OŚWIADCZENIE

Producent Columbus Energy S.A. oświadcza, iż pompy ciepła

1) PC-CE-MB-HT-1P-06-01
Oznaczenie/typ/identyfikator modelu

2) PC-CE-MB-HT-3P-12-00
Oznaczenie/typ/identyfikator modelu

3) PC-CE-MB-HT-3P-12-01
Oznaczenie/typ/identyfikator modelu

4) PC-CE-MB-HT-3P-18-00
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.

Kraków, 01.07.2024
Miejscowość, data

Michał Gondek
Podpis osoby upoważnionej
Wiceprezes Zarządu

Columbus Energy S.A.
31-358 Kraków, ul. Jasnogórska 9
KRS 0000373608 biuro@columbusenergy.pl
NIP: 9492163154 REGON: 241811803
tel. 12 307 30 90 fax: 12 311 33 13
ColumbusEnergy

OBJAŚNIENIE NAZWY MODELU UŻYTEGO W CELACH CERTYFIKACJI

Model PC-CE-MB-HT-3P-12-0* użyty w badaniach urządzenia jest nazwą ogólną.

* oznacza różne wersje produktu, które nie różnią się podstawowymi elementami i konstrukcją ani niczym, co mogłoby wpłynąć na wydajność urządzenia.

W związku z tym wyniki testów dotyczą następujących produktów:

- PC-CE-MB-HT-3P-12-00
- PC-CE-MB-HT-3P-12-01

10.12.2024, Kraków

.....

Data, miejsce

.....

Podpis osoby upoważnionej

Columbus Energy S.A.
31-358 Kraków, ul. Jasnogórska 9
KRS 0000373608 biuro@columbusenergy.pl
NIP: 9492163154 REGON: 241811803
tel. 12 307 30 90 fax: 12 311 33 13
ColumbusEnergy

PEŁNOMOCNICTWO

Ja niżej podpisany, **Dawid Zieliński (PESEL: 85100706814) jako Prezes Zarządu spółki COLUMBUS ENERGY S.A. z siedzibą w Krakowie,** ul. Jasnogórska 9, 31 - 385 Kraków, wpisanej do rejestru przedsiębiorców Krajowego Rejestru Sądowego prowadzonego przez Sąd Rejonowy dla Krakowa - Śródmieścia w Krakowie, Wydział XI Gospodarczy Krajowego Rejestru Sądowego, pod nr KRS 0000373608, posiadającej NIP: 9492163154, REGON: 241811803 oraz BDO: 000258633 z kapitałem zakładowym w wysokości 129.982.198,50 zł w całości opłaconym (dalej: "Spółka"), niniejszym udzielam:

Pani Ewelinie Kierdelewicz posiadającej numer PESEL: 78061403388

pełnomocnictwa i upoważnienia do dokonywania w imieniu i na rzecz Spółki czynności zwykłego zarządu.

Pełnomocnik jest upoważniony do zaciągania zobowiązań w imieniu Spółki do kwoty nieprzekraczającej 500.000,00 zł (słownie: pięćset tysięcy złotych)

Na podstawie niniejszego pełnomocnictwa pełnomocnik upoważniony jest do podejmowania wszelkich czynności faktycznych, jak i prawnych, jakie okażą się niezbędne dla należytej realizacji zakresu niniejszego pełnomocnictwa. Pełnomocnik upoważniony jest do podpisywania w powyższym zakresie wszelkich dokumentów, protokołów, składania wszelkich oświadczeń woli i wiedzy oraz zapewnień, zawierania umów, aneksów, porozumień w imieniu Spółki.

Pełnomocnik jest zobowiązany do niezwłocznego powiadomienia Spółki o każdej czynności dokonanej na jej rzecz w zakresie oraz w wykonaniu niniejszego pełnomocnictwa.

Pełnomocnik nie może być drugą stroną czynności prawnych dokonywanych na podstawie niniejszego pełnomocnictwa, nie może reprezentować innych stron tych czynności oraz nie może udzielać dalszych pełnomocnictw.

Pełnomocnictwo upoważnia pełnomocnika do działania w imieniu Spółki do dnia **31.12.2024** lub do dnia ustania zatrudnienia w Spółce Columbus Energy S.A. z/s w Krakowie, jeśli nastąpi to przed wskazaną datą. Pełnomocnictwo może być w każdym czasie zmienione lub odwołane.

W przypadku upływu czasu na jaki pełnomocnictwo zostało udzielone albo odwołania pełnomocnictwa, pełnomocnik winien niezwłocznie zaprzestać jakichkolwiek działań, do których został upoważniony na podstawie niniejszego pełnomocnictwa oraz niezwłocznie zwrócić Spółce niniejszy dokument pełnomocnictwa.

Dawid Zieliński

PREZES ZARZĄDU

.....27.03.2024

osoba reprezentująca, data

Instrukcja dla pełnomocnika

I. [Ogólne informacje]

1. Pełnomocnictwo uprawnia do działania w imieniu i na rzecz Columbus Energy S.A. w zakresie zawierania umów oraz dokonywania innych czynności w zakresie zwykłego zarządu.
2. Pełnomocnik zobowiązany jest do stosowania się do wewnętrznych procedur dotyczących przekazywania zawartych umów, aneksów czy porozumień w oryginale do właściwych działów w Grupie CE.
3. Po upływie terminu obowiązywania pełnomocnictwa, pełnomocnik zobowiązany jest zwrócić oryginał pełnomocnictwa do Biura Zarządu - nie później niż 3 dni od dnia upływu tego terminu.

II. [Informacje dot. zawierania umów NDA]

1. Zawarcie NDA w imieniu Mocodawcy powinno zostać poprzedzone analizą treści NDA przez Dział Prawny CE.
2. Zlecenie dot. analizy NDA powinno zostać skierowane do Działu Prawnego via Jira (Pion Biznesu).
3. Dział Prawny przekazuje uwagi dot. NDA lub wprowadzi zmiany do dokumentu. Finalnym rezultatem weryfikacji jest podsumowanie wniosków Działu Prawnego wraz z rekomendacją dot. zawarcia umowy NDA oraz wskazaniem ryzyk prawnych.

Potwierdzam zapoznanie się z instrukcją do pełnomocnictwa udzielonego mi przez **Dawida Zielińskiego** z dnia 28.08.2024

28.08.24 [signature]

podpis pełnomocnika, data

Signatář EA MLA
Český institut pro akreditaci, o.p.s.
Olšanská 54/3, 130 00 Praha 3

vydává

v souladu s § 16 zákona č. 22/1997 Sb., o technických požadavcích na výrobky, ve znění pozdějších předpisů

OSVĚDČENÍ O AKREDITACI

č. **523/2023**

Strojírenský zkušební ústav, s.p.
se sídlem Hudcova 424/56b, Medlánky, 621 00 Brno, IČO 00001490

pro zkušební laboratoř č. **1045.1**
Zkušební laboratoř

Rozsah udělené akreditace:

Zkoušení strojírenských, elektrických a stavebních výrobků pro ústřední vytápění, plynových, mechanických, tlakových a vytápěcích zařízení, hasicích přístrojů, čerpadel a chladících zařízení, osobních ochranných prostředků, zdravotnických prostředků, EMC, manipulační techniky, strojních zařízení, hraček, nábytku, sportovních potřeb a spotřebního zboží vymezené přílohou tohoto osvědčení.

Toto osvědčení je dokladem o udělení akreditace na základě posouzení splnění akreditačních požadavků podle

ČSN EN ISO/IEC 17025:2018

Subjekt posuzování shody je při své činnosti oprávněn odkazovat se na toto osvědčení v rozsahu udělené akreditace po dobu její platnosti, pokud nebude akreditace pozastavena, a je povinen plnit stanovené akreditační požadavky v souladu s příslušnými předpisy vztahujícími se k činnosti akreditovaného subjektu posuzování shody.

Toto osvědčení o akreditaci nahrazuje v plném rozsahu osvědčení č.: 205/2022 ze dne 2. 5. 2022, popřípadě správní akty na ně navazující.

Udělení akreditace je platné do **2. 5. 2027**

V Praze dne 6. 10. 2023

Český institut pro akreditaci, o.p.s. -5-

Ing. Jan Velíšek
ředitel oboru zkušebních a
kalibračních laboratoří
Český institut pro akreditaci, o.p.s.

Translation from Czech

EA MLA Signatory
Český institut pro akreditaci, o.p.s.
(Czech Accreditation Institute, Public Service Company)
Olšanská 54/3, 130 00 Praha 3

issues

in compliance with Section 16 of Act 22/1997 Sb., on the technical requirements for products, as amended

CERTIFICATE OF ACCREDITATION

No. 523/2023

to

Strojírenský zkušební ústav, s.p.
with its registered office at Hudcova 424/56b, Medlánky, 621 00 Brno, ID No.: 00001490

for Testing Laboratory No. **1045.1**
Testing Laboratory

Scope of accreditation:

Testing of engineering, electrical and construction products for central heating; gas, mechanical, pressure and heating equipment; fire extinguishers; pumps and cooling equipment; personal protective equipment; medical devices; EMC; handling equipment; machinery; toys; furniture; sports equipment and sports goods defined in an annex hereto.

The present Certificate documents that accreditation has been awarded on the basis of an assessment of fulfilment of the accreditation criteria in accordance with

ČSN EN ISO/IEC 17025:2018

In its activities, performed within the scope and for the period of validity of this Certificate, the entity subject to conformity assessment is entitled to make reference to this accreditation unless the accreditation has been suspended and is obliged to fulfil the accreditation requirements determined in accordance with the applicable regulations concerning the activities of the accredited body for conformity assessment.

The present Certificate of Accreditation supersedes Certificate No. 205/2022 dated 2 May 2022 and/or related administrative acts to the full extent.

The accreditation is valid until **2 May 2027**

In Prague, date: 6 October 2023

[signature illegible]
Ing. Jan Velíšek
Director of the Section of Testing and Calibrating Equipment
Český institut pro akreditaci, o.p.s.

[seal illegible]

[seal]
Český institut pro akreditaci, o.p.s.

PŘEKLADATELSKÁ DOLOŽKA

Já, Mgr. Lukáš Utíkal, jsem provedl překladatelský úkon jako tlumočník jmenovaný podle zákona č. 36/1967 Sb. rozhodnutím předsedy Krajského soudu v Ostravě ze dne 18. září 2007, č.j. Spr 3362/07, pro jazyk český a anglický, zapsaný v seznamu soudních tlumočníků a soudních překladatelů vedeném Ministerstvem spravedlnosti ČR, v souladu s § 44 zákona č. 354/2019 Sb., o soudních tlumočnících a soudních překladatelích.
Úkon byl zadán orgánem veřejné moci: - - - pod č.j. - - -
K provedení úkonu jsem přibral(a) konzultanta: - - - z důvodu - - -
Uvedený konzultant posuzoval tyto dílčí otázky: - - -

Stvrzuji, že překlad souhlasí s textem připojené listiny.

Úkon je zapsán v evidenci úkonů pod číslem 154894/2023

V Praze, dne 26. 10. 2023

Mgr. Lukáš UTÍKAL 1 soudní překladatel jazyka českého, anglického a španělského

TRANSLATOR'S PROVISION

I, Mgr. Lukáš Utíkal, have conducted the translating operation as a translator appointed under Act 36/1967 Coll. by decision of the Presiding Judge of the Regional Court in Ostrava dated 18 September 2007 under Ref. No. Spr 3362/07 for the Czech and English language, entered on the list of sworn translators and interpreters maintained by the Ministry of Justice of the Czech Republic, in accordance with Section 44 of Act 354/2019 Coll., on sworn translators and sworn interpreters.
The translating operation was commissioned to me by public authority - - - under ref no. - - -
I have taken on - - - as consultant on the grounds of - - - in order to address the following partial issues: - - -

I hereby certify that the translation is in agreement with the text of the attached document.

This translating operation is recorded in my translator's journal under serial number 154894/2023

In Prague, date: 26. 10. 2023

Mgr. Lukáš UTÍKAL 1 soudní překladatel jazyka českého, anglického a španělského

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
39-17865/H

Product:	Outdoor Air/Water Heat pump - monobloc
Type designation:	**PC-CE-MB-HT-3P-12-0***
Customer:	Columbus Energy Spółka Akcyjna ul. Janogórksa 9 31-358 Kraków POLAND
Manufacturer:	V-TAC Poland Sp. z o.o. Ul. Obornicka 330 60-689 Poznań POLAND
Report issue date:	2024-08-29
Distribution list:	1 copy to the Customer 1 copy to the Engineering Test Institute

This test report takes over the results of Test report 39-17566/H issued 2024-06-17.

I. Description of product tested

The Heat pump **PC-CE-MB-HT-3P-12-01** supplied by the company **Columbus Energy Spółka Akcyjna** is structurally adapted to operate in air/water system. Device is designed as monobloc placed outdoor with an indoor display. Refrigerant R290 is used with charge of 1.05 kg. Power supply is a three-phase. Heat pump is reversible and working with a fixed flow rate.

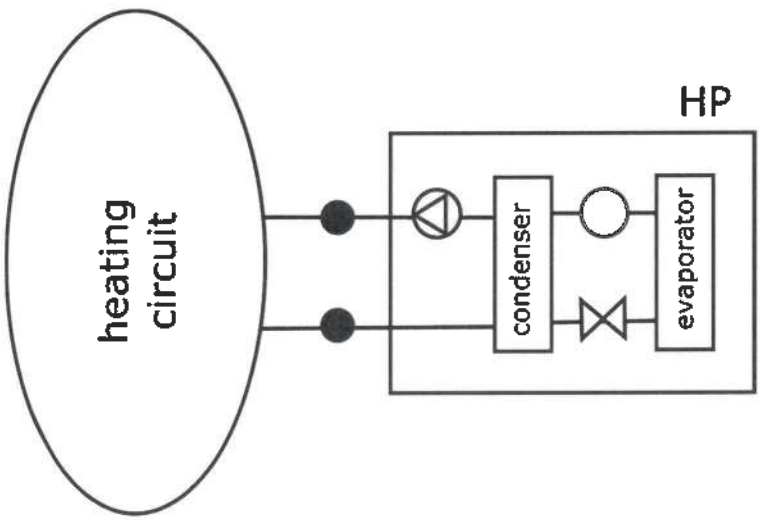
Main components of the outdoor unit **PC-CE-MB-HT-3P-12-01**:

- Serial number 31070002000032
- Cubic shape with dimensions 1285 × 446 × 920 mm (W × D × H)
- Frame and casing made of varnished steel sheets
- L-shaped evaporator, 3 rows, dimensions 1100 × 700 × 855 mm (W × D × H), spacing 1.5 mm
- Plate condenser, dimensions 135 × 100 × 350 mm (W × D × H) including insulation
- Compressor Highly WHP13300PSDPC8FQ
- Refrigerant R290 (1.05 kg)
- Electric expansion valve Fujikoki FKS-47R
- 4-way reversing valve Saginomiya STF-H0404
- Refrigerant accumulator
- Axial fan Ø60 cm with motor Jiangmen LT Motor RD200HC
- 2x pressure control ChangZhou Match-Well Pressure Control
- Circulation pump Shimge APM25-9-130 PWM1
- Temperature sensors
- Refrigerant pipes
- Air vent

PC-CE-MB-HT-3P-12-0* is a general name. * represents different product versions that do not differ in fundamental elements and construction or anything that could affect the performance of the unit. Thus, these test results apply to the following:

- **PC-CE-MB-HT-3P-12-00**
- **PC-CE-MB-HT-3P-12-01**

Scheme:



Photodocumentation:

Heat pump **PC-CE-MB-HT-3P-12-01** – outdoor unit – Front view –

Heat pump **PC-CE-MB-HT-3P-12-01** – outdoor unit – Back view –

Heat pump **PC-CE-MB-HT-3P-12-01** – outdoor unit – Compressor label –

Heat pump **PC-CE-MB-HT-3P-12-01** – outdoor unit – Label –

Heat pump **PC-CE-MB-HT-3P-12-01** – outdoor unit
– Without cover –

II. Sample tested

SZU reg. no.	Product name	Date of submission
	PC-CE-MB-HT-3P-12-01	

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. 7-13	+
2.	Acoustic measurements – Sound power level	Art. 8	**ČSN EN 12102-1:2023**	Page No. 6-13	+

***) 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 **PC-CE-MB-HT-3P-12-0***
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 ($\Delta p \leq 20$ kPa) or ± 5 % ($\Delta p > 20$ 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 ($\Delta p \leq 100$ Pa) or ± 5 % ($\Delta p > 100$ 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)

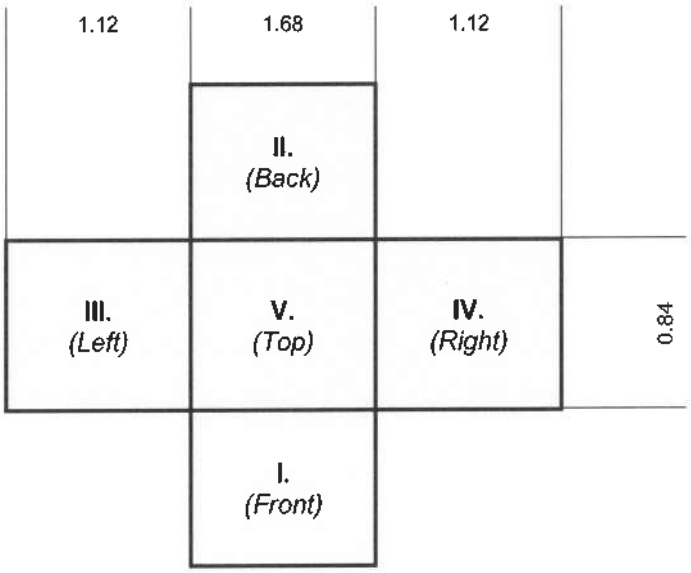
a) Measurement surface

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

Test Sample: Air/Water Heat pump **PC-CE-MB-HT-3P-12-0***			
Distance from the test sample	*d*	[m]	0.20
Height of measurement surface	*h*	[m]	1.12
Width of measurement surface	*w*	[m]	1.68
Depth of measurement surface	*l*	[m]	0.84
Total measurement surface area	*S*	[m²]	7.06
Minimal measuring time per surface	t_M	[s]	90.00

Sketch of measurement surface (not to scale):

Air/Water Heat pump **PC-CE-MB-HT-3P-12-0***
– Outdoor unit –



b) Acoustic environment

The testing sample was placed inside a climate chamber (with dimensions shown below); sound absorbing panels were mounted on the walls and the ceiling of the chamber. The outdoor unit was placed in the middle of the chamber, at a sufficient distance from the surrounding walls, and was rotated by about 5÷10 °.

