Eurovent Product Group 'Air Handling Units', Position Paper, PP – 2014-04-27

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Questions and answers concerning the Ventilation Units Regulation

Overview

The Eurovent Product Group 'Air Handling Units' represents a vast majority of all 'Air Handling Unit' manufacturers in Europe, including Turkey and Russia. The association's independent subunit Eurovent Certita Certification runs a globally-known performance certification programme on Air Handling Units, with close to 100 participating manufacturers.

With this document, the Product Group offers a guideline providing a common interpretation on the Commission Regulation (EU) No 1253/2014 of 7 July 2014 on non-residential ventilation units (bidirectional and unidirectional units).

In particular, the document will explain how to calculate SFPint as this parameter is new.

Bidirectional units consist of two main groups: tailor-made units and standardised compact units. They deviate in the matter of working point. A tailor-made unit is designed for one specific working point but a compact unit is used for a wide range of working points. The two groups should compete at same conditions and shall have the same treatment. Yet, a compact unit requires another possible treatment in case the customer has not specified the working point.

This document below provides the initial guidance for an interpretation where reference documents are lacking.

Some clarifications and the evaluation procedures are expected to be a part of EN 13053 and some in a Frequently Asked Questions, FAQ, on this subject.

Eurovent trusts that this input to the technical assistance study will support the implementation of this Regulation. If you have any questions or remarks, please do not hesitate to contact our Team.

Excerpt of the regulation with respect to NRVU and added Eurovent comments

Article 1

Subject matter and scope

1. This Regulation applies to ventilation units and establishes ecodesign requirements for their placing on the market or putting into service.

2. This Regulation shall not apply to ventilation units which:

   (a) are unidirectional (exhaust or supply) with an electric power input of less than 30 W, except for information requirements;

   (b) are bidirectional, with a total electric power input for the fans of less than 30 W per air stream, except for information requirements;

   (c) are axial or centrifugal fans only equipped with a housing in terms of Regulation (EU) No 327/2011;

   (d) are exclusively specified as operating in a potentially explosive atmosphere as defined in Directive 94/9/EC of the European Parliament and of the Council;

   (e) are exclusively specified as operating for emergency use, for short periods of time, and which comply with the basic requirements for construction works with regard to safety in case of fire as set out in Regulation (EU) No 305/2011 of the European Parliament and of the Council;

   (f) are exclusively specified as operating:

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

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

      (iii) where the temperature of the air being moved or the operating ambient temperature for the motor, if located outside the air stream, are lower than -40 °C;

      (iv) where the supply voltage exceeds 1 000 V AC or 1 500 V DC;

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

   (g) include a heat exchanger and a heat pump for heat recovery or allowing heat transfer or extraction being additional to that of the heat recovery system, except heat transfer for frost protection or defrosting;

Eurovent comment:

A heat exchanger shall be interpreted as a heat recovery section.

We hold that an NRVU which is equipped with a heat recovery device and combined with a complete heat pump (the main task is normally to be a cooler) shall apply to this Regulation. An NRVU equipped with a heating or cooling coil, which are connected to a separate heat pump, shall also apply to this Regulation. The heat recovery device shall, in such case, be included in all applicable requirements, but the heat pump shall have no impact and its parts shall be considered as additional non-ventilation components. An NRVU with just a complete heat pump shall not apply to this Regulation.

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Example:

An NRVU for a swimming pool with plate heat exchanger and additional cooling coil (condenser) in exhaust air for separate heat pump is included, but the cooling coil is a non-ventilation component.

(h) are classified as range hoods covered by Commission Regulation (EU) No 66/2014 on kitchen appliances.

Article 2
Definitions

For the purposes of this Regulation the following definitions shall apply:

(1) 'ventilation unit (VU)' means an electricity driven appliance equipped with at least one impeller, one motor and a casing and intended to replace utilised air by outdoor air in a building or a part of a building;

Eurovent comment:

Recirculation NRVUs are excluded, they are not connected to the outdoor air.

(3) 'non-residential ventilation unit' (NRVU) means a ventilation unit where the maximum flow rate of the ventilation unit exceeds 250 m^3/h, and, where the maximum flow rate is between 250 and 1 000 m^3/h, the manufacturer has not declared its intended use as being exclusively for a residential ventilation application;

Eurovent comment:

The definition does not cover ventilation units when the supply and extract air flows are unequal. The ventilation unit is a non-residential ventilation unit if:

- nominal **supply** flow rate > 1.000 m^3/h,
- nominal **supply** flow rate between 250 and 1.000 m^3/h, for which manufacturer has not declared its intended use as being exclusively for a residential ventilation application.

(4) 'maximum flow rate' is the declared maximum air volume flow rate of a ventilation unit that can be achieved with integrated or separately co-supplied controls at standard air conditions (20 °C) and 101325 Pa, where the unit is installed complete (e.g. including clean filters) and according to the manufacturer's instructions;

(5) 'unidirectional ventilation unit' (UVU) means a ventilation unit producing an air flow in one direction only, either from indoors to outdoors (exhaust) or from outdoors to indoors (supply), where the mechanically produced air flow is balanced by natural air supply or exhaust;

(6) 'bidirectional ventilation unit' (BVU) means a ventilation unit which produces an air flow between indoors and outdoors and is equipped with both exhaust and supply fans;

(7) 'equivalent ventilation unit model' means a ventilation unit with the same technical characteristics according to the applicable product information requirements, but placed on the market as a different ventilation unit model by the same manufacturer, authorized representative or importer.

