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Prezračevanje stavb - Preskusni postopki in merilne metode za predajo klimatskih in prezračevalnih sistemov ter klimatskih sistemov za prezračevanje nestanovanjskih stavb

Ventilation for buildings - Test procedures and measurement methods to hand over air conditioning and ventilation systems and air conditioning systems for non-residential buildings

Lüftung von Gebäuden - Prüf- und Messverfahren für die Übergabe raumluftechnischer Anlagen und Luftbehandlungssysteme in Nichtwohngebäuden

Ventilation des bâtiments - Modes opératoires d'essai et méthodes de mesure pour la réception des systèmes de ventilation et de conditionnement d'air et des systèmes de conditionnement d'air pour les bâtiments non résidentiels

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ICS:

91.140.30	Prezračevalni in klimatski sistemi	Ventilation and air-conditioning systems
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EUROPEAN STANDARD
NORME EUROPÉENNE
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EN 12599

October 2026

ICS 91.140.30

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**Ventilation for buildings - Test procedures and
measurement methods to hand over air conditioning and
ventilation systems for non-residential buildings**

Ventilation des bâtiments - Modes opératoires d'essai
et méthodes de mesure pour la remise des systèmes de
conditionnement d'air et de ventilation pour les
bâtiments non résidentiels

Lüftung von Gebäuden - Prüf- und Messverfahren für
die Übergabe raumlufttechnischer Anlagen und
Luftbehandlungssysteme in Nichtwohngebäuden

This European Standard was approved by CEN on 5 July 2026.

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Contents

Page

European foreword	4
Introduction	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions.....	7
4 Test and check procedure.....	7
5 Administrative check.....	9
6 Completeness check.....	9
7 Functional checks	9
8 Measurements.....	10
8.1 General.....	10
8.2 Range of measurements	10
8.3 Procedure	11
8.4 Measuring methods and measuring instruments	12
8.4.1 General.....	12
8.4.2 Measurement of the air flow rate.....	12
8.4.3 Measurement of the ductwork airtightness.....	13
8.4.4 Measurement of the indoor air velocity	19
8.4.5 Measurement of air temperature	21
8.4.6 Measurement of the air humidity	22
8.4.7 Measurement of the sound pressure level.....	22
8.4.8 Measurement of the electrical power of the fan	22
8.4.9 Measurement of the pressure difference at the air filter	26
8.5 Accompanying measurements	26
9 Additional measurements	26
9.1 General.....	26
9.2 Measurements of components	27
9.2.1 Fans	27
9.2.2 Filters	27
9.2.3 Heat exchangers	27
9.2.4 Air humidifiers.....	28
9.3 Check of regulating, control and switching systems	28
10 Uncertainty of measurements.....	29
11 Test reports.....	29
11.1 General.....	29
11.2 Handing over report	29
11.3 Inspection report on the completeness check	30
11.4 Inspection report on the functional check.....	31
11.5 Test report on the measurements	31
11.6 Test report on the additional measurements.....	31
Annex A (informative) Administrative and completeness check.....	32

A.1	Administrative check	32
A.2	Completeness check.....	33
A.3	Example of a test report for the completeness check.....	37
	Annex B (informative) Functional checks.....	39
B.1	General	39
B.2	Functional checks	39
	Annex C (normative) Determination of the extent of functional checks or measurements.....	42
C.1	General	42
C.2	Parameters and similar locations.....	42
C.3	Determination of the total number of similar locations	43
C.4	Extent of checks or measurements	43
	Annex D (normative) Surface area calculation of ductworks.....	46
D.1	General	46
D.2	Calculation rules	46
D.3	Example of measurement and calculation of a circular ductwork	47
D.4	Example of measurement and calculation of a rectangular ductwork	47
	Annex E (normative) Additional measurements.....	49
E.1	Measuring of parameters.....	49
E.2	Measurements in rooms.....	52
	Annex F (informative) Technical specifications for checks and measurements for the purpose of handing over	54
	Annex G (informative) Examples for determination of the number of functional checks and measurements	55
G.1	Functional checks	55
G.2	Measurements	55
	Annex H (informative) Examples for measurement uncertainty.....	57
H.1	Uncertainty of the result of a measurement.....	57
H.2	Type B evaluation of standard uncertainty.....	57
H.3	Combined standard uncertainty	59
H.4	Expanded uncertainty.....	59
H.5	Examples.....	60
	Annex I (informative) Calculations on air flow correction under reference conditions	63

EN 12599:2026 (E)**European foreword**

This document (EN 12599:2026) 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 April 2027, and conflicting national standards shall be withdrawn at the latest by April 2027.

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 12599:2012.

