

Working Document on a Draft

COMMISSION REGULATION (EU) No .../..

of XXX

**implementing Directive 2009/125/EC of the European Parliament and of the Council
with regard to ecodesign requirements for ventilation units**

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products¹, and in particular Article 15 (1) thereof,

After consulting the Ecodesign Consultation Forum referred to in Article 18 of Directive 2009/125/EC,

Whereas:

- (1) Under Directive 2009/125/EC ecodesign requirements should be set by the Commission for energy-related products representing significant volumes of sales and trade, having significant environmental impact and presenting significant potential for improvement in terms of their environmental impact without entailing excessive costs.
- (2) Article 16(2), first indent, of Directive 2009/125/EC provides that in accordance with the procedure referred to in Article 19(3) and the criteria set out in Article 15(2), and after consulting the Ecodesign Consultation Forum, the Commission shall, as appropriate, introduce an implementing measure for ventilation systems. The product group has been incurred in the indicative list of the Working Plan for the period 2009-2011 (COM 2008 660).
- (3) Fans are an important part of ventilation units. Generic minimum energy efficiency requirements have been established for fans in Commission Regulation (EU) No 327/2011 of 30 March 2011 with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW². However, many ventilation units covered by this Regulation are used in combination with fans not covered by Regulation (EU) No 327/2011.
- (4) This Regulation distinguishes between measures for residential and non-residential ventilation units, defined as a general rule on the basis of their individual flow rate. However, considering that they offer similar functionalities, this issue should be addressed at review of the regulation.
- (5) Ventilation units with a single fan and nominal power input smaller than 30 W have particular application characteristics as a supplementary device, represent a considerable administrative burden in terms of market surveillance because of large sales numbers, contribute only to a small portion of the saving potential and should

¹ OJ L 285, 31.10.2009, p. 10–35

² OJ L 90, 6.4.2011, p. 8-21

therefore be exempted from the scope of this Regulation. Furthermore, ventilation units specified to operate exclusively for emergency purposes or in exceptional or hazardous environments should also be exempted. However, considering that they offer similar functionalities as other Ventilation Units, they should be addressed again at review of the measure.

- (6) The Commission has carried out preparatory studies to analyse the technical, environmental and economic aspects of residential and non-residential ventilation units. The studies have been developed together with stakeholders and interested parties from the Community and third countries, and the results have been made publicly available.
- (7) The environmental aspect of the products covered, identified as the most significant for the purposes of this Regulation, is energy consumption in the use phase. The annual electricity consumption of products subject to this Regulation was estimated at 77.6 TWh in the Community in 2010. At the same time, these products save 2570 PJ on space heating energy. In aggregate, using a primary energy conversion coefficient of 2.5 for electricity, the energy balance is 1872 PJ primary energy of annual saving in 2010. Without specific measures, the aggregated saving is projected to grow to 2829 PJ in 2025.
- (8) The preparatory studies show that the energy consumption of products subject to this Regulation can be significantly reduced. The combined effect of the ecodesign requirements set out in this Regulation and the Commission Delegated Regulation (EU) No ... of ... supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of residential ventilation units³, is expected to result in an aggregated saving increase by 1300 PJ (45%) to a level of 4130 PJ in 2025.
- (9) The preparatory studies show that requirements regarding other ecodesign parameters referred to in Annex I, Part 1, of Directive 2009/125/EC are not necessary as energy consumption in the use phase is by far the most important environmental aspect.
- (10) The ecodesign requirements should not affect functionality from the end-user's perspective and should not negatively affect health, safety or the environment. In particular, the benefits of reducing energy consumption during the use phase should more than offset any additional environmental impacts during the production phase and the disposal.
- (11) The ecodesign requirements should be introduced gradually in order to provide a sufficient timeframe for manufacturers to re-design products subject to this Regulation. The timing should take into account the cost impact for end-users and manufacturers, in particular small and medium-sized enterprises, while ensuring timely achievement of the objectives of this Regulation.
- (12) Product parameters should be measured and calculated using reliable, accurate and reproducible methods which take into account recognised state-of-the-art measurement and calculation methods, including, where available, harmonised standards adopted by the European standardisation bodies following a request by the Commission, in accordance with the procedures laid down in Regulation (EU) 1025/2012 of the

³ OJ [...] [...], [...], [...].

European Parliament and of the Council of 25 October 2012 on European standardisation⁴.

- (13) The verification tolerances set out in Annex III should be applied only for conformity verification purposes by Member State authorities, representing the variations of the measurement results of the verification tests compared to the respective values of the ecodesign specific requirements. Tolerances should not be used by the manufacturer or importer in establishing the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means. All parameters declared or published by the manufacturer or importer should not be more favourable for the manufacturer or importer than the values contained in the technical documentation.
- (14) In accordance with Article 8 of Directive 2009/125/EC, this Regulation should specify the applicable conformity assessment procedures.
- (15) In order to facilitate compliance checks, manufacturers should provide information in the technical documentation referred to in Annexes V and VI of Directive 2009/125/EC insofar as this information relates to the requirements laid down in this Regulation.
- (16) Benchmarks for currently available ventilation unit types with high energy efficiency should be identified. This will help to ensure the wide availability and easy accessibility of information, in particular for small and medium-sized enterprises and very small firms, which will further facilitate the integration of best design technologies and facilitate the development of more efficient products for reducing energy consumption.

