TECHNICAL CERTIFICATION RULES OF THE EUROVENT CERTIFIED PERFORMANCE MARK

AIR TO AIR REGENERATIVE HEAT EXCHANGERS

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The purpose of this Technical Certification Rules is to prescribe procedures for the operation of the Eurovent Certified Performance (ECP) certification programme for AIR TO AIR REGENERATIVE HEAT EXCHANGERS (AARE), in accordance with the Certification Manual.

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I. GENERAL INFORMATION

I.1 Scope

I.1.1 General

This certification programme applies to all ranges of Air-to-Air Regenerative Heat Exchangers (including sealing systems) which are included in the certified public selection software of the Applicant/Participant. Units sold without casing and sealing systems are also included in the scope. Participants shall certify all models in the ranges, including:

- all classes:
  - condensation RHE = non hygroscopic RHE = non enthalpy RHE
  - hygroscopic RHE = enthalpy hygroscopic RHE
  - sorption RHE = enthalpy sorption RHE
- all RHE geometry (wave height, foil thickness)
- all sizes (rotor diameters and rotor depths and surface areas of alternating storage matrices - ASM)
- all materials
- all airflow rates
- all different types of sealing (if available)

The class “sorption RHE” has to fulfil specific requirements on the humidity efficiency (see section I.2)

I.1.2 Certify-all principle

Whenever a company participates in the programme for AARE, all AARE that are promoted by the applicant/participant to end-users, specifiers, trading companies, contractors by means of paper or electronic catalogue, price list or software within the scope of the programme, shall be certified, in accordance with these Technical Certification Rules. This includes all models in modular ranges.

For the AARE programme the certify-all principle applies not only to Europe but to all markets.

I.2 Certified performances

The following performance items shall be certified.

- Under standard conditions (20°C, 50% rel. Humidity and 1.013 $10^5$ Pa – or 1.20 kg/m$^3$)
  - Airflow
  - Pressure drop
  - Outdoor Air Correction Factor
  - Exhaust Air Transfer ratio
- Under “regular” winter conditions for all RHEs
  - Temperature efficiency
  - Humidity efficiency
- Under “regular” summer conditions for Enthalpy and Sorption RHEs
  - Temperature efficiency
  - Humidity efficiency

I.3 Definitions

Air to Air Regenerative Heat Exchanger: Device incorporating an alternating storage system or a rotating cylinder or wheel for the purpose of transferring energy (sensible or total) from one air stream to the other. It incorporates heat transfer material, a drive mechanism, a casing or frame, and includes any seals which are provided to retard the bypassing and leakage of air from one air stream to the other.

Face Air velocity: Velocity of air entering the unit. It shall be calculated as follows:
\[ v = \frac{q_v}{A_{tot}/2} \]

where \( q_v \) is the Volume flow under standard conditions (with density \( \rho = 1.2 \text{ kg/m}^3 \), according to 20°C/50% rel. humidity, 1013 hPa atmospheric pressure)

and for rotors, \( A_{tot} = \pi \cdot \frac{D_o^2 - D_i^2}{4} \) is the free face area with free diameter \( D_o \) and inside diameter \( D_i \) (diameter of the hub).

For alternating storage systems, \( A_{tot} = (h_{i1} + h_{i2}) \cdot (w_{i1} + w_{i2}) \)

It is recommended to use this definition of face air velocity to simplify the comparability for the user of RHE. This definition allows translating the certified characteristics to other RHEs of the same class, material, RHE geometry and depth but different diameters.

**Free area:** Area of a RHE where the air can go through.

**Free diameter:** Diameter of the free area of a rotor.

*Figure 1: Illustration for free diameter*
Foil thickness: Total thickness of the foil, including the coating.

Wave Length: Mean length of one wave (bottom).

The mean length of one wave shall be obtained from the length of the arc corresponding to 10 waves. The following formula for the arc of a circle, L, shall be used: $L = D \cdot \arcsin(c/D)$ with L the arc of the rotor, D the diameter, and c the chord.

Wave Height: Mean height of one wave, including one flat foil thickness.
Temperature efficiency ($\eta_t$) [%]: Ratio of temperature differences:

$$\eta_t = \frac{t_{22} - t_{21}}{t_{11} - t_{21}}$$

with:
- $t_1$ temperature [°C]
- 11 exhaust air inlet
- 12 exhaust air outlet
- 21 supply air inlet
- 22 supply air outlet

Humidity efficiency ($\eta_x$) [%]: Ratio of absolute humidity differences

$$\eta_x = \frac{x_{22} - x_{21}}{x_{11} - x_{21}}$$

Pressure drop (DP) [%]: Loss in total pressure between the inlet and the outlet of the unit within one air stream.

External leakage ($\lambda_{ext}$) [%] (not tested): Air leakage between the casing and the environment:

$$\lambda_{ext} = \frac{q_{L,\text{external}}}{q_{\text{nominal}}}; \quad \lambda_{co} = \frac{q_{\text{carry over}}}{q_{\text{nominal}}}$$

Exhaust Air Transfer ratio (EATR) [%]: Transfer of exhaust air into the supply air side in air to air regenerative heat exchanger. EATR provides information on the level of the percentage of the exhaust air in the supply air.

$$\text{EATR} = \frac{a_{\text{sup,ply, out}} - a_{\text{sup,ply, in}}}{a_{\text{exhaust,in}}}$$, with $a$: average tracer gas concentration

Outdoor Air Correction Factor (OACF) [\%]: Ratio of the entering supply mass airflow rate and the leaving supply mass airflow rate. This parameter can be used as a correction factor for the supply air fan:

- If OACF>1: the outdoor air mass flow is higher than the supply air mass flow
- If OACF=1: the outdoor air mass flow equals the supply air mass flow
- If OACF<1: the outdoor air mass flow is lower than the supply air mass flow

$$\text{OACF} = \frac{q_{m,\text{sup,ply,in}}}{q_{m,\text{sup,ply,out}}}$$

Absolute leakage rate: Difference between the entering supply mass airflow rate and the leaving supply mass airflow rate:

$$q_{m,\text{leakage}} = q_{m,\text{sup,ply,in}} - q_{m,\text{sup,ply,out}} = (OACF - 1) \cdot q_{m,\text{sup,ply,out}}$$

Sealing leakage rate: Leakage rate only due to sealing (that is when there is no purge sector)

$$q_{m,\text{sealing}} = q_{m,\text{leakage,without purge}}$$

$$q_{m,\text{sealing}} = (OACF_{\text{without purge}} - 1) \cdot q_{m,\text{sup,ply,out,without purge}}$$

If one can assume that: $q_{m,\text{nominal}} \approx q_{m,\text{sup,ply,out,with purge}}$, then:

$$q_{m,\text{leakage}} \approx (OACF_{\text{without purge}} - 1) \cdot q_{m,\text{no nominal}}$$

Purge leakage rate: Leakage rate only due to the purge sector

$$q_{m,\text{purge}} = q_{m,\text{leakage,with purge}} - q_{m,\text{leakage,without purge}}$$
\[ q_{m,\text{purge}} = \left( OACF_{\text{withpurge}} - 1 \right) \cdot q_{m,\text{sup pty,out,withpurge}} - \left( OACF_{\text{withoutpurge}} - 1 \right) \cdot q_{m,\text{sup pty,out,withoutpurge}} \]

