

TEST REPORT

Report no.:
300-KLAB-23-009



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Customer: Company: Panasonic Marketing Europe GmbH
Address: Hagenauer Str. 43
City: D-65203 Wiesbaden
Tel.: +49 1724 141441

Component: Brand: Panasonic
Type: Air to water heat pump
Model: Outdoor Unit: WH-UDZ05KE5 Indoor Unit: WH-ADC0309K3E5
Series no.: Unit: 5624301068 Indoor Unit: 5706600032
Prod. year: Unit: 2023.02 Indoor Unit: N/A

Dates: Component tested: March 2023 – September 2023

Procedure: See objective (page 2) for list of standards.

Remarks: The unit was delivered by the customer. The installation and test settings were done according to the manufacturer's instructions. All tests are done with enabled defrost mode. The outdoor unit was delivered as model no. WH-UDZ09KE5, cf. the rating plates of the units. By changing the software, the unit was changed to model no. WH-UDZ05KE5.

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Test Req. nr.



Objective

The objective of this report is to document the following:

The Seasonal Coefficient of Performance (SCOP) at low and medium temperature application for average climate according to EN 14825:2018. In order to calculate the SCOP, tests were carried out at the part load conditions stated in the tables on page 5 and 6.

Rating conditions at low temperature application (heating mode) according to EN 14511:2018 at A7/W35, A2/W35 and A-7/W35.

Rating conditions at medium temperature application (heating mode) according to EN 14511:2018 at A7/W55, A2/W55 and A-7/W55.

Additional performance test at quiet mode 3 according to EN 14511:2018 at A2/W35.

Operating requirements according to EN 14511-4:2018:

- 4.2.1 Starting and operating tests
- 4.5 Shutting off the heat transfer medium flows
- 4.6 Complete power supply failure

The Seasonal Energy Efficiency Ratio (SEER) for space cooling for fan coil application according to EN 14825:2018. In order to calculate the SEER, tests were carried out at the part load conditions stated in the tables on page 9.

Pre-running and post-running time of liquid pump when the heat pump starts and stops.

Power consumption of liquid pump for COP and SCOP test points.

Sound power measurements according to EN 12102-1:2017 for rating conditions (A7/W35), quiet mode level 3 (A7/W35), (A7/W55), quiet mode level 3 (A7/W55), (A2/W55), quiet mode level 3 (A2/W55), (A-7/W55), quiet mode level 3 (A2/W55) and ErP energy label (A7/W55).

This report includes all the requirements for the European KEYMARK Scheme for Heat Pumps.



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Test conditions

SCOP test conditions for low temperature – EN 14825

Part load conditions for reference SCOP and reference SCOPon calculation of air to water units for low temperature application for the reference heating season;

"A" = average, "W" = warmer, and "C" = colder.

Condition ^a	Part Load Ratio in %				Outdoor heat exchanger		Indoor heat exchanger			
					Inlet dry (wet) bulb temperature °C		Fixed outlet °C	Variable outlet ^d °C		
	Formula	A	W	C	Outdoor air	Exhaust air	All climates	A	W	C
A	$(-7 - 16) / (T_{\text{designh}} - 16)$	88	n/a	61	-7(-8)	20(12)	^a / 35	^a / 34	n/a	^a / 30
B	$(+2 - 16) / (T_{\text{designh}} - 16)$	54	100	37	2(1)	20(12)	^a / 35	^a / 30	^a / 35	^a / 27
C	$(+7 - 16) / (T_{\text{designh}} - 16)$	35	64	24	7(6)	20(12)	^a / 35	^a / 27	^a / 31	^a / 25
D	$(+12 - 16) / (T_{\text{designh}} - 16)$	15	29	11	12(11)	20(12)	^a / 35	^a / 24	^a / 26	^a / 24
E	$(TOL - 16) / (T_{\text{designh}} - 16)$				TOL	20(12)	^a / 35	^a / b	^a / b	^a / b
F	$(T_{\text{bivalent}} - 16) / (T_{\text{designh}} - 16)$				T _{bivalent}	20(12)	^a / 35	^a / c	^a / c	^a / c
G	$(-15 - 16) / (T_{\text{designh}} - 16)$	n/a	n/a	82	-15	20(12)	^a / 35	n/a	n/a	^a / 32

^a With the water flow rate as determined at the standard rating conditions given in EN 14511-2 at 30/35 conditions for units with a fixed water flow rate, and with a fixed delta T of 5 K for units with a variable flow rate. If the resulting flow rate is below the minimum flow rate then this minimum flow rate is used with the outlet temperature.

^b Variable outlet shall be calculated by interpolation from T_{designh} and the temperature which is closest to the TOL.

^c Variable outlet shall be calculated by interpolation between the upper and lower temperatures which are closest to the bivalent temperature.

^d If the variable outlet temperature is below the minimum of the operation range of the unit, this minimum should be considered.

Conditions C and F = HP Keymark

Additional information

Climate	T _{designh} [°C]	T _{bivalent} [°C]	TOL [°C]	Outlet temperature	Flow rate
Average	-10	-10	-10	Variable	Variable





SCOP test conditions for medium temperature – EN 14825

Part load conditions for reference SCOP and reference SCOPon calculation of air to water units for medium temperature application for the reference heating season;

“A” = average, “W” = warmer, and “C” = colder.

Condition	Part Load Ratio in %				Outdoor heat exchanger		Indoor heat exchanger			
					Inlet dry (wet) bulb temperature °C		Fixed outlet °C	Variable outlet ^d °C		
	Formula	A	W	C	Outdoor air	Exhaust air	All climates	A	W	C
A	$\frac{-7 - 16}{(T_{designh} - 16)}$	88	n/a	61	-7(-8)	20(12)	^a / 55	^a / 52	n/a	^a / 44
B	$\frac{+2 - 16}{(T_{designh} - 16)}$	54	100	37	2(1)	20(12)	^a / 55	^a / 42	^a / 55	^a / 37
C	$\frac{+7 - 16}{(T_{designh} - 16)}$	35	64	24	7(6)	20(12)	^a / 55	^a / 36	^a / 46	^a / 32
D	$\frac{+12 - 16}{(T_{designh} - 16)}$	15	29	11	12(11)	20(12)	^a / 55	^a / 30	^a / 34	^a / 28
E	$(TOL - 16) / (T_{designh} - 16)$				TOL	20(12)	^a / 55	^a / ^b	^a / ^b	^a / ^b
F	$(T_{bivalent} - 16) / (T_{designh} - 16)$				$T_{bivalent}$	20(12)	^a / 55	^a / ^c	^a / ^c	^a / ^c
G	$\frac{-15 - 16}{(T_{designh} - 16)}$	n/a	n/a	82	-15	20(12)	^a / 55	n/a	n/a	^a / 49

^a With the water flow rate as determined at the standard rating conditions given in EN 14511-2 at 47/55 conditions for units with a fixed water flow rate, and with a fixed delta T of 8 K for units with a variable flow rate. If the resulting flow rate is below the minimum flow rate then this minimum flow rate is used with the outlet temperature.

^b Variable outlet shall be calculated by interpolation $T_{designh}$ and the temperature which is closest to the TOL.

^c Variable outlet shall be calculated by interpolation between the upper and lower temperatures which are closest to the bivalent temperature.

^d If the variable outlet temperature is below the minimum of the operation range of the unit, this minimum should be considered.

Conditions C, and F = HP Keymark

Additional information

Climate	$T_{designh}$ [°C]	$T_{bivalent}$ [°C]	TOL [°C]	Outlet temperature	Flow rate
Average	-10	-10	-10	Variable	Variable





Test conditions for rating conditions low temperature – EN 14511

N#	Heat source		Heat sink		
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^K	7	6	30	35	
2	2	1	30	35	
3	-7	-8	30	35	

K) Keymark

Test conditions for rating conditions medium temperature – EN 14511

N#	Heat source		Heat sink		
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^K	7	6	47	55	
2	2	1	47	55	
3	-7	-8	47	55	

K) Keymark

Test condition for quiet mode 3 – EN 14511

N#	Heat source		Heat sink		
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1	2	1	30	35	



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Test conditions for starting and operating tests – EN 14511-4: 2018

N#	Heat source		Heat sink		Water flow rate at indoor heat exchanger	Test
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)			
1 ^K	-25	-	15		Minimum	Starting
2 ^K	-25	-	47		Minimum	Operating

K) Keymark

Test conditions for shutting off the heat transfer medium – EN 14511-4

N#	Heat source		Heat sink		Heat exchanger
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^K	7	6	30	35	Indoor
2 ^K	7	6	30	35	Outdoor

K) Keymark

Test conditions for complete power supply failure – EN 14511-4

N#	Heat source		Heat sink		
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^K	7	6	30	35	

K) Keymark



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SEER test conditions for fan coil application – EN 14825

Part load conditions for reference SEER and reference SEERon calculation of air to water units for fan coil application for space cooling.

Part load ratio	Part load ratio %	Outdoor heat exchanger	Indoor heat exchanger			
		Air dry bulb temperature °C	Fan coil application Inlet/outlet water(brine) temperatures		Cooling floor application Inlet/outlet water(brine) temperatures °C	
			Fixed outlet °C	Variable outlet ^b °C		
A	$(35-16)/(T_{designc} -16)$	100	35	12 / 7	12 / 7	23 / 18
B	$(30-16)/(T_{designc} -16)$	74	30	^a / 7	^a / 8,5	^a / 18
C	$(25-16)/(T_{designc} -16)$	47	25	^a / 7	^a / 10	^a / 18
D	$(20-16)/(T_{designc} -16)$	21	20	^a / 7	^a / 11,5	^a / 18

^a With the flow rate as determined during "A" test for units with a fixed flow rate or with a fixed delta T of 5 K for units with a variable flow rate. If for any of the test conditions the resulting flow rate is below the minimum flow rate then this minimum flow rate is used as a fixed flow rate with the outlet temperature for this test condition.

^b if the variable outlet temperature is above the maximum of the operating range of the unit, this maximum should be considered.