HAS ADOPTED THIS REGULATION:

Chapter 1

Subject matter and scope

1. This Regulation establishes eco-design requirements for placing on the market of ventilation units.
2. This Regulation shall not apply to ventilation units which are:
 - (a) unidirectional (exhaust or supply) and equipped with one or more individual fans with an electric power input less than 30 W;
 - (b) specified to operate exclusively in potentially explosive atmosphere as defined in Directive 94/9/EC of the European Parliament and of the Council⁵;
 - (c) specified to operate exclusively for emergency use only, at short-time duty, with regard to basic requirements for construction works on safety in case of fire as set out in Regulation (EU) 305/2011⁶;
 - (d) specified to operate exclusively:
 - (1) where operating temperatures of the air being moved exceed 100 °C;
 - (2) where the operating ambient temperature for the motor, if located outside the air stream, driving the fan exceeds 65 °C;

⁴ OJ L 316, 14.11.2012, p. 12.

⁵ OJ L 100, 19.4.1994, p.1

⁶ OJ L 88, 4.4.2011, p. 5

- (3) where the annual average temperature of the air being moved and/or the operating ambient temperature for the motor, if located outside the air stream, are lower than $-40\text{ }^{\circ}\text{C}$;
 - (4) with a supply voltage $> 1\ 000\text{ V AC}$ or $> 1\ 500\text{ V DC}$;
 - (5) in toxic, highly corrosive or flammable environments or in environments with abrasive substances;
- (e) units including a heat exchanger or a heat pump for heat recovery, whereby the purpose of the unit is predominantly heating or cooling.

Chapter 2

Definitions

In addition to the definitions set out in Article 2 of Directive 2009/125/EC, the following definitions shall apply for the purpose of this Regulation:

- (1) ‘Ventilation unit (VU)’ means an electric mains-operated appliance equipped with at least a fan, motor, fan housing and a casing of the appliance intended to replace utilised air by fresh air in a building or part of a building;
- (2) ‘Residential ventilation unit (RVU)’ means a ventilation unit where the maximum flow rate as defined in Annex I or the nominal flow rate as defined in Annex II do not exceed $1000\text{ m}^3/\text{h}$ or is between 250 and $1000\text{ m}^3/\text{h}$ and the manufacturer does not declare its intended use exclusively for a non-residential ventilation application;
- (3) ‘Non-residential ventilation unit (NRVU)’ means a ventilation unit where the maximum flow rate as defined in Annex I or the nominal flow rate as defined in Annex II exceed $1000\text{ m}^3/\text{h}$ or is between 250 and $1000\text{ m}^3/\text{h}$ and the manufacturer declares its intended use exclusively for a non-residential ventilation application;
- (4) ‘Unidirectional ventilation unit’ (UVU) means a ventilation unit with air treatment producing an air volume flow only in one direction, either from indoors to outdoors (exhaust) or from outdoors to indoors (supply), operating in a building ventilation system where the mechanically produced air flow is balanced by natural air supply or extraction provisions;
- (5) ‘Bidirectional ventilation unit’ (BVU) means a ventilation unit producing a mass air flow between indoors and outdoors and which is equipped with both exhaust and supply fans;
- (6) ‘Central’ ventilation unit, or ducted ventilation unit, means a ventilation unit intended to ventilate more than one enclosed spaces in a building through the use of air-ducts, equipped with appropriate means for duct-connection.
- (7) ‘Local’ ventilation unit, or non-ducted, or room based ventilation unit, means a ventilation unit intended to ventilate a single enclosed room or space in a building, not equipped with appropriate means for duct-connection.

Chapter 3

Ecodesign requirements and timetable

- 1. The specific ecodesign requirements for ventilation units are set out in Annex I point 2 for RVUs and Annex II point 2 for NRVUs.
- 2. Ventilation units shall meet:

- (a) from 1 January 2016 the requirements set out in Annex I point 2.1 and 3 for RVUs and Annex II point 2.1 and 3 for NRVUs; and
 - (b) from 1 January 2018 additionally the requirements set out in Annex I point 2.2 for RVUs and Annex II point 2.2 for NRVUs.
3. Compliance with ecodesign requirements shall be measured and calculated in accordance with the methods set out in Annex III.

Chapter 4 **Conformity assessment**

- (1) The conformity assessment procedure referred to in Article 8 of Directive 2009/125/EC shall be the internal design control system set out in Annex IV to that Directive or the management system set out in Annex V to that Directive.
- (2) For the purposes of conformity assessment pursuant to Article 8 of Directive 2009/125/EC, the technical documentation file shall contain a copy of the product information set out under point 3 of Annex I and II to this Regulation.
- (3) Where the information included in the technical documentation for a particular ventilation unit model has been obtained by calculation on the basis of design, or extrapolation from other equivalent Ventilation Units, or both, the technical documentation shall include details of such calculations or extrapolations, or both, and of tests undertaken by manufacturers to verify the accuracy of the calculations undertaken. In such cases, the technical documentation shall also include a list of all other equivalent Ventilation Unit models where the information included in the technical documentation was obtained on the same basis.

Chapter 5 **Verification procedure for market surveillance purposes**

When performing the market surveillance checks referred to in Article 3(2) of Directive 2009/125/EC for compliance with requirements set out in Annex I for RVUs or Annex II for NRVUs to this Regulation, the Member States authorities shall apply the verification procedure described in Annex III to this Regulation.

