

Annex A

HP-KEYMARK testing conditions and rerating rules

Rev.-No.:

06/12/2023

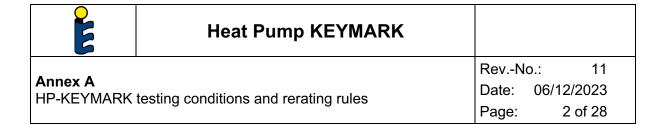
Page:

Date:

1 of 28

CONTENTS

Date	Description of modification	Revision number
14/12/2015	Initial version	1
10/03/2017	Addition of air/air Editorial changes Annex E included in Annex A – reference to prEN12102-2 suppressed – Reference to EN 15979-1 is added – rerating process chart was added –one testing point is added for periodic control test – periodic control test selection has been modified	2
12/09/2017	SCOP tool usage details Editorial changes Safety test for domestic hot water heat pumps Periodic surveillance process and rerating rules have been modified	3
07/03/2018	Addition of "one off admission testing approach" Precisions on 4 way valves in type definition Addition of nominal point for air/air heat pumps Safety tests have been renamed "operating test" Addition of operating test in the surveillance process Operating tests EN14511-4 have been updated according EN14511-4 revision Clarification of admission sample process Correction of Pes tolerance Clarification of surveillance test matrix table 4 Chart 1 is deleted	4
13/09/2018	Addition of space cooling testing requirements for water-based heat pumps Addition of non-heated space air heat source for domestic hot water heat pumps Update of EN12102-1 standard	5
19/03/2019	Re-organisation: other sections than test description and rerating rules are moved to scheme rules Hours to be considered for SEER calculation for water based heat pumps Operating test for DHW heat pump for surveillance test is corrected Introduction of testing conditions for gas heat pumps and hybrid heat pumps	6
24/09/2019	Addition of part D: CO ₂ heat pumps Addition of bin hours for the cooling mode	7
17/03/2021	Addition of part E with specific requirements for models within the same subtype not showing the same performance Clarification of acoustic test Errors in the rerating rules are corrected +	8



	Clarification of DHW testing standards for hybrid heat pumps Addition of tolerance on P _{dh} (T _i)	
10/06/2022	A.3.3: tolerance on heating up period is revised for heat pump water heaters Air/air heat pumps also providing domestic hot water are added. Section A.1.4.1,is revised; sections A.2.2.4, A.3.2.4 are added	9
28/03/2023	Rules for the selection of the operating test to be performed section A.2 Clarification of Part E	10
06/12/2023	Clarification of acoustic test Addition of separate method for hybrid testing	11



Annex AHP-KEYMARK testing conditions and rerating rules

Rev.-No.: 11

06/12/2023 Date:

Page: 3 of 28

Α.		_	iriven neat pumps	
	A.1.	Tests de	escription	5
		A.1.1.	Space heating tests	5
		A.1.2.	Space cooling tests	6
		A.1.3.	Sound power level tests	6
		A.1.4.	Hot water tests	6
		A.1.5.	Operating tests	7
		A.1.6.	SCOP and SEER calculations	7
	A.2.	Tests to	be performed at admission	8
		A.2.1.	All types except air/air type	8
		A.2.2.	Air/air type	
	A.3.	Test to	be performed for surveillance tests	
		A.3.1.	All types except air/air type	9
		A.3.2.	Air/air type	
	A.4.	•	g rules	
		A.4.1.	General rules	
		A.4.2.	Space heating/cooling performances rerating rules	11
		A.4.3.	Domestic hot water performances rerating rules	15
		A.4.4.	Sound power level rerating rules	17
		A.4.5.	Operating tests	18
B.	Hybr	id heat i	oumps	19
	B.1.	Space h	neating hybrid heat pump (cooling in option)	19
		B.1.1.	Space heating tests	19
		B.1.2.	Sound power level tests	19
		B.1.3.	Operating tests	19
		B.1.4.	Air flow for exhaust air hybrid heat pumps	19
		B.1.5.	Space cooling tests	19
	B.2.	Combin	ation hybrid heat pump	20
		B.2.1.	Space heating test	20
		B.2.2.	Sound power level tests	20
		B.2.3.	Domestic hot water tests	20
		B.2.4.	Operating tests	21
		B.2.5.	Space cooling tests	
	B.3.	SCOP a	and SEER calculations	21
C.	Gas		nps	
	C.1.	•	neating tests for low temperature heat pumps	
			neating tests for medium temperature heat pump	
			oower level testsfor exhaust air heat pumps	
			cooling tests	
	C.6.	SPER _h	and SPER _c calculations	24
			nissions	

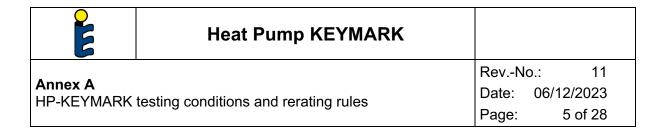


Annex AHP-KEYMARK testing conditions and rerating rules

Rev.-No.: 11

06/12/2023 Date: Page: 4 of 28

D.	CO ₂ Heat pump for domestic hot water	26
	D.1. Performance test	
	D.2. Sound power level test	
	D.3. Operating tests	
E.	Part Models within the same subtype having deviating performance	27
	E.1. Background	
	E.2. Additional tests	
	E.3. Rerating rules	



A. Electrically driven heat pumps

Electrically driven heat pump application shall be conducted using the periodic testing approach or one off admission testing approach.

A.1. Tests description

A.1.1. Space heating tests

A.1.1.1. All types except air/air type

A.1.1.1. Space heating low temperature application

The testing points to be performed are the following:

- a) A7/W35; A20/W35; B0/W35; W10/W35 according to EN 14511-2 and E4/W35 according to EN 15879-1.
- b) Bivalent temperature condition according to EN 14825 for average climate
- c) One other testing condition to be chosen by the certification body according to EN 14825 for average climate
- d) For any other climate, bivalent temperature condition shall be tested according to EN 14825

For water (brine)/water type, in case brine and water as heat source are declared, only one heat source shall be tested. The heat source to be tested is chosen by the certification body.

For exhaust air heat pump, the applicant shall declare the exhaust air volume flow that shall be used for space heating test.

A.1.1.1.2. Space heating medium temperature application

The testing points to be performed are the following:

- a) A7/W55; A20/W55; B0/W55; W10/W55 according to EN 14511-2 and E4/W55 according to EN 15879-1.
- b) Bivalent temperature condition according to EN 14825 for average climate
- c) One other testing condition to be chosen by the certification body according to EN 14825 for average climate
- d) For any other climate, bivalent temperature condition shall be tested according to EN 14825

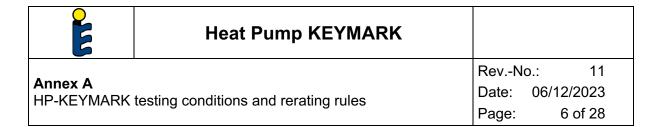
For water (brine)/water type, in case brine and water as heat source are declared, only one heat source shall be tested. The heat source to be tested is chosen by the certification body.

