

TEST REPORT

Report no.:
300-KLAB-20-009



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File no.: 918124
Enclosures: 0

Customer: Company: Panasonic Marketing Europe
Address: Hagenauer Strasse 43
City: 65203 Wiesbaden
Tel.: +49 1724 141441

Component: Brand: Panasonic
Type: Mono bloc heat pump air to water
Model: WH-MDC07J3E5 / Tank DGC 200
Series no.: 5622401010 / %2101002719
Production year: 2020.01 / 2019.12

Dates: Component tested: May - June 2020

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.

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Test Rep. 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 14825:2016. In order to calculate the SCOP, tests were carried out at the part load conditions stated in the tables on page 5 and 6.

SEER test points for cooling mode, fan coil according to EN 14825:2016 at A35/W7 and A25/W10

SEER test points for cooling mode, floor according to EN14825:2016 at A35/W18 and A25/W18

Standard rating conditions (heating) according to EN 14511:2018 at A7/W35 and A7/W55

Full load test (heating) according to EN14511:2018 at A2/W35, A-7/W35 and A-7/W55

Part load test (heating) according to EN14511:2018 at A7/W35, A2/W35 and A-7/W35

Operating requirements according to EN 14511-4:2013:

- 4.2.1 Starting and operating tests

Operating requirements according to EN 14511-4:2018:

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

The performance of the domestic hot water heat pump according to EN 16147:2017, large cycle.

Sound power level according to EN 12102-1:2017 for Full load, Quiet mode 3 and ERP labelling at A7/W55.

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



DANAK
Test Rep. nr.



Contents:

Test conditions	5
SCOP test conditions for low temperature – EN 14825	5
SCOP test conditions for medium temperature – EN 14825	6
Test conditions for SEER test points for cooling mode, fan coil - EN 14825	7
Test conditions for SEER test points for cooling mode, floor – EN 14825	7
Test conditions for standard rating test for heating mode – EN 14511	7
Test conditions for full load test for heating mode – EN 14511.....	8
Test conditions for part load test for heating mode – EN 14511	8
Test conditions for operating requirements – EN 14511-4: 2013	9
Test conditions for operating requirements – EN 14511-4: 2018	9
Test conditions for shutting of the heat transfer medium – EN 14511-4	9
Test conditions for complete power supply failure – EN 14511-4	10
Test conditions for domestic hot water test – EN 16147	10
Test conditions for sound power level – EN 12102-1.....	10
Test results.....	11
SCOP main test results at low temperature - heating season average – EN 14825.....	11
SCOP main test results at medium temperature - heating season average – EN 14825.....	12
Test results of SEER test points at cooling mode, fan coil – EN 14825.....	13
Test results of SEER test points at cooling mode, floor – EN 14825	13
Test results of standard rating test at heating mode – EN 14511	13
Test results of full load test at heating mode – EN 14511.....	14
Test results of part load test at heating mode – EN 14511	14
Test results of operating requirements – EN 14511-4:2013.....	14
Test results of operating requirements – EN 14511-4: 2018.....	15
Test results of shutting of the heat transfer medium – EN 14511-4	15
Test results of complete power supply failure – EN 14511-4	15
Test Results of domestic hot water test – EN 16147	16
Test results of sound power test – EN 12102.....	17
Photo	18



SCOP - detailed calculation	19
Detailed SCOP calculation of low temperature and average climate conditions – EN 14825	19
Detailed SCOP calculation of medium temperature and average climate conditions – EN 14825	21
Detailed test results	23
Detailed SCOP test results - low temperature application – EN 14825	23
Detailed SCOP test results - Medium temperature application - EN 14825	28
Detailed SEER test results for cooling mode, fan coil - EN 14825	33
Detailed SEER test results for cooling mode, floor - EN 14825	35
Detailed test results of standard rating conditions – EN 14511	37
Detailed test results of full load – EN 14511	39
Detailed test results of part load – EN 14511	42
Detailed test results of sound power measurements – Test 1	45
Detailed test results of sound power measurements – Test 2	46
Detailed test results of sound power measurements – Test 3	47
Appendix 1: Test Procedure	48





Test conditions

SCOP test conditions for low temperature – EN 14825

Part load conditions for reference SCOP and reference SCOP_{on} 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.

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	$\frac{(-7 - 16)}{(T_{\text{designh}} - 16)}$	88	n/a	61	-7(-8)	20(12)	^a / 55	^a / 52	n/a	^a / 44
B	$\frac{(+2 - 16)}{(T_{\text{designh}} - 16)}$	54	100	37	2(1)	20(12)	^a / 55	^a / 42	^a / 55	^a / 37
C	$\frac{(+7 - 16)}{(T_{\text{designh}} - 16)}$	35	64	24	7(6)	20(12)	^a / 55	^a / 36	^a / 46	^a / 32
D	$\frac{(+12 - 16)}{(T_{\text{designh}} - 16)}$	15	29	11	12(11)	20(12)	^a / 55	^a / 30	^a / 34	^a / 28
E	$(TOL - 16) / (T_{\text{designh}} - 16)$				TOL	20(12)	^a / 55	^a / ^b	^a / ^b	^a / ^b
F	$(T_{\text{bivalent}} - 16) / (T_{\text{designh}} - 16)$				T _{bivalent}	20(12)	^a / 55	^a / ^c	^a / ^c	^a / ^c
G	$\frac{(-15 - 16)}{(T_{\text{designh}} - 16)}$	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.

