

TEST REPORT

Report no.:
300-KLAB-22-003



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

Component: Brand: Panasonic
Type: Air to water heat pump (mono bloc)
Model: Unit: WH-MXC09J3E8
Series no.: Unit: 5623400001
Prod. year: Unit: 2021.07

Dates: Component tested: March 2022 – April 2022

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

Remarks: The unit was delivered by the customer. The installation and test settings were done according to the manufacturer's instructions. All tests are done with enabled defrost mode. The unit was delivered as model no. WH-MXC12J9E8, cf. the rating plates of the units. By changing the software, the unit was changed to model no. WH-MXC09J3E8.

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Objective

The objective of this report is to document the following:

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

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

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

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 off the heat transfer medium flows
- 4.6 Complete power supply failure

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

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

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

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





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Test conditions

SCOP test conditions for low temperature – EN 14825

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

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

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

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

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

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

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

Conditions A and E = Keymark

Additional information

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



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

Conditions A, E, and one more test condition were chosen by the certification body = Keymark

Additional information

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



Test conditions for rating conditions low temperature – EN 14511

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

K) Keymark

Test conditions for rating conditions medium temperature – EN 14511

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

K) Keymark



Test conditions for starting and operating tests – EN 14511-4: 2013

N [#]	Heat source		Heat sink	Water flow rate at indoor heat exchanger	Test
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Outlet temperature (°C)		
1	-20	-	20	Minimum	Starting
2	-20	-	47	Minimum	Operating

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

N [#]	Heat source		Heat sink	Water flow rate at indoor heat exchanger	Test
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)		
1 ^K	-20	-	20	Minimum	Starting
2 ^K	-20	-	47	Minimum	Operating

K) Keymark

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

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

K) Keymark



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

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

K) Keymark

Test conditions for sound power measurements – EN 12102-1

N [#]	Test condition		Heat pump setting			
	Outdoor heat exchanger (dry bulb/ wet bulb) (°C)	Indoor heat exchanger (inlet/ outlet) (°C)	Compressor speed (Hz)	Fan speed Outdoor 1/2 (rpm)	Heating capacity (kW)	Power input (kW)
1 ^R	7/6	30/35	48	350/440	9.2	1.80
2 ^Q	7/6	30/35	31	210/270	5.6	1.10
3 ^R	7/6	47/55	49	380/450	9.0	2.96
4 ^Q	7/6	47/55	32	240/280	4.9	1.84
5 ^R	2/1	47/55	56	510/520	10.6	3.90
6 ^Q	2/1	47/55	46	340/420	7.0	2.60
7 ^R	-7/-8	47/55	63	620/590	9.6	4.40
8 ^Q	-7/-8	47/55	54	400/500	5.6	2.76
9 ^{E-K}	7/6	47/55	35	210/310	4.8	1.74

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



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Test results

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

Model (Outdoor)	WH-MXC09J3E8
Air-to-water heat pump mono bloc	Y
Low-temperature heat pump	N
Equipped with supplementary heater	Y
Heat pump combination heater	N

Rated heat output¹⁾	P_{rated}	9 [kW]
Seasonal space heating energy efficiency	η_s	204.3 [%]
	SCOP	5.18 [-]

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}	8.43 [kW]
		$T_j = 2\text{ °C}$	P_{dh}	4.90 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	5.34 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	6.31 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	9.07 [kW]
		$T_j = \text{operation limit}$	P_{dh}	9.07 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate - Low temperature application	$T_j = -15\text{ °C}$	COPd	- [-]
		$T_j = -7\text{ °C}$	COPd	3.24 [-]
		$T_j = 2\text{ °C}$	COPd	5.18 [-]
		$T_j = 7\text{ °C}$	COPd	6.54 [-]
		$T_j = 12\text{ °C}$	COPd	8.59 [-]
		$T_j = \text{bivalent temperature}$	COPd	3.07 [-]
		$T_j = \text{operation limit}$	COPd	3.07 [-]

Bivalent temperature	$T_{bivalent}$	-10 [°C]
Operation limit temperatures	TOL	-10 [°C]
	WTOL	- [°C]
Degradation coefficient	C_{dh}	0.99 [-]

Power consumption in modes other than active mode	Off mode	P_{OFF}	0.008 [kW]
	Thermostat-off mode	P_{TO}	0.008 [kW]
	Standby mode	P_{SB}	0.008 [kW]
	Crankcase heater mode	P_{CK}	0.008 [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}	3588 [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, $sup(T_j)$.

Conditions A and E = Keymark



Test Rep. nr.



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

Model (Outdoor)	WH-MXC09J3E8
Air-to-water heat pump mono bloc	Y
Low-temperature heat pump	N
Equipped with supplementary heater	Y
Heat pump combination heater	N

Rated heat output¹⁾	P_{rated}	9 [kW]
Seasonal space heating energy efficiency	η_s	147.2 [%]
	SCOP	3.75 [-]

Measured capacity for heating for part load at outdoor temperature T_j	Average Climate	$T_j = -15\text{ °C}$	P_{dh}	- [kW]
	-	$T_j = -7\text{ °C}$	P_{dh}	7.89 [kW]
	Medium temperature application	$T_j = 2\text{ °C}$	P_{dh}	4.98 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	5.08 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	6.12 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	8.89 [kW]
		$T_j = \text{operation limit}$	P_{dh}	8.89 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate	$T_j = -15\text{ °C}$	COPd	- [-]
	-	$T_j = -7\text{ °C}$	COPd	2.42 [-]
	Medium temperature application	$T_j = 2\text{ °C}$	COPd	3.67 [-]
		$T_j = 7\text{ °C}$	COPd	4.76 [-]
		$T_j = 12\text{ °C}$	COPd	6.42 [-]
		$T_j = \text{bivalent temperature}$	COPd	2.12 [-]
		$T_j = \text{operation limit}$	COPd	2.12 [-]

Bivalent temperature	$T_{bivalent}$	-10 [°C]
Operation limit temperatures	TOL	-10 [°C]
	WTOL	- [°C]
Degradation coefficient	C_{dh}	0.99 [-]

Power consumption in modes other than active mode	Off mode	P_{OFF}	0.008 [kW]
	Thermostat-off mode	P_{TO}	0.008 [kW]
	Standby mode	P_{SB}	0.008 [kW]
	Crankcase heater mode	P_{CK}	0.008 [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}	4953 [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, $sup(T_j)$.