For exhaust air heat pump, the applicant shall declare the exhaust air volume flow that shall be used for space heating test.

A.1.1.2. Air/airr type

The testing points to be performed are the following:

- a) Bivalent temperature condition according to EN 14825 for average climate
- b) One other testing condition to be chosen by the certification body according to EN 14825 for average climate
- c) For any other climate, bivalent temperature condition shall be tested according to EN 14825
- d) As an option, A7/A20 according to EN 14511-2 can also be tested



A.1.2. Space cooling tests

A.1.2.1. All type except air/air

SEER and $P_{designc}$ for $+7^{\circ}$ C/+12 $^{\circ}$ C and/or +18 $^{\circ}$ C/+23 $^{\circ}$ C applications can be certified as an option.

The testing points to be performed for the certified application are the following:

- a) "A" testing condition according to EN 14825;
- b) One other testing condition to be chosen by the certification body according to EN 14825

If both +7°C/+12°C and/or +18°C/+23°C applications are certified, the test shall be performed as described above for both applications.

If both water and brine as heat source are certified, tests shall be carried out with either brine or water as heat source; the heat source being chosen by the certification body.

For exhaust air heat pump, the applicant shall declare the exhaust air volume flow that shall be used for space cooling test.

A.1.2.2. Air/air type

The testing points to be performed are the following:

- a) Test condition "A" according to EN 14825
- b) One other testing condition to be chosen by the certification body according to EN 14825

A.1.3. Sound power level tests

A.1.3.1. All types of space heater except air/air type

Tests shall be performed according to EN 12102-1 in heating mode for average climate at the certified highest temperature application.

For combination heat pumps certified for brine and water as heat source, the acoustic test is carried out using brine.

In case the heat pump is made of an indoor and an outdoor units, both outdoor and indoor units shall be tested.

A.1.3.2. Air/air type

Tests shall be performed according to EN 12102-1. Both outdoor and indoor units shall be tested where relevant. For package units, both outdoor and indoor sound power levels shall be measured.

A.1.3.3. Heat pump for hot water only

Tests shall be performed for average climate according to EN 12102-2 and with the same heat source as for performance tests.

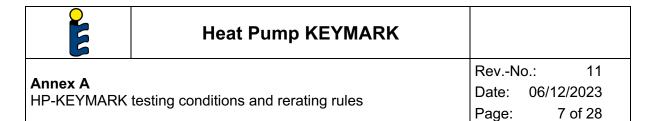
Both outdoor and indoor units shall be tested where relevant.

A.1.4. Hot water tests

A.1.4.1. Combination heat pump and air/air heat pump providing domestic hot

Tests shall be performed according to EN 16147 for average climate.

Tests may also be performed according to EN 16147 for any other declared climate.



The tests shall be performed for the load profiles as declared by the applicant for each declared climate.

For water (brine)/water type, in case brine and water as heat source are declared, only one heat source shall be tested. The heat source to be tested is chosen by the certification body.

For exhaust air heat pump, the applicant shall declare the exhaust air volume flow that shall be used for hot water test.

A.1.4.2. Heat pump for hot water only

Tests shall be performed according to EN 16147 for average climate.

Tests may also be performed according to EN 16147 for any other declared climate.

The tests shall be performed for the load profiles as declared by the applicant for each declared climate.

For hot water heat pumps that can operate with several air sources (outdoor air, exhaust air; indoor air; brine, water) only one heat source shall be tested. The heat source to be tested is chosen by the certification body.

As an option, heat pump for domestic hot water can also be tested using non-heated space air conditions, i.e. +15°C (+12°C). The test under non-heated space air condition shall be conducted in addition to the test performed using a heat source defined in regulation 814/2013.

For exhaust air heat pump, the applicant shall declare the exhaust air volume flow that shall be used for hot water test.

A.1.5. Operating tests

A.1.5.1. Space heating and cooling heat pump

Operating tests shall be performed according to EN 14511-4 as follows:

- starting and operating tests
- o shutting off the heat transfer medium flows,
- o complete power supply failure.

In case the heat pump can be used with brine or water, only one heat source (brine or water) shall be tested.

For direct exchange type, operating tests shall be carried out according to EN 15879-1 sections as follows:

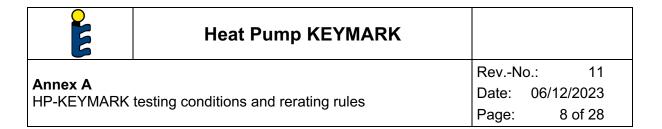
- chapter 7.1 starting tests according to Table 8
- o chapter 7.2.2 pressure drop
- o chapter 7.2.3 shutting off the heat transfer medium flow
- o chapter 7.2.4 complete power supply failure

A.1.5.2. Heat pump for hot water only

Operating test shall be performed according to EN 16147:

- 8.1.: temperature operating range
- o 8.3.: safety devices checking test
- 8.4.: condensate draining

A.1.6. SCOP and SEER calculations



For SCOP and/or SEER calculations, certification bodies shall use the calculation tools approved by the HPSG.

For water based heat pump also certified in cooling mode, the following hours shall be used for the SEER calculation:

j	Tj	hj
#	°C	h
1	17	205
2	18	227
3	19	225
4	20	225
5	21	216
6	22	215
7	23	218
8	24	197
9	25	178
10	26	158
11	27	137
12	28	109
13	29	88
14	30	63
15	31	39
16	32	31
17	33	24
18	34	17
19	35	13
20	36	9
21	37	4
# 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	T _i °C 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40	h _j h 205 227 225 225 216 215 218 197 178 158 137 109 88 63 39 31 24 17 13 9 4 3 1 0
23	39	1
24	40	0

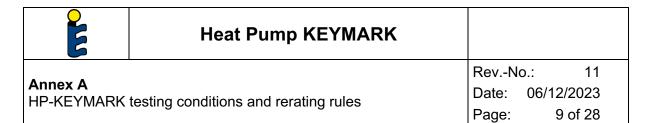
Mode	Symbol	Hours
Active mode	H _{HE}	600
Off mode	Poff	0
Thermostat off mode	P _{to}	659
Standby mode	P _{sb}	1377
Crankcase heater mode	P _{ck}	2036

A.2. Tests to be performed at admission

A.2.1. All types except air/air type

A.2.1.1. Low temperature heat pump

- space heating tests for low temperature application
- sound power level tests
- operating tests in space heating mode
- cooling tests shall be performed in case cooling performance are to be certified