Additional information

Climate	T _{designh} [°C]	T _{bivalent} [°C]	TOL [°C]	Outlet temperature	Flow rate
Average	-10	-7	-10	Variable	Variable



Test conditions for SEER test points for cooling mode, fan coil - EN 14825

N [#]	Heat source		Heat sink		Test mode no./Comp. frequency
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
A ^K	35	-	12	7	59
C ^K	25	-	15	10	61

K) Keymark

Test conditions for SEER test points for cooling mode, floor – EN 14825

N [#]	Heat source		Heat sink		Test mode no./Comp. frequency
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
A ^K	35	-	23	18	59
C ^K	25	-	23	18	61

K) Keymark

Test conditions for standard rating test for heating mode – EN 14511

N [#]	Heat source		Heat sink		Test mode no./Comp. frequency
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^K	7	6	30	35	1
2 ^K	7	6	47	55	1

K) Keymark



Test conditions for full load test for heating mode – EN 14511

N [#]	Heat source		Heat sink		Test mode no./Comp. frequency
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^E	2	1	30	35	1
2 ^V	-7	-8	30	35	1
3 ^N	-7	-8	47	55	1

E) EHPA, V) VDI, N) NFPAC

Test conditions for part load test for heating mode – EN 14511

N [#]	Heat source		Heat sink		Test mode no./Comp. frequency
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^V	2	1	30	35	25 Hz
2 ^V	-7	-8	30	35	25 Hz
3 ^V	7	6	30	35	34 Hz

V) VDI



Test conditions for operating requirements – EN 14511-4: 2013

N#	Heat source		Heat sink	Water flow rate at indoor heat exchanger (l/h)	Test
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Outlet temperature (°C)		
1	35	-	55	1500	Starting
2	-20	-	25	460	Starting

Test conditions for operating requirements – EN 14511-4: 2018

N#	Heat source		Heat sink	Water flow rate at indoor heat exchanger (l/h)	Test
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)		
1	-20	-	20	460	Starting
2	-20	-	47	480	Operating

Test conditions for shutting of 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	7	6	30	35	Indoor
2	7	6	30	35	Outdoor



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	7	6	30	35	

Test conditions for domestic hot water test – EN 16147

N#	Test climate	Heat source		Domestic hot water Tapping profile	Set point tank temperature (°C)
		Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)		
1	Average	7	6	L	52

Test conditions for sound power level – EN 12102-1

N#	Test condition		Heat pump setting			
	Outdoor heat exchanger (dry/wet bulb) (°C)	Indoor heat exchanger (inlet/outlet) (°C)	Compressor speed (Hz)	Fan speed outdoor (rpm)	Heating capacity (kW)	Power input (kW)
1 ^F	7/6	47/55	52-53	590	7.1	2.35
2 ^Q	7/6	47/55	38-39	380	4.95	1.65
3 ^{ERP}	7/6	47/55	25-26	430-440	2.9	1.17

F) Full load, Q) Quiet mode 3, E) ERP labelling



Test results

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

Model (Outdoor)	WH-MDC07J3E5
Air-to-water heat pump mono bloc	Y
Low-temperature heat pump	N
Equipped with supplementary heater	N
Heat pump combination heater	Y

Rated heat output ¹⁾	P _{rated}	6 [kW]
Seasonal space heating energy efficiency	η_s SCOP	203.8 [%] 5.17 [-]

Measured capacity for heating for part load at outdoor temperature T _j	Average Climate - Low temperature application	T _j = -15 °C	P _{dH}	- [kW]
		T _j = -7 °C	P _{dH}	5.53 [kW]
		T _j = 2 °C	P _{dH}	3.33 [kW]
		T _j = 7 °C	P _{dH}	3.06 [kW]
		T _j = 12 °C	P _{dH}	3.58 [kW]
		T _j = bivalent temperature	P _{dH}	5.97 [kW]
		T _j = operation limit	P _{dH}	5.97 [kW]

Measured coefficient of performance at outdoor temperature T _j	Average Climate - Low temperature application	T _j = -15 °C	COP _d	- [-]
		T _j = -7 °C	COP _d	3.25 [-]
		T _j = 2 °C	COP _d	5.18 [-]
		T _j = 7 °C	COP _d	6.66 [-]
		T _j = 12 °C	COP _d	8.38 [-]
		T _j = bivalent temperature	COP _d	2.84 [-]
		T _j = operation limit	COP _d	2.84 [-]

Bivalent temperature	T _{bivalent}	-10 [°C]
Operation limit temperatures	TOL	-10 [°C]
	WTOL	- [°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}	0.008 [kW]
	Standby mode	P _{SB}	0.007 [kW]
	Crankcase heater mode	P _{CK}	0.007 [kW]
Supplementary heater ¹⁾	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}	2398 [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_{designh}, and the rated heat output of a supplementary heater, P_{sup}, is equal to the supplementary capacity for heating, sup(T_j).



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

Model (Outdoor)	WH-MDC07J3E5
Air-to-water heat pump mono bloc	Y
Low-temperature heat pump	N
Equipped with supplementary heater	N
Heat pump combination heater	Y

Rated heat output ¹⁾	P _{rated}	7 [kW]
Seasonal space heating energy efficiency	η_s	145.6 [%]
	SCOP	3.71 [-]

Measured capacity for heating for part load at outdoor temperature T _j	Average Climate - Medium temperature application	T _j = -15 °C	P _{dh}	- [kW]
		T _j = -7 °C	P _{dh}	6.15 [kW]
		T _j = 2 °C	P _{dh}	3.97 [kW]
		T _j = 7 °C	P _{dh}	2.86 [kW]
		T _j = 12 °C	P _{dh}	3.46 [kW]
		T _j = bivalent temperature	P _{dh}	6.15 [kW]
		T _j = operation limit	P _{dh}	6.37 [kW]

Measured coefficient of performance at outdoor temperature T _j	Average Climate - Medium temperature application	T _j = -15 °C	COP _d	- [-]
		T _j = -7 °C	COP _d	2.18 [-]
		T _j = 2 °C	COP _d	3.69 [-]
		T _j = 7 °C	COP _d	4.91 [-]
		T _j = 12 °C	COP _d	6.71 [-]
		T _j = bivalent temperature	COP _d	2.18 [-]
		T _j = operation limit	COP _d	1.91 [-]

Bivalent temperature	T _{bivalent}	-7 [°C]
Operation limit temperatures	TOL	-10 [°C]
	WTOL	- [°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}	0.008 [kW]
	Standby mode	P _{SB}	0.007 [kW]
	Crankcase heater mode	P _{CK}	0.007 [kW]
Supplementary heater ¹⁾	Rated heat output	P _{SUP}	0.63 [kW]
	Type of energy input		Electrical

Other items	Capacity control		Variable
	Water flow control		Variable
	Water flow rate		-
	Annual energy consumption	Q _{HE}	3893 [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_{designh}, and the rated heat output of a supplementary heater, P_{sup}, is equal to the supplementary capacity for heating, sup(T_j).



