

TEST REPORT

Report no.:
300-KLAB-22-002



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Page 1 of 51
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Customer: Company: Panasonic Marketing Europe GmbH
Address: Hagenauer Str. 43
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Tel.: +49 1724 141441

Component: Brand: Panasonic
Type: Air to water heat pump (mono bloc)
Model: Unit: WH-MXC12J9E8 Tank: PAW-TD23B6E5, Optima
Series no.: Unit: 5623400001 Tank: 80341990
Prod. year: Unit: 2021.07 Tank: 2020.01

Dates: Component tested: December 2021 – January 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.

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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 14825:2018. 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

The performance of the domestic hot water according to EN 16147:2017

- Test at average climate, load profile L and XL with the same hot water tank

Pre-running and post running time of liquid pump when 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 requirements for the European KEYMARK Scheme for Heat Pumps.





Contents:

Test conditions	5
SCOP test conditions for low temperature – EN 14825	5
SCOP test conditions for medium temperature – EN 14825	6
Test conditions for rating conditions low temperature – EN 14511	7
Test conditions for rating conditions medium temperature – EN 14511	7
Test conditions for starting and operating tests – EN 14511-4: 2013	8
Test conditions for starting and operating tests – EN 14511-4: 2018	8
Test conditions for shutting off the heat transfer medium – EN 14511-4	8
Test conditions for complete power supply failure – EN 14511-4	9
Test conditions for domestic hot water test - EN16147:2017	9
Test conditions for sound power measurements – EN 12102-1	10
Test results.....	11
Test results of SCOP test at low temperature - heating season average – EN 14825.....	11
Test results of SCOP test at medium temperature - heating season average – EN 14825	12
Test results of standard rating test at low temperature – EN 14511.....	13
Test results of standard rating test at medium temperature – EN 14511	13
Test results of starting and operating tests – EN 14511-4:2013	14
Test results of starting and operating tests – EN 14511-4:2018	14
Test results of shutting off the heat transfer medium – EN 14511-4	14
Test results of complete power supply failure – EN 14511-4	14
Test results of domestic hot water test, average climate, load profile L - EN16147:2017 test, Tank PAW-TD23B6E5	15
Test results of domestic hot water test, average climate, load profile XL - EN16147:2017 test, Tank PAW-TD23B6E5	16
Pre-running and after running time of liquid pump when heat pump starts and stops	16
Power consumption of liquid pump for COP test points.....	17
Power consumption of liquid pump for SCOP test points – low temperature application	17
Power consumption of liquid pump for SCOP test points – medium temperature application	18
Test results of sound power measurements – EN 12102	19
Photo	20
Detailed SCOP calculation of low temperature and average climate conditions – EN 14825.....	22
Detailed SCOP calculation of medium temperature and average climate conditions – EN 14825	24
Detailed test results	26
Detailed SCOP test results - low temperature application – EN 14825.....	26
Detailed SCOP test results - medium temperature application - EN 14825.....	31
Detailed test results for rating conditions – low temperature – EN 14511	36
Detailed test results for rating conditions – medium temperature – EN 14511	39





Detailed test results of sound power measurement – Test N#1	42
Detailed test results of sound power measurement – Test N#2	43
Detailed test results of sound power measurement – Test N#3	44
Detailed test results of sound power measurement – Test N#4	45
Detailed test results of sound power measurement – Test N#5	46
Detailed test results of sound power measurement – Test N#6	47
Detailed test results of sound power measurement – Test N#7	48
Detailed test results of sound power measurement – Test N#8	49
Detailed test results of sound power measurement – Test N#9	50
Appendix 1: Test Procedure.....	51





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.

Condition 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



Test Rep. nr.



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				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.

Condition A, E and one more test condition 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	35	-	55	Maximum	Starting
2	35	-	25	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 domestic hot water test - EN16147:2017

N#	Test climate	Tank type	Inlet air dry bulb/ wet bulb temperature (°C)	Domestic hot water tapping profile	Setpoint tank temp./ re-heat temp. (°C)/(°C)
1 ^K	Average	PAW-TD23B6E6	7/6	L	52/44
2 ^K	Average	PAW-TD23B6E6	7/6	XL	53/45

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	45	510/540	12.2	2.51
2 ^Q	7/6	30/35	33	320/360	8.4	1.70
3 ^R	7/6	47/55	51	510/550	12.1	3.94
4 ^Q	7/6	47/55	35	330/380	8.4	2.73
5 ^R	2/1	47/55	70	580/620	14.0	5.5
6 ^Q	2/1	47/55	48	400/430	9.7	3.6
7 ^R	-7/-8	47/55	85	580/620	13.4	6.3
8 ^Q	-7/-8	47/55	60	480/530	9.8	4.3
9 ^{E-K}	7/6	47/55	22	330/360	4.8	1.73

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



Test Rep. nr.



Test results

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

Model (Outdoor)	WH-MXC12J9E8
Air-to-water heat pump mono bloc	Y
Low-temperature heat pump	N
Equipped with supplementary heater	Y
Heat pump combination heater	Y

Rated heat output¹⁾	P_{rated}	9.0 [kW]
Seasonal space heating energy efficiency	η_s	203.0 [%]
	SCOP	5.15 [-]

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}	8.63 [kW]
		$T_j = 2\text{ °C}$	P_{dh}	4.91 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	5.34 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	6.29 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	9.28 [kW]
		$T_j = \text{operation limit}$	P_{dh}	9.28 [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	3.31 [-]
		$T_j = 2\text{ °C}$	COPd	5.11 [-]
		$T_j = 7\text{ °C}$	COPd	6.48 [-]
		$T_j = 12\text{ °C}$	COPd	8.39 [-]
		$T_j = \text{bivalent temperature}$	COPd	3.13 [-]
		$T_j = \text{operation limit}$	COPd	3.13 [-]

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}	3611 [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, $sup(T_j)$.

Condition A and E = Keymark



Test Rep. nr.



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

Model (Outdoor)	WH-MXC12J9E8
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}	9.0 [kW]
Seasonal space heating energy efficiency	η_s	144.9 [%]
	SCOP	3.70 [-]

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}	7.76 [kW]
		$T_j = 2\text{ °C}$	P_{dh}	4.94 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	5.04 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	6.05 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	8.90 [kW]
		$T_j = \text{operation limit}$	P_{dh}	8.90 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate - Medium temperature application	$T_j = -15\text{ °C}$	COPd	- [-]
		$T_j = -7\text{ °C}$	COPd	2.38 [-]
		$T_j = 2\text{ °C}$	COPd	3.62 [-]
		$T_j = 7\text{ °C}$	COPd	4.69 [-]
		$T_j = 12\text{ °C}$	COPd	6.24 [-]
		$T_j = \text{bivalent temperature}$	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}	5028 [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, $sup(T_j)$.

Condition 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	12.22	4.88
2	A2/W35	12.01	3.48
3	A-7/W35	12.57	2.82

K) Keymark

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

N#	Test conditions	Heating capacity [kW]	COP
1 ^K	A7/W55	12.05	3.06
2	A2/W55	12.03	2.41
3	A-7/W55	12.40	2.03

K) Keymark





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	1839	Passed
2	A35/W25	997	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	965	Passed
2 ^K	A-20/W47	568	Passed

K) Keymark

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

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

K) Keymark

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

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



Test Rep. nr.



