

Irish Standard I.S. EN 13141-8:2022

Version 3.00

Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 8: Performance testing of non-ducted mechanical supply and exhaust ventilation units (including heat recovery)

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National Foreword

I.S. EN 13141-8:2022 V3.00 is the version of the NSAI adopted European document EN 13141-8:2022, *Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 8: Performance testing of non-ducted mechanical supply and exhaust ventilation units (including heat recovery)*, including any Corrections, Amendments etc. to EN 13141-8:2022.

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EUROPEAN STANDARD NORME EUROPÉENNE EUROPÄISCHE NORM

EN 13141-8

September 2022

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English Version

Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 8: Performance testing of non-ducted mechanical supply and exhaust ventilation units (including heat recovery)

Ventilation des bâtiments - Essais de performance des composants/produits pour la ventilation des logements - Partie 8 : Essais de performance des unités de ventilation double flux décentralisées (y compris la récupération de chaleur) Lüftung von Gebäuden - Leistungsprüfungen von Bauteilen/Produkten für die Lüftung von Wohnungen -Teil 8: Leistungsprüfung von mechanischen Zuluft- und Ablufteinheiten ohne Luftführung (einschließlich Wärmerückgewinnung)

This European Standard was approved by CEN on 10 January 2022.

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Contents

Europe	ean foreword	4
Introd	uction	6
1	Scope	8
2	Normative references	9
3	Terms and definitions	9
4	Symbols and abbreviations	14
5	Categories of heat exchangers	18
6	Requirements	19
7	Test methods	20
7.1	General	20
7.2	Performance testing of aerodynamic characteristics	20
7.2.1	Leakages, mixing and air transfer	20
7.2.2	In/out airtightness	23
723	Filter hynass	23
724	Air flow	23
725	Floctrical nowar input	26
7.2.3	Derformance testing of thermal characteristics	20
7.5	Conorol	27
7.3.1	Test operating conditions	27
7.3.2	Test operating conditions	27
/.3.3	Temperature conditions	28
7.3.4	Test procedure	29
7.3.5	Evaluation on supply air side (mandatory measurement) excluding alternating ventilation units	30
736	Figure and a subject of side (antional measurement) excluding alternating	50
7.5.0	vontilation units	21
74	Deviating concerts concorning alternating ventilation units	JI 21
7.4	Comorol	16
7.4.1	General lashaga Fahayat ain tuan afan natia	31
7.4.2	Internal leakage - Exnaust air transfer ratio	31
7.4.3	Determination of air volume flow	32
7.4.4	Electrical power input	36
7.4.5	Performance testing of thermal characteristics	36
8	Classification	42
8.1	Leakage classification	42
8.2	Air flow sensitivity classification	43
8.3	Indoor/outdoor airtightness of the complete unit	44
9	Performance testing of acoustic characteristics	44
9.1	General	44
9.2	Radiative sound power in the indoor or outdoor space	44
9.2.1	General	44
9.2.2	Reverberant room method	45
9.2.3	Anechoic or semi-anechoic room method	45
9.2.4	Free field method	45
9.3	Airborne sound insulation	46

10	Test results	
10.1	Test report	
10.2	Product specifications	
10.3	Additional information related to the performance of the product	
10.4	Leakages	
10.5	Filter bypass	
10.6	Air flow	49
10.7	Effective power input	
10.8	Temperature and humidity ratios	50
10.9	Acoustic characteristics	50
Annex	x A (normative) Test layouts	52
Annez	x B (normative) Pressure leakage test method	55
B.1	General	55
B.2	External leakage test	55
B.3	Internal leakage test	56
Annex	x C (normative) Indoor mixing	57
C.1	General	57
C.2	Determination of indoor mixing - First test	57
C.3	Determination of indoor mixing - Second test	57
C.4	Indoor mixing calculation	57
Biblio	ography	58

European foreword

This document (EN 13141-8:2022) 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 March 2023, and conflicting national standards shall be withdrawn at the latest by March 2023.

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 13141-8:2014.

