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OPERATIONAL MANUAL
for the
CERTIFICATION
of
AIR TO AIR REGENERATIVE HEAT EXCHANGERS

OM-10-2018

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Modifications as against last version:

No.	Modifications	Section	Page
1	*The list of manufacturing sites shall be sent by the Applicant prior to the qualifying procedure.*	*III.1*	*4*
2	*Clarification and update of the qualification procedures as per the changes below*	*III.2*	*4*
3	*Clarification and update of the repetition procedures as per the changes below*	*III.3*	*5*
4	*Deletion of the paragraph "Diploma" which is a repetition of what is described in the Qualifiying and Repetition procedures*	*IV*	*6*
5	*Characteristics and performances can be declared in non-SI units if requested by ECC*	*IV.1*	*6*
6	*It is not allowed for an Applicant/Participant to witness the test (should it be a first or second test)*	*IV.4*	*7*
7	*Description of the audit procedure*	*IV.6*	*8*
8	*Additional scheme describing the qualification procedure*	*APPENDIX A*	*12*
9	*Update of the certification schedule for repetition procedure*	*APPENDIX A*	*13*
10	*All four airflows shall be given as outputs and on the printouts. It is allowed to show any other volume flow (additionally) if accompanied by the underlying density.*	*APPENDIX B*	*14*
11	*Update of the laboratory limits for rotary heat exchangers. Addition of the limits for alternative storage matrices*	*APPENDIX C*	*17*
12	*Deletion of declaration form, TDS form and test result form, which are now available in a better format upon request.*	*APPENDIX D*	*19*
13	*Addition of the Software update record sheet form*	*APPENDIX D*	*19*
14	*Editorial revisions*	*VARIOUS*	

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I. PURPOSE

The purpose of this Operational Manual is to prescribe procedures for the operation of the Certification Programme for Air-to-Air Regenerative Heat Exchangers (RHE) of Eurovent Certita Certification, in accordance with the Certification Manual.

II. SCOPE OF THE PROGRAMME

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. The certify-all principle applies not only to Europe but to all markets.

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 Rating Standard RS 8/C/0002, chapter “Certified performance items”)

III. BASIC OUTLINE OF THE PROGRAMME

Participation in this programme consists of the following:

III.1 Application

The Applicant, after signing the Licence Agreement, shall send to Eurovent Certita Certification all information as required by Eurovent Certita Certification Rating Standard RS 8/C/002: software name and version, the software itself, declaration list, *list of manufacturing sites* and relevant literature.

III.2 Qualifying procedure

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

a. 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 (see APPENDIX B) requirements and its consistency with the declaration file provided with the Applicant.

b. 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 (see §IV.6)*
- *proceeds to the selection (see §IV.2a) 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" (see §IV.5) to evaluate the test success.*

If the aforementioned checks prove the products compliance with the requirements specified in Rating Standard RS/8/C/002 and that all other requirements from the present Operational Manual 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 as specified in §V.1. Once the certificate is received, the participant is entitled to use the certification mark according to applicable requirements (see §V.2).

III.3 Repetition procedure

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):*
    - *check of the software (or DLL) consistency with the declaration file provided by the participant;*
    - *audit of all production sites (see §IV.6)*
    - *selection (see §IV.2a) of the models to be tested in the independent laboratory based on the declaration file;*
    - *order of the product performance testing to the independent laboratory;*
    - *"test-check" (see §IV.5) to evaluate the test success.*

For the repetition procedure, the certification is renewed at the date specified in the Certification Schedule (see APPENDIX A) 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.

III.4 Failure treatment

When the test results fail to comply with the requirements of the Rating Standard *RS/8/C/002*, the failure treatment shall be applied.

III.5 Challenge procedure

Under special conditions a complaint procedure may be carried out, as described in the Certification Manual of Eurovent Certita Certification.

IV. OPERATION OF THE PROGRAMME

IV.1 Declaration of data

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 aor 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 in 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.

IV.2 Selection, delivery and recovering of units

a. Selection of units to be tested

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

For the repetition 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 repetition test campaign, a model selected was the same than in a previous test campaign, the Participant shall manufacture and provide a new physical unit.

b. 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 Compliance 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).

c. 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.

IV.3 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 in the APPENDIX B.

- *The performances shall be consistent:with the declaration file AARE-1;*
- *with one another (see consistency rules in the RS/8/C/002).*

IV.4 Tests at the laboratory

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.

