, was issued in 1937.

The state regulations from BABS 46 and onwards applied to the areas of exhaust air ducts, transfer air units and outdoor air units but not any flows. Additionally, exhaust air openings were included for bathrooms and kitchens as well as the types of supply air and exhaust air units.

According to the 1937 Stockholm City Building Committee regulations the following requirements were placed on exhaust air ventilation in dwellings. Outdoor air is taken "from window fresh air intakes which are easy to manoeuvre and fit tightly when shut. They should be placed under the window-sill and the front edge should open". Transferred air should be obtained through the upper end of the door. The airflows were to be 110 m³/h in the kitchen, 80 m³/h in the bathroom and 1.5 air changes/h in living rooms.

Balanced ventilation

The first time state regulations for balanced ventilation were published was in SBN 67 and requirements for supply air, transferred air and flows were included.

- Supply air was to come from a supply air terminal unit which could be adjusted and locked at the position to which it was turned.
- Transferred air was provided through valves or other means.
- The same flows were required as for mechanical exhaust ventilation. Somewhat larger exhaust airflow rates were required compared with the supply airflow rate.

Air speed

SBN 67 stated that supply air should be provided without discomforting draughts or other inconvenience. Earlier regulations were similarly formulated.

SBN 75 gave the accepted solution that an outdoor supply air unit is positioned and designed so that outdoor air is rapidly mixed with warm air e.g. from radiators.

SBN 80 included a quantified requirement for highest air speed as a condition in the calculation of directive operative temperatures. In the title of the tables with acceptable values, the following could be read: Acceptable dimensioning values of directive operative and for surface temperatures of floors, on condition that air speed is less than 0.2m/s. These values were only intended for checking calculations and not for checks when measuring temperatures.

Outside air pollution

SBN 75 included a requirement that an air intake was placed so that the carbon monoxide (CO) content of outside air did not exceed a higher value than 1/10 of the hygienic limit then set by the National Board of Industrial Safety. This requirement was unchanged in SBN 80.

Radon

SBN 80 described the highest radon gas concentration permissible: Homes shall be arranged so that the annual mean value of radon gas concentration in indoor air in premises where people remain constantly rises to max 70 Bq/m³. The annual mean value of radon gas concentration is determined by methods prescribed by the National Institute for Materials Testing in consultation with the National Radiation Protection Institute.

Need for ventilation duct cleaning

The 1981 Commentary to the Swedish Building Standards included a classification of exhaust air ducts with regard to cleaning needs. Suitable cleaning intervals for exhaust air ducts in dwellings were given as 2 years.

Regulations for modernization

When carrying out alterations to a building, the Building Ordinance required the application of the same regulations as for new buildings. However, building committees could permit exemptions. Up to SBN 75 there were no state regulations for modernization.

SBN 75

SBN 75 contained modernization regulations. With regard to ventilation it was prescribed that exemptions could be made to the requirement for fan ventilation in multi-storey buildings.

An acceptable solution was given: Natural ventilation arrangements, similar to natural ventilation systems in new buildings, were to be accepted. For windowless bath or shower rooms the following alternatives could be accepted:

- A separate fan started by a special switch. Transfer air from the rest of the flat was accepted as a supply air terminal unit.
- Connection to an existing natural ventilation system of older type and arranged with a vertical supply air duct which was led over the building's roof was accepted.
- For bath and shower rooms in one room flats, natural ventilation was accepted using transfer air and a separate exhaust air duct.

SBN 80

SBN 80 contained more detailed regulations for ventilation systems in modernized buildings.

With regard to fan ventilation of the mechanical exhaust ventilation or balanced ventilation types, the following solutions were accepted:

- Any existing air treatment installation was adjusted so that an overall air change of at least 0.35 l/s m² was achieved for flats. In kitchens, bathrooms and separate toilets, checks were made that the lowest air flow rates for new construction were achieved. Alternatively, it was accepted that the older regulations for fan ventilation, valid when the building was erected, were complied with.

With regard to natural ventilation in multi-family dwellings, the following solution was accepted:

- The existing natural ventilation system was accepted in dwellings if its original function could be assessed as satisfactory and if measures had not been taken that led to the deterioration of the installation's function; in addition, it was assumed that kitchen installations were supplemented with a hood, of adequate collector volume, installed over the stove etc. If a stove fan had been installed then it should be connected to a separate duct with documented airtightness.

