

# TEST REPORT

Report no.: 300-KLAB-20-008 rev. 2  
(This report replaces report 300-KLAB-20-008 rev. 1)



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**Customer:** Company: Panasonic Marketing Europe  
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**Component:** Brand: Panasonic  
Type: Mono bloc heat pump air to water  
Model: WH-MDC05J3E5 / Tank DGC200  
Series no.: 5622701011 / Tank %2101002719  
Production year: 2020.02 / Tank 2019.12

**Dates:** Component tested: March-May 2020

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

**Remarks:** This report has been revised due to the T<sub>biv</sub> has been changed to -10°C for Avg. medium temperature and for the DHW test the Tank re-heat temperature has been changed to -10°C. The unit was delivered by the customer. The installation and test settings were done according to the manufacturer's instructions. All test are done with enabled defrost mode.

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Test Rep. nr.



## Objective

The objective of this report is to document the following:

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

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

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

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

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

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

Operating requirements according to EN 14511-4:2013:

- 4.2.1 Starting and operating tests

Operating requirements according to EN 14511-4:2018:

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

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

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

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



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## Test conditions

### SCOP test conditions for low temperature - EN14825

Part load conditions for reference SCOP and reference SCOP<sub>on</sub> calculation of air to water units for low temperature application for the reference heating season "A" = average, "W" = warmer, and "C" = colder.

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

<sup>a</sup> 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.

<sup>b</sup> Variable outlet shall be calculated by interpolation from T<sub>designh</sub> and the temperature which is closest to the TOL.

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

<sup>d</sup> If the variable outlet temperature is below the minimum of the operation range of the unit, this minimum should be considered.

### Additional information

Climate	T <sub>designh</sub> [°C]	T <sub>bivalent</sub> [°C]	TOL [°C]	Outlet temperature	Flow rate
Average	-10	-10	-10	Variable	Variable





## SCOP test conditions for medium temperature – EN14825

Part load conditions for reference SCOP and reference SCOP<sub>on</sub> calculation of air to water units for medium temperature application for the reference heating season "A" = average, "W" = warmer, and "C" = colder.

Condition	Part Load Ratio in %				Outdoor heat exchanger		Indoor heat exchanger			
					Inlet dry (wet) bulb temperature °C		Fixed outlet °C	Variable outlet <sup>d</sup> °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)	<sup>a</sup> / 55	<sup>a</sup> / 52	n/a	<sup>a</sup> / 44
B	$\frac{(+2 - 16)}{(T_{\text{designh}} - 16)}$	54	100	37	2(1)	20(12)	<sup>a</sup> / 55	<sup>a</sup> / 42	<sup>a</sup> / 55	<sup>a</sup> / 37
C	$\frac{(+7 - 16)}{(T_{\text{designh}} - 16)}$	35	64	24	7(6)	20(12)	<sup>a</sup> / 55	<sup>a</sup> / 36	<sup>a</sup> / 46	<sup>a</sup> / 32
D	$\frac{(+12 - 16)}{(T_{\text{designh}} - 16)}$	15	29	11	12(11)	20(12)	<sup>a</sup> / 55	<sup>a</sup> / 30	<sup>a</sup> / 34	<sup>a</sup> / 28
E	$(TOL - 16) / (T_{\text{designh}} - 16)$				TOL	20(12)	<sup>a</sup> / 55	<sup>a</sup> / <sup>b</sup>	<sup>a</sup> / <sup>b</sup>	<sup>a</sup> / <sup>b</sup>
F	$(T_{\text{bivalent}} - 16) / (T_{\text{designh}} - 16)$				T <sub>bivalent</sub>	20(12)	<sup>a</sup> / 55	<sup>a</sup> / <sup>c</sup>	<sup>a</sup> / <sup>c</sup>	<sup>a</sup> / <sup>c</sup>
G	$\frac{(-15 - 16)}{(T_{\text{designh}} - 16)}$	n/a	n/a	82	-15	20(12)	<sup>a</sup> / 55	n/a	n/a	<sup>a</sup> / 49

<sup>a</sup> 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.

<sup>b</sup> Variable outlet shall be calculated by interpolation T<sub>designh</sub> and the temperature which is closest to the TOL.

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

<sup>d</sup> If the variable outlet temperature is below the minimum of the operation range of the unit, this minimum should be considered.

## Additional information

Climate	T <sub>designh</sub> [°C]	T <sub>bivalent</sub> [°C]	TOL [°C]	Outlet temperature	Flow rate
Average	-10	-10	-10	Variable	Variable



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

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

K) Keymark

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

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

K) Keymark

### Test conditions for standard rating tests at heating mode - EN14511

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

K) Keymark



### Test conditions for full load test at heating mode - EN14511

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

E) EHPA, V) VDI, N) NFPAC

### Test conditions for part load test at heating mode - EN14511

N <sup>#</sup>	Heat source		Heat sink		Test mode no./Comp. frequency
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 <sup>V</sup>	7	6	30	35	34 Hz
2 <sup>V</sup>	2	1	30	35	25 Hz
3 <sup>V</sup>	-7	-8	30	35	29 Hz

V) VDI





### Test conditions for operating requirements - EN14511-4: 2013

N#	Heat source		Heat sink	Water flow rate at indoor heat exchanger (l/h)	Test
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Outlet temperature (°C)		
1	35	-	55	813	Starting
2	-20	-	25	460	Starting

### Test conditions for operating requirements - EN14511-4: 2018

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

### Test conditions for shutting off the heat transfer medium - EN14511-4

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



### Test conditions for complete power supply failure - EN14511-4

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

### Test conditions for Domestic hot water test - EN16147

N#	Test climate	Heat source		Domestic hot water Tapping profile	Set point tank temp./ Re-heat temp. (°C)
		Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)		
1	Average	7	6	L	52/-10

### Test conditions for sound power level - EN12102-1

N#	Test condition		Heat pump setting			
	Outdoor heat exchanger (dry/wet bulb) (°C)	Indoor heat exchanger (inlet/outlet) (°C)	Compressor speed (Hz)	Fan speed outdoor (rpm)	Heating capacity (kW)	Power input (kW)
1 <sup>F</sup>	7/6	47/55	37-38	540-550	5.2	1.64
2 <sup>Q</sup>	7/6	47/55	28-29	220-230	3.4	1.22
3 <sup>E</sup>	7/6	47/55	25-26	480-490	3.15	1.2

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



## Test results

### SCOP main test results of low temperature - heating season average – EN14825

<b>Model (Outdoor)</b>	WH-MDC05J3E5
<b>Air-to-water heat pump mono bloc</b>	Y
<b>Low-temperature heat pump</b>	N
<b>Equipped with supplementary heater</b>	N
<b>Heat pump combination heater</b>	Y

<b>Rated heat output<sup>1)</sup></b>	$P_{rated}$	<b>5 [kW]</b>
<b>Seasonal space heating energy efficiency</b>	$\eta_s$	<b>203.0 [%]</b>
	SCOP	<b>5.15 [-]</b>