Chapter 6 **Benchmarks**

The indicative benchmarks for best-performing Ventilation Units available on the market at the time of entry into force of this Regulation are set out in Annex IV.

Chapter 7 **Review**

The Commission shall review this Regulation in the light of technological progress no later than 1 January 2019 and present the result of this review to the Ecodesign Consultation Forum. The review shall in particular assess the verification tolerances set out in Annex III, the need to set requirements on leakage rates, and possibilities of a single set, or at least a more harmonised set of requirements for both RVUs and NRVUs.

Chapter 8
Entry into force

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

For the Commission
On behalf of the President

[Position]

ANNEX I
Ecodesign requirements for RVUs

1. Definitions for the purpose of Annex I, point 2,

- (1) '*Specific Energy Consumption*' or 'SEC' is a specific coefficient for RVUs to describe the energy consumed for ventilation per m² heated floor area of a dwelling or building, calculated using the appropriate formula in Annex V;
- (2) '*Sound power level*' or 'L_{WA}' means the casing radiated A-weighted sound power level expressed in decibels (dB) with reference to the sound power of one picowatt (1pW), transmitted by the air, at reference air flow for non-ducted ventilation units, in the room where the UVU or BVU is located.
- (3) '*Multi-speed drive*' means a fan motor that can be operated at 3 or more fixed speed steps plus zero ('off');
- (4) '*Variable speed drive*' or 'VSD' means an electronic power converter integrated — or functioning as one system — with the motor and the fan, that continuously adapts the electrical power supplied to the electric motor in order to control the mechanical power output of the motor according to the torque-speed characteristic of the load being driven by the motor, excluding variable voltage controllers where only the supply voltage for the motor is varied.
- (5) '*Heat Recovery System*' or 'HRS' means the part of a Bidirectional Ventilation Unit equipped with a heat exchanger designed to transfer the heat contained in the (contaminated) exhaust air to the (fresh) supply air;
- (6) '*Thermal efficiency of a residential HRS*' or ' η_t ' means the ratio of the supply air temperature gain and the exhaust air temperature loss, both with respect of the outdoor temperature, measured under dry conditions of the HR, and standard air conditions, with balanced mass flow, an indoor-outdoor temperature difference of 13 K and no correction for thermal heat gain from fan motors and no specific restrictions on internal leakage;
- (7) '*Internal leakage rate*' means the fraction of extract air in the supply air of ventilation units with HRS as a result of leakage between extract and supply air flows inside the casing when the unit is operated at reference air volume flow, measured at the ducts
- (8) '*External leakage rate*' means the fraction of reference air volume flow escaping from the casing of a unit when it is subject to a pressure test.
- (9) '*Mixing*' means the immediate recirculation or short-circuiting of airflows between discharge and intake ports at both the indoor and outdoor terminals and is thus not contributing to the effective ventilation of a building space, when operated at reference air volume rate.
- (10) '*Mixing rate*' means the fraction of extract air flow, as part of the total reference air volume, that is recirculating between discharge and intake ports at both the indoor and outdoor terminals and is thus not contributing to the effective ventilation of a building space, when operated at reference air volume measured at 1 m distance from indoor supply duct reduced by the internal leakage rate.

- (11) *'Effective power input'* in W means the electric power input at reference flow rate and corresponding external total pressure difference and includes the electrical demand for fans, controls (including remote controls) and (if integrated) any heat pump;
- (12) *'Specific Power Input'* or 'SPI' in W/(m³/h) means the ratio of the electric power input in W and reference flow rate in m³/h;
- (13) *'flow rate/pressure diagram'* means a set of curves for flow rate (horizontal axis) and pressure difference of an unidirectional RVU or the supply side of a bidirectional RVU, whereby each curve represents one fan speed with at least 8 equidistant test-points and the number of curves is given by the number of discrete fan speed options (1, 2 or 3 speed) or, in case of a variable fan speed drive, includes at least a minimum, maximum and an appropriate intermediate curve close to the reference air volume and pressure difference for SPI testing;
- (14) *'Maximum flow rate'* is the declared maximum air volume flow rate of a ventilation unit that can be achieved with integrated and/or separately co-supplied controls at standard air conditions 20 °C and 101325 Pa, whereby the unit is installed complete (e.g. including clean filters) and according to manufacturer instructions (e.g. with wall-ducts and grills for non-ducted units as appropriate) and for ducted RVUs relates to the air flow at 100 Pa of external static pressure difference and for non-ducted RVU relates to the air flow at the lowest achievable total pressure difference to be chosen from a set of values of 10 (minimum)-20-50-100-150-200-250 Pa, whichever is equal or just below the measured pressure difference value;
- (15) *'Reference flow rate'* in m³/s is the abscissa value to a point on a curve in the flowrate/pressure diagram which is on or closest to a reference point at least at 70% of the maximum flow rate and exactly at 50 Pa for ducted units and at a minimum pressure for non-ducted units. For bidirectional ventilation units the reference air volume flow rate applies to the air supply outlet;
- (16) *'Control factor'* or 'CTRL' means a correction factor relating to the type of control that is part of the ventilation unit following the description in Table 1;
- (17) *'Control parameter'* means a measurable parameter or set of measurable parameters that are assumed to be representative of the ventilation demand, such as the level of relative humidity (RH), carbon-dioxide (CO₂) or other gases, motion or occupancy detection from infrared body heat, motion or occupancy from reflection of ultrasonic waves, electric signals from human operation of electric lights or equipment;
- (18) *'Manual control'* means any control type that does not use demand control;
- (19) *'Demand control'* means a device or set of devices, part of the ventilation unit product package placed on the market, that measures a control parameter and uses the result to automatically regulate the flow rate of the ventilation unit and/or the flow rates of the air terminals that are part of the ventilation unit package placed on the market;
- (20) *'Clock control'* means a clocked (daytime-controlled) human interface to control the fan speed/ flow-rate of the ventilation unit, with at least 7 weekday manual settings of the adjustable flow-rate for at least 2 or more setback periods, i.e. periods where a reduced or no flow rate applies;
- (21) *'Demand controlled ventilation'* or 'DCV' means a ventilation unit that uses demand control;