For the purposes of Annexes II to IX, additional definitions are set out in Annex I.

Article 3
Ecodesign requirements

2. From 1 January 2016 NRVUs shall comply with the specific ecodesign requirements set out in Annex III, point.1.

4. From 1 January 2018 NRVUs shall comply with the specific ecodesign requirements set out in Annex III point 2.

Article 4
Information requirements

2. From 1 January 2016 manufacturers, their authorized representatives and importers of NRVUs shall comply with the information requirements set out in Annex V.

Article 5
Conformity assessment

1. Manufacturers of ventilation units shall carry out the conformity assessment laid down in Article 8 of Directive 2009/125/EC using 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.

   For the purposes of the conformity assessment of NRVUs, measurements and calculations for the specific ecodesign requirements shall be carried out in accordance with Annex IX to this Regulation.

2. The technical documentation file compiled in accordance with Annex IV to Directive 2009/125/EC shall contain a copy of the product information set out in Annexes IV and V 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 ventilation units, or both, the technical documentation shall include the following information:

   (a) details of such calculations or extrapolations, or both;

   (b) details of tests undertaken by manufacturers to verify the accuracy of the calculations and extrapolations;

   (c) a list of any other ventilation unit models where the information included in the technical documentation was obtained on the same basis;

   (d) a list of equivalent ventilation unit models.

Article 6
Verification procedure for market surveillance purposes

The authorities of the Member States shall apply the verification procedure set out in Annex VI when performing the market surveillance referred to in Article 3(2) of Directive 2009/125/EC to ensure compliance with the requirements set out for NRVUs in Annex III to this Regulation.

Article 7
Benchmarks

The benchmarks referred to in point (2) of Part 3 of Annex I to Directive 2009/125/EC, which are to be applied to ventilation units, are set out in Annex VII to this Regulation.

Article 8
Review

The Commission shall assess the need to set requirements on air leakage rates in the light of technological progress and present the results of this assessment to the Consultation Forum no later than 1 January 2017.
The Commission shall review this Regulation in the light of technological progress and present the results of this review to the Consultation Forum no later than 1 January 2020.
The review shall include an assessment of the following:

(a) the possible extension of the scope of this Regulation to cover unidirectional units with an electric power input of less than 30 W, and bidirectional units, with a total electric power input for the fans of less than 30 W per air stream;

(b) the verification tolerances set out in Annex VI;

(c) the appropriateness of taking into account the effects of low-energy consuming filters on the energy efficiency;

(d) the need to set a further tier with tightened ecodesign requirements.

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ANNEX I

Definitions

Definitions applicable for the purposes of Annexes II to IX to this Regulation:

1. **Definitions:**

(2) *'sound power level (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 airflow;

(3) *'multi-speed drive'* means a fan motor that can be operated at three or more fixed speeds plus zero ('off');

(4) *'variable speed drive (VSD)'* means an electronic controller, integrated or functioning as one system or as a separate delivery with the motor and the fan, which continuously adapts the electrical power supplied to the motor in order to control the flow rate;

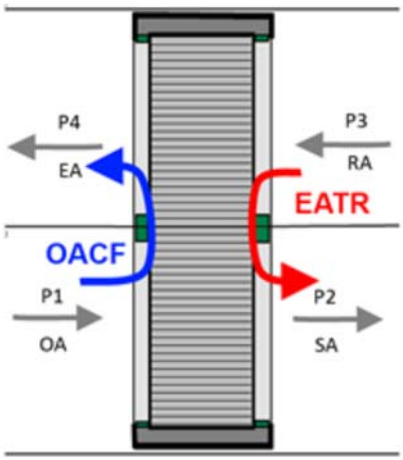
(5) *'heat recovery system (HRS)'* means the part of a bidirectional ventilation unit equipped with a heat exchanger designed to transfer the heat contained in the (contaminated) exhaust air to the (fresh) supply air;

(7) *'internal leakage rate'* means the fraction of extract air present in the supply air of ventilation units with HRS as a result of leakage between extract and supply airflows inside the casing when the unit is operated at reference air volume flow, measured at the ducts; the test shall be performed for NRVUs at 250 Pa;

Eurovent comment:

The 'internal leakage rate' corresponds to the 'Internal exhaust air leakage' as defined in EN 308 and to EATR, see definition below.

Internal leakage test, if not an EATR test, shall be performed with a pressure difference of 250 Pa between supply and extract air side, the higher pressure on supply air side; $\Delta p_{22\text{-}11}$=250 Pa. All NRVU connections shall be closed during the leakage test. The supply air side is pressurised to 250 Pa with an external fan. The extract air side is connected to a flow measurement device and then to a suction fan. The pressure in the extract air is adjusted to be 0 Pa in order to avoid extract air side external leakage. The measured air flow will be the internal leakage.



Run-around HRS are connected through a heat transfer system and are not allowed to have any internal leakage, if there is a common wall between the supply and extract air side, then the leakage shall be tested with a differential pressure of 250 Pa in accordance with EN 308 and the leakage have to be negligible (less than 0.1 %). Recuperators can be tested with 250 Pa pressure difference in accordance with EN 308 or with an EATR test. EATR shall be tested for regenerators. EATR is defined as:

Extract Air Transfer Ratio (EATR) [%]: percentage of the extract air transferred to the supply air. With $qm,22,net$ the portion of the supply air mass flow that originated as outdoor air (net supply air mass flow), EATR is defined as:

$$EATR = \frac{q_{m,22} - q_{m,22,net}}{q_{m,22}} = 1 - \frac{q_{m,22,net}}{q_{m,22}}$$

EATR is measured by gas concentrations of inert gas and represents the extract air leakage to the supply airflow, which is in general described as internal extract air leakage.

