OŚWIADCZENIE

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

1) 2HHH-01-15K-R290-R5-M
Oznaczenie/typ/identyfikator modelu

2) .....
Oznaczenie/typ/identyfikator modelu

3) .....
Oznaczenie/typ/identyfikator modelu

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

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

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

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

MANUFACTURER OF PROFESSIONAL REFRIGERATION EQUIPMENT
JBG2
JBG-2 Sp. z o.o.
43-254 Warszowice
ul. Gajowa 5
www.jbg2.com
VAT no. PL-6342383421

Warszowice, 08.04.2024r.
Miejscowość, data

WICEPREZES ZARZĄDU
Krzysztof Swoboda

PROKURENT
Monika Michalik

Podpis osoby upoważnionej

CORRECTED COPY

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

L 1045.1

TEST REPORT
32-10951/T

Product:	Outdoor Air/Water Heat Pumps – monobloc
Type designation:	**ZHHH-01-15K-R290-R5-M + BSEM01-0000**
Customer:	JBG-2 Sp. z o.o. Gajowa 5 43-254 Warszowice POLAND
Manufacturer:	JBG-2 Sp. z o.o. Gajowa 5 43-254 Warszowice POLAND
Employee responsible:	Ing. Mario Jankola
Report issue date:	2023-10-04
Distribution list:	1 copy to the Customer 1 copy to the Engineering Test Institute

I. Description of product tested

The Heat pump **ZHHH-01-15K-R290-R5-M + BSEM01-0000** supplied by the company **JBG-2 Sp. z o.o.** is structurally adapted to operate in air/water system. Device is designed as monobloc placed outdoor and indoor electrical box hanging on a wall. Outdoor and indoor units are connected by cables. Refrigerant R290 is used with charge 0.8 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 **ZHHH-01-15K-R290-R5-M**:

-
-
-
-
-
-
-
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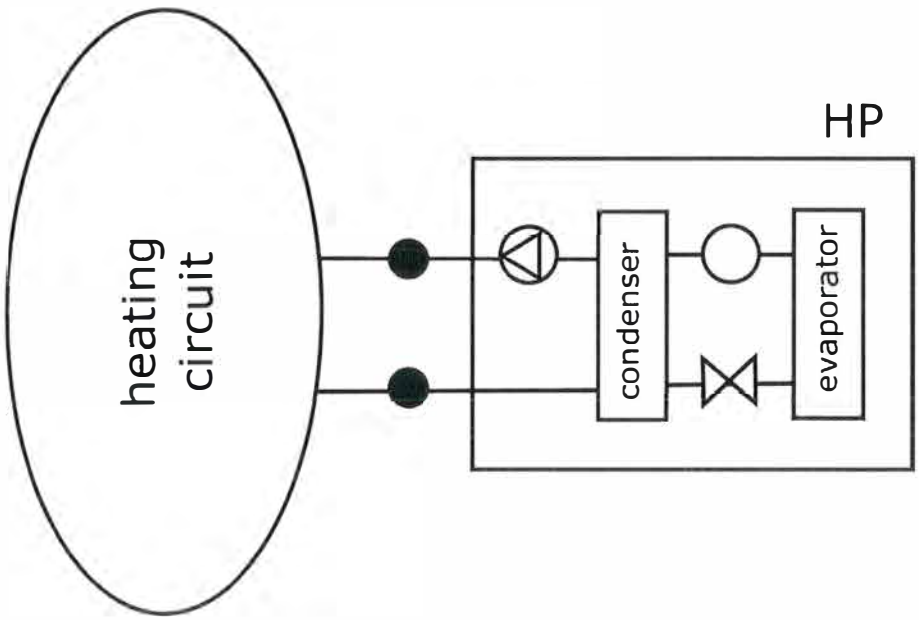
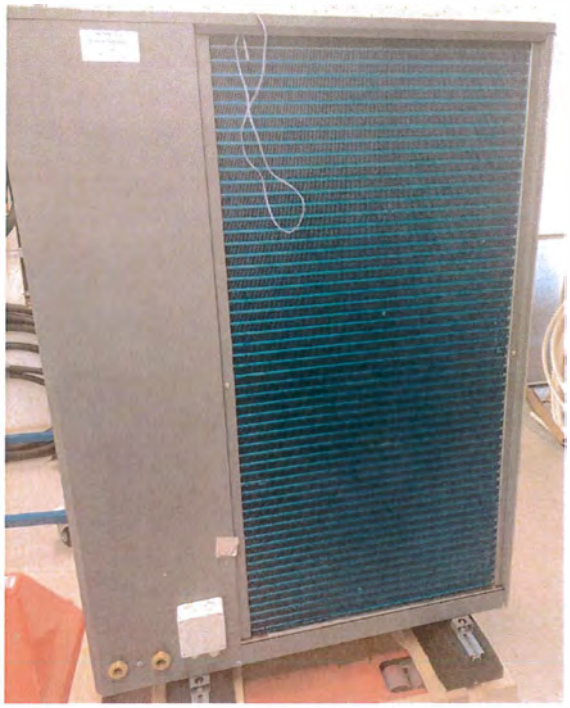
-
-
-
-
-
-
-

Electrical box with display **BSEM01-0000**

Scheme:

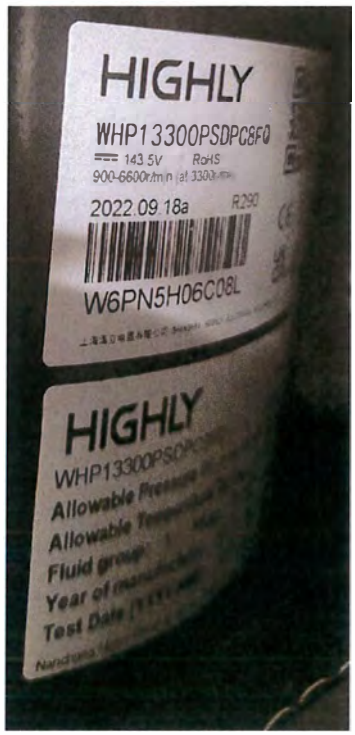


Photodocumentation:



Outdoor unit **ZHHH-01-15K-R290-R5-M**
– Front view –

Outdoor unit **ZHHH-01-15K-R290-R5-M**
– Back view –



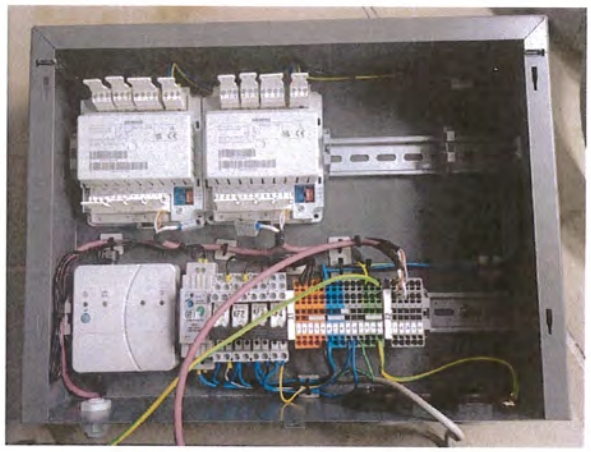
Outdoor unit **ZHHH-01-15K-R290-R5-M**
– Compressor label –