<b>Measured capacity for heating for part load at outdoor temperature <math>T_j</math></b>	Average Climate	$T_j = -15\text{ °C}$	$P_{dh}$	- [kW]
	-	$T_j = -7\text{ °C}$	$P_{dh}$	4.61 [kW]
	Low temperature application	$T_j = 2\text{ °C}$	$P_{dh}$	2.69 [kW]
		$T_j = 7\text{ °C}$	$P_{dh}$	3.18 [kW]
		$T_j = 12\text{ °C}$	$P_{dh}$	3.55 [kW]
		$T_j = \text{bivalent temperature}$	$P_{dh}$	5.25 [kW]
		$T_j = \text{operation limit}$	$P_{dh}$	5.25 [kW]

<b>Measured coefficient of performance at outdoor temperature <math>T_j</math></b>	Average Climate	$T_j = -15\text{ °C}$	COPd	- [-]
	-	$T_j = -7\text{ °C}$	COPd	3.42 [-]
	Low temperature application	$T_j = 2\text{ °C}$	COPd	5.06 [-]
		$T_j = 7\text{ °C}$	COPd	6.76 [-]
		$T_j = 12\text{ °C}$	COPd	8.65 [-]
		$T_j = \text{bivalent temperature}$	COPd	3.04 [-]
		$T_j = \text{operation limit}$	COPd	3.04 [-]

<b>Bivalent temperature</b>	$T_{bivalent}$	-10 [°C]
<b>Operation limit temperatures</b>	TOL	-10 [°C]
	WTOL	- [°C]
<b>Degradation coefficient</b>	$C_{dh}$	0.98 [-]

<b>Power consumption in modes other than active mode</b>	Off mode	$P_{OFF}$	0.008 [kW]
	Thermostat-off mode	$P_{TO}$	0.009 [kW]
	Standby mode	$P_{SB}$	0.008 [kW]
	Crankcase heater mode	$P_{CK}$	0.008 [kW]
<b>Supplementary heater<sup>1)</sup></b>	Rated heat output	$P_{SUP}$	0.00 [kW]
	Type of energy input		Electrical

<b>Other items</b>	Capacity control		Variable
	Water flow control		Variable
	Water flow rate		-
	Annual energy consumption	$Q_{HE}$	2005 [kWh]

<sup>1)</sup>For heat pump space heaters and heat pump combination heaters, the rated heat output,  $P_{rated}$ , is equal to the design load for heating,  $P_{design,h}$ , and the rated heat output of a supplementary heater,  $P_{sup}$ , is equal to the supplementary capacity for heating,  $sup(T_j)$ .



## SCOP main test results of medium temperature - heating season average – EN14825

<b>Model (Outdoor)</b>	WH-MDC05J3E5
<b>Air-to-water heat pump mono bloc</b>	Y
<b>Low-temperature heat pump</b>	N
<b>Equipped with supplementary heater</b>	N
<b>Heat pump combination heater</b>	Y

<b>Rated heat output<sup>1)</sup></b>	P <sub>rated</sub>	<b>5 [kW]</b>
<b>Seasonal space heating energy efficiency</b>	$\eta_s$	<b>143.4 [%]</b>
	SCOP	<b>3.66 [-]</b>

<b>Measured capacity for heating for part load at outdoor temperature T<sub>j</sub></b>	Average Climate - Medium temperature application	T <sub>j</sub> = -15 °C	P <sub>dH</sub>	- [kW]
		T <sub>j</sub> = -7 °C	P <sub>dH</sub>	4.54 [kW]
		T <sub>j</sub> = 2 °C	P <sub>dH</sub>	2.80 [kW]
		T <sub>j</sub> = 7 °C	P <sub>dH</sub>	2.97 [kW]
		T <sub>j</sub> = 12 °C	P <sub>dH</sub>	3.40 [kW]
		T <sub>j</sub> = bivalent temperature	P <sub>dH</sub>	4.93 [kW]
		T <sub>j</sub> = operation limit	P <sub>dH</sub>	4.93 [kW]

<b>Measured coefficient of performance at outdoor temperature T<sub>j</sub></b>	Average Climate - Medium temperature application	T <sub>j</sub> = -15 °C	COP <sub>d</sub>	- [-]
		T <sub>j</sub> = -7 °C	COP <sub>d</sub>	2.27 [-]
		T <sub>j</sub> = 2 °C	COP <sub>d</sub>	3.61 [-]
		T <sub>j</sub> = 7 °C	COP <sub>d</sub>	4.85 [-]
		T <sub>j</sub> = 12 °C	COP <sub>d</sub>	6.39 [-]
		T <sub>j</sub> = bivalent temperature	COP <sub>d</sub>	1.94 [-]
		T <sub>j</sub> = operation limit	COP <sub>d</sub>	1.94 [-]

<b>Bivalent temperature</b>	T <sub>bivalent</sub>	-10 [°C]
<b>Operation limit temperatures</b>	TOL	-10 [°C]
	WTOL	- [°C]
<b>Degradation coefficient</b>	C <sub>dH</sub>	0.98 [-]

<b>Power consumption in modes other than active mode</b>	Off mode	P <sub>OFF</sub>	0.008 [kW]
	Thermostat-off mode	P <sub>TO</sub>	0.009 [kW]
	Standby mode	P <sub>SB</sub>	0.008 [kW]
	Crankcase heater mode	P <sub>CK</sub>	0.008 [kW]
<b>Supplementary heater<sup>1)</sup></b>	Rated heat output	P <sub>SUP</sub>	0.00 [kW]
	Type of energy input		Electrical

<b>Other items</b>	Capacity control		Variable
	Water flow control		Variable
	Water flow rate		-
	Annual energy consumption	Q <sub>HE</sub>	2822 [kWh]

<sup>1)</sup>For heat pump space heaters and heat pump combination heaters, the rated heat output, P<sub>rated</sub>, is equal to the design load for heating, P<sub>designh</sub>, and the rated heat output of a supplementary heater, P<sub>sup</sub>, is equal to the supplementary capacity for heating, sup(T<sub>j</sub>).



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

N <sup>#</sup>	Test conditions	Cooling capacity [kW]	EER
A <sup>K</sup>	A35/W7	5.39	3.59
C <sup>K</sup>	A25/W10	3.02	6.97

K) Keymark

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

N <sup>#</sup>	Test conditions	Cooling capacity [kW]	EER
A <sup>K</sup>	A35/W18	7.03	4.67
C <sup>K</sup>	A25/W18	3.5	7.80

K) Keymark

### Test results of standard rating test for heating mode - EN14511

N <sup>#</sup>	Test conditions	Heating capacity [kW]	COP
1 <sup>K</sup>	A7/W35	5.28	5.57
2 <sup>K</sup>	A7/W55	5.22	3.18

K) Keymark





### Test results of full load test for heating mode - EN14511

N#	Test conditions	Heating capacity [kW]	COP
1 <sup>E</sup>	A2/W35	4.71	3.58
2 <sup>V</sup>	A-7/W35	5.88	3.33
3 <sup>N</sup>	A-7/W55	4.93	2.06