Conditions A and C = HP Keymark





Test conditions for sound power measurements – EN 12102-1

N#	Test condition		Heat pump setting			
	Outdoor heat exchanger (dry bulb/wet bulb) (°C)	Indoor heat exchanger (inlet/outlet) (°C)	Compressor speed (Hz)	Fan speed Outdoor (rpm)	Heating capacity (kW)	Power input (kW)
1 ^R	7/6	30/35	39	510	5.30	1.0
2 ^Q	7/6	30/35	25	360	3.30	0.67
3 ^R	7/6	47/55	42	540	5.00	1.63
4 ^Q	7/6	47/55	28	360	2.8	1.12
5 ^R	-7/-8	30/35	64	730	5.4	1.74
6 ^Q	-7/-8	30/35	41	570	3.70	1.1
7 ^R	-7/-8	47/55	64	730	4.65	2.35
8 ^Q	-7/-8	47/55	41	570	3.00	1.5
9 ^{E-K}	7/6	47/55	26	430	2.70	1.06
10 ^Q	2/1	30/35	35	480	4.10	0.94

R) Rating capacity, Q) Quiet mode 3, E) ErP labelling, K) Keymark



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Test results

Test results of SCOP test at low temperature - heating season average - EN 14825

Model (Outdoor)	WH-UDZ05KE5
Air-to-water heat pump mono bloc	N
Low-temperature heat pump	N
Equipped with supplementary heater	Y
Heat pump combination heater	Y

Rated heat output¹⁾	P_{rated}	5 [kW]
Seasonal space heating energy efficiency	η_s	211.3 [%]
	SCOP	5.36 [-]

Measured capacity for heating for part load at outdoor temperature T_j	Average Climate	$T_j = -15\text{ °C}$	P_{dh}	- [kW]
	-	$T_j = -7\text{ °C}$	P_{dh}	4.57 [kW]
	Low temperature application	$T_j = 2\text{ °C}$	P_{dh}	2.61 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	2.79 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	3.21 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	5.10 [kW]
		$T_j = \text{operation limit}$	P_{dh}	5.10 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate	$T_j = -15\text{ °C}$	COPd	- [-]
	-	$T_j = -7\text{ °C}$	COPd	3.51 [-]
	Low temperature application	$T_j = 2\text{ °C}$	COPd	5.28 [-]
		$T_j = 7\text{ °C}$	COPd	6.62 [-]
		$T_j = 12\text{ °C}$	COPd	8.76 [-]
		$T_j = \text{bivalent temperature}$	COPd	3.10 [-]
		$T_j = \text{operation limit}$	COPd	3.10 [-]

Bivalent temperature	$T_{bivalent}$	-10 [°C]
Operation limit temperatures	TOL	-10 [°C]
Degradation coefficient	C_{dh}	0.98 [-]

Power consumption in modes other than active mode	Off mode	P_{OFF}	0.007 [kW]
	Thermostat-off mode	P_{TO}	0.007 [kW]
	Standby mode	P_{SB}	0.007 [kW]
	Crankcase heater mode	P_{CK}	0.007 [kW]
Supplementary heater¹⁾	Rated heat output	P_{SUP}	0.00 [kW]
	Type of energy input		Electrical

Other items	Capacity control		Variable
	Water flow control		Variable
	Water flow rate		-
	Annual energy consumption	Q_{HE}	1928 [kWh]

¹⁾For heat pump space heaters and heat pump combination heaters, the rated heat output, P_{rated} , is equal to the design load for heating, $P_{design,h}$, and the rated heat output of a supplementary heater, P_{sup} , is equal to the supplementary capacity for heating, $sup(T_j)$.

Conditions A&E (operation limit) = Keymark



Test Rep. nr.



Test results of SCOP test at medium temperature - heating season average – EN 14825

Model (Outdoor)	WH-UDZ05KE5
Air-to-water heat pump mono bloc	N
Low-temperature heat pump	N
Equipped with supplementary heater	Y
Heat pump combination heater	Y

Rated heat output¹⁾	P_{rated}	5 [kW]
Seasonal space heating energy efficiency	η_s	145.1 [%]
	SCOP	3.70 [-]

Measured capacity for heating for part load at outdoor temperature T_j	Average Climate	$T_j = -15\text{ °C}$	P_{dh}	- [kW]
	-	$T_j = -7\text{ °C}$	P_{dh}	4.13 [kW]
	Medium temperature application	$T_j = 2\text{ °C}$	P_{dh}	2.70 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	2.58 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	3.10 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	4.83 [kW]
		$T_j = \text{operation limit}$	P_{dh}	4.83 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate	$T_j = -15\text{ °C}$	COPd	- [-]
	-	$T_j = -7\text{ °C}$	COPd	2.19 [-]
	Medium temperature application	$T_j = 2\text{ °C}$	COPd	3.65 [-]
		$T_j = 7\text{ °C}$	COPd	4.79 [-]
		$T_j = 12\text{ °C}$	COPd	6.65 [-]
		$T_j = \text{bivalent temperature}$	COPd	1.98 [-]
		$T_j = \text{operation limit}$	COPd	1.98 [-]

Bivalent temperature	$T_{bivalent}$	-10 [°C]
Operation limit temperatures	TOL	-10 [°C]
Degradation coefficient	C_{dh}	0.98 [-]

Power consumption in modes other than active mode	Off mode	P_{OFF}	0.007 [kW]
	Thermostat-off mode	P_{TO}	0.007 [kW]
	Standby mode	P_{SB}	0.007 [kW]
	Crankcase heater mode	P_{CK}	0.007 [kW]
Supplementary heater¹⁾	Rated heat output	P_{SUP}	0.00 [kW]
	Type of energy input		Electrical

Other items	Capacity control		Variable
	Water flow control		Variable
	Water flow rate		-
	Annual energy consumption	Q_{HE}	2790 [kWh]

¹⁾For heat pump space heaters and heat pump combination heaters, the rated heat output, P_{rated} , is equal to the design load for heating, $P_{design,h}$, and the rated heat output of a supplementary heater, P_{sup} , is equal to the supplementary capacity for heating, $sup(T_j)$.

Conditions A&E (operation limit) = Keymark



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Test results of standard rating test at low temperature – EN 14511

N#	Test conditions	Heating capacity [kW]	COP
1 ^K	A7/W35	5.25	5.44
2	A2/W35	5.36	4.04
3	A-7/W35	5.59	3.35

K) Keymark

Test results of standard rating test at medium temperature – EN 14511

N#	Test conditions	Heating capacity [kW]	COP
1 ^K	A7/W55	5.00	3.15
2	A2/W55	5.03	2.54
3	A-7/W55	4.65	2.02

K) Keymark

Test results of quiet mode 3 – EN 14511

N#	Test conditions	Heating capacity [kW]	COP
1	A2/W35	3.211	3.675





Test results of starting and operating tests – EN 14511-4:2018

N#	Test conditions	Water flow rate at indoor heat exchanger (l/h)	Test validation
1 ^K	A-25/W15	480	Passed
2 ^K	A-25/W47	480	Passed

K) Keymark

Test results of shutting off the heat transfer medium – EN 14511-4

N#	Test conditions	Test validation
1 ^K	A7/W35	Passed

K) Keymark

Test results of complete power supply failure – EN 14511-4

N#	Test conditions	Test validation
1 ^K	A7/W35	Passed





Test results of SEER test points at fan cooling application for space cooling - EN 14825

Model (Outdoor)	WH-UDZ05KE5
Air-to-water heat pump mono bloc	N
Low-temperature heat pump	N
Equipped with supplementary heater	Y
Heat pump combination heater	Y

Rated cooling output	$P_{rated,c}$	5 [kW]
	$\eta_{s,c}$	227.37 [%]
	SEER	5.76 [-]

	Air dry bulb temperature	T _j =35 °C	P _{dc}	4.81 [kW]
		T _j =30 °C	P _{dc}	3.68 [kW]
		T _j =25 °C	P _{dc}	2.60 [kW]
		T _j =20°C	P _{dc}	1.86 [kW]
		T _j =35 °C	EER _d	3.49 [-]
		T _j =30 °C	EER _d	5.03 [-]
		T _j =25 °C	EER _d	6.94 [-]
		T _j =20°C	EER _d	7.57 [-]

Degradation coefficient	C _{dc}	0.97 [-]
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Power consumption in modes other than active mode	Off mode	P _{OFF}	0.007 [kW]
	Thermostat-off mode	P _{TO}	0.007 [kW]
	Standby mode	P _{SB}	0.007 [kW]
	Crankcase heater mode	P _{CK}	0.007 [kW]
Supplementary heater	Rated heat output	P _{SUP}	0.00 [kW]
	Type of energy input		Electrical

Other items	Capacity control		Variable
	Water flow control		Variable
	Water flow rate		-
	Annual energy consumption	Q _{HE}	304 [kWh]





Pre-running and post-running time of liquid pump when the heat pump starts and stops

N#	Pre-running time in seconds (S)	Post-running time in seconds (S)
1 ^K	186	60

K) Keymark

Power consumption of liquid pump for COP test points

N#	COP test points	Measured power consumption (W)	Test mode no.
1	A7/W35	42	1
2	A2/W35	44	1
3	A-7/W35	43	1
4	A7/W55	34	1
5	A2/W55	35	1
6	A-7/W55	33	1

The power consumptions of the liquid pump have been measured separately.





Power consumption of liquid pump for SCOP test points – low temperature application

N#	SCOP test points	Measured power consumption (W)	Test mode no.
1	A12/W24	36	3
2	A7/W27	35	4
3	A2/W30	35	5
4	A-7/W34	40	6
5	A-10/W35	42	7

The power consumptions of the liquid pump have been measured separately.

Power consumption of liquid pump for SCOP test points – medium temperature application

N#	SCOP test points	Measured power consumption (W)	Test mode no.
1	A12/W30	35	8
2	A7/W36	35	9
3	A2/W42	33	10
4	A-7/W52	33	11
5	A-10/W55	33	12

The power consumptions of the liquid pump have been measured separately.





