Joint Industry Expert Group – COMMENTS

January 2013

Draft Working Document Ventilation Units

(including ca. 190 comments, visible in "Final: Showing Markup" mode in MS Word (Review menu); for readability "Final"mode is recommended; for stakeholder comments please use the separate version without comments. Date: 10.10.2012)

INTRODUCTION AND OVERVIEW

Ventilation units replace indoor air by fresh outdoor air in buildings by mechanical means ('fan-assisted') in order to guarantee an appropriate indoor air quality. This type of ventilation is also known as 'mechanical ventilation' to make a distinction to 'natural ventilation', where the same function is fulfilled by minimum infiltration openings, window airing and buoyancy ('passive stack'), possibly supplemented by small intermittently operating fans in the kitchen, bath and toilet.

Mechanical ventilation units, even without heat recovery, are an important instrument for energy saving through offering more control over the ventilation rate required. Compared to natural ventilation, mechanical ventilation reduces the total ventilation rate of a house (in m³/h or air changes per hour). Thereby the fresh air that needs to be heated by the space heating (and cooling) system is reduced and space heating energy saving is achieved. At the same time, being largely independent of unpredictable wind and pressure differences, mechanical ventilation systems do a better job in achieving good indoor air quality. In new buildings where building regulations prescribe a minimum air-tightness of the building shell, mechanical ventilation is indispensable. The mechanical ventilation unit is thus both and 'Energy-using Product'(EuP), in the sense that it consumes electricity, and an 'Energy-related Product' (ErP) that saves on space heating (and cooling) energy of the boiler (and chiller) with respect of a reference situation without mechanical ventilation, at equal performance in terms of indoor air quality, climate and boiler(chiller) efficiency.

Air-moving devices that are intended for other purposes e.g. flue gas extraction, convection enhancement, transportation of solids and liquids, transportation of (positive or negative) heating energy, induction of combustion air or process air and the operation of (pneumatic) equipment are thus implicitly excluded from the scope. Explicitly excluded from the scope are units for technical ventilation, i.e. where the performance requirements are predominantly determined by the special pollution characteristics and/or safety requirements of the processes that occur or may occur in the ventilated space. Examples are the ventilation of mines, operating theatres in hospitals, clean rooms as well as ventilation of potentially hazardous or explosive environments similar to those defined in in the Fan Regulation.

Products relevant to this working document include unidirectional (exhaust, supply or reversible) units as well as balanced ventilation systems, with or without heat recovery system.

Based on nominal electric power input of the individual fans and in line with existing legislation such as the Fan Regulation, two main categories can be distinguished:

- ventilation units with individual fan electric power input less than 125 W, called RVUs (from Residential Ventilation Units after their most common application), and
- ventilation units with individual fan electric power input of 125 W or more, called NRVUs (from Non-Residential Ventilation Units, although they also include units applied in collective residential buildings).

An intermediate category are ventilation units with individual fan electric power input of 125 W or more, featuring a reference external pressure difference of 100 Pa or less, where the manufacturer may choose to pertain either to the RVU or NRVU category. This allows to appropriately evaluate the large residential ventilation units and small commercial units with characteristics that are similar to RVUs.

Unidirectional fans with individual fan electric power input of less than 30 W or less are excluded from the (RVU) scope. The inclusion of these small, usually intermittently operating extraction or supply units (<30 W) does not bring much extra saving (max. ca. 10%) but would constitute a significant extra burden, given the large sales numbers and the diversity of application. It is thus proposed to exclude unidirectional ventilation units with power <30 W from the scope of the proposed measures.

The draft legislation in this WD employs, for each of the two main categories and in line with the current standardisation practice, a different set of requirements, technical definitions, test and calculation methods. The WD proposes specific minimum requirements under the Ecodesign directive 2009/125/EC for both categories. Energy labelling under directive 2010/30/EC is proposed only for RVUs; NRVUs are purchased by professional buyers and mandatory product information requirements under the Ecodesign directive can be just as effective.

The physical configuration of the products being regulated depends on the typical 'package' that is placed on the market. For unidirectional ventilation units the product is a casing plus one or more fans, including motor(s) and drive, with (RVU) or without (NRVU) specific controls for the indoor air quality (IAQ). For balanced ventilation units, always equipped with at least two fans, the RVU-package may also include the heat recovery system and filters; the NRVU-package includes filter-holders but not include filters; also control options are not included as they are typically realised at system level. Ductwork, silencers and air terminal units are not in the scope. Humidifiers/ dehumidifiers, (pre-)heating and (pre-)cooling coils are not in the scope, i.e. they are not included in the requirements and test & calculation methods. Defrosting energy is taken into account in the Energy Label calculations of annual energy consumption for cold and average climates, but there is no regulation of different defrosting methods foreseen as the optimal solution depends on the overall design of the unit.

Comment [A1]: We discussed the limits with the Comission
Possible borders could be 1.000 or 1.500 m³/h.
Below it could be RVU or NRVU. Above only NRVU

Comment [A2]: For energy efficiency issues the pressure drop of the filter should be included!
All other components like heater, cooler, silencer, humidifier, etc. are excluded. We agree.

Ventilation units were subject to preparatory studies ENER Lot 10[1] (Residential) and ENTR Lot 6 [2] (Non-residential), who found ventilation units eligible for measures and proposed targets in accordance with Art. 15 of Directive 2009/125/EC. The main environmental and resources impact relates to the electricity consumption and the savings on space heating/ cooling.

The Commission services, with external technical assistance[3], also retrieved information through stakeholder consultation and additional research. In particular, a written consultation with a preliminary Working Document was conducted on residential ventilation units in December 2010.