- (22) ‘*Central demand control*’ means a demand control of a ducted ventilation unit that allows the regulation of its fan speed(s) and flow rate;
- (23) ‘*Local demand control*’ means a demand control of a ducted ventilation unit that allows the regulation of the overall fan speed(s) and the individual regulation of flow rates in at least three different enclosed spaces serviced by the ventilation unit.
- (24) ‘*Single variable demand control*’ means a demand control that is able to continuously detect the rate of deviation of a control parameter from a set value and regulate flow rate proportionally;
- (25) ‘*Multi-variable demand control*’ means a demand control that is able to continuously detect the rate of deviation of at least two different control parameters from set values, and regulate flow rate proportionally;
- (26) ‘*Static pressure*’ or p_{sf} means the total pressure minus the fan dynamic pressure;.
- (27) ‘*Total pressure*’ or p_f means the difference between the stagnation pressure at the fan outlet and the stagnation pressure at the fan inlet;
- (28) ‘*Stagnation pressure*’ means the pressure measured at a point in a flowing gas if it were brought to rest via an isentropic process;
- (29) ‘*Dynamic pressure*’ means the pressure calculated from the mass flow rate, the average gas density at the outlet and the unit outlet area;
- (30) ‘*Recuperative heat exchanger*’ means a heat exchanger intended to transfer thermal energy from one air stream to another without moving parts, such as plate or tubular heat exchangers with parallel flow, cross flow or counter flow or a combination of these as well as plate or tubular heat exchanger with vapour diffusion.
- (31) ‘*Regenerative heat exchanger*’ means a rotary heat exchanger incorporating a rotating wheel for the purpose of transferring thermal energy from one air stream to the other, including material allowing latent heat transfer, a drive mechanism, a casing or frame as well as seals to reduce bypassing and leakage of air from one stream or another, with the characteristic that the regenerative heat exchangers have varying degrees of moisture recovery depending on the material used.
- (32) ‘*Airflow sensitivity to pressure variations*’ of a non-ducted RVU is the ratio of the maximum deviation from the maximum RVU flow rate at +20 Pa and at -20 Pa external total pressure difference.
- (33) ‘*Indoor/outdoor air tightness*’ of a non-ducted RVU is the flow rate in m³/h between indoor and outdoor when the fan(s) is(are) switched off.

2. Specific ecodesign requirements for RVUs

2.1 From 1 January 2016:

- SEC shall be at the most 0 kWh/(m².a);
- Non-ducted, single room units shall have a maximum L_{WA} of 45 dB;
- All VUs shall be equipped with a multi-speed drive or variable speed drive;
- All BVUs shall have a thermal by-passable heat recovery system;

2.2 From 1 January 2018:

- SEC shall be at the most -20 kWh/(m².a);
- Non-ducted, single room units shall have a maximum L_{WA} of 40 dB;

- The ventilation unit including a filter shall be equipped with a visual filter change warning signal.

The test parameters above are assessed in accordance with the definitions in point 1 and refer to measurements and calculations in Annex V. They shall be complemented by reliable, accurate and reproducible measurement procedures, which take into account the generally recognised state of the art measurement methods, including methods set out in documents the reference numbers of which have been published for that purpose in the Official Journal of the European Union.

3. Product information requirements on RVUs

1. The information on RVUs set out in points 2(a) to (v) shall be visibly displayed on:
 - (a) The technical documentation of RVUs; and
 - (b) Free access websites of RVU manufacturers.
2. The following information shall be displayed:
 - (a) supplier's name or trade mark;
 - (b) supplier's model identifier which means the code, usually alphanumeric, which distinguishes a specific residential ventilation unit model from other models with the same trade mark or supplier's name;
 - (c) specific energy consumption (*SEC*) in kWh/a.m² ;
 - (d) declared typology in accordance with art. 2 of this Regulation (RVU or NRVU, unidirectional or bidirectional, central or local);
 - (e) type of drive installed (multi-speed drive or variable speed drive);
 - (f) type of heat recovery system (recuperative, regenerative, none);
 - (g) thermal efficiency of heat recovery (in %), as appropriate (if 'none' then zero);
 - (h) maximum flow rate in m³/h;
 - (i) electric power input of the fan drive, including any motor control equipment, at maximum flow rate (W);
 - (j) sound power level (*L_{WA}*), rounded to the nearest integer;
 - (k) reference flow rate in m³/s at design external pressure drop in Pa;
 - (l) reference pressure difference in Pa;
 - (m) SPI in W/m³/h;
 - (n) control factor and control typology in accordance with relevant definitions and classification in Annex I;
 - (o) internal and external leakage factors (%) for bidirectional ventilation units or external leakage factor (%) for ducted unidirectional ventilation units;
 - (p) mixing rate of local bidirectional ventilation units with fixed air terminals;
 - (q) position and description of visual filter warning for RVUs intended to be used with filters, including text pointing out the importance of regular filter change for performance and energy efficiency of the unit;
 - (r) for unidirectional ventilation systems: instructions to install regulated supply/exhaust grilles in façade for natural air supply/extraction;