Test results of SEER test points at cooling mode, fan coil – EN 14825

N [#]	Test conditions	Cooling capacity [kW]	EER
A ^K	A35/W7	6.06	3.28
C ^K	A25/W10	3.09	6.78

K) Keymark

Test results of SEER test points at cooling mode, floor – EN 14825

N [#]	Test conditions	Cooling capacity [kW]	EER
A ^K	A35/W18	8.32	4.33
C ^K	A25/W18	3.67	8.54

K) Keymark

Test results of standard rating test at heating mode – EN 14511

N [#]	Test conditions	Heating capacity [kW]	COP
1 ^K	A7/W35	7.13	5.05
2 ^K	A7/W55	7.05	3.01

K) Keymark



Test Rep. nr.



Test results of full load test at heating mode – EN 14511

N [#]	Test conditions	Heating capacity [kW]	COP
1 ^E	A2/W35	7.36	3.59
2 ^V	A-7/W35	7.35	2.98
3 ^N	A-7/W55	6.71	2.03

E) EHPA, V) VDI, N) NFPAC

Test results of part load test at heating mode – EN 14511

N [#]	Test conditions	Heating capacity [kW]	COP
1 ^V	A2/W35	3.22	4.43
2 ^V	A-7/W35	2.3	3.11
3 ^V	A7/W35	4.97	5.33

V) VDI

Test results of operating requirements – EN 14511-4:2013

N [#]	Test conditions	Test validation
1	A35/W55	Passed
2	A-20/W25	Passed



Test results of operating requirements – EN 14511-4: 2018

N#	Test conditions	Test validation
1	A-20/W25	Passed
2	A-20/W50	Passed

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

N#	Test conditions	Test validation
1	A7/W35	Passed
2	A7/W35	Passed

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

N#	Test conditions	Test validation
1	A7/W35	Passed



Test Results of domestic hot water test – EN 16147

No		Symbol	Result	Unit
1)	Load profile	-	L	-
2)	Settings of the control	-	52	-
3)	Heating up time	t_h	3860	[s]
4)	Heating up electrical energy consumption	W_{eh-HP}	3.30	[kWh]
5)	Stand-by power input	P_{es}	0.03	[kW]
6)	Total useful energy content during the load profile	Q_{LP}	11.84	[kWh]
7)	Total electrical energy consumption during load profile	W_{EL-LP}	3.94	[kWh]
8)	Daily electrical energy consumption	Q_{elec}	3.88	[kWh]
9)	Coefficient of Performance	COP_{DHW}	3.01	[-]
10)	Water heating energy consumption	η_{wh}	125.4%	[%]
11)	Annual electrical energy consumption	AEC	816	[kWh/a]
12)	Reference hot water temperature	θ'_{WH}	52.7	[°C]
13)	Maximum volume of mixed water at 40°C	V_{40}	257	[L]
19)	Rated heat output	P_{rated}	-	[kW]
20)	Seasonal coefficient of performance	$SCOP_{DHW}$	-	[-]



Test results of sound power test – EN 12102

N [#]	Sound power level LW(A) [dB re 1pW]	Uncertainty (dB) (weighted value)
1 ^F	61	0.5
2 ^Q	58	0.5
3 ^{ERP}	57	0.5

F) Full load, Q) Quiet mode 3, E) ERP labelling

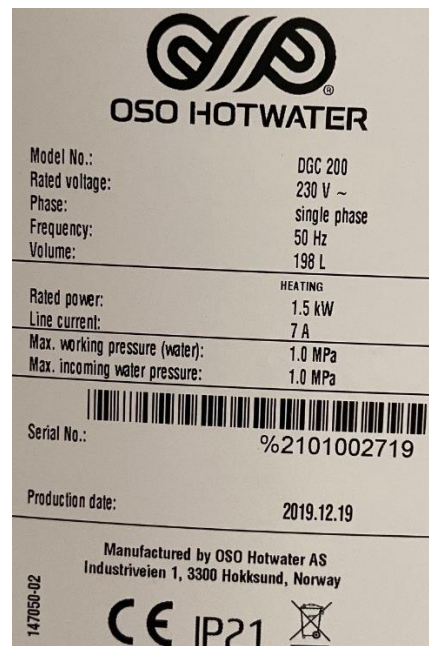
The uncertainty value is a weighted value using the level and frequency dependant influence for each 1/1-octave level on the final A-weighted sound power level.

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





Photo





SCOP - detailed calculation

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

Calculation of reference SCOP

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

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	5.31	5.53	3.25	1.00	1.00	3.25
B	2	54	3.23	3.33	5.18	0.99	1.00	5.18
C	7	35	2.08	3.06	6.66	0.98	0.68	6.61
D	12	15	0.92	3.58	8.38	0.98	0.26	7.95
E	-10	100	6.00	5.97	2.84	1.00	1.00	2.84
F - BIV	-10	100	6.00	5.97	2.84	1.00	1.00	2.84

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	3672	0.007	0.007	25.704
Thermostat off	178	0.008	0.008	1.424
Standby	0	0.007	0.007	0
Crankcase heater	3850	0.007	0	0



