

TEST REPORT

Report no.:
300-KLAB-19-019 rev.1



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Page 1 of 34
Init: PRES/HSG
File no.: 877350
Enclosures: 0

Customer: Company: Panasonic Marketing Europe
Address: Hagenauer Strasse 43
City: 65203 Wiesbaden
Tel.: +49 1724 141441

Component: Brand: Panasonic
Type: Air to water heat pump
Model: WH-ADC0309J3E5 + WH-UD07JE5
Series no.: Outdoor: 5621401261 Indoor: 5704001319
Production year: 2019/2019

Dates: Component tested: September 2019

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

Remarks: This report has been revised due to a correction of Full load test at A-7/W35. The unit was delivered by the customer. The installation and test settings were done according to the manufacturer's instructions.

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Division/Centre: Danish Technological Institute
Energy and Climate
Heat Pump Laboratory, Aarhus

Date: 2019.11.20

Signature: Kamalathasan Arumugam
B.Sc. Engineer



Test Reg. nr. 300



Objective

The following tests were carried out:

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 3 & 4.

Standard rating condition (A7/W35) according to EN 14511:2018

Standard rating condition (A7/W55) according to EN 14511:2018

Part load test according to EN14511:2018 at A7/W35 and A2/W35

Full load test according to EN14511:2018 at A-7/W35

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

Safety tests according to EN 14511-4:2018:

- 4.5 Shutting of the heat transfer medium flow
- 4.2.1 Starting test and operating test

Sound power level of the outdoor unit according to EN 12102:2017 for average climate at the highest temperature application. The measurement of the sound power level is performed using the Class A method. ISO 3743-1 is the basic method of carrying out sound power measurements. The method is briefly described in appendix 1. For a more detailed description, please view the accreditation papers DANAK-300 (in Danish only).

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



Test conditions for low temperature application at reference heating season average

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

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

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

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

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

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

Additional information

Climate	T _{design}	T _{bivalent}	TOL	Outlet temperature	Flow rate
Average	-10	-10	-10	Variable	Variable



Test conditions for medium temperature application at reference heating season average

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

Condition	Part Load Ratio in %				Outdoor heat exchanger		Indoor heat exchanger			
					Inlet dry (wet) bulb temperature °C		Fixed outlet °C	Variable outlet ^d °C		
	Formula	A	W	C	Outdoor air	Exhaust air	All climates	A	W	C
A	$\frac{(-7 - 16)}{(T_{\text{designh}} - 16)}$	88	n/a	61	-7(-8)	20(12)	^a / 55	^a / 52	n/a	^a / 44
B	$\frac{(+2 - 16)}{(T_{\text{designh}} - 16)}$	54	100	37	2(1)	20(12)	^a / 55	^a / 42	^a / 55	^a / 37
C	$\frac{(+7 - 16)}{(T_{\text{designh}} - 16)}$	35	64	24	7(6)	20(12)	^a / 55	^a / 36	^a / 46	^a / 32
D	$\frac{(+12 - 16)}{(T_{\text{designh}} - 16)}$	15	29	11	12(11)	20(12)	^a / 55	^a / 30	^a / 34	^a / 28
E	$(TOL - 16) / (T_{\text{designh}} - 16)$				TOL	20(12)	^a / 55	^a / ^b	^a / ^b	^a / ^b
F	$(T_{\text{bivalent}} - 16) / (T_{\text{designh}} - 16)$				T _{bivalent}	20(12)	^a / 55	^a / ^c	^a / ^c	^a / ^c
G	$\frac{(-15 - 16)}{(T_{\text{designh}} - 16)}$	n/a	n/a	82	-15	20(12)	^a / 55	n/a	n/a	^a / 49

^a With the water flow rate as determined at the standard rating conditions given in EN 14511-2 at 47/55 conditions for units with a fixed water flow rate, and with a fixed delta T of 8 K for units with a variable flow rate. If the resulting flow rate is below the minimum flow rate then this minimum flow rate is used with the outlet temperature.

