Test Report / Prüfbericht

Project Designation
Projektbezeichnung

Sound power measurement of a heat pump

Product name
Produktbezeichnung

CGK-040V4P

Clients
Auftraggeber

WRW Pipes GmbH
FAO: Hr. Werner Klammer
Kruppstraße 29
59227 Ahlen
Germany

Guangzhou Sprsun New Energy
Technology Development Co., Ltd.
Add: No. 15 Tangxi Road
Yinsha Industrial Park
Xintang, Zengcheng
Guangzhou 511338
China

Order from / No.
Auftrag von / Nummer

11 / 2023

Project number
Projekt Nummer

SGP-24785
2.04.01884.1.0
Test report no. 1

Test engineers
Prüfer

Martin Czuka (Acoustics)
Wolfgang Zach (Thermodynamics)

Date of issue
Ausstellungsdatum

12.03.2024

No. / Total number of issues
Ausfertigungen: Nr. / Anzahl

1 / 1

Number of pages
Anzahl der Seiten

9

Annex: Number of pages
Beilagen: Anzahl der Seiten

-

The results relate exclusively to the items tested.
Die Prüfergebnisse beziehen sich ausschließlich auf die geprüften Gegenstände.

This report may only be reproduced or published in full, without omissions, alterations or additions.
Im Falle einer Vervielfältigung oder Veröffentlichung dieser Ausfertigung darf der Inhalt nur wort- und formgetreu und ohne Auslassung oder Zusatz wiedergegeben werden.

The reproduction or publishing of extracts from this report require the written approval of the testing laboratory.
Die auszugsweise Vervielfältigung oder Veröffentlichung bedarf der schriftlichen Zustimmung der Prüfstelle.

1 Task

The Competence Unit Transportation Infrastructure Technologies of the Austrian Institute of Technology GmbH was commissioned to perform sound power measurements according to EN 12102-1:2017 of a heat pump of the company Guangzhou Sprsun New Energy Technology Development Co., Ltd. EN ISO 9614-2:1996 was used as the acoustic measurement method.

Annotation: Depending on their type, measurands and numeric values in this report are rounded to 1, 2 or 3 decimal places. Necessary calculations that lead to these numeric values were carried out with higher accuracy and then rounded to the respective number of decimal places.

2 Standards used in this test report

Test method (within accreditation)
EN 12102-1:2017 with EN ISO 9614-2:1996 was selected as acoustic test method according to section 7.2 in EN 12102-1:2017.

Supporting standards (not within accreditation)
IEC 60942:2017, Electroacoustics - Sound calibrators
IEC 61043:1993, Electroacoustics - Instruments for the measurement of sound intensity - Measurements with pairs of pressure sensing microphones

3 Device under test (DUT)

Type

Air / water heat pump.

Technical data

The DUT can be specified with the following technical data:

Manufacturer	Guangzhou Sprsun New Energy Technology Development Co., Ltd
Type	CGK-040V4P
Serial number	KBL112210610700014
Year of manufacture	2023
Refrigerant	R290
Refrigerant filling quantity	1000 g

Dimensions

The DUT had a cuboid reference surface with the following dimensions:

Width	1.109 m
Depth	0.494 m
Height	0.957 m

Qualitative Description

The DUT was an air / water heat pump.

4 Measurement conditions

Operating conditions

The acoustic measurements for the determination of the sound power were performed at operating point A7W55 MTA-AC-C. According to the manufacturer's specifications, the measurements were performed at the minimum mass flow rate of 0.15 kg/s and at the minimum compressor speed. In order to achieve the specified heating capacity with stable operating behaviour of the heat pump, the outside air temperature had to be set to -1.0 °C.

Table 1: Operating conditions during measurements.

Measurand	Mean value	Dimension	Instrument type	Instrument no.	Uncertainty
WQA inlet temperature	-1.04	°C	E+E temperature / humidity-sensor	1005T/1007T 1012T/1017T	0.050
WQA inlet humidity	86.97	% r. H.	E+E temperature / humidity-sensor	1005F/1007F 1012F/1017F	1.561
WNA inlet temperature	50.73	°C	PT100	139	0.050
WNA outlet temperature	54.92	°C	PT100	107	0.050
WNA temperature difference	4.18	K	-	-	-
WNA mass flow	0.15	kg/s	Coriolis mass flow meter	908	0.001
Heating capacity	2.61	kW	-	-	

Installation conditions

The measurements were performed in the heat pump testing facilities of the competence unit Sustainable Thermal Energy Systems at TECHbase Vienna. The heat pump was installed in the test bed and connected with the necessary aggregates and conduits for operation. The installation conditions are in accordance with EN 12102-1:2017. The acoustic measurements were performed at the following average environmental conditions:

Air temperature	-1.0 °C
Air pressure	1008.0 hPa
Relative air humidity	87.0 %

Acoustic suitability of the test bed

The test bed is equipped with a sound-reflecting floor and is otherwise lined with acoustically absorbing panels.