Outdoor unit **ZHHH-01-15K-R290-R5-M**
– Label –

Outdoor unit **ZHHH-01-15K-R290-R5-M**
– Without cover –

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

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



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

II. Sample tested

SZU reg. no.	Product name	Date of submission
0213.23.38460.001-002	**ZHHH-01-15K-R290-R5-M + BSEM01-0000**	2023-05-29

The visual inspection, tests and verification were carried out by Ing. Michal Faltýnek 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.	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 – 15	x
3.	Seasonal performance tests and SCOP calculation – Medium temperature application	–	ČSN EN 14511-3:2023 ČSN EN 14825:2023	Page No. 16 – 23	x
4.	Safety tests	Art. 4.2.1.2 Art. 4.5 sect. a) Art. 4.5 sect. b) Art. 4.6	ČSN EN 14511-4:2023	Page No. 24 – 26	+

*) **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:	**T 037* - Tests of leakage, pressure resistance, thermal and technical parameters, combustion efficiency, safety functions**
Test method:	ČSN EN 14511-2:2023, ČSN EN 14511-3:2023
Sample tested:	Heat pump **ZHHH-01-15K-R290-R5-M + BSEM01-0000**
Measuring equipment used:	see Chapter III

Specification of the assessment condition*		**A7/W35**	**A7/W55**
Date of testing		**2023-05-29**	**2023-05-29**
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]	35.08	54.91
Input heating water – temperature calculation	[°C]	30.09	46.97
Output heating water temperature	[°C]	35.08	54.91
Input heating water temperature	[°C]	30.09	46.97
Air temperature – dry bulb temperature	[°C]	7.00	7.00
Air temperature – wet bulb temperature	[°C]	5.87	5.86
Relative humidity	[%]	87.07	87.00
Barometric pressure	[kPa]	72.517	72.517
Ambient temperature	[°C]	6.64	6.59
Secondary circuit pressure difference	[kPa]	8.970	12.144
Efficiency of the secondary liquid pump	[–]	0.167	0.178
Volume flow rate of heating water	$[m^3 \cdot h^{-1}]$	1.7052	1.5350
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	4.178
Voltage	[V]	400.85	401.75
Total current	[A]	9.68	23.96
Overall power input	[kW]	2.084	5.196
Capacity correction of sec. liquid pump	[W]	21.249	23.902
Power input correction of sec. liquid pump	[W]	25.50	29.08
Heating capacity – heating water	[kW]	9.812	13.952
Corrected heating capacity – heating water	**[kW]**	**9.791**	**13.928**
Uncertainty of corrected heating capacity	[kW]	± 0.183	± 0.183
Effective electric power input	**[kW]**	**2.059**	**5.166**
COP	**[–]**	**4.756**	**2.696**
Uncertainty of COP	[–]	± 0.090	± 0.036
Control settings	**[Hz]**	**48**	**73**
Circulation pump settings – heating water	[–]	50	50

Test objective:	Seasonal performance tests and SCOP calculation – Low temperature application
Exact name of the test procedure:	**T 037* - Tests of leakage, pressure resistance, thermal and technical parameters, combustion efficiency, safety functions**
Test method:	ČSN EN 14511-3:2023, ČSN EN 14825:2023
Sample tested:	Heat pump **ZHHH-01-15K-R290-R5-M + BSEM01-0000**
Measuring equipment used:	see Chapter III

Design			Air / water – monobloc			
Conditions specification according to ČSN EN 14825:2020	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>195.5</u>**	%
		Warmer	η_s		–	%
		Colder	η_s		–	%
Seasonal efficiency according to ČSN EN 14825:2020	Heating	Average	**SCOP**		**<u>4.96</u>**	–
		Warmer	SCOP		–	–
		Colder	SCOP		–	–
Function	Cooling				Yes	
	Heating	Yes	Reference heating season	Average	Yes	
				Warmer	Yes	
				Colder	Yes	
Full heating load	Cooling		$P_{designc}$		–	kW
	Heating	Average	$P_{designh}$		**<u>10.23</u>**	kW
		Warmer	$P_{designh}$		10.25	kW
		Colder	$P_{designh}$		13.05	kW
Bivalent temperatures	Heating	Average	$T_{bivalent}$		-10	°C
		Warmer	$T_{bivalent}$		2	°C
		Colder	$T_{bivalent}$		-15	°C
Operation limit temperatures	Heating	Average	TOL		-10	°C
		Warmer	TOL		2	°C
		Colder	TOL		-22	°C
Seasonal power consumption according to ČSN EN 14825:2020	Cooling		Q_{CE}		–	kWh
	Heating	Average	Q_{HE}		4259	kWh
		Warmer	Q_{HE}		–	kWh
		Colder	Q_{HE}		–	kWh
Modes other than „active mode“	Off mode			P_{OFF}	19.3	W
	Thermostat off mode			P_{TO}	19.8	W
	Standby mode			P_{SB}	19.3	W
	Crankcase heater mode			P_{CK}	0.0	W

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

Calculation of SCOP according to ČSN EN 14825:2023:

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

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

Measured data:

P_{TO}	0.0198	[kW]
P_{SB}	0.0193	[kW]
P_{CK}	0.0000	[kW]
P_{OFF}	0.0193	[kW]
$P_{designh}$	10.22	[kW]
$SCOP_{ON}$	4.97	[–]

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]

$Q_H = 10.23 \cdot 2066 = 21135$ [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]

$Q_{HE} = 21135 / 4.97 + 178 \cdot 0.0198 + 0 \cdot 0.0193 + 178 \cdot 0 + 0 \cdot 0.0193 = 4259$ [kWh]

7.2 General formula for calculation of reference SCOP

$SCOP = Q_H / Q_{HE}$ [–]

$SCOP = 21135 / 4259 = 4.96$ [–]

7.1 Calculation of the seasonal space heating efficiency η_s

$\Sigma F(i) = F(1) + F(2)$ [–]

$\Sigma F = 0.03 + 0 = 0.03$ [–]

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

$\eta_s (A) = (1 / 2.5) \cdot 4.96 – 0.03 =$ **1.955** [–]