The main findings for RVUs and NRVUs are presented below. Note that data availability for this dynamic sector is poor and many of the figures presented below are estimates.

RVUs

Residential dwellings with whole-house mechanical ventilation represent 24% of the total residential building stock. Natural ventilation (windows and infiltration), often supplemented by small intermittently operating exhaust fans in bath/kitchen/toilet, represents 76%. Around 1,5% of EU dwellings in the scope have mechanical ventilation with heat recovery.

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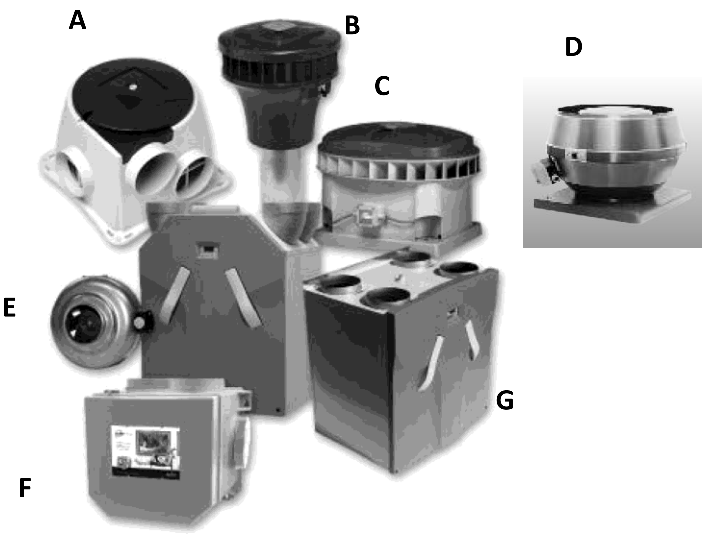
[1] Riviere, Ph. (ARMINES) et. al., *Preparatory study on the environmental performance of residential room conditioning appliances* (airco and ventilation, Lot 10), *Study on residential ventilation*, ARMINES (F) with University of Porto (PT), Austrian Energy Agency (AT), BRE (UK) for the European Commission DG ENER, Final Report 2009.

[2] Kemna, R. (VHK) et al., *Ventilation systems*, Task-reports1 to 7, part of preparatory study Lot 6: Air-conditioning and ventilation systems, Main contractor ARMINES (F), for the European Commission DG ENTR, 14 June 2012.

[3] VHK technical assistance framework contract.



A/F. Boxed fans (exhaust) for central house ventilation (typical 250 m³/h @ 150 Pa).

B/C/D. Rooftop fans (exhaust) for central house, small office, school ventilation. B=centrifugal (radial outlet); C= centrifugal, diagonal outlet. D=mixed flow with vertical outlet.

E. Duct fan.

G. Small central HR ventilation unit (250-500 m³/h).

It is estimated that, even at the currently low market penetration rates, mechanical ventilation is saving around 256 PJ/a[4] (2010) in EU space heating fuel for the residential sector. At the current annual market growth rate of 5-6% this figure will double before 2025, but the saving potential is much larger.

The electricity consumption of residential ventilation is estimated at 18,7 TWh/a, growing at 5-6% per year. Balancing the primary energy consumption from electricity (2,5[5] * 3,6[6] * 18,7 TWh= 168 PJ) against the fuel saving (256 PJ/a), the current park of residential ventilation units is producing a net primary energy saving of 88 PJ per year. This results in around 7 Mt CO2 equivalent of net carbon emission savings.

In 2010, around 7,8 million residential ventilation units were sold at an industry annual revenue of € 1 billion in units and € 0,9 billion in additional installation-materials (grilles, ducts, etc.). Revenue to installers is over € 2,5 billion per year. Between manufacturers (26%), OEM suppliers (7%), wholesale (3%) and installers (64%) the sector represents the equivalent of 56.000 full-time jobs.

In 2010, EU-consumers spent over € 5,2 billion on the purchase and installation of residential ventilation units. Over the product life[7], these consumers will be spending a further € 2,5 billion on running costs (electricity, maintenance) but also saving some € 10,7 billion on

[4] 265 PJ/a represents the space heating fuel saving of mechanical ventialtin with respect of natural ventilatioin, as calculated in Annex I of the delegated Regulation.

[5] Primary energy conversion factor for power generation and distribution.

[6] Conversion TWh (10^{12} Watt hour) to PJ (10^{15} Joules); 1 W= 1 J/s → 1 Wh= 3600 J.

[7] 17 years.

avoided space heating energy (gas, oil) because of more effective ventilation and ventilation heat recovery.

Two-thirds of residential ventilation unit sales and less than 15% of revenue relate to small local extraction ventilation units, that are mainly sold as a supplement to natural ventilation..

Whole-house ventilation systems represent one-third of unit sales and 85% of revenue, mainly in the form of central exhaust units (with natural air supply) and more-and-more central and local balanced heat recovery systems. The market for heat recovery units in Western and Northern Europe is achieving double digit growth rates. Southern and Eastern Europe are lagging behind.

The saving potential of energy efficient units is significant. Economical savings range between 10-20% for local exhaust fans, running up to 90% for central heat recovery ventilation units. For central exhaust systems a substantial saving can be realized through the use of room-based advanced controls.

The main market drivers for these 'invisible' installation products are government regulations. In large parts of the European Union, specific legislation is lacking or not fully implemented in practice. Market barriers relate to infrastructure and to installers and consumers being unfamiliar with the relatively new technologies. A major barrier for rapid retrofit of ducted (central) units is the substantial changes to the dwelling, limiting their application beyond new built dwellings. Renovation-friendlier (local) heat recovery solutions have recently become available but are still not well known. The same can be said about the more advanced control options (air-sensors, etc.), which have only recently become affordable for the residential sector.