A.2.1.2. Medium temperature heat pump

- space heating tests for low and for medium temperature applications
- sound power level tests.
- operating tests in space heating mode
- cooling test shall be performed in case cooling performance are to be certified

A.2.1.3. Combination heat pump

- space heating tests for medium temperature application
- hot water tests
- · sound power level tests
- operating tests according to EN14511-4 in space heating mode
- space heating tests for low temperature application in case the low temperature application is to be certified
- cooling tests shall be performed in case cooling performance are to be certified

A.2.1.4. Heat pump for hot water only

- hot water tests
- sound power level tests
- operating tests

A.2.2. Air/air type

A.2.2.1. Air/air heat pump for space heating only

- space heating tests
- sound power level tests in heating mode for average climate
- operating tests in heating mode

A.2.2.2. Air/air heat pump for space cooling only

- · space cooling tests
- · sound power level tests in cooling mode
- operating tests in cooling mode

A.2.2.3. Air/air heat pump for space heating and cooling

- space cooling tests
- space heating tests
- sound power level tests in cooling mode
- operating tests in cooling mode

A.2.2.4. Air/air heat pump providing domestic hot water

hot water tests

The hot water tests are to be performed in addition to the space cooling and/or heating tests.

A.3. Test to be performed for surveillance tests

A.3.1. All types except air/air type

A.3.1.1. Low temperature heat pump

- space heating tests for low temperature application
- sound power level tests in heating mode

	Heat Pump KEYMARK		
		RevNo	o.: 11
Annex A HP-KEYMARK testing conditions and rerating rules		Date:	06/12/2023
		Page:	10 of 28

- operating tests: The test is to be chosen by the certification body among the two following tests: "Shutting off the heat transfer medium flow" and "complete power supply failure"
- cooling tests shall be performed in case cooling performance are certified. In case both +7°C/+12°C and +18°C/+23°C applications are certified, only one of them is tested

A.3.1.2. Medium temperature heat pump

- space heating tests for low OR for medium temperature application
- sound power level tests in heating mode
- operating tests: The test is to be chosen by the certification body among the two following tests: "Shutting off the heat transfer medium flow" and "complete power supply failure"
- cooling tests shall be performed in case cooling performance are certified. In case both +7°C/+12°C and +18°C/+23°C applications are certified, only one of them is tested

A.3.1.3. Combination heat pump

- in case only medium temperature application is certified: space heating tests for medium temperature application
- in case both low and medium applications are certified: space heating tests for low OR for medium temperature application
- hot water tests
- sound power level tests in heating mode
- operating tests: The test is to be chosen by the certification body among the two following tests: "Shutting off the heat transfer medium flow" and "complete power supply failure".
- cooling tests shall be performed in case cooling performance are certified. In case both +7°C/+12°C and +18°C/+23°C applications are certified, only one of them is tested

A.3.1.4. Heat pump for domestic hot water only

- hot water tests
- sound power tests
- operating tests: the test is to be chosen by the certification body among the two following tests: Safety devices checking test" and "condensate draining".

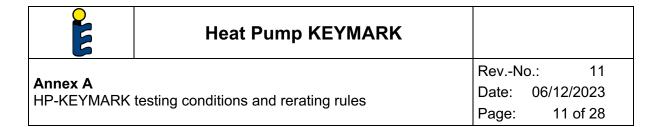
A.3.2. Air/air type

A.3.2.1. Air/air heat pump for space heating only

- space heating tests
- sound power level tests in heating mode for average climate
- operating tests in heating mode: The test is to be chosen by the certification body among the two following tests: "Shutting off the heat transfer medium flow" and "complete power supply failure".

A.3.2.2. Air/air heat pump for space cooling only

- space cooling test
- sound power level tests in cooling mode
- operating tests in cooling mode: the test is to be chosen by the certification body among the two following tests: "Shutting off the heat transfer medium flow" and "complete power supply failure".



A.3.2.3. Air/air heat pump for space heating and cooling

- space cooling tests
- space heating tests
- sound power level tests in cooling mode
- operating tests in cooling mode: "Shutting off the heat transfer medium flow" and "complete power supply failure".

A.3.2.4. Air/air heat pump also providing domestic hot water

Hot water tests

The hot water tests are to be performed in addition to the space cooling and/or heating tests.

A.4. Rerating rules

Rerating rules only apply to heat pump certified under periodic testing approach.

Rerating rules only apply where measured performance are lower than declared performance, unless specify differently. In case measured performance are higher than declared performance, unless specify differently, the test is passed and the declared performance remain unchanged.

A.4.1. General rules

- when a performance test is "failed" the rerating rules apply to the corresponding performance of all the models in the sub-type in which the tested unit belongs to.
- for the performances non-listed in the Scheme Rules section 7 that are tested (eg: EN 14511-2 performances), in case measured data don't match with declared data, the rerating rules apply to all the models in the sub-type in which the tested unit belongs to.
- several operating modes are tested during surveillance tests: acoustic, heating, cooling and DHW. Rerating rules apply independently to each mode and to the characteristics for which the tolerances are set in the scheme rules section 7. that has failed within this mode
- ⇒ E.g.: failure on outdoor unit sound power level test leads to rerating of sound power level of the outdoor unit of the models of the considered sub-type.

A.4.2. Space heating/cooling performances rerating rules A.4.2.1. Performances according to EN 14511-2 or to EN 15879-1

Tolerance on heating capacity and COP measured at standard rating conditions according to EN 14511-2 is equal to -8% of the declared value.

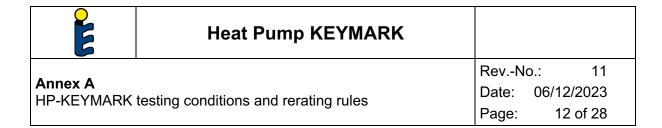
If both the measured heating capacity and COP are not lower than 8% compared to declared values, then the EN 14825 tests shall be performed according the flowrate declared by the applicant.

If an observed deviation between declared and measured heating capacity or COP exceeds - 8 %, then EN 14825 tests shall be performed according to the measured flowrate and the EN 14511-2 declared performances shall be rerated as follows:

Rerating of tested model

rerated heating capacity = measured capacity \times (1 + 0.08) rerated COP = measured COP \times (1 + 0.08) Equation 1 Equation 2

Rerating of the other models of the sub-type



Same relative deviation in between declared and rerated heating capacity of the tested model shall be applied to the heating capacity of the other models of the sub-type.

