SPECIFICATIONS FOR THE

NF ELECTRICITE PEFORMANCE MARK

N° LCIE 103-15 / C

AUTONOMOUS STORAGE WATER HEATER WITH ELECTRICALLY DRIVEN COMPRESSOR

Contents

Introduction

These specifications:

- define the minimal criteria the autonomous storage water heaters with electrically driven compressors has to comply with for obtaining the NF ELECTRICITE *Performance* Mark
- cover various thermodynamics sources
- apply to the storage water heaters with electrically driven compressors with a volume greater or equal than75 liters and less than 400 liters
- take into account the requirements of the standard EN 16147 (2017)

List of relevant standards

EN 60335-1	General requirements for the safety of household and similar electrical appliances
EN 60335-2-21	Particular requirements for storage water heaters
EN 60335-2-40	Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers
EN 62233	Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure
EN 16147	Heat pumps with electrically driven compressors – Testing and requirements for marking of domestic hot water unit

Dates

Date of implementation of the specifications LCIE 103-15 / C	01/06/2018
Date of withdrawal of the specifications LCIE 103-15 / B	31/12/2018
Deadline for manufacturing certified products according to the specifications LCIE 103-15 / B	30/06/2020

1 Scope

These specifications apply to storage water heaters with electrically driven compressors hereafter named “units”, using an electric heat pump regardless of any additional energy.
These units are equipped with at least one control thermostat and the storage volume is greater than or equal to 50 liters and less than 400 liters.
This specification defines the applicable test methods as well as the general and specific requirements for different types of units.

2 General requirements for obtaining the NF ELECTRICITE PERFORMANCE mark

Obtaining the NF ELECTRICITE PERFORMANCE mark requires compliance with the required standards in force for the attribution of the NF ELECTRICITE mark, to which must be added the general and specific requirements described below and defined on the basis of the EN 16147 standard (performance).

3 Définitions

The unit is an autonomous hot water system. Thanks to thermodynamic technology, it makes it possible to heat water using mainly renewable energy. The apparatus comprises all the elements of a heat pump associated with a hot water storage tank.

3.1 Types of heat source

Exhaust Air:
The heat pump uses only the calories of the air extracted from the housing from a single flow controlled mechanical ventilation (VMC).
This system also provides general and permanent ventilation of the dwelling in accordance with the French regulations of March 24th, 1982 and October 28th, 1983, or according to a technical notice

Outside Air:
The heat pump uses the calories from the outside air.

Mixed Exhaust Air[1]:
The heat pump uses the calories of the extracted air mixed with the outside air.
This system also provides general and permanent ventilation of the dwelling in accordance with the French regulations of March 24th, 1982 and October 28th, 1983, or according to a technical notice. It must be equipped with a control system for extract air / outdoor air mixture.

Multisource Exhaust Air[2] :
The heat pump uses the calories of the extracted air and at least another source of air located outside the heated volume, from non-upgraded energies, with a temperature above 20 ° C. These systems are equipped with a system for controlling this combination of air, in the apparatus or in a remote manner.
This system also provides general and permanent ventilation of the dwelling in accordance with the French regulations of March 24th, 1982 and October 28th, 1983, or according to a technical notice.

Ambient air (indoor air or air from an unheated space):
The heat pump uses the calories from the ambient air where the appliance is placed.

Geothermal sensor with water and glycol water:
The heat pump uses the calories of a network of buried sensors containing glycol water. In a system with water on ribbon, the evaporator shall be provided with a safety minimum flow.

[1] Since the source type "Mixed Exhaust Air" is not currently automatically taken into account in IdCET and Th-BCE, it may be necessary to use a "titre V" to valuate the COP and Pes certified values.
[2] Since the source type "Multisource Exhaust Air" is not currently automatically taken into account in IdCET and Th-BCE, it may be necessary to use a "titre V" to valuate the COP and Pes certified values.

Geothermal sensor with direct expansion (evaporation):
The heat pump uses the calories of the ground through a buried sensor with direct expansion which plays the role of the evaporator.

Return of the heating circuit and regulated water loop[3]:
The heat pump uses the calories from the return of the heating circuit. This allows you to recover, during a period of non-heating, the calories that are generated by the sunshine of the rooms and by the equipment present on the premises.

