

TEST REPORT

Report no.:
300-KLAB-21-003



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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-MXC12J6E5 Tank 1: PAW-TD20C1E5
Tank 2: PAW-TD30C1E5HI
Series no.: Unit: 5623200003 Tank 1: %2102002223 Tank 2 %210?00002
Prod. year: Unit: 2020.11 Tank 1: 2020.11.16 Tank 2: 2021.01.27

Dates: Component tested: January-April 2021

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

Remarks: The unit was delivered by the customer. The installation and test settings were done according to the manufacturer's instructions. All tests are done with enabled defrost mode.

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Test Rep. nr.



Objective

The objective of this report is to document the following:

The Seasonal Coefficient of Performance (SCOP) at low and medium temperature application for average climate according to EN 14825:2016. In order to calculate the SCOP, tests were carried out at the part load conditions stated in the tables on page 5 and 6.

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.

SEER test points at fan cooling application for space cooling according to EN 14825:2016 at test condition A (A35/W7) and test condition C (A25/W10)

SEER test points at floor cooling application for space cooling according to EN 14825:2016 at test condition A (A35/W18) and test condition C (A25/W18)

Operating requirements according to EN 14511-4:2013:

- 4.2.1 Starting and operating tests

Operating requirements according to EN 14511-4:2018:

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

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

- Test at average climate, load profile XL, L and M with two different hot water tanks

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

Sound power measurements according to EN 12102-1:2017 for standard rating condition (A7/W55), quiet mode level 3 (A7/W55) and energy label (A7/W55).

This report includes all 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 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



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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				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.

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 conditions for rating condition 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 condition 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 SEER test points at fan cooling application for space cooling - EN 14825

N [#]	Heat source		Heat sink		Test point
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^K	35	-	12	7	A
2 ^K	25	-	15	10	C

K) Keymark

Test conditions for SEER test points at floor cooling application for space cooling - EN 14825

N [#]	Heat source		Heat sink		Test point
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^K	35	-	23	18	A
2 ^K	25	-	23	18	C

K) Keymark

Test conditions for operating requirements – 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 operating requirements – 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 of the heat transfer medium – EN 14511-4

N [#]	Heat source		Heat sink		Heat exchanger
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^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	Average	TD20C1E5	7/6	M	52/44
2 ^K	Average	TD20C1E5	7/6	L	52/44
3 ^K	Average	TD30C1E5-HI	7/6	L	52/44
4	Average	TD30C1E5-HI	7/6	XL	52/44

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	47/55	51	520/560	12.0	4.0
2 ^Q	7/6	47/55	36	370/410	8.3	2.7
3 ^{E-K}	7/6	47/55	22	360/400	4.75	1.72

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



Test results

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

Model (Outdoor)	WH-MXC12J6E5
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 [kW]
Seasonal space heating energy efficiency	η_s	206.2 [%]
	SCOP	5.23 [-]

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}	7.90 [kW]
		$T_j = 2\text{ °C}$	P_{dh}	4.85 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	5.43 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	6.36 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	9.23 [kW]
		$T_j = \text{operation limit}$	P_{dh}	9.23 [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	3.20 [-]
		$T_j = 2\text{ °C}$	COPd	5.19 [-]
		$T_j = 7\text{ °C}$	COPd	6.76 [-]
		$T_j = 12\text{ °C}$	COPd	8.91 [-]
		$T_j = \text{bivalent temperature}$	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}	3556 [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 SCOP test at medium temperature - heating season average – EN 14825

Model (Outdoor)	WH-MXC12J6E5
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 [kW]
Seasonal space heating energy efficiency	η_s	147.8 [%]
	SCOP	3.77 [-]

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}	7.48 [kW]
	Medium temperature application	$T_j = 2\text{ °C}$	P_{dh}	4.98 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	5.11 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	6.02 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	8.99 [kW]
		$T_j = \text{operation limit}$	P_{dh}	8.99 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate	$T_j = -15\text{ °C}$	COP_d	- [-]
	-	$T_j = -7\text{ °C}$	COP_d	2.35 [-]
	Medium temperature application	$T_j = 2\text{ °C}$	COP_d	3.72 [-]
		$T_j = 7\text{ °C}$	COP_d	4.82 [-]
		$T_j = 12\text{ °C}$	COP_d	6.39 [-]
		$T_j = \text{bivalent temperature}$	COP_d	2.14 [-]
		$T_j = \text{operation limit}$	COP_d	2.14 [-]

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}	4931 [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	12.20	4.96
2	A2/W35	12.24	3.55
3	A-7/W35	12.28	2.83

K) Keymark

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

N#	Test conditions	Heating capacity [kW]	COP
1 ^K	A7/W55	12.12	3.11
2	A2/W55	11.40	2.31
3	A-7/W55	11.10	1.94

K) Keymark

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

N#	Test conditions	Cooling capacity [kW]	EER
1 ^K	A35/W7	11.46	2.90
2 ^K	A25/W10	5.36	5.38

K) Keymark



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

N#	Test conditions	Cooling capacity [kW]	EER
1 ^K	A35/W23	13.25	3.28
2 ^K	A25/W23	6.74	7.95

K) Keymark

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

N#	Test conditions	Water flow rate at indoor heat exchanger (l/h)	Test validation
1	A35/W55	1840	passed
2	A35/W25	950	passed

Test results of operating requirements – 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	570	passed

K) Keymark

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

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

K) Keymark



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

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

Test results of domestic hot water test - EN16147:2017 test. Tank PAW-TD20C1E5

No		Symbol	Result	Unit
1)	Load profile	-	M	-
2)	Settings of the control	-	52	-
3)	Heating up time	t_h	3218	[s]
4)	Heating up electrical energy consumption	W_{eh-HP}	3.42	[kWh]
5)	Stand-by power input	P_{es}	0.05	[kW]
6)	Total useful energy content during the load profile	Q_{LP}	6.09	[kWh]
7)	Total electrical energy consumption during load profile	W_{EL-LP}	2.94	[kWh]
8)	Daily electrical energy consumption	Q_{elec}	2.82	[kWh]
9)	Coefficient of Performance	COP_{DHW}	2.07	[-]
10)	Water heating energy consumption	η_{wh}	91.4%	[%]
11)	Annual electrical energy consumption	AEC	562	[kWh/a]
12)	Reference hot water temperature	θ'_{WH}	52.1	[°C]
13)	Maximum volume of mixed water at 40°C	V_{40}	257	[L]
19)	Rated heat output	P_{rated}	-	[kW]
20)	Seasonal coefficient of performance	$SCOP_{DHW}$	-	[-]



