OŚWIADCZENIE

Producent Immergas Polska Sp. z o.o. oświadcza, iż pompy ciepła

1) Magis M12 T EH9
Oznaczenie/typ/identyfikator modelu
2) Magis M14 T EH9
Oznaczenie/typ/identyfikator modelu
3) Magis M16 T EH9
Oznaczenie/typ/identyfikator modelu
4) Magis M12 T
Oznaczenie/typ/identyfikator modelu
5) Magis M16 T
Oznaczenie/typ/identyfikator modelu

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

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

IMMERGAS POLSKA Sp. z o.o.
mgr inż. Kamil Rosa
Produkt Menadżer OZE

Łódź, 27.06.2024
Miejscowość, data

Kamil Rosa
Podpis osoby upoważnionej

Tłumaczenie uwierzytelnione z języka angielskiego

RAPORT Z BADANIA

Raport nr: 300-KLAB-23-039-12

[logo]
DUŃSKI INSTYTUT TECHNOLOGICZNY
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Strona 1 z 44
Ref.: PRES/RTHI
Nr pliku: 226006
Załączniki: 2

Klient: Spółka: GD MIDEA HEATING & VENTILATING EQUIPMENT CO., LTD.
Adres: Penglai Industry Road, Beijiao
Miasto: Shunde, Foshan, Guangdong, 528311, Chiny
Tel: +86 13902810522

Komponent: Marka: Midea
Typ: Pompa ciepła powietrze-woda (monoblok)
Model: MHC-V16W/D2RN8-B
Nr serii:541K814480238190100003
Rok produkcji: Jednostka zewnętrzna: NIE DOTYCZY

Daty: Badany komponent: grudzień 2023 - styczeń 2024

Marka: Marka: IMMERGAS
Typ: Pompa ciepła powietrze-woda (monoblok)
Model: MAGIS M16 T

Procedura: Aby zapoznać się z listą norm, patrz cel (strona 2)

Uwagi: Urządzenie zostało dostarczone przez klienta. Montaż i ustawienia badawcze zostały wykonane zgodnie z instrukcjami producenta. Pomiędzy każdym badaniem Midea zmieniono różne parametry obejmujące prędkość sprężarki, zawór rozprężny, prędkość wentylatora, prędkość pompy, czas odszraniania, czas nagrzewania. Raport dla badanego urządzenia pod nazwą 300-KLAB-23-039 został wydany w dniu 21 marca 2024 r. Patrz też załącznik 2.

Warunki:

Niniejsze badanie zostało przeprowadzone w ramach akredytacji zgodnie z międzynarodowymi wymogami (ISO/IEC 17025:2017) oraz zgodnie z Ogólnymi Warunkami Duńskiego Instytutu Technologicznego. Wyniki badania odnoszą się wyłącznie do badanego przedmiotu. Niniejszy raport z badania może być publikowany we fragmentach wyłącznie za pisemną zgodą Duńskiego Instytutu Technologicznego.
Klient nie może powoływać się na Duński Instytut Technologiczny lub pracowników Duńskiego Instytutu Technologicznego w celach reklamowych lub marketingowych, chyba że Duński Instytut Technologiczny udzielił pisemnej zgody w każdym przypadku.

Dział/Centrum: Duński Instytut Technologiczny
Energia i klimat
Laboratorium pomp ciepła, Aarhus

Data: 26 kwietnia 2024 r.

Podpisał:
Preben Eskerod
B.TecMan & MarEng

Sprawdził:
Rasmus Thisgaard
B.TecMan & MarEng

Dokument podpisany elektronicznie, 26 kwietnia 2024 r.
DUŃSKI INSTYTUT TECHNOLOGICZNY

Pompy ciepła o identycznej konstrukcji

Według GD MIDEA HEATING & VENTILATING EQUIPMENT CO. LTD. Pompy ciepła wymienione w poniższej tabeli są uważane za identyczne z badaną jednostką. Mają one identyczne parametry:

a. wydajność grzewcza
b. cykl czynnika chłodniczego (w tym masa czynnika chłodniczego)
c. źródło ciepła i medium pochłaniające
d. główne komponenty / zasada eksploatacji i strategia sterowania
e. ta sama obudowa zewnętrzna

Midea	MHC-V16W/D2N8-B
Midea	MHC-V16W/D2N8-BE30
Midea	MHC-V16W/D2N8-BER60
Midea	MHC-V16W/D2N8-BER90
Midea	MHC-V16W/D2N8-B1
Midea	MHC-V16W/D2N8-B1E30

Midea	MHC-V16W/D2N8-B1ER60
Midea	MHC-V16W/D2N8-B1ER90
Midea	MHC-V16W/D2N8-B2
Midea	MHC-V16W/D2N8-B2E30
Midea	MHC-V16W/D2N8-B2ER60
Midea	MHC-V16W/D2N8-B2ER90
Midea	MHC-V16W/D2RN8-B
Midea	MHC-V16W/D2RN8-BE30
Midea	MHC-V16W/D2RN8-BER60
Midea	MHC-V16W/D2RN8-BER90
Midea	MHC-V16W/D2RN8-B1
Midea	MHC-V16W/D2RN8-B1E30
Midea	MHC-V16W/D2RN8-B1ER60
Midea	MHC-V16W/D2RN8-B1ER90
Midea	MHC-V16W/D2RN8-B2
Midea	MHC-V16W/D2RN8-B2E30
Midea	MHC-V16W/D2RN8-B2ER60
Midea	MHC-V16W/D2RN8-B2ER90

Cel

Celem niniejszego raportu jest udokumentowanie następujących kwestii:

Sezonowy współczynnik wydajności (SCOP) przy zastosowaniu w niskiej i średniej temperaturze dla klimatu umiarkowanego zgodnie z normą EN 14825:2022.

W celu obliczenia SCOP przeprowadzono badania w warunkach obciążenia częściowego podanych w tabelach na stronie 5 i 6.

Badanie obciążenia częściowego SCOP w warunkach $SCOP_B$ i $SCOP_C$ przy zastosowaniu w niskiej temperaturze dla cieplejszego klimatu zgodnie z EN 14825:2022.

Warunki badania obciążenia częściowego: $SCOP_A$ i $SCOP_{F/G}$ przy zastosowaniu w niskiej temperaturze dla chłodniejszego klimatu zgodnie z EN 14825:2022.

Standardowe warunki znamionowe badania COP A7/W35 i A7/W55 zgodnie z normą EN 14511:2022.

Wymagania eksploatacyjne zgodnie z normą EN 14511-4:2022
- 4.2.1 Badania rozruchowe i eksploatacyjne
- 4.5 Odcięcie przepływu nośnika ciepła
- 4.6 Całkowita awaria zasilania

Pomiary mocy akustycznej zgodnie z normą EN 12102-1:2022.

Warunki badawcze

Warunki badawcze SCOP dla niskich temperatur – EN 14825

Warunki częściowego obciążenia dla referencyjnego SCOP i referencyjnego SCOPon przy obliczaniu jednostek powietrze-woda dla zastosowań niskotemperaturowych dla referencyjnego sezonu grzewczego; „A" = umiar, klimat, „W" = cieplejszy klimat, „C" = zimniejszy klimat.