In addition to a number of editorial revisions, the following main changes have been made with respect to EN 13141-8:2014:

- scope has been changed, and concerns now also non-ducted units which ventilate more than one single room;
- terms and definitions as well as symbols and abbreviations have been updated in accordance with the parameters used in the document;
- new categories of heat exchanger have been added;
- designations in 7.2.1.4 and the Formulae (1) to (4) have been changed;
- reference of the internal and external leakage rates has been changes to the reference air volume flow;
- extrapolation of the leakage rates has been added;
- 7.2.1.3.2 concerning exhaust air transfer ratio has been added;
- 7.2.4 concerning air flow measurement has been revised;
- requirements to convert the measured values to standard conditions have been added in 7.2.4 and 7.3.2;
- 7.3.3 has been divided into two separate subclauses 7.3.3.1 for standard tests and 7.3.3.2 for cold climate tests;
- formulae to calculate the temperature ratios have been changed;
- wet bulb temperature for the cold climate test has been changed;
- the order of the specific test for alternating units including storage heat exchanges has been changed;
- deviating aspects for alternating units to determine the air flow correction, thermal performance and the exhaust air transfer ratio have been revised;
- Table 10 concerning the temperature conditions for the cooling performance test has been moved in EN 13142.

A list of all parts in the EN 13141 series, published under the general title *Ventilation for buildings* — *Performance testing of components/products for residential ventilation* can be found on the CEN website.

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

This document specifies methods for the performance testing of components used in residential ventilation systems to establish the performance characteristics as identified in EN 13142.

This document incorporates many references to other European and International Standards, especially on characteristics other than the aerodynamic characteristics, for instance on acoustic characteristics.

In most cases some additional tests or some additional conditions are given for the specific use in residential ventilation systems.

This document can be used for the following applications:

- laboratory testing;
- attestation purposes.

The position of this document in the field of standards for the mechanical building services is shown in Figure 1.



Figure 1 — Position of EN 13141-8 in the field of the mechanical building services

1 Scope

This document specifies the laboratory test methods and test requirements for the testing of aerodynamic, thermal, acoustic and the electrical performance characteristics of non-ducted mechanical supply and exhaust residential ventilation units used in single dwellings.

The purpose of this document is not to consider the quality of ventilation but to test the performance of the equipment.

This document is applicable to ventilation units, the latter:

- a) containing either:
 - fans for mechanical supply and exhaust;
 - air filters;
 - air-to-air heat exchanger for heat and possibly humidity recovery;
 - control system;
 - inlet and outlet grilles; or
 - alternating heat exchangers which provide separate supply and exhaust air flows;
- b) provided either:
 - in one assembly; or
 - in more than one assembly, the separate assemblies of which are designed to be used together.

This document does not deal with ducted units which are covered by EN 13141-7 or units with heat pumps.

Safety requirements are given in EN 60335-2-40 and EN 60335-2-80.

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 12792:2003, Ventilation for buildings - Symbols, terminology and graphical symbols

EN ISO 717-1, Acoustics - Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation (ISO 717-1)

EN ISO 5801, Fans - Performance testing using standardized airways (ISO 5801)

EN ISO 10140-1, Acoustics - Laboratory measurement of sound insulation of building elements — Part 1: Application rules for specific products (ISO 10140-1)

EN ISO 10140-2, Acoustics - Laboratory measurement of sound insulation of building elements — Part 2: Measurement of airborne sound insulation (ISO 10140-2)

EN ISO 10140-4, Acoustics - Laboratory measurement of sound insulation of building elements — Part 4: Measurement procedures and requirements (ISO 10140-4)

EN ISO 10140-5, Acoustics - Laboratory measurement of sound insulation of building elements — Part 5: Requirements for test facilities and equipment (ISO 10140-5)

EN ISO 16890 (all parts), Air filters for general ventilation (ISO 16890 (all parts))

ISO 13347-2, Industrial fans - Determination of fan sound power levels under standardized laboratory conditions - Part 2: Reverberant room method

ISO 13347-3, Industrial fans - Determination of fan sound power levels under standardized laboratory conditions - Part 3: Enveloping surface methods

ISO 13347-4, Industrial fans - Determination of fan sound power levels under standardized laboratory conditions - Part 4: Sound intensity method

EN ISO/IEC 17025:2017, General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2017)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12792:2003 and the following apply.