For windowless bath or shower rooms it was assumed that one of the following solutions would be applied;

- A separate fan which could be started by a special switch should be installed. In such cases a supply air terminal device could be accepted if there was a transferred-air-device in the flat.
- An existing natural ventilation system of older type could be accepted if it had a vertical supply air duct which ran out in the lower

section of the sanitary area and a separate exhaust air duct which ran up to the building's roof.

- For a bath and shower room in a one room flat, natural ventilation was accepted with transferred air and a separate exhaust air duct. An accepted alternative was the design of a natural ventilation system in accordance with the regulations for single-family dwellings as applied to flats in in a multi-storey block. It was also assumed that there was a hood above the stove with sufficient collector volume.

APPENDICES

EXTRACTS FROM GOVERNMENT BILL

1990/91:145

4.1 Checks on performance

My proposal: A regulation is to be introduced concerning the checking of the performance of ventilation systems. The owner of a building is to be responsible for performance checks being carried out before a building is brought into use and also thereafter at regular intervals. Checks are to be carried out by qualified personnel approved of by the National Board of Housing, Building and Planning. Municipal building committees will be responsible for ensuring that regulations are followed.

It will be the task of the Government or its appointed body (the National Board of Housing, Building and Planning) to issue the regulations required for checking the performance of ventilation systems. I suggest that the Planning and Building Act be amended to facilitate the inclusion, among other things, of these regulations.

The working group's proposal: Agrees with mine.

Comments resulting from the circulation of proposals: Most bodies supported the proposed performance checks. However, several bodies had comments on particular aspects of the proposals. These referred among other things to the competence of the inspectors who will issue the certificates relating to performance checks, the building committees' tasks as well as comments on the financial resources demanded by the proposals. One question taken up by a number of bodies is to what extent one or two-dwelling houses should be included in these performance checks. Other details in the proposals have also been discussed. Among the few who suggested rejecting the proposals were the Swedish Property Owners' Association and some building contractors.

The reason for my proposals: According to section 3, article 5 of the Planning and Building Act, buildings shall be suitable for their purpose and provide opportunities for comfort, good hygiene, a good working environment and a satisfactory indoor climate. The National Board of Housing, Building and Planning's Regulations for New Construction containing instructions and advice about e.g. air change follow from this article. It is further noted in section 3, article 13 that a ventilation system must be looked after and maintained. The municipal Building Committees have, under section 10 of the Planning and Building Act, an opportunity of intervening with an order, if required, to ensure that the maintenance requirement is followed. The requirement about maintenance means that a building's function may not manifestly deteriorate in relation to what was originally required.

Using as a starting point the maintenance requirement which follows from section 3, article 13 in the Planning and Building Act, the working group has suggested that as a general rule, all buildings should be covered by a regulation on the checking of the performance of ventilation systems. To this end the working group has drawn up proposals for instructions covering the checking of ventilation system performance (see Appendix 2). To clarify matters the working group has also suggested an amendment to section 16, article 1 of the Planning and Building Act. According to the present formulation of the legislation, the Government or an authority appointed by the Government, can issue regulations about requirements on buildings, etc. in addition to the regulations in section 3 of the Planning and Building Act about the protection of life, personal safety and health (compare section 8, article 7 of the Constitution Act). The working group's proposals for an amendment to section 16, article 1 of the Planning and Building Act expressly requires the Government, or an authority appointed by the Government, to issue instructions to ensure that the regulations to protect life, personal safety and health are followed.

I agree with the working group's opinion about the need for statutory regulations concerning the checking of the performance of ventilation systems. A check of this sort has been approved by an overwhelming majority of those to whom material has been circulated for comments. In accordance with the working group's proposals, I suggest that the regulations should be taken up in a special ordinance primarily containing what the group has proposed. To this end, and also in agreement with the group's proposals, section 16, article 1 of the Planning and Building Act should be amended to clarify these points. If Parliament accepts my proposal concerning such an amendment, I subsequently intend to propose to the Government that an ordinance is issued about the regulations required for checking the performance of ventilation systems.

However, as a result of the comments on the working group's proposals, I would like to present my views in principle on the issues taken up in the group's proposal.

The working group's proposal states that performance checks will be made when a ventilation system is installed as well as at regular intervals during its operation. According to the proposal, the National Board of Housing, Building and Planning will be expected to determine the intervals at which checks will be carried out. The intervals should vary for different types of buildings. The goal for multi-family dwellings should be, in accordance with the group's proposal, a check every three years. Performance checks should, according to the group's proposal, only be carried out by persons approved as inspectors by the National Board of Housing, Building and Planning.

