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-01823-24**

Producent *Customer*	Termet S.A. ul. Długa 13 58-160 Świebodzice POLAND
Produkt *Product*	Pompa Ciepła powietrze/woda – monoblok *Air/water heat pump –monobloc*
Rodzaj oznaczenie / znak towarowy *Type designation / Trade mark*	**Termet Heat Titanium Pro 8**
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*: 39-17612/T z dnia - *of* 2024-10-25 39-17612/H z dnia - *of* 2024-10-25 Dokumentacja techniczna przedstawiona przez - *Technical documents of* Termet S.A.
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*
7.68	**$P_{designh}$ [kW]** ... Obciążenie obliczeniowe dla trybu ogrzewania - *Full load heating*	**7.55**
4.25	**SCOP [-]** ... Wskaźnik sezonowej efektywności - *Seasonal coefficient of performance*	**3.39**

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	6.796	2.698	T_j = -7	6.679	1.995
T_j = +2	4.060	4.032	T_j = +2	4.028	3.291
T_j = +7	3.594	5.987	T_j = +7	3.453	4.684
T_j = +12	4.085	7.336	T_j = +12	4.013	5.945
T_j = TOL = -10	6.590	2.187	T_j = TOL = -10	7.448	1.742
T_j = $T_{bivalent}$ = -7	6.796	2.698	T_j = $T_{bivalent}$ = -7	6.679	1.995

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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"*				
20.3	Tryb wyłączenia *Off mode*	P_{OFF}	[W]	20.3
20.1	Tryb wyłączonego termostatu *Thermostat off mode*	P_{TO}	[W]	20.1
20.3	Tryb czuwania *Standby mode*	P_{SB}	[W]	20.3
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*:				
3732	ČSN EN 14825:2023	Q_{HE}	[kWh]	**4596**
Sezonowa efektywność energetyczna ogrzewania pomieszczeń - *Seasonal Space heating energy efficiency*				
167.1	ČSN EN 14825:2023	η_s	[%]	**132.8**
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*				
0.6231/1.3435	Woda grzewcza *Heating water*	Min/Max	[m^3/h]	**0.4994/0.8449**

Poziom mocy akustycznej dla warunków - Sound power level at condition A7W55* (at 31 Hz):

venkovní jednotka – Jednostka zewnętrzna – *– outdoor unit –*	L_{WA}	64.4 ± 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)*	**Zmienna** ***Variable***
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 certyfikatem 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, 2024-11-21

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.
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Testing Laboratory 1045.1 accredited by the CAI pursuant to ČSN EN ISO/IEC 17025:2018

L 1045.1

TEST REPORT
39-17612/T

Product:	Outdoor Air/Water Heat pump - monobloc
Type designation:	**Termet Heat Titanium Pro 8**
Customer:	Termet S.A. ul. Długa 13 58-160 Świebodzice POLAND
Manufacturer:	Termet S.A. ul. Długa 13 58-160 Świebodzice POLAND
Report issue date:	2024-10-25
Distribution list:	1 copy to the Customer 1 copy to the Engineering Test Institute

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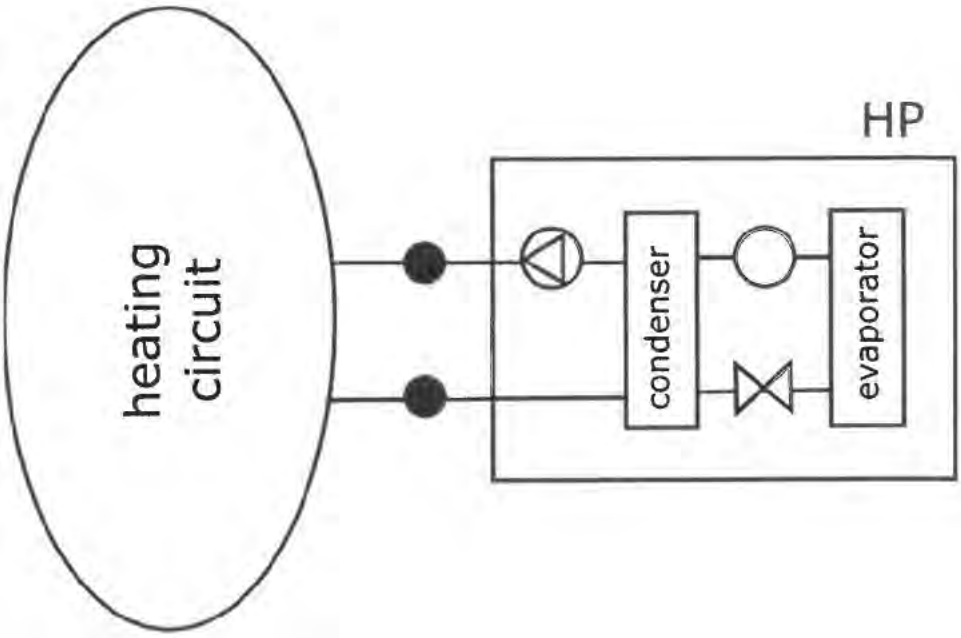
I. Description of product tested

The Heat pump **Termet Heat Titanium Pro 8** supplied by the company **Termet S.A.** is structurally adapted to operate in air/water system. Device is designed as monobloc placed outdoor. Refrigerant R290 used with charge 1.5 kg. Power supply is a three-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 **Termet Heat Titanium Pro 8**:

- Serial number 8800EU1T00001/2444
- Cubic shape with dimensions 1150 × 620 × 825 mm (W × D × H)
- Frame and casing made of varnished steel sheets
- Cubic-shaped evaporator [redacted]
- Plate condenser, [redacted]
- Compressor [redacted]
- Refrigerant R290 (1.5 kg)
- Electric expansion valve [redacted]
- [redacted]
- 4-way reversing valve [redacted] with coil [redacted]
- Refrigerant accumulator [redacted]
- Filter drier [redacted]
- Axial fan ø = 43 cm, [redacted]
- Pressure sensors [redacted]
- Temperature sensors
- Refrigerant pipes
- Air vent
- Safety valve
- Inverter [redacted]

Scheme:

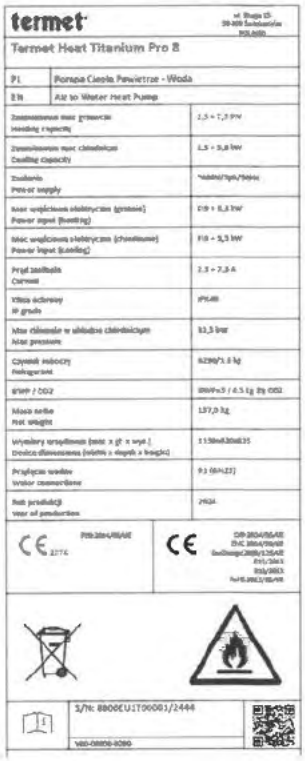


Photodocumentation:

Heat pump **Termet Heat Titanium Pro 8** – outdoor unit – Front view –

Heat pump **Termet Heat Titanium Pro 8** – outdoor unit – Back view –

Heat pump **Termet Heat Titanium Pro 8** – outdoor unit – Compressor label –



Heat pump **Termet Heat Titanium Pro 8** – outdoor unit – Label –

Heat pump **Termet Heat Titanium Pro 8** – outdoor unit
– Without cover –

II. Sample tested

SZU reg. no.	Product name	Date of submission
1212.24.40525.001	**Termet Heat Titanium Pro 8**	2024-09-03

The visual inspection, tests and verification were carried out by Ing. Jakub Čederle and Ing. Tomáš Sedláček 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	8.1.3 TECH_K2_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 **Termet Heat Titanium Pro 8**
Measuring equipment used:	see Chapter III

Specification of the assessment condition		**A7/W35**	**A7/W55**
Date of testing		**2024-10-25**	**2024-10-25**
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]	35.00	55.00
Input heating water – temperature calculation	[°C]	30.00	47.00
Output heating water temperature	[°C]	35.00	55.00
Input heating water temperature	[°C]	30.00	47.00
Air temperature – dry bulb temperature	[°C]	7.00	7.01
Air temperature – wet bulb temperature	[°C]	6.02	6.02
Relative humidity	[%]	87.08	86.96
Barometric pressure	[kPa]	99.350	99.267
Ambient temperature	[°C]	7.11	7.12
Secondary circuit pressure difference	[kPa]	-15.302	-6.077
Efficiency of the secondary liquid pump	[–]	0.190	0.132
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	1.4544	0.9132
Density of heating water	[$kg \cdot m^{-3}$]	994.0	986.0
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.175	4.179
Voltage	[V]	400.24	400.47
Total current	[A]	8.73	13.33
Overall power input	[kW]	1.830	2.966
Capacity correction of sec. liquid pump	[W]	-26.358	-10.133
Power input correction of sec. liquid pump	[W]	-32.54	-11.67
Heating capacity – heating water	[kW]	8.374	8.391
Corrected heating capacity – heating water	**[kW]**	**8.400**	**8.401**
Uncertainty of corrected heating capacity	[kW]	± 0.145	± 0.093
Effective electric power input	**[kW]**	**1.863**	**2.977**
COP	**[–]**	**4.509**	**2.822**
Uncertainty of COP	[–]	± 0.079	± 0.031
Control settings	**[rps]**	**75**	**84**
Circulation pump settings – heating water	[–]	–	–

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 **Termet Heat Titanium Pro 8**
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		**<u>167.1</u>**	%
		Warmer	η_s		–	%
		Colder	η_s		–	%
Seasonal efficiency according to ČSN EN 14825:2023	Heating	Average	**SCOP**		**<u>4.25</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	$\mathbf{P_{designh}}$		**<u>7.68</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}		3732	kWh
		Warmer	Q_{HE}		–	kWh
		Colder	Q_{HE}		–	kWh
Modes other than „active mode“	Off mode			P_{OFF}	20.3	W
	Thermostat off mode			P_{TO}	20.1	W
	Standby mode			P_{SB}	20.3	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}	0.0201	[kW]
P_{SB}	0.0203	[kW]
P_{CK}	0.0000	[kW]
P_{OFF}	0.0203	[kW]
$P_{designh}$	7.68	[kW]
$SCOP_{ON}$	4.26	[–]

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]

$Q_H = 7.68 \cdot 2066 = 15872$ [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]

$Q_{HE} = 15872 / 4.26 + 178 \cdot 0.0201 + 0 \cdot 0.0203 + 178 \cdot 0 + 0 \cdot 0.0203 = 3732$ [kWh]

7.2 General formula for calculation of reference SCOP

$SCOP = Q_H / Q_{HE}$ [–]

$SCOP = 15872 / 3732 = 4.25$ [–]

7.1 Calculation of the seasonal space heating efficiency η_s

$\Sigma F(i) = F(1) + F(2)$ [–]

$\Sigma F = 0.03 + 0 = 0.03$ [–]

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

$\eta_s (A) = (1 / 2.5) \cdot 4.25 - 0.03 =$ **1.671** [–]

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/W28.3**
Date of testing		**2024-10-21**	**2024-10-23**	**2024-10-24**
Transient test procedure	YES / NO	YES	YES	NO
Average defrost time of 1 cycle	[min]	4.0	4.3	–
Average time of 1 cycle	[min]	83.9	102.8	–
Calculation time	[min]	83.9	102.8	70.0
Output heating water – temperature calculation	[°C]	33.62	29.55	28.26
Input heating water – temperature calculation	[°C]	28.97	25.02	23.26
Output heating water temperature	[°C]	34.03	29.98	28.26
Input heating water temperature	[°C]	28.98	25.02	23.26
Air temperature – dry bulb temperature	[°C]	-7.03	2.00	7.02
Air temperature – wet bulb temperature	[°C]	-8.02	1.01	6.03
Relative humidity	[%]	74.83	83.83	86.92
Barometric pressure	[kPa]	99.804	100.289	99.795
Ambient temperature	[°C]	-6.89	2.10	7.13
Secondary circuit pressure difference	[kPa]	-12.501	-4.905	-3.263
Efficiency of the secondary liquid pump	[–]	0.168	0.126	0.119
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	1.2605	0.7769	0.6231
Density of heating water	[$kg \cdot m^{-3}$]	994.5	995.7	996.1
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.175	4.176	4.176
Voltage	[V]	398.88	402.57	399.79
Total current	[A]	11.42	5.43	3.68
Overall power input	[kW]	2.493	0.998	0.596
Capacity correction of sec. liquid pump	[W]	-21.594	-7.371	-4.163
Power input correction of sec. liquid pump	[W]	-26.00	-8.44	-4.73
Heating capacity – heating water	[kW]	6.774	4.052	3.590
Corrected heating capacity – heating water	**[kW]**	**6.796**	**4.060**	**3.594**
Uncertainty of corrected heating capacity	[kW]	± 0.125	± 0.077	± 0.062
Effective electric power input	**[kW]**	**2.519**	**1.007**	**0.600**
COP	**[–]**	**2.698**	**4.032**	**5.987**
Uncertainty of COP	[–]	± 0.050	± 0.077	± 0.104
Control settings	**[rps]**	**102**	**47**	**31**
Circulation pump settings – heating water	[–]	–	–	–

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/W27.55**	**A-10/W35**
Date of testing		**2024-10-24**	**2024-10-22**
Transient test procedure	YES / NO	NO	YES
Average defrost time of 1 cycle	[min]	–	11.3
Average time of 1 cycle	[min]	–	91.2
Calculation time	[min]	70.0	91.2
Output heating water – temperature calculation	[°C]	27.56	34.01
Input heating water – temperature calculation	[°C]	22.57	30.00
Output heating water temperature	[°C]	27.56	35.02
Input heating water temperature	[°C]	22.57	30.02
Air temperature – dry bulb temperature	[°C]	11.99	-10.05
Air temperature – wet bulb temperature	[°C]	11.00	-11.08
Relative humidity	[%]	89.10	68.52
Barometric pressure	[kPa]	99.958	99.740
Ambient temperature	[°C]	12.10	-9.91
Secondary circuit pressure difference	[kPa]	-4.119	-13.659
Efficiency of the secondary liquid pump	[–]	0.123	0.177
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	0.7091	1.3435
Density of heating water	[$kg \cdot m^{-3}$]	996.3	994.3
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.177	4.175
Voltage	[V]	400.87	401.55
Total current	[A]	3.57	13.45
Overall power input	[kW]	0.550	2.984
Capacity correction of sec. liquid pump	[W]	-5.804	-23.547
Power input correction of sec. liquid pump	[W]	-6.62	-28.73
Heating capacity – heating water	[kW]	4.079	6.567
Corrected heating capacity – heating water	**[kW]**	**4.085**	**6.590**
Uncertainty of corrected heating capacity	[kW]	± 0.071	± 0.133
Effective electric power input	**[kW]**	**0.557**	**3.013**
COP	**[–]**	**7.336**	**2.187**
Uncertainty of COP	[–]	± 0.128	± 0.044
Control settings	**[rps]**	**31**	**120**
Circulation pump settings – heating water	[–]	–	–

