OŚWIADCZENIE

Producent JBG-2 Sp. z o.o. oświadcza, iż pompy ciepła

1) 2HHH-P1-010K-R290-R5-M
Oznaczenie/typ/identyfikator modelu

2) 2HHH-P1-006K-R290-R5-M
Oznaczenie/typ/identyfikator modelu

3) 2HHH-Z1-010K-R290-R5-M
Oznaczenie/typ/identyfikator modelu

4) .....
Oznaczenie/typ/identyfikator modelu

5) .....
Oznaczenie/typ/identyfikator modelu

Należą do jednego podtypu w danym typoszeregu i spełniają łącznie następujące warunki:

- identyczna konstrukcja obiegu chłodniczego, ten sam czynnik chłodniczy/roboczy;
- ten sam producent, typ i liczba sprężarek;
- ten sam typ elementu rozprężnego;
- ten sam typ skraplacza;
- ten sam typ parownika;
- ten sam typ procesu odszraniania;
- ten sam sterownik i zasada sterowania wydajnością;
- ten sam producent, typ i liczba wentylatorów parownika (w przypadku powietrznych pomp ciepła) i zasada sterowania wydajnością (stała, zmienna lub stopniowana regulacja prędkości obrotowej);
- urządzenia z i bez zaworu czterodrogowego nie mogą być zaliczone do tego samego typoszeregu.

MANUFACTURER OF PROFESSIONAL REFRIGERATION EQUIPMENT

JBG2

JBG-2 Sp. z o.o.
43-254 Warszowice
ul. Gajowa 5
www.jbg2.com
VAT no. PL-6342383421

Warszowice 02.07.2024 r.
Miejscowość, data

Prezes Zarządu
Krzysztof Sitarski

WICEPREZES ZARZĄDU
Krzysztof Swoboda
Podpis osoby upoważnionej

CORRECTED COPY

Testing Laboratory 1045.1 accredited by the Czech Accreditation Institute pursuant to
ČSN EN ISO/IEC 17025:2018
Strojírenský zkušební ústav, s.p. Zkušební laboratoř
(Engineering Test Institute, Public Enterprise, Testing Laboratory)
Hudcova 424/56b, Medlánky, 621 00 Brno

L 1045.1

TEST REPORT
39-17723/H

Product:	Outdoor Air/Water Heat pump - monobloc
Type designation:	**ZHHH-P1-010K-R290-R5-M**
Customer:	JBG-2 Sp. z o.o. Gajowa 5 43-254 Warszowice POLAND
Manufacturer:	JBG-2 Sp. z o.o. Gajowa 5 43-254 Warszowice POLAND
Report issue date:	2024-06-14
Distribution list:	1 copy to the Customer 1 copy to the Engineering Test Institute

I. Description of product tested

The Heat pump **ZHHH-P1-010K-R290-R5-M** supplied by the company **JBG-2 Sp. z o.o.** is structurally adapted to operate in air/water system. Device is designed as monobloc placed outside and indoor electric box hanging on inner wall. Outdoor and indoor units are connected by electrical wires. Refrigerant R290 is used with charge 1.3 kg. Power supply is a one-phase. Heat pump is able to work in heating and cooling mode. Heat pump is working with variable flow rate.

Main components of the outdoor unit **ZHHH-P1-010K-R290-R5-M**:

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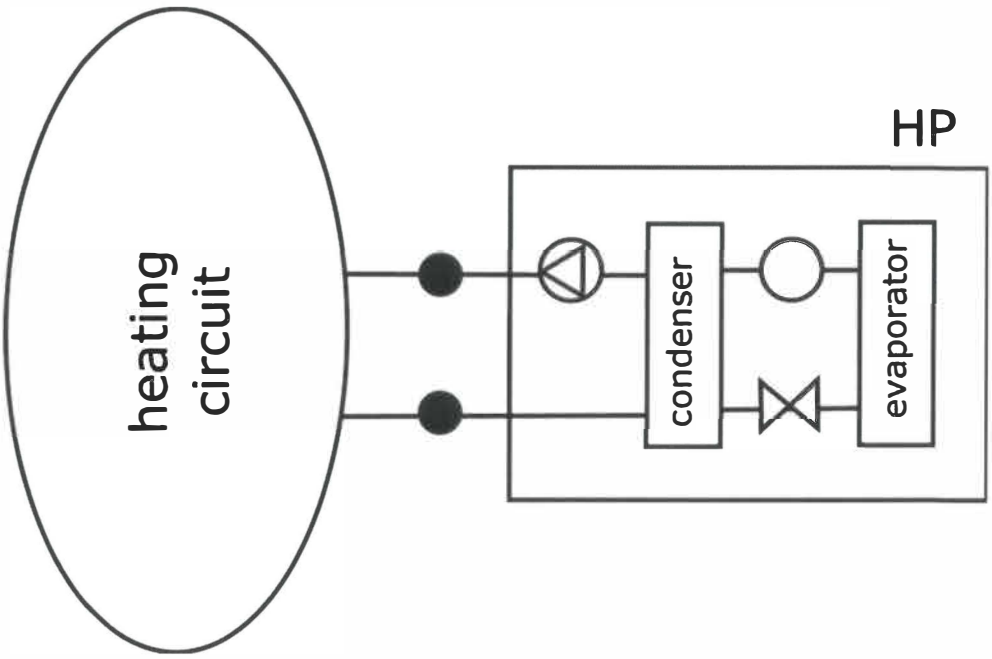
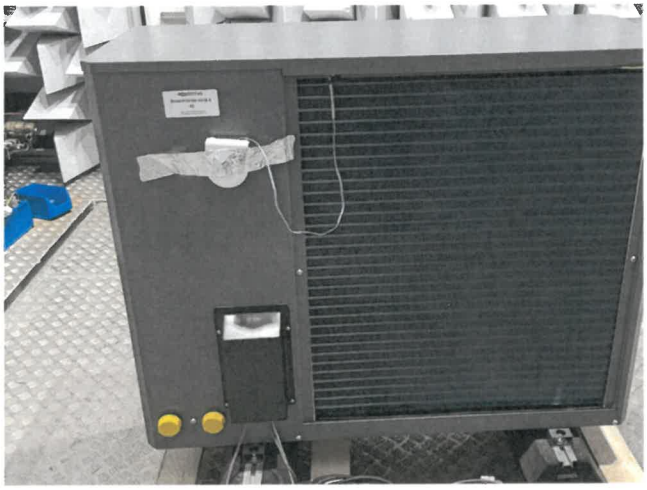
- Electrical box **BSEM01-0000 Electrical box**

Scheme:

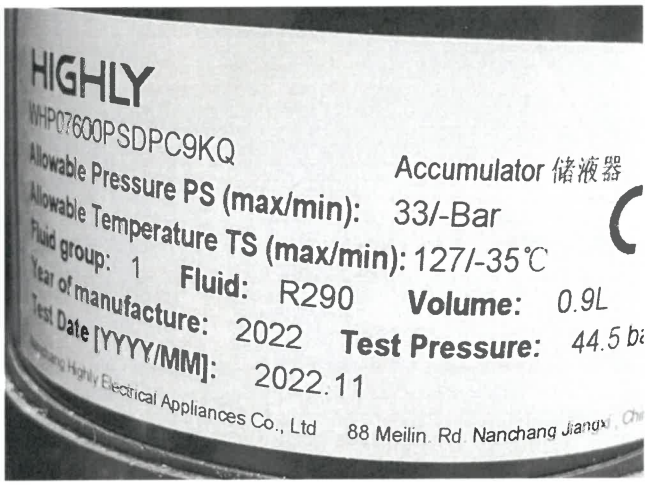


Photodocumentation:

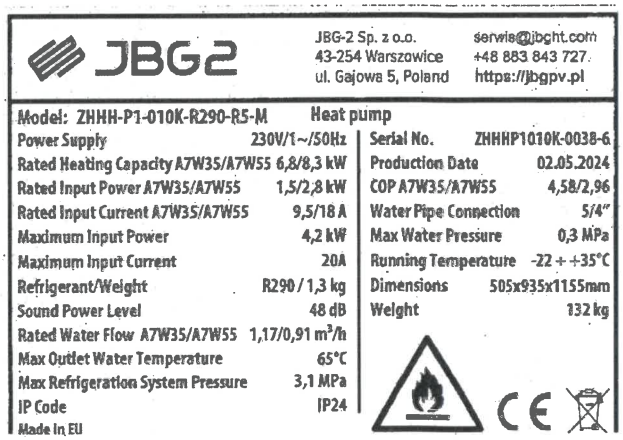


Heat pump **ZHHH-P1-010K-R290-R5-M**
– Back view –

Heat pump **ZHHH-P1-010K-R290-R5-M**
– Front view –



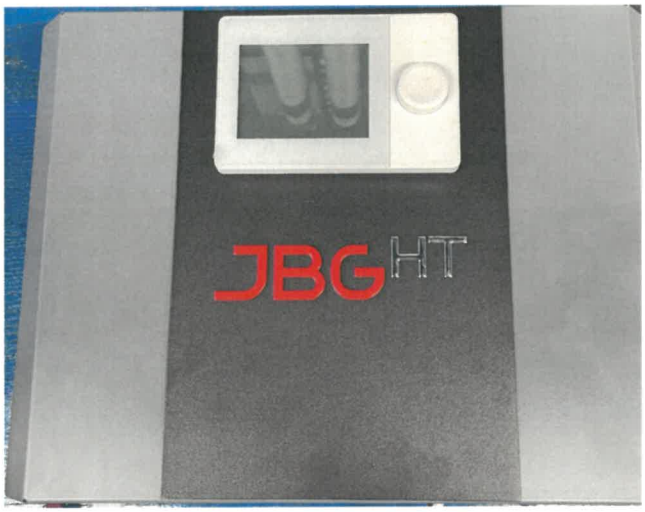
Heat pump **ZHHH-P1-010K-R290-R5-M**
– Compressor label –



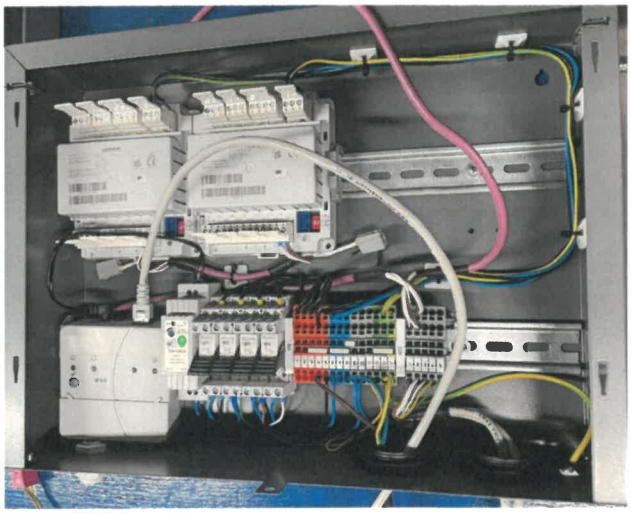
Heat pump **ZHHH-P1-010K-R290-R5-M**
– Label –

Heat pump **ZHHH-P1-010K-R290-R5-M**
– Without cover –

Electrical box **BSEM01-0000 Electrical box**
– Label –



Electrical box **BSEM01-0000 Electrical box**
– With cover –



Electrical box **BSEM01-0000 Electrical box**
– Without cover –

II. Sample tested

SZU reg. no.	Product name	Date of submission
1212.24.39986.001	**ZHHH-P1-010K-R290-R5-M**	2024-05-06

The visual inspection, tests and verification were carried out by Ing. Ondrej Bilkovič at the test station of SZU. The tests were performed using measuring and testing equipment with valid calibration.

III. Measuring and test equipment:

No.	Description	Inventory number
1.	Electrical energy meter	E2.1
2.	Digital watt meter	1.2.2 ENERGIE ANALYZATOR_2
3.	Flow meter Krohne Optiflux	8.1.2 TECH_K2_V_DN15
4.	Barometer	2.3 MAR18_1_PB
5.	Differential pressure gauge	3.2 MAR18_2_dP
6.	Thermometers	3.4 MAR18_T
7.	Thermo-hydro meter 608-H1	117043
8.	Tape measure	ME 475
9.	Multi-analyser SINUS SoundBook MK2	000-000-000-875/1
10.	Microphone pair G.R.A.S. 40 AK, wind deflector	000-000-000-875/2
11.	Calibrator G.R.A.S. 42AG	000-000-000-875/3

IV. Methods, results of tests and verifications

No.	Test objective	Requirement	Method of test	Documentation	Test evaluation/ verification *
1.	Calculation of sound power level	Art. 9	**ČSN ISO 9614-2:1997**	Page No. 6-13	+
2.	Acoustic measurements – Sound power level	Art. 8	**ČSN EN 12102-1:2023**	Page No. 7-13	+

***) Evaluation / statement of conformity:**

+..... Requirement fulfilled
-..... Requirement not fulfilled
0 .....Not applicable
x .....Not evaluated

Note:
The stated extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient k=2, corresponding to the coverage certainty of 95% as regards standard classification.

If a statement of conformity is provided, the decision rule pursuant to ILAC-G8:09/2019, Art. 4.2.1 – binary statement for the simple acceptance rule shall apply.

Test objective:	Heating and cooling equipment
Exact name of the test procedure:	**2.136*** - Measurement of noise characteristics
Test method:	**ČSN EN 12102-1:2023; ČSN ISO 9614-2:1997**
Sample tested:	Air/Water Heat pump **ZHHH-P1-010K-R290-R5-M**
Measuring equipment used:	see Chapter III
Place of test:	Engineering Test Institute, Hudcova 424/56b, 621 00 Brno, CZ

Measurement uncertainty:

Measured quantity	**Unit**	**Uncertainty of measurement**	**Evaluation**
Liquid			
- temperature difference (dT)	[K]	± 0.15 K	fulfilled
- temperature inlet/outlet	[°C]	± 0.15 K	fulfilled
- volume flow	[m^3/s]	± 1 %	fulfilled
- static pressure difference	[kPa]	± 1 kPa (Δp ≤ 20 kPa) or ± 5 % (Δp > 20 kPa)	fulfilled
Air			
- dry bulb temperature	[°C]	± 0.2 K	fulfilled
- wet bulb temperature	[°C]	± 0.4 K	fulfilled
- volume flow	[m^3/s]	± 5 %	not applied
- static pressure difference	[Pa]	± 5 Pa (Δp ≤ 100 Pa) or ± 5 % (Δp > 100 Pa)	not applied
Refrigerant			
- pressure at compressor outlet	[kPa]	± 1 %	not applied
- temperature	[°C]	± 0.5 K	not applied
Concentration (in volume)			
- heat transfer medium	[%]	± 2	not applied
Electrical quantities			
- electric power	[W]	± 1 %	fulfilled
- voltage	[V]	± 0.5 %	fulfilled
- current	[A]	± 0.5 %	fulfilled
- electric energy	[kWh]	± 1 %	not applied
Compressor rotational speed	[min^{-1}]	± 0.5 %	not applied
The heating or cooling capacities measured on the liquid side shall be determined within a maximum uncertainty of 5 % independent of the individual uncertainties of measurement including the uncertainties on the properties of fluids.			fulfilled

Note:
Comment to abbreviated marking: e.g. A7/W55
A (air) 7 (input source air temperature in °C) / W (water), 55 (output heating water temperature in °C)

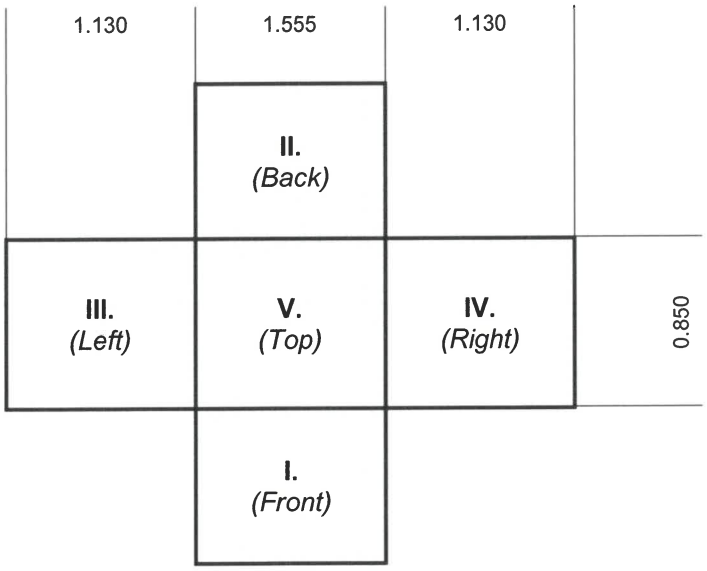
a) Measurement surface

Tested samples were surrounded by a cuboid-shape measuring surface set at the distance *d* [m].

Test Sample: Air/Water Heat pump **ZHHH-P1-010K-R290-R5-M**			
Distance from the test sample	*d*	[m]	0.200
Height of measurement surface	*h*	[m]	1.130
Width of measurement surface	*w*	[m]	1.555
Depth of measurement surface	*l*	[m]	0.850
Total measurement surface area	*S*	[m²]	6.757
Minimal measuring time per surface	t_M	[s]	90.00

Sketch of measurement surface (not to scale):

Air/Water Heat pump **ZHHH-P1-010K-R290-R5-M**
– Outdoor unit –



b) Acoustic environment

The device under test was placed inside a climate chamber (dimensions shown below). The chamber was acoustically treated to be compliant with ČSN EN ISO 3745:2012 requirements for hemi-anechoic chambers. The background noise was stable with the main noise source being the air conditioning of the climate chamber which was set to lower power or momentarily turned off for sufficient signal to noise ratio. The device under test was placed in a position offset from the middle of the chamber, at a sufficient distance from the surrounding walls, and was rotated by about 5÷10 °. Care was taken to ensure low air flow at the measurement surface by varying the measurement distance and positions.

Climate-acoustic chamber *(corresponds to free field over a reflecting plane)*			
Width of testing room	l_1	[m]	6.95
Length of testing room	l_2	[m]	4.50
Height of testing room	l_3	[m]	3.60

c) Measured and calculated data – General overview:

Test sample			Air/Water Heat pump **ZHHH-P1-010K-R290-R5-M**
The measured values are in accordance with ČSN EN 12102-1:2023			YES
The measured values are in accordance with ČSN EN ISO 9614-2:1997			YES
Operation mode			Heating
Specification of the assessment condition			A7/W55*
Type of HP capacity regulation			Inverter
Compressor speed settings			24 %
Fan speed settings			AUTO
Date of testing (YYYY-MM-DD)			2024-05-14
Reference air temperature	t_{amb}	[°C]	7.0
Relative humidity of air	RH	[%]	87.2
Ambient pressure	p_{amb}	[hPa]	985.1
Overall sound power level (linear)	L_W	[dB]	57.0 ± 1.5
Overall A-weighted sound power level	L_{WA}	**[dB(A)]**	**48.0 ± 1.5**
Accuracy class			**Engineering** (grade 2)

*) *Comment to abbreviated marking: i.e. A7/W55*
A (water), 7 (input source liquid temperature in °C) / W (water), 55 (outlet heating water temperature in °C)

1A) **Measurement results** – octave bands

Air/Water Heat pump **ZHHH-P1-010K-R290-R5-M** Outdoor unit at A7/W55; Compressor at 24 %; Fan at AUTO	**Engineering (Grade 2)**

f_m	Criterion 1			Criterion 2		Criterion 3	All criteria passed?	L_W	L_{WA}	U	Evaluation
[Hz]	L_d	F_{pl}	$L_d > F_{pl}$	$F_{+/-}$	$F_{+/-} \leq 3$	$L_{W(1)}-L_{W(2)} \leq s$		[dB]	[dB(A)]	[dB]	
125	27.2	5.7	YES	0.2	YES	YES	YES	54.7	38.1	± 3.0	passed
250	27.8	2.5	YES	0.0	YES	YES	YES	51.1	42.4	± 2.0	passed
500	**27.9**	**3.4**	**YES**	**0.0**	**YES**	**YES**	**YES**	**47.9**	**44.0**	**± 1.5**	**passed**
1000	20.8	3.5	YES	0.0	YES	YES	YES	40.7	40.6	± 1.5	passed
2000	21.2	4.1	YES	0.0	YES	YES	YES	31.8	32.9	± 1.5	c
4000	20.6	9.9	YES	0.0	YES	YES	YES	25.1	26.1	± 1.5	c
8000**)	20.8	10.6	YES	1.1	YES	NO	NO	21.1	21.0	± 2.5	nc
Total								**57.0**	**48.0**	**± 1.5**	

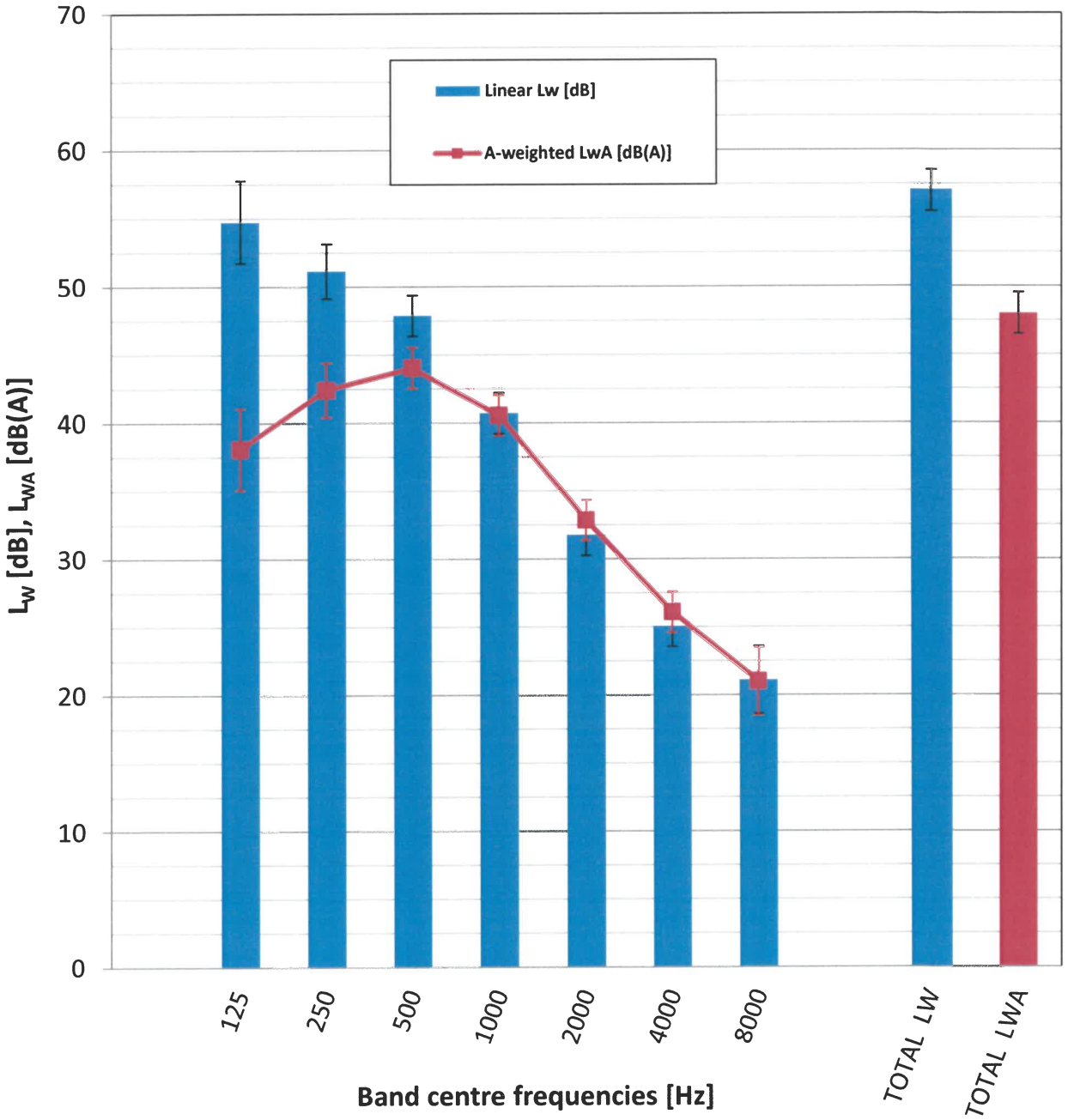
**) *Due to the sound intensity method limitations, the frequency of 6300 Hz was measured only.*

Legend:

passed	*Frequency bands with this description are significant for the calculation of A-weighted total sound power level L_{WA}. Required accuracy class is fulfilled in this band.*
not passed	*Frequency bands with this description are significant for the calculation of A-weighted total sound power level L_{WA}. Required accuracy class is not fulfilled in this band.*
c	*Frequency bands with this description are not significant for the calculation of A-weighted total sound power level L_{WA}. These bands are evaluated in the calculation of L_{WA}.*
nc	*Frequency bands with this description are not significant for the calculation of A-weighted total sound power level L_{WA}. These bands are not evaluated in the calculation of L_{WA}.*

Spectrum of Sound power level L_W – octave bands

Air/Water Heat pump **ZHHH-P1-010K-R290-R5-M** Outdoor unit at A7/W55; Compressor at 24 %; Fan at AUTO	**Engineering (Grade 2)**



1B) **Measurement results** – one-third octave bands

Air/Water Heat pump **ZHHH-P1-010K-R290-R5-M** Outdoor unit at A7/W55; Compressor at 24 %; Fan at AUTO	**Engineering (Grade 2)**