3.2 Installation of the water heater

The units must be installed according to the manufacturer's instructions and in accordance with § 5 of EN 16147.

3.3 Symbols and abbreviations

The symbols and abbreviations are those listed in § 4 of EN 16147.

Additional abbreviations:

θ_A: Maximum value of the temperature of the hot water withdrawn observed during the first two withdrawals of step E
θ_{SC}: Rated temperature of the heat source (Rated value)
θ_{as}: Rated ambient temperature of the storage tank (Rated value)
V_n Nominal volume declared by the manufacturer (see §6)
Vm Measured storage volume (l)

Throughout the document the COPDHW is noted COP.

4 General requirements and test methodology

4.1 Test conditions :

The settings and test conditions are those described in § 6 of EN 16147.
For outdoor air, the test is performed according to average climate conditions.

4.2 Additional test conditions:

Type of heat source	Heat source Air temperature (°C) (a)	Heat source Inlet / outlet temperatures or bath temperature (°C)	Ambient temperature range of the heat pump (°C)	Ambient temperature of the storage tank (°C)
Return of the heating circuit and regulated water loop	/	25/22	Between 15 and 30	20
Mixed Exhaust Air	7 (6)	/	Between 15 and 30	20
Multisource Exhaust Air	20 (12)		Between 15 and 30	20

(a) All air temperatures are dry, wet temperatures are in brackets

[3] Since the source type "Return of the heating circuit …" is not currently automatically taken into account in IdCET and Th-BCE, it may be necessary to use a "titre V" to valuate the COP and Pes certified values.

A unit operating in "ambient air" is compulsorily tested in "indoor air at 20 ° C" and "air unheated space at 15 ° C" condition. The information necessary for the adjustment of the product to carry out the tests must be indicated (whether on the instructions or via the control interface or any other available means accompanying the device).

4.3 Additional test conditions for units using exhaust air or mixed exhaust air or multisource exhaust air as a source of heat:

4.3.1 Determination of test rates and associated performance

The manufacturer declares the scope of use covered by the unit for the production of Hot Water (DE_{ECS}). This field of use must be included in the ventilation application area (DE_{VENT}).
DE_{ECS} is tested at least twice:

- for the average flow of its minimal configuration
- for the average flow of the maximum configuration

Note: the field of use of DE_{ECS} can be different for the same product in humidity-controlled and self-regulating ventilation.

The average flow rates for the tests are determined as follows:
Minimum usage domain configuration: average flow = MIN ($Q_{ventmoy}$ x C_{dep} ; $Q_{varepspec}$ x C_{dep})
Maximum usage domain configuration: average flow = MAX ($Q_{ventmoy}$ x C_{dep} ; $Q_{varepspec}$ x C_{dep})

In self-regulating ventilation, average flow = $Q_{ventmoy}$ x C_{dep}
With: $Q_{ventmoy}$ = [(D_{ugd} x $Q_{vpointe}$ + (168 - D_{udg}) x Q_{vbase}] / 168
D_{ugd}: duration of use in high flow kitchen in h per week
$Q_{vpointe}$: high flow
Q_{vbase}: basic flow
C_{dep} = 1,1 (fixed value to be used in this document)

In humidity-controlled ventilation, average flow = $Q_{varepspec}$ x C_{dep}
With: $Q_{varepspec}$ = defrosting flow of the humidity-controlled ventilation system, according to technical opinion
C_{dep} = 1,1 (fixed value to be used in this document)

For "individual" units, including a fan:

- the average flow test of the minimum configuration of DE_{ECS} is carried out with a pressure difference of at least 50 Pa
- the average flow test of the maximum configuration of DE_{ECS} is carried out with a minimum pressure difference of 70 Pa

A COP, a stabilized power absorbed Pes, a warm-up time th and an energetic efficiency are determined for each of the tests carried out.
The certified COP and energetic efficiency value for these devices is calculated by linear interpolation from the test values for the average ventilation rate corresponding to the F4 housing configuration (1 Bath + 1 WC + 1 Shower room) and this for each ventilation systems. However, for water heaters that do not cover this configuration, the housing configuration F2 (1Bain + 1WC) is retained.

This certified COP and energetic efficiency values will be displayed for each system:
COP air exhaust on self-regulating ventilation
COP air exhaust on humidity-controlled VMC type A and B
The setting parameters for the testing of the product submitted for admission must be clearly identified to allow reproducibility of these tests during the checks.