Alignment of the DUT in the test bed

The alignment of the DUT in the test bed can be seen from the following drawing:

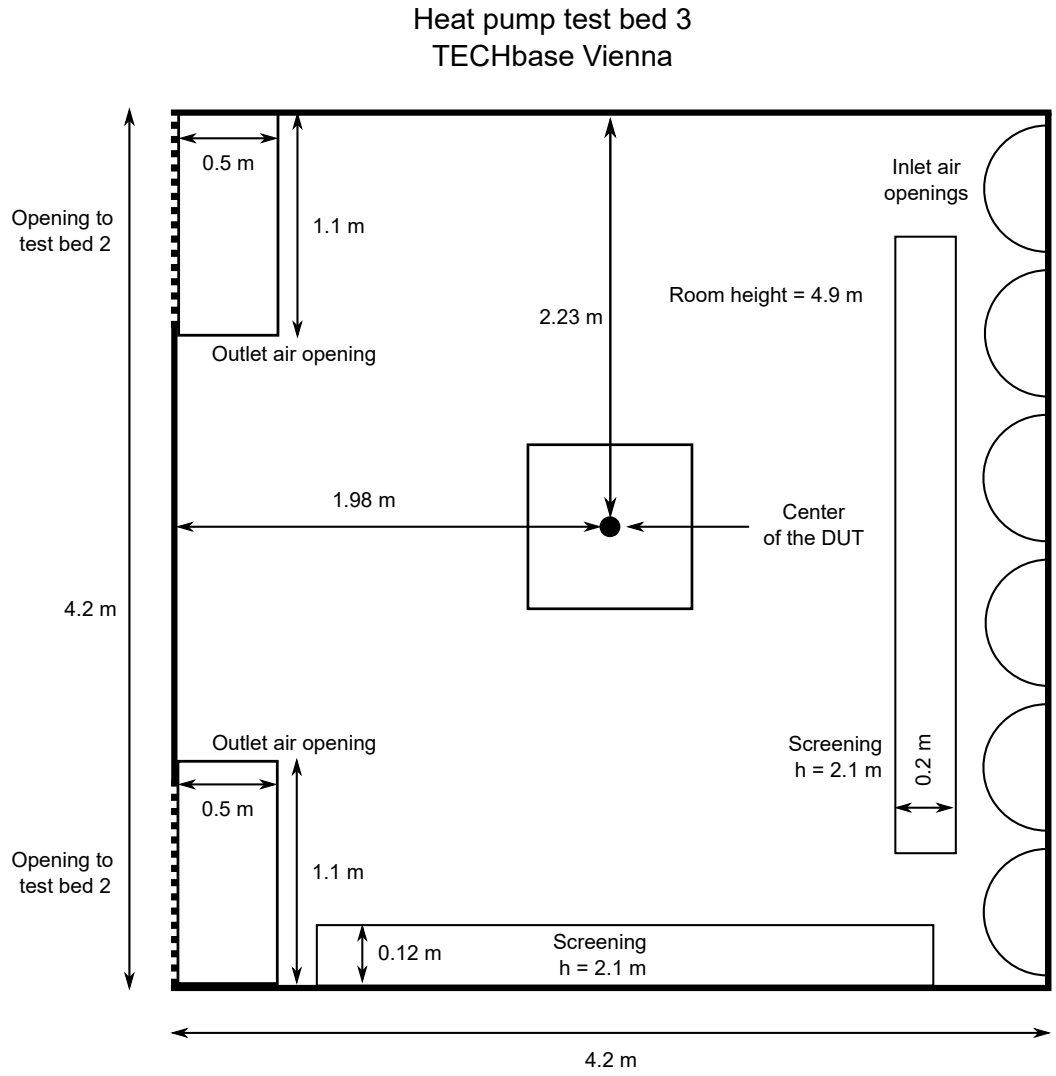


Figure 1: Alignment of the DUT in the test bed. Not to scale.