Test results of domestic hot water test - EN16147:2017 test.^K

Tank PAW-TD20C1E5

No		Symbol	Result	Unit
1)	Load profile	-	L	-
2)	Settings of the control	-	52	-
3)	Heating up time	t_h	3218	[s]
4)	Heating up electrical energy consumption	W_{eh-HP}	3.42	[kWh]
5)	Stand-by power input	P_{es}	0.05	[kW]
6)	Total useful energy content during the load profile	Q_{LP}	11.69	[kWh]
7)	Total electrical energy consumption during load profile	W_{EL-LP}	5.17	[kWh]
8)	Daily electrical energy consumption	Q_{elec}	5.15	[kWh]
9)	Coefficient of Performance	COP_{DHW}	2.26	[-]
10)	Water heating energy consumption	η_{wh}	96.1%	[%]
11)	Annual electrical energy consumption	AEC	1066	[kWh/a]
12)	Reference hot water temperature	θ'_{WH}	52.0	[°C]
13)	Maximum volume of mixed water at 40°C	V_{40}	256	[L]
19)	Rated heat output	P_{rated}	-	[kW]
20)	Seasonal coefficient of performance	$SCOP_{DHW}$	-	[-]

K) Keymark

Test results of domestic hot water test - EN16147:2017 test.^K

Tank PAW-TD30C1E5HI

No		Symbol	Result	Unit
1)	Load profile	-	L	-
2)	Settings of the control	-	52	-
3)	Heating up time	t_h	3898	[s]
4)	Heating up electrical energy consumption	W_{eh-HP}	4.33	[kWh]
5)	Stand-by power input	P_{es}	0.05	[kW]
6)	Total useful energy content during the load profile	Q_{LP}	11.74	[kWh]
7)	Total electrical energy consumption during load profile	W_{EL-LP}	4.74	[kWh]
8)	Daily electrical energy consumption	Q_{elec}	4.66	[kWh]
9)	Coefficient of Performance	COP_{DHW}	2.48	[-]
10)	Water heating energy consumption	η_{wh}	104.7%	[%]
11)	Annual electrical energy consumption	AEC	970	[kWh/a]
12)	Reference hot water temperature	θ'_{WH}	51.8	[°C]
13)	Maximum volume of mixed water at 40°C	V_{40}	386	[L]
19)	Rated heat output	P_{rated}	-	[kW]
20)	Seasonal coefficient of performance	$SCOP_{DHW}$	-	[-]

K) Keymark



Test Rep. nr.



Test results of domestic hot water test - EN16147:2017 test. Tank PAW-TD30C1E5HI

No		Symbol	Result	Unit
1)	Load profile	-	XL	-
2)	Settings of the control	-	52	-
3)	Heating up time	t_h	3898	[s]
4)	Heating up electrical energy consumption	W_{eh-HP}	4.33	[kWh]
5)	Stand-by power input	P_{es}	0.05	[kW]
6)	Total useful energy content during the load profile	Q_{LP}	19.15	[kWh]
7)	Total electrical energy consumption during load profile	W_{EL-LP}	6.24	[kWh]
8)	Daily electrical energy consumption	Q_{elec}	6.21	[kWh]
9)	Coefficient of Performance	COP_{DHW}	3.07	[-]
10)	Water heating energy consumption	η_{wh}	128.0%	[%]
11)	Annual electrical energy consumption	AEC	1309	[kWh/a]
12)	Reference hot water temperature	θ'_{WH}	52.0	[°C]
13)	Maximum volume of mixed water at 40°C	V_{40}	384	[L]
19)	Rated heat output	P_{rated}	-	[kW]
20)	Seasonal coefficient of performance	$SCOP_{DHW}$	-	[-]

Power consumption of liquid pump for COP test points

N#	COP test points	Measured power consumption (W)
1	A7/W35	65
2	A2/W35	69
3	A-7/W35	69
4	A7/W55	65
5	A2/W55	65
6	A-7/W55	65



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

N#	SCOP test points	Measured power consumption (W)
1	A12/W24	60
2	A7/W27	60
3	A2/W30	56
4	A-7/W34	58
5	A10/W35	56

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

N#	SCOP test points	Measured power consumption (W)
1	A12/W30	52
2	A7/W36	50
3	A2/W42	50
4	A-7/W52	52
5	A10/W55	52

The power consumptions of the liquid pump have been measured separately



Test results of sound power measurements – EN 12102

N [#]	Sound power level LW(A) [dB re 1pW]	Uncertainty (dB) (weighted value)
1 ^R	63	0.50
2 ^Q	57.5	0.50
3 ^{E-K}	55	0.50

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.

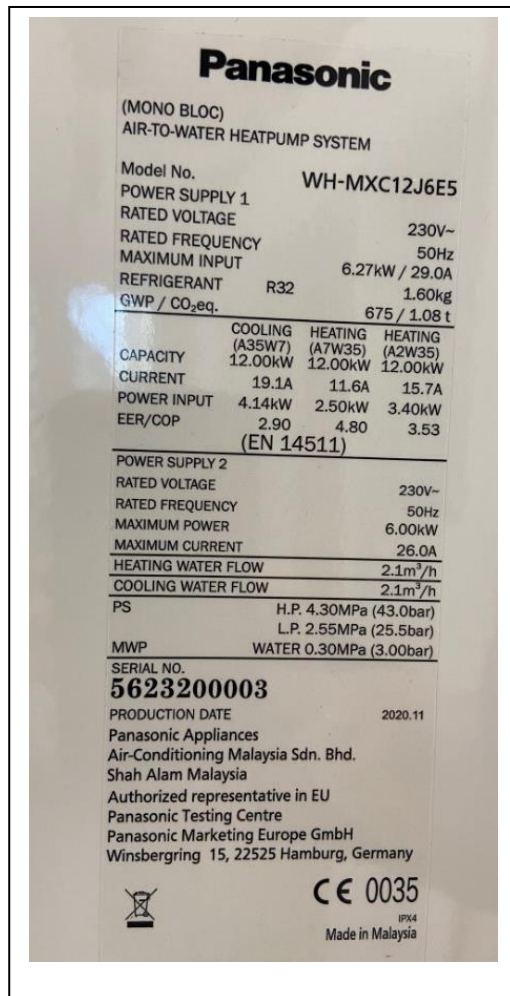
The A-weighted total sound power level is determined for the measured frequency range from 100 Hz to 10 kHz.