Test results of sound power measurements – EN 12102

N#	Test conditions	Sound power level LW(A) [dB re 1pW]	Uncertainty (dB) (weighted value)
1 ^R	A7/W35	57.4	0.5
2 ^Q	A7/W35	53.7	0.5
3 ^R	A7/W55	59.6	0.5
4 ^Q	A7/W55	54.8	0.5
5 ^R	A-7/W35	65.4	0.5
6 ^Q	A-7/W35	59.9	0.5
7 ^R	A-7/W55	65.7	0.5
8 ^Q	A-7/W55	59.8	0.5
9 ^{E-K}	A7/W55	55.5	0.5
10 ^Q	A2/35	55.9	0.5

R) Rating capacity, Q) Quiet mode 3, E) ERP labelling K) Keymark

The uncertainty value is a weighted value using the level and frequency dependant influence for each 1/1-octave level on the final A-weighted sound power level.

The A-weighted total sound power level is determined for the measured frequency range from 100 Hz to 10 kHz.

The sound power measurements are carried out by Kamalathan Arumugam (KAMA) and co-read by Birger Bech Jessen (BBJN).



Test Rep. nr.



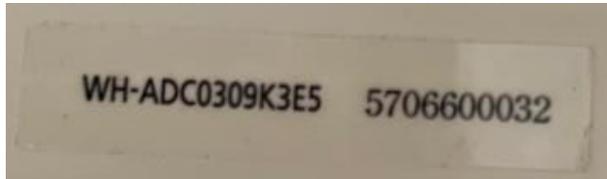
Photo
Rating plate

Unit





Rating plate indoor unit



Indoor unit





SCOP - detailed calculation

Detailed SCOP calculation of low temperature and average climate conditions – EN 14825

Calculation of reference SCOP

$$SCOP = \frac{P_{designh} \times H_{he}}{\frac{P_{designh} \times H_{he}}{SCOP_{on}} + H_{TO} \times P_{TO} + H_{SB} \times P_{SB} + H_{CK} \times P_{CK} + H_{OFF} \times P_{OFF}}$$

Where

P_{design} =

Heating load of the building at design temperature, kW

H_{he} =

Number of equivalent heating hours, 2066 h

H_{TO} , H_{SB} , H_{CK} , H_{OFF} =

Number of hours for which the unit is considered to work in thermostat off mode, standby mode, crankcase heater mode and off mode, h, respectively

P_{TO} , P_{SB} , P_{CK} , P_{OFF} =

Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode, kW, respectively

Data for SCOP

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COPbin [-]
A	-7	88	4.42	4.57	3.51	0.99	1.00	3.51
B	2	54	2.69	2.61	5.28	0.99	1.00	5.28
C	7	35	1.73	2.79	6.62	0.98	0.62	6.55
D	12	15	0.77	3.21	8.76	0.98	0.24	8.24
E	-10	100	5.00	5.10	3.10	1.00	1.00	3.10
F - BIV	-10	100	5.00	5.10	3.10	1.00	1.00	3.10

Energy consumption for thermostat off, standby, off mode, crankcase heater mode

	Hours [h]	Power input [kW]	Applied to SCOP calculation [kW]	Energy consumption [kWh]
Off mode	0	0.0067	0.0067	0
Thermostat off	178	0.0073	0.0073	1.2994
Standby	0	0.0067	0.0067	0
Crankcase heater	178	0.0066	0	0



Calculation Bin for SCOP_{on}

	Bin [-]	Outdoor temperature [°C]	Hours [h]	Heat load [kW]	Heat load covered by heat pump [kW]	Electrical back up heater [kW]	backup heater energy input [kWh]	COP _{bin} [-]	Annual heating demand [kWh]	Annual energy input [kWh]	Net annual heating capacity [kWh]	Net annual power input [kWh]
E / F - BIV	21	-10	1	5.00	5.00	0.00	0.00	3.10	5.00	1.61	5.00	1.61
	22	-9	25	4.81	4.81	0.00	0.00	3.24	120.19	37.13	120.19	37.13
	23	-8	23	4.62	4.62	0.00	0.00	3.37	106.15	31.47	106.15	31.47
A	24	-7	24	4.42	4.42	0.00	0.00	3.51	106.15	30.24	106.15	30.24
	25	-6	27	4.23	4.22	0.00	0.00	3.71	114.23	30.82	114.23	30.82
	26	-5	68	4.04	4.02	0.00	0.00	3.90	274.62	70.35	274.62	70.35
	27	-4	91	3.85	3.82	0.00	0.00	4.10	350.00	85.37	350.00	85.37
	28	-3	89	3.65	3.62	0.00	0.00	4.30	325.19	75.68	325.19	75.68
	29	-2	165	3.46	3.42	0.00	0.00	4.49	571.15	127.11	571.15	127.11
	30	-1	173	3.27	3.21	0.00	0.00	4.69	565.58	120.59	565.58	120.59
	31	0	240	3.08	3.01	0.00	0.00	4.89	738.46	151.12	738.46	151.12
	32	1	280	2.88	2.81	0.00	0.00	5.08	807.69	158.89	807.69	158.89
	B	33	2	320	2.69	2.61	0.00	0.00	5.28	861.54	163.17	861.54
34		3	357	2.50	2.43	0.00	0.00	5.53	892.50	161.27	892.50	161.27
35		4	356	2.31	2.26	0.00	0.00	5.79	821.54	141.93	821.54	141.93
36		5	303	2.12	2.08	0.00	0.00	6.04	640.96	106.08	640.96	106.08
37		6	330	1.92	1.91	0.00	0.00	6.30	634.62	100.79	634.62	100.79
C	38	7	326	1.73	1.73	0.00	0.00	6.55	564.23	86.13	564.23	86.13
	39	8	348	1.54	1.54	0.00	0.00	6.89	535.38	77.72	535.38	77.72
	40	9	335	1.35	1.35	0.00	0.00	7.23	450.96	62.41	450.96	62.41
	41	10	315	1.15	1.15	0.00	0.00	7.56	363.46	48.05	363.46	48.05
	42	11	215	0.96	0.96	0.00	0.00	7.90	206.73	26.16	206.73	26.16
D	43	12	169	0.77	0.77	0.00	0.00	8.24	130.00	15.78	130.00	15.78
	44	13	151	0.58	0.58	0.00	0.00	8.58	87.12	10.16	87.12	10.16
	45	14	105	0.38	0.38	0.00	0.00	8.91	40.38	4.53	40.38	4.53
	46	15	74	0.19	0.19	0.00	0.00	9.25	14.23	1.54	14.23	1.54

SUM	10328.08	1926.12	10328.08	1926.12
SCOP_{on}		5.36	SCOP_{net}	5.36



Detailed SCOP calculation of medium temperature and average climate conditions – EN 14825

Calculation of reference SCOP

$$SCOP = \frac{P_{designh} \times H_{he}}{\frac{P_{designh} \times H_{he}}{SCOP_{on}} + H_{TO} \times P_{TO} + H_{SB} \times P_{SB} + H_{CK} \times P_{CK} + H_{OFF} \times P_{OFF}}$$

Where

- P_{design} = Heating load of the building at design temperature, kW
 H_{he} = Number of equivalent heating hours, 2066 h
 $H_{TO}, H_{SB}, H_{CK}, H_{OFF}$ = Number of hours for which the unit is considered to work in thermostat off mode, standby mode, crankcase heater mode and off mode, h, respectively
 $P_{TO}, P_{SB}, P_{CK}, P_{OFF}$ = Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode, kW, respectively

Data for SCOP

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COPbin [-]
A	-7	88	4.42	4.13	2.19	1.00	1.00	2.19
B	2	54	2.69	2.70	3.65	0.99	1.00	3.65
C	7	35	1.73	2.58	4.79	0.99	0.67	4.76
D	12	15	0.77	3.10	6.65	0.98	0.25	6.35
E	-10	100	5.00	4.83	1.98	1.00	1.00	1.98
F - BIV	-10	100	5.00	4.83	1.98	1.00	1.00	1.98

Energy consumption for thermostat off, standby, off mode, crankcase heater mode

	Hours [h]	Power input [kW]	Applied to SCOP calculation [kW]	Energy consumption [kWh]
Off mode	0	0.0067	0.0067	0
Thermostat off	178	0.0073	0.0073	1.2994
Standby	0	0.0067	0.0067	0
Crankcase heater	178	0.0065	0	0