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

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

3.1

external leakage

 $q_{\rm ve}$

leakage to or from the air flowing inside the casing of the ventilation unit to or from the surrounding air

[SOURCE: EN 13141-4:2021, 3.11]

3.2 internal

internal leakage

 $\boldsymbol{q}_{\mathrm{vi}}$

leakage inside the unit between the exhaust and the supply air flows

[SOURCE: EN 13141-7:2021, 3.2]

3.3

filter bypass leakage air bypass around filter cells

[SOURCE: EN 13141-7:2021, 3.4]

3.4

indoor/outdoor airtightness

 $q_{\rm vio}$

maximum air volume flow between the indoor and the outdoor environments at static pressure difference of -20 Pa and +20 Pa when the fans are "OFF" and all shutters are closed

Note 1 to entry: Indoor/outdoor airtightness is not the external leakage.

[SOURCE: EN 13141-4:2021, 3.13, modified – Removal of "through a non-ducted ventilation unit", "corresponding to the setting" and "additional", adding of "between the indoor and the outdoor environments"]

3.5

exhaust air transfer ratio

R_s

mass transfer of the discharged air to a zone from extract to supply that is actually recirculated air from the same zone, due to internal leakage and external casing leakage

3.6

outdoor mixing

R_{me}

mixing of the two air flows external to the equipment under test between discharge and intake ports at outdoor terminal points caused by short circuiting

3.7

indoor mixing

R_{mi}

mixing of the two air flows external to the equipment under test between discharge and intake ports at indoor terminal points caused by short circuiting

3.8

declared maximum air volume flow

 $q_{\rm vmax,d}$

declared maximum air volume flow of the unit at 0 Pa static pressure difference, between indoor and outdoor

[SOURCE: EN 13141-4:2021, 3.6, modified – "at 0 Pa static pressure difference, between indoor and outdoor" has been added]

3.9 maximum air volume flow

$\boldsymbol{q}_{\mathrm{vmax}}$

air volume flow corresponding to the maximum achievable fan curve setting of the unit at 0 Pa static pressure difference between indoor and outdoor, either declared or measured

Note 1 to entry: If the supply and exhaust air volume flows are different, then the maximum air volume flow is equal to the smaller of the two air volume flows.

[SOURCE: EN 13141-4:2021, 3.7, modified – Note 1 to entry has been replaced by "If the supply and exhaust air volume flows are different, then the maximum air volume flow is equal to the smaller of the two air volume flows."]

3.10 declared minimum air volume flow

 $q_{\rm vmin,d}$

minimum air volume flow of the unit declared at 0 Pa static pressure difference between indoor and outdoor

Note 1 to entry: If the supply and exhaust air volume flows are different, then the minimum air volume flow is equal to the higher of the two air volume flows.

[SOURCE: EN 13141-7:2021, 3.8, modified – "at the reference pressure declared" has been replaced by "at 0 Pa static pressure difference between indoor and outdoor"]

3.11 reference air volume flow

 $q_{\rm vref}$

air volume flow at 70 % of the maximum air volume flow

Note 1 to entry: If the air volume flow at 70 % of the maximum air volume flow cannot be adjusted on the product itself, the closest value above is selected.

[SOURCE: EN 13141-4:2021, 3.8, modified – Note 1 to entry "To determine reference air volume flow, see 5.2.3.4, Table 6." has been replaced by the one above]

3.12 unit static pressure

 $p_{\rm us}$

pressure increase induced by the ventilation unit given as difference between the static pressure at the unit outlet and the total pressure at the unit inlet

Note 1 to entry: The parameter p_{us} for a ventilation unit is defined as the parameter p_{fs} described in EN ISO 5801 for a stand alone fan.

[SOURCE: EN 13141-4:2021, 3.2]

3.13 external static pressure difference

$p_{\rm s,ext}$

pressure increase induced by the ventilation unit given as difference between the static pressures at the unit outlet and the unit inlet

Note 1 to entry: The external static pressure difference, $p_{s,ext}$, is used to determine the maximum air volume flow, the reference air volume flow and the minimum air volume flow.