Policy measures promoting energy-efficient residential ventilation units could combine all available instruments: minimum Ecodesign requirements, Energy Label and – possibly, but outside the scope of the underlying proposal – measures under the Energy Performance of Buildings Directive.

A realistic target is to keep the electricity consumption in 2025 at 2010 levels, which implies, given the current growth rate, an electricity efficiency improvement of about 40-50%. By 2020, around 30% electric efficiency improvement could be realized (about 7 TWh).

For the saving on space heating energy it is realistic to aim for a 50-60% increase beyond the ca. 500 PJ/a already expected in 2025 at a continuation of current trend. This means an extra saving of 300 PJ/a through the above measures.

All in all, the realization of both these targets should give an extra primary energy saving of over 360 PJ (100 TWh primary, for comparison: equivalent to around 40 TWh electric savings) and savings on greenhouse gas emissions of around 20 Mt CO_2.

NRVUs

In the non-residential and collective residential sector, a total of 40% of building volume is mechanically ventilated, with 19% exhaust or supply systems, 15% balanced systems without heat recovery and 7% balanced systems with heat recovery. The other 60% is using natural ventilation, including the use of small intermittently operating exhaust fans.

The market penetration of mechanical systems is strongest (68% of ventilated volume) in commercial buildings like retail, hotels or business offices and significantly lower (52%) in (semi-) public buildings for education, health care and public administration. Multi-family dwellings (35% penetration) mostly use exhaust units (e.g. 'rooftop' or 'boxed' ventilation units) and –for various reasons- the mechanical ventilation of warehouses, industrial and agricultural buildings is limited (17% of volume).

In 2010, NRVUs are saving an estimated 2210 PJ in EU space heating fuel in the non-residential and collective residential sector. This figure is expected to grow to approx. 3200 PJ in 2025 in the baseline scenario.

The electricity consumption of residential ventilation is estimated at 59 TWh/a (2010), expected . As with RVUs, balancing the primary energy consumption from electricity (2,5[8] * 3,6[9] * 59 TWh= 168 PJ) against the fuel saving (2210 PJ/a) yields a net primary energy saving of 1678 PJ per year. This results in around 100 Mt CO2 equivalent of net carbon emission savings.

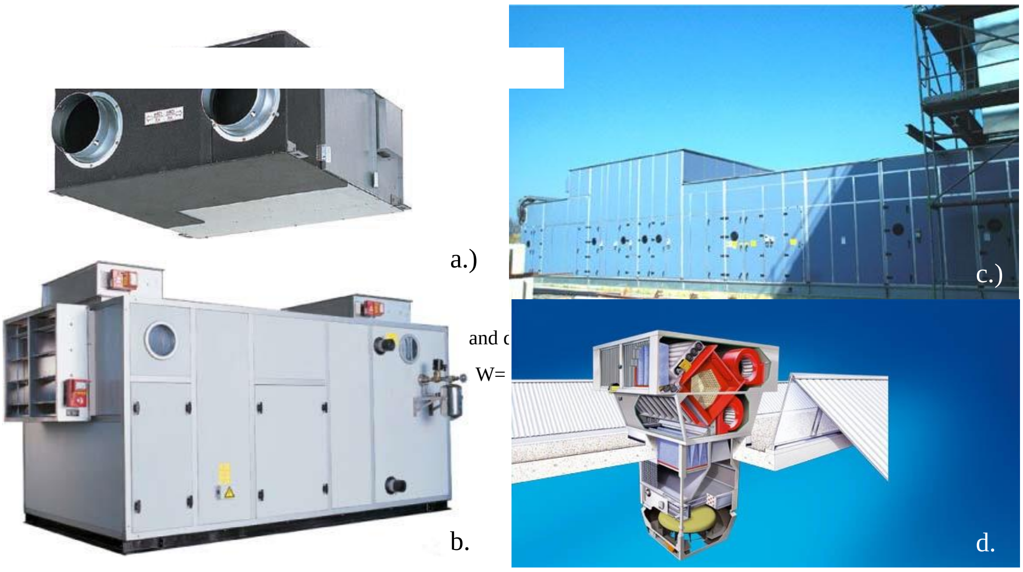
In 2010, around 1,1 million unidirectional (mainly exhaust) and 0,32 million balanced NRVUs were sold at € 1,7 billion (market price strictly for the units); related revenues in installation products and services amount to around € 20 billion. On average, end-users of NRVUs are spending € 7,1 billion on electricity costs but also saving € 22,7 billion on avoided space heating energy (gas, oil) because of more effective ventilation and ventilation heat recovery. Monetary savings thus amount to around € 14 billion.

Current industry employment in the manufacturing the units is estimated at 15 000 jobs, while the employment in the installation sector –for more than 80% SMEs—is between 300 000 and 400 000 jobs.

The saving potential of energy efficient units is significant. Economical savings range between 10-20% for simple exhaust fans without controls, running up to 90% for central heat recovery ventilation units. For central exhaust systems a substantial saving can be realized through the use of room-based advanced controls.

As with RVUs, the building regulations on energy performance (compare: EPBD) are an important market driver for efficient systems with demand-control ventilation (DCV) and heat recovery, but certainly also economic considerations (energy costs, higher labour productivity) play an important role. The main market failure occurs because the buyer is not the user. Mechanical ventilation systems are one of the last items to be added to a building, i.e. when budgets are tightening up and it is tempting to save some money on the quality of these systems. For renovation and retrofitting, lack of knowledge with the decision makers and also installation companies, very often leads to replacement with suboptimal solutions.