If one can assume that: \( q_{m,\text{nornal}} \approx q_{m,\text{sup pty,out,withpurge}} \approx q_{m,\text{sup pty,out,withoutpurge}} \), then:

\[ q_{m,\text{purge}} \approx \left( OACF_{\text{withpurge}} - OACF_{\text{withoutpurge}} \right) \cdot q_{m,\text{nominal}} \]

**Static pressure difference** \( \Delta p_{22-11} \): Static pressure difference as defined in EN 308:1997 (static pressure of the supply air outlet minus static pressure of the exhaust air inlet).

\[ \Delta p_{22-11} = p_{22} - p_{11} \]

Sorption RHE = enthalpy sorption RHE: RHE demonstrating a latent efficiency which is at least 70 % of the temperature efficiency under all tested conditions with nominal airflow rate. Units having a lower humidity efficiency only can be certified in the class "hygroscopic RHE = enthalpy hygroscopic RHE".

\[ \eta_s \geq 0.7 \]

**I.4 Contributors**

The lists of contributors are given for information and may be modified by EUROVENT CERTITA CERTIFICATION whenever necessary.

**I.4.1 Audit body**

The audit functions are performed by the following body(ies), called audit body:

**EUROVENT CERTITA CERTIFICATION SAS**

48/50 rue de la Victoire
FR-75009 PARIS
Tel : + 33 1 75 44 71 71
www.eurovent-certification.com

**I.4.2 Independent laboratory / test body**

When the checks carried out involve product tests, these are performed at the request of EUROVENT CERTITA CERTIFICATION by the following laboratories, known as Independent laboratory:

**HOCHSCHULE LUZERN TECHNIK & ARCHITEKTUR**

Technikumstrasse 21
CH-6048 – HORW
II. REQUIREMENTS OF THE REFERENCE DOCUMENT

II.1 Reference documents

II.1.1 Product and test standards
Performance ratings claimed by manufacturers shall be verified by tests performed in the independent laboratory selected by Eurovent Certita Certification.
The following standard shall be used as a basis for these tests:

II.1.2 Specific Software requirements
General software (selection tool) requirements are described in the dedicated appendix of the Certification Manual. In addition:

- Each technical selection has to be reproducible without any protection by login and/or password.
- Vocabulary and symbols shall be in accordance with reference vocabulary available on the Eurovent Certified Performance website and in Appendix E.
- It is mandatory for the Applicant/Participant to provide, as inputs of the software:
  - the mass flows (as a mandatory option) on the building side (exhaust inlet and supply outlet);
  - the temperature on the entry sides (extract and supply inlet);
  - the humidity on the entry sides (extract and supply inlet).
- It is mandatory for the Applicant/Participant to display the following items as outputs and on the printouts:
  - the temperature efficiency (also called temperature ratio);
  - the pressure drop under standard conditions. It is allowed to display any other pressure drop values if accompanied by the underlying air density;
  - the actual extract and supply outlet mass flows (at least).
  - all four airflows (inlet and outlet on both extract and supply sides).
- All airflows shall be given at standard density (1.2 kg/m$^3$) as a minimum. It is authorized to show any other volume flow (additionally) if accompanied by the underlying density.
- Wave lengths and heights do not have to be displayed in printouts.
- It is allowed to ask the location of the customer in the software, however all data provided by the software shall be the same whatever the location of the customer is.
- If a unit is selected without a casing and sealing system no leakage data shall be presented on the printouts.
- If a wheel is selected with a casing and sealing system:
  - Airflows on the building side shall be provided in the printouts (supply outlet and extract)
  - If the static pressure difference is not specified during the selection then leakage data (OACF, EATR) at 250 Pa pressure difference, purge configuration and sealing system shall be provided:
  - If the purge is selected by the customer: with the purge configuration selected by the customer
  - If the pressure difference is specified during the selection:
    - The sealing system shall be specified (key code or designation) in the printouts
- Leakage data (OACF, EATR) shall be specified in the software printouts for the given pressure difference at standard conditions and the given purge sector configuration

- It is forbidden to display the Extract/Exhaust Air Temperature Efficiency and Humidity Efficiency in both outputs and printouts.

- All defined dimensional characteristics must be used explicitly in accordance to this TCR definitions and the mentioned wordings must not be used for other purposes.

- If a Regenerative Heat Exchanger is selected without casing, its performances cannot be higher than the Eurovent Certified Performances values.¹

¹ See Minutes of the Programme committee meeting held on 1st October 2015
### TABLE 1: Information to be found as outputs and on the printouts

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>RECOMMENDED NAME</th>
<th>Output</th>
<th>Printout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type key</td>
<td>Mandatory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic material</td>
<td>Mandatory (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter (rotary) in mm</td>
<td>Mandatory (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal length in mm</td>
<td>Mandatory (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purge angle in deg</td>
<td>Mandatory (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotating speed (rotary)</td>
<td>Mandatory (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td>Mandatory (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wave height in mm</td>
<td>Mandatory (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit type (condensation/hygroscopic/sorption)</td>
<td>Mandatory (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Face air velocity in m/s</td>
<td>Mandatory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$q_m$ $q_v$ $q_{vn}$</td>
<td>air mass flow rate or Standard air volume flow rate (1.2 kg/m³)</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$P_a$</td>
<td>Atmospheric pressure</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\ell_{11}$</td>
<td>Extract air inlet (1) [if Exhaust air is used]</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\ell_{11}$</td>
<td>Extract air temperature</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\varphi_{11}$</td>
<td>Extract air relative or absolute humidity</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$q_{11}$</td>
<td>Extract air airflow</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\ell_{21}$</td>
<td>Supply air inlet (1)</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\ell_{21}$</td>
<td>Supply air inlet temperature</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\varphi_{21}$</td>
<td>Supply air relative or absolute humidity</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$q_{21}$</td>
<td>Supply air inlet airflow</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\ell_{12}$</td>
<td>Exhaust air inlet (1) [if Extract air is used]</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\ell_{12}$</td>
<td>Exhaust air temperature</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\varphi_{12}$</td>
<td>Exhaust air relative or absolute humidity</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$q_{12}$</td>
<td>Exhaust air airflow</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\ell_{22}$</td>
<td>Supply air outlet (1)</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\ell_{22}$</td>
<td>Supply air temperature</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\varphi_{22}$</td>
<td>Supply air relative or absolute humidity</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$q_{22}$</td>
<td>Supply air airflow</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\Delta p_1$</td>
<td>Pressure drop on exhaust air side at standard condition (1.2 kg/m³)</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\Delta p_2$</td>
<td>Pressure drop on supply air side at standard condition (1.2 kg/m³)</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\eta_t$</td>
<td>Temperature efficiency dry [for plates]</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\eta_t$</td>
<td>Temperature efficiency wet [for plates without humidity transfer]</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\eta_t$</td>
<td>Temperature efficiency [for regeneratives]</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\eta_x$</td>
<td>Humidity efficiency (plates with humidity transfer)</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\eta_x$</td>
<td>Humidity efficiency (regenerative)</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$EATR$</td>
<td>Exhaust air transfer ratio in %</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$OACF$</td>
<td>Outdoor air correction factor (-)</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>$\Delta p_{22-11}$</td>
<td>Static pressure difference</td>
<td>Mandatory</td>
<td></td>
</tr>
</tbody>
</table>

(1): the information can be found in the type key
II.2 Marking
It is highly recommended that the participating company indicates participation in the EUROVENT CERTIFIED PERFORMANCE (ECP) programme for AIR TO AIR REGENERATIVE HEAT EXCHANGERS by the following means.

