



**RS 6/C/003A-2015**

Published December 2014

**RATING STANDARD  
for the  
CERTIFICATION  
of  
HEATING-ONLY  
HYDRONIC HEAT PUMPS**

# RS 6/C/003A-2015

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## Modifications as against last version:

Nb	Modifications	Section	Page
1	Updating Testing Requirements with new EN 14511:2013 and EN 14825:2013	IV.1, IV.2	5 & 6
1	TOL Verification + test method according EN 14511	IV.3	6
2	New sound power level tests according Regulation + Optional sound power level tests for water cooled units	IV.4	6
3	Splitting CHF Application in 2: Heating Floor and Cooling Floor	V.4	10
5	Adding Certified performances in Seasonal Efficiency	VI	10

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Published by Eurovent Certita Certification S.A.S  
48-50 rue de la Victoire, 75009  
Paris, France

Tel: +33 1 75 44 71 55  
E-mail: [a.lacourt@eurovent-certification.com](mailto:a.lacourt@eurovent-certification.com)

## TABLE OF CONTENTS

<b>I. PURPOSE</b>	<b>4</b>
<b>II. SCOPE</b>	<b>4</b>
<b>III. DEFINITIONS</b>	<b>4</b>
III.1 General definitions .....	4
III.2 Energy Classification .....	5
<b>IV. TESTING REQUIREMENTS</b>	<b>5</b>
IV.1 Heating Capacity for heating-only Hydronic Heat Pumps .....	5
IV.2 <i>Power consumption during off mode, thermostat off mode, standby mode and crankcase heater mode.</i> .....	6
IV.3 <i>TOL verification</i> .....	6
IV.4 Sound Power Level .....	6
IV.5 Testing in Participant's Laboratory .....	7
a. Introduction .....	7
b. Basic outline of the procedure .....	7
c. Detailed procedure .....	7
IV.6 P <sub>sb</sub> .....	9
IV.7 LR <sub>contmin</sub> and CcpLR <sub>contmin</sub> .....	9
<b>V. RATING REQUIREMENTS</b>	<b>9</b>
V.1 General requirements .....	9
V.2 Treatment of heat exchangers frosting .....	9
V.3 Checking of refrigerant .....	9
a. Composition of refrigerant .....	9
b. Refrigerant charge .....	10
V.4 Capacity Tests .....	10
<b>VI. CERTIFIED PERFORMANCES</b>	<b>11</b>
<b>VII. TOLERANCES</b>	<b>12</b>

## I. PURPOSE

The purpose of this Rating Standard is to establish definitions and specifications for the operation of the Certification Programme for heating-only Hydronic Heat Pumps.

## II. SCOPE

The scope of the programme is defined in the relevant Operational Manual OM-3.

This standard describes the rating standards for heating-only Heat Pumps. Rating standards for cooling-only and reversible Liquid Chilling Packages or Heat Pumps are given in RS 6/C/003.

## III. DEFINITIONS

### III.1 General definitions

**Certified Published Ratings:** A statement of the assigned values of those performance characteristics under stated rating conditions, by which a unit may be chosen to fit its application. These values apply to all units of nominal size and type produced by the same Participant.

The term "published rating" includes those shown on the unit, published in specifications, advertising computer selection programmes and other literature controlled by the Company. If the Participant publishes non-certified ratings they shall be clearly indicated.

**Standard Ratings:** A statement of performance characteristics based on tests performed at standard rating conditions as specified in this Rating Standard.

**Application Ratings:** A statement of performance characteristics based on other than standard test conditions.

**Basic Model Groups (BMG):** The basic models shall be defined by units which are essentially the same in terms of thermal performance and function and application. The same or comparable in terms of basic components, specifically fans, coils, compressors and motors. Single-phase and three-phase versions of one model belong to the same BMG.

**Hydronic Heat Pump:** A factory assembled unit of the self-contained type designed to heat liquid using a compressor, an evaporator and an integral condenser and appropriate controls.