If any functional component is inoperative, or the unit is damaged and cannot be repaired at the Laboratory, then it is considered as a component failure. 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 one week for test.

IV.5 Report and conclusion of test

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 tolerances, the test is considered as “Passed”. If at least one deviation is out of allowed tolerance, the test is considered as “Failed” and the procedure for failure treatment shall be applied.

IV.6 Audit Procedure

a. Introduction of the audits in the programme

Factory visits are introduced in 2018 in the certification programme for Air-to-Air Regenerative heat Exchangers. As a transition period, it was decided that all production sites shall be audited within the period 2018-2019 (with at least one production site audited per year).

When this transition period will be over, all production site will be audited annually.

b. General

General audit requirements are stated in the Certification Manual.

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 IV.6c 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.

c. 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 Operational Manuals;*
- *that the products in the sales record are compliant with the declaration list;*
- *that the corrective actions plan is completed or under implementation.*

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:*

Item to be checked	***Frequency***	***Tolerance***
Foil thicknesses	*1 / lot*	*0.01 mm*

- *that the performances 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 defined in the QMS. In particular for each item listed in the table below, it will be checked that:*
  - *measurement methods are reliable;*

- *measurements are recorded.*

The auditor will check those items on a sample of five units from different batches in the production.

Item to be checked	***Frequency***	***Tolerance***
Wave length	*1 / batch[1]*	*As per RS (+/-10%)*
Wave Height	*1 / batch[1]*	*As per RS (+/- 0.1 mm)*
Average Diameter	*1 / batch[1]*	*As per RS (+/- 1%)*
Internal length	*1 / batch[1]*	*1 mm*
Purge angle	*1 / batch[1]*	*1°*
Rotor speed	*1 / batch[1]*	*2 rpm*
Aluminium foil thickness	*1 / batch[1]*	*Acc. manufacturer*
Sorption coating thickness Or % of the weight	*1 / batch[1]*	*Acc. manufacturer*

[1] 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.

- *that the factory personnel is qualified to perform the specific tasks if any;*
- *that every product traceability is ensured;*
- *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));*
- *that the delay for the distribution of the selection programme is described in the QMS (maximum 1 month after each update);*
- *that the sealing material and configuration is in accordance with the declaration.*

d. 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.

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.*

IV.7 Failure treatment

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.

In case of failure on efficiency for sorption unit, Eurovent Certita Certification shall reconsider the unit's classification given by the manufacturer and update the website with the new classification according to test results.

(2) Ask for a second test on the same unit. 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).

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

IV.8 Non-application of procedures

See dedicated chapter in Certification Manual.