**Test results of domestic hot water test, average climate, load profile L
- EN16147:2017 test, Tank PAW-TD23B6E5**

No		Symbol	Result	Unit
1)	Load profile	-	L	-
2)	Settings of the control	-	52	-
3)	Heating up time	t_h	3127	[s]
4)	Heating up electrical energy consumption	W_{eh-HP}	3.29	[kWh]
5)	Stand-by power input	P_{es}	0.06	[kW]
6)	Total useful energy content during the load profile	Q_{LP}	13.61	[kWh]
7)	Total electrical energy consumption during load profile	W_{EL-LP}	5.40	[kWh]
8)	Daily electrical energy consumption	Q_{elec}	4.62	[kWh]
9)	Coefficient of Performance	COP_{DHW}	2.52	[-]
10)	Water heating energy consumption	η_{wh}	108.0%	[%]
11)	Annual electrical energy consumption	AEC	948	[kWh/a]
12)	Reference hot water temperature	θ'_{WH}	50.4	[°C]
13)	Maximum volume of mixed water at 40°C	V_{40}	246	[L]
19)	Rated heat output	P_{rated}	-	[kW]
20)	Seasonal coefficient of performance	$SCOP_{DHW}$	-	[-]



Test results of domestic hot water test, average climate, load profile XL - EN16147:2017 test, Tank PAW-TD23B6E5

No		Symbol	Result	Unit
1)	Load profile	-	XL	-
2)	Settings of the control	-	53	-
3)	Heating up time	t_h	3250	[s]
4)	Heating up electrical energy consumption	W_{eh-HP}	3.38	[kWh]
5)	Stand-by power input	P_{es}	0.05	[kW]
6)	Total useful energy content during the load profile	Q_{LP}	19.06	[kWh]
7)	Total electrical energy consumption during load profile	W_{EL-LP}	7.97	[kWh]
8)	Daily electrical energy consumption	Q_{elec}	7.97	[kWh]
9)	Coefficient of Performance	COP_{DHW}	2.39	[-]
10)	Water heating energy consumption	η_{wh}	99.4%	[%]
11)	Annual electrical energy consumption	AEC	1686	[kWh/a]
12)	Reference hot water temperature	θ'_{WH}	51.5	[°C]
13)	Maximum volume of mixed water at 40°C	V_{40}	250	[L]
19)	Rated heat output	P_{rated}	-	[kW]
20)	Seasonal coefficient of performance	$SCOP_{DHW}$	-	[-]

Pre-running and post running time of liquid pump when 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	61	1
2	A2/W35	61	1
3	A-7/W35	61	1
4	A7/W55	61	1
5	A2/W55	61	1
6	A-7/W55	61	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	60	3
2	A7/W27	60	4
3	A2/W30	61	5
4	A-7/W34	61	6
5	A10/W35	60	7

The power consumptions of the liquid pump have been measured separately



Test Rep. nr.



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	61	8
2	A7/W36	61	9
3	A2/W42	61	10
4	A-7/W52	60	11
5	A10/W55	60	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	60.1	0.5
2 ^Q	A7/W35	53.9	0.5
3 ^R	A7/W55	62.0	0.5
4 ^Q	A7/W55	57.2	0.5
5 ^R	A2/W55	65.3	0.5
6 ^Q	A2/W55	59.6	0.5
7 ^R	A-7/W55	65.6	0.5
8 ^Q	A-7/W55	61.4	0.5
9 ^{E-K}	A7/W55	55.0	1.0

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.



Test Rep. nr.



Photo

Rating plate

Panasonic

(MONO BLOC)

AIR-TO-WATER HEATPUMP SYSTEM

Model No.

WH-MXC12J9E8

POWER SUPPLY 1

RATED VOLTAGE

PHASE

RATED FREQUENCY

MAXIMUM INPUT

REFRIGERANT

GWP / CO₂eq.

400V

3N~

50Hz

7.93kW / 11.8A

R32

1.60kg

675 / 1.080t

COOLING
(A35W7)

HEATING
(A7W35)

HEATING
(A2W35)

CAPACITY

CURRENT

POWER INPUT

EER/COP

12.00kW

12.00kW

12.00kW

6.3A

3.7A

5.1A

4.23kW

2.50kW

3.40kW

2.84

4.80

3.53

(EN 14511)

POWER SUPPLY 2

RATED VOLTAGE

PHASE

RATED FREQUENCY

MAXIMUM POWER

MAXIMUM CURRENT

HEATING WATER FLOW

COOLING WATER FLOW

400V

3N~

50Hz

9.00kW

13.0A

2.1m³/h

2.1m³/h

PS

MWP

H.P. 4.30MPa (43.0bar)
L.P. 2.55MPa (25.5bar)
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

Winsberggring 15, 22525 Hamburg, Germany





CE 0035


IPX4


Made in Malaysia


R32












THIS PRODUCT CONTAINS FLUORINATED
GREENHOUSE GASES



WARNING

Unit





Rating plate tank

MODEL PAW-TD23B6E5, Optima Stainless steel Indoor unit for heatpump			
PRODUCT INFORMATION		TECHNICAL SPECIFICATIONS	
MODEL	PAW-TD23B6E5	B x D x H	
PRODUCT NO.	80341990	DIMENSIONS MM	750x790x2000
MFG DATE	27/01/2020	WEIGHT KG	125
		VOLUME M ³	1.2
		ELECTRIC	2.8 kW - 230V~
		MAX PRESSURE	1MPa (10 bar)
		PRODUCT NO.	GTIN
		80341990	7070644007409
Manufactured BY OSO HOTWATER AS, 3300 HOKKSUND, NORWAY			
Manufactured in accordance with EN 12897:2016			

Tank





SCOP - detailed calculation

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

Calculation of reference SCOP

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

Where

$P_{design} =$

Heating load of the building at design temperature, kW

$H_{he} =$

Number of equivalent heating hours, 2066 h

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

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

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

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

Data for SCOP

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COPbin [-]
A	-7	88	7.96	8.63	3.31	1.00	1.00	3.31
B	2	54	4.85	4.91	5.11	0.99	1.00	5.11
C	7	35	3.12	5.34	6.48	0.99	0.58	6.44
D	12	15	1.38	6.29	8.39	0.99	0.22	8.08
E	-10	100	9.00	9.28	3.13	1.00	1.00	3.13
F - BIV	-10	100	9.00	9.28	3.13	1.00	1.00	3.13