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	6.80	6.796	2.698	0.900	1.00	2.698	–
B	2	30.00	53.85	4.14	4.060	4.032	0.900	1.00	4.032	–
C	7	28.30	34.62	2.66	3.594	5.987	0.967	0.74	5.917	0.0201
D	12	27.55	15.38	1.18	4.085	7.336	0.964	0.29	6.739	0.0201
TOL (E)	-10	35.00	100.00	7.68	6.590	2.187	0.900	1.00	2.187	–
Tbiv (F)	-7	34.00	88.46	6.80	6.796	2.698	0.900	1.00	2.698	–

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	4.085	[kW]
Declared capacity $_{standard\,rating\,condition\,A7/W35}$	–	[kW]
Part load	1.18	[kW]

Calculation of water temperature

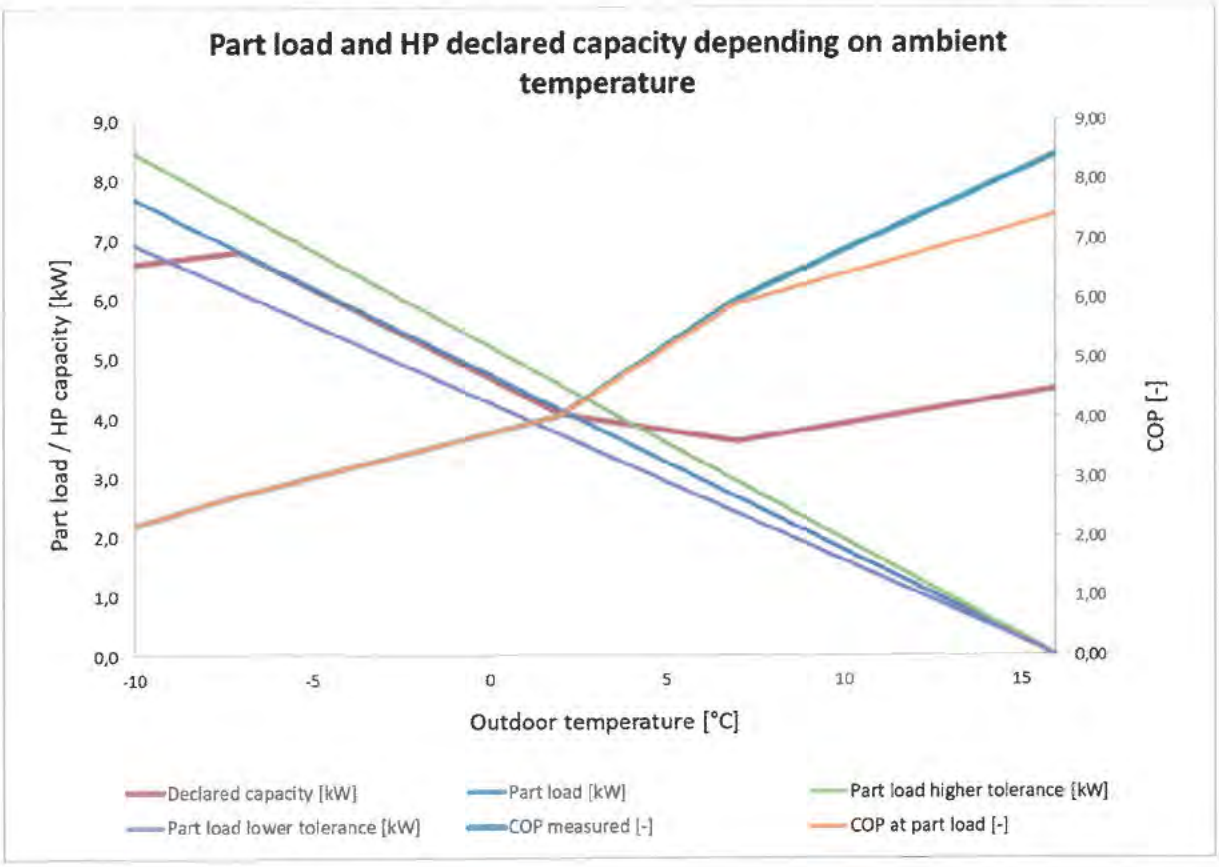
$t_{outlet,\,capacity\,test,\,variable\,flow} = 24 + 5 - 1.18 / 4.085 \cdot 5 =$ **27.55** [°C]

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 Ph(Tj)		hj x (Ph(Tj) - elbu(Tj))	
	[–]	[°C]	[h]	[%]	[kW]	[kW]	[kW]	[kW]	[kWh]	[–]	[kWh]	[kWh]	[kWh]	[kWh]
TOL(E)	21	-10	1	100.00	7.68	6.59	6.59	1.09	1.09	2.19	8	4	7	3
	22	-9	25	96.15	7.39	6.66	6.66	0.73	18.21	2.36	185	89	166	71
	23	-8	23	92.31	7.09	6.73	6.73	0.36	8.37	2.53	163	70	155	61
A, Tbiv (F)	24	-7	24	88.46	6.80	6.80	6.80	0.00	0.00	2.70	163	60	163	60
	25	-6	27	84.62	6.50	6.49	6.49	0.00	0.00	2.85	176	62	176	62
	26	-5	68	80.77	6.21	6.19	6.19	0.00	0.00	2.99	422	141	422	141
	27	-4	91	76.92	5.91	5.88	5.88	0.00	0.00	3.14	538	171	538	171
	28	-3	89	73.08	5.61	5.58	5.58	0.00	0.00	3.29	500	152	500	152
	29	-2	165	69.23	5.32	5.28	5.28	0.00	0.00	3.44	878	255	878	255
	30	-1	173	65.38	5.02	4.97	4.97	0.00	0.00	3.59	869	242	869	242
	31	0	240	61.54	4.73	4.67	4.67	0.00	0.00	3.74	1135	304	1135	304
	32	1	280	57.69	4.43	4.36	4.36	0.00	0.00	3.88	1241	320	1241	320
B	33	2	320	53.85	4.14	4.06	4.06	0.00	0.00	4.03	1324	328	1324	328
	34	3	357	50.00	3.84	3.97	3.84	0.00	0.00	4.41	1371	311	1371	311
	35	4	356	46.15	3.55	3.87	3.55	0.00	0.00	4.79	1262	264	1262	264
	36	5	303	42.31	3.25	3.78	3.25	0.00	0.00	5.16	985	191	985	191
	37	6	330	38.46	2.95	3.69	2.95	0.00	0.00	5.54	975	176	975	176
C	38	7	326	34.62	2.66	3.59	2.66	0.00	0.00	5.92	867	147	867	147
	39	8	348	30.77	2.36	3.69	2.36	0.00	0.00	6.08	823	135	823	135
	40	9	335	26.92	2.07	3.79	2.07	0.00	0.00	6.25	693	111	693	111
	41	10	315	23.08	1.77	3.89	1.77	0.00	0.00	6.41	558	87	558	87
	42	11	215	19.23	1.48	3.99	1.48	0.00	0.00	6.57	318	48	318	48
D	43	12	169	15.38	1.18	4.09	1.18	0.00	0.00	6.74	200	30	200	30
	44	13	151	11.54	0.89	4.18	0.89	0.00	0.00	6.90	134	19	134	19
	45	14	105	7.69	0.59	4.28	0.59	0.00	0.00	7.07	62	9	62	9
	46	15	74	3.85	0.30	4.38	0.30	0.00	0.00	7.23	22	3	22	3
		Σ	4910							Σ	15869	3728	15841	3700

SCOPon	4.26	SCOPnet	4.28
		SCOP	**4.25**

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 **Termet Heat Titanium Pro 8**
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		**132.8**	%	
		Warmer	η_s		–	%	
		Colder	η_s		–	%	
Seasonal efficiency according to ČSN EN 14825:2023	Heating	Average	**SCOP**		**3.39**	–	
		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	**$P_{designh}$**		**7.55**	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}		4596	kWh	
		Warmer	Q_{HE}		–	kWh	
		Colder	Q_{HE}		–	kWh	
Modes other than „active mode“	Off mode			P_{OFF}	20.3	W	
	Thermostat off mode			P_{TO}	20.1	W	
	Standby mode			P_{SB}	20.3	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}	0.0201	[kW]
P_{SB}	0.0203	[kW]
P_{CK}	0.0000	[kW]
P_{OFF}	0.0203	[kW]
$P_{designh}$	7.55	[kW]
$SCOP_{ON}$	3.40	[–]

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]

$Q_H = 7.55 \cdot 2066 = 15599$ [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]

$Q_{HE} = 15599 / 3.4 + 178 \cdot 0.0201 + 0 \cdot 0.0203 + 178 \cdot 0 + 0 \cdot 0.0203 = 4596$ [kWh]

7.2 General formula for calculation of reference SCOP

$SCOP = Q_H / Q_{HE}$ [–]

$SCOP = 15599 / 4596 = 3.39$ [–]

7.1 Calculation of the seasonal space heating efficiency η_s

$\Sigma F(i) = F(1) + F(2)$ [–]

$\Sigma F = 0.03 + 0 = 0.03$ [–]

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

$\eta_s (A) = (1 / 2.5) \cdot 3.39 - 0.03 =$ **1.328** [–]

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/W37.94**
Date of testing		**2024-10-22**	**2024-10-23**	**2024-10-25**
Transient test procedure	YES / NO	YES	YES	NO
Average defrost time of 1 cycle	[min]	3.3	3.1	–
Average time of 1 cycle	[min]	82.8	108.9	–
Calculation time	[min]	165.6	108.9	70.0
Output heating water – temperature calculation	[°C]	51.47	41.45	37.87
Input heating water – temperature calculation	[°C]	43.98	34.46	31.88
Output heating water temperature	[°C]	51.98	41.95	37.87
Input heating water temperature	[°C]	43.98	34.44	31.88
Air temperature – dry bulb temperature	[°C]	-7.02	1.99	6.99
Air temperature – wet bulb temperature	[°C]	-7.97	1.00	6.02
Relative humidity	[%]	75.85	83.90	87.09
Barometric pressure	[kPa]	99.806	100.329	99.503
Ambient temperature	[°C]	-6.90	2.09	7.10
Secondary circuit pressure difference	[kPa]	-4.767	-2.148	-2.115
Efficiency of the secondary liquid pump	[–]	0.125	0.116	0.116
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	0.7727	0.5000	0.5006
Density of heating water	[$kg \cdot m^{-3}$]	987.7	991.8	993.1
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.178	4.176	4.175
Voltage	[V]	400.96	401.73	401.02
Total current	[A]	14.93	6.27	4.29
Overall power input	[kW]	3.339	1.221	0.735
Capacity correction of sec. liquid pump	[W]	-7.163	-2.272	-2.240
Power input correction of sec. liquid pump	[W]	-8.19	-2.57	-2.53
Heating capacity – heating water	[kW]	6.672	4.025	3.451
Corrected heating capacity – heating water	**[kW]**	**6.679**	**4.028**	**3.453**
Uncertainty of corrected heating capacity	[kW]	± 0.078	± 0.051	± 0.050
Effective electric power input	**[kW]**	**3.347**	**1.224**	**0.737**
COP	**[–]**	**1.995**	**3.291**	**4.684**
Uncertainty of COP	[–]	± 0.024	± 0.042	± 0.068
Control settings	**[rps]**	**102**	**47**	**31**
Circulation pump settings – heating water	[–]	–	–	–

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/W35.68**	**A-10/W55**
Date of testing		**2024-10-24**	**2024-10-22**
Transient test procedure	YES / NO	NO	YES
Average defrost time of 1 cycle	[min]	–	3.1
Average time of 1 cycle	[min]	–	82.6
Calculation time	[min]	70.0	165.3
Output heating water – temperature calculation	[°C]	35.71	54.58
Input heating water – temperature calculation	[°C]	28.74	46.99
Output heating water temperature	[°C]	35.71	55.02
Input heating water temperature	[°C]	28.74	46.99
Air temperature – dry bulb temperature	[°C]	12.02	-10.02
Air temperature – wet bulb temperature	[°C]	11.02	-11.05
Relative humidity	[%]	88.96	68.58
Barometric pressure	[kPa]	100.158	99.723
Ambient temperature	[°C]	12.12	-9.91
Secondary circuit pressure difference	[kPa]	-2.103	-5.615
Efficiency of the secondary liquid pump	[–]	0.116	0.129
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	0.4994	0.8449
Density of heating water	[$kg \cdot m^{-3}$]	993.9	986.2
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.175	4.179
Voltage	[V]	402.41	400.83
Total current	[A]	4.04	18.93
Overall power input	[kW]	0.673	4.264
Capacity correction of sec. liquid pump	[W]	-2.223	-8.934
Power input correction of sec. liquid pump	[W]	-2.52	-10.27
Heating capacity – heating water	[kW]	4.011	7.439
Corrected heating capacity – heating water	**[kW]**	**4.013**	**7.448**
Uncertainty of corrected heating capacity	[kW]	± 0.051	± 0.086
Effective electric power input	**[kW]**	**0.675**	**4.274**
COP	**[–]**	**5.945**	**1.742**
Uncertainty of COP	[–]	± 0.075	± 0.020
Control settings	**[rps]**	**31**	**120**
Circulation pump settings – heating water	[–]	–	–

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	6.68	6.679	1.995	0.900	1.00	1.995	–
B	2	42.00	53.85	4.07	4.028	3.291	0.900	1.00	3.291	–
C	7	37.94	34.62	2.61	3.453	4.684	0.973	0.76	4.643	0.0201
D	12	35.68	15.38	1.16	4.013	5.945	0.970	0.29	5.540	0.0201
TOL (E)	-10	55.00	100.00	7.55	7.448	1.742	0.900	1.00	1.742	–
Tbiv (F)	-7	52.00	88.46	6.68	6.679	1.995	0.900	1.00	1.995	–

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	4.013	[kW]
Declared capacity $_{standard\,rating\,condition\,A7/W55}$	–	[kW]
Part load	1.16	[kW]