Calculation Bin for SCOP_{on}

	Bin	Outdoor temperature [°C]	Hours [h]	Heat load [kW]	Heat load covered by heat pump [kW]	Electrical back up heater [kW]	backup heater energy input [kWh]	COP _{bin} [-]	Annual heating demand [kWh]	Annual energy input [kWh]	Net annual heating capacity [kWh]	Net annual power input [kWh]
E / F - BIV	21	-10	1	5.00	4.83	0.00	0.00	1.98	5.00	2.53	5.00	2.53
	22	-9	25	4.81	4.60	0.00	0.00	2.05	120.19	58.63	120.19	58.63
	23	-8	23	4.62	4.36	0.00	0.00	2.12	106.15	50.07	106.15	50.07
A	24	-7	24	4.42	4.13	0.00	0.00	2.19	106.15	48.47	106.15	48.47
	25	-6	27	4.23	3.97	0.00	0.00	2.35	114.23	48.56	114.23	48.56
	26	-5	68	4.04	3.81	0.00	0.00	2.51	274.62	109.22	274.62	109.22
	27	-4	91	3.85	3.65	0.00	0.00	2.68	350.00	130.76	350.00	130.76
	28	-3	89	3.65	3.49	0.00	0.00	2.84	325.19	114.55	325.19	114.55
	29	-2	165	3.46	3.33	0.00	0.00	3.00	571.15	190.31	571.15	190.31
	30	-1	173	3.27	3.17	0.00	0.00	3.16	565.58	178.79	565.58	178.79
	31	0	240	3.08	3.01	0.00	0.00	3.33	738.46	222.06	738.46	222.06
	32	1	280	2.88	2.85	0.00	0.00	3.49	807.69	231.58	807.69	231.58
B	33	2	320	2.69	2.69	0.00	0.00	3.65	861.54	236.04	861.54	236.04
	34	3	357	2.50	2.50	0.00	0.00	3.87	892.50	230.52	892.50	230.52
	35	4	356	2.31	2.31	0.00	0.00	4.09	821.54	200.70	821.54	200.70
	36	5	303	2.12	2.12	0.00	0.00	4.32	640.96	148.54	640.96	148.54
	37	6	330	1.92	1.92	0.00	0.00	4.54	634.62	139.89	634.62	139.89
C	38	7	326	1.73	1.73	0.00	0.00	4.76	564.23	118.58	564.23	118.58
	39	8	348	1.54	1.54	0.00	0.00	5.08	535.38	105.46	535.38	105.46
	40	9	335	1.35	1.35	0.00	0.00	5.39	450.96	83.60	450.96	83.60
	41	10	315	1.15	1.15	0.00	0.00	5.71	363.46	63.62	363.46	63.62
	42	11	215	0.96	0.96	0.00	0.00	6.03	206.73	34.28	206.73	34.28
D	43	12	169	0.77	0.77	0.00	0.00	6.35	130.00	20.48	130.00	20.48
	44	13	151	0.58	0.58	0.00	0.00	6.67	87.12	13.07	87.12	13.07
	45	14	105	0.38	0.38	0.00	0.00	6.98	40.38	5.78	40.38	5.78
	46	15	74	0.19	0.19	0.00	0.00	7.30	14.23	1.95	14.23	1.95

SUM	10328.08	2788.03	10328.08	2788.03
SCOP_{on}		3.70	SCOP_{net}	3.70



Detailed SEER calculation of fan coil application – EN 14825

Calculation of reference SEER

Where

P_{design} = Cooling load of the building at design temperature, kW
 H_{he} = Number of equivalent heating hours, 350 h
 $H_{TO}, H_{SB}, H_{CK}, H_{OFF}$ = Number of hours for which the unit is considered to work in thermostat off mode, standby mode, crankcase heater mode and off mode, h, respectively

$P_{TO}, P_{SB}, P_{CK}, P_{OFF}$ = Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode. kW. respectively

Data for SEER

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared EER [-]	cdc [-]	CR [-]	EERbin [-]
A	35	100	5.00	4.81	3.49	0.99	1.00	3.49
B	30	74	3.68	3.68	5.03	0.99	1.00	5.03
C	25	47	2.37	2.60	6.94	0.98	1.00	6.94
D	20	21	1.05	1.86	7.57	0.97	0.57	7.40

Energy consumption for thermostat off, standby, off mode, crankcase heater mode

	Hours [h]	Power input [kW]	Applied to SCOP calculation [kW]	Energy consumption [kWh]
Off mode	0	0.00697	0.00697	0
Thermostat off	221	0.00731	0.00731	1.61551
Standby	2142	0.00697	0.00697	14.92974
Crankcase heater	2672	0.00708	0.00011	0.29392

Where

P_{design} = Cooling load of the building at design temperature, kW
 H_{he} = Number of equivalent heating hours, 350 h
 $H_{TO}, H_{SB}, H_{CK}, H_{OFF}$ = Number of hours for which the unit is considered to work in thermostat off mode, standby mode, crankcase heater mode and off mode, h, respectively

$P_{TO}, P_{SB}, P_{CK}, P_{OFF}$ = Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode, kW, respectively





Calculation Bin for SEERon

	Bin [-]	Outdoor temperature [°C]	Hours [h]	Cooling load [kW]	EERbin [-]	Annual cooling demand [kWh]	Annual energy input [kWh]
	1	17	205	0.26	7.40	53.95	7.29
	2	18	227	0.53	7.40	119.47	16.14
	3	19	225	0.79	7.40	177.63	24.00
D	4	20	225	1.05	7.40	236.84	32.00
	5	21	216	1.32	7.31	284.21	38.89
	6	22	215	1.58	7.22	339.47	47.04
	7	23	218	1.84	7.12	401.58	56.37
	8	24	197	2.11	7.03	414.74	58.98
C	9	25	178	2.37	6.94	421.58	60.75
	10	26	158	2.63	6.56	415.79	63.40
	11	27	137	2.89	6.18	396.58	64.21
	12	28	109	3.16	5.79	344.21	59.41
	13	29	88	3.42	5.41	301.05	55.63
B	14	30	63	3.68	5.03	232.11	46.14
	15	31	39	3.95	4.72	153.95	32.60
	16	32	31	4.21	4.41	130.53	29.57
	17	33	24	4.47	4.11	107.37	26.15
	18	34	17	4.74	3.80	80.53	21.20
A	19	35	13	5.00	3.49	65.00	18.62
	20	36	9	5.26	3.49	47.37	13.57
	21	37	4	5.53	3.49	22.11	6.33
	22	38	3	5.79	3.49	17.37	4.98
	23	39	1	6.05	3.49	6.05	1.73
	24	40	0	6.32	3.49	0.00	0.00

SUM	4769.47	785.01
SEERon		6.08





Detailed test results

Detailed SCOP test results - low temperature application – EN 14825

Detailed result for 'EN14825:2018' Average Low (A) A -7 /W34		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:	Average	
Temperature application:	Low	
Condition name:	A	
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent:	°C	-10
Tdesign:	°C	-10
Pdesign:	kW	5.00
Heating demand:	kW	4.42
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	4.570
COP	-	3.511
Power consumption	kW	1.302
Measured		
Heating capacity	kW	4.603
COP	-	3.435
Power consumption	kW	1.340
During heating		
Air_inlet temperature dry bulb	°C	-6.97
Air temperature wet bulb	°C	-8.14
Air_outlet temperature dry bulb	°C	-8.91
Water_inlet temperature	°C	29.12
water_outlet temperature	°C	34.18
Water_outlet temperature (Time averaged)	°C	34.18
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	44181
Calculated Hydraulic power	W	10
Calculated global efficiency	η	0.23
Calculated Capacity correction	W	33
Calculated Power correction	W	43
Water Flow	m ³ /s	0.000219



Detailed result for 'EN14825:2018' Average Low (B) A 2 /W30		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:	Average	
Temperature application:	Low	
Condition name:	B	
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent:	°C	-10
Tdesign:	°C	-10
Pdesign:	kW	5.00
Heating demand:	kW	2.69
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	2.608
COP	-	5.279
Power consumption	kW	0.494
Measured		
Heating capacity	kW	2.634
COP	-	5.000
Power consumption	kW	0.527
During heating		
Air_inlet temperature dry bulb	°C	2.13
Air temperature wet bulb	°C	0.83
Air_outlet temperature dry bulb	°C	0.09
Water_inlet temperature	°C	25.18
water_outlet temperature	°C	29.93
Water_outlet temperature (Time averaged)	°C	29.93
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	45997
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	26
Calculated Power correction	W	32
Water Flow	m ³ /s	0.000133





Detailed result for 'EN14825:2018' Average Low (C) A 7 /W27		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:	Average	
Temperature application:	Low	
Condition name:	C	
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent:	°C	-10
Tdesign:	°C	-10
Pdesign:	kW	5.00
Heating demand:	kW	1.73
CR:	-	0.6
Minimum flow reached:	-	Yes
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	2.786
COP	-	6.624
Power consumption	kW	0.421
Measured		
Heating capacity	kW	2.812
COP	-	6.208
Power consumption	kW	0.453
During heating		
Air_inlet temperature dry bulb	°C	7.00
Air temperature wet bulb	°C	6.01
Air_outlet temperature dry bulb	°C	4.84
Water_inlet temperature	°C	23.89
water_outlet temperature	°C	28.96
Water_outlet temperature (Time averaged)	°C	27.04
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	46066
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	26
Calculated Power correction	W	32
Water Flow	m ³ /s	0.000133





Detailed result for 'EN14825:2018' Average Low (D) A 12 /W24		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:	Average	
Temperature application:	Low	
Condition name:	D	
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent:	°C	-10
Tdesign:	°C	-10
Pdesign:	kW	5.00
Heating demand:	kW	0.77
CR:	-	0.2
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	3.213
COP	-	8.755
Power consumption	kW	0.367
Measured		
Heating capacity	kW	3.241
COP	-	8.087
Power consumption	kW	0.401
During heating		
Air_inlet temperature dry bulb	°C	12.00
Air temperature wet bulb	°C	10.88
Air_outlet temperature dry bulb	°C	9.39
Water_inlet temperature	°C	22.81
water_outlet temperature	°C	27.82
Water_outlet temperature (Time averaged)	°C	24.01
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	45266
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	28
Calculated Power correction	W	35
Water Flow	m ³ /s	0.000155





Detailed result for 'EN14825:2018' Average Low (E and F) A -10 /W35		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:	Average	
Temperature application:	Low	
Condition name:	E and F	
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent:	°C	-10
Tdesign:	°C	-10
Pdesign:	kW	5.00
Heating demand:	kW	5.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	5.099
COP	-	3.091
Power consumption	kW	1.650
Measured		
Heating capacity	kW	5.134
COP	-	3.030
Power consumption	kW	1.694
During heating		
Air_inlet temperature dry bulb	°C	-10.00
Air temperature wet bulb	°C	-11.22
Air_outlet temperature dry bulb	°C	-12.21
Water_inlet temperature	°C	30.00
water_outlet temperature	°C	34.85
Water_outlet temperature (Time averaged)	°C	34.85
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	43221
Calculated Hydraulic power	W	11
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	35
Calculated Power correction	W	46
Water Flow	m ³ /s	0.000255