Same relative deviation in between declared and rerated COP of the tested model shall be applied to the COP of the other models of the sub-type.

o Input power rerating for all models
$$rerated\ input\ power = \frac{rerated\ heating\ capacity}{rerated\ COP}$$

Equation 3

A.4.2.2. Performances according to EN 14825 Space heating

The rerating rules apply independently to each declared climate

In case a test in heating mode is "failed" and in case of two heat sources are declared, both heat sources shall be rerated unless the certificate holder asks for a full test on both heat sources for all the declared temperature applications for the failed climate. A full test means: test according to EN 14511-2, test according to EN 14825 at every part load conditions and test of an auxiliary mode chosen by the certification body.

For the space heating test to be considered as "passed" the space heating tests for all declared climates need to be "passed".

A.4.2.3. Test at bivalent temperature condition

Bivalent temperature condition shall be tested first. If the measured heating capacity at T_{biv} fulfils the following criteria:

$$P_j[T_{biv}] = \frac{T_{biv} - 16}{T_{designh} - 16} P_{declared\ Pesignh} \pm 10\%$$

Equation 4

then the test continues. If not, the test is interrupted. The certificate holder shall provide a new complete set of declared values to the certification body and to the recognised testing laboratory within two weeks after the interrupted test. The tests may then be restarted from the beginning and the P_{designh} shall be rerated as follows:

o Rerating of the tested model:

$$rerated \ P_{designh} = P_{j}[T_{biv}] \times \frac{Tdesignh-16}{T_{biv}-16}$$

Equation 5

 Rerating of the other models of the sub-type and of the other heat source when relevant:

Same relative deviation between declared and rerated $P_{designh}$ of the tested model shall be applied to all other models of the sub-type and to the other heat source when relevant.

When test at bivalent temperature condition has been completed, the other selected part loads shall be tested: if any.

Rules described in paragraph b) of A.4.2.4. apply to COP measured at T_{biv}.

A.4.2.4. Test at other part load conditions

- a) Heating capacity
- Part load condition where the temperature is below T_{biv}

At each part load condition where the temperature is below T_{biv} , the measured heating capacity shall not be lower than -8% nor be higher than +8% of the declared heating capacity $P_{dh}(T_j)$. If



Annex AHP-KEYMARK testing conditions and rerating rules

Rev.-No.:

Date:

lo.: 11 06/12/2023

Page: 13 of 28

the measured heating capacity is not within $\pm 8\%$ of $P_{dh}(T_j)$, then $P_{dh}(T_j)$ shall be rerated as follow:

Rerating of the tested model

rerated $P_{dh}(T_j) = measured P_{dh}(T_j) \times (1 + 0.08)$

Equation 6

If the measured heating capacity is below the declared capacity, or

rerated $P_{dh}(T_j) = measured P_{dh}(T_j) \times (1 - 0.08)$

Equation 7

If the measured capacity is above the declared capacity.

The rerated heating capacity is the one to be considered for the SCOP calculation.

 Rerating of the other models of the sub-type and of the other heat source when relevant:

Same relative deviation in between declared and rerated $P_{dh}(T_j)$ of the tested model shall be applied to the $P_{dh}(T_j)$ (corresponding to the tested part load) of all other models of the sub-type and the other heat source when relevant.

Part load condition where the temperature is above or equal Tbiv

At each part load condition where the temperature is above or equal to T_{biv} , if the measured heating capacity is below -10% of the heating load $P_h(T_j)$ the test is interrupted and the certificate holder shall provide a new complete set of declared values to the certification body and to the recognised testing laboratory within two weeks after the interrupted test. The test is restarted from the start.

If the measured heating capacity is not below -10% of the heating load $P_h(T_j)$ and if the measured heating capacity is within ±8% of the declared heating capacity $P_{dh}(T_j)$, then $P_{dh}(T_j)$ is considered as being valid and is used for the calculation of the SCOP.

If the measured heating capacity is not within $\pm 8\%$ of $P_{dh}(T_j)$, then and $P_{dh}(T_j)$ shall be rerated as follow:

Rerating of the tested model

rerated $P_{dh}(T_j) = measured P_{dh}(T_j) \times (1 + 0.08)$

Equation 8

If the measured heating capacity is below the declared capacity, or

rerated $P_{dh}(T_i) = measured P_{dh}(T_i) \times (1 - 0.08)$

Equation 9

If the measured capacity is above the declared capacity.

The rerated heating capacity is the one to be considered for the SCOP calculation.

 Rerating of the other models of the sub-type and of the other heat source when relevant:

Same relative deviation in between declared and rerated $P_{dh}(T_j)$ of the tested model shall be applied to the $P_{dh}(T_j)$ (corresponding to the tested part load) of all other models of the sub-type and the other heat source when relevant.

b) Declared COP and SCOP

At each part load condition, measured COP shall not be lower than -8% compared to the declared COP.

If each measured COP is within the tolerance, the declared COP for each part load condition and the declared auxiliary mode consumptions are used for the calculation of the SCOP. If the calculated SCOP is not lower than -8% compared to the declared SCOP, then the test is over and nor SCOP nor η are rerated. If the calculated SCOP is lower than -8% compared to the declared SCOP, the declared SCOP and η shall be rerated. The rerated SCOP and η shall be equalled to the calculated ones. SCOP and



 η for each models of the sub-type for each declared applications and each declared climates shall be calculated according the declared part load data and auxiliary modes consumption. Each SCOP being lower than the calculated value -8% shall be replaced by the calculated SCOP and η shall be recalculated accordingly

- If at least one of the measured COP is lower than -8% compared to the declared COP then, all the non-tested part load conditions and one auxiliary mode condition (chosen by the certification body) shall be tested. SCOP is calculated using the declared COP and/or declared heating capacities when they are within the 8% tolerance (rules for heating capacities as described in the above paragraph apply), otherwise using the measured heating capacities and/or COP. For the calculation, the measured auxiliary mode consumption and the declared values for the modes that have not been tested shall be considered
 - If the calculated SCOP is not lower than -8% compared to the declared SCOP,
 SCOP and η are not rerated and the COP at part load remain unchanged.
 - o If the calculated SCOP is lower than -8% compared to the declared SCOP then, SCOP and η shall be rerated and all the other declared applications shall be fully tested at every part load conditions and one auxiliary mode chosen by certification body. The same rerating procedure applies to each application
 - o Rerating of tested model

 $rerated SCOP = measured SCOP \times (1 + 0.08)$

Equation 10

Rerated n is recalculated according rerated SCOP.

The COP at each part load shall be rerated as well and correspond to the measured COP at each part load condition. Auxiliary mode consumptions remain unchanged except for the one being tested and if the measured value is not within the tolerance with the declared value.

Rerating of all other models of the sub-type and of the other heat source when relevant Same relative deviation in between declared and rerated SCOP of the tested model shall be applied to the SCOP of all other models of the sub-type and the other heat source when relevant.

η is recalculated according rerated SCOP.

The declared COP at each part load shall be revised to ensure consistency with the rerated SCOP.