Calculation of water temperature

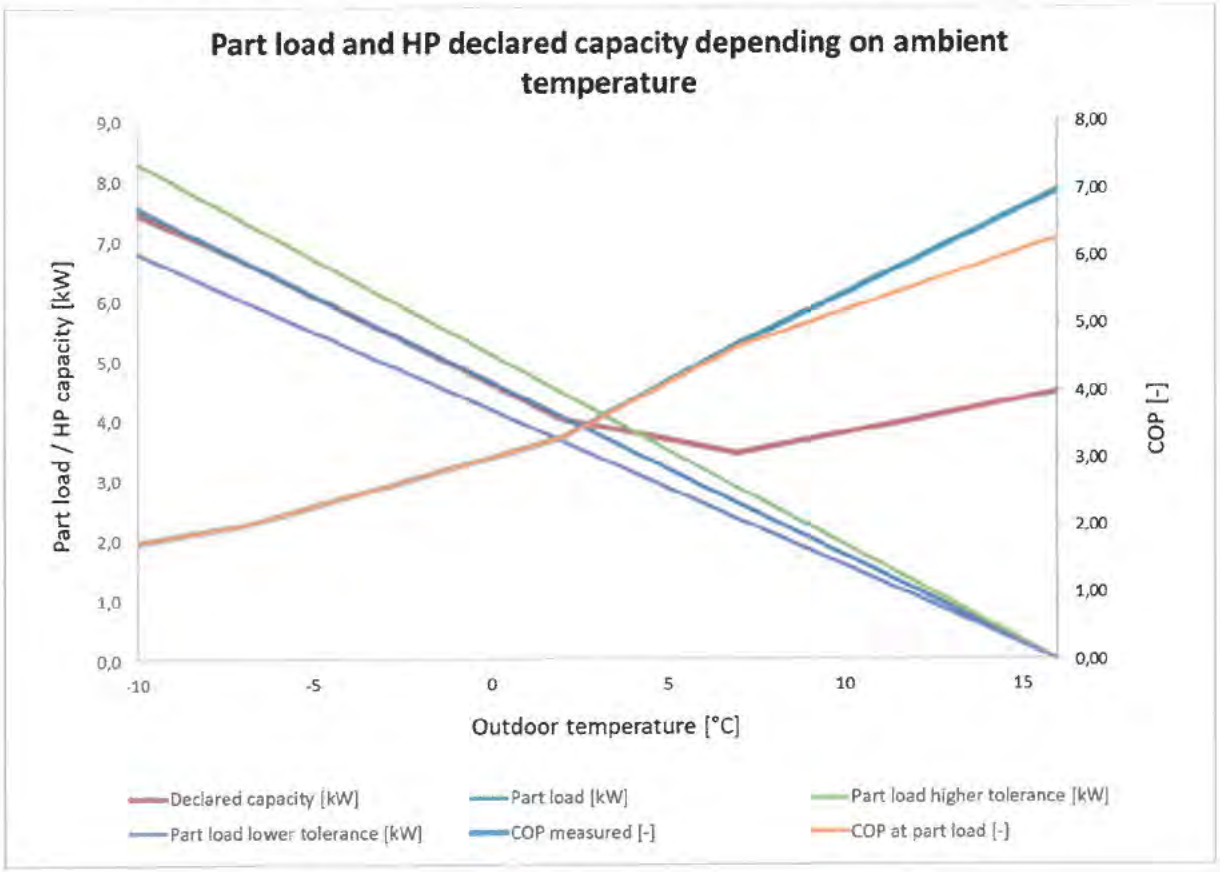
$t_{outlet,\,capacity\,test,\,variable\,flow} = 30 + 8 - 1.16 / 4.013 \cdot 8 =$ **35.68** [°C]

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	7.55	7.45	7.45	0.10	0.10	1.74	8	4	7	4
	22	-9	25	96.15	7.26	7.19	7.19	0.07	1.70	1.83	181	100	180	98
	23	-8	23	92.31	6.97	6.94	6.94	0.03	0.78	1.91	160	84	160	83
A. Tbiv (F)	24	-7	24	88.46	6.68	6.68	6.68	0.00	0.00	2.00	160	80	160	80
	25	-6	27	84.62	6.39	6.38	6.38	0.00	0.00	2.14	172	81	172	81
	26	-5	68	80.77	6.10	6.09	6.09	0.00	0.00	2.28	415	182	415	182
	27	-4	91	76.92	5.81	5.80	5.80	0.00	0.00	2.43	529	218	529	218
	28	-3	89	73.08	5.52	5.50	5.50	0.00	0.00	2.57	491	191	491	191
	29	-2	165	69.23	5.23	5.21	5.21	0.00	0.00	2.72	862	318	862	318
	30	-1	173	65.38	4.94	4.91	4.91	0.00	0.00	2.86	854	299	854	299
	31	0	240	61.54	4.65	4.62	4.62	0.00	0.00	3.00	1115	371	1115	371
	32	1	280	57.69	4.36	4.32	4.32	0.00	0.00	3.15	1220	388	1220	388
B	33	2	320	53.85	4.07	4.03	4.03	0.00	0.00	3.29	1301	395	1301	395
	34	3	357	50.00	3.78	3.91	3.78	0.00	0.00	3.56	1348	378	1348	378
	35	4	356	46.15	3.48	3.80	3.48	0.00	0.00	3.83	1241	324	1241	324
	36	5	303	42.31	3.19	3.68	3.19	0.00	0.00	4.10	968	236	968	236
	37	6	330	38.46	2.90	3.57	2.90	0.00	0.00	4.37	958	219	958	219
C	38	7	326	34.62	2.61	3.45	2.61	0.00	0.00	4.64	852	183	852	183
	39	8	348	30.77	2.32	3.57	2.32	0.00	0.00	4.82	808	168	808	168
	40	9	335	26.92	2.03	3.68	2.03	0.00	0.00	5.00	681	136	681	136
	41	10	315	23.08	1.74	3.79	1.74	0.00	0.00	5.18	549	106	549	106
	42	11	215	19.23	1.45	3.90	1.45	0.00	0.00	5.36	312	58	312	58
D	43	12	169	15.38	1.16	4.01	1.16	0.00	0.00	5.54	196	35	196	35
	44	13	151	11.54	0.87	4.13	0.87	0.00	0.00	5.72	132	23	132	23
	45	14	105	7.69	0.58	4.24	0.58	0.00	0.00	5.90	61	10	61	10
	46	15	74	3.85	0.29	4.35	0.29	0.00	0.00	6.08	21	4	21	4
		Σ	4910							Σ	15596	4592	15593	4589

SCOPon	3.40	SCOPnet	3.40
		SCOP	**3.39**

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

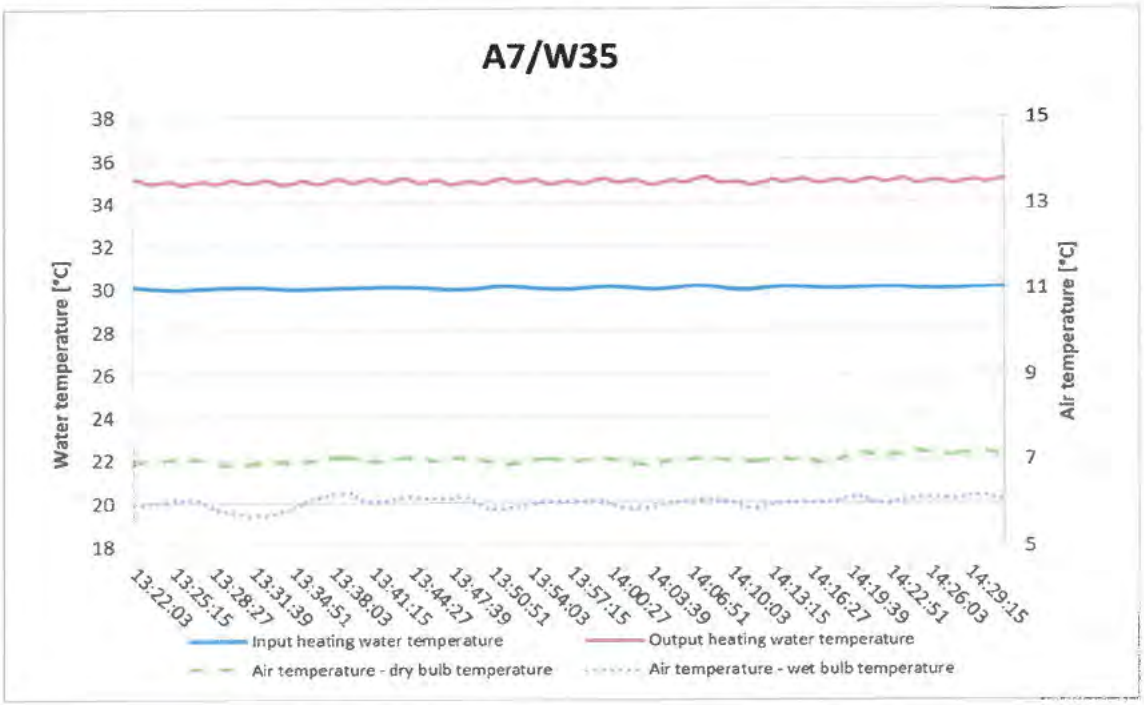


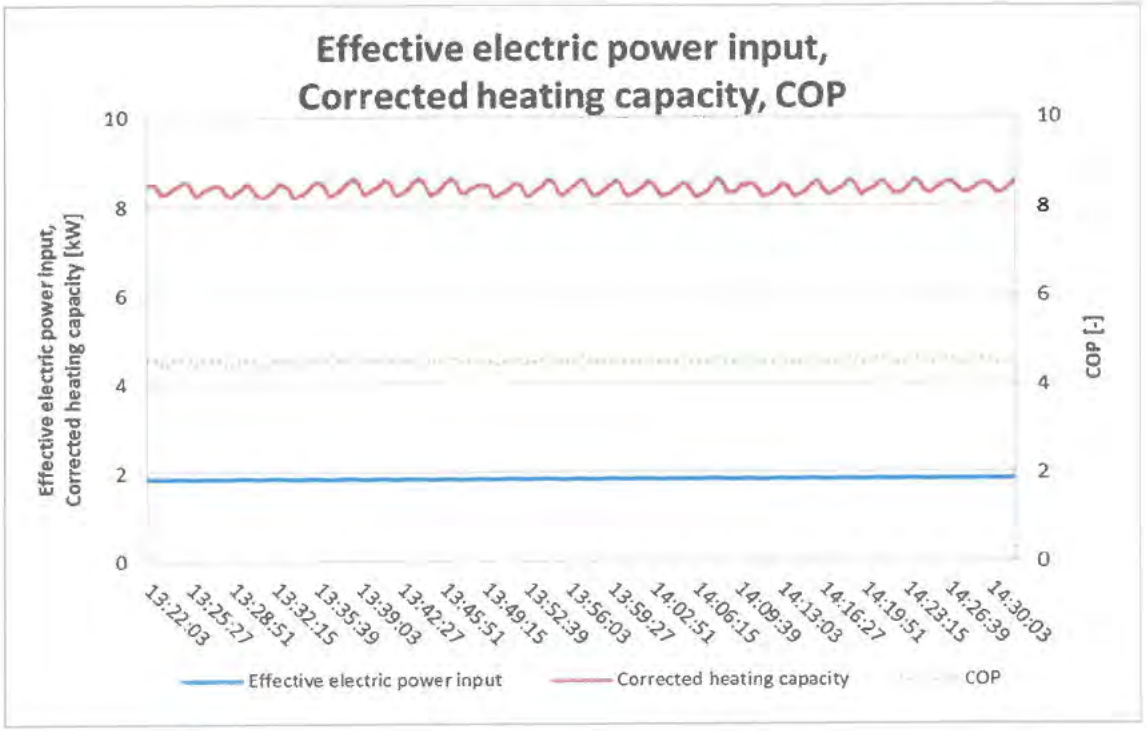
Tested by:	Ing. Jakub Čederle	Date:	2024-10-25	Signed:	Čederle
Reviewed and approved by:	Ing. Michal Faltýnek	Date:	2024-10-25	Signed:	Faltýnek

V. Graphs

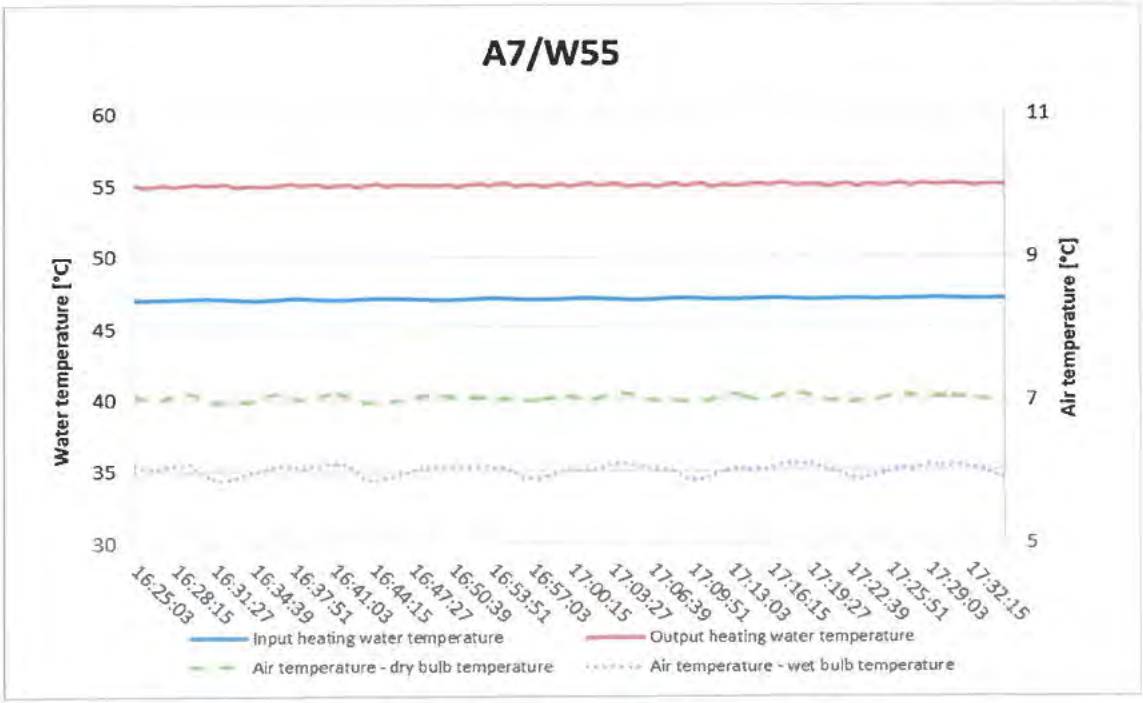
1. Rating conditions

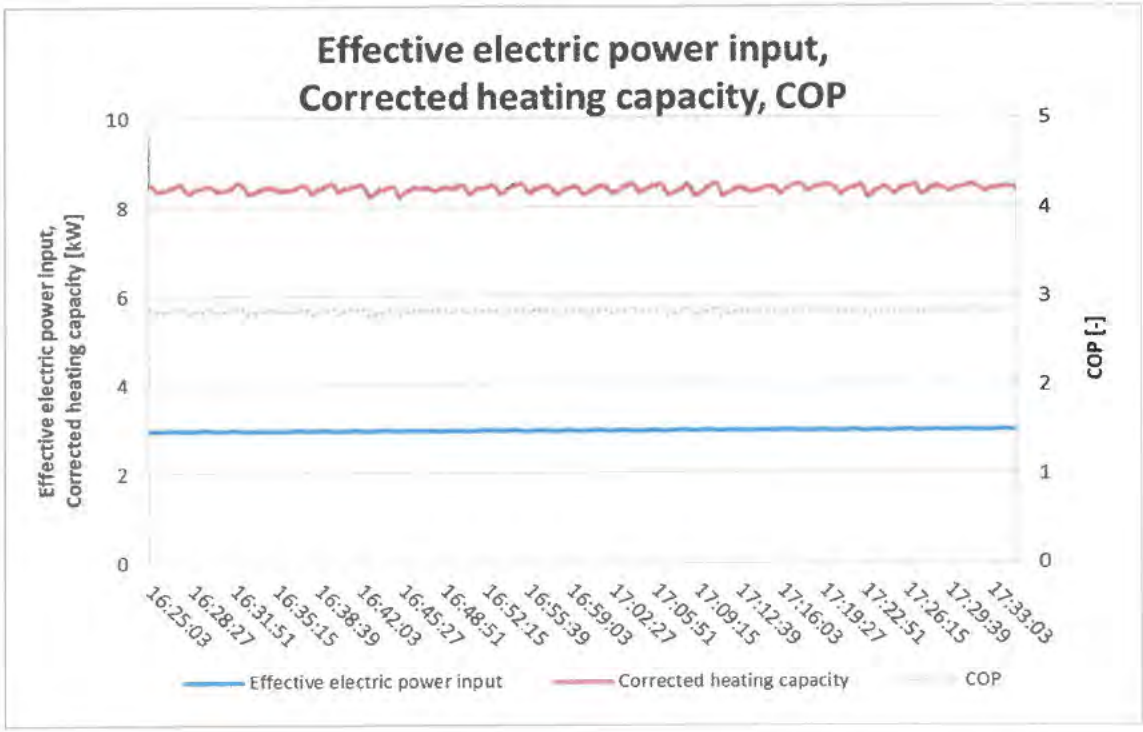
A7/W35 (75 rps)