Detailed SCOP test results - medium temperature application - EN 14825

Detailed result for 'EN14825:2018' Average Medium (A) A -7 /W52		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:	Average	
Temperature application:	Medium	
Condition name:	A	
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	4.42
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	4.133
COP	-	2.188
Power consumption	kW	1.889
Measured		
Heating capacity	kW	4.160
COP	-	2.166
Power consumption	kW	1.920
During heating		
Air_inlet temperature dry bulb	°C	-7.02
Air temperature wet bulb	°C	-8.07
Air_outlet temperature dry bulb	°C	-8.68
Water_inlet temperature	°C	44.37
water_outlet temperature	°C	51.97
Water_outlet temperature (Time averaged)	°C	51.97
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	48243
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	27
Calculated Power correction	W	33
Water Flow	m ³ /s	0.000132





Detailed result for 'EN14825:2018' Average Medium (B) A 2 /W42		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Medium
Condition name:		B
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	2.69
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	2.702
COP	-	3.648
Power consumption	kW	0.741
Measured		
Heating capacity	kW	2.728
COP	-	3.542
Power consumption	kW	0.770
During heating		
Air_inlet temperature dry bulb	°C	2.13
Air temperature wet bulb	°C	0.93
Air_outlet temperature dry bulb	°C	0.08
Water_inlet temperature	°C	37.05
water_outlet temperature	°C	41.99
Water_outlet temperature (Time averaged)	°C	41.99
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	47660
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	27
Calculated Power correction	W	33
Water Flow	m ³ /s	0.000133



Detailed result for 'EN14825:2018' Average Medium (C) A 7/W36		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Medium
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	1.73
CR:	-	0.7
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	2.580
COP	-	4.788
Power consumption	kW	0.539
Measured		
Heating capacity	kW	2.607
COP	-	4.562
Power consumption	kW	0.571
During heating		
Air_inlet temperature dry bulb	°C	7.00
Air temperature wet bulb	°C	5.90
Air_outlet temperature dry bulb	°C	5.06
Water_inlet temperature	°C	32.90
water_outlet temperature	°C	37.61
Water_outlet temperature (Time averaged)	°C	36.06
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	46507
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	26
Calculated Power correction	W	33
Water Flow	m ³ /s	0.000133



Detailed result for 'EN14825:2018' Average Medium (D) A 12 /W30		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Medium
Condition name:		D
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	0.77
CR:	-	0.2
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.097
COP	-	6.654
Power consumption	kW	0.466
Measured		
Heating capacity	kW	3.124
COP	-	6.266
Power consumption	kW	0.498
During heating		
Air_inlet temperature dry bulb	°C	12.00
Air temperature wet bulb	°C	10.90
Air_outlet temperature dry bulb	°C	9.61
Water_inlet temperature	°C	28.62
water_outlet temperature	°C	34.26
Water_outlet temperature (Time averaged)	°C	30.02
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	46641
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	26
Calculated Power correction	W	33
Water Flow	m ³ /s	0.000133





Detailed result for 'EN14825:2018' Average Medium (E and F) A -10 /W55		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:	Average	
Temperature application:	Medium	
Condition name:	E and F	
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent:	°C	-10
Tdesign:	°C	-10
Pdesign:	kW	5.00
Heating demand:	kW	5.00
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	4.831
COP	-	1.983
Power consumption	kW	2.436
Measured		
Heating capacity	kW	4.859
COP	-	1.965
Power consumption	kW	2.472
During heating		
Air_inlet temperature dry bulb	°C	-9.95
Air temperature wet bulb	°C	-10.96
Air_outlet temperature dry bulb	°C	-11.56
Water_inlet temperature	°C	46.98
water_outlet temperature	°C	54.98
Water_outlet temperature (Time averaged)	°C	54.98
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	48298
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	28
Calculated Power correction	W	35
Water Flow	m ³ /s	0.000147



Detailed test results for rating conditions – low temperature – EN 14511

Detailed result for 'EN14511:2018' A7/W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.248
COP	-	5.439
Power consumption	kW	0.965
Measured		
Heating capacity	kW	5.283
COP	-	5.226
Power consumption	kW	1.011
During heating		
Air_inlet temperature dry bulb	°C	7.00
Air temperature wet bulb	°C	5.90
Air_outlet temperature dry bulb	°C	4.29
Water_inlet temperature	°C	30.02
water_outlet temperature	°C	35.03
Water_outlet temperature (Time averaged)		
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	43255
Calculated Hydraulic power	W	11
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	35
Calculated Power correction	W	46
Water Flow	m ³ /s	0.000253



Detailed result for 'EN14511:2018' A2/W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Transient
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.361
COP	-	4.042
Power consumption	kW	1.326
Measured		
Heating capacity	kW	5.395
COP	-	3.933
Power consumption	kW	1.372
During heating		
Air_inlet temperature dry bulb	°C	2.08
Air temperature wet bulb	°C	0.83
Air_outlet temperature dry bulb	°C	-1.45
Water_inlet temperature	°C	29.40
water_outlet temperature	°C	35.08
Water_outlet temperature (Time averaged)		
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	42843
Calculated Hydraulic power	W	11
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	35
Calculated Power correction	W	45
Water Flow	m ³ /s	0.000252





Detailed result for 'EN14511:2018' A-7/W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.590
COP	-	3.342
Power consumption	kW	1.673
Measured		
Heating capacity	kW	5.625
COP	-	3.273
Power consumption	kW	1.718
During heating		
Air_inlet temperature dry bulb	°C	-6.98
Air temperature wet bulb	°C	-8.09
Air_outlet temperature dry bulb	°C	-9.31
Water_inlet temperature	°C	29.80
water_outlet temperature	°C	35.14
Water_outlet temperature (Time averaged)		
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	42897
Calculated Hydraulic power	W	11
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	35
Calculated Power correction	W	46
Water Flow	m ³ /s	0.000253





Detailed test results for rating conditions – medium temperature – EN 14511

Detailed result for 'EN14511:2018' A7/W55		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.006
COP	-	3.152
Power consumption	kW	1.588
Measured		
Heating capacity	kW	5.035
COP	-	3.099
Power consumption	kW	1.624
During heating		
Air_inlet temperature dry bulb	°C	7.00
Air temperature wet bulb	°C	5.91
Air_outlet temperature dry bulb	°C	4.67
Water_inlet temperature	°C	47.00
water_outlet temperature	°C	54.98
Water_outlet temperature (Time averaged)		
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	48035
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	29
Calculated Power correction	W	36
Water Flow	m ³ /s	0.000152



Detailed result for 'EN14511:2018' A2/W55		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Transient
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.034
COP	-	2.539
Power consumption	kW	1.982
Measured		
Heating capacity	kW	5.064
COP	-	2.507
Power consumption	kW	2.020
During heating		
Air_inlet temperature dry bulb	°C	2.11
Air temperature wet bulb	°C	0.88
Air_outlet temperature dry bulb	°C	-0.59
Water_inlet temperature	°C	47.07
water_outlet temperature	°C	54.99
Water_outlet temperature (Time averaged)		
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	47494
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.21
Calculated Capacity correction	W	30
Calculated Power correction	W	38
Water Flow	m ³ /s	0.000166





Detailed result for 'EN14511:2018' A-7/W55		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	4.645
COP	-	2.016
Power consumption	kW	2.304
Measured		
Heating capacity	kW	4.673
COP	-	1.998
Power consumption	kW	2.339
During heating		
Air_inlet temperature dry bulb	°C	-7.01
Air temperature wet bulb	°C	-8.13
Air_outlet temperature dry bulb	°C	-8.66
Water_inlet temperature	°C	46.98
water_outlet temperature	°C	54.84
Water_outlet temperature (Time averaged)		
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	48323
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	28
Calculated Power correction	W	35
Water Flow	m ³ /s	0.000144



Detailed test results for rating conditions – quiet mode – EN 14511

Detailed result for 'EN14511:2018' A2/W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.211
COP	-	3.675
Power consumption	kW	0.874
Measured		
Heating capacity	kW	3.245
COP	-	3.534
Power consumption	kW	0.918
During heating		
Air temperature dry bulb	°C	2.03
Air temperature wet bulb	°C	1.10
Air temperature dry bulb outlet	°C	-0.95
Inlet temperature	°C	31.42
Outlet temperature	°C	35.04
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	42248
Calculated Hydraulic power	W	10
Calculated global efficiency	η	0.23
Calculated Capacity correction	W	34
Calculated Power correction	W	44
Water Flow	m ³ /s	0.000246





Detailed SEER test results for fan coil application

Detailed result for 'EN14825:2018 Cooling fan (A) A35/W7		
Tested according to:	EN14511:2018 and	EN14825:2018
Climate zone:		N/A
Temperature application:		Cooling fan
Condition name:		A
Condition temperature:	°C	35
Part load:	%	100%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	5.00
Cooling demand:	kW	5.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Cooling capacity	kW	4.814
EER	-	3.494
Power consumption	kW	1.378
Measured		
Cooling capacity	kW	4.779
EER	-	3.355
Power consumption	kW	1.424
During cooling		
Air_inlet temperature dry bulb	°C	34.92
Air_outlet temperature dry bulb	°C	39.01
Water_inlet temperature	°C	12.01
Water_outlet temperature	°C	7.10
Water_outlet temperature (Time averaged)	°C	7.10
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	48562
Calculated Hydraulic power	W	11
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	35
Calculated Power correction	W	47
Water Flow	m ³ /s	0.000232





Detailed result for 'EN14825:2018 Cooling fan (B) A30/W8.5		
Tested according to:	EN14511:2018 and	EN14825:2018
Climate zone:		N/A
Temperature application:		Cooling fan
Condition name:		B
Condition temperature:	°C	30
Part load:	%	74%
Chosen T _{bivalent}	°C	N/A
T _{design}	°C	35
P _{design}	kW	5.00
Cooling demand:	kW	3.70
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Cooling capacity	kW	3.677
EER	-	5.030
Power consumption	kW	0.731
Measured		
Cooling capacity	kW	3.646
EER	-	4.725
Power consumption	kW	0.772
During cooling		
Air _{inter} temperature dry bulb	°C	29.91
Air _{outlet} temperature dry bulb	°C	33.52
Water _{Inlet} temperature	°C	13.51
Water _{outlet} temperature	°C	8.52
Water _{outlet} temperature (Time averaged)	°C	8.52
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	51004
Calculated Hydraulic power	W	9
Calculated global efficiency	η	0.22
Calculated Capacity correction	W	32
Calculated Power correction	W	41
Water Flow	m ³ /s	0.000175