4.3.2 Determination of the Performance for "collective" appliances that do not incorporate a fan but are evaluated from a model incorporating a fan

It is necessary to determine the power of the fan (Pvent) to exclude for the calculation of the performances of the model of use "collective" not integrating fan. Only the consumption of the fan is to be excluded. Consumptions of other auxiliaries (regulator, display, etc.) must not be removed.
Note: Absorbed power corrections defined by the formula (2) of § 7.4.1 of EN 16147 apply.

Pvent definition:
This is the power consumed by the fans built into the water heater. It is calculated by difference between the consumption of the water heater with fan in operation (Pvent + aux) and the consumption of the water heater with fan disengaged (Paux_mes), the compressor and the electrical backup being stopped in both case.
Pvent = Pvent + aux - Paux_mes

Determination method of Pvent and Paux_mes
The manufacturer must provide the method to disengage the fan during the measurement of Paux_mes. This software or mechanical method, installed permanently or temporarily for the test, must be able to be implemented from outside the thermodynamic water heater without generating malfunction.

4.3.3 Determining IdCET Performance

For exclusive use in RT2012 calculations, performance is also defined (COP and Pes) that does not integrate the auxiliary powers already taken into account in the ventilation unit.
Note: COP IdCET and Pes IdCET values are not calculated if the electrical back-up is activated during one of the stages C, D, E or F (§7 figure 2 of standard EN 16147).

4.3.3.1 Cases of "individual" use, incorporating a fan

For the calculation of the IdCET COP and the Pes IdCET the power Pvent + aux is subtracted from the electrical consumptions on the respective durations t_{TTC} and t_{es}. The corrections in formula (3) of §7.4.1 of EN 16147 do not apply.

4.3.3.2 Cases of "collective" units

The power consumed by the outdoor fan (s) is not taken into account.
For appliances with "collective" use that do not incorporate a fan but are evaluated using a model incorporating a fan, the methods of 5.3.2 apply. Consumptions of other auxiliaries (regulator, display, etc. ...) should not be removed. In any case, the corrections of formula (2) of §7.4.1 of EN 16147 do not apply.

5 Step and order of the tests

If the unit is declared to be operating entirely in off-peak hours (§ 7.3 of EN 16147), the laboratory must perform the tests taking into account this type of operation. All the tests are carried out according to the modalities of § 7.2 of the standard EN 16147.

5.1 Measurement of the storage volume V_m (l)

The test is performed according to §7.6 of EN16147..

Result
Storage capacity: **V_m** = ###, # **l**

NOTE : adding a ", #" because the standard requires a 1 / 10th indication.

5.2 Warm-up period t_h (h.min)

Test is performed according to §7.7 of standard EN 16147.

5.3 Absorbed power in steady state Pes (kW)

Test is performed according to § 7.8 of standard EN 16147.

5.4 Coefficient of Performance (COP) and Energetic Efficiency

The draw profile is the profile declared by the manufacturer. It corresponds to the one with the highest reference energy that a water heater can supply by filling the temperature and flow conditions of the said withdrawal profile, or the immediately lower withdrawal profile, the latter being at a minimum of type M. The test is carried out in accordance with § 7.9 and §7.12 of EN 16147.

The water temperature at the end of stage E (§ 7.2 figure 1 of standard EN 16147) must be greater than or equal to θ_A – 1°C, where θ_A is the temperature of the water at the beginning of step E.
During the withdrawal phases, the acquisition step is less than or equal to 3 seconds.
During the other phases of this step, the acquisition step is less than or equal to 60 seconds.

The calculated COP is rounded to the nearest 0.01 (example 3.564 => 3.56 / 3.565 => 3.57)
The calculated energetic efficiency is rounded to the nearest unit (example 94.4 => 94 / 94.5 => 95)

5.5 Reference hot water temperature and mixed water volume at 40 ° C V_{40} (l)

Test is performed according to §7.10 of standard EN 16147.

5.6 Anti-corrosion system

The unit must be equipped with an anti-corrosion system.

5.6.1 Permanent system

System that protects the tank against maintenance free corrosion throughout the life of the unit. This system allows the joint use of a permanent anti-corrosion system and one or more sacrificial anodes.
Control: Manufacturer's declaration on the presence of a 24-hour protection system, regardless of the type of power supply used.