Conditions A and E = Keymark



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

N#	Test conditions	Heating capacity [kW]	COP
1 ^K	A7/W35	9.17	5.21
2	A2/W35	9.05	3.81
3	A-7/W35	9.27	3.12

K) Keymark

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

N#	Test conditions	Heating capacity [kW]	COP
1 ^K	A7/W55	9.01	3.15
2	A2/W55	9.12	2.54
3	A-7/W55	9.40	2.16

K) Keymark



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Test results of starting and operating tests – EN 14511-4:2013

N#	Test conditions	Water flow rate at indoor heat exchanger (l/h)	Test validation
1	A35/W55	1600	Passed
2	A35/W25	760	Passed

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

N#	Test conditions	Water flow rate at indoor heat exchanger (l/h)	Test validation
1 ^K	A-20/W20	570	Passed
2 ^K	A-20/W47	992	Passed

K) Keymark

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

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

K) Keymark

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

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



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

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

Power consumption of liquid pump for COP test points

N#	COP test points	Measured power consumption (W)	Test mode no.
1	A7/W35	46	1
2	A2/W35	46	1
3	A-7/W35	46	1
4	A7/W55	46	1
5	A2/W55	46	1
6	A-7/W55	46	1

The power consumptions of the liquid pump have been measured separately



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

N#	SCOP test points	Measured power consumption (W)	Test mode no.
1	A12/W24	45	3
2	A7/W27	45	4
3	A2/W30	45	5
4	A-7/W34	45	6
5	A-10/W35	45	7

The power consumptions of the liquid pump have been measured separately

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

N#	SCOP test points	Measured power consumption (W)	Test mode no.
1	A12/W30	45	8
2	A7/W36	45	9
3	A2/W42	45	10
4	A-7/W52	45	11
5	A-10/W55	45	12

The power consumptions of the liquid pump have been measured separately





Test results of sound power measurements – EN 12102

N [#]	Test conditions	Sound power level LW(A) [dB re 1pW]	Uncertainty (dB) (weighted value)
1 ^R	A7/W35	56.6	0.5
2 ^Q	A7/W35	50.5	0.5
3 ^R	A7/W55	58.6	0.5
4 ^Q	A7/W55	54.1	0.5
5 ^R	A2/W55	61.8	0.5
6 ^Q	A2/W55	58.1	0.5
7 ^R	A-7/W55	65.1	0.5
8 ^Q	A-7/W55	61.6	0.5
9 ^{E-K}	A7/W55	54.0	0.5

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

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

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



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Photo

Rating plate

Panasonic

(MONO BLOC)
AIR-TO-WATER HEATPUMP SYSTEM

Model No. **WH-MXC12J9E8**

POWER SUPPLY 1
RATED VOLTAGE 400V
PHASE 3N~
RATED FREQUENCY 50Hz
MAXIMUM INPUT 7.93kW / 11.8A
REFRIGERANT R32 1.60kg
GWP / CO₂eq. 675 / 1.080t

	COOLING (A35W7)	HEATING (A7W35)	HEATING (A2W35)
CAPACITY	12.00kW	12.00kW	12.00kW
CURRENT	6.3A	3.7A	5.1A
POWER INPUT	4.23kW	2.50kW	3.40kW
EER/COP	2.84	4.80	3.53

(EN 14511)

POWER SUPPLY 2
RATED VOLTAGE 400V
PHASE 3N~
RATED FREQUENCY 50Hz
MAXIMUM POWER 9.00kW
MAXIMUM CURRENT 13.0A
HEATING WATER FLOW 2.1m³/h
COOLING WATER FLOW 2.1m³/h

PS H.P. 4.30MPa (43.0bar)
L.P. 2.55MPa (25.5bar)
MWP WATER 0.30MPa (3.00bar)

SERIAL NO.
5623400001
PRODUCTION DATE 2021.07

Panasonic Appliances
Air-Conditioning Malaysia Sdn. Bhd.
Shah Alam Malaysia
Authorized representative in EU
Panasonic Testing Centre
Panasonic Marketing Europe GmbH
Winsbergring 15, 22525 Hamburg, Germany

CE 0035
IPX4
Made in Malaysia

R32

THIS PRODUCT CONTAINS FLUORINATED GREENHOUSE GASES

WARNING

Unit





SCOP - detailed calculation

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

Calculation of reference SCOP

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

Where

P_{design} = Heating load of the building at design temperature, kW

H_{he} = Number of equivalent heating hours, 2066 h

H_{TO} , H_{SB} , H_{CK} , H_{OFF} = Number of hours for which the unit is considered to work in thermostat off mode, standby mode, crankcase heater mode and off mode, h, respectively

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

Data for SCOP

	Outdoor tempera- ture [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COPbin [-]
A	-7	88	7.96	8.43	3.24	1.00	1.00	3.24
B	2	54	4.85	4.90	5.18	0.99	1.00	5.18
C	7	35	3.12	5.34	6.54	0.99	0.58	6.49
D	12	15	1.38	6.31	8.59	0.99	0.22	8.27
E	-10	100	9.00	9.07	3.07	1.00	1.00	3.07
F - BIV	-10	100	9.00	9.07	3.07	1.00	1.00	3.07

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	0.008	0.008	29.376
Thermostat off	178	0.008	0.008	1.424
Standby	0	0.008	0.008	0
Crankcase heater	3850	0.008	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	9.00	9.00	0.00	0.00	3.07	9.00	2.93	9.00	2.93
	22	-9	25	8.65	8.65	0.00	0.00	3.13	216.35	69.19	216.35	69.19
	23	-8	23	8.31	8.31	0.00	0.00	3.18	191.08	60.02	191.08	60.02
A	24	-7	24	7.96	7.96	0.00	0.00	3.24	191.08	58.97	191.08	58.97
	25	-6	27	7.62	7.62	0.00	0.00	3.46	205.62	59.50	205.62	59.50
	26	-5	68	7.27	7.27	0.00	0.00	3.67	494.31	134.65	494.31	134.65
	27	-4	91	6.92	6.92	0.00	0.00	3.89	630.00	162.09	630.00	162.09
	28	-3	89	6.58	6.58	0.00	0.00	4.10	585.35	142.69	585.35	142.69
	29	-2	165	6.23	6.23	0.00	0.00	4.32	1028.08	238.10	1028.08	238.10
	30	-1	173	5.88	5.88	0.00	0.00	4.53	1018.04	224.57	1018.04	224.57
	31	0	240	5.54	5.54	0.00	0.00	4.75	1329.23	279.90	1329.23	279.90
	32	1	280	5.19	5.19	0.00	0.00	4.96	1453.85	292.85	1453.85	292.85
	33	2	320	4.85	4.85	0.00	0.00	5.18	1550.77	299.38	1550.77	299.38
B	34	3	357	4.50	4.50	0.00	0.00	5.44	1606.50	295.15	1606.50	295.15
	35	4	356	4.15	4.15	0.00	0.00	5.71	1478.77	259.17	1478.77	259.17
	36	5	303	3.81	3.81	0.00	0.00	5.97	1153.73	193.30	1153.73	193.30
	37	6	330	3.46	3.46	0.00	0.00	6.23	1142.31	183.31	1142.31	183.31
	38	7	326	3.12	3.12	0.00	0.00	6.49	1015.62	156.38	1015.62	156.38
C	39	8	348	2.77	2.77	0.00	0.00	6.85	963.69	140.69	963.69	140.69
	40	9	335	2.42	2.42	0.00	0.00	7.20	811.73	112.67	811.73	112.67
	41	10	315	2.08	2.08	0.00	0.00	7.56	654.23	86.54	654.23	86.54
	42	11	215	1.73	1.73	0.00	0.00	7.91	372.12	47.02	372.12	47.02
	43	12	169	1.38	1.38	0.00	0.00	8.27	234.00	28.30	234.00	28.30
D	44	13	151	1.04	1.04	0.00	0.00	8.62	156.81	18.18	156.81	18.18
	45	14	105	0.69	0.69	0.00	0.00	8.98	72.69	8.10	72.69	8.10
	46	15	74	0.35	0.35	0.00	0.00	9.33	25.62	2.74	25.62	2.74
	46	15	74	0.35	0.35	0.00	0.00	9.33	25.62	2.74	25.62	2.74
SUM									18590.54	3556.40	18590.54	3556.40
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	7.96	7.89	2.42	1.00	1.00	2.42
B	2	54	4.85	4.98	3.67	0.99	1.00	3.67
C	7	35	3.12	5.08	4.76	0.99	0.61	4.74
D	12	15	1.38	6.12	6.42	0.99	0.23	6.24
E	-10	100	9.00	8.89	2.12	1.00	1.00	2.12
F - BIV	-10	100	9.00	8.89	2.12	1.00	1.00	2.12