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	3.13	9.00	2.88	9.00	2.88
	22	-9	25	8.65	8.65	0.00	0.00	3.19	216.35	67.82	216.35	67.82
	23	-8	23	8.31	8.31	0.00	0.00	3.25	191.08	58.79	191.08	58.79
A	24	-7	24	7.96	7.96	0.00	0.00	3.31	191.08	57.73	191.08	57.73
	25	-6	27	7.62	7.62	0.00	0.00	3.51	205.62	58.58	205.62	58.58
	26	-5	68	7.27	7.27	0.00	0.00	3.71	494.31	133.24	494.31	133.24
	27	-4	91	6.92	6.92	0.00	0.00	3.91	630.00	161.13	630.00	161.13
	28	-3	89	6.58	6.58	0.00	0.00	4.11	585.35	142.42	585.35	142.42
	29	-2	165	6.23	6.23	0.00	0.00	4.31	1028.08	238.53	1028.08	238.53
	30	-1	173	5.88	5.88	0.00	0.00	4.51	1018.04	225.73	1018.04	225.73
	31	0	240	5.54	5.54	0.00	0.00	4.71	1329.23	282.21	1329.23	282.21
	32	1	280	5.19	5.19	0.00	0.00	4.91	1453.85	296.10	1453.85	296.10
	33	2	320	4.85	4.85	0.00	0.00	5.11	1550.77	303.48	1550.77	303.48
B	34	3	357	4.50	4.50	0.00	0.00	5.38	1606.50	298.88	1606.50	298.88
	35	4	356	4.15	4.15	0.00	0.00	5.64	1478.77	262.19	1478.77	262.19
	36	5	303	3.81	3.81	0.00	0.00	5.91	1153.73	195.37	1153.73	195.37
	37	6	330	3.46	3.46	0.00	0.00	6.17	1142.31	185.13	1142.31	185.13
	38	7	326	3.12	3.12	0.00	0.00	6.44	1015.62	157.82	1015.62	157.82
C	39	8	348	2.77	2.77	0.00	0.00	6.77	963.69	142.45	963.69	142.45
	40	9	335	2.42	2.42	0.00	0.00	7.09	811.73	114.41	811.73	114.41
	41	10	315	2.08	2.08	0.00	0.00	7.42	654.23	88.11	654.23	88.11
	42	11	215	1.73	1.73	0.00	0.00	7.75	372.12	47.99	372.12	47.99
	43	12	169	1.38	1.38	0.00	0.00	8.08	234.00	28.94	234.00	28.94
D	44	13	151	1.04	1.04	0.00	0.00	8.41	156.81	18.64	156.81	18.64
	45	14	105	0.69	0.69	0.00	0.00	8.74	72.69	8.31	72.69	8.31
	46	15	74	0.35	0.35	0.00	0.00	9.07	25.62	2.82	25.62	2.82

SUM	18590.54	3579.69	18590.54	3579.69
SCOPon	5.19	SCOPnet	5.19	



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

Calculation of reference SCOP

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

Where

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

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

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

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

Data for SCOP

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COPbin [-]
A	-7	88	7.96	7.76	2.38	1.00	1.00	2.38
B	2	54	4.85	4.94	3.62	0.99	1.00	3.62
C	7	35	3.12	5.04	4.69	0.99	0.62	4.67
D	12	15	1.38	6.05	6.24	0.99	0.23	6.07
E	-10	100	9.00	8.90	2.12	1.00	1.00	2.12
F - BIV	-10	100	9.00	8.90	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	8.90	0.00	0.00	2.12	9.00	4.25	9.00	4.25
	22	-9	25	8.65	8.52	0.00	0.00	2.21	216.35	98.04	216.35	98.04
	23	-8	23	8.31	8.14	0.00	0.00	2.29	191.08	83.32	191.08	83.32
A	24	-7	24	7.96	7.76	0.00	0.00	2.38	191.08	80.28	191.08	80.28
	25	-6	27	7.62	7.44	0.00	0.00	2.52	205.62	81.67	205.62	81.67
	26	-5	68	7.27	7.11	0.00	0.00	2.66	494.31	186.14	494.31	186.14
	27	-4	91	6.92	6.79	0.00	0.00	2.79	630.00	225.54	630.00	225.54
	28	-3	89	6.58	6.46	0.00	0.00	2.93	585.35	199.70	585.35	199.70
	29	-2	165	6.23	6.14	0.00	0.00	3.07	1028.08	335.00	1028.08	335.00
	30	-1	173	5.88	5.82	0.00	0.00	3.21	1018.04	317.48	1018.04	317.48
	31	0	240	5.54	5.49	0.00	0.00	3.34	1329.23	397.44	1329.23	397.44
	32	1	280	5.19	5.17	0.00	0.00	3.48	1453.85	417.51	1453.85	417.51
	33	2	320	4.85	4.85	0.00	0.00	3.62	1550.77	428.39	1550.77	428.39
B	34	3	357	4.50	4.50	0.00	0.00	3.83	1606.50	419.48	1606.50	419.48
	35	4	356	4.15	4.15	0.00	0.00	4.04	1478.77	366.09	1478.77	366.09
	36	5	303	3.81	3.81	0.00	0.00	4.25	1153.73	271.52	1153.73	271.52
	37	6	330	3.46	3.46	0.00	0.00	4.46	1142.31	256.19	1142.31	256.19
C	38	7	326	3.12	3.12	0.00	0.00	4.67	1015.62	217.55	1015.62	217.55
	39	8	348	2.77	2.77	0.00	0.00	4.95	963.69	194.72	963.69	194.72
	40	9	335	2.42	2.42	0.00	0.00	5.23	811.73	155.22	811.73	155.22
	41	10	315	2.08	2.08	0.00	0.00	5.51	654.23	118.73	654.23	118.73
	42	11	215	1.73	1.73	0.00	0.00	5.79	372.12	64.26	372.12	64.26
D	43	12	169	1.38	1.38	0.00	0.00	6.07	234.00	38.54	234.00	38.54
	44	13	151	1.04	1.04	0.00	0.00	6.35	156.81	24.69	156.81	24.69
	45	14	105	0.69	0.69	0.00	0.00	6.63	72.69	10.96	72.69	10.96
	46	15	74	0.35	0.35	0.00	0.00	6.91	25.62	3.71	25.62	3.71
SUM									18590.54	4996.41	18590.54	4996.41
SCOPon										3.72	SCOPnet	3.72



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	9.28
Heating demand:	kW	8.21
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	8.63
COP	-	3.31
Power consumption	kW	2.61
Measured		
Heating capacity	kW	8.66
COP	-	3.27
Power consumption	kW	2.65
During heating		
Air temperature dry bulb	°C	-6.89
Air temperature wet bulb	°C	-8.20
Air temperature dry bulb outlet	°C	-11.13
Inlet temperature	°C	29.02
Outlet temperature	°C	34.05
Outlet temperature (Time averaged)	°C	34.05
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	27336
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	0.000414



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	9.28
Heating demand:	kW	5.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	4.91
COP	-	5.11
Power consumption	kW	0.96
Measured		
Heating capacity	kW	4.95
COP	-	4.89
Power consumption	kW	1.01
During heating		
Air temperature dry bulb	°C	2.11
Air temperature wet bulb	°C	0.90
Air temperature dry bulb outlet	°C	-0.41
Inlet temperature	°C	24.98
Outlet temperature	°C	30.03
Outlet temperature (Time averaged)	°C	30.03
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	55505
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	0.000235