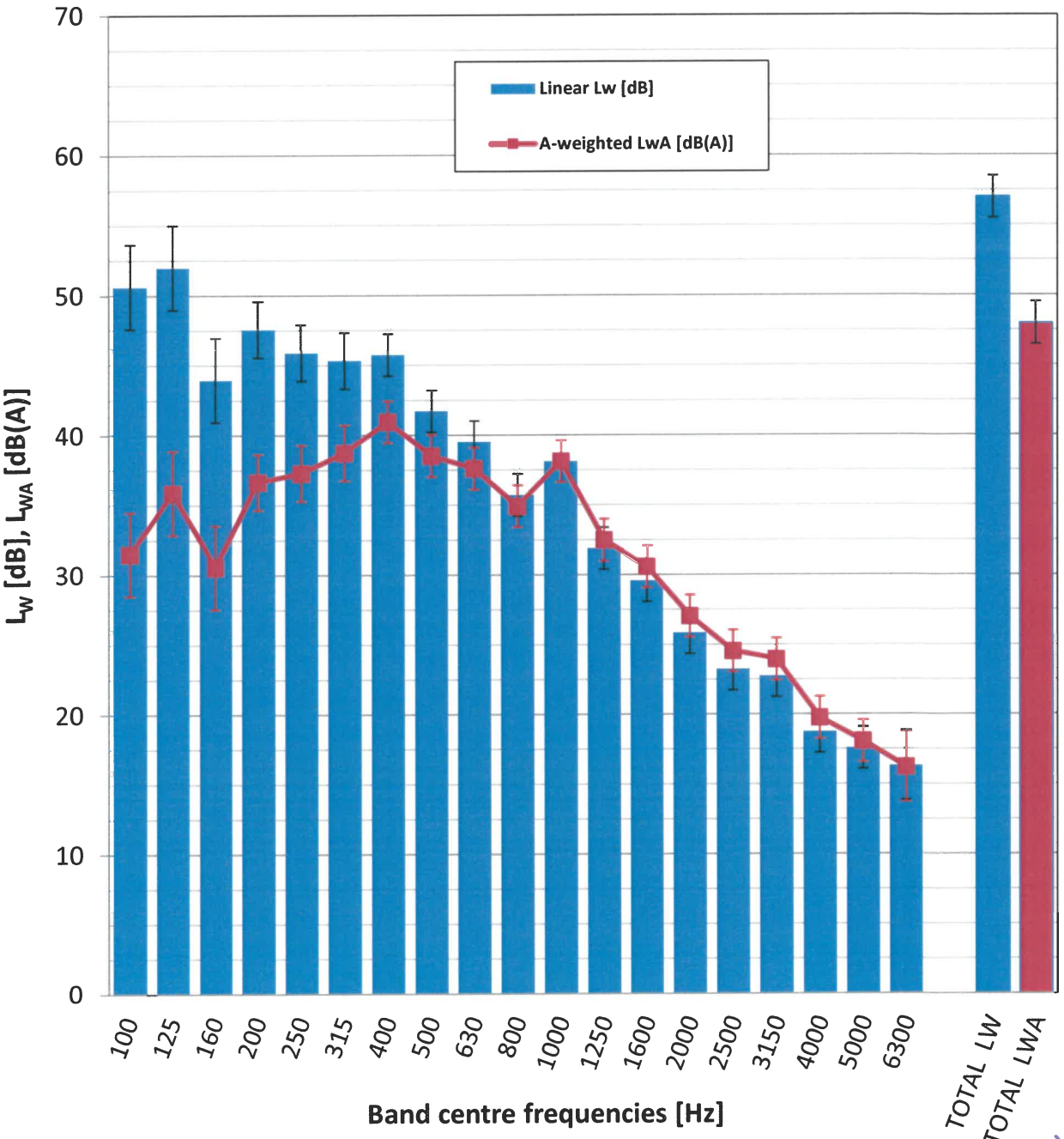
f_m	Criterion 1			Criterion 2		Criterion 3	All criteria passed?	L_W	L_{WA}	U	Evaluation
[Hz]	L_d	F_{pl}	$L_d > F_{pl}$	$F_{+/-}$	$F_{+/-} \leq 3$	$L_{W(1)}-L_{W(2)} \leq s$		[dB]	[dB(A)]	[dB]	
100	27.4	5.0	YES	0.0	YES	YES	YES	50.6	31.5	± 3.0	passed
125	27.2	5.7	YES	0.2	YES	YES	YES	52.0	35.9	± 3.0	passed
160	27.3	9.2	YES	0.2	YES	YES	YES	44.0	30.6	± 3.0	passed
200	27.6	3.2	YES	0.0	YES	YES	YES	47.6	36.7	± 2.0	passed
250	27.8	2.5	YES	0.0	YES	YES	YES	45.9	37.3	± 2.0	passed
315	28.0	2.9	YES	0.0	YES	YES	YES	45.3	38.7	± 2.0	passed
400	**28.0**	**4.2**	**YES**	**0.0**	**YES**	**YES**	**YES**	**45.8**	**41.0**	**± 1.5**	**passed**
500	27.9	3.4	YES	0.0	YES	YES	YES	41.7	38.5	± 1.5	passed
630	27.7	3.6	YES	0.0	YES	YES	YES	39.5	37.6	± 1.5	passed
800	21.0	3.8	YES	0.0	YES	YES	YES	35.7	34.9	± 1.5	passed
1000	20.8	3.5	YES	0.0	YES	YES	YES	38.1	38.1	± 1.5	passed
1250	27.0	4.3	YES	0.0	YES	YES	YES	31.9	32.5	± 1.5	passed
1600	27.0	3.9	YES	0.0	YES	YES	YES	29.6	30.6	± 1.5	passed
2000	21.2	4.1	YES	0.0	YES	YES	YES	25.9	27.1	± 1.5	passed
2500	20.9	4.9	YES	0.0	YES	YES	YES	23.3	24.6	± 1.5	c
3150	20.7	5.2	YES	0.0	YES	YES	YES	22.8	24.0	± 1.5	c
4000	20.6	9.9	YES	0.0	YES	YES	YES	18.8	19.8	± 1.5	c
5000	20.5	7.6	YES	0.0	YES	NO	NO	17.6	18.1	± 1.5	c
6300	20.8	10.6	YES	1.1	YES	NO	NO	16.3	16.2	± 2.5	c
Total								**57.0**	**48.0**	**± 1.5**	

Legend:

passed	*Frequency bands with this description are significant for the calculation of A-weighted total sound power level L_{WA}. Required accuracy class is fulfilled in this band.*
not passed	*Frequency bands with this description are significant for the calculation of A-weighted total sound power level L_{WA}. Required accuracy class is not fulfilled in this band.*
c	*Frequency bands with this description are not significant for the calculation of A-weighted total sound power level L_{WA}. These bands are evaluated in the calculation of L_{WA}.*
nc	*Frequency bands with this description are not significant for the calculation of A-weighted total sound power level L_{WA}. These bands are not evaluated in the calculation of L_{WA}.*

Spectrum of Sound power level L_W – one-third octave bands

Air/Water Heat pump **ZHHH-P1-010K-R290-R5-M** Outdoor unit at A7/W55; Compressor at 24 %; Fan at AUTO	**Engineering (Grade 2)**



Tested by: Ing. Ondrej Bilkovič Date: 2024-06-14 Signed:

Reviewed and approved by: Ing. Antonín Kolbábek, Ph.D. Date: 2024-06-14 Signed:

V. A list of referenced documents

- Order of 2024-04-22 (Order reg. no. B-82120, received on 2024-04-25)
- Contract B-82120/39

- ČSN EN 12102-1:2023 - Air conditioners, liquid chilling packages, heat pumps, process chillers and dehumidifiers with electrically driven compressors - Determination of the sound power level - Part 1: Air conditioners, liquid chilling packages, heat pumps for space heating and cooling, dehumidifiers and process chillers
- ČSN ISO 9614-2:1997 - Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scannig

- ČSN EN 14511-2:2023 - Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 2: Test conditions
- ČSN EN 14511-3:2023 - Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 3: Test methods
- ČSN EN 14511-4:2023 - Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 4: Requirements
- ČSN EN 14825:2023 - Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling, commercial and process cooling - Testing and rating at part load conditions and calculation of seasonal performance

- Background of the SZU task no. 39-17723
- Record measurement file 39-17723-H.zip

Test Report compiled by: **Ing. Ondrej Bilkovič**
Test engineer

Test Report approved by: **Ing. Antonín Kolbábek, Ph.D.**
Hydraulic and Pressure Equipment Manager

– End of Test Report –

Testing Laboratory 1045.1 accredited by the Czech Accreditation Institute pursuant to
ČSN EN ISO/IEC 17025:2018
Strojírenský zkušební ústav, s.p. Zkušební laboratoř
(Engineering Test Institute, Public Enterprise, Testing Laboratory)
Hudcova 424/56b, Medlánky, 621 00 Brno

L 1045.1

TEST REPORT
39-17723/T

Product:	Outdoor Air/Water Heat pump - monobloc
Type designation:	**ZHHH-P1-010K-R290-R5-M**
Customer:	JBG-2 Sp. z o.o. Gajowa 5 43-254 Warszowice POLAND
Manufacturer:	JBG-2 Sp. z o.o. Gajowa 5 43-254 Warszowice POLAND
Report issue date:	2024-06-14
Distribution list:	1 copy to the Customer 1 copy to the Engineering Test Institute

I. Description of product tested

The Heat pump **ZHHH-P1-010K-R290-R5-M** supplied by the company **JBG-2 Sp. z o.o.** is structurally adapted to operate in air/water system. Device is designed as monobloc placed outside and indoor electric box hanging on inner wall. Outdoor and indoor units are connected by electrical wires. Refrigerant R290 is used with charge 1.3 kg. Power supply is a one-phase. Heat pump is able to work in heating and cooling mode. Heat pump is working with variable flow rate.

Main components of the outdoor unit **ZHHH-P1-010K-R290-R5-M**:

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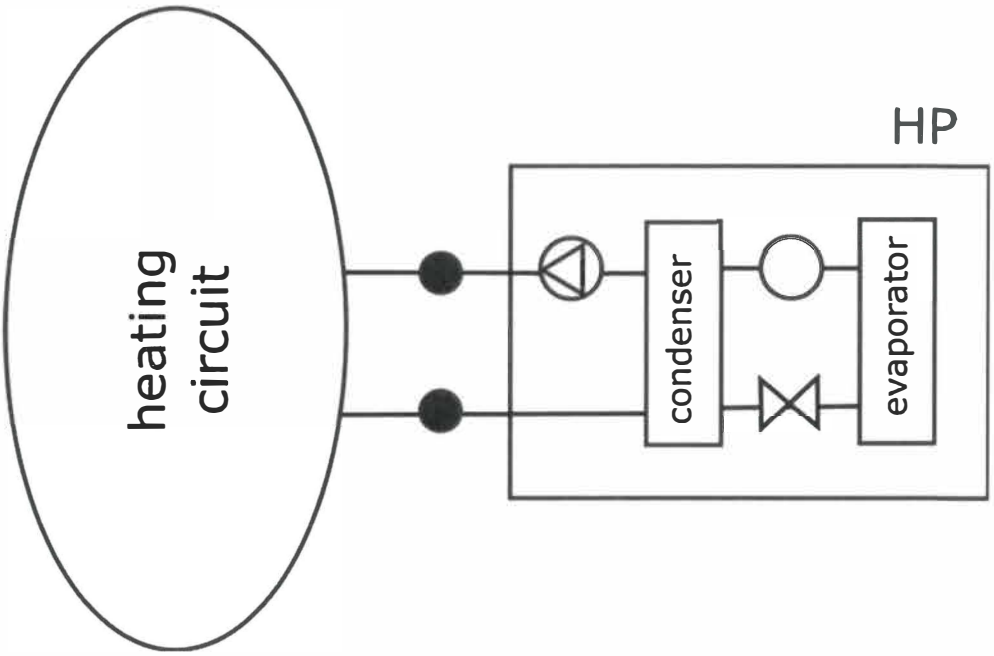
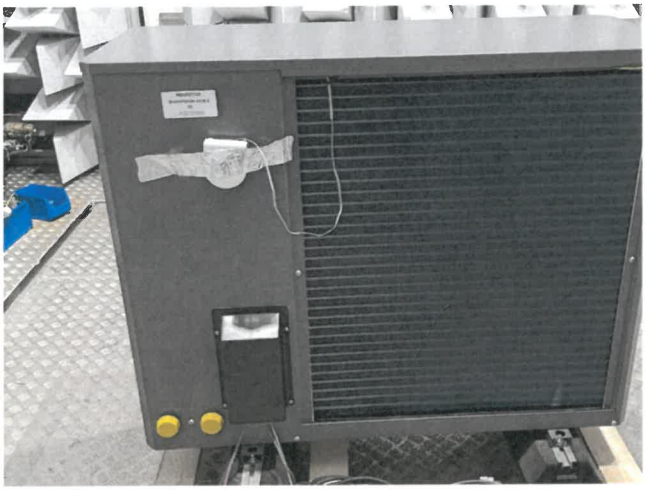
- Electrical box **BSEM01-0000 Electrical box**

Scheme:

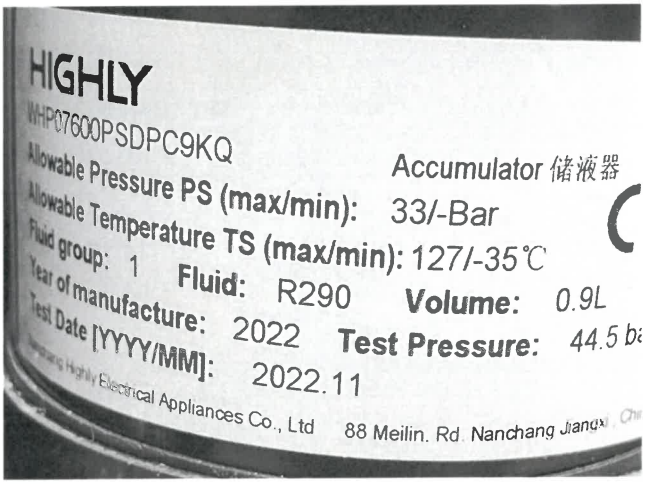


Photodocumentation:

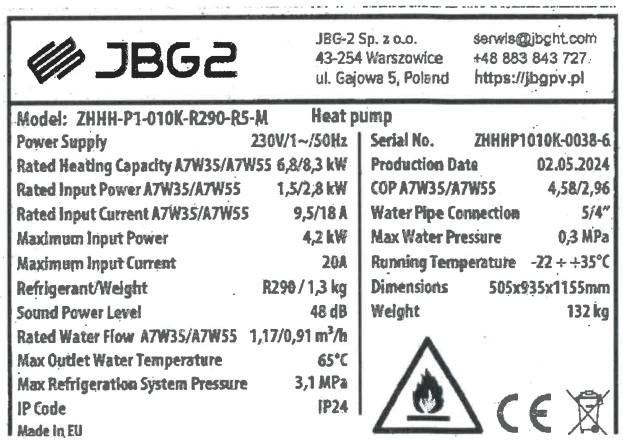


Heat pump **ZHHH-P1-010K-R290-R5-M**
– Back view –

Heat pump **ZHHH-P1-010K-R290-R5-M**
– Front view –

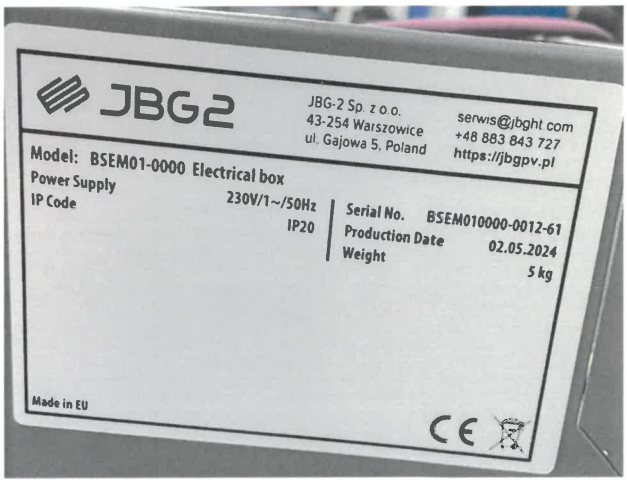


Heat pump **ZHHH-P1-010K-R290-R5-M**
– Compressor label –



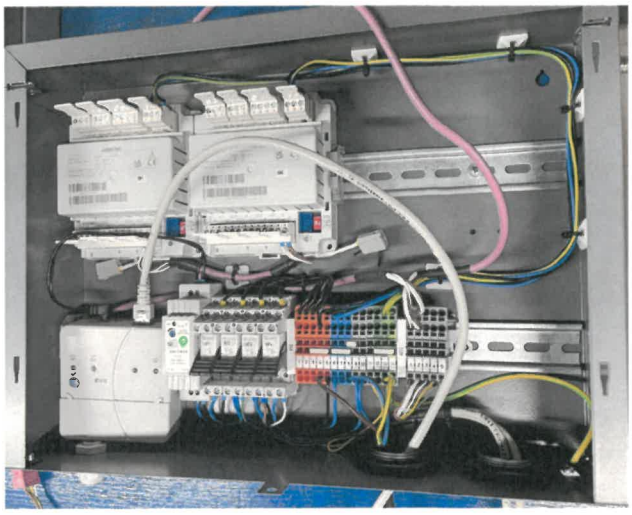
Heat pump **ZHHH-P1-010K-R290-R5-M**
– Label –

Heat pump **ZHHH-P1-010K-R290-R5-M**
– Without cover –



Electrical box **BSEM01-0000 Electrical box**
– Label –

Electrical box **BSEM01-0000 Electrical box**
– With cover –



Electrical box **BSEM01-0000 Electrical box**
– Without cover –

II. Sample tested

SZU reg. no.	Product name	Date of submission
1212.24.39986.001	**ZHHH-P1-010K-R290-R5-M**	2024-05-06

The visual inspection, tests and verification were carried out by Ing. Jakub Čederle at the test station of SZU
The tests were performed using measuring and testing equipment with valid calibration.

III. Measuring and test equipment:

No.	Description:	Inventory number:
1.	Electrical energy meter	E2.1
2.	Digital watt meter	1.2.2 ENERGIE ANALYZATOR_2
3.	Flow meter Krohne Optiflux	8.1.1 TECH_K1_V_DN15
4.	Barometer	2.4 MAR18_1_PB
5.	Differential pressure gauge	3.2 MAR18_2_dP
6.	Temperature-humidity meter HF532	3.1.1 K2_VLHKOST_1
7.	Temperature-humidity meter HF532	3.1.3 K2_VLHKOST_2
8.	Thermometers	3.4 MAR18_T

IV. Methods, results of tests and verifications

No.	Test objective	Requirement	Method of test	Documentation	Test evaluation/ verification *
1.	Rating conditions	–	ČSN EN 14511-2:2023 ČSN EN 14511-3:2023	Page No. 7	x
2.	Seasonal performance tests and SCOP calculation – Low temperature application	–	ČSN EN 14511-3:2023 ČSN EN 14825:2023	Page No. 8 – 14	x
3.	Seasonal performance tests and SCOP calculation – Medium temperature application	–	ČSN EN 14511-3:2023 ČSN EN 14825:2023	Page No. 15 – 21	x
4.	Safety tests	Art. 4.2.1.2 Art. 4.2.1.3 Art. 4.5 sect. a) Art. 4.5 sect. b) Art. 4.6	ČSN EN 14511-4:2023	Page No. 22 – 24	+
5.	Seasonal performance tests and SEER calculation – Floor cooling	–	ČSN EN 14511-3:2023 ČSN EN 14825:2023	Page No. 25	x
6.	Seasonal performance tests and SEER calculation – Fan coil	–	ČSN EN 14511-3:2023 ČSN EN 14825:2023	Page No. 26	x

*) **Evaluation / statement of conformity:**
+..... Requirement fulfilled
-..... Requirement not fulfilled
0 .....Not applicable
x .....Not evaluated

Measured quantity	Unit	Uncertainty of measurement	Evaluation
Liquid			
- temperature difference (dT)	[K]	± 0.15 K	fulfilled
- temperature inlet/outlet	[°C]	± 0.15 K	fulfilled
- volume flow	[m3/s]	± 1 %	fulfilled
- static pressure difference	[kPa]	± 1 kPa (Δp ≤ 20 kPa) or ± 5 % (Δp > 20 kPa)	fulfilled
Air			
- dry bulb temperature	[°C]	± 0.2 K	fulfilled
- wet bulb temperature	[°C]	± 0.4 K	fulfilled
- volume flow	[m3/s]	± 5 %	not applied
- static pressure difference	[Pa]	± 5 Pa (Δp ≤ 100 Pa) or ± 5 % (Δp > 100 Pa)	not applied
Refrigerant			
- pressure at compressor outlet	[kPa]	± 1 %	not applied
- temperature	[°C]	± 0.5 K	not applied
Concentration (in volume)			
- heat transfer medium	[%]	± 2	not related
Electrical quantities			
- electric power	[W]	± 1 %	fulfilled
- voltage	[V]	± 0.5 %	fulfilled
- current	[A]	± 0.5 %	fulfilled
- electric energy	[kWh]	± 1 %	not applied
Compressor rotational speed	[min-1]	± 0.5 %	not applied
The heating or cooling capacities measured on the liquid side shall be determined within a maximum uncertainty of 5 % independent of the individual uncertainties of measurement including the uncertainties on the properties of fluids.			fulfilled

Note:
The stated extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient k=2, corresponding to the coverage certainty of 95% as regards standard classification.

If a statement of conformity is provided, the decision rule pursuant to ILAC-G8:09/2019, Art. 4.2.1 - binary statement for the simple acceptance rule shall apply.

Comment to abbreviated marking: e.g. A7/W35
A (air) 7 (input air, dry-bulb temperature in °C) / W (water), 35 (output heating water temperature in °C)

Test objective:	Rating conditions
Exact name of the test procedure:	**1.37* - Tests of leakage, pressure resistance, thermal and technical parameters, combustion efficiency, safety functions**
Test method:	ČSN EN 14511-2:2023, ČSN EN 14511-3:2023
Sample tested:	Heat pump **ZHHH-P1-010K-R290-R5-M**
Measuring equipment used:	see Chapter III

Specification of the assessment condition		**A7/W35**	**A7/W55**
Date of testing		**2024-05-06**	**2024-05-06**
Transient test procedure	YES / NO	NO	NO
Average defrost time of 1 cycle	[min]	–	–
Average time of 1 cycle	[min]	–	–
Calculation time	[min]	70.0	70.0
Output heating water – temperature calculation	[°C]	35.02	55.00
Input heating water – temperature calculation	[°C]	30.01	47.00
Output heating water temperature	[°C]	35.02	55.00
Input heating water temperature	[°C]	30.01	47.00
Air temperature – dry bulb temperature	[°C]	7.00	6.99
Air temperature – wet bulb temperature	[°C]	6.05	6.00
Relative humidity	[%]	87.60	87.04
Barometric pressure	[kPa]	97.747	97.558
Ambient temperature	[°C]	6.96	6.93
Secondary circuit pressure difference	[kPa]	-4.943	12.600
Efficiency of the secondary liquid pump	[–]	0.133	0.153
Volume flow rate of heating water	$[m^3 \cdot h^{-1}]$	1.1699	0.9102
Density of heating water	$[kg \cdot m^{-3}]$	994.0	985.9
Specific heat capacity of heating water	$[kJ \cdot kg^{-1} \cdot K^{-1}]$	4.175	4.178
Voltage	[V]	232.01	231.70
Total current	[A]	9.54	18.02
Overall power input	[kW]	1.467	2.821
Capacity correction of sec. liquid pump	[W]	-10.48	17.607
Power input correction of sec. liquid pump	[W]	-12.09	20.79
Heating capacity – heating water	[kW]	6.768	8.329
Corrected heating capacity – heating water	**[kW]**	**6.778**	**8.312**
Uncertainty of corrected heating capacity	[kW]	± 0.116	± 0.092
Effective electric power input	**[kW]**	**1.479**	**2.801**
COP	**[–]**	**4.584**	**2.968**
Uncertainty of COP	[–]	± 0.079	± 0.033
Control settings	**[%]**	**53**	**70**
Circulation pump settings – heating water	[%]	25	43

Test objective:	Seasonal performance tests and SCOP calculation – Low temperature application
Exact name of the test procedure:	**1.37* - Tests of leakage, pressure resistance, thermal and technical parameters, combustion efficiency, safety functions**
Test method:	ČSN EN 14511-3:2023, ČSN EN 14825:2023
Sample tested:	Heat pump **ZHHH-P1-010K-R290-R5-M**
Measuring equipment used:	see Chapter III

Design				Air / water – monobloc		
Conditions specification according to ČSN EN 14825:2023	Temperature application			**Low** (reference water temperature 35 °C)		
	Reference heating season			**Average**		
	Outlet water temperature - indoor heat exchanger			Variable		
	Compressor speed control			Variable		
	Water flow rate – primary circuit			–		
	Water flow rate – secondary circuit			Variable		
Seasonal space heating energy efficiency	Heating	Average	η_s		**203.6**	%
		Warmer	η_s		–	%
		Colder	η_s		–	%
Seasonal efficiency according to ČSN EN 14825:2023	Heating	Average	**SCOP**		**5.16**	–
		Warmer	SCOP		–	–
		Colder	SCOP		–	–
Function	Cooling				Yes	
	Heating	Yes	Reference heating season	Average	Yes	
				Warmer	–	
				Colder	–	
Full heating load	Cooling		$P_{designc}$		–	kW
	Heating	Average	$P_{designh}$		**6.80**	kW
		Warmer	$P_{designh}$		–	kW
		Colder	$P_{designh}$		–	kW
Bivalent temperatures	Heating	Average	$T_{bivalent}$		-10	°C
		Warmer	$T_{bivalent}$		–	°C
		Colder	$T_{bivalent}$		–	°C
Operation limit temperatures	Heating	Average	TOL		-10	°C
		Warmer	TOL		–	°C
		Colder	TOL		–	°C
Seasonal power consumption according to ČSN EN 14825:2023	Cooling		Q_{CE}		–	kWh
	Heating	Average	Q_{HE}		2719	kWh
		Warmer	Q_{HE}		–	kWh
		Colder	Q_{HE}		–	kWh
Modes other than „active mode“	Off mode			P_{OFF}	13.0	W
	Thermostat off mode			P_{TO}	13.0	W
	Standby mode			P_{SB}	13.0	W
	Crankcase heater mode			P_{CK}	0.0	W

(Not tested): The technical data were declared by the Manufacturer and were not tested by the Testing Laboratory.