5.6.2 Temporary system

System using one or more sacrificial anodes.
Control: declaration of the manufacturer on the presence of one or more sacrificial anodes.

5.6.3 Other system

Control: declaration of the manufacturer justifying the effectiveness of the technology used.

5.7 Thermal load of the electric back-up

The thermal load of the electrical back-up is defined as the power of the resistance (in W) divided by the surface of the body of the appliance in contact with the water contained in the tank (in cm2).
Calculation as appropriate:
- Resistance placed in a sleeve: Heating power (in W) / surface (in cm²), submerged neutral zone of the tube of the heating body including.
- Immersed resistance (shielded): Heating power (in W) / actual heating area (in cm²), neutral zone included.

Verification of the manufacturer's declaration, by calculation made according to the plans provided.

5.8 Acoustic emissions

The sound power value dB (A) must be declared by the manufacturer, who must specify the test conditions.

5.9 Tank Warranty

Control of documents accompanying the unit to ensure that the manufacturer guarantees, at least for 5 years, the tightness of the tank.

5.10 Installation and Operating Instructions

5.10.1 Unit operating on ambient air

The manufacturer must include in the installation instructions of the unit a warning about the risk of underperformance, if the device is not installed in a sufficient volume

5.10.2 Unit operating on return of the heating circuit and on regulated water loop

The manufacturer must state in the installation instructions of the unit that the heat pump uses the calories of a controlled temperature water loop and that this water loop must be heated mainly by a source of renewable energy.

5.11 Switching on the electric booster

Check that the electric back-up is switched on or off during steps C, D, E and F.

5.12 Auxiliary power

Under the thermal regulation applicable to new buildings, the power of the auxiliaries Paux is conventionally set to zero because the consumption of the auxiliaries are already integrated in the consumptions used to determine the performances of the apparatus (COP, energetic efficiency, Pes). This also applies to devices for which a non-zero Paux_mes has been measured according to §4.3.2.

6 Définitions et critères d'obtention des catégories

Measured value	Abreviation	Unit	Categorie ★★	Categorie ★★★
Storage capacity	Vm	l	$\geq V_n$	$\geq V_n$
Reference hot water temperature	θ'_{WH}	°C	≥ 52,5	≥ 52,5
Absorbed power in steady state	P_{es}	kW	$\leq 0.0001^* V_n + 0.029 + (20 - \theta_{as})/1000$	$\leq 0.0001^* V_n + 0.024 + (20 - \theta_{as})/1000$
Thermal load of the electric auxiliary		W/cm²	≤ 12	≤ 12
Volume of mixed water at 40 ° C	V_{40}	l	$\geq (\theta_A - 10) / 30 / 1.33^*V$	$\geq (\theta_A -10) / 30 / 1.22^*V$
Energetic Efficiency	η_{WH}	%	$\geq Qref / (Qref + 2.44) + \theta_{SC} / 100$	$\geq Qref / (Qref + 1.95) + \theta_{SC} / 100$
Duration of temperature: Exhaust air, mixed exhaust air, multisource exhaust air others technologies	t_h	*h.min*	 ≤ 18.00 ≤ 14.00	 ≤ 18.00 ≤ 14.00
Switching on the electric auxiliary (if existing) [4]			Switching on the electrical back-up authorized in the appliance during steps C, D, E or F	Switching on the electrical back-up not allowed in the appliance during steps C, D, E or F

[4] When the back-up is activated, the certified COP and Pes values can not be valued in IdCET and Th-BCE

7 Criteria to be Included in the License

7.1 Outdoor air

Power (W).
Voltage (V) / Frequency (Hz)
Class
IP degree
Category
Capacity (l)
Switching on the electric back-up YES / NO
COP at 7°C
Energetic Efficiency
Volume of mixed water at 40°C : V_{40} (l)
Reference hot water temperature (°C)
Absorbed power in steady state: Pes (kW)
Racking cycle
Duration of temperature setting: th
Heat load of the electrical back-up (W / cm²)
Auxiliary power (RT 2012): Paux = 0 W