Photo

Rating plate

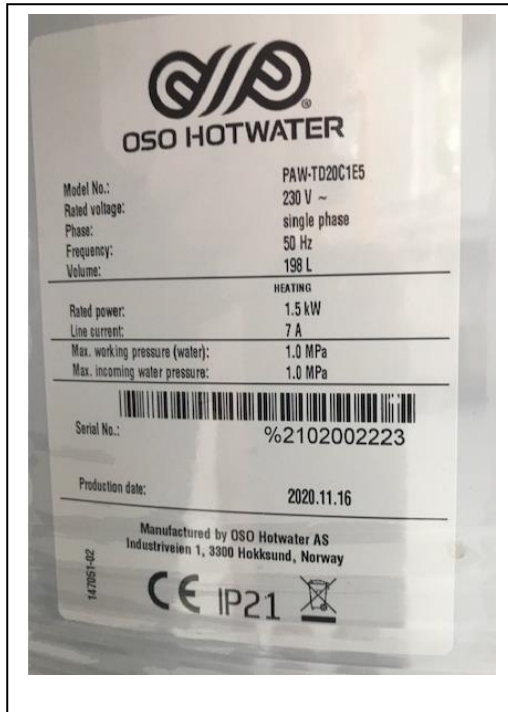


Unit





Rating plate tank 1



Tank 1





Rating plate tank 2



Tank 2





SCOP - detailed calculation

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

Calculation of reference SCOP

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

Where

P_{design} =

Heating load of the building at design temperature, kW

H_{he} =

Number of equivalent heating hours, 2066 h

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

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

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

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

Data for SCOP

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COPbin [-]
A	-7	88	7.96	7.90	3.20	1.00	1.00	3.20
B	2	54	4.85	4.85	5.19	0.99	1.00	5.19
C	7	35	3.12	5.43	6.76	0.99	0.57	6.71
D	12	15	1.38	6.36	8.91	0.99	0.22	8.57
E	-10	100	9.00	9.23	3.13	1.00	1.00	3.13
F - BIV	-10	100	9.00	9.23	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	8.63	0.00	0.00	3.15	216.35	68.61	216.35	68.61
	23	-8	23	8.31	8.27	0.00	0.00	3.18	191.08	60.15	191.08	60.15
A	24	-7	24	7.96	7.90	0.00	0.00	3.20	191.08	59.71	191.08	59.71
	25	-6	27	7.62	7.56	0.00	0.00	3.42	205.62	60.10	205.62	60.10
	26	-5	68	7.27	7.22	0.00	0.00	3.64	494.31	135.72	494.31	135.72
	27	-4	91	6.92	6.88	0.00	0.00	3.86	630.00	163.07	630.00	163.07
	28	-3	89	6.58	6.54	0.00	0.00	4.08	585.35	143.31	585.35	143.31
	29	-2	165	6.23	6.20	0.00	0.00	4.31	1028.08	238.78	1028.08	238.78
	30	-1	173	5.88	5.86	0.00	0.00	4.53	1018.04	224.90	1018.04	224.90
	31	0	240	5.54	5.52	0.00	0.00	4.75	1329.23	279.97	1329.23	279.97
	32	1	280	5.19	5.19	0.00	0.00	4.97	1453.85	292.59	1453.85	292.59
B	33	2	320	4.85	4.85	0.00	0.00	5.19	1550.77	298.80	1550.77	298.80
	34	3	357	4.50	4.50	0.00	0.00	5.49	1606.50	292.41	1606.50	292.41
	35	4	356	4.15	4.15	0.00	0.00	5.80	1478.77	255.04	1478.77	255.04
	36	5	303	3.81	3.81	0.00	0.00	6.10	1153.73	189.07	1153.73	189.07
	37	6	330	3.46	3.46	0.00	0.00	6.41	1142.31	178.31	1142.31	178.31
C	38	7	326	3.12	3.12	0.00	0.00	6.71	1015.62	151.35	1015.62	151.35
	39	8	348	2.77	2.77	0.00	0.00	7.08	963.69	136.09	963.69	136.09
	40	9	335	2.42	2.42	0.00	0.00	7.45	811.73	108.92	811.73	108.92
	41	10	315	2.08	2.08	0.00	0.00	7.82	654.23	83.63	654.23	83.63
	42	11	215	1.73	1.73	0.00	0.00	8.19	372.12	45.41	372.12	45.41
D	43	12	169	1.38	1.38	0.00	0.00	8.57	234.00	27.32	234.00	27.32
	44	13	151	1.04	1.04	0.00	0.00	8.94	156.81	17.55	156.81	17.55
	45	14	105	0.69	0.69	0.00	0.00	9.31	72.69	7.81	72.69	7.81
	46	15	74	0.35	0.35	0.00	0.00	9.68	25.62	2.65	25.62	2.65

SUM	18590.54	3524.14	18590.54	3524.14
SCOPon		5.28	SCOPnet	5.28



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	7.48	2.35	1.00	1.00	2.35
B	2	54	4.85	4.98	3.72	0.99	1.00	3.72
C	7	35	3.12	5.11	4.82	0.99	0.61	4.80
D	12	15	1.38	6.02	6.39	0.99	0.23	6.21
E	-10	100	9.00	8.99	2.14	1.00	1.00	2.14
F - BIV	-10	100	9.00	8.99	2.14	1.00	1.00	2.14