Climate-acoustic chamber *(corresponds to free field over a reflecting plane)*			
Width of testing room	l_1	[m]	3.75
Length of testing room	l_2	[m]	4.50
Height of testing room	l_3	[m]	4.25

c) Measured and calculated data – General overview:

Test sample			Air/Water Heat pump **PC-CE-MB-HT-3P-12-0***
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			27 Hz
Fan speed settings			AUTO
Date of testing (YYYY-MM-DD)			2024-04-23
Reference air temperature	t_{amb}	[°C]	7.0
Relative humidity of air	RH	[%]	83.4
Ambient pressure	p_{amb}	[hPa]	987.2
Overall sound power level (linear)	L_W	[dB]	64.6 ± 1.5
Overall A-weighted sound power level	L_{WA}	**[dB(A)]**	**54.3 ± 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 **PC-CE-MB-HT-3P-12-0*** Outdoor unit at A7/W55; Compressor at 27 Hz; 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}	$L_d > F_{pl}$	$F_{+/-}$	$F_{+/-} \leq 3$	$L_{W(1)}$-$L_{W(2)} \leq 5$		[dB]	[dB(A)]	[dB]	
125	23.9	2.4	YES	0.0	YES	YES	YES	63.4	46.9	± 3.0	c
250	24.5	3.5	YES	0.0	YES	YES	YES	57.0	48.7	± 2.0	passed
500	**24.6**	**2.9**	**YES**	**0.0**	**YES**	**YES**	**YES**	**52.4**	**48.9**	**± 1.5**	**passed**
1000	24.3	3.9	YES	0.0	YES	YES	YES	46.9	46.8	± 1.5	passed
2000	24.7	3.4	YES	0.0	YES	YES	YES	41.1	42.1	± 1.5	c
4000	23.5	3.8	YES	0.0	YES	YES	YES	34.0	34.9	± 1.5	passed
8000**)	22.8	6.2	YES	0.0	YES	YES	YES	28.5	28.4	± 2.5	c
Total								**64.6**	**54.3**	**± 1.5**	

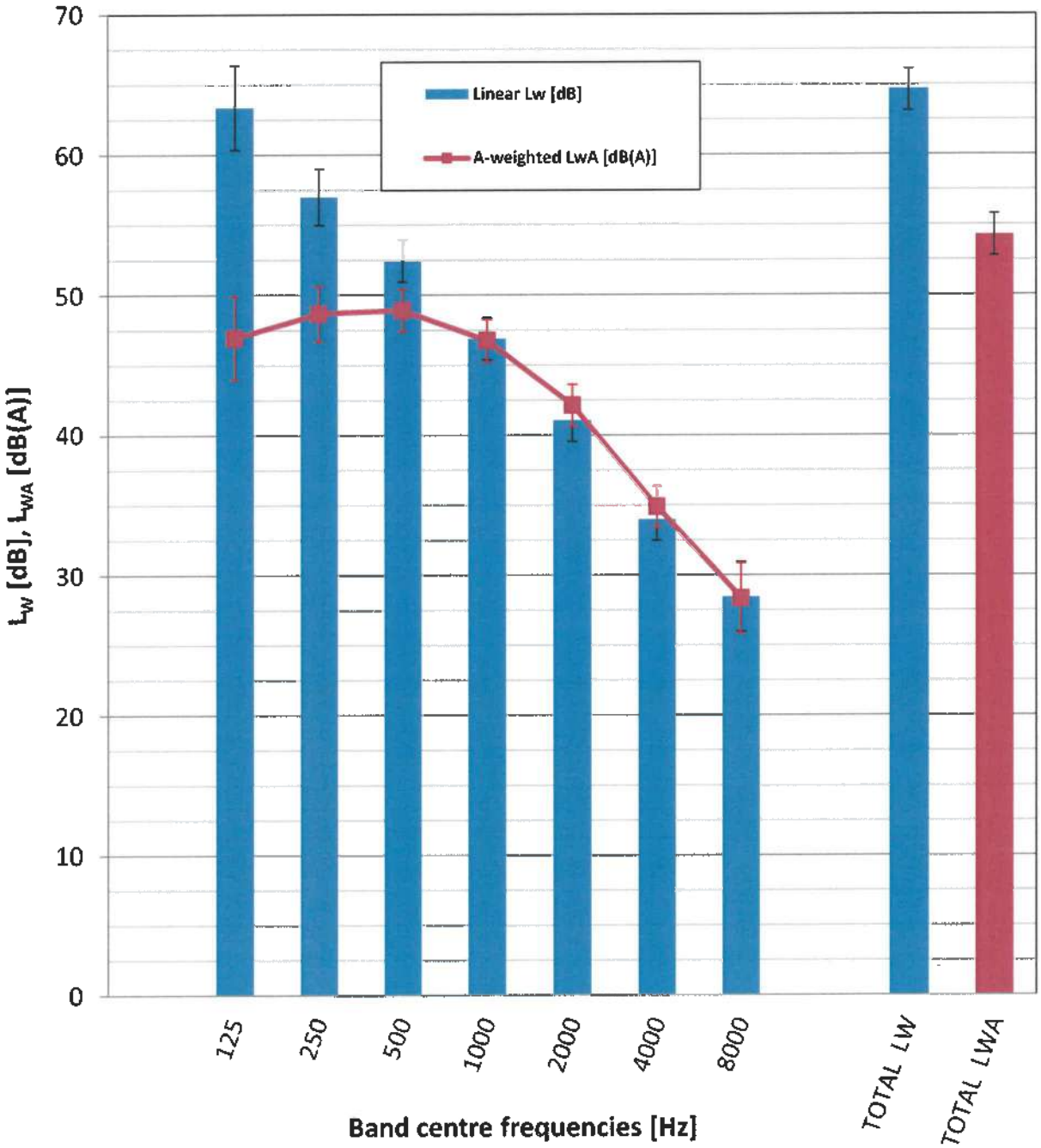
***) Due to the sound intensity method limitations, the frequency of 6300 Hz was measured only.*

Legend:

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

Spectrum of Sound power level L_W – octave bands

Air/Water Heat pump **PC-CE-MB-HT-3P-12-0*** Outdoor unit at A7/W55; Compressor at 27 Hz; Fan at AUTO	**Engineering** **(Grade 2)**



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

Air/Water Heat pump **PC-CE-MB-HT-3P-12-0*** Outdoor unit at A7/W55; Compressor at 27 Hz; Fan at AUTO	**Engineering (Grade 2)**

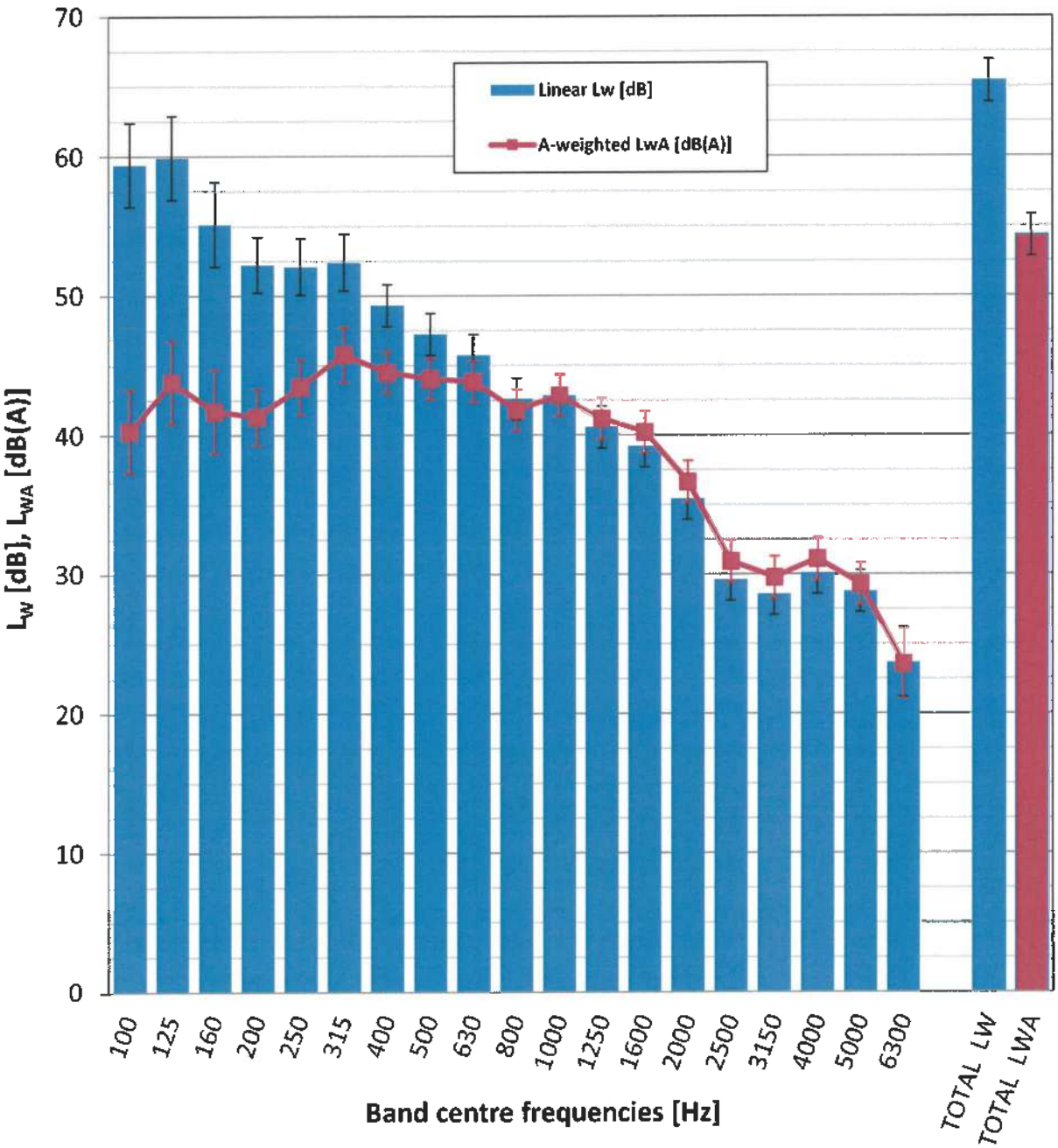
f_m	Criterion 1			Criterion 2		Criterion 3	All criteria passed?	L_W	L_{WA}	U	Evaluation
[Hz]	L_d	F_{pl}	$L_d > F_{pl}$	$F_{+/-}$	$F_{+/-} \leq 3$	$L_{W(1)}$-$L_{W(2)} \leq 5$		[dB]	[dB(A)]	[dB]	
100	22.1	2.6	YES	0.0	YES	YES	YES	59.4	40.3	± 3.0	passed
125	20.9	2.4	YES	0.0	YES	YES	YES	59.9	43.8	± 3.0	passed
160	21.3	2.9	YES	0.0	YES	YES	YES	55.1	41.7	± 3.0	passed
200	21.3	3.6	YES	0.0	YES	YES	YES	52.2	41.3	± 2.0	passed
250	21.5	3.5	YES	0.0	YES	YES	YES	52.1	43.5	± 2.0	passed
315	**21.6**	**3.4**	**YES**	**0.0**	**YES**	**YES**	**YES**	**52.4**	**45.8**	**± 2.0**	**passed**
400	21.8	3.3	YES	0.0	YES	YES	YES	49.3	44.5	± 1.5	passed
500	21.6	2.9	YES	0.0	YES	YES	YES	47.2	44.0	± 1.5	passed
630	21.4	2.9	YES	0.0	YES	YES	YES	45.7	43.8	± 1.5	passed
800	20.7	3.1	YES	0.0	YES	YES	YES	42.6	41.8	± 1.5	passed
1000	21.3	3.9	YES	0.0	YES	YES	YES	42.8	42.8	± 1.5	passed
1250	20.8	3.4	YES	0.0	YES	YES	YES	40.6	41.2	± 1.5	passed
1600	21.0	3.4	YES	0.0	YES	YES	YES	39.2	40.2	± 1.5	passed
2000	21.7	3.4	YES	0.0	YES	YES	YES	35.4	36.6	± 1.5	passed
2500	20.8	3.2	YES	0.0	YES	YES	YES	29.6	30.9	± 1.5	c
3150	20.6	3.4	YES	0.0	YES	YES	YES	28.6	29.8	± 1.5	c
4000	20.5	3.8	YES	0.0	YES	YES	YES	30.1	31.1	± 1.5	c
5000	19.8	3.9	YES	0.0	YES	YES	YES	28.8	29.3	± 1.5	c
6300	19.8	6.2	YES	0.0	YES	YES	YES	23.7	23.6	± 2.5	c
Total								**65.4**	**54.3**	**± 1.5**	

Legend:

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

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

Air/Water Heat pump **PC-CE-MB-HT-3P-12-0*** Outdoor unit at A7/W55; Compressor at 27 Hz; Fan at AUTO	**Engineering (Grade 2)**



Tested by: Ing. Ondrej Bilkovič Date: 2024-08-29 Signed:

Reviewed and approved by: Ing. Antonín Kolbábek, Ph.D. Date: 2024-08-29 Signed:

V. A list of referenced documents

- Order of 2024-06-28 (Order reg. no. B-82548, received on 2024-06-28)
- Contract B-82548/39

- 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 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. 39-17566
- Record measurement file 39-17566-H.zip

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

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

– End of Test Report –

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
39-17865/T

Product:	Outdoor Air/Water Heat pump - monobloc
Type designation:	**PC-CE-MB-HT-3P-12-0***
Customer:	Columbus Energy Spółka Akcyjna ul. Janogórksa 9 31-358 Kraków POLAND
Manufacturer:	V-TAC Poland Sp. z o.o. Ul. Obornicka 330 60-689 Poznań POLAND
Report issue date:	2024-08-29
Distribution list:	1 copy to the Customer 1 copy to the Engineering Test Institute

I. Description of product tested

The Heat pump **PC-CE-MB-HT-3P-12-01** supplied by the company **Columbus Energy Spółka Akcyjna** is structurally adapted to operate in air/water system. Device is designed as monobloc placed outdoor with an indoor display. Refrigerant R290 is used with charge of 1.05 kg. Power supply is a three-phase. Heat pump is reversible and working with a fixed flow rate.

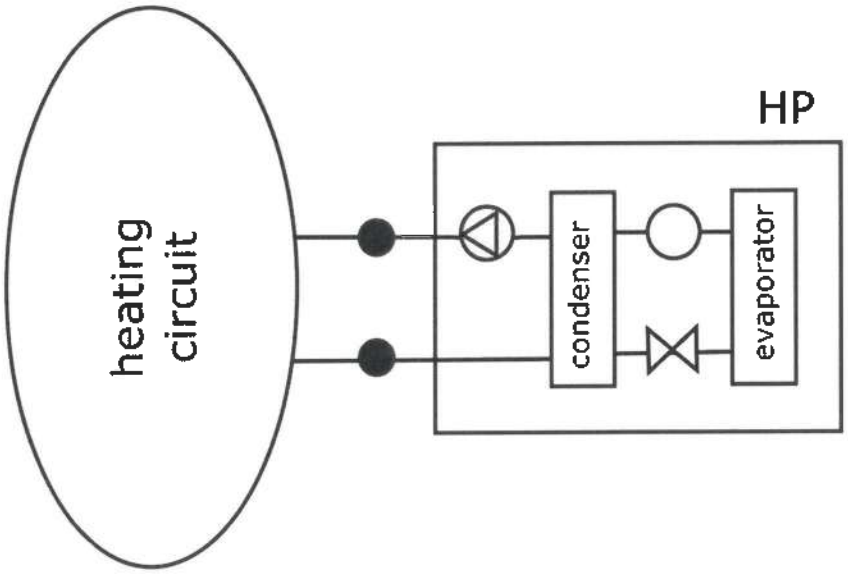
Main components of the outdoor unit **PC-CE-MB-HT-3P-12-01**:

- Serial number 31070002000032
- Cubic shape with dimensions 1285 × 446 × 920 mm (W × D × H)
- Frame and casing made of varnished steel sheets
- L-shaped evaporator, 3 rows, dimensions 1100 × 700 × 855 mm (W × D × H), spacing 1.5 mm
- Plate condenser, dimensions 135 × 100 × 350 mm (W × D × H) including insulation
- Compressor Highly WHP13300PSDPC8FQ
- Refrigerant R290 (1.05 kg)
- Electric expansion valve Fujikoki FKS-47R
- 4-way reversing valve Saginomiya STF-H0404
- Refrigerant accumulator
- Axial fan Ø60 cm with motor Jiangmen LT Motor RD200HC
- 2x pressure control ChangZhou Match-Well Pressure Control
- Circulation pump Shimge APM25-9-130 PWM1
- Temperature sensors
- Refrigerant pipes
- Air vent

PC-CE-MB-HT-3P-12-0* is a general name. * represents different product versions that do not differ in fundamental elements and construction or anything that could affect the performance of the unit. Thus, these test results apply to the following:

- **PC-CE-MB-HT-3P-12-00**
- **PC-CE-MB-HT-3P-12-01**

Scheme:



Photodocumentation:

Heat pump **PC-CE-MB-HT-3P-12-01** – outdoor unit – Front view –

Heat pump **PC-CE-MB-HT-3P-12-01** – outdoor unit – Back view –

Heat pump **PC-CE-MB-HT-3P-12-01** – outdoor unit – Compressor label –

Heat pump **PC-CE-MB-HT-3P-12-01** – outdoor unit – Label –

Heat pump **PC-CE-MB-HT-3P-12-01** – outdoor unit
– Without cover –

II. Sample tested

SZU reg. no.	Product name	Date of submission
	PC-CE-MB-HT-3P-12-01	

The visual inspection, tests and verification were carried out by Ing. Tomáš Sedláček and 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

*) **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 **PC-CE-MB-HT-3P-12-0***
Measuring equipment used:	see Chapter III

Specification of the assessment condition		**A7/W35**	**A7/W55**
Date of testing		**2024-04-17**	**2024-04-19**
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]	35.05	55.06
Input heating water – temperature calculation	[°C]	30.06	47.06
Output heating water temperature	[°C]	35.05	55.06
Input heating water temperature	[°C]	30.06	47.06
Air temperature – dry bulb temperature	[°C]	6.96	7.00
Air temperature – wet bulb temperature	[°C]	6.00	6.01
Relative humidity	[%]	87.37	87.02
Barometric pressure	[kPa]	97.473	98.253
Ambient temperature	[°C]	6.82	6.84
Secondary circuit pressure difference	[kPa]	14.699	15.008
Efficiency of the secondary liquid pump	[–]	0.216	0.181
Volume flow rate of heating water	$[m^3 \cdot h^{-1}]$	2.0840	1.2919
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]	398.53	402.02
Total current	[A]	13.23	18.82
Overall power input	[kW]	2.517	3.974
Capacity correction of sec. liquid pump	[W]	30.962	24.441
Power input correction of sec. liquid pump	[W]	39.47	29.83
Heating capacity – heating water	[kW]	11.991	11.827
Corrected heating capacity – heating water	**[kW]**	**11.960**	**11.802**
Uncertainty of corrected heating capacity	[kW]	± 0.207	± 0.131
Effective electric power input	**[kW]**	**2.477**	**3.944**
COP	**[–]**	**4.828**	**2.992**
Uncertainty of COP	[–]	± 0.085	± 0.034
Control settings	**[Hz]**	**65**	**73**
Circulation pump settings – heating water	[%]	60	50

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 **PC-CE-MB-HT-3P-12-0***
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				Fixed		
Seasonal space heating energy efficiency	Heating	Average	η_s		**<u>202.1</u>**	%	
		Warmer	η_s		–	%	
		Colder	η_s		–	%	
Seasonal efficiency according to ČSN EN 14825:2023	Heating	Average	**SCOP**		**<u>5.13</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>10.30</u>**	kW	
		Warmer	$P_{designh}$		–	kW	
		Colder	$P_{designh}$		–	kW	
Bivalent temperatures	Heating	Average	$T_{bivalent}$		-7	°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}		4150	kWh	
		Warmer	Q_{HE}		–	kWh	
		Colder	Q_{HE}		–	kWh	
Modes other than „active mode“	Off mode			P_{OFF}	13.3	W	
	Thermostat off mode			P_{TO}	16.6	W	
	Standby mode			P_{SB}	13.3	W	
	Crankcase heater mode			P_{CK}	0.0	W	