Calculation of SCOP according to ČSN EN 14825:2023:

Number of hours used for calculation of reference SCOP (Annex B – Table B. 2, B. 3)

- For reversible heat pumps and reference heating season „A“ = average

H_{HE}	2066	[h]
H_{TO}	178	[h]
H_{SB}	0	[h]
H_{CK}	178	[h]
H_{OFF}	0	[h]

Measured data:

P_{TO}	0.0130	[kW]
P_{SB}	0.0130	[kW]
P_{CK}	0.0000	[kW]
P_{OFF}	0.0130	[kW]
$P_{designh}$	6.80	[kW]
$SCOP_{ON}$	5.17	[–]

Coefficient and correction:

F(1)	3	[%]
F(2)	0	[%]
CC	2.5	[–]

Calculation of SCOP:

7.3 Calculation of the reference annual heating demand (Q_H)

$Q_H = P_{designh} \cdot H_{HE}$ [kWh]

$Q_H = 6.8 \cdot 2066 = 14041$ [kWh]

7.4 Calculation of the annual electricity consumption (Q_{HE})

$Q_{HE} = Q_H / SCOP_{on} + H_{TO} \cdot P_{TO} + H_{SB} \cdot P_{SB} + H_{CK} \cdot P_{CK} + H_{OFF} \cdot P_{OFF}$ [kWh]

$Q_{HE} = 14041 / 5.17 + 178 \cdot 0.013 + 0 \cdot 0.013 + 178 \cdot 0 + 0 \cdot 0.013 = 2719$ [kWh]

7.2 General formula for calculation of reference SCOP

$SCOP = Q_H / Q_{HE}$ [–]

$SCOP = 14041 / 2719 = 5.16$ [–]

7.1 Calculation of the seasonal space heating efficiency η_s

$\Sigma F(i) = F(1) + F(2)$ [–]

$\Sigma F = 0.03 + 0 = 0.03$ [–]

$\eta_s = 1 / CC \cdot SCOP - \Sigma F(i)$ [–]

$\eta_s (A) = (1 / 2.5) \cdot 5.16 – 0.03 =$ **2.036** [–]

Temperature level		Low (reference water temperature 35 °C)		
Reference heating season		„A" = average ($T_{designh}$ = -10 °C)		
Assessment condition		**A**	**B**	**C**
Specification of the assessment condition		**A-7/W34**	**A2/W30**	**A7/W27**
Date of testing		**2024-05-15**	**2024-05-10**	**2024-05-10**
Transient test procedure	YES / NO	NO	NO	NO
Average defrost time of 1 cycle	[min]	–	–	–
Average time of 1 cycle	[min]	–	–	–
Calculation time	[min]	70.0	70.0	70.0
Output heating water – temperature calculation	[°C]	33.94	29.97	27.00
Input heating water – temperature calculation	[°C]	28.95	24.99	23.02
Output heating water temperature	[°C]	33.94	29.97	27.00
Input heating water temperature	[°C]	28.95	24.99	23.02
Air temperature – dry bulb temperature	[°C]	-7.00	2.00	7.00
Air temperature – wet bulb temperature	[°C]	-8.01	1.01	6.01
Relative humidity	[%]	74.96	84.00	86.99
Barometric pressure	[kPa]	98.247	99.097	99.006
Ambient temperature	[°C]	-7.23	1.92	6.95
Secondary circuit pressure difference	[kPa]	10.249	15.550	16.342
Efficiency of the secondary liquid pump	[–]	0.152	0.149	0.144
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	1.0929	0.6627	0.5431
Density of heating water	[$kg \cdot m^{-3}$]	994.3	995.6	996.4
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.175	4.177	4.178
Voltage	[V]	232.03	232.08	231.49
Total current	[A]	8.84	5.32	3.01
Overall power input	[kW]	2.017	0.755	0.389
Capacity correction of sec. liquid pump	[W]	17.322	16.340	14.659
Power input correction of sec. liquid pump	[W]	20.43	19.20	17.12
Heating capacity – heating water	[kW]	6.299	3.813	2.499
Corrected heating capacity – heating water	**[kW]**	**6.282**	**3.797**	**2.484**
Uncertainty of corrected heating capacity	[kW]	± 0.109	± 0.066	± 0.054
Effective electric power input	**[kW]**	**1.996**	**0.736**	**0.372**
COP	**[–]**	**3.147**	**5.161**	**6.673**
Uncertainty of COP	[–]	± 0.055	± 0.091	± 0.147
Control settings	**[%]**	**68**	**34**	**20**
Circulation pump settings – heating water	[%]	43	43	43

Temperature level		Low (reference water temperature 35 °C)	
Reference heating season		„A" = average ($T_{designh}$ = -10 °C)	
Assessment condition		**D**	**TOL (E), Tbiv (F)**
Specification of the assessment condition		**A12/W27.15**	**A-10/W35**
Date of testing		**2024-05-10**	**2024-05-09**
Transient test procedure	YES / NO	NO	YES
Average defrost time of 1 cycle	[min]	–	–
Average time of 1 cycle	[min]	–	–
Calculation time	[min]	70.0	180.0
Output heating water – temperature calculation	[°C]	27.18	34.97
Input heating water – temperature calculation	[°C]	22.66	29.98
Output heating water temperature	[°C]	27.18	34.97
Input heating water temperature	[°C]	22.66	29.98
Air temperature – dry bulb temperature	[°C]	11.94	-10.09
Air temperature – wet bulb temperature	[°C]	10.98	-11.09
Relative humidity	[%]	89.33	69.52
Barometric pressure	[kPa]	99.073	99.078
Ambient temperature	[°C]	11.91	-10.43
Secondary circuit pressure difference	[kPa]	16.346	8.720
Efficiency of the secondary liquid pump	[–]	0.144	0.149
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	0.5434	1.1845
Density of heating water	[$kg \cdot m^{-3}$]	996.3	994.0
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.178	4.175
Voltage	[V]	230.89	232.13
Total current	[A]	2.80	11.68
Overall power input	[kW]	0.374	2.673
Capacity correction of sec. liquid pump	[W]	14.667	16.289
Power input correction of sec. liquid pump	[W]	17.13	19.14
Heating capacity – heating water	[kW]	2.845	6.813
Corrected heating capacity – heating water	**[kW]**	**2.831**	**6.796**
Uncertainty of corrected heating capacity	[kW]	± 0.054	± 0.118
Effective electric power input	**[kW]**	**0.357**	**2.654**
COP	**[–]**	**7.928**	**2.561**
Uncertainty of COP	[–]	± 0.154	± 0.045
Control settings	**[%]**	**20**	**90**
Circulation pump settings – heating water	[%]	43	43

Data for SCOP calculation

- Low temperature application (reference water temperature 35 °C)
- Reference heating season „A“ – average

	Outdoor heat exchanger Outdoor air inlet	Indoor heat exchanger Outlet water temperature	Part load ratio	Part load	DC Declared capacity	COPd at declared capacity	Cdh degradation coefficient	CR	COPbin (Tj)	Eff. power input of compressor off state
	[°C]	[°C]	[%]	[kW]	[kW]	[–]	[–]	[–]	[–]	[kW]
A	-7	34.00	88.46	6.01	6.282	3.147	0.900	1.00	3.147	–
B	2	30.00	53.85	3.66	3.797	5.161	0.900	1.00	5.161	–
C	7	27.00	34.62	2.35	2.484	6.673	0.900	1.00	6.673	–
D	12	27.15	15.38	1.05	2.831	7.928	0.964	0.37	7.464	0.0130
TOL (E)	-10	35.00	100.00	6.80	6.796	2.561	0.900	1.00	2.561	–
Tbiv (F)	-10	35.00	100.00	6.80	6.796	2.561	0.900	1.00	2.561	–

Adaption of water temperature – according to ČSN EN 14825:2023, Annex E

- Low temperature application (reference water temperature 35 °C)
- Reference season „A“– average
- Condition D
- Variable water flow rate – secondary circuit

General formulas and derivation:

$t_{outlet,\,average} = t_{inlet,\,capacity\,test} + (t_{outlet,\,capacity\,test} - t_{inlet,\,capacity\,test}) \cdot CR$ [°C]

$t_{outlet,\,average} = t_{inlet,\,capacity\,test} + (\Delta t) \cdot CR$ [°C]

$t_{outlet,\,average} = t_{outlet,\,capacity\,test} - \Delta t + \Delta t \cdot CR$ [°C]

$t_{outlet,\,capacity\,test} = t_{outlet,\,average} + \Delta t - \Delta t \cdot CR$ [°C]

For variable flow:

$\Delta t = 5$

$CR \cdot \Delta t$ = Part load / Declared capacity · 5

$t_{outlet,\,capacity\,test,\,variable\,flow} = t_{outlet,\,average} + 5$ - Part load / Declared capacity · 5

Measured data:

$t_{outlet,\,average}$	24.00	[°C]
Declared capacity	2.831	[kW]
Declared capacity $_{standard\,rating\,condition\,A7/W35}$	–	[kW]
Part load	1.05	[kW]

Calculation of water temperature

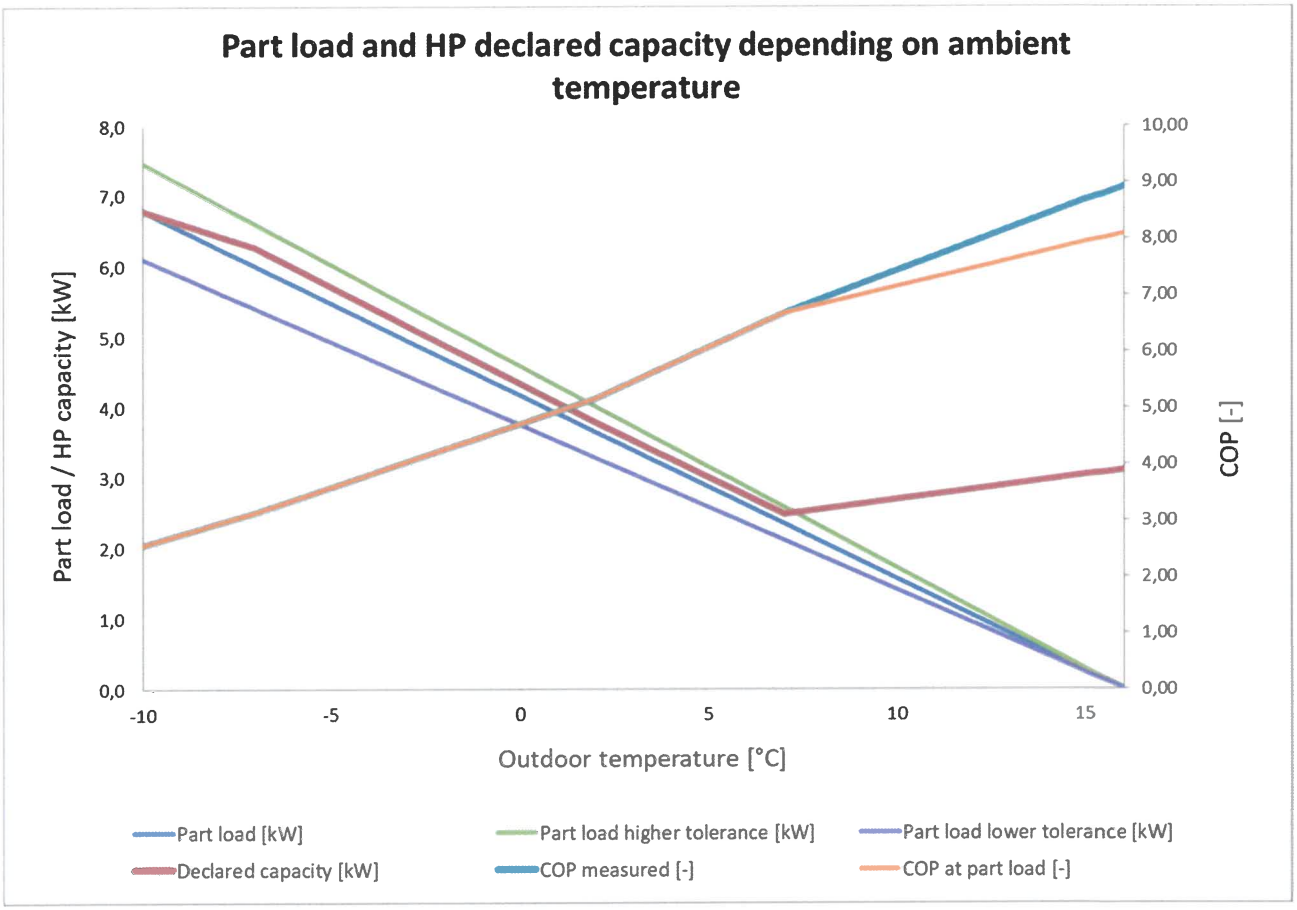
$t_{outlet,\,capacity\,test,\,variable\,flow} = 24 + 5 - 1.05 / 2.831 \cdot 5 =$ **27.15** [°C]

Calculation SCOP, $SCOP_{on}$, $SCOP_{net}$
- Low temperature application (reference water temperature 35 °C)
- Reference heating season „A“ – average

	Bin	Outdoor temp. (dry bulb)	Hours	Part load ratio	Heat load	Capacity of HP	Heat load covered by heat pump	Resistive heat elbu (Tj)	Annual resistive heat	COPbin (Tj)	Annual heating demand	Annual power input including electric back up heating	Net annual heating capacity	Net annual power input without electric back up heating
	j	Tj	hj		Ph(Tj)			elbu(Tj)	hj x elbu(Tj)	COPbin (Tj)	hj x P h(Tj)		hj × (P h(Tj) - elbu(Tj))	
	[–]	[°C]	[h]	[%]	[kW]	[kW]	[kW]	[kW]	[kWh]	[–]	[kWh]	[kWh]	[kWh]	[kWh]
TOL(E), Tbiv(F)	**21**	**-10**	**1**	**100.00**	**6.80**	**6.80**	**6.80**	**0.00**	**0.00**	**2.56**	**7**	**3**	**7**	**3**
	22	-9	25	96.15	6.53	6.62	6.53	0.00	0.00	2.76	163	59	163	59
	23	-8	23	92.31	6.27	6.45	6.27	0.00	0.00	2.95	144	49	144	49
A	**24**	**-7**	**24**	**88.46**	**6.01**	**6.28**	**6.01**	**0.00**	**0.00**	**3.15**	**144**	**46**	**144**	**46**
	25	-6	27	84.62	5.75	6.01	5.75	0.00	0.00	3.37	155	46	155	46
	26	-5	68	80.77	5.49	5.73	5.49	0.00	0.00	3.59	373	104	373	104
	27	-4	91	76.92	5.23	5.45	5.23	0.00	0.00	3.82	476	125	476	125
	28	-3	89	73.08	4.97	5.18	4.97	0.00	0.00	4.04	442	109	442	109
	29	-2	165	69.23	4.70	4.90	4.70	0.00	0.00	4.27	776	182	776	182
	30	-1	173	65.38	4.44	4.63	4.44	0.00	0.00	4.49	769	171	769	171
	31	0	240	61.54	4.18	4.35	4.18	0.00	0.00	4.71	1004	213	1004	213
	32	1	280	57.69	3.92	4.07	3.92	0.00	0.00	4.94	1098	222	1098	222
B	**33**	**2**	**320**	**53.85**	**3.66**	**3.80**	**3.66**	**0.00**	**0.00**	**5.16**	**1171**	**227**	**1171**	**227**
	34	3	357	50.00	3.40	3.53	3.40	0.00	0.00	5.46	1213	222	1213	222
	35	4	356	46.15	3.14	3.27	3.14	0.00	0.00	5.77	1117	194	1117	194
	36	5	303	42.31	2.88	3.01	2.88	0.00	0.00	6.07	871	144	871	144
	37	6	330	38.46	2.61	2.75	2.61	0.00	0.00	6.37	863	135	863	135
C	**38**	**7**	**326**	**34.62**	**2.35**	**2.48**	**2.35**	**0.00**	**0.00**	**6.67**	**767**	**115**	**767**	**115**
	39	8	348	30.77	2.09	2.55	2.09	0.00	0.00	6.83	728	107	728	107
	40	9	335	26.92	1.83	2.62	1.83	0.00	0.00	6.99	613	88	613	88
	41	10	315	23.08	1.57	2.69	1.57	0.00	0.00	7.15	494	69	494	69
	42	11	215	19.23	1.31	2.76	1.31	0.00	0.00	7.31	281	38	281	38
D	**43**	**12**	**169**	**15.38**	**1.05**	**2.83**	**1.05**	**0.00**	**0.00**	**7.46**	**177**	**24**	**177**	**24**
	44	13	151	11.54	0.78	2.90	0.78	0.00	0.00	7.62	118	16	118	16
	45	14	105	7.69	0.52	2.97	0.52	0.00	0.00	7.78	55	7	55	7
	46	15	74	3.85	0.26	3.04	0.26	0.00	0.00	7.94	19	2	19	2
		Σ	4910							Σ	14038	2716	14038	2716

SCOPon	5.17	SCOPnet	5.17
		SCOP	**5.16**

Part load performance diagram
- Low temperature application (reference water temperature 35 °C)
- Reference heating season „A“ – average



Test objective:	Seasonal performance tests and SCOP calculation – Medium temperature application
Exact name of the test procedure:	**1.37* - Tests of leakage, pressure resistance, thermal and technical parameters, combustion efficiency, safety functions**
Test method:	ČSN EN 14511-3:2023, ČSN EN 14825:2023
Sample tested:	Heat pump **ZHHH-P1-010K-R290-R5-M**
Measuring equipment used:	see Chapter III

Design					Air / water – monobloc		
Conditions specification according to ČSN EN 14825:2023	Temperature application				**Medium** (reference water temperature 55 °C)		
	Reference heating season				**Average**		
	Outlet water temperature - indoor heat exchanger				Variable		
	Compressor speed control				Variable		
	Water flow rate – primary circuit				–		
	Water flow rate – secondary circuit				Variable		
Seasonal space heating energy efficiency	Heating	Average	η_s		**<u>152.8</u>**	%	
		Warmer	η_s		–	%	
		Colder	η_s		–	%	
Seasonal efficiency according to ČSN EN 14825:2023	Heating	Average	**SCOP**		**<u>3.90</u>**	–	
		Warmer	SCOP		–	–	
		Colder	SCOP		–	–	
Function	Cooling				Yes		
	Heating	Yes	Reference heating season	Average	Yes		
				Warmer	–		
				Colder	–		
Full heating load	Cooling		$P_{designc}$		–	kW	
	Heating	Average	$P_{designh}$		**<u>7.34</u>**	kW	
		Warmer	$P_{designh}$		–	kW	
		Colder	$P_{designh}$		–	kW	
Bivalent temperatures	Heating	Average	$T_{bivalent}$		-10	°C	
		Warmer	$T_{bivalent}$		–	°C	
		Colder	$T_{bivalent}$		–	°C	
Operation limit temperatures	Heating	Average	TOL		-10	°C	
		Warmer	TOL		–	°C	
		Colder	TOL		–	°C	
Seasonal power consumption according to ČSN EN 14825:2023	Cooling		Q_{CE}		–	kWh	
	Heating	Average	Q_{HE}		3892	kWh	
		Warmer	Q_{HE}		–	kWh	
		Colder	Q_{HE}		–	kWh	
Modes other than „active mode“	Off mode			P_{OFF}	13.0	W	
	Thermostat off mode			P_{TO}	13.0	W	
	Standby mode			P_{SB}	13.0	W	
	Crankcase heater mode			P_{CK}	0.0	W	

(Not tested): The technical data were declared by the Manufacturer and were not tested by the Testing Laboratory.

Calculation of SCOP according to ČSN EN 14825:2023:

Number of hours used for calculation of reference SCOP (Annex B – Table B. 2, B. 3)
- For reversible heat pumps and reference heating season „A“ = average

H_{HE}	2066	[h]
H_{TO}	178	[h]
H_{SB}	0	[h]
H_{CK}	178	[h]
H_{OFF}	0	[h]

Measured data:

P_{TO}	0.0130	[kW]
P_{SB}	0.0130	[kW]
P_{CK}	0.0000	[kW]
P_{OFF}	0.0130	[kW]
$P_{designh}$	7.34	[kW]
$SCOP_{ON}$	3.90	[–]

Coefficient and correction:

F(1)	3	[%]
F(2)	0	[%]
CC	2.5	[–]

Calculation of SCOP:

7.3 Calculation of the reference annual heating demand (Q_H)

$Q_H = P_{designh} \cdot H_{HE}$ [kWh]

$Q_H = 7.34 \cdot 2066 = 15164$ [kWh]

7.4 Calculation of the annual electricity consumption (Q_{HE})

$Q_{HE} = Q_H / SCOP_{on} + H_{TO} \cdot P_{TO} + H_{SB} \cdot P_{SB} + H_{CK} \cdot P_{CK} + H_{OFF} \cdot P_{OFF}$ [kWh]

$Q_{HE} = 15164 / 3.9 + 178 \cdot 0.013 + 0 \cdot 0.013 + 178 \cdot 0 + 0 \cdot 0.013 = 3892$ [kWh]

7.2 General formula for calculation of reference SCOP

$SCOP = Q_H / Q_{HE}$ [–]

$SCOP = 15164 / 3892 = 3.9$ [–]

7.1 Calculation of the seasonal space heating efficiency η_s

$\Sigma F(i) = F(1) + F(2)$ [–]

$\Sigma F = 0.03 + 0 = 0.03$ [–]

$\eta_s = 1 / CC \cdot SCOP - \Sigma F(i)$ [–]

$\eta_s (A) = (1 / 2.5) \cdot 3.9 – 0.03 =$ **1.528** [–]

Temperature level		Medium (reference water temperature 55 °C)		
Reference heating season		„A" = average ($T_{designh}$ = -10 °C)		
Assessment condition		**A**	**B**	**C**
Specification of the assessment condition		**A-7/W52**	**A2/W42**	**A7/W36**
Date of testing		**2024-05-15**	**2024-05-15**	**2024-05-14**
Transient test procedure	YES / NO	NO	NO	NO
Average defrost time of 1 cycle	[min]	–	–	–
Average time of 1 cycle	[min]	–	–	–
Calculation time	[min]	70.0	70.0	70.0
Output heating water – temperature calculation	[°C]	51.99	42.02	35.95
Input heating water – temperature calculation	[°C]	43.99	35.18	32.23
Output heating water temperature	[°C]	51.99	42.02	35.95
Input heating water temperature	[°C]	43.99	35.18	32.23
Air temperature – dry bulb temperature	[°C]	-6.99	2.01	7.00
Air temperature – wet bulb temperature	[°C]	-7.93	1.01	6.01
Relative humidity	[%]	76.61	84.04	86.99
Barometric pressure	[kPa]	98.310	98.166	98.395
Ambient temperature	[°C]	-7.21	1.94	6.99
Secondary circuit pressure difference	[kPa]	15.333	16.260	16.275
Efficiency of the secondary liquid pump	[–]	0.149	0.144	0.144
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	0.6789	0.5417	0.5457
Density of heating water	[$kg \cdot m^{-3}$]	987.5	991.6	993.7
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.177	4.175	4.175
Voltage	[V]	231.51	231.79	232.31
Total current	[A]	11.51	7.40	3.64
Overall power input	[kW]	2.635	1.116	0.481
Capacity correction of sec. liquid pump	[W]	16.458	14.577	14.667
Power input correction of sec. liquid pump	[W]	19.35	17.02	17.13
Heating capacity – heating water	[kW]	6.222	4.261	2.340
Corrected heating capacity – heating water	**[kW]**	**6.206**	**4.247**	**2.326**
Uncertainty of corrected heating capacity	[kW]	± 0.069	± 0.055	± 0.054
Effective electric power input	**[kW]**	**2.616**	**1.099**	**0.464**
COP	**[–]**	**2.372**	**3.864**	**5.015**
Uncertainty of COP	[–]	± 0.027	± 0.050	± 0.117
Control settings	**[%]**	**76**	**40**	**20**
Circulation pump settings – heating water	[%]	43	43	43

