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Ventilation for buildings - Performance measurement and checks for residential ventilation systems

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Ventilation for buildings - Performance measurement and checks for residential ventilation systems

Ventilation des bâtiments - Mesure de la performance et vérifications des systèmes de ventilation résidentiels

Lüftung von Gebäuden - Leistungsprüfung und Funktionsprüfungen von Lüftungsanlagen in Wohnungen

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European foreword

This document (EN 14134:2019) has been prepared by Technical Committee CEN/TC 156 “Ventilation for buildings”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2019, and conflicting national standards shall be withdrawn at the latest by August 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14134:2004.

In comparison to EN 14134:2004 the following changes have been made:

— modification of the title to be in accordance with terms defined in this document;

— modification of the scope to delete identification of responsible people;

— modification of the scope to define the on-site and large scale use of this document;

— modification of the definitions to complete them;

— addition of preliminary requirements for the application of this document;

— modification of methods to delete steps order;

— modification of sampling method to be applicable to all checks and measurement defined in this document;

— modification of sampling method to explain the different levels;

— modification of pre-check and functional check methods to be more exhaustive and more detailed;

— additional pre-check for Ecodesign requirements and product labelling;

— addition of requirements for equipment uncertainties;

— removal of requirement for global measurement uncertainties;

— modification of methods for air flow measurement and for ductwork air leakage measurement to be consistent with existing European standards;

— removal of method for control measurement to be consistent with on-site measurement conditions;

— modification of method for noise measurement;

— replacement of Annex A to give example of checklists;

— replacement of Annex B to give example of test pressures;

— removal of Annex C.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The purpose of a residential ventilation system is to supply air to and extract air from rooms in a dwelling.

The ventilation system should be designed to achieve the purpose whilst minimizing energy use and possible discomfort (e.g. noise, draught).

The performance requirements of the ventilation system are laid down by the designer in the dwelling specifications.

1 Scope

This document specifies checks and measurement methods in order to verify the fitness for purpose of installed ventilation systems in dwellings. It can be applied to commissioning of new systems and performance testing of existing systems. It provides choice between simple test methods, when sufficient, and extensive measurements, when necessary.

Considering that this document has been developed for large scale application and considering the practical conditions of field measurements, no correction regarding ambient conditions (temperature and barometric pressure) is applied to functional measurements.

This document deals with items d), e), f), and g) of the following list giving the different stages of the design, installation, checking and measuring of a ventilation system:

a) design and dimensioning of residential system;

b) installation of system;

c) balancing and adjustment of system;

d) pre-checks on system;

e) functional checks on system;

f) functional measurements on system;

g) special measurements on system if required.

This document applies to ventilation systems (mechanical, hybrid, natural) comprising any of the following elements:

— air terminal devices (supply, extract, intake and exhaust);

— air transfer devices (externally mounted, internally mounted);

— controls;

— ducts;

— fans;

— filters;

— heat recovery;

— heating/cooling of supply air;

— recirculation air;

— cooker hood;

— cowls;

— dampers;

— sound reduction devices.

In case of multi-functional units, the checking and measuring only apply to the ventilation part. Therefore, this document does not apply to:

— heating systems and their control;

— refrigerating systems and their control;

— electrical power supply systems.

It does not cover the following points:

— airtightness of the building envelope; the whole dwelling and the individual room ventilation rates can be influenced by air infiltration through the building envelope (see EN ISO 9972);

— effect of the ventilation system on indoor air speed within the occupied zone (see for example EN 15726).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1507, *Ventilation for buildings - Sheet metal air ducts with rectangular section - Requirements for strength and leakage*

EN 12237, *Ventilation for buildings - Ductwork - Strength and leakage of circular sheet metal ducts*

EN 12792, *Ventilation for buildings - Symbols, terminology and graphical symbols*

EN ISO 16032, *Acoustics - Measurement of sound pressure level from service equipment in buildings - Engineering method (ISO 16032)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12792 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
check
observation of the operation of a system or devices, against a specification without resorting to specific measurements

[SOURCE: EN 12792:2003; definition 193]

3.2
pre-check
verification of the documentation of a system or devices intended to be used during the check process

3.3
measurement
process of experimentally obtaining one or more quantity values that can reasonably be attributed to a quantity

[SOURCE: JCGM 200:2012; definition 2.1, modified – Notes have been removed.]