E) EHPA, V) VDI, N) NFPAC

### Test results of part load test for heating mode - EN14511

N#	Test conditions	Heating capacity [kW]	COP
1 <sup>V</sup>	A7/W35	5.02	5.30
2 <sup>V</sup>	A2/W35	3.25	4.37
3 <sup>V</sup>	A-7/W35	2.73	2.92

V) VDI

### Test results of operating requirements - EN14511-4:2013

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



### Test results of operating requirements - EN14511-4: 2018

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

### Test results of shutting off the heat transfer medium - EN14511-4

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

### Test results of complete power supply failure - EN14511-4

N#	Test conditions	Test validation
1	A7/W35	Passed



### Test Results of domestic hot water test - EN16147

No		Symbol	Result	Unit
1)	Load profile	-	L	-
2)	Settings of the control	-	52	-
3)	Heating up time	$t_h$	5480	[s]
4)	Heating up electrical energy consumption	$W_{eh-HP}$	2.98	[kWh]
5)	Stand-by power input	$P_{es}$	0.04	[kW]
6)	Total useful energy content during the load profile	$Q_{LP}$	12.06	[kWh]
7)	Total electrical energy consumption during load profile	$W_{EL-LP}$	4.07	[kWh]
8)	Daily electrical energy consumption	$Q_{elec}$	3.94	[kWh]
9)	Coefficient of Performance	$COP_{DHW}$	2.96	[-]
10)	Water heating energy consumption	$\eta_{wh}$	125.1%	[%]
11)	Annual electrical energy consumption	AEC	819	[kWh/a]
12)	Reference hot water temperature	$\theta'_{WH}$	53.3	[°C]
13)	Maximum volume of mixed water at 40°C	$V_{40}$	268	[L]
19)	Rated heat output	$P_{rated}$	-	[kW]
20)	Seasonal coefficient of performance	$SCOP_{DHW}$	-	[-]



### Test results of sound power test - EN12102

N#	Sound power level LW(A) [dB re 1pW]	Uncertainty (dB) (weighted value)
1 <sup>F</sup>	60	0.5
2 <sup>Q</sup>	56	0.5
3 <sup>E</sup>	57	0.5

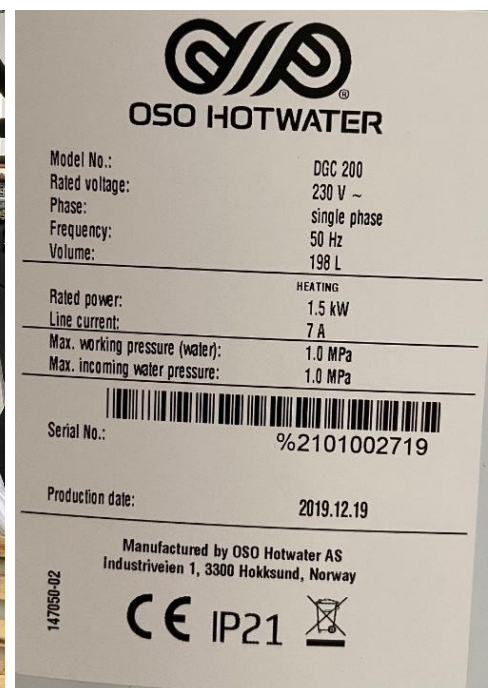
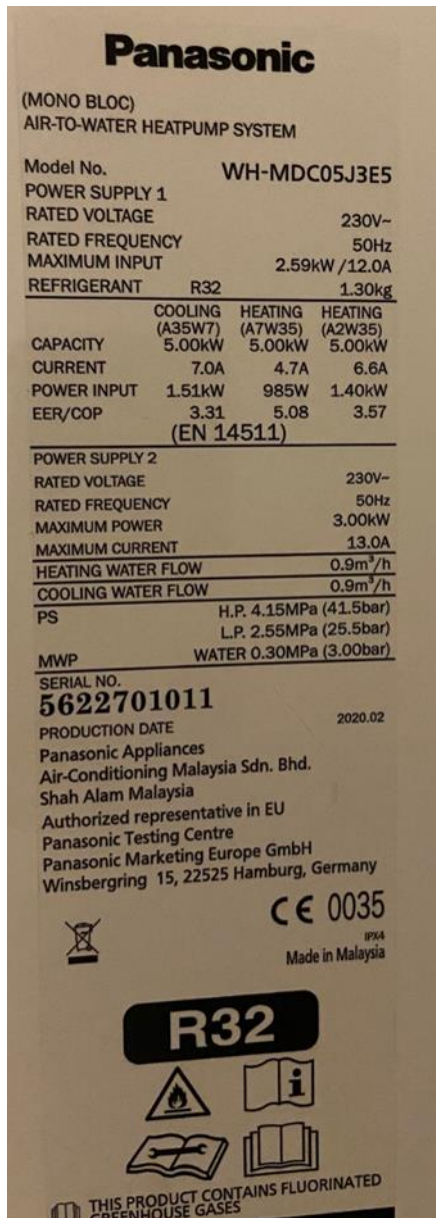
F) Full load, Q) Quiet mode 3, E) ERP labelling

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

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



Photo







## SCOP - detailed calculation

### Detailed SCOP calculation of low temperature and average climate conditions – EN14825

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	4.42	4.54	2.27	1.00	1.00	2.27
B	2	54	2.69	2.80	3.61	0.99	1.00	3.61
C	7	35	1.73	2.97	4.85	0.99	0.58	4.80
D	12	15	0.77	3.40	6.39	0.98	0.23	6.04
E	-10	100	5.00	4.93	1.94	1.00	1.00	1.94
F - BIV	-10	100	5.00	4.54	2.27	1.00	1.00	2.27

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	0.009	0.009	1.602
Standby	0	0.008	0.008	0
Crankcase heater	3850	0.008	0	0