Heating test is "passed" if none of the $P_{designh}$, heating capacity at part load and η for all tested applications has been rerated.

A.4.2.5. Space cooling

a) Condition A test

Condition A is tested. If cooling capacity measured under condition A does not deviate from $P_{designc}$ from more than -8% then the test continues. If not, the test is interrupted. The certificate holder shall provide a new complete set of declared values to the certification body and the chosen recognised testing laboratory within two weeks of the interrupted test. The tests may then be restarted from the beginning and the $P_{designc}$ shall be rerated as follows:

o For the tested model:



Annex AHP-KEYMARK testing conditions and rerating rules

Rev.-No.:

Date: 06/12/2023

11

Page: 15 of 28

rerated $P_{designc} = P_{dc}(35)$

Equation 11

 For the other models of the sub-type, same deviation in between declared and rerated P_{designc} of the tested model shall be applied.

When test at A temperature condition is completed, the other selected part load condition shall be tested.

b) Test at other part load conditions

At each of the part load conditions, measured EER shall not be lower than -8% compared to the declared EER.

- If all measured EER values are within the tolerance, SEER is calculated using the declared EER values for all part load conditions and declared auxiliary modes consumptions.
- If at least one of the measured EER is lower than -8% compared to the declared EER
 then, all non-tested part load conditions and one auxiliary mode condition (chosen by
 the certification body) shall be tested. SEER is then calculated using the declared EER
 values when they are within the 8% tolerance, otherwise using the measured values
 and the measured auxiliary mode consumption and the other declared auxiliary mode
 consumptions for those not tested.

If the calculated SEER is not lower than -8% compared to the declared SEER, SEER is not regated

If the calculated SEER is lower than -8% compared to the declared SEER then, SEER shall be rerated.

Rerating of tested model

rerated SEER = measured SEER

Equation 12

The EER at each part load shall be rerated as well and correspond to the measured EER at each part load condition. Auxiliary mode consumptions remain unchanged except for the one being tested and if the measured value is not within the tolerance with the declared value.

o Rerating of the other models of the sub-type

Same relative deviation in between declared and rerated SEER of the tested model shall be applied to the SEER of all other models of the sub-type.

Cooling test is "passed" if neither P_{designc} nor SEER has been rerated.

A.4.3. Domestic hot water performances rerating rules

The rerating rules apply independently to each declared climate.

In case the test is "failed" and in case several heat sources are declared, all heat sources shall be rerated unless the certificate holder asks for a full performance test on the non-tested heat source.

If the test cannot fulfil the requirements of EN 16147 in term of water temperature; the certificate holder shall provide a new complete set of declared values: load profile; η_{DHW} and V_{40} (only for DHW heat pumps) to the certification body and the chosen recognised testing laboratory within two weeks of the interrupted test. The tests may then be restarted from the beginning.



DHW test is "passed" if for each declared climate the test has been performed for the declared load profile and if neither η_{DHW} nor V_{40} has been rerated, otherwise the test is "failed".

A.4.3.1. **η** DHW

If an observed deviation between declared and measured η_{DHW} exceeds -8 % of the declared value, then η_{DHW} shall be rerated.

Rerating of tested model

$rerated \eta_{DHW} = measured \eta_{DHW} \times (1 + 0.08)$

Equation 13

 \circ Rerating of the other models of the sub-type and of the other heat source when relevant Same relative deviation in between declared and rerated η_{DHW} of the tested model shall be applied to the η_{DHW} of all other models of the sub-type and for the other heat source when relevant.

A.4.3.2. V_{40} – only for domestic hot water heat pumps

If an observed deviation between declared and measured V_{40} exceeds -3 % of the declared value, then V_{40} shall be rerated.

Rerating of tested model

$rerated V_{40} = measured V_{40} \times (1 + 0.03)$

Equation 14

 $_{\odot}$ Rerating of the other models of the sub-type and of the other heat source when relevant Same relative deviation in between declared and rerated V₄₀ of the tested model shall be applied to the V₄₀ of all other models of the sub-type and for the other heat source when relevant.

A.4.3.3. Heating up period

In case the measured duration of heating up period exceeds the declared value by more than 8% or at least 15 minutes, than the heating up period shall be rerated.

In case the limit of 15 minutes exceeds the deviation of 8%, equation (15) applies. In case the deviation of 8% exceeds the limit of 15 minutes, equation (16) applies.

Rerating of tested model

rerated heating up period = measured heating up period -15 minutes Equation 15 rerated heating up period = measured heating up period $\times (1-0.08)$ Equation 16

o Rerating of all other models of the sub-type and of the other heat source when relevant Same deviation (in minutes) in between declared and rerated heating up period of the tested model shall be applied to the heating up period of all other models of the sub-type and for the other heat source when relevant.

A.4.3.4. Pes

Tolerance is equal to +10% of the declared value.

Rerating of tested model



Annex A

HP-KEYMARK testing conditions and rerating rules

Rev.-No.:

lo.: 11 06/12/2023

Page:

Date:

17 of 28

rerated $P_{es} = measured P_{es} \times (1 - 0.1)$

Equation 17

 \circ Rerating of all other models of the sub-type and of the other heat source when relevant Same relative deviation in between declared and rerated P_{es} of the tested model shall be applied to the P_{es} of all other models of the sub-type and for the other heat source when relevant.

A.4.3.5. Reference temperature

If an observed deviation between declared and measured reference temperature exceed -1K of the declared value, then the reference temperature shall be rerated.

Rerating of tested model

$rerated\ reference\ temperature = measured\ reference\ temperature + 1$ Equation 18

 Rerating of all other models of the sub-type and for the other heat source when relevant

Same deviation (in Kelvin) in between declared and reference temperature of the tested model shall be applied to the reference temperature of all other models of the sub-type and for the other heat source when relevant.

A.4.3.6. V₄₀ (for combination heat pump)

If an observed deviation between declared and measured V_{40} exceed $\,$ -3% of the declared value, then the V_{40} shall be rerated.

Rerating of tested model

rerated $V_{40} = measured V_{40} \times (1 + 0.03)$

Equation 19

 \circ Rerating of all other models of the sub-type and of the other heat source when relevant Same relative deviation in between declared and rerated V₄₀ of the tested model shall be applied to the V₄₀ of all other models of the sub-type and for the other heat source when relevant.

A.4.4. Sound power level rerating rules

The rerating rules apply independently to indoor and outdoor units.

In case the test is "failed" and in case several heat sources are declared, all heat sources shall be rerated unless the certificate holder asks for a full test on the non-tested heat source.

Sound power level test is "passed" if neither indoor unit (when relevant) nor outdoor unit (when relevant) has been rerated.

