BARKELL
AIR HANDLING UNITS
An Airedale Company

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Commission Regulation 1253/2014/EG Consultants Requirements & Criteria

In order to comply with the Eco-Design directive, the following requirements and criteria, as laid out in the Commission Regulation 1253/2014/EG implementing Directive 2009/125/EC for ventilation units and the published transitional methods, must be met:

1. **All ventilation units, except dual use units, shall be equipped with a multi-speed drive or a variable speed drive.**

Acceptable speed controllers are:

- Variable speed drives;
- Multi speed drives;
- Electronically commutated fans (EC fans);

The speed controller must either:

- be supplied and installed with the unit;
- be supplied in a separate delivery by the AHU manufacturer or a 3rd party.

In any case the AHU manufacturer is compelled, at the time of delivery of the unit, to provide information of the recommended drives to be installed with the equipment provided as well as documentation detailing the procedures for installing and operating such drive.

2. **All bidirectional ventilation units shall be equipped with a heat recovery system (HRS) with thermal bypass facility.**

Acceptable heat recovery system with thermal bypass facility are:

- Plate heat exchanger with face and by-pass dampers;
- Thermal wheel with rotor speed control;
- Heat pipes with face and bypass dampers on the extract leg;
- Run around coils with pump pack;

Not acceptable:

- Mixing or recirculation boxes;

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3. Heat recovery efficiency of all heat recovery systems (HRS) equipped in a bidirectional ventilation unit must be in excess of the requirements and calculated in accordance with correct criteria.

From 2018:

The minimum thermal efficiency η_{t_nrvu} of all HRS, except run-around coils HRS, installed in BVUs shall be 73 %

The minimum thermal efficiency η_{t_nrvu} of run-around HRS installed in BVUs shall be 68 %

The thermal efficiency shall be calculated as per the following formula:

$$\eta_{t\_nrvu} = \frac{(t_{22} - t_{21})}{(t_{11} - t_{21})}$$

Where:

t_{21} is the fresh air (outdoor) temperature (K)

t_{22} is the supply air temperature (K)

t_{11} is the exhaust air (indoor) temperature (K)

Additionally it's paramount that the thermal efficiency is calculated as per the conditions laid out in *EN308:1997 - Test procedures for establishing the performance of air to air and flue gases heat recovery devices*:

- For winter operation;
- With a ΔT of 20 degrees between the indoor and outdoor air excluding the fan heat gains. Typical air conditions for selection of the HRS are 5oC for the ambient airflow and 25oC on the extract airflow (EN308:1997 test conditions);
- With balanced airflows adjusted to the supply airflow;
- At dry reference conditions; effects of condensation on the finned plates (latent heat/moisture recovery) are not to be considered;
- Without considering the heat gains from the fan or from the internal leakage of the exchanger or the unit;
- For a RAC system, with the percentage of glycol intended for the system design or if otherwise not specified 25% ethylene glycol (freezing point approximately - 12oC).

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In the case of unbalanced airflows for **run around coil systems only**:

The following formula, suggested in the draft standard BS EN 13053:2017 can be used to calculate the equivalent efficiency with unbalanced airflows valid for a ratio of the supply airflow mass divided by the extract airflow mass is between 0.67 and 1.5:

$$\eta_{t\ 1:1} = \eta_t * \frac{1 + \frac{m_2}{m_1}}{2}$$

Where:

ηt 1:1	supply air dry temperature ratio at balanced mass flows (K)
ηt	supply air dry temperature ratio at actual mass flows (K)
m2	supply air mass flow in kilogram per second (kg/s)
m1	extract air mass flow in kilogram per second (kg/s)

4. Fan efficiency of unidirectional ventilation units (UVU) must be in excess of the requirements and calculated in accordance with the correct criteria.

From 2018:

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

- 6,2 % * ln(P) + 42,0 % if P $\leq$ 30 kW and,
- 63,1 % if P > 30 kW.

Fan efficiency (n_{fan}) shall be calculated as follows:

$$\eta_{\text{fan}} = \frac{q_{nom} * \Delta P_{s,fan}}{P}$$

Where:

η_{fan} is the internal static fan efficiency, including the losses for any motor control equipment as well as the effects of the installation on the air handling unit casing, at the nominal external pressure and the nominal airflow (expressed in %)

q_{nom} is the NRVU nominal flow rate (expressed in m^3/s)

ΔPs,fan is the static pressure difference between the fan outlet and inlet section (expressed in Pa)

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

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5. The internal specific fan power of ventilation components (SFPint) shall be lower than the limit set by the requirements and calculated in accordance with the correct criteria (not the same as Part L of the UK Building Regulations)

From 2018 the limits are calculated as follows:

The maximum internal specific fan power of ventilation components ($SFP_{int\ limit}$) expressed in W/(m^3/s) is:

- for a bidirectional ventilation unit with run-around heat recovery system:
  - 1 600 + E – 300 * q_{nom}/2 – F if the nominal airflow is **< 2 m^3/s** and,
  - 1 300 + E – F if the nominal airflow is ≥ **2 m^3/s**;
- for a bidirectional ventilation unit with other heat recovery system:
  - 1 100 + E – 300 * q_{nom}/2 – F if the nominal airflow is **< 2 m^3/s** and,
  - 800 + E – F if the nominal airflow is ≥ **2 m^3/s**;
- 230 for a unidirectional ventilation unit intended to be used with a filter.