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	0.008	0.008	29.376
Thermostat off	178	0.008	0.008	1.424
Standby	0	0.008	0.008	0
Crankcase heater	3850	0.008	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	9.00	8.89	0.00	0.00	2.12	9.00	4.25	9.00	4.25
	22	-9	25	8.65	8.56	0.00	0.00	2.22	216.35	97.45	216.35	97.45
	23	-8	23	8.31	8.22	0.00	0.00	2.32	191.08	82.36	191.08	82.36
A	24	-7	24	7.96	7.89	0.00	0.00	2.42	191.08	78.96	191.08	78.96
	25	-6	27	7.62	7.55	0.00	0.00	2.56	205.62	80.35	205.62	80.35
	26	-5	68	7.27	7.21	0.00	0.00	2.70	494.31	183.23	494.31	183.23
	27	-4	91	6.92	6.88	0.00	0.00	2.84	630.00	222.09	630.00	222.09
	28	-3	89	6.58	6.54	0.00	0.00	2.98	585.35	196.72	585.35	196.72
	29	-2	165	6.23	6.20	0.00	0.00	3.11	1028.08	330.10	1028.08	330.10
	30	-1	173	5.88	5.86	0.00	0.00	3.25	1018.04	312.92	1018.04	312.92
	31	0	240	5.54	5.52	0.00	0.00	3.39	1329.23	391.85	1329.23	391.85
	32	1	280	5.19	5.18	0.00	0.00	3.53	1453.85	411.72	1453.85	411.72
	33	2	320	4.85	4.85	0.00	0.00	3.67	1550.77	422.55	1550.77	422.55
B	34	3	357	4.50	4.50	0.00	0.00	3.88	1606.50	413.67	1606.50	413.67
	35	4	356	4.15	4.15	0.00	0.00	4.10	1478.77	360.94	1478.77	360.94
	36	5	303	3.81	3.81	0.00	0.00	4.31	1153.73	267.65	1153.73	267.65
	37	6	330	3.46	3.46	0.00	0.00	4.52	1142.31	252.49	1142.31	252.49
	38	7	326	3.12	3.12	0.00	0.00	4.74	1015.62	214.37	1015.62	214.37
C	39	8	348	2.77	2.77	0.00	0.00	5.04	963.69	191.27	963.69	191.27
	40	9	335	2.42	2.42	0.00	0.00	5.34	811.73	152.04	811.73	152.04
	41	10	315	2.08	2.08	0.00	0.00	5.64	654.23	116.01	654.23	116.01
	42	11	215	1.73	1.73	0.00	0.00	5.94	372.12	62.64	372.12	62.64
	43	12	169	1.38	1.38	0.00	0.00	6.24	234.00	37.49	234.00	37.49
D	44	13	151	1.04	1.04	0.00	0.00	6.54	156.81	23.97	156.81	23.97
	45	14	105	0.69	0.69	0.00	0.00	6.84	72.69	10.62	72.69	10.62
	46	15	74	0.35	0.35	0.00	0.00	7.14	25.62	3.59	25.62	3.59

SUM	18590.54	4921.32	18590.54	4921.32
SCOPon	3.78		SCOPnet	3.78



Detailed test results

Detailed SCOP test results - low temperature application – EN 14825

Detailed result for 'EN14825:2018' Average Low (A) A -7 /W34		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:	Average	
Temperature application:	Low	
Condition name:	A	
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	7.96
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Transient with no defrost cycle	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Heating capacity	kW	8.43
COP	-	3.24
Power consumption	kW	2.60
Measured		
Heating capacity	kW	8.46
COP	-	3.21
Power consumption	kW	2.63
During heating		
Air temperature dry bulb	°C	-6.89
Air temperature wet bulb	°C	-8.07
Air temperature dry bulb outlet	°C	-11.21
Inlet temperature	°C	28.99
Outlet temperature	°C	33.90
Outlet temperature (Time averaged)	°C	33.90
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	14551
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	26
Calculated Power correction	W	32
Water Flow	m³/s	0.000415



Detailed result for 'EN14825:2018' Average Low (B) A 2 /W30		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Low
Condition name:		B
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	4.85
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient with no defrost cycle
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	4.90
COP	-	5.18
Power consumption	kW	0.95
Measured		
Heating capacity	kW	4.93
COP	-	4.98
Power consumption	kW	0.99
During heating		
Air temperature dry bulb	°C	2.10
Air temperature wet bulb	°C	0.90
Air temperature dry bulb outlet	°C	-0.33
Inlet temperature	°C	24.99
Outlet temperature	°C	30.01
Outlet temperature (Time averaged)	°C	30.01
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	42322
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	0.000236



Detailed result for 'EN14825:2018' Average Low (C) A 7 /W27		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Low
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	3.12
CR:	-	0.6
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.34
COP	-	6.54
Power consumption	kW	0.82
Measured		
Heating capacity	kW	5.38
COP	-	6.24
Power consumption	kW	0.86
During heating		
Air temperature dry bulb	°C	7.01
Air temperature wet bulb	°C	5.92
Air temperature dry bulb outlet	°C	3.33
Inlet temperature	°C	24.11
Outlet temperature	°C	29.11
Outlet temperature (Time averaged)	°C	27.03
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	41072
Calculated Hydraulic power	W	11
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	34
Calculated Power correction	W	45
Water Flow	m ³ /s	0.000258



Detailed result for 'EN14825:2018' Average Low (D) A 12 /W24		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Low
Condition name:		D
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	1.38
CR:	-	0.2
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	6.31
COP	-	8.59
Power consumption	kW	0.73
Measured		
Heating capacity	kW	6.34
COP	-	8.12
Power consumption	kW	0.78
During heating		
Air temperature dry bulb	°C	12.00
Air temperature wet bulb	°C	11.00
Air temperature dry bulb outlet	°C	8.14
Inlet temperature	°C	22.86
Outlet temperature	°C	27.84
Outlet temperature (Time averaged)	°C	23.95
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	37080
Calculated Hydraulic power	W	11
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	36
Calculated Power correction	W	47
Water Flow	m ³ /s	0.000306



