

TEST REPORT



**DANISH
TECHNOLOGICAL
INSTITUTE**

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300-KLAB-20-010 rev. 3
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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-MDC09J3E5 / Tank DGC200
Series no.: 5622601009 / Tank %2101002719
Production year: 2020.01 / Tank 2019.12

Dates: Component tested: March-May 2020

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

Remarks: This report is revised because the test of DHW test was repeated.
The unit was delivered by the customer. The installation and test settings were done according to the manufacturer's instructions. All test 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 page 5 & 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 European KEYMARK Scheme for Heat Pumps.



DANAK
Test Rep. nr.



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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 SCOP_{on} 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	7	6	30	35	34 Hz
2 ^V	2	1	30	35	25 Hz
3 ^V	-7	-8	30	35	25 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	1100	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	580	Operating

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	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	67-68	690	9.23	3.15
2 ^Q	7/6	47/55	50-51	500-510	6.74	2.25
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-MDC09J3E5
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 output¹⁾	P_{rated}	7 [kW]
Seasonal space heating energy efficiency	η_s	204.7 [%]
	SCOP	5.19 [-]

Measured capacity for heating for part load at outdoor temperature T_j	Average Climate - Low temperature application	$T_j = -15\text{ °C}$	P_{dh}	- [kW]
		$T_j = -7\text{ °C}$	P_{dh}	6.72 [kW]
		$T_j = 2\text{ °C}$	P_{dh}	3.82 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	3.05 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	3.57 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	7.17 [kW]
		$T_j = \text{operation limit}$	P_{dh}	7.17 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate - Low temperature application	$T_j = -15\text{ °C}$	COP_d	- [-]
		$T_j = -7\text{ °C}$	COP_d	3.12 [-]
		$T_j = 2\text{ °C}$	COP_d	5.17 [-]
		$T_j = 7\text{ °C}$	COP_d	6.82 [-]
		$T_j = 12\text{ °C}$	COP_d	8.90 [-]
		$T_j = \text{bivalent temperature}$	COP_d	2.83 [-]
		$T_j = \text{operation limit}$	COP_d	2.83 [-]

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 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}	2786 [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-MDC09J3E5
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 output¹⁾	P_{rated}	8 [kW]
Seasonal space heating energy efficiency	η_s	144.1 [%]
	SCOP	3.68 [-]

Measured capacity for heating for part load at outdoor temperature T_j	Average Climate - Medium temperature application	$T_j = -15\text{ °C}$	P_{dh}	- [kW]
		$T_j = -7\text{ °C}$	P_{dh}	7.57 [kW]
		$T_j = 2\text{ °C}$	P_{dh}	4.86 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	2.86 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	3.43 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	7.57 [kW]
		$T_j = \text{operation limit}$	P_{dh}	7.00 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate - Medium temperature application	$T_j = -15\text{ °C}$	COP_d	- [-]
		$T_j = -7\text{ °C}$	COP_d	2.17 [-]
		$T_j = 2\text{ °C}$	COP_d	3.60 [-]
		$T_j = 7\text{ °C}$	COP_d	4.99 [-]
		$T_j = 12\text{ °C}$	COP_d	6.62 [-]
		$T_j = \text{bivalent temperature}$	COP_d	2.17 [-]
		$T_j = \text{operation limit}$	COP_d	1.87 [-]

Bivalent temperature	$T_{bivalent}$	-7 [°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}	0.008 [kW]
	Standby mode	P_{SB}	0.007 [kW]
	Crankcase heater mode	P_{CK}	0.007 [kW]
Supplementary heater¹⁾	Rated heat output	P_{SUP}	1.00 [kW]
	Type of energy input		Electrical

Other items	Capacity control		Variable
	Water flow control		Variable
	Water flow rate		-
	Annual energy consumption	Q_{HE}	4495 [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	6.98	3.24
C ^K	A25/W10	3.67	6.83

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	9.55	4.2
C ^K	A25/W18	4.79	10.19

K) Keymark

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

N [#]	Test conditions	Heating capacity [kW]	COP
1 ^K	A7/W35	9.12	4.67
2 ^K	A7/W55	9.23	2.92

K) Keymark



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

N#	Test conditions	Heating capacity [kW]	COP
1 ^E	A2/W35	8.22	3.54
2 ^V	A-7/W35	7.54	2.73
3 ^N	A-7/W55	7.54	1.96