**Liquid Pressure Drop on Evaporator:** Chilled liquid internal pressure difference between inlet and outlet of evaporator (kPa).

**Liquid Pressure Drop on Condenser:** Condenser liquid internal pressure difference between inlet and outlet of condenser (kPa).

**A-weighted Sound Power Level:** Sound power level radiated by the air source heat-pump ( $L_w(A)$ ) expressed in dB(A)

The following definitions are in accordance with EN 14511-1:

**Effective Power Input:** Average electrical power input of the unit within the defined interval of time (kW) obtained from:

- the power input for operation of the compressor(s) and any power input for defrosting
- the power input of all control and safety devices of the unit;
- proportional power input of the conveying devices (e.g. fans, pumps) for ensuring the transport of the heat transfer media inside the unit

**Heating Capacity:** Heat given off by the unit to the heat transfer medium per unit of time (kW)

**Coefficient of Performance (COP):** Ratio of the heating capacity to the effective power input of the unit (-).

**Power input in stand-by mode  $P_{sb}$ :** as defined in EN 14825:2012.

**$LR_{contmin}$ :** Load rate under which a unit with a variable speed compressor behaves as an ON/OFF unit. For staged capacity units it is the load rate of the smallest capacity step in full mode. For ON/OFF units  $LR_{contmin}$  equals 1.

**$C_{cpLRcontmin}$ :** Ratio of the COP (or EER) at  $LR_{contmin}$  and the COP (or EER) at full load.

## III.2 Energy Classification

Classification concerns COP at full load operation.

The energy efficiency of heat-pumps is designated by “Eurovent Certita Certification Class ...” in catalogues and in the present Eurovent Certita Certification Directory of Certified products. The following limits between classes have been defined (see Table 1).

**Table 1: Eurovent Certita Certification energy classification for heat pumps**

Heating Mode					
Air cooled	Air cooled ducted	Air cooled, Floor	Water cooled	Water cooled	COP Class
LCP/A/R/.../N/..	LCP/A/R/.../D/...	LCP/A/R/.../N/..	LCP/A/R/.../N/..	LCP/A/R/.../N/..	
AC	AC	CHF	AC	CHF	
$\geq 3.2$	$\geq 3.0$	$\geq 4.05$	$\geq 4.45$	$\geq 4.5$	A
$3.0 \leq COP < 3.2$	$2.8 \leq COP < 3.0$	$3.9 \leq COP < 4.05$	$4.15 \leq COP < 4.45$	$4.25 \leq COP < 4.5$	B
$2.8 \leq COP < 3.0$	$2.6 \leq COP < 2.8$	$3.75 \leq COP < 3.9$	$3.85 \leq COP < 4.15$	$4 \leq COP < 4.25$	C
$2.6 \leq COP < 2.8$	$2.4 \leq COP < 2.6$	$3.6 \leq COP < 3.75$	$3.55 \leq COP < 3.85$	$3.75 \leq COP < 4$	D
$2.4 \leq COP < 2.6$	$2.2 \leq COP < 2.4$	$3.45 \leq COP < 3.6$	$3.25 \leq COP < 3.55$	$3.5 \leq COP < 3.75$	E
$2.2 \leq COP < 2.4$	$2.0 \leq COP < 2.2$	$3.3 \leq COP < 3.45$	$2.95 \leq COP < 3.25$	$3.25 \leq COP < 3.5$	F
$< 2.2$	$< 2.0$	$< 3.3$	$< 2.95$	$< 3.25$	G

## IV. TESTING REQUIREMENTS

All standard ratings shall be verified by tests conducted by an approved independent laboratory in accordance with the following standards, and shall be established at the Standard Rating Conditions specified in Section V.

### IV.1 Heating Capacity for heating-only Hydronic Heat Pumps

**Test method:** **EN 14511-3:2013** “Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling- Part 3: Test methods”.

Test conditions: **EN 14825:2013** "Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling. Testing and rating at part load conditions and calculation of seasonal performance".