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]	<u>COP</u> bin [-]	Annual heating demand [kWh]	Annual energy input [kWh]	Net annual heating capacity [kWh]	Net annual power input [kWh]
E / F - BIV	21	-10	1	9.00	8.99	0.00	0.00	2.14	9.00	4.21	9.00	4.21
	22	-9	25	8.65	8.49	0.00	0.00	2.21	216.35	97.89	216.35	97.89
	23	-8	23	8.31	7.98	0.00	0.00	2.28	191.08	83.81	191.08	83.81
A	24	-7	24	7.96	7.48	0.00	0.00	2.35	191.08	81.31	191.08	81.31
	25	-6	27	7.62	7.19	0.00	0.00	2.50	205.62	82.17	205.62	82.17
	26	-5	68	7.27	6.89	0.00	0.00	2.65	494.31	186.22	494.31	186.22
	27	-4	91	6.92	6.60	0.00	0.00	2.81	630.00	224.47	630.00	224.47
	28	-3	89	6.58	6.31	0.00	0.00	2.96	585.35	197.83	585.35	197.83
	29	-2	165	6.23	6.02	0.00	0.00	3.11	1028.08	330.45	1028.08	330.45
	30	-1	173	5.88	5.72	0.00	0.00	3.26	1018.04	311.96	1018.04	311.96
	31	0	240	5.54	5.43	0.00	0.00	3.42	1329.23	389.17	1329.23	389.17
	32	1	280	5.19	5.14	0.00	0.00	3.57	1453.85	407.49	1453.85	407.49
	33	2	320	4.85	4.85	0.00	0.00	3.72	1550.77	416.87	1550.77	416.87
B	34	3	357	4.50	4.50	0.00	0.00	3.94	1606.50	408.22	1606.50	408.22
	35	4	356	4.15	4.15	0.00	0.00	4.15	1478.77	356.27	1478.77	356.27
	36	5	303	3.81	3.81	0.00	0.00	4.37	1153.73	264.25	1153.73	264.25
	37	6	330	3.46	3.46	0.00	0.00	4.58	1142.31	249.33	1142.31	249.33
C	38	7	326	3.12	3.12	0.00	0.00	4.80	1015.62	211.73	1015.62	211.73
	39	8	348	2.77	2.77	0.00	0.00	5.08	963.69	189.70	963.69	189.70
	40	9	335	2.42	2.42	0.00	0.00	5.36	811.73	151.35	811.73	151.35
	41	10	315	2.08	2.08	0.00	0.00	5.65	654.23	115.86	654.23	115.86
	42	11	215	1.73	1.73	0.00	0.00	5.93	372.12	62.75	372.12	62.75
D	43	12	169	1.38	1.38	0.00	0.00	6.21	234.00	37.66	234.00	37.66
	44	13	151	1.04	1.04	0.00	0.00	6.50	156.81	24.14	156.81	24.14
	45	14	105	0.69	0.69	0.00	0.00	6.78	72.69	10.72	72.69	10.72
	46	15	74	0.35	0.35	0.00	0.00	7.06	25.62	3.63	25.62	3.63

SUM	18590.54	4899.45	18590.54	4899.45
SCOPon	3.79	SCOPnet	3.79	



Detailed test results

Detailed SCOP test results - low temperature application – EN 14825

Detailed result for 'EN14825:2016' Average Low (A) A -7 /W34		
Tested according to:		EN14825:2016
Climate zone:		Average
Temperature application:		Low
Condition name:		A
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	9.00
Heating demand:	kW	7.96
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	7.90
COP	-	3.20
Power consumption	kW	2.47
Measured		
Heating capacity	kW	7.95
COP	-	3.14
Power consumption	kW	2.53
During heating		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-8.0
Air temperature dry bulb outlet	°C	-10.4
Inlet temperature	°C	29.0
Outlet temperature	°C	34.1
Outlet temperature (Time averaged)	°C	34.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	37387
Calculated Hydraulic power	W	16
Calculated global efficiency	η	0.27
Calculated Capacity correction	W	41
Calculated Power correction	W	57
Water Flow	m ³ /s	0.000418



Detailed result for 'EN14825:2016' Average Low (B) A 2 /W30		
Tested according to:	EN14511:2018 and	EN14825:2016
Climate zone:		Average
Temperature application:		Low
Condition name:		B
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	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	4.85
COP	-	5.19
Power consumption	kW	0.94
Measured		
Heating capacity	kW	4.89
COP	-	4.95
Power consumption	kW	0.99
During heating		
Air temperature dry bulb	°C	2.1
Air temperature wet bulb	°C	0.9
Air temperature dry bulb outlet	°C	-0.1
Inlet temperature	°C	25.0
Outlet temperature	°C	30.1
Outlet temperature (Time averaged)	°C	30.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	60379
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	0.000229



Detailed result for 'EN14825:2016' Average Low (C) A 7 /W27

Tested according to:		EN14825:2016
Climate zone:		Average
Temperature application:		Low
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	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	5.43
COP	-	6.76
Power consumption	kW	0.80
Measured		
Heating capacity	kW	5.47
COP	-	6.36
Power consumption	kW	0.86
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	5.9
Air temperature dry bulb outlet	°C	4.3
Inlet temperature	°C	24.1
Outlet temperature	°C	29.1
Outlet temperature (Time averaged)	°C	27.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	59422
Calculated Hydraulic power	W	16
Calculated global efficiency	η	0.28
Calculated Capacity correction	W	41
Calculated Power correction	W	57
Water Flow	m ³ /s	0.000265



Detailed result for 'EN14825:2016' Average Low (D) A12/W24

Tested according to:		EN14825:2016
Climate zone:		Average
Temperature application:		Low
Condition name:		D
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	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	6.36
COP	-	8.91
Power consumption	kW	0.71
Measured		
Heating capacity	kW	6.41
COP	-	8.27
Power consumption	kW	0.78
During heating		
Air temperature dry bulb	°C	12.0
Air temperature wet bulb	°C	10.9
Air temperature dry bulb outlet	°C	9.1
Inlet temperature	°C	22.9
Outlet temperature	°C	27.9
Outlet temperature (Time averaged)	°C	24.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	56723
Calculated Hydraulic power	W	17
Calculated global efficiency	η	0.29
Calculated Capacity correction	W	43
Calculated Power correction	W	61
Water Flow	m ³ /s	0.000305