Last but not least, physical restrictions can play an important role with retrofits: Installation of ductwork for a central heat recovery system in an existing building is invasive and expensive and not everybody is convinced by the lower life cycle costs to make such an investment. But also in this context, know-how and creativity of planners and installers is important because very often solutions are available that are less invasive and expensive.



Examples of balanced non-residential ventilation units: a) ceiling mounted balanced unit (500-1000 m³/h) small commercial; b) floor-standing balanced unit (5000-12000 m³/h) medium-size office building; c) extra-large balanced air handling unit (>100 000 m³/h); d) rooftop non-ducted balanced unit for warehouses and industry.

In a Least Life Cycle Cost (LLCC) scenario the electricity consumption will increase less than 10% to 63 TWh/a in 2025. Given the expected grow in market penetration of NRVUs over the same period, this implies an electric efficiency improvement of about 30-40%. In other words, with respect of the baseline 2025 of 11 TWh/a is envisaged through the implementation of Ecodesign measures. Roughly half of these electricity savings can be attributed to measures under the Ecodesign Fan Regulation 327/2011. Technically, these improvements are projected to be realised through, amongst others, an increased application of EC motors, variable speed drives, more efficient fans, direct drives, smart controls, lower internal pressure drop of internal components.

The extra space heating savings in 2025, i.e. more than what will be realised in the baseline (BaU) scenario 2025, are estimated at more than 1000 PJ.[10] These will be realised through better controls and a higher penetration of heat recovery.

Balancing electricity consumption, strictly due to the measures in this WD, and the extra space heating energy saving, it is estimated that the NRVU-measures will save around 900-950 PJ primary energy in 2025. This is comparable to saving the equivalent of 100 TWh electricity consumption and around 50 Mt CO2 eq. greenhouse gas emissions.

Manufacturer's revenue is expected to more than double over the 2010-2025 period with similar consequences for industry job creation. This does not mean that ventilation installation costs for builders in the non-residential sector will double, because the ventilation units constitute only 5-10% of total system costs. Installers, and the creation of installer jobs, are expected to benefit, but it is hard to make a detailed projection.

Conclusion

Adding up the RVU and NRVU categories, the measures proposed in this Working Documents lead to an energy saving versus the baseline of around 1300 PJ primary energy, equivalent to around 140 TWh electricity saving in 2025. The carbon emission saving, mostly from reduced space heating load, amounts to 70 Mt CO2.

Saving potential residential

24% of RB are fitted with RVU´s

1,5 % of RB are supplied with HR

But around 256 PJ/year (2010) heat space are realized!

minus 168 PJ electro energy demand

= 88 PJ primary energy saving equivalent 7 Million tons CO_2-emission per year

[10] Compared to the current situation (BAU 2010), the LLCC scenario saves almost 2000 PJ.

In 2025 + 60 % more energy saving potential means around + 500 PJ/year additional heat saving. Minus electro demand = around 360 PJ/year.

This means a reduction of add. 20 million tons CO_2-emission.

Saving potential non-residential

40% of NRB are ventilated. 7% of the units are equipped with a HR.

In 2010 these units saved 2.210 PJ heat space

The electro energy demand is 532 PJ.

Saving potential is now 1.678 PJ = CO_{2}-emission around 100 million tons per year.

In 2025 a saving of min. 3.200 PJ is expected. This means an add. potential of 950 PJ an primary energy or 50 million tons CO_{2}-emission.

conclusion

The yearly saving potential of primary energy will be in 2025 around **448 PJ** in **residential Buildings** (**14,6%**) and approx. **2.630 PJ** (**85%**) in **non-residential buildings**.

Working Document on a possible

COMMISSION REGULATION

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 products[11] , and in particular Article 15(1) thereof,

After consulting the Ecodesign Consultation Forum,

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 kW.([12]) However, many ventilation units covered by this Regulation are used in combination with fans not covered by Regulation (EU) No 327/2011.

(4) For the purpose of synchronisation with Regulation (EU) No 327/2011 and following current differentiated test and calculation methods, this Regulation distinguishes between measures for residential and non-residential ventilation units, defined as a general rule on the basis of their individual fan electric power input. However, considering that they offer similar functionalities, this issue should be addressed again 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

[11] OJ L 285, 31.10.2009, p. 10–35

[12] OJ L 90, 6.4.2011, p. 8-21

sales numbers, contribute only to a small portion of the saving potential and should therefore be exempted from the scope of this Regulation. However, considering that they offer similar functionalities as other Ventilation Units, they should be addressed again at review of the measure.

(6) Ventilation systems are installed in buildings. National legislation based on Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings ([13]), may set new stricter energy efficiency requirements on those ventilation systems. It is furthermore recognised that several Member States building regulations are bound upon a Specific Fan Power (SFP) approach. However, as product specific ecodesign requirements should be set independently from building configurations and the related external static pressure, this regulation does not consider SFP directly, but should be compatible to SFP and allow its application consistently.

(7) 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.

(8) 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. Indirectly, in the same year and area, products subject to this Regulation save 2570 PJ on space heating energy compared to a situation without these products, i.e. where natural ventilation through infiltration openings and airing needs to guarantee the same level of indoor air quality. In aggregate, using a primary energy factor 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. With specific measures, including energy labelling measures for residential ventilation units under Directive 2010/30/EU, the aggregated saving can increase by 1300 PJ (45%) to a level of 4130 PJ in 2025. The preparatory studies show that the energy consumption of products subject to this Regulation and related energy-using products can be significantly reduced.

(9) The preparatory study shows that requirements regarding other ecodesign parameters referred to in Annex I, Part 1, of Directive 2009/125/EC are not necessary as energy consumption and sound power level of ventilation units in the use phase are by far the most important environmental aspect.