[SOURCE: EN 13141-4:2021, 3.3, modified – "and the minimum air volume flow" has been added in Note 1 to entry]

3.14

air flow sensitivity

v

maximum relative deviation of the maximum air volume flow q_{vmax} due to a static pressure difference of +20 Pa and – 20 Pa

Note 1 to entry: Unbalanced (unequal) supply and exhaust air streams influence the thermal efficiency of the ventilation unit and its air exchange capacity.

[SOURCE: EN 13141-4:2021, 3.12, modified – "of a non-ducted ventilation unit" has been removed from the definition, Note 1 to entry has been added]

3.15

temperature ratio

 η_{θ}

temperature difference between inlet and outlet of one of the air flows divided by the temperature difference between the inlets of both air flows

[SOURCE: EN 13141-7:2021, 3.15]

3.16

humidity ratio

 $\eta_{\rm x}$

difference of vapour mixing ratio between inlet and outlet of one of the air flows divided by the difference of vapour mixing ratio between the inlets of both air flows

[SOURCE: EN 13141-7:2021, 3.16]

3.17 electrical power input $P_{\rm E}$

average overall electrical power input to the equipment within a defined interval of time for standard air conditions obtained from:

- the power input of the fans;
- controller(s), compressor(s), safety devices of the equipment(s) excluding additional electrical heating devices not used for defrosting

Note 1 to entry: Electrical power consumption includes the consumption of the heating device for defrosting during the cold climate test.

[SOURCE: EN 13141-4:2021, 3.15, modified – Note 1 to entry has been added]

3.18 maximum electrical power input

 $P_{\rm E,max}$

electrical power input at maximum air volume flow, q_{ymax}

[SOURCE: EN 13141-4:2021, 3.17, modified – ", and its corresponding pressure, p_{qvmax} " has been removed]

3.19 electrical power input at the reference air volume flow

P_{E,ref}

electrical power input at reference air volume flow $q_{\rm vref}$

[SOURCE: EN 13141-4:2021, 3.16, modified – ", and reference pressure, p_{ref} " has been removed]

3.20 supply air transfer ratio

R_e

mass fraction of the discharged air to a zone from outdoor to exhaust that is actually recirculated air from the same zone, due to internal leakage, external casing leakage and short circuiting

3.21

alternating ventilation unit

pair of mechanical ventilation devices using storage heat exchangers operating in opposite, synchronized periodically changing air flow direction incorporated in common or two separate casing(s)

3.22

alternating mode

operating mode in which a ventilation unit periodically changes from exhausting air to supplying air and vice versa

3.23

ventilation mode

constant operating mode where the alternating devices are running in an opposite direction with no heat recovery

3.24

indoor side

supply and extract air side of the ventilation devices

3.25

cycle time

duration of a cycle in which each path of the alternating device performs one complete supply and exhaust phase

4 Symbols and abbreviations

For the purposes of this document, the symbols and abbreviations given in EN 12792 and in Table 1 apply.

Symbol	Designation	Unit
С	concentration of tracer gas	ppm
dq _{v,over}	absolute deviation of maximum air volume flow due to over pressure of 20 Pa	_
dq _{v,under}	absolute deviation of maximum air volume flow due to under pressure of 20 Pa	_
d/λ	thermal resistance	K/W
D _{n,e}	airborne sound insulation in third octave bands	dB
D _{n,e,w}	global airborne sound insulation index	dB
f _{red}	quotient reduction factor	_
L_{W}	sound power level in third octave band	dB
$L_{\rm WA}$	A-weighted sound power level	dB
n	fan speed	min ⁻¹
n _{vent}	fan speed in ventilation mode	min ⁻¹
P _E	electrical power input	W
P _{E,ref}	electrical power input at the reference air volume flow	W
P _{E,max}	maximum electrical power input	W
P _{E,Te}	electrical power input under test conditions measured at the density $\rho_{\rm Te}$	W
P _{el,max}	electrical power input at the maximum air flow, $q_{\rm vmax}$	W