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	A7/W35	4.93	5.32
2 ^V	A2/W35	3.22	4.45
3 ^V	A-7/W35	2.37	3.24

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 off 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	3935	[s]
4)	Heating up electrical energy consumption	W_{eh-HP}	3.56	[kWh]
5)	Stand-by power input	P_{es}	0.04	[kW]
6)	Total useful energy content during the load profile	Q_{LP}	11.75	[kWh]
7)	Total electrical energy consumption during load profile	W_{EL-LP}	4.38	[kWh]
8)	Daily electrical energy consumption	Q_{elec}	4.35	[kWh]
9)	Coefficient of Performance	COP_{DHW}	2.68	[-]
10)	Water heating energy consumption	η_{wh}	112.5%	[%]
11)	Annual electrical energy consumption	AEC	910	[kWh/a]
12)	Reference hot water temperature	θ'_{WH}	52.6	[°C]
13)	Maximum volume of mixed water at 40°C	V_{40}	268	[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	65	0.5
2 ^Q	59	0.5
3 ^{ERP}	56	1.0

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

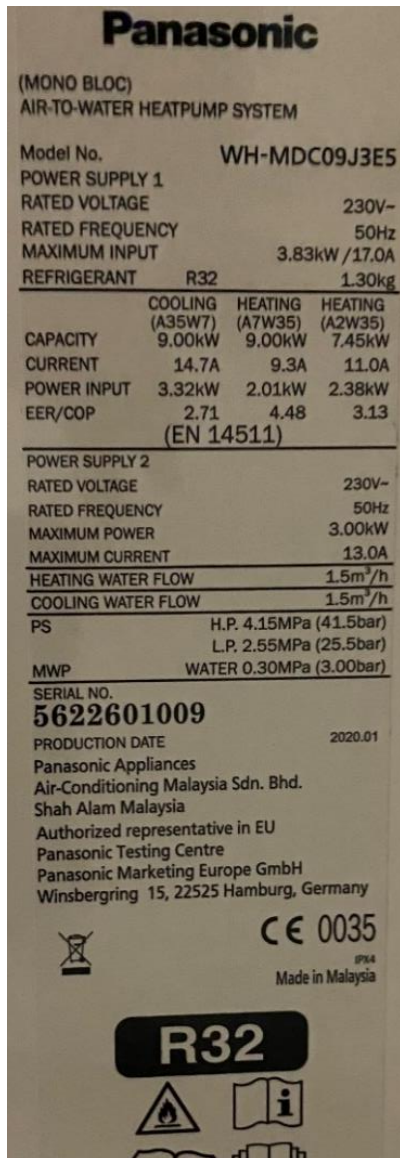
The uncertainty value is a weighted value using the level and frequency dependant influence for each 1/1-octave level on the final A-weighted sound power level.

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

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

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	6.72	3.12	1.00	1.00	3.12
B	2	54	3.77	3.82	5.17	0.99	1.00	5.17
C	7	35	2.42	3.05	6.82	0.98	0.79	6.79
D	12	15	1.08	3.57	8.90	0.98	0.30	8.51
E	-10	100	7.00	7.17	2.83	1.00	1.00	2.83
F - BIV	-10	100	7.00	7.17	2.83	1.00	1.00	2.83