I would like to state, right from the beginning, that it should be the property owner who is responsible for the performance checks being carried out as well for the costs involved. This completely agrees with the responsibility property owners have today according to the above-mentioned section 3, article 13 in the Planning and Building Act with regard to the maintenance of buildings so that their specific technical properties are largely retained. According to section 11, article 1, note 5 in the Planning and Building Act, it is the responsibility of the municipal Building Committee to also supervise how the legislation is followed. As the working group has suggested, the Building Committees should supervise that property owners fulfil their responsibilities regarding ventilation performance checks.

A system which involves a municipal check of the buildings in the municipality - similar to the method employed for the cleaning of chimneys - is in my opinion unrealistic. I therefore agree with the working group's proposal that performance checks of ventilation systems shall be carried out by a special inspector, engaged by the property owner, who notes the results of the performance check in a report.

The working group has suggested that the inspector carrying out the performance check shall, if defects in the ventilation system so warrant, inform the Building Committee. While agreeing with some bodies' comments, among others the National Swedish Association of Certified Chimney Sweepers and the National Cooperative Association, I feel that the above procedure is not completely satisfactory. I propose instead that the inspector shall always inform the Building Committee about the results of the performance check. This is best achieved by sending one copy of the inspection records to the municipality. This should help the municipality monitor how regulations are followed. In order to further assist municipal supervision, a building owner should place a copy of the inspection record, stating that a check has been carried out and on what date, in a clearly visible position. In this way tenants and others are provided with an opportunity of checking whether the property owner has fulfilled his/her responsibilities. What I have proposed here regarding supervision involves a departure from the working group's proposal.

At later performance checks it should be noted whether the ventilation system has primarily retained the characteristics noted when the system was first brought into operation. Even here a check should be made that the ventilation system works in the manner intended.

The requirement that the system should not contain any contamination which can spread to other parts of the building, means that the system should be kept clean as far as possible. In the case of older buildings this can sometimes create problems even though cleansing techniques are advancing. No absolute cleaning requirement should be introduced. Ensuring that the filters being used are of high quality can sometimes replace cleaning.

In the case of older buildings, later recurrent checks should be concerned with investigating whether the ventilation system meets the requirements in force when the building was taken into use. This means that the first of the recurrent checks may need to be carried out more thoroughly than those carried out later. In some respects it will be similar to the first check of a newly-installed ventilation system. With regard to buildings with natural ventilation systems it may, for practical reasons, be sufficient to limit the performance check to ensuring that the ventilation ducts do not contain contamination.

The National Board of Housing, Building and Planning should issue general advice about how the performance checks should be carried out and documented. One aspect which needs to be studied is the extent of the inspections. General guidelines may also be needed about how to prevent contamination spreading in a building.

The different character of the first performance checks of ventilation installations and subsequent checks will place varying demands on the competence of the inspectors. Their competence may also need to be higher for complicated ventilation systems, e.g. in industrial buildings, than for detached or semi-detached dwellings.

The competence requirement is very similar to that required for an authorized supervisor. The same principles for approval should therefore be applied in

both cases. (Compare section 9, article 3 of the Planning and Building Act and articles 17 and 18 of the Planning and Building Ordinance [1987:383]). This means the property owner selects the supervisor to be engaged, and that that person must be approved for the type of checks involved either by The National Board of Housing, Building and Planning (national approval) or by a municipal Building Committee (local approval). Regulations should be drawn up by the National Board of Housing, Building and Planning concerning how competence is to be assessed.

Finally I would like to point out that the chimney sweepers' organization could be employed to a wide extent for performance checks of ventilation systems. This could particularly apply to the recurrent checks of ordinary ventilation systems which could be co-ordinated with chimney sweeping. With regard to checks of newly-installed or more complicated ventilation systems more special competence will be required. For newly-installed ventilation systems co-ordination with the normal building contractor's inspection is also important. In this context the inspector should in many cases rely on the other inspections carried out and, where these are sufficiently reliable, use them as the basis for his own assessments. I would emphasize that there is nothing in my proposal which prevents a building contractor from using his own employees as experts assuming that they are approved of by the National Board of Housing, Building and Planning in accordance with my proposal.

If Parliament approves my proposal for performance checks of ventilation systems, the regulations should come into force on 1 January 1992. The first performance checks in older buildings should be carried out by 1 January 1994 at the latest or at a later date stipulated by the National Board of Housing, Building and Planning.