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}	0.0166	[kW]
P_{SB}	0.0133	[kW]
P_{CK}	0.0000	[kW]
P_{OFF}	0.0133	[kW]
$P_{designh}$	10.30	[kW]
$SCOP_{ON}$	5.13	[–]

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]

$Q_H = 10.3 \cdot 2066 = 21279$ [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]

$Q_{HE} = 21279 / 5.13 + 178 \cdot 0.0166 + 0 \cdot 0.0133 + 178 \cdot 0 + 0 \cdot 0.0133 = 4150$ [kWh]

7.2 General formula for calculation of reference SCOP

$SCOP = Q_H / Q_{HE}$ [–]

$SCOP = 21279 / 4150 = 5.13$ [–]

7.1 Calculation of the seasonal space heating efficiency η_s

$\Sigma F(i) = F(1) + F(2)$ [–]

$\Sigma F = 0.03 + 0 = 0.03$ [–]

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

$\eta_s (A) = (1 / 2.5) \cdot 5.13 - 0.03 =$ **2.021** [–]

Temperature level		Low (reference water temperature 35 °C)		
Reference heating season		„A" = average ($T_{designh}$ = -10 °C)		
Assessment condition		**A, Tbiv (F)**	**B**	**C**
Specification of the assessment condition		**A-7/W34**	**A2/W30**	**A7/W27**
Date of testing		**2024-04-18**	**2024-04-19**	**2024-04-22**
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]	34.02	30.00	27.00
Input heating water – temperature calculation	[°C]	30.23	27.65	25.43
Output heating water temperature	[°C]	34.02	30.00	27.00
Input heating water temperature	[°C]	30.23	27.65	25.43
Air temperature – dry bulb temperature	[°C]	-6.99	2.01	7.00
Air temperature – wet bulb temperature	[°C]	-8.05	1.01	6.02
Relative humidity	[%]	73.76	83.91	87.05
Barometric pressure	[kPa]	98.001	97.960	98.848
Ambient temperature	[°C]	-7.17	1.88	6.89
Secondary circuit pressure difference	[kPa]	2.699	15.144	14.940
Efficiency of the secondary liquid pump	[–]	0.132	0.218	0.217
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	2.0866	2.0840	2.0858
Density of heating water	[$kg \cdot m^{-3}$]	994.4	995.6	996.4
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.175	4.176	4.177
Voltage	[V]	399.64	402.73	401.19
Total current	[A]	14.04	6.62	3.66
Overall power input	[kW]	2.772	1.203	0.585
Capacity correction of sec. liquid pump	[W]	10.212	31.407	31.216
Power input correction of sec. liquid pump	[W]	11.78	40.17	39.87
Heating capacity – heating water	[kW]	9.121	5.655	3.782
Corrected heating capacity – heating water	**[kW]**	**9.111**	**5.624**	**3.751**
Uncertainty of corrected heating capacity	[kW]	± 0.206	± 0.205	± 0.205
Effective electric power input	**[kW]**	**2.760**	**1.163**	**0.545**
COP	**[–]**	**3.301**	**4.835**	**6.881**
Uncertainty of COP	[–]	± 0.075	± 0.178	± 0.382
Control settings	**[Hz]**	**70**	**34**	**20**
Circulation pump settings – heating water	[%]	60	60	60

Temperature level		Low (reference water temperature 35 °C)	
Reference heating season		„A" = average ($T_{designh}$ = -10 °C)	
Assessment condition		**D**	**TOL (E)**
Specification of the assessment condition		**A12/W25.17**	**A-10/W35**
Date of testing		**2024-04-24**	**2024-04-18**
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]	25.18	34.96
Input heating water – temperature calculation	[°C]	23.35	30.71
Output heating water temperature	[°C]	25.18	34.96
Input heating water temperature	[°C]	23.35	30.71
Air temperature – dry bulb temperature	[°C]	12.00	-9.98
Air temperature – wet bulb temperature	[°C]	11.00	-11.03
Relative humidity	[%]	88.97	68.43
Barometric pressure	[kPa]	97.595	98.025
Ambient temperature	[°C]	11.88	-10.18
Secondary circuit pressure difference	[kPa]	2.773	10.421
Efficiency of the secondary liquid pump	[–]	0.133	0.188
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	2.0839	2.0804
Density of heating water	[$kg \cdot m^{-3}$]	996.9	994.1
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.179	4.175
Voltage	[V]	400.90	401.19
Total current	[A]	3.20	17.29
Overall power input	[kW]	0.500	3.576
Capacity correction of sec. liquid pump	[W]	10.475	25.450
Power input correction of sec. liquid pump	[W]	12.08	31.47
Heating capacity – heating water	[kW]	4.404	10.175
Corrected heating capacity – heating water	**[kW]**	**4.393**	**10.149**
Uncertainty of corrected heating capacity	[kW]	± 0.205	± 0.206
Effective electric power input	**[kW]**	**0.488**	**3.544**
COP	**[–]**	**9.000**	**2.863**
Uncertainty of COP	[–]	± 0.421	± 0.058
Control settings	**[Hz]**	**20**	**88**
Circulation pump settings – heating water	[%]	50	60

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	9.11	9.111	3.301	0.900	1.00	3.301	–
B	2	30.00	53.85	5.55	5.624	4.835	0.900	1.00	4.835	–
C	7	27.00	34.62	3.57	3.751	6.881	0.900	1.00	6.881	–
D	12	25.17	15.38	1.58	4.393	9.000	0.966	0.36	8.488	0.0166
TOL (E)	-10	35.00	100.00	10.30	10.149	2.863	0.900	1.00	2.863	–
Tbiv (F)	-7	34.00	88.46	9.11	9.111	3.301	0.900	1.00	3.301	–

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
- Fixed 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 fixed flow:

Δt = Declared capacity / Declared capacity $_{standard\ rating\ conditions\ A7W35} \cdot 5$

$CR \cdot \Delta t$ = Part load / Declared capacity · Declared capacity / Declared capacity$_{standard\ rating\ conditions\ A7W35} \cdot 5$

$CR \cdot \Delta t$ = Part load / Declared capacity $_{standard\ rating\ conditions\ A7W35} \cdot 5$

$t_{outlet,\,capacity\,test,\,fixed\,flow} = t_{outlet,\,average}$ + Declared capacity / Declared capacity$_{standard\ rating\ conditions\ A7W35} \cdot 5$ - Part load / Declared capacity $_{standard\ rating\ conditions\ A7W35} \cdot 5$

$t_{outlet,\,capacity\,test,\,fixed\,flow} = t_{outlet,\,average} + 5$ / Declared capacity$_{standard\ rating\ conditions\ A7W35}$ · (Declared capacity - Part load)

Measured data:

$t_{outlet,\,average}$	24.00	[°C]
Declared capacity	4.393	[kW]
Declared capacity $_{standard\ rating\ condition\ A7/W35}$	11.960	[kW]
Part load	1.58	[kW]

Calculation of water temperature

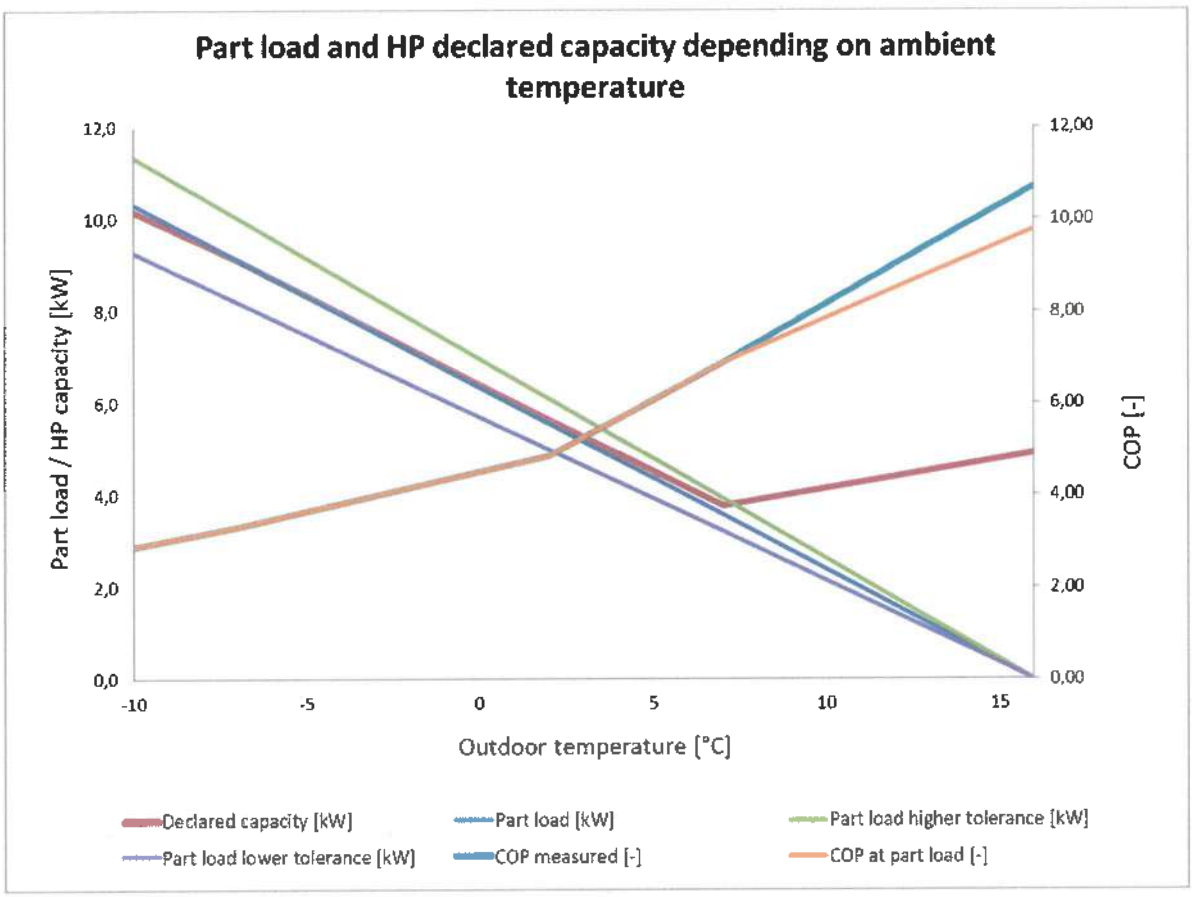
$t_{outlet,\,capacity\,test,\,fixed\,flow} = 24 + 5 / 11.96 \cdot (4.393 - 1.58) =$ **25.17** [°C]

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 x (P h(Tj) - elbu(Tj))	
	[–]	[°C]	[h]	[%]	[kW]	[kW]	[kW]	[kW]	[kWh]	[–]	[kWh]	[kWh]	[kWh]	[kWh]
TOL (E)	**21**	**-10**	**1**	**100.00**	**10.30**	**10.15**	**10.15**	**0.15**	**0.15**	**2.86**	**10**	**4**	**10**	**4**
	22	-9	25	96.15	9.90	9.80	9.80	0.10	2.51	3.01	248	84	245	81
	23	-8	23	92.31	9.51	9.46	9.46	0.05	1.15	3.16	219	70	218	69
A, Tbiv (F)	**24**	**-7**	**24**	**88.46**	**9.11**	**9.11**	**9.11**	**0.00**	**0.00**	**3.30**	**219**	**66**	**219**	**66**
	25	-6	27	84.62	8.71	8.72	8.71	0.00	0.00	3.47	235	68	235	68
	26	-5	68	80.77	8.32	8.34	8.32	0.00	0.00	3.64	566	155	566	155
	27	-4	91	76.92	7.92	7.95	7.92	0.00	0.00	3.81	721	189	721	189
	28	-3	89	73.08	7.53	7.56	7.53	0.00	0.00	3.98	670	168	670	168
	29	-2	165	69.23	7.13	7.17	7.13	0.00	0.00	4.15	1177	283	1177	283
	30	-1	173	65.38	6.73	6.79	6.73	0.00	0.00	4.32	1165	269	1165	269
	31	0	240	61.54	6.34	6.40	6.34	0.00	0.00	4.49	1521	338	1521	338
	32	1	280	57.69	5.94	6.01	5.94	0.00	0.00	4.66	1664	357	1664	357
B	**33**	**2**	**320**	**53.85**	**5.55**	**5.62**	**5.55**	**0.00**	**0.00**	**4.84**	**1775**	**367**	**1775**	**367**
	34	3	357	50.00	5.15	5.25	5.15	0.00	0.00	5.24	1838	351	1838	351
	35	4	356	46.15	4.75	4.87	4.75	0.00	0.00	5.65	1692	299	1692	299
	36	5	303	42.31	4.36	4.50	4.36	0.00	0.00	6.06	1320	218	1320	218
	37	6	330	38.46	3.96	4.13	3.96	0.00	0.00	6.47	1307	202	1307	202
C	**38**	**7**	**326**	**34.62**	**3.57**	**3.75**	**3.57**	**0.00**	**0.00**	**6.88**	**1162**	**169**	**1162**	**169**
	39	8	348	30.77	3.17	3.88	3.17	0.00	0.00	7.20	1103	153	1103	153
	40	9	335	26.92	2.77	4.01	2.77	0.00	0.00	7.52	929	123	929	123
	41	10	315	23.08	2.38	4.14	2.38	0.00	0.00	7.85	749	95	749	95
	42	11	215	19.23	1.98	4.26	1.98	0.00	0.00	8.17	426	52	426	52
D	**43**	**12**	**169**	**15.38**	**1.58**	**4.39**	**1.58**	**0.00**	**0.00**	**8.49**	**268**	**32**	**268**	**32**
	44	13	151	11.54	1.19	4.52	1.19	0.00	0.00	8.81	179	20	179	20
	45	14	105	7.69	0.79	4.65	0.79	0.00	0.00	9.13	83	9	83	9
	46	15	74	3.85	0.40	4.78	0.40	0.00	0.00	9.45	29	3	29	3
		Σ	4910							Σ	21275	4146	21271	4142

SCOPon	5.13	SCOPnet	5.13
		SCOP	**5.13**

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 **PC-CE-MB-HT-3P-12-0***
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				Fixed		
Seasonal space heating energy efficiency	Heating	Average	η_s			**153.9**	%
		Warmer	η_s			–	%
		Colder	η_s			–	%
Seasonal efficiency according to ČSN EN 14825:2023	Heating	Average	**SCOP**			**3.92**	–
		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	$P_{designh}$			**9.84**	kW
		Warmer	$P_{designh}$			–	kW
		Colder	$P_{designh}$			–	kW
Bivalent temperatures	Heating	Average	$T_{bivalent}$			-7	°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}			5180	kWh
		Warmer	Q_{HE}			–	kWh
		Colder	Q_{HE}			–	kWh
Modes other than „active mode“	Off mode			P_{OFF}		13.3	W
	Thermostat off mode			P_{TO}		12.3	W
	Standby mode			P_{SB}		13.3	W
	Crankcase heater mode			P_{CK}		0.0	W

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}	0.0123	[kW]
P_{SB}	0.0133	[kW]
P_{CK}	0.0000	[kW]
P_{OFF}	0.0133	[kW]
$P_{designh}$	9.84	[kW]
$SCOP_{ON}$	3.92	[–]

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]

$Q_H = 9.84 \cdot 2066 = 20321$ [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]

$Q_{HE} = 20321 / 3.92 + 178 \cdot 0.0123 + 0 \cdot 0.0133 + 178 \cdot 0 + 0 \cdot 0.0133 = 5180$ [kWh]

7.2 General formula for calculation of reference SCOP

$SCOP = Q_H / Q_{HE}$ [–]

$SCOP = 20321 / 5180 = 3.92$ [–]

7.1 Calculation of the seasonal space heating efficiency η_s

$\Sigma F(i) = F(1) + F(2)$ [–]

$\Sigma F = 0.03 + 0 = 0.03$ [–]

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

$\eta_s (A) = (1 / 2.5) \cdot 3.92 - 0.03 =$ **1.539** [–]

Temperature level		Medium (reference water temperature 55 °C)		
Reference heating season		„A" = average ($T_{designh}$ = -10 °C)		
Assessment condition		**A, Tbiv (F)**	**B**	**C**
Specification of the assessment condition		**A-7/W52**	**A2/W42**	**A7/W36**
Date of testing		**2024-04-22**	**2024-04-19**	**2024-04-22**
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	41.99	36.01
Input heating water – temperature calculation	[°C]	46.09	38.24	33.59
Output heating water temperature	[°C]	51.99	41.99	36.01
Input heating water temperature	[°C]	46.09	38.24	33.59
Air temperature – dry bulb temperature	[°C]	-7.01	2.01	7.01
Air temperature – wet bulb temperature	[°C]	-7.94	1.00	6.03
Relative humidity	[%]	76.79	83.92	87.06
Barometric pressure	[kPa]	98.876	97.707	98.856
Ambient temperature	[°C]	-7.16	1.88	6.90
Secondary circuit pressure difference	[kPa]	17.830	15.146	14.930
Efficiency of the secondary liquid pump	[–]	0.192	0.181	0.180
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	1.2919	1.2919	1.2920
Density of heating water	[$kg \cdot m^{-3}$]	987.4	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]	402.03	401.20	401.92
Total current	[A]	18.23	8.27	4.37
Overall power input	[kW]	3.775	1.485	0.723
Capacity correction of sec. liquid pump	[W]	26.841	24.567	24.371
Power input correction of sec. liquid pump	[W]	33.24	30.00	29.73
Heating capacity – heating water	[kW]	8.727	5.580	3.597
Corrected heating capacity – heating water	**[kW]**	**8.701**	**5.556**	**3.573**
Uncertainty of corrected heating capacity	[kW]	± 0.129	± 0.127	± 0.127
Effective electric power input	**[kW]**	**3.742**	**1.455**	**0.693**
COP	**[–]**	**2.325**	**3.819**	**5.152**
Uncertainty of COP	[–]	± 0.035	± 0.088	± 0.185
Control settings	**[Hz]**	**76**	**36**	**20**
Circulation pump settings – heating water	[%]	50	50	50

Temperature level		Medium (reference water temperature 55 °C)	
Reference heating season		„A" = average ($T_{designh}$ = -10 °C)	
Assessment condition		**D**	**TOL (E)**
Specification of the assessment condition		**A12/W31.83**	**A-10/W55**
Date of testing		**2024-04-23**	**2024-04-22**
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]	31.84	54.99
Input heating water – temperature calculation	[°C]	29.00	48.36
Output heating water temperature	[°C]	31.84	54.99
Input heating water temperature	[°C]	29.00	48.36
Air temperature – dry bulb temperature	[°C]	12.01	-10.01
Air temperature – wet bulb temperature	[°C]	11.01	-10.84
Relative humidity	[%]	88.95	74.88
Barometric pressure	[kPa]	98.636	98.873
Ambient temperature	[°C]	11.89	-10.16
Secondary circuit pressure difference	[kPa]	4.878	11.377
Efficiency of the secondary liquid pump	[–]	0.135	0.165
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	1.2923	1.2918
Density of heating water	[$kg \cdot m^{-3}$]	995.0	986.0
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.176	4.178
Voltage	[V]	402.32	401.06
Total current	[A]	3.81	22.23
Overall power input	[kW]	0.604	4.750
Capacity correction of sec. liquid pump	[W]	11.233	20.670
Power input correction of sec. liquid pump	[W]	12.98	24.75
Heating capacity – heating water	[kW]	4.231	9.802
Corrected heating capacity – heating water	**[kW]**	**4.220**	**9.781**
Uncertainty of corrected heating capacity	[kW]	± 0.127	± 0.129
Effective electric power input	**[kW]**	**0.591**	**4.725**
COP	**[–]**	**7.138**	**2.070**
Uncertainty of COP	[–]	± 0.216	± 0.027
Control settings	**[Hz]**	**20**	**92**
Circulation pump settings – heating water	[%]	60	50