Detailed result for 'EN14825:2018' Average Low (E and F) A -10 /W35		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Low
Condition name:		E and F
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	9.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	9.07
COP	-	3.07
Power consumption	kW	2.96
Measured		
Heating capacity	kW	9.09
COP	-	3.05
Power consumption	kW	2.99
During heating		
Air temperature dry bulb	°C	-10.00
Air temperature wet bulb	°C	-11.08
Air temperature dry bulb outlet	°C	-13.35
Inlet temperature	°C	30.00
Outlet temperature	°C	34.99
Outlet temperature (Time averaged)	°C	34.99
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	9809
Calculated Hydraulic power	W	4
Calculated global efficiency	η	0.17
Calculated Capacity correction	W	21
Calculated Power correction	W	26
Water Flow	m ³ /s	0.000439



Detailed SCOP test results - medium temperature application - EN 14825

Detailed result for 'EN14825:2018' Average Medium (A) A -7 /W52		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:	Average	
Temperature application:	Medium	
Condition name:	A	
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	7.96
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Heating capacity	kW	7.89
COP	-	2.42
Power consumption	kW	3.26
Measured		
Heating capacity	kW	7.92
COP	-	2.40
Power consumption	kW	3.30
During heating		
Air temperature dry bulb	°C	-6.90
Air temperature wet bulb	°C	-8.07
Air temperature dry bulb outlet	°C	-9.68
Inlet temperature	°C	44.01
Outlet temperature	°C	51.98
Outlet temperature (Time averaged)	°C	51.98
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	40446
Calculated Hydraulic power	W	10
Calculated global efficiency	η	0.23
Calculated Capacity correction	W	33
Calculated Power correction	W	43
Water Flow	m³/s	0.000241



Detailed result for 'EN14825:2018' Average Medium (B) A 2 /W42		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Medium
Condition name:		B
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	4.85
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	4.98
COP	-	3.67
Power consumption	kW	1.36
Measured		
Heating capacity	kW	5.01
COP	-	3.60
Power consumption	kW	1.39
During heating		
Air temperature dry bulb	°C	2.11
Air temperature wet bulb	°C	0.92
Air temperature dry bulb outlet	°C	-0.14
Inlet temperature	°C	34.48
Outlet temperature	°C	42.07
Outlet temperature (Time averaged)	°C	42.07
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	48055
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	0.000159



Detailed result for 'EN14825:2018' Average Medium (C) A 7 /W36		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Medium
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	3.12
CR:	-	0.6
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.08
COP	-	4.76
Power consumption	kW	1.07
Measured		
Heating capacity	kW	5.11
COP	-	4.62
Power consumption	kW	1.10
During heating		
Air temperature dry bulb	°C	7.01
Air temperature wet bulb	°C	5.88
Air temperature dry bulb outlet	°C	3.74
Inlet temperature	°C	31.28
Outlet temperature	°C	39.00
Outlet temperature (Time averaged)	°C	36.02
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	49509
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	0.000159



Detailed result for 'EN14825:2018' Average Medium (D) A 12 /W30		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Medium
Condition name:		D
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	1.38
CR:	-	0.2
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	6.12
COP	-	6.42
Power consumption	kW	0.95
Measured		
Heating capacity	kW	6.15
COP	-	6.19
Power consumption	kW	0.99
During heating		
Air temperature dry bulb	°C	11.99
Air temperature wet bulb	°C	10.91
Air temperature dry bulb outlet	°C	8.44
Inlet temperature	°C	28.20
Outlet temperature	°C	36.12
Outlet temperature (Time averaged)	°C	30.00
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	48501
Calculated Hydraulic power	W	9
Calculated global efficiency	η	0.22
Calculated Capacity correction	W	32
Calculated Power correction	W	41
Water Flow	m ³ /s	0.000187



Detailed result for 'EN14825:2018' Average Medium (E and F) A -10 /W55		
Tested according to:	EN14511:2018 and EN14825:2018	
Climate zone:		Average
Temperature application:		Medium
Condition name:		E and F
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	9.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	8.89
COP	-	2.12
Power consumption	kW	4.20
Measured		
Heating capacity	kW	8.93
COP	-	2.10
Power consumption	kW	4.25
During heating		
Air temperature dry bulb	°C	-9.92
Air temperature wet bulb	°C	-10.93
Air temperature dry bulb outlet	°C	-12.50
Inlet temperature	°C	46.98
Outlet temperature	°C	54.95
Outlet temperature (Time averaged)	°C	54.95
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	45498
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	0.000272



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

Detailed result for 'EN14511:2018' A7/W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	9.17
COP	-	5.21
Power consumption	kW	1.76
Measured		
Heating capacity	kW	9.20
COP	-	5.12
Power consumption	kW	1.80
During heating		
Air temperature dry bulb	°C	7.00
Air temperature wet bulb	°C	5.90
Air temperature dry bulb outlet	°C	3.65
Inlet temperature	°C	30.00
Outlet temperature	°C	35.05
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	16589
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	0.000439



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	9.05
COP	-	3.81
Power consumption	kW	2.37
Measured		
Heating capacity	kW	9.05
COP	-	3.81
Power consumption	kW	2.38
During heating		
Air temperature dry bulb	°C	2.02
Air temperature wet bulb	°C	0.77
Air temperature dry bulb outlet	°C	-2.52
Inlet temperature	°C	30.05
Outlet temperature	°C	35.01
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	547
Calculated Hydraulic power	W	0
Calculated global efficiency	η	0.12
Calculated Capacity correction	W	2
Calculated Power correction	W	2
Water Flow	m ³ /s	0.000505



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	9.27
COP	-	3.12
Power consumption	kW	2.97
Measured		
Heating capacity	kW	9.29
COP	-	3.11
Power consumption	kW	2.99
During heating		
Air temperature dry bulb	°C	-7.06
Air temperature wet bulb	°C	-8.13
Air temperature dry bulb outlet	°C	-11.11
Inlet temperature	°C	30.05
Outlet temperature	°C	34.93
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	4690
Calculated Hydraulic power	W	2
Calculated global efficiency	η	0.14
Calculated Capacity correction	W	14
Calculated Power correction	W	16
Water Flow	m ³ /s	0.000486



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

Detailed result for 'EN14511:2018' A7/W55		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	9.01
COP	-	3.15
Power consumption	kW	2.86
Measured		
Heating capacity	kW	9.04
COP	-	3.11
Power consumption	kW	2.91
During heating		
Air temperature dry bulb	°C	6.99
Air temperature wet bulb	°C	5.76
Air temperature dry bulb outlet	°C	4.04
Inlet temperature	°C	47.01
Outlet temperature	°C	54.84
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	42398
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	0.000280