If measured sound power level is higher than declared sound power level is more than 2 dB(A) higher than the declared value, the following rerating rules apply:

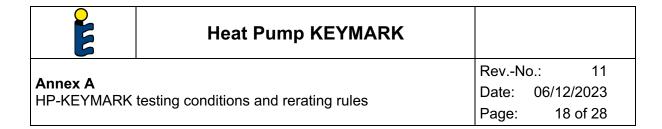
Rerating of tested model

rerated sound power level = measured sound power level - 2

Equation 20

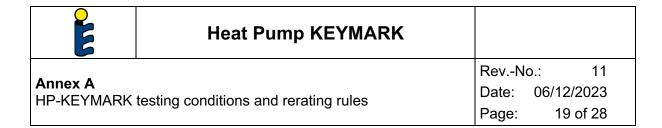
o Rerating of all other models of the sub-type and for the other heat source when relevant Same absolute deviation in between declared and rerated sound power level of the tested model shall be applied to the sound power level of all other models of the sub-type and for the other heat source when relevant.

Sound power test is "passed" if neither outdoor nor indoor unit, where relevant, sound power level has been rerated; otherwise, the test is "failed".



A.4.5. Operating tests

In case operating test failed, certificate holder shall provide the certification body with corrective actions within one month after the failed test was performed.



B. Hybrid heat pumps

Hybrid heat pump application shall be conducted using one-off admission testing approach.

Admission test description

B.1. Space heating hybrid heat pump (cooling in option)

B.1.1. Space heating tests

Space heating test shall be performed according to the combined test method or separate test method described in EN 14825

If both water and brine as heat sources are certified, tests shall be carried out with both heat sources.

For each low and medium temperature applications, the following tests shall be performed:

- a) A7/W35/55; A20/W35/55; B0/W35/55; W10/W35/55; according to EN 14511-2 and E4/W35/55 according to EN 15879-1
- b) Design temperature condition for average climate (-10°C)
- c) Switch temperature boiler off condition according to EN 14825 for average climate
- d) One other testing condition to be chosen by the certification body according to EN 14825 for average climate
- e) For any other climate, switch temperature boiler off condition shall be tested according to EN 14825

B.1.2. Sound power level tests

Tests shall be performed according to EN 12102-1 in heating mode for average climate at medium temperature application.

For heat pumps certified for brine and water as heat sources, the sound power level test is performed using brine.

B.1.3. Operating tests

Operating tests shall be performed according to EN 14511-4 as follows:

- starting and operating tests
- o shutting off the heat transfer medium flows
- o complete power supply failure.

In case the heat pump can be used with brine or water, only one heat source (brine or water) shall be tested.

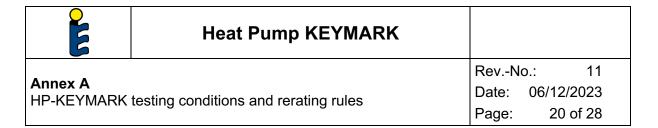
For direct exchange units operating tests shall be performed according to EN 15879-1 sections as follows:

- chapter 7.1 starting test according to Table 8
- o chapter 7.2.2 pressure dropchapter 7.2.3 shutting of the heat transfer medium flowchapter 7.2.4 complete power supply failure

B.1.4. Air flow for exhaust air hybrid heat pumps

The applicant shall declare the exhaust air volume flow that shall be used for space heating test.

B.1.5. Space cooling tests



SEER and $P_{designc}$ for +7°C/+12°C and/or +18°C/+23°C applications can be certified as an option.

The testing points to be performed for the certified application are the following:

- a) "A" testing condition according to EN 14825;
- b) One other testing condition to be chosen by the certification body according to EN 14825

If both +7°C/+12°C and/or +18°C/+23°C applications are certified, the test shall be performed as described above for both applications.

If both water and brine as heat sources are certified, tests shall be carried out with either brine or water as heat source; the heat source being chosen by the certification body.

For exhaust air heat pump, the applicant shall declare the exhaust air volume flow that shall be used for space cooling test.

B.2. Combination hybrid heat pump

B.2.1. Space heating test

If both water and brine as heat sources are certified, tests shall be carried out with both heat sources.

- a) A7/W55; A20/W55; B0/W55; W10/W55 according to EN 14511-2 and E4/W55 according to EN 15879-1.
- b) Design temperature condition for average climate (-10°C)
- c) Switch temperature boiler off condition according to EN 14825 for average climate
- d) One other testing condition to be chosen by the certification body according to EN 14825 for average climate
- e) For any other climate, Switch temperature boiler off condition shall be tested according to EN 14825

Low temperature application can be certified as an option; in this case, testing at low temperature application shall be performed as follows:

- a) A7/W35; A20/W35; B0/W35; W10/W35 according to EN 14511-2 and E4/W35 according to EN 15879-1.
- b) Design temperature condition for average climate (-10°C)
- c) Switch temperature boiler off condition according to EN 14825 for average climate
- d) One other testing condition to be chosen by the certification body according to EN 14825 for average climate
- e) For any other climate, Switch temperature boiler off condition shall be tested according to EN 14825

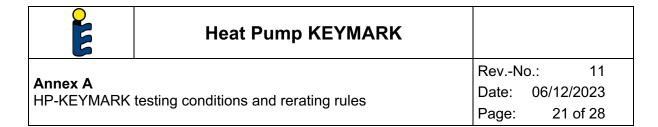
B.2.2. Sound power level tests

Tests shall be carried out according to EN 12102-1 in heating mode for medium temperature application for average climate.

For heat pumps certified for brine and water as heat sources, the acoustic test is carried out using brine.

B.2.3. Domestic hot water tests

Tests shall be performed for average climate according to EN 16147 in case the domestic hot water is produced by the heat pump only, and to EN13203-5 in case the boiler is contributing to the domestic hot water production.



For any other declared climate, test may also be performed by using the relevant standard, EN 16147 or EN 13203-5, depending on any contribution of the boiler or not.

The tests shall be performed for the load profiles as declared by the applicant for each climate where relevant.

For water (brine)/water type, in case brine and water as heat sources are declared, only one heat source shall be tested. The heat source to be tested is chosen by the certification body.

B.2.4. Operating tests

Operating tests shall be performed according to EN 14511-4 as follows:

- starting and operating tests
- shutting off the heat transfer medium flows,
- complete power supply failure.

In case the heat pump can be used with brine or water, only one heat source (brine or water) shall be tested.

For direct exchange units operating tests shall be performed according to EN 15879-1 sections as follows:

chapter 7.1 starting tests according to Table 8

chapter 7.2.2 pressure drop

chapter 7.2.3 shutting off the heat transfer medium flow

chapter 7.2.4 complete power supply failure

B.2.5. Space cooling tests

SEER and $P_{designc}$ for +7°C/+12°C and/or +18°C/+23°C applications can be certified as an option.