This document includes the following significant technical changes with respect to EN 12599:2012:

- the scope was modified so that EN 12599 applies for non-residential buildings. It was deleted that the document can be used for residential buildings. The procedures specified can support handing over and inspections of systems;
- the normative references have been updated;
- the air flow rate measurement methods were transferred to EN 16211;
- the method of measuring the ductwork air tightness according to the air tightness classes of EN 16798-3 was included;
- Annex C on the determination of the extend of functional checks and measurements for e.g. similar locations was revised. New sampling levels based on sampling errors were specified;
- Annex D was included in Clause 8 “Measurements”;
- the surface area calculation of ductworks was included as new Annex D;
- “Special measurements” were renamed to “Additional measurements”;
- the determination of the measurement uncertainty was revised.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

The measurement methods and procedures presented in this document are specified in such a way that they are particularly suitable for the handover of ventilation and air conditioning systems.

Due to the accessibility, for some measurements it might be of advantage to perform them during installation (e.g. air tightness).

The measurement methods can be useful for verification of the fitness for purpose of the installed ventilation in different stages of the life cycle of ventilation systems.

The measuring methods in this document in connection with EN 16211 are applicable in the frame of the energy inspection of air-conditioning systems according to EN 16798-17 and CEN/TR 16798-18.

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EN 12599:2026 (E)**1 Scope**

This document specifies checks, measurement methods and procedures in order to verify the fitness for purpose of the installed ventilation systems and air conditioning systems according to design.

It establishes a procedure intended to technically support the handing over and inspection of these systems.

This document enables the choice between checks and measurements when sufficient, and additional measurements, when necessary.

This document applies to mechanical ventilation systems (including the mechanical part of hybrid systems) and full (or partial) air conditioning systems in non-residential (parts of) buildings.

This document does not apply to:

- heat generating systems and their control;
- refrigerating systems and their control;
- distribution of heating and cooling medium to the air handling units;
- compressed air supplying systems;
- water conditioning systems;
- central steam generating systems for air humidifying;
- electric supply systems.

This document is not applicable to ventilation systems and air conditioning systems for industrial or other special process environments.

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 16211, *Ventilation for buildings — Measurement of air flows on site — Methods*

EN 16798-3, *Energy performance of buildings - Ventilation for buildings - Part 3: For non-residential buildings - Performance requirements for ventilation and room-conditioning systems (Modules M5-1, M5-4)*

JCGM 100, *Evaluation of measurement data — Guide to the expression of uncertainty in measurement*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

3.1

handover

process of transferring responsibility for an installation to another person or organization

3.2

check

examination of something, without resorting to measurements, in order to make certain that it is correct or the way it should be

3.3

administrative check

check of documentation and specifications of an installation

3.4

completeness check

check of the completeness and the arrangement of an installation

3.5

functional check

check of the operation of a primary function of an installation

Note 1 to entry: An example of primary function of a ventilation installation is to provide air flow rate.

3.6

balancing

process of adjusting the flow rates in each circuit of an installation to meet the specifications

4 Test and check procedure

To verify the fitness of purpose of an installed system by checks and measurements it is necessary to give specifications for checks and measurements (e.g. maximal permissible errors, sample selection) as well as for the installation (e.g. tolerances). Annex F gives a list of such specifications.

The following steps shall be carried out in the given order:

- a) administrative check;
- b) completeness checks;
- c) functional checks;
- d) measurements;
- e) additional measurements;
- f) report.

EN 12599:2026 (E)

In general, functional checks and measurements on the system are performed for each component of the system. For same kind of components at comparable locations and operation conditions the functional checks and measurements may be performed on a sample selection. The extent of functional checks and measurements shall be determined in accordance with Annex C.

Ensure the system is set up at disventing conditions.

The additional measurements in accordance with Clause 9 and Annex E shall be carried out only when required and especially agreed.

The steps of the checks, measurements and report are shown in Table 1.

Table 1 — List of checks, measurements and report to verify the quality of the systems

Required steps	Purpose	Activities	Annexes
Administrative check	Verify that the documentation of the installation is complete	Check the Completeness of documents 1. Specifications 2. Inventory 3. Operation and maintenance 4. Measurement reports	Annex A
Completeness checks	Ensure that the ventilation system or air conditioning system has been installed entirely in accordance with contract	1. Comparison of equipment with the design 2. Compliance with technical rules (contract and official) 3. Balancing	Annex A
Functional checks	Verify the operation of the system	1. Put system into use 2. Operation of components and system 3. Accessibility 4. Cleanliness	Annex C Determination of extent Annex B Functional checks
Measurements	Verify on a statistical basis that the system achieves the values according to design	1. Determine which measurements and recordings are necessary 2. Extent of measurements, specified by means the sampling level SL 3. Measurements 4. Accompanying measurements (see 8.5) 5. Air tightness	Annex C Determination of extent
Additional measurements (if necessary)	In case of doubts concerning the quality of the system or parts of the system additional measurements can be applicable	1. Determine which measurements and recordings are necessary 2. Determine uncertainty of the measurements 3. Measurements	Annex E Additional measurements

Required steps	Purpose	Activities	Annexes
Report		1. Report 2. Handing over the report	Annex A Example of completeness check report

5 Administrative check

Prior to on site inspection, the administrative check of the available documents shall be done.