Detailed result for 'EN14825:2016' Average Low (E and F) A -10 /W35

Tested according to:		EN14825:2016
Climate zone:		Average
Temperature application:		Low
Condition name:		E and F
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	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	9.23
COP	-	3.13
Power consumption	kW	2.95
Measured		
Heating capacity	kW	9.27
COP	-	3.08
Power consumption	kW	3.01
During heating		
Air temperature dry bulb	°C	-9.9
Air temperature wet bulb	°C	-11.1
Air temperature dry bulb outlet	°C	-12.8
Inlet temperature	°C	30.0
Outlet temperature	°C	35.1
Outlet temperature (Time averaged)	°C	35.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	32993
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	0.000436



Detailed SCOP test results - medium temperature application - EN 14825

Detailed result for 'EN14825:2016' Average Medium (A) A -7 /W52		
Tested according to:		EN14825:2016
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:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	7.48
COP	-	2.35
Power consumption	kW	3.19
Measured		
Heating capacity	kW	7.52
COP	-	2.32
Power consumption	kW	3.24
During heating		
Air temperature dry bulb	°C	-6.9
Air temperature wet bulb	°C	-8.2
Air temperature dry bulb outlet	°C	-9.6
Inlet temperature	°C	44.0
Outlet temperature	°C	51.8
Outlet temperature (Time averaged)	°C	51.8
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	61046
Calculated Hydraulic power	W	14
Calculated global efficiency	η	0.26
Calculated Capacity correction	W	39
Calculated Power correction	W	54
Water Flow	m ³ /s	0.000232



Detailed result for 'EN14825:2016' Average Medium (B) A 2 /W42		
Tested according to:		EN14825:2016
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:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	4.98
COP	-	3.72
Power consumption	kW	1.34
Measured		
Heating capacity	kW	5.01
COP	-	3.62
Power consumption	kW	1.38
During heating		
Air temperature dry bulb	°C	2.1
Air temperature wet bulb	°C	0.9
Air temperature dry bulb outlet	°C	0.2
Inlet temperature	°C	34.4
Outlet temperature	°C	42.0
Outlet temperature (Time averaged)	°C	42.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	69145
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	0.000159



Detailed result for 'EN14825:2016' Average Medium (C) A 7 /W36		
Tested according to:		EN14825:2016
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	5.11
COP	-	4.82
Power consumption	kW	1.06
Measured		
Heating capacity	kW	5.14
COP	-	4.65
Power consumption	kW	1.11
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.0
Air temperature dry bulb outlet	°C	4.7
Inlet temperature	°C	31.3
Outlet temperature	°C	39.1
Outlet temperature (Time averaged)	°C	36.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	68906
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	0.000160



Detailed result for 'EN14825:2016' Average Medium (D) A 12 /W30		
Tested according to:		EN14825:2016
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	6.02
COP	-	6.39
Power consumption	kW	0.94
Measured		
Heating capacity	kW	6.06
COP	-	6.10
Power consumption	kW	0.99
During heating		
Air temperature dry bulb	°C	12.0
Air temperature wet bulb	°C	10.9
Air temperature dry bulb outlet	°C	9.3
Inlet temperature	°C	28.2
Outlet temperature	°C	36.2
Outlet temperature (Time averaged)	°C	30.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	68734
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	0.000183



Detailed result for 'EN14825:2016' Average Medium (E and F) A -10 /W55		
Tested according to:	EN14825:2016	
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:	-	Yes
Measurement type:	Steady State	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Heating capacity	kW	8.99
COP	-	2.14
Power consumption	kW	4.19
Measured		
Heating capacity	kW	9.02
COP	-	2.13
Power consumption	kW	4.24
During heating		
Air temperature dry bulb	°C	-9.9
Air temperature wet bulb	°C	-10.9
Air temperature dry bulb outlet	°C	-12.0
Inlet temperature	°C	47.0
Outlet temperature	°C	55.0
Outlet temperature (Time averaged)	°C	55.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	40669
Calculated Hydraulic power	W	11
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	35
Calculated Power correction	W	46
Water Flow	m³/s	0.000274



Detailed test results for rating conditions – low temperature

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	12.20
COP	-	4.96
Power consumption	kW	2.46
Measured		
Heating capacity	kW	12.23
COP	-	4.89
Power consumption	kW	2.50
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	5.9
Air temperature dry bulb outlet	°C	3.5
Inlet temperature	°C	29.9
Outlet temperature	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	14441
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.21
Calculated Capacity correction	W	31
Calculated Power correction	W	39
Water Flow	m ³ /s	0.000580



Detailed result for 'EN14511:2018' A2/W35 full load		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	12.24
COP	-	3.55
Power consumption	kW	3.44
Measured		
Heating capacity	kW	12.24
COP	-	3.55
Power consumption	kW	3.45
During heating		
Air temperature dry bulb	°C	2.1
Air temperature wet bulb	°C	0.8
Air temperature dry bulb outlet	°C	-3.0
Inlet temperature	°C	29.9
Outlet temperature	°C	35.2
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	191
Calculated Hydraulic power	W	0
Calculated global efficiency	η	0.11
Calculated Capacity correction	W	1
Calculated Power correction	W	1
Water Flow	m ³ /s	0.000641



Detailed result for 'EN14511:2018' A-7/W35 full load

Tested according to:	EN14511:2018	
Minimum flow reached:	No	
Measurement type:	Transient	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Heating capacity	kW	12.28
COP	-	2.83
Power consumption	kW	4.34
Measured		
Heating capacity	kW	12.28
COP	-	2.83
Power consumption	kW	4.34
During heating		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-8.2
Air temperature dry bulb outlet	°C	-11.7
Inlet temperature	°C	30.0
Outlet temperature	°C	35.2
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	300
Calculated Hydraulic power	W	0
Calculated global efficiency	η	0.11
Calculated Capacity correction	W	1
Calculated Power correction	W	2
Water Flow	m ³ /s	0.000635