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	8.70	8.701	2.325	0.900	1.00	2.325	–
B	2	42.00	53.85	5.30	5.556	3.819	0.900	1.00	3.819	–
C	7	36.00	34.62	3.40	3.573	5.152	0.900	1.00	5.152	–
D	12	31.83	15.38	1.51	4.220	7.138	0.979	0.36	6.882	0.0123
TOL (E)	-10	55.00	100.00	9.84	9.781	2.070	0.900	1.00	2.070	–
Tbiv (F)	-7	52.00	88.46	8.70	8.701	2.325	0.900	1.00	2.325	–

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
- Fixed 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 fixed flow:

Δt = Declared capacity / Declared capacity $_{standard\,rating\,conditions\,A7W55} \cdot 8$

$CR \cdot \Delta t$ = Part load / Declared capacity · Declared capacity / Declared capacity$_{standard\,rating\,conditions\,A7W55} \cdot 8$

$CR \cdot \Delta t$ = Part load / Declared capacity $_{standard\,rating\,conditions\,A7W55} \cdot 8$

$t_{outlet,\,capacity\,test,\,fixed\,flow} = t_{outlet,\,average}$ + Declared capacity / Declared capacity$_{standard\,rating\,conditions\,A7W55} \cdot 8$ - Part load / Declared capacity $_{standard\,rating\,conditions\,A7W55} \cdot 8$

$t_{outlet,\,capacity\,test,\,fixed\,flow} = t_{outlet,\,average} + 8$ / Declared capacity$_{standard\,rating\,conditions\,A7W55}$ · (Declared capacity - Part load)

Measured data:

$t_{outlet,\,average}$	30.00	[°C]
Declared capacity	4.220	[kW]
Declared capacity $_{standard\,rating\,condition\,A7/W55}$	11.802	[kW]
Part load	1.51	[kW]

Calculation of water temperature

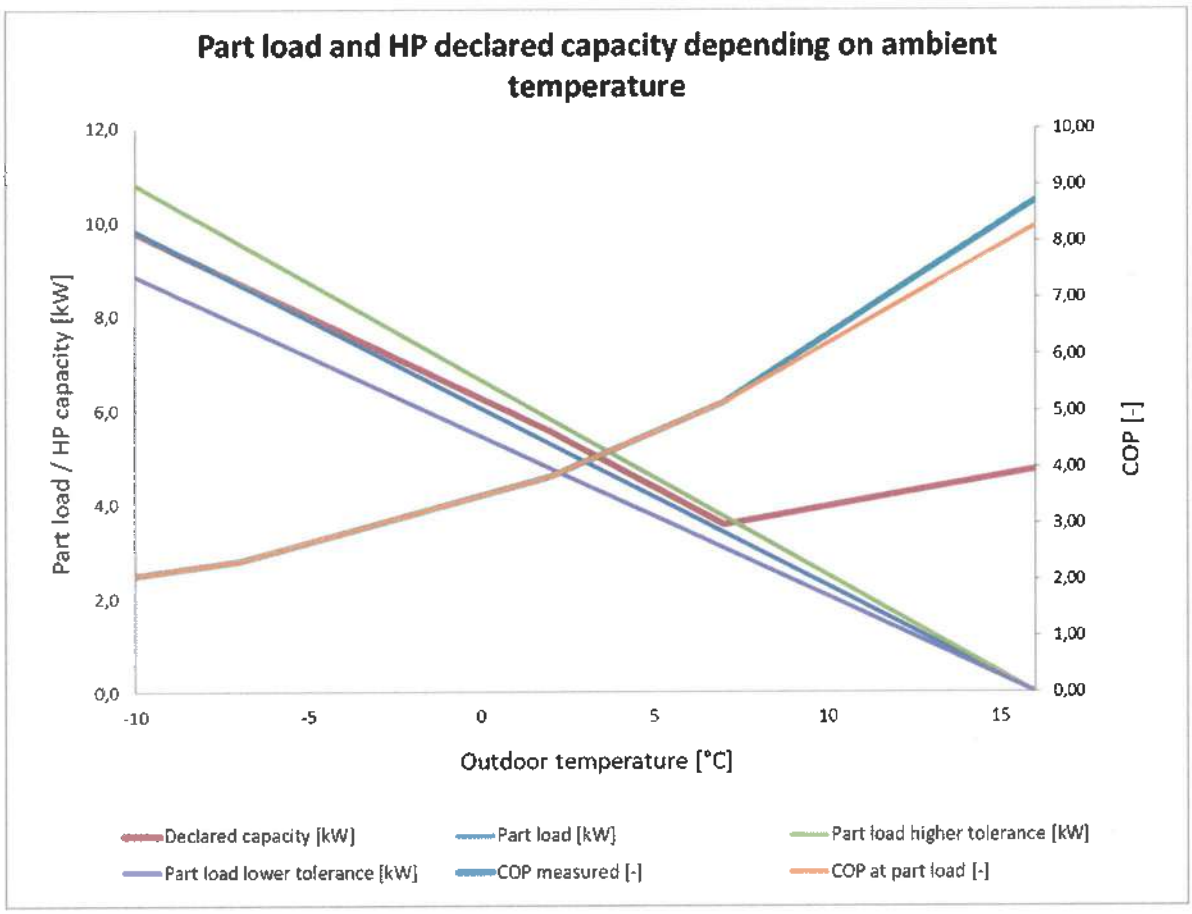
$t_{outlet,\,capacity\,test,\,fixed\,flow} = 30 + 8 / 11.802 \cdot (4.22 - 1.51) =$ **31.83** [°C]

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)	21	-10	1	100.00	9.84	9.78	9.78	0.05	0.05	2.07	10	5	10	5
	22	-9	25	96.15	9.46	9.42	9.42	0.04	0.92	2.16	236	110	236	109
	23	-8	23	92.31	9.08	9.06	9.06	0.02	0.42	2.24	209	93	208	93
A, Tbiv (F)	24	-7	24	88.46	8.70	8.70	8.70	0.00	0.00	2.33	209	90	209	90
	25	-6	27	84.62	8.32	8.35	8.32	0.00	0.00	2.49	225	90	225	90
	26	-5	68	80.77	7.94	8.00	7.94	0.00	0.00	2.66	540	203	540	203
	27	-4	91	76.92	7.57	7.65	7.57	0.00	0.00	2.82	689	244	689	244
	28	-3	89	73.08	7.19	7.30	7.19	0.00	0.00	2.99	640	214	640	214
	29	-2	165	69.23	6.81	6.95	6.81	0.00	0.00	3.16	1124	356	1124	356
	30	-1	173	65.38	6.43	6.60	6.43	0.00	0.00	3.32	1113	335	1113	335
	31	0	240	61.54	6.05	6.25	6.05	0.00	0.00	3.49	1453	417	1453	417
	32	1	280	57.69	5.67	5.91	5.67	0.00	0.00	3.65	1589	435	1589	435
B	33	2	320	53.85	5.30	5.56	5.30	0.00	0.00	3.82	1695	444	1695	444
	34	3	357	50.00	4.92	5.16	4.92	0.00	0.00	4.09	1756	430	1756	430
	35	4	356	46.15	4.54	4.76	4.54	0.00	0.00	4.35	1616	371	1616	371
	36	5	303	42.31	4.16	4.37	4.16	0.00	0.00	4.62	1261	273	1261	273
	37	6	330	38.46	3.78	3.97	3.78	0.00	0.00	4.89	1248	256	1248	256
C	38	7	326	34.62	3.40	3.57	3.40	0.00	0.00	5.15	1110	215	1110	215
	39	8	348	30.77	3.03	3.70	3.03	0.00	0.00	5.50	1053	192	1053	192
	40	9	335	26.92	2.65	3.83	2.65	0.00	0.00	5.84	887	152	887	152
	41	10	315	23.08	2.27	3.96	2.27	0.00	0.00	6.19	715	116	715	116
	42	11	215	19.23	1.89	4.09	1.89	0.00	0.00	6.54	407	62	407	62
D	43	12	169	15.38	1.51	4.22	1.51	0.00	0.00	6.88	256	37	256	37
	44	13	151	11.54	1.13	4.35	1.13	0.00	0.00	7.23	171	24	171	24
	45	14	105	7.69	0.76	4.48	0.76	0.00	0.00	7.57	79	10	79	10
	46	15	74	3.85	0.38	4.61	0.38	0.00	0.00	7.92	28	4	28	4
		Σ	4910							Σ	20317	5177	20316	5176

SCOPon	3.92	SCOPnet	3.93
		SCOP	**3.92**

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

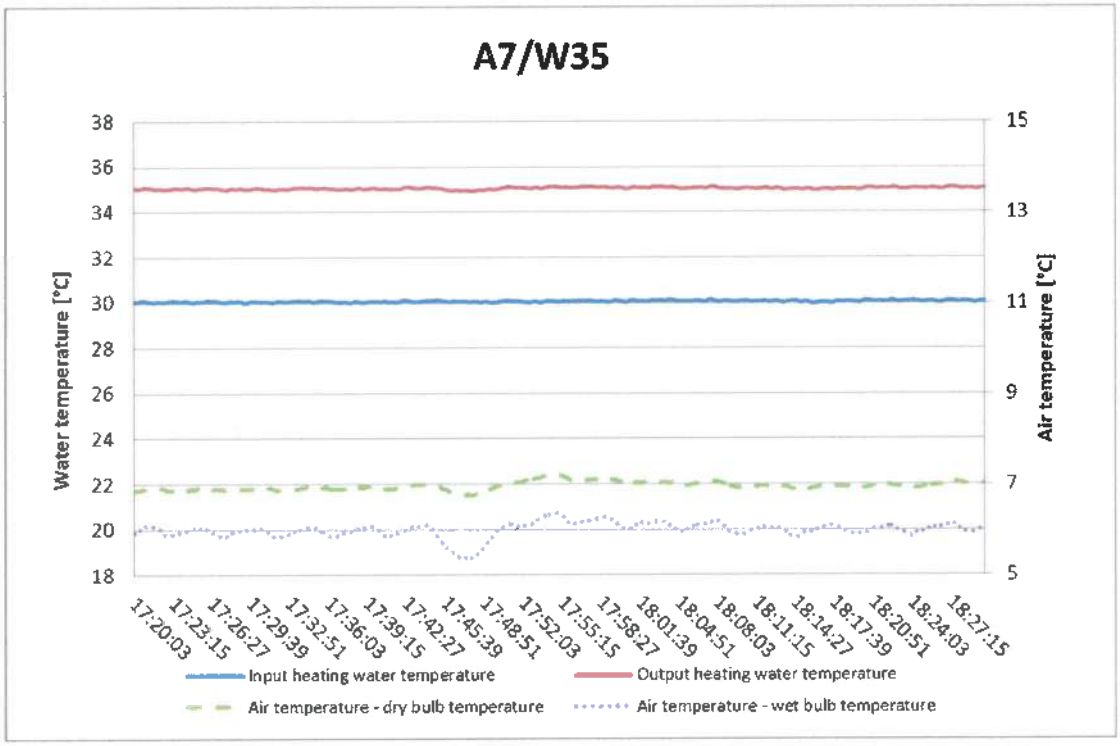


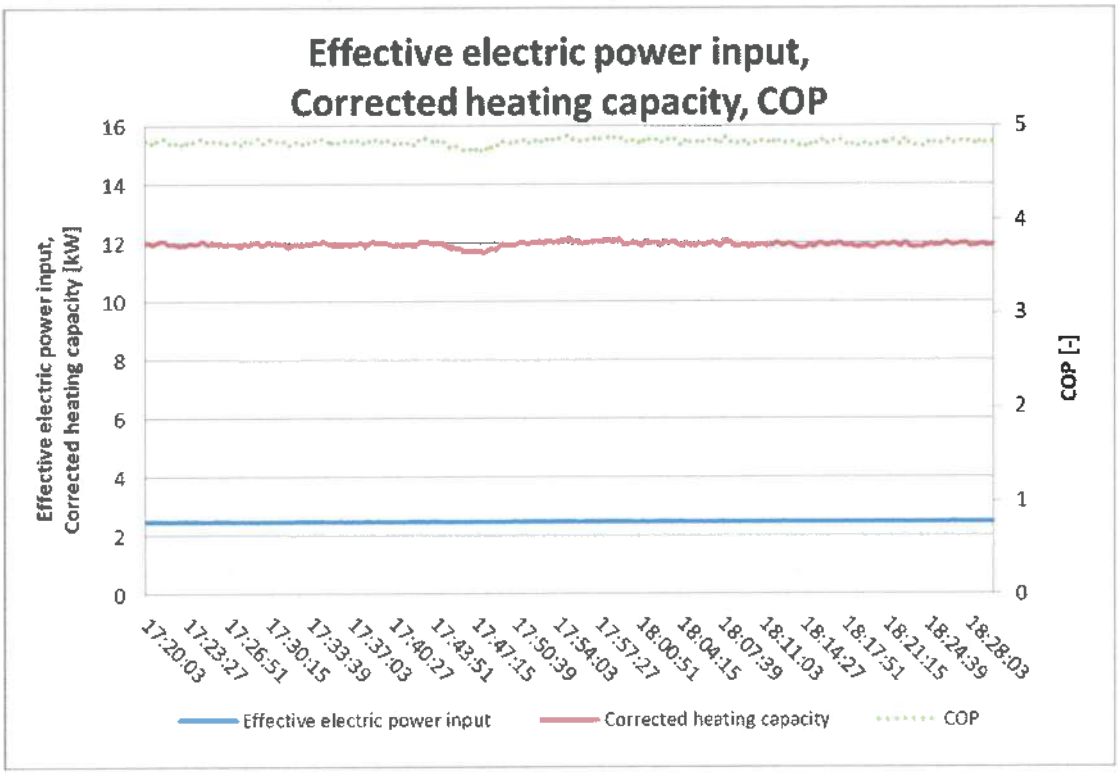
Tested by:	Ing. Tomáš Sedláček	Date:	2024-08-29	Signed:	Sedláček
Reviewed and approved by:	Ing. Michal Faltýnek	Date:	2024-08-29	Signed:	Faltýnek

V. Graphs

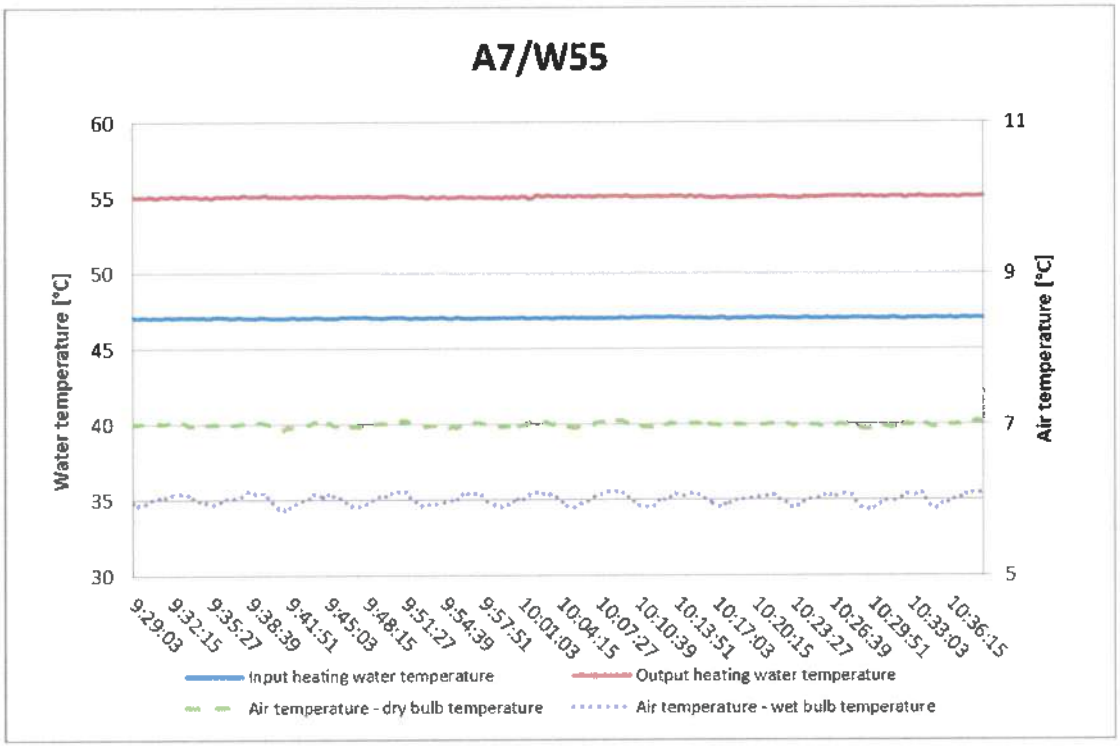
1. Rating conditions

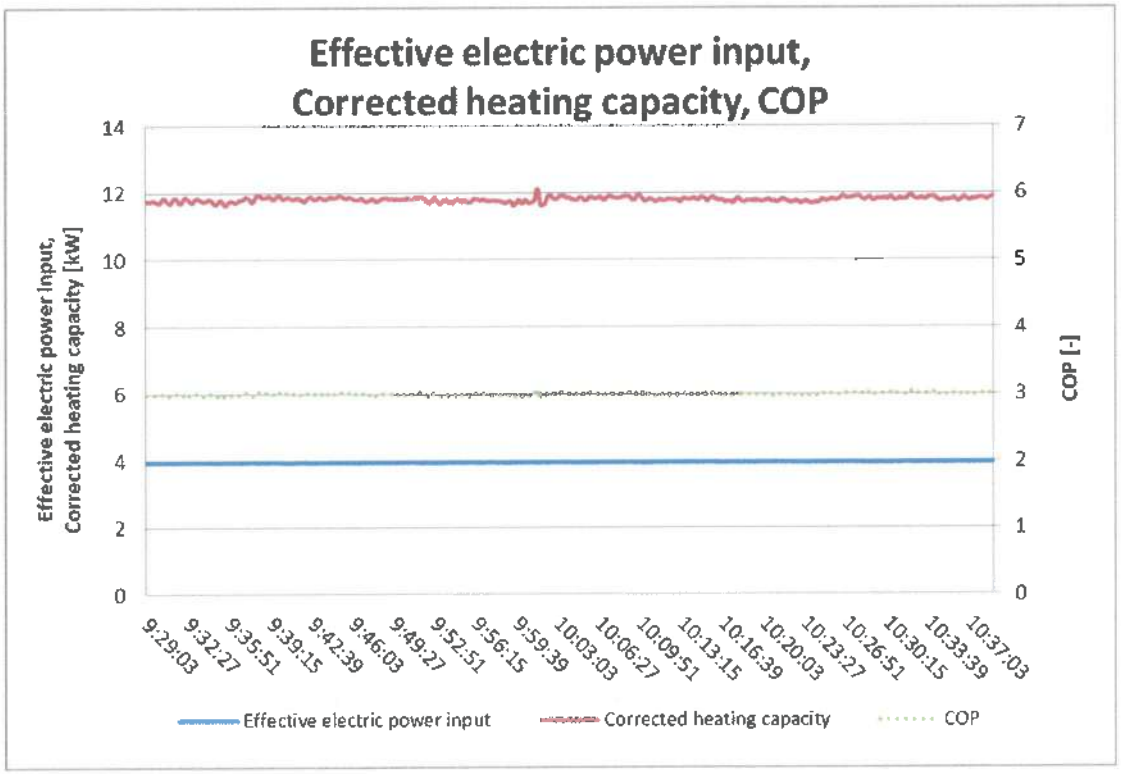
A7/W35 (65 Hz)