3.4
run-on timer
device which ensures that air flow through a ventilation system or an air terminal device (ATD) continues for a specific time period after a user operated control has been turned off

Note 1 to entry: Run-on-timers are commonly used to control extract fans which are activated by the room light switch in internal rooms.

3.5
maximum permissible measurement error
extreme value of measurement error, with respect to a known reference quantity value, permitted by specifications or regulations for a given measurement, measuring instrument, or measuring system

[SOURCE: JCGM 200:2012; definition 4.26, modified – Notes have been removed.]

3.6
housing estate
group of homes and other buildings built together as a single development

Note 1 to entry: The exact form can vary from country to country. A housing estate is usually built by a single contractor, with only a few styles of houses or building design, so they tend to be uniform in appearance.

4 Symbols and abbreviations

For the purpose of this document, the symbols given in EN 12792 and the following (see Table 1) apply.

Table 1 — Symbols

Symbol	Designation
e	sampling error (decimal value)
L_{pA}	A-weighted installation sound pressure level
n	sample size
N	total numbers of apartments or houses
SL1	Sampling level

5 Check and measurement procedures

5.1 General

This document includes procedures for:

— pre-check;

— functional checks;

— functional measurements;

— special measurements.

Checks and measurements to be performed shall be defined beforehand to meet the needs.

The installation work should be completed and the system should be adjusted before starting checks and measurements.

Safe access to the ventilation system is required for on-site checks and measurement.

5.2 Checks and measurements conditions

Checks and measurements conditions are as follows:

— the mechanical ventilation system shall be switched on;

— the system settings shall remain unchanged during measurements;

— all external and internal doors, and windows shall be closed;

— all other ventilation provisions such as externally and internally mounted air transfer devices should be set in their intended position which shall be recorded in the report;

— as set points of control devices have an impact on the performances of the system, they shall be recorded in the report.

— in the case of occupancy control or demand control and as the value of the relevant parameters has an impact on the performances of the system, these parameters or any overriding of the controls should be recorded in the report.

5.3 Sampling

Checks and measurements for ventilation systems of the same type (example of types are natural ventilation, unidirectional ventilation or bidirectional ventilation) within apartments belonging to the same building or within houses belonging to the same housing estate can be performed on a sample of these apartments or houses.

NOTE The basic assumption behind the authorization for sampling is that ventilation systems that belong to such groups (same type and same building or same housing estate) and that are considered together for the purpose of measurement and checks (for example because of same owner or same general contractor or same installer) have enough similarities to make sampling relevant.

The sample size depends on the selected sampling level and the total number of apartments or houses of the considered group. Table 2 gives the sampling error for each sampling level for a level of confidence of 95 %. Table 3 gives the sample size as a function of the total number of apartments or houses for each sampling level. For total numbers of apartments or houses that are not in Table 3, the sample size is calculated using Formula (1).

Table 2 — Sampling error of sampling levels for a level of confidence of 95 %

Sampling level	Sampling error %
SL1	0
SL2	5
SL3	10
SL4	20
SL5	30
SL6	40
SL7	50

$$n = \frac{N \cdot 1{,}96^2 \cdot 0{,}5^2}{\left(N\text{-}1\right) \cdot e^2 + 1{,}96^2 \cdot 0{,}5^2} \quad (1)$$

where

n is the sample size;

N is the total number of apartments or houses;

e is the sampling error (decimal value).

NOTE Details of the formula can be found in “Theory and problems of statistics” (confidence intervals for proportions) by M.R. Spiegel edited by Schaum's Outlines (ISBN 0-07-060281–6).

By default, the sampling level is SL1. Different sampling levels may be selected for different types of checks or measurements. Checks or measurements at the same sampling level shall be carried out within the same sample.

EXAMPLE 1 Sampling level SL3 is chosen for flow measurements and pressure measurements. In this case these two types of measurement are performed on the same sample.

Smaller samples shall only include apartments or houses from larger samples.

EXAMPLE 2 Sampling level SL3 is chosen for flow measurements and sampling level SL4 is chosen for acoustic measurements. In this case the sample for acoustic measurements is chosen within the sample for flow measurements.

Sampling is not applicable for checks and measurements within a single house or apartment.