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	Hours	Heat load	Heat load covered by heat pump	Electrical back up heater	Annual backup heater energy input	COPbin	Annual heating demand	Annual energy input	Net annual heating capacity	Net annual power input
	[-]	[°C]	[h]	[kW]	[kW]	[kW]	[kWh]	[-]	[kWh]	[kWh]	[kWh]	[kWh]
E / F - BIV	21	-10	1	7.00	7.00	0.00	0.00	2.83	7.00	2.47	7.00	2.47
	22	-9	25	6.73	6.73	0.00	0.00	2.93	168.27	57.50	168.27	57.50
	23	-8	23	6.46	6.46	0.00	0.00	3.02	148.62	49.16	148.62	49.16
A	24	-7	24	6.19	6.19	0.00	0.00	3.12	148.62	47.63	148.62	47.63
	25	-6	27	5.92	5.92	0.00	0.00	3.35	159.92	47.77	159.92	47.77
	26	-5	68	5.65	5.65	0.00	0.00	3.58	384.46	107.52	384.46	107.52
	27	-4	91	5.38	5.38	0.00	0.00	3.80	490.00	128.83	490.00	128.83
	28	-3	89	5.12	5.12	0.00	0.00	4.03	455.27	112.94	455.27	112.94
	29	-2	165	4.85	4.85	0.00	0.00	4.26	799.62	187.75	799.62	187.75
	30	-1	173	4.58	4.58	0.00	0.00	4.49	791.81	176.48	791.81	176.48
	31	0	240	4.31	4.31	0.00	0.00	4.71	1033.85	219.29	1033.85	219.29
	32	1	280	4.04	4.04	0.00	0.00	4.94	1130.77	228.80	1130.77	228.80
B	33	2	320	3.77	3.77	0.00	0.00	5.17	1206.15	233.30	1206.15	233.30
	34	3	357	3.50	3.50	0.00	0.00	5.49	1249.50	227.44	1249.50	227.44
	35	4	356	3.23	3.23	0.00	0.00	5.82	1150.15	197.71	1150.15	197.71
	36	5	303	2.96	2.96	0.00	0.00	6.14	897.35	146.12	897.35	146.12
	37	6	330	2.69	2.69	0.00	0.00	6.46	888.46	137.43	888.46	137.43
C	38	7	326	2.42	2.42	0.00	0.00	6.79	789.92	116.36	789.92	116.36
	39	8	348	2.15	2.15	0.00	0.00	7.13	749.54	105.09	749.54	105.09
	40	9	335	1.88	1.88	0.00	0.00	7.48	631.35	84.45	631.35	84.45
	41	10	315	1.62	1.62	0.00	0.00	7.82	508.85	65.07	508.85	65.07
	42	11	215	1.35	1.35	0.00	0.00	8.16	289.42	35.45	289.42	35.45
D	43	12	169	1.08	1.08	0.00	0.00	8.51	182.00	21.39	182.00	21.39
	44	13	151	0.81	0.81	0.00	0.00	8.85	121.96	13.78	121.96	13.78
	45	14	105	0.54	0.54	0.00	0.00	9.19	56.54	6.15	56.54	6.15
	46	15	74	0.27	0.27	0.00	0.00	9.54	19.92	2.09	19.92	2.09

SUM	14459.31	2757.98	14459.31	2757.98
SCOPon	5.24		SCOPnet	5.24



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	7.08	7.57	2.17	1.00	1.00	2.17
B	2	54	4.31	4.86	3.60	0.99	0.89	3.60
C	7	35	2.77	2.86	4.99	0.99	1.00	4.99
D	12	15	1.23	3.43	6.62	0.98	0.36	6.44
E	-10	100	8.00	7.00	1.87	1.00	1.00	1.87
F - BIV	-7	88	7.08	7.57	2.17	1.00	1.00	2.17

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]	COP _{bin} [-]	Annual heating demand [kWh]	Annual energy input [kWh]	Net annual heating capacity [kWh]	Net annual power input [kWh]
E	21	-10	1	8.00	7.00	1.00	1.00	1.87	8.00	4.74	7.00	3.74
	22	-9	25	7.69	7.03	0.67	16.67	1.97	192.31	105.82	175.64	89.16
	23	-8	23	7.38	7.05	0.33	7.67	2.07	169.85	86.01	162.18	78.35
A / F - BIV	24	-7	24	7.08	7.08	0.00	0.00	2.17	169.85	78.27	169.85	78.27
	25	-6	27	6.77	6.77	0.00	0.00	2.33	182.77	78.49	182.77	78.49
	26	-5	68	6.46	6.46	0.00	0.00	2.49	439.38	176.66	439.38	176.66
	27	-4	91	6.15	6.15	0.00	0.00	2.65	560.00	211.66	560.00	211.66
	28	-3	89	5.85	5.85	0.00	0.00	2.80	520.31	185.54	520.31	185.54
	29	-2	165	5.54	5.54	0.00	0.00	2.96	913.85	308.43	913.85	308.43
	30	-1	173	5.23	5.23	0.00	0.00	3.12	904.92	289.90	904.92	289.90
	31	0	240	4.92	4.92	0.00	0.00	3.28	1181.54	360.21	1181.54	360.21
	32	1	280	4.62	4.62	0.00	0.00	3.44	1292.31	375.81	1292.31	375.81
B	33	2	320	4.31	4.31	0.00	0.00	3.60	1378.46	383.20	1378.46	383.20
	34	3	357	4.00	4.00	0.00	0.00	3.88	1428.00	368.44	1428.00	368.44
	35	4	356	3.69	3.69	0.00	0.00	4.15	1314.46	316.41	1314.46	316.41
	36	5	303	3.38	3.38	0.00	0.00	4.43	1025.54	231.35	1025.54	231.35
	37	6	330	3.08	3.08	0.00	0.00	4.71	1015.38	215.51	1015.38	215.51
C	38	7	326	2.77	2.77	0.00	0.00	4.99	902.77	180.92	902.77	180.92
	39	8	348	2.46	2.46	0.00	0.00	5.28	856.62	162.22	856.62	162.22
	40	9	335	2.15	2.15	0.00	0.00	5.57	721.54	129.52	721.54	129.52
	41	10	315	1.85	1.85	0.00	0.00	5.86	581.54	99.22	581.54	99.22
	42	11	215	1.54	1.54	0.00	0.00	6.15	330.77	53.77	330.77	53.77
D	43	12	169	1.23	1.23	0.00	0.00	6.44	208.00	32.29	208.00	32.29
	44	13	151	0.92	0.92	0.00	0.00	6.73	139.38	20.70	139.38	20.70
	45	14	105	0.62	0.62	0.00	0.00	7.02	64.62	9.20	64.62	9.20
	46	15	74	0.31	0.31	0.00	0.00	7.31	22.77	3.11	22.77	3.11