Detailed result for 'EN14825:2018 Cooling fan (C) A25/W10		
Tested according to:	EN14511:2018 and	EN14825:2018
Climate zone:		N/A
Temperature application:		Cooling fan
Condition name:		C
Condition temperature:	°C	25
Part load:	%	47%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	5.00
Cooling demand:	kW	2.35
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Cooling capacity	kW	2.598
EER	-	6.937
Power consumption	kW	0.375
Measured		
Cooling capacity	kW	2.570
EER	-	6.277
Power consumption	kW	0.409
During cooling		
Air_inter temperature dry bulb	°C	24.97
Air_outlet temperature dry bulb	°C	28.47
Water_Inlet temperature	°C	14.55
Water_outlet temperature	°C	9.94
Water_outlet temperature (Time averaged)	°C	9.94
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	51955
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	28
Calculated Power correction	W	35
Water Flow	m ³ /s	0.000133



Detailed result for 'EN14825:2018 Cooling fan (D) A20/W11.5		
Tested according to:	EN14511:2018 and	EN14825:2018
Climate zone:		N/A
Temperature application:		Cooling fan
Condition name:		D
Condition temperature:	°C	20
Part load:	%	21%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	5.00
Cooling demand:	kW	1.05
CR:	-	0.6
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Cooling capacity	kW	1.856
EER	-	7.567
Power consumption	kW	0.245
Measured		
Cooling capacity	kW	1.828
EER	-	6.533
Power consumption	kW	0.280
During cooling		
Air_inter temperature dry bulb	°C	20.00
Air_outlet temperature dry bulb	°C	25.63
Water_Inlet temperature	°C	13.39
Water_outlet temperature	°C	10.11
Water_outlet temperature (Time averaged)	°C	11.54
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	51101
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	28
Calculated Power correction	W	35
Water Flow	m ³ /s	0.000133





Detailed test results of sound power measurement – Test N#1

		Sound power levels according to ISO 3743-1:2010	
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms			
Client: Panasonic Marketing Europe GmbH		Date of test: 11-09-2023	
Object: Type: Air to water heat pump Model: WH-UDZ05KE5			
Mounting conditions: The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.			
Operating conditions: A7/W35, Compressor speed: 39[Hz], Fan speed: 510[rpm], Heating capacity: 5.3 [kW], Power input: 1.0 [kW], Water flow rate: 910 [l/h], dp_water: 470 [mbar]			
Static pressure: 1024 kPa		Reference box:	
Air temperature: 7.0 °C		L1: 0.9 m	
Relative air humidity: 84.0 %		L2: 0.4 m	
Test room volume: 102.8 m³	Room: Room 2	L3: 0.8 m	
Area, S, of test room: 138.9 m²		Volume: 0.3 m³	

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	63.8	
125	52.3	64.5
160	53.7	
200	51.1	
250	54.4	58.7
315	55.2	
400	53.4	
500	49.1	56.0
630	49.8	
800	48.2	
1000	45.5	51.3
1250	45.1	
1600	42.9	
2000	40.6	45.9
2500	39.2	
3150	39.7	
4000	35.7	42.2
5000	35.5	
6300	38.4	
8000	35.2	40.5
10000	29.8	

¹ Diff. to backgr. noise < 6dB

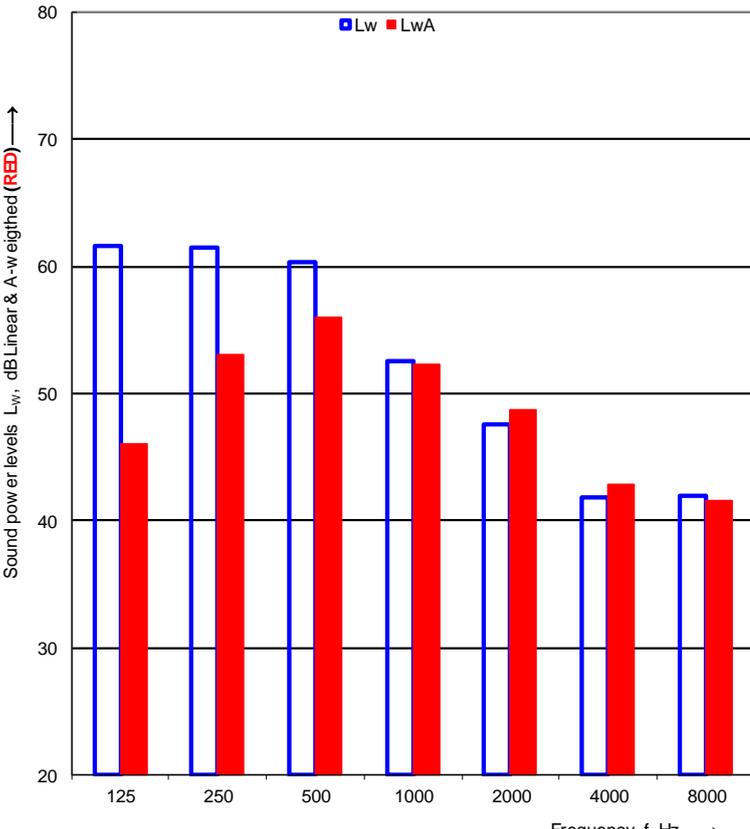
Sound power level L_w(A): 57.4 dB [re 1pW]

Name of test institute: DTI	Date: 11-09-2023
No. of test report: 300-KLAB-23-009	
Measurements are in full conformity with ISO 3743	





Detailed test results of sound power measurement – Test N#3

		Sound power levels according to ISO 3743-1:2010																																																																	
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																			
Client: Panasonic Marketing Europe GmbH		Date of test: 11-09-2023																																																																	
Object: Type: Air to water heat pump Model: WH-UDZ05KE5																																																																			
Mounting conditions: The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																			
Operating conditions: A7/W55, Compressor speed: 42[Hz], Fan speed: 540[rpm], Heating capacity: 5.0 [kW], Power input: 1.63 [kW], Water flow rate: 550 [l/h], dp_water: 465 [mbar]																																																																			
Static pressure: 1024 kPa		Reference box:																																																																	
Air temperature: 7.0 °C		L1: 0.9 m																																																																	
Relative air humidity: 84.0 %		L2: 0.4 m																																																																	
Test room volume: 102.8 m³		Room: Room 2																																																																	
Area, S, of test room: 138.9 m²		L3: 0.8 m																																																																	
		Volume: 0.3 m³																																																																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Frequency f [Hz]</th> <th>L_w 1/3 octave [dB]</th> <th>1/1 oct [dB]</th> </tr> </thead> <tbody> <tr><td>100</td><td>58.0</td><td></td></tr> <tr><td>125</td><td>52.9</td><td>61.5</td></tr> <tr><td>160</td><td>57.8</td><td></td></tr> <tr><td>200</td><td>53.9</td><td></td></tr> <tr><td>250</td><td>59.4</td><td>61.5</td></tr> <tr><td>315</td><td>54.6</td><td></td></tr> <tr><td>400</td><td>59.5</td><td></td></tr> <tr><td>500</td><td>50.1</td><td>60.3</td></tr> <tr><td>630</td><td>49.4</td><td></td></tr> <tr><td>800</td><td>49.9</td><td></td></tr> <tr><td>1000</td><td>46.2</td><td>52.5</td></tr> <tr><td>1250</td><td>45.9</td><td></td></tr> <tr><td>1600</td><td>45.0</td><td></td></tr> <tr><td>2000</td><td>42.1</td><td>47.6</td></tr> <tr><td>2500</td><td>39.9</td><td></td></tr> <tr><td>3150</td><td>39.2</td><td></td></tr> <tr><td>4000</td><td>36.6</td><td>41.8</td></tr> <tr><td>5000</td><td>33.5</td><td></td></tr> <tr><td>6300</td><td>40.8</td><td></td></tr> <tr><td>8000</td><td>34.3</td><td>41.9</td></tr> <tr><td>10000</td><td>29.2</td><td></td></tr> </tbody> </table>	Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	58.0		125	52.9	61.5	160	57.8		200	53.9		250	59.4	61.5	315	54.6		400	59.5		500	50.1	60.3	630	49.4		800	49.9		1000	46.2	52.5	1250	45.9		1600	45.0		2000	42.1	47.6	2500	39.9		3150	39.2		4000	36.6	41.8	5000	33.5		6300	40.8		8000	34.3	41.9	10000	29.2		
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800	49.9																																																																		
1000	46.2	52.5																																																																	
1250	45.9																																																																		
1600	45.0																																																																		
2000	42.1	47.6																																																																	
2500	39.9																																																																		
3150	39.2																																																																		
4000	36.6	41.8																																																																	
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6300	40.8																																																																		
8000	34.3	41.9																																																																	
10000	29.2																																																																		
¹ Diff. to backgr. noise < 6dB																																																																			
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> Sound power level L_w(A): 59.6 dB [re 1pW] </div>																																																																			
Name of test institute: DTI		Date: 11-09-2023																																																																	
No. of test report: 300-KLAB-23-009																																																																			
Measurements are in full conformity with ISO 3743																																																																			





Detailed test results of sound power measurement – Test N#4

		Sound power levels according to ISO 3743-1:2010	
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms			
Client:	Panasonic Marketing Europe GmbH	Date of test:	11-09-2023
Object:	Type: Air to water heat pump Model: WH-UDZ05KE5		
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.		
Operating conditions:	A7/W55, Compressor speed: 28[Hz], Fan speed: 360[rpm], Heating capacity: 2.8 [kW], Power_input: 1.12 [kW], Water flow rate: 480 [l/h], dp_water: 473 [mbar]		
Static pressure:	1024 kPa	<u>Reference box:</u>	
Air temperature:	7.0 °C	L1:	0.9 m
Relative air humidity:	84.0 %	L2:	0.4 m
Test room volume:	102.8 m³	L3:	0.8 m
Area, S, of test room:	138.9 m²	Volume:	0.3 m³