Detailed test results for rating conditions – medium temperature

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	12.12
COP	-	3.11
Power consumption	kW	3.89
Measured		
Heating capacity	kW	12.17
COP	-	3.07
Power consumption	kW	3.96
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.0
Air temperature dry bulb outlet	°C	4.2
Inlet temperature	°C	47.0
Outlet temperature	°C	55.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	51031
Calculated Hydraulic power	W	19
Calculated global efficiency	η	0.29
Calculated Capacity correction	W	45
Calculated Power correction	W	64
Water Flow	m ³ /s	0.000369



Detailed result for 'EN14511:2018' A2/W55 full load

Tested according to:	EN14511:2018	
Minimum flow reached:	No	
Measurement type:	Transient	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Heating capacity	kW	11.40
COP	-	2.31
Power consumption	kW	4.93
Measured		
Heating capacity	kW	11.44
COP	-	2.29
Power consumption	kW	4.99
During heating		
Air temperature dry bulb	°C	2.0
Air temperature wet bulb	°C	0.8
Air temperature dry bulb outlet	°C	-2.1
Inlet temperature	°C	47.0
Outlet temperature	°C	55.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	43583
Calculated Hydraulic power	W	18
Calculated global efficiency	η	0.29
Calculated Capacity correction	W	45
Calculated Power correction	W	63
Water Flow	m ³ /s	0.000418



Detailed result for 'EN14511:2018' A-7/W55 full load

Tested according to:	EN14511:2018	
Minimum flow reached:	No	
Measurement type:	Transient	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Heating capacity	kW	11.10
COP	-	1.94
Power consumption	kW	5.72
Measured		
Heating capacity	kW	11.15
COP	-	1.93
Power consumption	kW	5.78
During heating		
Air temperature dry bulb	°C	-6.9
Air temperature wet bulb	°C	-8.0
Air temperature dry bulb outlet	°C	-10.3
Inlet temperature	°C	47.0
Outlet temperature	°C	55.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	42705
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	0.000380



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

Detailed result for 'EN14825:2016 Cooling fan (A) A 35 /W7		
Tested according to:	EN14511:2018 and	EN14825:2016
Climate zone:		N/A
Temperature application:		Cooling fan
Condition name:		A
Condition temperature:	°C	35
Part load:	%	100%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	11.50
Cooling demand:	kW	11.50
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Cooling capacity	kW	11.46
EER	-	2.90
Power consumption	kW	3.96
Measured		
Cooling capacity	kW	11.43
EER	-	2.85
Power consumption	kW	4.01
During heating		
Air temperature dry bulb	°C	35.0
Air temperature wet bulb	°C	18.5
Air temperature dry bulb outlet	°C	41.9
Inlet temperature	°C	12.0
Outlet temperature	°C	7.1
Outlet temperature (Time averaged)	°C	7.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	21259
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	0.000551



Detailed result for 'EN14825:2016 Cooling fan (C) A 25 /W10		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		N/A
Temperature application:		Cooling fan
Condition name:		C
Condition temperature:	°C	25
Part load:	%	47%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	11.50
Cooling demand:	kW	5.41
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Cooling capacity	kW	5.36
EER	-	5.38
Power consumption	kW	1.00
Measured		
Cooling capacity	kW	5.32
EER	-	5.05
Power consumption	kW	1.05
During heating		
Air temperature dry bulb	°C	25.0
Air temperature wet bulb	°C	14.2
Air temperature dry bulb outlet	°C	30.5
Inlet temperature	°C	15.0
Outlet temperature	°C	10.0
Outlet temperature (Time averaged)	°C	10.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	62000
Calculated Hydraulic power	W	16
Calculated global efficiency	η	0.28
Calculated Capacity correction	W	41
Calculated Power correction	W	57
Water Flow	m ³ /s	0.000254



Detailed SEER test results for cooling mode, floor - EN 14825




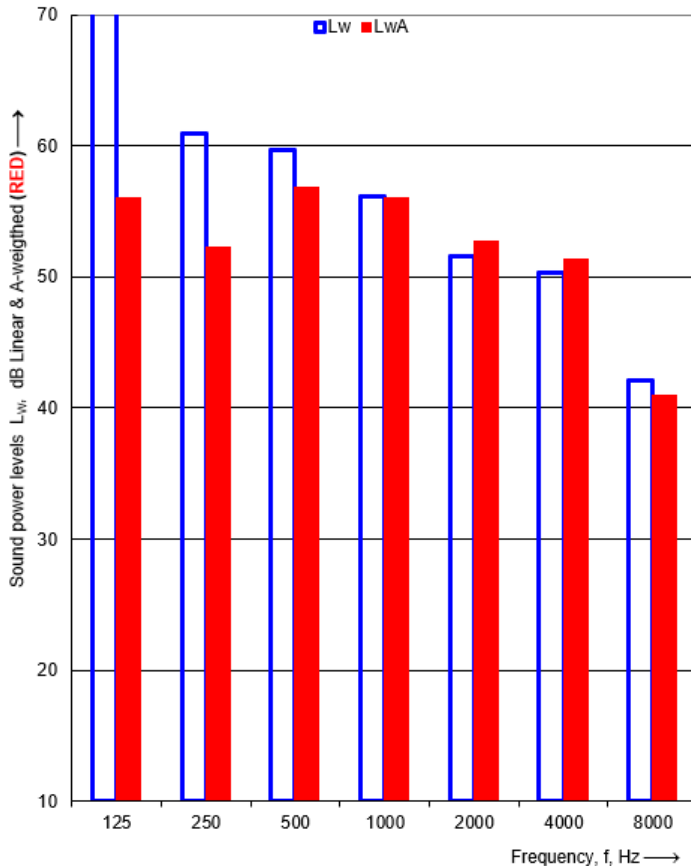
Detailed result for 'EN14825:2016 Cooling floor (A) A35/W18		
Tested according to:	EN14511:2018 and	EN14825:2016
Climate zone:		N/A
Temperature application:		Cooling floor
Condition name:		A
Condition temperature:	°C	35
Part load:	%	100%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	13.00
Cooling demand:	kW	13.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Cooling capacity	kW	13.25
EER	-	3.28
Power consumption	kW	4.04
Measured		
Cooling capacity	kW	13.23
EER	-	3.25
Power consumption	kW	4.07
During heating		
Air temperature dry bulb	°C	35.0
Air temperature wet bulb	°C	19.4
Air temperature dry bulb outlet	°C	42.6
Inlet temperature	°C	23.0
Outlet temperature	°C	18.0
Outlet temperature (Time averaged)	°C	18.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	9872
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	27
Calculated Power correction	W	33
Water Flow	m ³ /s	0.000634