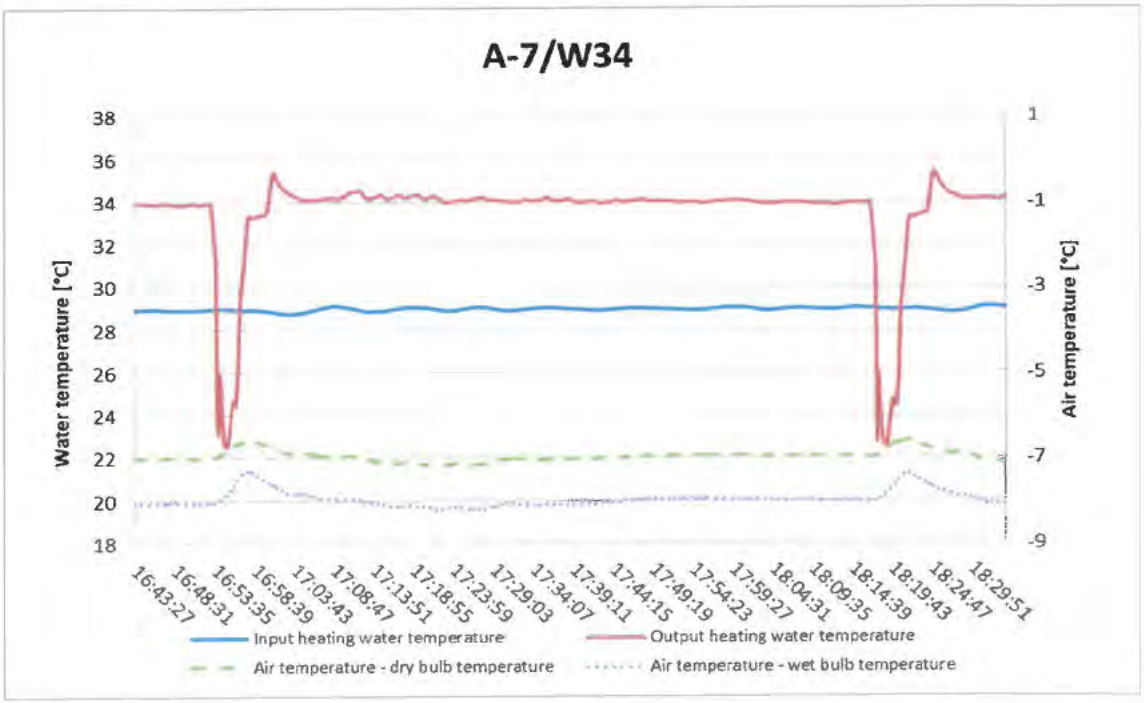
A7/W55 (84 rps)

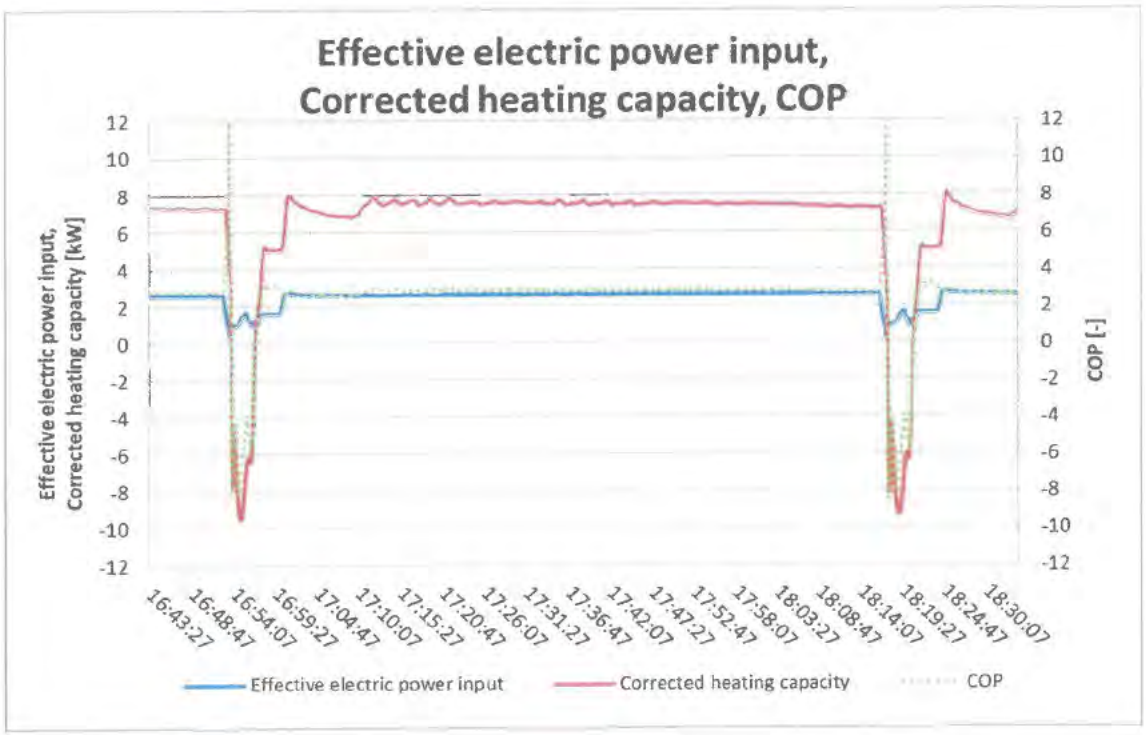

A7/W55
Water temperature [°C]
Air temperature [°C]
60
55
50
45
40
35
30
11
9
7
5
16:25:03
16:28:15
16:31:27
16:34:39
16:37:51
16:41:03
16:44:15
16:47:27
16:50:39
16:53:51
16:57:03
17:00:15
17:03:27
17:06:39
17:09:51
17:13:03
17:16:15
17:19:27
17:22:39
17:25:51
17:29:03
17:32:15
Input heating water temperature
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 [-]
10
8
6
4
2
0
5
4
3
2
1
0
16:25:03
16:28:27
16:31:51
16:35:15
16:38:39
16:42:03
16:45:27
16:48:51
16:52:15
16:55:39
16:59:03
17:02:27
17:05:51
17:09:15
17:12:39
17:16:03
17:19:27
17:22:51
17:26:15
17:29:39
17:33:03
Effective electric power input
Corrected heating capacity
COP

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

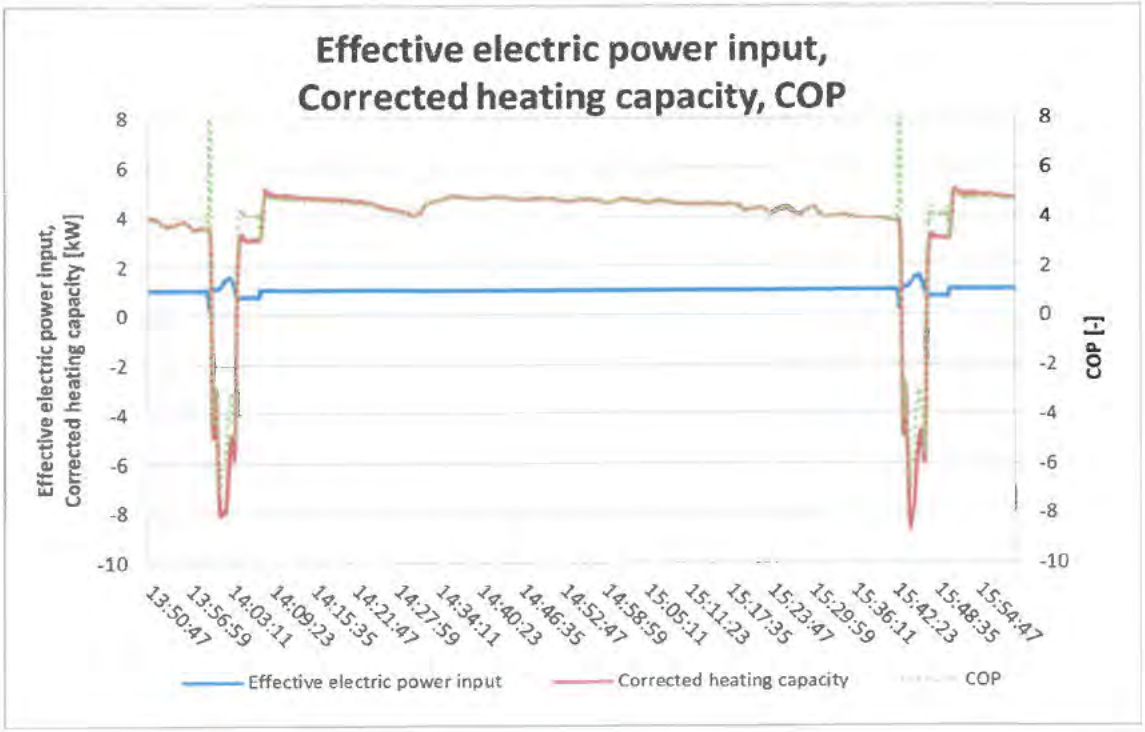
A-7/W34 (102 rps)



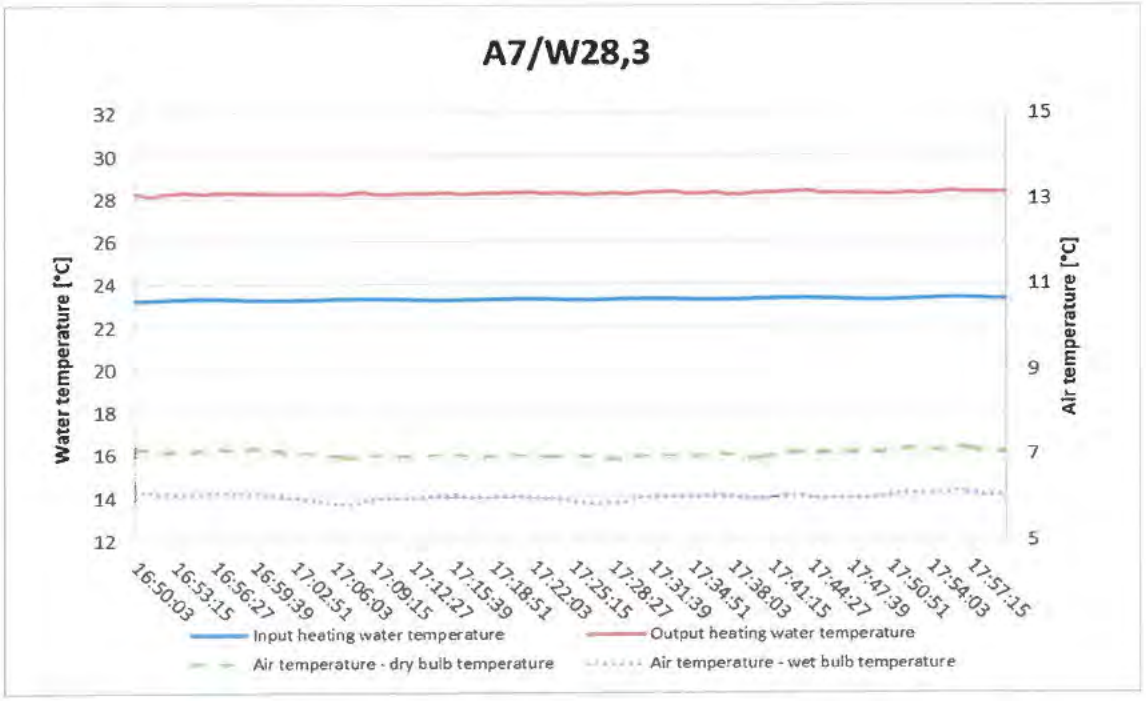


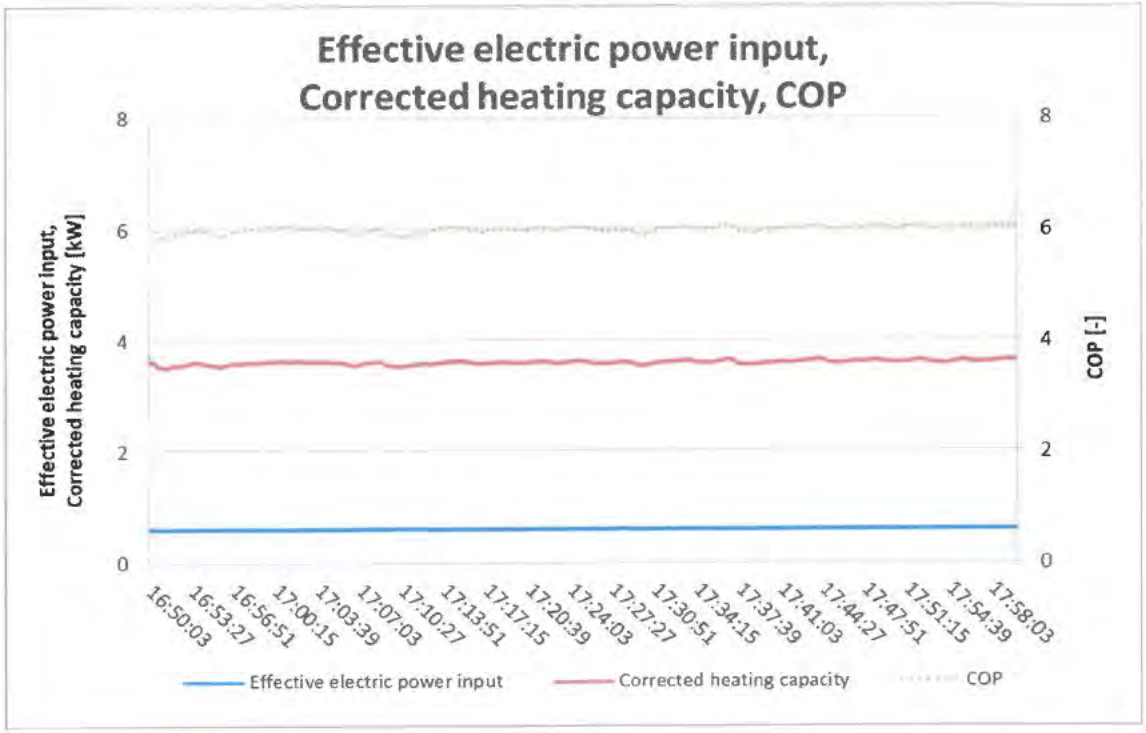
A2/W30 (47 rps)