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

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

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

Additional information

Climate	T _{design}	T _{bivalent}	TOL	Outlet temperature	Flow rate
Average	-10	-7	-10	Variable	Variable





Performance test according to EN14511 (standard rating)

N°	Test condition	Heat source		Heat sink	
		Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)
1 ^a	A7/W35	7	6	30	35
2 ^a	A7/W55	7	6	47	55

a) Test mode 1

Test conditions for EN14511:2018, part load and full load tests

No.	Inlet dry bulb air temperature (°C)	Inlet wet bulb air temperature (°C)	Outlet water temperature (°C)	Inlet water temperature (°C)
1 ^a	2	1	35	30
2 ^b	7	6	35	30
3 ^c	-7	-8	35	30

a) Part load test at test mode 28, (60% of the heating capacity of A-7W35)

b) Part load test at test mode 3, (40% of the heating capacity of A-7W35)

c) Full load test at test mode 1



Domestic hot water tests according to EN16147 average climate

N°	Test condition	Heat source		Domestic hot water
		Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Tapping profile
1	Average Climate	7	6	L

Safety test according to EN14511-4

N°	Safety test
1	Starting test and operating test (EN 14511-4 clause 4.2.1)
2	Shutting of the heat transfer medium flows (EN 14511-4 clause 4.5)
3	Complete power supply failure (EN 14511-4 clause 4.6)

Sound power test according to EN12102

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)
1	7/6	47/55	23-25	460-480	2.8



Main test results for low temperature application at reference heating season average

Model (Indoor + Outdoor)	WH-ADC0309J3E5 + WH-UD07JE5
Air-to-water heat pump monobloc	N
Low-temperature heat pump	N
Equipped with supplementary heater	Y
Heat pump combination heater	Y

Rated heat output¹⁾	P_{rated}	6 [kW]
Seasonal space heating energy efficiency	η_s	198.2 [%]
	SCOP	5.03 [-]

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}	5.39 [kW]
	Low temperature application	$T_j = 2\text{ °C}$	P_{dh}	3.33 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	2.98 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	3.59 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	6.11 [kW]
		$T_j = \text{operation limit}$	P_{dh}	6.11 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate	$T_j = -15\text{ °C}$	COPd	- [-]
	-	$T_j = -7\text{ °C}$	COPd	3.02 [-]
	Low temperature application	$T_j = 2\text{ °C}$	COPd	5.15 [-]
		$T_j = 7\text{ °C}$	COPd	6.20 [-]
		$T_j = 12\text{ °C}$	COPd	8.94 [-]
		$T_j = \text{bivalent temperature}$	COPd	2.82 [-]
		$T_j = \text{operation limit}$	COPd	2.82 [-]

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

Power consumption in modes other than active mode	Off mode	P_{OFF}	0.007 [kW]
	Thermostat-off mode	P_{TO}	0.008 [kW]
	Standby mode	P_{SB}	0.007 [kW]
	Crankcase heater mode	P_{CK}	0.007 [kW]
Supplementary heater¹⁾	Rated heat output	P_{SUP}	0.00 [kW]
	Type of energy input		Electrical

Other items	Capacity control		Variable
	Water flow control		Variable
	Water flow rate		-
	Annual energy consumption	Q_{HE}	2465 [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, $sup(T_j)$.



Main test results for medium temperature application at reference heating season average

Model (Indoor + Outdoor)	WH-ADC0309J3E5 + WH-UD07JE5
Air-to-water heat pump monobloc	N
Low-temperature heat pump	N
Equipped with supplementary heater	Y
Heat pump combination heater	Y

Rated heat output¹⁾	P_{rated}	7 [kW]
Seasonal space heating energy efficiency	η_s	138.1 [%]
	SCOP	3.53 [-]

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}	6.05 [kW]
	Medium temperature application	$T_j = 2\text{ °C}$	P_{dh}	3.85 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	2.80 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	3.41 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	6.05 [kW]
		$T_j = \text{operation limit}$	P_{dh}	5.89 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate	$T_j = -15\text{ °C}$	COPd	- [-]
	-	$T_j = -7\text{ °C}$	COPd	1.93 [-]
	Medium temperature application	$T_j = 2\text{ °C}$	COPd	3.54 [-]
		$T_j = 7\text{ °C}$	COPd	4.78 [-]
		$T_j = 12\text{ °C}$	COPd	6.58 [-]
		$T_j = \text{bivalent temperature}$	COPd	1.93 [-]
		$T_j = \text{operation limit}$	COPd	1.81 [-]

Bivalent temperature	$T_{bivalent}$	-7 [°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}	0.007 [kW]
	Thermostat-off mode	P_{TO}	0.007 [kW]
	Standby mode	P_{SB}	0.008 [kW]
	Crankcase heater mode	P_{CK}	0.007 [kW]
Supplementary heater¹⁾	Rated heat output	P_{SUP}	1.11 [kW]
	Type of energy input		Electrical

Other items	Capacity control		Variable
	Water flow control		Variable
	Water flow rate		-
	Annual energy consumption	Q_{HE}	4100 [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, $sup(T_j)$.



Results of performance test according to EN14511 (standard rating)

N°	Test condition	Heating capacity [kW]	COP
1 ^a	A7/W35	7.22	4.84
2 ^a	A7/W55	7.15	2.85

a) Test mode 1

Test results for EN14511:2018 part load and full load tests

No.	Test condition	Heating capacity – [kW]	COP
1 ^a	A2/W35	4.12	4.13
2 ^b	A7/W35	2.83	5.09
3 ^c	A-7/W35	6.02	3.07

a) Part load test at test mode 28, (60% of the heating capacity of A-7W35)

b) Part load test at test mode 3, (40% of the heating capacity of A-7W35)

c) Full load test at test mode 1



Test Results of domestic hot water test according to EN16147:2017

Presentation of main results

No		Symbol	Result	Unit
1)	Load profile	-	L	-
2)	Settings of the control	-	52	-
3)	Heating up time	t_h	3467	[s]
4)	Heating up electrical energy consumption	W_{eh-HP}	2.95	[kWh]
5)	Stand-by power input	P_{es}	0.03	[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}	3.83	[kWh]
8)	Daily electrical energy consumption	Q_{elec}	3.80	[kWh]
9)	Coefficient of Performance	COP_{DHW}	3.06	[-]
10)	Water heating energy consumption	η_{wh}	128.4%	[%]
11)	Annual electrical energy consumption	AEC	797	[kWh/a]
12)	Reference hot water temperature	θ'_{WH}	52.9	[°C]
13)	Maximum volume of mixed water at 40°C	V_{40}	247	[L]
19)	Rated heat output	P_{rated}	-	[kW]
20)	Seasonal coefficient of performance	$SCOP_{DHW}$	-	[-]

Results of safety test according to EN14511-4

N°	Safety test	Result
1	Starting test and operating test (EN 14511-4 clause 4.2.1)	Passed
2	Shutting of the heat transfer medium flows (EN 14511-4 clause 4.5)	Passed
3	Complete power supply failure (EN 14511-4 clause 4.6)	Passed



Results of sound power test according to EN12102

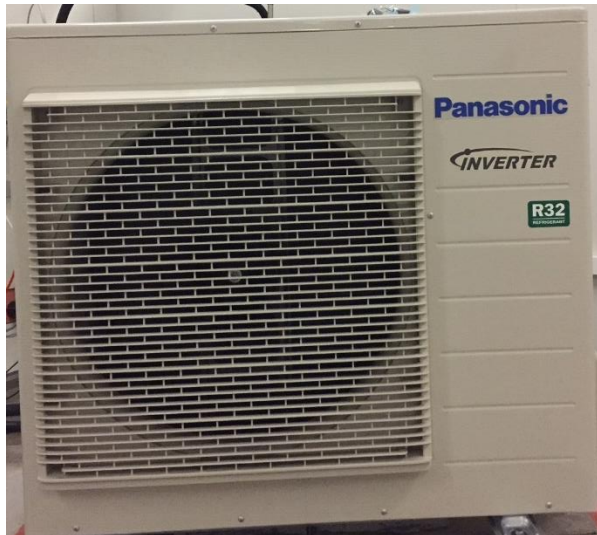
N°	Sound power level LW(A) [dB re 1pW]	Uncertainty (dB) (weighted value)
1	59	0.5

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.



Outdoor unit

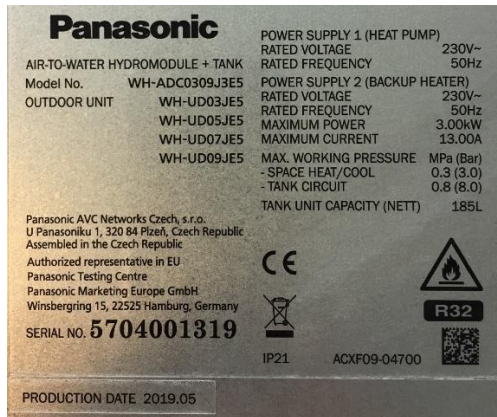


Outdoor unit rating plate





Indoor unit rating plate



Indoor unit





Detailed SCOP calculation for low temperature and average climate conditions

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	5.31	5.39	3.02	1.00	1.00	3.02
B	2	54	3.23	3.33	5.15	0.99	1.00	5.15
C	7	35	2.08	2.98	6.20	0.98	0.70	6.16
D	12	15	0.92	3.59	8.94	0.98	0.26	8.45
E	-10	100	6.00	6.11	2.82	1.00	1.00	2.82
F - BIV	-10	100	6.00	6.11	2.82	1.00	1.00	2.82

Energy consumption for thermostat off, standby, off mode, crankcase heater mode

	Hours [h]	Power input [kW]	Applied to SCOP calculation [kW]	Energy consumption [kWh]
Off mode	3672	0.007	0.007	25.704
Thermostat off	178	0.008	0.008	1.424
Standby	0	0.007	0.007	0
Crankcase heater	3850	0.007	0	0



Calculation Bin for SCOPon

	Bin	Outdoor temperature [°C]	Hours [h]	Heat load [kW]	Heat load covered by heat pump [kW]	Electrical back up heater [kW]	Annual backup heater energy input [kWh]	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	6.00	6.00	0.00	0.00	2.82	6.00	2.13	6.00	2.13
	22	-9	25	5.77	5.77	0.00	0.00	2.89	144.23	49.96	144.23	49.96
	23	-8	23	5.54	5.54	0.00	0.00	2.95	127.38	43.13	127.38	43.13
A	24	-7	24	5.31	5.31	0.00	0.00	3.02	127.38	42.18	127.38	42.18
	25	-6	27	5.08	5.08	0.00	0.00	3.26	137.08	42.09	137.08	42.09
	26	-5	68	4.85	4.85	0.00	0.00	3.49	329.54	94.33	329.54	94.33
	27	-4	91	4.62	4.62	0.00	0.00	3.73	420.00	112.60	420.00	112.60
	28	-3	89	4.38	4.38	0.00	0.00	3.97	390.23	98.38	390.23	98.38
	29	-2	165	4.15	4.15	0.00	0.00	4.20	685.38	163.06	685.38	163.06
	30	-1	173	3.92	3.92	0.00	0.00	4.44	678.69	152.86	678.69	152.86
	31	0	240	3.69	3.69	0.00	0.00	4.68	886.15	189.48	886.15	189.48
	32	1	280	3.46	3.46	0.00	0.00	4.91	969.23	197.27	969.23	197.27
B	33	2	320	3.23	3.23	0.00	0.00	5.15	1033.85	200.75	1033.85	200.75
	34	3	357	3.00	3.00	0.00	0.00	5.35	1071.00	200.15	1071.00	200.15
	35	4	356	2.77	2.77	0.00	0.00	5.55	985.85	177.56	985.85	177.56
	36	5	303	2.54	2.54	0.00	0.00	5.75	769.15	133.69	769.15	133.69
	37	6	330	2.31	2.31	0.00	0.00	5.95	761.54	127.90	761.54	127.90
C	38	7	326	2.08	2.08	0.00	0.00	6.16	677.08	110.00	677.08	110.00
	39	8	348	1.85	1.85	0.00	0.00	6.62	642.46	97.12	642.46	97.12
	40	9	335	1.62	1.62	0.00	0.00	7.07	541.15	76.49	541.15	76.49
	41	10	315	1.38	1.38	0.00	0.00	7.53	436.15	57.89	436.15	57.89
	42	11	215	1.15	1.15	0.00	0.00	7.99	248.08	31.03	248.08	31.03
D	43	12	169	0.92	0.92	0.00	0.00	8.45	156.00	18.45	156.00	18.45
	44	13	151	0.69	0.69	0.00	0.00	8.91	104.54	11.73	104.54	11.73
	45	14	105	0.46	0.46	0.00	0.00	9.37	48.46	5.17	48.46	5.17
	46	15	74	0.23	0.23	0.00	0.00	9.83	17.08	1.74	17.08	1.74

SUM	12393.69	2437.13	12393.69	2437.13
SCOPon		5.09	SCOPnet	5.09



Detailed SCOP calculation for medium temperature and average climate conditions

Calculation of reference SCOP

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

Where

P_{design} =

Heating load of the building at design temperature, kW

H_{he} =

Number of equivalent heating hours, 2066 h

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

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

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

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

Data for SCOP

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COPbin [-]
A	-7	88	6.19	6.05	1.93	1.00	1.00	1.93
B	2	54	3.77	3.85	3.54	0.99	1.00	3.54
C	7	35	2.42	2.80	4.78	0.99	0.87	4.77
D	12	15	1.08	3.41	6.58	0.99	0.32	6.39
E	-10	100	7.00	5.89	1.81	1.00	1.00	1.81
F - BIV	-7	88	6.19	6.05	1.93	1.00	1.00	1.93

Energy consumption for thermostat off, standby, off mode, crankcase heater mode

	Hours [h]	Power input [kW]	Applied to SCOP calculation [kW]	Energy consumption [kWh]
Off mode	3672	0.007	0.007	25.704
Thermostat off	178	0.007	0.007	1.246
Standby	0	0.008	0.008	0
Crankcase heater	3850	0.007	0	0



Calculation Bin for SCOP_{on}

	Bin	Outdoor temperature [°C]	Hours [h]	Heat load [kW]	Heat load covered by heat pump [kW]	Electrical back up heater [kW]	Annual backup heater energy input [kWh]	COP _{bin} [-]	Annual heating demand [kWh]	Annual energy input [kWh]	Net annual heating capacity [kWh]	Net annual power input [kWh]
E	21	-10	1	7.00	5.89	1.11	1.11	1.81	7.00	4.36	5.89	3.25
	22	-9	25	6.73	5.94	0.79	19.69	1.85	168.27	100.00	148.58	80.32
	23	-8	23	6.46	6.00	0.46	10.69	1.89	148.62	83.67	137.92	72.98
A / F - BIV	24	-7	24	6.19	6.05	0.00	0.00	1.93	148.62	77.00	148.62	77.00
	25	-6	27	5.92	5.80	0.00	0.00	2.11	159.92	75.83	159.92	75.83
	26	-5	68	5.65	5.54	0.00	0.00	2.29	384.46	168.05	384.46	168.05
	27	-4	91	5.38	5.29	0.00	0.00	2.47	490.00	198.65	490.00	198.65
	28	-3	89	5.12	5.04	0.00	0.00	2.65	455.27	172.09	455.27	172.09
	29	-2	165	4.85	4.78	0.00	0.00	2.82	799.62	283.11	799.62	283.11
	30	-1	173	4.58	4.53	0.00	0.00	3.00	791.81	263.64	791.81	263.64
	31	0	240	4.31	4.28	0.00	0.00	3.18	1033.85	324.88	1033.85	324.88
	32	1	280	4.04	4.02	0.00	0.00	3.36	1130.77	336.43	1130.77	336.43
B	33	2	320	3.77	3.77	0.00	0.00	3.54	1206.15	340.72	1206.15	340.72
	34	3	357	3.50	3.50	0.00	0.00	3.79	1249.50	330.01	1249.50	330.01
	35	4	356	3.23	3.23	0.00	0.00	4.03	1150.15	285.22	1150.15	285.22
	36	5	303	2.96	2.96	0.00	0.00	4.28	897.35	209.73	897.35	209.73
	37	6	330	2.69	2.69	0.00	0.00	4.52	888.46	196.35	888.46	196.35
C	38	7	326	2.42	2.42	0.00	0.00	4.77	789.92	165.56	789.92	165.56
	39	8	348	2.15	2.15	0.00	0.00	5.10	749.54	147.10	749.54	147.10
	40	9	335	1.88	1.88	0.00	0.00	5.42	631.35	116.49	631.35	116.49
	41	10	315	1.62	1.62	0.00	0.00	5.74	508.85	88.58	508.85	88.58
	42	11	215	1.35	1.35	0.00	0.00	6.07	289.42	47.69	289.42	47.69
D	43	12	169	1.08	1.08	0.00	0.00	6.39	182.00	28.47	182.00	28.47
	44	13	151	0.81	0.81	0.00	0.00	6.72	121.96	18.16	121.96	18.16
	45	14	105	0.54	0.54	0.00	0.00	7.04	56.54	8.03	56.54	8.03
	46	15	74	0.27	0.27	0.00	0.00	7.37	19.92	2.70	19.92	2.70

SUM	14459.31	4072.53	14427.82	4041.04
SCOP_{on}	3.55	SCOP_{net}	3.57	



Detailed test results - low temperature application

Detailed result for 'EN14825:2016' Average Low (A) A-7/W34		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:	Average	
Temperature application:	Low	
Condition name:	A	
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	6.00
Heating demand:	kW	5.31
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Transient	
Integrated circulation pump:	Yes	
Included corrections (Final result)		
Heating capacity	kW	5.39
COP	-	3.02
Power consumption	kW	1.78
Measured		
Heating capacity	kW	5.42
COP	-	2.98
Power consumption	kW	1.82
During heating		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-8.0
Inlet temperature	°C	29.0
Outlet temperature	°C	34.0
Outlet temperature (Time averaged)	°C	34.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	27082
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.21
Calculated Capacity correction	W	29
Calculated Power correction	W	37
Water Flow	m³/s	0.000283



Detailed result for 'EN14825:2016' Average Low (B) A2/W30		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Low
Condition name:		B
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	6.00
Heating demand:	kW	3.23
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.33
COP	-	5.15
Power consumption	kW	0.65
Measured		
Heating capacity	kW	3.35
COP	-	4.95
Power consumption	kW	0.68
During heating		
Air temperature dry bulb	°C	2.2
Air temperature wet bulb	°C	1.1
Inlet temperature	°C	25.0
Outlet temperature	°C	30.0
Outlet temperature (Time averaged)	°C	30.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	35600
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.18
Calculated Capacity correction	W	25
Calculated Power correction	W	31
Water Flow	m ³ /s	0.000161



Detailed result for 'EN14825:2016' Average Low (C) A7/W27		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Low
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	6.00
Heating demand:	kW	2.08
CR:	-	0.7
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	2.98
COP	-	6.20
Power consumption	kW	0.48
Measured		
Heating capacity	kW	2.99
COP	-	6.03
Power consumption	kW	0.50
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.0
Inlet temperature	°C	23.5
Outlet temperature	°C	28.5
Outlet temperature (Time averaged)	°C	27.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	15256
Calculated Hydraulic power	W	2
Calculated global efficiency	η	0.14
Calculated Capacity correction	W	13
Calculated Power correction	W	16
Water Flow	m ³ /s	0.000144



Detailed result for 'EN14825:2016' Average Low (D) A12/W24		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Low
Condition name:		D
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	6.00
Heating demand:	kW	0.92
CR:	-	0.3
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.59
COP	-	8.94
Power consumption	kW	0.40
Measured		
Heating capacity	kW	3.62
COP	-	8.34
Power consumption	kW	0.43
During heating		
Air temperature dry bulb	°C	12.0
Air temperature wet bulb	°C	10.9
Inlet temperature	°C	22.7
Outlet temperature	°C	27.7
Outlet temperature (Time averaged)	°C	24.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	34401
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	26
Calculated Power correction	W	32
Water Flow	m ³ /s	0.000174



Detailed result for 'EN14825:2016' Average Low (E and F) A-10/W35		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Low
Condition name:		E and F
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent	°C	-10
Tdesign	°C	-10
Pdesign	kW	6.00
Heating demand:	kW	6.00
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	6.11
COP	-	2.82
Power consumption	kW	2.17
Measured		
Heating capacity	kW	6.14
COP	-	2.78
Power consumption	kW	2.21
During heating		
Air temperature dry bulb	°C	-10.0
Air temperature wet bulb	°C	-11.0
Inlet temperature	°C	30.0
Outlet temperature	°C	35.0
Outlet temperature (Time averaged)	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	25604
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.21
Calculated Capacity correction	W	29
Calculated Power correction	W	37
Water Flow	m ³ /s	0.000297



Detailed test results - medium temperature application

Detailed result for 'EN14825:2016' Average Medium (A and F) A-7/W52		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		A and F
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	7.00
Heating demand:	kW	6.19
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	6.05
COP	-	1.93
Power consumption	kW	3.13
Measured		
Heating capacity	kW	6.08
COP	-	1.92
Power consumption	kW	3.17
During heating		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-8.0
Inlet temperature	°C	44.0
Outlet temperature	°C	52.2
Outlet temperature (Time averaged)	°C	52.2
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	35738
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	28
Calculated Power correction	W	35
Water Flow	m ³ /s	0.000194



Detailed result for 'EN14825:2016' Average Medium (B) A2/W42		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		B
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	7.00
Heating demand:	kW	3.77
CR:	-	1.0
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.85
COP	-	3.54
Power consumption	kW	1.09
Measured		
Heating capacity	kW	3.88
COP	-	3.47
Power consumption	kW	1.12
During heating		
Air temperature dry bulb	°C	2.1
Air temperature wet bulb	°C	0.9
Inlet temperature	°C	34.5
Outlet temperature	°C	42.0
Outlet temperature (Time averaged)	°C	42.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	38610
Calculated Hydraulic power	W	5
Calculated global efficiency	η	0.17
Calculated Capacity correction	W	23
Calculated Power correction	W	28
Water Flow	m ³ /s	0.000125



Detailed result for 'EN14825:2016' Average Medium (C) A7/W36		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	7.00
Heating demand:	kW	2.42
CR:	-	0.9
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	2.80
COP	-	4.78
Power consumption	kW	0.59
Measured		
Heating capacity	kW	2.82
COP	-	4.60
Power consumption	kW	0.61
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	6.0
Inlet temperature	°C	31.3
Outlet temperature	°C	36.7
Outlet temperature (Time averaged)	°C	36.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	38470
Calculated Hydraulic power	W	5
Calculated global efficiency	η	0.17
Calculated Capacity correction	W	23
Calculated Power correction	W	28
Water Flow	m ³ /s	0.000125