(8) *'carry over'* means the percentage of the exhaust air which is returned to the supply air for a regenerative heat exchanger according to the reference flow;

Eurovent comment:

The carry over flow will be zero if the purging sector works in an ideal manner. Carry over will be present if insufficient or lack of purging sector. More information can be found in Eurovent 6/8, page 53. There is always a carryover from outdoor air to exhaust air.

(9) *'external leakage rate'* means the leakage fraction of the reference air volume flow to or from the inside of the casing of a unit to or from the surrounding air when it is subjected to a pressure test; the test shall be performed at 400 Pa for NRVUs, for both under and over pressure;

Eurovent comment:

The external leakage for a NVRU is normally classified according to EN 1886:2007. The leakage classes is L1 (special applications or for filter class superior to F9), L2 (for filter classes F8 to F9) and L3 (filter classes G1 to F7). Maximum leakage rate for L3 is 1.32 l x s^{-1} x m^{-2} and, if calculated on a "worst" case a small NVRU with just a 287 x 592 filter, the nominal air flow is 0.47 m^3/s (1700 m^3/h). The circumference will be about 2 m and length about 1.6 m which gives a total surface of 3.68 m^2. The leakage will be less than 1 %. Recommendation: Declare the external leakage class according to EN 1886 for the real AHU.

(30) *'recuperative heat exchanger'* means a heat exchanger intended to transfer thermal energy from one air stream to another without moving parts, such as a plate or tubular heat exchanger with parallel flow, cross flow or counter flow, or a combination of these, or a 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, and seals to reduce bypassing and leakage of air from one stream or another; such heat exchangers have varying degrees of moisture recovery depending on the material used;

(34) *'dual use unit'* means a ventilation unit designed for ventilation purposes as well as fire or smoke extraction, complying with the basic requirements for construction works with regard to safety in case of fire as set out in Regulation (EU) No 305/2011;

(35) *'thermal by-pass facility'* means any solution that circumvents the heat exchanger or controls automatically or manually its heat recovery performance, without necessarily requiring a physical airflow bypass (for example: summer box, rotor speed control, control of air flow);

2. Definitions for NRVU, in addition to the definitions in Annex I Part 1:

(1) *'nominal electric power input* (P)' (expressed in kW) means the effective electric power input of the fan drives, including any motor control equipment, at the nominal external pressure and the nominal airflow;

Eurovent comment:

The motor control equipment shall always be included in the delivery to be compliant with this Regulation.

(2) *'fan efficiency* (η_{fan})' means the static efficiency including motor and drive efficiency of the individual fan(s) in the ventilation unit (reference configuration) determined at nominal air flow and nominal external pressure drop;

Eurovent comment:

The fan efficiency is the "overall static efficiency drive" according to ISO 12759 but for the fan when it is placed in intended casing i.e. considering system effects.

Placement of a fan in a casing will affect both the fan pressure rise (less pressure rise due to system losses) and the power consumption.

System losses shall be declared and applied as a part of the static pressure rise of the fan, when using data for a stand-alone fan.

System losses is treated if the fan is tested inside its intended casing, fan pressure rise and overall static efficiency drive will be less, so system losses shall be set to zero in such case.

Components upstream and downstream which are placed nearby the fan will also affect the efficiency (a kind of system effect) but will not be taken in consideration because the number of options will makes it impossible to handle. The pressure drop of a component nearby the fan shall include the impact, the extra pressure loss. This is especially important in case of use of a fan with scroll house.

It is preferable to test a unit of reference configuration as an entity, one air side at a time, and include pressure measurement of all included components.

The overall static efficiency drive is the ratio between the nominal air flow multiplied with the static pressure rise of the fan (equal to the sum of pressure drops for all components, clean and dry, and the nominal external pressure) divided by the electrical power to the fan drive.

(3) *'reference configuration of a BVU'* means a product configured with a casing, at least two fans with variable speed or multi-speed drives, a HRS, a clean fine filter on the inlet-side and a clean medium filter on the exhaust-side;

Eurovent comment:

Inlet-side shall be interpreted as in the supply air stream and exhaust-side as in the extract air stream.

The heat load may, in some industrial environments, be so high that heat recovery is never required (the NRVU may not comprise a heating coil). In such case can other options, without HRS (and its associated pressure drop), be more efficient (e.g. mixing section).

(4) *'reference configuration of an UVU'* means 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 clean fine filter;

Eurovent comment:

Inlet-side shall be interpreted as in the supply air stream.

(5) *'minimum fan efficiency* (η_{vu})*'* is the specific minimum efficiency requirement for VUs within the scope of this Regulation;

(6) *'nominal flow rate* (q_{nom})'(expressed 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 (for example, including filters) and according to the manufacturer instructions;

Eurovent Comment:

The *'nominal flow rate'* can not be higher than the highest air flow at which the *'thermal efficiency of a non-residential HRS* (η_{t_nrvu})*'* is fulfilled at equal air flows, supply and extract.