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		**2023-05-30**	**2023-05-30**	**2023-05-30**
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]	34.07	30.05	27.05
Input heating water – temperature calculation	[°C]	29.07	25.05	22.74
Output heating water temperature	[°C]	34.07	30.05	27.05
Input heating water temperature	[°C]	29.07	25.05	22.74
Air temperature – dry bulb temperature	[°C]	-6.99	2.01	7.01
Air temperature – wet bulb temperature	[°C]	-8.21	0.84	5.87
Relative humidity	[%]	74.83	83.97	87.02
Barometric pressure	[kPa]	72.517	72.517	72.517
Ambient temperature	[°C]	-7.30	1.62	6.85
Secondary circuit pressure difference	[kPa]	11.389	10.279	12.721
Efficiency of the secondary liquid pump	[–]	0.176	0.149	0.145
Volume flow rate of heating water	$[m^3 \cdot h^{-1}]$	1.5743	0.9886	0.7311
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	4.177	4.178
Voltage	[V]	399.57	401.50	402.17
Total current	[A]	12.64	5.40	3.13
Overall power input	[kW]	2.719	1.164	0.634
Capacity correction of sec. liquid pump	[W]	23.371	16.177	15.174
Power input correction of sec. liquid pump	[W]	28.35	19.00	17.76
Heating capacity – heating water	[kW]	9.065	5.710	3.645
Corrected heating capacity – heating water	**[kW]**	**9.042**	**5.694**	**3.630**
Uncertainty of corrected heating capacity	[kW]	± 0.169	± 0.106	± 0.077
Effective electric power input	**[kW]**	**2.690**	**1.145**	**0.616**
COP	**[–]**	**3.361**	**4.975**	**5.893**
Uncertainty of COP	[–]	± 0.064	± 0.094	± 0.129
Control settings	**[Hz]**	**59**	**35**	**25**
Circulation pump settings – heating water	[–]	**50**	**40**	**40**

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/W26.27**	**A-10/W35**
Date of testing		**2023-06-01**	**2023-05-31**
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]	26.27	35.04
Input heating water – temperature calculation	[°C]	22.64	29.99
Output heating water temperature	[°C]	26.27	35.04
Input heating water temperature	[°C]	22.64	29.99
Air temperature – dry bulb temperature	[°C]	12.00	-10.00
Air temperature – wet bulb temperature	[°C]	10.87	-11.12
Relative humidity	[%]	88.97	72.81
Barometric pressure	[kPa]	72.517	72.517
Ambient temperature	[°C]	11.82	-10.29
Secondary circuit pressure difference	[kPa]	12.678	7.985
Efficiency of the secondary liquid pump	[–]	0.145	0.162
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	0.7284	1.7587
Density of heating water	[$kg \cdot m^{-3}$]	996.6	994.1
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.178	4.175
Voltage	[V]	400.44	401.64
Total current	[A]	2.34	16.26
Overall power input	[kW]	0.442	3.523
Capacity correction of sec. liquid pump	[W]	15.095	20.138
Power input correction of sec. liquid pump	[W]	17.66	24.04
Heating capacity – heating water	[kW]	3.059	10.251
Corrected heating capacity – heating water	**[kW]**	**3.044**	**10.230**
Uncertainty of corrected heating capacity	[kW]	± 0.075	± 0.189
Effective electric power input	**[kW]**	**0.425**	**3.499**
COP	**[–]**	**7.167**	**2.924**
Uncertainty of COP	[–]	± 0.185	± 0.054
Control settings	**[Hz]**	**21**	**70**
Circulation pump settings – heating water	[–]	**40**	**50**

Temperature level		Low (reference water temperature 35 °C)	
Reference heating season		„W" = warmer ($T_{designh}$ = 2 °C)	„C" = colder ($T_{designh}$ = -22 °C)
Assessment condition		**B, TOL (E), Tbiv (F)**	**Tbiv (F), G**
Specification of the assessment condition*		**A2/W35**	**A-15/W32**
Date of testing		**2023-06-13**	**2023-06-14**
Transient test procedure	YES / NO	YES	NO
Average defrost time of 1 cycle	[min]	6.5	–
Average time of 1 cycle	[min]	132.7	–
Calculation time	[min]	132.7	70.0
Output heating water – temperature calculation	[°C]	34.61	31.95
Input heating water – temperature calculation	[°C]	29.99	26.95
Output heating water temperature	[°C]	35.00	31.95
Input heating water temperature	[°C]	29.99	26.95
Air temperature – dry bulb temperature	[°C]	2.01	-15.00
Air temperature – wet bulb temperature	[°C]	1.01	-15.74
Relative humidity	[%]	83.89	68.45
Barometric pressure	[kPa]	98.416	98.474
Ambient temperature	[°C]	2.01	-15.07
Secondary circuit pressure difference	[kPa]	4.313	5.857
Efficiency of the secondary liquid pump	[–]	0.142	0.151
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	1.9261	1.8477
Density of heating water	[$kg \cdot m^{-3}$]	994.2	995.0
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.175	4.176
Voltage	[V]	400.42	401.19
Total current	[A]	13.49	18.39
Overall power input	[kW]	2.915	4.002
Capacity correction of sec. liquid pump	[W]	13.950	16.914
Power input correction of sec. liquid pump	[W]	16.26	19.92
Heating capacity – heating water	[kW]	10.268	10.663
Corrected heating capacity – heating water	**[kW]**	**10.254**	**10.646**
Uncertainty of corrected heating capacity	[kW]	± 0.204	± 0.198
Effective electric power input	**[kW]**	**2.899**	**3.982**
COP	**[–]**	**3.537**	**2.673**
Uncertainty of COP	[–]	± 0.071	± 0.050
Control settings	**[Hz]**	**59**	**80**
Circulation pump settings – heating water	[–]	**50**	**50**

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	9.05	9.042	3.361	0.900	1.00	3.361	–
B	2	30.00	53.85	5.51	5.694	4.975	0.900	1.00	4.975	–
C	7	27.00	34.62	3.54	3.630	5.893	0.900	1.00	5.893	–
D	12	26.41	15.38	1.57	3.044	7.167	0.953	0.52	6.868	0.0198
TOL (E)	-10	35.00	100.00	10.23	10.230	2.924	0.900	1.00	2.924	–
Tbiv (F)	-10	35.00	100.00	10.23	10.230	2.924	0.900	1.00	2.924	–

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

- 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	3.044	[kW]
Declared capacity standard rating condition A7/W35	–	[kW]
Part load	1.57	[kW]