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	9.28
Heating demand:	kW	3.21
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	-	6.48
Power consumption	kW	0.82
Measured		
Heating capacity	kW	5.38
COP	-	6.13
Power consumption	kW	0.88
During heating		
Air temperature dry bulb	°C	7.02
Air temperature wet bulb	°C	5.83
Air temperature dry bulb outlet	°C	3.32
Inlet temperature	°C	24.01
Outlet temperature	°C	29.07
Outlet temperature (Time averaged)	°C	27.05
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	54352
Calculated Hydraulic power	W	14
Calculated global efficiency	η	0.26
Calculated Capacity correction	W	39
Calculated Power correction	W	53
Water Flow	m ³ /s	0.000255



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	9.28
Heating demand:	kW	1.43
CR:	-	0.2
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	6.29
COP	-	8.39
Power consumption	kW	0.75
Measured		
Heating capacity	kW	6.33
COP	-	7.86
Power consumption	kW	0.81
During heating		
Air temperature dry bulb	°C	11.99
Air temperature wet bulb	°C	10.88
Air temperature dry bulb outlet	°C	7.91
Inlet temperature	°C	22.91
Outlet temperature	°C	27.95
Outlet temperature (Time averaged)	°C	24.05
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	50935
Calculated Hydraulic power	W	15
Calculated global efficiency	η	0.27
Calculated Capacity correction	W	41
Calculated Power correction	W	56
Water Flow	m ³ /s	0.000301



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	9.28
Heating demand:	kW	9.28
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	9.28
COP	-	3.13
Power consumption	kW	2.96
Measured		
Heating capacity	kW	9.31
COP	-	3.10
Power consumption	kW	3.00
During heating		
Air temperature dry bulb	°C	-9.89
Air temperature wet bulb	°C	-11.18
Air temperature dry bulb outlet	°C	-13.09
Inlet temperature	°C	29.99
Outlet temperature	°C	35.03
Outlet temperature (Time averaged)	°C	35.03
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	20739
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	0.000445



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 T _{bivalent}	°C	-10
T _{design}	°C	-10
P _{design}	kW	9.00
Heating demand:	kW	7.96
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:	Transient with no defrost cycle	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Heating capacity	kW	7.76
COP	-	2.38
Power consumption	kW	3.27
Measured		
Heating capacity	kW	7.80
COP	-	2.35
Power consumption	kW	3.32
During heating		
Air temperature dry bulb	°C	-6.99
Air temperature wet bulb	°C	-8.00
Air temperature dry bulb outlet	°C	-9.76
Inlet temperature	°C	44.01
Outlet temperature	°C	52.00
Outlet temperature (Time averaged)	°C	52.00
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	56768
Calculated Hydraulic power	W	13
Calculated global efficiency	η	0.26
Calculated Capacity correction	W	38
Calculated Power correction	W	52
Water Flow	m ³ /s	0.000237



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:	-	Yes
Measurement type:		Transient with no defrost cycle
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	4.94
COP	-	3.62
Power consumption	kW	1.36
Measured		
Heating capacity	kW	4.98
COP	-	3.53
Power consumption	kW	1.41
During heating		
Air temperature dry bulb	°C	2.09
Air temperature wet bulb	°C	0.92
Air temperature dry bulb outlet	°C	-0.33
Inlet temperature	°C	34.43
Outlet temperature	°C	42.06
Outlet temperature (Time averaged)	°C	42.06
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	64014
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	0.000157





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:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.04
COP	-	4.69
Power consumption	kW	1.07
Measured		
Heating capacity	kW	5.07
COP	-	4.53
Power consumption	kW	1.12
During heating		
Air temperature dry bulb	°C	7.00
Air temperature wet bulb	°C	5.91
Air temperature dry bulb outlet	°C	3.40
Inlet temperature	°C	31.29
Outlet temperature	°C	38.99
Outlet temperature (Time averaged)	°C	36.05
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	66728
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	0.000159



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	6.05
COP	-	6.24
Power consumption	kW	0.97
Measured		
Heating capacity	kW	6.09
COP	-	5.98
Power consumption	kW	1.02
During heating		
Air temperature dry bulb	°C	12.00
Air temperature wet bulb	°C	10.84
Air temperature dry bulb outlet	°C	7.92
Inlet temperature	°C	28.20
Outlet temperature	°C	36.19
Outlet temperature (Time averaged)	°C	30.03
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	65171
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	0.000184



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	8.90
COP	-	2.12
Power consumption	kW	4.20
Measured		
Heating capacity	kW	8.94
COP	-	2.10
Power consumption	kW	4.26
During heating		
Air temperature dry bulb	°C	-10.00
Air temperature wet bulb	°C	-10.98
Air temperature dry bulb outlet	°C	-12.70
Inlet temperature	°C	46.99
Outlet temperature	°C	54.89
Outlet temperature (Time averaged)	°C	54.89
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	51980
Calculated Hydraulic power	W	14
Calculated global efficiency	η	0.27
Calculated Capacity correction	W	40
Calculated Power correction	W	54
Water Flow	m ³ /s	0.000275



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:		No
Included corrections (Final result)		
Heating capacity	kW	12.22
COP	-	4.88
Power consumption	kW	2.51
Measured		
Heating capacity	kW	12.21
COP	-	4.89
Power consumption	kW	2.50
During heating		
Air temperature dry bulb	°C	7.15
Air temperature wet bulb	°C	5.88
Air temperature dry bulb outlet	°C	3.00
Inlet temperature	°C	30.01
Outlet temperature	°C	35.00
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	2123
Calculated Hydraulic power	W	1
Calculated global efficiency	η	0.13
Calculated Capacity correction	W	-9
Calculated Power correction	W	-10
Water Flow	m ³ /s	0.000589



Detailed result for 'EN14511:2018' A2/W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Transient
Integrated circulation pump:		No
Included corrections (Final result)		
Heating capacity	kW	12.01
COP	-	3.48
Power consumption	kW	3.45
Measured		
Heating capacity	kW	11.97
COP	-	3.52
Power consumption	kW	3.40
During heating		
Air temperature dry bulb	°C	2.09
Air temperature wet bulb	°C	0.96
Air temperature dry bulb outlet	°C	-3.49
Inlet temperature	°C	29.91
Outlet temperature	°C	35.06
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	21117
Calculated Hydraulic power	W	14
Calculated global efficiency	η	0.26
Calculated Capacity correction	W	-39
Calculated Power correction	W	-53
Water Flow	m ³ /s	0.000658



Detailed result for 'EN14511:2018' A-7/W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Transient
Integrated circulation pump:		No
Included corrections (Final result)		
Heating capacity	kW	12.57
COP	-	2.82
Power consumption	kW	4.46
Measured		
Heating capacity	kW	12.53
COP	-	2.84
Power consumption	kW	4.42
During heating		
Air temperature dry bulb	°C	-6.84
Air temperature wet bulb	°C	-8.09
Air temperature dry bulb outlet	°C	-12.38
Inlet temperature	°C	29.91
Outlet temperature	°C	35.12
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	16210
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	0.000636



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	12.05
COP	-	3.06
Power consumption	kW	3.94
Measured		
Heating capacity	kW	12.10
COP	-	3.03
Power consumption	kW	3.99
During heating		
Air temperature dry bulb	°C	7.00
Air temperature wet bulb	°C	5.91
Air temperature dry bulb outlet	°C	3.49
Inlet temperature	°C	47.00
Outlet temperature	°C	55.02
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	43558
Calculated Hydraulic power	W	16
Calculated global efficiency	η	0.28
Calculated Capacity correction	W	42
Calculated Power correction	W	58
Water Flow	m ³ /s	0.000366