Temperature level		Medium (reference water temperature 55 °C)	
Reference heating season		„A" = average ($T_{designh}$ = -10 °C)	
Assessment condition		**D**	**TOL (E), Tbiv (F)**
Specification of the assessment condition		**A12/W34.7**	**A-10/W55**
Date of testing		**2024-05-14**	**2024-05-13**
Transient test procedure	YES / NO	NO	NO
Average defrost time of 1 cycle	[min]	–	–
Average time of 1 cycle	[min]	–	–
Calculation time	[min]	70.0	70.0
Output heating water – temperature calculation	[°C]	34.67	54.97
Input heating water – temperature calculation	[°C]	30.31	46.98
Output heating water temperature	[°C]	34.67	54.97
Input heating water temperature	[°C]	30.31	46.98
Air temperature – dry bulb temperature	[°C]	12.00	-10.00
Air temperature – wet bulb temperature	[°C]	10.82	-10.92
Relative humidity	[%]	86.99	72.07
Barometric pressure	[kPa]	98.268	98.423
Ambient temperature	[°C]	12.02	-10.33
Secondary circuit pressure difference	[kPa]	16.214	14.036
Efficiency of the secondary liquid pump	[–]	0.144	0.153
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	0.5465	0.8041
Density of heating water	[$kg \cdot m^{-3}$]	994.1	986.0
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.175	4.178
Voltage	[V]	231.85	231.18
Total current	[A]	3.46	16.00
Overall power input	[kW]	0.457	3.692
Capacity correction of sec. liquid pump	[W]	14.642	17.415
Power input correction of sec. liquid pump	[W]	17.10	20.55
Heating capacity – heating water	[kW]	2.749	7.358
Corrected heating capacity – heating water	**[kW]**	**2.734**	**7.340**
Uncertainty of corrected heating capacity	[kW]	± 0.054	± 0.081
Effective electric power input	**[kW]**	**0.440**	**3.671**
COP	**[–]**	**6.212**	**1.999**
Uncertainty of COP	[–]	± 0.125	± 0.022
Control settings	**[%]**	**20**	**95**
Circulation pump settings – heating water	[%]	43	43

Data for SCOP calculation

- Medium temperature application (reference water temperature 55 °C)
- Reference heating season „A“ – average

	Outdoor heat exchanger / Outdoor air inlet	Indoor heat exchanger / Outlet water temperature	Part load ratio	Part load	DC Declared capacity	COPd at declared capacity	Cdh degradation coefficient	CR	COPbin (Tj)	Eff. power input of compressor off state
	[°C]	[°C]	[%]	[kW]	[kW]	[–]	[–]	[–]	[–]	[kW]
A	-7	52.00	88.46	6.49	6.206	2.372	0.900	1.00	2.372	–
B	2	42.00	53.85	3.95	4.247	3.864	0.900	1.00	3.864	–
C	7	36.00	34.62	2.54	2.326	5.015	0.900	1.00	5.015	–
D	12	34.70	15.38	1.13	2.734	6.212	0.970	0.41	5.962	0.0130
TOL (E)	-10	55.00	100.00	7.34	7.340	1.999	0.900	1.00	1.999	–
Tbiv (F)	-10	55.00	100.00	7.34	7.340	1.999	0.900	1.00	1.999	–

Adaption of water temperature – according to ČSN EN 14825:2023, Annex E

- Medium temperature application (reference water temperature 55 °C)
- Reference season „A“– average
- Condition D
- Variable water flow rate – secondary circuit

General formulas and derivation:

$t_{outlet,\ average} = t_{inlet,\ capacity\ test} + (t_{outlet,\ capacity\ test} - t_{inlet,\ capacity\ test}) \cdot CR$ [°C]

$t_{outlet,\ average} = t_{inlet,\ capacity\ test} + (\Delta t) \cdot CR$ [°C]

$t_{outlet,\ average} = t_{outlet,\ capacity\ test} - \Delta t + \Delta t \cdot CR$ [°C]

$t_{outlet,\ capacity\ test} = t_{outlet,\ average} + \Delta t - \Delta t \cdot CR$ [°C]

For variable flow:

$\Delta t = 8$

$CR \cdot \Delta t$ = Part load / Declared capacity · 8

$t_{outlet,\ capacity\ test,\ variable\ flow} = t_{outlet,\ average} + 8$ - Part load / Declared capacity · 8

Measured data:

$t_{outlet,\ average}$	30.00	[°C]
Declared capacity	2.734	[kW]
Declared capacity standard rating condition A7/W55	–	[kW]
Part load	1.13	[kW]

Calculation of water temperature

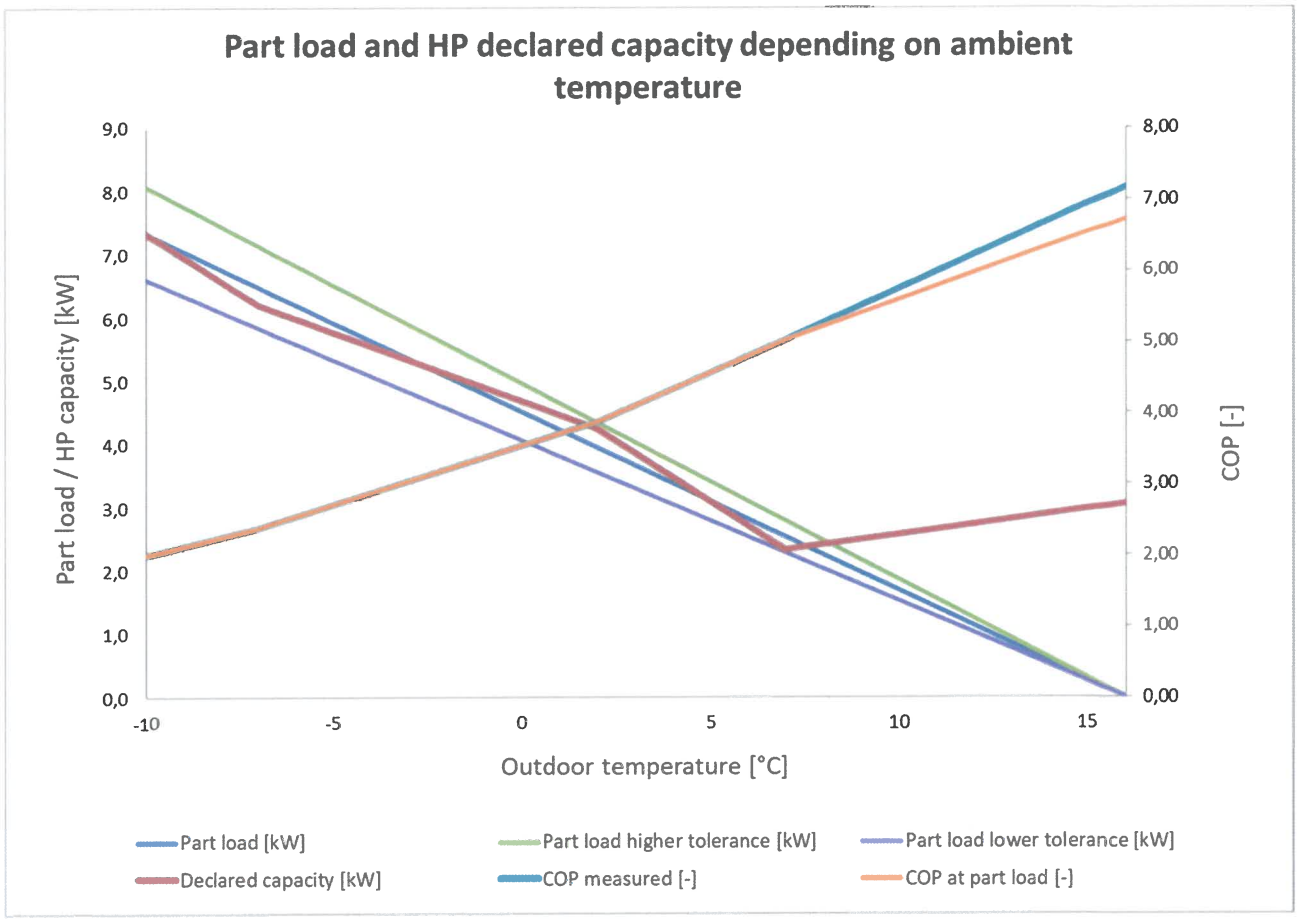
$t_{outlet,\ capacity\ test,\ variable\ flow} = 30 + 8 - 1.13 / 2.734 \cdot 8 =$ **34.7** [°C]

Calculation SCOP, $SCOP_{on}$, $SCOP_{net}$
- Medium temperature application (reference water temperature 55 °C)
- Reference heating season „A“ – average

	Bin	Outdoor temp. (dry bulb)	Hours	Part load ratio	Heat load	Capacity of HP	Heat load covered by heat pump	Resistive heat elbu (Tj)	Annual resistive heat	COPbin (Tj)	Annual heating demand	Annual power input including electric back up heating	Net annual heating capacity	Net annual power input without electric back up heating
	j	Tj	hj		Ph(Tj)			elbu(Tj)	hj x elbu(Tj)	COPbin (Tj)	hj x P h(Tj)		hj x (P h(Tj) - elbu(Tj))	
	[–]	[°C]	[h]	[%]	[kW]	[kW]	[kW]	[kW]	[kWh]	[–]	[kWh]	[kWh]	[kWh]	[kWh]
TOL(E), Tbiv(F)	**21**	**-10**	**1**	**100.00**	**7.34**	**7.34**	**7.34**	**0.00**	**0.00**	**2.00**	**7**	**4**	**7**	**4**
	22	-9	25	96.15	7.06	6.96	6.96	0.00	0.00	2.12	176	83	176	83
	23	-8	23	92.31	6.78	6.58	6.58	0.00	0.00	2.25	156	69	156	69
A	**24**	**-7**	**24**	**88.46**	**6.49**	**6.21**	**6.21**	**0.00**	**0.00**	**2.37**	**156**	**66**	**156**	**66**
	25	-6	27	84.62	6.21	5.99	5.99	0.00	0.00	2.54	168	66	168	66
	26	-5	68	80.77	5.93	5.77	5.77	0.00	0.00	2.70	403	149	403	149
	27	-4	91	76.92	5.65	5.55	5.55	0.00	0.00	2.87	514	179	514	179
	28	-3	89	73.08	5.36	5.34	5.34	0.00	0.00	3.04	477	157	477	157
	29	-2	165	69.23	5.08	5.12	5.08	0.00	0.00	3.20	838	262	838	262
	30	-1	173	65.38	4.80	4.90	4.80	0.00	0.00	3.37	830	247	830	247
	31	0	240	61.54	4.52	4.68	4.52	0.00	0.00	3.53	1084	307	1084	307
	32	1	280	57.69	4.23	4.46	4.23	0.00	0.00	3.70	1186	321	1186	321
B	**33**	**2**	**320**	**53.85**	**3.95**	**4.25**	**3.95**	**0.00**	**0.00**	**3.86**	**1265**	**327**	**1265**	**327**
	34	3	357	50.00	3.67	3.86	3.67	0.00	0.00	4.09	1310	320	1310	320
	35	4	356	46.15	3.39	3.48	3.39	0.00	0.00	4.32	1206	279	1206	279
	36	5	303	42.31	3.11	3.09	3.09	0.00	0.00	4.55	941	207	941	207
	37	6	330	38.46	2.82	2.71	2.71	0.00	0.00	4.78	932	195	932	195
C	**38**	**7**	**326**	**34.62**	**2.54**	**2.33**	**2.33**	**0.00**	**0.00**	**5.02**	**828**	**165**	**828**	**165**
	39	8	348	30.77	2.26	2.41	2.26	0.00	0.00	5.20	786	151	786	151
	40	9	335	26.92	1.98	2.49	1.98	0.00	0.00	5.39	662	123	662	123
	41	10	315	23.08	1.69	2.57	1.69	0.00	0.00	5.58	534	96	534	96
	42	11	215	19.23	1.41	2.65	1.41	0.00	0.00	5.77	303	53	303	53
D	**43**	**12**	**169**	**15.38**	**1.13**	**2.73**	**1.13**	**0.00**	**0.00**	**5.96**	**191**	**32**	**191**	**32**
	44	13	151	11.54	0.85	2.82	0.85	0.00	0.00	6.15	128	21	128	21
	45	14	105	7.69	0.56	2.90	0.56	0.00	0.00	6.34	59	9	59	9
	46	15	74	3.85	0.28	2.98	0.28	0.00	0.00	6.53	21	3	21	3
		Σ	4910							Σ	15162	3889	15162	3889

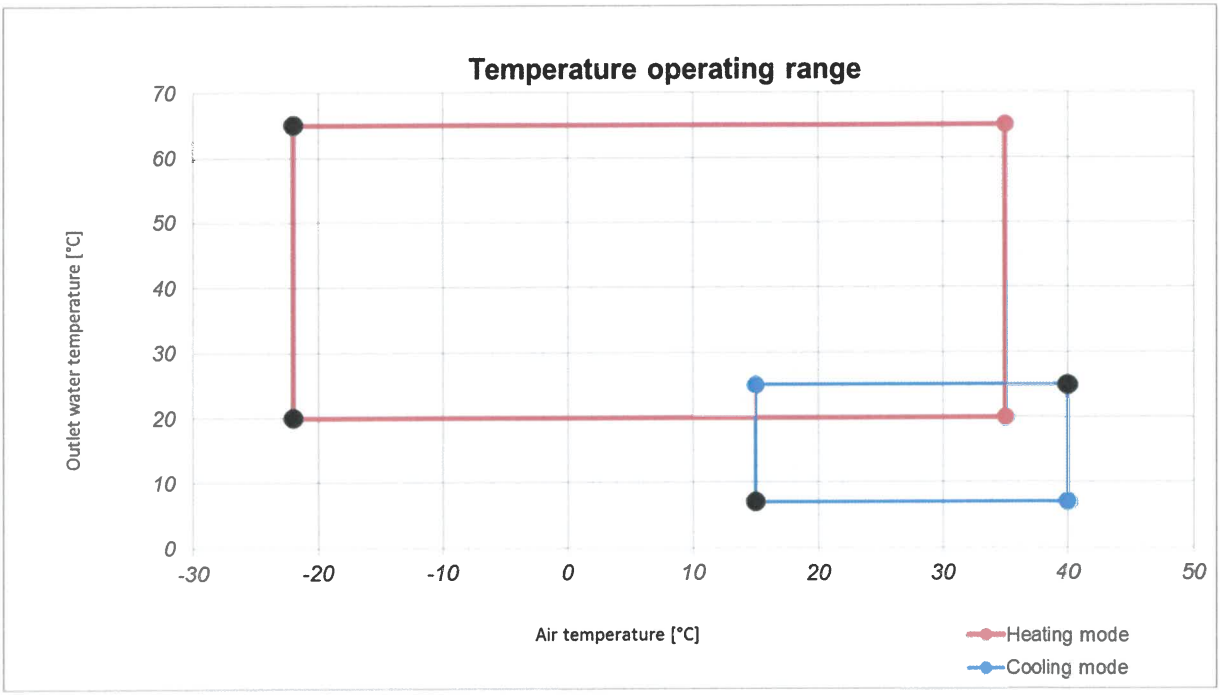
SCOPon	3.90	SCOPnet	3.90
		SCOP	**3.90**

Part load performance diagram
- Medium temperature application (reference water temperature 55 °C)
- Reference heating season „A“ – average



Test objective:	Safety tests
Exact name of the test procedure:	**1.37* - Tests of leakage, pressure resistance, thermal and technical parameters, combustion efficiency, safety functions**
Test method:	ČSN EN 14511-4:2023
Sample tested:	Heat pump **ZHHH-P1-010K-R290-R5-M**
Measuring equipment used:	see Chapter III

1) Temperature operating range



Test point	Inlet air dry bulb temperature [°C]		Outlet heating water temperature [°C]		Water flow rate in condenser [m³/h]	Note
Heating mode						
1.	A	-22	W	20	Minimum	Minimum water flow rate: **0.5417 m³·h⁻¹** Maximum water flow rate: **1.6771 m³·h⁻¹**
2.	A	-22	W	65	Minimum	
Cooling mode						
1.	A	15	W	7	Minimum	Minimum starting water flow rate: **0.5417 m³·h⁻¹** Maximum water flow rate: **1.6771 m³·h⁻¹**
2.	A	40	W	25	Maximum	

Heat pump **ZHHH-P1-010K-R290-R5-M** is fully operational in the temperature operating range.

Starting and operating tests (heating mode)
Test according to Article 4.2.1.2 of ČSN EN 14511-4:2023

Operational requirements conditions for air-to-water units					
Test point	**Inlet temperature at outdoor heat exchanger (°C)**	**Inlet temperature at indoor heat exchanger (°C)**	**Water flow rate at indoor heat exchanger**	**Voltage (V)**	**Test result**
1 (starting)	Lower limit of use	Lower limit of use	minimum	Rated voltage	+
2 (operating)	Lower limit of use	Upper limit of use	minimum	Rated voltage	+

Evaluation:
+... For a starting test, the unit shall start and operate during 15 min, for an operating test, the unit shall be able to operate during 1 h, without tripping of the motor overload protective devices.
–... The unit did not fulfill test requirements.
0... The requirement does not apply to the product concerned.
x... Test was not required.

Starting and operating tests (cooling mode)
Test according to Article 4.2.1.3 of ČSN EN 14511-4:2023

Operational requirements conditions for air-to-water units					
Test point	**Inlet temperature at outdoor heat exchanger (°C)**	**Inlet temperature at indoor heat exchanger (°C)**	**Water flow rate at indoor heat exchanger**	**Voltage (V)**	**Test result**
1 (starting)	Lower limit of use	Lower limit of use	minimum	Rated voltage	+
2 (starting)	Upper limit of use	Upper limit of use	maximum	Rated voltage	+

Evaluation:
+... For a starting test, the unit shall start and operate during 15 min, without tripping of the motor overload protective devices.
–... The unit did not fulfill test requirements.
0... The requirement does not apply to the product concerned.
x... Test was not required.

2) Outside the operating range

Requirements for outside the operating range	Requirement specification	Test result	Note
If operating outside the temperature range can cause damage to the unit, it shall be provided with safety devices which ensure that the unit suffers no damage when the operating limits of use indicated by the manufacturer are exceeded and remains capable of operating when coming back within these limits. A safety device that does not automatically reset may trip provided that a warning device is fitted. The manufacturer shall indicate any safety devices provided and their operating conditions according to 7.2.3.	ČSN EN 14511-4:2023 Art. 4.3	x	–

Evaluation:
+... The unit fulfills test requirements.
–... The unit did not fulfill test requirements.
0... The requirement does not apply to the product concerned.
x... Test was not required.

3) Freeze-up test in cooling mode

Air-to-air and water(brine)-to-air units

Required operating conditions	Test result	Note
Test according to Article 4.4 of ČSN EN 14511-4:2023	0	–

Evaluation:
+... After the unit has operated for 6 hours or after the last freeze up cycle has been completed after these 6 h, the following requirements shall be fulfilled:
- no ice shall have accumulated on the evaporator;
- no ice shall drip from the unit;
- no water shall drip or be blown off the unit into the room.

–... The unit did not fulfill test requirements.
0... The requirement does not apply to the product concerned.
x... Test was not required.

4) Shutting off the heat transfer medium flows

Required operating conditions	Test result	Note
Test for section a) Art. 4.5 ČSN EN 14511-4:2023 – heating	+	Unit ran with lower power output, after restoration ran with original parametres
Test for section a) Art. 4.5 ČSN EN 14511-4:2023 – cooling	+	Unit ran with higher power input and lower output, after restoration ran with original parametres
Test for section b) Art. 4.5 ČSN EN 14511-4:2023 – heating	+	After restoration of the flow rate and reset ran with original parametres
Test for section b) Art. 4.5 ČSN EN 14511-4:2023 – cooling	+	Unit shut off immediately after stopping the flow, after restoration ran normally
Test for section c) Art. 4.5 ČSN EN 14511-4:2023	0	–

Evaluation:
+... The unit shall remain capable of operating after restoration of the flow rates for 30 min once the compressor has restarted.
–... The unit did not fulfill test requirements.
0... The requirement does not apply to the product concerned.
x... Test was not required.

5) Complete power supply failure

Required operating conditions	Test result	Note
Test according to Article 4.6 of ČSN EN 14511-4:2023	+	–

Evaluation:
+... The unit has to restart automatically within 30 min. When manufacturer states that the unit does not automatically restart, fault detection is necessary. The unit is checked for any damage sustained during the test and if any safety devices have operated during the test.
–... The unit did not fulfill test requirements.
0... The requirement does not apply to the product concerned.
x... Test was not required.

6) Condensate draining and enclosure sweat test

Air-to-air and water(brine)-to-air units

Required operating conditions	Test result	Note
Test according to Article 4.7 of ČSN EN 14511-4:2023	0	–

Evaluation:
+... During the test of 4 hours no condensed water shall drip, run or blow off the unit except through the drain. For indoor units, drain holes shall be provided with suitable pipe connection, the minimum diameter of which shall be 12 mm.
–... The unit did not fulfill test requirements.
0... The requirement does not apply to the product concerned.
x... Test was not required.

Test objective:	Seasonal performance tests and SEER calculation – Floor cooling
Exact name of the test procedure:	**1.37* - Tests of leakage, pressure resistance, thermal and technical parameters, combustion efficiency, safety functions**
Test method:	ČSN EN 14511-3:2023, ČSN EN 14825:2023
Sample tested:	Heat pump **ZHHH-P1-010K-R290-R5-M**
Measuring equipment used:	see Chapter III

Specification of the assessment condition		**A35/W18**	**A30/W18**
Date of testing		**2024-05-23**	**2024-05-24**
Transient test procedure	YES / NO	NO	NO
Average defrost time of 1 cycle	[min]	–	–
Average time of 1 cycle	[min]	–	–
Calculation time	[min]	35.0	35.0
Output cooling water – temperature calculation	[°C]	17.96	18.05
Input cooling water – temperature calculation	[°C]	23.02	23.02
Output cooling water temperature	[°C]	17.96	18.05
Input cooling water temperature	[°C]	23.02	23.02
Air temperature - dry bulb temperature	[°C]	35.00	30.00
Air temperature - wet bulb temperature	[°C]	25.38	21.56
Relative humidity	[%]	46.47	47.67
Barometric pressure	[kPa]	98.390	98.752
Ambient temperature	[°C]	35.11	30.13
Secondary circuit pressure difference	[kPa]	8.591	13.054
Efficiency of the secondary liquid pump	[–]	0.147	0.152
Volume flow rate of cooling water	[$m^3 \cdot h^{-1}$]	1.1339	0.8483
Density of cooling water	[$kg \cdot m^{-3}$]	998.4	998.4
Specific heat capacity of cooling water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.181	4.181
Voltage	[V]	402.23	232.24
Total current	[A]	6.68	5.14
Overall power input	[kW]	1.496	0.806
Capacity correction of sec. liquid pump	[W]	15.693	17.188
Power input correction of sec. liquid pump	[W]	18.40	20.26
Cooling capacity - cooling water	[kW]	6.659	4.897
Corrected cooling capacity	**[kW]**	**6.674**	**4.914**
Uncertainty of corrected cooling capacity	[kW]	± 0.114	± 0.085
Effective electric power input	**[kW]**	**1.477**	**0.785**
EER	**[–]**	**4.518**	**6.258**
Uncertainty of EER	[–]	± 0.077	± 0.109
Control settings	**[%]**	**47**	**30**
Circulation pump settings – cooling water	[%]	43	43

Test objective:	Seasonal performance tests and SEER calculation – Fan coil
Exact name of the test procedure:	**1.37* - Tests of leakage, pressure resistance, thermal and technical parameters, combustion efficiency, safety functions**
Test method:	ČSN EN 14511-3:2023, ČSN EN 14825:2023
Sample tested:	Heat pump **ZHHH-P1-010K-R290-R5-M**
Measuring equipment used:	see Chapter III