Calculation Bin for SCOPon

	Bin	Outdoor temperature [°C]	Hours [h]	Heat load [kW]	Heat load covered by heat pump [kW]	Electrical back up heater [kW]	Annual backup heater energy input [kWh]	COPbin [-]	Annual heating demand [kWh]	Annual energy input [kWh]	Net annual heating capacity [kWh]	Net annual power input [kWh]
E / F - BIV	21	-10	1	6.00	5.97	0.00	0.00	2.84	6.00	2.11	6.00	2.11
	22	-9	25	5.77	5.75	0.00	0.00	2.98	144.23	48.45	144.23	48.45
	23	-8	23	5.54	5.53	0.00	0.00	3.11	127.38	40.92	127.38	40.92
A	24	-7	24	5.31	5.31	0.00	0.00	3.25	127.38	39.20	127.38	39.20
	25	-6	27	5.08	5.08	0.00	0.00	3.46	137.08	39.57	137.08	39.57
	26	-5	68	4.85	4.85	0.00	0.00	3.68	329.54	89.58	329.54	89.58
	27	-4	91	4.62	4.62	0.00	0.00	3.89	420.00	107.88	420.00	107.88
	28	-3	89	4.38	4.38	0.00	0.00	4.11	390.23	95.00	390.23	95.00
	29	-2	165	4.15	4.15	0.00	0.00	4.32	685.38	158.57	685.38	158.57
	30	-1	173	3.92	3.92	0.00	0.00	4.54	678.69	149.60	678.69	149.60
	31	0	240	3.69	3.69	0.00	0.00	4.75	886.15	186.52	886.15	186.52
	32	1	280	3.46	3.46	0.00	0.00	4.97	969.23	195.19	969.23	195.19
B	33	2	320	3.23	3.23	0.00	0.00	5.18	1033.85	199.58	1033.85	199.58
	34	3	357	3.00	3.00	0.00	0.00	5.47	1071.00	195.97	1071.00	195.97
	35	4	356	2.77	2.77	0.00	0.00	5.75	985.85	171.44	985.85	171.44
	36	5	303	2.54	2.54	0.00	0.00	6.04	769.15	127.44	769.15	127.44
	37	6	330	2.31	2.31	0.00	0.00	6.32	761.54	120.49	761.54	120.49
C	38	7	326	2.08	2.08	0.00	0.00	6.61	677.08	102.50	677.08	102.50
	39	8	348	1.85	1.85	0.00	0.00	6.87	642.46	93.45	642.46	93.45
	40	9	335	1.62	1.62	0.00	0.00	7.14	541.15	75.75	541.15	75.75
	41	10	315	1.38	1.38	0.00	0.00	7.41	436.15	58.84	436.15	58.84
	42	11	215	1.15	1.15	0.00	0.00	7.68	248.08	32.29	248.08	32.29
D	43	12	169	0.92	0.92	0.00	0.00	7.95	156.00	19.62	156.00	19.62
	44	13	151	0.69	0.69	0.00	0.00	8.22	104.54	12.72	104.54	12.72
	45	14	105	0.46	0.46	0.00	0.00	8.49	48.46	5.71	48.46	5.71
	46	15	74	0.23	0.23	0.00	0.00	8.76	17.08	1.95	17.08	1.95

SUM	12393.69	2370.33	12393.69	2370.33
SCOPon	5.23		SCOPnet	5.23



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	6.19	6.15	2.18	1.00	1.00	2.18
B	2	54	3.77	3.97	3.69	0.99	1.00	3.69
C	7	35	2.42	2.86	4.91	0.99	0.85	4.90
D	12	15	1.08	3.46	6.71	0.98	0.31	6.49
E	-10	100	7.00	6.37	1.91	1.00	1.00	1.91
F - BIV	-7	88	6.19	6.15	2.18	1.00	1.00	2.18

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	3672	0.007	0.007	25.704
Thermostat off	178	0.008	0.008	1.424
Standby	0	0.007	0.007	0
Crankcase heater	3850	0.007	0	0



Calculation Bin for SCOPon

	Bin	Outdoor temperature [°C]	Hours [h]	Heat load [kW]	Heat load covered by heat pump [kW]	Electrical back up heater [kW]	Annual backup heater energy input [kWh]	COPbin	Annual heating demand [kWh]	Annual energy input [kWh]	Net annual heating capacity [kWh]	Net annual power input [kWh]
E	21	-10	1	7.00	6.37	0.63	0.63	1.91	7.00	3.97	6.37	3.34
	22	-9	25	6.73	6.30	0.43	10.85	2.00	168.27	89.56	157.42	78.71
	23	-8	23	6.46	6.22	0.24	5.48	2.09	148.62	73.97	143.14	68.49
A / F - BIV	24	-7	24	6.19	6.15	0.00	0.00	2.18	148.62	68.17	148.62	68.17
	25	-6	27	5.92	5.89	0.00	0.00	2.35	159.92	68.12	159.92	68.12
	26	-5	68	5.65	5.62	0.00	0.00	2.52	384.46	152.83	384.46	152.83
	27	-4	91	5.38	5.36	0.00	0.00	2.68	490.00	182.61	490.00	182.61
	28	-3	89	5.12	5.09	0.00	0.00	2.85	455.27	159.68	455.27	159.68
	29	-2	165	4.85	4.83	0.00	0.00	3.02	799.62	264.87	799.62	264.87
	30	-1	173	4.58	4.56	0.00	0.00	3.19	791.81	248.48	791.81	248.48
	31	0	240	4.31	4.30	0.00	0.00	3.35	1033.85	308.20	1033.85	308.20
	32	1	280	4.04	4.03	0.00	0.00	3.52	1130.77	321.04	1130.77	321.04
B	33	2	320	3.77	3.77	0.00	0.00	3.69	1206.15	326.87	1206.15	326.87
	34	3	357	3.50	3.50	0.00	0.00	3.93	1249.50	317.81	1249.50	317.81
	35	4	356	3.23	3.23	0.00	0.00	4.17	1150.15	275.61	1150.15	275.61
	36	5	303	2.96	2.96	0.00	0.00	4.41	897.35	203.26	897.35	203.26
	37	6	330	2.69	2.69	0.00	0.00	4.66	888.46	190.81	888.46	190.81
C	38	7	326	2.42	2.42	0.00	0.00	4.90	789.92	161.28	789.92	161.28
	39	8	348	2.15	2.15	0.00	0.00	5.22	749.54	143.71	749.54	143.71
	40	9	335	1.88	1.88	0.00	0.00	5.53	631.35	114.09	631.35	114.09
	41	10	315	1.62	1.62	0.00	0.00	5.85	508.85	86.96	508.85	86.96
	42	11	215	1.35	1.35	0.00	0.00	6.17	289.42	46.91	289.42	46.91
D	43	12	169	1.08	1.08	0.00	0.00	6.49	182.00	28.05	182.00	28.05
	44	13	151	0.81	0.81	0.00	0.00	6.81	121.96	17.92	121.96	17.92
	45	14	105	0.54	0.54	0.00	0.00	7.12	56.54	7.94	56.54	7.94
	46	15	74	0.27	0.27	0.00	0.00	7.44	19.92	2.68	19.92	2.68