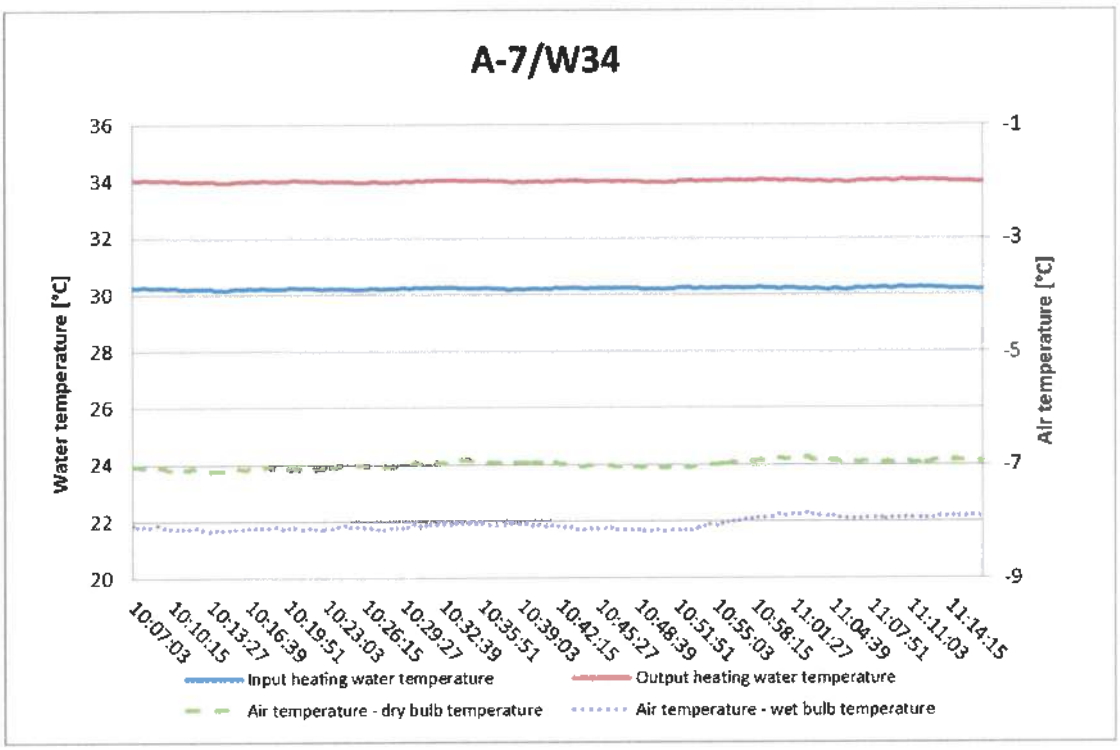
A7/W55 (73 Hz)

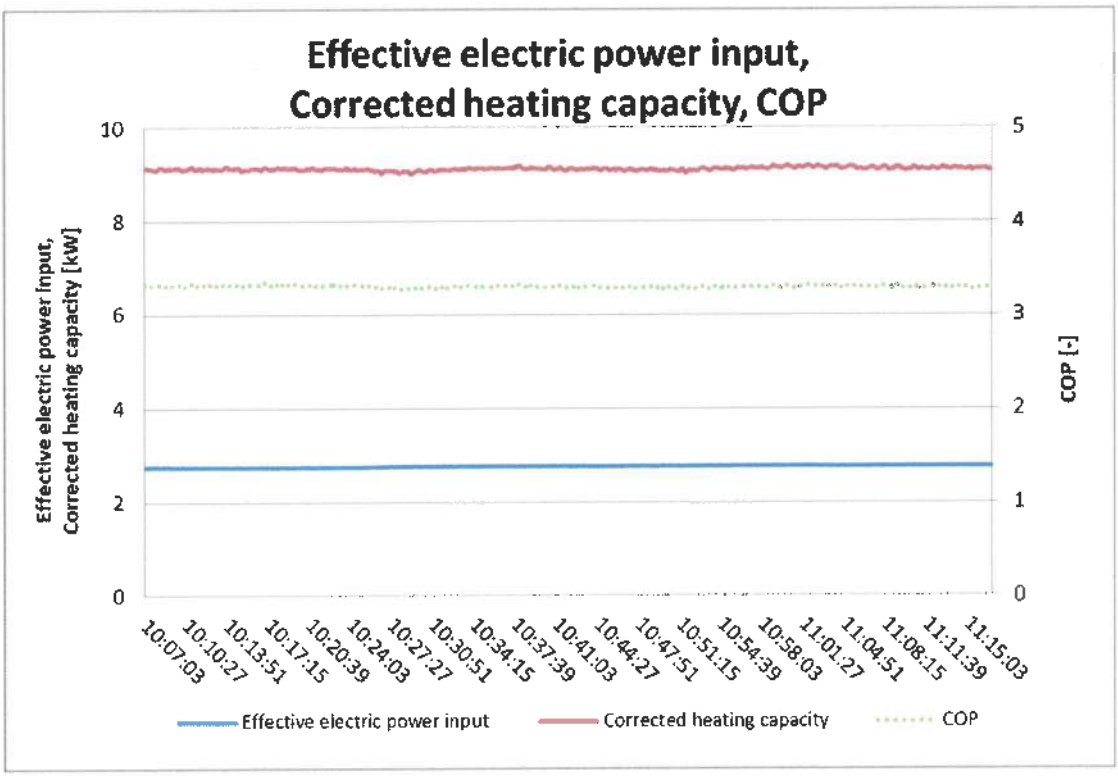

A7/W55
Water temperature [°C]
Air temperature [°C]
60
55
50
45
40
35
30
11
9
7
5
9:29:03
9:32:15
9:35:27
9:38:39
9:41:51
9:45:03
9:48:15
9:51:27
9:54:39
9:57:51
10:01:03
10:04:15
10:07:27
10:10:39
10:13:51
10:17:03
10:20:15
10:23:27
10:26:39
10:29:51
10:33:03
10:36:15
Input heating water temperature
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 [-]
14
12
10
8
6
4
2
0
7
6
5
4
3
2
1
0
9:29:03
9:32:27
9:35:51
9:39:15
9:42:39
9:46:03
9:49:27
9:52:51
9:56:15
9:59:39
10:03:03
10:06:27
10:09:51
10:13:15
10:16:39
10:20:03
10:23:27
10:26:51
10:30:15
10:33:39
10:37:03
Effective electric power input
Corrected heating capacity
COP

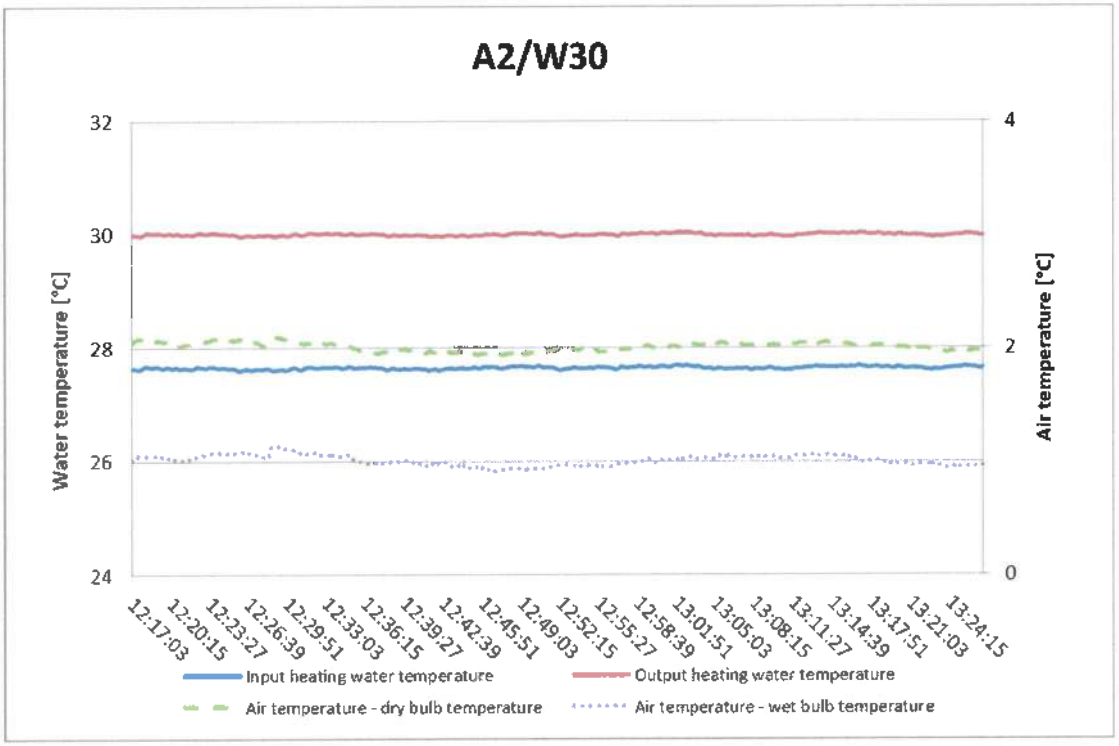
2. Seasonal performance tests and SCOP calculation – Low temperature application

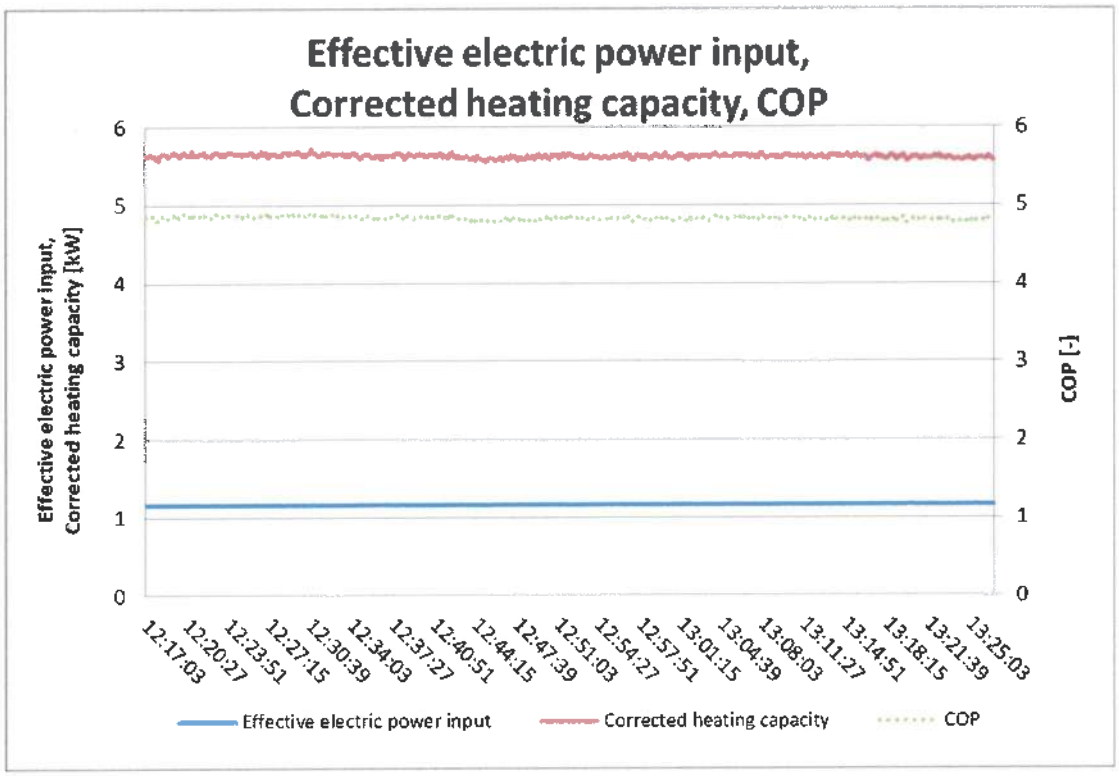
A-7/W34 (70 Hz)



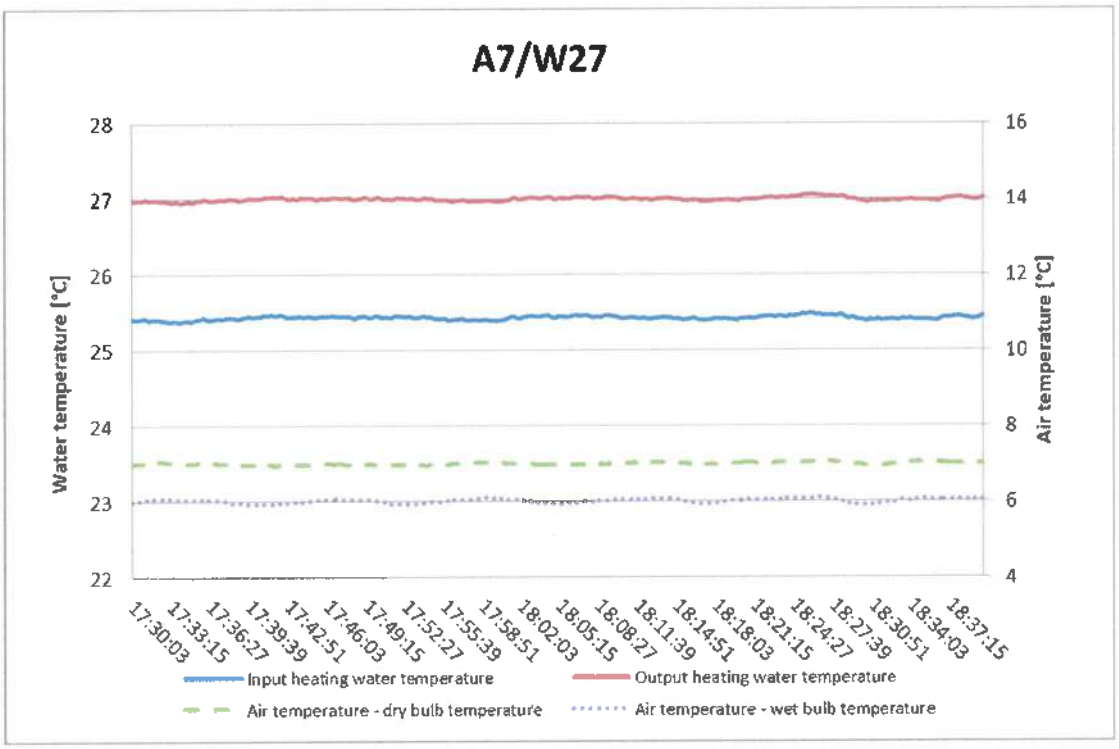


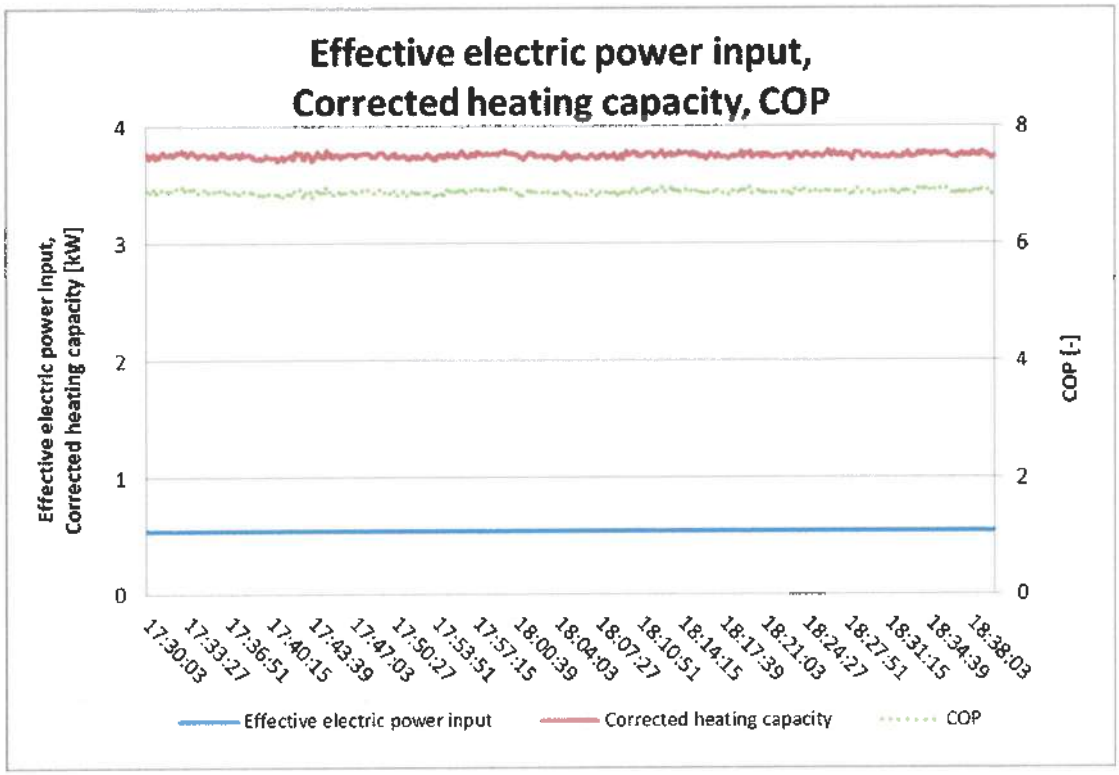
A2/W30 (34 Hz)


A2/W30
Water temperature [°C]
Air temperature [°C]
32
30
28
26
24
4
2
0
12:17:03
12:20:15
12:23:27
12:26:39
12:29:51
12:33:03
12:36:15
12:39:27
12:42:39
12:45:51
12:49:03
12:52:15
12:55:27
12:58:39
13:01:51
13:05:03
13:08:15
13:11:27
13:14:39
13:17:51
13:21:03
13:24:15
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature

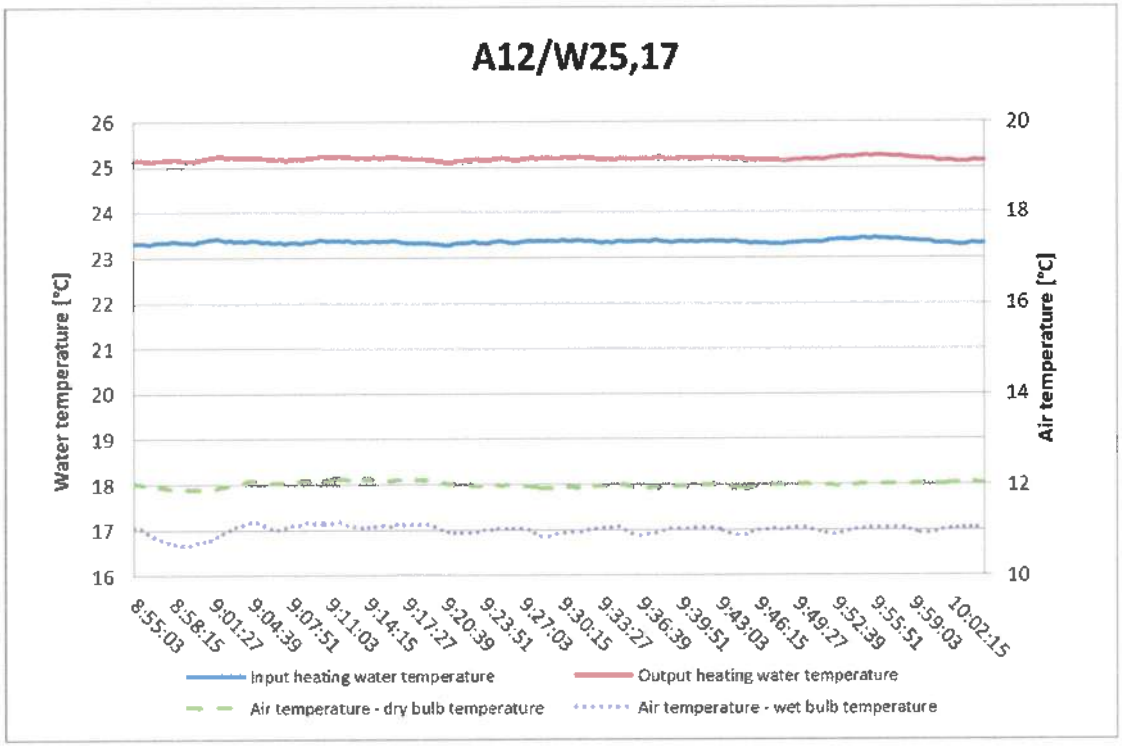

Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
6
5
4
3
2
1
0
12:17:03
12:20:27
12:23:51
12:27:15
12:30:39
12:34:03
12:37:27
12:40:51
12:44:15
12:47:39
12:51:03
12:54:27
12:57:51
13:01:15
13:04:39
13:08:03
13:11:27
13:14:51
13:18:15
13:21:39
13:25:03
Effective electric power input
Corrected heating capacity
COP

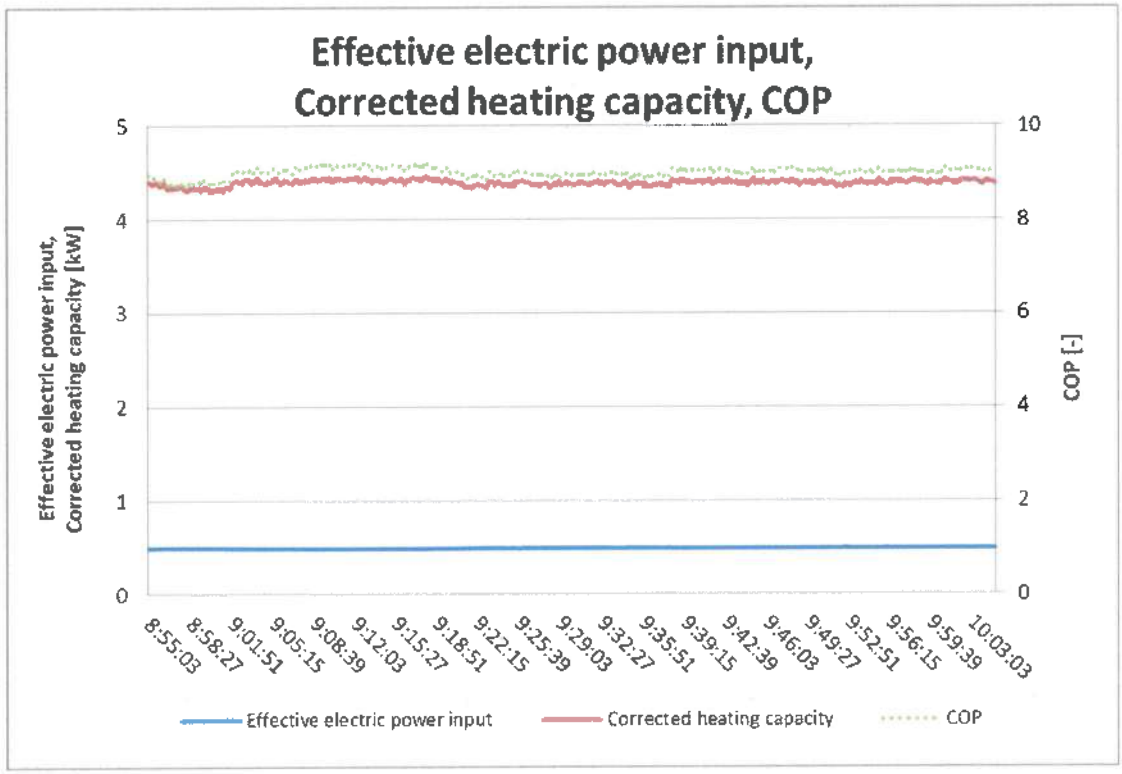
A7/W27 (20 Hz)


A7/W27
Water temperature [°C]
Air temperature [°C]
28
27
26
25
24
23
22
16
14
12
10
8
6
4
17:30:03
17:33:15
17:36:27
17:39:39
17:42:51
17:46:03
17:49:15
17:52:27
17:55:39
17:58:51
18:02:03
18:05:15
18:08:27
18:11:39
18:14:51
18:18:03
18:21:15
18:24:27
18:27:39
18:30:51
18:34:03
18:37:15
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature

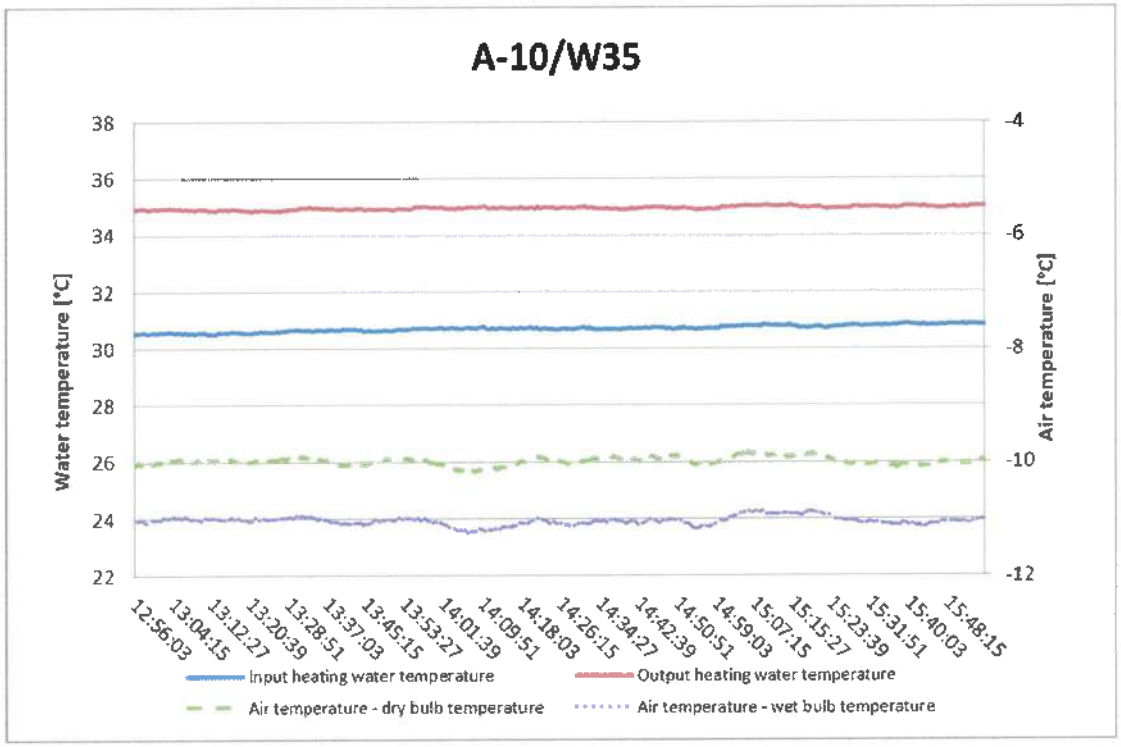

Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
4
3
2
1
0
8
6
4
2
0
17:30:03
17:33:27
17:36:51
17:40:15
17:43:39
17:47:03
17:50:27
17:53:51
17:57:15
18:00:39
18:04:03
18:07:27
18:10:51
18:14:15
18:17:39
18:21:03
18:24:27
18:27:51
18:31:15
18:34:39
18:38:03
Effective electric power input
Corrected heating capacity
COP

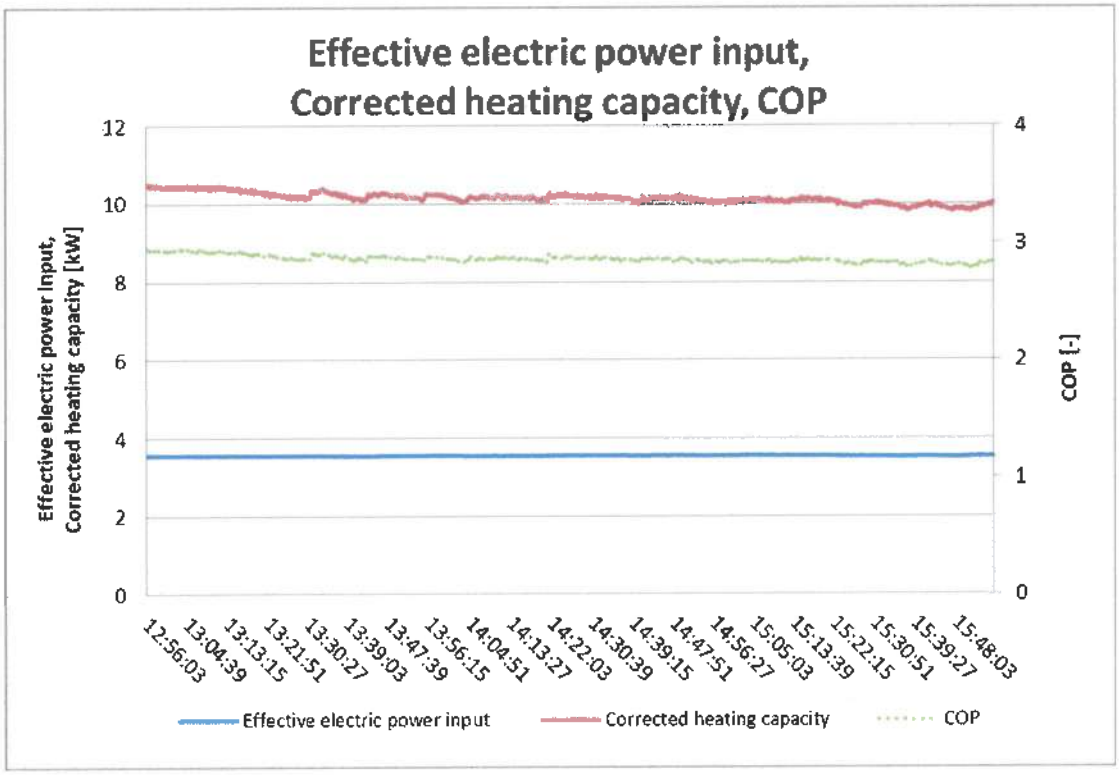
A12/W25.17 (20 Hz)





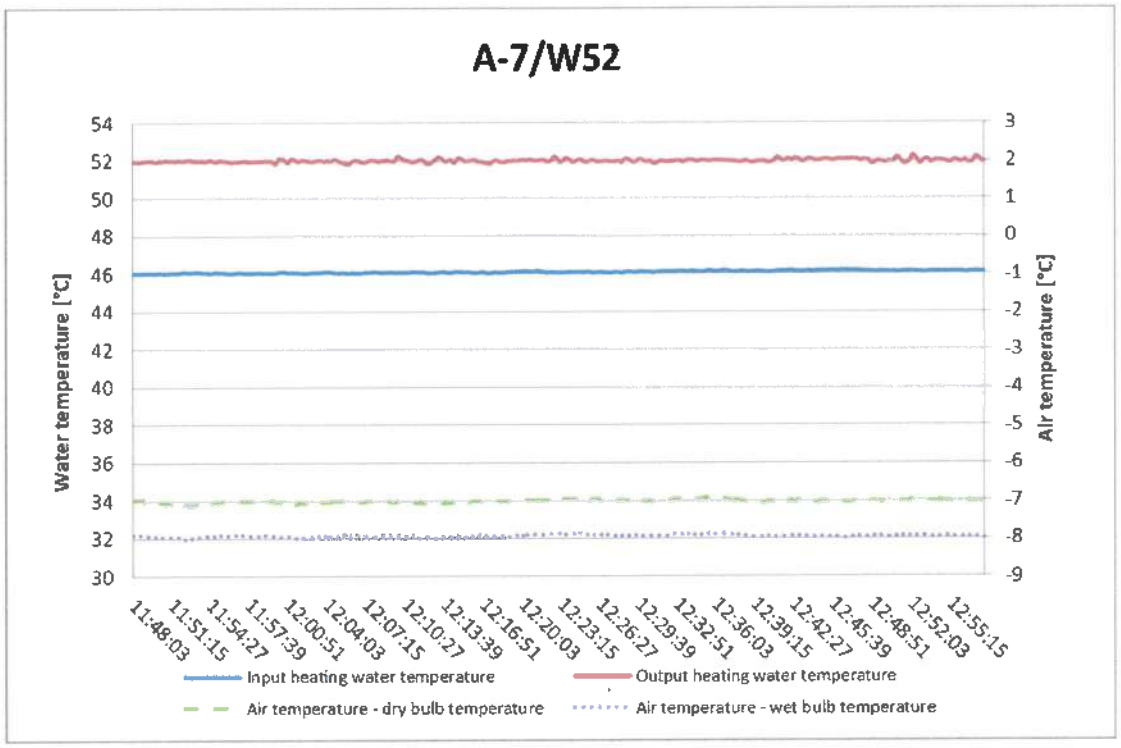
A-10/W35 (88 Hz)

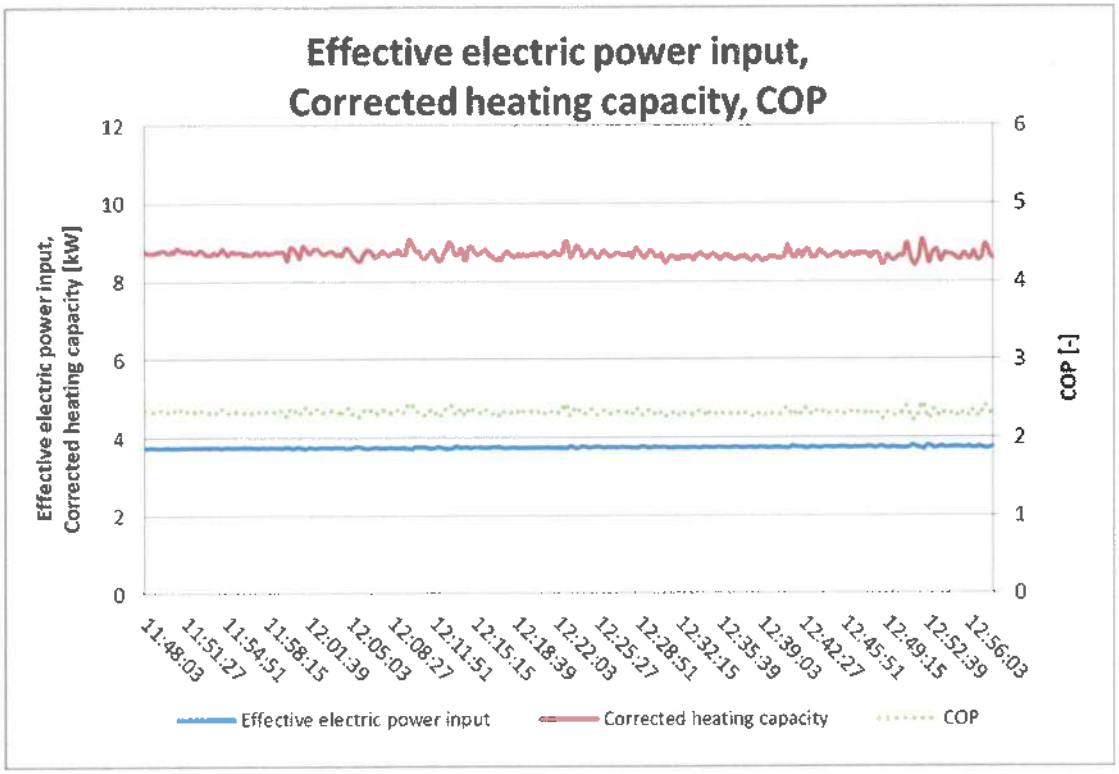

A-10/W35
Water temperature [°C]
Air temperature [°C]
38
36
34
32
30
28
26
24
22
-4
-6
-8
-10
-12
12:56:03
13:04:15
13:12:27
13:20:39
13:28:51
13:37:03
13:45:15
13:53:27
14:01:39
14:09:51
14:18:03
14:26:15
14:34:27
14:42:39
14:50:51
14:59:03
15:07:15
15:15:27
15:23:39
15:31:51
15:40:03
15:48:15
Input 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 [-]
12
10
8
6
4
2
0
4
3
2
1
0
12:56:03
13:04:39
13:13:15
13:21:51
13:30:27
13:39:03
13:47:39
13:56:15
14:04:51
14:13:27
14:22:03
14:30:39
14:39:15
14:47:51
14:56:27
15:05:03
15:13:39
15:22:15
15:30:51
15:39:27
15:48:03
Effective electric power input
Corrected heating capacity
COP

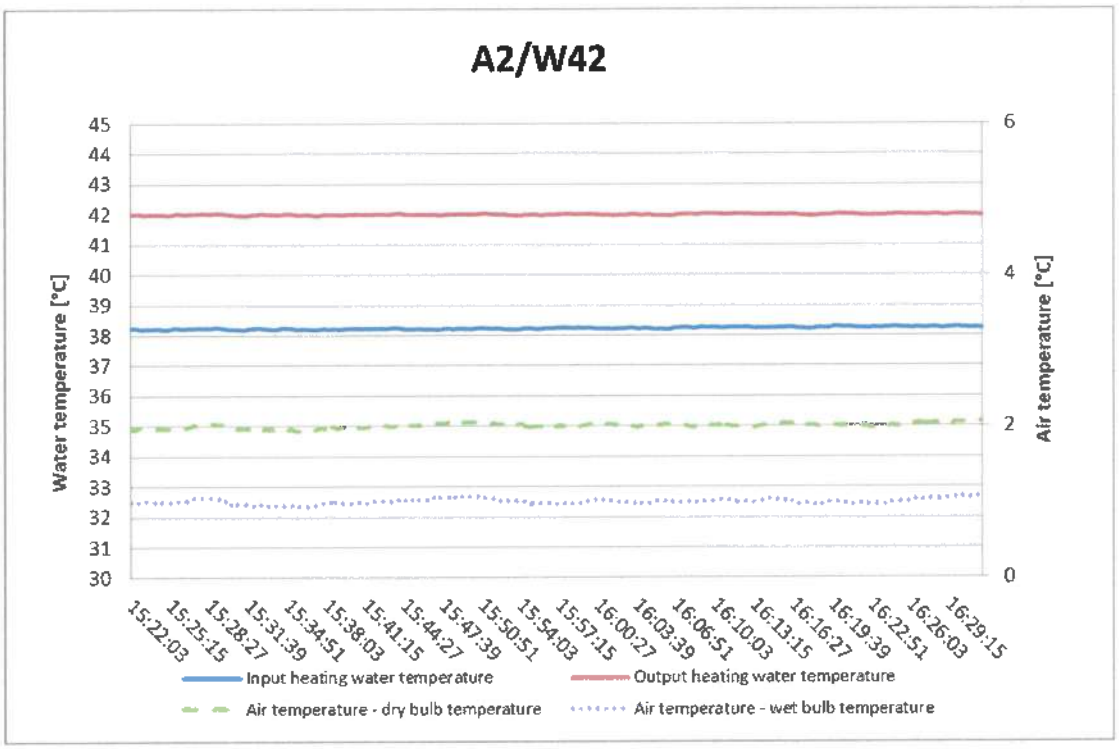
3. Seasonal performance tests and SCOP calculation – Medium temperature application