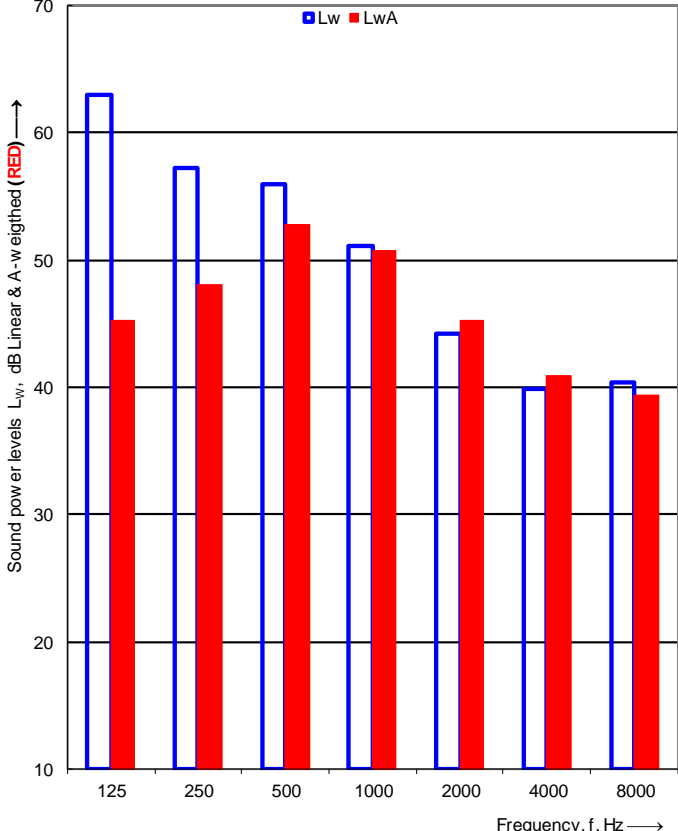
Detailed result for 'EN14511:2018' A2/W55		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	9.12
COP	-	2.54
Power consumption	kW	3.60
Measured		
Heating capacity	kW	9.16
COP	-	2.51
Power consumption	kW	3.65
During heating		
Air temperature dry bulb	°C	2.03
Air temperature wet bulb	°C	0.76
Air temperature dry bulb outlet	°C	-1.78
Inlet temperature	°C	47.04
Outlet temperature	°C	54.80
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	36011
Calculated Hydraulic power	W	11
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	35
Calculated Power correction	W	47
Water Flow	m ³ /s	0.000313



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	9.40
COP	-	2.16
Power consumption	kW	4.35
Measured		
Heating capacity	kW	9.43
COP	-	2.15
Power consumption	kW	4.40
During heating		
Air temperature dry bulb	°C	-6.90
Air temperature wet bulb	°C	-8.10
Air temperature dry bulb outlet	°C	-10.53
Inlet temperature	°C	46.98
Outlet temperature	°C	55.23
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	39147
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	0.000277






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

 		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: 05-04-2022																																																																			
Object:	Type: Mono air to water heat pump Model: WH-MXC09J3E8																																																																						
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed in a water drop tray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																						
Operating conditions:	A7/W30-35, Compressor speed: 48 [Hz], Fan speed_1: 350 [rpm], Fan speed_2: 440 [rpm], Heating capacity: 9.2 [kW], Power_input: 1.80 [kW], Water flow rate: 1580 [l/h], dP_water: 165																																																																						
Static pressure:	997 kPa			<u>Reference box:</u>																																																																			
Air temperature:	7.0 °C			L1:	1.3 m																																																																		
Relative air humidity:	85.0 %			L2:	0.4 m																																																																		
Test room volume:	102.8 m³	Room:	Room 2	L3:	1.4 m																																																																		
Area, S, of test room:	138.9 m²			Volume:	0.7 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>62.1</td><td></td></tr><tr><td>125</td><td>53.1</td><td>63.0</td></tr><tr><td>160</td><td>52.4</td><td></td></tr><tr><td>200</td><td>54.3</td><td></td></tr><tr><td>250</td><td>52.0</td><td>57.2</td></tr><tr><td>315</td><td>49.6</td><td></td></tr><tr><td>400</td><td>48.5</td><td></td></tr><tr><td>500</td><td>53.7</td><td>55.9</td></tr><tr><td>630</td><td>49.2</td><td></td></tr><tr><td>800</td><td>49.1</td><td></td></tr><tr><td>1000</td><td>44.4</td><td>51.0</td></tr><tr><td>1250</td><td>42.6</td><td></td></tr><tr><td>1600</td><td>41.2</td><td></td></tr><tr><td>2000</td><td>38.9</td><td>44.1</td></tr><tr><td>2500</td><td>37.0</td><td></td></tr><tr><td>3150</td><td>35.8</td><td></td></tr><tr><td>4000</td><td>36.8</td><td>39.9</td></tr><tr><td>5000</td><td>30.6</td><td></td></tr><tr><td>6300</td><td>29.0</td><td></td></tr><tr><td>8000</td><td>39.6</td><td>40.4</td></tr><tr><td>10000</td><td>30.4</td><td></td></tr></tbody></table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	62.1		125	53.1	63.0	160	52.4		200	54.3		250	52.0	57.2	315	49.6		400	48.5		500	53.7	55.9	630	49.2		800	49.1		1000	44.4	51.0	1250	42.6		1600	41.2		2000	38.9	44.1	2500	37.0		3150	35.8		4000	36.8	39.9	5000	30.6		6300	29.0		8000	39.6	40.4	10000	30.4					
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Sound power level L_w(A): 56.6 dB [re 1pW]																																																																							
Name of test institute:	DTI																																																																						
No. of test report:	300-KLAB-22-003																																																																						
Date:	05-04-2022																																																																						