Calculation Bin for SCOPon

	Bin	Outdoor temperature	Hours	Heat load	Heat load covered by heat pump	Electrical back up heater	Annual backup heater energy input	COPbin	Annual heating demand	Annual energy input	Net annual heating capacity	Net annual power input
	[-]	[°C]	[h]	[kW]	[kW]	[kW]	[kWh]	[-]	[kWh]	[kWh]	[kWh]	[kWh]
<b>E / F - BIV</b>	21	-10	1	5.00	5.00	0.00	0.00	3.04	5.00	1.64	5.00	1.64
	22	-9	25	4.81	4.81	0.00	0.00	3.17	120.19	37.96	120.19	37.96
	23	-8	23	4.62	4.62	0.00	0.00	3.29	106.15	32.23	106.15	32.23
<b>A</b>	24	-7	24	4.42	4.42	0.00	0.00	3.42	106.15	31.04	106.15	31.04
	25	-6	27	4.23	4.23	0.00	0.00	3.60	114.23	31.71	114.23	31.71
	26	-5	68	4.04	4.04	0.00	0.00	3.78	274.62	72.56	274.62	72.56
	27	-4	91	3.85	3.85	0.00	0.00	3.97	350.00	88.24	350.00	88.24
	28	-3	89	3.65	3.65	0.00	0.00	4.15	325.19	78.38	325.19	78.38
	29	-2	165	3.46	3.46	0.00	0.00	4.33	571.15	131.87	571.15	131.87
	30	-1	173	3.27	3.27	0.00	0.00	4.51	565.58	125.31	565.58	125.31
	31	0	240	3.08	3.08	0.00	0.00	4.70	738.46	157.27	738.46	157.27
	32	1	280	2.88	2.88	0.00	0.00	4.88	807.69	165.59	807.69	165.59
<b>B</b>	33	2	320	2.69	2.69	0.00	0.00	5.06	861.54	170.26	861.54	170.26
	34	3	357	2.50	2.50	0.00	0.00	5.38	892.50	165.93	892.50	165.93
	35	4	356	2.31	2.31	0.00	0.00	5.70	821.54	144.20	821.54	144.20
	36	5	303	2.12	2.11	0.00	0.00	6.02	640.96	106.54	640.96	106.54
	37	6	330	1.92	1.92	0.00	0.00	6.33	634.62	100.18	634.62	100.18
<b>C</b>	38	7	326	1.73	1.73	0.00	0.00	6.65	564.23	84.80	564.23	84.80
	39	8	348	1.54	1.54	0.00	0.00	6.93	535.38	77.30	535.38	77.30
	40	9	335	1.35	1.35	0.00	0.00	7.20	450.96	62.65	450.96	62.65
	41	10	315	1.15	1.15	0.00	0.00	7.47	363.46	48.66	363.46	48.66
	42	11	215	0.96	0.96	0.00	0.00	7.74	206.73	26.70	206.73	26.70
<b>D</b>	43	12	169	0.77	0.77	0.00	0.00	8.01	130.00	16.22	130.00	16.22
	44	13	151	0.58	0.58	0.00	0.00	8.29	87.12	10.51	87.12	10.51
	45	14	105	0.38	0.38	0.00	0.00	8.56	40.38	4.72	40.38	4.72
	46	15	74	0.19	0.19	0.00	0.00	8.83	14.23	1.61	14.23	1.61

<b>SUM</b>	10328.08	1974.10	10328.08	1974.10
<b>SCOPon</b>		5.23	<b>SCOPnet</b>	5.23



## Detailed SCOP calculation of medium temperature and average climate conditions – EN14825

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	4.42	4.54	2.27	1.00	1.00	2.27
B	2	54	2.69	2.80	3.61	0.99	1.00	3.61
C	7	35	1.73	2.97	4.85	0.99	0.58	4.80
D	12	15	0.77	3.40	6.39	0.98	0.23	6.04
E	-10	100	5.00	4.93	1.94	1.00	1.00	1.94
F - BIV	-10	100	5.00	4.93	1.94	1.00	1.00	1.94

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	0.009	0.009	1.602
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]
<b>E / F - BIV</b>	21	-10	1	5.00	4.93	0.00	0.00	1.94	5.00	2.58	5.00	2.58
	22	-9	25	4.81	4.76	0.00	0.00	2.05	120.19	58.63	120.19	58.63
	23	-8	23	4.62	4.59	0.00	0.00	2.16	106.15	49.15	106.15	49.15
<b>A</b>	24	-7	24	4.42	4.42	0.00	0.00	2.27	106.15	46.76	106.15	46.76
	25	-6	27	4.23	4.23	0.00	0.00	2.42	114.23	47.22	114.23	47.22
	26	-5	68	4.04	4.04	0.00	0.00	2.57	274.62	106.95	274.62	106.95
	27	-4	91	3.85	3.85	0.00	0.00	2.72	350.00	128.83	350.00	128.83
	28	-3	89	3.65	3.65	0.00	0.00	2.87	325.19	113.48	325.19	113.48
	29	-2	165	3.46	3.46	0.00	0.00	3.01	571.15	189.47	571.15	189.47
	30	-1	173	3.27	3.27	0.00	0.00	3.16	565.58	178.79	565.58	178.79
	31	0	240	3.08	3.08	0.00	0.00	3.31	738.46	222.95	738.46	222.95
	32	1	280	2.88	2.88	0.00	0.00	3.46	807.69	233.36	807.69	233.36
<b>B</b>	33	2	320	2.69	2.69	0.00	0.00	3.61	861.54	238.65	861.54	238.65
	34	3	357	2.50	2.50	0.00	0.00	3.85	892.50	231.94	892.50	231.94
	35	4	356	2.31	2.31	0.00	0.00	4.09	821.54	201.07	821.54	201.07
	36	5	303	2.12	2.12	0.00	0.00	4.32	640.96	148.24	640.96	148.24
	37	6	330	1.92	1.92	0.00	0.00	4.56	634.62	139.12	634.62	139.12
<b>C</b>	38	7	326	1.73	1.73	0.00	0.00	4.80	564.23	117.56	564.23	117.56
	39	8	348	1.54	1.54	0.00	0.00	5.05	535.38	106.06	535.38	106.06
	40	9	335	1.35	1.35	0.00	0.00	5.30	450.96	85.15	450.96	85.15
	41	10	315	1.15	1.15	0.00	0.00	5.54	363.46	65.56	363.46	65.56
	42	11	215	0.96	0.96	0.00	0.00	5.79	206.73	35.69	206.73	35.69
<b>D</b>	43	12	169	0.77	0.77	0.00	0.00	6.04	130.00	21.52	130.00	21.52
	44	13	151	0.58	0.58	0.00	0.00	6.29	87.12	13.85	87.12	13.85
	45	14	105	0.38	0.38	0.00	0.00	6.54	40.38	6.18	40.38	6.18
	46	15	74	0.19	0.19	0.00	0.00	6.79	14.23	2.10	14.23	2.10

<b>SUM</b>	10328.08	2790.89	10328.08	2790.89
<b>SCOPon</b>		3.70	<b>SCOPnet</b>	3.70



## Detailed test results

### Detailed SCOP test results - Low temperature application –EN14825

<b>Detailed result for 'EN14825:2016' Average Low (A) A-7/W34</b>		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Low
Condition name:		A
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	4.42
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>4.61</b>
COP	-	<b>3.42</b>
Power consumption	kW	<b>1.35</b>
<b>Measured</b>		
Heating capacity	kW	4.64
COP	-	3.34
Power consumption	kW	1.39
<b>During heating</b>		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-8.1
Inlet temperature	°C	29.0
Outlet temperature	°C	34.0
Outlet temperature (Time averaged)	°C	<b>34.0</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	41700
Calculated Hydraulic power	W	9
Calculated global efficiency	η	0.22
Calculated Capacity correction	W	32
Calculated Power correction	W	42
Water Flow	m <sup>3</sup> /s	0.000224





<b>Detailed result for 'EN14825:2016' Average Low (B) A2/W30</b>		
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	5.00
Heating demand:	kW	2.69
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>2.69</b>
COP	-	<b>5.06</b>
Power consumption	kW	<b>0.53</b>
<b>Measured</b>		
Heating capacity	kW	2.72
COP	-	4.83
Power consumption	kW	0.56
<b>During heating</b>		
Air temperature dry bulb	°C	2.0
Air temperature wet bulb	°C	1.0
Inlet temperature	°C	25.1
Outlet temperature	°C	30.2
Outlet temperature (Time averaged)	°C	<b>30.2</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	42437
Calculated Hydraulic power	W	5
Calculated global efficiency	η	0.18
Calculated Capacity correction	W	25
Calculated Power correction	W	30
Water Flow	m <sup>3</sup> /s	0.000127