Table 1 — Symbols

Symbol	Designation	Unit	
P _{el,ref}	electrical power input at the reference air volume flow	W	
P _{el,max,vent}	electrical power input at the maximum air flow, q_{vmax} in ventilation mode	W	
P _{el,ref,vent}	electrical power input at the reference air volume flow in ventilation mode	W	
p _s	static pressure	Ра	
p _{s,ext}	external static pressure difference	Ра	
p _{s,ext,Te}	external static pressure difference under test conditions measured at the density $\rho_{\rm Te}^{}$	Ра	
p _{s,max}	maximum static pressure	Ра	
<i>p</i> _{s,vent,D1/2,ex/su}	maximum static pressure for each device and each direction	Ра	
p _{us}	unit static pressure	Ра	
p _{us,Te}	unit static pressure under test conditions measured at the density $\rho_{\rm Te}^{}$	Ра	
q _m	air mass flow	kg · s ^{−1 b}	
q _{m,max,vent}	unit mass air flow	kg⋅s ^{-1 b}	
q _{mp}	purge mass air flow	kg · s⁻¹ b	
q _{mp,I}	purge mass air flow on the indoor side	kg · s ^{-1 b}	
q _{mp,0}	purge mass air flow on the outdoor side	kg · s ^{-1 b}	
q _{m,ex,alt}	mean extract mass air flow rate of the device in alternating mode	kg · s ^{-1 b}	
$q_{\mathrm{m,set}}$	to be set air mass flow	kg · s ^{−1 b}	
$q_{\mathrm{m,su,alt}}$	mean supply mass air flow rate of the device in alternating mode	kg · s ^{−1 b}	
q_v	air volume flow	$m^3 \cdot s^{-1 a}$	
q _{v,alt}	air volume flow for alternating ventilation unit	$m^3 \cdot s^{-1} a$	
q _{ve}	external leakage air volume flow	$m^3 \cdot s^{-1 a}$	
q _{v,ex,alt}	mean extract air volume flow in alternating mode	$m^3 \cdot s^{-1 a}$	
q _{v,ex,Di}	extract air flow in ventilation mode of device x	$m^3 \cdot s^{-1 a}$	
q _{v,ex,vent}	mean extract air volume flow in ventilation mode	$m^3 \cdot s^{-1 a}$	

Symbol	Designation	Unit	
q _{vi}	internal leakage air volume flow	$m^3 \cdot s^{-1 a}$	
q _{vin}	flow rate at intermediate fan speed setting	$m^3 \cdot s^{-1 a}$	
q _{vio}	indoor/outdoor airtightness	$m^3 \cdot s^{-1 a}$	
q _{vmax}	maximum air volume flow	$m^3 \cdot s^{-1 a}$	
q _{vmax,d}	declared maximum air volume flow	$m^3 \cdot s^{-1 a}$	
q _{vmin}	minimum air volume flow	$m^3 \cdot s^{-1 a}$	
q _{vmin,d}	declared minimum air volume flow	$m^3 \cdot s^{-1 a}$	
q _{v,p}	purge air volume flow	$m^3 \cdot s^{-1} a$	
q _{vref}	reference air volume flow	$m^3 \cdot s^{-1 a}$	
q _{v,set}	air volume flow $q_{ve,set}$ at a density of 1,2 kg/m ³	$m^3 \cdot s^{-1 a}$	
q _{v,su,alt}	mean supply air volume flow in alternating mode	$m^3 \cdot s^{-1} a$	
q _{v,su,Di}	supply air flow in ventilation mode of device x	$m^3 \cdot s^{-1 a}$	
q _{v,su,vent}	mean supply air volume flow in ventilation mode	$m^3 \cdot s^{-1 a}$	
q _{v,vent}	air volume flow in ventilation mode	$m^3 \cdot s^{-1} a$	
R _e	supply air transfer ratio	%	
R _{me}	outdoor mixing	%	
R _{mi}	indoor mixing	%	
R _s	exhaust air transfer ratio	%	
t _{cycle}	time of an operating cycle for alternating ventilation units	s	
V	air flow sensitivity	%	
V _a	air volume content of device	m ³	
V _c	volume of the casing	m ³	
θ	air temperature	°C	
θ_{I1}	purge air temperature on the indoor side	°C	
θ_{01}	purge air temperature on the outdoor side	°C	
$\theta_{\rm w}$	wet bulb temperature	°C	
$\theta_{\rm wI1}$	wet bulb temperature on the indoor side	°C	