5 Instrumentation

The following measurement equipment was used for the test:

Table 2: List of the acoustic measurement equipment used.

Measurement equipment	Manufacturer	Type	Serial number
Real time analyzer	Brüel & Kjaer	LAN-XI 3050-A-060	3050-109322
Sound intensity probe	Brüel & Kjaer	3599	3192926
Calibrator	Brüel & Kjaer	4297	3214947

During the measurements, an ellipsoidal wind screen UA-0781 from the manufacturer Brüel & Kjaer was used. The sound intensity probe and the calibrator fulfil the requirements of IEC 60942 and IEC 61043.

Equipment check

The whole measurement chain was checked on site. The sound pressure sensitivity of both microphones was checked using the Brüel & Kjaer calibrator with a reference sound pressure level of 94 dB at a frequency of 251.2 Hz at the microphones.

6 Acoustical data

A parallelepiped on a reflecting surface was chosen as the measurement surface, which encloses the DUT reference surface with a distance of d = 0.25 m. The front measurement segment was parallel to the surface of the DUT where the main ventilator was located. In order to stay below the maximum airflow limit of EN ISO 9614-2:1996, the distance between the front reference surface and the front measurement segment was increased to d = 1 m. This results in the following dimensions of the measurement surface, which is also depicted in Figure 2:

Dimensions:	
Width	1.609 m
Depth	1.744 m
Height	1.207 m
Total measurement surface area	10.900 m^2

The resulting measurement segments and the relevant measurement durations are listed in Table 3. The measurements were performed using two spacers, where the results of the larger spacer (50 mm, S1) were used for the frequency bands from 50 Hz to 250 Hz, and the results of the smaller spacer (8.5 mm, S2) for the frequency bands from 315 Hz to 6.3 kHz.

Table 3: Dimensions and measurement durations.

Segment	Dimensions (m)	Area (m^2)	Meas. dur. 1 S1 (s)	Meas. dur. 2 S1 (s)	Meas. dur. 1 S2 (s)	Meas. dur. 2 S2 (s)
Back	1.61 x 1.21	1.94	81.06	65.06	77.69	61.94
Front	1.61 x 1.21	1.94	75.00	67.00	59.25	54.31
Top	1.61 x 1.74	2.81	88.81	85.25	69.75	84.06
Right	1.74 x 1.21	2.11	71.50	70.88	71.88	62.75
Left	1.74 x 1.21	2.11	78.19	70.12	57.00	56.25

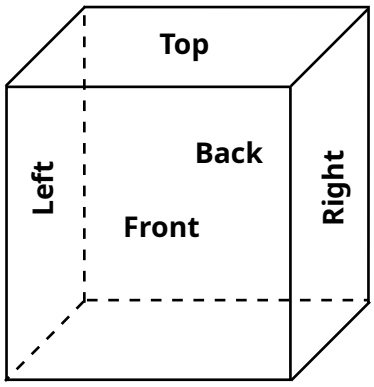


Figure 2: Measurement surface of DUT and assignment of measurement segments. Not to scale.

For the determination of the overall sound power level, the following quantities were used:

Table 4: Sound power levels and field indicators. The index j indicates the frequency band number.

One-third octave band (Hz)	F_{pl} (dB)	L_d (dB)	Criterion 1	$F_{+/-}$ (dB)	Criterion 2	Criterion 3	$L_{WA,j}$ (dB(A))	Relevant one-third octave band
50	14.3	9.5	FAIL	11.7	FAIL	OK	29.1	
63	6.0	14.1	OK	0.0	OK	OK	35.1	
80	4.7	20.8	OK	0.0	OK	OK	36.3	
100	3.4	18.6	OK	0.0	OK	OK	40.4	
125	3.3	24.4	OK	0.0	OK	OK	46.7	
160	5.0	18.8	OK	0.0	OK	OK	42.8	
200	4.5	20.3	OK	0.0	OK	OK	47.2	
250	3.8	21.2	OK	0.0	OK	OK	56.1	x
315	3.3	23.1	OK	0.0	OK	OK	47.6	
400	2.9	25.0	OK	0.0	OK	OK	48.3	
500	3.0	27.8	OK	0.0	OK	OK	47.4	
630	3.0	34.1	OK	0.0	OK	OK	47.1	
800	3.1	35.5	OK	0.0	OK	OK	47.3	
1000	3.0	35.9	OK	0.0	OK	OK	46.9	
1250	3.3	28.8	OK	0.0	OK	OK	45.7	
1600	3.4	25.9	OK	0.0	OK	OK	44.6	
2000	3.1	25.9	OK	0.0	OK	OK	43.5	
2500	2.7	29.9	OK	0.0	OK	OK	41.3	
3150	2.5	29.4	OK	0.0	OK	OK	37.9	
4000	2.9	23.9	OK	0.0	OK	OK	34.6	
5000	3.8	21.7	OK	0.0	OK	OK	30.6	
6300	5.3	20.1	OK	0.0	OK	OK	25.4	