<b>Detailed result for 'EN14825:2016' Average Medium (C) A7/W27</b>		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	1.73
CR:	-	0.5
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>3.18</b>
COP	-	<b>6.76</b>
Power consumption	kW	<b>0.47</b>
<b>Measured</b>		
Heating capacity	kW	3.21
COP	-	6.37
Power consumption	kW	0.50
<b>During heating</b>		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.1
Inlet temperature	°C	24.3
Outlet temperature	°C	29.3
Outlet temperature (Time averaged)	°C	<b>27.0</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	41700
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	27
Calculated Power correction	W	33
Water Flow	m <sup>3</sup> /s	0.000154



<b>Detailed result for 'EN14825:2016' Average Low (D) A12/W24</b>		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Low
Condition name:		D
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	0.77
CR:	-	0.2
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>3.55</b>
COP	-	<b>8.65</b>
Power consumption	kW	<b>0.41</b>
<b>Measured</b>		
Heating capacity	kW	3.58
COP	-	8.02
Power consumption	kW	0.45
<b>During heating</b>		
Air temperature dry bulb	°C	12.0
Air temperature wet bulb	°C	11.0
Inlet temperature	°C	22.9
Outlet temperature	°C	27.9
Outlet temperature (Time averaged)	°C	<b>24.0</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	41934
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	29
Calculated Power correction	W	36
Water Flow	m <sup>3</sup> /s	0.000173



<b>Detailed result for 'EN14825:2016' Average Medium (E and F) A-10/W35</b>		
Tested according to:	EN14511:2018	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	5.00
Heating demand:	kW	5.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>5.25</b>
COP	-	<b>3.04</b>
Power consumption	kW	<b>1.73</b>
<b>Measured</b>		
Heating capacity	kW	5.28
COP	-	2.98
Power consumption	kW	1.77
<b>During heating</b>		
Air temperature dry bulb	°C	-10.1
Air temperature wet bulb	°C	-11.0
Inlet temperature	°C	30.0
Outlet temperature	°C	35.0
Outlet temperature (Time averaged)	°C	<b>35.0</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	41700
Calculated Hydraulic power	W	11
Calculated global efficiency	η	0.24
Calculated Capacity correction	W	34
Calculated Power correction	W	45
Water Flow	m <sup>3</sup> /s	0.000256



## Detailed SCOP test results - Medium temperature application – EN14825

<b>Detailed result for 'EN14825:2016' Average Medium (A) A-7/W52</b>		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		A
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	4.42
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>4.54</b>
COP	-	<b>2.27</b>
Power consumption	kW	<b>2.00</b>
<b>Measured</b>		
Heating capacity	kW	4.56
COP	-	2.25
Power consumption	kW	2.03
<b>During heating</b>		
Air temperature dry bulb	°C	-6.8
Air temperature wet bulb	°C	-8.0
Inlet temperature	°C	44.0
Outlet temperature	°C	52.2
Outlet temperature (Time averaged)	°C	<b>52.2</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	41700
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.18
Calculated Capacity correction	W	25
Calculated Power correction	W	31
Water Flow	m <sup>3</sup> /s	0.000135



<b>Detailed result for 'EN14825:2016' Average Medium (B) A2/W42</b>		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		B
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	2.69
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>2.80</b>
COP	-	<b>3.61</b>
Power consumption	kW	<b>0.78</b>
<b>Measured</b>		
Heating capacity	kW	2.83
COP	-	3.50
Power consumption	kW	0.81
<b>During heating</b>		
Air temperature dry bulb	°C	2.0
Air temperature wet bulb	°C	1.0
Inlet temperature	°C	36.7
Outlet temperature	°C	42.1
Outlet temperature (Time averaged)	°C	<b>42.1</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	41700
Calculated Hydraulic power	W	5
Calculated global efficiency	η	0.18
Calculated Capacity correction	W	24
Calculated Power correction	W	30
Water Flow	m <sup>3</sup> /s	0.000128



<b>Detailed result for 'EN14825:2016' Average Medium (C) A7/W36</b>		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	1.73
CR:	-	0.6
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>2.97</b>
COP	-	<b>4.85</b>
Power consumption	kW	<b>0.61</b>
<b>Measured</b>		
Heating capacity	kW	3.00
COP	-	4.67
Power consumption	kW	0.64
<b>During heating</b>		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.0
Inlet temperature	°C	32.6
Outlet temperature	°C	38.3
Outlet temperature (Time averaged)	°C	<b>35.9</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	41700
Calculated Hydraulic power	W	5
Calculated global efficiency	η	0.18
Calculated Capacity correction	W	24
Calculated Power correction	W	30
Water Flow	m <sup>3</sup> /s	0.000128





<b>Detailed result for 'EN14825:2016' Average Medium (D) A12/W30</b>		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		D
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	5.00
Heating demand:	kW	0.77
CR:	-	0.2
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>3.40</b>
COP	-	<b>6.39</b>
Power consumption	kW	<b>0.53</b>
<b>Measured</b>		
Heating capacity	kW	3.42
COP	-	6.08
Power consumption	kW	0.56
<b>During heating</b>		
Air temperature dry bulb	°C	12.0
Air temperature wet bulb	°C	11.0
Inlet temperature	°C	28.5
Outlet temperature	°C	35.0
Outlet temperature (Time averaged)	°C	<b>30.0</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	46099
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	26
Calculated Power correction	W	32
Water Flow	m <sup>3</sup> /s	0.000127



<b>Detailed result for 'EN14825:2016' Average Medium (E and F) A-10/W55</b>		
Tested according to:	EN14511:2018 and 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	5.00
Heating demand:	kW	5.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>4.93</b>
COP	-	<b>1.94</b>
Power consumption	kW	<b>2.54</b>
<b>Measured</b>		
Heating capacity	kW	4.96
COP	-	1.93
Power consumption	kW	2.57
<b>During heating</b>		
Air temperature dry bulb	°C	-10.0
Air temperature wet bulb	°C	-11.0
Inlet temperature	°C	47.0
Outlet temperature	°C	54.8
Outlet temperature (Time averaged)	°C	<b>54.8</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	42019
Calculated Hydraulic power	W	6
Calculated global efficiency	$\eta$	0.19
Calculated Capacity correction	W	27
Calculated Power correction	W	34
Water Flow	m <sup>3</sup> /s	0.000154