	Współczynnik obciążenia częściowego w %				**Zewnętrzny wymiennik ciepła**		**Wewnętrzny wymiennik ciepła**			
					Temperatura termometru suchego (mokrego) °C		Stały wylot °C	Zmienny wylot[d] °C		
	Wzór	Umiar.	Cieplejszy	Chłodniejszy	Powietrze zewnętrz.	Wylot powietrza	Wszystkie klimaty	Umiar.	Cieplejszy	Chłodniejszy
A	(-7-16)/ (Tdesignh - 16)	88,46	nie dotyczy	60,53	-7(-8)	20(12)	a/35	a/34	nie dotyczy	a/30
B	(+2-16)/ (Tdesignh - 16)	53,85	100,00	36,84	2(1)	20(12)	a/35	a/30	a/35	a/27
C	(+7-16)/ (Tdesignh - 16)	34,62	64,29	23,68	7(6)	20(12)	a/35	a/27	a/31	a/25
D	(+12-16)/ (Tdesignh - 16)	15,38	28,57	10,53	12(11)	20(12)	a/35	a/24	a/26	a/24
E	*TOLe-16)/* (Tdesignh -16)				*TOLe*	20(12)	a/35	a/b	a/b	a/b
F	*(Tbiv -16)/* (Tdesignh -16)				*Tbiv*	20(12)	a/35	a/c	a/c	a/c
G	(-15-16)/ (Tdesignh - 16)	nie dotyczy	nie dotyczy	81,58	-15	20(12)	a/35	nie dotyczy	nie dotyczy	a/32

Dodatkowe informacje

Klimat	Tdesignh (°C)	Tbivalent (°C)	TOL (°C)	Temperatura na wylocie	Natężenie przepływu
Klimat umiar.	-10	-7	-10	Zmienna	Zmienne
Klimat zimniejszy	-22	-15	-22	Zmienna	Zmienne
Klimat cieplejszy	2	7	2	Zmienna	Zmienne

Warunki badawcze SCOP dla średnich temperatur – EN 14825

Warunki częściowego obciążenia dla referencyjnego SCOP i referencyjnego SCOPon przy obliczaniu jednostek powietrze-woda dla zastosowań średniotemperaturowych dla referencyjnego sezonu grzewczego; „A" = umiar, klimat, „W" = cieplejszy klimat, „C" = zimniejszy klimat.

	Współczynnik obciążenia częściowego w %				**Zewnętrzny wymiennik ciepła**		**Wewnętrzny wymiennik ciepła**			
					Temperatura termometru suchego (mokrego) °C		Stały wylot °C	Zmienny wylot[d] °C		
	Wzór	Umiar.	Cieplejszy	Chłodniejszy	Powietrze zewnętrz.	Wylot powietrza	Wszystkie klimaty	Umiar.	Cieplejszy	Chłodniejszy
A	(-7-16)/ (Tdesignh - 16)	88,46	nie dotyczy	60,53	-7(-8)	20(12)	a/55	a/52	nie dotyczy	a/44
B	(+2-16)/ (Tdesignh - 16)	53,85	100,00	36,84	2(1)	20(12)	a/55	a/42	a/55	a/37
C	(+7-16)/ (Tdesignh - 16)	34,62	64,29	23,68	7(6)	20(12)	a/55	a/36	a/46	a/32
D	(+12 -16) / Tdesignh - 16)	15,38	28,57	10,53	12(11)	20(12)	a/55	a/30	a/34	a/28
E	*(TOLe-16)*/(Tdesignh -16)				*TOLe*	20(12)	a/55	a/b	a/b	a/b
F	*(Tbiv -16)* / (Tdesignh -16)				*Tbiv*	20(12)	a/55	a/c	a/c	a/c
G	(-15 -16) / (Tdesignh - 16)	nie dotyczy	nie dotyczy	81,58	-15	20(12)	a/55	nie dotyczy	nie dotyczy	a/49

Dodatkowe informacje

Klimat	Tdesignh (°C)	Tbivalent (°C)	TOL (°C)	Temperatura na wylocie	Natężenie przepływu
Klimat umiar.	-10	-7	-10	Zmienna	Zmienne

Warunki badawcze COP – niska temperatura – EN 14511

Nr	Źródło ciepła		Radiator	
	Temperatura termometru suchego na wlocie (°C)	Temperatura termometru mokrego na wlocie (°C)	Temperatura na wlocie (°C)	Temperatura na wylocie (°C)
1^S	7	6	30	35

S: Standardowy warunek oceny

Warunki badawcze COP – średnia temperatura – EN 14511

Nr	Źródło ciepła		Radiator	
	Temperatura termometru suchego na wlocie (°C)	Temperatura termometru mokrego na wlocie (°C)	Temperatura na wlocie (°C)	Temperatura na wylocie (°C)
1^S	7	6	47	55

S: Standardowy warunek oceny

Warunki badawcze dla wymagań eksploatacyjnych – EN 14511-4

Nr	Źródło ciepła		Radiator	Natężenie przepływu wody w wewnętrznym wymienniku ciepła	Badanie
	Temperatura termometru suchego na wlocie (°C)	Temperatura termometru mokrego na wlocie (°C)	Temperatura na wlocie (°C)		
1	-25	-	12	800 L/h	Rozruchowe
2	-25	-	38	710 L/h	Eksploatacyjne

Warunki badawcze odcięcia nośnika ciepła – EN 14511-4

Nr	Źródło ciepła		Radiator		Wymiennik ciepła
	Temperatura termometru suchego na wlocie (°C)	Temperatura termometru mokrego na wlocie (°C)	Temperatura na wlocie (°C)	Temperatura na wylocie (°C)	
1	7	6	47	55	Wewnętrzny
2	7	6	47	55	Zewnętrzny

Warunki badania dla całkowitej awarii zasilania – EN 14511-4

Nr	Źródło ciepła		Radiator	
	Temperatura termometru suchego na wlocie (°C)	Temperatura termometru mokrego na wlocie (°C)	Temperatura na wlocie (°C)	Temperatura na wylocie (°C)
1	7	6	47	55

Warunki badawcze dla pomiarów mocy akustycznej – EN 12102-1

Nr	Warunki badania		Ustawienie pompy ciepła			
	Zewnętrzny wymiennik ciepła (termometr suchy / mokry) (°C)	Wewnętrzny wymiennik ciepła (wlot / wylot) (°C)	Prędkość sprężarki (Hz)	Prędkość wentylatora na zewnątrz (obr./min)	Moc grzewcza (kW)	Moc wejściowa (kW)
1F	7/6	30/35	64	730	15,70	3,49
2P	7/6	30/35	24	400	5,67	1,16
3F	7/6	47/55	72	650	16,14	5,65
4E	7/6	47/55	32	450	7,10	2,34

F) Pełne obciążenie, P) Częściowe obciążenie i E) Oznaczenie ErP

Wyniki badania

Wyniki badania SCOP w niskiej temperaturze – średnia sezonu grzewczego – EN 14825

Model (zewnętrzny)	MHC-V16W/D2RN8-B
Monoblokowa pompa ciepła powietrze-woda	T
Niskotemperaturowa pompa ciepła	N
Wyposażony w dodatkową grzałkę	T
Kombinowany podgrzewacz z pompą ciepła	N
Odwracalny	T

Znamionowa moc cieplna 1)		Pznam.		**15,2** (kW)
Sezonowa efektywność energetyczna ogrzewania pomieszczeń		ηs		**184,1** (%)
		SCOP		**4,68** (-)
Zmierzona wydajność ogrzewania dla częściowego obciążenia przy temperaturze zewnętrznej Tj	Klimat umiarkowany Zastosowanie w niskich temperaturach	Tj=-15°C	Pdh	- (kW)
		Tj=-7°C	Pdh	13,27 (kW)
		Tj=2°C	Pdh	8,24 (kW)
		Tj=7°C	Pdh	6,26 (kW)
		Tj=12°C	Pdh	7,26 (kW)
		Tj= temperatura dwuwartościowa	Pdh	13,27 (kW)
		Tj= limit operacyjny	Pdh	12,62 (kW)
Zmierzony współczynnik wydajności w temperaturze zewnętrznej Tj	Klimat umiarkowany Zastosowanie w niskich temperaturach	Tj=-15°C	COPd	- (-)
		Tj=-7°C	COPd	2,64 (-)
		Tj=2°C	COPd	4,59 (-)
		Tj=7°C	COPd	6,62 (-)
		Tj=12°C	COPd	8,13 (-)
		Tj= temperatura dwuwartościowa	COPd	2,64 (-)
		Tj= limit operacyjny	COPd	2,51 (-)
Temperatura dwu wartościowa		Tbivalent		-7 (°C)
Limit eksploatacji		TOL		-10 (°C)
temperatury		WTOL		- (°)
Współczynnik degradacji		Cdh		0,97 (-)
		Tryb Off	P_{OFF}	0,021 (kW)
Zużycie energii w trybach innych niż tryb aktywny		Termostat - Tryb off	P_{TO}	0,026 (kW)
		Tryb gotowości	P_{SB}	0,021 (kW)
		Tryb grzałki skrzyni korbowej[2]1	P_{CK}	0,021 (kW)
Grzałka dodatkowa 1)		Znamionowa moc cieplna Rodzaj pobieranej energii	P_{SUP}	2,58 (kW) Elektryczna
Inne pozycje		Kontrola wydajności		Zmienna
		Kontrola przepływu wody		Zmienna
		Natężenie przepływu wody		
		Roczne zużycie energii	Q_{HE}	6712 (kWh)

1) W przypadku ogrzewaczy pomieszczeń z pompą ciepła i wielofunkcyjnych ogrzewaczy z pompą ciepła znamionowa moc cieplna, Pznam., jest równa projektowemu obciążeniu grzewczemu, Pdesignh, a wskaźnik mocy cieplnej dodatkowego ogrzewacza, Psup jest równy dodatkowej wydajności grzewczej, sup(Tj).