V. PROMOTION OF THE PROGRAMME

V.1 By 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

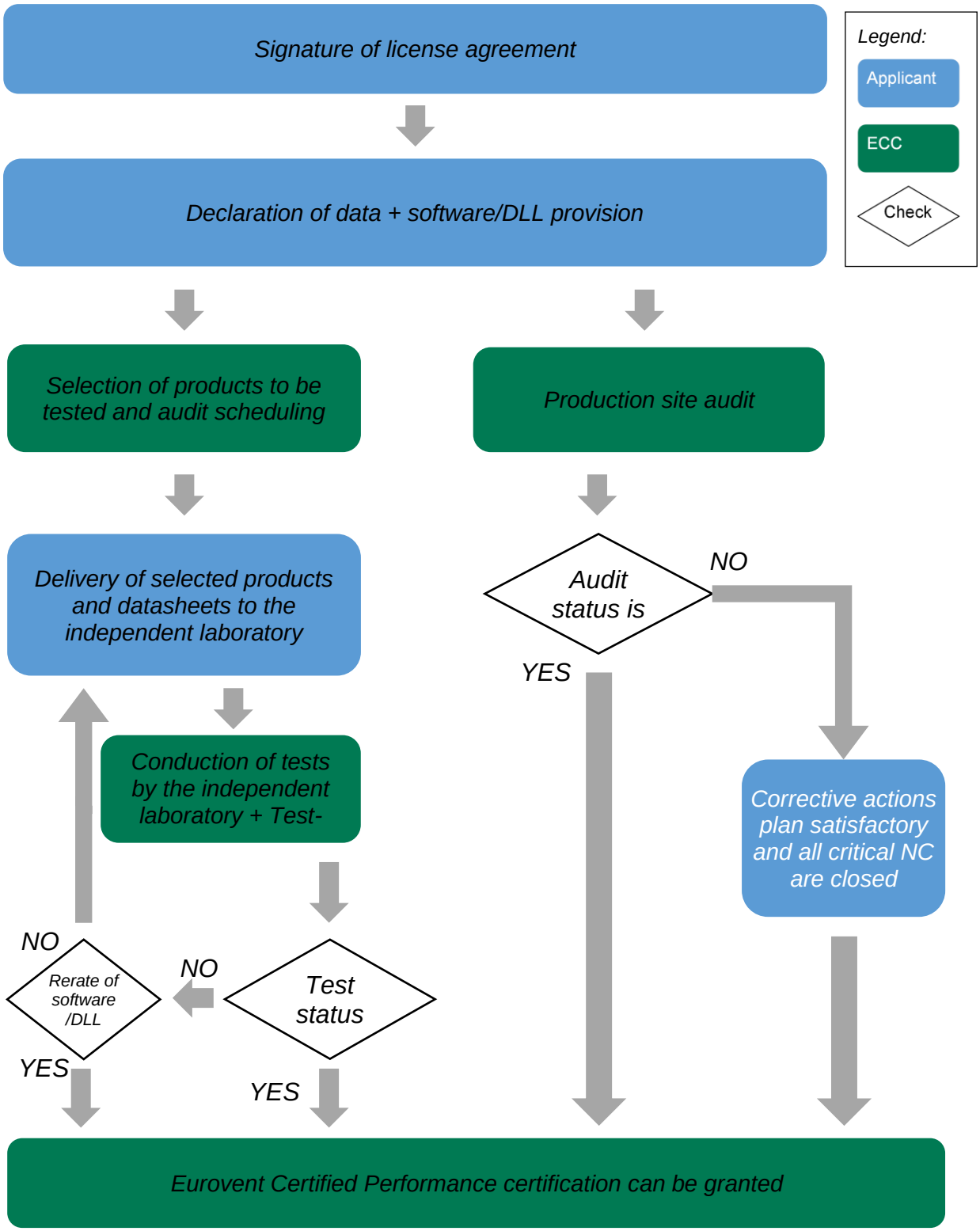
V.2 By Participants

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).

APPENDIX A. CERTIFICATION PROCESS AND SCHEDULE

A.I. Qualification procedure



A.II. Repetition procedure

Certification step	*Deadline*
Eurovent Certita Certification asks for update of list and software from the Participant *and sends the notification(s)/invoice(s) for the audits in all factories.*	*30/09/n-1*
The participant sends the updated declaration file as well as the software/DLL	*15/11/n-1*
Eurovent Certita Certification sends *the list of selected models to the participant* (regular tests + penalty tests from the previous test campaign) *and schedules the audit of all production sites.* *All payments linked to the audits are completed by the participant.*	*15/12/n-1*
Selection list is confirmed	31/01/n
The auditor audits all the production sites Delivery + Technical data sheet + payments are completed *for all tests.*	31/03/n
The participantsends the non-conformity corrective action plan whenever applicable	*Deadline set up by the auditor*
The auditor evaluates the corrective action plan relevance	*31/05/n*
Eurovent Certita Certification sends the diploma if all elements are received	30/06/n
Diploma validity	30/06/n+1
All first tests finished by the laboratory	31/07/n
Eurovent Certita Certification sends test results (software checking)	30/08/n
Eurovent Certita Certification sends selection list for second test	30/09/n
Delivery + Technical data sheet + payment are completed for second tests	31/10/n
Second tests are finished by the laboratory	30/11/n
Correction of the software after failure	1 month

APPENDIX B. 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 extraxt 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 explicitely in accordance to Rating Standard 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 Compliance Committee meeting held on 1st October 2015