Calculation of water temperature

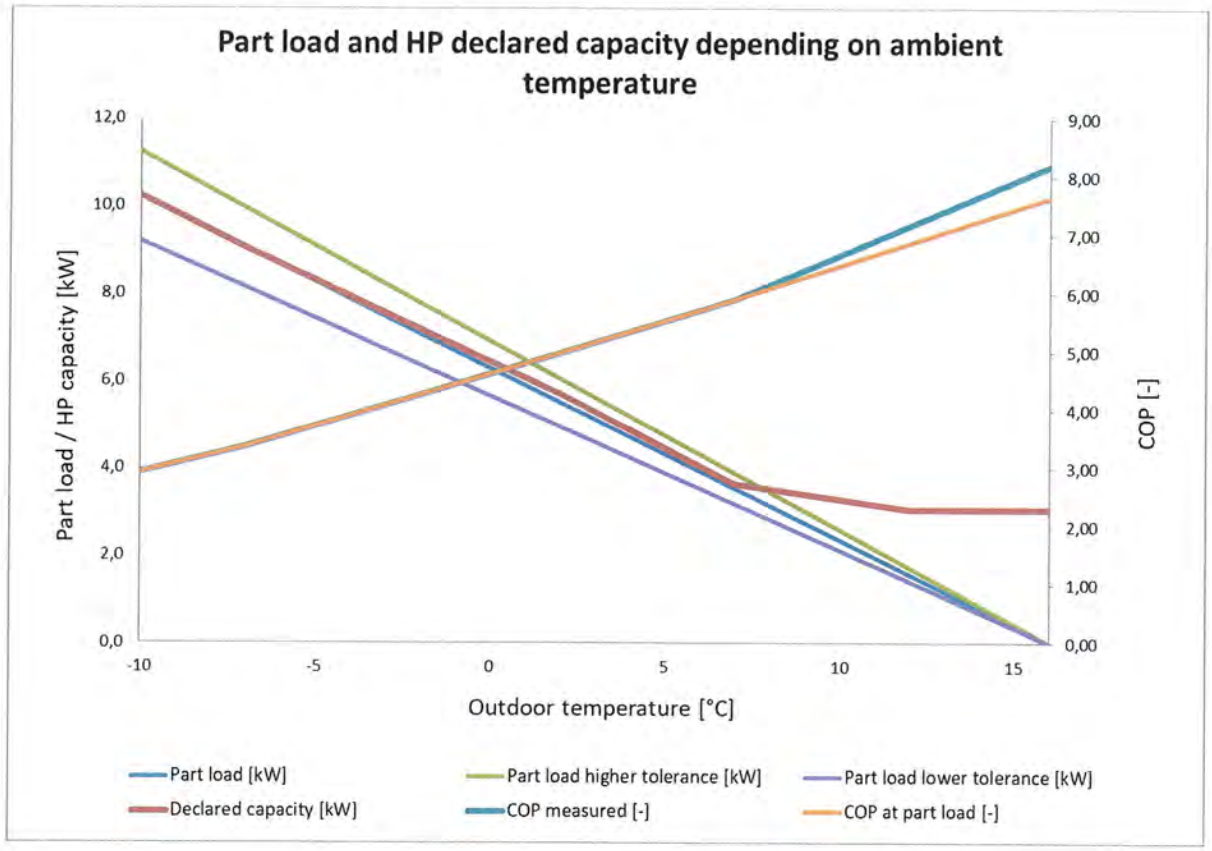
$t_{outlet,\,capacity\,test,\,variable\,flow} = 24 + 5 - 1.57 / 3.044 \cdot 5 =$ **26.41** [°C]

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

	Bin j [–]	Outdoor temp. (dry bulb) Tj [°C]	Hours hj [h]	Part load ratio [%]	Heat load Ph(Tj) [kW]	Capacity of HP [kW]	Heat load covered by heat pump [kW]	Resistive heat elbu (Tj) elbu(Tj) [kW]	Annual resistive heat hj x elbu(Tj) [kWh]	COPbin (Tj) COPbin (Tj) [–]	Annual heating demand hj x P h(Tj) [kWh]	Annual power input including electric back up heating [kWh]	Net annual heating capacity hj × (P h(Tj) - elbu(Tj)) [kWh]	Net annual power input without electric back up heating [kWh]
TOL (E), Tbiv (F)	**21**	**-10**	**1**	**100.00**	**10.23**	**10.23**	**10.23**	**0.00**	**0.00**	**2.92**	**10**	**3**	**10**	**3**
	22	-9	25	96.15	9.84	9.83	9.83	0.00	0.00	3.07	246	80	246	80
	23	-8	23	92.31	9.44	9.44	9.44	0.00	0.00	3.22	217	68	217	68
A	24	-7	24	88.46	9.05	9.04	9.04	0.00	0.00	3.36	217	65	217	65
	25	-6	27	84.62	8.66	8.67	8.66	0.00	0.00	3.54	234	66	234	66
	26	-5	68	80.77	8.26	8.30	8.26	0.00	0.00	3.72	562	151	562	151
	27	-4	91	76.92	7.87	7.93	7.87	0.00	0.00	3.90	716	184	716	184
	28	-3	89	73.08	7.48	7.55	7.48	0.00	0.00	4.08	665	163	665	163
	29	-2	165	69.23	7.08	7.18	7.08	0.00	0.00	4.26	1169	274	1169	274
	30	-1	173	65.38	6.69	6.81	6.69	0.00	0.00	4.44	1157	261	1157	261
	31	0	240	61.54	6.30	6.44	6.30	0.00	0.00	4.62	1511	327	1511	327
	32	1	280	57.69	5.90	6.07	5.90	0.00	0.00	4.80	1653	345	1653	345
B	**33**	**2**	**320**	**53.85**	**5.51**	**5.69**	**5.51**	**0.00**	**0.00**	**4.98**	**1763**	**354**	**1763**	**354**
	34	3	357	50.00	5.12	5.28	5.12	0.00	0.00	5.16	1826	354	1826	354
	35	4	356	46.15	4.72	4.87	4.72	0.00	0.00	5.34	1681	315	1681	315
	36	5	303	42.31	4.33	4.46	4.33	0.00	0.00	5.53	1311	237	1311	237
	37	6	330	38.46	3.93	4.04	3.93	0.00	0.00	5.71	1298	227	1298	227
C	**38**	**7**	**326**	**34.62**	**3.54**	**3.63**	**3.54**	**0.00**	**0.00**	**5.89**	**1154**	**196**	**1154**	**196**
	39	8	348	30.77	3.15	3.51	3.15	0.00	0.00	6.09	1095	180	1095	180
	40	9	335	26.92	2.75	3.40	2.75	0.00	0.00	6.28	923	147	923	147
	41	10	315	23.08	2.36	3.28	2.36	0.00	0.00	6.48	744	115	744	115
	42	11	215	19.23	1.97	3.16	1.97	0.00	0.00	6.67	423	63	423	63
D	**43**	**12**	**169**	**15.38**	**1.57**	**3.04**	**1.57**	**0.00**	**0.00**	**6.87**	**266**	**39**	**266**	**39**
	44	13	151	11.54	1.18	2.93	1.18	0.00	0.00	7.06	178	25	178	25
	45	14	105	7.69	0.79	2.81	0.79	0.00	0.00	7.26	83	11	83	11
	46	15	74	3.85	0.39	2.69	0.39	0.00	0.00	7.45	29	4	29	4
		Σ	4910							Σ	21131	4255	21131	4255