2) Do obliczenia SCOP używana jest wartość PCK-PSB. Patrz strona 15

Wyniki badania SCOP w średniej temperaturze – średnia sezonu grzewczego – EN 14825

Model (Zewnętrzny)	MHC-V16W/D2RN8-B
Monoblokowa pompa ciepła powietrze- woda	T
Niskotemperaturowa pompa ciepła	N
Wyposażony w dodatkową grzałkę	T
Kombinowany podgrzewacz z pompą ciepła	N
Odwracalny	T

Znamionowa moc cieplna 1)		Pznam.		**13** (kW)
Sezonowa efektywność energetyczna ogrzewania pomieszczeń		ns		**137,3** (%)
		SCOP		**3,51** (-)
Zmierzona wydajność ogrzewania dla częściowego obciążenia przy temperaturze zewnętrznej Tj	Klimat umiarkowany Zastosowanie w niskich temperaturach	Tj=-15°C	Pdh	- (kW)
		Tj=-7°C	Pdh	11,68 (kW)
		Tj=2°C	Pdh	7,29 (kW)
		Tj=7°C	Pdh	6,03 (kW)
		Tj=12°C	Pdh	6,89 (kW)
		Tj= temperatura dwuwartościowa	Pdh	11,68 (kW)
		Tj= limit operacyjny	Pdh	10,53 (kW)
Zmierzony współczynnik wydajności w temperaturze zewnętrznej Tj	Klimat umiarkowany Zastosowanie w niskich temperaturach	Tj=-15°C	COPd	- (-)
		Tj=-7°C	COPd	2,02 (-)
		Tj=2°C	COPd	3,42 (-)
		Tj=7°C	COPd	4,93 (-)
		Tj=12°C	COPd	6,02 (-)
		Tj= temperatura dwuwartościowa	COPd	2,02 (-)
		Tj= limit operacyjny	COPd	1,82 (-)
Temperatura dwuwartościowa		Tbivalent		-7 (°C)
Limit eksploatacji		TOL		-10 [°C)
temperatury		WTOL		- (°C)
Współczynnik degradacji		Cdh		0,98 (-)
		Tryb Off	P_{OFF}	0,021 (kW)
Zużycie energii w trybach innych niż tryb aktywny		Termostat-Tryb off	P_{TO}	0,026 (kW)
		Tryb gotowości	P_{SB}	0,021 (kW)
		Tryb grzałki skrzyni korbowej	P_{CK}	0,021 (kW)
Grzałka dodatkowa 1)		Znamionowa moc cieplna Rodzaj pobieranej energii	P_{SUP}	2,47 (kW) Elektryczna
Inne pozycje		Kontrola wydajności		Zmienna
		Kontrola przepływu wody		Zmienna
		Natężenie przepływu wody		
		Roczne zużycie energii	Q_{HE}	7655 (kWh)

1) W przypadku ogrzewaczy pomieszczeń z pompą ciepła i wielofunkcyjnych ogrzewaczy z pompą ciepła znamionowa moc cieplna, Pznam., jest równa projektowemu obciążeniu grzewczemu, Pdesignh, a wskaźnik mocy cieplnej dodatkowego ogrzewacza, Psup jest równy dodatkowej wydajności grzewczej, sup(Tj).

2) Do obliczenia SCOP używana jest wartość PCK-PSB. Patrz strona 17

Wyniki badań dla cieplejszego klimatu, niska temperatura zgodnie z EN14825

Nr	Warunki badania	Moc grzewcza (kW)	COP
1	B	13,106	3,508
2	Tbivalent F i C	8,750	5,514

Wyniki badań dla chłodniejszego klimatu, niska temperatura zgodnie z EN14825

Nr	Warunki badania	Moc grzewcza (kW)	COP
1	A	8,383	3,315
2	Tbivalent F i G	11,301	2,497

Wyniki badania COP – niska temperatura – EN 14511

Nr	Warunki badania	Moc grzewcza (kW)	COP
1	A7/W35	15,707	4,498

Wyniki badania COP – średnia temperatura – EN 14511

Nr	Warunki badania	Moc grzewcza (kW)	COP
1	A7/W55	16,139	2,854

Wyniki badania rozruchu i eksploatacji – EN 14511-4

Nr	Warunki badawcze wlot powietrza/wody (°C)	Ocena badania
Rozruch	A-25/W18	Zaliczono
Eksploatacja	A-25/W38	Zaliczono

Wyniki badania odcięcia nośnika ciepła – EN 14511-4

Nr	Wymiennik ciepła	Ocena badania
1	Wewnętrzny	Zaliczono
2	Zewnętrzny	Zaliczono

Wyniki badania dla całkowitej awarii zasilania – EN 14511-4

Nr	Ocena badania
1	Zaliczono

Wyniki pomiarów mocy akustycznej – EN 12102-1

Nr	Warunki badania	Poziom mocy akustycznej LW(A) (dB re 1pW)	Niepewność σ_{tot} (dB)
1^F	A7/W35	66,5	1,6
2^P	A7/W35	51,5	1,6
3^F	A7/W55	65,2	1,6
4^E	A7/55	55,6	1,6

F) Pełne obciążenie, P) Częściowe obciążenie i E) Oznaczenie ErP

Całkowity poziom mocy akustycznej skorygowany charakterystyką A jest określany dla mierzonego zakresu częstotliwości od 100 Hz do 10 kHz. W celu obliczenia niepewności proszę zapoznać się z dodatkiem 1.

Pomiary mocy akustycznej są przeprowadzane przez Kamalathasana Arumugama (KAMA) i sprawdzane przez Patricka Gliberta (PGL) z Duńskiego Instytutu Technologicznego.

Załącznik 2
Deklaracja stałości

Produkt: Powietrzna pompa ciepła
Marka: IMMERGAS
Nazwa producenta: GD Midea HEATING&VENTILATING Equipment Co., Ltd.
Adres producenta: Midea Industrial City, Shunde, Foshan, Guangdong, Chińska Republika Ludowa
Nazwa importera: IMMERGAS S.P.A
Adres importera: 42041 Brescello (RE) Włochy

My, GD Midea Heating & Ventilating Equipment Co., Ltd, niniejszym deklarujemy, że następujące pompy ciepła wyprodukowane na rzecz IMMERGAS S.P.A są identyczne z następującymi modelami,

Nazwa modelu Midea	Model IMMERGAS
MHC-V4W/D2N8-B	MAGIS M4
MHC-V6VWD2N8-B	MAGIS M6
MHC-V8VWD2N8-B	MAGIS M8
MHC-V10W/D2N8-B	MAGIS M10
MHC-V12W/D2N8-B	MAGIS M12
MHC-V14W/D2N8-B	MAGIS M14
MHC-V16W/D2N8-B	MAGIS M16
MHC-V12W/D2RN8-B	MAGIS M12 T
MHC-V14W/D2RN8-B	MAGIS M14 T
MHC-V16W/D2RN8-B	MAGIS M16 T
MHC-V4W/D2N8-BE30	MAGIS M4 EH3
MHC-V6W/D2N8-BE30	MAGIS M6 EH3
MHC-V8W/D2N8-BE30	MAGIS M8 EH3
MHC-V12W/D2RN8-BER90	MAGIS M12T E H9
MHC-V14W/D2RN8-BER90	MAGIS M14T E H9
MHC-V16W/D2RN8-BER90	MAGIS M16T E H9

GD Midea Heating & Ventilating Equipment Co. Ltd.
Adres: Midea Industrial City, Beijiao, Shunde, Foshan, Guangdong, Chińska Republika Ludowa
Kod pocztowy: 528311
Tel.: +86-757-26338495 Faks: +86-757-22390205 Strona internetowa: http://www.midea.com http://cac.midea.com

[logotypy]
Nr badania 300

[Logo]
DUŃSKI INSTYTUT TECHNOLOGICZNY
Strona 44 z 44
300-KLAB-23-039-12

Uwaga: Niniejsza deklaracja stanie się nieważna w przypadku wprowadzenia technicznych lub operacyjnych modyfikacji bez zgodny producenta.
Rok produkcji: 2020
Rok przyznawania oznaczenia CE: 2020
Adres: Midea Industrial City, Beijiao, Shunde, Foshan, Guangdong, Chińska Republika Ludowa
Data: 25 marca 2024 r.
Poświadczenie:

GD Midea Heating & Ventilating Equipment Co. Ltd.