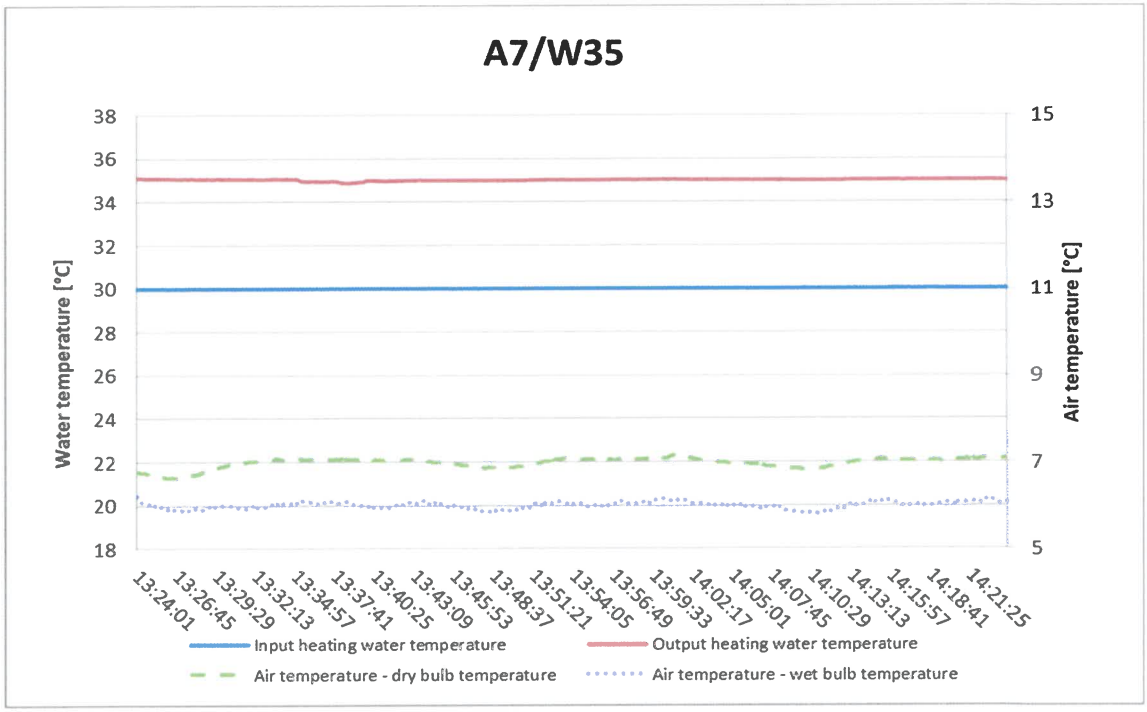
Specification of the assessment condition		**A35/W7**	**A30/W8.5**
Date of testing		**2024-05-22**	**2024-05-24**
Transient test procedure	YES / NO	NO	NO
Average defrost time of 1 cycle	[min]	–	–
Average time of 1 cycle	[min]	–	–
Calculation time	[min]	35.0	35.0
Output cooling water – temperature calculation	[°C]	7.04	8.51
Input cooling water – temperature calculation	[°C]	12.04	13.49
Output cooling water temperature	[°C]	7.04	8.51
Input cooling water temperature	[°C]	12.04	13.49
Air temperature - dry bulb temperature	[°C]	35.03	30.00
Air temperature - wet bulb temperature	[°C]	26.71	21.42
Relative humidity	[%]	52.70	46.94
Barometric pressure	[kPa]	98.001	98.791
Ambient temperature	[°C]	35.14	30.17
Secondary circuit pressure difference	[kPa]	12.073	14.892
Efficiency of the secondary liquid pump	[–]	0.150	0.147
Volume flow rate of cooling water	$[m^3 \cdot h^{-1}]$	0.8777	0.6585
Density of cooling water	$[kg \cdot m^{-3}]$	999.8	999.7
Specific heat capacity of cooling water	$[kJ \cdot kg^{-1} \cdot K^{-1}]$	4.196	4.193
Voltage	[V]	402.74	230.19
Total current	[A]	7.16	5.67
Overall power input	[kW]	1.616	0.870
Capacity correction of sec. liquid pump	[W]	16.666	15.770
Power input correction of sec. liquid pump	[W]	19.61	18.49
Cooling capacity - cooling water	[kW]	5.123	3.819
Corrected cooling capacity	**[kW]**	**5.139**	**3.834**
Uncertainty of corrected cooling capacity	[kW]	± 0.088	± 0.066
Effective electric power input	**[kW]**	**1.596**	**0.852**
EER	**[–]**	**3.220**	**4.502**
Uncertainty of EER	[–]	± 0.056	± 0.078
Control settings	**[%]**	**51**	**32**
Circulation pump settings – cooling water	[%]	43	43

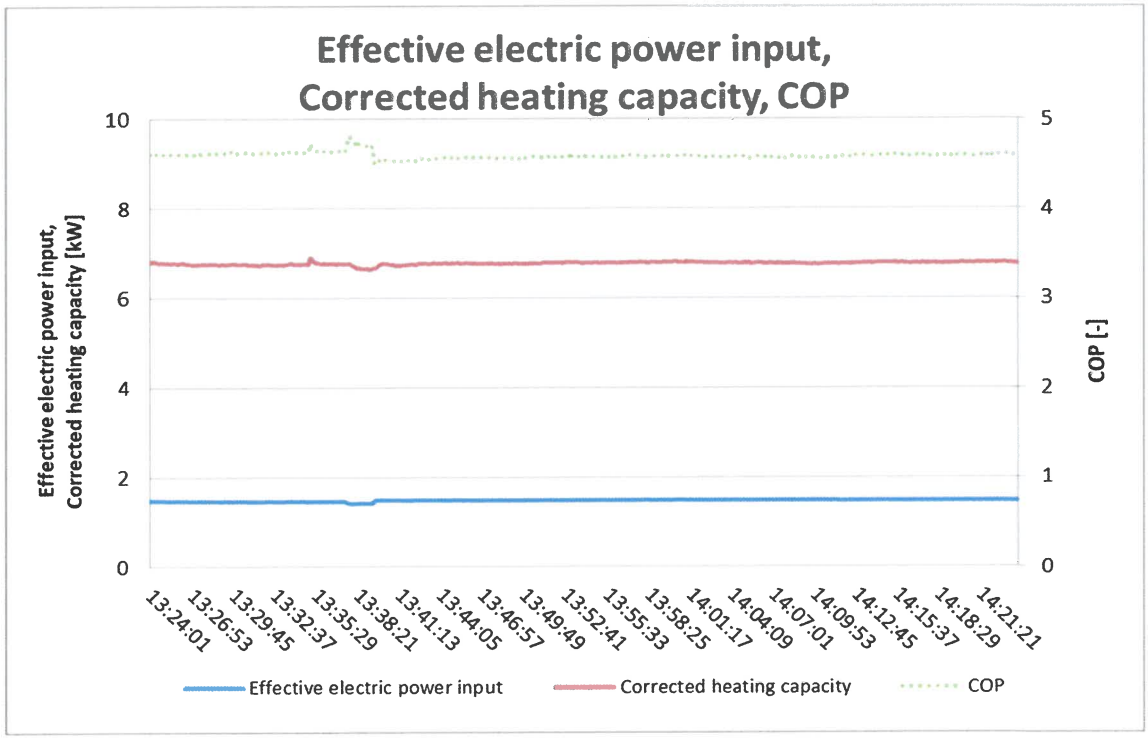
Tested by:	Ing Jakub Čederle	Date:	2024-06-14	Signed:	Čederle
Reviewed and approved by:	Ing. Michal Faltýnek	Date:	2024-06-14	Signed:	Faltýnek

I. Graphs

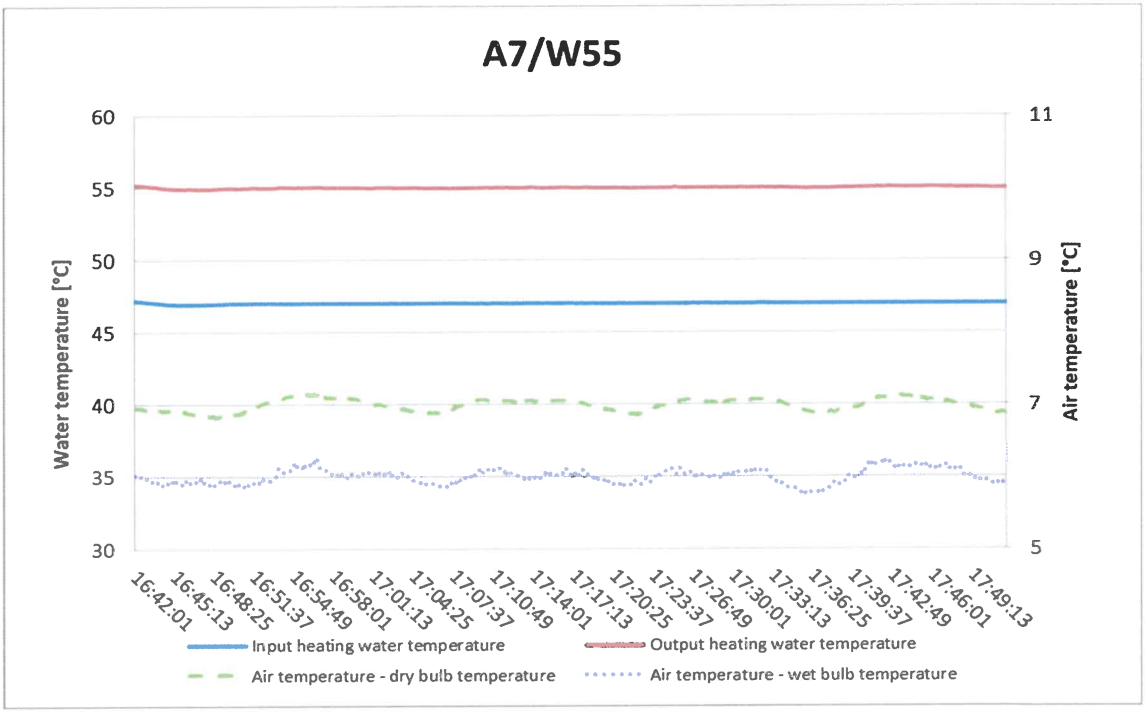
1. Rating conditions

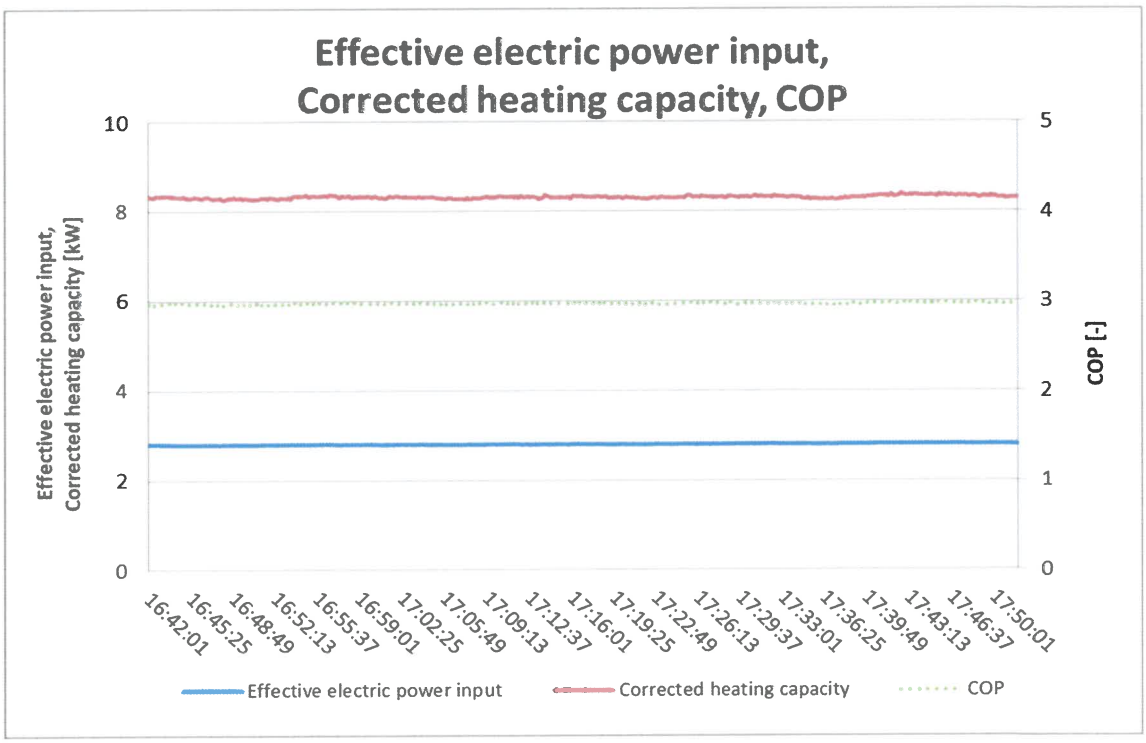
A7/W35 (53 %)





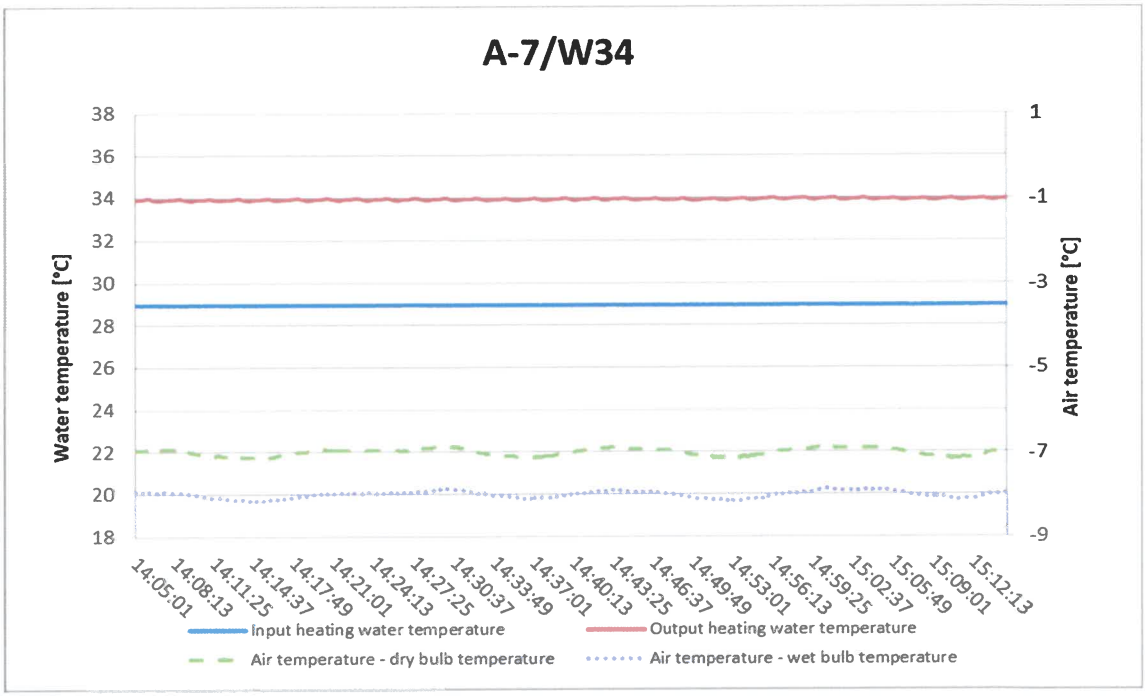
A7/W55 (70 %)

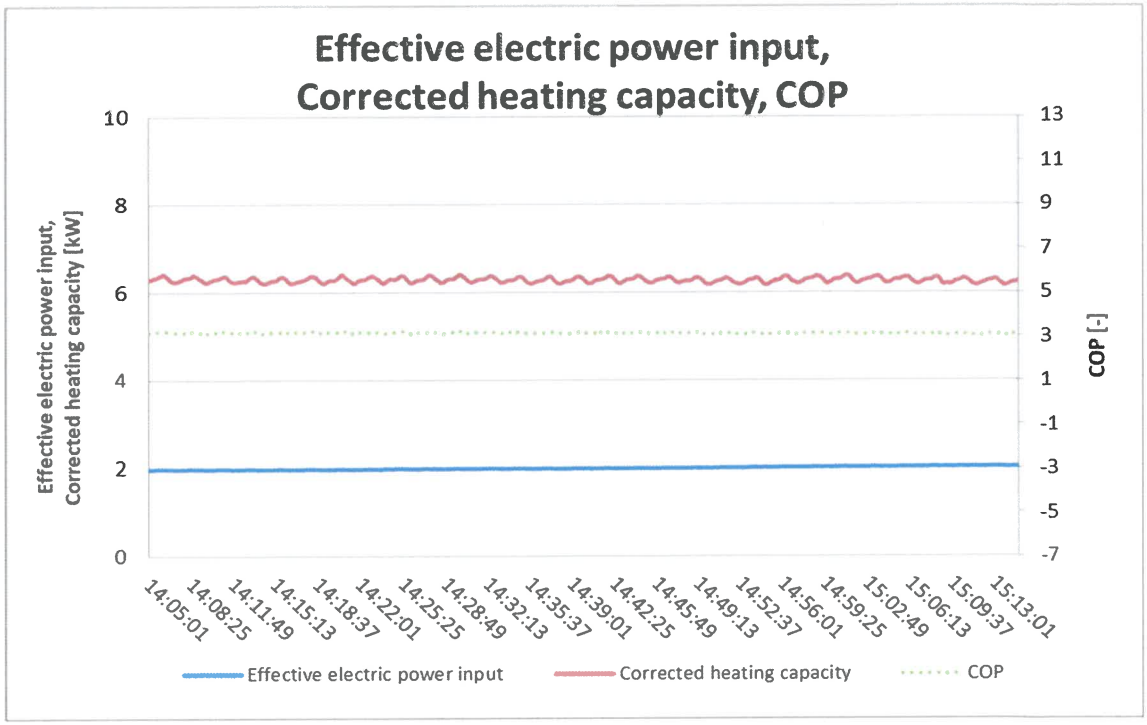

A7/W55
Water temperature [°C]
Air temperature [°C]
60
55
50
45
40
35
30
11
9
7
5
16:42:01
16:45:13
16:48:25
16:51:37
16:54:49
16:58:01
17:01:13
17:04:25
17:07:37
17:10:49
17:14:01
17:17:13
17:20:25
17:23:37
17:26:49
17:30:01
17:33:13
17:36:25
17:39:37
17:42:49
17:46:01
17:49:13
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature


Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
10
8
6
4
2
0
5
4
3
2
1
0
16:42:01
16:45:25
16:48:49
16:52:13
16:55:37
16:59:01
17:02:25
17:05:49
17:09:13
17:12:37
17:16:01
17:19:25
17:22:49
17:26:13
17:29:37
17:33:01
17:36:25
17:39:49
17:43:13
17:46:37
17:50:01
Effective electric power input
Corrected heating capacity
COP

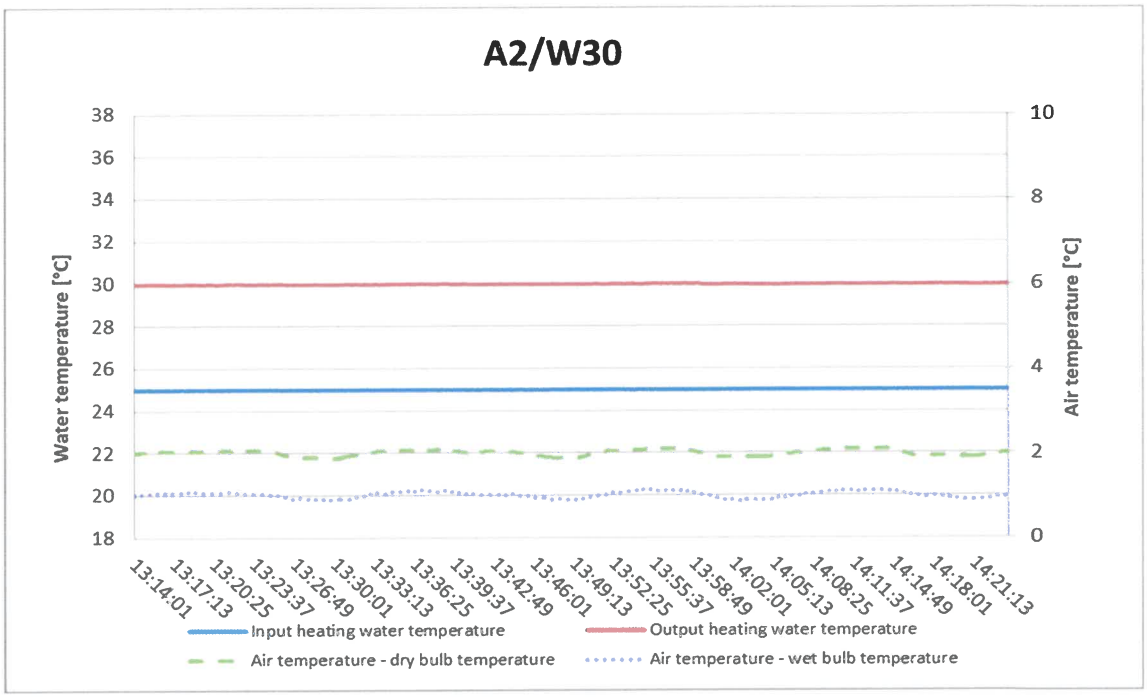
2. Seasonal performance tests and SCOP calculation – Low temperature application

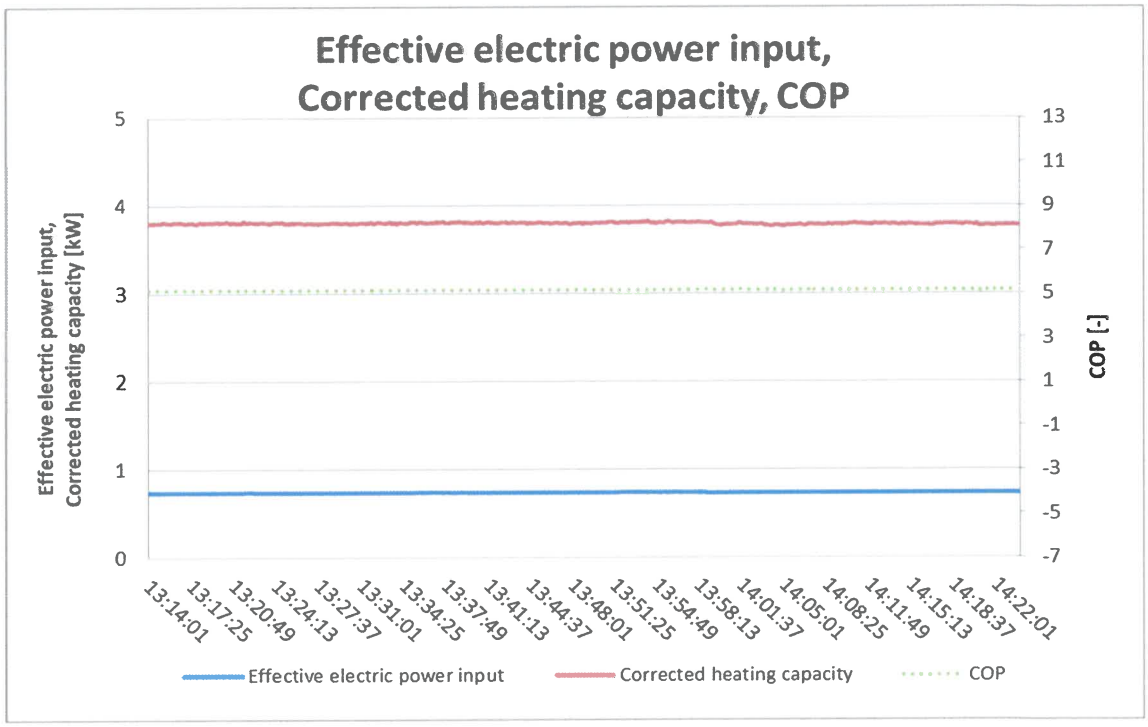
A-7/W34 (68 %)



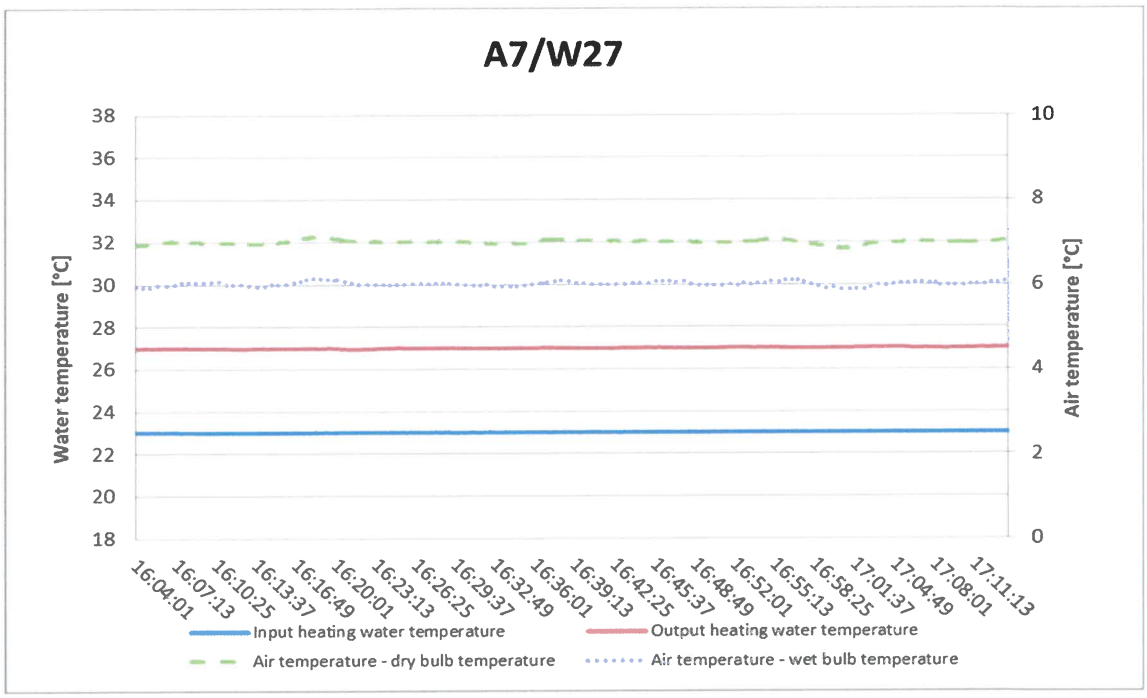


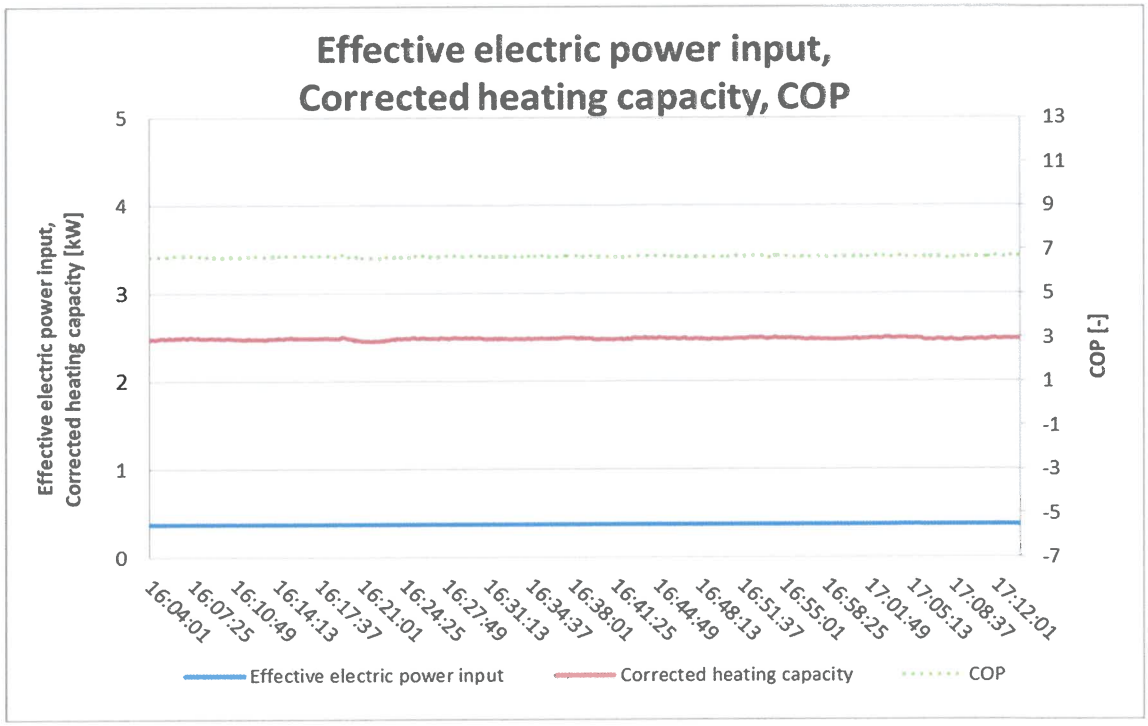
A2/W30 (34 %)