- (s) electronic Internet address to (pre-) disassembly instructions on the free access manufacturer's website as set out in point 6;
 - (t) for non-ducted units only, the airflow sensitivity to pressure variations at +20Pa and -20 Pa.
 - (u) for non-ducted units only, the indoor/outdoor air tightness in m³/h;
 - (v) for non-ducted units only, the airborne sound insulation.
3. The information from items (a) to (j) above shall be displayed on the nameplate.
 4. One fiche may cover a number of models supplied by the same supplier.
 5. The information contained in the fiche may be given in the form of a copy of the label, either in colour or in black and white. Where this is the case, the information listed in point 1 not already displayed on the label shall also be provided.
 6. Detailed instructions including the required tools for the manual (pre-)disassembly from the ventilation unit of electronics parts (printed wiring boards/printed circuit boards and displays >10 g or > 10 cm²), batteries and larger plastic parts (>100 g) for the purpose of efficient materials recycling shall be available on the free access website of the manufacturer.

ANNEX II
Ecodesign requirements for NRVU

1. Definitions for the purpose of Annex II, point 2, in addition to definitions in Annex I

- (1) *'Nominal electric power input'* (P) in kW means the electric power consumption of the fan drives, including any motor control equipment, at the nominal external pressure and the nominal airflow;
- (2) *'Fan efficiency'* (η_{fan}) means static efficiency of the individual fan(s) in the ventilation unit as defined in and tested in accordance with the Fan Regulation Commission Regulation (EU) 327/2011;
- (3) *'Minimum fan efficiency'* (η_{vu}) is the specific minimum efficiency requirement for VUs within the scope of this regulation;
- (4) *'Nominal flow rate'* (q_v) in m³/s means the declared design flow rate of an NRVU at standard air conditions 20 °C and 101325 Pa, whereby the unit is installed complete (e.g. including filters) and according to manufacturer instructions .
- (5) *'Nominal external pressure'* ($\Delta p_{s, ext}$) in Pa means the declared design external static pressure difference at nominal flow rate;
- (6) *'Maximum rated fan speed'* ($v_{fan, rated}$) in rpm (rounds per minute) is the fan speed at nominal flow rate and nominal external pressure;
- (7) *'Internal pressure drop of ventilation components'* ($\Delta p_{s, int}$) in Pa means the sum of the static pressure drops at nominal flow rate and nominal external pressure for a BVU over the casing, clean fine filter on the supply side, clean intermediate filter on the exhaust side and heat recovery system at both supply and exhaust side, and for a UVU over the casing and possibly a clean fine filter.
- (8) *'Internal pressure drop of additional non-ventilation components'* ($\Delta p_{s, add}$) in Pa means the remainder of the sum of all internal static pressure drops at nominal flow rate and nominal external pressure after subtraction of the internal pressure drop of ventilation components $\Delta p_{s, int}$.
- (9) *'Thermal efficiency of a non-residential HRS'* ($\eta_{t, nrvu}$) means the ratio of the supply air temperature gain and the exhaust air temperature loss, both with respect of the outdoor temperature, measured under dry reference conditions, with balanced mass flow, an indoor-outdoor air temperature difference of 20 K, excluding thermal heat gain from fan motors and with restricted maximum 3% internal leakage, and as further defined in Annex VI point 1;
- (10) *'Internal specific fan power of ventilation components'* (SFP_{int}) is the ratio of the internal pressure drop of ventilation components and the fan efficiency, determined for the reference configuration, as described in Annex VI;
- (11) *'Maximum internal specific fan power of ventilation components'* ($SFP_{int, limit}$) in W/(m³/s) is the specific efficiency requirement for SFP_{int} for VUs within the scope of this regulation;
- (12) *'Run-around HRS'* is a heat recovery system where the heat recovery device on the exhaust side and the device supplying the recovered heat to the air stream on the supply side of a ventilated space are connected through a heat transfer system that allows free positioning of the two sides of the HRS in different parts of a building.

- (13) 'Efficiency bonus' (E) is a correction factor considering that more efficient heat recovery causes more pressure drops requiring more specific fan power.
- (14) 'Filter correction' (F) is a correction value in Pa is a correction value to be applied if a unit deviates from the reference configuration of a BVU;
- (15) 'Fine filter' ($F7$) means a filter that meets the conditions described in Annex VI;
- (16) 'Medium filter' ($M5$) means a filter that meets the conditions described in Annex VI;
- (17) 'Filter efficiency' means the average gravimetric ratio between the dust fraction captured and the amount fed into the filter, under the conditions described for fine and medium filters in Annex VI.