II.2.1 Use of the certification mark by the Eurovent Certita Certification
For each certified model, the following general information, and certified performance and characteristics shall be published on the Eurovent Certified Performance website: www.eurovent-certification.com for regenerative heat exchangers:

- Name of Company
- Trade or brand name of model
- Production site (city, country)
- Model designation(s)
- Basic Material
- Velocity [m/s]
- Geometric data: diameter [m], depth [m], thickness [mm], wave height [mm]
- Rotor speed (for rotary heat exchangers) [rpm]
- Alternating period (for alternating storage systems) [s]
- Purge angle
- Nominal air flow [m$^3$/h]
- Pressure drop [Pa]
- Temperature and humidity efficiency for summer and winter conditions
- Outdoor Air Correction Factor (OACF) and Exhaust Air Transfer Ratio (EATR), both with and without purge at the following conditions:
  - OACF @250 Pa at 2.0 m/s for RHE and 1.5m/s for ASM
  - EATR @250 Pa at 2.0 m/s for rotors and 1.5m/s for ASM
- Designation of the sealing systems
- Web address of the documentation on the sealing systems

II.2.2 Use of the certification mark by the Participant
See dedicated chapter in Certification Manual.
Additionally, each sealing system shall be documented and specified (type key or designation) and with pictures in the participant documentation. This information shall be made public (e.g. product catalogue).
III. CERTIFICATION PROCESS

III.1 Admission procedure

III.1.1 Declaration of data

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

The Applicant, after signing the Certification Agreement, shall send to EUROVENT CERTITA CERTIFICATION all information required for the qualification: software name and version, the software itself, declaration list, list of manufacturing sites and relevant literature.

All characteristics and performance items shall be expressed in SI Units unless otherwise specified by Eurovent Certita Certification.

Submittal of certification of models shall be sent to Eurovent Certita Certification as .xls or .xlsx declaration file. The following forms shall be fully completed:

- Declaration file AARE-1 will be used:
  - for manufacturing companies (Original Equipment Manufacturer – OEM) to declare products, performances and technical data;
  - for Brand Name (BN) companies to identify the corresponding models’ number of the OEM.

- Technical data sheet AARE-2 will be used to complete technical description of all raw material or basic components for the units selected.

Confidentiality of certification data: All data submitted to Eurovent Certita Certification shall be held confidential except for information authorised to be published on the website.

In case there is an infinity of sizes to declare, the Participant/Applicant shall declare, as a minimum, the following sizes (if existing): 1000, 2000, 4000 mm (or maximum).

The Applicant/Participant shall inform Eurovent Certita Certification of any modification of models by updating declaration file and selection software by sending Software update record sheet AARE-3. In the case of significant modifications Eurovent Certita Certification is entitled to request adequate tests to check the influence on performance data.

III.1.1.1 Rated performance data

All characteristics shall be expressed in SI Units as a minimum. The manufacturer is authorized to display data from the selection software in non-SI units as an option.

III.1.1.2 Certification forms

Submittal of certification of models shall be completed and sent to Eurovent Certita Certification as .xlsx files. The forms shall be sent by e-mail to EUROVENT CERTITA CERTIFICATION within the time limits specified in Certification Schedule (see Appendix B, if applicable).

Copies of the forms are part of these Technical Certification Rules (see Appendix D):

- Declaration file AARE-1 will be used.
- Technical data sheet AARE-2 will be used to complete technical description of all raw material or incoming goods for the units selected.
- Software/DLL update record sheet AARE-3 will be used.

III.1.2 Admissibility of the application

Once the application is completed, the admission procedure is articulated as follows:

III.1.2.1 General Procedure (for Original Equipment Manufacturers)

For Original Equipment Manufacturers (OEM), Eurovent Certita Certification:

- checks the software (or DLL) compliance to general (see Certification Manual) and specific (see APPENDIX B) requirements and its consistency with the declaration file provided with the Applicant;
- audit of all production sites.
• proceeds to the selection of the models to be tested in the independent laboratory based on the declaration file AARE-1;
• orders the product performances testing to the independent laboratory;
• performs a “test-check” to evaluate the test success.

If the aforementioned checks prove the products compliance with the requirements specified in Appendix A and that all other requirements from the present Technical Certification Rules are fulfilled, the certification is granted. If not, the procedure for failure treatment shall be applied. When certified, the products are published on the Eurovent Certified Performance (ECP) website. Once the certificate is received, the participant is entitled to use the certification mark according to applicable requirements.

III.1.2.2 Procedure for Brand Name companies
For Brand Name (BN) companies, Eurovent Certita Certification conducts checks of the software (or DLL) compliance to general (see Certification Manual) and specific requirements and its consistency with the declaration file provided with the Applicant.

III.1.3 Implementation of checking operations
The provisions of the Certification Manual apply.

III.1.3.1 Initial admission audit
a. General
General audit requirements are stated in the Certification Manual. An audit last one (1) day. The objective of an audit is to make sure that the Applicant/Participant produces and delivers what is promoted in the software, documentation or any other material. In particular it shall focus on any advertising and manufacturing process that has an influence on the certified performances.

The audits will consist on the verification that the applicable requirements specified in the paragraph Audit requirements are fulfilled. If the audits are not conducted within the time limitations specified in the notification received from Eurovent Certita Certification, it is considered as a non-application of procedures.

In case of force majeure (e.g. accidents, labour disputes, natural events, acts of war) which would not allow Eurovent Certita Certification to perform a factory audit Eurovent Certita Certification can decide to replace it by another mean of verification, to postpone it within a reasonable deadline or to cancel it.

a. Audit requirements
During the audit, the auditor will check:
• that the ECP mark is displayed on the produced units and on the documentation in compliance with the requirements defined in the Certification Manual and this TCR;
• that the products in the catalogue (or website)/software are compliant with the declaration list;
• that the corrective actions plan from the previous audit is completed. The auditor shall also perform a review of performance related items in the Quality Management System (QMS) to check:
• that the suppliers are regularly evaluated and that the corresponding evaluations are recorded;
• that the following checks are performed on incoming raw materials:

<table>
<thead>
<tr>
<th>Item to be checked</th>
<th>Frequency</th>
<th>Acceptance criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foil thicknesses (without sorption coating)</td>
<td>1 / lot</td>
<td>7%</td>
</tr>
</tbody>
</table>
that the related material (e.g. foil, desiccant, sealing) or incoming goods conformity with the bill of material (BOM) specifications is regularly evaluated and that the corresponding evaluations are recorded;

that the manufacturing process key steps are submitted to a validation check (e.g. defined in the QMS). In particular for each item listed in the table below, the manufacturer shall ensure that:
  o measurement methods are reliable;
  o measurements are recorded.