A2/W30
Water temperature [°C]
Air temperature [°C]
38
36
34
32
30
28
26
24
22
20
18
10
8
6
4
2
0
13:14:01
13:17:13
13:20:25
13:23:37
13:26:49
13:30:01
13:33:13
13:36:25
13:39:37
13:42:49
13:46:01
13:49:13
13:52:25
13:55:37
13:58:49
14:02:01
14:05:13
14:08:25
14:11:37
14:14:49
14:18:01
14:21:13
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature

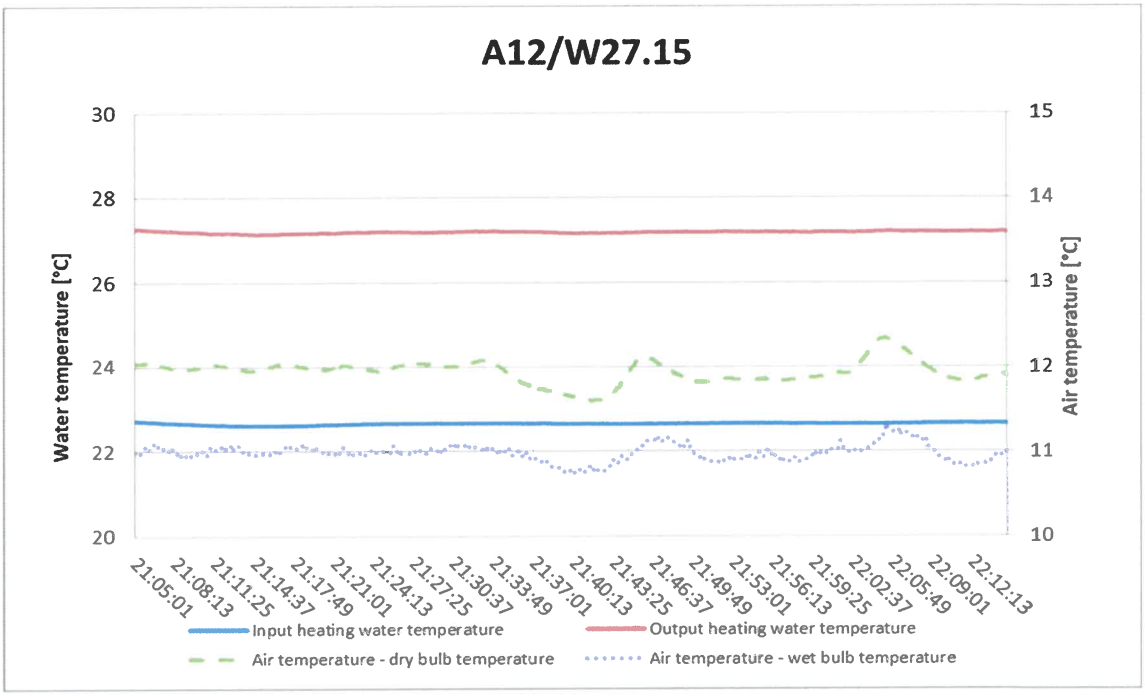

Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
5
4
3
2
1
0
13
11
9
7
5
3
1
-1
-3
-5
-7
13:14:01
13:17:25
13:20:49
13:24:13
13:27:37
13:31:01
13:34:25
13:37:49
13:41:13
13:44:37
13:48:01
13:51:25
13:54:49
13:58:13
14:01:37
14:05:01
14:08:25
14:11:49
14:15:13
14:18:37
14:22:01
Effective electric power input
Corrected heating capacity
COP

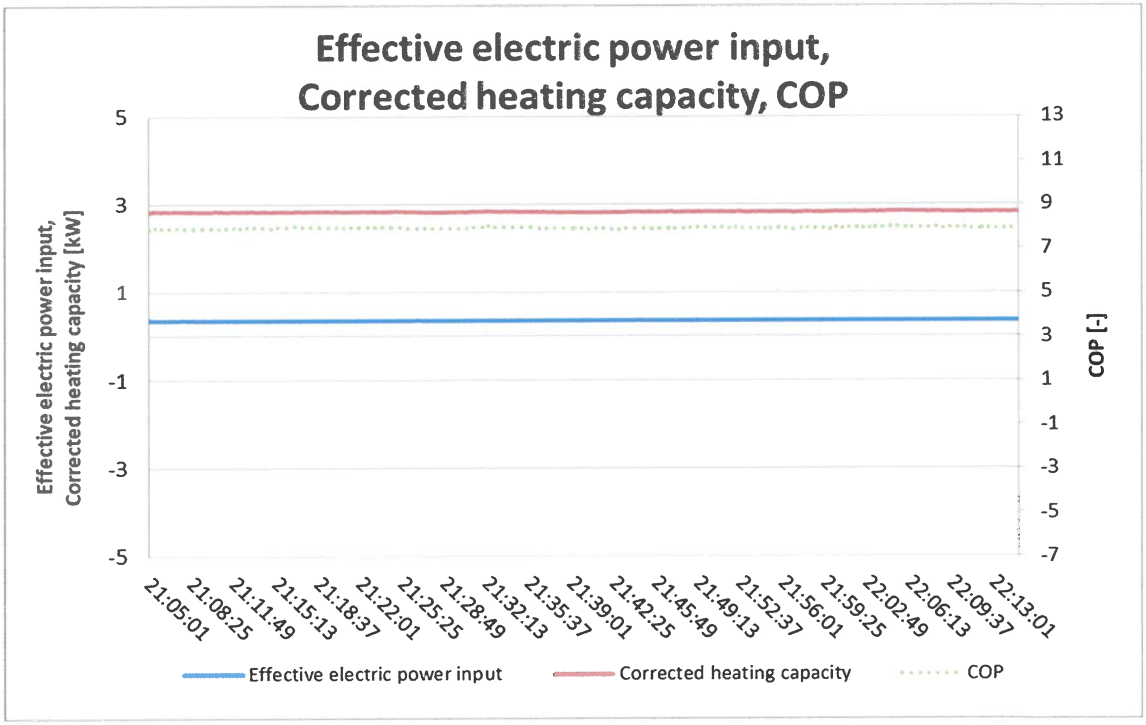
A7/W27 (20 %)


A7/W27
Water temperature [°C]
Air temperature [°C]
38
36
34
32
30
28
26
24
22
20
18
10
8
6
4
2
0
16:04:01
16:07:13
16:10:25
16:13:37
16:16:49
16:20:01
16:23:13
16:26:25
16:29:37
16:32:49
16:36:01
16:39:13
16:42:25
16:45:37
16:48:49
16:52:01
16:55:13
16:58:25
17:01:37
17:04:49
17:08:01
17:11:13
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature

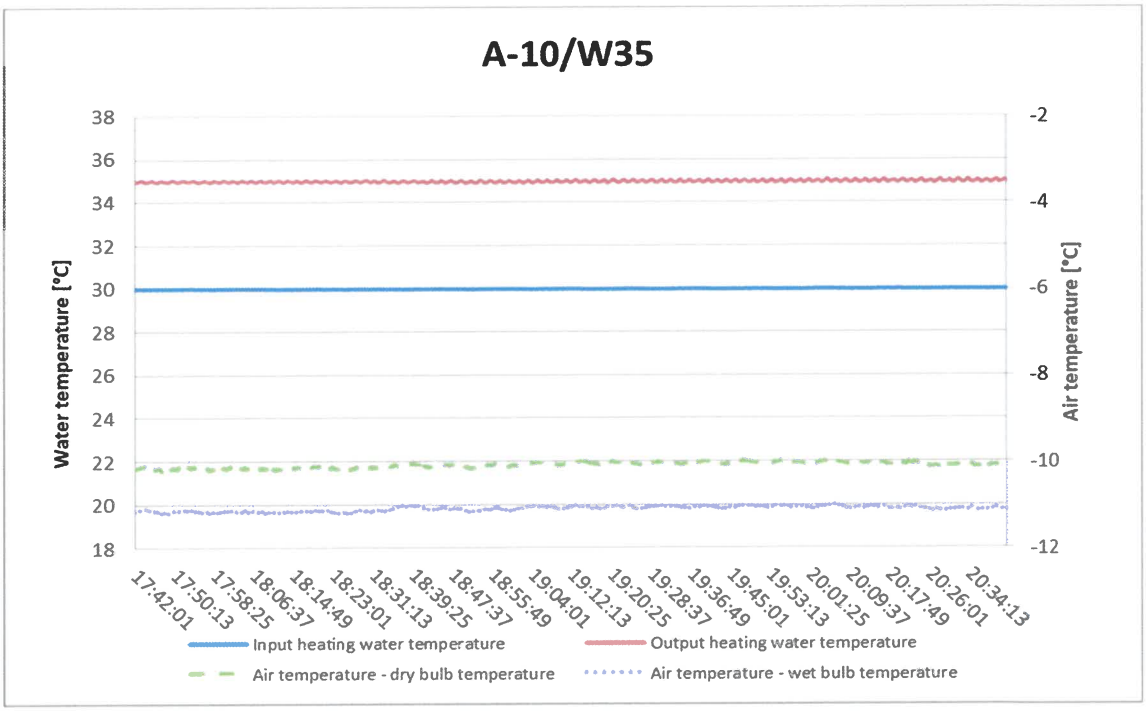

Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
5
4
3
2
1
0
13
11
9
7
5
3
1
-1
-3
-5
-7
16:04:01
16:07:25
16:10:49
16:14:13
16:17:37
16:21:01
16:24:25
16:27:49
16:31:13
16:34:37
16:38:01
16:41:25
16:44:49
16:48:13
16:51:37
16:55:01
16:58:25
17:01:49
17:05:13
17:08:37
17:12:01
Effective electric power input
Corrected heating capacity
COP

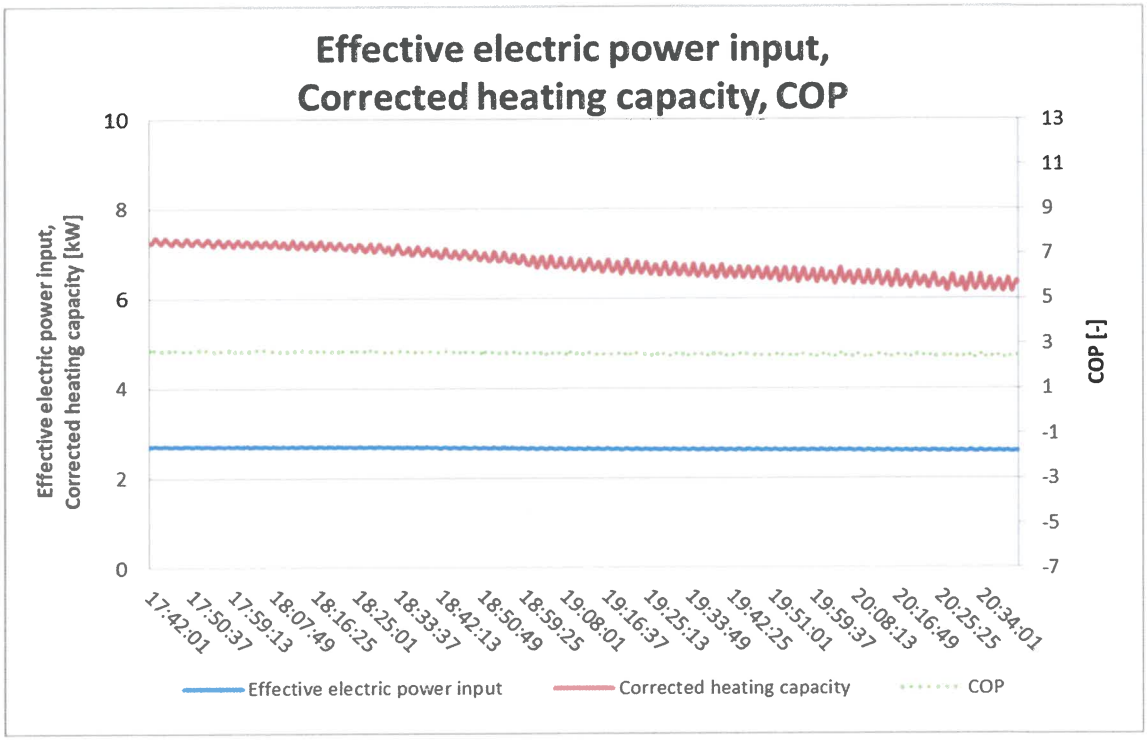
A12/W27.15 (20 %)


A12/W27.15
Water temperature [°C]
Air temperature [°C]
30
28
26
24
22
20
15
14
13
12
11
10
21:05:01
21:08:13
21:11:25
21:14:37
21:17:49
21:21:01
21:24:13
21:27:25
21:30:37
21:33:49
21:37:01
21:40:13
21:43:25
21:46:37
21:49:49
21:53:01
21:56:13
21:59:25
22:02:37
22:05:49
22:09:01
22:12:13
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature


Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
5
3
1
-1
-3
-5
13
11
9
7
5
3
1
-1
-3
-5
-7
21:05:01
21:08:25
21:11:49
21:15:13
21:18:37
21:22:01
21:25:25
21:28:49
21:32:13
21:35:37
21:39:01
21:42:25
21:45:49
21:49:13
21:52:37
21:56:01
21:59:25
22:02:49
22:06:13
22:09:37
22:13:01
Effective electric power input
Corrected heating capacity
COP

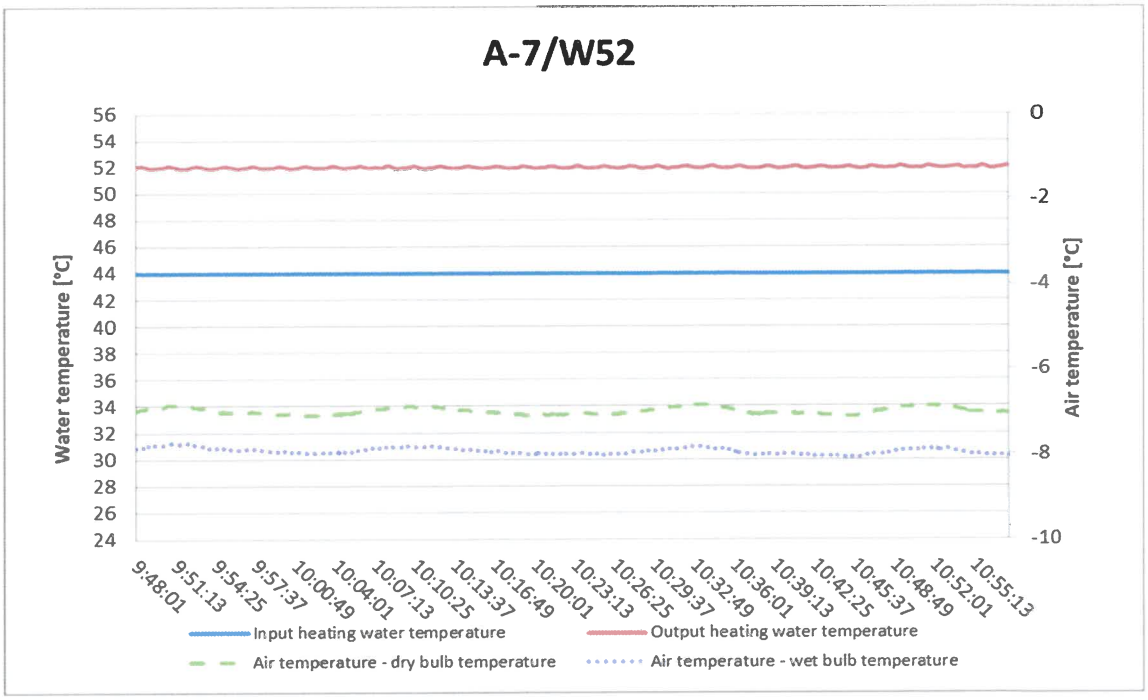
A-10/W35 (90 %)

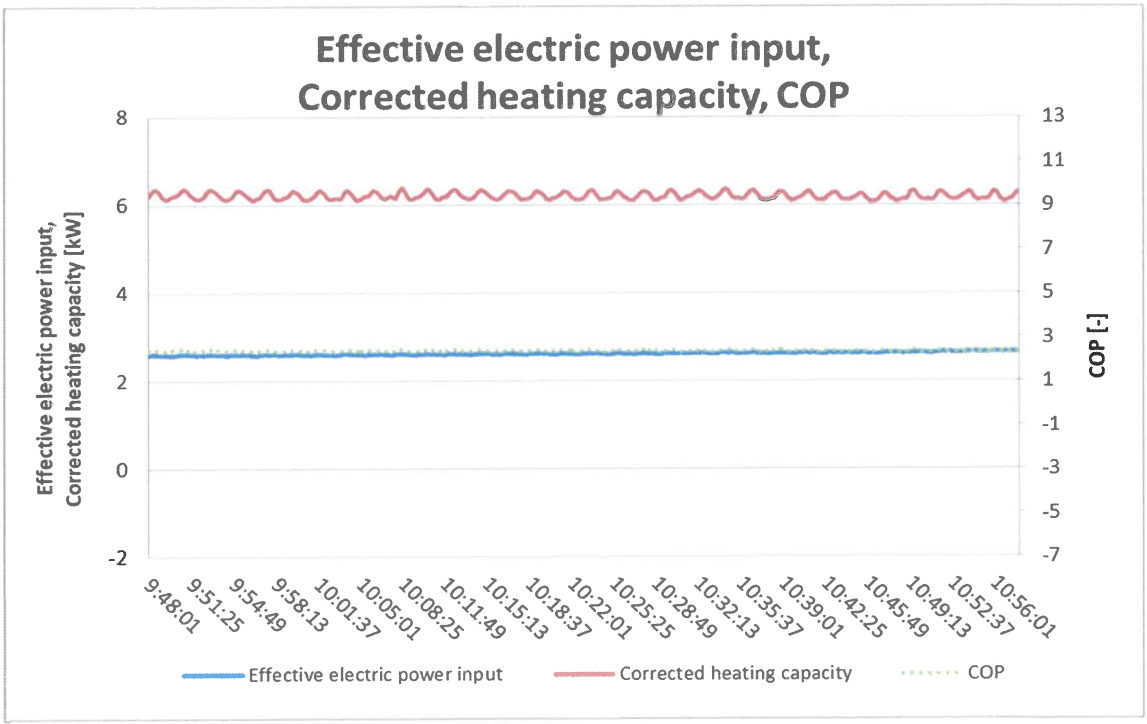

A-10/W35
Water temperature [°C]
Air temperature [°C]
38
36
34
32
30
28
26
24
22
20
18
-2
-4
-6
-8
-10
-12
17:42:01
17:50:13
17:58:25
18:06:37
18:14:49
18:23:01
18:31:13
18:39:25
18:47:37
18:55:49
19:04:01
19:12:13
19:20:25
19:28:37
19:36:49
19:45:01
19:53:13
20:01:25
20:09:37
20:17:49
20:26:01
20:34:13
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature


Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
10
8
6
4
2
0
13
11
9
7
5
3
1
-1
-3
-5
-7
17:42:01
17:50:37
17:59:13
18:07:49
18:16:25
18:25:01
18:33:37
18:42:13
18:50:49
18:59:25
19:08:01
19:16:37
19:25:13
19:33:49
19:42:25
19:51:01
19:59:37
20:08:13
20:16:49
20:25:25
20:34:01
Effective electric power input
Corrected heating capacity
COP

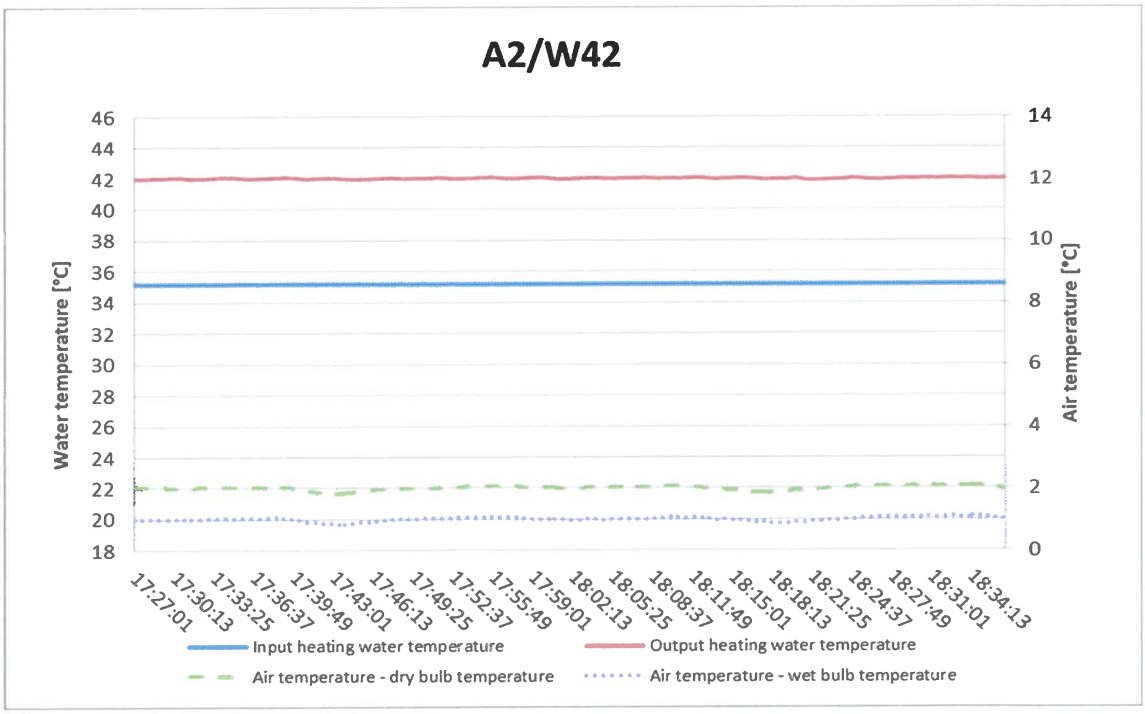
3. Seasonal performance tests and SCOP calculation – Medium temperature application

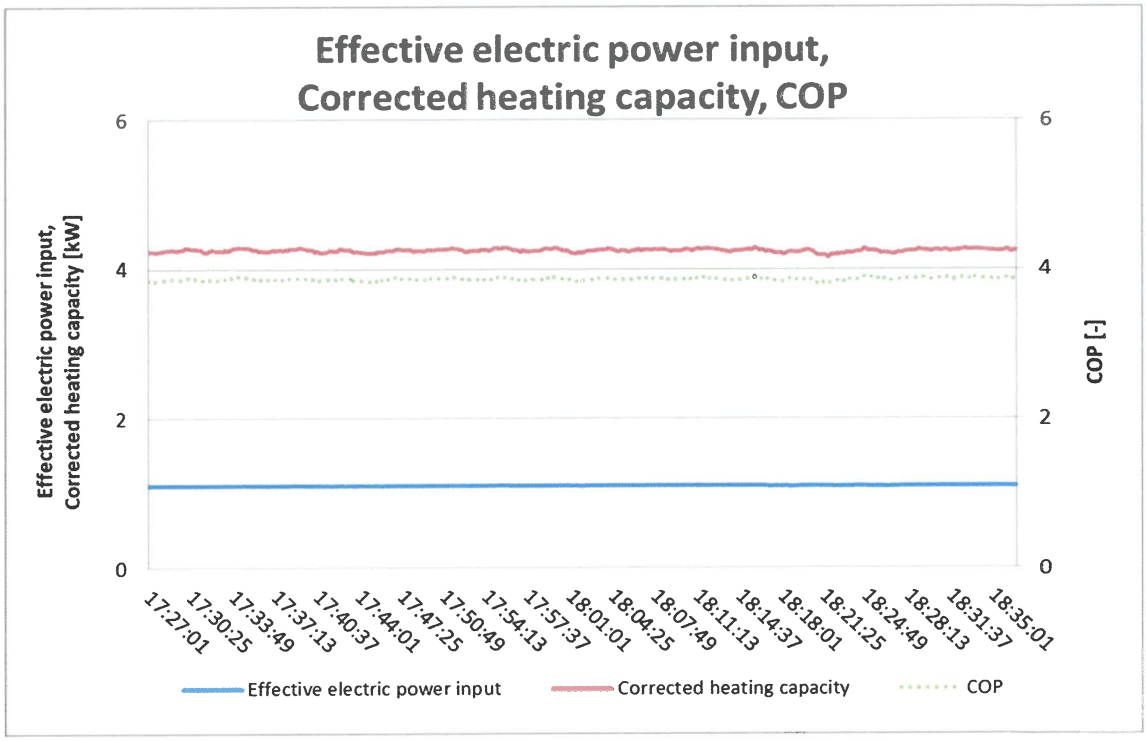
A-7/W52 (76 %)