7.2 Ambiant air

Power (W).
Voltage (V) / Frequency (Hz)
Class
IP degree
Category
Capacity (l)
Racking cycle
Heat load of the electrical back-up (W / cm²)
Switching on the electric back-up at 15°C or 20°C YES / NO
COP at 15°C
Energetic Efficiency at 15°C
Volume of mixed water at 40 ° C usable at 15°C: V_{40} (l) :
Hot water temperature of reference at 15°C (°C)
Absorbed power in steady state at 15°C : Pes (kW)
Duration of temperature setting at 15°C : th (h.min)
Auxiliary power at 15°C (RT 2012) : Paux = 0 W
COP at 20°C
Efficiency at 20°C
Volume of mixed water at 40 ° C usable at 20°C: V_{40} (l) :
Hot water temperature of reference at 20°C (°C)
Absorbed power in steady state at 20°C : Pes (kW)
Duration of temperature setting at 20°C : th (h.min)
Auxiliary power at 20°C (RT 2012): Paux= 0 W

7.3 Exhaust air or mixed exhaust air or multisource exhaust air

Power (W).
Voltage (V) / Frequency (Hz)
Class
IP degree
Category
Capacity (l)
Switching on the electric back-up YES / NO
Racking cycle
Heat load of the electrical back-up (W / cm²)
Auxiliary power (RT 2012): Paux = 0 W
Flow min Q1 et max Q2 of the field of use, as well as any intermediate flows
Air flow Qi (m³/h)
Volume of water mixed at 40 ° C usable at air flow Qi : Vmax (l)
Reference hot water temperature at air flow Qi (° C)
COP at 20 ° C with air flow Qi: COPi
Energetic Efficiency
Power absorbed in stabilized regime with air flow Qi : Pes (kW)
Duration of temperature with air flow Qi : th
COPIdCET with air flowr Qi
PesIdCET with air flow Qi
Air flow in Hygro A mode for F4 type housing (F2 if applicable): Qventmoy (m³ / h)
COP certified at 20°C Hygro A
Energetic Efficiency at 20°C Hygro A
COPIdCET at 20°C Hygro A
Air flow in Hygro B mode for F4 type housing (F2 if applicable): Qventmoy (m³ / h)
COP certified at 20°C Hygro B
Energetic Efficiency at 20°C Hygro B
COPIdCET at 20°C Hygro B
Air flow in auto-adjustable mode for F4 type housing (F2 if applicable): Qventmoy (m³ / h)
COP certified at 20°C Auto-adjustable
Energetic Efficiency at 20°C Auto-adjustable
COPIdCET at 20°C Auto-adjustable

Annexe I Test protocol for equipment operating on exhaust air (air flow measurements)

The purpose of this instruction is to specify the protocol for aerodynamic tests for thermodynamic water heaters operating on exhaust air.
It refers to §4 of the CDC LCIE 103-15 / C - General prescription and test methodology.

Symbols
D: connection diameter
Pe: static pressure at the entrance
Ps: static pressure at the exit
Q1: average flow of the manufacturer's minimum configuration of the field of use
Q2: average flow of the manufacturer's maximum configuration of the field of use
Qi (i≥3): additional flow (s) (optional)