A NVRU is normally designed for one specific working point but when Variable Air Volume flow system or Demand Controlled Ventilation are used there will be a range of working points from a minimum air flow up to a maximum. The *'nominal flow rate'* shall in such case be the design working point winter time when heat recovery is fully used. The design working point summer time can be at a higher air flow but will only be used a short period during the year and may not fulfil the requirements in this Regulation. The minimum air flow point, which is desirable in energy point of view, may also be outside the requirements of this Regulation.

NVRU consists of two main groups; tailor-made NVRUs and standardized compact NVRUs. They deviate in the matter of working point. A tailor-made NVRU is designed for specific working points but a compact NVRU is used for a wide range of working points. The *'nominal flow rate'* shall be the air flow, origin from outdoor air (ventilation part of supply air) or leaving to outdoor air (ventilation part of extract air) at design working point.

If the working point is not specified by the customer, which could be the case for a small compact NVRU, one have to declare a field of nominal air flows with associated *'nominal external pressure* ($\Delta p_{s,\ ext}$)', see (7) below. The field can be depicted in a graph, see annex I.2.(12) *'internal specific fan power of ventilation components* (SFP_{int})*'*, for the specific NVRU considering type of heat recovery, size of fan and motor etc. The NRVU is considered to have balanced air flows.

Nominal flow rate is used to calculate the internal pressure losses of the ventilation components (HRS+filter). When a mixing section is installed, HRS and filter are selected for outdoor air demand only and in some cases they are not able to handle the full design flow rate of the unit – calculate the internal pressure losses of the ventilation components (HRS+filter) for the design air flow. If they are designed only for the outdoor air and not for the total air flow, calculate only the outdoor air part.

Fan characteristics, system losses, fan efficiency etc. shall be calculated with the total air flow through the fan.

(7) *'nominal external pressure* ($\Delta p_{s,\ ext}$)' in (expressed in Pa) means the declared design external static pressure difference at nominal flow rate;

Eurovent comment:

The *'nominal external pressure'* shall be the external static pressure at the design working point. If the *'nominal external pressure'* is not given, which could be the case for a small compact NVRU, use the declared nominal external static pressure for the specific NVRU considering type of heat recovery, size of fan and motor etc.

(8) *'maximum rated fan speed* (v_{fan_rated}) *'* (expressed in rounds per minute – rpm) is the fan speed at nominal flow rate and nominal external pressure;

Eurovent comment:

The common interpretation of *'maximum rated fan speed'* is the maximum limiting speed of the impeller or motor capacity or any other safety aspects.

The *'maximum rated fan speed'* can't be used because a fan motor is always somewhat oversized in order to have some margin to make it possible to handle deviations between the designed ventilation system and the reality. Another case is an air flow controlled system where the speed of the motor is adjusted in order to compensate pressure drop changes e.g. changed filter pressure drop due to the amount of loading dust by the filter and it can only be done if the motor is somewhat oversized.

A change from *maximum rated* to *nominal* gives the opportunity for the following statement; the *'nominal fan speed'* shall be fan speed in the working point given by *'nominal flow rate'* and associated design external pressure.

(9) *'internal pressure drop of ventilation components* ($\Delta p_{s,int}$) *'* (expressed in Pa) means the sum of the static pressure drops of a reference configuration of a BVU or an UVU at nominal flow rate;

Eurovent comment:

The internal pressure drop of ventilation components shall, for a BVU, be calculated separately for each airstream, supply and extract. The pressure drop is the sum of the filter pressure drop for the filter in the *'reference configuration'* (not including pre or post filter stages) and the pressure drop of the heat recovery section all clean and dry.

The internal pressure drop of ventilation components shall, for an UVU in the supply air stream which are intended to be equipped with a filter, be the clean filter pressure drop for the filter in the *'reference configuration'* (not including pre or post filter stages) otherwise it is zero.

Regarding filter pressure drop (BVU and UVU):

1) if the filter is missing or have lower filter class than in the reference configuration; use default values according to Annex IX
2) if the filter is in accordance with the filter class in the reference configuration; use the actual filter pressure drop
3) if the filter is better than the filter class in the reference configuration;
   - the filter pressure drop for the filter class in the reference configuration may be applied
   - the actual value may be applied

Internal pressure drop of ventilation components shall also include system losses if the fan is not measured inside the NRVU enclosure, but selected from fan supplier software based on standardised test rigs (free-standing). This includes such NRVU inlet and outlet losses which can be considered as system losses e.g. when a fan with scroll house is the last component of an NRVU.

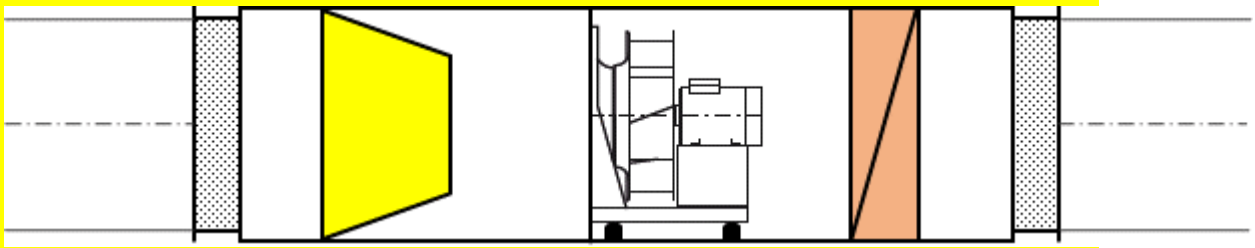
(10) *'internal pressure drop of additional non-ventilation components* ($\Delta p_{s,add}$)' (expressed in Pa) means the remainder of the sum of all internal static pressure drops at nominal flow rate and nominal external pressure after subtraction of the internal pressure drop of ventilation components ($\Delta p_{s,int}$);