Detailed test results of sound power measurement – Test N#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:		Panasonic Europe GmbH		Date of test: 05-04-2022																																																																			
Object:		Type: Mono air to water heat pump Model: WH-MXC09J3E8																																																																					
Mounting conditions:		The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed in a water drop tray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:		A7/W30-35, Quiet mode 3, Compressor speed: 31 [Hz], Fan speed_1: 210 [rpm], Fan speed_2: 270 [rpm], Heating capacity: 5.6 [kW], Power_input: 1.1 [kW], Water flow rate: 950 [l/h],																																																																					
Static pressure:		997 kPa		<u>Reference box:</u>																																																																			
Air temperature:		7.0 °C		L1: 1.3 m																																																																			
Relative air humidity:		85.0 %		L2: 0.4 m																																																																			
Test room volume:		102.8 m³		Room: Room 2																																																																			
Area, S, of test room:		138.9 m²		L3: 1.4 m																																																																			
				Volume: 0.7 m³																																																																			
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¹ Too high																																																																							
Sound power level L_w(A): 50.5 dB [re 1pW]																																																																							
Name of test institute:		DTI																																																																					
No. of test report:		300-KLAB-22-003																																																																					
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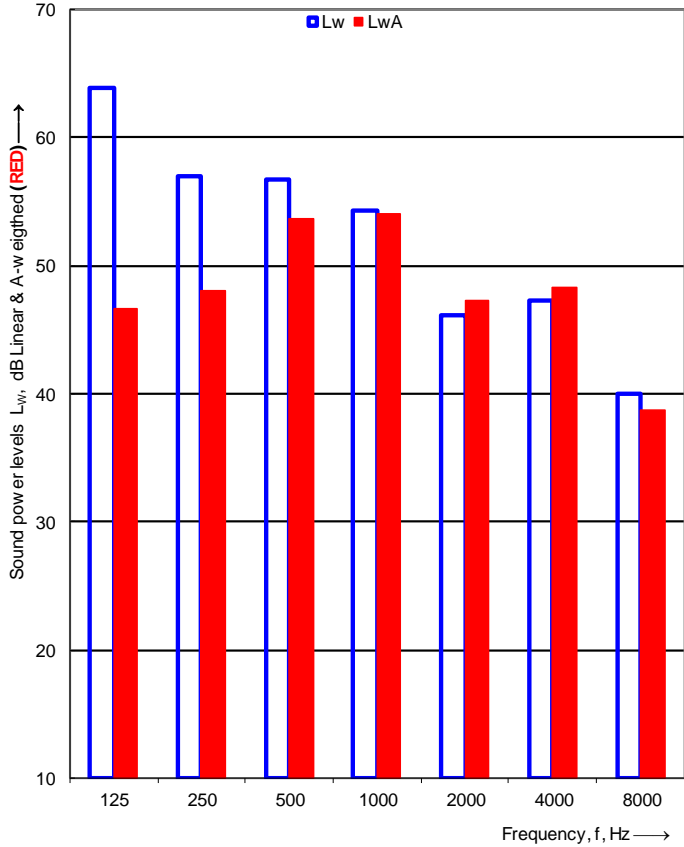


Detailed test results of sound power measurement – Test N#3

 		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: 05-04-2022		
Object:	Type: Mono air to water heat pump Model: WH-MXC09J3E8				
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed in a water drop tray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.				
Operating conditions:	A7/W47-55, Compressor speed: 49 [Hz], Fan speed_1: 380 [rpm], Fan speed_2: 450 [rpm], Heating capacity: 9.0 [kW], Power_input: 2.96 [kW], Water flow rate: 1008 [l/h], dP_water : 423				
Static pressure:	997 kPa			<u>Reference box:</u>	
Air temperature:	7.0 °C			L1:	1.3 m
Relative air humidity:	85.0 %			L2:	0.4 m
Test room volume:	102.8 m³	Room:	Room 2	L3:	1.4 m
Area, S, of test room:	138.9 m²			Volume:	0.7 m³

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	62.7	
125	53.0	63.9
160	55.9	
200	53.5	
250	52.4	56.9
315	49.7	
400	50.0	
500	53.3	56.6
630	51.7	
800	51.5	
1000	49.7	54.3
1250	45.2	
1600	41.2	
2000	39.4	46.1
2500	42.8	
3150	45.3	
4000	41.8	47.2
5000	35.8	
6300	31.7	
8000	37.6	40.0
10000	34.5	

¹ Too high






Sound power level L _w (A):	58.6 dB [re 1pW]
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Name of test institute:	DTI
No. of test report:	300-KLAB-22-003
Date:	05-04-2022

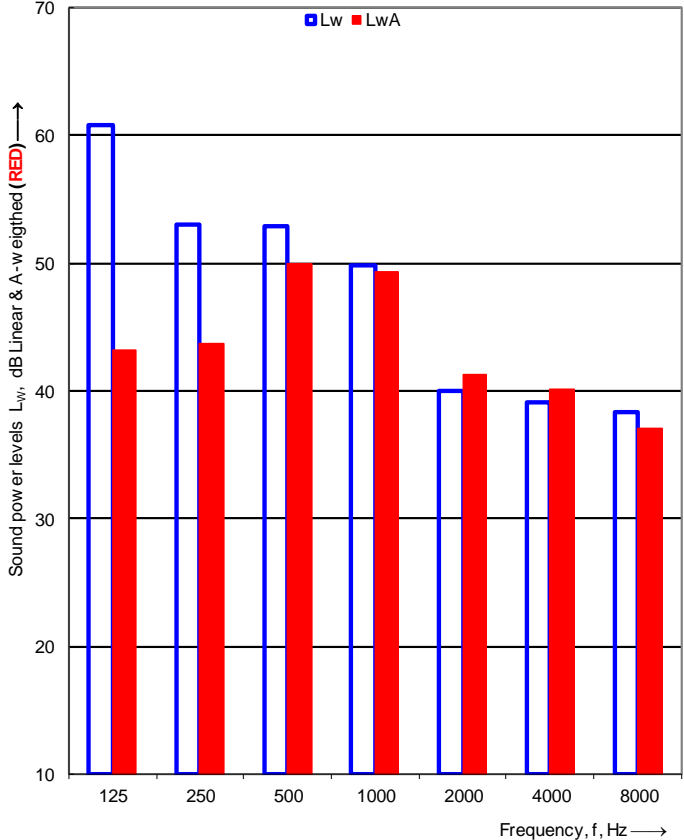


Detailed test results of sound power measurement – Test N#4

 		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: 05-04-2022		
Object:	Type: Mono air to water heat pump Model: WH-MXC09J3E8				
Mounting conditions:	The out door unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed in a water drop tray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the out door unit has been measured in Test room 2.				
Operating conditions:	A7/W47.5-55, Quiet mode 3, Compressor speed: 32 [Hz], Fan speed_1: 240 [rpm], Fan speed_2: 280 [rpm], Heating capacity: 4.86 [kW], Power_input: 1.84 [kW], Water flow rate: 570 [l/h],				
Static pressure:	997 kPa	Reference box:			
Air temperature:	7.0 °C	L1:		1.3 m	
Relative air humidity:	85.0 %	L2:		0.4 m	
Test room volume:	102.8 m³	Room:	Room 2	L3:	1.4 m
Area, S, of test room:	138.9 m²	Volume:		0.7 m³	

Frequency f [Hz]	L_w 1/3 octave [dB]	1/1 oct [dB]
100	59.6	
125	53.2	60.8
160	49.7	
200	50.9	
250	46.0	53.0
315	45.6	
400	43.4	
500	50.1	52.8
630	48.3	
800	48.2	
1000	43.5	49.8
1250	38.6	
1600	34.5	40.0
2000	33.8	
2500	36.8	
3150	35.3	
4000	35.8	39.1
5000	29.4	
6300	29.1	
8000	36.6	38.3
10000	31.2	



¹ Too high




Sound power level $L_w(A)$:	54.1 dB [re 1pW]
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Name of test institute:	DTI
No. of test report:	300-KLAB-22-003
Date:	05-04-2022

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



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: 06-04-2022

Object: Type: Mono air to water heat pump Model: WH-MXC09J3E8

Mounting conditions: The out door unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed in a water drop tray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the out door unit has been measured in Test room 2.