Adres: Midea Industrial City, Beijiao, Shunde, Foshan, Guangdong, Chińska Republika Ludowa
Kod pocztowy: 528311
Tel.: +86-757-26338495 Faks: +86-757-22390205 Strona internetowa: http://www.midea.com http://cac.midea.com

[logotypy]
Nr badania 300

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Ja, niżej podpisana Amalia Woźna, tłumacz przysięgły języka angielskiego, wpisana na listę tłumaczy przysięgłych Ministra Sprawiedliwości pod numerem TP/56/11, niniejszym potwierdzam zgodność powyższego tłumaczenia z okazanym mi dokumentem w języku angielskim.
Wrocław, 3 czerwca 2024 r.
Nr repertorium 916/2024
Liczba znaków ze spacjami: 16 763

AMALIA WOŹNA TŁUMACZ PRZYSIĘGŁY JĘZYKA ANGIELSKIEGO TP/56/11

|

TEST REPORT

Report no.:
300-KLAB-23-039-12

DANISH TECHNOLOGICAL INSTITUTE

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Kongsvang Allé 29
DK-8000 Aarhus C
+45 72 20 20 00
Info@teknologisk.dk
www.teknologisk.dk

Init: PRES/RTHI
File no.: 226006
Enclosures: 2

Customer:	Company:	GD MIDEA HEATING & VENTILATING EQUIPMENT CO., LTD.
	Address:	Penglai Industry Road, Beijiao
	City:	Shunde, Foshan, Guangdong, 528311, China
	Tel.:	+86 13902810522
Component:	Brand:	Midea
	Type:	Air to water heat pump (mono block)
	Model:	MHC-V16W/D2RN8-B
	Series no.:	541K814480238190100003
	Prod. year:	Outdoor unit: N/A
Dates:	Component tested:	December 2023 – January 2024
Brand name:	Brand:	IMMERGAS
	Type:	Air to water heat pump (mono block)
	Model:	MAGIS M16 T

Procedures See objective (page 2) for list of standards.

Remarks: The unit was delivered by the customer. The installation and test settings were done according to the manufacturer's instructions. Between each test condition Midea has been changing various parameters like compressor speed, expansion valve, fan speed, pump speed, defrost time, heating time. The report for the tested unit is named 300-KLAB-23-039 issued 2024.03.21 Also see appendix 2.

Terms: This test was conducted under accreditation in accordance with international requirements (ISO/IEC 17025:2017) and in accordance with the General Terms and Conditions of Danish Technological Institute. The test results solely apply to the tested item. This test report may be quoted in extract only if Danish Technological Institute has granted its written consent.

The customer may not mention or refer to Danish Technological Institute or Danish Technological Institute's employees for advertising or marketing purposes unless Danish Technological Institute has granted its written consent in each case.

Division/Centre: Danish Technological Institute
Energy and Climate
Heat Pump Laboratory, Aarhus

Date: 2024.04.26

Signature:
Preben Eskerod
B.TecMan & MarEng

Co-reader:
Rasmus Thisgaard
B.TecMan & MarEng

DANAK
Test Reg. nr. 300

Heat pumps of identical design

According to GD MIDEA HEATING & VENTILATING EQUIPMENT CO. LTD. The heat pumps listed in the table below are considered identical with the tested unit. They have identical:

a. heating capacity
b. refrigerant cycle (incl. refrigerant mass)
c. heat source and sink medium
d. main components / operating principle and control strategy
e. same outdoor casing

Midea	MHC-V16W/D2N8-B
Midea	MHC-V16W/D2N8-BE30
Midea	MHC-V16W/D2N8-BER60
Midea	MHC-V16W/D2N8-BER90
Midea	MHC-V16W/D2N8-B1
Midea	MHC-V16W/D2N8-B1E30
Midea	MHC-V16W/D2N8-B1ER60
Midea	MHC-V16W/D2N8-B1ER90
Midea	MHC-V16W/D2N8-B2
Midea	MHC-V16W/D2N8-B2E30
Midea	MHC-V16W/D2N8-B2ER60
Midea	MHC-V16W/D2N8-B2ER90
Midea	MHC-V16W/D2RN8-B
Midea	MHC-V16W/D2RN8-BE30
Midea	MHC-V16W/D2RN8-BER60
Midea	MHC-V16W/D2RN8-BER90
Midea	MHC-V16W/D2RN8-B1
Midea	MHC-V16W/D2RN8-B1E30
Midea	MHC-V16W/D2RN8-B1ER60
Midea	MHC-V16W/D2RN8-B1ER90
Midea	MHC-V16W/D2RN8-B2
Midea	MHC-V16W/D2RN8-B2E30
Midea	MHC-V16W/D2RN8-B2ER60
Midea	MHC-V16W/D2RN8-B2ER90

Objective

The objective of this report is to document the following:

The Seasonal Coefficient of Performance (SCOP) at low and medium temperature application for average climate according to EN 14825:2022.

In order to calculate the SCOP, tests were carried out at the part load conditions stated in the tables on page 5 and 6.

SCOP part load test in conditions $SCOP_B$ and $SCOP_C$ at low temperature application for warmer climate according to EN 14825:2022.

SCOP part load test conditions $SCOP_A$ and $SCOP_{F/G}$ at low temperature application for colder climate according to EN 14825:2022.

COP test standard rating conditions A7/W35 and A7/W55 according to EN 14511:2022.

Operating requirements according to EN 14511-4:2022
- 4.2.1 Starting and operating tests
- 4.5 Shutting of the heat transfer medium flows
- 4.6 Complete power supply failure

Sound power measurements according to EN 12102-1:2022.

Contents:

Test conditions

SCOP test conditions for low temperature – EN 14825

Part load conditions for reference SCOP and reference SCOPon calculation of air to water units for low temperature application for the reference heating season;
"A" = average, "W" = warmer, and "C" = colder.

	Part load ratio in %				**Outdoor heat exchanger** Dry (wet) bulb temperature °C		**Indoor heat exchanger** Fixed outlet °C	Variable outlet[d] °C		
	Formula	Average	Warmer	Colder	Outdoor air	Exhaust air	All climates	Average	Warmer	Colder
A	(−7 - 16) / ($T_{designh}$ − 16)	88,46	n.a.	60,53	−7(−8)	20(12)	[a] / 35	[a] / 34	n.a.	[a] / 30
B	(+2 - 16) / ($T_{designh}$ − 16)	53,85	100,00	36,84	2(1)	20(12)	[a] / 35	[a] / 30	[a] / 35	[a] / 27
C	(+7 - 16) / ($T_{designh}$ − 16)	34,62	64,29	23,68	7(6)	20(12)	[a] / 35	[a] / 27	[a] / 31	[a] / 25
D	(+12 - 16) / ($T_{designh}$ − 16)	15,38	28,57	10,53	12(11)	20(12)	[a] / 35	[a] / 24	[a] / 26	[a] / 24
E	(TOL[e] - 16) / ($T_{designh}$ − 16)				TOL[e]	20(12)	[a] / 35	[a] / [b]	[a] / [b]	[a] / [b]
F	(T_{biv} - 16) / ($T_{designh}$ − 16)				T_{biv}	20(12)	[a] / 35	[a] / [c]	[a] / [c]	[a] / [c]
G	(−15 - 16) / ($T_{designh}$ − 16)	n.a.	n.a.	81,58	−15	20(12)	[a] / 35	n.a.	n.a.	[a] / 32

Additional information

Climate	**$T_{designh}$ [°C]**	**$T_{bivalent}$ [°C]**	**TOL [°C]**	**Outlet temperature**	**Flow rate**
Average	-10	-7	-10	Variable	Variable
Colder	-22	-15	-22	Variable	Variable
Warmer	2	7	2	Variable	Variable

SCOP test conditions for medium temperature – EN 14825

Part load conditions for reference SCOP and reference SCOPon calculation of air to water units for medium temperature application for the reference heating season;
"A" = average, "W" = warmer, and "C" = colder.