<table>
<thead>
<tr>
<th>Item to be checked</th>
<th>Frequency</th>
<th>Acceptance criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wave length</td>
<td>1 / batch</td>
<td>As per TCR (+/-10%)</td>
</tr>
<tr>
<td>Wave Height</td>
<td>1 / batch</td>
<td>As per TCR (+/- 0.1 mm)</td>
</tr>
<tr>
<td>Average Diameter</td>
<td>1 / batch</td>
<td>As per TCR (+/- 1%)</td>
</tr>
<tr>
<td>Internal length</td>
<td>1 / batch</td>
<td>1 mm</td>
</tr>
<tr>
<td>Purge angle</td>
<td>1 / batch</td>
<td>1°</td>
</tr>
<tr>
<td>Rotor speed</td>
<td>1 / batch</td>
<td>2 rpm</td>
</tr>
<tr>
<td>Sorption coating thickness</td>
<td>1 / batch</td>
<td>Acc. manufacturer</td>
</tr>
<tr>
<td>Or % of the weight</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The auditor will check the items of the table above on a sample of two units (three if necessary) from different models in the production.

- that the factory personnel is qualified to perform the specific tasks if any (competence shall be recorded);
- that to ensure the traceability of the products each certified product shall be marked with respect to the plant (e.g. serial number);
- the regularity of the calibration of measuring devices;
- that production non-conformities are recorded and corrective actions initiated;
- that customers complaints are registered and treated (for both Original Equipment Manufacturer (OEM) and Brand Name (BN));
- that the delay for the distribution of the selection programme is described (e.g. in the QMS) (maximum 1 month from the date the software is approved by ECC);
- that the sealing material and configuration is in accordance with the declaration.

b. Audit non-conformity

After evaluation, a non-conformity is classified as critical when, on the basis of objective evidence, the following cases are identified:

- there is a significant risk to the product conformity with respect to specified requirements;
- there is a significant risk regarding the quality management system ability to control the product conformity to specified requirements;
- there is systematic or repeated non-conformity to a specified requirement;

Otherwise the non-conformity is classified as not-critical.

In case of a non-conformity, the applicant/participant shall be requested to provide Eurovent Certita Certification with a corrective actions plan within the deadline specified by the auditor.

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2 A batch is a group of similar units produced at the same time (in series), using the same process and under the same setup of the production line.
Unless otherwise indicated by the auditor:

- any critical non-conformity shall be corrected within a maximum delay of four weeks;
- any non-critical non-conformity shall be corrected no later than the next factory audit.

### III.1.3.2 Selection of units to be tested

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

EUROVENT CERTITA CERTIFICATION shall select units to be tested based on its evaluation of the declaration file AARE-1 communicated by the applicant.

For the qualifying procedure, one unit per class of Regenerative Heat Exchangers shall be selected by Eureau Certita Certification and tested in the Independent laboratory selected by Eurovent Certita Certification.

Eurovent Certita Certification can select the production sites from which the unit will be delivered if several production sites are declared by the participant.

### III.1.3.3 Tests at the independent laboratory

In addition to the provisions laid down in the Certification Manual, the following requirements apply:

Before testing, the laboratory shall check the product against the information declared in the technical datasheet to ensure that the unit corresponds to the selection.

The laboratory shall not perform the test and contact EUROVENT CERTITA CERTIFICATION when:

- one of the information is not compliant with the technical datasheet (see Appendix A),
- one of the units appears damaged

EUROVENT CERTITA CERTIFICATION will contact the applicant to give instructions regarding further actions.

Tests shall be performed at the Independent laboratory selected by EUROVENT CERTITA CERTIFICATION.

The laboratory shall be responsible for uncrating, handling, testing and recrating the unit for shipment. Only the independent laboratory personnel shall be permitted to handle test units.

The Applicant/Participant shall provide to the laboratory full information about the installation. Units shall be installed in test facility in accordance with the Applicant/Participant's published installation instructions.

No Applicant/Participant's personnel shall be present in the test facility during the measurements.

#### a. Test conditions

The units shall be tested at the conditions as stated in Appendix A.

#### b. Test report and tests results

Upon completion of the test on each unit, the laboratory will render its complete report as a pdf file to Eurovent Certita Certification, which will immediately forward it to the Participant.

For each performance item, deviation is calculated as the difference between claimed value (calculated using the selection software under the test conditions) and result of test in the independent laboratory. When completed, Eurovent Certita Certification shall transmit to the Participant the results of the checking and conclusions (Form AARE-4).

If all deviations are inside the allowed acceptance criterias, the test is considered as “Passed”. If at least one deviation is out of allowed acceptance criteria, the test is considered as “Failed” and the procedure for failure treatment shall be applied.

### III.1.3.4 Software checking procedure

In addition with the general software requirements which are described in the dedicated appendix of the Certification Manual, the software must comply with the requirements described section II.1.2

- The performances shall be consistent: with the declaration file AARE-1;
- with one another (see consistency rules in Appendix A).
III.2 Time limitation of acquisition and recovery of units
The provisions of the Certification Manual apply.

III.2.1 Time limitation of acquisition of unit
Deadline for delivery of units to the laboratory, together with the technical data sheet completed and the payment shall be decided by Eurovent Certita Certification in accordance with the Programme committee.

If elements are not delivered within the time limitations (specified in the notification received from Eurovent Certita Certification), it is considered as non-application of procedures (see dedicated chapter in Certification Manual).

III.2.2 Recovering of units
Applicant/Participant shall recover its products four working weeks after receiving its test report and results. When the units are not recovered on time, the laboratory can destroy the units, and the corresponding invoice shall be sent by Eurovent Certita Certification to the Applicant/Participant.

III.3 Failure treatment

III.3.1 Initial test failure
As defined in the Certification Manual (latest version in force), is considered as an initial test failure any situation where:

- the unit to be tested cannot be operated, or
- any functional component of the unit to be tested is out of order
- the unit to be tested, or any of its components is damaged, e.g. due to transportation.

The applicant/participant shall then send a new unit of the same model. In specific cases, products or components can be repaired at the laboratory, under the responsibility of the manufacturer and the supervision of the laboratory.

If internal air leakage (EATR) or dimensions of the unit are outside the acceptance criteria defined in Appendix A, the laboratory shall stop the test. In both cases, the laboratory shall inform Eurovent Certita Certification and the technical contact of the Applicant/Participant. The laboratory may make repairs to the test unit only in agreement with Eurovent Certita Certification and the Applicant/Participant.

The laboratory will send a short report to Eurovent Certita Certification, explaining why the unit could not be tested. A further unit shall then be delivered within 4 weeks for test.

III.3.2 Unit failure
After a failure, the applicant/participant shall examine the reasons of the failure.

If a failure occurred, the Applicant/Participant has four working weeks from the notification of failure to choose one of the following alternatives:

1) Rerate the data, by adapting the selection software to the test results. The corrected software with its new version number shall be sent to Eurovent Certita Certification who will check the consistency of the modifications. If the software is in accordance with all the measurements, new selection documentation with a new reference and date of publication shall be put in the Eurovent Certified Performance website. After verification ("test recheck"), if the software is still not in accordance with the test results manufacturer will have two additional weeks for final adjustment of the software. In case of new failure, the Participant shall be temporarily suspended until he updates his software in accordance with the tests results.

2) Ask for a second test on the same unit after analysis of the non-conformity and implementation of actions if applicable. If this second test is successful, no revision of selection software will be required. If the second test is unsuccessful, the Participant shall comply with point (1). When
the second test is carried out on another unit that the one already tested, then penalty test will be required.