SUM	16524.92	4467.40	16499.59	4442.07
SCOPon		3.70	SCOPnet	3.71



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	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	6.72
COP	-	3.12
Power consumption	kW	2.16
Measured		
Heating capacity	kW	6.76
COP	-	3.06
Power consumption	kW	2.21
During heating		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-8.2
Inlet temperature	°C	29.0
Outlet temperature	°C	33.9
Outlet temperature (Time averaged)	°C	33.9
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	38330
Calculated Hydraulic power	W	13
Calculated global efficiency	η	0.25
Calculated Capacity correction	W	37
Calculated Power correction	W	50
Water Flow	m ³ /s	0.000329



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	7.00
Heating demand:	kW	3.77
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.82
COP	-	5.17
Power consumption	kW	0.74
Measured		
Heating capacity	kW	3.85
COP	-	4.92
Power consumption	kW	0.78
During heating		
Air temperature dry bulb	°C	2.0
Air temperature wet bulb	°C	0.9
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	52831
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	0.000188



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	7.00
Heating demand:	kW	2.42
CR:	-	0.8
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.05
COP	-	6.82
Power consumption	kW	0.45
Measured		
Heating capacity	kW	3.09
COP	-	6.33
Power consumption	kW	0.49
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.0
Inlet temperature	°C	23.1
Outlet temperature	°C	28.1
Outlet temperature (Time averaged)	°C	27.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	58585
Calculated Hydraulic power	W	9
Calculated global efficiency	η	0.22
Calculated Capacity correction	W	31
Calculated Power correction	W	40
Water Flow	m ³ /s	0.000148



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	7.00
Heating demand:	kW	1.08
CR:	-	0.3
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.57
COP	-	8.90
Power consumption	kW	0.40
Measured		
Heating capacity	kW	3.61
COP	-	8.10
Power consumption	kW	0.45
During heating		
Air temperature dry bulb	°C	12.0
Air temperature wet bulb	°C	11.1
Inlet temperature	°C	22.5
Outlet temperature	°C	27.5
Outlet temperature (Time averaged)	°C	24.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	58739
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	0.000173



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	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	7.17
COP	-	2.83
Power consumption	kW	2.54
Measured		
Heating capacity	kW	7.21
COP	-	2.79
Power consumption	kW	2.59
During heating		
Air temperature dry bulb	°C	-10.0
Air temperature wet bulb	°C	-11.1
Inlet temperature	°C	30.0
Outlet temperature	°C	35.0
Outlet temperature (Time averaged)	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	34861
Calculated Hydraulic power	W	12
Calculated global efficiency	η	0.25
Calculated Capacity correction	W	37
Calculated Power correction	W	49
Water Flow	m ³ /s	0.000348



Detailed SCOP test results - Medium temperature application - EN 14825

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	8.00
Heating demand:	kW	4.31
CR:	-	0.9
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	4.86
COP	-	3.60
Power consumption	kW	1.35
Measured		
Heating capacity	kW	4.89
COP	-	3.52
Power consumption	kW	1.39
During heating		
Air temperature dry bulb	°C	2.0
Air temperature wet bulb	°C	0.9
Inlet temperature	°C	34.8
Outlet temperature	°C	43.0
Outlet temperature (Time averaged)	°C	42.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	58825
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.22
Calculated Capacity correction	W	31
Calculated Power correction	W	39
Water Flow	m ³ /s	0.000144