	Part load ratio in %				**Outdoor heat exchanger**		**Indoor heat exchanger**			
					Dry (wet) bulb temperature °C		Fixed outlet °C	Variable outlet[d] °C		
	Formula	Average	Warmer	Colder	Outdoor air	Exhaust air	All climates	Average	Warmer	Colder
A	$(-7 - 16) / (T_{designh} - 16)$	88,46	n.a.	60,53	−7(−8)	20(12)	[a] / 55	[a] / 52	n.a.	[a] / 44
B	$(+2 - 16) / (T_{designh} - 16)$	53,85	100	36,84	2(1)	20(12)	[a] / 55	[a] / 42	[a] / 55	[a] / 37
C	$(+7 - 16) / (T_{designh} - 16)$	34,62	64,29	23,68	7(6)	20(12)	[a] / 55	[a] / 36	[a] / 46	[a] / 32
D	$(+12 - 16) / (T_{designh} - 16)$	15,38	28,57	10,53	12(11)	20(12)	[a] / 55	[a] / 30	[a] / 34	[a] / 28
E	$(TOL^{e} - 16) / (T_{designh} - 16)$				TOL^{e}	20(12)	[a] / 55	[a] / [b]	[a] / [b]	[a] / [b]
F	$(T_{biv} - 16) / (T_{designh} - 16)$				T_{biv}	20(12)	[a] / 55	[a] / [c]	[a] / [c]	[a] / [c]
G	$(-15 - 16) / (T_{designh} - 16)$	n.a.	n.a.	81,58	−15	20(12)	[a] / 55	n.a.	n.a.	[a] / 49

Additional information

Climate	**$T_{designh}$ [°C]**	**$T_{bivalent}$ [°C]**	**TOL [°C]**	**Outlet temperature**	**Flow rate**
Average	-10	-7	-10	Variable	Variable

COP test conditions - low temperature – EN 14511

N#	Heat source		Heat sink	
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)
1S	7	6	30	35

S: Standard rating condition

COP test conditions - medium temperature – EN 14511

N#	Heat source		Heat sink	
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)
1S	7	6	47	55

S: Standard rating condition

Test conditions for operating requirements – EN 14511-4

N#	Heat source		Heat sink	Water flow rate at indoor heat exchanger	Test
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)		
1	-25	-	12	800 L/h	Starting
2	-25	-	38	710 L/h	Operating

Test conditions for shutting off the heat transfer medium – EN 14511-4

N#	Heat source		Heat sink		Heat exchanger
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)	
1	7	6	47	55	Indoor
2	7	6	47	55	Outdoor

Test conditions for complete power supply failure – EN 14511-4

N#	Heat source		Heat sink	
	Inlet dry bulb temperature (°C)	Inlet wet bulb temperature (°C)	Inlet temperature (°C)	Outlet temperature (°C)
1	7	6	47	55

Test conditions for sound power measurements – EN 12102-1

N#	Test condition		Heat pump setting			
	Outdoor heat exchanger (dry bulb/ wet bulb) (°C)	Indoor heat exchanger (inlet/ outlet) (°C)	Compressor speed (Hz)	Fan speed outdoor (rpm)	Heating capacity (kW)	Power input (kW)
1F	7/6	30/35	64	730	15.70	3.49
2P	7/6	30/35	24	400	5.67	1.16
3F	7/6	47/55	72	650	16.14	5.65
4E	7/6	47/55	32	450	7.10	2.34

F) Full load, P) part load and E) ErP labelling

Test results

Test results of SCOP test at low temperature - heating season average – EN 14825

Model (Outdoor)	MHC-V16W/D2RN8-B
Air-to-water heat pump mono bloc	Y
Low-temperature heat pump	N
Equipped with supplementary heater	Y
Heat pump combination heater	N
Reversible	Y

Rated heat output[1)]	P_{rated}	**15.2**	[kW]
Seasonal space heating energy efficiency	η_s	**184.1**	[%]
	SCOP	**4.68**	[-]

Measured capacity for heating for part load at outdoor temperature Tj	Average Climate - Low temperature application	Tj=-15 °C	Pdh	-	[kW]
		Tj=-7 °C	Pdh	13.27	[kW]
		Tj=2 °C	Pdh	8.24	[kW]
		Tj=7 °C	Pdh	6.26	[kW]
		Tj=12 °C	Pdh	7.26	[kW]
		Tj=bivalent temperature	Pdh	13.27	[kW]
		Tj=operation limit	Pdh	12.62	[kW]

Measured coefficient of performance at outdoor temperature Tj	Average Climate - Low temperature application	Tj=-15 °C	COPd	-	[-]
		Tj=-7 °C	COPd	2.64	[-]
		Tj=2 °C	COPd	4.59	[-]
		Tj=7 °C	COPd	6.62	[-]
		Tj=12 °C	COPd	8.13	[-]
		Tj=bivalent temperature	COPd	2.64	[-]
		Tj=operation limit	COPd	2.51	[-]

Bivalent temperature	Tbivalent	-7	[°C]
Operation limit	TOL	-10	[°C]
temperatures	WTOL	-	[°C]
Degradation coefficient	Cdh	0.97	[-]

Power consumption in modes other than active mode	Off mode	P_{OFF}	0.021	[kW]
	Thermostat-off mode	P_{TO}	0.026	[kW]
	Standby mode	P_{SB}	0.021	[kW]
	Crankcase heater mode [2)]	P_{CK}	0.021	[kW]
Supplementary heater[1)]	Rated heat output	P_{SUP}	2.58	[kW]
	Type of energy input		Electrical	

Other items	Capacity control		Variable	
	Water flow control		Variable	
	Water flow rate		-	
	Annual energy consumption	Q_{HE}	6712	[kWh]

[1)]For heat pump space heaters and heat pump combination heaters, the rated heat output, Prated, is equal to the design load for heating, Pdesignh, and the rated heat output of a supplementary heater, Psup, is equal to the supplementary capacity for heating, sup(Tj).

[2)] For SCOP calculation the value PCK - PSB is used. See page 15

Test results of SCOP test at medium temperature - heating season average – EN 14825

Model (Outdoor)	MHC-V16W/D2RN8-B
Air-to-water heat pump mono bloc	Y
Low-temperature heat pump	N
Equipped with supplementary heater	Y
Heat pump combination heater	N
Reversible	Y

Rated heat output[1)]	P_{rated}	**13** [kW]
Seasonal space heating energy efficiency	η_s	**137.3** [%]
	SCOP	**3.51** [-]

Measured capacity for heating for part load at outdoor temperature Tj	Average Climate - Medium temperature application	Tj=-15 °C	Pdh	- [kW]
		Tj=-7 °C	Pdh	11.68 [kW]
		Tj=2 °C	Pdh	7.29 [kW]
		Tj=7 °C	Pdh	6.03 [kW]
		Tj=12 °C	Pdh	6.89 [kW]
		Tj=bivalent temperature	Pdh	11.68 [kW]
		Tj=operation limit	Pdh	10.53 [kW]

Measured coefficient of performance at outdoor temperature Tj	Average Climate - Medium temperature application	Tj=-15 °C	COPd	- [-]
		Tj=-7 °C	COPd	2.02 [-]
		Tj=2 °C	COPd	3.42 [-]
		Tj=7 °C	COPd	4.93 [-]
		Tj=12 °C	COPd	6.02 [-]
		Tj=bivalent temperature	COPd	2.02 [-]
		Tj=operation limit	COPd	1.82 [-]

Bivalent temperature	Tbivalent	-7 [°C]
Operation limit	TOL	-10 [°C]
temperatures	WTOL	- [°C]
Degradation coefficient	Cdh	0.98 [-]

Power consumption in modes other than active mode	Off mode	P_{OFF}	0.021 [kW]
	Thermostat-off mode	P_{TO}	0.026 [kW]
	Standby mode	P_{SB}	0.021 [kW]
	Crankcase heater mode	P_{CK}	0.021 [kW]
Supplementary heater[1)]	Rated heat output	P_{SUP}	2.47 [kW]
	Type of energy input		Electrical

Other items	Capacity control		Variable
	Water flow control		Variable
	Water flow rate		-
	Annual energy consumption	Q_{HE}	7655 [kWh]

[1)] For heat pump space heaters and heat pump combination heaters, the rated heat output, Prated, is equal to the design load for heating, Pdesignh, and the rated heat output of a supplementary heater, Psup, is equal to the supplementary capacity for heating, sup(Tj).