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	12.03
COP	-	2.41
Power consumption	kW	4.99
Measured		
Heating capacity	kW	12.06
COP	-	2.39
Power consumption	kW	5.04
During heating		
Air temperature dry bulb	°C	1.98
Air temperature wet bulb	°C	0.76
Air temperature dry bulb outlet	°C	-2.18
Inlet temperature	°C	47.06
Outlet temperature	°C	54.94
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	30667
Calculated Hydraulic power	W	13
Calculated global efficiency	η	0.25
Calculated Capacity correction	W	38
Calculated Power correction	W	50
Water Flow	m ³ /s	0.000418




Detailed result for 'EN14511:2018' A-7/W55		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	12.40
COP	-	2.03
Power consumption	kW	6.11
Measured		
Heating capacity	kW	12.44
COP	-	2.02
Power consumption	kW	6.15
During heating		
Air temperature dry bulb	°C	-7.05
Air temperature wet bulb	°C	-8.18
Air temperature dry bulb outlet	°C	-11.21
Inlet temperature	°C	47.05
Outlet temperature	°C	54.92
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	31271
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	0.000400

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

Sound power levels according to ISO 3743-1:2010



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

Client: Panasonic Europe GmbH
 Object: Type: Mono air to water heat pump Model: WH-MXC12J9E8
 Mounting: The outdoor unit is mounted on the supporting metal support frame using six vibration isolators.
 conditions: The support is placed on two 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.

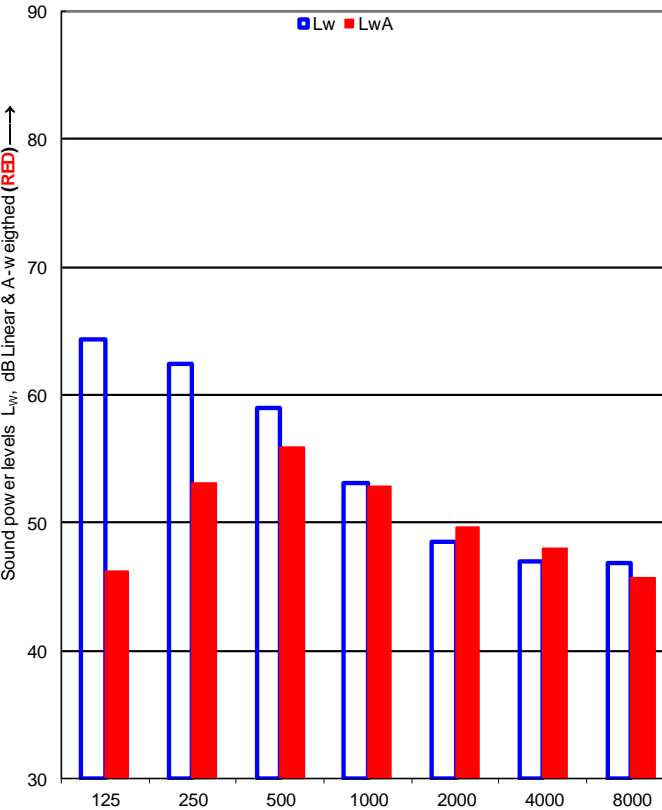
Date of test: 10-01-2022

Operating conditions: A7/W35, Compressor speed: 46 [Hz], Fan speed_1: 510 [rpm], Fan speed_2: 540 [rpm], Heating capacity: 12.2 [kW], Power_input: 2.51 [kW], Water flow rate: 2121 [l/h], dP_water : -21 [mBar]

Static pressure: 1021 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	63.6	
125	54.1	64.3
160	52.2	
200	59.6	
250	58.4	62.4
315	51.5	
400	51.5	
500	56.4	58.9
630	53.1	
800	50.1	
1000	47.8	53.1
1250	46.2	
1600	44.9	
2000	43.1	48.5
2500	43.0	
3150	42.7	
4000	43.8	46.9
5000	38.4	
6300	35.0	
8000	45.9	46.8
10000	37.5	






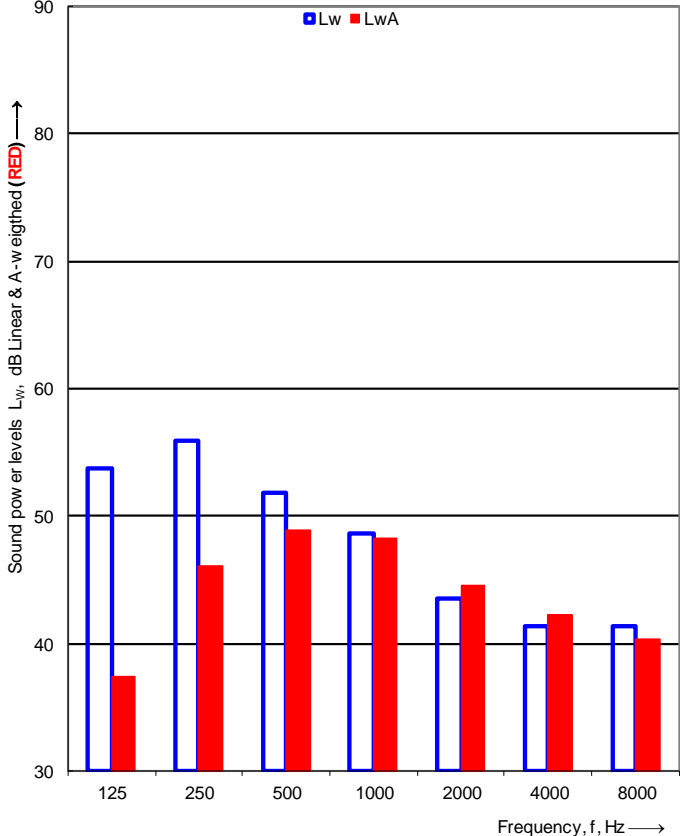
1 Too high

Sound power level L_w(A): 60.1 dB [re 1pW]

Name of test institute: DTI
 No. of test report: 300-KLAB-22-002
 Date: 10-01-2022