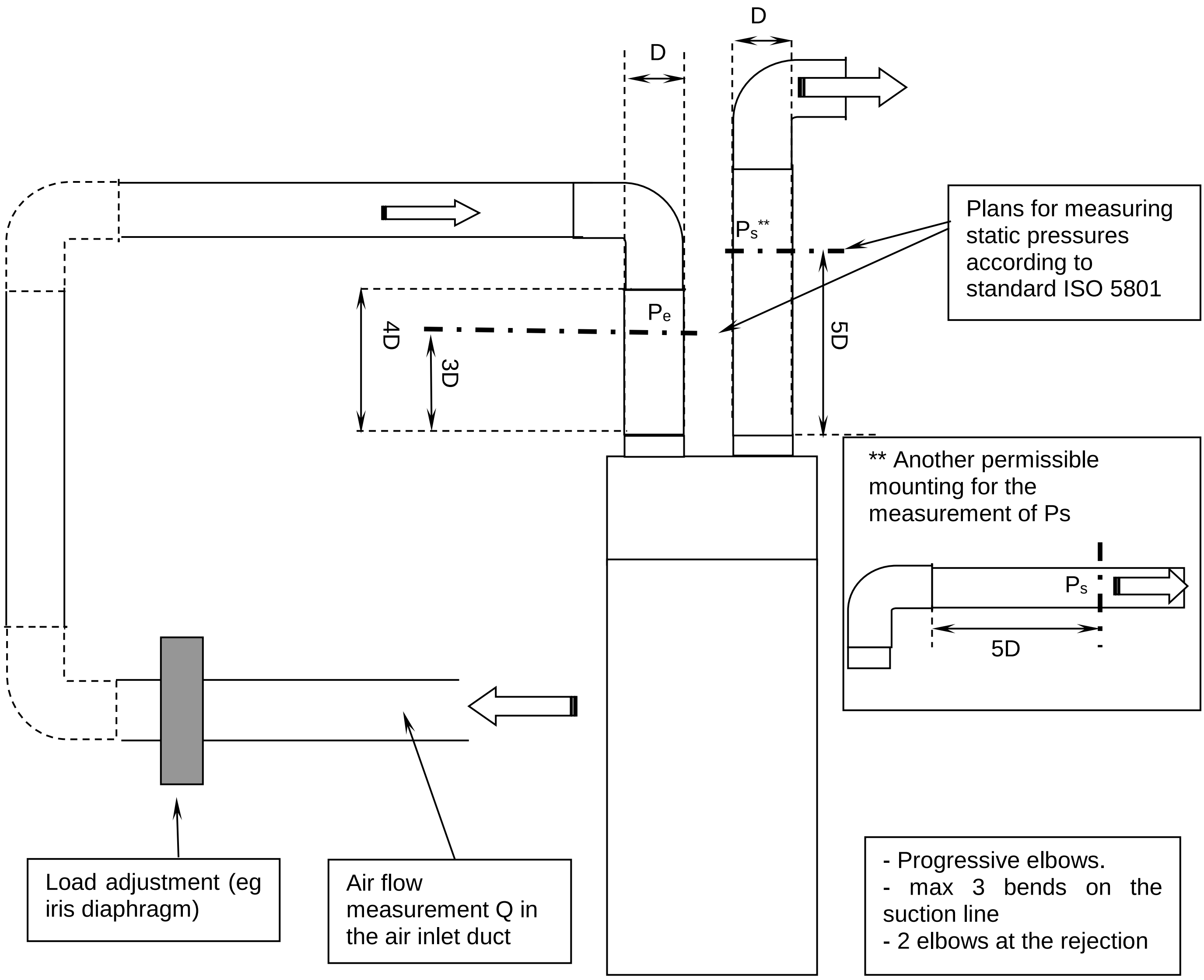

Figure n°1 : Example of aeration installation with pressure drop adjustment and air flow measurement in the inlet duct

Any aeraulic installation with pressure drop adjustment and air flow measurement in the outlet duct is also acceptable as long as it complies with the conditions of use of the equipment used.

At least two COPs called COP1 and COP2 are determined at the respective flow rates Q1 and Q2

The flow rate Q2 must be achievable with a minimum static pressure difference Ps-Pe of 70 Pa.

The flow rate Q1 must be achievable with a minimum static pressure difference Ps-Pe of 50 Pa.

Note: The flow rate setting of the device is either following the instructions provided by the manufacturer, or using an additional pressure drop.

Reference configuration:

The COP and energetic efficiency values certified for these devices are calculated for an average ventilation flow Qmref corresponding to the F4 housing configuration: 1 Bath + 1 WC + 1 Shower room or, for appliances that do not cover this area. configuration, for an average ventilation flow Qmref corresponding to configuration F2: 1 bath + 1 WC.

The COP and energetic efficiency values certified at Qmref will be linearly interpolated using the test values (at least 2) and the reference values for each system will be displayed:
VMC auto
VMC hygro

Linear interpolation of reference values from 2 tests

Figure 2 shows an example of a linear interpolation between COP1 and COP2 to determine the reference value (s) COPcertified at the average flow rate (s) of ventilation Qmref **