In a surveillance procedure, if the failure on regular measuring points is confirmed and accepted by the Applicant/Participant for

- at least 2 failures over the 11 measurements for Condensation AARE
- at least 4 failures over the 21 measurements for Enthalpy and Sorption AARE

of a test of campaign n, a penalty test will be required on a unit from the same factory in test campaign n+1. The penalty test will be performed on another unit of different type but the same class (if available) selected by Eurovent Certita Certification.

**III.3.3 Mean Value of Failure**

Mean Value of Failure (MVF) is equal, for each manufacturer, to the ratio between the total numbers of measurements of all the considered characteristics above intermediate deviations and the total performed measurements in the considered years. It is calculated as follows:

\[
\text{MVF} = \frac{\sum_{3 \text{ years}} N_{\text{performances failed}}}{\sum_{3 \text{ years}} N_{\text{performances tested}}}
\]

One global value will be considered. The following certified performances are considered:

- Pressure Drop at 1m/s
- Pressure Drop at 2m/s
- Pressure Drop at 3m/s
- Winter temperature efficiency at 1m/s
- Winter temperature efficiency at 2m/s (1.5m/s for ASM) at regular test conditions
- Winter temperature efficiency at 2m/s (1.5m/s for ASM) at additional test conditions
- Winter temperature efficiency at 3m/s (2.5m/s for ASM)
- Winter humidity efficiency at 1m/s
- Winter humidity efficiency at 2m/s (1.5m/s for ASM) at regular test conditions
- Winter humidity efficiency at 2m/s (1.5m/s for ASM) at additional test conditions 1
- Winter humidity efficiency at 3m/s (2.5m/s for ASM)
- Summer temperature efficiency at 1m/s
- Summer temperature efficiency at 2m/s (1.5m/s for ASM) at regular test conditions
- Summer temperature efficiency at 2m/s (1.5m/s for ASM) at additional test conditions 1
- Summer temperature efficiency at 2m/s (1.5m/s for ASM) at additional test conditions 2
- Summer temperature efficiency at 3m/s (2.5m/s for ASM)
- Summer humidity efficiency at 1m/s
- Summer humidity efficiency at 2m/s (1.5m/s for ASM) at regular test conditions
- Summer humidity efficiency at 2m/s (1.5m/s for ASM) at additional test conditions 1
- Summer humidity efficiency at 2m/s (1.5m/s for ASM) at additional test conditions 2
- Summer humidity efficiency at 3m/s (2.5m/s for ASM)

Should be considered for the calculation of the MVF any results of the above list of performances out of the acceptance criteria defined in Appendix A.

The following calendar will be followed for the next 3 years:

- End of year 2019: assessment of the MVF based on years 2018-2019 with a MVF threshold of 35%
- End of year 2020: assessment of the MVF based on years 2018-2019-2020 with a MVF threshold of 30%
• End of year 2021: assessment of the MVF based on years 2019-2020-2021 with a MVF threshold of 25%.

Then from 2022 calculation of the MVF will be based on the results of the past 3 years with a threshold of 25%.

III.3.4 Penalty test in case of high failure
In case of high failure (as defined in Appendix A) on one of the following performances: Pressure drop, temperature efficiency (dry and wet), or humidity efficiency, a penalty test will be required on a unit from the same factory in test campaign n+1. Only one penalty test per test can be required.

III.3.5 Penalty test in case of Mean Value of Failure (MVF)
Should the MVF be higher than:
• 35% in 2019
• 30% in 2020
• 25% in 2021 and following years

3 additional units shall be selected and tested with a high priority in the same campaign. The manufacturer shall show that the actions implemented are efficient to lower significantly the failure rate by having, on each of the 3 tests, a failure rate below 15% and no high failure. Should this requirement not be fulfilled, the participant shall be suspended, and a new selection of 3 units shall be made.

III.4 Challenge procedure
Under special conditions a challenge procedure may be carried out, as described in the Certification Manual.

III.5 Surveillance procedure
The provisions of the Certification Manual apply.

III.5.1 Implementation of surveillance operations
Every year Eurovent Certita Certification checks whether the certified products still fulfil the requirements:

• For Brand Name (BN) companies, applicable requirements of the software/DLL shall be fulfilled
• For Original Equipment Manufacturers (OEM), the following steps are conducted annually in compliance with the Certification Schedule (see Appendix A):
  o check of the software (or DLL) consistency with the declaration file provided by the participant;
  o audit of all production sites
  o selection of the models to be tested in the independent laboratory based on the declaration file;
  o order of the product performance testing to the independent laboratory;
  o “test-check” to evaluate the test success.

For the surveillance procedure, the certification is renewed at the date specified in the Certification Schedule on condition that:

• The previous test campaign (N-1) has been successfully completed;
• The scheduled audits have been performed by the auditor and are successful or the corrective actions plan is considered satisfactory;
• The selected product together with the technical datasheet delivery and the payment have been completed.

The company receives then a renewed certificate and the display of data is maintained on the Eurovent Certified Performance (ECP) website. If not, failure treatment shall be applied.

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III.5.1.1 Surveillance audit
The provisions laid down in the initial admission audit (section III.1.3.1) apply for the surveillance audit.

III.5.1.2 Selection of units to be tested
In addition to the provisions laid down in the Certification Manual, the following requirements apply: For the surveillance procedure, one unit for all certified ranges shall be selected by Eurovent Certita Certification every year and tested. Eurovent Certita Certification can select the production sites from which the unit will be delivered if several production sites are declared by the participant. In case for a surveillance test campaign, a model selected was the same than in a previous test campaign, the Participant shall manufacture and provide a new physical unit.

III.5.1.3 Surveillance tests
The provisions laid down in the admission procedure (section III.1.3.3) apply for the surveillance audit.

III.5.1.4 Software checking procedure
The provisions laid down in the admission procedure (section III.1.3.4) apply for the surveillance audit.

III.6 Declaration of modifications
The provisions of the Certification Manual apply.

III.6.1 Changes concerning the participant
The provisions of the Certification Manual apply.

III.6.2 Changes concerning production entities
The provisions of the Certification Manual apply.

III.6.3 Changes concerning the quality organisation of the manufacturing and/or marketing process
The provisions of the Certification Manual apply.

III.6.4 Changes concerning the certified range
The provisions of the Certification Manual apply.

III.6.5 Changes concerning the certified product
In addition to the provisions laid down in the Certification Manual, the following requirements apply: The applicant/participant shall inform Eurovent Certita Certification of any modification of the product portfolio by updating the declaration file (AARE-1) and sending the updated selection software together with the software update record sheet AARE-3.

III.7 Suspension/cessation conditions
The general consequences of non-application of procedures are described in Certification Manual.

III.8 Production identification and traceability
The participant shall use suitable means to identify the products by a unique identification code (the minimum traceable information: production plant, N° of lot, components), and the retention of documented information (records) necessary to enable traceability.
APPENDIX A. TECHNICAL APPENDIXES

A.1 Purpose
The purpose of these Technical appendixes is to establish definitions and specifications for testing and rating of AIR TO AIR REGENERATIVE HEAT EXCHANGERS for the related Eurovent Certified Performance Programme, in accordance with these Technical Certification Rules.

A.2 Test standard
Performance ratings claimed by manufacturers shall be verified by tests performed in the independent laboratory selected by Eurovent Certita Certification.