SUM	14459.31	3865.39	14442.35	3848.43
SCOPon		3.74	SCOPnet	3.75



Detailed test results

Detailed SCOP test results - low temperature application – EN 14825

Detailed result for 'EN14825:2016' Average Low (A) A-7/W34		
Tested according to:	EN14511:2018 and EN14825:2016	
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	6.00
Heating demand:	kW	5.31
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.53
COP	-	3.25
Power consumption	kW	1.70
Measured		
Heating capacity	kW	5.57
COP	-	3.17
Power consumption	kW	1.75
During heating		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-8.1
Inlet temperature	°C	29.0
Outlet temperature	°C	34.1
Outlet temperature (Time averaged)	°C	34.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	54771
Calculated Hydraulic power	W	14
Calculated global efficiency	η	0.27
Calculated Capacity correction	W	40
Calculated Power correction	W	54
Water Flow	m ³ /s	0.000264



Detailed result for 'EN14825:2016' Average Low (B) A2/W30		
Tested according to:	EN14511:2018 and EN14825:2016	
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	6.00
Heating demand:	kW	3.23
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.33
COP	-	5.18
Power consumption	kW	0.64
Measured		
Heating capacity	kW	3.36
COP	-	4.96
Power consumption	kW	0.68
During heating		
Air temperature dry bulb	°C	2.0
Air temperature wet bulb	°C	1.0
Inlet temperature	°C	25.0
Outlet temperature	°C	30.0
Outlet temperature (Time averaged)	°C	30.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	41402
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	27
Calculated Power correction	W	34
Water Flow	m ³ /s	0.000161



Detailed result for 'EN14825:2016' Average Low (C) A7/W27		
Tested according to:	EN14511:2018 and EN14825:2016	
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	6.00
Heating demand:	kW	2.08
CR:	-	0.7
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.06
COP	-	6.66
Power consumption	kW	0.46
Measured		
Heating capacity	kW	3.09
COP	-	6.30
Power consumption	kW	0.49
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.1
Inlet temperature	°C	23.1
Outlet temperature	°C	28.9
Outlet temperature (Time averaged)	°C	27.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	42786
Calculated Hydraulic power	W	5
Calculated global efficiency	η	0.18
Calculated Capacity correction	W	25
Calculated Power correction	W	30
Water Flow	m ³ /s	0.000128



Detailed result for 'EN14825:2016' Average Low (D) A12/W24		
Tested according to:	EN14511:2018 and EN14825:2016	
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	6.00
Heating demand:	kW	0.92
CR:	-	0.3
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.58
COP	-	8.38
Power consumption	kW	0.43
Measured		
Heating capacity	kW	3.60
COP	-	7.85
Power consumption	kW	0.46
During heating		
Air temperature dry bulb	°C	12.0
Air temperature wet bulb	°C	11.1
Inlet temperature	°C	22.3
Outlet temperature	°C	29.1
Outlet temperature (Time averaged)	°C	24.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	46946
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	0.000128



Detailed result for 'EN14825:2016' Average Low (E and F) A-10/W35		
Tested according to:	EN14511:2018 and EN14825:2016	
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	6.00
Heating demand:	kW	6.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.97
COP	-	2.84
Power consumption	kW	2.10
Measured		
Heating capacity	kW	6.00
COP	-	2.81
Power consumption	kW	2.14
During heating		
Air temperature dry bulb	°C	-10.0
Air temperature wet bulb	°C	-10.7
Inlet temperature	°C	30.0
Outlet temperature	°C	35.1
Outlet temperature (Time averaged)	°C	35.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	27897
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	0.000283



Detailed SCOP test results - Medium temperature application - EN 14825

Detailed result for 'EN14825:2016' Average Medium (A and F) A-7/W52		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		A and F
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	7.00
Heating demand:	kW	6.19
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	6.15
COP	-	2.18
Power consumption	kW	2.83
Measured		
Heating capacity	kW	6.17
COP	-	2.16
Power consumption	kW	2.85
During heating		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-8.1
Inlet temperature	°C	44.0
Outlet temperature	°C	51.9
Outlet temperature (Time averaged)	°C	51.9
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	21816
Calculated Hydraulic power	W	4
Calculated global efficiency	η	0.16
Calculated Capacity correction	W	21
Calculated Power correction	W	25
Water Flow	m ³ /s	0.000189



Detailed result for 'EN14825:2016' Average Medium (B) A2/W42		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		B
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	7.00
Heating demand:	kW	3.77
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.97
COP	-	3.69
Power consumption	kW	1.08
Measured		
Heating capacity	kW	4.00
COP	-	3.61
Power consumption	kW	1.11
During heating		
Air temperature dry bulb	°C	2.1
Air temperature wet bulb	°C	1.1
Inlet temperature	°C	34.5
Outlet temperature	°C	42.0
Outlet temperature (Time averaged)	°C	42.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	44920
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.18
Calculated Capacity correction	W	25
Calculated Power correction	W	31
Water Flow	m ³ /s	0.000128



Detailed result for 'EN14825:2016' Average Medium (C) A7/W36		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	7.00
Heating demand:	kW	2.42
CR:	-	0.8
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	2.86
COP	-	4.91
Power consumption	kW	0.58
Measured		
Heating capacity	kW	2.89
COP	-	4.70
Power consumption	kW	0.62
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.1
Inlet temperature	°C	31.4
Outlet temperature	°C	36.8
Outlet temperature (Time averaged)	°C	36.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	46432
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	0.000128



Detailed result for 'EN14825:2016' Average Medium (D) A12/W30		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		D
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	7.00
Heating demand:	kW	1.08
CR:	-	0.3
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.46
COP	-	6.71
Power consumption	kW	0.52
Measured		
Heating capacity	kW	3.48
COP	-	6.36
Power consumption	kW	0.55
During heating		
Air temperature dry bulb	°C	12.0
Air temperature wet bulb	°C	11.1
Inlet temperature	°C	28.0
Outlet temperature	°C	34.5
Outlet temperature (Time averaged)	°C	30.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	47800
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	0.000128



Detailed result for 'EN14825:2016' Average Medium (E) A-10/W55		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		E
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	7.00
Heating demand:	kW	7.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	6.37
COP	-	1.91
Power consumption	kW	3.34
Measured		
Heating capacity	kW	6.39
COP	-	1.90
Power consumption	kW	3.36
During heating		
Air temperature dry bulb	°C	-10.0
Air temperature wet bulb	°C	-10.8
Inlet temperature	°C	47.0
Outlet temperature	°C	55.0
Outlet temperature (Time averaged)	°C	55.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	24493
Calculated Hydraulic power	W	5
Calculated global efficiency	η	0.17
Calculated Capacity correction	W	23
Calculated Power correction	W	28
Water Flow	m ³ /s	0.000194