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	8.00
Heating demand:	kW	2.77
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	2.86
COP	-	4.99
Power consumption	kW	0.57
Measured		
Heating capacity	kW	2.89
COP	-	4.73
Power consumption	kW	0.61
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	5.8
Inlet temperature	°C	30.7
Outlet temperature	°C	36.1
Outlet temperature (Time averaged)	°C	36.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	61843
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	0.000128



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	8.00
Heating demand:	kW	1.23
CR:	-	0.4
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.43
COP	-	6.62
Power consumption	kW	0.52
Measured		
Heating capacity	kW	3.46
COP	-	6.23
Power consumption	kW	0.55
During heating		
Air temperature dry bulb	°C	11.9
Air temperature wet bulb	°C	11.0
Inlet temperature	°C	27.8
Outlet temperature	°C	34.3
Outlet temperature (Time averaged)	°C	30.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	60064
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	0.000128



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	8.00
Heating demand:	kW	8.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	7.00
COP	-	1.87
Power consumption	kW	3.73
Measured		
Heating capacity	kW	7.03
COP	-	1.86
Power consumption	kW	3.78
During heating		
Air temperature dry bulb	°C	-10.0
Air temperature wet bulb	°C	-11.1
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	51597
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	0.000214



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	8.00
Heating demand:	kW	7.08
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	7.57
COP	-	2.17
Power consumption	kW	3.50
Measured		
Heating capacity	kW	7.61
COP	-	2.15
Power consumption	kW	3.55
During heating		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-8.2
Inlet temperature	°C	44.0
Outlet temperature	°C	52.0
Outlet temperature (Time averaged)	°C	52.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	49932
Calculated Hydraulic power	W	12
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	36
Calculated Power correction	W	47
Water Flow	m ³ /s	0.000231



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	6.98
Heating demand:	kW	6.98
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Cooling capacity	kW	6.98
EER	-	3.24
Power consumption	kW	2.16
Measured		
Cooling capacity	kW	6.94
EER	-	3.14
Power consumption	kW	2.21
During cooling		
Air temperature dry bulb	°C	35.0
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	45101
Calculated Hydraulic power	W	15
Calculated global efficiency	η	0.27
Calculated Capacity correction	W	40
Calculated Power correction	W	55
Water Flow	m³/s	0.000331



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	6.98
Heating demand:	kW	3.28
CR:	-	0.9
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Cooling capacity	kW	3.67
EER	-	6.83
Power consumption	kW	0.54
Measured		
Cooling capacity	kW	3.64
EER	-	6.26
Power consumption	kW	0.58
During Cooling		
Air temperature dry bulb	°C	25.0
Air temperature wet bulb	°C	-
Inlet temperature	°C	14.4
Outlet temperature	°C	9.4
Outlet temperature (Time averaged)	°C	10.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	57970
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	0.000174



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:	Colling floor	
Condition name:	A	
Condition temperature:	°C	35
Part load:	%	100%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	9.55
Heating demand:	kW	9.55
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Cooling capacity	kW	9.55
EER	-	4.20
Power consumption	kW	2.27
Measured		
Cooling capacity	kW	9.51
EER	-	4.09
Power consumption	kW	2.33
During Cooling		
Air temperature dry bulb	°C	35.1
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	32186
Calculated Hydraulic power	W	14
Calculated global efficiency	η	0.27
Calculated Capacity correction	W	40
Calculated Power correction	W	54
Water Flow	m³/s	0.000450



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	9.55
Heating demand:	kW	4.49
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Cooling capacity	kW	4.79
EER	-	10.19
Power consumption	kW	0.47
Measured		
Cooling capacity	kW	4.75
EER	-	9.13
Power consumption	kW	0.52
During Cooling		
Air temperature dry bulb	°C	25.0
Air temperature wet bulb	°C	-
Inlet temperature	°C	23.0
Outlet temperature	°C	18.0
Outlet temperature (Time averaged)	°C	18.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	56580
Calculated Hydraulic power	W	13
Calculated global efficiency	η	0.25
Calculated Capacity correction	W	38
Calculated Power correction	W	51
Water Flow	m ³ /s	0.000228