It shall be checked whether all relevant documents are available, including:

- a list of all specifications;
- all inventory documents;
- all documents necessary for operation and maintenance;
- the balancing reports;
- the existing reports of measurements (e.g. the air tightness test) if any.

Details of the administrative check are included in Annex A.

6 Completeness check

The completeness check is intended to ensure that installation is done according to specification and in compliance with the relevant technical rules.

The following checks are included:

- comparison of the delivered system with the specification, with regard to amount, number of pieces and material and, if necessary, also with regard to characteristics and spare parts;
- comparison of the delivered system with the specification, with regard to location of components;
- comparison of the delivered system with the specification, with regard to arrangement of the installation;

Check that the balancing has been done in accordance with the report.

An example description of the completeness check is included in Annex A.

7 Functional checks

The purpose of the functional checks is to verify the operation of the installation in different operational conditions in compliance with the relevant technical rules and the specification. The checks show whether the particular elements of the system such as filters, fans, heat exchangers, coolers, humidifiers have been properly installed.

In the case of occupancy control or demand control it should be checked if the reaction of the system to changes of sensor values is in accordance with the design requirements.

Functional checks shall be carried out on all types of installed equipment.

Before starting the checks, a checklist should be drawn up.

EN 12599:2026 (E)

The extent of functional checks is specified in Annex C.

The locations for the checks should be specified.

Instruction for the procedure and a list of functional checks are given in Annex B.

8 Measurements

8.1 General

The purpose of the measurements is to verify that the system achieves the design conditions and set points as specified.

Together with the measurement results, the measurement conditions shall be recorded in accordance with the measurement procedures in 8.4.

When measurements take place at other conditions than design conditions they may be converted into temperature and pressure design conditions.

If some of the tests are already done prior to the handing over the documentation should be verified in the administrative check.

8.2 Range of measurements

Table 2 indicates which measurements are necessary for each type of ventilation and air conditioning system.

The extent of measurements is specified in Annex C.

Table 2 — Measurements

Type of systems/Functions		Total system	Central system/appliance				Ductwork	Room					
		Additional cleanliness test	Current drawn and power by the motor	Air flow ^a	Air temperature ^a	Pressure drop across filter	Ductwork leakage test	Supply air flow (mechanical)	Extract air flow (mechanical)	Supply air temperature ^b	Supply air humidity	Sound pressure level	Indoor air velocity
Ventilation system	Z	2	2	1	0	1	2	1	1	0	0	2	2
	H	2	2	1	1	1	2	1	1	2	0	2	2
	C	2	2	1	1	1	2	1	1	2	2	2	2
	M/D	2	2	1	1	1	2	1	1	2	1	2	2
Partial air conditioning system	HC	2	2	1	1	1	2	1	1	1	2	2	2
	HM/HD/CM/CD	2	2	1	1	1	2	1	1	1	1	2	2
	MD	2	2	1	1	1	2	1	1	2	1	2	2
	HCM/MCD/CHD/HMD	2	2	1	1	1	2	1	1	1	1	2	2

		Total system	Central system/appliance				Ductwork	Room					
Type of systems/Functions		Additional cleanliness test	Current drawn and power by the motor	Air flow ^a	Air temperature ^a	Pressure drop across filter	Ductwork leakage test	Supply air flow (mechanical)	Extract air flow (mechanical)	Supply air temperature ^b	Supply air humidity	Sound pressure level	Indoor air velocity
Full air conditioning system	HCMD	2	2	1	1	1	2	1	1	1	1	2	2
Explanations Figures 0 to 2 indicate the relevance of a measurement in order to verify the fitness of purpose of the system. 0 measurement not relevant 1 required measurement 2 optional measurement C cooling D dehumidification H heating M humidification (moisture) Z without any thermodynamic functions (zero)													
^a Outdoor air, supply air and exhaust air ^b Depending on control principles, if relevant													

8.3 Procedure

Before starting the measurement, the measuring locations shall be specified and the procedures and measuring instruments shall be agreed upon and given in the technical documents.