EXAMPLE 3 An apartment with 10 air terminal devices is part of a sample for flow measurements. In this case, all 10 air terminal devices are measured whatever the sampling level.

Table 3 — Sample size as a function of the total number of apartments or houses for each sampling level

Total number of houses or apartments	Sample size *n*						
	SL1	**SL2**	**SL3**	**SL4**	**SL5**	**SL6**	**SL7**
1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	2	2
4	4	4	4	4	3	3	2
5	5	5	5	4	4	3	2
6	6	6	6	5	4	3	3
7	7	7	7	6	4	4	3
8	8	8	7	6	5	4	3
9	9	9	8	7	5	4	3
10	10	10	9	7	5	4	3
11	11	11	10	8	6	4	3
12	12	12	11	8	6	4	3
13	13	13	12	9	6	4	3
14	14	14	12	9	6	4	3
15	15	14	13	9	6	5	3
16	16	15	14	10	7	5	3
17	17	16	15	10	7	5	3
18	18	17	15	11	7	5	3
19	19	18	16	11	7	5	3
20	20	19	17	11	7	5	3
21	21	20	17	11	7	5	3
22	22	21	18	12	7	5	3
23	23	22	19	12	8	5	3
24	24	23	19	12	8	5	3
25	25	24	20	13	8	5	3
30	30	28	23	14	8	5	4

Total number of houses or apartments	Sample size n						
	SL1	**SL2**	**SL3**	**SL4**	**SL5**	**SL6**	**SL7**
40	40	36	28	15	9	5	4
50	50	44	33	16	9	5	4
60	60	52	37	17	9	6	4
70	70	59	41	18	9	6	4
80	80	66	44	19	10	6	4
90	90	73	47	19	10	6	4
100	100	80	49	20	10	6	4
200	200	132	65	22	10	6	4
300	300	169	73	22	10	6	4
400	400	196	78	23	10	6	4
500	500	217	81	23	10	6	4
600	600	234	83	23	11	6	4
700	700	248	85	23	11	6	4
800	800	260	86	23	11	6	4
900	900	269	87	23	11	6	4
1000	1000	278	88	23	11	6	4

6 Pre-check

6.1 General

The aim of the pre-check is to collate and assess all relevant documentation relating to the building and the installed ventilation systems with particular regard to:

— design parameters, system characteristics and settings; and

— operation, maintenance and use.

6.2 Documents for design parameters, system characteristics and settings

The following documents shall be collated:

— general building drawings with the positions and the functions of all rooms;

— ventilation system design specification;

— fiche with product technical data.

It shall be checked that the design specification contains the following elements:

— type of ventilation system (e.g. central or decentral, natural, fan assisted natural, mechanical supply/exhaust/balanced or a combination of these);

— air flow control strategy (central, zonal or room based);

— type of controls (if any):

  — manual control (the system runs according to a manually controlled switch);

  — time control (the system runs staged according to a given time schedule);

  — presence control (the system runs dependent on the presence of people);

  — demand control (the system runs staged dependent on any indicator for the need of ventilation);

— location of the control devices;

— specification of the control devices (e.g. range and response of humidity sensor);

— design air flow rates for the ventilation system as a whole, for individual rooms and for individual air terminals (or equivalent information for natural ventilation systems (e.g. duct sizes, equivalent areas of air transfer devices));

— designed range of static pressure available at ATD;

— information on the different components of the ventilation system as given in Table 4.

Table 4 — Information for each component of a ventilation system

Component	Information
ducted air terminal devices (inside)	— location; — reference and name; — intended pressure range; — intended air flow range.
internally and/or externally mounted air transfer devices	— location; — type; — size; — reference pressure; — intended air flow.
ductworks	— type and nature; — intended airtightness class; — thermal insulation; — drawing.

Component	Information
air handling unit	— location; — reference; — SFP class; — design settings.
heat recovery systems	— location; — reference and type; — minimum efficiency; — thermal bypass facility; — type of frost protection.
filters	— location; — type; — class; — visual filter warning.
air intake and discharge openings (outside)	— location; — type; — size; — intended air flow rates.
control devices	— location; — type; — specification.
sound attenuators	— location; — type; — specification.
other components	— location; — type.