#### **IV.2 Power consumption during off mode, thermostat off mode, standby mode and crankcase heater mode.**

**EN 14825:2013** "Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling. Testing and rating at part-load conditions and calculation of seasonal performance".

#### **IV.3 TOL verification**

**EN 14511-4:2013** "Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling".

*The unit should be tested at the temperatures conditions indicated by the manufacturer as the lowest outdoor operating temperature and the laboratory testing capacity.*

*The water temperature will be at the highest temperature declared by manufacturer (Low or medium temperature)*

*The TOL verification is a start-up and running test (with clean coils), 30 minutes after starting-up, according with §4.2.1 of EN 14511.*

#### **IV.4 Sound Power Level**

Standard EN 12102:2013 shall be used in conjunction with:

- ISO Standard 9614:2009 by sound intensity method (Part 1: Measurement by discrete points)  
or
- ISO Standard 3741:2012, Precision methods for reverberation test rooms

For sound testing the following conditions shall be used:

- Test at full load in heating mode for the AC application (at 45°C)
- With the pump running
- All fans running at nominal speed
- For ducted air cooled units the same airflow and ESP shall be kept as in cooling mode
- Inlet air temperature at the evaporator shall be +7°C
- For non-ducted air-source units, the sound power to be tested is the sound power radiated outdoor side
- For ducted air-source units the sound power to be tested is the discharge sound power level.
- If defrosting occurs, data acquisition must be done 5 minutes after defrosting is completed.

*For air-cooled units with  $P_{designh}$  below 70 kW, the sound testing can be carried out also always Standard conditions (EN 14511) but in heating mode (Air Temperature = +7°C) with a water temperature in accordance with Regulations: +35°C or +55°C*

*For water-cooled units, the sound testing can be carried out, as an option, at Standard conditions (EN 14511:2013) in heating mode with a water temperature in accordance with Regulations: +35°C or +55°C*

## **IV.5 Testing in Participant's Laboratory**

### **a. Introduction**

All units with cooling capacity at Eurovent Certita Certification Standard Rating Conditions below the limits defined in the relevant Operational Manual shall be tested in an independent laboratory approved and under contract with Eurovent Certita Certification. The choice of the independent laboratory is made by Eurovent Certita Certification.

Units with higher capacity shall be tested either in an independent laboratory or in a Participant laboratory (approved by Eurovent Certita Certification) by an independent agency (selected by Eurovent Certita Certification) following the procedures specified in the Rating Standard.

The test agency is requested to install its own instruments and to carry out the complete test under its own responsibility. The Participant's personnel are requested to help during the preparation and to operate the test installation during the measurement. The Participant may perform its own measurement in parallel, but only results obtained by the independent test agency are considered by Eurovent Certita Certification.

### **b. Basic outline of the procedure**

The following procedure shall be applied:

- Approval of independent test agencies by Eurovent Certita Certification (based on technical capabilities and cost)
- Approval of Participant's laboratory by the independent agency selected by Eurovent Certita Certification (based on characteristics of test installation)
- Selection of unit to be tested by Eurovent Certita Certification
- Selection of test agency by Eurovent Certita Certification (based on availability, cost or other considerations)
- The Participant provides the selected test agency with all the required information concerning test installation
- The test agency notifies the Participant of its requirements to prepare adjustments for installation of measuring probes and instruments
- On the agreed date of test, the test agency installs its own instruments and performs the test; the Participant's personnel assures the correct operation of the installation
- Test report prepared by the test agency is sent to Eurovent Certita Certification

### **c. Detailed procedure**

#### **1. Approval of Independent Test Agencies**

The Independent Test Agency shall have qualified personnel and adequate instruments in order to meet the requirements concerning maximum acceptable uncertainty of measurement as specified in EN 14511:2013.

The cooling and heating capacity at full load shall be determined within a maximum tolerance of 5% independent of the individual uncertainties of measurement, including the uncertainties on the properties of fluids.