The following standard shall be used as a basis for these tests:

A.3 Testing requirements

A.3.1 Test pre-quisites

A.3.1.1 Production place

The laboratory shall verify that the production place of the delivered unit corresponds to the production place selected by Eurovent Certita Certification.

If a unit is not compliant, the laboratory shall not perform the test and contact Eurovent Certita Certification who shall ask the Participant to send another unit.

A.3.1.2 Sealing system

The laboratory shall verify that the sealing system of the delivered unit corresponds to the sealing system declared on Eurovent Certified Performance website.

If a unit is not compliant, the laboratory shall not perform the test and contact Eurovent Certita Certification who shall ask the Participant to send another unit.

A.3.1.3 Dimensions

Tests shall be carried out on the sealing system selected by Eurovent Certita Certification, with a wheel which nominal diameter within the limits of the laboratory or an alternating storage system of 0.785 m² of free area. Before testing, the laboratory shall check minimum and maximum free diameter for rotors, or surface area for alternating storage systems, to evaluate mean free diameter as (min+max)/2. The following acceptance criteria is acceptable:

- Free diameter for rotors:
  +/-1 %

- Free area for alternating storage system:
  +/-1 % (i.e. 0.00785 m² for alternating storage system)

If a unit is not compliant, the laboratory shall not perform the test and contact Eurovent Certita Certification who shall ask the Participant to send another unit.

A.3.1.4 Wave length and height

30 wave heights shall be measured at two locations (one at 50% of the radius and one at 80% of the radius). The mean wave height measured shall be compared to the declared value. If the measured value doesn't correspond to the declared value within +/- 0.1 mm the laboratory shall stop the test and contact Eurovent Certita Certification who shall ask the participant to send another unit.

The chord of 10 wave lengths shall be measured at the same two locations. The mean wave length measured shall be compared to the declared value. If the measured value doesn't correspond to the declared value within +/- 10 % the laboratory shall stop the test and contact Eurovent Certita Certification who shall ask the participant to send another unit.
A.3.1.5 Exhaust air transfer ratio

Air tightness of the casing shall be ensured. The internal leakage test according to EN 308:1997 shall be carried out at the following testing conditions:

- Static pressure difference (Leaving supply airflow static pressure, minus Entering exhaust airflow static pressure) remaining between 0 Pa and 20 Pa
- Nominal air flow according to the face air velocity of 2 m/s (1.5 m/s for ASM)
- Density between 1.16 kg/m³ and 1.24 kg/m³

Measured values outside this range shall be converted into standard conditions.

If the EATR is higher than 3% of the nominal air flow rate according to the face air velocity of 2 m/s (1.5 m/s for ASM) the unit shall not be further tested.

If a unit is not compliant, the laboratory shall stop the test and contact Eurovent Certita Certification who shall ask the Participant to repair or send another unit.

A.4 Test specifications

<table>
<thead>
<tr>
<th>*) The Condensation units shall be tested only under the Heating condition.</th>
<th>“Regular” test conditions</th>
<th>“Additional” conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heating</td>
<td>Cooling*</td>
</tr>
<tr>
<td>Entering Supply Airflow</td>
<td>Temperature</td>
<td>2° C</td>
</tr>
<tr>
<td></td>
<td>Relative humidity</td>
<td>80%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entering Exhaust Airflow</td>
<td>Temperature</td>
<td>22° C</td>
</tr>
<tr>
<td></td>
<td>Relative humidity</td>
<td>45%</td>
</tr>
<tr>
<td>Leaving Supply Airflow for rotors</td>
<td>Face air velocity</td>
<td>1 m/s, 2 m/s, 3 m/s</td>
</tr>
<tr>
<td>Leaving Supply Airflow for alternating storage systems</td>
<td>Face air velocity</td>
<td>1 m/s, 1.5 m/s, 2.5 m/s</td>
</tr>
<tr>
<td>Entering Exhaust Airflow</td>
<td>Face air velocity</td>
<td>Same rate as ‘Leaving supply airflow’ (Mass Flow Ration of 1.0)</td>
</tr>
<tr>
<td>Pressure Difference</td>
<td>‘Leaving supply airflow static pressure’ minus ‘Entering exhaust airflow static pressure’</td>
<td>0 Pa ... 20 Pa</td>
</tr>
<tr>
<td>Rotor speed [rpm] or damper alternate period [s]</td>
<td>Specified by the manufacturer</td>
<td></td>
</tr>
<tr>
<td>Purge configuration</td>
<td>Specified by the manufacturer</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Testing conditions for sensible and latent efficiency and pressure drop

The following particular specifications shall be applied during the test in the independent laboratory selected by Eurovent Certita Certification:

- For Condensation RHEs, temperature efficiency, humidity efficiency and pressure drop shall be measured under the above three “regular” heating and one “additional” conditions (see Table 2).
• For Enthalpy and Sorption RHEs, temperature efficiency, humidity efficiency and pressure drop shall be measured under the above six “regular and three “additional” conditions (see Table 2).

• All ratings shall be performed at the rotor speed or damper alternate period specified by the manufacturer. If an adjustable purge/cleaning sector is provided, it shall be set to the manufacturer’s specified purge angle or setting. All ratings shall be performed at the same rotor speed or damper alternate period and purge setting.

• The pressure drop has to be established in all tests in both air flows, for each test the average of the two measured values has to be compared with the average of the two rated values. This is to eliminate asymmetries due to the arrangement of sealing or of the purge system.

<table>
<thead>
<tr>
<th>Standard conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entering Supply Airflow</strong></td>
</tr>
</tbody>
</table>
| | Relative humidity | 50% +/-3%-
| **Entering Exhaust Airflow** | Temperature | 20° C (+/-3K) |
| | Relative humidity | 50% +/-3%-
| **Leaving Supply Airflow for rotors** | Face air velocity | 2 m/s |
| **Leaving Supply Airflow for alternating storage systems** | Face air velocity | 1.5 m/s |
| **Entering Exhaust Airflow** | Face air velocity | Same rate as ‘Leaving supply airflow’ (Mass Flow Ratio of 1.0) |
| **Pressure Difference** | ‘Leaving supply airflow static pressure’ minus ‘Entering exhaust airflow static pressure’ | OACF: 0, 250, 500, 750 Pa(1) |
| | | OACF and EATR: 250 Pa |
| **Rotor speed [rpm]** | Specified by the manufacturer |
| **or damper alternate period [s]** | Specified by the manufacturer |
| **Purge configuration (for rotors)** | Without purge |
| | With purge configuration optimized for 250 Pa |

Table 3: Testing conditions for OACF and EATR

(1) If the software does not allow using 750 Pa, the maximum pressure difference allowed by the software will be tested.

**A.4.1 Checking specifications**

When calculating the deviation between the claimed values and the measured values using the selection software under the tests conditions, Eurovent Certita Certification shall use the following inputs:

• for airflows: exhaust air inlet (1.1) and supply air outlet (2.2);
• for temperature: exhaust air inlet (1.1) and supply air inlet (2.1);
• for humidity: exhaust air inlet (1.1) and supply air inlet (2.1).
A.5 Rating requirements

Translation of performance data to different RHE surface areas: Other RHE of the same class, material, geometry and depth but different surface areas shall have the same thermal performance data at the same face air velocity defined under “3. Definitions”.