Eurovent comment:

This internal pressure drop shall include NRVU inlet and outlet losses if applicable, see below pictures. Regarding fan system effects see annex I.2.(9) *'internal pressure drop of ventilation components* ($\Delta p_{s,int}$) *'.*

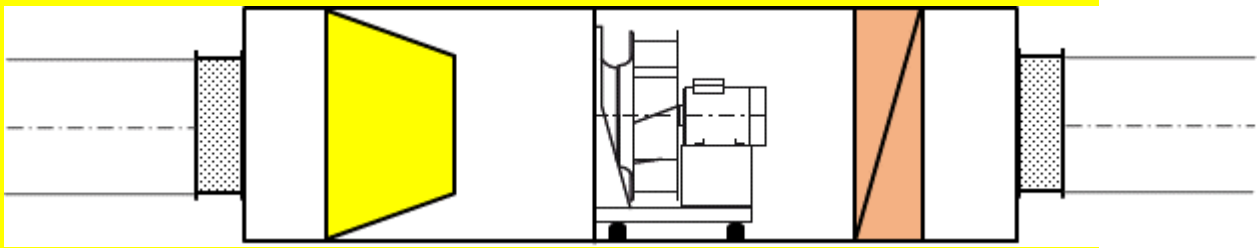
Air handling unit without in- and outlet pressure losses

A ducted air handling unit with full size openings has no additional pressure losses at the inlet and outlet opening, caused by expansions and contractions. The internal cross section of the duct systems is equal to the cross section of the NRVU.



Air handling unit with in- and outlet pressure losses

A ducted air handling unit with ductwork connections smaller than the cross section of the NRVU has an extra pressure loss at the inlet opening, caused by the expansion of air and an additional pressure loss at the outlet opening due to contraction of the air stream.



(11) *'thermal efficiency of a non-residential HRS* (η_{t_nrvu})' means the ratio between supply air temperature gain and the exhaust air temperature loss, both relative to 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 from internal leakages;

Eurovent comment:

It is the dry temperature ratio measured according to EN 308 with outdoor air temperature +5 °C and extract air temperature +25 °C. Use the actual mixture when calculating the temperature ratio of a run around coils system.

In case of unbalanced air volume flows across the heat recovery section, the temperature ratio shall be calculated for both air volume flows equal to the supply air volume flow.

When the extract air flow is much lower than the supply air flow, a smaller extract air unit can be used (especially for run around HRS). This unit is not able to handle the supply air flow and therefore the calculation of thermal efficiency with a balanced air flow is not possible. In such case, the values may be calculated by the empiric equation:

$$\eta_{t\,1:1} = \eta_t * \left(\frac{q_{m,ODA}}{q_{m,ETA}}\right)^{0.4}$$

(12) *'internal specific fan power of ventilation components* (SFP_{int})*'* (expressed in W/(m³/s)) is the ratio between the internal pressure drop of ventilation components and the fan efficiency, determined for the reference configuration;

Eurovent comment:

The SFP_{int}, for a unidirectional ventilation unit (UVU) in the supply air stream which are intended to be equipped with a filter, shall be calculated as:

$$SFP_{int} = 100 * \left(\frac{\Delta p_{int,nom}}{\eta_e}\right)$$

Where

- SFP_{int} is the internal specific fan power, Pa (or W/(m³/s))
- $\Delta p_{int,nom}$ is the internal pressure drop at nominal flow rate, see annex I.2.(6) *'nominal flow rate* (q_{nom})'; the static pressure drop for a clean fine filter (F7) and system effect, see annex I.2.(9) *internal pressure drop of ventilation components* ($\Delta p_{s,int}$)*'*, in Pa
- η_e is overall static efficiency drive of the fan at nominal air flow and nominal external pressure drop, to be measured at the fan section, in %

The SFP_{int} for a bidirectional ventilation unit (BVU) shall be calculated as:

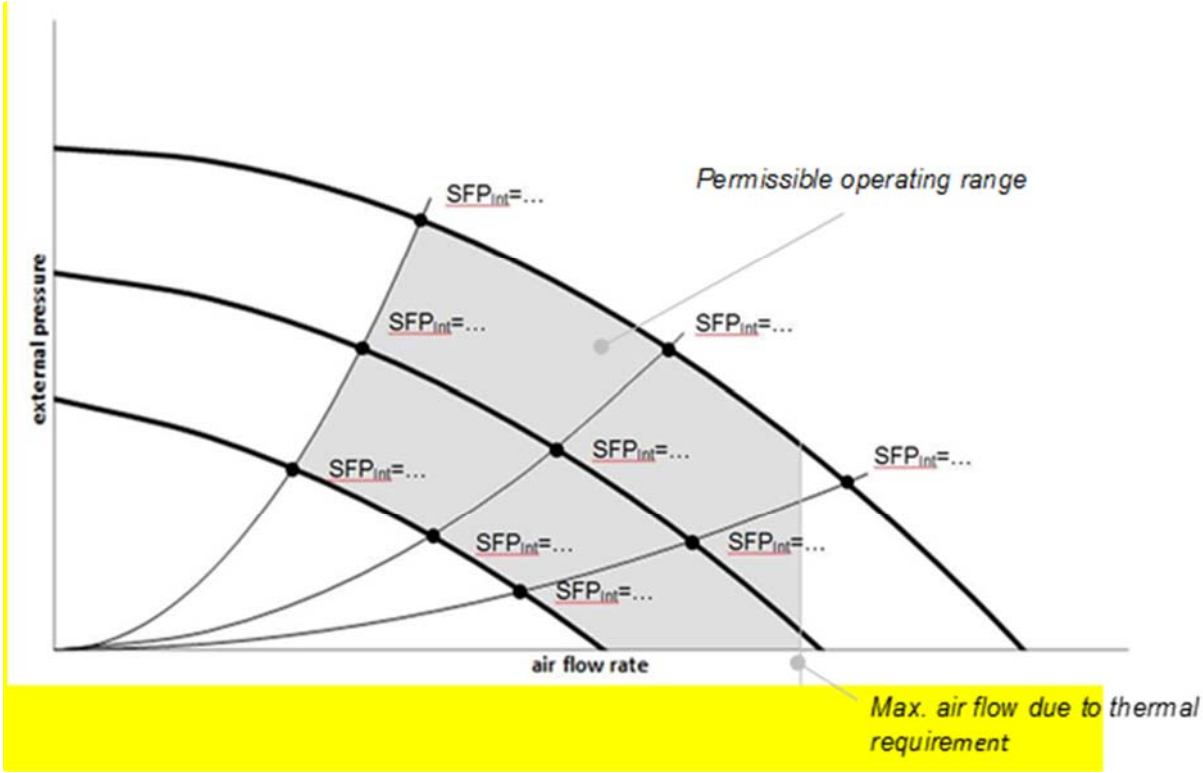
$$SFP_{int} = 100 * \left(\frac{\Delta p_{int,nom,SUP}}{\eta_{e,SUP}} + \frac{\Delta p_{int,nom,ETA}}{\eta_{e,ETA}}\right)$$

Where

- SFP_{int} is the internal specific fan power, Pa (or W/(m³/s))
- $\Delta p_{int,nom,SUP}$ is the internal pressure drop at nominal flow rate on supply air side, see annex I.2.(6) *'nominal flow rate* (q_{nom})'; the sum of the static pressure drops for clean fine filter (F7), heat recovery system and system effect, see annex I.2.(9) *internal pressure drop of ventilation components* ($\Delta p_{s,int}$)*'*, in Pa
- $\Delta p_{int,nom,ETA}$ is the internal pressure drop at nominal air flow on extract air side, see annex I.2.(6) *'nominal flow rate* (q_{nom})'; the sum of the static pressure drops for clean medium filter (M5), heat recovery system and system effect, see annex I.2.(9) *internal pressure drop of ventilation components* ($\Delta p_{s,int}$)*'*, in Pa

- $\eta_{e,SUP}$	is overall static efficiency drive of the supply air fan at nominal air flow and nominal external pressure drop, to be measured at the fan section, in %
- $\eta_{e,ETA}$	is overall static efficiency drive of the extract air fan at nominal air flow and nominal external pressure drop, to be measured at the fan section, in %

If a compact NVRU and the working point is not specified by the customer one have to declare a field of nominal air flows with associated nominal external pressures, see below picture. The customer is allowed to use the NRVU if the design working point is within the declared field. The NRVU is considered to have balanced air flows. The requirement of SFP_{int} shall be fulfilled throughout the declared range. The requirement of thermal efficiency of a non-residential HRS have to be fulfilled at maximum nominal air flow.



(13) *'maximum internal specific fan power of ventilation components* (SFP_{int_limit})*'* (expressed in W/(m³/s)) is the specific efficiency requirement for SFP_{int} for VUs within the scope of this Regulation;

(14) *'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 where the two sides of the HRS can be freely positioned in different parts of a building;

Eurovent comment:

A BVU with *run-around HRS* can consist of separated supply and extract or joined parts.

(15) *'face velocity'* (expressed in m/s) is the larger of supply and extract air velocity. The velocities are the air velocities in the VU based on the inside unit area for supply respectively extract air

flow of the VU. The velocity is based on the area of the filter section of the respective unit, or if no filter is installed, based on the area of the fan section;

(16) *'efficiency bonus [E]'* is a correction factor taking account of the fact that more efficient heat recovery causes more pressure drops requiring more specific fan power;

(17) *'filter correction [F]'* (expressed in Pa) is a correction value to be applied if a unit deviates from the reference configuration of a BVU;

(18) *'fine filter'* means a filter that meets the relevant conditions described in Annex IX;

Eurovent comment:

Filter class F7

(19) *'medium filter'* means a filter that meets the relevant conditions described in Annex IX;

Eurovent comment:

Filter class M5

(20) *'filter efficiency'* means the average ratio between the dust fraction captured and the amount fed into the filter, under the conditions described for fine and medium filters in Annex IX.

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ANNEX III

Specific ecodesign requirements for NRVUs, as referred to in Article 3(2) and 3(4)

1. From 1 January 2016:

– All ventilation units, except dual use 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.