The testing points to be performed for the certified application are the following:

- a) "A" testing condition according to EN 14825;
- b) One other testing condition to be chosen by the certification body according to EN 14825

If both +7°C/+12°C and/or +18°C/+23°C applications are certified, the test shall be performed as described above for both applications.

If both water and brine as heat sources are certified, tests shall be carried out with either brine or water as heat source; the heat source being chosen by the certification body.

For exhaust air heat pump, the applicant shall declare the exhaust air volume flow that shall be used for space cooling test.

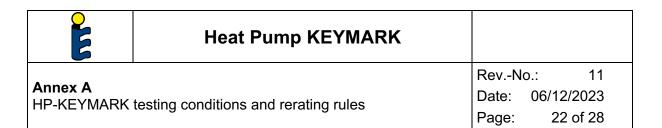
B.3. SCOP and SEER calculations

For SCOP and SEER calculations, certification bodies shall use the calculation tool approved by the HPSG.

For the SCOP calculation, hours defined in EN14825 annex B shall be used.

For heat pump also certified in cooling mode, the following hours shall be used for the SEER calculation:

j	T_j	hj
#	°C	h
1	17	205
2	18	227



3 19 225 4 20 225 5 21 216 6 22 215 7 23 218 8 24 197 9 25 178 10 26 158 11 27 137 12 28 109 13 29 88 14 30 63 15 31 39 16 32 31 17 33 24 18 34 17 19 35 13 20 36 9 21 37 4 22 38 3 23 39 1 24 40 0			
4 20 225 5 21 216 6 22 215 7 23 218 8 24 197 9 25 178 10 26 158 11 27 137 12 28 109 13 29 88 14 30 63 15 31 39 16 32 31 17 33 24 18 34 17 19 35 13 20 36 9 21 37 4 22 38 3 23 39 1	3		225
8 24 197 9 25 178 10 26 158 11 27 137 12 28 109 13 29 88 14 30 63 15 31 39 16 32 31 17 33 24 18 34 17 19 35 13 20 36 9 21 37 4 22 38 3 23 39 1	4	20	225
8 24 197 9 25 178 10 26 158 11 27 137 12 28 109 13 29 88 14 30 63 15 31 39 16 32 31 17 33 24 18 34 17 19 35 13 20 36 9 21 37 4 22 38 3 23 39 1	5	21	216
8 24 197 9 25 178 10 26 158 11 27 137 12 28 109 13 29 88 14 30 63 15 31 39 16 32 31 17 33 24 18 34 17 19 35 13 20 36 9 21 37 4 22 38 3 23 39 1	6	22	215
20 36 9 21 37 4 22 38 3 23 39 1	7	23	218
20 36 9 21 37 4 22 38 3 23 39 1	8	24	197
20 36 9 21 37 4 22 38 3 23 39 1	9	25	178
20 36 9 21 37 4 22 38 3 23 39 1	10	26	158
20 36 9 21 37 4 22 38 3 23 39 1	11	27	137
20 36 9 21 37 4 22 38 3 23 39 1	12	28	109
20 36 9 21 37 4 22 38 3 23 39 1	13	29	88
20 36 9 21 37 4 22 38 3 23 39 1	14	30	63
20 36 9 21 37 4 22 38 3 23 39 1	15	31	39
20 36 9 21 37 4 22 38 3 23 39 1	16	32	31
20 36 9 21 37 4 22 38 3 23 39 1	17	33	24
20 36 9 21 37 4 22 38 3 23 39 1	18	34	17
20 36 9 21 37 4 22 38 3 23 39 1	19	35	13
23 39 1	20	36	9
23 39 1	21	37	4
23 39 1	22	38	3
24 40 0	23	39	1
	24	40	0

Mode	Symbol	Hours
Active mode	H _{HE}	600
Off mode	P _{off}	0
Thermostat off mode	P _{to}	659
Standby mode	P _{sb}	1377
Crankcase heater mode	P _{ck}	2036

	Heat Pump KEYMARK		
		RevN	o.: 11
Annex A	testing conditions and rerating rules	Date:	06/12/2023
	testing conditions and relating fules	Page:	23 of 28

C. Gas heat pumps

Gas heat pump application shall be conducted using one-off admission testing approach.

Admission test description

C.1. Space heating tests for low temperature heat pumps

If both water and brine as heat sources are certified, tests shall be carried out with both heat sources.

- a) A7/W35; A20/W35; B0/W35; W10/W35 according to EN 12309-4, EN 16905-4; EN 16905-4 or EN 16905-3
- b) Bivalent temperature condition for average climate according EN 12309-4, EN 12309-6, EN 16905-4 or EN 16905-3 for gas heat pumps
- c) One other testing condition for average climate to be chosen by the certification body according to EN 12309-4; EN 12309-6, EN 16905-4 or EN 16905-3 for gas heat pumps
- d) For any other climate, bivalent temperature condition shall be tested according to EN 12309-4, EN 12309-6, EN 16905-4 or EN 16905-3 for gas heat pumps

C.2. Space heating tests for medium temperature heat pump

If both water and brine as heat sources are certified, tests shall be carried out with both heat sources.

For each low and medium temperature application, the following tests shall be performed:

- a) A7/W35/55; A20/W35/55; B0/W35/55; W10/W35/55; according to EN 12309-4, EN 12309-6, EN 16905-4 or EN 16905-3
- b) Bivalent temperature condition for average climate according to EN 12309-4, EN 12309-6, EN 16905-4 or EN 16905-3
- c) One other testing condition for average climate to be chosen by the certification body according to EN12309-4, EN12309-6, EN16905-4 or EN16905-3
- d) For any other climate, bivalent temperature condition shall be tested according to EN12309-4, EN12309-6, EN16905-4 or EN16905-3

C.3. Sound power level tests

Tests shall be performed according to EN 12102-1 for average climate at the certified highest temperature application.

For heat pumps certified for brine and water as heat sources, the sound power level test shall be performed using brine.

C.4. Air flow for exhaust air heat pumps

The applicant shall declare the exhaust air volume flow that shall be used for space heating test.

C.5. Space cooling tests

SPERc and P_{designc} for +7°C/+12°C and/or +18°C/+23°C applications can be certified as an option.

If both water and brine as heat sources are certified, tests shall be carried out with either brine or water as heat source; the heat source being chosen by the certification body.

