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RATING STANDARD
for the
CERTIFICATION
of
**Heat Recovery Systems with
intermediate heat transfer medium**

RS/7/C/009-2016

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I. PURPOSE

The purpose of this Rating Standard is to establish definitions and specifications for testing and rating of Heat Recovery Systems with intermediate heat transfer medium (HRS-COIL) for the related Eurovent Certified Performance (ECP) certification programme, in accordance with Operational Manual OM-18.

II. SCOPE

II.1 General

The programme scope covers the heat recovery exchangers with intermediate heat transfer medium corresponding to the category IIa (“without phase change”) of the EN 308:1997 standard, that is Run Around Coils systems.

The present programme does not cover other types of air to air heat exchangers like Air to Air Plate Heat Exchangers (AAHE) or Air to Air Regenerative Heat Exchangers (AARE) for which dedicated Eurovent Certified Performance programmes exist.

II.2 Certify-all requirement

Whenever a company participates in the programme for HRS-COIL, all heat recovery exchangers with intermediate heat transfer medium 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 the relevant Rating Standard. This includes all models in modular ranges. For the HRS-COIL programme, the certify-all requirement as defined in the Certification Manual is applicable not only to the European market but worldwide.

III. DEFINITIONS

For definitions regarding the certification scheme refer to Certification Manual.

III.1 Heat recovery system with intermediary heat transfer medium

Heat exchanger or combination of heat exchangers that transfer heat between exhaust and supply air flows by the means of an intermediary heat transfer medium and depending on the differential of temperatures.

III.2 Run around coil system

A run around coil system, simply called “system” in the programme, consists of a coil in the extract air and a coil in the supply air; with a pipe system in between to transfer the recovered energy from one air stream to another.

The coil located in the extract-exhaust air stream is called “exhaust coil” and the coil located in the outdoor-supply air stream is called “supply coil” in the HRS-COIL Certification programme.

III.3 Range for Run around coils

Coils dedicated to heat recovery and having the following identical features:

- designation
- tube outside diameter
- tube arrangement :
 - pitch height : tube spacing (i.e perpendicular to the air flow)

- pitch depth : row spacing (i.e in direction of the air flow)
- tube alignment (in-line or staggered)
- minimum and maximum number of rows
- minimum and maximum number of tubes per row
- minimum and maximum finned length

III.4 Row

A bank of tubes that are located in a plane at right angle to the direction of the air flow.

III.5 Basic Model Group

Within a range, models which are essentially the same or comparable in terms of basic components and/or configurations combinations are gathered into basic model groups (BMG).

The following variations distinguish one BMG from another:

- tube type (plain or inner-grooved)
- tube material category
 - standard : Copper (Cu);
 - special : any other material;
- fin type (flat, corrugated, louvered, wavy)
- fin material for a given fin type
- reference fin spacing (RFS) for a given fin thickness

A reference fin spacing (RFS) is considered representative of a range of fin spacings from 0.7 to 1.3 times its value.

Example: The applicant range covers fin spacings (FS) from 2.0 to 8 mm in the following steps: 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 7.0 and 8.0 mm. Considering the aforementioned rule there are three (3) reference fin spacings (RFS):

- **2.5** covers the range [1.8; 3.3] so it is considered representative of 2.0, 2.5, 3.0
- **5.0** covers the range [3.5; 6.5] so it is considered representative of 4.0, 5.0, 6.0
- **8.0** covers the range [5.6; 10.4] so it is considered representative of 7.0 and 8.0

III.6 Dry heat recovery efficiency

The dry heat recovery efficiency is a temperature ratio defined on the supply-air side for equal air flows and winter conditions (no condensation on the exhaust air side):

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

The temperatures at the coils limits are the following:

- t₁₁: exhaust air inlet (“extract air”) dry temperature (°C)
- t₁₂: exhaust air outlet (“exhaust air”) dry temperature (°C)
- t₂₁: supply air inlet (“outdoor air”) dry temperature (°C)
- t₂₂: supply air outlet (“supply air”) dry temperature (°C)

IV. TESTING REQUIREMENTS

IV.1 Test standard

Test shall be conducted in accordance with EN 308:1997, “Heat Exchangers - Test procedures for establishing performance of air to air and flue gases heat recovery devices”.