Eurovent comment:

In some special applications a thermal by-pass facility is never needed for control purposes and even unfavourable for the reduction of energy consumption (for example plate heat exchangers in NRVUs for swimming pools in moderate climate zones).
Proposal to abandon this requirement if there is never a free cooling demand and the NRVU is not equipped with a cooling coil.

– The minimum thermal efficiency η_{t_nrvu} of all HRS except run-around HRS in BVUs shall be 67 % and the efficiency bonus E = (η_{t_nrvu} -0.67)*3000 if the thermal efficiency η_{t_nrvu} is at least 67 %, otherwise E = 0.

– The minimum thermal efficiency η_{t_nrvu} of run-around HRS in BVUs shall be 63 % and the efficiency bonus E = (η_{t_nrvu} -0.63)*3 000 if the thermal efficiency η_{t_nrvu} is at least 63 %, otherwise E = 0.

– The minimum fan efficiency for UVUs (η_{vu})is

6.2 % * ln(P) + 35.0 % if P ≤ 30 kW and

56.1 % if P > 30 kW.

Eurovent comment:

This requirement is valid for UVUs not intended to be used with a filter.

– The maximum internal specific fan power of ventilation components (SFP_{int_limit}) in W/(m³/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} ≥ 2 m³/s;

Eurovent comment:

If supply air flow deviates from extract air flow use the larger air flow as q_{nom} in the formulas above.

– 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} ≥ 2 m³/s;

Eurovent comment:

If supply air flow deviates from extract air flow use the larger air flow as q_{nom} in the formulas above.

- 250 for an UVU intended to be used with a filter.

2. From 1 January 2018:

- All ventilation units, except dual use 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.

Eurovent comment:

In some special applications a thermal by-pass facility is never needed for control purposes and even unfavourable for the reduction of energy consumption (for example plate heat exchangers in NRVUs for swimming pools in moderate climate zones).
Proposal to abandon this requirement if there is never a free cooling demand and the NRVU is not equipped with a cooling coil.

- The minimum thermal efficiency η_{t_nrvu} of all HRS except run-around HRS in BVUs shall be 73 % and the efficiency bonus E = (η_{t_nrvu} -0.73)*3 000 if the thermal efficiency η_{t_nrvu} is at least 73 %, otherwise E = 0.
- The minimum thermal efficiency η_{t_nrvu} of run-around HRS in BVUs shall be 68 % and the efficiency bonus E = (η_{t_nrvu} -0.68)*3 000 if the thermal efficiency η_{t_nrvu} is at least 68 %, otherwise E = 0.
- The minimum fan efficiency for UVUs (η_{vu}) is

  6,2 % * ln(P) + 42,0 % if P ≤ 30 kW and

  63,1 % if P > 30 kW.

Eurovent comment:

This requirement is valid for UVUs not intended to be used with a filter.

- 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} ≥ 2 m³/s;

    Eurovent comment:

    If supply air flow deviates from extract air flow use the larger air flow as q_{nom} in the formulas above.

  - 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} ≥ 2 m³/s;

Eurovent comment:

If supply air flow deviates from extract air flow use the larger air flow as q_{nom} in the formulas above.

– 230 for an UVU intended to be used with a filter.

– If a filter unit is part of the configuration the product shall be equipped with a visual signalling or an alarm in the control system which shall be activated if the filter pressure drop exceeds the maximum allowable final pressure drop.

Eurovent comment:

The visual signalling shall, at least, consist of a switch which visually indicate the status.

ANNEX V

Information requirements for NRVUs as referred to in Article 4(2)

1. From 1 January 2016, the following product information shall be provided:

(a) manufacturer's name or trade mark;

(b) manufacturer's model identifier, i.e. the code, usually alphanumeric, used to distinguish 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 Article 2 (RVU or NRVU, UVU or BVU,);

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

(e) type of HRS (run-around, other, none);

(f) thermal efficiency of heat recovery (in % or not applicable' if the product has no heat recovery system);;

(g) nominal NRVU flow rate in m^3/s;

(h) effective electric power input (kW);

(i) SPF_{int} in $W/(m^3/s)$;

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

(k) nominal external pressure ($\Delta p_{s,\,ext}$) in Pa;

(l) internal pressure drop of ventilation components ($\Delta p_{s,int}$) in Pa;

(m) optional: internal pressure drop of non-ventilation components ($\Delta p_{s,add}$) in Pa;

(n) static efficiency of fans used in accordance with Regulation (EU) No 327/2011;

Eurovent comment:

to publish instead the *'fan efficiency* (η_{fan})' see comments on this definition in annex I.2.(2).

(o) declared maximum external leakage rate (%) of the casing of ventilation units; and declared maximum internal leakage rate (%) of bidirectional ventilation units or carry

over (for regenerative heat exchangers only); both measured or calculated according to the pressurisation test method or tracer gas test method at declared system pressure;

Eurovent comment:

Declare the external leakage class according to EN 1886 for the real AHU and the internal leakage rate in accordance with 'Internal exhaust air leakage' defined in EN 308 and to EATR, see annex I.1.(7) *'internal leakage rate'.*

(p) energy performance, preferably energy classification, of the filters (declared information about the calculated annual energy consumption);

(q) description of visual filter warning for NRVUs intended for use with filters, including text pointing out the importance of regular filter changes for performance and energy efficiency of the unit;

Eurovent comment:

This point is valid from 1 January 2018.

(r) in the case of NRVUs specified for use indoors, the casing sound power level (L_{WA}), rounded to the nearest integer;

(s) internet address for disassembly instructions as referred to in point 3.