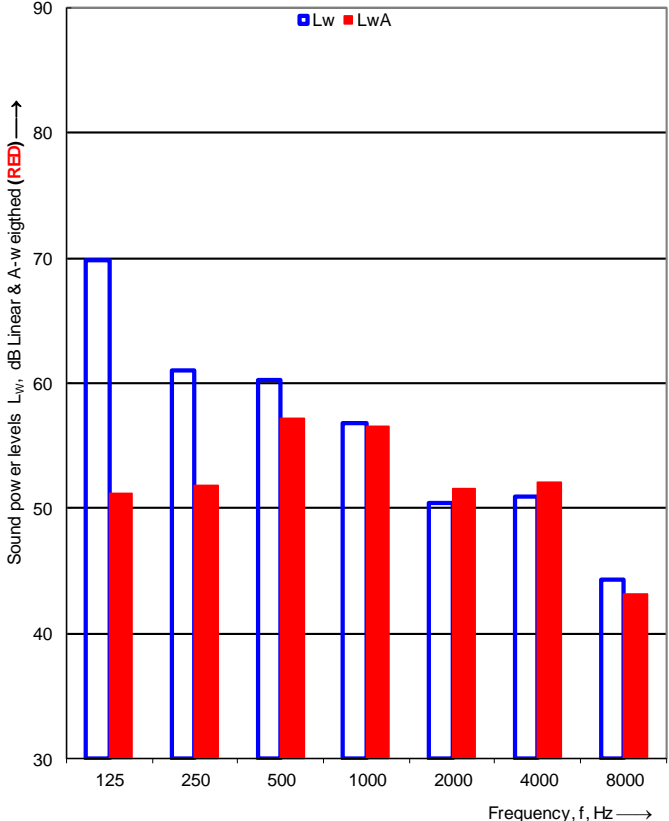


Detailed test results of sound power measurement – Test N#2

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:	Panasonic Europe GmbH		Date of test: 10-01-2022																																																																				
Object:	Type: Mono air to water heat pump Model: WH-MXC12J9E8																																																																						
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed on two heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																						
Operating conditions:	A7/W35, Quiet mode 3, Compressor speed: 33 [Hz], Fan speed_1: 320 [rpm], Fan speed_2: 360 [rpm], Heating capacity: 8.4 [kW], Power_input: 1.7 [kW], Water flow rate: 1460 [l/h], dP_water :																																																																						
Static pressure:	1021 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																																																																			
<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>50.3</td><td></td></tr> <tr><td>125</td><td>49.5</td><td>53.8</td></tr> <tr><td>160</td><td>46.2</td><td></td></tr> <tr><td>200</td><td>54.3</td><td></td></tr> <tr><td>250</td><td>49.9</td><td>55.9</td></tr> <tr><td>315</td><td>44.0</td><td></td></tr> <tr><td>400</td><td>44.1</td><td></td></tr> <tr><td>500</td><td>49.3</td><td>51.8</td></tr> <tr><td>630</td><td>46.2</td><td></td></tr> <tr><td>800</td><td>46.4</td><td></td></tr> <tr><td>1000</td><td>41.7</td><td>48.6</td></tr> <tr><td>1250</td><td>41.5</td><td></td></tr> <tr><td>1600</td><td>39.6</td><td></td></tr> <tr><td>2000</td><td>38.9</td><td>43.4</td></tr> <tr><td>2500</td><td>37.2</td><td></td></tr> <tr><td>3150</td><td>36.5</td><td></td></tr> <tr><td>4000</td><td>38.4</td><td>41.3</td></tr> <tr><td>5000</td><td>33.1</td><td></td></tr> <tr><td>6300</td><td>34.3</td><td></td></tr> <tr><td>8000</td><td>39.4</td><td>41.4</td></tr> <tr><td>10000</td><td>33.7</td><td></td></tr> </tbody> </table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	50.3		125	49.5	53.8	160	46.2		200	54.3		250	49.9	55.9	315	44.0		400	44.1		500	49.3	51.8	630	46.2		800	46.4		1000	41.7	48.6	1250	41.5		1600	39.6		2000	38.9	43.4	2500	37.2		3150	36.5		4000	38.4	41.3	5000	33.1		6300	34.3		8000	39.4	41.4	10000	33.7					
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<div style="border: 1px solid black; padding: 5px;"> Sound power level L_w(A): 53.9 dB [re 1pW] </div>																																																																							
Name of test institute:	DTI																																																																						
No. of test report:	300-KLAB-22-002																																																																						
Date:	10-01-2022																																																																						




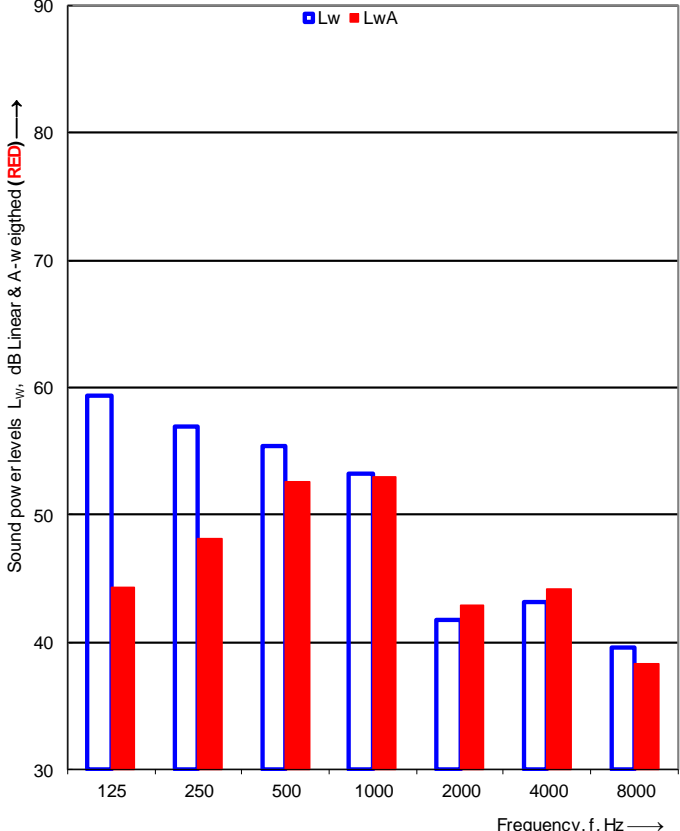


Detailed test results of sound power measurement – Test N#3

 		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: 06-01-2022																																																																			
Object:		Type: Mono air to water heat pump Model: WH-MXC12J9E8																																																																					
Mounting conditions:		The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed on two heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:		A7/W55, Compressor speed: 51[Hz], Fan speed_1: 510[RPM], Fan speed_2: 550[RPM], Heating capacity: 12.05[kW], Power_input: 3.94[kW], Water flow rate: 1317[l/h], dP_water: 436 [mBar]																																																																					
Static pressure:		991 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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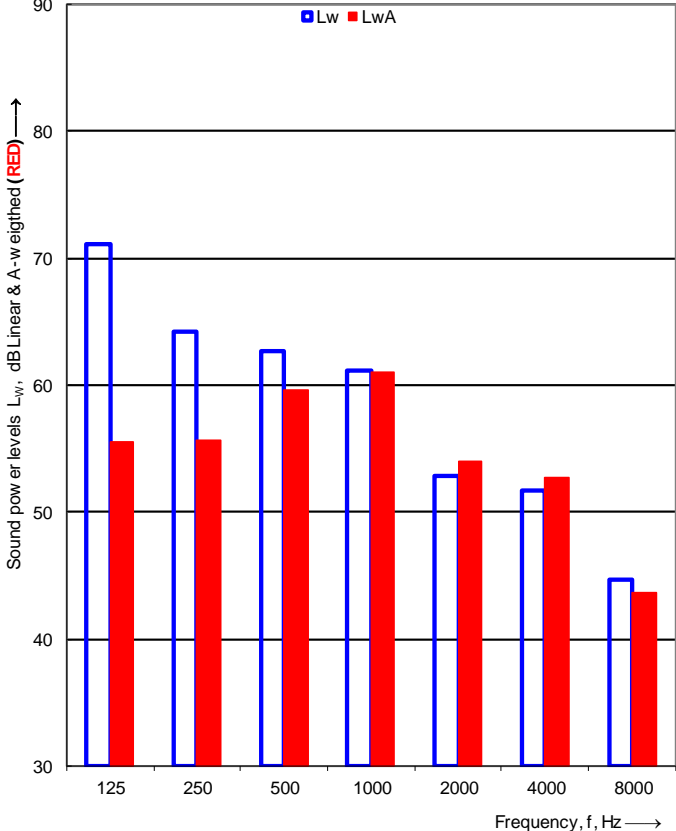