(10) The energy consumption of products subject to this Regulation should be made more efficient by applying existing non-proprietary cost-effective technologies that can reduce the combined costs of purchasing and operating these products.

(11) 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.

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[13] OJ L 153, 18.6.2010, p. 13

(12) 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 be such as to avoid negative impacts on the functionalities of equipment on the market, and to take into account cost impacts for end-users and manufacturers, in particular small and medium-sized enterprises, while ensuring timely achievement of the objectives of this Regulation.

(10) Measurements of the relevant product parameters should be performed through reliable, accurate and reproducible measurement methods, which take into account the recognised state of the art measurement methods including, where available, harmonised standards adopted by the European standardisation bodies, as listed in Annex I to Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations and of rules on Information Society services[14].

(13) In accordance with Article 8 of Directive 2009/125/EC, this Regulation should specify the applicable conformity assessment procedures.

(14) 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.

(15) 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.

(16) The measures provided for in this Regulation are in accordance with the opinion of the Committee established by Article 19(1) of Directive 2009/125/EC.

HAS ADOPTED THIS REGULATION:

Article 1

Subject matter and scope

1. This Regulation establishes eco-design requirements for the placing on the market of electric mains-operated ventilation units that are placed on the market after [date to be inserted: 12 months after entry into force of the delegated Regulation].

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 a nominal electric power input less than 30 W

(b) designed specifically to operate in potentially explosive atmosphere as defined in Directive 94/9/EC of the European Parliament and of the Council ([15]);

[14] OJ L 204, 21.7.1998, p. 37.

[15] OJ L 100, 19.4.1994, p.1

(c) designed for emergency use only, at short-time duty, with regard to fire safety requirements set out in Council Directive 89/106/EC ([16])

(d) designed specifically to operate:

(i) (a) where operating temperatures of the air being moved exceed 100 °C;

(b) where the operating ambient temperature for the motor, if located outside the air stream, driving the fan exceeds 65 °C;

(ii) 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 °C;

(iii) with a supply voltage > 1 000 V AC or > 1 500 V DC;

(iv) in toxic, highly corrosive or flammable environments or in environments with abrasive substances;

(v) in environments for the storage and/or handling of biological agents of risk groups 2, 3 or 4 as defined in Directive 2000/54/EC of the European Parliament and of the Council ([17]);

(vi) in sterile or clean manufacturing environments where the use of HEPA or ULPA filters as defined in Annex II mandatory.

Article 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 appliance equipped with at least a fan, motor and casing 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 nominal (maximum) power consumption of the individual fan(s) does not exceed 125 W or where the manufacturer has explicitly indicated in the product information requirements of Annex I (4) that the unit shall be classified as a RVU, and the (maximum) power consumption of the individual fan(s) does not exceed 250 W, and the maximum external pressure difference is less than 100 Pa as defined in Annex I (1) and (2);

(3) 'Non-residential ventilation unit (NRVU)' means a ventilation unit where the nominal (maximum) power consumption of the individual fan(s) is more than 125 W except where the manufacturer complies with the stipulations of sub (2) and declares in the product information requirements of Annex I (4) that the unit shall be classified as a residential ventilation unit;

(4) 'Unidirectional ventilation unit' means a ventilation unit producing an air flow only in one direction, either from indoors to outdoors (exhaust) or from outdoors to indoors

Comment [A3]: Question remains about dual purpose fans (comfort and smoke remover)
A reduction of 10 % could be implemented

Comment [A4]: Fans WG prepared a definition for the FAQ on 327/2011 Regulation

Comment [A5]: It was discussed to leave HEPA applications, like hospital applications inside the scope
The JIEG would like to keep even iv, v and vi in the scope of ecodesign!

Comment [A6]: A possiblea limit was discussed with the Commission
e. g. 1.000 m³/h
JIEG would like to have air low as a limit.

Comment [A7]: above 1.000 m³/h or 1.500 m³/h as a limit

[16] OJ L 40, 11.2.1989, p. 12

[17] OJ L 262, 17.10.2000, p. 21.

(supply), operating in a building ventilation system where the mechanically produced air flow is balanced by natural air supply or extraction provisions;

(5) ‘Balanced ventilation unit’ means a ventilation unit producing a balanced mass air flow between indoors and outdoors and which is equipped with both exhaust and supply fans;

(6) ‘ducted’ or ‘central’ ventilation unit means a ventilation unit intended to ventilate multiple enclosed spaces in a building through the use of air-ducts, equipped with appropriate means for duct-connection.

(7) ‘non-ducted’, ‘room based’ or ‘local’ ventilation unit means a ventilation unit intended to ventilate a single enclosed space in a building, not equipped with appropriate means for duct-connection.

Article 3

Ecodesign requirements

The specific ecodesign requirements for ventilation units are set out in Annex I point 2 for RVUs and Annex II point 3 for NRVUs.

Article 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 calculation set out in Annex III to this Regulation.

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.

Article 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.

Article 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.

Article 7
Revision

The Commission shall review this Regulation in the light of technological progress no later than five years after its entry into force 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.

Article 8
Entry into force

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

2. The specific ecodesign requirements set out in point 1(1) of Annex I shall apply from [date to be inserted: [2] years after the entry into force of the Regulation].