2. The information listed in point 1. (a) to (s) shall be available:

- in the technical documentation of NRVUs; and
- on free access websites of manufacturers, their authorised representatives, and importers.

Eurovent comment:

One source is considered to be enough.

3. The manufacturer's free access website shall make available detailed instructions inter alia identifying the required tools for the manual pre-/dis-assembly of permanent magnet motors, and of electronics parts (printed wiring boards/printed circuit boards and displays >10 g or >10 cm^2), batteries and larger plastic parts (>100 g) for the purpose of efficient materials recycling, except for models of which less than 5 units per year are produced.

ANNEX VI
Verification procedure for market surveillance purposes

For the purposes of checking conformity with the requirements laid down in Annexes II to V, Member State authorities shall test a single ventilation unit. If the measured values or values calculated on the basis of measured values do not match the manufacturer's declared values within the meaning of Article 5, subject to the tolerances in Table 1:

Eurovent comment:

BVU in test shall be equipped in accordance with the reference configuration which means: a product configured with a casing, at least two fans with variable speed or multi-speed drives, a HRS, a clean F7 filter in the supply air stream and a clean M5 filter in the extract air stream. If the filters deviates from above configuration or from what the manufacturer provides; a new set-up of filters, which complies with the reference configuration, shall be ordered from the manufacturer.

- for models that are produced in lower quantities than 5 per year, the model shall be considered not to comply with this Regulation,

Eurovent comment:

In the custom NRVU, model means not only the model size number of the unit with which the manufacturer identify all the possible units with that specific size but the exact configuration of the unit according the specification of the customer. Not complying means that the NRVU is not possible to sell in the European market. The construction of the NRVU and similar NRVUs have to be redesigned in order to comply with this Regulation.

- for models that are produced in quantities of 5 or more per year, the market surveillance authority shall randomly test 3 additional units.

If the arithmetic mean of the measured values for these units does not meet the requirements, subject to the tolerances in Table 1, the model and all other equivalent models shall be considered not to comply with the requirements of Annexes II to V.

Eurovent comment:

This text suggests that NRVUs with exactly the same technical specifications are produced in larger quantities than 5 per year. For customized units however there are in general always (small) performance differences even for units of the same size with identical unit configuration! Not complying means that the NRVU is not possible to sell in the European market. The construction of the NRVU and similar NRVUs have to be redesigned in order to comply with this Regulation.

The Member State authorities shall provide the test results and other relevant information to the authorities of the other Member States and to the Commission within one month of the decision being taken on the non-compliance of the model.

Member State authorities shall use the measurement and calculation methods set out in Annexes VIII and IX and apply only those tolerances that are set out in Table 1.

Table 1

Parameter	Verification tolerances
SPI	The measured value shall be no more than 1.07 times the maximum declared value.
Thermal efficiency NRVU	The measured value shall be no less than 0.93 times the minimum declared value.
SFP_{int}	The measured value shall be no more than 1.07 times the maximum declared value.
Fan efficiency UVU, non-residential	The measured value shall be no less than 0.93 times the minimum declared value.
Sound power level NRVU	The measured value shall be no more than the maximum declared value plus 5 dB.

The verification tolerances shall 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.

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ANNEX IX

Measurements and calculations for NRVUs

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

Dual use units shall be tested and calculated in the ventilation mode.

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

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

$$\eta_{t\_nrvu} = (t_2'' - t_2') / (t_1' - t_2')$$

where

- 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 1 January 2016:

F=0 in case the reference configuration is complete;

F=160 if the medium filter is missing;

F=200 if the fine filter is missing;

F=360 if both the medium and the fine filters are missing.

From 1 January 2018

F=150 if the medium filter is missing;

F=190 if the fine filteris missing;

F=340 if both the medium and the fine filters are missing.

'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.

'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.

About Eurovent

Eurovent, the European Committee of HVAC&R Manufacturers, is the representative of Europe's major national associations in the industry of heating, ventilation, air conditioning and refrigeration. Based on objective and verifiable data, its 24 members from 18 European states represent more than 1000 companies, the majority small and medium-sized. In 2013, these accounted for a combined annual turnover of around 25bn euros and employed more than 120.000 people – making Eurovent one of the largest industry committees of its kind.

Eurovent's roots date back to 1958. Over the years, the Brussels-based umbrella association has become a well-respected and known stakeholder that builds bridges between companies it represents, legislators and standardisation bodies on a EU and international level. The association favours a level-playing field for the entire industry and strongly supports energy-efficient and environmental-friendly solutions. Eurovent holds in-depth relations with partner associations around the globe. It is a founding member of the ICARHMA network, supporter of REHVA and contributor to the EU's BUILD UP initiative.

Eurovent possesses two subunits. With Eurovent Certita Certification (ECC), it majority owns an independent certification company, which holds the ISO 45011 (17065) accreditation – fulfilling highest independency, reliability and integrity standards. Open to any company, it is known for its globally-recognised brand 'Eurovent Certified Performance'. Activities are complemented by Eurovent Market Intelligence (EMI), the association's second independent unit. Its Europe-wide data sets are frequently being used to support the development of EU regulation.

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Independent Subunits

Organisations with own structures that guarantee a full independency from the Eurovent association

Enclosed:

Files linked within this documents can be found within the 'Attachment' section of Adobe Acrobat.

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