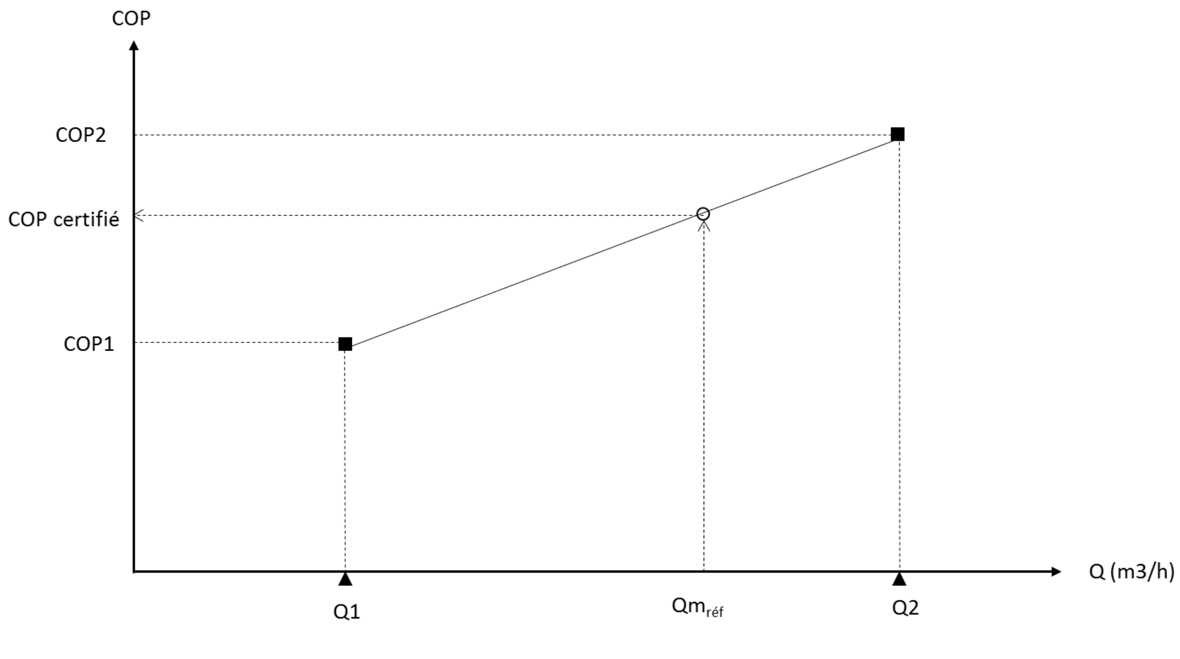

Figure n°2 : Determination of the certified COP from 2 tests

At the request of the manufacturer, the interpolation can be refined with one or more additional test points, without limiting the number of points. The static pressure rise generated by the Ps-Pe product shall be greater than 50 Pa for each additional test point.
Figure 3 shows an example of refined linear interpolation between COP1, COP3 and COP2 to determine the reference value (s) COP certified at the average flow rate (s) of ventilation Qmréf *
The principle is the same for the following certified values: energetic efficiency - warm up period t_h -