A2/W30
Water temperature [°C]
Air temperature [°C]
34
32
30
28
26
24
22
20
18
16
14
10
8
6
4
2
0
13:50:47
13:56:43
14:02:39
14:08:35
14:14:31
14:20:27
14:26:23
14:32:19
14:38:15
14:44:11
14:50:07
14:56:03
15:01:59
15:07:55
15:13:51
15:19:47
15:25:43
15:31:39
15:37:35
15:43:31
15:49:27
15:55:23
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature

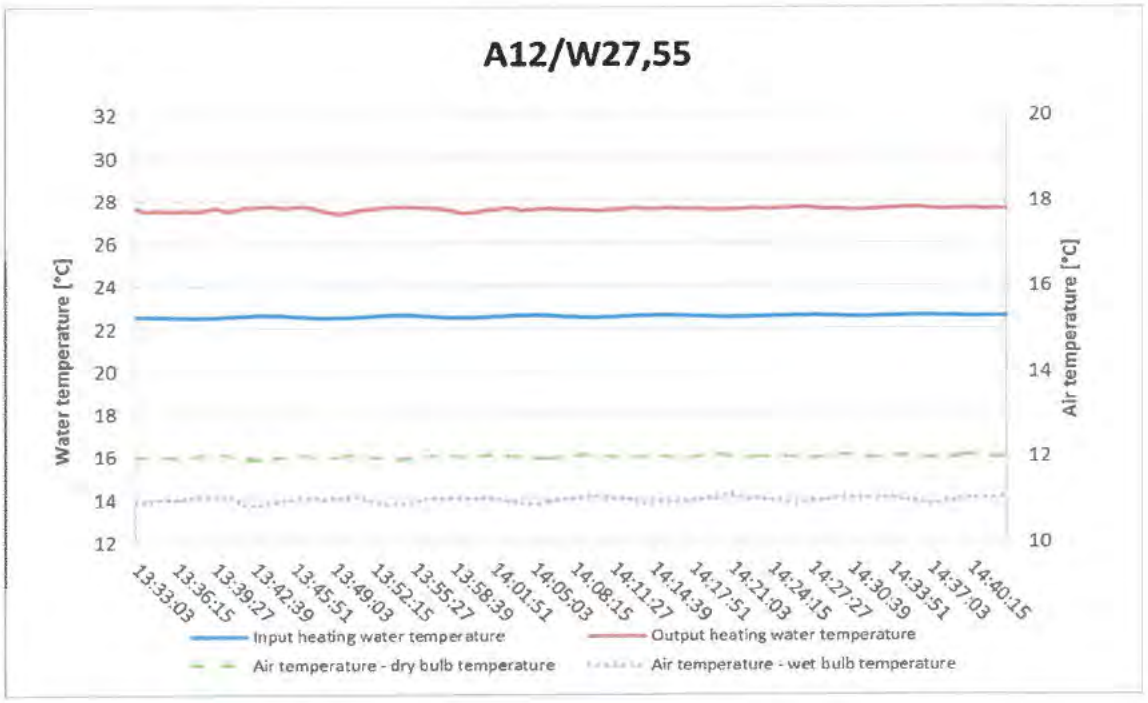

Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
8
6
4
2
0
-2
-4
-6
-8
-10
13:50:47
13:56:59
14:03:11
14:09:23
14:15:35
14:21:47
14:27:59
14:34:11
14:40:23
14:46:35
14:52:47
14:58:59
15:05:11
15:11:23
15:17:35
15:23:47
15:29:59
15:36:11
15:42:23
15:48:35
15:54:47
Effective electric power input
Corrected heating capacity
COP

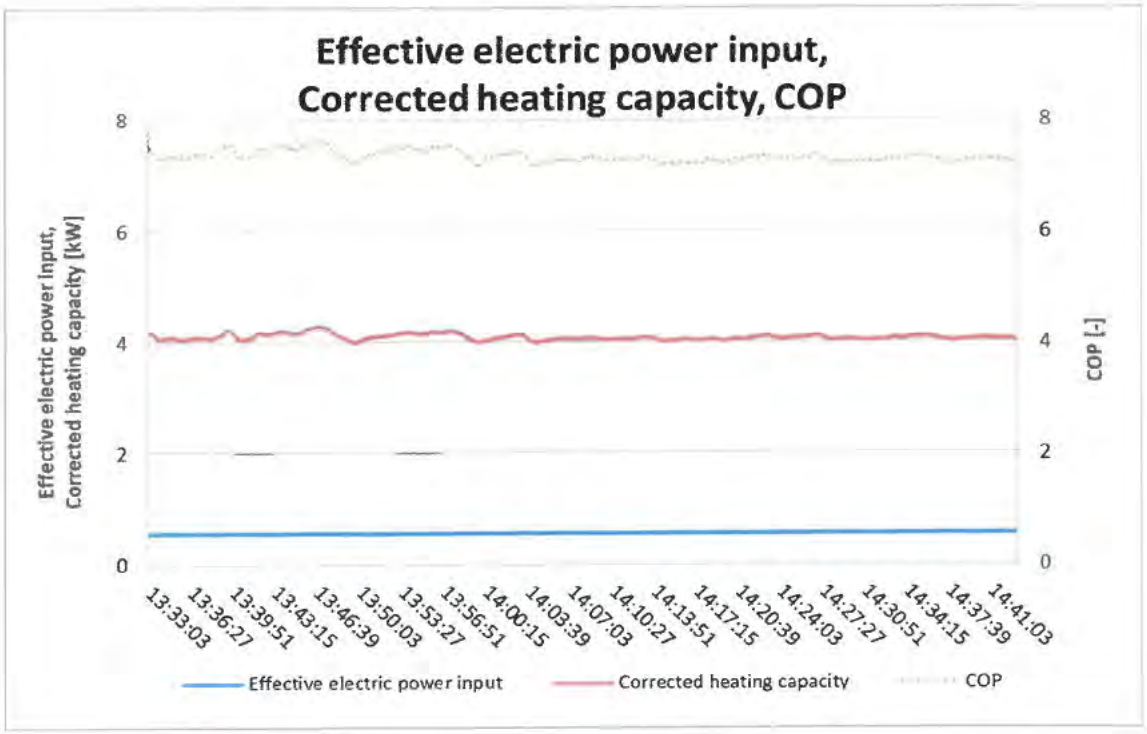
A7/W28.3 (31 rps)



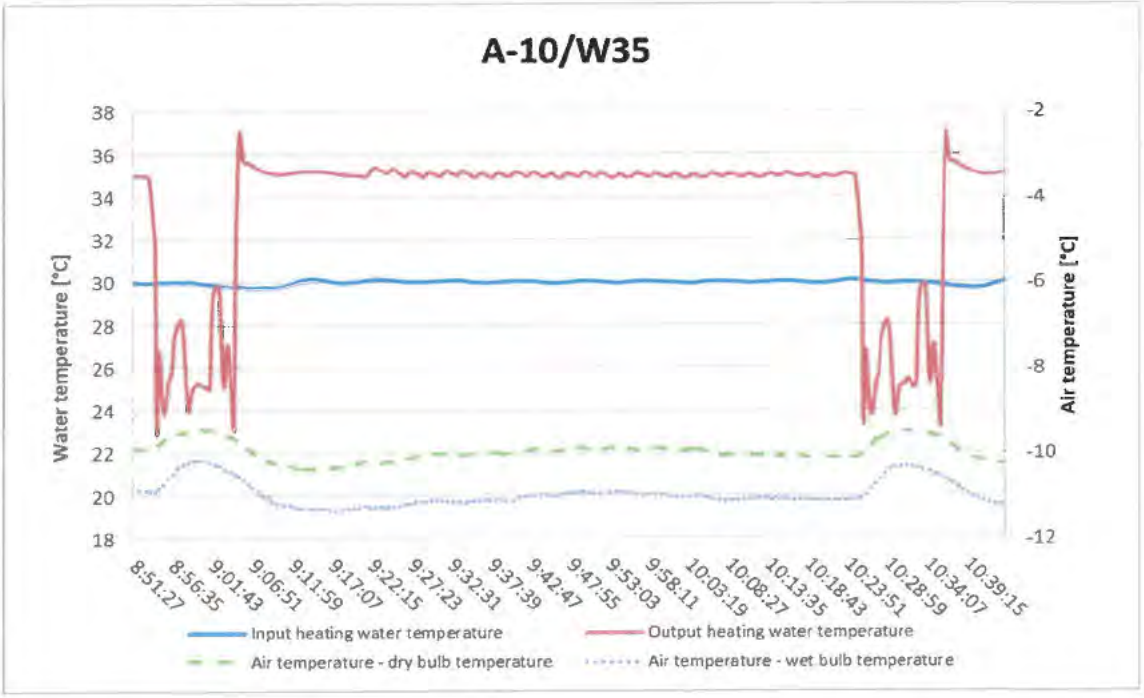


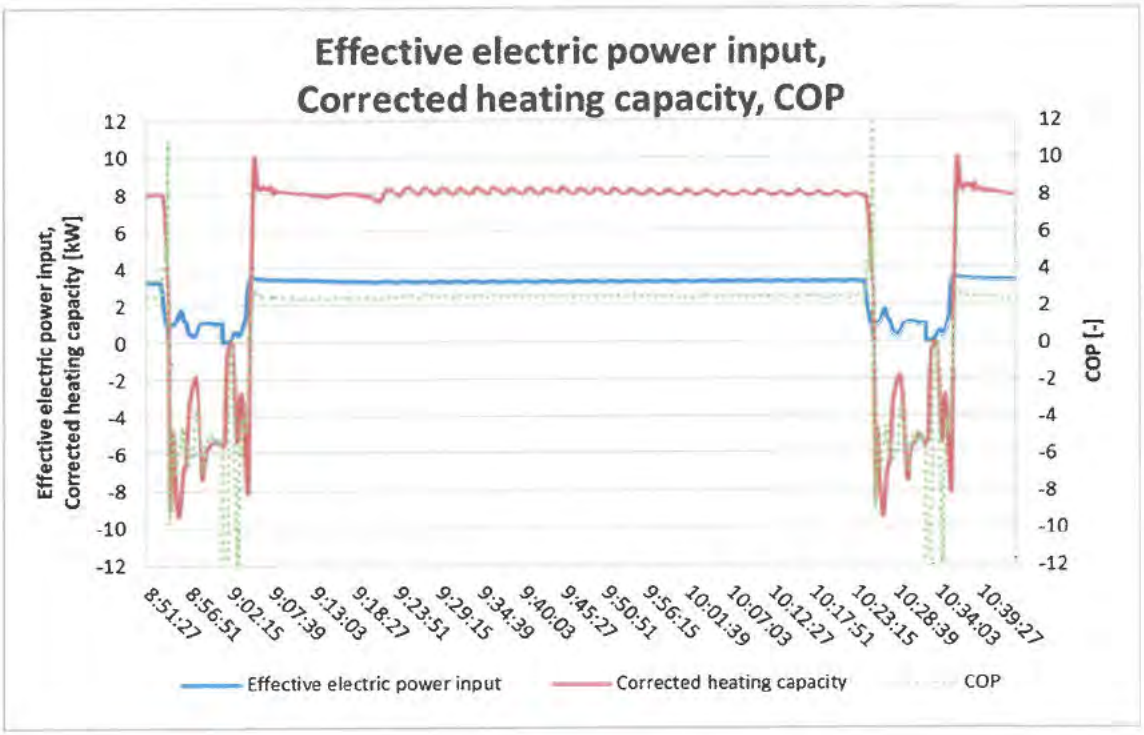
A12/W27.55 (31 rps)





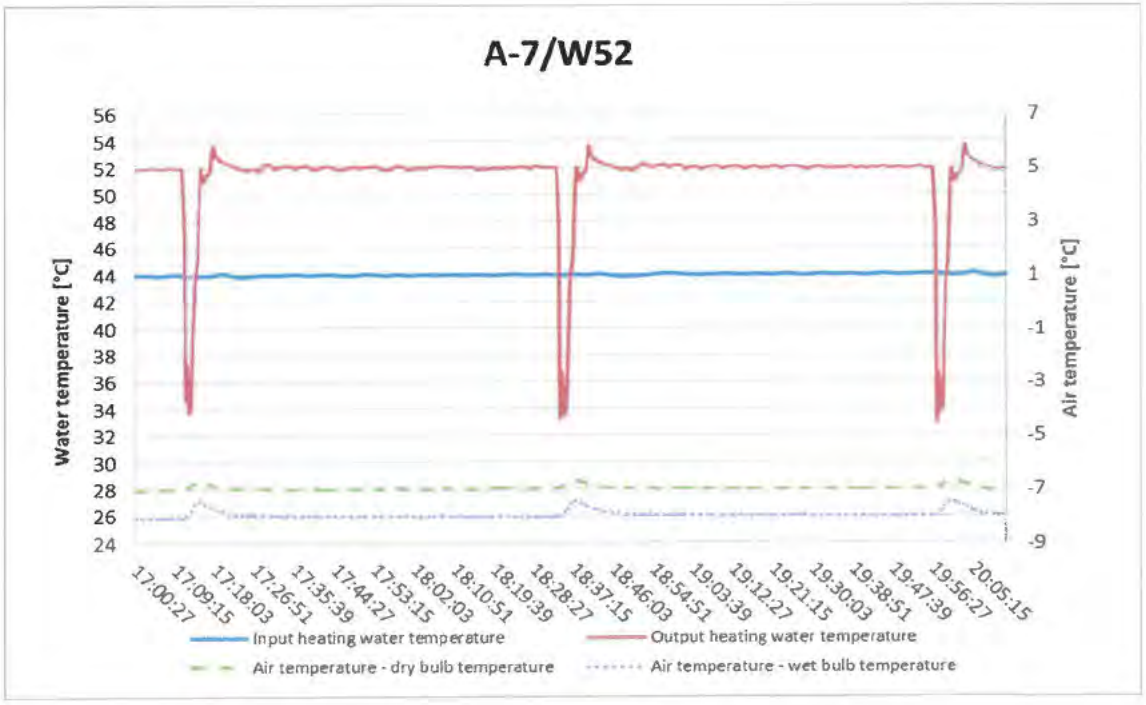
A-10/W35 (120 rps)