Operating conditions: A2/W47-55, Compressor speed: 56 [Hz], Fan speed_1: 510 [rpm], Fan speed_2: 520 [rpm], Heating capacity: 10.6 [kW], Power_input: 3.90 [kW], Water flow rate: 1127 [l/h], dP_water : 363

Static pressure: 988 kPa

Air temperature: 7.0 °C

Relative air humidity: 85.0 %

Test room volume: 102.8 m³

Area, S, of test room: 138.9 m²

Reference box:

L1: 1.3 m

L2: 0.4 m

L3: 1.4 m

Volume: 0.7 m³

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	70.5	
125	57.5	70.8
160	54.2	
200	57.8	
250	55.4	60.6
315	52.9	
400	52.6	
500	55.0	59.0
630	54.8	
800	54.5	
1000	52.5	57.4
1250	49.3	
1600	46.0	
2000	44.1	50.2
2500	46.0	
3150	47.9	
4000	46.4	50.7
5000	40.6	
6300	36.1	
8000	39.9	43.2
10000	38.6	

Sound power levels L_w, dB Linear & A-weighted (RED)

L_w

L_w(A)

70

60

50

40

30

20

10

125

250

500

1000

2000

4000

8000

Frequency, f, Hz

Sound power level L_w(A): 61.8 dB [re 1pW]




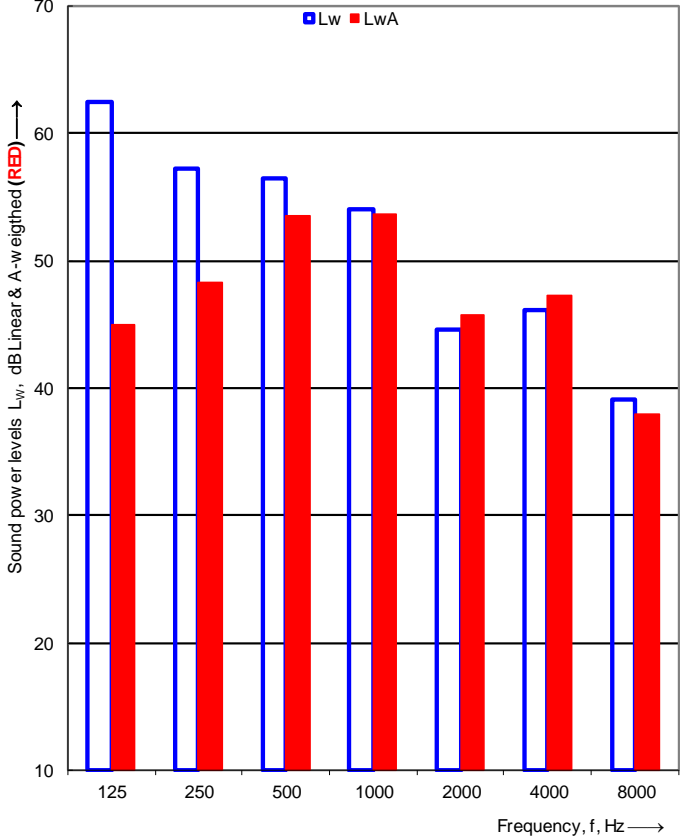
Name of test institute: DTI

No. of test report: 300-KLAB-22-003

Date: 06-04-2022




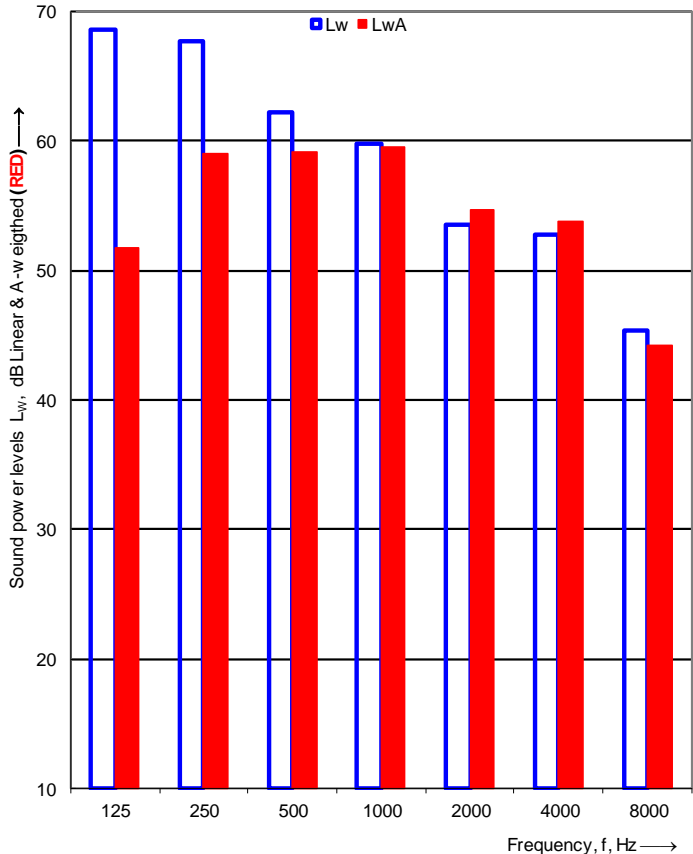


Detailed test results of sound power measurement – Test N#6

 		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: 06-04-2022																																																																				
Object:	Type: Mono air to water heat pump Model: WH-MXC09J3E8																																																																						
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed in a water drop tray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																						
Operating conditions:	A2/W47-55, Quiet mode 3, Compressor speed: 46 [Hz], Fan speed_1: 340 [rpm], Fan speed_2: 420 [rpm], Heating capacity: 7.0 [kW], Power_input: 2.60 [kW], Water flow rate: 800 [l/h],																																																																						
Static pressure:	997 kPa	Reference box:																																																																					
Air temperature:	7.0 °C	L1:		1.3 m																																																																			
Relative air humidity:	85.0 %	L2:		0.4 m																																																																			
Test room volume:	102.8 m³	Room:	Room 2	L3:	1.4 m																																																																		
Area, S, of test room:	138.9 m²	Volume:		0.7 m³																																																																			
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Name of test institute:	DTI																																																																						
No. of test report:	300-KLAB-22-003																																																																						
Date:	06-04-2022																																																																						