SCOPon	4.97	SCOPnet	4.97
		SCOP	**4.96**

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:	**T 037* - Tests of leakage, pressure resistance, thermal and technical parameters, combustion efficiency, safety functions**
Test method:	ČSN EN 14511-3:2023, ČSN EN 14825:2023
Sample tested:	Heat pump **ZHHH-01-15K-R290-R5-M + BSEM01-0000**
Measuring equipment used:	see Chapter III

Design				Air / water – monobloc		
Conditions specification according to ČSN EN 14825:2020	Temperature application			**Medium** (reference water temperature 55 °C)		
	Reference heating season			**Average**		
	Outlet water temperature - indoor heat exchanger			Variable		
	Compressor speed control			Variable		
	Water flow rate – primary circuit			–		
	Water flow rate – secondary circuit			Variable		
Seasonal space heating energy efficiency	Heating	Average	η_s		**<u>147.7</u>**	%
		Warmer	η_s		–	%
		Colder	η_s		–	%
Seasonal efficiency according to ČSN EN 14825:2020	Heating	Average	**SCOP**		**<u>3.77</u>**	–
		Warmer	SCOP		–	–
		Colder	SCOP		–	–
Function	Cooling				Yes	
	Heating	Yes	Reference heating season	Average	Yes	
				Warmer	Yes	
				Colder	Yes	
Full heating load	Cooling		$P_{designc}$		–	kW
	Heating	Average	$P_{designh}$		**<u>9.97</u>**	kW
		Warmer	$P_{designh}$		10.20	kW
		Colder	$P_{designh}$		13.41	kW
Bivalent temperatures	Heating	Average	$T_{bivalent}$		-10	°C
		Warmer	$T_{bivalent}$		2	°C
		Colder	$T_{bivalent}$		-15	°C
Operation limit temperatures	Heating	Average	TOL		-10	°C
		Warmer	TOL		2	°C
		Colder	TOL		-22	°C
Seasonal power consumption according to ČSN EN 14825:2020	Cooling		Q_{CE}		–	kWh
	Heating	Average	Q_{HE}		5469	kWh
		Warmer	Q_{HE}		–	kWh
		Colder	Q_{HE}		–	kWh
Modes other than „active mode“	Off mode			P_{OFF}	19.3	W
	Thermostat off mode			P_{TO}	19.8	W
	Standby mode			P_{SB}	19.3	W
	Crankcase heater mode			P_{CK}	0.0	W

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

Calculation of SCOP according to ČSN EN 14825:2023:

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

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

Measured data:

P_{TO}	0.0198	[kW]
P_{SB}	0.0193	[kW]
P_{CK}	0.0000	[kW]
P_{OFF}	0.0193	[kW]
$P_{designh}$	9.97	[kW]
$SCOP_{ON}$	3.77	[–]

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]

$Q_H = 9.97 \cdot 2066 = 20602$ [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]

$Q_{HE} = 20602 / 3.77 + 178 \cdot 0.0198 + 0 \cdot 0.0193 + 178 \cdot 0 + 0 \cdot 0.0193 = 5469$ [kWh]

7.2 General formula for calculation of reference SCOP

$SCOP = Q_H / Q_{HE}$ [–]

$SCOP = 20602 / 5469 = 3.77$ [–]

7.1 Calculation of the seasonal space heating efficiency η_s

$\Sigma F(i) = F(1) + F(2)$ [–]

$\Sigma F = 0.03 + 0 = 0.03$ [–]

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

$\eta_s (A) = (1 / 2.5) \cdot 3.77 - 0.03 =$ **1.477** [–]

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		**2023-05-31**	**2023-06-09**	**2023-06-01**
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]	51.95	41.94	35.96
Input heating water – temperature calculation	[°C]	43.95	35.58	31.88
Output heating water temperature	[°C]	51.95	41.94	35.96
Input heating water temperature	[°C]	43.95	35.58	31.88
Air temperature – dry bulb temperature	[°C]	-7.00	2.00	7.01
Air temperature – wet bulb temperature	[°C]	-8.23	1.01	5.87
Relative humidity	[%]	74.92	84.11	87.07
Barometric pressure	[kPa]	72.517	98.278	72.517
Ambient temperature	[°C]	-7.33	1.77	6.87
Secondary circuit pressure difference	[kPa]	10.331	12.543	12.676
Efficiency of the secondary liquid pump	[–]	0.149	0.145	0.145
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	0.9828	0.7284	0.7308
Density of heating water	[$kg \cdot m^{-3}$]	987.5	991.7	993.8
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.177	4.175	4.175
Voltage	[V]	402.87	402.69	403.20
Total current	[A]	16.23	6.58	3.71
Overall power input	[kW]	3.550	1.432	0.777
Capacity correction of sec. liquid pump	[W]	16.167	14.977	15.130
Power input correction of sec. liquid pump	[W]	18.99	17.51	17.70
Heating capacity – heating water	[kW]	9.008	5.327	3.434
Corrected heating capacity – heating water	**[kW]**	**8.992**	**5.312**	**3.419**
Uncertainty of corrected heating capacity	[kW]	± 0.118	± 0.082	± 0.076
Effective electric power input	**[kW]**	**3.531**	**1.414**	**0.760**
COP	**[–]**	**2.547**	**3.756**	**4.501**
Uncertainty of COP	[–]	± 0.034	± 0.059	± 0.102
Control settings	**[Hz]**	**62**	**35**	**25**
Circulation pump settings – heating water	[–]	40	40	40

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/W33.73**	**A-10/W55**
Date of testing		**2023-06-01**	**2023-05-31**
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]	33.77	54.96
Input heating water – temperature calculation	[°C]	30.27	46.96
Output heating water temperature	[°C]	33.77	54.96
Input heating water temperature	[°C]	30.27	46.96
Air temperature – dry bulb temperature	[°C]	12.00	-10.00
Air temperature – wet bulb temperature	[°C]	10.88	-11.28
Relative humidity	[%]	88.96	68.78
Barometric pressure	[kPa]	72.517	72.517
Ambient temperature	[°C]	11.82	-10.37
Secondary circuit pressure difference	[kPa]	12.654	9.034
Efficiency of the secondary liquid pump	[–]	0.145	0.147
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	0.7299	1.0912
Density of heating water	[$kg \cdot m^{-3}$]	994.5	986.1
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.175	4.178
Voltage	[V]	402.84	400.96
Total current	[A]	2.78	20.92
Overall power input	[kW]	0.550	4.568
Capacity correction of sec. liquid pump	[W]	15.097	15.825
Power input correction of sec. liquid pump	[W]	17.66	18.56
Heating capacity – heating water	[kW]	2.946	9.988
Corrected heating capacity – heating water	**[kW]**	**2.931**	**9.972**
Uncertainty of corrected heating capacity	[kW]	± 0.075	± 0.131
Effective electric power input	**[kW]**	**0.532**	**4.549**
COP	**[–]**	**5.510**	**2.192**
Uncertainty of COP	[–]	± 0.145	± 0.029
Control settings	**[Hz]**	**21**	**75**
Circulation pump settings – heating water	[–]	40	40