   The specific ecodesign requirements set out in point 1(2) of Annex I shall apply from [date to be inserted: [4] year after the entry into force of the Regulation]

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

Done at Brussels,

(1) *For the Commission*

The President

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 power input*' in kW means electrical power consumption at the nominal pressure external static pressure difference and the nominal airflow;
2. '*Nominal flow rate'* (q_v) in m³/s means the declared design flow rate of an NRVU at a nominal external static pressure difference that can be achieved at maximum rated fan speed and at standard air conditions 20 °C and 101325 Pa, whereby the unit is installed complete (e.g. including filters) and according to manufacturer instructions .
3. '*Nominal pressure'* (Δp_{stat}) in Pa means the declared design external static pressure difference at nominal flow rate. For balanced ventilation units the nominal pressure difference applies to the air supply outlet.
4. '*Energy efficiency of a HRS'* (η_e) means the thermal efficiency of a HRS with a negative correction for extra electricity consumption of the ventilation unit for the pressure loss caused by the HRS, as indicated in the following section 2.1.
5. '*Filter efficiency'* means the average gravimetric ratio between the dust fraction captured and the amount fed into the filter, under conditions as described in section 2.3.
6. '*Fan efficiency'* (η_{fan}) means efficiency of the individual fan(s) in the ventilation unit as defined in and tested in accordance with Commission Regulation 327/2011.
7. '*Unit electric efficiency'* means efficiency of an unidirectional ventilation unit, without possible provisions for thermodynamic air treatment or filters, as defined in and tested in accordance with Commission Regulation 327/2011.
8. '*Unit reference power consumption'* (*Pmref*) in kW means reference power consumption of a balanced ventilation unit as derived from external static pressure difference and reference flow rate, measured without possible provisions for thermodynamic air treatment or filters, as defined in point 2(1) below.
9. '*Low energy consuming fine filter'* means a filter that meets the conditions for filter efficiency and maximum pressure drop as defined in point 2(3) below.
10. '*High Efficiency Particulate Air filter'* (*HEPA filter*) means a filter with an efficiency of separating at least 85% of 0.3 µm particles in an appropriate test procedure.
11. '*Ultra-Low Particulate Air filter'* (*ULPA filter*) means a filter with an efficiency of separating at least 99,995% of 0,12 µm particles in an appropriate test procedure.

Comment [A8]: No, it´s the total static pressure acc. EN 13053

The external pressure should be defined

Comment [A9]: External pressure is related to both inlet and outlet of the unit!

2. Test and calculation methods

2.1 Reference electric power consumption Pmref and maximum electric efficiency for balanced ventilation units

Calculation method Pmref

$$Pmref = \left(\frac{\Delta p_{stat}}{450}\right)^{0,925} * (q_v + 0,08)^{0,95}$$

where

— *Pmref* is the reference power consumption [kW];

— Δp_{stat} is nominal pressure [Pa];

— q_v is nominal airflow [m³/s].

Comment [A10]: Total static pressure

2.2 Energy efficiency of a heat recovery system

Comment [A11]: Acc. EN 13053

Calculation method

$$\eta_e = \eta_t * (1 - 1/\varepsilon)$$

where

— η_e is the energy efficiency of the heat recovery system HRS [-],

— η_t is the thermal efficiency of the HRS [-], where

$\eta_t = (t_2'' - t_2')/(t_1' - t_2')$, with

— 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]

Comment [A12]: Delete: "and entering the room". Possible temperature rise in fan section shall be excluded!

Comment [A13]: Delete "leaving the room". Possible temperature rise in fan section shall be excluded!

— ε is the coefficient of performance [-], where

$\varepsilon = Q_{HRS} / P_{el}$, with

— Q_{HRS} is the capacity of the heat recovery system [W], where

$Q_{HRS} = q_m \bullet c_{pA} \bullet (t_2'' - t_2')$, with

— q_m is the mass flow of the air [kg/s] (air density, by convention: 1.2 kg/m³);

— c_{pA} is specific thermal capacity [kJ/kg K] (dry air ca. 1 kJ/kg K);

— $(t_2'' - t_2')$ is the difference between supply and outdoor air temperature [K]

— P_{el} is the electric power consumption attributed to the pressure loss of the heat recovery system [W], where

$P_{el} = q_v \bullet \Delta p_{HRS} / \eta_D + P_{el\,aux}$, with

— Δp_{HRS} is the sum of pressure loss [Pa] at supply side and exhaust side of the heat recovery system with $\Delta p_{HRS} = \Delta_{supply} + \Delta_{exhaust}$

— η_D is 0,6 is the efficiency [-] of electric power generation (EN 13053)

— $P_{el\,aux}$ is the auxiliary electric power consumption [W], e.g. of circulation pump in a run-around system.

Test methods

Thermal efficiency η_t is determined with reference testing conditions entailing dry exhaust 'indoor' air t_1' at 25 °C dry bulb temperature (wet bulb temperature 18 °C for regenerative hygroscopic recovery devices, <14 °C for other types) and dry 'outdoor' air t_2' supplied to the heat recovery system on the supply side at 5 °C dry bulb temperature (for regenerative hygroscopic recovery devices 3 °C wet bulb temperature) , with no influence of fan motor waste heat during the test. The test procedure consists of 7 tests at the following combinations of supply (q_{m^2}) and exhaust(q_{m1}) air flows:

qm²	qmn	0,67 qmn	1,5 qmn	0,67 qmn	qmn	qmn	1,5 qmn
qml	qmn	qmn	qmn	0,67 *qmn*	0,67 qmn	1,5 qmn	1,5 qmn

Wher q_{mn} is the nominal air flow. Thermal efficiency is the non-weighted average of the test results.

The pressure drop of the heat recovery system Δp_{HRS} is the sum of supply side and exhaust side pressure drops Δp_2 and Δp_1. Static pressure drops shall be measured, and dynamic pressure calculated, both sides of the recovery device for the 7 different air flow rate combinations mentioned above. The pressure drops Δp_2 and Δp_1 are the non-weighted averages of the individual 7 test results.