An important question is, of course, which buildings should be included under the compulsory check of the performance of ventilation systems. I agree with the working group that it is more useful if the ordinance covers all buildings but that the National Board of Housing, Building and Planning should be authorized to exempt certain types of buildings. Naturally, homes are particularly important in this context. I would also like to emphasize the great importance that ventilation issues have in buildings used by children, e.g. daycare centres and schools, and where the indoor environment is of greatest importance. In this context work environment issues are also of considerable significance. It is here that special demands may be required as a result of the work environment legislation. As the National Board of Industrial Safety pointed out in its comments, the relation between the demands in the work environment legislation and in the building legislation needs to be clarified. I assume that consultations will be held on this matter between the National Board of Industrial Safety and the National Board of Housing, Building and Planning.

Some comments, including those from the magazine "Homeowner" (*Vi i småhus*) and the Swedish Homeowners Association, take the view that semi-detached and detached houses should not be subjected to recurrent checks of ventilation performance and that checks at the new installation of ventilation systems should be sufficient. I understand these viewpoints, among other things with regard to the costs related to performance checks and the extra work for building committees that these checks may involve. However, in spite of this, I think it is important that semi-detached and detached houses are included in the system of performance checks. In this case the interval between

performance checks can be longer than in other contexts. Consideration must be given to whether the working group's proposal regarding performance checks at ten year intervals is a suitable compromise.

In this context attention should be drawn to the comments of the National Board for Radiation Safety which regards performance checks of ventilation systems as of immense significance if radon, which inevitably exists in homes, is not to increase as a result of neglected maintenance. According to the Board, this is of greatest importance not only in existing development, because of the occurrence of blue cement, but also in to new development.

In my opinion, however, vacation cottages should be exempt from checks. With regard to exemptions for other types of buildings, as I stated previously, this matter should be submitted to the National Board of Housing, Building and Planning so that it, after further consideration, can issue appropriate regulations. In this context I am thinking particularly about the special considerations which will be necessary with regard to industrial and similar buildings.

With regard to the major stages which should be included in a performance check, I agree almost completely with the working group's proposals. These involve

the function and attributes of a newly-installed system agreeing with the regulations currently in force,

the function and attributes of ventilation system's already in operation primarily agreeing with the regulations that were in force when the system was brought into operation,

the system not containing any contamination which can spread within the building,

instruction and maintenance handbooks being readily accessible to those who are responsible for the systems operation, and

the system in general working in the way intended.

The first performance check of new installations will differ considerably from subsequent checks. The first should not only check that current regulations are observed but also that drawings and design documents have been followed, that the ventilation system is correctly adjusted and that it actually works in a satisfactory manner. The basis for assessments will be the building permit documents, where these have been approved of by the Building Committee in accordance with section 8, article 29 of the Planning and Building Act. In other respects the check shall cover the performance requirements as noted in current regulations. In the case where a building contractor has placed higher demands on the ventilation system than required by these regulations, then the check should also ensure that the ventilation system works in the way intended. At the first performance check it should also be noted whether suitable instruction and maintenance handbooks are available.

THE SWEDISH CODE OF STATUTES 1991:1273.

Ordinance concerning performance checks of ventilation systems

The Swedish Code of Statutes

SFS 1991:1273

(SFS:Swedish Code of Statutes)

Issued on 24 September 1991

Ordinance about the performance checks of ventilation systems; issued 12 September 1991.

The Government prescribes the following.

Article 1. To ensure a satisfactory indoor climate in buildings, in accordance with the regulations in section 3 of the Planning and Building Act (1987:10), the owner of a building shall check the performance of the ventilation system in accordance with the regulations in this ordinance.

Article 2. The National Board of Housing, Building and Planning issues regulations concerning those types of ventilation systems and systems in certain types of buildings which shall either be completely or partially exempt from the regulations in this ordinance.

Article 3. The checking of the performance of a ventilation system shall be carried out by an inspector who has been either authorized (national authorization) by the National Board of Housing, Building and Planning or by the municipal committee(s) responsible for planning and building matters in a municipality.

For authorization as an inspector only those persons can be accepted who have the required training and experience and who are suitable for the task.

The National Board of Housing, Building and Planning issues regulations about the fees to be charged by the Board for the authorization referred to in the first paragraph.

Article 4. Performance checks shall be made before a ventilation system is brought into use for the first time (first inspection) and thereafter at regular intervals (recurrent inspection).

The National Board of Housing, Building and Planning, after consultations with the National Rescue Service Board, issues regulations about the intervals for recurrent inspections.