Translation of sealing leakage rate $q_{m,\text{sealing}}$ to different rotors surface areas: Other rotors of the same class, material, geometry, depth, sealing system, rotor speed but different surface areas shall have the same ratio between sealing leakage rate and rotor diameter at the same pressure differences defined under section I.3.

$$\frac{q_{\text{sealing},1}}{D_1} = \frac{q_{\text{sealing},2}}{D_2} \text{ or } \frac{q_{\text{sealing},1}}{D} = \text{cst}$$

$$\frac{q_{m,\text{sealing}}}{D} = \frac{(OACF_{\text{without purge}} - 1) \cdot q_{m,\text{supply out,without purge}}}{D} \approx \text{cst}$$

$$\frac{q_{m,\text{sealing}}}{D} = \frac{(OACF_{\text{without purge}} - 1) \cdot \text{cst} \cdot D^2}{D} \approx \text{cst}$$

Translation of purge leakage rate $q_{m,\text{purge}}$ to different rotors surface areas: Other rotors of the same class, material, geometry, depth, sealing system, rotor speed, purge configuration but different surface areas shall have the same ratio between purge leakage rate and the square of the rotor diameter at the same pressure differences defined under section I.3.

$$\frac{q_{\text{purge},1}}{D_1} = \frac{q_{\text{purge},2}}{D_2} \text{ or } \frac{q_{\text{purge},1}}{D^2} = \text{cst}$$

$$\frac{(OACF_{\text{with purge}} - OACF_{\text{without purge}}) \cdot q_{m,\text{nom}}}{D^2} \approx \text{cst}$$

$$\frac{(OACF_{\text{with purge}} - OACF_{\text{without purge}}) \cdot \text{cst} \cdot D^2}{D^2} \approx \text{cst}$$

$$OACF_{\text{with purge}} - OACF_{\text{without purge}} \approx \text{cst}$$

Translation of absolute leakage data to different ASM surface areas: Other ASM of the same class, material, geometry, depth, sealing system, alternating period but different surface areas shall have the same ratio between absolute leakage performance and sealing length at the same pressure differences defined under section I.3.

$$\frac{q_{\text{sealing},1}}{\sqrt{A_1}} = \frac{q_{\text{sealing},2}}{\sqrt{A_2}} \Rightarrow \frac{q_{\text{sealing}}}{\sqrt{A}} = \text{cst}$$

$$\frac{q_{m,\text{sealing}}}{\sqrt{A}} = \frac{(OACF - 1) \cdot q_{m,\text{supply out}}}{\sqrt{A}} \approx \text{cst}$$

$$\frac{q_{m,\text{sealing}}}{\sqrt{A}} = \frac{(OACF - 1) \cdot \text{cst} \cdot A}{\sqrt{A}} \approx \text{cst}$$

$$\frac{OACF - 1}{\sqrt{A}} \approx \text{cst}$$

Translation of EATR to different RHE surface areas: Other RHE of the same class, material, geometry, depth, sealing system, rotor speed, purge configuration but different surface areas shall have the same EATR at the same pressure differences defined under section I.3.

Consistency of certified data:

- Pressure drop and efficiencies of rotors having different wave heights and wave lengths (the other characteristics being the same) shall be consistent with the following statements:
  1) the pressure drop shall increase with decreasing wave height and decreasing wave
length; 2) the efficiency shall increase with decreasing wave height and decreasing wave length.

- Rotors having different diameters (all the other characteristics being the same) shall have the same pressure drop (+/- max(2 %; 3 Pa) and efficiency (+/- 1 %-point).
- Given two rotors with different wave height and wave length (all other characteristics being the same), the slope of the Pressure Drop vs Efficiency line at a given air speed shall be between the slopes of the higher and lower air speeds.
- For a given technology line drawn for the Pressure drop / efficiency points at a given air speed, for rotors with different wave heights and wave lengths (all other characteristics being the same), all points shall be within a band which centre is defined by the trend line of 2nd degree polynomial of the technology line and which width corresponds to the acceptance criteria of the programme.
- Unless proven by test, a manufacturer shall not declare higher values than the one given by these formulas or statement. Should a unit be rerated following a test, the complete range shall also be rerated so that the consistency of the previous formulas or statements is maintained.

### A.6 Acceptance criteria

For the test to be acceptable, the testing unit shall not differ from a wheel with the selected diameter or an alternating storage matrix of 0.785 m² of free area from more than:

<table>
<thead>
<tr>
<th>Performance</th>
<th>Acceptance criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free diameter for rotors or free surface area for alternating storage system</td>
<td>+/- 1%</td>
</tr>
</tbody>
</table>

For the test to be acceptable, measured leakage shall be below (as defined in EN 308:1997):

<table>
<thead>
<tr>
<th>Performance</th>
<th>Acceptance criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>EATR</td>
<td>+3%</td>
</tr>
</tbody>
</table>

When tested in the laboratory the obtained performance data shall be different than the acceptance criteria defined in the table below:

<table>
<thead>
<tr>
<th>Performance</th>
<th>Acceptance criteria</th>
<th>High deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure drop at standard condition</td>
<td>+10 %, at least 10 Pa</td>
<td>+15% or +20Pa</td>
</tr>
<tr>
<td>Temperature efficiency</td>
<td>-3%-point</td>
<td>-4.5%-point</td>
</tr>
<tr>
<td>Humidity efficiency</td>
<td>- 5%-point³</td>
<td>-7.5%-point</td>
</tr>
<tr>
<td>Outdoor Air Correction factor (OACF)</td>
<td>0.05</td>
<td>N/A</td>
</tr>
<tr>
<td>Exhaust Air Transfer Ratio (EATR)</td>
<td>+1%-points</td>
<td>N/A</td>
</tr>
</tbody>
</table>

³ with a minimum acceptance criterion of 0.2 g/kg in absolute humidity of leaving supply air
APPENDIX B. CERTIFICATION PROCESS AND SCHEDULE

B.1 Admission procedure

Legend:
- Applicant
- ECC
- Check

Signature of license agreement

Declaration of data + software/DLL provision

Selection of products to be tested and audit scheduling

Production site audit

Delivery of selected products and datasheets to the independent laboratory

Conduction of tests by the independent laboratory + Test-

Audit status is

Corrective actions plan satisfactory and all critical NC are closed

NO

NO

NO

YES

YES

YES

YES

NO

YES

Eurovent Certified Performance certification can be granted
### B.2 Surveillance procedure

<table>
<thead>
<tr>
<th>Certification step</th>
<th>Deadline (For information only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurovent Certita Certification asks for update of list and software from the</td>
<td>15/04/n</td>
</tr>
<tr>
<td>Participant and sends the notification(s)/invoice(s) for the audits in all factories.</td>
<td></td>
</tr>
<tr>
<td>The participant sends the updated declaration file as well as the software/DLL</td>
<td>15/05/n</td>
</tr>
<tr>
<td>Eurovent Certita Certification sends the list of selected models to the participant (regular tests + penalty tests from the previous test campaign)</td>
<td>15/06/n</td>
</tr>
<tr>
<td>Selection list is confirmed</td>
<td>31/08/n</td>
</tr>
<tr>
<td>Delivery + Technical data sheet + payments are completed for all tests.</td>
<td>30/11/n</td>
</tr>
<tr>
<td>All first tests finished by the laboratory</td>
<td>28/02/n+1</td>
</tr>
<tr>
<td>Diploma validity</td>
<td>Q(^4)(n+1)+3 months</td>
</tr>
<tr>
<td>Eurovent Certita Certification sends test results (software checking)</td>
<td>30/03/n+1</td>
</tr>
<tr>
<td>Eurovent Certita Certification sends selection list for second test</td>
<td>30/04/n+1</td>
</tr>
<tr>
<td>Correction of the software after failure</td>
<td>1 month</td>
</tr>
</tbody>
</table>