2. Specific ecodesign requirements

Non-residential ventilation units shall comply with the following requirements:

2.1 From 1 January 2016:

- All ventilation units shall be equipped with a multi-speed drive or a variable speed drive;
- All BVUs shall have a HRS;
- The HRS shall have a thermal by-pass facility;
- The minimum thermal efficiency η_{t_nrvu} of run-around HRS in BVUs shall be 63% and the efficiency bonus $E = (\eta_{t_nrvu} - 0,63) * 3000$ if the thermal efficiency η_{t_nrvu} is at least 63 % else $E = 0$;
- the minimum thermal efficiency η_{t_nrvu} of all other heat recovery systems (HRS) in BVUs shall be 67% and the efficiency bonus $E = (\eta_{t_nrvu} - 0,67) * 3000$ if the thermal efficiency η_{t_nrvu} is at least 67 % else $E = 0$;
- The minimum fan efficiency for UVUs (η_{vu}) is
 - 6.2 % * $\ln(P) + 35.0$ % if $P \leq 30$ kW and
 - 56.1 % if $P > 30$ kW,
- The maximum internal specific fan power of ventilation components (SFP_{int_limit}) in $W/(m^3/s)$ is
 - for a BVU with run-around HRS
 - 1700 + $E - 300 * q_{nom} / 2 - F$ if $q_{nom} < 2$ m³/s and
 - 1400 + $E - F$ if $q_{nom} \geq 2$ m³/s;
 - for a BVU with other HRS
 - 1200 + $E - 300 * q_{nom} / 2 - F$ if $q_{nom} < 2$ m³/s and
 - 900 + $E - F$ if $q_{nom} \geq 2$ m³/s;
 - 250 for an UVU intended to be used with a filter.

2.2 From 1 January 2018:

- The minimum thermal efficiency η_{t_nrvu} of run-around HRS in BVUs shall be 68 % and the efficiency bonus $E = (\eta_{t_nrvu} - 0,68) * 3000$ if the thermal efficiency η_{t_nrvu} is at least 68 % else $E = 0$;

- The minimum thermal efficiency η_{t_nrvu} of all other heat recovery systems (HRS) in BVUs shall be 73% and the efficiency bonus $E = (\eta_{t_nrvu} - 0,73) * 3000$ if the thermal efficiency η_{t_nrvu} is at least 73 % else $E = 0$;
- The minimum fan efficiency for unidirectional fan unit (fan + casing) is
 - 6.2 % * $\ln(P)$ + 42.0 % if $P \leq 30$ kW and
 - 63.1% if $P > 30$ kW.
- The maximum internal specific fan power of ventilation components (SFP_{int_limit}) in W/(m³/s) is
 - for a BVU with run-around HRS
 - 1600 + E – $300 * q_{nom} / 2 - F$ if $q_{nom} < 2$ m³/s and
 - 1300 + E – F if $q_{nom} \geq 2$ m³/s;
 - for a BVU with other HRS
 - 1100 + E – $300 * q_{nom} / 2 - F$ if $q_{nom} < 2$ m³/s and
 - 800 + E – F if $q_{nom} \geq 2$ m³/s;
 - 230 for an UVU intended to be used with a filter.
- In case a filter unit is part of the configuration the product shall be equipped with a visual signalling or an alarm in the control system when the filter pressure drop exceeds the maximum allowable final pressure drop.

3. Product information requirements on NRVUs

1. The information on NRVUs set out in points 2(a) to (x) shall be visibly displayed on:
 - (a) the technical documentation of NRVUs; and
 - (b) free access websites of NRVU manufacturers, exempt for tailor-made NRVU.
2. The following information shall be displayed:
 - (a) supplier's name or trade mark.
 - (b) supplier's model identifier which means the code, usually alphanumeric, which distinguishes a specific non-residential ventilation unit model from other models with the same trade mark or supplier's name.
 - (c) declared typology in accordance with art. 2 of this Regulation (RVU or NRVU, UVU or BVU, central or local)
 - (d) type of drive installed (multi-speed drive or variable speed drive);
 - (e) type of heat recovery system (run-around, other, none);
 - (f) thermal efficiency of heat recovery (in %), as appropriate (if 'none' then zero);
 - (g) nominal NRVU flow rate in m³/s;
 - (h) electric power input of the fan drive, including any motor control equipment, at nominal flow rate and external static pressure difference (kW);
 - (i) face velocity in m/s at design flow rate;
 - (j) nominal external pressure ($\Delta p_{s, ext}$) in Pa;
 - (k) internal pressure drop of ventilation components ($\Delta p_{s, int}$) in Pa ;