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	49.8 ²	
125	47.4 ²	58.3
160	57.2	
200	51.2 ²	
250	52.1	56.5
315	51.7	
400	49.3	
500	49.5	53.2
630	45.5	
800	45.5	
1000	42.7	48.7
1250	42.9	
1600	38.8	
2000	35.5	41.9
2500	36.3	
3150	35.5	
4000	36.7	40.7
5000	35.5	
6300	40.1	
8000	35.6	41.6
10000	27.2 ²	

¹ Diff. to backgr. noise < 6dB

² Correction

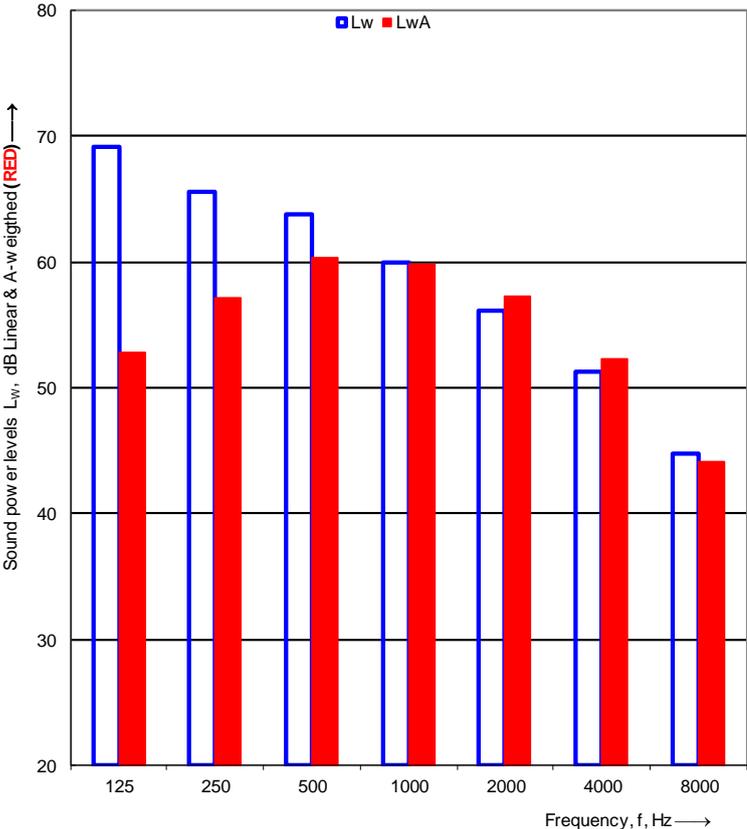
Sound power level L_w(A): 54.8 dB [re 1pW]

Name of test institute:	DTI	Date:	11-09-2023
No. of test report:	300-KLAB-23-009		
Measurements are in full conformity with ISO 3743			





Detailed test results of sound power measurement – Test N#5

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:	Panasonic Marketing Europe GmbH			Date of test:	12-09-2023																																																																		
Object:	Type: Air to water heat pump Model: WH-UDZ05KE5																																																																						
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																						
Operating conditions:	A-7/W35, Compressor speed: 64[Hz], Fan speed: 730[rpm], Heating capacity: 5.4 [kW], Power input: 1.72 [kW], Water flow rate: 953 [l/h], dp_water: 427 [mbar]																																																																						
Static pressure:	1011 kPa	<u>Reference box:</u>		L1:	0.9 m																																																																		
Air temperature:	-7.0 °C			L2:	0.4 m																																																																		
Relative air humidity:	74.0 %			L3:	0.8 m																																																																		
Test room volume:	102.8 m³	Room:	Room 2	Volume:	0.3 m³																																																																		
Area, S, of test room:	138.9 m²																																																																						
<table border="1"> <thead> <tr> <th>Frequency f [Hz]</th> <th>L_w 1/3 octave [dB]</th> <th>1/1 oct [dB]</th> </tr> </thead> <tbody> <tr><td>100</td><td>66.5</td><td></td></tr> <tr><td>125</td><td>62.5</td><td>69.2</td></tr> <tr><td>160</td><td>63.0</td><td></td></tr> <tr><td>200</td><td>60.7</td><td></td></tr> <tr><td>250</td><td>61.5</td><td>65.6</td></tr> <tr><td>315</td><td>60.1</td><td></td></tr> <tr><td>400</td><td>59.4</td><td></td></tr> <tr><td>500</td><td>59.7</td><td>63.7</td></tr> <tr><td>630</td><td>57.4</td><td></td></tr> <tr><td>800</td><td>56.2</td><td></td></tr> <tr><td>1000</td><td>54.7</td><td>59.9</td></tr> <tr><td>1250</td><td>54.2</td><td></td></tr> <tr><td>1600</td><td>52.7</td><td></td></tr> <tr><td>2000</td><td>51.0</td><td>56.1</td></tr> <tr><td>2500</td><td>49.7</td><td></td></tr> <tr><td>3150</td><td>48.0</td><td></td></tr> <tr><td>4000</td><td>46.4</td><td>51.2</td></tr> <tr><td>5000</td><td>44.2</td><td></td></tr> <tr><td>6300</td><td>42.2</td><td></td></tr> <tr><td>8000</td><td>39.3</td><td>44.8</td></tr> <tr><td>10000</td><td>37.1</td><td></td></tr> </tbody> </table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	66.5		125	62.5	69.2	160	63.0		200	60.7		250	61.5	65.6	315	60.1		400	59.4		500	59.7	63.7	630	57.4		800	56.2		1000	54.7	59.9	1250	54.2		1600	52.7		2000	51.0	56.1	2500	49.7		3150	48.0		4000	46.4	51.2	5000	44.2		6300	42.2		8000	39.3	44.8	10000	37.1					
Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]																																																																					
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10000	37.1																																																																						
¹ Diff. to backgr. noise < 6dB		<div style="border: 1px solid black; padding: 5px;"> Sound power level L_w(A): 65.4 dB [re 1pW] </div>																																																																					
Name of test institute:	DTI			Date:	12-09-2023																																																																		
No. of test report:	300-KLAB-23-009																																																																						
Measurements are in full conformity with ISO 3743																																																																							





Detailed test results of sound power measurement – Test N#6

		Sound power levels according to ISO 3743-1:2010																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																					
Client: Panasonic Marketing Europe GmbH		Date of test: 12-09-2023																																																																			
Object: Type: Air to water heat pump Model: WH-UDZ05KE5																																																																					
Mounting conditions: The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions: A-7/W35, Compressor speed: 41[Hz], Fan speed: 570[rpm], Heating capacity: 3.7 [kW], Power_input: 1.1 [kW], Water flow rate: 650 [l/h], dp_water: 452 [mbar]																																																																					
Static pressure: 1011 kPa		<u>Reference box:</u>																																																																			
Air temperature: -7.0 °C		L1: 0.9 m																																																																			
Relative air humidity: 74.0 %		L2: 0.4 m																																																																			
Test room volume: 102.8 m³		L3: 0.8 m																																																																			
Area, S, of test room: 138.9 m²		Volume: 0.3 m³																																																																			
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Frequency f [Hz]</th> <th>L_w 1/3 octave [dB]</th> <th>1/1 oct [dB]</th> </tr> </thead> <tbody> <tr><td>100</td><td>59.2</td><td></td></tr> <tr><td>125</td><td>60.6</td><td>63.7</td></tr> <tr><td>160</td><td>55.7</td><td></td></tr> <tr><td>200</td><td>54.4</td><td></td></tr> <tr><td>250</td><td>61.2</td><td>62.7</td></tr> <tr><td>315</td><td>54.3</td><td></td></tr> <tr><td>400</td><td>54.3</td><td></td></tr> <tr><td>500</td><td>52.5</td><td>57.9</td></tr> <tr><td>630</td><td>52.2</td><td></td></tr> <tr><td>800</td><td>50.5</td><td></td></tr> <tr><td>1000</td><td>48.1</td><td>53.8</td></tr> <tr><td>1250</td><td>48.1</td><td></td></tr> <tr><td>1600</td><td>45.9</td><td></td></tr> <tr><td>2000</td><td>43.8</td><td>49.1</td></tr> <tr><td>2500</td><td>42.6</td><td></td></tr> <tr><td>3150</td><td>39.6</td><td></td></tr> <tr><td>4000</td><td>37.6</td><td>42.6</td></tr> <tr><td>5000</td><td>35.4</td><td></td></tr> <tr><td>6300</td><td>38.9</td><td></td></tr> <tr><td>8000</td><td>33.5</td><td>40.2</td></tr> <tr><td>10000</td><td>27.4</td><td></td></tr> </tbody> </table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	59.2		125	60.6	63.7	160	55.7		200	54.4		250	61.2	62.7	315	54.3		400	54.3		500	52.5	57.9	630	52.2		800	50.5		1000	48.1	53.8	1250	48.1		1600	45.9		2000	43.8	49.1	2500	42.6		3150	39.6		4000	37.6	42.6	5000	35.4		6300	38.9		8000	33.5	40.2	10000	27.4			
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Name of test institute: DTI		Date: 12-09-2023																																																																			
No. of test report: 300-KLAB-23-009																																																																					
Measurements are in full conformity with ISO 3743																																																																					





Detailed test results of sound power measurement – Test N#7

		Sound power levels according to ISO 3743-1:2010	
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms			
Client:	Panasonic Marketing Europe GmbH	Date of test:	12-09-2023
Object:	Type: Air to water heat pump Model: WH-UDZ05KE5		
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.		
Operating conditions:	A-7/W55, Compressor speed: 64[Hz], Fan speed: 730[rpm], Heating capacity: 4.65 [kW], Power_input: 2.35 [kW], Water flow rate: 517 [l/h], dp_water: 468 [mbar]		
Static pressure:	1011 kPa	Reference box:	
Air temperature:	-7.0 °C	L1:	0.9 m
Relative air humidity:	74.0 %	L2:	0.4 m
Test room volume:	102.8 m³	L3:	0.8 m
Area, S, of test room:	138.9 m²	Volume:	0.3 m³