6.3 Documents for operation, maintenance and use

It shall be checked that the documents for operation, maintenance and use contain instructions to the occupants on how and when to use the ventilation system and how and when components of the ventilation system should be cleaned and maintained. Depending upon the type of system and how it is controlled this may include (but is not limited to) information on the following:

— using externally mounted air transfer devices (if adjustable);

— setting automatic controls (if user-adjustable, e.g. humidity controls);

— using on/off and boost settings for fan assisted ventilation systems;

— using controls for natural air extract devices (e.g. adjustable extract air terminals on vertical ducts);

— instructions to the occupants and/or maintenance service providers on how any required cleaning and maintenance should be carried out;

— instructions for material recycling.

It shall be checked that the documents for the operation, maintenance and use also contain relevant manufacturers' literature originally supplied with the system or with individual components of the system.

NOTE The manufacturers' literature might include component specifications, installation guidance, operating instructions, maintenance schedules, guarantees or warranties, spare part lists, means of obtaining spare parts, etc.

7 Functional checks

7.1 General

The purpose of the functional checks is to assess the completeness and operational ability of the ventilation system according to the design specification. The checks show whether the particular components of the system (e.g. fans, filters, heat exchangers) have been properly assembled and installed and whether those components containing moving parts operate correctly.

The objective is to check whether:

— all components have been installed and are in good condition; and

— the system has been installed correctly and in accordance with the design specification and relevant standards and regulations; and

— the system is free from loose objects and reasonably clean; and

— the system does not exhibit abnormal noise; and

— the system is safe to operate and maintain; and

— there is adequate access to and space around the ventilation system for the purposes of operation and maintenance; and

— all controls are readily accessible.

7.2 Checklist

It shall be checked that all the components listed in Table 5 are present and installed as required in the design specification.

Checks shall be made that these components are fitted in their correct positions relative to each other, and relative to other parts of the building (e.g. fire dampers in walls and floors which are intended to be fire resisting).

An example of a checklist based on list of Table 5 is given in Annex A (informative).

Table 5 — Checks for each component

Component	Checks
ducted air terminal devices (inside)	— location (room, respect of minimum distance from wall and ceiling, accessibility); — reference and name; — intended pressure range; — intended air flow range; — state (intact, clean, adequately sealed); — airtight junctions with ductwork (for extract and supply air terminal devices); — where required, maximum flow rate control is readily accessible and works correctly.
internally mounted air transfer device	— adequate internal air transfer (undercut on doors or internally mounted air transfer devices);
externally mounted air transfer device	— adequate external air transfer; — adequate junction with the outdoors;
ductwork	— type and nature; — adequate thermal insulation; — no visible leaks or deformation; — consistency of the installation with the drawing; — adequate support;
air handling unit	— location (room, accessibility); — working; — design settings; — adequate settings; — adequate and airtight junctions with ductwork; — adequate acoustic treatment; — acoustic separation from the building;
heat recovery systems	— location (room, accessibility); — reference and type; — adequate thermal insulation; — presence of by-pass; — adequate condensate drainage; — type of frost protection;
filters	— accessibility; — type and class; — visual indication (filter warning, pressure drop); — state of cleanliness;

Component	Checks
air intake and discharge openings (outside)	— location; — type; — size; — adequate and airtight junction with air handling unit;
control devices	— location; — type;
sound attenuators	— location; — type;
other components	— location; — type.

8 Functional measurements

8.1 General

The purpose of the functional measurements is to provide information needed to assess whether the system complies with the design specifications with respect to the following aspects of performance:

— air flow rate and direction; and

— static pressure; and

— running time.

Methods for mechanical air flow measurement apply also for hybrid ventilation systems when the fan is mechanically driven.

Other aspects of performance may be handled under special measurements.

8.2 Air flow rate and direction

8.2.1 Mechanical ventilation

8.2.1.1 Principle

At all air terminal devices (ATDs):

— the air flow rate shall be measured; and

— the direction of air flow shall be determined.

The measurement can be performed by different methods, e.g.:

— pressure compensating air flow device;

— vane anemometer;

— constant injection tracer gas;

— pilot static tube;

— velocity probe;

— bag method (for supply only).

Possible methods for airflow measurement are described in EN 16211.

8.2.1.2 Equipment

Uncertainty due to the measuring instrument has an important impact on total uncertainty of the measurement.