Concerning the acquisition time period for the output measurement, it is necessary to record all the meaningful data continuously; in the case of recording instruments which operate on a cyclic basis, the sequence shall be adjusted such that a complete recording is effected at least once every 10 s.

The test agency shall have at least the following equipment:

- Water flow rate (uncertainty + 1%): Electromagnetic flow meter class 0.3 or Ultrasonic flow meter (only intrusion)
- Temperatures (uncertainty: Liquid + 0.1 K, Air + 0.5 K): 12 PT 100 probes with display giving 0.01°C resolution
- Pressure drop (uncertainty + 5%): 2 differential transducers up to 1 bar with display (class 0.5)
- Electrical measurements (uncertainty + 1%): Wattmeter (class 0.5) or Network analyser
- Refrigerant pressure (uncertainty + 1%): Manometer (class 0.5) or Pressure transducers with display (class 0.5)
- Data acquisition system

## **2. Approval of Participant Laboratory**

The Participant shall send an application form to Eurovent Certita Certification. Essential characteristics of test installation shall be indicated. The test installation shall be able to satisfy the requirement of the EN 14511 Standard concerning the maximum permissible deviations of measured values from set values

The test installation shall be designed in such a way that requirement from test agencies concerning installation of measuring probes and instruments could be satisfied. That concerns in particular the installation of a water flow meter for which the diameter and length of the connecting pipe are specified. In order to obtain a homogeneous water temperature, a mixing device shall be used on the leaving water.

In case the test agency determines that the Participant laboratory does not fulfil the required specifications, the test shall not be carried out. The Participant shall then send his unit to the Independent Laboratory for testing.

## **3. Organisation of test**

When the unit to be tested and the test agency have been selected by Eurovent Certita Certification, the direct contact between test agency and Participant shall be established. The test agency shall provide detailed request for preparation to be executed by Participants:

- Connection of water flow meter
- Adaptor for temperature probes
- Adaptor for pressure transducer

This preparation shall be carried out before the day of the test.



The test agency and Participant shall agree on the date of test. The test agency personnel shall inspect the test installation and connect measuring devices. The test is then performed under full responsibility of the test agency.

Eurovent Certita Certification shall receive the test report prepared by the test agency.

#### IV.6 Psb

EN 14825:2012 shall be used.

#### IV.7 LRcontmin and CcpLRcontmin

A test shall be performed at LRcontmin under standard condition 30/35 in heating mode (CHF application).

### V. RATING REQUIREMENTS

#### V.1 General requirements

Tests with brine shall be carried out with the brine composition as specified in Table 2: Brine composition.

**Table 2: Brine composition**

	Medium Brine	Low Brine
Applications concerned	<b>MB, AC-MB, CHF-MB, HT-MB, VHT-MB</b>	<b>LB</b>
Brine type	<b>Ethylene Glycol</b>	
Brine composition	<b>30% (weight)</b>	<b>50% (weight)</b>

All tests shall be carried out with clean heat exchangers and that shall be specified in catalogues with published ratings.

For ducted air-source heat-pumps, tests for capacity shall be carried out at the air flow rate specified as nominal in the published ratings. A unit is considered as ducted if the measured ESP at the declared nominal airflow is higher than 30 Pa.

#### V.2 Treatment of heat exchangers frosting

The treatment of frosting shall be done according to EN 14511:2013.

#### V.3 Checking of refrigerant

##### a. Composition of refrigerant

For 10% of the total number of tests in a test campaign, randomly chosen by Eurovent Certita Certification, a sample of refrigerant is taken just after the end of the test for composition checking.<sup>1</sup>

<sup>1</sup> See minutes of meeting held on 25/04/2004

**b. Refrigerant charge**

The lack of refrigerant is a principal reason of failure on capacity. A Participant can choose to send units already equipped with Pressure / Temperature gauges (one for suction, one for discharge). In that case, checking of the values by simple reading is part of the instructions of installation of the unit.<sup>2</sup>

As an option, a Participant can request that the laboratory provide information on suction and discharge pressures and sub-cooling and superheating temperatures. That may help Participants to explain the failure. If the laboratory detects a leak of refrigerant, the test shall be stopped and the leak repaired.