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

<b>Detailed result for 'EN14825:2016' (A) A35/W7</b>		
Tested according to:	EN14511:2018	EN14825:2016
Climate zone:		N/A
Temperature application:		Fan coil
Condition name:		A
Condition temperature:	°C	35
Part load:	%	100%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	6.98
Heating demand:	kW	6.98
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Cooling capacity	kW	<b>5.39</b>
EER	-	<b>3.59</b>
Power consumption	kW	<b>1.50</b>
<b>Measured</b>		
Cooling capacity	kW	5.36
EER	-	3.47
Power consumption	kW	1.54
<b>During cooling</b>		
Air temperature dry bulb	°C	35.2
Air temperature wet bulb	°C	-
Inlet temperature	°C	12.0
Outlet temperature	°C	7.0
Outlet temperature (Time averaged)	°C	<b>7.0</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	38244
Calculated Hydraulic power	W	10
Calculated global efficiency	η	0.23
Calculated Capacity correction	W	33
Calculated Power correction	W	43
Water Flow	m <sup>3</sup> /s	0.000255



<b>Detailed result for 'EN14825:2016' (C) A25/W10</b>		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		N/A
Temperature application:		Fan coil
Condition name:		C
Condition temperature:	°C	35
Part load:	%	47%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	7.03
Heating demand:	kW	3.30
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Cooling capacity	kW	<b>3.20</b>
EER	-	<b>6.97</b>
Power consumption	kW	<b>0.46</b>
<b>Measured</b>		
Cooling capacity	kW	3.17
EER	-	6.43
Power consumption	kW	0.49
<b>During cooling</b>		
Air temperature dry bulb	°C	25.0
Air temperature wet bulb	°C	-
Inlet temperature	°C	15.0
Outlet temperature	°C	10.0
Outlet temperature (Time averaged)	°C	<b>10.0</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	44387
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	28
Calculated Power correction	W	34
Water Flow	m <sup>3</sup> /s	0.000152



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

Detailed result for 'EN14825:2016' (C) A35/W18		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:	N/A	
Temperature application:	Cooling floor	
Condition name:	C	
Condition temperature:	°C	35
Part load:	%	100%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	6.98
Heating demand:	kW	6.98
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Cooling capacity	kW	7.03
EER	-	4.67
Power consumption	kW	1.51
Measured		
Cooling capacity	kW	6.99
EER	-	4.50
Power consumption	kW	1.55
During cooling		
Air temperature dry bulb	°C	34.9
Air temperature wet bulb	°C	-
Inlet temperature	°C	23.0
Outlet temperature	°C	17.8
Outlet temperature (Time averaged)	°C	17.8
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	34696
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	0.000322



<b>Detailed result for 'EN14825:2016' (C) A25/W18</b>		
Tested according to:	EN14511:2018 and	EN14825:2016
Climate zone:		N/A
Temperature application:		Cooling floor
Condition name:		C
Condition temperature:	°C	35
Part load:	%	47%
Chosen Tbivalent	°C	N/A
Tdesign	°C	35
Pdesign	kW	7.03
Heating demand:	kW	3.30
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Cooling capacity	kW	<b>3.50</b>
EER	-	<b>7.80</b>
Power consumption	kW	<b>0.45</b>
<b>Measured</b>		
Cooling capacity	kW	3.47
EER	-	7.14
Power consumption	kW	0.49
<b>During cooling</b>		
Air temperature dry bulb	°C	25.0
Air temperature wet bulb	°C	-
Inlet temperature	°C	22.8
Outlet temperature	°C	17.9
Outlet temperature (Time averaged)	°C	<b>17.9</b>
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	45005
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.21
Calculated Capacity correction	W	29
Calculated Power correction	W	37
Water Flow	m <sup>3</sup> /s	0.000170



## Detailed test results of standard rating conditions - EN14511

<b>Detailed result for 'EN14511:2018' A7/W35</b>			
Tested according to:		EN14511:2018	
Minimum flow reached:		No	
Measurement type:		Steady State	
Integrated circulation pump:		Yes	
<b>Included corrections (Final result)</b>			
Heating capacity	kW	<b>5.25</b>	
COP	-	<b>5.57</b>	
Power consumption	kW	<b>0.94</b>	
<b>Measured</b>			
Heating capacity	kW	5.28	
COP	-	5.37	
Power consumption	kW	0.98	
<b>During heating</b>			
Air temperature dry bulb	°C	7.1	
Air temperature wet bulb	°C	6.0	
Inlet temperature	°C	30.0	
Outlet temperature	°C	35.0	
<b>Circulation pump</b>			
Measured: Static differential pressure, liquid pump	Pa	36397	
Calculated Hydraulic power	W	9	
Calculated global efficiency	$\eta$	0.22	
Calculated Capacity correction	W	32	
Calculated Power correction	W	42	
Water Flow	m <sup>3</sup> /s	0.000254	





<b>Detailed result for 'EN14511:2018' A7/W55</b>		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>5.22</b>
COP	-	<b>3.18</b>
Power consumption	kW	<b>1.64</b>
<b>Measured</b>		
Heating capacity	kW	5.25
COP	-	3.13
Power consumption	kW	1.68
<b>During heating</b>		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	5.9
Inlet temperature	°C	46.8
Outlet temperature	°C	54.8
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	46441
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	29
Calculated Power correction	W	36
Water Flow	m <sup>3</sup> /s	0.000159



## Detailed test results of full load – EN14511

<b>Detailed result for 'EN14511:2018' A2/W35</b>			
Tested according to:		EN14511:2018	
Minimum flow reached:		No	
Measurement type:		Transient	
Integrated circulation pump:		Yes	
<b>Included corrections (Final result)</b>			
Heating capacity	kW	<b>4.71</b>	
COP	-	<b>3.58</b>	
Power consumption	kW	<b>1.31</b>	
<b>Measured</b>			
Heating capacity	kW	4.74	
COP	-	3.49	
Power consumption	kW	1.36	
<b>During heating</b>			
Air temperature dry bulb	°C	1.9	
Air temperature wet bulb	°C	1.0	
Inlet temperature	°C	30.1	
Outlet temperature	°C	34.9	
<b>Circulation pump</b>			
Measured: Static differential pressure, liquid pump	Pa	34424	
Calculated Hydraulic power	W	10	
Calculated global efficiency	$\eta$	0.23	
Calculated Capacity correction	W	34	
Calculated Power correction	W	45	
Water Flow	m <sup>3</sup> /s	0.000304	



<b>Detailed result for 'EN14511:2018' A-7/W35</b>			
Tested according to:		EN14511:2018	
Minimum flow reached:		No	
Measurement type:		Steady State	
Integrated circulation pump:		Yes	
<b>Included corrections (Final result)</b>			
Heating capacity	kW	<b>5.88</b>	
COP	-	<b>3.33</b>	
Power consumption	kW	<b>1.77</b>	
<b>Measured</b>			
Heating capacity	kW	5.91	
COP	-	3.27	
Power consumption	kW	1.81	
<b>During heating</b>			
Air temperature dry bulb	°C	-7.0	
Air temperature wet bulb	°C	-8.2	
Inlet temperature	°C	30.0	
Outlet temperature	°C	35.0	
<b>Circulation pump</b>			
Measured: Static differential pressure, liquid pump	Pa	30560	
Calculated Hydraulic power	W	9	
Calculated global efficiency	η	0.22	
Calculated Capacity correction	W	31	
Calculated Power correction	W	40	
Water Flow	m <sup>3</sup> /s	0.000285	