Temperature level		Medium (reference water temperature 55 °C)	
Reference heating season		„W" = warmer ($T_{designh}$ = 2 °C)	„C" = colder ($T_{designh}$ = -22 °C)
Assessment condition		**B, TOL (E), Tbiv (F)**	**Tbiv (F), G**
Specification of the assessment condition*		**A2/W55**	**A-15/W49**
Date of testing		**2023-06-13**	**2023-06-14**
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]	54.96	49.00
Input heating water – temperature calculation	[°C]	46.96	41.01
Output heating water temperature	[°C]	54.96	49.00
Input heating water temperature	[°C]	46.96	41.01
Air temperature – dry bulb temperature	[°C]	2.01	-15.00
Air temperature – wet bulb temperature	[°C]	1.01	-15.74
Relative humidity	[%]	83.99	68.51
Barometric pressure	[kPa]	98.264	98.507
Ambient temperature	[°C]	1.99	-15.08
Secondary circuit pressure difference	[kPa]	8.593	7.555
Efficiency of the secondary liquid pump	[–]	0.147	0.145
Volume flow rate of heating water	[$m^3 \cdot h^{-1}$]	1.1154	1.1952
Density of heating water	[$kg \cdot m^{-3}$]	986.1	988.8
Specific heat capacity of heating water	[$kJ \cdot kg^{-1} \cdot K^{-1}$]	4.178	4.176
Voltage	[V]	400.82	400.55
Total current	[A]	17.71	24.71
Overall power input	[kW]	3.833	5.335
Capacity correction of sec. liquid pump	[W]	15.507	14.847
Power input correction of sec. liquid pump	[W]	18.17	17.36
Heating capacity – heating water	[kW]	10.213	10.958
Corrected heating capacity – heating water	**[kW]**	**10.197**	**10.943**
Uncertainty of corrected heating capacity	[kW]	± 0.134	± 0.143
Effective electric power input	**[kW]**	**3.815**	**5.318**
COP	**[–]**	**2.673**	**2.058**
Uncertainty of COP	[–]	± 0.035	± 0.027
Control settings	**[Hz]**	**59**	**96**
Circulation pump settings – heating water	[–]	40	40

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	8.82	8.992	2.547	0.900	1.00	2.547	–
B	2	42.00	53.85	5.37	5.312	3.756	0.900	1.00	3.756	–
C	7	36.00	34.62	3.45	3.419	4.501	0.900	1.00	4.501	–
D	12	33.81	15.38	1.53	2.931	5.510	0.963	0.52	5.329	0.0198
TOL (E)	-10	55.00	100.00	9.97	9.972	2.192	0.900	1.00	2.192	–
Tbiv (F)	-10	55.00	100.00	9.97	9.972	2.192	0.900	1.00	2.192	–

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

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

General formulas and derivation:

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

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

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

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

For variable flow:

$\Delta t = 8$

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

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

Measured data:

$t_{outlet,\,average}$	30.00	[°C]
Declared capacity	2.931	[kW]
Declared capacity standard rating condition A7/W55	–	[kW]
Part load	1.53	[kW]

Calculation of water temperature

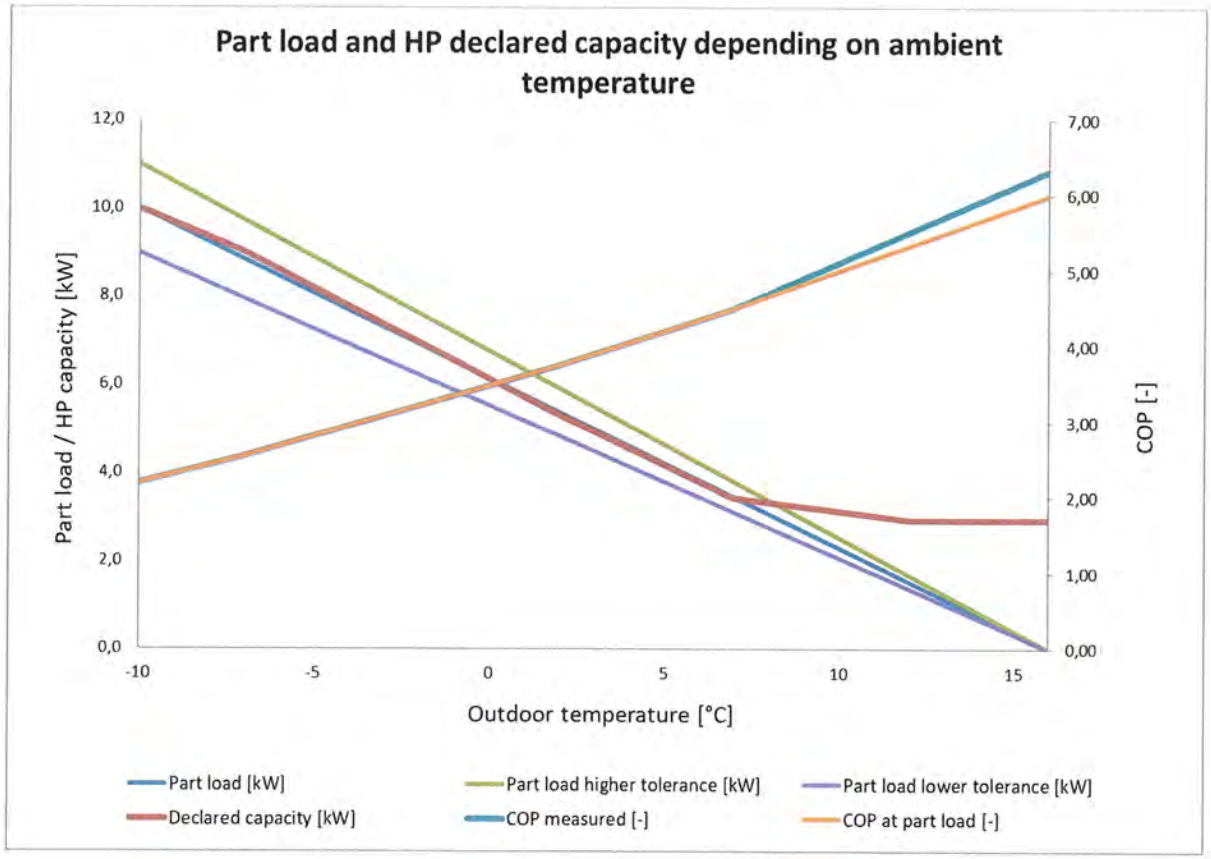
$t_{outlet,\,capacity\,test,\,variable\,flow} = 30 + 8 - 1.53 / 2.931 \cdot 8 =$ **33.81** [°C]