IV.2 Particular specifications for testing

The following specifications are applicable for qualification tests and repetition tests.

a. Maximum dimensions

The coils constituting the system to be tested shall have the following dimensions:

- Casing length (external) maximum 1 meter
- Casing height (external) maximum 1 meter

For simplicity, the exhaust and supply coils size shall be the same whenever possible.

b. Dimensional check

Before testing, the laboratory shall check dimensions to ensure that the coils delivered correspond to the selected system. The following tolerances are acceptable:

- Finned length $\pm 0,5 \%$, with at least ± 5 mm
- Finned height of the coil ± 5 mm
- Finned depth (width) of the coil ± 5 mm
- Total number of fins $\pm 4 \%$, with at least ± 2 fins
- Diameter of (expanded) tube outside the coil ± 1 mm

If one of the dimensions is not compliant, the laboratory shall not perform the test and contact Eurovent Certita Certification who shall ask the applicant/participant to send a new coil for testing (see also Operational Manual).

c. Heat exchange fluid

The tests shall be performed with water+25% ethylene-glycol mix. It is considered that testing with the water+25% ethylene-glycol mix is representative of run-around-coil systems using a water + 0-50% ethylene-glycol or propylene-glycol mix. To ensure the comparability of test results the CLARIANT product “Antifrogen® N” shall be used.

d. Standard conditions

The certified performances shall be measured for the three (3) standard conditions defined in Table 1.

The standard condition 1 (SC1) will be used as design condition to run the software in design mode, with a dry heat recovery efficiency of 63% (68% from January, 1st 2018) as minimum requirement for design, contrary to SC2 and SC3 which will be operating conditions only.

Table 1: Test Standard Conditions (SC)

SC	t_{11}	t_{w11}	t_{21}	q_{v11}	q_{v21}	Heat transfer medium
1	25	<14	5	6000	6000	<i>Water + 25% ethylene-glycol mix</i>
2	25	<14	5	3000	3000	
3	25	<14	5	5100	6000	

The abbreviations used in Table 1 are detailed in Table 2.

Table 2: Abbreviations used in Table 1

t	Dry bulb air inlet temperature	°C
t_w	Wet bulb air inlet temperature	°C
q_v	Air volume flow rate	m ³ /h
11	Subscript related to exhaust air inlet (“extract air”)	-
21	Subscript related to supply air inlet (“outdoor air”)	-

V. RATING REQUIREMENTS

V.1 Test-check

Eurovent Certita Certification shall conduct a “test-check”, i.e. the performances will be recalculated at the test operating conditions using the selection software.

A performance item fails when the difference between the recalculated value recalculated and the test results differs by more than the allowable tolerance (see VII).

A test fails when one or more performance items fail.

V.2 Air density

Standard air density is set at 1.20 kg/m³. It is mandatory to display the certified performances items under the standard conditions in the software outputs. It is allowed to display any other values if accompanied by the underlying air density.

VI. CERTIFIED PERFORMANCE ITEMS

The following performance characteristics, as defined in EN 308:1997, declared by the applicant/participant shall be verified by tests:

- Dry heat recovery efficiency [%]
- Air side pressure drop at standard air density [Pa]
- Fluid (water+25% ethylene-glycol mix) side pressure drop [kPa]

VII. TOLERANCES

When tested in the laboratory the obtained performance data shall not differ from the recalculated values (“test-check”) by more than the following tolerance values:

- Dry heat recovery efficiency: -3 percentage points (abs. deviation)
- Air side pressure drop at standard conditions for each coil: Maximum [+10 % ; +15 Pa]
- Fluid side pressure drop for each coil: Maximum [+10 % ; +2 kPa]

The relative deviation (in %) between the measured value X_{meas} and the recalculated value X_{recal} is calculated as follows:

$$\Delta_{rel} = (X_{meas} - X_{recal}) / X_{recal}$$

The absolute deviation between the measured value X_{meas} and the recalculated value X_{recal} is calculated as follows:

$$\Delta_{abs} = X_{meas} - X_{recal}$$

If any of individual points of measurement shows a deviation larger than the acceptable tolerance, the failure shall be declared and the failure procedure applied.