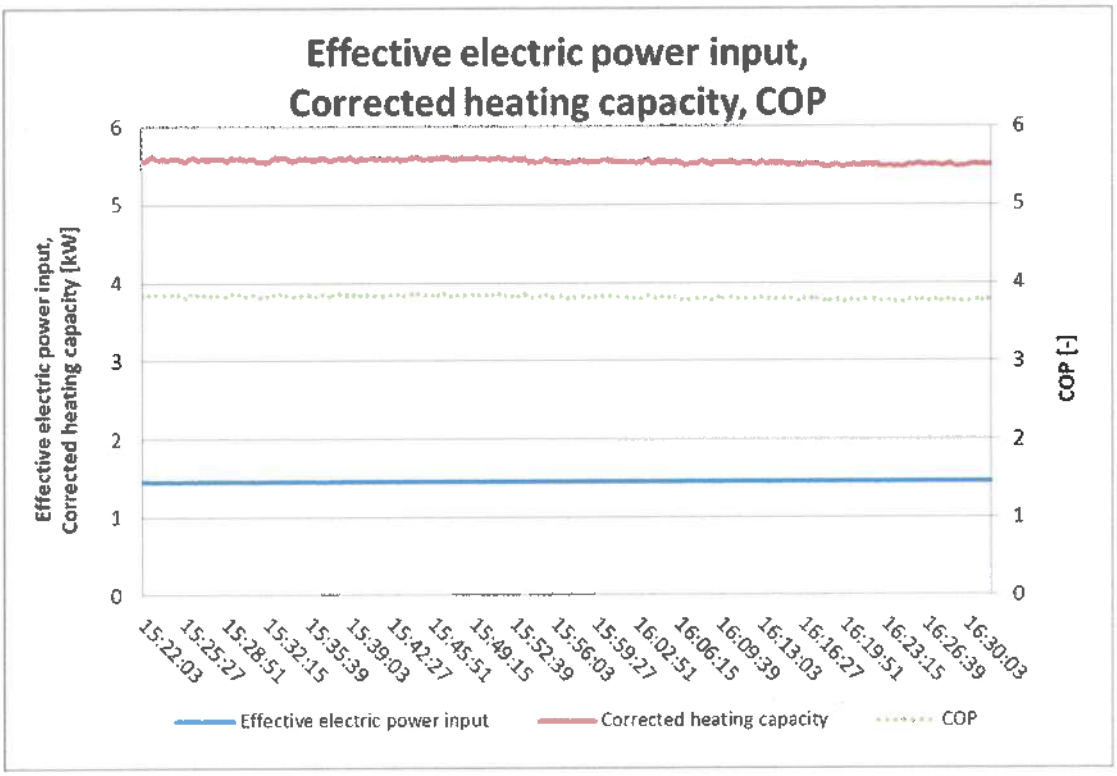
A-7/W52 (76 Hz)



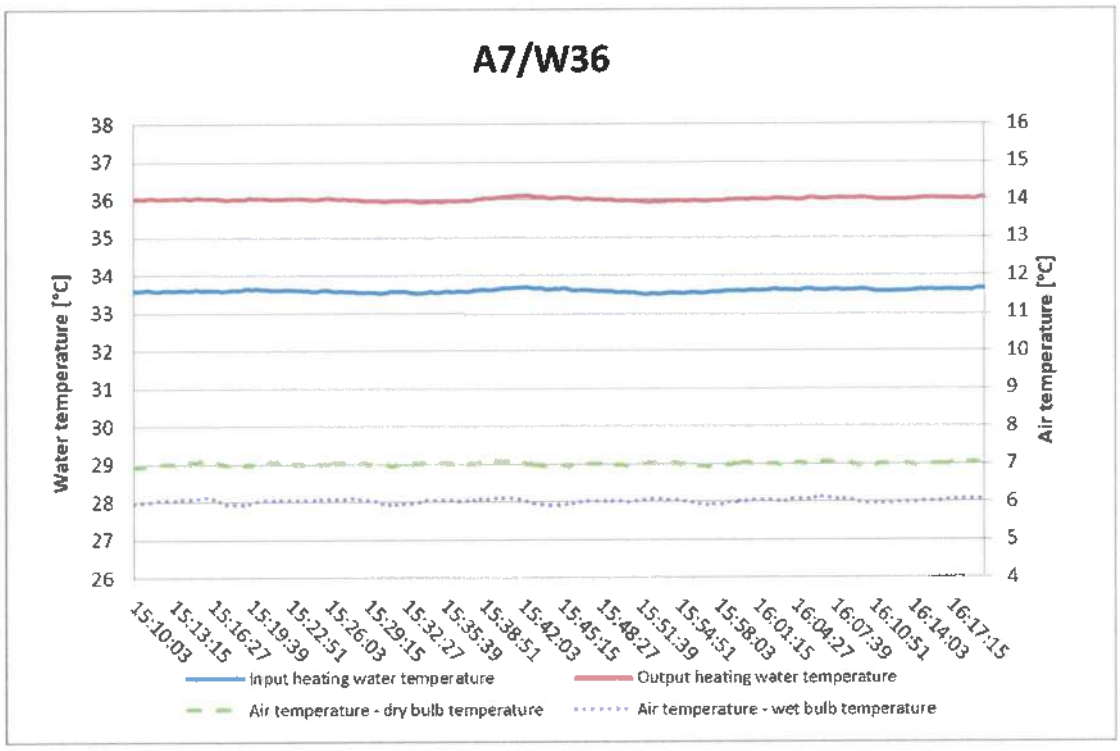


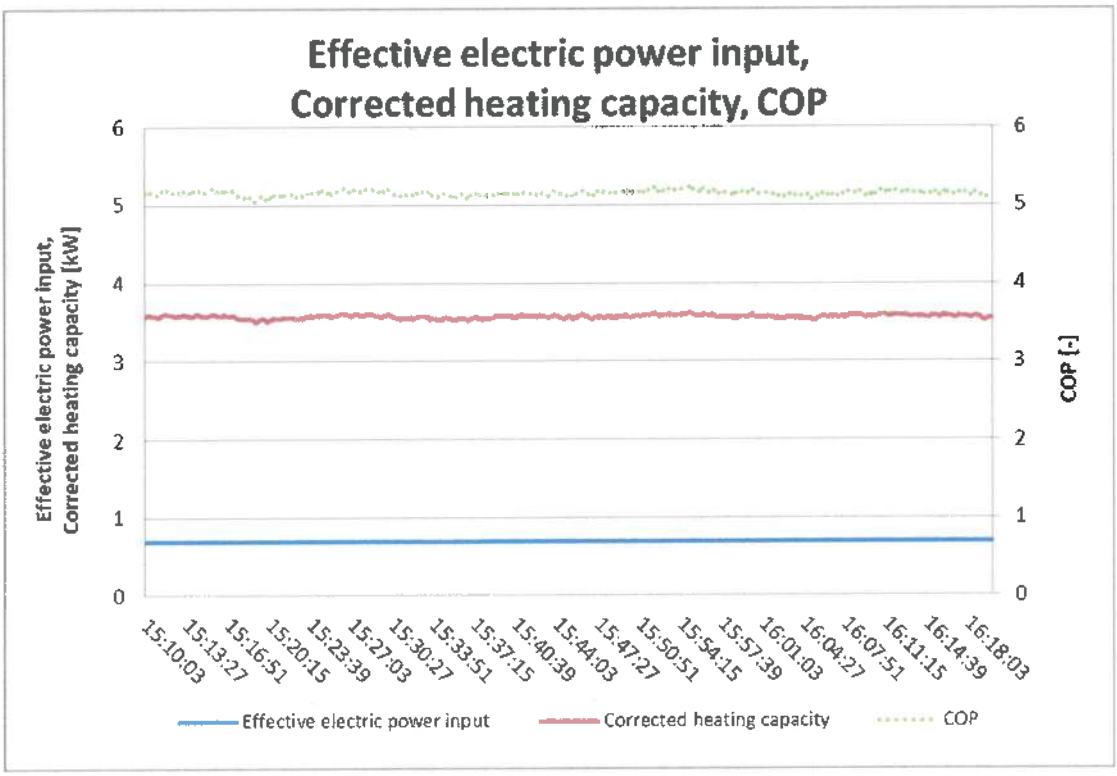
A2/W42 (36 Hz)


A2/W42
Water temperature [°C]
Air temperature [°C]
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
6
4
2
0
15:22:03
15:25:15
15:28:27
15:31:39
15:34:51
15:38:03
15:41:15
15:44:27
15:47:39
15:50:51
15:54:03
15:57:15
16:00:27
16:03:39
16:06:51
16:10:03
16:13:15
16:16:27
16:19:39
16:22:51
16:26:03
16:29:15
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature

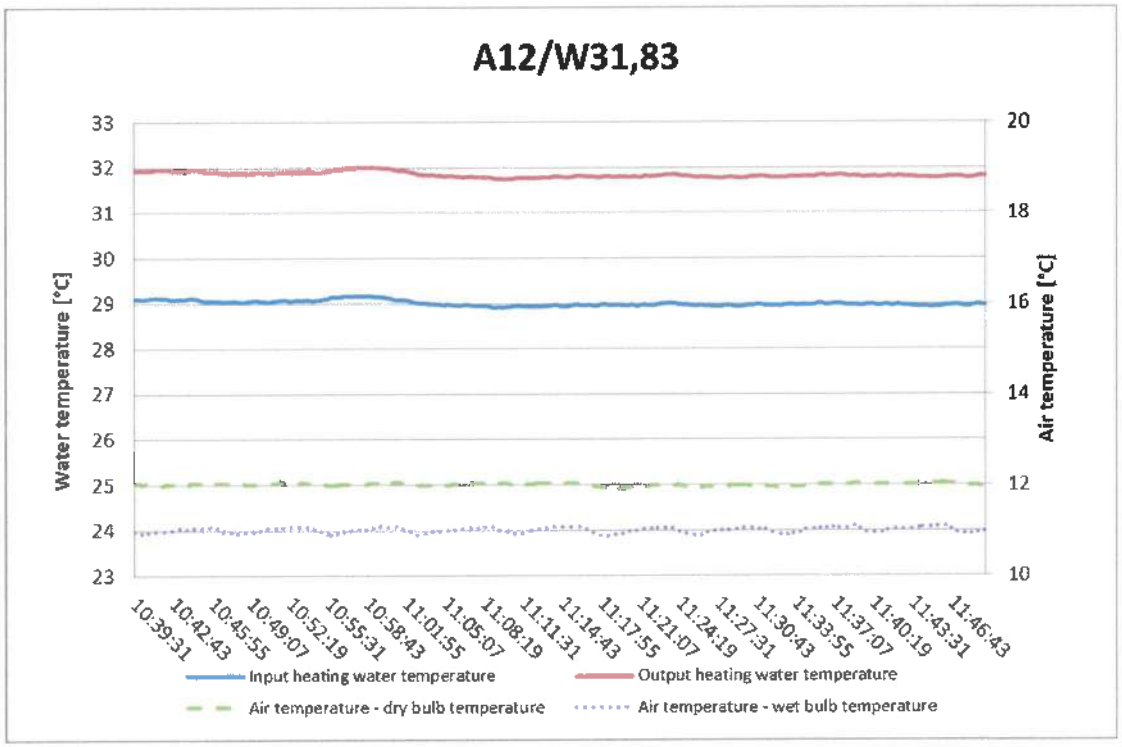

Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
6
5
4
3
2
1
0
15:22:03
15:25:27
15:28:51
15:32:15
15:35:39
15:39:03
15:42:27
15:45:51
15:49:15
15:52:39
15:56:03
15:59:27
16:02:51
16:06:15
16:09:39
16:13:03
16:16:27
16:19:51
16:23:15
16:26:39
16:30:03
Effective electric power input
Corrected heating capacity
COP

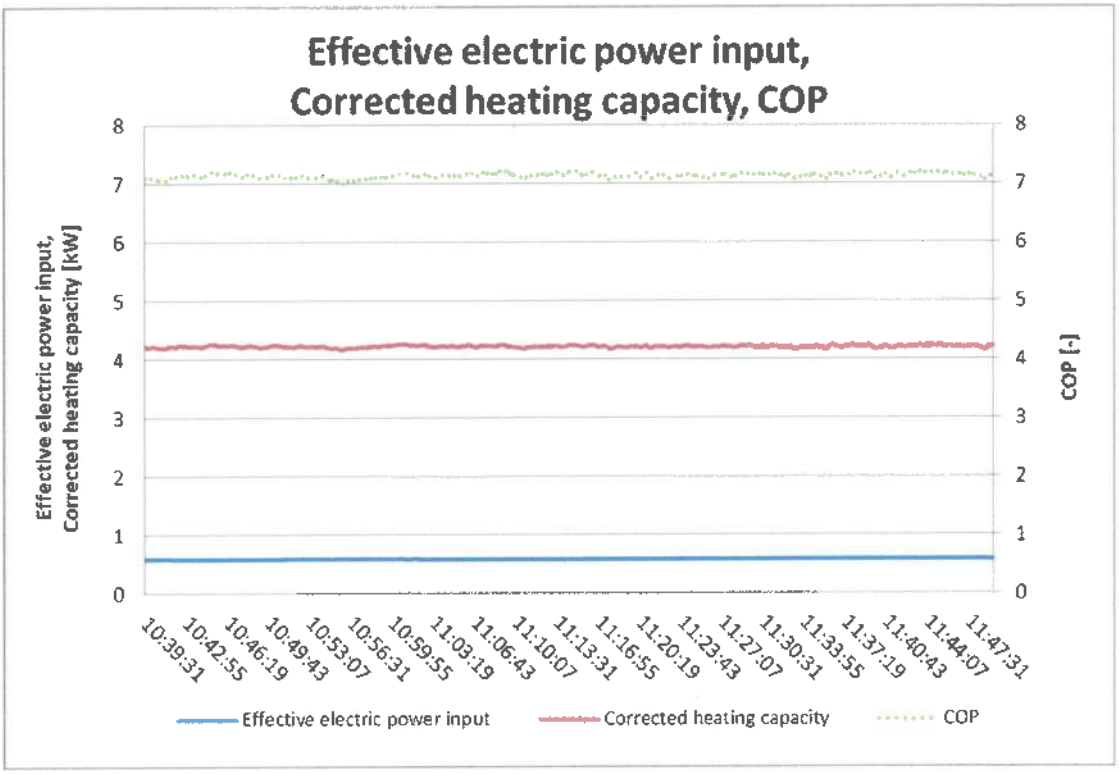
A7/W36 (20 Hz)


A7/W36
Water temperature [°C]
Air temperature [°C]
38
37
36
35
34
33
32
31
30
29
28
27
26
16
15
14
13
12
11
10
9
8
7
6
5
4
15:10:03
15:13:15
15:16:27
15:19:39
15:22:51
15:26:03
15:29:15
15:32:27
15:35:39
15:38:51
15:42:03
15:45:15
15:48:27
15:51:39
15:54:51
15:58:03
16:01:15
16:04:27
16:07:39
16:10:51
16:14:03
16:17:15
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature

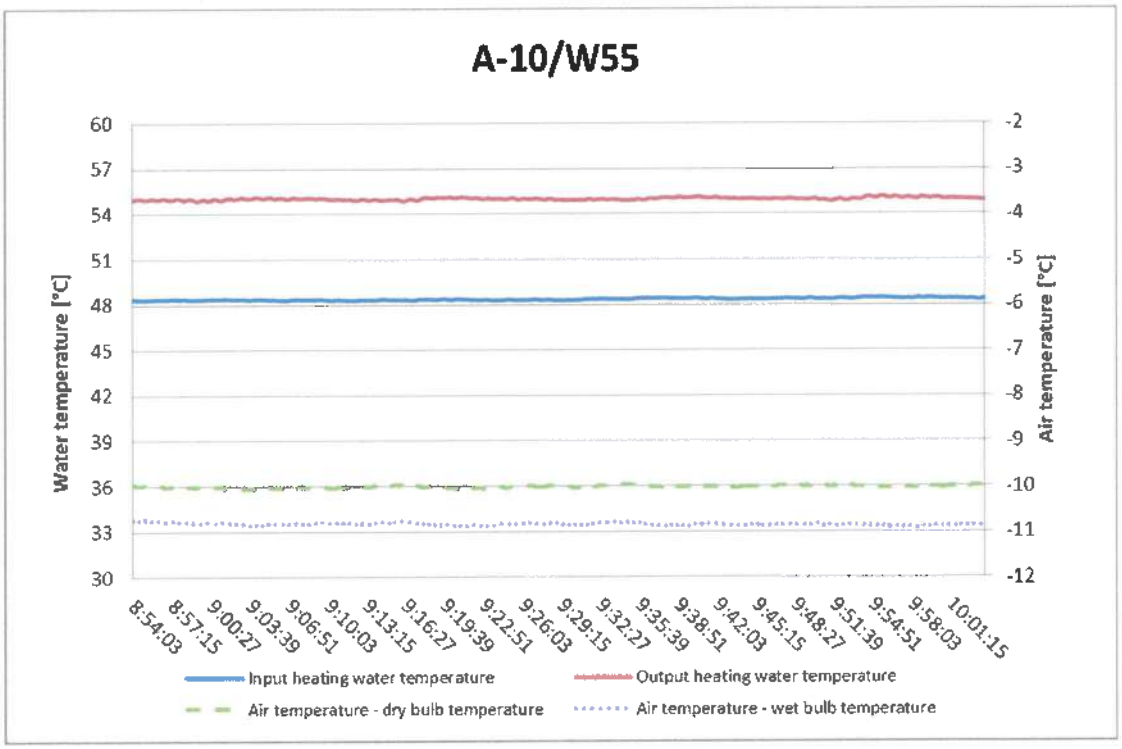

Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
6
5
4
3
2
1
0
15:10:03
15:13:27
15:16:51
15:20:15
15:23:39
15:27:03
15:30:27
15:33:51
15:37:15
15:40:39
15:44:03
15:47:27
15:50:51
15:54:15
15:57:39
16:01:03
16:04:27
16:07:51
16:11:15
16:14:39
16:18:03
Effective electric power input
Corrected heating capacity
COP