Symbol	Designation	Unit
θ_{w02}	wet bulb temperature on the outdoor side	°C
X	vapour mixing ratio	kg water/kg dry air
11	extract air (ETA) (see Figure 2)	—
12	exhaust air (EHA) (see Figure 2)	—
21	outdoor air (ODA) (see Figure 2)	—
22	supply air (SUP) (see Figure 2)	—
$\eta_{\mathrm{x,ex}}$	humidity ratio of the unit on exhaust air side	—
$\eta_{\rm x,su}$	humidity ratio of the unit on supply air side	_
$\eta_{ heta,\mathrm{ex}}$	temperature ratio of the unit on exhaust air side	_

Symbol	Designation	Unit	
$\eta_{ heta,\mathrm{su}}$	temperature ratio of the unit on supply air side		
$ ho_{st}$	density of 1,2 kg/m ³ corresponding to the air under standard conditions (20 °C and 101 325 Pa)	kg/m ³	
$ ho_{ m Te}$	density of the ambient air at the test enclosure	kg/m ³	

 a $\,$ l/s or m^3/h can be used for measurement of air flow but it shall be verified that all parameters are consistent with the chosen unit.

 b kg \cdot h⁻¹ or g \cdot s⁻¹ can be used for measurement of air flow but it shall be verified that all parameters are consistent with the chosen unit.

For the purposes of this document, the following abbreviations apply.

POM Power input in Operable Mode

PSM Power input in Standby Mode

5 Categories of heat exchangers

Categories of heat exchangers are given in Table 2.

Fable 2 — Categories of heat exchange
--

Category	Definition
HRC1	Recuperative heat exchangers (e.g. air-to-air plate or tube heat exchanger)
HRC1a	Recuperative heat exchangers of the category 1a are designed to transfer sensible thermal energy from one air stream to another without moving parts. Heat transfer surfaces are in form of plates or tubes. This heat exchanger can have parallel flow, cross flow or counter flow construction or a combination of these.
HRC1x	Recuperative heat exchangers of the category 1x are designed to transfer total thermal energy including vapour diffusion from one air stream to another without moving parts. Heat transfer surfaces are in form of plates or tubes. This heat exchanger can have parallel flow, cross flow or counter flow construction or a combination of these.
HRC3	Regenerative heat exchangers
HRC3a	Regenerative heat exchangers with moving masses e.g. rotary
HRC3b	Regenerative heat exchangers with stationary masses and changing of flow direction

6 Requirements

In addition, to assess correctly the thermal performance, aerodynamic characteristics, including all leakages, shall be tested before or together with any thermal characteristics testing (see 7.3 or 7.4.5).

Aerodynamic characteristics (see 7.2) shall include three characteristics listed below:

- external leakage;
- internal leakage or exhaust air transfer ratio;
- air flow.

Other characteristics such as filter bypass leakage are optional.

The tests for thermal performances shall not be made because of measurement uncertainty when leakages according to 7.2.1 are too high. Units with heat recovery category HRC3b shall fulfil U1 or U2 leakage class, all other units shall have the leakage class specified in Table 3.

Table 3 — Classification requirements for thermal performance

Fan position	Required leakage class to allow measurements
Exhaust fan upstream and supply fan downstream of the heat exchanger	U1
Supply fan upstream and exhaust fan downstream of the heat exchanger	U1, U2
Other fan positions	U1, U2, U3

The following points shall be declared:

- maximum air volume flow;
- minimum air volume flow;
- category of heat exchanger;
- filter classes supply and exhaust air;
- presence, type of by-pass and its control;
- minimum outdoor operation temperature;
- frost protection function(s) and control (for cold climate test);
- minimum distance between the inlets and outlets for alternating units in two separate casings;
- maximum and minimum length of the wall duct;
- possibility of balancing the air volume flows;
- nominal revolutions of the heat recovery wheel;
- control parameter and sensors;
- type of fan and speed control;

- indented use;
- possible mounting positions.