If the Participant requests to check the refrigerant charge before the test, it can be done and the extra cost will be invoiced accordingly. In this case, the laboratory cannot be held responsible in case of failure due to lack of refrigerant.

**V.4 Capacity Tests**

For capacity tests the following Standard Rating Conditions (Table 3) shall be used:

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<sup>2</sup> See minutes of meeting held on 10/03/2008

**Table 3: Standard rating conditions for capacity tests in heating mode**

	Code	Evap	Cond
Heating Floor	LCP/A . . /CHF <sup>2</sup>	7 (6)	30 / 35
		2 (1)	<sup>3</sup> / 35
	LCP/W . . /CHF Water/Water	10 / 7	30 / 35
	LCP/W . . /CHF-MB Brine/Water	0 / -3	30 / 35
Air Conditioning	LCP/A . . /AC <sup>2</sup>	7 (6)	40 / 45
		2 (1)	<sup>c</sup> / 45
	LCP/W . . /AC Water/Water	10 / 7	40 / 45
	LCP/W . . /AC-MB Brine/Water	0 / -3	40 / 45
High Temperature	LCP/A . . /HT <sup>2</sup>	7 (6)	47 / 55
		2 (1)	<sup>c</sup> / 55
	LCP/W . . /HT Water/Water	10 / 7	47 / 55
	LCP/W . . /HT-MB Brine/Water	0 / -3	47 / 55
Very High Temperature	LCP/A . . /VHT <sup>2</sup>	7 (6)	55 / 65
		2 (1)	<sup>c</sup> / 65
	LCP/W . . /VHT Water/Water	10 / 7	55 / 65
	LCP/W . . /VHT-MB Brine/Water	0 / -3	55 / 65

<sup>2</sup> For air source units, both tests at +7°C and +2°C are mandatory.

## VI. CERTIFIED PERFORMANCES

The following performances at standard conditions shall be certified for heating-only Heat Pumps:

- Heating capacity [kW]
- Coefficient of Performance (COP) for the same conditions of the heating capacity [-]
- Water pressure drop at evaporator in heating mode for water-to-water units [kPa]
- Water pressure drop at condenser in heating mode [kPa]
- A-weighted sound power level for air source units in heating mode at +7°C [Lw(A)]

All ratings refer to a fouling factor equal to zero.

- P<sub>sb</sub>, LR<sub>contmin</sub> and C<sub>cp</sub>LR<sub>contmin</sub> in heating

From 26 September 2015 and for relevant unit (see OM § II.4.b)

- Capacity at P<sub>designh</sub> [kW]
- Seasonal Efficiency (SCOP & η<sub>s</sub>) [-]

The published literature or computer programme for all the products shall include all the certified performances.

<sup>3</sup> Measurement with the same *flowrate* as for the test at 7°C

## VII. TOLERANCES

When tested by the laboratory selected by Eurovent Certita Certification, the obtained values shall not differ from the claimed values by more than the tolerance (see Table 4). High deviation lead to penalty tests (see IV.4 Failure treatment in the relevant Operational Manual).

**Table 4: Table of tolerances, intermediate and high deviations**

	Tolerance	Intermediate	High deviation
<b>Heating capacity and COP at full load</b>	< -5%	< -8%	< -10%
<b>A-weighted sound power level rounded to the closest integer value</b>	> +3 dB(A)	> +5 dB(A)	> +7 dB(A)
<b>Water pressure drop</b>	+ 15%		
<b>Psb</b>	> +10%		
<b>LRcontmin</b>	+/- 5% (point)		
<b>CcpLRcontmin</b>	< - 5% (point)		