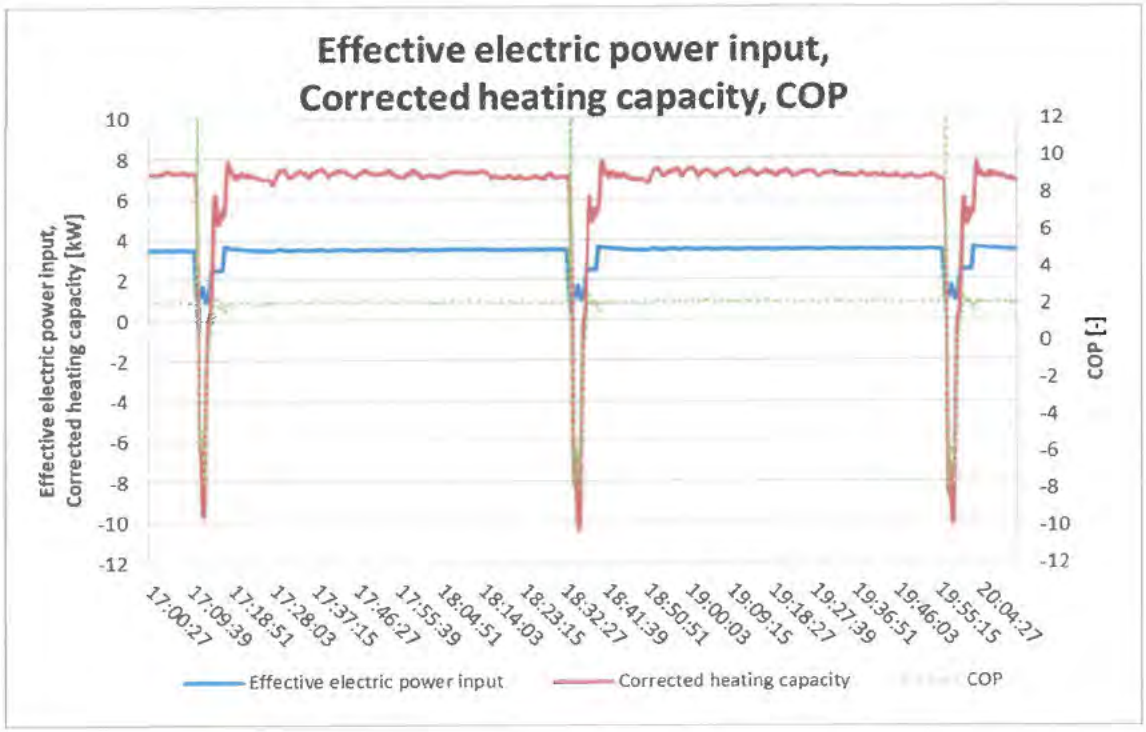




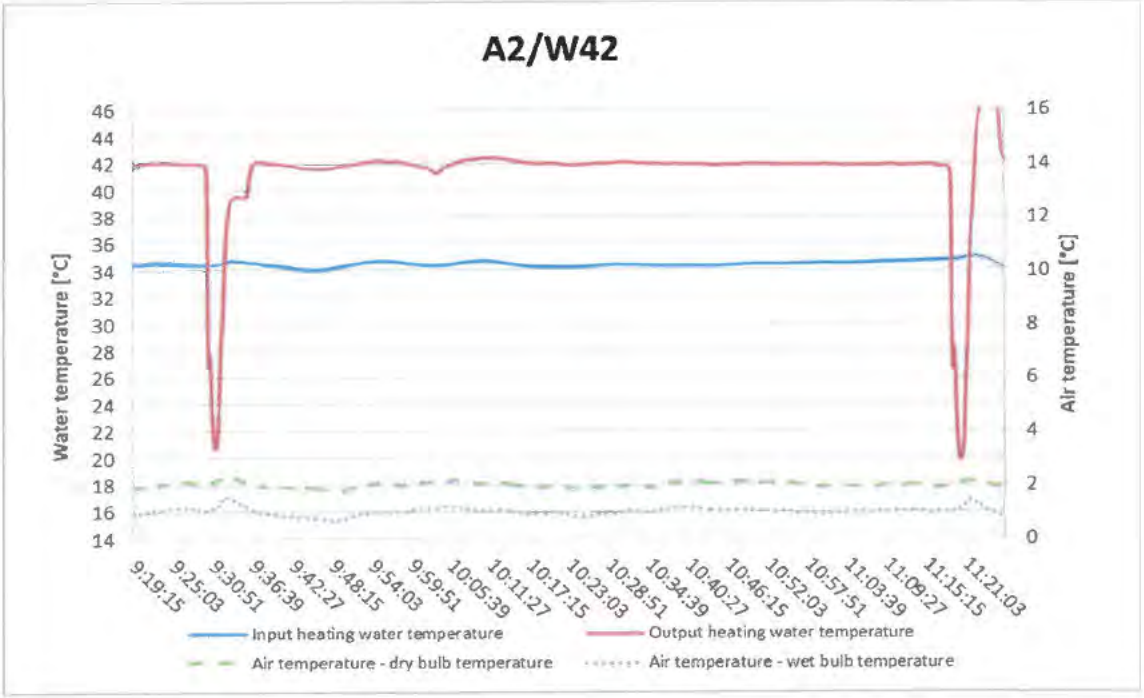
3. Seasonal performance tests and SCOP calculation – Medium temperature application

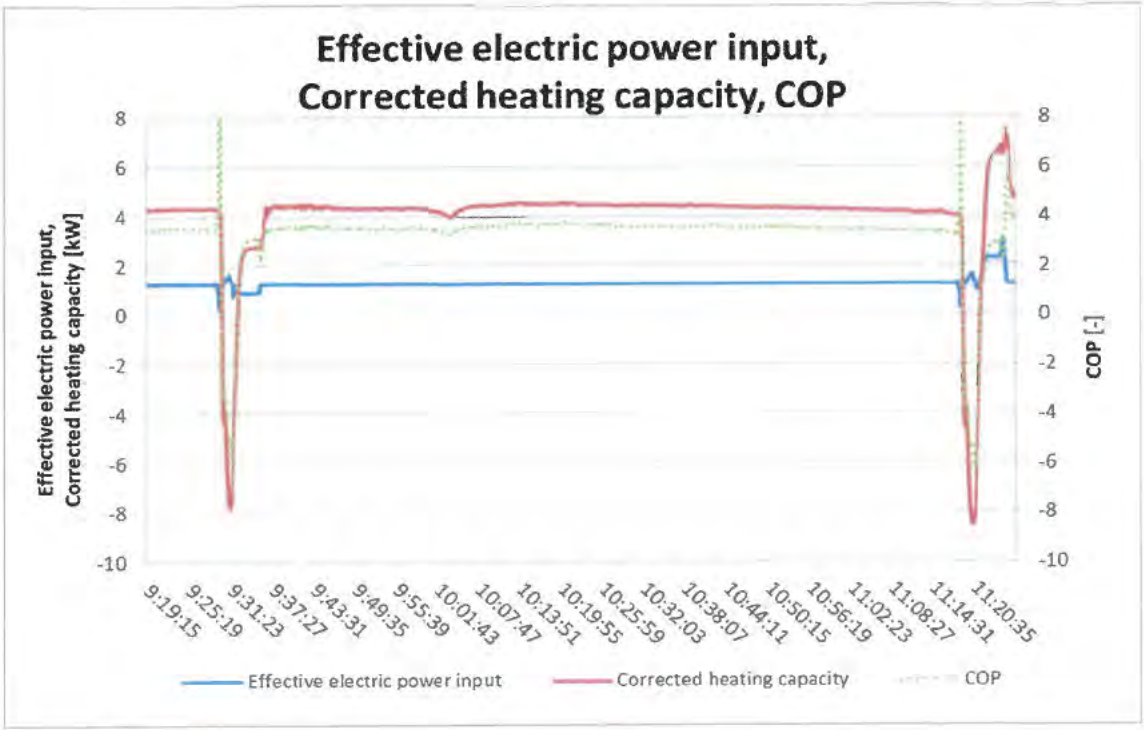
A-7/W52 (102 rps)



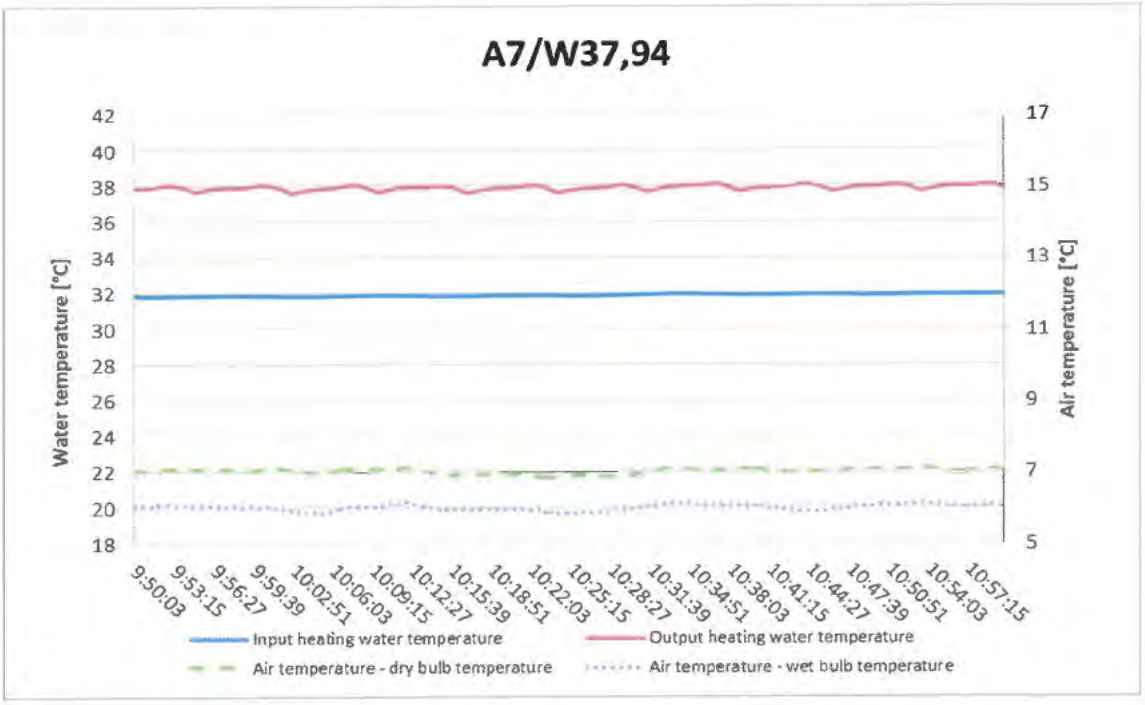


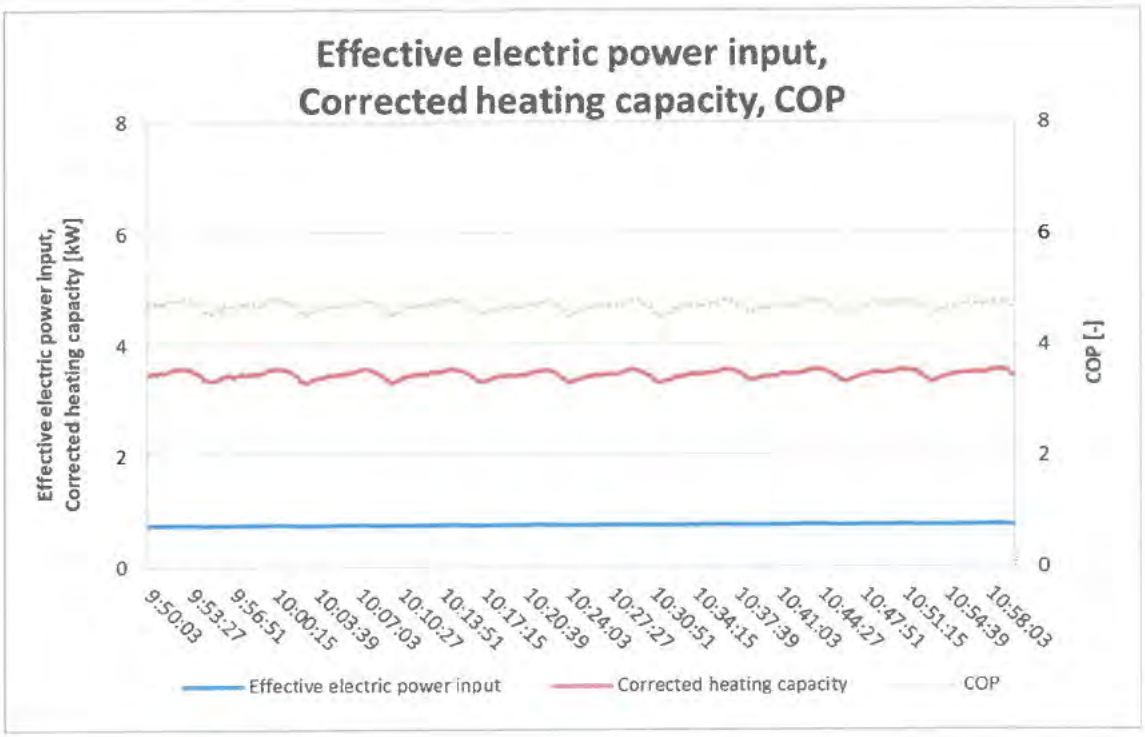
A2/W42 (47 rps)


A2/W42
Water temperature [°C]
Air temperature [°C]
Input heating water temperature
Output heating water temperature
Air temperature - dry bulb temperature
Air temperature - wet bulb temperature

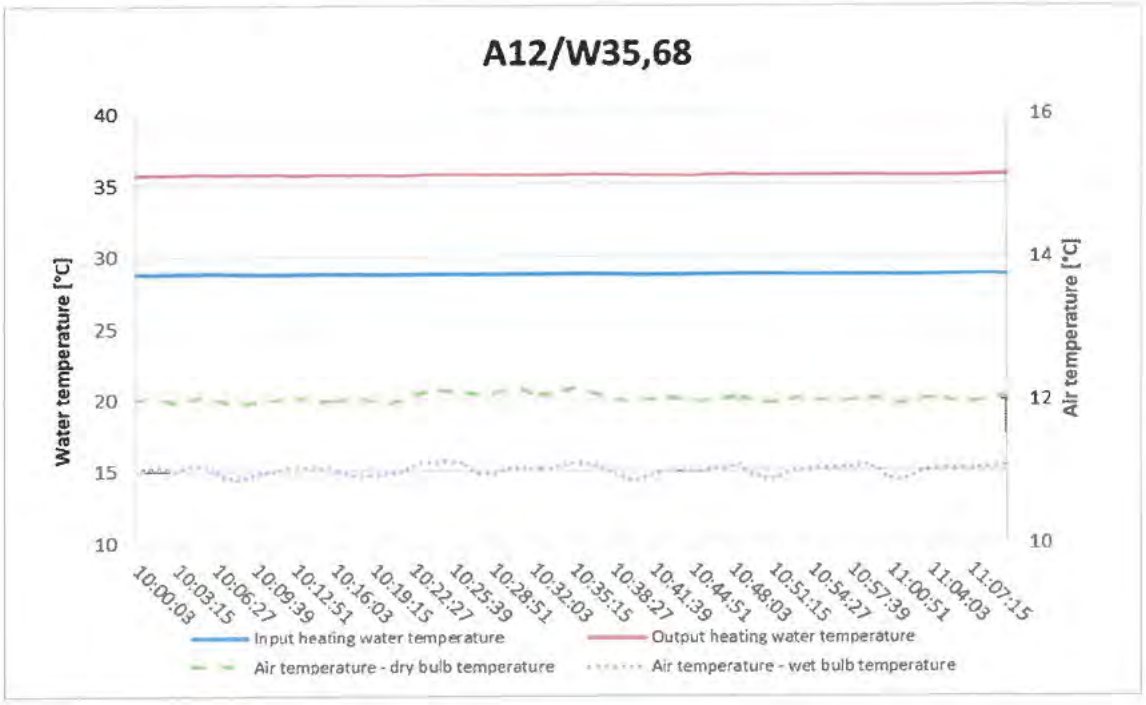

Effective electric power input,
Corrected heating capacity, COP
Effective electric power input, Corrected heating capacity [kW]
COP [-]
Effective electric power input
Corrected heating capacity
COP