Detailed result for 'EN14825:2016 Cooling floor (C) A25/W18		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		N/A
Temperature application:		Cooling floor
Condition name:		C
Condition temperature:	°C	25
Part load:	%	47%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	13.00
Cooling demand:	kW	6.11
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Cooling capacity	kW	6.74
EER	-	7.95
Power consumption	kW	0.85
Measured		
Cooling capacity	kW	6.70
EER	-	7.35
Power consumption	kW	0.91
During heating		
Air temperature dry bulb	°C	25.1
Air temperature wet bulb	°C	15.4
Air temperature dry bulb outlet	°C	31.4
Inlet temperature	°C	23.0
Outlet temperature	°C	18.0
Outlet temperature (Time averaged)	°C	18.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	57662
Calculated Hydraulic power	W	18
Calculated global efficiency	η	0.29
Calculated Capacity correction	W	45
Calculated Power correction	W	63
Water Flow	m ³ /s	0.000320






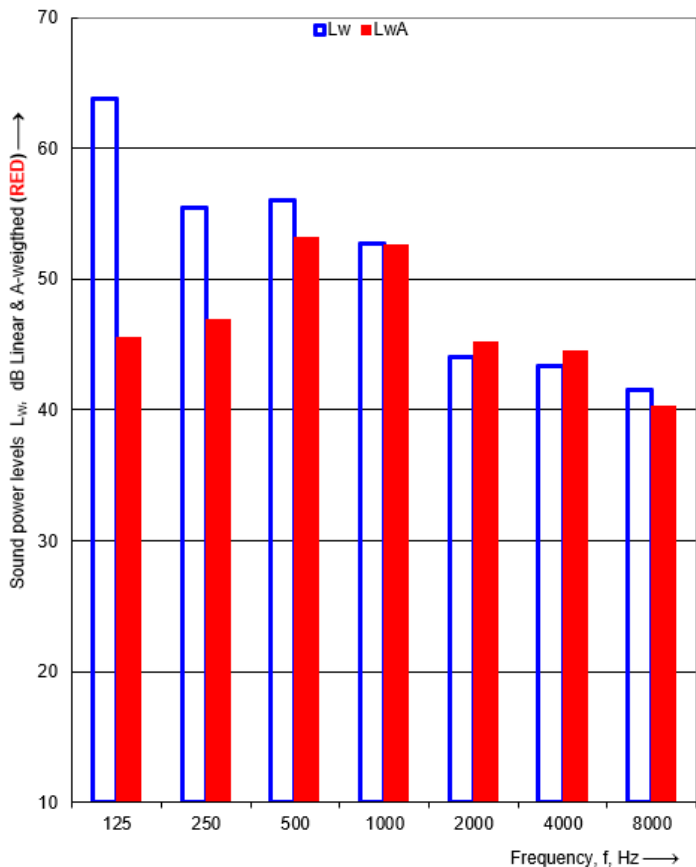
Detailed test results of sound power measurement – Test N#1

 		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:	02-03-2021																																																																		
Object:	Type: Mono air to water unit Model: WH-MXC12J6E5																																																																						
Mounting conditions:	The unit is standing free on two pieces of heavy concrete tiles (90x90x9cm) laying on the floor. The unit is mounted on supporting metal frame using 6 vibration isolators.																																																																						
Operating conditions: A7/55, Compressor speed: 51[Hz], Heating capacity: 12.2[kW], Power_input: 4.0[kW], Fan speed _1: 520 [rpm], Fan speed_2: 560 [rpm], Water flow rate: 1320[l/h] and dp_water: 510 [mbar]																																																																							
Static pressure:	1034 kPa			<u>Reference box:</u>																																																																			
Air temperature:	7.0 °C			L1:	1.3 m																																																																		
Relative air humidity:	85.0 %			L2:	0.3 m																																																																		
Test room volume:	102.8 m³	Room:	Room 2	L3:	1.3 m																																																																		
Area, S, of test room:	138.9 m²			Volume:	0.5 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>74.5</td><td></td></tr> <tr><td>125</td><td>61.1</td><td>74.8</td></tr> <tr><td>160</td><td>57.2</td><td></td></tr> <tr><td>200</td><td>57.3</td><td></td></tr> <tr><td>250</td><td>55.6</td><td>60.9</td></tr> <tr><td>315</td><td>55.3</td><td></td></tr> <tr><td>400</td><td>52.8</td><td></td></tr> <tr><td>500</td><td>56.0</td><td>59.7</td></tr> <tr><td>630</td><td>55.4</td><td></td></tr> <tr><td>800</td><td>52.4</td><td></td></tr> <tr><td>1000</td><td>51.8</td><td>56.2</td></tr> <tr><td>1250</td><td>49.4</td><td></td></tr> <tr><td>1600</td><td>45.5</td><td></td></tr> <tr><td>2000</td><td>44.4</td><td>51.5</td></tr> <tr><td>2500</td><td>49.0</td><td></td></tr> <tr><td>3150</td><td>47.6</td><td></td></tr> <tr><td>4000</td><td>45.8</td><td>50.3</td></tr> <tr><td>5000</td><td>40.4</td><td></td></tr> <tr><td>6300</td><td>36.2</td><td></td></tr> <tr><td>8000</td><td>38.5</td><td>42.1</td></tr> <tr><td>10000</td><td>37.1</td><td></td></tr> </tbody> </table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	74.5		125	61.1	74.8	160	57.2		200	57.3		250	55.6	60.9	315	55.3		400	52.8		500	56.0	59.7	630	55.4		800	52.4		1000	51.8	56.2	1250	49.4		1600	45.5		2000	44.4	51.5	2500	49.0		3150	47.6		4000	45.8	50.3	5000	40.4		6300	36.2		8000	38.5	42.1	10000	37.1					
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No. of test report: 300-KLAB-21-003																																																																							
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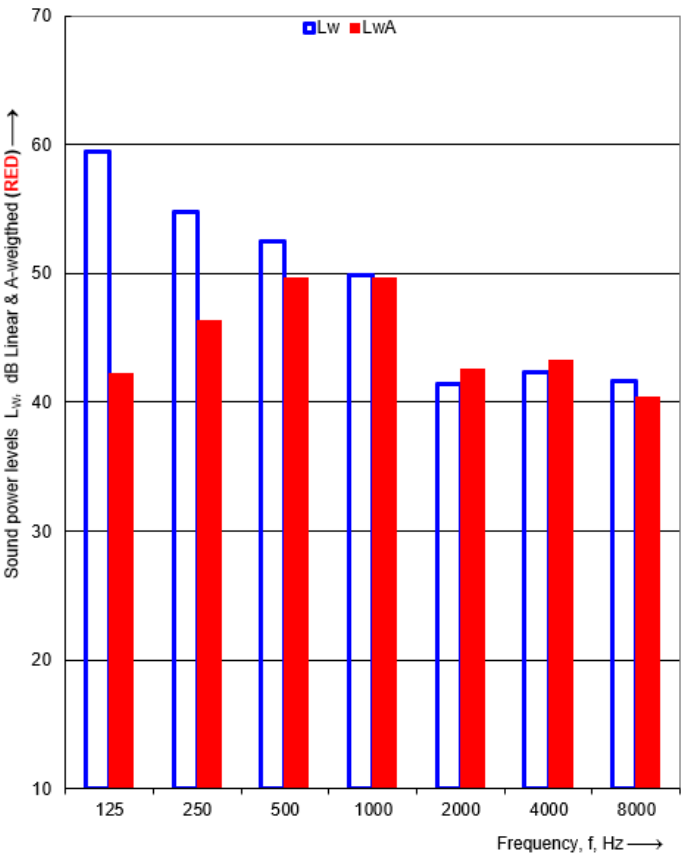