Detailed test results of sound power measurement – Test N#4

 		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: 05-01-2022																																																																			
Object:	Type: Mono air to water heat pump Model: WH-MXC12J9E8																																																																					
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed on two heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.																																																																					
Operating conditions:	A7/W55, Quiet mode 3, Compressor speed: 35[Hz], Fan speed_1: 330[RPM], Fan speed_2: 380 [RPM], Heating capacity: 8.36[kW], Power input: 2.73[kW], Water flow rate: 908[l/h], dP_water :																																																																					
Static pressure:	991 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>53.9</td><td></td></tr> <tr><td>125</td><td>52.3</td><td>59.3</td></tr> <tr><td>160</td><td>56.4</td><td></td></tr> <tr><td>200</td><td>52.5</td><td></td></tr> <tr><td>250</td><td>53.3</td><td>56.9</td></tr> <tr><td>315</td><td>49.8</td><td></td></tr> <tr><td>400</td><td>46.8</td><td></td></tr> <tr><td>500</td><td>52.2</td><td>55.4</td></tr> <tr><td>630</td><td>51.3</td><td></td></tr> <tr><td>800</td><td>50.1</td><td></td></tr> <tr><td>1000</td><td>49.5</td><td>53.3</td></tr> <tr><td>1250</td><td>43.1</td><td></td></tr> <tr><td>1600</td><td>37.5</td><td></td></tr> <tr><td>2000</td><td>35.2</td><td>41.7</td></tr> <tr><td>2500</td><td>37.7</td><td></td></tr> <tr><td>3150</td><td>39.3</td><td></td></tr> <tr><td>4000</td><td>39.4</td><td>43.1</td></tr> <tr><td>5000</td><td>35.2</td><td></td></tr> <tr><td>6300</td><td>31.1</td><td></td></tr> <tr><td>8000</td><td>37.3</td><td>39.5</td></tr> <tr><td>10000</td><td>33.5</td><td></td></tr> </tbody> </table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	53.9		125	52.3	59.3	160	56.4		200	52.5		250	53.3	56.9	315	49.8		400	46.8		500	52.2	55.4	630	51.3		800	50.1		1000	49.5	53.3	1250	43.1		1600	37.5		2000	35.2	41.7	2500	37.7		3150	39.3		4000	39.4	43.1	5000	35.2		6300	31.1		8000	37.3	39.5	10000	33.5				
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<div style="border: 1px solid black; padding: 5px;"> Sound power level L_w(A): 57.2 dB [re 1pW] </div>																																																																						
Name of test institute:	DTI																																																																					
No. of test report:	300-KLAB-22-002																																																																					
Date:	05-01-2022																																																																					






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

 		Sound power levels according to ISO 3743-1:2010		 TEKNOLOGISK INSTITUT																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:	Panasonic Europe GmbH			Date of test: 07-01-2022																																																																			
Object:	Type: Mono air to water heat pump Model: WH-MXC12J9E8																																																																						
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed on two 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/W55, Compressor speed: 70 [Hz], Fan speed_1: 580 [RPM], Fan speed_2: 620 [RPM], Heating capacity: 14.0 [kW], Power input: 5.5 [kW], Water flow rate: 1537 [l/h], dP_water : 332 [mBar]																																																																						
Static pressure:	1003 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																																																																				
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Sound power level L_w(A): 65.3 dB [re 1pW]																																																																							
Name of test institute:	DTI																																																																						
No. of test report:	300-KLAB-22-002																																																																						
Date:	07-01-2022																																																																						

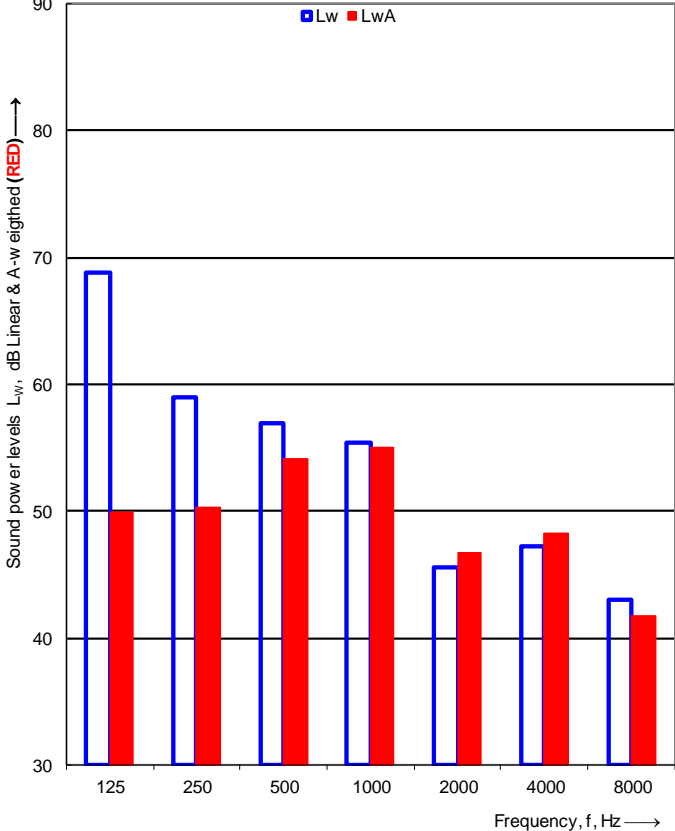


Detailed test results of sound power measurement – Test N#6

 		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: 07-01-2022		
Object:	Type: Mono air to water heat pump Model: WH-MXC12J9E8				
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed on two 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/W55, Quiet mode 3, Compressor speed: 48 [Hz], Fan speed_1: 400 [rpm], Fan speed_2: 430 [rpm], Heating capacity: 9.7 [kW], Power input: 3.6 [kW], Water flow rate: 1075 [l/h], dP_water :				
Static pressure:	1003 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	68.7	
125	49.9	68.8
160	49.4	
200	55.6	
250	53.4	59.0
315	53.3	
400	48.6	
500	53.3	56.9
630	53.1	
800	52.2	
1000	51.3	55.3
1250	46.0	
1600	40.5	
2000	38.8	45.5
2500	42.2	
3150	42.8	
4000	44.4	47.2
5000	37.7	
6300	34.0	
8000	40.2	43.1
10000	38.6	

¹ Too high






Sound power level L _w (A):	59.6 dB [re 1pW]
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Name of test institute:	DTI
No. of test report:	300-KLAB-22-002
Date:	07-01-2022