[*)] For SCOP calculation the value PCK - PSB is used. See page 17

Test results for warmer climate, low temperature according to EN14825

N °	Test condition	Heating capacity [kW]	COP
1	B	13.106	3.508
2	Tbivalent F and C	8.750	5.514

Test results for colder climate, low temperature according to EN14825

N °	Test condition	Heating capacity [kW]	COP
1	A	8.383	3.315
2	Tbivalent F and G	11.301	2.497

COP test results - low temperature – EN 14511

N#	Test conditions	Heating capacity [kW]	COP
1	A7/W35	15.707	4.498

COP test results - medium temperature – EN 14511

N#	Test conditions	Heating capacity [kW]	COP
1	A7/W55	16.139	2.854

Test results for starting and operating test - EN 14511-4

N#	Test conditions air/water inlet [°C]	Test validation
Starting	A-25/W18	Passed
Operating	A-25/W38	Passed

Test results for shutting off the heat transfer medium – EN 14511-4

N#	Heat exchanger	Test validation
1	Indoor	Passed
2	Outdoor	Passed

Test results for complete power supply failure – EN 14511-4

N#	Test validation
1	Passed

Test results of sound power measurements – EN 12102-1

N#	Test conditions	Sound power level LW(A) [dB re 1pW]	Uncertainty σ_{tot} [dB]
1F	A7/W35	66.5	1.6
2P	A7/W35	51.5	1.6
3F	A7/W55	65.2	1.6
4E	A7/55	55.6	1.6

F) Full load, P) part load and E) ErP labelling

The A-weighted total sound power level is determined for the measured frequency range from 100 Hz to 10 kHz. For the calculation of uncertainty, see appendix 1.

The sound power measurements are carried out by Kamalathasan Arumugam (KAMA) and co-read by Patrick Glibert (PGL), Danish Technological Institute.

Photos

Rating plate

Outdoor unit

SCOP - detailed calculation

Detailed SCOP calculation of low temperature and average climate conditions – EN 14825

Calculation of reference SCOP

$$SCOP = \frac{P_{designh} \times H_{he}}{\frac{P_{designh} \times H_{he}}{SCOP_{on}} + H_{TO} \times P_{TO} + H_{SB} \times P_{SB} + H_{CK} \times P_{CK} + H_{OFF} \times P_{OFF}}$$

Where

P_{design} =	Heating load of the building at design temperature, kW
H_{he} =	Number of equivalent heating hours, 2066 h
H_{TO}, H_{SB}, H_{CK}, H_{OFF} =	Number of hours for which the unit is considered to work in thermostat off mode, standby mode, crankcase heater mode and off mode, h, respectively
P_{TO}, P_{SB}, P_{CK}, P_{OFF} =	Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode, kW, respectively

Data for SCOP

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COPbin [-]
A	-7	88	13.45	13.27	2.64	0.99	1.00	2.64
B	2	54	8.18	8.24	4.59	0.99	1.00	4.59
C	7	35	5.26	6.26	6.62	0.97	0.84	6.58
D	12	15	2.34	7.26	8.13	0.97	0.32	7.66
E	-10	100	15.20	12.62	2.51	0.99	1.00	2.51
F - BIV	-7	88	13.45	13.27	2.64	0.99	1.00	2.64

Energy consumption for thermostat off, standby, off mode, crankcase heater mode

	Hours [h]	Power input [kW]	Applied to SCOP calculation [kW]	Energy consumption [kWh]
Off mode	0	0.02097	0.02097	0
Thermostat off	178	0.02612	0.02612	4.64936
Standby	0	0.02097	0.02097	0
Crankcase heater	178	0.02111	0.00014	0.02492

Calculation Bin for SCOPon

	Bin [-]	Outdoor temperature [°C]	Hours [h]	Heat load [kW]	Heat load covered by heat pump [kW]	Electrical back up heater [kW]	Annual backup heater energy input [kWh]	COPbin [-]	Annual heating demand [kWh]	Annual energy input [kWh]	Net annual heating capacity [kWh]	Net annual power input [kWh]
E	21	-10	1	15.20	12.62	2.58	2.58	2.51	15.20	7.61	12.62	5.03
	22	-9	25	14.62	12.84	1.78	44.46	2.55	365.38	170.15	320.93	125.69
	23	-8	23	14.03	13.05	0.98	22.47	2.60	322.71	138.05	300.24	115.58
A / F - BIV	24	-7	24	13.45	13.27	0.00	0.00	2.64	322.71	122.15	322.71	122.15
	25	-6	27	12.86	12.71	0.00	0.00	2.86	347.26	121.49	347.26	121.49
	26	-5	68	12.28	12.14	0.00	0.00	3.07	834.83	271.52	834.83	271.52
	27	-4	91	11.69	11.58	0.00	0.00	3.29	1064.00	323.31	1064.00	323.31
	28	-3	89	11.11	11.01	0.00	0.00	3.51	988.58	281.86	988.58	281.86
	29	-2	165	10.52	10.45	0.00	0.00	3.72	1736.31	466.29	1736.31	466.29
	30	-1	173	9.94	9.88	0.00	0.00	3.94	1719.35	436.38	1719.35	436.38
	31	0	240	9.35	9.31	0.00	0.00	4.16	2244.92	540.12	2244.92	540.12
	32	1	280	8.77	8.75	0.00	0.00	4.37	2455.38	561.53	2455.38	561.53
B	33	2	320	8.18	8.18	0.00	0.00	4.59	2619.08	570.73	2619.08	570.73
	34	3	357	7.60	7.60	0.00	0.00	4.99	2713.20	544.02	2713.20	544.02
	35	4	356	7.02	7.02	0.00	0.00	5.39	2497.48	463.73	2497.48	463.73
	36	5	303	6.43	6.43	0.00	0.00	5.78	1948.52	336.88	1948.52	336.88
	37	6	330	5.85	5.85	0.00	0.00	6.18	1929.23	312.06	1929.23	312.06
C	38	7	326	5.26	5.26	0.00	0.00	6.58	1715.26	260.66	1715.26	260.66
	39	8	348	4.68	4.68	0.00	0.00	6.80	1627.57	239.46	1627.57	239.46
	40	9	335	4.09	4.09	0.00	0.00	7.01	1370.92	195.48	1370.92	195.48
	41	10	315	3.51	3.51	0.00	0.00	7.23	1104.92	152.84	1104.92	152.84
	42	11	215	2.92	2.92	0.00	0.00	7.45	628.46	84.41	628.46	84.41
D	43	12	169	2.34	2.34	0.00	0.00	7.66	395.20	51.58	395.20	51.58
	44	13	151	1.75	1.75	0.00	0.00	7.88	264.83	33.61	264.83	33.61
	45	14	105	1.17	1.17	0.00	0.00	8.09	122.77	15.17	122.77	15.17
	46	15	74	0.58	0.58	0.00	0.00	8.31	43.26	5.21	43.26	5.21

SUM	31397.35	6706.27	31327.85	6636.77
SCOPon		4.68	**SCOPnet**	4.72

Detailed SCOP calculation of medium temperature and average climate conditions – EN 14825

Calculation of reference SCOP

$$SCOP = \frac{P_{designh} \times H_{he}}{\frac{P_{designh} \times H_{he}}{SCOP_{on}} + H_{TO} \times P_{TO} + H_{SB} \times P_{SB} + H_{CK} \times P_{CK} + H_{OFF} \times P_{OFF}}$$

Where

P_{design} =	Heating load of the building at design temperature, kW
H_{he} =	Number of equivalent heating hours, 2066 h
H_{TO}, H_{SB}, H_{CK}, H_{OFF} =	Number of hours for which the unit is considered to work in thermostat off mode, standby mode, crankcase heater mode and off mode, h, respectively
P_{TO}, P_{SB}, P_{CK}, P_{OFF} =	Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode, kW, respectively