Table 1: Information to be found as outputs and on the printouts

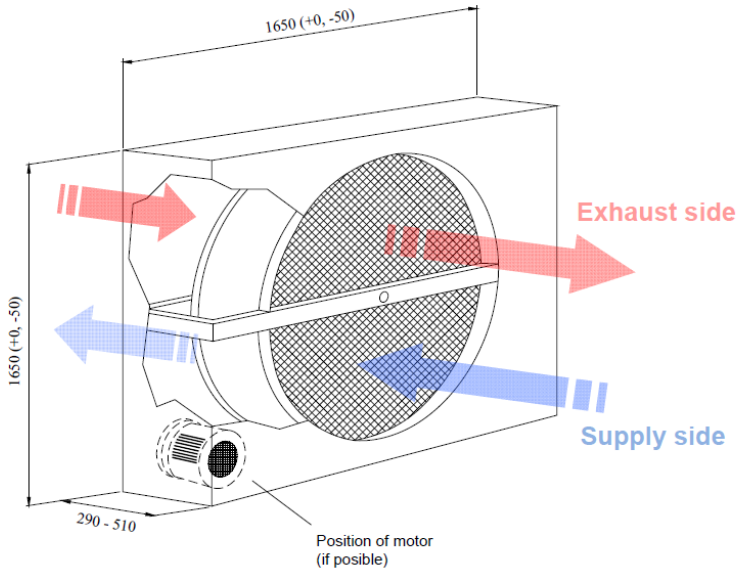
SYMBOL	RECOMMENDED NAME	Output	Printout
	Type key		Mandatory
	Basic material		Mandatory(1)
	Diameter (rotary) in mm		Mandatory(1)
	Internal length in mm		Mandatory(1)
	Purge angle in deg		Mandatory(1)
n	Rotating speed (rotary)		Mandatory
	Thickness		Mandatory(1)
	Wave height in mm		Mandatory(1)
	Unit type (condensation/hygroscopic/sorption)		Mandatory(1)
	Face air velocity in m/s	Mandatory	Mandatory
$\mathbf{q_m}$ $\mathbf{q_v}$ $\mathbf{q_{vn}}$	air mass flow rate or Standard air volume flow rate (1.2 kg/m3)	Mandatory	Mandatory
$\mathbf{p_a}$	Atmospheric pressure		Mandatory
$\cdots_{11}$	Extract air [if Exhaust air is used]		Mandatory
	Exhaust air inlet(1) [if Exhaust air outlet is used]		
t_{11}	Extract air temperature		Mandatory
φ_{11}	Extract air relative or absolute humidity		Mandatory
q_{11}	Extract air airflow		Mandatory
$\cdots_{21}$	Supply air inlet(1)		Mandatory
t_{21}	Supply air inlet temperature		Mandatory
φ_{21}	Supply air relative or absolute humidity		Mandatory
q_{21}	Supply air inlet airflow		Mandatory
$\cdots_{12}$	Exhaust air [if Extract air is used]	Mandatory	Mandatory
	Exhaust air outlet(1) [if Exhaust air inlet is used]		
t_{12}	Exhaust air temperature	Mandatory	Mandatory
φ_{12}	Exhaust air relative or absolute humidity	Mandatory	Mandatory
q_{12}	Exhaust air airflow	Mandatory	Mandatory
$\cdots_{22}$	Supply air outlet(1)	Mandatory	Mandatory
t_{22}	Supply air temperature	Mandatory	Mandatory
q_{22}	Supply air airflow	Mandatory	Mandatory
$\mathbf{\Delta p_1}$	Pressure drop on exhaust air side at standard condition (1.2 kg/m3)	Mandatory	Mandatory
$\mathbf{\Delta p_2}$	Pressure drop on supply air side at standard condition (1.2 kg/m3)	Mandatory	Mandatory
η_t	Temperature efficiency dry [for plates]	Mandatory	Mandatory
	Temperature efficiency wet [*for plates without humidity transfer*]		
	Temperature efficiency [for regeneratives]		
η_x	Humidity efficiency (plates with humidity transfer)	Mandatory	Mandatory
	Humidity efficiency (regenerative)	Mandatory	Mandatory
EATR	Exhaust air transfer ratio in %	Mandatory	Mandatory
OACF	Outdoor air correction factor (-)	Mandatory	Mandatory
$\mathbf{\Delta p_{22\text{-}11}}$	Static pressure difference	Mandatory	Mandatory
(1): the information can be found in the type key			

APPENDIX C. LABORATORY LIMITS

C.I. For rotary heat exchangers

Minimum air flow rate: 1500 m^3/h
Maximum air flow rate: 7000 m^3/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.II. For alternative storage matrices