- (l) optional: Internal pressure drop of non-ventilation components ($\Delta p_{s,int}$) in Pa;
 - (m) static efficiency of fans employed according EU 327/2011 (%);
 - (n) external leakage factor (%) of the casing of ventilation units, measured according pressurisation test method or tracer gas test method at declared system pressure; and internal leakage factor (%) of bidirectional ventilation units or heat recovery systems, measured according pressurisation test method or tracer gas test method at declared system pressure;;
 - (o) description of visual filter warning for NRVUs intended to be used with filters, including text pointing out the importance of regular filter change for performance and energy efficiency of the unit;
 - (p) in case of NRVUs specified to be used in inhabited rooms, the casing sound power level (L_{WA}), rounded to the nearest integer;
 - (q) electronic internet address to (pre-) disassembly instructions on the free access manufacturer's website as set out in point 5;
 - (r) maximum rated fan speed in rpm;
 - (s) legal notice saying that the manufacturer does not accept any liability whatsoever for damages, material or immaterial, from operating the ventilation unit at a fan speed exceeding the maximum rated fan speed indicated under point (r).
3. The information from items (a) to (h) above shall be displayed on the nameplate.
 4. One set of information may cover a number of models supplied by the same supplier.
 5. Detailed instructions including the required tools for the manual (pre-)disassembly from the ventilation unit of permanent magnet motors, and of electronics parts (printed wiring boards/printed circuit boards and displays >10 g or > 10 cm²), batteries and larger plastic parts (>100 g) for the purpose of efficient materials recycling shall be available on the free access website of the manufacturer, exempt for tailor-made units.

ANNEX III

Verification procedure for market surveillance purposes

For the purposes of checking conformity with the requirements laid down in Annexes I and II, Member State authorities shall test a single Ventilation Unit. If the measured or calculated values based on measured values do not meet the declared values within the meaning of Chapter 4(2) of the manufacturer within the ranges set out in Table 1, the measurements shall be carried out on three more Ventilation Units. The arithmetic mean of the measured values of these three Ventilation Units shall meet the requirements within the ranges set out in Table 1.

Otherwise, the model and all other equivalent Ventilation Unit models shall be considered not to comply with the requirements laid down in Annex I.

Member State authorities shall use the measurement and calculation methods set out in Annex V and VI

Member State authorities shall only apply those tolerances that are set out in Table 1..

Table 1

<u>Measured parameter</u>	<u>Verification tolerances</u>
SEC	The measured value shall not be greater than 1.07 times the maximum required value
Thermal efficiency NRVU	The measured value shall not be smaller than 0.93 times the minimum required value
SFP _{int}	The measured value shall not be greater than 1.07 times the maximum required value
Fan efficiency UVU, non-residential	The measured value shall not be smaller than 0.93 times the minimum required value
Sound power level RVU	The measured value shall not be greater than the maximum required value plus 2 dB

ANNEX IV **Benchmarks**

At the time of entry into force of this Regulation, the best available technology on the market for residential ventilation units is in terms of:

- SEC: -42 for BVUs, and -30 for UVUs.
- Heat recovery η_t : 90% for BVUs.

The best available technology on the market for non-residential ventilation units is in terms of:

- SFP_{int} : 150 W/(m³/s) below the Tier 2 limit for NRVUs with flow rate ≥ 2 m³/s, and 250 W/(m³/s) below the Tier 2 limit for custom-built NRVUs with flow rate < 2 m³/s and at the Tier 2 limit for modular NRVUs
- Heat recovery η_{t_nrvu} : 85%, and with run-around heat recovery systems 80%.

ANNEX V

Measurements and calculations for RVU

1. For the purposes of compliance and verification of compliance with the requirements of this Regulation, measurements and calculations shall be made using harmonised standards the reference numbers of which have been published in the Official Journal of European Union, or other reliable, accurate and reproducible method, which takes into account the generally recognised state of the art methods, and whose results are deemed to be of low uncertainty.
2. The specific energy consumption SEC is calculated with the following equation:

$$SEC = t_a \cdot p_{ef} \cdot q_{net} \cdot MISC \cdot CTRL^x \cdot SPI - t_h \cdot \Delta T_h \cdot \eta_h^{-1} \cdot c_{air} \cdot (q_{ref} - q_{net} \cdot CTRL \cdot MISC \cdot (1 - \eta_t)) + Q_{defr}$$

where

- *SEC* is Specific Energy Consumption for ventilation per m² heated floor area of a dwelling or building [kWh/m².a];
- *t_a* is annual operating hours [h/a];
- *p_{ef}* is primary energy factor for electric power generation and distribution [-];
- *q_{net}* is net ventilation rate demand per m² heated floor area [m³/h.m²];
- *MISC* is an aggregated general typology factor, incorporating factors for ventilation effectiveness, duct leakage and extra infiltration [-];
- *CTRL* is ventilation control factor [-];
- *x* is an exponent that takes into account non-linearity between thermal energy and electricity saving, depending on motor and drive characteristics [-];
- *SPI* is Specific Power Input [kW/(m³/h)];
- *t_h* is total hours heating season [h];
- *ΔT_h* is the average difference in indoor (19°C) and outdoor temperature over a heating season, minus 3K correction for solar and internal gains [K];
- *η_h* is the average space heating efficiency [-];
- *c_{air}* is the specific heat capacity of air at constant pressure and density [kWh/(m³ K)];
- *q_{ref}* is the reference natural ventilation rate per m² heated floor area [m³/h.m²];
- *η_t* is the thermal efficiency of heat recovery [-];
- *Q_{defr}* is the annual heating energy per m² heated floor area [kWh/m².a] for defrosting, based on a variable electric resistance heating.

$$Q_{defr} = t_{defr} \cdot \Delta t_{defr} \cdot c_{air} \cdot q_{net} \cdot p_{ef},$$

where

- t_{defr} is the duration of defrosting period, i.e. when the outdoor temperature is below -4°C [h/a], and
- ΔT_{defr} is the average difference in K between the outdoor temperature and -4°C during the defrosting period.