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	9.12
COP	-	4.67
Power consumption	kW	1.95
Measured		
Heating capacity	kW	9.16
COP	-	4.57
Power consumption	kW	2.00
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	30293
Calculated Hydraulic power	W	13
Calculated global efficiency	η	0.26
Calculated Capacity correction	W	38
Calculated Power correction	W	51
Water Flow	m ³ /s	0.000438



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	9.23
COP	-	2.92
Power consumption	kW	3.16
Measured		
Heating capacity	kW	9.27
COP	-	2.88
Power consumption	kW	3.21
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.1
Inlet temperature	°C	47.0
Outlet temperature	°C	55.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	53576
Calculated Hydraulic power	W	15
Calculated global efficiency	η	0.27
Calculated Capacity correction	W	40
Calculated Power correction	W	55
Water Flow	m ³ /s	0.000279



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	8.22
COP	-	3.54
Power consumption	kW	2.32
Measured		
Heating capacity	kW	8.26
COP	-	3.49
Power consumption	kW	2.37
During heating		
Air temperature dry bulb	°C	2.1
Air temperature wet bulb	°C	0.9
Inlet temperature	°C	30.1
Outlet temperature	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	24945
Calculated Hydraulic power	W	12
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	36
Calculated Power correction	W	47
Water Flow	m ³ /s	0.000461



Detailed result for 'EN14511:2018' A-7/W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	7.54
COP	-	2.73
Power consumption	kW	2.76
Measured		
Heating capacity	kW	7.58
COP	-	2.70
Power consumption	kW	2.81
During heating		
Air temperature dry bulb	°C	-7.1
Air temperature wet bulb	°C	-7.9
Inlet temperature	°C	30.0
Outlet temperature	°C	35.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	29237
Calculated Hydraulic power	W	12
Calculated global efficiency	η	0.25
Calculated Capacity correction	W	36
Calculated Power correction	W	48
Water Flow	m ³ /s	0.000406



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	7.54
COP	-	1.96
Power consumption	kW	3.85
Measured		
Heating capacity	kW	7.58
COP	-	1.95
Power consumption	kW	3.90
During heating		
Air temperature dry bulb	°C	-6.9
Air temperature wet bulb	°C	-8.2
Inlet temperature	°C	47.0
Outlet temperature	°C	54.9
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	49963
Calculated Hydraulic power	W	12
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	36
Calculated Power correction	W	48
Water Flow	m ³ /s	0.000233



Detailed test results of part load – EN 14511

Detailed result for 'EN14511:2018' A7/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	4.93
COP	-	5.32
Power consumption	kW	0.93
Measured		
Heating capacity	kW	4.96
COP	-	5.12
Power consumption	kW	0.97
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.0
Inlet temperature	°C	30.0
Outlet temperature	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	41364
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	0.000239




Detailed result for 'EN14511:2018' A2/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	3.22	
COP	-	4.45	
Power consumption	kW	0.72	
Measured			
Heating capacity	kW	3.24	
COP	-	4.28	
Power consumption	kW	0.76	
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	44575	
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	0.000156	




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	2.37
COP	-	3.24
Power consumption	kW	0.73
Measured		
Heating capacity	kW	2.40
COP	-	3.14
Power consumption	kW	0.76
During heating		
Air temperature dry bulb	°C	-6.9
Air temperature wet bulb	°C	-7.9
Inlet temperature	°C	30.2
Outlet temperature	°C	34.7
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	44601
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 test results of sound power measurements – Test 1