Measured values shall be within the measuring interval of the equipment.

NOTE Regular verification of calibration of measuring instruments is essential, see ISO/IEC 17025.

Air flow measuring instruments shall respect a maximum permissible measurement error of 10 % of the measured value or 1 l/s whichever is the greater.

8.2.1.3 Control settings

If there is no manual control available to the end user, measurement shall be performed in the current setting.

If there is a manual control available to the end user, measurement shall be performed at beforehand agreed control settings, if any.

If no control settings are agreed then measurement shall be performed at the maximum setting of the manual control (e.g. highest number or largest pictogram available on a multi position switch, most open position of an air terminal device (ATD)).

8.2.2 Natural ventilation

No measurement required.

NOTE For natural ventilation, air flows on site depend on environmental conditions (e.g. wind speed, temperature difference), location of the device and geometry of the building.

8.3 Static pressure

8.3.1 Mechanical ventilation

8.3.1.1 General

For automatically controlled ATD (e.g. humidity control ATD), a static pressure measurement at air terminal devices is appropriate to assess the systems runs with sufficient airflow. Indeed, verifying that the static pressure is consistent with the design pressure range can be more accurate than airflow measurement. In particular, static pressure measurement is appropriate when the air flow rate is low or the humidity is unknown for humidity control devices.

NOTE For humidity control ATDs, the static pressure measurement is appropriate to verify the functioning of the ATDs for any air humidity situation.

8.3.1.2 Principle

At all automatically ATDs, the static pressure shall be measured.

The measurement is performed with a pressure gauge connected to:

— a static pressure probe integrated to the ATDs; or

— a measuring tube inserted in the ATDs. The tube shall be positioned in the ducts upstream the regulating part of the ATD.

Possible methods for pressure measurement are described in EN 16211.

8.3.1.3 Equipment

Uncertainty due to the measuring instrument has an important impact on total uncertainty of the measurement.

Measured values shall be within the measuring interval of the equipment.

NOTE Regular verification of calibration of measuring instruments is essential, see ISO/IEC 17025.

Pressure measuring instruments shall respect a maximum permissible measurement error of 2 % of the measured value or 1 Pa whichever is the greater.

8.3.1.4 Control settings

If there is no manual control available to the end user, measurement shall be performed in the current setting.

If there is a manual control available to the end user, measurement shall be performed at control settings as previously agreed.

If no control settings are agreed then measurement shall be performed at the maximum setting of the manual control (e.g. highest number or largest pictogram available on a multi position switch, most open position of an air terminal device (ATD)).

8.3.2 Natural ventilation

No measurement required.

8.4 Running time

Functional measurements of the system running times apply to both natural and mechanical ventilation systems if they incorporate devices which automatically control air flow rate by means of times switches and/or run-on timers.

Where a ventilation system or air terminal device (ATD) incorporates a time switch, the running time shall be determined by reading the durations of all “ON” periods from the time switch dial/display.

Where a ventilation system or air terminal device (ATD) incorporates a run-on timer then the duration of the run-on time shall be determined by operating the control switch and measuring the run-on time (e.g. using a stopwatch).

9 Special measurement

9.1 General

The purpose of special measurement is to provide a more detailed assessment of system performance.

9.2 Ductwork leakage

Air leakage measurement shall be performed according to EN 12237 (sheet metal air ducts with circular section) or EN 1507 (sheet metal air ducts with rectangular section). Air leakage measurement of non-metallic ducts shall be performed according to any relevant standard or following the principles of EN 12237 or EN 1507.

The section to be tested shall be subjected to positive test pressures for supply ductwork and to negative test pressures for extract ductwork. Examples of test pressures are given in Annex B (informative).

9.3 Sound pressure level

9.3.1 Principle

Measurement of the A-weighted installation sound pressure level, L_{pA}, in the habitable rooms shall be performed according to EN ISO 16032.

NOTE When measurement results are compared with legal requirements it might be ensured that both refer to the same unit: generally, either Equivalent continuous sound pressure (L_{eq}) or Maximum sound pressure level, time weighting "S" (L_S) or "F" (L_F).

For room volume lower than 100 m^3, it is allowed:

— to perform measurement in only one point at the centre of the room, 1,5 m height;

— to skip the reverberation time measurement and assume a standard 0,5 s default value in a furnished room and 0,8 s in a not furnished room (and this choice shall be stated in the report).