Only one cooling application is certified

	Heat Pump KEYMARK		
		RevNo	o.: 11
Annex A HP-KEYMARK testing conditions and rerating rules		Date:	06/12/2023
	testing conditions and relating fales	Page:	24 of 28

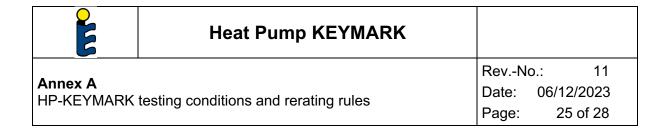
- a) "A" testing condition according to EN12309-4, EN12309-6, EN16905-4 or EN16905-3
- b) One other testing condition to be chosen by the certification body to EN12309-4, EN12309-6, EN16905-4 or EN16905-3
- Both cooling applications are certified
- a) "A" testing condition according to EN12309-4, EN12309-6, EN16905-4 or EN16905-3
- b) One other testing condition from one of the 2 applications to be chosen by the certification body according to EN12309-4, EN12309-6, EN16905-4 or EN16905-3

C.6. SPER_h and SPER_c calculations

SPER $_h$ shall be calculated using the hours defined in the corresponding standard. For heat pump also certified in cooling mode, the following hours shall be used for the SPER $_c$ calculation:

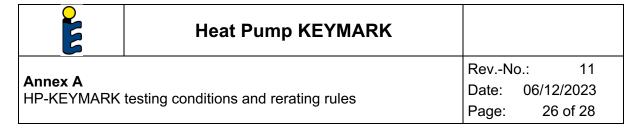
Tj	h_{j}
°C	h
17	205
18	227
19	225
20	225
21	216
22	215
23	218
24	197
25	178
26	158
27	137
28	109
29	88
30	63
31	39
32	31
33	24
34	17
35	13
36	h _i h 205 227 225 225 216 215 218 197 178 158 137 109 88 63 39 31 24 17 13 9 4 3 1
37	4
38	3
39	1
40	0
	T _j °C 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

Mode	Symbol	Hours
Active mode	H _{HE}	600
Off mode	P _{off}	0
Thermostat off mode	P _{to}	659
Standby mode	P _{sb}	1377
Crankcase heater mode	P _{ck}	2036



C.7. NOx emissions

NOx emissions shall be measured according the appropriate standard.



D. CO₂ Heat pump for domestic hot water

CO₂ heat pump application shall be conducted using one-off admission testing approach.

This section applies to CO₂ heat pumps designed for domestic hot water production placed on the market without a storage tank.

Admission test description

D.1. Performance test

If both water and brine as heat sources are certified, tests shall be carried out with both heat sources.

The test shall be conducted following the EN14511-3 test procedure and using the following set of conditions depending on the heat source:

Table D.1. – Test conditions for performance test of CO₂ heat pumps

Heat source	intlet water	Outlet water			
Туре		Temperatur	temperature	temperature	
	Average	Colder	Warmer	temperature	temperature
Air (dry bulb/wet bulb)	7°C(6°C)	2°C(1°C)	14°C(13°C)		
Water		10°C	15°C	60°C	
Brine		0°C	15 C	60 C	
Exhaust air		20°C (12°C)		

The test shall be conducted for each declared climate.

For heat pump using exhaust air as heat source; the applicant shall declare the exhaust air volume flow that shall be used for the performance test.

D.2. Sound power level test

Tests shall be performed according to EN 12102-1 for average climate at the inlet and outlet water temperature conditions defined in the above Table D.1.

For heat pumps certified for brine and water as heat sources, the sound power level test is performed using brine.

D.3. Operating tests

Operating tests shall be performed according to EN 14511-4 as follows:

- starting and operating tests
- shutting off the heat transfer medium flows,
- o complete power supply failure.

In case the heat pump can be used with brine or water, only one heat source (brine or water) shall be tested.

	Heat Pump KEYMARK		
A A		RevNo	o.: 11
Annex A HP-KEYMARK testing conditions and rerating rules			06/12/2023
	testing conditions and relating rules	Page:	27 of 28

E. Part Models within the same subtype having deviating performance

E.1. Background

Applicant may declare several models within a single subtype which have deviating performance. The deviation between two or more models may concern:

- the performance according to EN14511-2 (heating and/or cooling mode),
- the performance according to EN14825 (heating and/or cooling mode),
- the performance according to EN16147 (deviating tapping profile),
- the performance according to EN12102-1.
- some models may be certified only for average climate whereas other models are certified also for colder and/or warmer climates and/or
- some models may be certified only for space cooling or space heating whereas other models are certified for both space cooling and/or space heating

In consequence, testing one model does not allow the verification of the declared performance of the deviating models. Therefore, additional testing points are required.

E.2. Additional tests

Additional testing is required if at least one condition occurs according to E.1.

Within one sub-type, model A is selected for the test and tested according to Part A of this document. For every additional model B having deviating performance, additional tests shall be performed:

deviating	EN 14511-2	EN 14825	EN 16147	EN 12102-1	Colder and/or	Space cooling or
performance					warmer climate	space heating
Model B	No test	One test at	Test acc. to	Test acc. to	If model A is	If model A is not
	required.	T _{biv} (medium	EN 16147	EN12102-1	certified only for	certified for space
		or low	required.	required.	average climate,	cooling or space
		temperature			the test procedure	heating, the test
		to be chosen			of Model B for	procedure of Model B
		by the CB).			colder and/or	for cooling or heating
					warmer climate	mode applies
					applies according	according to Annex A
					to Annex A Part A.	Part A.

Table E.1: type of additional test depending on the deviating performances

For **first admission and surveillance** tests, tests on model A are required according to Part A. However, the additional tests in table E.1 are performed on model A using the software setting corresponding to model B. As all models have the same refrigerating circuit, only model A needs to be sampled for testing.

	Heat Pump KEYMARK		
		RevN	o.: 11
Annex A HP-KEYMARK testing conditions and rerating rules			06/12/2023
	testing conditions and relating rules	Page:	28 of 28

For **the addition of a deviating model** B to an existing subtype, the additional tests are performed on the model B.

For heat pumps being certified for both brine and water as heat source, only one heat source, chosen by the certification body, shall be tested.

EN 14511-2	EN 1482 average				EN 12102-1	Cooling mode in addition	type of additonal tests	no. of additonal tests		
ves	uverage	Joidel	Warrier			III dadition	no additional test required	0		
yes	yes						Tbiv average climate acc. to EN 14825	1		
							Tbiv average climate acc. to EN 14825			
yes	yes	yes	yes				Tbiv colder climate acc. to EN 14825	3		
							Tbiv warmer climate acc. to EN 14825			
V/06	VOS				VOS		Tbiv acc. to EN 14825	2		
yes	yes				yes		yes		sound power level test acc. to EN 12102-1	2
yes				yes			DHW test acc. EN 16147	1		
yes						yes	Condition A in cooling mode acc. to EN 14825	1		

Table E.2: different scenarios of deviating performance resulting in different additional tests

E.3. Rerating rules

The declared performance of each deviating model in the data base will be rerated separately. If the surveillance test acc. to a standard fails, all models having the identical performance acc. to this standard are rerated.

The rerating rules according to Part A section 4 apply.