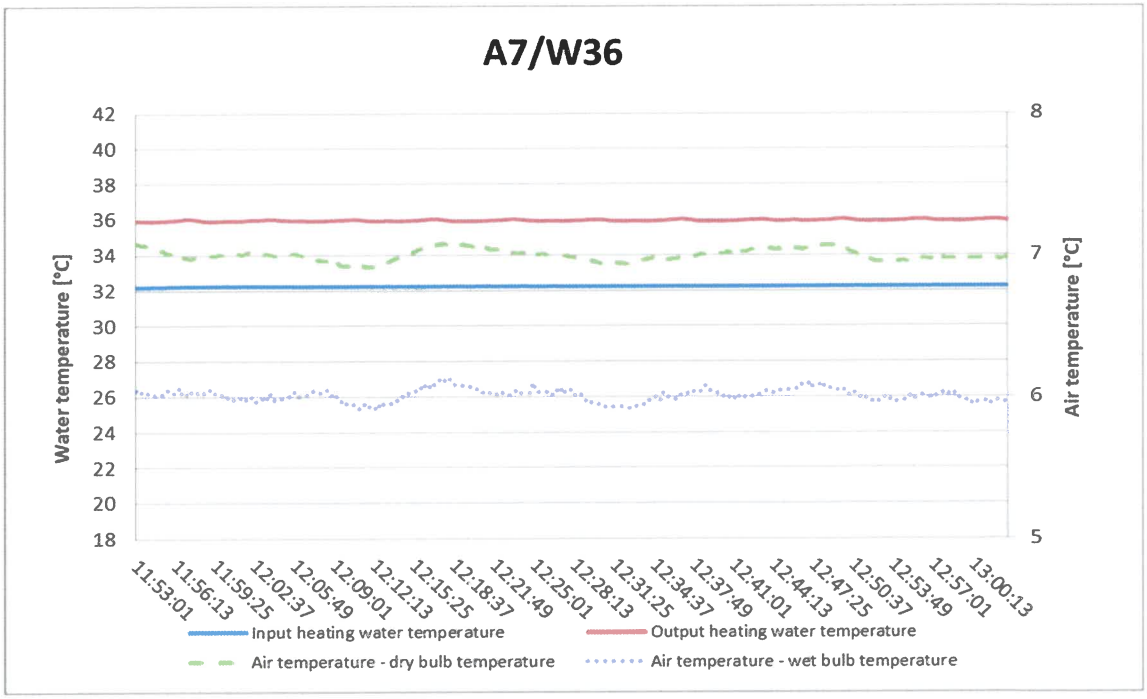


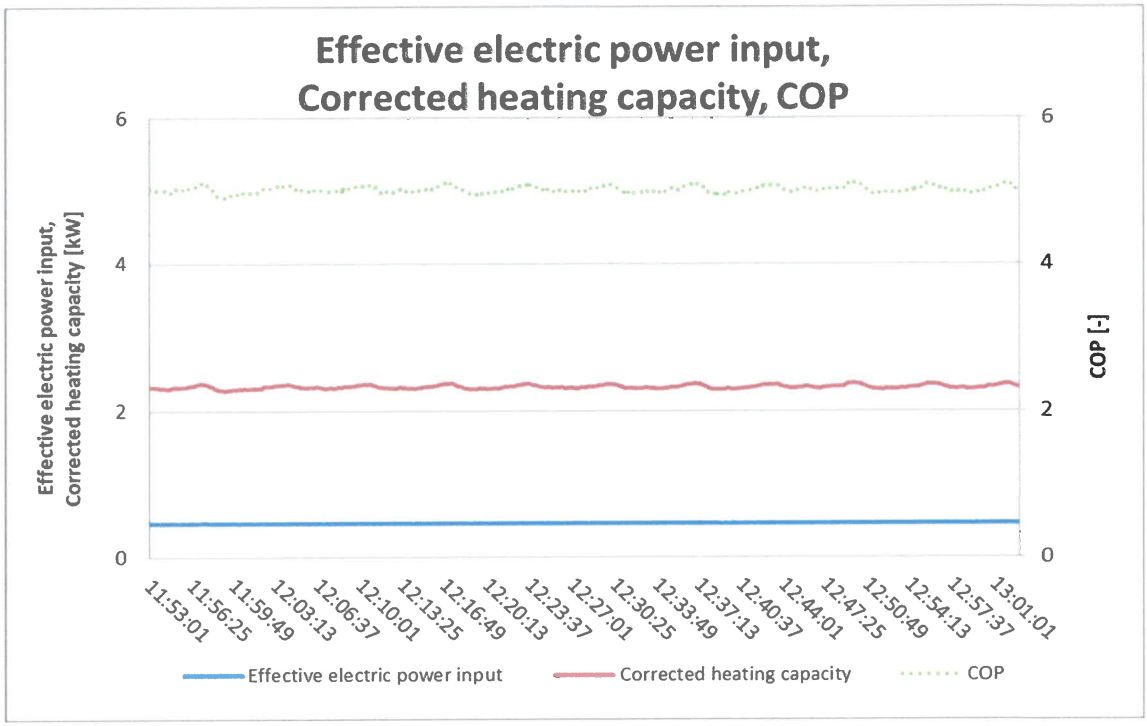
A2/W42 (40 %)


A2/W42
Water temperature [°C]
Air temperature [°C]
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
14
12
10
8
6
4
2
0
17:27:01
17:30:13
17:33:25
17:36:37
17:39:49
17:43:01
17:46:13
17:49:25
17:52:37
17:55:49
17:59:01
18:02:13
18:05:25
18:08:37
18:11:49
18:15:01
18:18:13
18:21:25
18:24:37
18:27:49
18:31:01
18:34:13
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature

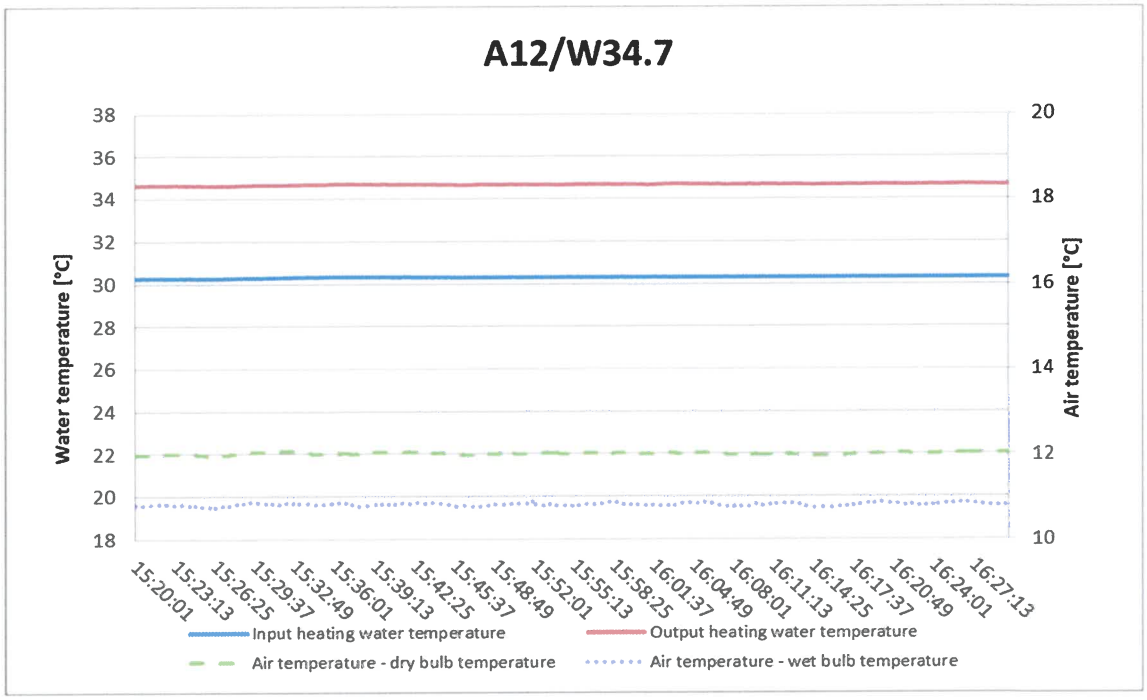

Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
6
4
2
0
6
4
2
0
17:27:01
17:30:25
17:33:49
17:37:13
17:40:37
17:44:01
17:47:25
17:50:49
17:54:13
17:57:37
18:01:01
18:04:25
18:07:49
18:11:13
18:14:37
18:18:01
18:21:25
18:24:49
18:28:13
18:31:37
18:35:01
Effective electric power input
Corrected heating capacity
COP

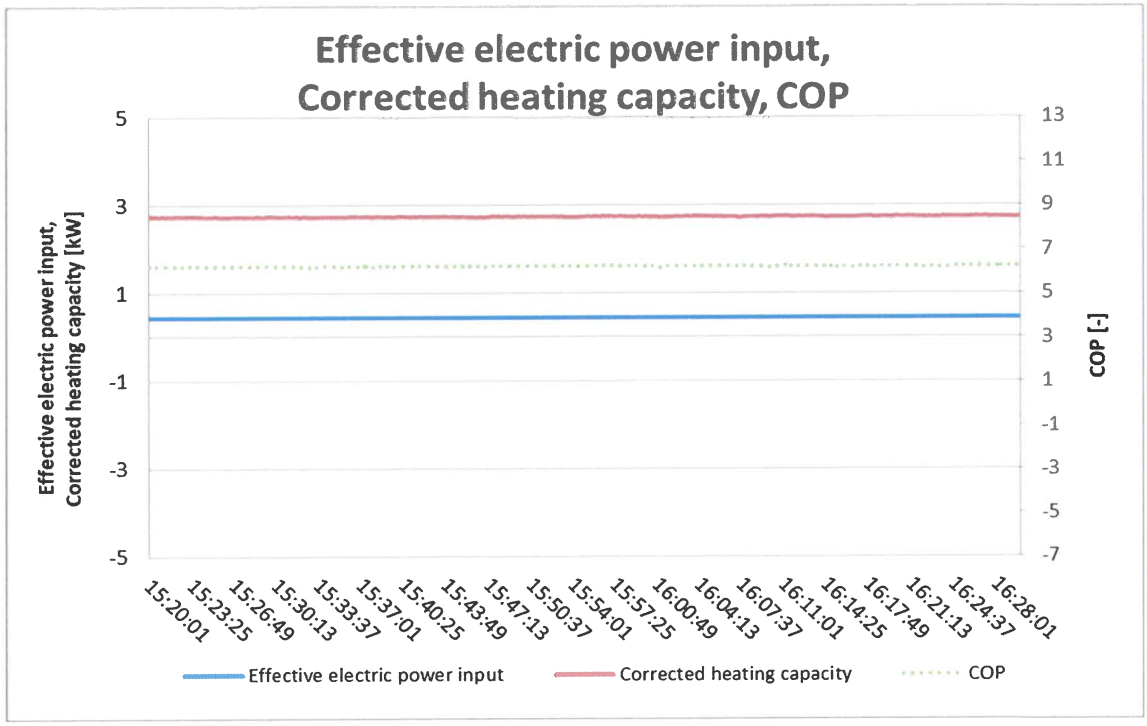
A7/W36 (20 %)


A7/W36
Water temperature [°C]
Air temperature [°C]
42
40
38
36
34
32
30
28
26
24
22
20
18
8
7
6
5
11:53:01
11:56:13
11:59:25
12:02:37
12:05:49
12:09:01
12:12:13
12:15:25
12:18:37
12:21:49
12:25:01
12:28:13
12:31:25
12:34:37
12:37:49
12:41:01
12:44:13
12:47:25
12:50:37
12:53:49
12:57:01
13:00:13
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature

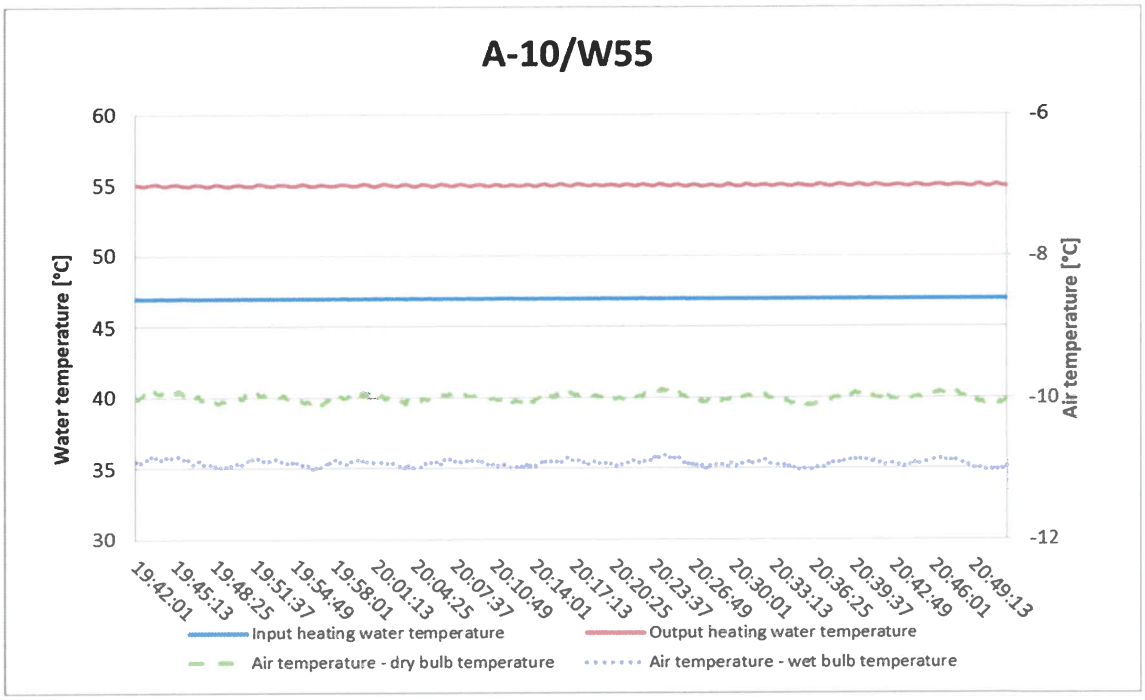

Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
6
4
2
0
6
4
2
0
11:53:01
11:56:25
11:59:49
12:03:13
12:06:37
12:10:01
12:13:25
12:16:49
12:20:13
12:23:37
12:27:01
12:30:25
12:33:49
12:37:13
12:40:37
12:44:01
12:47:25
12:50:49
12:54:13
12:57:37
13:01:01
Effective electric power input
Corrected heating capacity
COP

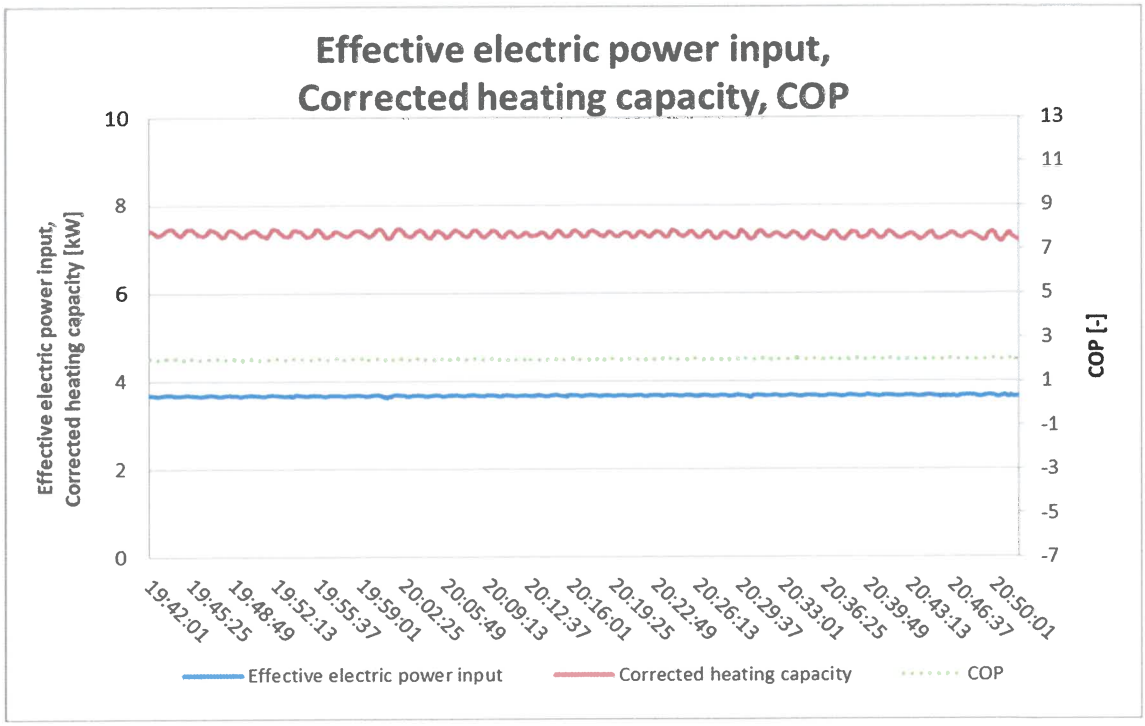
A12/W34.7 (20 %)


A12/W34.7
Water temperature [°C]
Air temperature [°C]
38
36
34
32
30
28
26
24
22
20
18
20
18
16
14
12
10
15:20:01
15:23:13
15:26:25
15:29:37
15:32:49
15:36:01
15:39:13
15:42:25
15:45:37
15:48:49
15:52:01
15:55:13
15:58:25
16:01:37
16:04:49
16:08:01
16:11:13
16:14:25
16:17:37
16:20:49
16:24:01
16:27:13
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature


Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
5
3
1
-1
-3
-5
13
11
9
7
5
3
1
-1
-3
-5
-7
15:20:01
15:23:25
15:26:49
15:30:13
15:33:37
15:37:01
15:40:25
15:43:49
15:47:13
15:50:37
15:54:01
15:57:25
16:00:49
16:04:13
16:07:37
16:11:01
16:14:25
16:17:49
16:21:13
16:24:37
16:28:01
Effective electric power input
Corrected heating capacity
COP

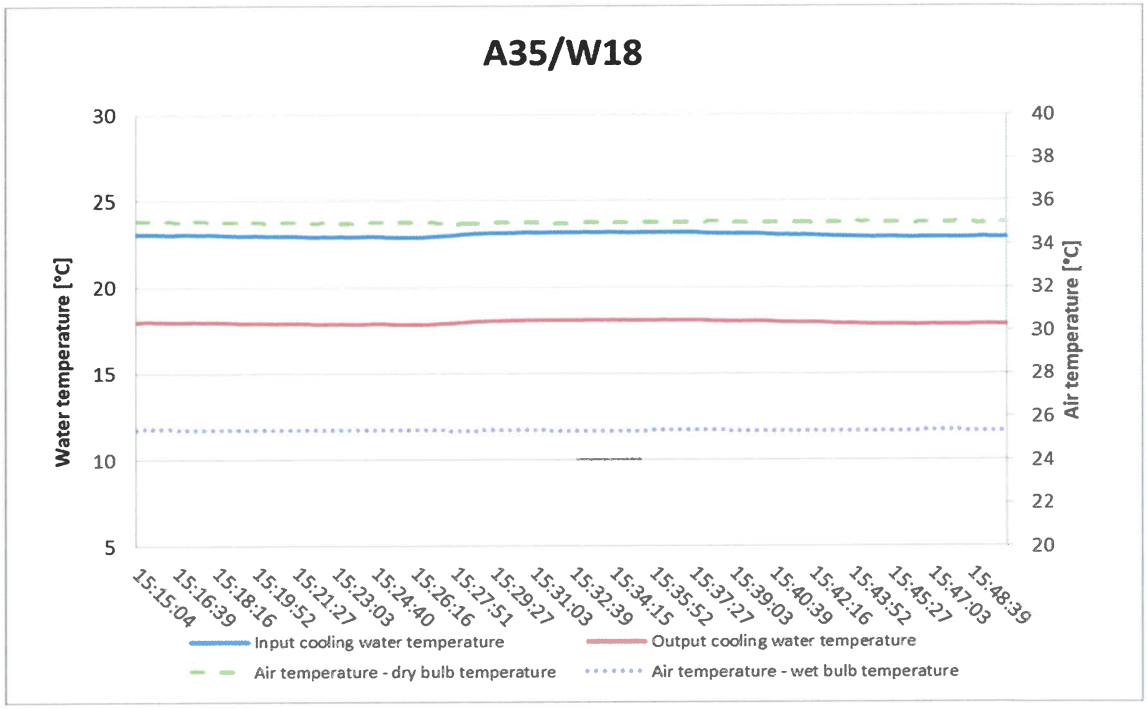
A-10/W55 (95 %)

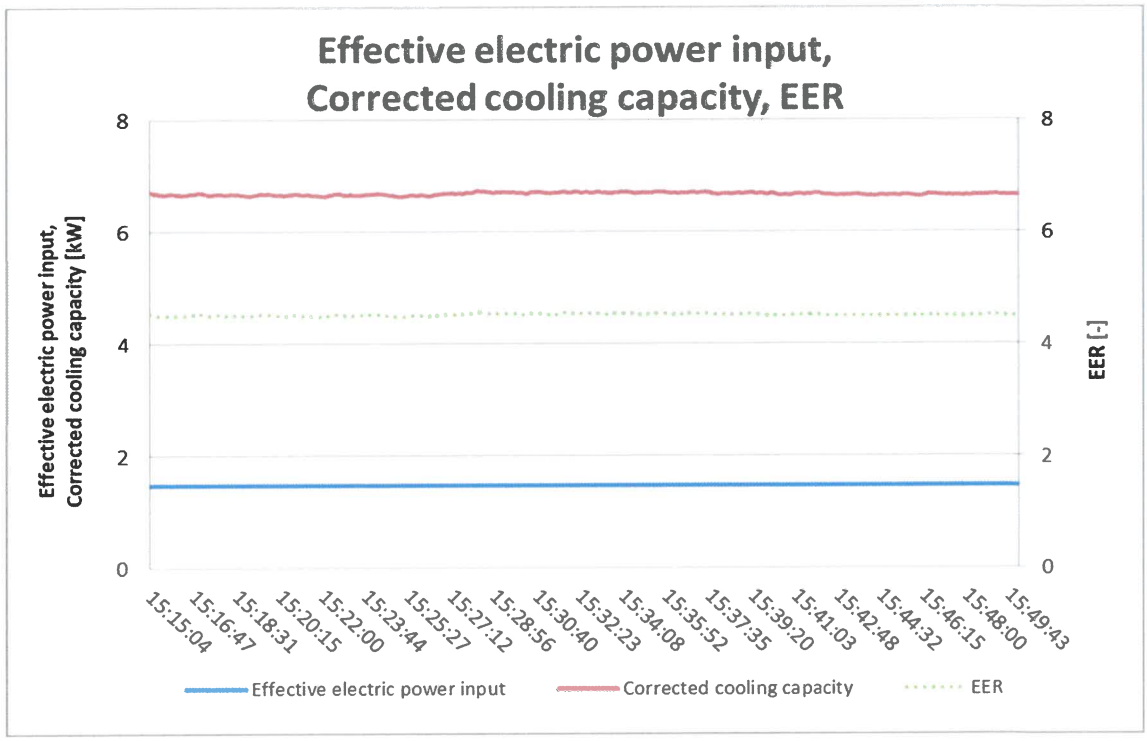

A-10/W55
Water temperature [°C]
Air temperature [°C]
60
55
50
45
40
35
30
-6
-8
-10
-12
19:42:01
19:45:13
19:48:25
19:51:37
19:54:49
19:58:01
20:01:13
20:04:25
20:07:37
20:10:49
20:14:01
20:17:13
20:20:25
20:23:37
20:26:49
20:30:01
20:33:13
20:36:25
20:39:37
20:42:49
20:46:01
20:49:13
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature


Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
10
8
6
4
2
0
13
11
9
7
5
3
1
-1
-3
-5
-7
19:42:01
19:45:25
19:48:49
19:52:13
19:55:37
19:59:01
20:02:25
20:05:49
20:09:13
20:12:37
20:16:01
20:19:25
20:22:49
20:26:13
20:29:37
20:33:01
20:36:25
20:39:49
20:43:13
20:46:37
20:50:01
Effective electric power input
Corrected heating capacity
COP