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

 		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: 06-04-2022																																																																			
Object:		Type: Mono air to water heat pump Model: WH-MXC09J3E8																																																																					
Mounting conditions:		The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed in a water drop tray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:		A-7/W47-55, Compressor speed: 63 [Hz], Fan speed_1: 620 [rpm], Fan speed_2: 590 [rpm], Heating capacity: 9.6 [kW], Power_input: 4.40 [kW], Water flow rate: 1040 [l/h], dP_water : 375																																																																					
Static pressure: 988 kPa		<u>Reference box:</u>																																																																					
Air temperature: 7.0 °C		L1: 1.3 m																																																																					
Relative air humidity: 85.0 %		L2: 0.4 m																																																																					
Test room volume: 102.8 m³		Room: Room 2	L3: 1.4 m																																																																				
Area, S, of test room: 138.9 m²		Volume: 0.7 m³																																																																					
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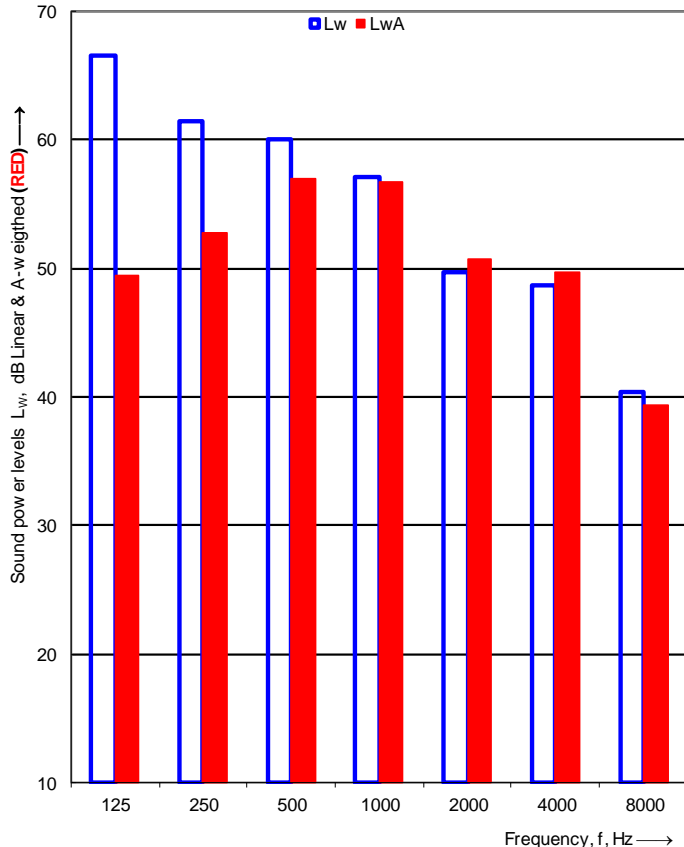


Detailed test results of sound power measurement – Test N#8

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT	
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms					
Client:	Panasonic Europe GmbH		Date of test: 06-04-2022		
Object:	Type: Mono air to water heat pump Model: WH-MXC09J3E8				
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed in a water drop tray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.				
Operating conditions:	A-7/W47-55, Quiet mode 3, Compressor speed: 54 [Hz], Fan speed_1: 400 [rpm], Fan speed_2: 500 [rpm], Heating capacity: 5.6 [kW], Power_input: 2.76 [kW], Water flow rate: 640 [l/h],				
Static pressure:	988 kPa			<u>Reference box:</u>	
Air temperature:	7.0 °C			L1:	1.3 m
Relative air humidity:	85.0 %			L2:	0.4 m
Test room volume:	102.8 m³	Room:	Room 2	L3:	1.4 m
Area, S, of test room:	138.9 m²			Volume:	0.7 m³

Frequency f [Hz]	L_w 1/3 octave [dB]	1/1 oct [dB]
100	65.0	
125	58.0	66.5
160	58.5	
200	57.2	
250	57.6	61.5
315	54.8	
400	54.5	
500	56.0	60.0
630	55.1	
800	54.6	
1000	51.4	57.1
1250	49.1	
1600	46.3	
2000	44.2	49.6
2500	43.6	
3150	43.6	
4000	46.4	48.6
5000	38.1	
6300	34.2	
8000	37.6	40.4
10000	34.2	

¹ Too high






Sound power level $L_w(A)$:	61.6 dB [re 1pW]
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Name of test institute:	DTI
No. of test report:	300-KLAB-22-003
Date:	06-04-2022

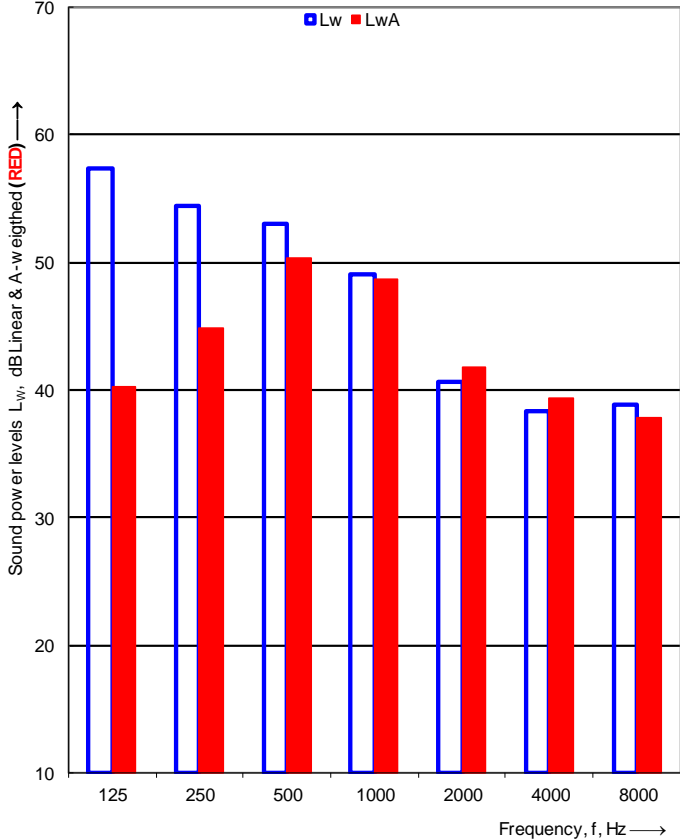


Detailed test results of sound power measurement – Test N#9

 		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: 05-04-2022		
Object:	Type: Mono air to water heat pump Model: WH-MXC09J3E8				
Mounting conditions:	The out door unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed in a water drop tray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the out door unit has been measured in Test room 2.				
Operating conditions:	A7/W47.5-55, Compressor speed: 35 [Hz], Fan speed_1: 210 [rpm], Fan speed_2: 310 [rpm], Heating capacity: 4.8 [kW], Power_input: 1.74 [kW], Water flow rate: 570 [l/h], dP_water : 515				
Static pressure:	997 kPa			<u>Reference box:</u>	
Air temperature:	7.0 °C			L1:	1.3 m
Relative air humidity:	85.0 %			L2:	0.4 m
Test room volume:	102.8 m³	Room:	Room 2	L3:	1.4 m
Area, S, of test room:	138.9 m²			Volume:	0.7 m³

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	55.5	
125	50.9	57.4
160	48.2	
200	52.6	
250	47.4	54.4
315	45.5	
400	43.9	
500	49.9	53.0
630	49.0	
800	47.1	
1000	43.4	49.1
1250	38.9	
1600	35.3	
2000	34.4	40.6
2500	37.2	
3150	33.3	
4000	35.5	38.3
5000	30.4	
6300	30.5	
8000	37.4	38.9
10000	30.4	

¹ Too high



Sound power level L _w (A):	54.0 dB [re 1pW]
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Name of test institute:	DTI
No. of test report:	300-KLAB-22-003
Date:	05-04-2022



Appendix 1: Test Procedure

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

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

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

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

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

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

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