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

	Bin j [–]	Outdoor temp. (dry bulb) Tj [°C]	Hours hj [h]	Part load ratio [%]	Heat load Ph(Tj) [kW]	Capacity of HP [kW]	Heat load covered by heat pump [kW]	Resistive heat elbu (Tj) elbu(Tj) [kW]	Annual resistive heat hj x elbu(Tj) [kWh]	COPbin (Tj) COPbin (Tj) [–]	Annual heating demand hj x Ph(Tj) [kWh]	Annual power input including electric back up heating [kWh]	Net annual heating capacity hj × (Ph(Tj) - elbu(Tj)) [kWh]	Net annual power input without electric back up heating [kWh]
TOL (E)	**21**	**-10**	**1**	**100.00**	**9.97**	**9.97**	**9.97**	**0.00**	**0.00**	**2.19**	**10**	**5**	**10**	**5**
	22	-9	25	96.15	9.59	9.65	9.59	0.00	0.00	2.31	240	104	240	104
	23	-8	23	92.31	9.20	9.32	9.20	0.00	0.00	2.43	212	87	212	87
A, Tbiv (F)	**24**	**-7**	**24**	**88.46**	**8.82**	**8.99**	**8.82**	**0.00**	**0.00**	**2.55**	**212**	**83**	**212**	**83**
	25	-6	27	84.62	8.44	8.58	8.44	0.00	0.00	2.68	228	85	228	85
	26	-5	68	80.77	8.05	8.17	8.05	0.00	0.00	2.82	548	195	548	195
	27	-4	91	76.92	7.67	7.77	7.67	0.00	0.00	2.95	698	237	698	237
	28	-3	89	73.08	7.29	7.36	7.29	0.00	0.00	3.08	649	210	649	210
	29	-2	165	69.23	6.90	6.95	6.90	0.00	0.00	3.22	1139	354	1139	354
	30	-1	173	65.38	6.52	6.54	6.52	0.00	0.00	3.35	1128	336	1128	336
	31	0	240	61.54	6.14	6.13	6.13	0.00	0.00	3.49	1473	422	1473	422
	32	1	280	57.69	5.75	5.72	5.72	0.00	0.00	3.62	1611	445	1611	445
B	**33**	**2**	**320**	**53.85**	**5.37**	**5.31**	**5.31**	**0.00**	**0.00**	**3.76**	**1718**	**457**	**1718**	**457**
	34	3	357	50.00	4.99	4.93	4.93	0.00	0.00	3.91	1780	456	1780	456
	35	4	356	46.15	4.60	4.55	4.55	0.00	0.00	4.05	1638	404	1638	404
	36	5	303	42.31	4.22	4.18	4.18	0.00	0.00	4.20	1278	304	1278	304
	37	6	330	38.46	3.84	3.80	3.80	0.00	0.00	4.35	1266	291	1266	291
C	**38**	**7**	**326**	**34.62**	**3.45**	**3.42**	**3.42**	**0.00**	**0.00**	**4.50**	**1125**	**250**	**1125**	**250**
	39	8	348	30.77	3.07	3.32	3.07	0.00	0.00	4.67	1068	229	1068	229
	40	9	335	26.92	2.68	3.22	2.68	0.00	0.00	4.83	899	186	899	186
	41	10	315	23.08	2.30	3.13	2.30	0.00	0.00	5.00	725	145	725	145
	42	11	215	19.23	1.92	3.03	1.92	0.00	0.00	5.16	412	80	412	80
D	**43**	**12**	**169**	**15.38**	**1.53**	**2.93**	**1.53**	**0.00**	**0.00**	**5.33**	**259**	**49**	**259**	**49**
	44	13	151	11.54	1.15	2.83	1.15	0.00	0.00	5.50	174	32	174	32
	45	14	105	7.69	0.77	2.74	0.77	0.00	0.00	5.66	81	14	81	14
	46	15	74	3.85	0.38	2.64	0.38	0.00	0.00	5.83	28	5	28	5
		Σ	4910							Σ	20598	5464	20598	5464

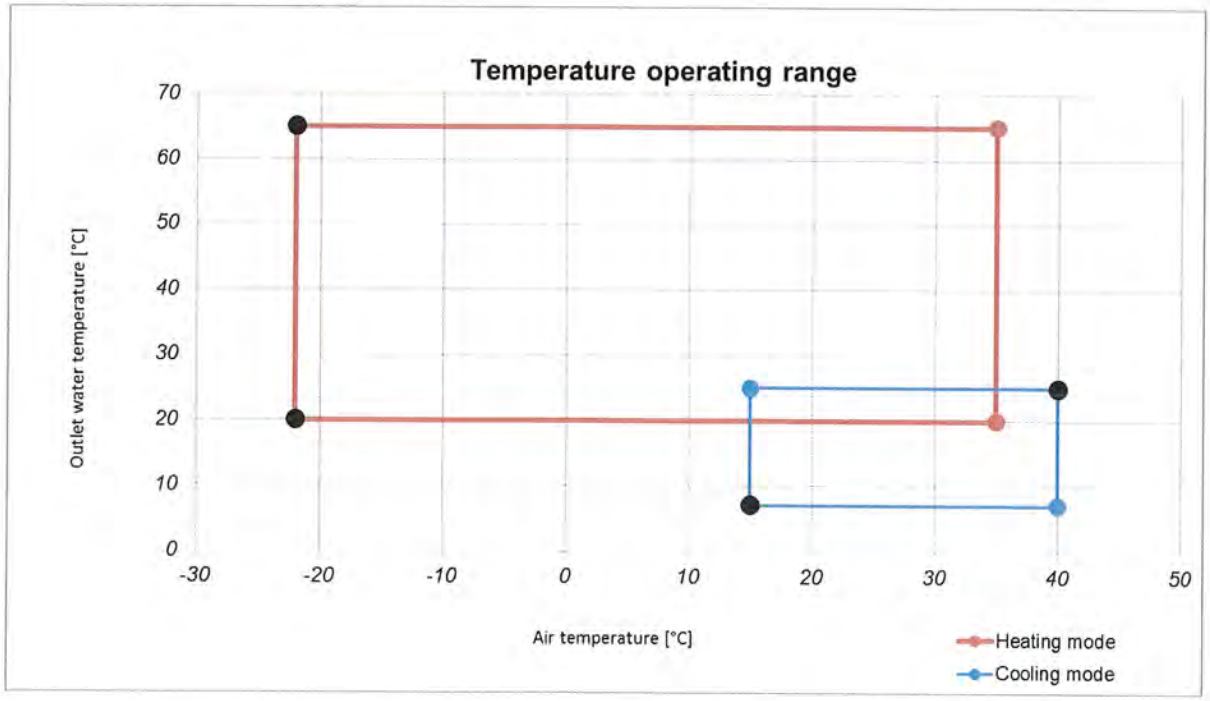
SCOPon	3.77	SCOPnet	3.77
		SCOP	**3.77**