Sound power levels according to ISO 3743-1:2010



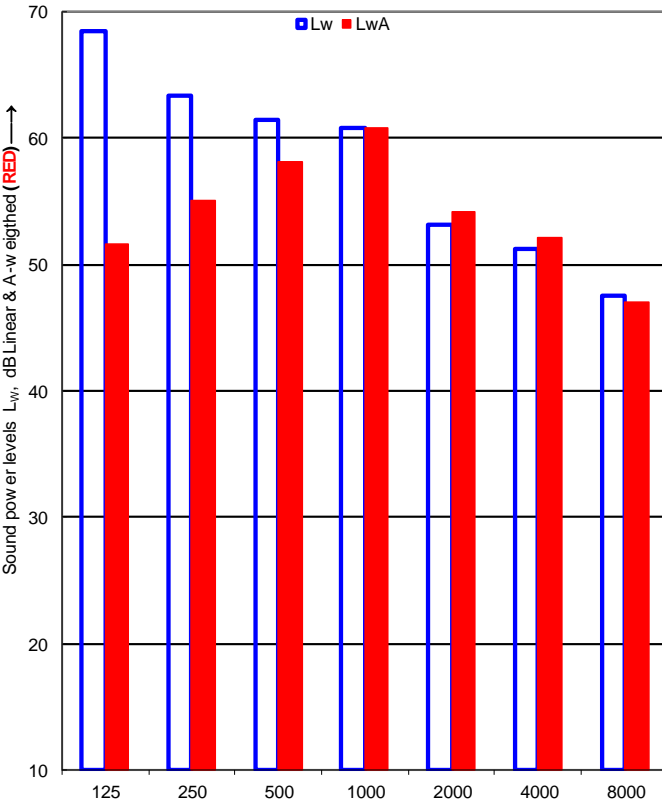
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms

Client:	Panasonic Europe GmbH	Date of test:	05-05-2020
Object:	Type: Mono Air to water heat pump Model: WH-MDC09J3E5		
Mounting conditions:	<p>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.</p>		

Operating conditions:	<p>A7/W47-55, Test mode 1, Compressor speed: 67 - 68[Hz], Heating capacity: 9.23 [kW], Power_input: 3.15 [kW], Water flow rate: 1020 [l/h], Fan_speed : 690 [rpm], dp_water : 558</p>		
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
Area, S, of test room:	138.9 m²	L3:	0.8 m
		Volume:	0.3 m³

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	64.8	
125	65.1	68.4
160	58.1	
200	57.7	
250	59.1	63.3
315	58.7	
400	57.0	
500	57.5	61.4
630	55.2	
800	55.9	
1000	56.8	60.8
1250	55.4	
1600	50.6	
2000	47.4	53.1
2500	45.4	
3150	45.1	
4000	44.8	51.3
5000	48.5	
6300	45.8	
8000	40.8	47.5
10000	38.0	

¹ Too high





Sound power level L_w(A):


65 dB [re 1pW]

Name of test institute:	DTI
No. of test report:	300-KLAB-20-010
Date:	05-05-2020

Detailed test results of sound power measurements – Test 2

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:

Object:

Mounting conditions:

Panasonic Europe GmbH

Type: Mono Air to water heat pump Model: WH-MDC09J3E5

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.

Date of test: 05-05-2020

Operating conditions:

Static pressure:

Air temperature:

Relative air humidity:

Test room volume:

Area, S, of test room:

A7/W47-55, Quiet mode 3, Compressor speed: 50 - 51[Hz], Heating capacity: 6.74 [kW], Power_input: 2.25 [kW], Water flow rate: 740 [l/h], Fan_speed : 500-510 [rpm], dp_water : 623

1021 kPa

7.0 °C

85.0 %

102.8 m³

138.9 m²

Room: Room 1

Reference box:

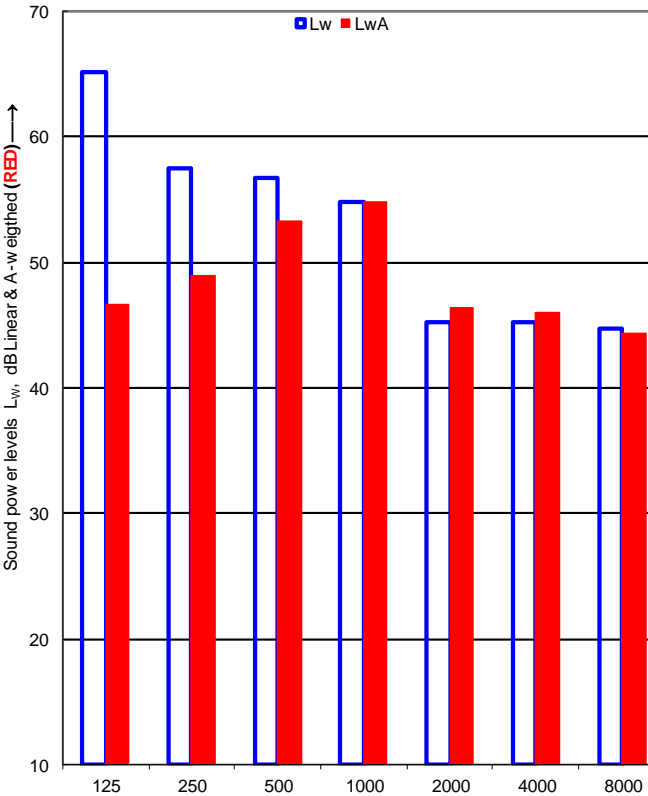
L1: 1.3 m

L2: 0.3 m

L3: 0.8 m

Volume: 0.3 m³

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	64.6	
125	53.5	65.1
160	50.1	
200	54.5	
250	48.9	57.5
315	53.0	
400	52.1	
500	53.6	56.7
630	48.6	
800	49.2	
1000	50.4	54.7
1250	50.2	
1600	43.1	
2000	38.9	45.2
2500	37.1	
3150	37.8	
4000	38.9	45.2
5000	42.8	
6300	43.6	
8000	36.8	44.7
10000	32.5	



1 Too high

Sound power level L_w(A): 59 dB [re 1pW]

Name of test institute:

No. of test report:

Date:




DTI

300-KLAB-20-010

05-05-2020

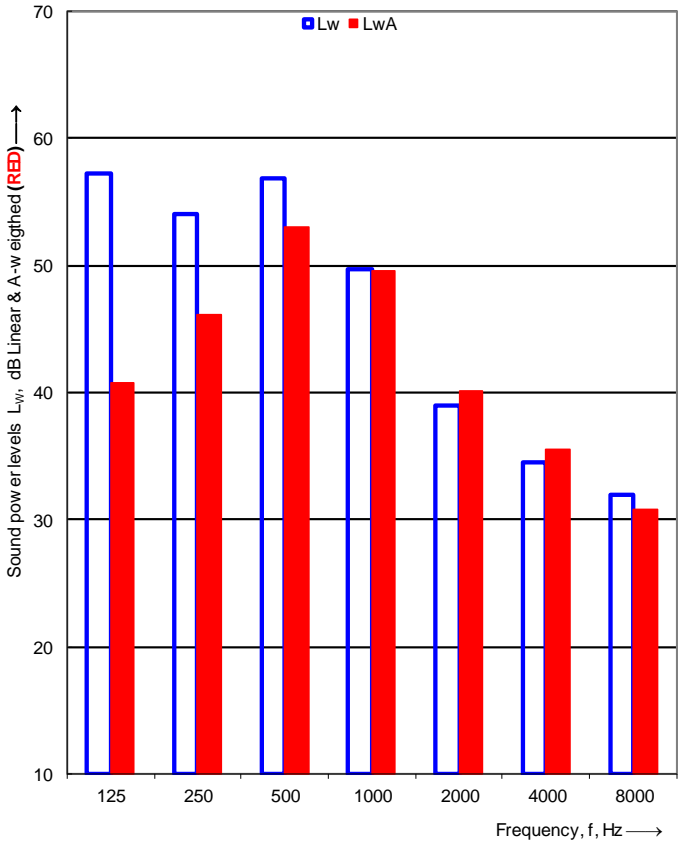


Detailed test results of sound power measurements – Test 3

 		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: 05-05-2020	
Object:		Type: Mono Air to water heat pump Model: WH-MDC09J3E5			
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/W49.6-55, Compressor speed: 25 - 26[Hz], Heating capacity: 2.9 [kW], Power_input: 1.17 [kW], Water flow rate: 460 [l/h], Fan_speed : 430 -440 [rpm], dp_water : 236 [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		L3: 0.8 m	
Area, S, of test room:		138.9 m²		Volume: 0.3 m³	
Room:		Room 1			

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	55.2	
125	47.5	57.2
160	51.4	
200	48.0	
250	48.3	54.0
315	50.9	
400	54.3	
500	52.7	56.9
630	45.1	
800	45.7	
1000	44.4	49.6
1250	44.4	
1600	36.4	
2000	33.7	39.0
2500	31.0	
3150	29.5	
4000	30.6	34.6
5000	29.1	
6300	26.6	
8000	27.9	32.0
10000	27.0	

¹ Too high



Frequency, f, Hz	L _w [dB]	L _{wA} [dB]
125	55.2	41.0
250	48.3	46.0
500	52.7	53.0
1000	44.4	49.6
2000	33.7	39.0
4000	30.6	34.6
8000	27.9	32.0

Sound power level L_w(A): 56 dB [re 1pW]

Name of test institute:	DTI
No. of test report:	300-KLAB-20-010
Date:	05-05-2020



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.