9.3.2 Control settings

See 8.2.1.3.

9.3.3 Description of the tests

According to EN ISO 16032, the measured installation sound pressure level shall be corrected with:

— background noise level measured during at least 30 s;

— room acoustics reverberation time.

9.4 Electric power

9.4.1 Principle

The electric input power of a fan drive including any motor control equipment and controls shall be measured using a power meter capable of measuring active (true) power, e.g. a true RMS (Root Mean Square) measuring device or a measuring device with a RMS converter.

9.4.2 Equipment

Uncertainty due to the measuring instrument has an important impact on total uncertainty of the measurement.

Measured values shall be within the measuring interval of the equipment.

Measuring instruments shall be calibrated.

Measuring instruments shall respect a maximum permissible measurement error of 3 %.

9.4.3 Control settings

See 8.2.1.3.

10 Report

10.1 General

The results of the measurements and checks shall be provided in a report.

10.2 General information

The report shall include (but not limited to) the following information:

a) testing organization including name, address and contact information;

b) report number;

c) date of the report;

d) name of report author;

e) name and address of the client;

f) address of the dwelling tested;

g) any deviations, additions to or exclusions from the test specification, and any other information relevant to a specific test;

h) reference to this document (i.e. EN 14134);

i) sampling scheme/report (when applicable).

10.3 Pre-check

For pre-check (see Clause 6), the report shall include (but not limited to) the following information:

— identification of missing or outdated documentation;

— information according to 5.2 and 5.3 (e.g. available, not available, not relevant or outdated).

10.4 Functional checks

For functional checks (see Clause 7), the report shall include (but not limited to) the following information:

— identification of the absence or incorrect installation of all ventilation system components according to 6.2.

10.5 Air flow measurement

For air flow measurements (see 8.2), the report shall include (but not limited to) the following information:

— location of measurements, a floor plan should be included;

— date of measurement;

— description of the measurement equipment used;

— measured air flow rates;

— direction of the air flow (supply/extract);

— control settings.

10.6 Static pressure measurement

For static pressure measurements (see 8.3), the report shall include (but not limited to) the following information:

— location of measurements, a floor plan should be included;

— date of measurement;

— description of the measurement equipment used;

— measured static pressures;

— control settings.

10.7 Running time measurement

For running time measurement (see 8.4), the report shall include (but not limited to) the following information:

— description of the locations of the components on which the measurements are carried out;

— description of the type and intended function of the controls and run-on timers.

10.8 Ductwork leakage

For ductwork leakage (see 9.2), the report shall include (but not limited to) the following information:

— section of measurement;

— date of measurement;

— description of the measurement equipment used;

— test pressure;

— leakage airflow;

— leakage class of the tested section.

10.9 Sound pressure level

For sound pressure level (see 9.3), the report shall include (but not limited to) the following information:

— location of measurement;

— date of measurement;

— frequency values and overall value corrected A-weighted sound pressure levels in the room;

— frequency values and overall value corrected A-weighted background noise levels;

— description of the measurement equipment used;

— standardized sound pressure level L_{nT} with corrections applied.

10.10 Electric power

For electric power (see 9.4), the report shall include (but not limited to) the following information:

— location of measurement;

— date of measurement;

— measured electric power;

— control settings;

— description of the measurement equipment used;

— if any, state of functioning of frost protection.

Annex A
(informative)

Check lists

Table A.1 gives an example of checklist based on list of Table 5.

Table A.1 — Checklist based on list of Table 5

Check	Check points	OK	Not OK	Comments (e.g. not relevant)
Ductworks				
Pre-check	Drawing			
	Type and nature			
	Intended airtightness class			
Functional check	Type and nature and size			
	Installed ductwork layout			
	Components to facilitate maintenance of ductwork systems			
	Installation of ducts (e.g. visible leaks, squashing, low point, superfluous length, connection with the units, connection with terminal devices)			
	Duct support			
	Thermal insulation of ductwork (e.g. adequate visible material, traces of condensation)			
	State of cleanliness of ductwork			
Functional measurement	Air tightness			