The efficiency bonus (E) expressed in W/(m^3/s) is:

- For run around coils heat recovery systems:
  - E = (η_{t_nrvu} – 0,68) * 3 000 if the thermal efficiency η_{t_nrvu} is at least 68 %, otherwise E = 0;
- For other heat recovery systems:
  - E = (η_{t_nrvu} – 0,73) * 3 000 if the thermal efficiency η_{t_nrvu} is at least 73 %, otherwise E = 0;

The filter corrections (F) expressed in W/(m^3/s) are:

If the reference configuration is complete	0
If the medium filter is missing	150
If the fine filter is missing	190
If the medium and the fine filters are missing	340

When fine filters with grading higher than F7 are applied no additional correction is assumed.

When medium filters with grading higher than M5 are applied no additional correction is assumed

When a fine filter is used on extract an additional allowance of 40 corresponding to the difference between the allowances for fine and medium filters is assumed.

When medium filter is used on supply an allowance of 40 is deducted from the limit specific fan power corresponding to the difference between the allowances for fine and medium filters is assumed.

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For the calculation of the maximum allowable internal specific fan power of ventilation components **SFP_{int_lim}** , where the nominal airflow of the unit does not exceed 2 m^3/s, the nominal airflow shall be calculated with the average of supply/extract airflow:

$$q_{v,nom} = \frac{q_{v,SUP} + q_{v,ETA}}{2}$$

Where:

$q_{v,nom}$, is the nominal airflow of the ventilation unit (expressed in m^3/s)

$q_{v,SUP}$, is the nominal supply airflow of the ventilation unit (expressed in m^3/s)

$q_{v,ETA}$ is the nominal extract airflow of the ventilation unit (expressed in m^3/s)

The actual internal specific fan power of ventilation components, SFP_{int} shall be calculated at dry and clean filter conditions as follows:

- For a unidirectional ventilation unit:

$$SFP_{int,UVU} = \frac{\Delta P_{s,int}}{\eta_{fan}}$$

- For a bidirectional ventilation unit:

$$SFP_{int,BVU} = \frac{\Delta P_{s,int\ SUP}}{\eta_{fan\ SUP}} + \frac{\Delta P_{s,int\ EHA}}{\eta_{fan\ EHA}}$$

Where:

SFP_{int}, UVU is the total internal SFP for the supply or extract leg of the unidirectional ventilation unit (expressed in $W/(m^3/s)$);

$\Delta P_{s,int}$ is the internal pressure drop of ventilation components (expressed in Pa);

η_{fan} is the internal static fan efficiency, including the losses for any motor control equipment as well as the effects of the installation on the air handling unit casing, at the nominal external pressure and the nominal airflow;

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The fan efficiency (η_{fan}) shall be calculated as:

$$\eta_{\text{fan}} = \frac{q_{nom} * \Delta P_{s,fan}}{P}$$

Where:

η_{fan} is the internal static fan efficiency, including the losses for any motor control equipment as well as the effects of the installation on the air handling unit casing, at the nominal external pressure and the nominal airflow (expressed in %)

q_{nom} is the ventilation unit nominal flow rate (expressed in m^3/s)

$\Delta P_{s,fan}$ is the static pressure difference between the fan outlet and inlet section (expressed in Pa)

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

The internal pressure drop of ventilation components $\Delta P_{s,\ int}$, includes the pressure drop of the following components, calculated at clean and dry conditions:

- Heat recovery system supply or extract pressure drop as applicable in the calculation for each airflow;
- Supply or extract filter pressure drop as applicable in the calculation for each airflow, unless a filter grade other than the one specified on the reference configuration, in which case the pressure drop shall not be considered and the penalisation for the filter correction (F) above shall be applied to the limit of maximum allowable internal specific fan power of ventilation components;
- Supply or extract fan section system effect and inherent fan pressure loss as applicable in the calculation for each airflow;
- Supply or extract inlet and outlet pressure losses as applicable in the calculation for each airflow, unless unit has full size openings in which case it has no additional pressure losses at the inlet and outlet openings;

The pressure drop of other components of the ventilation unit or the external ventilation system (external static pressure) are not to be considered for these calculations.

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For calculation of the effective electric power input of the fan drive (P), where the variable speed drive is not supplied as part of the delivery with the unit, a default correction must be applied to the electrical power input of the fan and motor without drive.

$$P_{el} = \frac{P_m}{C_{drive}}$$

Where:

P_m is the electrical power of fan and motor without drive

P_{el} is the electrical power of fan, motor and drive

When $P_{el} \geq 5kW$:

$$C_{drive} = \frac{1}{C_c} = \frac{1}{1.04} = 0.96$$

When $P_{el} \leq 5kW$

$$C_{drive} = \frac{1}{C_c}$$

Where:

$$C_c = -0.03\, x \ln(Pe) + 1.088$$

6. **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.**