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: 06-01-2022		
Object:	Type: Mono air to water heat pump Model: WH-MXC12J9E8				
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed on two heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.				
Operating conditions:	A-7/W55, Compressor speed: 85 [Hz], Fan speed_1: 580[RPM], Fan speed_2: 620[RPM], Heating capacity: 13.4 [kW], Power_input: 6.3 [kW], Water flow rate: 1489 [l/h], dP_water : 323 [mBar]				
Static pressure:	1013 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	63.2	
125	59.4	67.1
160	63.4	
200	61.5	
250	61.5	65.3
315	57.8	
400	56.7	
500	57.5	62.7
630	59.2	
800	57.7	60.9
1000	56.5	
1250	53.0	
1600	51.4	
2000	48.8	55.5
2500	51.5	
3150	51.4	
4000	52.0	55.1
5000	44.5	
6300	41.8	
8000	41.3	45.9
10000	40.0	

Sound power level L_w(A): 65.6 dB [re 1pW]

¹ Too high




Name of test institute: DTI
No. of test report: 300-KLAB-22-002
Date: 06-01-2022



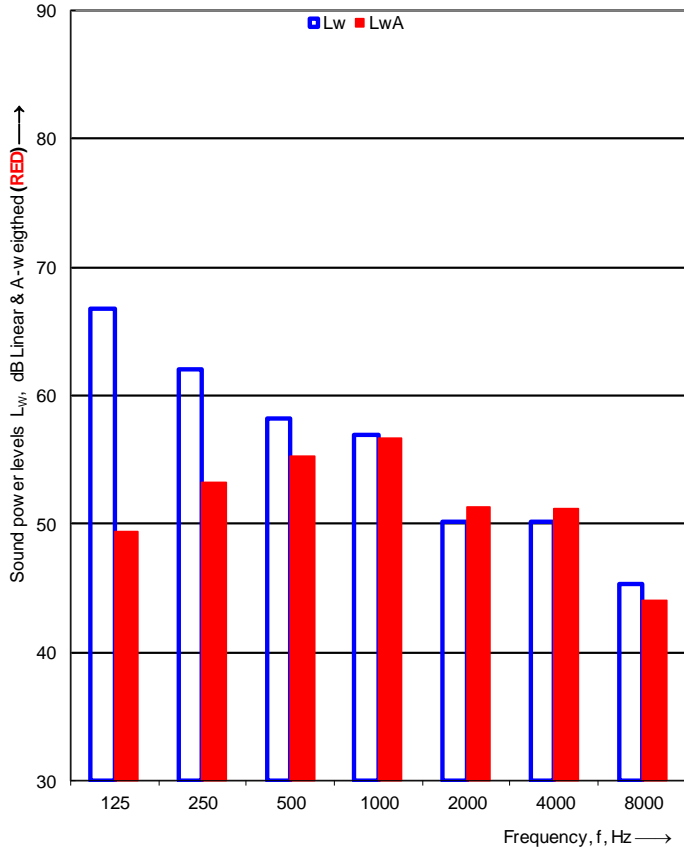
Test Rep. nr.



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: 06-01-2022		
Object:	Type: Mono air to water heat pump Model: WH-MXC12J9E8				
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed on two heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.				
Operating conditions:	A-7/W55, Quiet mode 3, Compressor speed: 60 [Hz], Fan speed_1: 480[rmp], Fan speed_2: 530[rmp], Heating capacity: 9.75 [kW], Power_input: 4.3 [kW], Water flow rate: 1077 [l/h].				
Static pressure:	1013 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	64.0	
125	63.0	66.7
160	51.8	
200	55.4	
250	60.3	62.0
315	52.0	
400	51.9	
500	54.4	58.2
630	53.6	
800	53.3	
1000	53.0	56.9
1250	48.7	
1600	44.5	
2000	43.4	50.2
2500	47.3	
3150	46.5	
4000	46.8	50.1
5000	39.8	
6300	37.1	
8000	43.0	45.3
10000	39.4	






1 Too high

Sound power level L_w(A): 61.4 dB [re 1pW]

Name of test institute:	DTI
No. of test report:	300-KLAB-22-002
Date:	06-01-2022

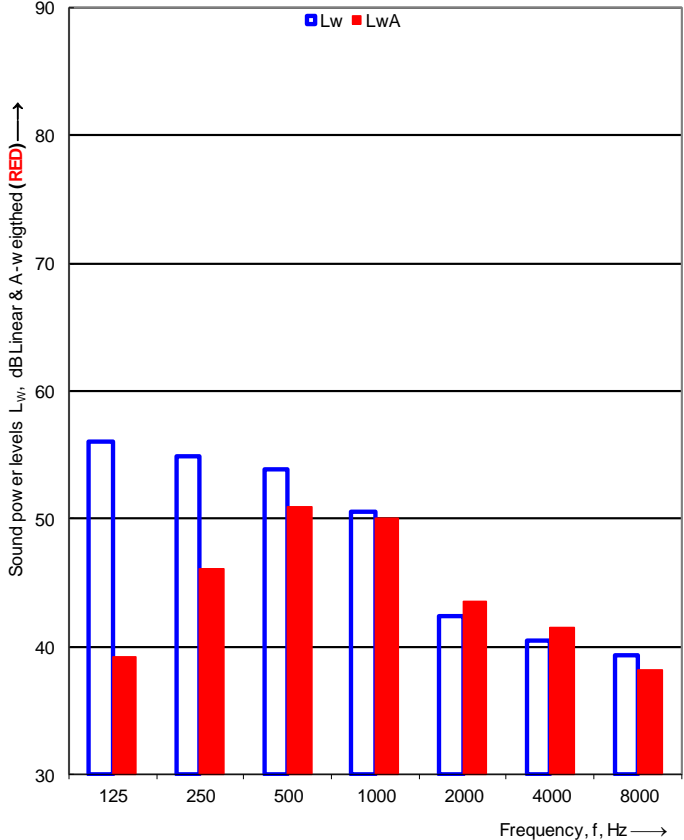


Detailed test results of sound power measurement – Test N#9

 		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: 06-01-2022		
Object:	Type: Mono air to water heat pump Model: WH-MXC12J9E8				
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration isolators. The support is placed on two heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.				
Operating conditions:	A7/W55, Compressor speed: 22[Hz], Fan speed_1: 330[RPM], Fan speed_2: 360 [RPM], Heating capacity: 4.77[kW], Power_input: 1.73[kW], Water flow rate: 520[l/h], dP_water : 710 [mBar]				
Static pressure:	991 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	53.8	
125	50.1	56.0
160	47.8	
200	50.2	
250	52.3	54.9
315	45.6	
400	46.5	
500	50.6	53.8
630	49.2	
800	48.5	
1000	44.8	50.5
1250	40.3	
1600	39.1	
2000	35.8	42.3
2500	37.2	
3150	36.3	
4000	37.4	40.4
5000	31.0	
6300	31.3	
8000	37.5	39.3
10000	32.0	

¹ Too high



Sound power level $L_w(A)$:	55.0 dB [re 1pW]
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Name of test institute:	DTI
No. of test report:	300-KLAB-22-002
Date:	06-01-2022



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.