Check	Check points	OK	Not OK	Comments (e.g. not relevant)
Air handling unit				
Pre-check	Location			
	Reference and type			
	Air flow and pressure design settings			
	SFP (class) at design flow rate and pressure			
	Fault indication			
Functional check	Location			
	Operating manual available			
	Accessibility for maintenance (e.g. safety and adequate lighting)			
	Settings (e.g. air flow, pressure, speed)			
	Acoustic separation from the building			
	Abnormal noise			
	State of cleanliness of the fan (e.g. fan blades, casing)			
	Fan belt			
	Pulley alignment			
	Electrical supply			
	Fault indication			
	Functional measurement: power of fan/motor			
Heat recovery systems				
Pre-check	Location			
	Reference and type			
	Efficiency at reference air flow			
	Thermal bypass facility			
	Freezing protection device			

Check	Check points	OK	Not OK	Comments (e.g. not relevant)
Functional check	Location			
	Accessibility			
	Reference and type			
	Thermal insulation			
	By-pass			
	Freezing protection device			
	Condensation drain			
Filters				
Pre-check	Type			
	Class			
	Location			
	Visual filter warning (fault indication)			
Functional check	Type			
	Class			
	Accessibility (without tools)			
	State of cleanliness (e.g. date of the last filter change, visual damages)			
	Visual filter warning (fault indication)			
	Pressure drop indication			

Check	Check points	OK	Not OK	Comments (e.g. not relevant)
Air discharge openings (outside)				
Pre-check	Location			
	Type			
	Size			
Functional check	Location			
	Type			
	Size			
Air intake terminals (outside)				
Pre-check	Location			
	Type			
	Size			
Functional check	Location			
	Type			
	Size			
	State of cleanliness			
Air flow controls				
Pre-check	Location			
	Type (manual, clock, sensor)			
	Type of control according to design specification			
Functional check	Location			
	Type			
	Influence of manual setting on air flow			

Check	Check points	OK	Not OK	Comments (e.g. not relevant)
Control devices (pressure switches, pressure pipes)				
Pre-check	Location			
	Type			
	Specification			
Functional check	Location			
	Type			
	Specification			
	Correctly functioning			
Sound attenuators				
Pre-check	Location			
	Type			
	Specification			
Functional check	Location			
	Type			
Other components				
Pre-check	Location			
	Type			
Functional check	Location			
	Type			

Table A.2 gives an example of checklist for internally and externally mounted air transfer devices (one table per device shall be completed).

Table A.2 — Checklist for internally and externally mounted air transfer devices

Check	Check points	OK	Not OK	Comments (e.g. not relevant)
Pre-check	Location			
	Type			
	Size			
	Reference pressure			
	Nominal air flow			
	Type of control (e.g. fixed, manually adjustable, automatically controlled)			
Functional check	Location			
	Type			
	Size			
	Reference pressure			
	Nominal air flow			
	Type of control (e.g. fixed, manually adjustable, automatically controlled, locked)			
	State of cleanliness			
	Labelling			

Table A.3 gives an example of checklist for extract and supply air terminal devices (one table per device shall be completed).

Table A.3 — Checklist for extract and supply air terminal devices

Check	Check points	OK	Not OK	Comments (e.g. not relevant)
Pre-check	Location			
	Type			
	Reference			
	Intended pressure range			
	Intended air flow (range)			
	Type of control (e.g. fixed, manually adjustable, automatically controlled)			
Functional check	Reference			
	Type			
	Intended air flow (range)			
	Location (e.g. distance from walls and ceiling)			
	State of cleanliness			
	Correctly functioning			
	Air flow direction			
	Type of control (e.g. fixed, manually adjustable, automatically controlled, locked)			
	Accessibility for cleaning and measurement (no obstacle in front of the device such as cupboard or boiler)			
Functional measurement	Air flow rate			
	Pressure difference			
Specific measurement	Air flow rate measured with windows and/or internal doors opened			
	Pressure difference measured with windows and/or internal doors opened (Pa)			

Annex B
(informative)

Test pressures for air leakage measurement

When the ventilation system provides service to a single apartment or house only, an example of convenient test pressure for air leakage measurement is - 80 Pa for extract ductwork and + 80 Pa for supply ductwork.

When the ventilation system provides service to several apartments, an example of convenient test pressure for air leakage measurement should be - 160 Pa for extract ductwork and + 160 Pa for supply ductwork.

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