The number of measuring points in a room should take into account the floor area and the measured parameters. At least one measuring position is required for measurements in rooms of area up to 20 m²; larger rooms should be subdivided accordingly. For the measurements in the room, the measuring positions in the occupied zone shall be agreed on between the parties concerned, preferably at positions intended for intensive occupancy.

With regard to the selection of the measuring instruments the overall uncertainty shall be taken into account.

The indoor climate factors and air flow rates, heating, cooling and humidifying performances, electrical characteristics and other design data shall be measured at the ventilation system design air flow rate. The maximum expanded measurement uncertainty ($k = 2$) of the measured values is given in Table 3. Accuracy classes for electric measuring instruments are given in Table 7.

Table 3 — Expanded measurement uncertainty U of measurands

Measurand	Expanded measurement uncertainty U^a
Air flow rate, each individual room	15 %
Air flow rate, each system	10 %
Air temperature in duct	2 °C
Relative humidity [RH]	15 % RH
Air velocity in occupied zone	0,05 m/s
Air temperature in occupied zone	1,5 °C
A-weighted sound pressure level in the room	3 dB
^a This document does not specify tolerances for the design values itself.	

Lower expanded measurement uncertainties can be required. This should be specified in the documentation of the system.

8.4 Measuring methods and measuring instruments

8.4.1 General

In the case of measurements in ducts and in air handling units with negative pressure, measurement error due to an air infiltration by the opening made for the insertion of the measuring device should be avoided.

In any case, the openings in the ducts shall be sealed after measuring.

Take into account that weather conditions can influence the measurement and measurement uncertainty.

8.4.2 Measurement of the air flow rate

The air flow rate can be evaluated by different methods in accordance with EN 16211.

The air flow rate of the ventilation system is measured in the duct or system and the following methods can be used:

- fixed devices for air flow rate measurement; or
- multi-point measurement in the duct cross-section with or without measurement plane criteria.

If ventilation systems are equipped with fixed devices to measure the air flow rate (e.g. pressure ports at the inlet cone of a fan with a corresponding characteristic), these should be preferably used for the purpose of handing over.

To measure the total air flow rate in larger ventilation systems with the multi-point measurement method the necessary undisturbed straight flow sections are often not given and the method without measurement plane criteria is recommended.

Measurements at the outdoor air intake or the exhaust vent determining the total air flow rate of a ventilation system are only recommended if no measurement can be done inside the system or duct.

The air flow rate at air terminal devices can be measured by the following measurement equipment:

- fixed devices, e.g. to measure the reference pressure at the plenum box;
- tight bag (only for supply terminals); or
- flow hoods.

8.4.3 Measurement of the ductwork airtightness

8.4.3.1 Principle

The objective of the ductwork airtightness test is to verify the belonging to a specified by design tightness class.

This document provides procedures to test on site the air distributions system tightness (classified with $ATC_{\text{Distribution}}$) and the ductwork tightness (classified with ATC_{Ductwork}) according to the classification of EN 16798-3.

The duct's component tightness (classified with $ATC_{\text{Component}}$) cannot be tested on site.

NOTE 1 Component tightness testing are covered for duct systems in EN 1507, EN 12237 and EN 17192 and for technical ductwork products in EN 15727 and EN 1751.

The air tightness classes shall be specified in accordance with EN 16798-3 as in Table 4.

According to the representativity of the sample tested (see 8.4.3.2) either $ATC_{\text{Distribution}}$ or ATC_{Ductwork} is measurable as specified in EN 16798-3:

- $ATC_{\text{Distribution}}$ represents the air distribution system leakage, it includes the whole installed air distribution system including all components but not including the air handling unit (AHU) and heat recovery (relevant for system performance);
- ATC_{Ductwork} represents the ductwork leakage, i.e. the leakage of ducts, fittings, sound attenuators and dampers measured in a real assembly or section on site.

Table 4 — Classification of system air tightness class

Air tightness class	Air leakage limit f_{max} $\text{m}^3 \cdot \text{s}^{-1} \cdot \text{m}^{-2}$
ATC 7	not classified
ATC 6	$0,067\,5 \cdot p_{\text{test}}^{0,65} \cdot 10^{-3}$
ATC 5	$0,027 \cdot p_{\text{test}}^{0,65} \cdot 10^{-3}$
ATC 4	$0,009 \cdot p_{\text{test}}^{0,65} \cdot 10^{-3}$
ATC 3	$0,003 \cdot p_{\text{test}}^{0,65} \cdot 10^{-3}$
ATC 2	$0,001 \cdot p_{\text{test}}^{0,65} \cdot 10^{-3}$
ATC 1	$0,000\,33 \cdot p_{\text{test}}^{0,65} \cdot 10^{-3}$
NOTE p_{test} is the test pressure in Pa.	