Data for SCOP

	Outdoor temperature [°C]	Part load ratio [%]	Part load [kW]	Declared capacity [kW]	Declared COP [-]	cdh [-]	CR [-]	COPbin [-]
A	-7	88	11.50	11.68	2.02	1.00	1.00	2.02
B	2	54	7.00	7.29	3.42	0.99	1.00	3.42
C	7	35	4.50	6.03	4.93	0.98	0.75	4.90
D	12	15	2.00	6.89	6.02	0.98	0.29	5.70
E	-10	100	13.00	10.53	1.82	1.00	1.00	1.82
F - BIV	-7	88	11.50	11.68	2.02	1.00	1.00	2.02

Energy consumption for thermostat off, standby, off mode, crankcase heater mode

	Hours [h]	Power input [kW]	Applied to SCOP calculation [kW]	Energy consumption [kWh]
Off mode	0	0.02097	0.02097	0
Thermostat off	178	0.02612	0.02612	4.64936
Standby	0	0.02097	0.02097	0
Crankcase heater	178	0.02111	0.00014	0.02492

Calculation Bin for $SCOP_{on}$

	Bin [-]	Outdoor temperature [°C]	Hours [h]	Heat load [kW]	Heat load covered by heat pump [kW]	Electrical back up heater [kW]	backup heater energy input [kWh]	COP_{bin} [-]	Annual heating demand [kWh]	Annual energy input [kWh]	Net annual heating capacity [kWh]	Net annual power input [kWh]
E	21	-10	1	13.00	10.53	2.47	2.47	1.82	13.00	8.26	10.53	5.79
	22	-9	25	12.50	10.85	1.65	41.15	1.89	312.50	185.05	271.35	143.90
	23	-8	23	12.00	11.18	0.82	18.93	1.95	276.00	150.54	257.07	131.61
A / F - BIV	24	-7	24	11.50	11.50	0.00	0.00	2.02	276.00	136.57	276.00	136.57
	25	-6	27	11.00	11.00	0.00	0.00	2.18	297.00	136.46	297.00	136.46
	26	-5	68	10.50	10.50	0.00	0.00	2.33	714.00	306.19	714.00	306.19
	27	-4	91	10.00	10.00	0.00	0.00	2.49	910.00	365.85	910.00	365.85
	28	-3	89	9.50	9.50	0.00	0.00	2.64	845.50	319.93	845.50	319.93
	29	-2	165	9.00	9.00	0.00	0.00	2.80	1485.00	530.69	1485.00	530.69
	30	-1	173	8.50	8.50	0.00	0.00	2.95	1470.50	497.86	1470.50	497.86
	31	0	240	8.00	8.00	0.00	0.00	3.11	1920.00	617.54	1920.00	617.54
	32	1	280	7.50	7.50	0.00	0.00	3.26	2100.00	643.27	2100.00	643.27
B	33	2	320	7.00	7.00	0.00	0.00	3.42	2240.00	654.97	2240.00	654.97
	34	3	357	6.50	6.50	0.00	0.00	3.72	2320.50	624.49	2320.50	624.49
	35	4	356	6.00	6.00	0.00	0.00	4.01	2136.00	532.45	2136.00	532.45
	36	5	303	5.50	5.50	0.00	0.00	4.31	1666.50	386.89	1666.50	386.89
	37	6	330	5.00	5.00	0.00	0.00	4.60	1650.00	358.44	1650.00	358.44
C	38	7	326	4.50	4.50	0.00	0.00	4.90	1467.00	299.45	1467.00	299.45
	39	8	348	4.00	4.00	0.00	0.00	5.06	1392.00	275.13	1392.00	275.13
	40	9	335	3.50	3.50	0.00	0.00	5.22	1172.50	224.62	1172.50	224.62
	41	10	315	3.00	3.00	0.00	0.00	5.38	945.00	175.64	945.00	175.64
	42	11	215	2.50	2.50	0.00	0.00	5.54	537.50	97.01	537.50	97.01
D	43	12	169	2.00	2.00	0.00	0.00	5.70	338.00	59.29	338.00	59.29
	44	13	151	1.50	1.50	0.00	0.00	5.86	226.50	38.64	226.50	38.64
	45	14	105	1.00	1.00	0.00	0.00	6.02	105.00	17.44	105.00	17.44
	46	15	74	0.50	0.50	0.00	0.00	6.18	37.00	5.98	37.00	5.98

SUM	26853.00	7648.65	26790.45	7586.11
$SCOP_{on}$		3.51	**$SCOP_{net}$**	3.53

Detailed test results

Detailed SCOP part load test results - low temperature application - average climate – EN 14825

Detailed result for 'EN14825:2022' Average Low (A and F) A -7 /W34		
Tested according to:		EN14511:2022 and EN14825:2022
Climate zone:		Average
Temperature application:		Low
Condition name:		A and F
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	15.20
Heating demand:	kW	13.45
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**13.271**
COP	-	**2.642**
Power consumption	kW	**5.023**
Measured		
Heating capacity	kW	13.299
COP	-	2.630
Power consumption	kW	5.057
During heating		
Air temperature dry bulb	°C	-7.16
Air temperature wet bulb	°C	-8.12
Inlet temperature	°C	29.15
Outlet temperature	°C	34.06
Outlet temperature (Time averaged)	°C	**34.06**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	9410
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	27
Calculated Power correction	W	34
Water Flow	m^3/s	0.000694

Detailed result for 'EN14825:2022' Average Low (B) A 2 /W30		
Tested according to:	EN14511:2022 and	EN14825:2022
Climate zone:		Average
Temperature application:		Low
Condition name:		B
Condition temperature:	°C	2
Part load:	%	54%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	15.20
Heating demand:	kW	8.18
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**8.235**
COP	-	**4.589**
Power consumption	kW	**1.795**
Measured		
Heating capacity	kW	8.249
COP	-	4.556
Power consumption	kW	1.810
During heating		
Air temperature dry bulb	°C	1.95
Air temperature wet bulb	°C	0.92
Inlet temperature	°C	24.97
Outlet temperature	°C	30.08
Outlet temperature (Time averaged)	°C	**30.08**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	5256
Calculated Hydraulic power	W	2
Calculated global efficiency	η	0.14
Calculated Capacity correction	W	13
Calculated Power correction	W	16
Water Flow	m^3/s	0.000417

Detailed result for 'EN14825:2022' Average Low (C) A 7 /W27		
Tested according to:	EN14511:2022 and	EN14825:2022
Climate zone:		Average
Temperature application:		Low
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	15.20
Heating demand:	kW	5.26
CR:	-	0.8
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**6.264**
COP	-	**6.615**
Power consumption	kW	**0.947**
Measured		
Heating capacity	kW	6.266
COP	-	6.601
Power consumption	kW	0.949
During heating		
Air temperature dry bulb	°C	7.04
Air temperature wet bulb	°C	6.02
Inlet temperature	°C	22.80
Outlet temperature	°C	27.77
Outlet temperature (Time averaged)	°C	**26.98**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	874
Calculated Hydraulic power	W	0
Calculated global efficiency	η	0.12
Calculated Capacity correction	W	2
Calculated Power correction	W	2
Water Flow	m^3/s	0.000303

Detailed result for 'EN14825:2022' Average Low (D) A 12 /W24		
Tested according to:	EN14511:2022 and	EN14825:2022
Climate zone:		Average
Temperature application:		Low
Condition name:		D
Condition temperature:	°C	12
Part load:	%	15%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	15.20
Heating demand:	kW	2.34
CR:	-	0.3
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**7.265**
COP	-	**8.134**
Power consumption	kW	**0.893**
Measured		
Heating capacity	kW	7.271
COP	-	8.081
Power consumption	kW	0.900
During heating		
Air temperature dry bulb	°C	12.00
Air temperature wet bulb	°C	10.92
Inlet temperature	°C	22.38
Outlet temperature	°C	27.40
Outlet temperature (Time averaged)	°C	**23.99**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	2308
Calculated Hydraulic power	W	1
Calculated global efficiency	η	0.12
Calculated Capacity correction	W	6
Calculated Power correction	W	7
Water Flow	m^3/s	0.000348