Air flow rates: **1500 m^3/h – 7000 m^3/h**

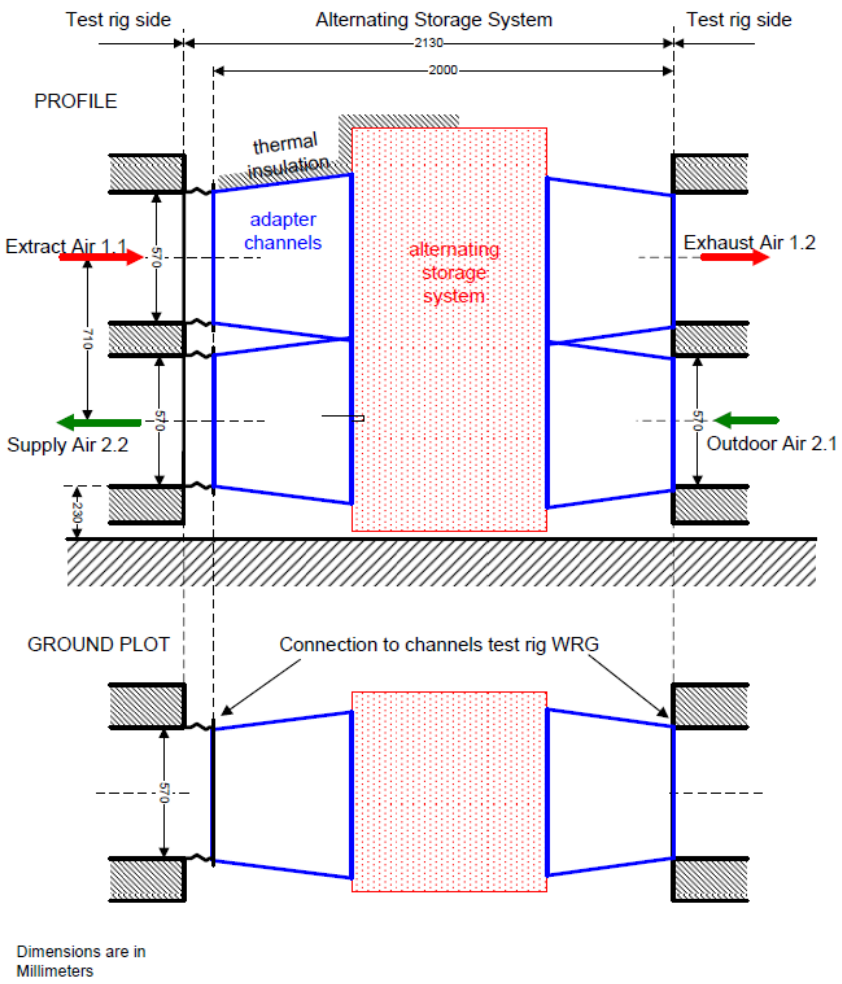


Figure 1: Installation situation alternating storage system. The whole unit with demountable adapter channels are delivered by the manufacturer (adequate thermal insulation included).

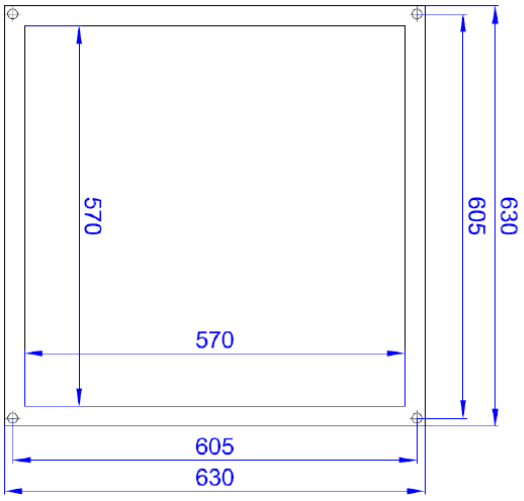


Figure 2: Connection frame of the four channels from the test rig WRG. The adapter channels have to fit to this frame

APPENDIX D. FORMS

D.I. Form AARE-1: Declaration file

The for 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.II. Form *AARE-2*: Technical datasheet *(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 fors AARE-1 duly completed.

A template will be available for information and upon request.

D.III. 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.

Software Revision	Date	Brief Description of update	Effect on software ECC Certified performance (Y/N)
		For instance: Logo update	Yes ☐ No ☐
		Prices	Yes ☐ No ☐
		Dll...	Yes ☐ No ☐
			Yes ☐ No ☐

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.