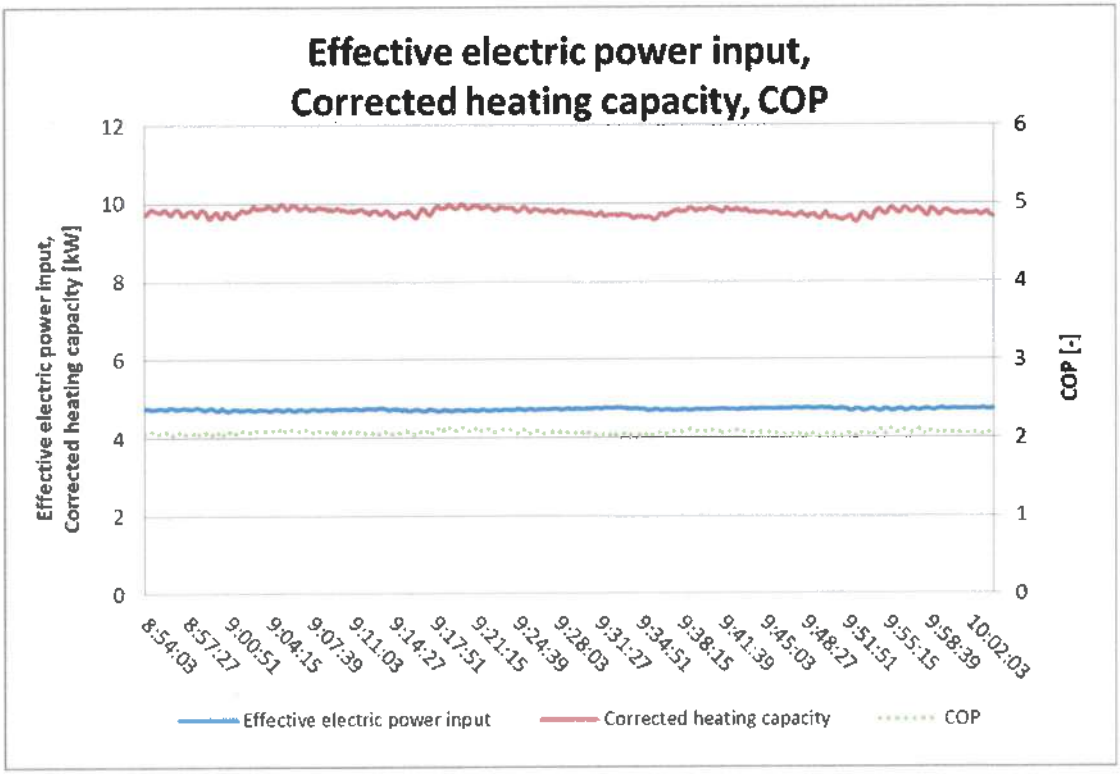
A12/W31.83 (20 Hz)





A-10/W55 (92 Hz)


A-10/W55
Water temperature [°C]
Air temperature [°C]
60
57
54
51
48
45
42
39
36
33
30
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
8:54:03
8:57:15
9:00:27
9:03:39
9:06:51
9:10:03
9:13:15
9:16:27
9:19:39
9:22:51
9:26:03
9:29:15
9:32:27
9:35:39
9:38:51
9:42:03
9:45:15
9:48:27
9:51:39
9:54:51
9:58:03
10:01:15
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 [-]
12
10
8
6
4
2
0
6
5
4
3
2
1
0
8:54:03
8:57:27
9:00:51
9:04:15
9:07:39
9:11:03
9:14:27
9:17:51
9:21:15
9:24:39
9:28:03
9:31:27
9:34:51
9:38:15
9:41:39
9:45:03
9:48:27
9:51:51
9:55:15
9:58:39
10:02:03
Effective electric power input
Corrected heating capacity
COP

VI. A list of referenced documents

- Order B-82548 of 2024-02-08 (Order reg. no. B-82548, received on 2024-02-08)
- Contract B-82548
- 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 a process chillers with electrically driven compressors - Part 3: Test methods
- ČSN EN 14825:2023 - Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling - Testing and rating at part load conditions and calculation of
- Background of the task 39-17865
- Record measurement file 39-17865

Test Report compiled by: Ing. Tomáš Sedláček

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

Number **O-B-01214-24 rev.1**

Producent *Customer*	Columbus Energy Spółka Akcyjna ul. Janogórksa 9 31-358 Kraków POLAND
Produkt *Product*	Pompa Ciepła powietrze/woda – monoblok Outdoor air/water heat pump – monobloc
Rodzaj oznaczenia / znak towarowy *Type designation / Trade mark*	**PC-CE-MB-HT-3P-12-0***
Metoda testowa *Test methods*	ČSN EN 14511-2:2023, ČSN EN 14511-3:2023, ČSN EN 12102-1:2023
Podstawy zaświadczenia *Basis of certificate*	Raport z badań - *Test reports*: 39-17865/T z dnia - *of* 2024-08-29 39-17865/H z dnia - *of* 2024-08-29 Dokumentacja techniczna przedstawiona przez - *Technical documents of Columbus Energy Spółka Akcyjna*
Zastosowanie *Temperature application*	**NISKOTEMPERATUROWA - *LOW*,** **WYSOKOTEMPERATUROWA - *MEDIUM*** referencyjna temperatura wody 35 °C i 55 °C - *Reference water temperature 35 °C and 55 °C*

Wyniki - *Results*:

Warunki cieplne* *Temperature conditions**		**A7/W35**	**A7/W55**
Skorygowana moc grzewcza *Corrected heat capacity*	[kW]	11.960	11.802
Efektywny pobór mocy elektrycznej *Effective electric power input*	[kW]	2.477	3.944
Współczynnik efektywności *Coefficient of performance*	[-]	4.828	2.992
Ustawienia sterowania *Control settings*	[Hz]	65	73

(*) Uwagi do skróconych oznaczeń: np. A7/W35: A (powietrze), 7 (temperatura wejściowa - temperatura termometru suchego) w °C, W (woda), 35 (temperatura wyjściowa) w °C.

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).

Poziom mocy akustycznej dla danych warunków temperaturowych A7/W55*:
Sound power level at temperature condition A7/W55*:

Pompa Ciepla Powietrze/Woda – monobloc *AirWater Heat Pump – monobloc*	**PC-CE-MB-HT-3P-12-0*** – Jednostka zewnętrzna – *– outdoor unit –*		
Poziom mocy akustycznej *Sound power level*	L_{WA}	54.3 ± 1.5	dB(A)
Klasa dokładności *Accuracy class*	Techniczna (2) *Engineering (2)*		

(*) Uwagi do skróconych oznaczeń: np. A7/W55: A (powietrze), 7 (temperatura wejściowa - temperatura termometru suchego) w °C, W (woda), 55 (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 *Compressor speed control*	**Zmienna** ***Variable***	Nominalne natężenie przepływu cieczy (wewnętrzny wymiennik ciepła) - *Rated liquid flow rate (indoor heat exchanger)*	**Stała** **Fixed**
Wylotowa temperatura wody (wewnętrzny wymiennik ciepła) - *Outlet water temperature (indoor heat*	**Zmienna** ***Variable***	Nominalne natężenie przepływu cieczy (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, 2024-12-09

Ing. Mario Jankola
Kierownik ds. Urządzeń Grzewczych i Wyrobów Budowlanych
Heating Equipment and Construction Products Manager
- KONIEC CERTYFIKATU Z BADAŃ -
- END OF TEST CERTIFICATE -

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

CERTYFIKAT Z BADAŃ
TEST CERTIFICATE

Number **O-B-01215-24 rev.1**

Producent *Customer*	Columbus Energy Spółka Akcyjna ul. Janogórksa 9 31-358 Kraków POLAND
Produkt *Product*	Pompa Ciepła powietrze/woda – monoblok Outdoor air/water heat pump – monobloc
Rodzaj oznaczenie / znak towarowy *Type designation / Trade mark*	**PC-CE-MB-HT-3P-12-0***
Metoda testowa *Test methods*	ČSN EN 14511-2:2023, ČSN EN 14511-3:2023, ČSN EN 14825:2023, ČSN EN 12102-1:2023
Podstawy zaświadczenia *Basis of certificate*	Raport z badań - *Test reports*: 39-17865/T z dnia - *of* 2024-08-29 39-17865/H z dnia - *of* 2024-08-29 Dokumentacja techniczna przedstawiona przez - *Technical documents of Columbus Energy Spółka Akcyjna*
Referencyjny okres grzewczy *Reference heating season*	**„A" = Średni - *„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*
10.30	**$P_{designh}$ [kW]** ... Obciążenie obliczeniowe dla trybu ogrzewania - *Full load heating*	**9.84**
5.13	**SCOP [-]** ... Wskaźnik sezonowej efektywności - *Seasonal coefficient of performance*	**3.92**

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	9.111	3.301	T_j = -7	8.701	2.325
T_j = +2	5.624	4.835	T_j = +2	5.556	3.819
T_j = +7	3.751	6.881	T_j = +7	3.573	5.152
T_j = +12	4.393	9.000	T_j = +12	4.220	7.138
T_j = TOL = -10	10.149	2.863	T_j = TOL = -10	9.781	2.070
T_j = $T_{bivalent}$ = -7	9.111	3.301	T_j = $T_{bivalent}$ = -7	8.701	2.325

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"*

13.3	Tryb wyłączenia *Off mode*	P_{OFF}	[W]	13.3
16.6	Tryb wyłączonego termostatu *Thermostat off mode*	P_{TO}	[W]	12.3
13.3	Tryb czuwania *Standby mode*	P_{SB}	[W]	13.3
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*:

4150	ČSN EN 14825:2023	Q_{HE}	[kWh]	**5180**

Sezonowa efektywność energetyczna ogrzewania pomieszczeń - *Seasonal Space heating energy efficiency*

202.1	ČSN EN 14825:2023	η_s	[%]	**153.9**

Przepływ cieczy w zewnętrznym wymienniku ciepła - *Liquid flow rate in outdoor heating exchanger*

–	Ciecz obiegu źródła *Source liquid*	Min/Max	[m^3/h]	–

Przepływ cieczy w wewnętrznym wymienniku ciepła - *Liquid flow rate in indoor heating exchanger*

2.0840	Woda grzewcza *Heating water*	Min/Max	[m^3/h]	1.2919

Poziom mocy akustycznej dla warunków - Sound power level at condition A7W55*:

PC-CE-MB-HT-3P-12-0* – Jednostka zewnętrzna – *– outdoor unit –*	L_{WA}	54.3 ± 1.5	dB(A)	Klasa dokładności 2 (Techniczna) *Accuracy class 2 (Engineering)*

(*) Uwagi do skróconych oznaczeń: np. A7/W55: A (powietrze), 7 (temperatura wejściowa - temperatura termometru suchego w °C), W (woda), 55 (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 *Compressor speed control*	**Zmienna** ***Variable***	Nominalne natężenie przepływu cieczy (wewnętrzny wymiennik ciepła) - *Rated liquid flow rate (indoor heat exchanger)*	**Stała** **Fixed**
Wylotowa temperatura wody (wewnętrzny wymiennik ciepła) - *Outlet water temperature (indoor heat*	**Zmienna** ***Variable***	Nominalne natężenie przepływu cieczy (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.
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Brno, 2024-12-09

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

Strojírenský zkušební ústav, s.p., Brno, Česká republika
Engineering Test Institute, Public Enterprise, Brno, Czech Republic

TEST CERTIFICATE

Number **O-B-01561-24 rev.1**

Customer	Columbus Energy Spółka Akcyjna ul. Janogórksa 9 31-358 Kraków POLAND
Product	Outdoor air/water heat pump – monobloc
Type designation / Trademark	**PC-CE-MB-HT-3P-6-0*** **PC-CE-MB-HT-3P-8-0*** **PC-CE-MB-HT-3P-12-0*** **PC-CE-MB-HT-3P-18-0***
Test methods	ČSN EN 14511-2:2023, ČSN EN 14511-3:2023, ČSN EN 12102-1:2023
Basis of certificate	Test reports: 39-17865/T *of* 2024-08-29 39-17865/H *of* 2024-08-29 Technical documents of Columbus Energy Spółka Akcyjna
Temperature application	**LOW TEMPERATURE** (Reference water temperature 35 °C)
Reference heating season	**„A" = average** (Reference design conditions for heating $T_{designh}$ = -10 °C)

Specification of conditions:

Compressor speed control	**Variable**	Heating water volume flow rate (indoor heat exchanger)	**Fixed**
Outlet water temperature (indoor heat exchanger)	**Variable**	Source liquid volume flow rate (outdoor heat exchanger)	–
Function	**Reversible**		

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Engineering Test Institute, public enterprise, Hudcova 424/56b, 621 00 Brno, Czech Republic
www.szutest.cz

Results:

Low temperature application

(Reference water temperature 35 °C)

Model names			PC-CE-MB-HT-3P-6-0* (Not tested)	PC-CE-MB-HT-3P-8-0* (Not tested)	PC-CE-MB-HT-3P-12-0* (Tested)	PC-CE-MB-HT-3P-18-0* (Not tested)
Full load heating	$P_{designh}$ [kW]	A	6.07	8.19	10.30	16.34
Bivalent temperature	$T_{bivalent}$ [°C]	A	-7	-7	-7	-7
Seasonal coefficient of performance	SCOP [–]	A	4.81	4.88	5.13	4.81
Seasonal Space heating energy efficiency	η_s [%]	A	189.3	192.4	202.1	189.5

(Tested) This test sample was tested at the Testing Laboratory.

(Not tested) The technical data were declared by the Manufacturer according to the model range specifications and were not tested by the Testing Laboratory.

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, 2024-12-09

STROJÍRENSKÝ ZKUŠEBNÍ ÚSTAV, s.p. CZ 1

Ing. Mario Jankola

Heating Equipment and Construction Products Manager

– END OF TEST CERTIFICATE –

Strojírenský zkušební ústav, s.p., Brno, Česká republika
Engineering Test Institute, Public Enterprise, Brno, Czech Republic

TEST CERTIFICATE

Number **O-B-01562-24 rev.1**

Customer	Columbus Energy Spółka Akcyjna ul. Janogórksa 9 31-358 Kraków POLAND
Product	Outdoor air/water heat pump – monobloc
Type designation / Trademark	**PC-CE-MB-HT-3P-6-0*** **PC-CE-MB-HT-3P-8-0*** **PC-CE-MB-HT-3P-12-0*** **PC-CE-MB-HT-3P-18-0***
Test methods	ČSN EN 14511-2:2023, ČSN EN 14511-3:2023, ČSN EN 12102-1:2023
Basis of certificate	Test reports: 39-17865/T *of* 2024-08-29 39-17865/H *of* 2024-08-29 Technical documents of Columbus Energy Spółka Akcyjna
Temperature application	**MEDIUM TEMPERATURE** (Reference water temperature 55 °C)
Reference heating season	**„A" = average** (Reference design conditions for heating $T_{designh}$ = -10 °C)

Specification of conditions:

Compressor speed control	**Variable**	Heating water volume flow rate (indoor heat exchanger)	**Fixed**
Outlet water temperature (indoor heat exchanger)	**Variable**	Source liquid volume flow rate (outdoor heat exchanger)	–
Function	**Reversible**		

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Engineering Test Institute, public enterprise, Hudcova 424/56b, 621 00 Brno, Czech Republic
www.szutest.cz

Results:

Medium temperature application

(Reference water temperature 55 °C)

Model names			PC-CE-MB-HT-3P-6-0* (Not tested)	PC-CE-MB-HT-3P-8-0* (Not tested)	PC-CE-MB-HT-3P-12-0* (Tested)	PC-CE-MB-HT-3P-18-0* (Not tested)
Full load heating	$P_{designh}$ [kW]	A	6.06	8.04	9.84	16.40
Bivalent temperature	$T_{bivalent}$ [°C]	A	-7	-7	-7	-7
Seasonal coefficient of performance	SCOP [–]	A	3.72	3.64	3.92	3.73
Seasonal Space heating energy efficiency	η_s [%]	A	145.9	142.6	153.9	146.0

(Tested) This test sample was tested at the Testing Laboratory.

(Not tested) The technical data were declared by the Manufacturer according to the model range specifications and were not tested by the Testing Laboratory

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Brno, 2024-12-09

STROJÍRENSKÝ ZKUŠEBNÍ ÚSTAV, s.p. CZ 1

Ing. Mario Jankola

Heating Equipment and Construction Products Manager

– END OF TEST CERTIFICATE –

Strojírenský zkušební ústav, s.p., Brno, Česká republika
Engineering Test Institute, Public Enterprise, Brno, Czech Republic

TEST CERTIFICATE

Number **O-B-01563-24 rev.1**

Customer	Columbus Energy Spółka Akcyjna ul. Janogórksa 9 31-358 Kraków POLAND
Product	Outdoor air/water heat pump – monobloc
Type designation / Trade mark	**PC-CE-MB-HT-3P-6-0*** **PC-CE-MB-HT-3P-8-0*** **PC-CE-MB-HT-3P-12-0*** **PC-CE-MB-HT-3P-18-0***
Test methods	ČSN EN 14511-2:2023, ČSN EN 14511-3:2023, ČSN EN 12102-1:2023
Basis of certificate	Test reports: 39-17865/T *of* 2024-08-29 39-17865/H *of* 2024-08-29 Technical documents of Columbus Energy Spółka Akcyjna
Temperature application	**LOW TEMPERATURE,** (Reference water temperature 35 °C) **MEDIUM TEMPERATURE** (Reference water temperature 55 °C)

Specification of conditions:

Compressor speed control	**Variable**	Heating water volume flow rate (indoor heat exchanger)	**Fixed**
Outlet water temperature (indoor heat exchanger)	**Variable**	Source liquid volume flow rate (outdoor heat exch.)	–
Function	**Reversible**		

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Engineering Test Institute, public enterprise, Hudcova 424/56b, 621 00 Brno, Czech Republic
www.szutest.cz

Results:

Model names			PC-CE-MB-HT-3P-6-0*	PC-CE-MB-HT-3P-8-0*	PC-CE-MB-HT-3P-12-0*	PC-CE-MB-HT-3P-18-0*
Temperature condition*			(Not tested)	(Not tested)	(Tested)	(Not tested)
A7/W35	Corrected heating capacity	[kW]	6.071	7.991	11.960	18.418
	Effective power input	[kW]	1.273	1.627	2.477	4.004
	Coefficient of performance	[–]	4.770	4.910	4.828	4.600
	Control settings	[Hz]	–	–	65	–
A7/W55	Corrected heating capacity	[kW]	6.096	8.122	11.802	18.303
	Effective power input	[kW]	1.954	1.627	3.944	5.943
	Coefficient of performance	[–]	3.120	3.130	2.992	3.080
	Control settings	[Hz]	–	–	73	–
Sound power level at condition A7/W55*:						
	L_{WA}	[dB(A)]	55.0 ± 1.5	58.0 ± 1.5	54.3 ± 1.5	72.0 ± 1.5

Accuracy class Engineering (2)

(*) Comment to abbreviated marking e.g. A7W35:

„A" air, „7" inlet temperature (dry-bulb temperature) in °C, „W" water, „35" outlet temperature in °C.

(Tested) This test sample was tested at the Testing Laboratory.

(Not tested) The technical data were declared by the Manufacturer according to the model range specifications and were not tested by the Testing Laboratory.

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Brno, 2024-12-09

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Ing. Mario Jankola
Heating Equipment and Construction Products Manager

– END OF TEST CERTIFICATE –