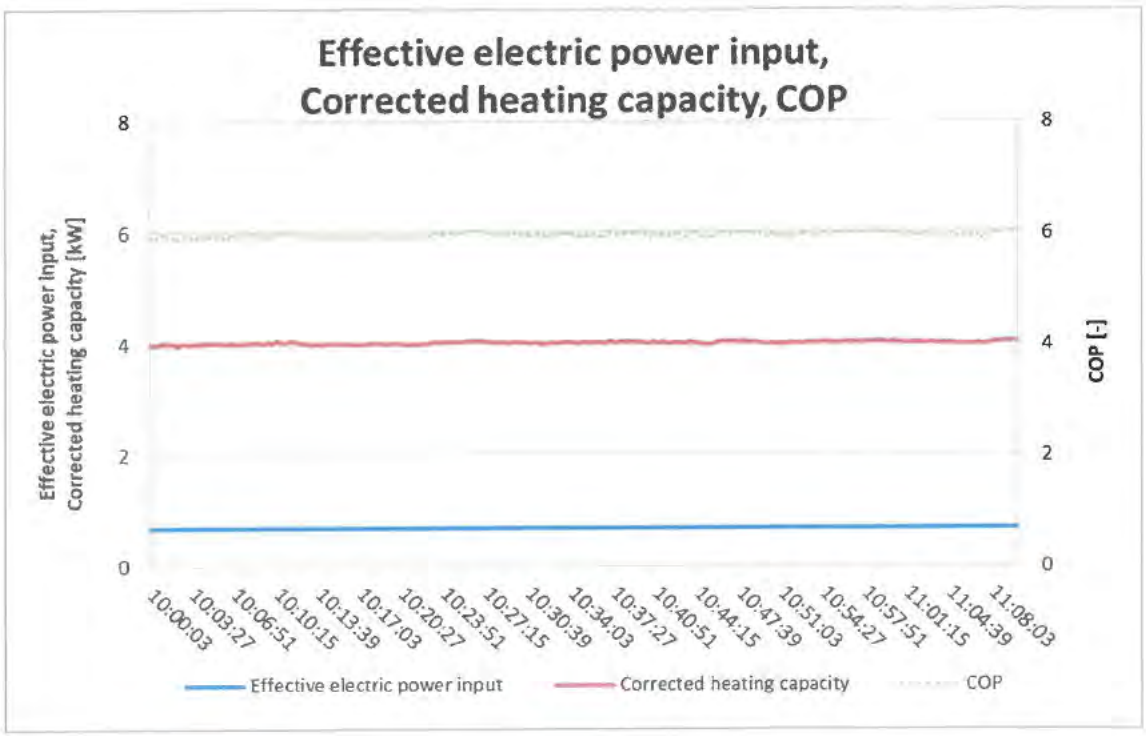
A7/W37.94 (31 rps)



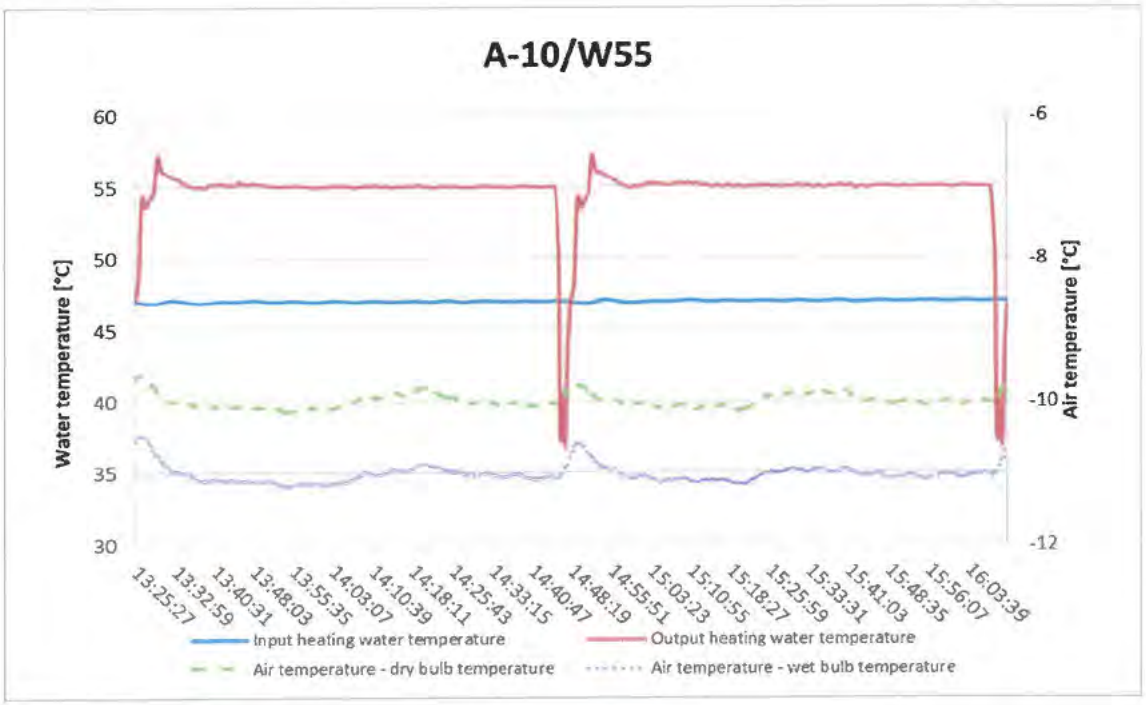


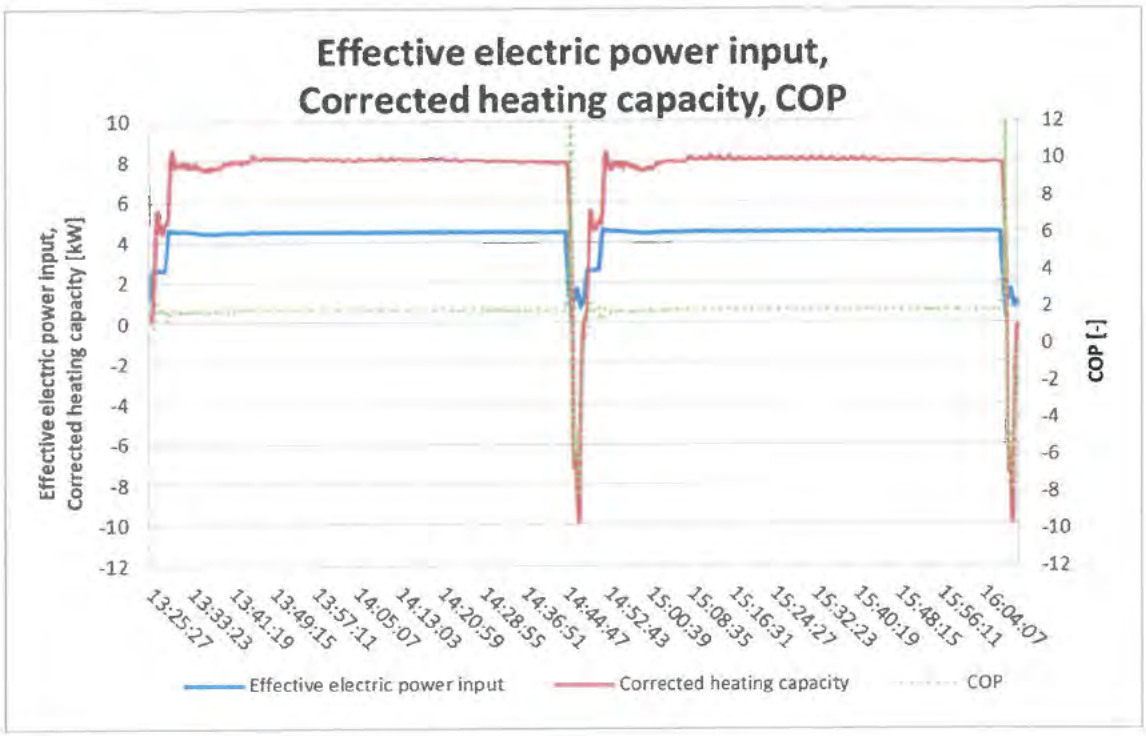
A12/W35.68 (31 rps)





A-10/W55 (120 rps)





VI. A list of referenced documents

- Order of 2024-03-14 (Order reg. no. B-81793, received on 2024-03-14)
- Contract B-81793/39
- 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 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 –

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

L 1045.1

TEST REPORT
39-17612/H

Product:	Outdoor Air/Water Heat pump - monobloc
Type designation:	**Termet Heat Titanium Pro 8**
Customer:	Termet S.A. ul. Długa 13 58-160 Świebodzice POLAND
Manufacturer:	Termet S.A. ul. Długa 13 58-160 Świebodzice POLAND
Report issue date:	2024-10-25
Distribution list:	1 copy to the Customer 1 copy to the Engineering Test Institute

This document may be copied in its entirety without written consent of the SZÚ. Partial copies are subject to approval. The results of the tests and verifications shall relate only to the products tested as received or presented. The testing laboratory is not responsible for the data provided by the customer specified in the report.

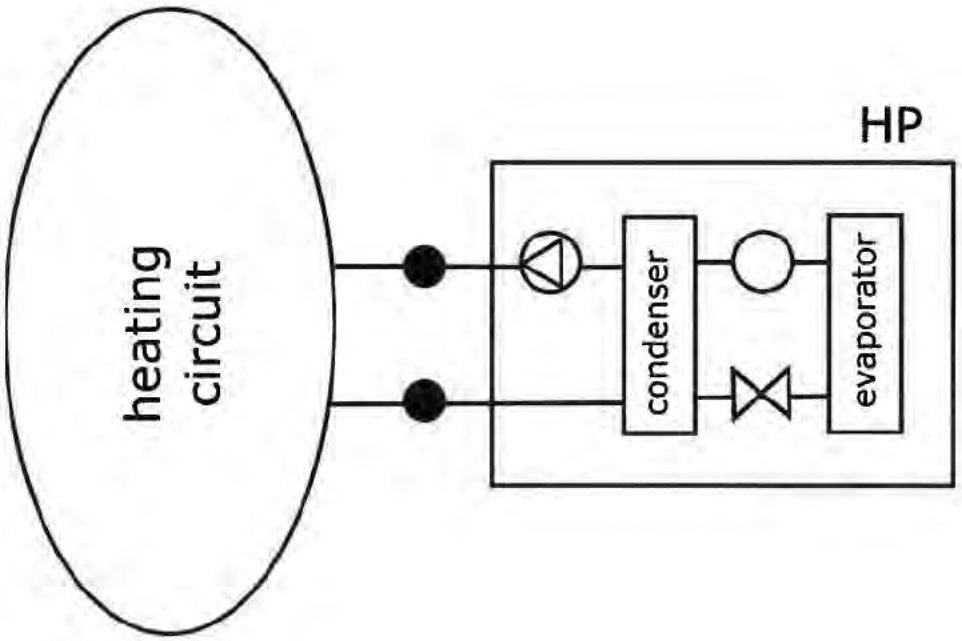
I. Description of product tested

The Heat pump **Termet Heat Titanium Pro 8** supplied by the company **Termet S.A.** is structurally adapted to operate in air/water system. Device is designed as monobloc placed outdoor. Refrigerant R290 used with charge 1.5 kg. Power supply is a three-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 **Termet Heat Titanium Pro 8**:

- Serial number 8800EU1T00001/2444
- Cubic shape with dimensions 1150 × 620 × 825 mm (W × D × H)
- Frame and casing made of varnished steel sheets
- Cubic-shaped evaporator
- Plate condenser
- Compressor
- Refrigerant R290 (1.5 kg)
- Electric expansion valve
-
- 4-way reversing valve with coil
- Refrigerant accumulator
- Filter drier
- Axial fan ø = 43 cm,
- Pressure sensors
- Temperature sensors
- Refrigerant pipes
- Air vent
- Safety valve
- Inverter

Scheme:



Photodocumentation:

Heat pump **Termet Heat Titanium Pro 8** – outdoor unit – Front view –

Heat pump **Termet Heat Titanium Pro 8** – outdoor unit – Back view –

Heat pump **Termet Heat Titanium Pro 8** – outdoor unit – Compressor label –

termet

ul. Długa 13
55-100 Świebodzice
POLAND

Termet Heat Titanium Pro 8

PL	Pompa Ciepła Powietrze - Woda
EN	Air to Water Heat Pump
Znamionowa moc grzewcza Heating capacity	1,5 ÷ 7,5 kW
Znamionowa moc chłodnicza Cooling capacity	1,5 ÷ 5,8 kW
Zasilanie Power supply	~400V/3ph/50Hz
Moc wejściowa elektryczna (grzanie) Power input (heating)	0,9 ÷ 3,9 kW
Moc wejściowa elektryczna (chłodzenie) Power input (cooling)	0,9 ÷ 3,9 kW
Prąd zasilania Current	2,3 ÷ 7,5 A
Klasa ochrony IP grade	IPX4D
Max ciśnienie w układzie chłodniczym Max pressure	33,5 bar
Czynnik roboczy Refrigerant	R290/1.3 kg
GWP / CO2	GWP=3 / 4.5 kg Eq CO2
Masa netto Net weight	157,0 kg
Wymiary urządzenia (szer. x gł. x wys.) Device dimensions (width x depth x height)	1350x620x825
Przyłącza wodne Water connections	G1 (DN25)
Rok produkcji Year of production	2024

CE 1274 PED 2014/68/UE

CE LVD 2014/35/UE
EMC 2014/30/UE
ErP 2009/125/UE
811/2013
813/2013
RoHS 2011/65/UE

S/N: 8800EU1T00001/2444

V00-00000-0000

Heat pump **Termet Heat Titanium Pro 8** – outdoor unit – Label –

Heat pump **Termet Heat Titanium Pro 8** – outdoor unit
– Without cover –

II. Sample tested

SZU reg. no.	Product name	Date of submission
1212.24.40525.001	**Termet Heat Titanium Pro 8**	2024-09-03