2.3 *Definition 'low energy consuming fine filter'*

A 'low energy consuming fine filter' is an air filter for a ventilation unit that meets the conditions as described 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

Comment [A14]: Change into: "system efficiency of the drive system (fan, motor, drive, speed control)"

Comment [A15]: Thermal efficiency is expressed by the value of the nominal or reference air flow point. The non-weighted average value is not realistic and it will only lead to confusion in the market.
Products do not have 1.5qmn mode.

Comment [A16]: Filters are not Subject of ecodesign.
No indoor air quality aspects should be implemented.
Only the possibility of low energy filters should be installed
JIEG agrees.

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.

To determine whether a fine filter is 'low energy consuming", the pressure drop curve shall be recorded with at least five data points, during the course of dust loading. At final pressure drop, Final dust load should reach maximum of 100g. Through curve fitting a 4tht order polynomial pressure difference equation is generated and from this the pressure drop after loading 100 g of test dust is derived. The determined pressure difference is used to calculate the yearly energy consumption of the filter under standardised conditions of operation (air flow rate=0.944 m³/s, *time* = 6000 h and fan efficiency η = 0.50). The 'low energy consuming fine filter' should have a calculated yearly energy consumption below 1200 kWh, with average efficiency above 80% and minimum efficiency above 35%.

3. Specific ecodesign requirements

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

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

– all Ventilation Units shall be equipped with a multi-speed drive or a variable speed drive;

– all Balanced Ventilation Units shall have a thermal by-passable heat recovery system;

– the energy efficiency of heat recovery systems (HRS) shall be at least 64%;

– the minimum fan efficiency for ventilation units is

4,56%*ln(P)-10,5% +53% for P≤ 10 kW and

1,1%*ln(P) – 2,6%+53% for P>10 kW,

where P is the nominal electric power input of the fan (in kW);

– the minimum efficiency of the unidirectional units (fan plus casing) is

4,56%*ln(P)-10,5% +45% for P≤ 10 kW and

1,1%*ln(P) – 2,6%+45% for P>10 kW,

where P is the nominal electric power input of the fan (in kW);

– the minimum electrical efficiency of balanced ventilation units is $0{,}001\Delta p_{stat} \cdot q_v / 0{,}9 Pmref$ for the supply side, whereby *Pmref*, Δp_{stat} *and* q_v are as defined in point 2.1 above ;

Comment [A17]: Multi speed drive could be a 2 step drive.

Comment [A18]: Definition: **capacity controllable heat recovery (e. g. by bypass, rotor or pump speed control)**. Thermal bypass A bypass on both air sides is not required.

Comment [A19]: H2 acc. EN 13053. JIEG has the idea to implement a bonus of e. g. 10 % if a enthalpy heat exchanger is installed.

Comment [A20]: It makes no sense to split between balanced units an unidirectional units

Comment [A21]: Values? Or a split between 1.000 m³/h (above and below) should be implemented.

Comment [A22]: It makes no sense to split between balanced units an unidirectional units

Comment [A23]: Values?

Comment [A24]: It makes no sense to define two requirements. Pmref and min. efficiency is redundant.

Comment [A25]: It make no sense to define Pm only the supply side!

– the maximum face velocity *V* is 1,8 m/s with exemptions as set out in point (3) below;

– if a filter module is required, the product shall be able to mount a low energy consuming fine filter, as defined in Annex II (1) and (2.3);

– sound power shall be no more than 50 dBa re 1pw at reference conditions (measured in duct for central units);

Alternativ the proposal of SFP could make sense, BUT ONLY if we define a NRVU related value:

$SFP = Pm / q_v = dP / \eta$ with $dP = dP_{internal} + dP_{external}$

$dP_{internal} = dP_{min\ (or\ standard)} + dP_{additional}$ (add. Components which are out of scope)

Note: both, $dP_{external}$ and $dP_{additional}$ are not in the scope of the ecodesign requirements! We agree.

So we have to define SFP_{min} (or standard) by calculating $SFP_{min} = dP_{min} / \eta$

Both: dP_{min} and η are both under our responsibility.

But JIEG will not accept a approach based on a pure SFP-value acc. EN 13779, even if it will be linked to external pressure. This will be to complex.
And the idea to shift the add. internal pressure to the external pressure is not practical too. This will cause a lot of discussions with customers.

$SFP_{EN\ 13779} = SFP_{min} + SFP_{add.} + SFP_{external}$

But only SFP_{min} will be the required value in ecodesign requirements.
Values still have to be proposed in the next step.

But we propose already to define values for unidirections units and balanced units.
And we propose to define same classes linked to the size of the units.

(2) From [date to be inserted: [4] years after the entry into force of the Regulation]:

– the energy efficiency of heat recovery systems (HRS) shall be at least 71%;

– the minimum fan efficiency of ventilation units is

4,56%*ln(P)-10,5% +57% for P≤ 10 kW and

1,1%*ln(P) – 2,6%+57% for P>10 kW,

where P is the nominal electric power input of the fan (in kW);

– the minimum electrical efficiency of unidirectional units (fan plus casing) is

4,56%*ln(P)-10,5% +50% for P≤ 10 kW and

1,1%*ln(P) – 2,6%+50% for P>10 kW,

Comment [A26]: If air treatment or air treatment components are installed.

Comment [A27]: Should be deleted. Sound requirements make no sense in NRVU.
Silencers could be arranged in the duct work.

Comment [A28]: H1 acc. EN 13053

Comment [A29]: Values?