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	66.9	
125	64.8	70.3
160	64.3	
200	60.7	
250	62.1	65.9
315	60.5	
400	59.4	
500	60.1	63.9
630	57.3	
800	56.3	
1000	54.8	59.9
1250	54.1	
1600	53.2	
2000	51.2	56.6
2500	50.5	
3150	48.6	
4000	49.0	52.6
5000	44.9	
6300	43.1	
8000	40.6	46.1
10000	39.4	

¹ Diff. to backgr. noise < 6dB

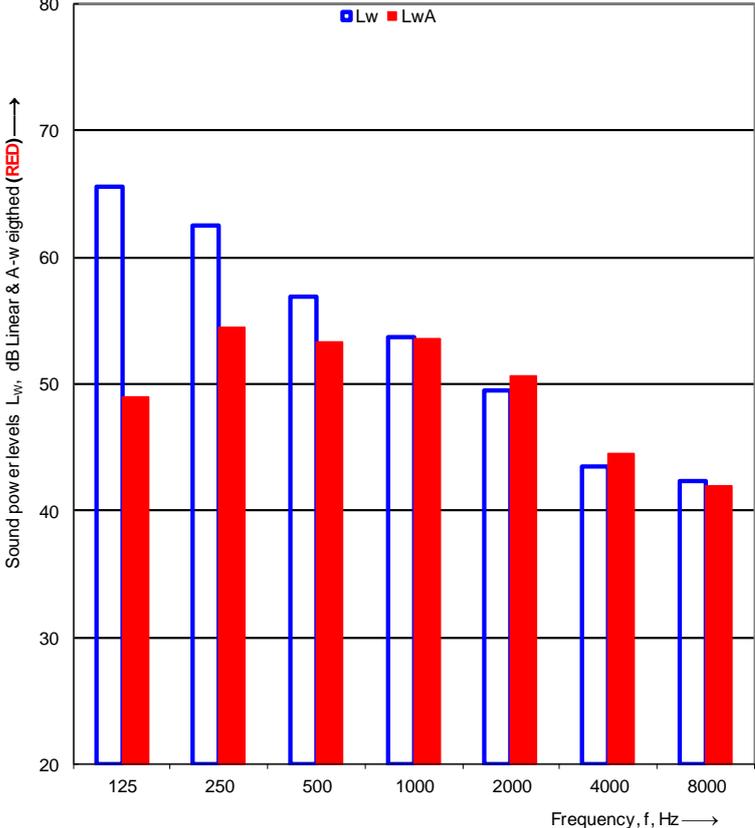
Sound power level L_w(A): 65.7 dB [re 1pW]

Name of test institute:	DTI	Date:	12-09-2023
No. of test report:	300-KLAB-23-009		
Measurements are in full conformity with ISO 3743			





Detailed test results of sound power measurement – Test N#8

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:		Panasonic Marketing Europe GmbH		Date of test: 12-09-2023																																																																			
Object:		Type: Air to water heat pump Model: WH-UDZ05KE5																																																																					
Mounting conditions:		The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:		A-7/W55, Compressor speed: 41[Hz], Fan speed: 570[rpm], Heating capacity: 3.0 [kW], Power_input: 1.5 [kW], Water flow rate: 480 [l/h], dp_water: 470 [mbar]																																																																					
Static pressure:		1011 kPa		<u>Reference box:</u>																																																																			
Air temperature:		-7.0 °C		L1: 0.9 m																																																																			
Relative air humidity:		74.0 %		L2: 0.4 m																																																																			
Test room volume:		102.8 m³		Room: Room 2																																																																			
Area, S, of test room:		138.9 m²		L3: 0.8 m																																																																			
				Volume: 0.3 m³																																																																			
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Sound power level L_w(A): 59.8 dB [re 1pW]																																																																							
Name of test institute:		DTI		Date: 12-09-2023																																																																			
No. of test report:		300-KLAB-23-009																																																																					
Measurements are in full conformity with ISO 3743																																																																							





Detailed test results of sound power measurement – Test N#9

		Sound power levels according to ISO 3743-1:2010	
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms			
Client:	Panasonic Marketing Europe GmbH	Date of test:	11-09-2023
Object:	Type: Air to water heat pump Model: WH-UDZ05KE5		
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.		
Operating conditions:	A7/W55, Compressor speed: 26[Hz], Fan speed: 430[rpm], Heating capacity: 2.7 [kW], Power_input: 1.06 [kW], Water flow rate: 480 [l/h], dp_water: 473 [mbar]		
Static pressure:	1024 kPa	<u>Reference box:</u>	
Air temperature:	7.0 °C	L1:	0.9 m
Relative air humidity:	84.0 %	L2:	0.4 m
Test room volume:	102.8 m³	L3:	0.8 m
Area, S, of test room:	138.9 m²	Volume:	0.3 m³

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	56.2 ²	
125	48.0 ²	59.4
160	56.0	
200	58.7	
250	55.2	60.7
315	49.7	
400	50.3	
500	48.3	53.0
630	43.8	
800	43.9	
1000	42.8	48.2
1250	43.6	
1600	40.4	
2000	37.7	43.1
2500	35.6	
3150	33.7	
4000	35.2	39.0
5000	33.6	
6300	41.4	
8000	34.8	42.5
10000	30.2 ²	

¹ Diff. to backgr. noise < 6dB

² Correction

Sound power level L_w(A): 55.5 dB [re 1pW]

Name of test institute:	DTI	Date:	11-09-2023
No. of test report:	300-KLAB-23-009		
Measurements are in full conformity with ISO 3743			





Detailed test results of sound power measurement – Test N#10

		Sound power levels according to ISO 3743-1:2010																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																					
Client: Panasonic Marketing Europe GmbH		Date of test: 11-09-2023																																																																			
Object: Type: Air to water heat pump Model: WH-UDZ05KE5																																																																					
Mounting conditions: The outdoor unit is mounted on the supporting metal support frame using four vibration damping insulators. The support is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions: A2/W35, Compressor speed: 35[Hz], Fan speed: 480[rpm], Heating capacity: 4.1 [kW], Power_input: 0.94 [kW], Water flow rate: 680 [l/h], dp_water: 450 [mbar]																																																																					
Static pressure: 1014 kPa		Reference box:																																																																			
Air temperature: 2.0 °C		L1: 0.9 m																																																																			
Relative air humidity: 85.0 %		L2: 0.4 m																																																																			
Test room volume: 102.8 m³		L3: 0.8 m																																																																			
Area, S, of test room: 138.9 m²		Volume: 0.3 m³																																																																			
Room: Room 2																																																																					
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Frequency f [Hz]</th> <th>L_w 1/3 octave [dB]</th> <th>1/1 oct [dB]</th> </tr> </thead> <tbody> <tr><td>100</td><td>61.8</td><td></td></tr> <tr><td>125</td><td>54.1</td><td>63.5</td></tr> <tr><td>160</td><td>56.8</td><td></td></tr> <tr><td>200</td><td>58.2</td><td></td></tr> <tr><td>250</td><td>51.9</td><td>60.2</td></tr> <tr><td>315</td><td>53.5</td><td></td></tr> <tr><td>400</td><td>49.1</td><td></td></tr> <tr><td>500</td><td>48.0</td><td>53.1</td></tr> <tr><td>630</td><td>47.8</td><td></td></tr> <tr><td>800</td><td>46.2</td><td></td></tr> <tr><td>1000</td><td>43.3</td><td>49.3</td></tr> <tr><td>1250</td><td>43.5</td><td></td></tr> <tr><td>1600</td><td>40.7</td><td></td></tr> <tr><td>2000</td><td>38.2</td><td>43.5</td></tr> <tr><td>2500</td><td>36.1</td><td></td></tr> <tr><td>3150</td><td>34.2</td><td></td></tr> <tr><td>4000</td><td>30.1</td><td>36.3</td></tr> <tr><td>5000</td><td>28.0</td><td></td></tr> <tr><td>6300</td><td>38.5</td><td></td></tr> <tr><td>8000</td><td>33.2</td><td>39.7</td></tr> <tr><td>10000</td><td>24.2</td><td>¹</td></tr> </tbody> </table>	Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	61.8		125	54.1	63.5	160	56.8		200	58.2		250	51.9	60.2	315	53.5		400	49.1		500	48.0	53.1	630	47.8		800	46.2		1000	43.3	49.3	1250	43.5		1600	40.7		2000	38.2	43.5	2500	36.1		3150	34.2		4000	30.1	36.3	5000	28.0		6300	38.5		8000	33.2	39.7	10000	24.2	¹			
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Appendix 1: Test Procedure

The measurements of the emitted sound power level from the heat pump are carried out according to the following:

- DS/EN 14511:2018
- EN 12102-1:2017
- ISO/EN 3743-1

The basic acoustic measurement standard ISO/EN 3743-1 is a comparison method using a calibrated reference sound source. Two series of sound pressure measurements are made under exactly the same acoustic conditions, e.g., the same microphone positions, temperature and air humidity. The calibrated sound power levels are known for the reference sound source at each frequency band, and they are used in the estimation of the acoustical correction factor for the calculation of the sound power emitted from the tested heat pump. The background noise levels are measured and used for relevant corrections.

The final total A-weighted sound power level is based on measurements and calculations in 1/3-octave levels, which then are summed into 1/1-octave levels. The uncertainty is estimated on the weighted standard deviations in 1/1-octave levels.

The actual microphone positions and correction values are saved in data files linked to the complete project documentation according to the DANAK-accreditation.

The complete measurement system is documented and regularly calibrated according to DANAK.

The detailed description of the measurement method is given in Danish in the quality database system "QA Web" at Danish Technological Institute, which is accessible by DANAK.