<b>Detailed result for 'EN14511:2018' A-7/W55</b>		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>4.93</b>
COP	-	<b>2.06</b>
Power consumption	kW	<b>2.40</b>
<b>Measured</b>		
Heating capacity	kW	4.95
COP	-	2.04
Power consumption	kW	2.43
<b>During heating</b>		
Air temperature dry bulb	°C	-7.1
Air temperature wet bulb	°C	-8.0
Inlet temperature	°C	47.0
Outlet temperature	°C	55.3
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	42471
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	26
Calculated Power correction	W	32
Water Flow	m <sup>3</sup> /s	0.000144



## Detailed test results of part load – EN14511

<b>Detailed result for 'EN14511:2018' A7/W35 Part load</b>			
Tested according to:		EN14511:2018	
Minimum flow reached:		No	
Measurement type:		Steady State	
Integrated circulation pump:		Yes	
<b>Included corrections (Final result)</b>			
Heating capacity	kW	<b>5.02</b>	
COP	-	<b>5.30</b>	
Power consumption	kW	<b>0.95</b>	
<b>Measured</b>			
Heating capacity	kW	5.06	
COP	-	5.01	
Power consumption	kW	1.01	
<b>During heating</b>			
Air temperature dry bulb	°C	7.0	
Air temperature wet bulb	°C	6.0	
Inlet temperature	°C	29.9	
Outlet temperature	°C	34.8	
<b>Circulation pump</b>			
Measured: Static differential pressure, liquid pump	Pa	73249	
Calculated Hydraulic power	W	18	
Calculated global efficiency	$\eta$	0.29	
Calculated Capacity correction	W	44	
Calculated Power correction	W	62	
Water Flow	m <sup>3</sup> /s	0.000247	



<b>Detailed result for 'EN14511:2018' A2/W35</b>		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
<b>Included corrections (Final result)</b>		
Heating capacity	kW	<b>3.25</b>
COP	-	<b>4.37</b>
Power consumption	kW	<b>0.74</b>
<b>Measured</b>		
Heating capacity	kW	3.29
COP	-	4.14
Power consumption	kW	0.79
<b>During heating</b>		
Air temperature dry bulb	°C	2.1
Air temperature wet bulb	°C	0.9
Inlet temperature	°C	29.9
Outlet temperature	°C	34.9
<b>Circulation pump</b>		
Measured: Static differential pressure, liquid pump	Pa	78629
Calculated Hydraulic power	W	12
Calculated global efficiency	η	0.25
Calculated Capacity correction	W	37
Calculated Power correction	W	49
Water Flow	m <sup>3</sup> /s	0.000158






<b>Detailed result for 'EN14511:2018' A-7/W35</b>			
Tested according to:		EN14511:2018	
Minimum flow reached:		No	
Measurement type:		Steady State	
Integrated circulation pump:		Yes	
<b>Included corrections (Final result)</b>			
Heating capacity	kW	<b>2.73</b>	
COP	-	<b>2.92</b>	
Power consumption	kW	<b>0.94</b>	
<b>Measured</b>			
Heating capacity	kW	2.73	
COP	-	2.91	
Power consumption	kW	0.94	
<b>During heating</b>			
Air temperature dry bulb	°C	-7.0	
Air temperature wet bulb	°C	-8.0	
Inlet temperature	°C	29.9	
Outlet temperature	°C	34.9	
<b>Circulation pump</b>			
Measured: Static differential pressure, liquid pump	Pa	4129	
Calculated Hydraulic power	W	1	
Calculated global efficiency	η	0.12	
Calculated Capacity correction	W	4	
Calculated Power correction	W	5	
Water Flow	m <sup>3</sup> /s	0.000133	








## Detailed test results of sound power measurements – Test 1

 		<b>Sound power levels according to ISO 3743-1:2010</b>		 <b>TEKNOLOGISK INSTITUT</b>																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:	Panasonic Europe GmbH		Date of test: 29-05-2020																																																																				
Object:	Type: Mono Air to water heat pump Model: WH-MDC05J3E5																																																																						
Mounting conditions:	The unit is standing free on two pieces of heavy concrete tiles (90x90x8cm) laying on the floor. The unit is mounted on the supporting metal support frame using 6 vibration insulators.																																																																						
Operating conditions:	A7/W47-55, Test mode 1, Compressor speed: 37 - 38 [Hz], Heating capacity: 5.2 [kW], Power_input: 1.64 [kW], Water flow rate: 570 [l/h], Fan_speed : 540 - 550 [rpm], dp_water : 464																																																																						
Static pressure:	1031 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: 0.8 m																																																																				
Area, S, of test room:	138.9 m²	Volume: 0.3 m³																																																																					
<table border="1"> <thead> <tr> <th>Frequency f [Hz]</th> <th>L<sub>w</sub> 1/3 octave [dB]</th> <th>1/1 oct [dB]</th> </tr> </thead> <tbody> <tr><td>100</td><td>61.8</td><td></td></tr> <tr><td>125</td><td>55.1</td><td>63.1</td></tr> <tr><td>160</td><td>53.1</td><td></td></tr> <tr><td>200</td><td>51.3</td><td></td></tr> <tr><td>250</td><td>53.6</td><td>59.0</td></tr> <tr><td>315</td><td>56.4</td><td></td></tr> <tr><td>400</td><td>54.9</td><td></td></tr> <tr><td>500</td><td>54.7</td><td>59.1</td></tr> <tr><td>630</td><td>53.0</td><td></td></tr> <tr><td>800</td><td>50.8</td><td></td></tr> <tr><td>1000</td><td>48.8</td><td>54.5</td></tr> <tr><td>1250</td><td>49.2</td><td></td></tr> <tr><td>1600</td><td>43.2</td><td></td></tr> <tr><td>2000</td><td>40.8</td><td>46.0</td></tr> <tr><td>2500</td><td>38.5</td><td></td></tr> <tr><td>3150</td><td>37.6</td><td></td></tr> <tr><td>4000</td><td>37.8</td><td>43.2</td></tr> <tr><td>5000</td><td>39.7</td><td></td></tr> <tr><td>6300</td><td>35.2</td><td></td></tr> <tr><td>8000</td><td>33.2</td><td>38.1</td></tr> <tr><td>10000</td><td>30.3</td><td></td></tr> </tbody> </table>		Frequency f [Hz]	L <sub>w</sub> 1/3 octave [dB]	1/1 oct [dB]	100	61.8		125	55.1	63.1	160	53.1		200	51.3		250	53.6	59.0	315	56.4		400	54.9		500	54.7	59.1	630	53.0		800	50.8		1000	48.8	54.5	1250	49.2		1600	43.2		2000	40.8	46.0	2500	38.5		3150	37.6		4000	37.8	43.2	5000	39.7		6300	35.2		8000	33.2	38.1	10000	30.3					
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<sup>1</sup> Too high																																																																							
<div style="border: 1px solid black; padding: 5px;"> <b>Sound power level L<sub>w</sub>(A): 60 dB [re 1pW]</b> </div>																																																																							
Name of test institute:	DTI																																																																						
No. of test report:	300-KLAB-20-008																																																																						
Date: 29-05-2020																																																																							