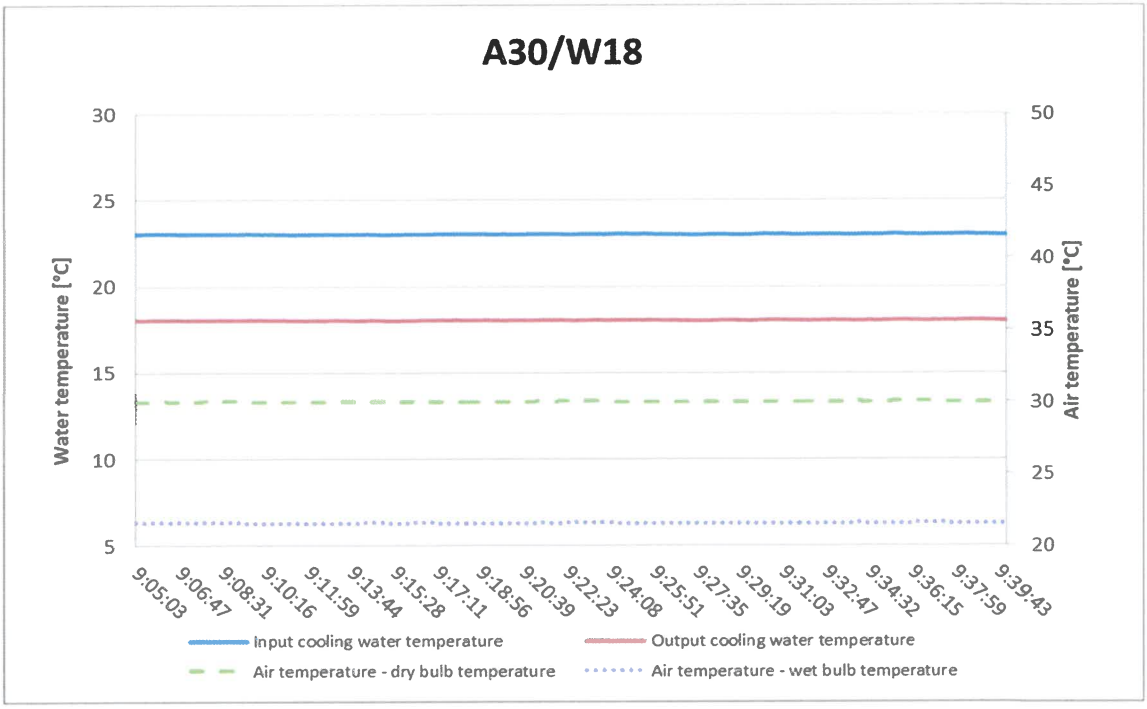
4. Seasonal performance tests and SEER calculation – Floor cooling

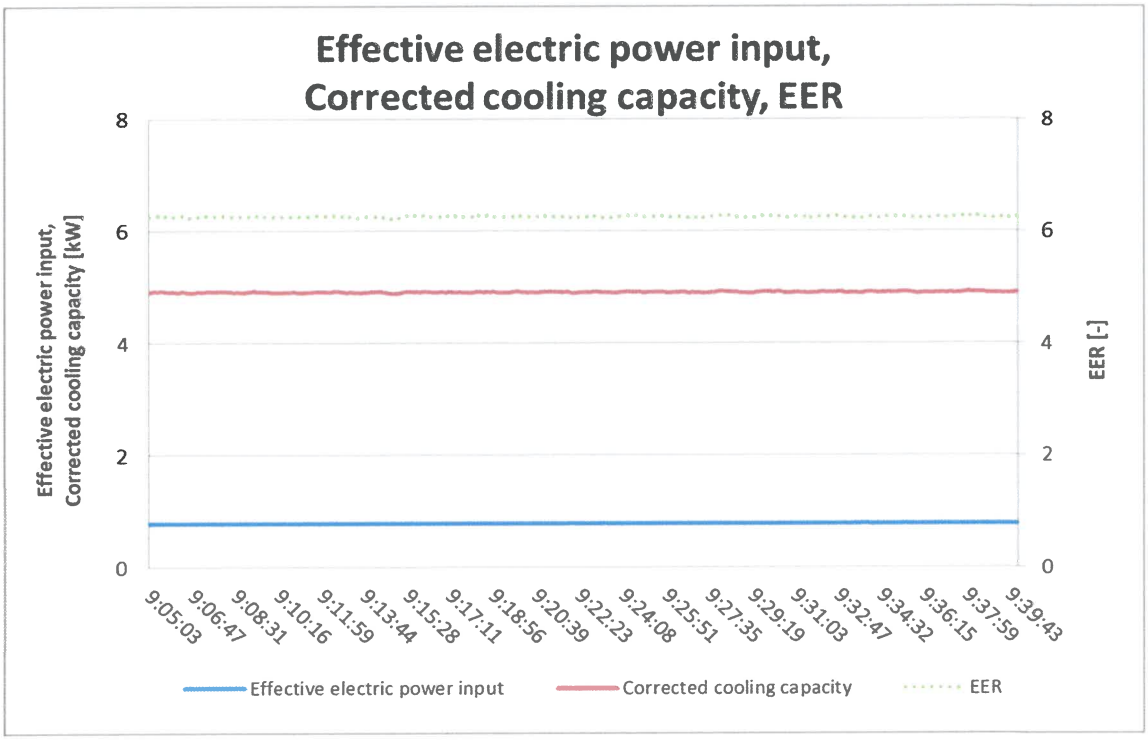
A35/W18 (47 %)





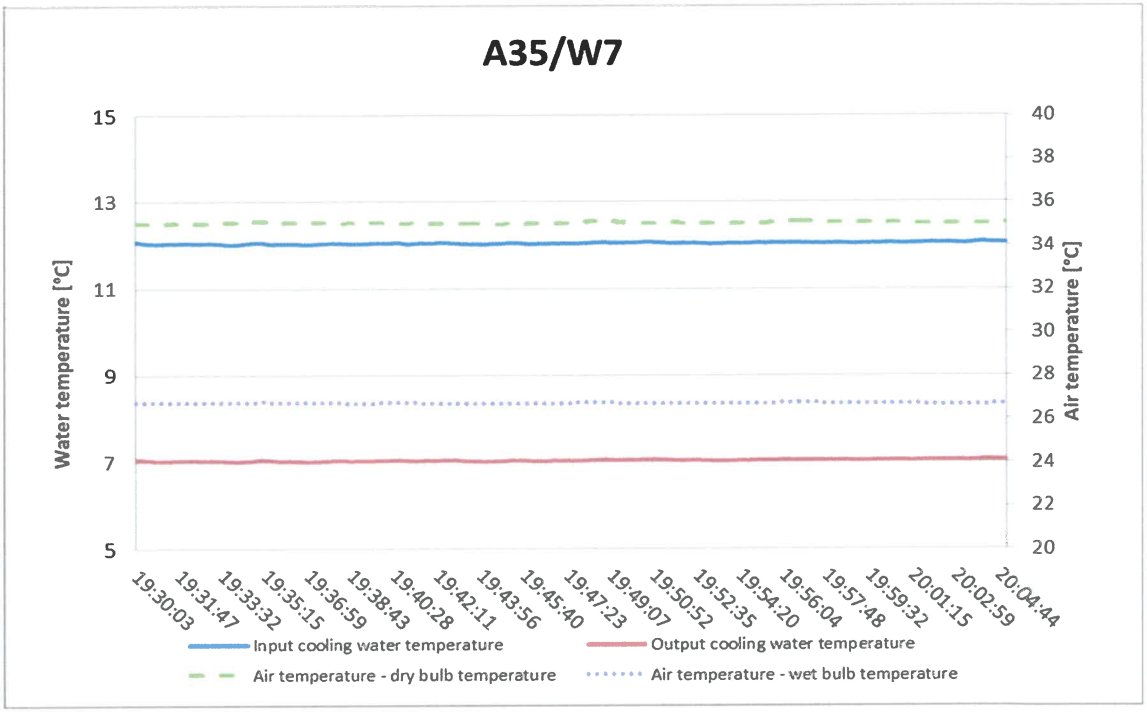
A30/W18 (30 %)

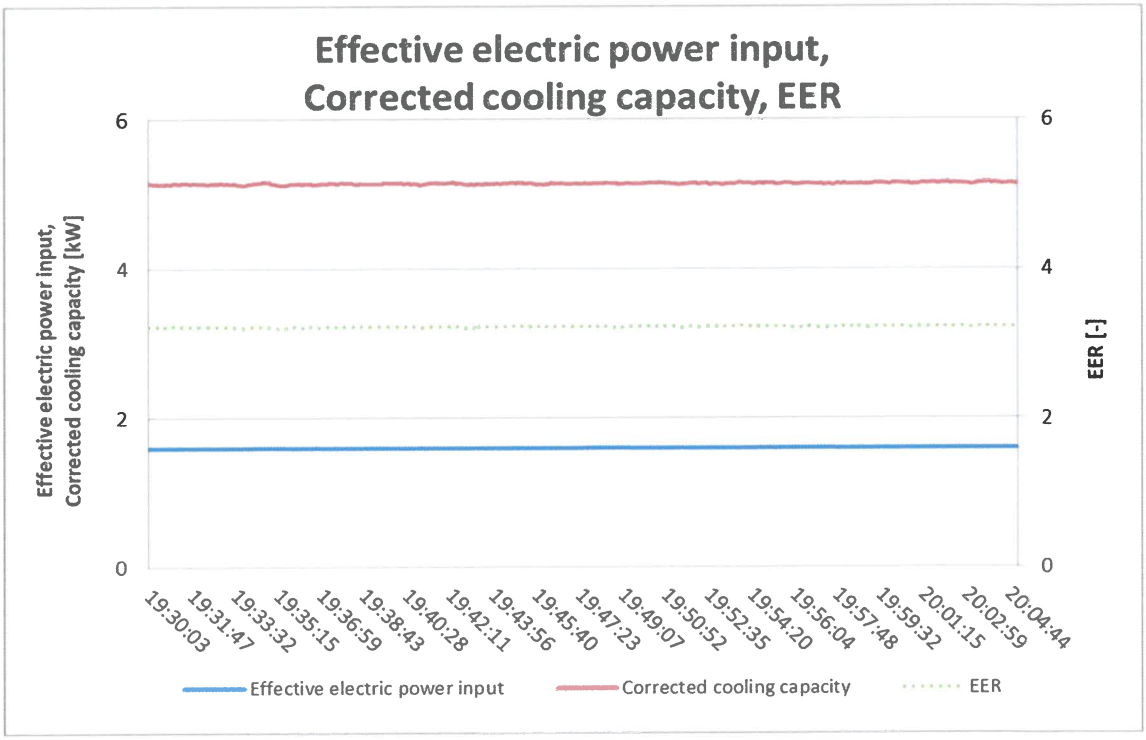

A30/W18
Water temperature [°C]
Air temperature [°C]
30
25
20
15
10
5
50
45
40
35
30
25
20
9:05:03
9:06:47
9:08:31
9:10:16
9:11:59
9:13:44
9:15:28
9:17:11
9:18:56
9:20:39
9:22:23
9:24:08
9:25:51
9:27:35
9:29:19
9:31:03
9:32:47
9:34:32
9:36:15
9:37:59
9:39:43
Input cooling water temperature
Output cooling water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature


Effective electric power input,
Corrected cooling capacity, EER
Effective electric power input, Corrected cooling capacity [kW]
EER [-]
8
6
4
2
0
9:05:03
9:06:47
9:08:31
9:10:16
9:11:59
9:13:44
9:15:28
9:17:11
9:18:56
9:20:39
9:22:23
9:24:08
9:25:51
9:27:35
9:29:19
9:31:03
9:32:47
9:34:32
9:36:15
9:37:59
9:39:43
Effective electric power input
Corrected cooling capacity
EER

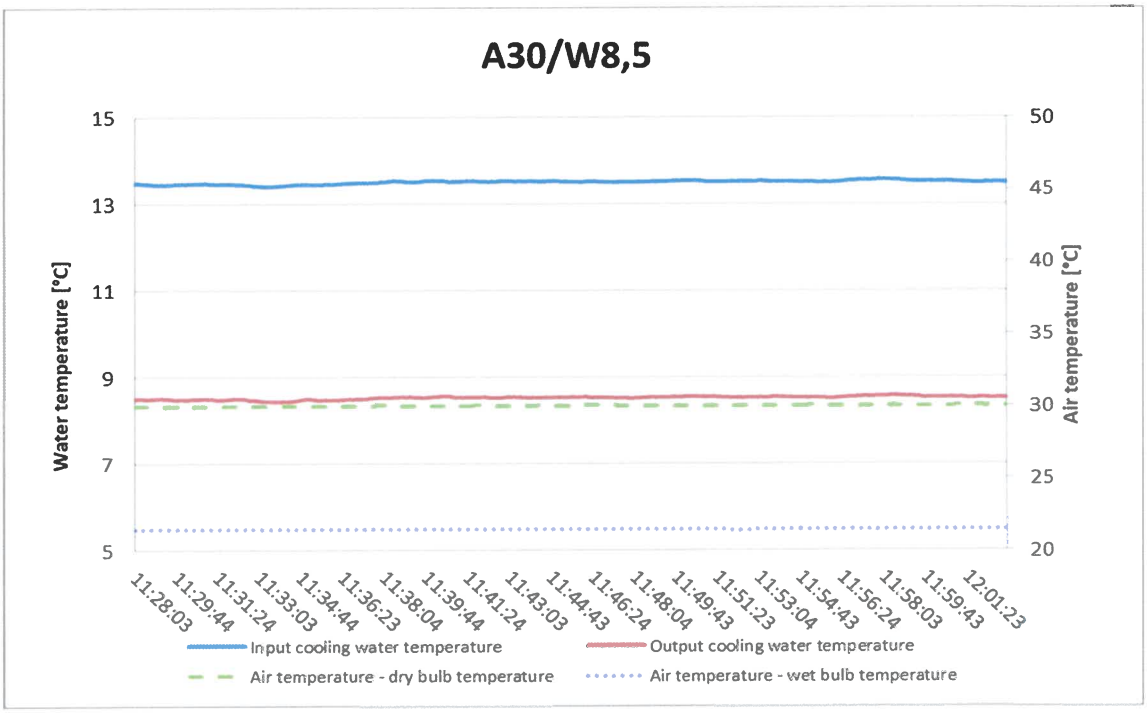
5. Seasonal performance tests and SEER calculation – Fan coil

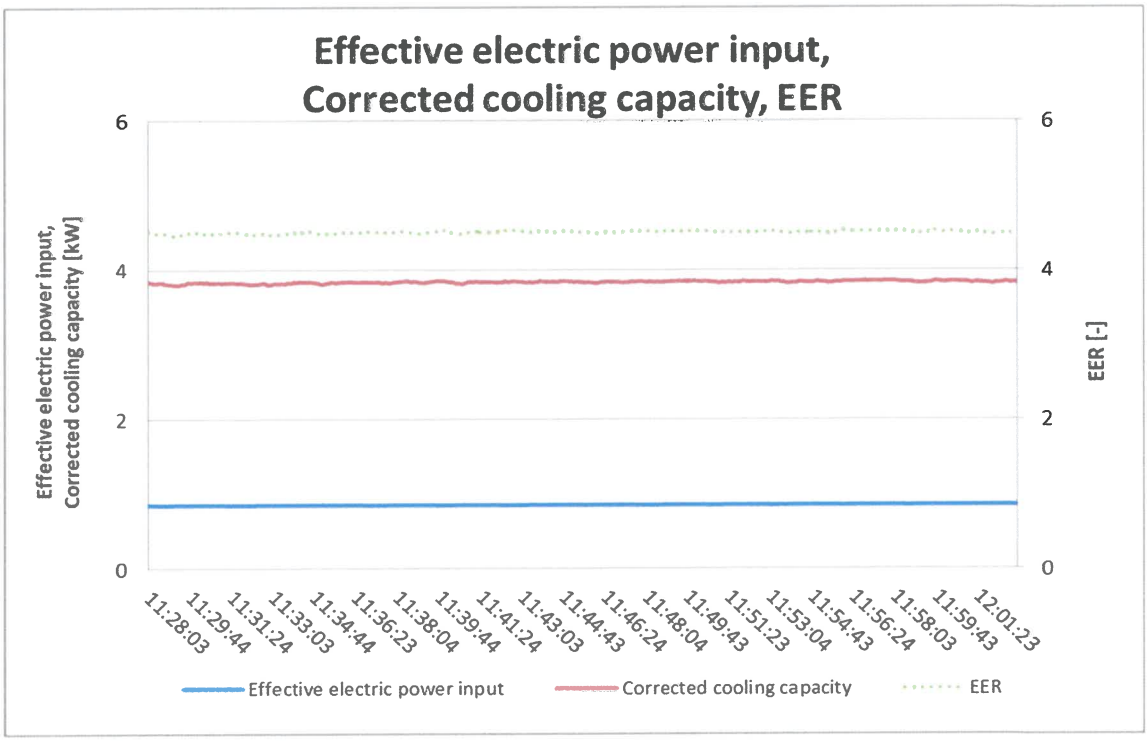
A35/W7 (51 %)





A30/W8.5 (32 %)


A30/W8,5
Water temperature [°C]
Air temperature [°C]
15
13
11
9
7
5
50
45
40
35
30
25
20
11:28:03
11:29:44
11:31:24
11:33:03
11:34:44
11:36:23
11:38:04
11:39:44
11:41:24
11:43:03
11:44:43
11:46:24
11:48:04
11:49:43
11:51:23
11:53:04
11:54:43
11:56:24
11:58:03
11:59:43
12:01:23
Input cooling water temperature
Output cooling water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature


Effective electric power input,
Corrected cooling capacity, EER
Effective electric power input, Corrected cooling capacity [kW]
EER [-]
6
4
2
0
11:28:03
11:29:44
11:31:24
11:33:03
11:34:44
11:36:23
11:38:04
11:39:44
11:41:24
11:43:03
11:44:43
11:46:24
11:48:04
11:49:43
11:51:23
11:53:04
11:54:43
11:56:24
11:58:03
11:59:43
12:01:23
Effective electric power input
Corrected cooling capacity
EER

V. A list of referenced documents

- Order of 2024-04-22 (Order reg. no. B-82120, received on 2024-04-25)
- Contract B-82120/39

- ČSN EN 14511-2:2023 - Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 2: Test conditions
- ČSN EN 14511-3:2023 - Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 3: Test methods
- ČSN EN 14511-4:2023 - Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 4: Requirements
- ČSN EN 14825:2023 - Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling, commercial and process cooling - Testing and rating at part load conditions and calculation of seasonal performance

Test Report compiled by: Ing Jakub Čederle

Test Report approved by: Ing. Mario Jankola
Heating Equipment and Construction Products Manager

– End of Test Report –

Instytut Badawczy Przemysłu Maszynowego, przedsiębiorstwo państwowe, Brno, Republika Czeska
Engineering Test Institute. Public Enterprise. Brno. Czech Republic

CERTYFIKAT Z BADAŃ
TEST CERTIFICATE

Numer - *Number* **O-B-00953-24**

Producent *Customer*	JBG-2 Sp. z o.o. Gajowa 5 43-254 Warszowice POLAND
Produkt *Product*	Pompa Ciepła powietrze/woda – monoblok *Air/Water Heat Pump – monobloc*
Rodzaj oznaczenie / znak towarowy *Type designation / Trade mark*	**ZHHH-P1-010K-R290-R5-M**
Metoda testowa *Test methods*	ČSN EN 14511-2:2023, ČSN EN 14511-3:2023, ČSN EN 14825:2023; ČSN EN 12102-1:2023, EHPA Testing regulation – Testing of Air/Water Heat Pumps, version 2.4a
Podstawy zaświadczenia *Basis of certificate*	Raport z badań - *Test reports*: 39-17723/T z dnia - *of* 2024-06-14 39-17723/H z dnia- *of* 2024-06-14 Dokumentacja techniczna przedstawiona przez - *Technical documents of JBG-2 Sp. z o.o.*
Referencyjny okres grzewczy *Reference heating season*	**„A" = average** (Warunki obliczeniowe odniesienia dla ogrzewania $T_{designh}$ = -10 °C - *Reference design temperature $T_{designh}$ = -10 °C*)

Wyniki - Results:

NISKA TEMPERATURA *LOW TEMPERATURE* (Referencyjna temperatura wody 35 °C - *Reference water temperature 35 °C*)		ŚREDNIA TEMPERATURA *MEDIUM TEMPERATURE* (Referencyjna temperatura wody 55 °C - *Reference water temperature 55 °C*)
6.80	**$P_{designh}$ [kW]** … Obciążenie obliczeniowe dla trybu ogrzewania - *Full load heating*	**7.34**
5.16	**SCOP [-]** … Wskaźnik sezonowej efektywności - *Seasonal coefficient of performance*	**3.90**

Temperatura zewnętrzna *Outdoor temperature* T_j [°C]	Deklarowana wydajność grzewcza *Heating declared capacity* P_{dh} [kW]	Wskaźnik efektywności dla deklarowanej wydajności *Coefficient of performance at the declared capacity* COP_d [-]	Temperatura zewnętrzna *Outdoor temperature* T_j [°C]	Deklarowana wydajność grzewcza *Heating declared capacity* P_{dh} [kW]	Wskaźnik efektywności dla deklarowanej wydajności *Coefficient of performance at the declared capacity* COP_d [-]
T_j = -7	6.282	3.147	T_j = -7	6.206	2.372
T_j = +2	3.797	5.161	T_j = +2	4.247	3.864
T_j = +7	2.484	6.673	T_j = +7	2.326	5.015
T_j = +12	2.831	7.928	T_j = +12	2.734	6.212
T_j = TOL = -10	6.796	2.561	T_j = TOL = -10	7.340	1.999
T_j = $T_{bivalent}$ = -10	6.796	2.561	T_j = $T_{bivalent}$ = -10	7.340	1.999

Strojírenský zkušební ústav, s.p., Hudcova 424/56b, 621 00 Brno, Česká republika
Engineering Test Institute, public enterprise, Hudcova 424/56b, 621 00 Brno, Czech Republic
www.szutest.cz

NISKA TEMPERATURA *LOW TEMPERATURE* (Referencyjna temperatura wody 35 °C - *Reference water temperature 35 °C*)				ŚREDNIA TEMPERATURA *MEDIUM TEMPERATURE* (Referencyjna temperatura wody 55 °C - *Reference water temperature 55 °C*)
Pobór mocy w trybach innych niż „tryb aktywny" - *Power consumption in modes other than „active mode"*				
13.0	Tryb wyłączenia *Off mode*	P_{OFF}	[W]	13.0
13.0	Tryb wyłączonego termostatu *Thermostat off mode*	P_{TO}	[W]	13.0
13.0	Tryb czuwania *Standby mode*	P_{SB}	[W]	13.0
0.0	Tryb włączonej grzałki karteru *Crankcase heater mode*	P_{CK}	[W]	0.0
Roczne zużycie energii elektrycznej na potrzeby ogrzewania wg: - *Annual electricity consumption for heating according to*:				
2719	ČSN EN 14825:2023	Q_{HE}	[kWh]	**3892**
Sezonowa efektywność energetyczna ogrzewania pomieszczeń - *Seasonal Space heating energy efficiency*				
203.6	ČSN EN 14825:2023	η_s	[%]	**152.8**
Przepływ cieczy w zewnętrznym wymienniku ciepła - *Liquid flow rate in outdoor heating exchanger*				
– – –	Ciecz źródłowa *Source liquid*	Min	[m^3/h]	– – –
– – –		Max	[m^3/h]	– – –
Przepływ cieczy w wewnętrznym wymienniku ciepła - *Liquid flow rate in indoor heating exchanger*				
0.5431 1.1845	Woda grzewcza *Heating water*	Min/ Max	[m^3/h]	0.5417 0.8041

Poziom mocy akustycznej dla warunków - Sound power level at condition B0/W55* (at 24 %) :

ZHHH-P1-010K-R290-R5-M Jednostka zewnętrzna outdoor unit	L_{WA}	48.0 ± 1.5	dB(A)	Klasa dokładności 2 *Accuracy class 2*

(*) Uwagi do skróconych oznaczeń: np. A7/W55 „A" powietrze, „7" temperatura wejściowa (temperatura termometru suchego) w °C, „W" woda, „35" temperatura wyjściowa w °C.
Comment to abbreviated marking: e.g. A7/W55: A (air), 7 (input air – dry bulb temperature in °C) / W (water), 55 (output heating water temperature in °C).

Specyfikacja warunków - *Specification of conditions*:

Kontrola prędkości kompresora u *Compressor speed control*	**Zmienna** ***Variable***	Nominalne natężenie przepływu ciecz (wewnętrzny wymiennik ciepła) - *Rated liquid flow rate (indoor heat exchanger)*	**Zmienna** ***Variable***
Wylotowa temperatura wody (wewnętrzny wymiennik ciepła) - *Outlet water temperature (indoor heat exchanger)*	**Zmienna** ***Variable***	Nominalne natężenie przepływu ciecz (zewnętrzny wymiennik ciepła) - *Rated liquid flow rate (outdoor heat exchanger)*	**–**
Funkcja *Function*	**Odwracalna** ***Reversible***		

Instytut Badawczy Przemysłu Maszynowego, przedsiębiorstwo państwowe potwierdza niniejszym certyficatem z badań, że badanie produktu, którego dotyczy dało wyniki wskazane powyżej. Instytut Badawczy Przemysłu Maszynowego, przedsiębiorstwo państwowe jest akredytowanym Laboratorium 1045.1.
Engineering Test Institute, Public Enterprise, confirms by this Test Certificate that the testing of the product in question was performed with the results as stated above. Engineering Test Institute, Public Enterprise, is an accredited Testing Laboratory 1045.1.

Brno, 2024-06-14

Ing. Mario Jankola

Kierownik ds. Urządzeń Grzewczych i Wyrobów Budowlanych
Heating Equipment and Construction Products Manager

- KONIEC CERTYFIKATU Z BADAŃ -
- END OF TEST CERTIFICATE -

STROJÍRENSKÝ ZKUŠEBNÍ ÚSTAV, s.p. CZ 1