Comment [A30]: Values

where P is the nominal electric power input of the fan (in kW);

– the minimum electrical efficiency of balanced ventilation is $0{,}001\Delta p_{stat} \cdot q_v$ / 0,85*Pmref* for the supply side, whereby *Pmref*, Δp_{stat} *and* q_v are as defined in point 2.1 above ;

– the maximum face velocity *V* is 1,6 m/s with exemptions as set out in point (3) below;

– in case a filter unit is part of the configuration the product shall equipped with a visual signalling when the filter pressure drop exceeds the maximum allowable final pressure drop;

– Sound power shall be no more than 45 dBa re 1pw at reference conditions (measured in duct for central units).

– Internal and external leakage for non-residential ducted balanced ventilation units with HRS using recuperative heat exchanger shall not be more than 10% when measured according to pressurisation test method or 6% when measured according to the tracer gas in-duct method

(3) Exemptions on face velocity requirements

For retrofit situations where NRVUs, subject to the requirements regarding face velocity under points (2) and (3) above, cannot fulfil these requirements because of insufficient physical space to install the regulated NRVUs, the manufacturer can place ventilation units on the market with a higher face velocity of up to 2,2 m/s from [date to be inserted: [2] year after the entry into force of the Regulation] and 2 m/s from [date to be inserted: [4] year after the entry into force of the Regulation], under the condition that the manufacturer can convincingly demonstrate through documentation that indeed the physical space is insufficient, underpinned by a description of the situation, the performance requirements for the new installation (maximum flow rate, reference pressure difference), verification of these performance requirements against the requirements of site-specific building regulations and the smallest dimensions of an installation using a ventilation unit in the manufacturer's catalogue that would meet such performance requirements.

Comment [A31]: Should be deleted. Sound requirements make no sense.

Comment [A32]: Why only recuperative? Thermal wheel should be included

Comment [A33]: Much to high!

Comment [A34R33]: This value does not reflect the actual operating point and hence is not realistic.

Comment [A35]: To high too

Comment [A36]: Deletion because no standard exists to measure leakage in NRU; and no methodology either

Comment [A37]: In general OK, but it should be really a exemption!!
And we need exemption also for HR and any other matters, if no space is to be realized.
In real live a unit will be much, much longer than the replaced unit which will be min. 20 to 30 years old!

3. Product information requirements on NRVUs

1. The information on NRVUs set out in points 2(a) to (u) shall be visibly displayed on:

   (a) the technical documentation of RVUs;

   (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) declared typology in accordance with art. 2 of this Regulation (RVU or NRVU, unidirectional or balanced, ducted/central or non-ducted/local/room-based) ;

(d) type of drive installed (multi-speed drive or variable speed drive);

(e) type of heat recovery system (recuperative, regenerative, none);

(f) nominal flow rate in m³/s;

(g) nominal flow rate in m³/s;

(h) nominal pressure in Pa;

(i) nominal power input (kW);

(j) target efficiency of fans employed (%);

(k) unit electric efficiency for unidirectional units (%) or fraction of reference power requirement for balanced units (in decimal places);

(l) energy efficiency of heat recovery (in %), as appropriate (if 'none' then zero);

(m) face velocity in m/s at design flow rate;

(n) internal and external leakage factor (%) for balanced ventilation units and external leakage factor (%) ducted unidirectional ventilation units;

(o) sound power level (L_{WA}), indoors expressed in dB re 1 pW and rounded to the nearest integer at design flow rate, for ducted units determined from in-duct radiative sound power measurements and for unducted units determined as radiative sound power of the casing; .

(p) in case of NRVUs intended to be used with filters, position and description of visual filter warning for including text pointing out the importance of regular filter change for performance and energy efficiency of the unit;

(q) power factor (cos phi);

(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 5.

Comment [A38]: double

Comment [A39]: nominal external pressure should be added

Comment [A40]: drives – electric efficiency

Comment [A41]: makes no sense – efficiency of drives

Comment [A42]: based on? Which standard?

Comment [A43]: Should be deleted – no sense

Comment [A44]: Should be deleted. This is in real live to part of the unit

List of Parameters to be declared by the manufacturer:

The following parameters shall be declared by the manufacturer of the unit:

– The intended use of the unit.

– Specific Fan Power of the unit according EN 13779

– Casing air leakage class according EN 1886 (real unit)

– Thermal insulation class EN 1886

– Thermal bridging factor class EN 1886

- Filter classes according EN 779 of the unit and recommended filter classes according EN 13779
- Filter bypass leakage in % of the real unit of nominal air flow
- Heat recover leakage at nominal operating point as selected under real conditions
- The grade of enthalpy or humidity recovery
- Sound power level and spectrum of Noise emitted at the casing and at the duct connections

3. One set of information may cover a number of models supplied by the same supplier.

4. The information contained in the technical documentation 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.

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.

Comment [A45]: Should be deleted and replace by "shall be given in a documentation together with the product"

ANNEX III

Verification procedure for market surveillance purposes

For the purposes of checking conformity with the requirements laid down in Annex I, Member State authorities shall test a single Ventilation Unit. If the measured parameters do not meet the declared values within the meaning of Article 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 Uni

ts 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 States authorities shall use 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.

Table 1 ***(illustrative/ to be discussed)***

Measured parameter	**Verification tolerances**
SPI	The measured value shall not be greater than the rated value* of *SPI* by more than [7]%.
Thermal efficiency	The measured value shall not be less than the rated value of η_t by more than [7] %.
[to be extended]	

*'rated value' means a value that is declared by the manufacturer

ANNEX IV

Benchmarks

At the time of entry into force of this Regulation, the best available technology on the market for residential ventilation units, in terms of their specific power input SPI is 0,08 W/m³/h.

Residential ventilation units with heat recovery system are on the market with declared heat recovery thermal efficiencies up to 90%.

Non-residential ventilation units with heat recovery system are on the market with declared heat recovery energy efficiencies up to 85%.