Article 5. At the *first inspection* a check shall be made that

1. the performance of the ventilation system and other mechanical aspects agree with current regulations,

2. the system does not contain any contamination which can spread to the rest of the building,
3. instruction and maintenance manuals are easily accessible to those in charge of the system, and that
4. the system generally performs in the manner intended.

At recurrent inspections a check must be made that the performance of the ventilation system and its other properties primarily agree with the regulations in force when the system was brought into use and that the requirements under points 2-4 above are met.

Article 6. A report shall be written at every inspection. The report shall include the results of checks according to article 5.

One copy of the report shall be submitted to the owner of the building and one copy to the municipal committee referred to in article 3, first paragraph.

A certificate shall be issued about the implementation and date of the inspection. The owner of the building shall display the certificate in a clearly-visible position in the building.

Article 7. If the inspection results in criticism regarding any of the points in article 5, then the building's owner shall remedy these defects as soon as possible.

Article 8. The municipal committee referred to under article 3, first paragraph, shall, in accordance with the regulations in the Planning and Building Act (1987:10), supervise that the owner of a building fulfils his/her responsibilities in accordance with this ordinance and in accordance with regulations issued on the basis of this ordinance.

This ordinance comes into force 1 January 1992.

In buildings where the ventilation system has already been brought into use when this ordinance comes into force, the first performance check shall be carried out before the end of 1993 or at a later date stipulated by the National Board of Housing, Building and Planning.

On behalf of the Government

ULFLÖNNQVIST

Cecilia Bergman
(Ministry of Housing and Physical Planning)

**THE NATIONAL BOARD OF HOUSING,
BUILDING AND PLANNING'S CODE OF
STATUTES 1992:15**

*Regulations concerning the amendment of
regulations about performance checks for
ventilation systems*

**THE NATIONAL BOARD OF HOUSING,
BUILDING AND PLANNING'S
CODE OF STATUTES**

BFS 1992:15

(BFS: Regulations issued
by the Swedish Board of Housing
Building and Planning)

Issued on 11 May 1992

**The National Board of Housing, Building and Planning's
regulations concerning amendments to the regulations about the
performance checks of ventilation systems;**

determined 16 April 1992.

On the basis of article 4 in the Ordinance (1991:1273) about performance checks to ventilation systems, the National Board of Housing, Building and Planning decides that this Board's regulations concerning performance checks of ventilation systems are to be supplemented with a new section headed *Intervals for recurrent inspections, etc.* with the following wording.

The regulations will have the following wording from the date that this ordinance comes into force.

Exemption from performance checks

The requirement for performance checks does not apply to detached and semi-detached dwellings with natural ventilation or only mechanical exhaust air ventilation. Nor does the requirement apply to buildings for agriculture, forestry or thereby similar livelihoods, industrial buildings or buildings which are for Total Defence purposes and are secret.

Intervals for recurrent inspections, etc.

Recurrent inspections shall be carried out within the intervals indicated in the following table.

Buildings	Inspection intervals
1. Day-care centres, schools, health care centres, etc.	2 years
2. Blocks of flats and office blocks, etc. Balanced ventilation.	3 years
3. Blocks of flats, office blocks, etc. Mechanical exhaust air ventilation.	6 years
4. Blocks of flats, office blocks, etc. Natural ventilation	9 years
5. One and two-dwelling houses. Balanced ventilation.	9 years

Balanced ventilation means the fan ventilation of supply and exhaust air. *Mechanical ventilation* refers only to fan-controlled exhaust air ventilation. *Natural ventilation* refers to the ventilation created by thermal forces.

For buildings where the ventilation system has already been brought into use by 1 January 1992, the first inspection shall be carried out before the end of 1993 with regard to buildings listed under point 1 in the above table. For buildings under point 2 the inspection shall be carried out before the end of 1994. For other buildings, inspections shall be carried out before the end of 1995.

If there are special reasons, the municipal committee(s) responsible for the municipality's tasks concerning planning and building may decide on the postponement of the inspection intervals referred to in paragraphs 1-3.

These regulations come into force 15 May 1992.

GÖSTA BLÜCHER

Curt H. Ivarsson
(Building Division)

The Swedish Board of Housing, Building and Planning

is promoting quality in housing and the environment

The Board promotes good management of natural resources and a rich and vital built environment.

The Board develops methods for effective and environmentally sound planning. Physical planning should support sustainable development.

The Board works for less regulation and more competition in the building sector while ensuring that health, safety, accessibility and energy management requirements are met.

The Board works to simplify housing finance regulations and is responsible for the efficient administration of government support for housing.

The Board also promotes the effective and uniform application of regulations and subsidy systems throughout its field of operations.