Q_{defr} applies only to bidirectional units with recuperative heat exchanger; for unidirectional units or unit with regenerative heat exchanger is $Q_{defr}=0$.

SPI and η_i are values derived from tests and calculation methods.

Other parameters and their defaults are given in Table 1.

Table 1.

SEC calculation parameters

<u>general typology</u>						MISC
<u>Bidirectional ventilation units</u>						1,1
<u>Unidirectional ventilation units</u>						1,21
<u>ventilation control</u>						CTRL
Manual control (no DCV)						1
Clock control (no DCV)						0,95
Central DCV single variable (ducted units)						0,85
Central DCV multi-variable (ducted units), Local DCV single variable (non-ducted units)						0,65
Local DCV multi-variable (non-ducted units, ducted units with local flow rate control)						0,5
<u>motor & drive</u>						x-value
on/off & single speed						1
2-speed						1,2
3-speed						1,5
variable speed						2
<u>Climate</u>	t_h in h	ΔT_h in K	t_{defr} in h	ΔT_{defr} in K	Q_{defr}^* in	
Cold	6552	14,5	1003	5,2	5,82	
Average	5112	9,5	168	2,4	0,45	
Warm	4392	5	-	-	-	
* Defrosting applies only to bidirectional units with recuperative heat exchanger and is calculated as $Q_{defr}=t_{defr}*\Delta T_{defr}*c_{air}*q_{net}*p_{ef}$. For unidirectional units or unit with regenerative heat exchanger is $Q_{defr}=0$						
<u>Defaults</u>						value
specific heat capacity of air, c_{air} in kWh/m ³						0,000344
net ventilation requirement per m ² heated floor area, q_{net} in m ³ /h.m ²						1,3
reference natural ventilation rate per m ² heated floor area, q_{ref} in m ³ /h.m ²						2,2
annual operating hours, t_a in h						8760
primary energy factor electric power generation & distribution, p_{ef}						2,5
space heating efficiency, η_h						75%

ANNEX VI

Measurements and calculations for NRVUs

NRVUs shall be tested and calculated using a ‘reference configuration’ of the product.

Under this reference configuration a BVU product shall be configured with a casing, at least two fans with variable speed or multi-speed drives, a HRS, a clean fine filter F7 on the inlet-side and a clean medium filter M5 on the exhaust-side,

Under this reference configuration, an UVUs is a product configured with a casing and at least one fan with variable speed or multi-speed drive, and --in case the product is intended to be equipped with a filter on the inlet-side-- this filter shall be a fine filter F7.

1. Thermal efficiency of a non-residential heat recovery system

The thermal efficiency of a residential heat recovery system is defined as

$$\eta_{t_nrvu} = (t_2'' - t_2') / (t_1' - t_2')$$

with

- η_t is the thermal efficiency of the HRS [-];
- t_2'' is temperature of the supply air leaving the HRS and entering the room [°C];
- t_2' is temperature of the outside air [°C];
- t_1' is temperature of the exhaust air, leaving the room and entering the HRS [°C].

2. Filter corrections

In case one or both filters are missing in comparison to reference configuration, the following filter correction shall be used

From [*date to be inserted: [2] year after the entry into force of the Regulation*]:

F=0 in case the reference configuration is complete;

F=160 if M5 is missing;

F=200 if F7 is missing;

F=360 if both M5 and F7 filters are missing and

From [*date to be inserted: [4] year after the entry into force of the Regulation*]:

F=150 if M5 is missing;

F=190 if F7 is missing;

F=340 if both M5 and F7 filters are missing.

F7 (fine filter) means a filter that meets the conditions for filter efficiency in the following test and calculation methods, to be declared by the filter supplier. Fine filters are tested at air flow of 0.944 m³/s and filter face 592x592 mm (installation frame 610x610 mm) (face velocity 2.7 m/s). After proper preparation, calibration and checking the airstream for uniformity, initial filter efficiency and pressure drop of the clean filter are measured. The filter is progressively loaded with appropriate dust up to a final filter pressure drop of 450 Pa. At first 30 g is loaded in the dust generator subsequently there must be at least 4 equidistant dust loading steps

before reaching the final pressure. The dust is fed to the filter at a concentration of 70 mg/m³. Filter efficiency is measured with droplets in the size range 0,2 to 3 µm of a test aerosol (DEHS DiEthylHexylSebacate) at a rate of about 0,39 dm³/s (1,4 m³/h), Particles are counted 13 times, successively upstream and downstream of the filter at minimum 20 seconds with an optical particle counter (OPC). Incremental filter efficiency and pressure drop values are established. Average filter efficiency over the test for the various particle size classes is calculated. To qualify as a 'fine filter' the average efficiency for particle size 0.4 µm should be more than 80% and the minimum efficiency should be more than 35%. The minimum efficiency is the lowest efficiency among the discharged efficiency, initial efficiency and the lowest efficiency throughout the loading procedure of the test. The discharge efficiency test is largely identical to the average efficiency test above, except that the flat sheet of filter media sample is electrostatically discharged with isopropanol (IPA) before testing.

M5 ('medium filter') means a filter that meets the following conditions for filter efficiency: A 'medium filter' is an air filter for a ventilation unit with performance tested and calculated as for the fine filter, but meeting the conditions that the average efficiency for particle size 0.4 µm should be more than 40%, to be declared by the filter supplier.