SYMBOL	FORMULA	RECOMMENDED	ACCEPTED	FORBIDDEN
$\mathbf{t}$		Temperature[1]		
$\mathbf{x}$		Absolute humidity[1]	Humidity	
			Moisture contents[1]	
			Moisture[2]	
$\mathbf{h}$		Total enthalpy[3]	Specific enthalpy[3]	
			Enthalpy[2]	
$\mathbf{\cdots 11}$		Extract air [if Exhaust air is used]		
		Exhaust air inlet[1] [if Exhaust air outlet is used]	Exhaust air in [if Exhaust air out is used]	
			Exhaust air entering[2]	
$\mathbf{\cdots 21}$		Supply air inlet[1]	Supply air in	
			Supply air entering[2]	
			Fresh air	
$\mathbf{\cdots 12}$		Exhaust air [if Extract air is used]		
		Exhaust air outlet[1] [if Exhaust air inlet is used]	Exhaust air out [if Exhaust air in is used]	
			Exhaust air leaving (2)	
$\mathbf{\cdots 22}$		Supply air outlet[1]	Supply air out	
			Supply air leaving[2]	
			Supply air [if Fresh air is used]	
$\mathbf{\cdots w}$		Wet bulb[1]		
$\mathbf{\cdots d}$		Dry bulb[2]		
$\mathbf{Q_{HRS}}$		Capacity of the heat recovery system	Capacity of the HRS[3]	
			HRS capacity	
			Recuperation power	
$\mathbf{P_{el}}$		Electric power consumption[3]		
$\mathbf{\eta_t}^{(*)}$	$\eta_t = \frac{t_{22} - t_{21}}{t_{11} - t_{21}}$	Temperature efficiency dry[*] [for plates]	Temperature ratio dry[*] [for plates]	Efficiency [without Temperature or Sensible or Latent in front]
		Temperature efficiency wet[*] [for plates]	Temperature ratio wet[*] [for plates]	
				Ratio [without Temperature in front]

		Temperature efficiency(*) [for rotaries]	Temperature ratio(*) (1) [for rotaries]	
				Temperature efficiency [for plates, without dry or wet after]
				Temperature ratio [for plates, without dry or wet after]
			Sensible efficiency(*)	
			Latent efficiency(*)	
η_x(*)	$\eta_x = \frac{x_{22} - x_{21}}{x_{11} - x_{21}}$	Humidity efficiency(*)	Humidity ratio(*) (1)	
η_h	$\eta_h = \frac{h_{22} - h_{21}}{h_{11} - h_{21}}$	Total efficiency	Total ratio	
			Enthalpy efficiency	
			Enthalpy ratio	
ϵ_t	$\epsilon_t = \frac{\dot{m}}{\dot{m}_{min}} \cdot \frac{t_{22} - t_{21}}{t_{11} - t_{21}}$	Sensible effectiveness dry [for plates]	Temperature effectiveness dry [for plates]	Effectiveness [without Temperature or Sensible in front]
		Sensible effectiveness wet [for plates]	Temperature effectiveness wet [for plates]	
				Temperature effectiveness [for plates, without dry or wet after]
		Sensible effectiveness(4) [for rotaries]	Temperature effectiveness [for rotaries]	
				Sensible effectiveness [for plates, without dry or wet after]
ϵ_x	$\epsilon_x = \frac{\dot{m}}{\dot{m}_{min}} \cdot \frac{x_{22} - x_{21}}{x_{11} - x_{21}}$	Latent effectiveness(4)	Humidity effectiveness	
ϵ_h	$\epsilon_h = \frac{\dot{m}}{\dot{m}_{min}} \cdot \frac{h_{22} - h_{21}}{h_{11} - h_{21}}$	Total effectiveness(4)	Enthalpy effectiveness	
			Total heat effectiveness	
η_e	$\eta_e = \eta_t \cdot (1 - 1/\epsilon)$	Energy efficiency (always defined for balanced airflows.)	Energetic efficiency	Efficiency(3) [without Energy or Energetic in front]
ϵ	$\epsilon = Q_{HRS}/P_{el}$	Coefficient of performance(3)		

(*): The use of "Exhaust", "Extract", or any equivalent before the temperature and humidity efficiencies is strictly forbidden (See also *APPENDIX B*)

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