As commissioned, only the A-weighted overall sound power level was to be determined. Therefore, only the measurement uncertainties in the marked one-third octave bands in Table 4 are relevant.

According to EN 12102-1:2017, the A-weighted overall sound power level of the heat pump for the frequency range from 100 Hz to 6.3 kHz results in a value of **L_{WA} = 59.9 dB(A)**, with a grade 2 measurement accuracy. The following standard deviations of reproducibility σ_R do apply for one-third octave bands where all criteria in Table 4 are fulfilled:

One-third octave band	σ_R
50 Hz – 160 Hz	3 dB
200 Hz – 315 Hz	2 dB
400 Hz – 5000 Hz	1.5 dB
6300 Hz	2.5 dB

Annotation: In the extended frequency range from 50 Hz to 6.3 kHz defined by EN ISO 9614-2:1996 the A-weighted overall sound power level of the heat pump results in a value of L_{WA} = 59.9 dB(A).

The measurements were performed on 11.01.2024 at 10:45 a.m.

Vienna, 12.03.2024

AIT Austrian Institute of Technology GmbH Vom Akkreditierung Austria akkreditierte Prüfstelle

SIGNATURINFORMATIONEN	**Unterzeichner**	Marco Conter
	Datum/Zeit-UTC	2024-03-14T09:26:03+01:00
	Prüfinformation	Informationen zur Prüfung der elektronischen Signatur finden Sie unter: https://www.signaturpruefung.gv.at
Hinweis	Dieses mit einer qualifizierten elektronischen Signatur versehene Dokument hat gemäß Art. 25 Abs. 2 der Verordnung (EU) Nr. 910/2014 vom 23. Juli 2014 ("eIDAS-VO") die gleiche Rechtswirkung wie ein handschriftlich unterschriebenes Dokument.	

i.A.

AIT Austrian Institute of Technology GmbH
Dipl.-Ing. Martin Czuka B.Sc.
Test engineer acoustics
Prüfer Akustik

i.A.

AIT Austrian Institute of Technology GmbH
Dott. Ing. Marco Conter
Authorised signatory acoustics
Zeichnungsberechtigte Person Akustik

Signiert von: Wolfgang Julius Zach
Datum: 14.03.2024 10:49:52
TRUST
Dieses Dokument ist digital signiert!
Dieses mit einer qualifizierten elektronischen Signatur versehene Dokument hat gemäß Art. 25 Abs. 2 der Verordnung (EU) Nr 910/2014 vom 23. Juli 2014 ("eIDAS-VO") die gleiche Rechtswirkung wie ein handschriftlich unterschriebenes Dokument.
Prüfinformation: Informationen zur Prüfung der elektronischen Signatur finden Sie unter: www.a-trust.at/pdf

i.A.

AIT Austrian Institute of Technology GmbH
Wolfgang Zach
Test engineer thermodynamics
Prüfer Thermodynamik

Signiert von: Andreas Zottl
Datum: 14.03.2024 10:25:05
TRUST
Dieses Dokument ist digital signiert!
Dieses mit einer qualifizierten elektronischen Signatur versehene Dokument hat gemäß Art. 25 Abs. 2 der Verordnung (EU) Nr 910/2014 vom 23. Juli 2014 ("eIDAS-VO") die gleiche Rechtswirkung wie ein handschriftlich unterschriebenes Dokument.
Prüfinformation: Informationen zur Prüfung der elektronischen Signatur finden Sie unter: www.a-trust.at/pdf

i.A.

AIT Austrian Institute of Technology GmbH
Dipl.-Ing. (FH) Andreas Zottl
Authorised signatory thermodynamics
Zeichnungsberechtigte Person Thermodynamik