Detailed SEER test results for cooling mode, fan coil - EN 14825

Detailed result for 'EN14825:2016' (A) A35/W7		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:	N/A	
Temperature application:	Fan coil	
Condition name:	A	
Condition temperature:	°C	35
Part load:	%	100%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	6.00
Heating demand:	kW	6.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Cooling capacity	kW	6.06
EER	-	3.28
Power consumption	kW	1.85
Measured		
Cooling capacity	kW	6.03
EER	-	3.19
Power consumption	kW	1.89
During cooling		
Air temperature dry bulb	°C	34.9
Air temperature wet bulb	°C	-
Inlet temperature	°C	12.0
Outlet temperature	°C	7.0
Outlet temperature (Time averaged)	°C	7.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	35815
Calculated Hydraulic power	W	10
Calculated global efficiency	η	0.23
Calculated Capacity correction	W	34
Calculated Power correction	W	44
Water Flow	m³/s	0.000289



Detailed result for 'EN14825:2016' (C) A25/W10		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		N/A
Temperature application:		Fan coil
Condition name:		C
Condition temperature:	°C	25
Part load:	%	47%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	6.00
Heating demand:	kW	2.82
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Cooling capacity	kW	3.09
EER	-	6.78
Power consumption	kW	0.46
Measured		
Cooling capacity	kW	3.07
EER	-	6.24
Power consumption	kW	0.49
During Cooling		
Air temperature dry bulb	°C	25.0
Air temperature wet bulb	°C	-
Inlet temperature	°C	15.0
Outlet temperature	°C	10.0
Outlet temperature (Time averaged)	°C	10.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	46338
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 SEER test results for cooling mode, floor - EN 14825

Detailed result for 'EN14825:2016' (A) A35/W18		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:	N/A	
Temperature application:	Cooling floor	
Condition name:	A	
Condition temperature:	°C	35
Part load:	%	100%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	8.30
Heating demand:	kW	8.30
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Cooling capacity	kW	8.32
EER	-	4.33
Power consumption	kW	1.92
Measured		
Cooling capacity	kW	8.29
EER	-	4.22
Power consumption	kW	1.97
During Cooling		
Air temperature dry bulb	°C	35.0
Air temperature wet bulb	°C	-
Inlet temperature	°C	23.0
Outlet temperature	°C	18.1
Outlet temperature (Time averaged)	°C	18.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	23145
Calculated Hydraulic power	W	9
Calculated global efficiency	η	0.22
Calculated Capacity correction	W	32
Calculated Power correction	W	42
Water Flow	m³/s	0.000403



Detailed result for 'EN14825:2016' (C) A25/W18		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		N/A
Temperature application:		Cooling floor
Condition name:		C
Condition temperature:	°C	25
Part load:	%	47%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	8.30
Heating demand:	kW	3.90
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Cooling capacity	kW	3.67
EER	-	8.54
Power consumption	kW	0.43
Measured		
Cooling capacity	kW	3.64
EER	-	7.78
Power consumption	kW	0.47
During Cooling		
Air temperature dry bulb	°C	25.0
Air temperature wet bulb	°C	-
Inlet temperature	°C	23.0
Outlet temperature	°C	17.9
Outlet temperature (Time averaged)	°C	17.9
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	45951
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	0.000172



Detailed test results of standard rating conditions – EN 14511

Detailed result for 'EN14511:2018' A7/W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	7.13
COP	-	5.05
Power consumption	kW	1.41
Measured		
Heating capacity	kW	7.16
COP	-	4.92
Power consumption	kW	1.46
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.1
Inlet temperature	°C	30.0
Outlet temperature	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	29754
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	0.000345



Detailed result for 'EN14511:2018' A7/W55		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	7.05
COP	-	3.01
Power consumption	kW	2.34
Measured		
Heating capacity	kW	7.08
COP	-	2.97
Power consumption	kW	2.38
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.1
Inlet temperature	°C	47.0
Outlet temperature	°C	55.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	44377
Calculated Hydraulic power	W	10
Calculated global efficiency	η	0.23
Calculated Capacity correction	W	33
Calculated Power correction	W	42
Water Flow	m ³ /s	0.000216



Detailed test results of full load – 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	7.36
COP	-	3.59
Power consumption	kW	2.05
Measured		
Heating capacity	kW	7.39
COP	-	3.54
Power consumption	kW	2.09
During heating		
Air temperature dry bulb	°C	2.1
Air temperature wet bulb	°C	0.9
Inlet temperature	°C	30.0
Outlet temperature	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	18156
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	0.000403



Detailed result for 'EN14511:2018' A-7/W35 full load		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	7.35
COP	-	2.98
Power consumption	kW	2.47
Measured		
Heating capacity	kW	7.38
COP	-	2.95
Power consumption	kW	2.51
During heating		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-7.9
Inlet temperature	°C	30.0
Outlet temperature	°C	34.9
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	21018
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.21
Calculated Capacity correction	W	29
Calculated Power correction	W	37
Water Flow	m ³ /s	0.000361



Detailed result for 'EN14511:2018' A-7/W55		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	6.71
COP	-	2.03
Power consumption	kW	3.30
Measured		
Heating capacity	kW	6.74
COP	-	2.02
Power consumption	kW	3.34
During heating		
Air temperature dry bulb	°C	-7.2
Air temperature wet bulb	°C	-7.8
Inlet temperature	°C	47.0
Outlet temperature	°C	54.8
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	39961
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.21
Calculated Capacity correction	W	31
Calculated Power correction	W	39
Water Flow	m ³ /s	0.000208



Detailed test results of part load – EN 14511

Detailed result for 'EN14511:2018' A7/W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	4.97
COP	-	5.33
Power consumption	kW	0.93
Measured		
Heating capacity	kW	5.00
COP	-	5.15
Power consumption	kW	0.97
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.1
Inlet temperature	°C	30.0
Outlet temperature	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	31790
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.21
Calculated Capacity correction	W	29
Calculated Power correction	W	37
Water Flow	m ³ /s	0.000239