Detailed test results of sound power measurement – Test N#2

 		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: 02-03-2021																																																																			
Object:		Type: Mono air to water unit Model: WH-MXC12J6E5																																																																					
Mounting conditions:		The unit is standing free on two pieces of heavy concrete tiles (90x90x9cm) laying on the floor. The unit is mounted on supporting metal frame using 6 vibration isolators.																																																																					
Operating conditions:		A7/55, Quiet mode 3, Compressor speed: 36[Hz], Heating capacity: 8.3 [kW], Power_input: 2.7[kW], Fan speed _1: 370 [rpm], Fan speed _2: 410 [rpm], Water flow rate: 910[l/h] and																																																																					
Static pressure:		1034 kPa		<u>Reference box:</u>																																																																			
Air temperature:		7.0 °C		L1: 1.3 m																																																																			
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Area, S, of test room:		138.9 m ²		Volume: 0.5 m ³																																																																			
		Room: Room 2																																																																					
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		Sound power level L_w(A): 57.5 dB [re 1pW]																																																																					
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No. of test report:		300-KLAB-21-003																																																																					
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Detailed test results of sound power measurement – Test N#3

 		Sound power levels according to ISO 3743-1:2010																																																																					
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:		Panasonic Europe GmbH		Date of test: 02-03-2021																																																																			
Object:		Type: Mono air to water unit Model: WH-MXC12J6E5																																																																					
Mounting conditions:		The unit is standing free on two pieces of heavy concrete tiles (90x90x9cm) laying on the floor. The unit is mounted on supporting metal frame using 6 vibration isolators.																																																																					
Operating conditions:		A7/55, Compressor speed: 22[Hz], Heating capacity: 4.75 [kW], Power_input: 1.72[kW], Fan speed_1: 360 [rpm], Fan speed_2: 400 [rpm], Water flow rate: 530[l/h] and dp_water: 720 [mbar]																																																																					
Static pressure:		1034 kPa		Reference box:																																																																			
Air temperature:		7.0 °C		L1: 1.3 m																																																																			
Relative air humidity:		85.0 %		L2: 0.3 m																																																																			
Test room volume:		102.8 m³		L3: 1.3 m																																																																			
Area, S, of test room:		138.9 m²		Volume: 0.5 m³																																																																			
Room:		Room 2																																																																					
<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>57.9</td><td></td></tr> <tr><td>125</td><td>51.7</td><td>59.4</td></tr> <tr><td>160</td><td>50.6</td><td></td></tr> <tr><td>200</td><td>48.6</td><td></td></tr> <tr><td>250</td><td>52.1</td><td>54.8</td></tr> <tr><td>315</td><td>48.4</td><td></td></tr> <tr><td>400</td><td>46.4</td><td></td></tr> <tr><td>500</td><td>48.0</td><td>52.5</td></tr> <tr><td>630</td><td>48.6</td><td></td></tr> <tr><td>800</td><td>46.5</td><td></td></tr> <tr><td>1000</td><td>45.5</td><td>49.8</td></tr> <tr><td>1250</td><td>42.0</td><td></td></tr> <tr><td>1600</td><td>37.6</td><td></td></tr> <tr><td>2000</td><td>34.9</td><td>41.4</td></tr> <tr><td>2500</td><td>37.0</td><td></td></tr> <tr><td>3150</td><td>37.4</td><td></td></tr> <tr><td>4000</td><td>38.5</td><td>42.4</td></tr> <tr><td>5000</td><td>36.7</td><td></td></tr> <tr><td>6300</td><td>34.6</td><td></td></tr> <tr><td>8000</td><td>39.0</td><td>41.6</td></tr> <tr><td>10000</td><td>35.7</td><td></td></tr> </tbody> </table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	57.9		125	51.7	59.4	160	50.6		200	48.6		250	52.1	54.8	315	48.4		400	46.4		500	48.0	52.5	630	48.6		800	46.5		1000	45.5	49.8	1250	42.0		1600	37.6		2000	34.9	41.4	2500	37.0		3150	37.4		4000	38.5	42.4	5000	36.7		6300	34.6		8000	39.0	41.6	10000	35.7					
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Appendix 1: Test Procedure

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

- DS/EN 14511
- EN 12102
- 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.