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 8.1.3 TECH_K2_V_DN25
4.	Barometer	2.4 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. 8-14	+
2.	Acoustic measurements – Sound power level	Art. 8	**ČSN EN 12102-1:2023**	Page No. 7-14	+

***) 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 **Termet Heat Titanium Pro 8**
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)

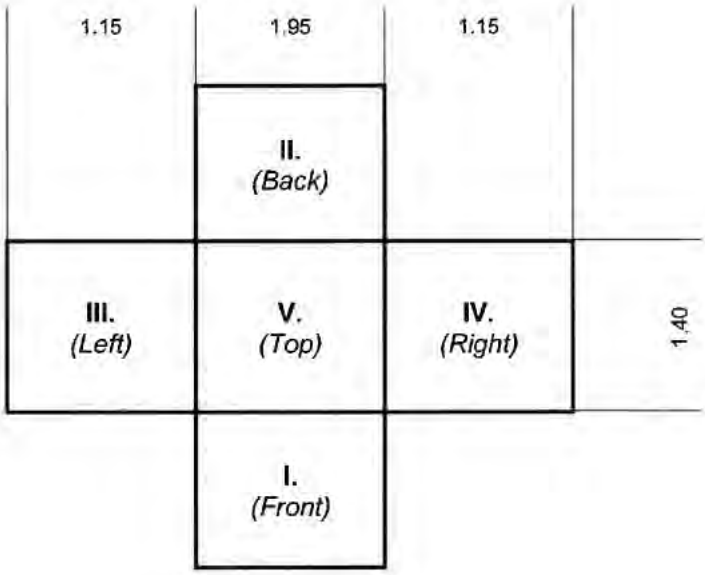
a) Measurement surface

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

Test Sample: Air/Water Heat pump **Termet Heat Titanium Pro 8**			
Distance from the test sample	*d*	[m]	0.40
Height of measurement surface	*h*	[m]	1.15
Width of measurement surface	*w*	[m]	1.95
Depth of measurement surface	*l*	[m]	1.40
Total measurement surface area	*S*	[m²]	10.43
Minimal measuring time per surface	t_M	[s]	90.00

Sketch of measurement surface (not to scale):

Air/Water Heat pump **Termet Heat Titanium Pro 8**
– 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 adjusting the measurement distance and positions.

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 **Termet Heat Titanium Pro 8**
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			31 Hz
Fan speed settings			AUTO
Date of testing (YYYY-MM-DD)			2024-09-20
Reference air temperature	t_{amb}	[°C]	7.0
Relative humidity of air	RH	[%]	86.7
Ambient pressure	p_{amb}	[hPa]	991.7
Overall sound power level (linear)	L_W	[dB]	74.4 ± 1.5
Overall A-weighted sound power level	L_{WA}	**[dB(A)]**	**64.4 ± 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 **Termet Heat Titanium Pro 8** Outdoor unit at A7/W55; Compressor at 31 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	27.9	2.4	YES	0.0	YES	YES	YES	73.0	56.9	± 3.0	passed
250	27.7	1.7	YES	0.0	YES	YES	YES	65.2	56.4	± 2.0	passed
500	28.4	2.0	YES	0.0	YES	YES	YES	61.5	58.2	± 1.5	passed
1000	**20.7**	**2.1**	**YES**	**0.0**	**YES**	**YES**	**YES**	**58.6**	**58.4**	**± 1.5**	**passed**
2000	21.5	1.6	YES	0.0	YES	YES	YES	54.8	56.0	± 1.5	passed
4000	20.3	1.8	YES	0.0	YES	YES	YES	46.5	47.6	± 1.5	c
8000**)	20.6	3.1	YES	0.0	YES	YES	YES	37.1	37.0	± 2.5	c
Total								**74.2**	**64.4**	**± 1.5**	

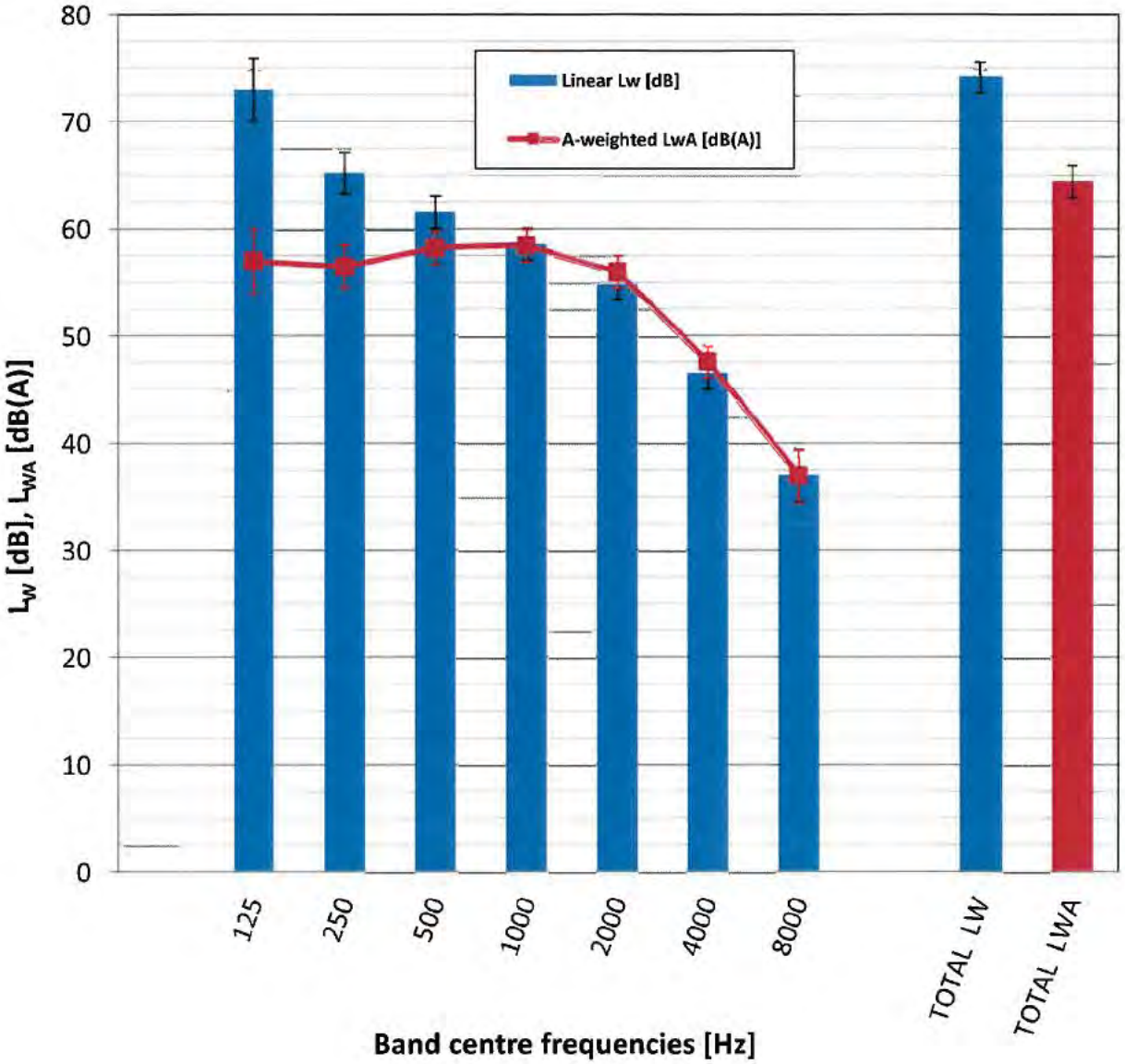
**) *Due to the sound intensity method limitations, the frequency of 6300 Hz was measured only.*

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 **Termet Heat Titanium Pro 8** Outdoor unit at A7/W55; Compressor at 31 Hz; Fan at AUTO	**Engineering (Grade 2)**



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

Air/Water Heat pump **Termet Heat Titanium Pro 8** Outdoor unit at A7/W55; Compressor at 31 Hz; Fan at AUTO	**Engineering (Grade 2)**

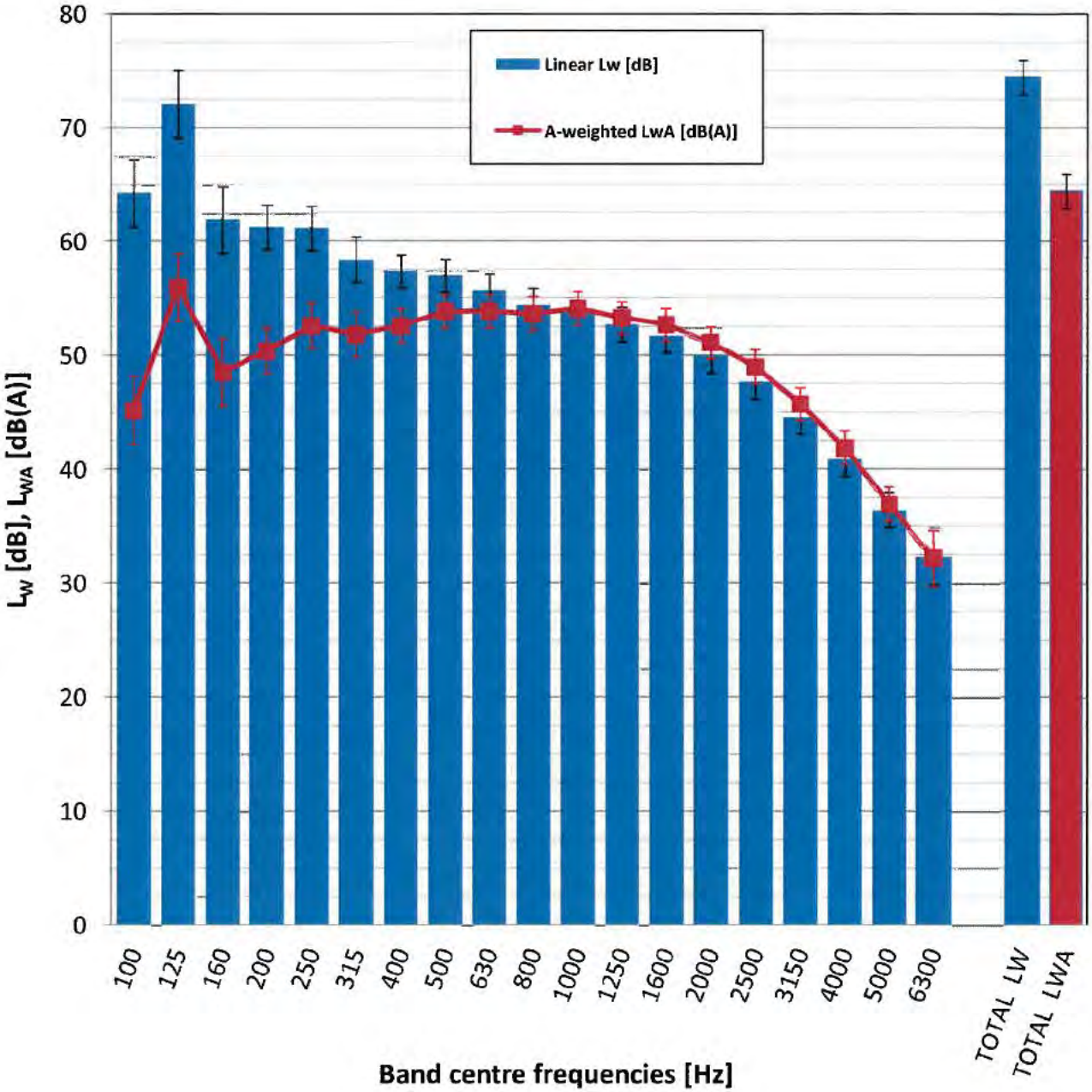
f_m	Criterion 1			Criterion 2		Criterion 3	All criteria passed?	L_W	L_{WA}	U	Evaluation
[Hz]	L_d	F_{pl}	$L_d > F_{pl}$	$F_{+/-}$	$F_{+/-} \leq 3$	$L_{W(1)}$-$L_{W(2)} \leq 5$		[dB]	[dB(A)]	[dB]	
100	28.2	2.1	YES	0.0	YES	YES	YES	64.3	45.2	± 3.0	c
125	**27.9**	**2.4**	**YES**	**0.0**	**YES**	**YES**	**YES**	**72.0**	**55.9**	**± 3.0**	**passed**
160	27.6	2.2	YES	0.0	YES	YES	YES	61.9	48.5	± 3.0	passed
200	27.6	1.5	YES	0.0	YES	YES	YES	61.3	50.4	± 2.0	passed
250	27.7	1.7	YES	0.0	YES	YES	YES	61.2	52.6	± 2.0	passed
315	27.9	1.7	YES	0.0	YES	YES	YES	58.4	51.8	± 2.0	passed
400	28.2	1.9	YES	0.0	YES	YES	YES	57.4	52.6	± 1.5	passed
500	28.4	2.0	YES	0.0	YES	YES	YES	57.0	53.8	± 1.5	passed
630	28.4	2.1	YES	0.0	YES	YES	YES	55.7	53.8	± 1.5	passed
800	28.5	2.2	YES	0.0	YES	YES	YES	54.4	53.6	± 1.5	passed
1000	**20.7**	**2.1**	**YES**	**0.0**	**YES**	**YES**	**YES**	**54.1**	**54.1**	**± 1.5**	**passed**
1250	21.8	2.0	YES	0.0	YES	YES	YES	52.7	53.3	± 1.5	passed
1600	21.7	1.8	YES	0.0	YES	YES	YES	51.7	52.7	± 1.5	passed
2000	21.5	1.6	YES	0.0	YES	YES	YES	49.9	51.1	± 1.5	passed
2500	20.4	1.6	YES	0.0	YES	YES	YES	47.7	49.0	± 1.5	passed
3150	20.3	1.9	YES	0.0	YES	YES	YES	44.5	45.7	± 1.5	c
4000	20.3	1.8	YES	0.0	YES	YES	YES	40.8	41.8	± 1.5	c
5000	20.3	2.2	YES	0.0	YES	YES	YES	36.4	36.9	± 1.5	c
6300	20.6	3.1	YES	0.0	YES	YES	YES	32.3	32.2	± 2.5	c
Total								**74.4**	**64.4**	**± 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 **Termet Heat Titanium Pro 8** Outdoor unit at A7/W55; Compressor at 31 Hz; Fan at AUTO	**Engineering (Grade 2)**



Tested by: Ing. Ondrej Bilkovič Date: 2024-10-25 Signed:

Reviewed and approved by: Ing. Antonín Kolbábek, Ph.D. Date: 2024-10-25 Signed:

V. A list of referenced documents

- Order of 2024-03-14 (Order reg. no. B-81793, received on 2024-03-14)
- Contract B-81793/39

- 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 14511-3:2024 - 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. 39-17612
- Record measurement file 39-17612-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 –