7 Test methods

7.1 General

Tests shall be conducted with a unit containing all components (including wall ducts and grilles, controls) as supplied for intended use, and installed according to the product's instructions. If the wall ducts are available in variable length the test shall be performed with the closest length to 500 mm.

The air mass flow rates q_{m11} and q_{m22} shall be measured in steady-state conditions at the same time.

For tests on alternating ventilation units, the deviating aspects in 7.4 shall be considered.

If internal and external leakage class U2 or better is reached, it can be assumed that $q_{m11} = q_{m12}$ and

 $q_{m21} = q_{m22}.$

The tests shall be conducted at the primary voltage of 230 V. This voltage shall be maintained throughout the testing to ± 1 %. Where a product requires a voltage regulation device (transformer), this device shall also be supplied or clearly specified. The power consumption of this device shall be taken into account.

7.2 Performance testing of aerodynamic characteristics

7.2.1 Leakages, mixing and air transfer

7.2.1.1 General

Methods for rating leakages, mixing and air transfer depending on the category of heat exchanger are summarized in Table 4.

Classification	Test method subclause	Category of heat exchanger			
Classification		HRC1a	HRC1x	HRC3a	HRC3b
External leakage	7.2.1.2	Х	Х	Х	Х
	7.2.1.3.1	Х	Х		—
Internal leakage	7.2.1.3.2			Х	—
	7.4.2	_			Х
Outdoor mixing	7014	Х	Х	Х	Х
Indoor mixing	7.2.1.4	Х	Х	Х	Х
Indoor/outdoor airtightness	7.2.2	Х	Х	Х	Х

There are four classes of leakage depending on the ratios between both leakage air flows and reference air volume flow.

7.2.1.2 External leakage

The external leakage shall be measured according to Annex B. During the tests, the fans of the unit under test shall be switched off.

The external leakage air volume flow, q_{ve} , at over and under-pressure of 50 Pa shall be reported as such and also compared to the reference air volume flow of the unit as a percentage. The leakage at 250 Pa is calculated according to Formula (1) (see EN 15727:2010, Table 3).

$$q_{\rm ve,250} = q_{\rm ve,50} \cdot \left(\frac{250}{50}\right)^{0,65} \tag{1}$$

The measured leakage flow shall be divided by the reference air flow to get the percentage.

7.2.1.3 Internal leakage

7.2.1.3.1 Pressure test

Internal leakage of category HRC1 heat exchangers shall be measured by means of pressurization test and the test shall be conducted as follows: during pressurization test, as defined in Annex B, the fan shall be off and the difference between the two air flows shall be fixed at 20 Pa.

The leakage at 100 Pa is calculated according to Formula (2) (see EN 15727:2010, Table 3).

$$q_{\rm vi,100} = q_{\rm vi,20} \cdot \left(\frac{100}{20}\right)^{0.65}$$
(2)

The measured leakage flow shall be divided by the reference air flow to get the percentage.

7.2.1.3.2 Exhaust air transfer ratio

The exhaust air transfer ratio measured by the tracer gas method applies to classify the internal leakages of category HRC3a heat exchanger units. The test as described below shall be done without applying any pressure drop on the system. The test shall be done using the test setups given in Annex A.

Test for tracer gas method:

- The fans shall be on and working at reference air volume flow.
- The tracer gas should be introduced into the indoor extract duct as close as possible to the grille, if this is not possible, a short length of duct (less than 150 mm) of the same cross section as the grille should be fastened to the grille and the tracer gas introduced into the ductwork.
- The tracer gas concentration should be measured at the line of the grilles. If this is impossible short
 pieces of ductwork of the same cross section as the grille should be applied and measurement made
 within the ductwork.
- To measure internal leakage a deflector is introduced between the outdoor grilles and sealed to ensure that exhaust gas cannot be mixed back into the intake port. The deflector should be applied between the exhaust and outdoor air intake ports. It should be fixed to the outside of the grille and extend to at least 300 mm in each direction. Tracer gas is introduced into the extract port and the concentration is measured in both the exhaust and supply ports.
- The exhaust air transfer ratio of the supply flow, is then the ratio of the two concentrations, as defined in 7.2.1.4.

NOTE The exhaust air transfer ratio of category HRC3b heat exchanger units is described in 7.4.2.



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