Detailed result for 'EN14511:2018' A2/W35 part load		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.22
COP	-	4.43
Power consumption	kW	0.73
Measured		
Heating capacity	kW	3.24
COP	-	4.29
Power consumption	kW	0.76
During heating		
Air temperature dry bulb	°C	2.0
Air temperature wet bulb	°C	1.1
Inlet temperature	°C	30.0
Outlet temperature	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	35497
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.18
Calculated Capacity correction	W	25
Calculated Power correction	W	30
Water Flow	m ³ /s	0.000155



Detailed result for 'EN14511:2018' A-7/W35 part load		
Tested according to:		EN14511:2018
Minimum flow reached:		Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	2.30
COP	-	3.11
Power consumption	kW	0.74
Measured		
Heating capacity	kW	2.32
COP	-	3.03
Power consumption	kW	0.77
During heating		
Air temperature dry bulb	°C	-6.9
Air temperature wet bulb	°C	-7.8
Inlet temperature	°C	30.7
Outlet temperature	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	35509
Calculated Hydraulic power	W	5
Calculated global efficiency	η	0.17
Calculated Capacity correction	W	22
Calculated Power correction	W	27
Water Flow	m ³ /s	0.000128

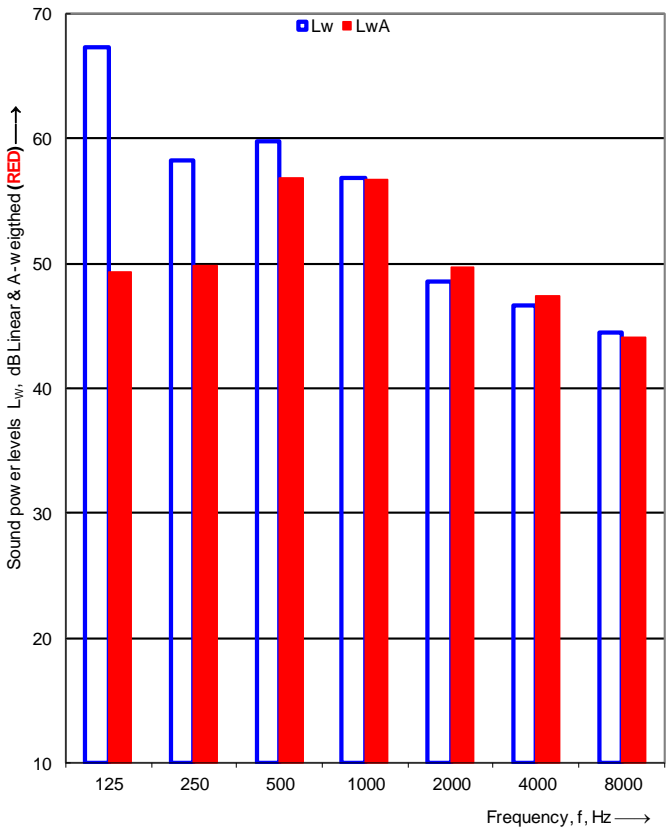


Detailed test results of sound power measurements – Test 1

 		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 Europe GmbH			Date of test: 26-05-2020	
Object:	Type: Mono Air to water heat pump Model: WH-MDC07J3E5				
Mounting conditions:	The unit is standing free in a water drop tray, which is located on a 2.5 cm thick wooden board. The wooden board is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on the floor. The unit is mounted on the supporting metal support frame using 6 vibration insulators.				
Operating conditions:	A7/W47-55, Test mode 1, Compressor speed: 52 - 53[Hz], Heating capacity: 7.1 [kW], Power_input: 2.35 [kW], Water flow rate: 770 [l/h], Fan_speed : 590 [rpm], dp_water : 420 [mbar]				
Static pressure:	1021 kPa			<u>Reference box:</u>	
Air temperature:	7.0 °C			L1:	1.3 m
Relative air humidity:	85.0 %			L2:	0.3 m
Test room volume:	102.8 m³	Room:	Room 1	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	66.3	
125	59.2	67.3
160	54.0	
200	54.0	
250	53.5	58.3
315	53.0	
400	54.9	
500	53.1	59.8
630	56.4	
800	52.3	
1000	51.9	56.8
1250	51.9	
1600	46.1	
2000	42.6	48.5
2500	40.9	
3150	40.1	
4000	40.1	46.6
5000	44.0	
6300	43.4	
8000	35.7	44.4
10000	32.7	

¹ Too high



Sound power level $L_w(A)$: **61 dB [re 1pW]**




Name of test institute: DTI
No. of test report: 300-KLAB-20-009
Date: 26-05-2020



Test Rep. nr.