\(^4\) Quarter of the audit
APPENDIX C. LABORATORY LIMITS

C.1 For rotary heat exchangers

Rotary heat exchangers with a diameter of 1000mm

Minimum air flow rate: 1500 m³/h
Maximum air flow rate: 7000 m³/h
Diameter Rotary: 1000 mm (depends on the air flow rate)

Casing size
Length = 1335 - 1340 mm
Height = 1380 - 1385 mm
Width = 260 – 390 mm
Rotary heat exchangers with a diameter of 1500mm

Minimum air flow rate: 1500 m³/h
Maximum air flow rate: 7000 m³/h
Diameter Rotary: 1500 mm (depends on the air flow rate)

Casing size
Length = 1600 - 1650 mm
Height = 1600 - 1650 mm
Width = 290 - 510 mm
C.2 For alternative storage matrices

Air flow rates: 1500 m³/h – 7000 m³/h

Figure 5: Installation situation alternating storage system. The whole unit with demountable adapter channels are delivered by the manufacturer (adequate thermal insulation included).

Figure 6: Connection frame of the four channels from the test rig WRG. The adapter channels have to fit to this frame.
APPENDIX D. FORMS

D.1 Form AARE-1: Declaration file
The form AARE-1 (declaration file to be filled in shall be sent by Eurovent Certita Certification to:
- applicants who have signed the license agreement;
- participants on an annual basis before the deadline specified in the certification schedule.
A template will be available for information and upon request.

D.2 Form AARE-2: Technical data sheet (TDS)
The form AARE-2 (Technical Data Sheet) to be filled in shall be sent by Eurovent Certita Certification to Applicants/Participants who have returned the form AARE-1 duly completed.
A template will be available for information and upon request.

D.3 Form AARE-3: Software/DLL update record sheet
The form AARE-3 shall be sent by the Applicant/Participant before any new version of the software is validates by Eurovent Certita Certification.

Company Name

XXXXX Software Name

AHU Software Update Record Sheet

Prepared By:

Date: Click here to enter a date.

<table>
<thead>
<tr>
<th>Software Revision</th>
<th>Date</th>
<th>Brief Description of update</th>
<th>Effect on software ECC Certified performance (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For instance: Logo update</td>
<td></td>
<td></td>
<td>Yes ☐ No ☐</td>
</tr>
<tr>
<td>Prices</td>
<td></td>
<td></td>
<td>Yes ☐ No ☐</td>
</tr>
<tr>
<td>Dll...</td>
<td></td>
<td></td>
<td>Yes ☐ No ☐</td>
</tr>
</tbody>
</table>

Signature:
## APPENDIX E. VOCABULARY

The use of recommended and accepted wordings may only take place in accordance with the symbols and equations listed in the Table below.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FORMULA</th>
<th>RECOMMENDED</th>
<th>ACCEPTED</th>
<th>FORBIDDEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>Temperature[^1]</td>
<td>Humidity</td>
<td>Moisture contents[^1]</td>
<td>Moisture[^2]</td>
</tr>
<tr>
<td>x</td>
<td>Absolute humidity[^1]</td>
<td></td>
<td>Moisture contents[^1]</td>
<td>Moisture[^2]</td>
</tr>
<tr>
<td>h</td>
<td>Total enthalpy[^3]</td>
<td></td>
<td>Specific enthalpy[^3]</td>
<td>Enthalpy[^2]</td>
</tr>
<tr>
<td>...11</td>
<td>Extract air [if Exhaust air is used]</td>
<td>Exhaust air inlet[^1] [if Exhaust air outlet is used]</td>
<td>Exhaust air in [if Exhaust air out is used]</td>
<td>Exhaust air entering[^2]</td>
</tr>
<tr>
<td>...21</td>
<td>Supply air inlet[^1]</td>
<td></td>
<td>Supply air entering[^2]</td>
<td>Fresh air</td>
</tr>
<tr>
<td>...12</td>
<td>Exhaust air [if Extract air is used]</td>
<td>Exhaust air outlet[^1] [if Exhaust air inlet is used]</td>
<td>Exhaust air out [if Exhaust air in is used]</td>
<td>Exhaust air leaving (^2)</td>
</tr>
<tr>
<td>...22</td>
<td>Supply air outlet[^1]</td>
<td></td>
<td>Supply air out</td>
<td>Supply air leaving[^2]</td>
</tr>
<tr>
<td>...w</td>
<td>Wet bulb[^1]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...d</td>
<td>Dry bulb[^2]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q_HRS</td>
<td>Capacity of the heat recovery system</td>
<td></td>
<td>Capacity of the HRS[^3]</td>
<td>Recuperation power</td>
</tr>
<tr>
<td>P_el</td>
<td>Electric power consumption[^3]</td>
<td></td>
<td>HRS capacity</td>
<td></td>
</tr>
<tr>
<td>(\eta_t)</td>
<td>(\eta_t = \frac{t_{22} - t_{21}}{t_{11} - t_{21}})</td>
<td>Temperature efficiency dry[^1] [for plates]</td>
<td>Temperature ratio dry[^1] [for plates]</td>
<td>Efficiency [without Temperature or Sensible or Latent in front]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temperature efficiency wet[^1] [for plates]</td>
<td>Temperature ratio wet[^1] [for plates]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temperature efficiency[^1] [for rotaries]</td>
<td>Temperature ratio[^1] [for rotaries]</td>
<td>Ratio [without Temperature in front]</td>
</tr>
</tbody>
</table>
### Temperature efficiency (for plates, without dry or wet after)

\[ \eta_x = \frac{x_{22} - x_{21}}{x_{11} - x_{21}} \]

### Temperature ratio (for plates, without dry or wet after)

\[ \frac{x_{22} - x_{21}}{x_{11} - x_{21}} \]

### Sensible efficiency (*)

\[ \eta_s = \frac{h_{22} - h_{21}}{h_{11} - h_{21}} \]

### Latent efficiency (*)

\[ \eta_l = \frac{x_{22} - x_{21}}{x_{11} - x_{21}} \]

### Humidity efficiency (*)

\[ \eta_h = \frac{h_{22} - h_{21}}{h_{11} - h_{21}} \]

### Humidity ratio (*) (1)

\[ \frac{h_{22} - h_{21}}{h_{11} - h_{21}} \]

### Total efficiency

\[ \eta_t = \frac{\dot{m}}{\dot{m}_{\text{min}}} \cdot \frac{t_{22} - t_{21}}{t_{11} - t_{21}} \]

### Energy efficiency (always defined for balanced airflows.)

\[ \eta_e = \eta_t \cdot (1 - 1/\epsilon) \]

### Coefficient of performance (3)

\[ \epsilon = \frac{Q_{\text{HRS}}}{P_{\text{el}}} \]

### References:
