

TEST REPORT

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300-KLAB-24-006



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Customer: Company: Home Star Sp. Z o.o.
Address: ul. Misjonarzy Oblatów MN 20A
City: 40-129 Katowice, Poland
Tel.: +48 327220203

Component: Brand: Thermatec
Type: Air to water heat pump
Model: Outdoor unit: TH-R290-S10-3P
Series no.: Outdoor unit: 8A00231228003090
Prod. year: N/A

Dates: Component tested: February – March 2024

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

Remarks: The unit was delivered by the customer. The installation and test settings were done according to the manufacturer's instructions.

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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 14825:2022.

In order to calculate the SCOP, tests were carried out at the part load conditions stated in the tables on page 4 and 5.

COP test conditions (heating mode) according to EN 14511:2022.

Operating requirements according to EN 14511-4:2022

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

Sound power measurements according to EN 12102-1:2022.



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Test conditions

SCOP test conditions for low temperature – EN 14825

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

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

	Part load ratio in %				Outdoor heat exchanger		Indoor heat exchanger			
					Dry (wet) bulb temperature °C		Fixed outlet °C	Variable outlet ^d °C		
	Formula	Average	Warmer	Colder	Outdoor air	Exhaust air	All climates	Average	Warmer	Colder
A	$(-7 - 16) / (T_{\text{designh}} - 16)$	88,46	n.a.	60,53	-7(-8)	20(12)	a / 35	a / 34	n.a.	a / 30
B	$(+2 - 16) / (T_{\text{designh}} - 16)$	53,85	100,00	36,84	2(1)	20(12)	a / 35	a / 30	a / 35	a / 27
C	$(+7 - 16) / (T_{\text{designh}} - 16)$	34,62	64,29	23,68	7(6)	20(12)	a / 35	a / 27	a / 31	a / 25
D	$(+12 - 16) / (T_{\text{designh}} - 16)$	15,38	28,57	10,53	12(11)	20(12)	a / 35	a / 24	a / 26	a / 24
E	$(TOL^e - 16) / (T_{\text{designh}} - 16)$				TOL^e	20(12)	a / 35	a / b	a / b	a / b
F	$(T_{\text{biv}} - 16) / (T_{\text{designh}} - 16)$				T_{biv}	20(12)	a / 35	a / c	a / c	a / c
G	$(-15 - 16) / (T_{\text{designh}} - 16)$	n.a.	n.a.	81,58	-15	20(12)	a / 35	n.a.	n.a.	a / 32

Additional information

Climate	T_{designh} [°C]	T_{bivalent} [°C]	TOL [°C]	Outlet temperature	Flow rate
Average	-10	-7	-10	Variable	Fixed



SCOP test conditions for medium temperature – EN 14825

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

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

	Part load ratio in %				Outdoor heat exchanger		Indoor heat exchanger			
					Dry (wet) bulb temperature °C		Fixed outlet °C	Variable outlet ^d °C		
	Formula	Average	Warmer	Colder	Outdoor air	Exhaust air	All climates	Average	Warmer	Colder
A	$(-7 - 16) / (T_{\text{designh}} - 16)$	88,46	n.a.	60,53	-7(-8)	20(12)	^a / 55	^a / 52	n.a.	^a / 44
B	$(+2 - 16) / (T_{\text{designh}} - 16)$	53,85	100	36,84	2(1)	20(12)	^a / 55	^a / 42	^a / 55	^a / 37
C	$(+7 - 16) / (T_{\text{designh}} - 16)$	34,62	64,29	23,68	7(6)	20(12)	^a / 55	^a / 36	^a / 46	^a / 32
D	$(+12 - 16) / (T_{\text{designh}} - 16)$	15,38	28,57	10,53	12(11)	20(12)	^a / 55	^a / 30	^a / 34	^a / 28
E	$(TOL^e - 16) / (T_{\text{designh}} - 16)$				TOL^e	20(12)	^a / 55	^a / ^b	^a / ^b	^a / ^b
F	$(T_{\text{biv}} - 16) / (T_{\text{designh}} - 16)$				T_{biv}	20(12)	^a / 55	^a / ^c	^a / ^c	^a / ^c
G	$(-15 - 16) / (T_{\text{designh}} - 16)$	n.a.	n.a.	81,58	-15	20(12)	^a / 55	n.a.	n.a.	^a / 49

Additional information

Climate	T_{designh} [°C]	T_{bivalent} [°C]	TOL [°C]	Outlet temperature	Flow rate
Average	-10	-7	-10	Variable	Fixed



COP test conditions - low temperature – EN 14511

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

S: Standard rating condition

COP test conditions - medium temperature – EN 14511

N [#]	Heat source		Heat sink		Heat pump settings
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1 ^S	7	6	47	55	

S: Standard rating condition

Test conditions for operating requirements – EN 14511-4

N [#]	Heat source		Heat sink	Water flow rate at indoor heat exchanger	Test
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)		
1	-25	-	20	1280	Starting
2	-25	-	60	1280	Operating



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

N#	Heat source		Heat sink		Heat exchanger
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1	7	6	47	55	Indoor
2	7	6	47	55	Outdoor

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

N#	Heat source		Heat sink	
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)
1	7	6	47	55

Test conditions for sound power measurements – EN 12102-1

N#	Test condition		Heat pump setting			
	Outdoor heat exchanger (dry bulb/wet bulb) (°C)	Indoor heat exchanger (inlet/outlet) (°C)	Compressor speed (Hz)	Fan speed outdoor (Hz)	Heating capacity (kW)	Power input (kW)
1 ^E	7/6	30/35	20	41	3.78	0.89
2 ^E	7/6	47/55	23	41	3.72	1.38

E) ErP labelling



Test results

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

Model (Outdoor)	TH-R290-S10-3P
Air-to-water heat pump mono bloc	Y
Low-temperature heat pump	N
Equipped with supplementary heater	N
Heat pump combination heater	N
SCOP calculation done as reversible	Y

Rated heat output¹⁾	P_{rated}	9.944 [kW]
Seasonal space heating energy efficiency	η_{ls}	202.8 [%]
	SCOP	5.14 [-]

Measured capacity for heating for part load at outdoor temperature T_j	Average Climate - Low temperature application	$T_j = -15\text{ °C}$	P_{dh}	- [kW]
		$T_j = -7\text{ °C}$	P_{dh}	9.13 [kW]
		$T_j = 2\text{ °C}$	P_{dh}	5.71 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	3.80 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	4.36 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	9.13 [kW]
		$T_j = \text{operation limit}$	P_{dh}	10.58 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate - Low temperature application	$T_j = -15\text{ °C}$	COPd	- [-]
		$T_j = -7\text{ °C}$	COPd	3.26 [-]
		$T_j = 2\text{ °C}$	COPd	4.88 [-]
		$T_j = 7\text{ °C}$	COPd	6.98 [-]
		$T_j = 12\text{ °C}$	COPd	9.15 [-]
		$T_j = \text{bivalent temperature}$	COPd	3.26 [-]
		$T_j = \text{operation limit}$	COPd	2.96 [-]

Bivalent temperature	$T_{bivalent}$	-7 [°C]
Operation limit temperatures	TOL	-10 [°C]
Degradation coefficient	C_{dh}	0.93 [-]

Power consumption in modes other than active mode	Off mode	P_{OFF}	0.014 [kW]
	Thermostat-off mode	P_{TO}	0.032 [kW]
	Standby mode	P_{SB}	0.014 [kW]
	Crankcase heater mode	P_{CK}	0.014 [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}	3993 [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, $P_{design,h}$, and the rated heat output of a supplementary heater, P_{sup} , is equal to the supplementary capacity for heating, $sup(T_j)$.



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

Model (Outdoor)	TH-R290-S10-3P	
Air-to-water heat pump mono bloc	Y	
Low-temperature heat pump	N	
Equipped with supplementary heater	N	
Heat pump combination heater	N	
SCOP calculation done as reversible	Y	

Rated heat output¹⁾	P_{rated}	9.921 [kW]
Seasonal space heating energy efficiency	η_s	153.9 [%]
	SCOP	3.92 [-]

Measured capacity for heating for part load at outdoor temperature T_j	Average Climate - Medium temperature application	$T_j = -15\text{ °C}$	P_{dh}	- [kW]
		$T_j = -7\text{ °C}$	P_{dh}	8.99 [kW]
		$T_j = 2\text{ °C}$	P_{dh}	5.71 [kW]
		$T_j = 7\text{ °C}$	P_{dh}	3.67 [kW]
		$T_j = 12\text{ °C}$	P_{dh}	3.19 [kW]
		$T_j = \text{bivalent temperature}$	P_{dh}	8.99 [kW]
		$T_j = \text{operation limit}$	P_{dh}	9.85 [kW]

Measured coefficient of performance at outdoor temperature T_j	Average Climate - Medium temperature application	$T_j = -15\text{ °C}$	COPd	- [-]
		$T_j = -7\text{ °C}$	COPd	2.40 [-]
		$T_j = 2\text{ °C}$	COPd	3.90 [-]
		$T_j = 7\text{ °C}$	COPd	5.23 [-]
		$T_j = 12\text{ °C}$	COPd	5.58 [-]
		$T_j = \text{bivalent temperature}$	COPd	2.40 [-]
		$T_j = \text{operation limit}$	COPd	2.07 [-]

Bivalent temperature	$T_{bivalent}$	-7 [°C]
Operation limit temperatures	TOL	-10 [°C]
	WTOL	- [°C]
Degradation coefficient	C_{dh}	0.94 [-]

Power consumption in modes other than active mode	Off mode	P_{OFF}	0.014 [kW]
	Thermostat-off mode	P_{TO}	0.032 [kW]
	Standby mode	P_{SB}	0.014 [kW]
	Crankcase heater mode	P_{CK}	0.014 [kW]
Supplementary heater¹⁾	Rated heat output	P_{SUP}	0.07 [kW]
	Type of energy input		Electrical

Other items	Capacity control	Variable	
	Water flow control	Variable	
	Water flow rate	-	
	Annual energy consumption	Q_{HE}	5226 [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, $P_{design,h}$, and the rated heat output of a supplementary heater, P_{sup} , is equal to the supplementary capacity for heating, $sup(T_j)$.



COP test results - low temperature – EN 14511

N#	Test conditions	Heating capacity [kW]	COP
1	A7/W35	10.309	4.912

COP test results - medium temperature – EN 14511

N#	Test conditions	Heating capacity [kW]	COP
1	A7/W55	9.995	3.163

Test results for starting and operating test - EN 14511-4

N#	Test conditions air/water inlet [°C]	Test validation
Starting	A-25/W20	Passed
Operating	A-25/W60	Passed

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

N#	Heat exchanger	Test validation
1	Indoor	Passed
2	Outdoor	Passed

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

N#	Test validation
1	Passed



Test results of sound power measurements – EN 12102-1

N [#]	Test conditions	Sound power level LW(A) [dB re 1pW]	Uncertainty σ_{tot} [dB]
1 ^E	A7/W35	66.5	1.6
1 ^E	A7/55	66.3	1.6

E) ErP labelling

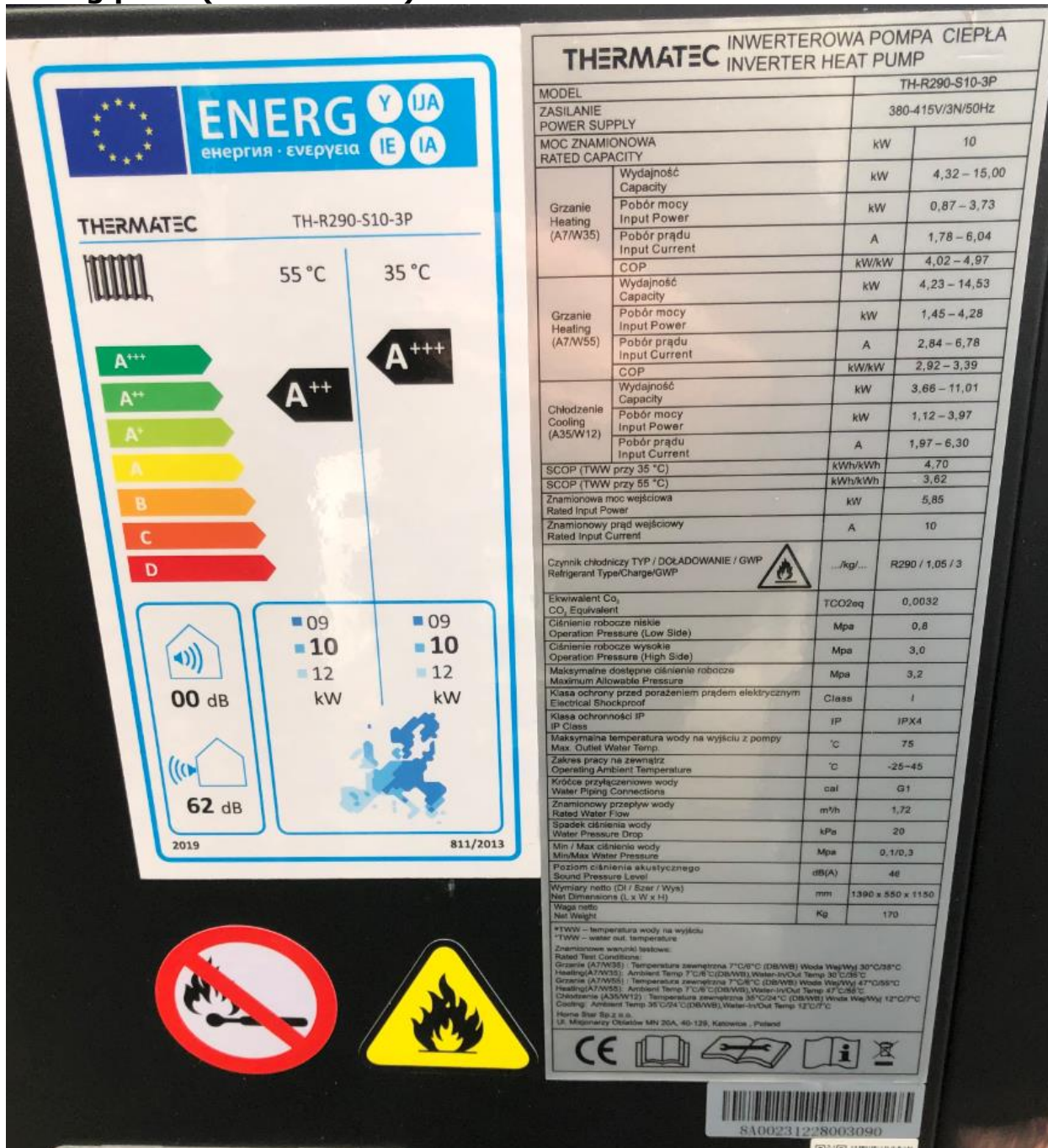
The A-weighted total sound power level is determined for the measured frequency range from 100 Hz to 10 kHz. For the calculation of uncertainty, see appendix 1.

The sound power measurements are carried out by Kamalathan Arumugam (KAMA) and co-read by Patrick Glibert (PGL), Danish Technological Institute.



Photos

Rating plate (outdoor unit)





Outdoor unit





SCOP - detailed calculation

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

Calculation of reference SCOP

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

Where

P_{design} =

Heating load of the building at design temperature, kW

H_{he} =

Number of equivalent heating hours, 2066 h

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

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

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

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

Data for SCOP

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COP _{bin} [-]
A	-7	88	8.80	9.13	3.26	0.99	1.00	3.26
B	2	54	5.35	5.71	4.88	0.97	1.00	4.88
C	7	35	3.44	3.80	6.98	0.94	1.00	6.98
D	12	15	1.53	4.36	9.15	0.93	0.35	8.13
E	-10	100	9.94	10.58	2.96	0.99	1.00	2.96
F - BIV	-7	88	8.80	9.13	3.26	0.99	1.00	3.26

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	0	0.0137	0.0137	0
Thermostat off	178	0.0322	0.0322	5.7316
Standby	0	0.0137	0.0137	0
Crankcase heater	178	0.0137	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]	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	9.94	9.94	0.00	0.00	2.96	9.94	3.36	9.94	3.36
	22	-9	25	9.56	9.56	0.00	0.00	3.06	239.04	78.13	239.04	78.13
	23	-8	23	9.18	9.18	0.00	0.00	3.16	211.12	66.82	211.12	66.82
A / F - BIV	24	-7	24	8.80	8.80	0.00	0.00	3.26	211.12	64.78	211.12	64.78
	25	-6	27	8.41	8.41	0.00	0.00	3.44	227.18	66.06	227.18	66.06
	26	-5	68	8.03	8.03	0.00	0.00	3.62	546.16	150.90	546.16	150.90
	27	-4	91	7.65	7.65	0.00	0.00	3.80	696.08	183.21	696.08	183.21
	28	-3	89	7.27	7.27	0.00	0.00	3.98	646.74	162.52	646.74	162.52
	29	-2	165	6.88	6.88	0.00	0.00	4.16	1135.91	273.08	1135.91	273.08
	30	-1	173	6.50	6.50	0.00	0.00	4.34	1124.82	259.19	1124.82	259.19
	31	0	240	6.12	6.12	0.00	0.00	4.52	1468.65	324.94	1468.65	324.94
	32	1	280	5.74	5.74	0.00	0.00	4.70	1606.34	341.78	1606.34	341.78
B	33	2	320	5.35	5.35	0.00	0.00	4.88	1713.43	351.11	1713.43	351.11
	34	3	357	4.97	4.97	0.00	0.00	5.30	1775.00	334.89	1775.00	334.89
	35	4	356	4.59	4.59	0.00	0.00	5.72	1633.88	285.62	1633.88	285.62
	36	5	303	4.21	4.21	0.00	0.00	6.14	1274.74	207.59	1274.74	207.59
	37	6	330	3.82	3.82	0.00	0.00	6.56	1262.12	192.37	1262.12	192.37
C	38	7	326	3.44	3.44	0.00	0.00	6.98	1122.14	160.74	1122.14	160.74
	39	8	348	3.06	3.06	0.00	0.00	7.21	1064.77	147.66	1064.77	147.66
	40	9	335	2.68	2.68	0.00	0.00	7.44	896.87	120.52	896.87	120.52
	41	10	315	2.29	2.29	0.00	0.00	7.67	722.85	94.22	722.85	94.22
	42	11	215	1.91	1.91	0.00	0.00	7.90	411.15	52.03	411.15	52.03
D	43	12	169	1.53	1.53	0.00	0.00	8.13	258.54	31.79	258.54	31.79
	44	13	151	1.15	1.15	0.00	0.00	8.36	173.26	20.72	173.26	20.72
	45	14	105	0.76	0.76	0.00	0.00	8.59	80.32	9.35	80.32	9.35
	46	15	74	0.38	0.38	0.00	0.00	8.82	28.30	3.21	28.30	3.21

SUM 20540.48 3986.63 20540.48 3986.63

SCOP_{on} 5.15 SCOP_{net} 5.15





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

Calculation of reference SCOP

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

Where

P_{design} =

Heating load of the building at design temperature, kW

H_{he} =

Number of equivalent heating hours, 2066 h

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

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

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

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

Data for SCOP

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COPbin [-]
A	-7	88	8.78	8.99	2.40	0.99	1.00	2.40
B	2	54	5.34	5.71	3.90	0.98	1.00	3.90
C	7	35	3.43	3.67	5.23	0.95	1.00	5.23
D	12	15	1.53	3.19	5.58	0.94	0.48	5.26
E	-10	100	9.92	9.85	2.07	0.99	1.00	2.07
F - BIV	-7	88	8.78	8.99	2.40	0.99	1.00	2.40

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	0	0.0137	0.0137	0
Thermostat off	178	0.0322	0.0322	5.7316
Standby	0	0.0137	0.0137	0
Crankcase heater	178	0.0137	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]	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	9.92	9.85	0.07	0.07	2.07	9.92	4.83	9.85	4.76
	22	-9	25	9.54	9.49	0.04	1.12	2.18	238.49	110.15	237.37	109.03
	23	-8	23	9.16	9.14	0.02	0.51	2.29	210.63	92.43	210.12	91.91
A / F - BIV	24	-7	24	8.78	8.78	0.00	0.00	2.40	210.63	87.95	210.63	87.95
	25	-6	27	8.39	8.39	0.00	0.00	2.56	226.66	88.48	226.66	88.48
	26	-5	68	8.01	8.01	0.00	0.00	2.73	544.89	199.71	544.89	199.71
	27	-4	91	7.63	7.63	0.00	0.00	2.90	694.47	239.88	694.47	239.88
	28	-3	89	7.25	7.25	0.00	0.00	3.06	645.25	210.74	645.25	210.74
	29	-2	165	6.87	6.87	0.00	0.00	3.23	1133.28	351.02	1133.28	351.02
	30	-1	173	6.49	6.49	0.00	0.00	3.40	1122.22	330.53	1122.22	330.53
	31	0	240	6.11	6.11	0.00	0.00	3.56	1465.26	411.36	1465.26	411.36
	32	1	280	5.72	5.72	0.00	0.00	3.73	1602.62	429.81	1602.62	429.81
B	33	2	320	5.34	5.34	0.00	0.00	3.90	1709.46	438.85	1709.46	438.85
	34	3	357	4.96	4.96	0.00	0.00	4.16	1770.90	425.46	1770.90	425.46
	35	4	356	4.58	4.58	0.00	0.00	4.43	1630.10	368.03	1630.10	368.03
	36	5	303	4.20	4.20	0.00	0.00	4.70	1271.80	270.82	1271.80	270.82
	37	6	330	3.82	3.82	0.00	0.00	4.96	1259.20	253.71	1259.20	253.71
C	38	7	326	3.43	3.43	0.00	0.00	5.23	1119.55	214.06	1119.55	214.06
	39	8	348	3.05	3.05	0.00	0.00	5.24	1062.31	202.89	1062.31	202.89
	40	9	335	2.67	2.67	0.00	0.00	5.24	894.80	170.71	894.80	170.71
	41	10	315	2.29	2.29	0.00	0.00	5.25	721.18	137.44	721.18	137.44
	42	11	215	1.91	1.91	0.00	0.00	5.25	410.20	78.09	410.20	78.09
D	43	12	169	1.53	1.53	0.00	0.00	5.26	257.95	49.05	257.95	49.05
	44	13	151	1.14	1.14	0.00	0.00	5.26	172.85	32.83	172.85	32.83
	45	14	105	0.76	0.76	0.00	0.00	5.27	80.13	15.20	80.13	15.20
	46	15	74	0.38	0.38	0.00	0.00	5.28	28.24	5.35	28.24	5.35
SUM									20492.97	5219.38	20491.27	5217.69
SCOP_{on}										3.93	SCOP_{net}	3.93



Detailed test results

Detailed SCOP test results - low temperature application - average climate – EN 14825

Detailed result for 'EN14825:2022' Average Low (A and F) A -7 /W34		
Tested according to:	EN14511:2022 and EN14825:2022	
Climate zone:		Average
Temperature application:		Low
Condition name:		A and F
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	9.94
Heating demand:	kW	8.80
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	9.125
COP	-	3.259
Power consumption	kW	2.800
Measured		
Heating capacity	kW	9.146
COP	-	3.237
Power consumption	kW	2.826
During heating		
Air_inlet temperature dry bulb	°C	-7.03
Air temperature wet bulb	°C	-8.00
Water_inlet temperature	°C	29.50
water_outlet temperature	°C	33.91
Water_outlet temperature (Time averaged)	°C	33.91
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	8608
Calculated Hydraulic power	W	4
Calculated global efficiency	η	0.17
Calculated Capacity correction	W	21
Calculated Power correction	W	26
Water Flow	m ³ /s	0.000499



Detailed result for 'EN14825:2022' Average Low (B) A 2 /W30		
Tested according to:	EN14511:2022 and EN14825:2022	
Climate zone:	Average	
Temperature application:	Low	
Condition name:	B	
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	9.94
Heating demand:	kW	5.35
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	5.705
COP	-	4.880
Power consumption	kW	1.169
Measured		
Heating capacity	kW	5.730
COP	-	4.774
Power consumption	kW	1.200
During heating		
Air_inlet temperature dry bulb	°C	2.02
Air temperature wet bulb	°C	1.01
Water_inlet temperature	°C	27.19
water_outlet temperature	°C	29.95
Water_outlet temperature (Time averaged)	°C	29.95
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	11386
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.18
Calculated Capacity correction	W	25
Calculated Power correction	W	31
Water Flow	m³/s	0.000500



Detailed result for 'EN14825:2022' Average Low (C) A 7 /W27

Tested according to:		EN14511:2022 and EN14825:2022	
Climate zone:		Average	
Temperature application:		Low	
Condition name:		C	
Condition temperature:	°C		7
Part load:	%		35%
Chosen Tbivalent	°C		-7
Tdesign	°C		-10
Pdesign	kW		9.94
Heating demand:	kW		3.44
CR:	-		1.0
Minimum flow reached:	-		No
Measurement type:		Steady State	
Integrated liquid pump:		Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes	
Included corrections (Final result)			
Heating capacity	kW		3.798
COP	-		6.981
Power consumption	kW		0.544
Measured			
Heating capacity	kW		3.826
COP	-		6.613
Power consumption	kW		0.579
During heating			
Air_inlet temperature dry bulb	°C		7.02
Air temperature wet bulb	°C		5.99
Water_inlet temperature	°C		25.19
water_outlet temperature	°C		27.03
Water_outlet temperature (Time averaged)	°C		27.03
Circulation pump			
Measured external static pressure difference, liquid pump	Pa		13402
Calculated Hydraulic power	W		7
Calculated global efficiency	η		0.20
Calculated Capacity correction	W		28
Calculated Power correction	W		34
Water Flow	m³/s		0.000500



Detailed result for 'EN14825:2022' Average Low (D) A 12 /W24

Tested according to:	EN14511:2022 and EN14825:2022	
Climate zone:	Average	
Temperature application:	Low	
Condition name:	D	
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	9.94
Heating demand:	kW	1.53
CR:	-	0.4
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
<hr/>		
Included corrections (Final result)		
Heating capacity	kW	4.357
COP	-	9.148
Power consumption	kW	0.476
Measured		
Heating capacity	kW	4.385
COP	-	8.583
Power consumption	kW	0.511
During heating		
Air_inlet temperature dry bulb	°C	12.00
Air temperature wet bulb	°C	10.98
Water_inlet temperature	°C	23.31
water_outlet temperature	°C	25.41
Water_outlet temperature (Time averaged)	°C	24.05
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	13699
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	0.000499



Detailed result for 'EN14825:2022' Average Low (E) A -10 /W35		
Tested according to:	EN14511:2022 and EN14825:2022	
Climate zone:	Average	
Temperature application:	Low	
Condition name:	E	
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	9.94
Heating demand:	kW	9.94
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	10.579
COP	-	2.960
Power consumption	kW	3.574
Measured		
Heating capacity	kW	10.598
COP	-	2.945
Power consumption	kW	3.598
During heating		
Air_inlet temperature dry bulb	°C	-9.99
Air temperature wet bulb	°C	-11.02
Water_inlet temperature	°C	29.80
water_outlet temperature	°C	34.91
Water_outlet temperature (Time averaged)	°C	34.91
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	7196
Calculated Hydraulic power	W	4
Calculated global efficiency	η	0.16
Calculated Capacity correction	W	19
Calculated Power correction	W	23
Water Flow	m³/s	0.000499



Detailed SCOP test results - medium temperature application - average climate – EN 14825

Detailed result for 'EN14825:2022' Average Medium (A and F) A -7 /W52		
Tested according to:	EN14511:2022 and EN14825:2022	
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	9.92
Heating demand:	kW	8.78
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	8.985
COP	-	2.395
Power consumption	kW	3.752
Measured		
Heating capacity	kW	9.015
COP	-	2.379
Power consumption	kW	3.790
During heating		
Air_inlet temperature dry bulb	°C	-7.24
Air temperature wet bulb	°C	-8.03
Water_inlet temperature	°C	44.46
water_outlet temperature	°C	51.78
Water_outlet temperature (Time averaged)	°C	51.78
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	26742
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.21
Calculated Capacity correction	W	30
Calculated Power correction	W	38
Water Flow	m³/s	0.000298



Detailed result for 'EN14825:2022' Average Medium (B) A 2 /W42

Tested according to:		EN14511:2022 and EN14825:2022	
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	9.92	
Heating demand:	kW	5.34	
CR:	-	1.0	
Minimum flow reached:	-	No	
Measurement type:		Steady State	
Integrated liquid pump:		Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes	
<hr/>			
Included corrections (Final result)			
Heating capacity	kW	5.713	
COP	-	3.895	
Power consumption	kW	1.467	
Measured			
Heating capacity	kW	5.752	
COP	-	3.784	
Power consumption	kW	1.520	
During heating			
Air_inlet temperature dry bulb	°C	2.10	
Air temperature wet bulb	°C	0.87	
Water_inlet temperature	°C	37.49	
water_outlet temperature	°C	42.14	
Water_outlet temperature (Time averaged)	°C	42.14	
Circulation pump			
Measured external static pressure difference, liquid pump	Pa	47522	
Calculated Hydraulic power	W	14	
Calculated global efficiency	η	0.26	
Calculated Capacity correction	W	39	
Calculated Power correction	W	54	
Water Flow	m ³ /s	0.000298	



Detailed result for 'EN14825:2022' Average Medium (C) A 7 /W36		
Tested according to:	EN14511:2022 and EN14825:2022	
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	9.92
Heating demand:	kW	3.43
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.666
COP	-	5.230
Power consumption	kW	0.701
Measured		
Heating capacity	kW	3.696
COP	-	5.008
Power consumption	kW	0.738
During heating		
Air_inlet temperature dry bulb	°C	7.00
Air temperature wet bulb	°C	6.00
Water_inlet temperature	°C	33.03
water_outlet temperature	°C	36.01
Water_outlet temperature (Time averaged)	°C	36.01
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	25810
Calculated Hydraulic power	W	8
Calculated global efficiency	η	0.21
Calculated Capacity correction	W	30
Calculated Power correction	W	37
Water Flow	m ³ /s	0.000298



Detailed result for 'EN14825:2022' Average Medium (D) A 12 /W30		
Tested according to:	EN14511:2022 and EN14825:2022	
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	9.92
Heating demand:	kW	1.53
CR:	-	0.5
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	3.191
COP	-	5.582
Power consumption	kW	0.572
Measured		
Heating capacity	kW	3.219
COP	-	5.307
Power consumption	kW	0.607
During heating		
Air_inlet temperature dry bulb	°C	12.01
Air temperature wet bulb	°C	10.99
Water_inlet temperature	°C	28.78
water_outlet temperature	°C	31.38
Water_outlet temperature (Time averaged)	°C	30.02
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	23147
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	0.000298



Detailed result for 'EN14825:2022' Average Medium (E) A -10 /W55		
Tested according to:	EN14511:2022 and EN14825:2022	
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	9.92
Heating demand:	kW	9.92
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:	Steady State	
Integrated liquid pump:	Yes	
Integrated liquid pump able to generate a positive ext. static pressure difference:	Yes	
Included corrections (Final result)		
Heating capacity	kW	9.854
COP	-	2.068
Power consumption	kW	4.765
Measured		
Heating capacity	kW	9.912
COP	-	2.043
Power consumption	kW	4.852
During heating		
Air_inlet temperature dry bulb	°C	-10.02
Air temperature wet bulb	°C	-10.90
Water_inlet temperature	°C	46.88
water_outlet temperature	°C	54.95
Water_outlet temperature (Time averaged)	°C	54.95
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	95802
Calculated Hydraulic power	W	29
Calculated global efficiency	η	0.33
Calculated Capacity correction	W	57
Calculated Power correction	W	86
Water Flow	m³/s	0.000298



Detailed COP test results - low temperature – EN 14511

Detailed result for 'EN14511:2022' A7/W35		
Tested according to:		EN14511:2022
Minimum flow reached:		No
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	10.309
COP	-	4.912
Power consumption	kW	2.099
Measured		
Heating capacity	kW	10.350
COP	-	4.804
Power consumption	kW	2.154
During heating		
Air_inlet temperature dry bulb	°C	6.99
Air temperature wet bulb	°C	6.00
Water_inlet temperature	°C	29.97
water_outlet temperature	°C	34.96
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	29874
Calculated Hydraulic power	W	15
Calculated global efficiency	η	0.27
Calculated Capacity correction	W	40
Calculated Power correction	W	55
Water Flow	m ³ /s	0.000499



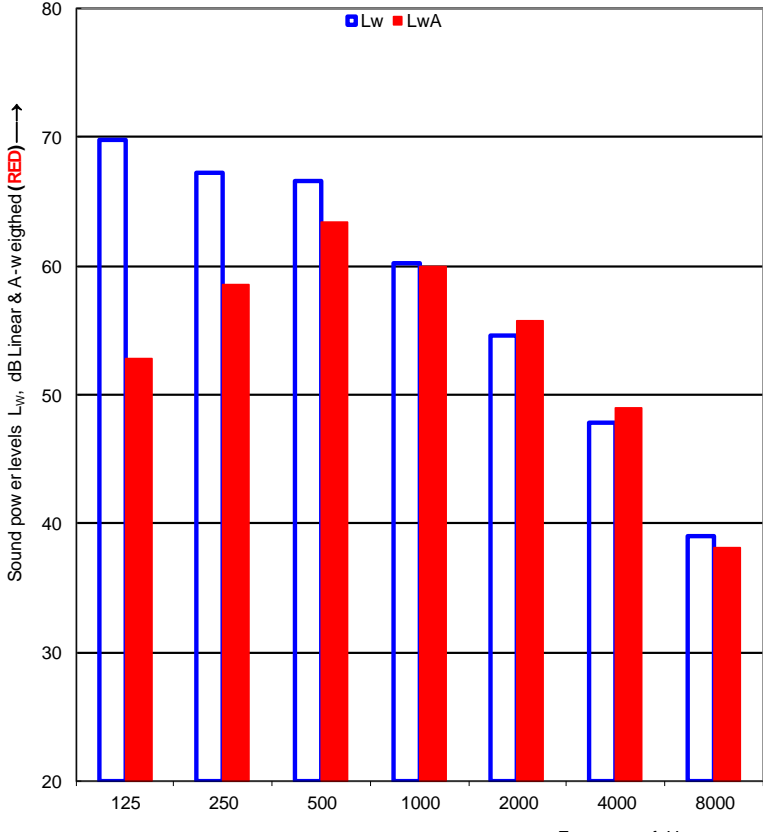


Detailed COP test results - medium temperature – EN 14511



Detailed result for 'EN14511:2022' A7/W55		
Tested according to:		EN14511:2022
Minimum flow reached:		No
Measurement type:		Steady State
Integrated liquid pump:		Yes
Integrated liquid pump able to generate a positive ext. static pressure difference:		Yes
Included corrections (Final result)		
Heating capacity	kW	9.995
COP	-	3.163
Power consumption	kW	3.160
Measured		
Heating capacity	kW	10.023
COP	-	3.136
Power consumption	kW	3.196
During heating		
Air_inlet temperature dry bulb	°C	7.01
Air temperature wet bulb	°C	5.98
Water_inlet temperature	°C	47.01
water_outlet temperature	°C	55.02
Circulation pump		
Measured external static pressure difference, liquid pump	Pa	23822
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	0.000304




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

 DANAK TEST Reg. nr. 300		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:	Home Star			Date of test:	14-04-2024																																																																		
Object:	Type: Air to water heat pump, Model: TH-R290-S10-3P																																																																						
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using four pieces of rubber feet supplied by the manufacture and placed on four pieces of concrete tiles (20x20x2.5 cm). All of these are placed in a water drop tray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 1.																																																																						
Operating conditions:	A7/W35, Compressor speed: 20[Hz], Fan speed: 41[Hz], Heating capacity: 3.78 [kW], Power_input: 0.89[kW], Water flow rate: 1800 [l/h] and dP_water: 850 [mbar]																																																																						
Static pressure:	1001 hPa			<u>Reference box:</u>																																																																			
Air temperature:	7.0 °C			L1:	1.4 m																																																																		
Relative air humidity:	85.0 %			L2:	0.6 m																																																																		
Test room volume:	102.8 m³	Room:	Room 1	L3:	1.1 m																																																																		
Area, S, of test room:	138.9 m²			Volume:	0.9 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>67.6</td><td></td></tr><tr><td>125</td><td>64.0</td><td>69.8</td></tr><tr><td>160</td><td>61.2</td><td></td></tr><tr><td>200</td><td>63.1</td><td></td></tr><tr><td>250</td><td>62.4</td><td>67.2</td></tr><tr><td>315</td><td>61.5</td><td></td></tr><tr><td>400</td><td>61.1</td><td></td></tr><tr><td>500</td><td>63.6</td><td>66.6</td></tr><tr><td>630</td><td>59.9</td><td></td></tr><tr><td>800</td><td>57.4</td><td></td></tr><tr><td>1000</td><td>54.6</td><td>60.2</td></tr><tr><td>1250</td><td>53.3</td><td></td></tr><tr><td>1600</td><td>51.6</td><td></td></tr><tr><td>2000</td><td>49.5</td><td>54.6</td></tr><tr><td>2500</td><td>47.2</td><td></td></tr><tr><td>3150</td><td>45.2</td><td></td></tr><tr><td>4000</td><td>43.0</td><td>47.9</td></tr><tr><td>5000</td><td>39.0</td><td></td></tr><tr><td>6300</td><td>35.5</td><td></td></tr><tr><td>8000</td><td>33.8</td><td>39.0</td></tr><tr><td>10000</td><td>33.1</td><td></td></tr></tbody></table>		Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	67.6		125	64.0	69.8	160	61.2		200	63.1		250	62.4	67.2	315	61.5		400	61.1		500	63.6	66.6	630	59.9		800	57.4		1000	54.6	60.2	1250	53.3		1600	51.6		2000	49.5	54.6	2500	47.2		3150	45.2		4000	43.0	47.9	5000	39.0		6300	35.5		8000	33.8	39.0	10000	33.1					
Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]																																																																					
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6300	35.5																																																																						
8000	33.8	39.0																																																																					
10000	33.1																																																																						
Sound power level L_w(A): 66.5 dB [re 1pW] Uncertainty σ_{tot}: 1.6 dB																																																																							
Name of test institute:	DTI			Date:	14-04-2024																																																																		
No. of test report:	300-KLAB-24-006																																																																						
Measurements are in full conformity with ISO 3743-1																																																																							

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



Sound power levels according to ISO 3743-1:2010



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

Client: Home Star

Date of test: 14-04-2024

Object: Type: Air to water heat pump, Model: TH-R290-S10-3P

Mounting conditions: The outdoor unit is mounted on the supporting metal support frame using four pieces of rubber feets supplied by the manufacture and placed on four pices of concrete tiles (20x20x2.5 cm). All of these are placed in a water drop dray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 1.

Operating conditions: A7/W55, Compressor speed: 23[Hz], Fan speed: 41[Hz], Heating capacity: 3.72 [kW], Power_input: 1.38[kW], Water flow rate: 1070 [l/h] and dP_water: 950 [mbar]

Static pressure: 1001 hPa

Reference box:
L1: 1.4 m
L2: 0.6 m
L3: 1.1 m
Volume: 0.9 m³

Air temperature: 7.0 °C

Room: Room 1

Relative air humidity: 85.0 %

Area, S, of test room: 138.9 m²

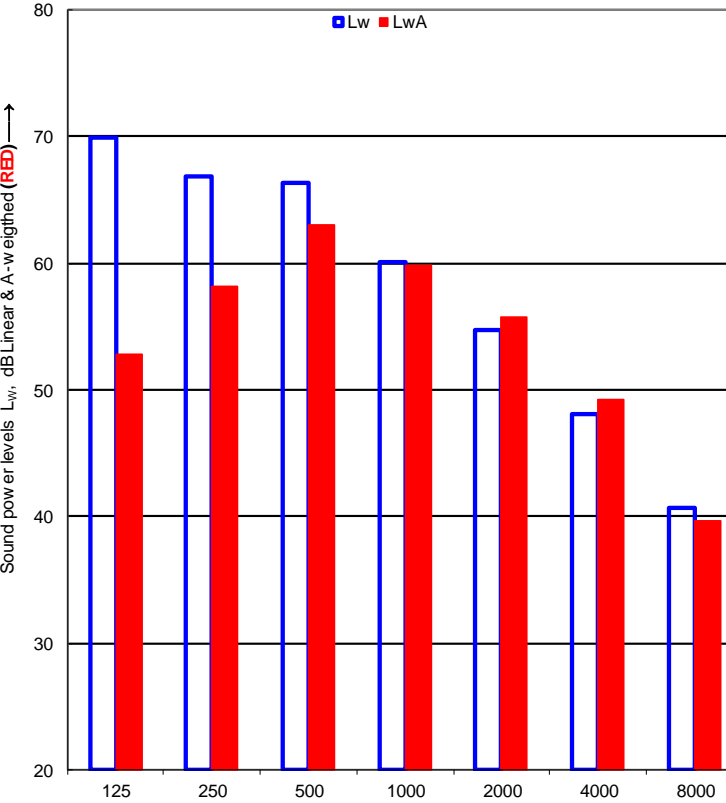
Test room volume: 102.8 m³

Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]
100	67.8	
125	63.9	69.9
160	61.0	
200	62.8	
250	62.0	66.8
315	61.2	
400	61.0	
500	63.1	66.3
630	59.7	
800	57.2	
1000	54.5	60.1
1250	53.2	
1600	51.6	
2000	49.7	54.6
2500	47.3	
3150	45.5	
4000	43.1	48.1
5000	39.4	
6300	36.2	
8000	36.9	40.6
10000	34.0	

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

L_w

L_wA



Sound power level L_w(A): 66.3 dB [re 1pW]

Uncertainty σ_{tot}: 1.6 dB

Name of test institute: DTI

Date: 14-04-2024

No. of test report: 300-KLAB-24-006

Measurements are in full conformity with ISO 3743-1



Appendix 1

Unit specification

Type of unit: Mono air to water heat pump
Manufacturer: Thermatec
Size of the heat pump: 0.6 x 1.4 x 1.1m (W x L x H)
Year of production: n/a.

Operating conditions and environment

The operating conditions of the unit under test fulfill the requirements for Class A.

The acoustic test chamber is a hard wall reverberant room (103 m³) and equipped with relevant sound diffusing reflector panels. The acoustic test chamber fulfils the requirements of ISO3743-1 accuracy grade 2 (engineering grade).

The measurements of the average sound pressure levels in 1/3 octave frequency bands are carried out using three microphones in the test chamber. During the measurements, the microphones are traversed up and down for one meter in the arc of a quarter circle.

The picture below shows the installation of the unit during test, position of microphones, sound diffusing reflector panels, and the reference sound source.





Measurement instruments

Id nr.	Manufacturer	Description	Calibration company
100864*	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 1	Norsonic A/S, Norway
100865*	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 1	Norsonic A/S, Norway
100866*	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 1	Norsonic A/S, Norway
100867	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 2	Norsonic A/S, Norway
100868	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 2	Norsonic A/S, Norway
100869	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 2	Norsonic A/S, Norway
100870	GRAS	Gras 40AE_26CA, ½" free field microphone, Roof monitor	Norsonic A/S, Norway
100873*	Brüel & Kjær	Acoustical calibrator, Brüel & Kjær 4231	Element Metech, Denmark
100859	Norsonic	Reference sound source, Norsonic Nor278 Room 1	RISE, Sweden
100872*	Norsonic	Reference sound source, Norsonic Nor278 Room 2	RISE, Sweden
100620*	Norsonic	Multi-channel measurement system Nor850	Norsonic A/S, Norway

*Instruments are used for the actual measurements for the calculation of the test results.

The other instruments are used for control measurements.
All microphones are equipped with windshields.



Test Procedure

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

- DS/EN 14511:2022
- EN 12102-1:2022
- ISO/EN 3743-1:2010

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

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.

Measurement uncertainty

The uncertainty of sound power level in decibel is determined in accordance with ISO 3743-1, equation 22 $\sigma_{tot} = \sqrt{\sigma_{RO}^2 + \sigma_{omc}^2}$ where:

- σ_{RO} is the standard deviation of the reproducibility of the method
- σ_{omc} is the standard deviation describing the uncertainty associated with the instability of the operating and mounting conditions for the particular noise source during test.

σ_{RO} expresses the uncertainty in test results delivered by the different accredited test laboratories due to different instrumentation and implementation of measurement procedure as well different radiation characteristics of the noise source during test.

σ_{omc} expresses the uncertainty associated with the instability of the operating and mounting conditions for the particular noise source during test. The mounting and installation conditions in two DTI acoustical test chambers are well defined in the test procedure. Possible instability of the operating conditions is monitored and assessed prior to each noise test.





The test uncertainty σ_{omc} is calculated according to ISO3743-1 Annex C formula C.1 and is typically below 1.0dB. However, the uncertainty is rounded up to the nearest 0.5 or 1.0dB increment in the report. As pr. Table C.1 (accuracy grade 2), the uncertainty σ_{RO} is set to 1.5.

The expanded uncertainty U is calculated according to ISO 3743-1 equation 23:
 $U = k \sigma_{\text{tot}}$ where $k = 2$ for 95% confidence.

EXAMPLE: $\sigma_{\text{tot}}: \sqrt{1.5^2 + 0.5^2} = 1.6 \text{ dB}$ and $U(95\%) = 3.2 \text{ dB}$

Note: The expanded uncertainty does not include the standard deviation of production which is used in ISO4871 for the purpose of making noise declaration for batches of machines.