Absorbed power in steady state Pes

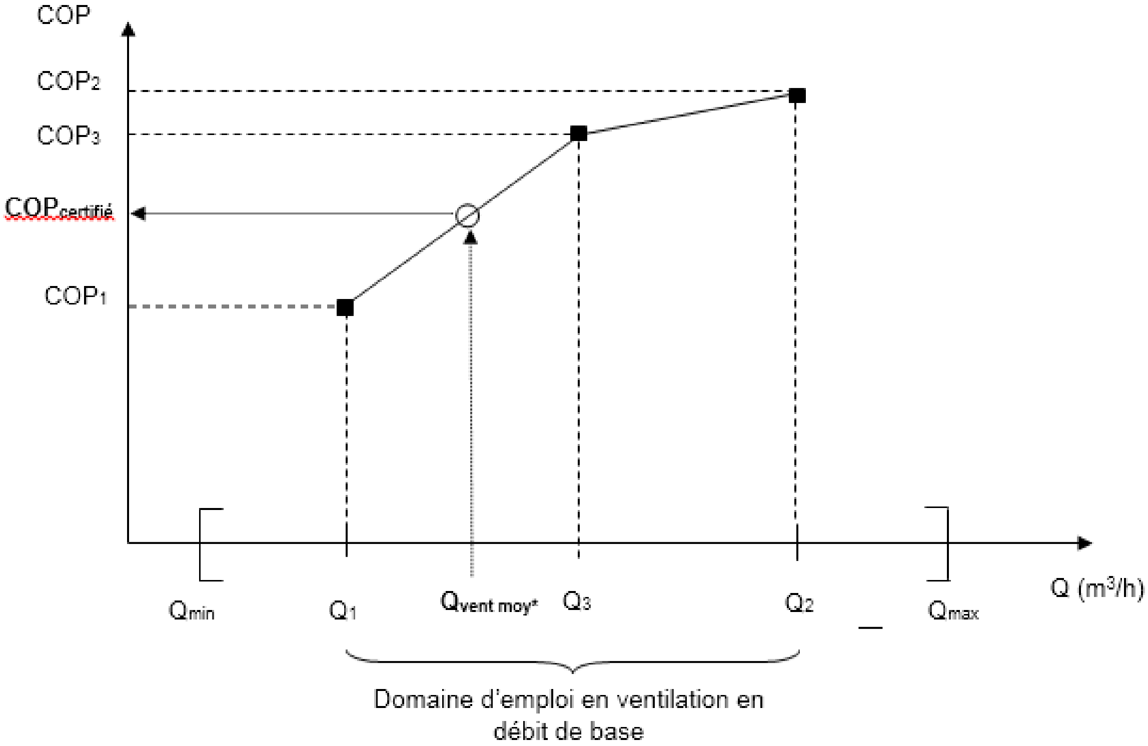

Figure n°3 : Determination of the certified COP from 3 tests

Determining the average flow rate Qmref
• For a self-adjusting system: Qmref = 126m3 / h (T4 1 Bath + 1 WC + 1 Shower room) or Qmref = 65m3 / h (T2 1 Bath + 1 WC)
• For a humidity-sensitive system: Qmref to be determined according to paragraph 4.3.1 and the technical advice issued by CSTB to the manufacturer

Annexe II Test protocol for thermodynamic water heaters with static external exchanger

This test protocol includes in all respects the EN16147: 2016 standard and the LCIE 103-15 / C specifications.

When solar gain is activated during the test, the following parameters are taken into account:
the solar flux is set at 170W / m²,
the daily sunshine duration is 12:50, it starts at 7:00 and ends at 19:50 (basic time of the test),
the sensor (s) is (are) installed vertically in the test cell facing a radiating panel placed at 1m distance. This panel is 3 meters long and 2 meters high, regardless of the size of the sensor (s) of the thermodynamic water heater. Depending on the size of the sensor (s) of the thermodynamic water heater, the laboratory of the certification body will judge the feasibility of the test.

During the entire test the aero-solar collector (s) + radiating panel assembly is in an environment with a dry temperature of 7 ° C and a humid temperature of 6 ° C (in accordance with the EN16147 standard of 2016 and the booklet). loads LCIE 103-15 / C.

The test protocol as described in the standard EN16147: 2016 and in the specification LCIE 103-15 / C remains applicable with the following specific points:
The temperature rise phase starts at 7:00 am ("virtual" time). The rise in temperature therefore starts at the same time as sunshine. If the rise in temperature was to exceed 12:50, the rest of the phase would be carried out without sunshine (time of sunshine elapsed).
At the end of the rise in temperature, the operating phase in steady state begins. Stabilized power consumption will be determined in accordance with EN16147: 2016. No sunlight will be made during this phase of tests,
The COP determination step will be carried out in accordance with the EN16147: 2016 standard and the LCIE 103-15 / C specifications with sunshine from 7:00 am ("virtual" time) to 19:50 ("virtual" time). Only one sunshine sequence will be performed during this test, regardless of the total duration of the test.
The measurement phase of the maximum water temperature achievable in thermodynamic mode takes place in the same sunshine conditions as the temperature rise phase. It starts at 7:00 am (virtual time), at the same time as sunshine. If this phase was to exceed 12:50, the rest of the phase would be done without sunshine.

Explanatory note for "solar" flux values
In order to take into account the solar contributions in determining the performances of this type of system, the evaporator is subjected to conditions of outside temperature and sunshine representative of a French "average" climate.
Calculations from the RT2005 RT 2012 weather files make it possible to determine that the average annual outdoor dry temperature of 7 ° C (EN16147: 2016 condition) is obtained for the Nancy weather. The solar radiation at the sensor level (South / inclination 90 °) and the average daily sunlight time for this geographical zone are respectively equal to 170 W / m² and 12h50min