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



Test objective:	Safety tests
Exact name of the test procedure:	**T 037* - Tests of leakage, pressure resistance, thermal and technical parameters, combustion efficiency, safety functions**
Test method:	ČSN EN 14511-4:2023
Sample tested:	Heat pump **ZHHH-01-15K-R290-R5-M + BSEM01-0000**
Measuring equipment used:	see Chapter III

1) Temperature operating range



Test point	Inlet air dry bulb temperature [°C]		Outlet heating water temperature [°C]		Water flow rate in condenser [m³/h]	Note
Heating mode						
1.	A	-22	W	20	Minimum	Minimum water flow rate: **0.7284 m³·h⁻¹** Maximum water flow rate: **1.9261 m³·h⁻¹**
2.	A	-22	W	65	Minimum	
Cooling mode						
1.	A	15	W	7	Minimum	Minimum starting water flow rate: **0.7284 m³·h⁻¹** Maximum water flow rate: **1.9261 m³·h⁻¹**
2.	A	40	W	25	Maximum	

Heat pump **ZHHH-01-15K-R290-R5-M + BSEM01-0000** is fully operational in the temperature operating range.

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

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

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

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

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

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

2) Outside the operating range

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

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

3) Freeze-up test in cooling mode

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

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

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

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

4) Shutting off the heat transfer medium flows

Required operating conditions	Test result	Note
Test for section a) Art. 4.5 ČSN EN 14511-4:2023 – heating	+	Flow supervision
Test for section a) Art. 4.5 ČSN EN 14511-4:2023 – cooling	+	–
Test for section b) Art. 4.5 ČSN EN 14511-4:2023 – heating	+	Flow supervision
Test for section b) Art. 4.5 ČSN EN 14511-4:2023 – cooling	+	–
Test for section c) Art. 4.5 ČSN EN 14511-4:2023	0	–

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

5) Complete power supply failure

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

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

6) Condensate draining and enclosure sweat test

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

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

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

Tested by:	Ing. Michal Faltýnek	Date:	2023-10-04	Signed:	
Reviewed and approved by:	Ing. Mario Jankola	Date:	2023-10-04	Signed:	

VI. A list of referenced documents

- Order of 2023-05-08 (Order reg. no. B-79322, received on 2023-05-09)
- Contract B-79322/32
- Amendments and changes of implementation date:
- B-79322.D1 of 2023-06-08

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

Test Report compiled by: Ing. Michal Faltýnek

Test Report approved by: Milan Holomek
Head of Heat and Environment-Friendly Equipment Test Station

– End of Test Report –

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

CERTYFIKAT Z BADAŃ
TEST CERTIFICATE

Numer - *Number* **O-B-00617-24 rev.1**

Producent *Customer*	JBG-2 Sp. z o.o. Gajowa 5 43-254 Warszowice POLAND
Produkt *Product*	Pompa Ciepła powietrze/woda – monoblok *Air/Water Heat Pump – monobloc*
Rodzaj oznaczenie / znak towarowy *Type designation / Trade mark*	**ZHHH-01-15K-R290-R5-M + BSEM01-0000**
Metoda testowa *Test methods*	ČSN EN 14825:2023, ČSN EN 12102:2023
Podstawy zaświadczenia *Basis of certificate*	Raport z badań - *Test reports*: 32-10951/T z - *of* 2023-06-15, 32-10951/H z - *of* 2023-10-04, Dokumentacja techniczna przedstawiona przez - *Technical documents of JBG-2 Sp. z o.o.*
Referencyjny okres grzewczy *Reference heating season*	**„A" = average** (Warunki obliczeniowe odniesienia dla ogrzewania $T_{designh}$ = -10 °C - *Reference design temperature $T_{designh}$ = -10 °C*)

Wyniki - Results:

NISKA TEMPERATURA ***LOW TEMPERATURE*** (Referencyjna temperatura wody 35 °C - *Reference water temperature 35 °C*)		**ŚREDNIA TEMPERATURA** ***MEDIUM TEMPERATURE*** (Referencyjna temperatura wody 55 °C - *Reference water temperature 55 °C*)
10.23	**$P_{designh}$ [kW]** … Obciążenie obliczeniowe dla trybu ogrzewania - *Full load heating*	**9.97**
4.96	**SCOP [-]** … Wskaźnik sezonowej efektywności - *Seasonal coefficient of performance*	**3.77**

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	9.042	3.361	T_j = -7	8.992	2.547
T_j = +2	5.694	4.975	T_j = +2	5.312	3.756
T_j = +7	3.630	5.893	T_j = +7	3.419	4.501
T_j = +12	3.044	7.167	T_j = +12	2.931	5.510
T_j = TOL = -10	10.230	2.924	T_j = TOL = -10	9.972	2.192
T_j = $T_{bivalent}$ = -10	10.230	2.924	T_j = $T_{bivalent}$ = -10	9.972	2.192

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

NISKA TEMPERATURA *LOW TEMPERATURE* (Referencyjna temperatura wody 35 °C - *Reference water temperature 35 °C*)		ŚREDNIA TEMPERATURA *MEDIUM TEMPERATURE* (Referencyjna temperatura wody 55 °C - *Reference water temperature 55 °C*)

Pobór mocy w trybach innych niż „tryb aktywny" - *Power consumption in modes other than „active mode"*

19.3	Tryb wyłączenia *Off mode*	P_{OFF}	[W]	19.3
19.8	Tryb wyłączonego termostatu *Thermostat off mode*	P_{TO}	[W]	19.8
19.3	Tryb czuwania *Standby mode*	P_{SB}	[W]	19.3
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*:

4259	ČSN EN 14825:2023	Q_{HE}	[kWh]	**5469**

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

195.5	ČSN EN 14825:2023	η_s	[%]	**147.7**

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

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

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

0.7284 1.9261	Woda grzewcza *Heating water*	Min/ Max	[m^3/h]	0.7284 1.9261

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

ZHHH-01-15K-R290-R5-M Jednostka zewnętrzna outdoor unit	L_{WA}	53.7 ± 3.0	dB(A)	Klasa dokładności 3 *Accuracy class 3*

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

Specyfikacja warunków - *Specification of conditions*:

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

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

Brno, 2024-04-12

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

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