## Detailed test results of sound power measurements – Test 2

 		<b>Sound power levels according to ISO 3743-1:2010</b>		 <b>TEKNOLOGISK INSTITUT</b>																																																																			
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																							
Client:		Panasonic Europe GmbH		Date of test: 02-06-2020																																																																			
Object:		Type: Mono Air to water heat pump Model: WH-MDC05J3E5																																																																					
Mounting conditions:		The unit is standing free on two pieces of heavy concrete tiles (90x90x8cm) laying on the floor. The unit is mounted on the supporting metal support frame using 6 vibration insulators.																																																																					
Operating conditions:		A7/W48.4-55, free mode, Quiet mode 3, Compressor speed: 28 - 29 [Hz], Heating capacity: 3.4 [kW], Power_input: 1.22 [kW], Water flow rate: 460 [l/h], Fan_speed : 220 - 230 [rpm], dp_water :																																																																					
Static pressure:		1031 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																																																																			
Area, S, of test room:		138.9 m²		L3: 0.8 m																																																																			
				Volume: 0.3 m³																																																																			
<table border="1"><thead><tr><th>Frequency f [Hz]</th><th>L<sub>w</sub> 1/3 octave [dB]</th><th>1/1 oct [dB]</th></tr></thead><tbody><tr><td>100</td><td>52.2</td><td></td></tr><tr><td>125</td><td>55.6</td><td>57.5</td></tr><tr><td>160</td><td>45.6</td><td></td></tr><tr><td>200</td><td>41.5</td><td></td></tr><tr><td>250</td><td>42.9</td><td>56.5</td></tr><tr><td>315</td><td>56.2</td><td></td></tr><tr><td>400</td><td>53.4</td><td></td></tr><tr><td>500</td><td>50.3</td><td>56.0</td></tr><tr><td>630</td><td>48.7</td><td></td></tr><tr><td>800</td><td>46.4</td><td></td></tr><tr><td>1000</td><td>48.4</td><td>51.2</td></tr><tr><td>1250</td><td>42.8</td><td></td></tr><tr><td>1600</td><td>35.7</td><td></td></tr><tr><td>2000</td><td>35.1</td><td>39.2</td></tr><tr><td>2500</td><td>31.1</td><td></td></tr><tr><td>3150</td><td>30.3</td><td></td></tr><tr><td>4000</td><td>32.2</td><td>37.7</td></tr><tr><td>5000</td><td>35.0</td><td></td></tr><tr><td>6300</td><td>30.8</td><td></td></tr><tr><td>8000</td><td>31.1</td><td>35.1</td></tr><tr><td>10000</td><td>28.6</td><td></td></tr></tbody></table>		Frequency f [Hz]	L <sub>w</sub> 1/3 octave [dB]	1/1 oct [dB]	100	52.2		125	55.6	57.5	160	45.6		200	41.5		250	42.9	56.5	315	56.2		400	53.4		500	50.3	56.0	630	48.7		800	46.4		1000	48.4	51.2	1250	42.8		1600	35.7		2000	35.1	39.2	2500	31.1		3150	30.3		4000	32.2	37.7	5000	35.0		6300	30.8		8000	31.1	35.1	10000	28.6					
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## Detailed test results of sound power measurements – Test 3

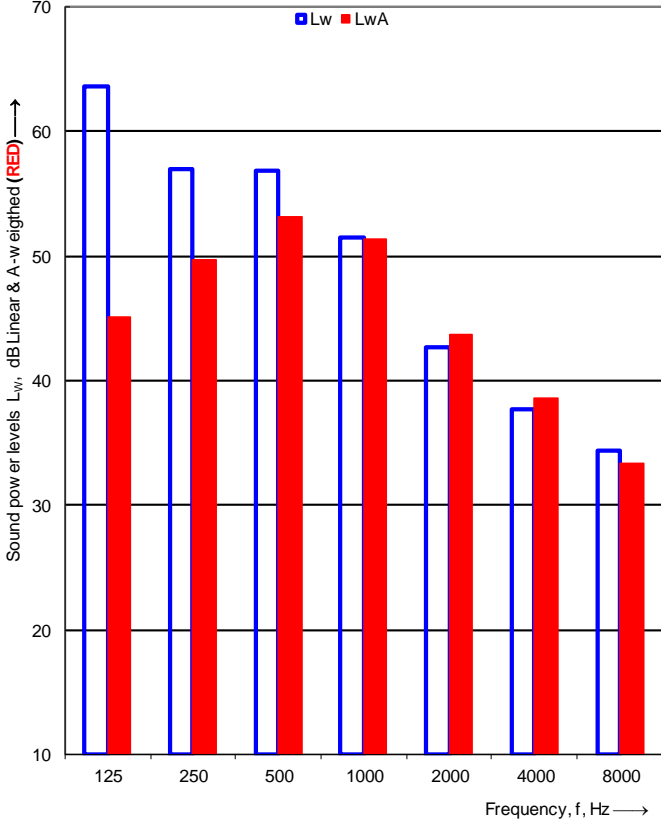
 		<b>Sound power levels according to ISO 3743-1:2010</b>		 <b>TEKNOLOGISK INSTITUT</b>	
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms					
Client:		Panasonic Europe GmbH		Date of test: 02-06-2020	
Object:		Type: Mono Air to water heat pump Model: WH-MDC05J3E5			
Mounting conditions:		The unit is standing free on two pieces of heavy concrete tiles (90x90x8cm) laying on the floor. The unit is mounted on the supporting metal support frame using 6 vibration insulators.			
Operating conditions:		A7/W49.1-55, free mode, Compressor speed: 25 - 26 [Hz], Heating capacity: 3.15 [kW], Power input: 1.2 [kW], Water flow rate: 460 [l/h], Fan speed: 480 - 490 [rpm], dp water: 140			
Static pressure:		1031 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: 0.8 m	
Area, S, of test room:		138.9 m²		Volume: 0.3 m³	
		Room: Room 2			

Frequency f [Hz]	L <sub>w</sub> 1/3 octave [dB]	L <sub>w</sub> 1/1 oct [dB]
100	63.3	
125	49.4	63.6
160	49.2	
200	48.7	
250	47.7	57.0
315	55.6	
400	54.1	
500	51.7	56.9
630	49.0	
800	46.6	
1000	48.1	51.4
1250	44.6	
1600	39.4	
2000	38.1	42.6
2500	34.9	
3150	33.0	
4000	32.7	37.6
5000	32.9	
6300	29.6	
8000	30.9	34.3
10000	27.6	

<sup>1</sup> Too high

Sound power level L <sub>w</sub> (A):	57 dB [re 1pW]
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Name of test institute:	DTI
No. of test report:	300-KLAB-20-008
Date:	02-06-2020



## Appendix 1: Test Procedure

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

- DS/EN 14511
- EN 12102
- DS/EN 3743/1

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

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

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

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

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