Detailed result for 'EN14825:2016' Average Medium (D) A12/W30		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		D
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	7.00
Heating demand:	kW	1.08
CR:	-	0.3
Minimum flow reached:	-	Yes
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.41
COP	-	6.58
Power consumption	kW	0.52
Measured		
Heating capacity	kW	3.43
COP	-	6.29
Power consumption	kW	0.55
During heating		
Air temperature dry bulb	°C	12.0
Air temperature wet bulb	°C	11.0
Inlet temperature	°C	27.9
Outlet temperature	°C	34.5
Outlet temperature (Time averaged)	°C	30.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	37497
Calculated Hydraulic power	W	5
Calculated global efficiency	η	0.17
Calculated Capacity correction	W	23
Calculated Power correction	W	27
Water Flow	m ³ /s	0.000125



Detailed result for 'EN14825:2016' Average Medium (E) A-10/W55		
Tested according to:	EN14511:2018 and EN14825:2016	
Climate zone:		Average
Temperature application:		Medium
Condition name:		E
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	7.00
Heating demand:	kW	7.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	5.89
COP	-	1.81
Power consumption	kW	3.25
Measured		
Heating capacity	kW	5.92
COP	-	1.80
Power consumption	kW	3.29
During heating		
Air temperature dry bulb	°C	-10.0
Air temperature wet bulb	°C	-11.0
Inlet temperature	°C	47.0
Outlet temperature	°C	55.2
Outlet temperature (Time averaged)	°C	55.2
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	37279
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	27
Calculated Power correction	W	34
Water Flow	m ³ /s	0.000175



Detailed test results for standard rating conditions

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	7.22
COP	-	4.84
Power consumption	kW	1.49
Measured		
Heating capacity	kW	7.25
COP	-	4.75
Power consumption	kW	1.53
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	5.9
Inlet temperature	°C	30.0
Outlet temperature	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	20018
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	28
Calculated Power correction	W	35
Water Flow	m ³ /s	0.000347



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	7.15
COP	-	2.85
Power consumption	kW	2.51
Measured		
Heating capacity	kW	7.18
COP	-	2.82
Power consumption	kW	2.54
During heating		
Air temperature dry bulb	°C	7.0
Air temperature wet bulb	°C	5.9
Inlet temperature	°C	47.0
Outlet temperature	°C	55.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	34260
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	29
Calculated Power correction	W	36
Water Flow	m ³ /s	0.000217



Detailed test results – for EN14511:2018 full load test

Detailed result for 'EN14511:2018' A-7/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	6.02
COP	-	3.07
Power consumption	kW	1.96
Measured		
Heating capacity	kW	6.05
COP	-	3.03
Power consumption	kW	2.00
During heating		
Air temperature dry bulb	°C	-7.0
Air temperature wet bulb	°C	-8.1
Inlet temperature	°C	30.0
Outlet temperature	°C	35.1
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	24881
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	28
Calculated Power correction	W	35
Water Flow	m ³ /s	0.000286



Detailed test results – for EN14511:2018 part load test




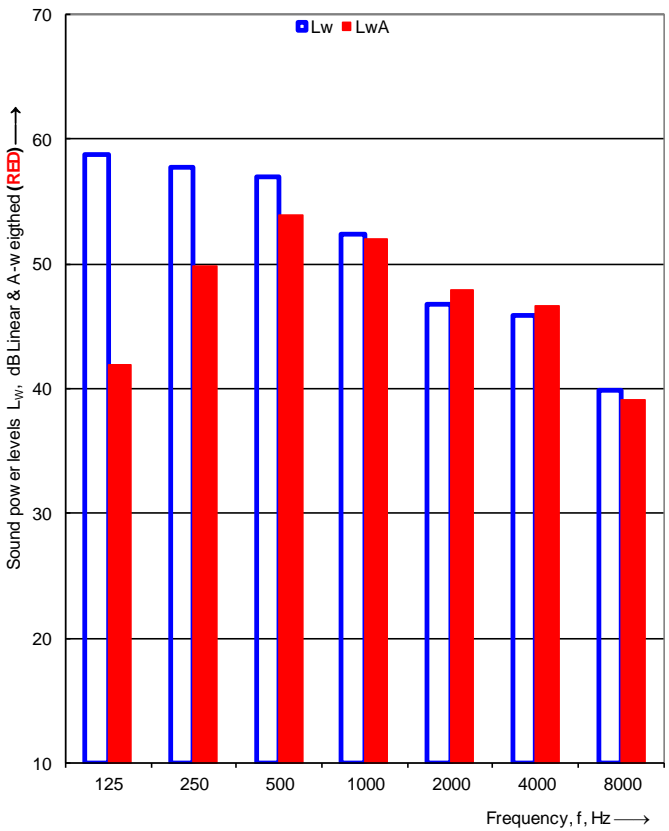
Detailed result for 'EN14511:2018' A2/W35 target 60% of the heating capacity of A-7W35		
Tested according to:		EN14511:2018
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	4.12
COP	-	4.13
Power consumption	kW	1.00
Measured		
Heating capacity	kW	4.15
COP	-	4.02
Power consumption	kW	1.03
During heating		
Air temperature dry bulb	°C	2.0
Air temperature wet bulb	°C	1.0
Inlet temperature	°C	30.0
Outlet temperature	°C	35.0
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	33747
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	28
Calculated Power correction	W	34
Water Flow	m ³ /s	0.000200



Detailed result for 'EN14511:2018' A7/W35 target 40% of the heating capacity of A-7W35			
Tested according to:		EN14511:2018	
Minimum flow reached:		Yes	
Measurement type:		Steady State	
Integrated circulation pump:		Yes	
Included corrections (Final result)			
Heating capacity	kW	2.83	
COP	-	5.09	
Power consumption	kW	0.56	
Measured			
Heating capacity	kW	2.86	
COP	-	4.88	
Power consumption	kW	0.59	
During heating			
Air temperature dry bulb	°C	7.0	
Air temperature wet bulb	°C	5.9	
Inlet temperature	°C	30.0	
Outlet temperature	°C	35.1	
Circulation pump			
Measured: Static differential pressure, liquid pump	Pa		37975
Calculated Hydraulic power	W	<div></div>	5
Calculated global efficiency	η		0.18
Calculated Capacity correction	W		24
Calculated Power correction	W		29
Water Flow	m³/s		0.000136



Detailed test results of sound power measurement

 		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		Date of test: 30-08-2019																																																																				
Object:	Type: Air to water heat pump Model: WH-UD07JES (Outdoor unit) + WH-ADC0309J3E5 (Indoor)																																																																						
Mounting conditions:	The outdoor unit is standing free on four 5.5 cm thick heavy concrete tiles placed on a vibration damping mat, which is placed on a water drop tray. The water drop tray is located on a 2.5 cm thick wooden board laying on the floor. The outdoor unit is mounted on the supporting metal support frame using 4 vibration isolators. The sound power measurement on outdoor unit only. The indoor unit is placed in the neighboring room.																																																																						
Operating conditions:	A7/W55, Compressor speed: 23-25 [Hz] (69%), Heating capacity: 2.8 [kW], Power input: 1.2 [kW], Water flow rate: 450 [l/h], dB_water: 392 [mbar], Fan_speed: 460 - 480 [rpm]																																																																						
Static pressure:	1015 kPa			<u>Reference box:</u>																																																																			
Air temperature:	7,0 °C			L1:	0,8 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:	0,2 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>57,1</td><td></td></tr><tr><td>125</td><td>49,6</td><td>58,8</td></tr><tr><td>160</td><td>51,7</td><td></td></tr><tr><td>200</td><td>49,7</td><td></td></tr><tr><td>250</td><td>53,9</td><td>57,7</td></tr><tr><td>315</td><td>54,0</td><td></td></tr><tr><td>400</td><td>52,8</td><td></td></tr><tr><td>500</td><td>49,5</td><td>57,0</td></tr><tr><td>630</td><td>53,4</td><td></td></tr><tr><td>800</td><td>50,0</td><td></td></tr><tr><td>1000</td><td>45,8</td><td>52,3</td></tr><tr><td>1250</td><td>45,2</td><td></td></tr><tr><td>1600</td><td>41,7</td><td></td></tr><tr><td>2000</td><td>42,5</td><td>46,8</td></tr><tr><td>2500</td><td>41,7</td><td></td></tr><tr><td>3150</td><td>39,1</td><td></td></tr><tr><td>4000</td><td>40,5</td><td>45,8</td></tr><tr><td>5000</td><td>42,8</td><td></td></tr><tr><td>6300</td><td>36,6</td><td></td></tr><tr><td>8000</td><td>35,6</td><td>39,9</td></tr><tr><td>10000</td><td>31,8</td><td></td></tr></tbody></table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	57,1		125	49,6	58,8	160	51,7		200	49,7		250	53,9	57,7	315	54,0		400	52,8		500	49,5	57,0	630	53,4		800	50,0		1000	45,8	52,3	1250	45,2		1600	41,7		2000	42,5	46,8	2500	41,7		3150	39,1		4000	40,5	45,8	5000	42,8		6300	36,6		8000	35,6	39,9	10000	31,8					
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Date:	30-08-2019																																																																						



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 14511:2013
- EN 12102:2017
- 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.