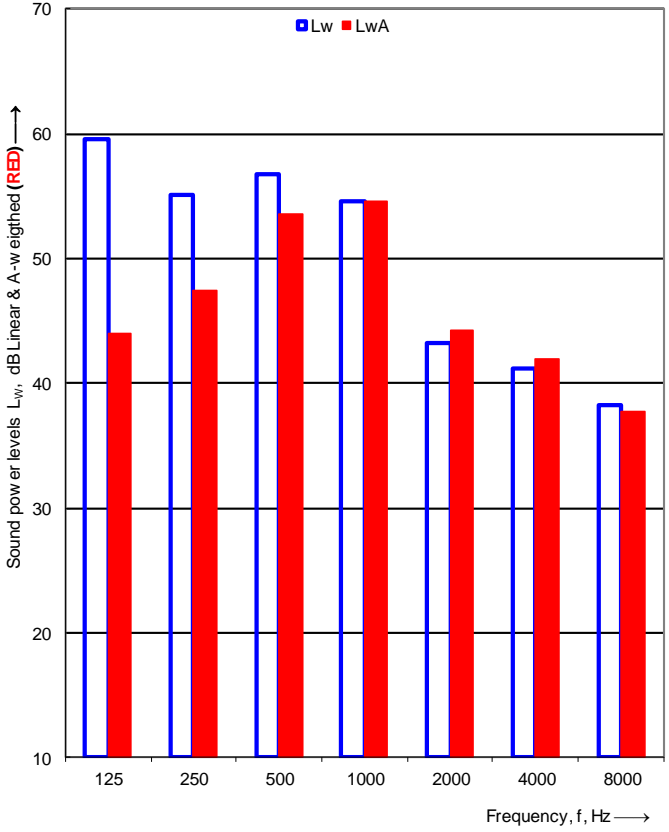


Detailed test results of sound power measurements – Test 2

 		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 Europe GmbH			Date of test: 26-05-2020	
Object:	Type: Mono Air to water heat pump Model: WH-MDC07J3E5				
Mounting conditions:	The unit is standing free in a water drop tray, which is located on a 2.5 cm thick wooden board. The wooden board is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on the floor. The unit is mounted on the supporting metal support frame using 6 vibration insulators.				
Operating conditions:	A7/W47-55, Quiet mode 3, Compressor speed: 38 - 39[Hz], Heating capacity: 4.95 [kW], Power_input: 1.65 [kW], Water flow rate: 550 [l/h], Fan_speed : 380 [rpm], dp_water : 266 [mbar]				
Static pressure:	1021 kPa			<u>Reference box:</u>	
Air temperature:	7.0 °C			L1:	1.3 m
Relative air humidity:	85.0 %			L2:	0.3 m
Test room volume:	102.8 m³	Room:	Room 1	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	56.3	
125	49.1	59.5
160	55.9	
200	43.3	
250	52.3	55.1
315	51.3	
400	53.5	
500	48.6	56.8
630	52.5	
800	50.1	
1000	48.1	54.5
1250	50.7	
1600	40.9	
2000	38.1	43.2
2500	33.0	
3150	34.1	
4000	35.0	41.1
5000	38.6	
6300	36.5	
8000	31.1	38.3
10000	29.7	

¹ Too high




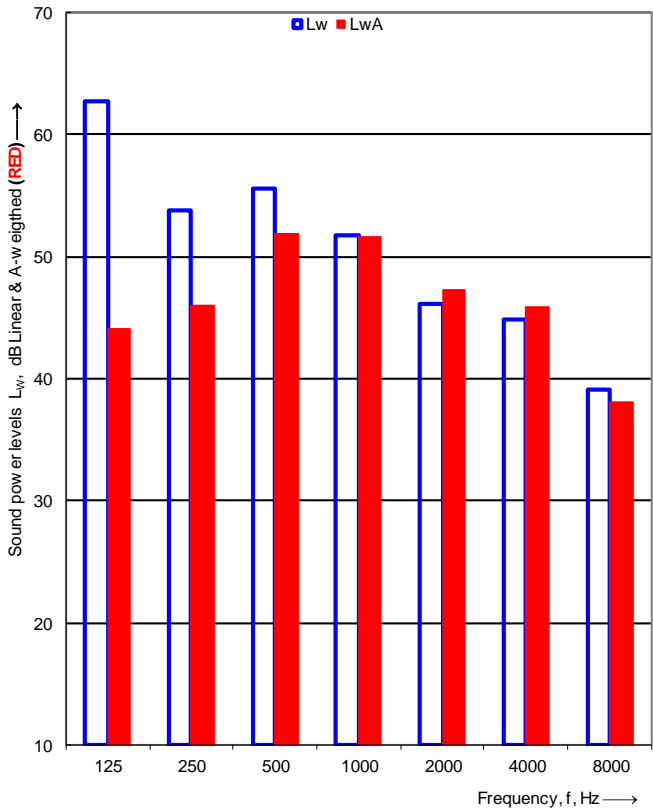


Sound power level L_w(A):	58 dB [re 1pW]
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Name of test institute:	DTI
No. of test report:	300-KLAB-20-009
Date:	26-05-2020



Detailed test results of sound power measurements – Test 3

 		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 Europe GmbH		Date of test: 26-05-2020																																																																				
Object:	Type: Mono Air to water heat pump Model: WH-MDC07J3E5																																																																						
Mounting conditions:	The unit is standing free in a water drop tray, which is located on a 2.5 cm thick wooden board. The wooden board is placed on two pieces of heavy concrete tiles (90x90x10cm) laying on the floor. The unit is mounted on the supporting metal support frame using 6 vibration insulators.																																																																						
Operating conditions:	A7/W49.4-55, free mode, Compressor speed: 25 - 26[Hz], Heating capacity: 2.9 [kW], Power_input: 1.17 [kW], Water flow rate: 460 [l/h], Fan_speed : 480 [rpm], dp_water : 274 [mbar]																																																																						
Static pressure:	1021 kPa	Room: Room 1		Reference box:																																																																			
Air temperature:	7.0 °C			L1: 1.3 m																																																																			
Relative air humidity:	85.0 %			L2: 0.3 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"> <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>62.3</td><td></td></tr> <tr><td>125</td><td>49.8</td><td>62.7</td></tr> <tr><td>160</td><td>47.4</td><td></td></tr> <tr><td>200</td><td>47.6</td><td></td></tr> <tr><td>250</td><td>46.9</td><td>53.7</td></tr> <tr><td>315</td><td>51.1</td><td></td></tr> <tr><td>400</td><td>52.7</td><td></td></tr> <tr><td>500</td><td>51.2</td><td>55.6</td></tr> <tr><td>630</td><td>46.3</td><td></td></tr> <tr><td>800</td><td>47.3</td><td></td></tr> <tr><td>1000</td><td>48.2</td><td>51.7</td></tr> <tr><td>1250</td><td>44.6</td><td></td></tr> <tr><td>1600</td><td>43.0</td><td></td></tr> <tr><td>2000</td><td>41.7</td><td>46.1</td></tr> <tr><td>2500</td><td>37.8</td><td></td></tr> <tr><td>3150</td><td>39.1</td><td></td></tr> <tr><td>4000</td><td>42.7</td><td>44.8</td></tr> <tr><td>5000</td><td>35.6</td><td></td></tr> <tr><td>6300</td><td>34.6</td><td></td></tr> <tr><td>8000</td><td>34.6</td><td>39.1</td></tr> <tr><td>10000</td><td>33.8</td><td></td></tr> </tbody> </table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	62.3		125	49.8	62.7	160	47.4		200	47.6		250	46.9	53.7	315	51.1		400	52.7		500	51.2	55.6	630	46.3		800	47.3		1000	48.2	51.7	1250	44.6		1600	43.0		2000	41.7	46.1	2500	37.8		3150	39.1		4000	42.7	44.8	5000	35.6		6300	34.6		8000	34.6	39.1	10000	33.8					
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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
- EN 12102
- DS/EN 3743/1

The basic acoustic measurement standard DS/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.