Detailed result for 'EN14825:2022' Average Low (E) A -10 /W35		
Tested according to:		EN14511:2022 and EN14825:2022
Climate zone:		Average
Temperature application:		Low
Condition name:		E
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	15.20
Heating demand:	kW	15.20
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**12.620**
COP	-	**2.509**
Power consumption	kW	**5.030**
Measured		
Heating capacity	kW	12.640
COP	-	2.501
Power consumption	kW	5.055
During heating		
Air temperature dry bulb	°C	-10.23
Air temperature wet bulb	°C	-11.37
Inlet temperature	°C	29.94
Outlet temperature	°C	35.02
Outlet temperature (Time averaged)	°C	**35.02**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	6527
Calculated Hydraulic power	W	4
Calculated global efficiency	η	0.16
Calculated Capacity correction	W	21
Calculated Power correction	W	25
Water Flow	m^3/s	0.000619

Detailed SCOP part load test results - medium temperature application - average climate – EN 14825

Detailed result for 'EN14825:2022' Average Medium (A and F) A -7 /W52		
Tested according to:		EN14511:2022 and EN14825:2022
Climate zone:		Average
Temperature application:		Medium
Condition name:		A and F
Condition temperature:	°C	-7
Part load:	%	88%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	13.00
Heating demand:	kW	11.50
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**11.680**
COP	-	**2.012**
Power consumption	kW	**5.805**
Measured		
Heating capacity	kW	11.694
COP	-	2.009
Power consumption	kW	5.821
During heating		
Air temperature dry bulb	°C	-7.05
Air temperature wet bulb	°C	-8.07
Inlet temperature	°C	44.07
Outlet temperature	°C	52.29
Outlet temperature (Time averaged)	°C	**52.29**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	6527
Calculated Hydraulic power	W	2
Calculated global efficiency	η	0.14
Calculated Capacity correction	W	14
Calculated Power correction	W	17
Water Flow	m^3/s	0.000361

Detailed result for 'EN14825:2022' Average Medium (B) A 2 /W42			
Tested according to:		EN14511:2022	EN14825:2022
Climate zone:			Average
Temperature application:			Medium
Condition name:			B
Condition temperature:	°C		2
Part load:	%		54%
Chosen Tbivalent	°C		-7
Tdesign	°C		-10
Pdesign	kW		13.00
Heating demand:	kW		7.00
CR:	-		1.0
Minimum flow reached:	-		No
Measurement type:			Transient
Integrated circulation pump:			Yes
Included corrections (Final result)			
Heating capacity	kW		**7.291**
COP	-		**3.420**
Power consumption	kW		**2.132**
Measured			
Heating capacity	kW		7.296
COP	-		3.414
Power consumption	kW		2.137
During heating			
Air temperature dry bulb	°C		1.91
Air temperature wet bulb	°C		0.91
Inlet temperature	°C		34.04
Outlet temperature	°C		42.18
Outlet temperature (Time averaged)	°C		**42.18**
Circulation pump			
Measured: Static differential pressure, liquid pump	Pa		2485
Calculated Hydraulic power	W		1
Calculated global efficiency	η		0.12
Calculated Capacity correction	W		4
Calculated Power correction	W		5
Water Flow	m^3/s		0.000231

Detailed result for 'EN14825:2022' Average Medium (C) A 7 /W36		
Tested according to:	EN14511:2022	EN14825:2022
Climate zone:		Average
Temperature application:		Medium
Condition name:		C
Condition temperature:	°C	7
Part load:	%	35%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	13.00
Heating demand:	kW	4.50
CR:	-	0.7
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**6.028**
COP	-	**4.935**
Power consumption	kW	**1.222**
Measured		
Heating capacity	kW	6.041
COP	-	4.884
Power consumption	kW	1.237
During heating		
Air temperature dry bulb	°C	6.99
Air temperature wet bulb	°C	6.03
Inlet temperature	°C	29.90
Outlet temperature	°C	37.90
Outlet temperature (Time averaged)	°C	**35.87**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	11703
Calculated Hydraulic power	W	2
Calculated global efficiency	η	0.14
Calculated Capacity correction	W	13
Calculated Power correction	W	15
Water Flow	m^3/s	0.000182

Detailed result for 'EN14825:2022' Average Medium (D) A 12 /W30			
Tested according to:	EN14511:2022		EN14825:2022
Climate zone:			Average
Temperature application:			Medium
Condition name:			D
Condition temperature:		°C	12
Part load:		%	15%
Chosen Tbivalent		°C	-7
Tdesign		°C	-10
Pdesign		kW	13.00
Heating demand:		kW	2.00
CR:		-	0.3
Minimum flow reached:		-	No
Measurement type:			Steady State
Integrated circulation pump:			Yes
Included corrections (Final result)			
Heating capacity		kW	**6.889**
COP		-	**6.019**
Power consumption		kW	**1.145**
Measured			
Heating capacity		kW	6.893
COP		-	6.001
Power consumption		kW	1.149
During heating			
Air temperature dry bulb		°C	12.01
Air temperature wet bulb		°C	11.00
Inlet temperature		°C	27.71
Outlet temperature		°C	35.68
Outlet temperature (Time averaged)		°C	**30.03**
Circulation pump			
Measured: Static differential pressure, liquid pump		Pa	2265
Calculated Hydraulic power		W	0
Calculated global efficiency		η	0.12
Calculated Capacity correction		W	4
Calculated Power correction		W	4
Water Flow		m^3/s	0.000208

Detailed result for 'EN14825:2022' Average Medium (E) A -10 /W55		
Tested according to:		EN14511:2022 and EN14825:2022
Climate zone:		Average
Temperature application:		Medium
Condition name:		E
Condition temperature:	°C	-10
Part load:	%	100%
Chosen Tbivalent	°C	-7
Tdesign	°C	-10
Pdesign	kW	13.00
Heating demand:	kW	13.00
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**10.531**
COP	-	**1.818**
Power consumption	kW	**5.792**
Measured		
Heating capacity	kW	10.545
COP	-	1.816
Power consumption	kW	5.807
During heating		
Air temperature dry bulb	°C	-10.00
Air temperature wet bulb	°C	-11.08
Inlet temperature	°C	47.07
Outlet temperature	°C	55.07
Outlet temperature (Time averaged)	°C	**55.07**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	6527
Calculated Hydraulic power	W	2
Calculated global efficiency	η	0.14
Calculated Capacity correction	W	13
Calculated Power correction	W	15
Water Flow	m^3/s	0.000329

Detailed SCOP part load test results - low temperature application - warmer climate – EN 14825

Detailed result for 'EN14825:2022' Warmer Low (B) A 2 /W35		
Tested according to:		EN14511:2022 and EN14825:2022
Climate zone:		Warmer
Temperature application:		Low
Condition name:		B
Condition temperature:	°C	2
Part load:	%	100%
Chosen Tbivalent	°C	2
Tdesign	°C	2
Pdesign	kW	13.10
Heating demand:	kW	13.10
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**13.106**
COP	-	**3.508**
Power consumption	kW	**3.736**
Measured		
Heating capacity	kW	13.134
COP	-	3.482
Power consumption	kW	3.772
During heating		
Air temperature dry bulb	°C	2.08
Air temperature wet bulb	°C	0.83
Inlet temperature	°C	30.07
Outlet temperature	°C	35.08
Outlet temperature (Time averaged)	°C	**35.08**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	10206
Calculated Hydraulic power	W	7
Calculated global efficiency	η	0.20
Calculated Capacity correction	W	29
Calculated Power correction	W	36
Water Flow	m^3/s	0.000709

Detailed result for 'EN14825:2022' Warmer Low (C) A 7 /W31		
Tested according to:		EN14511:2022 and EN14825:2022
Climate zone:		Warmer
Temperature application:		Low
Condition name:		C
Condition temperature:	°C	7
Part load:	%	64%
Chosen Tbivalent	°C	2
Tdesign	°C	2
Pdesign	kW	13.10
Heating demand:	kW	8.42
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		No
Included corrections (Final result)		
Heating capacity	kW	**8.750**
COP	-	**5.514**
Power consumption	kW	**1.587**
Measured		
Heating capacity	kW	8.737
COP	-	5.557
Power consumption	kW	1.572
During heating		
Air temperature dry bulb	°C	6.99
Air temperature wet bulb	°C	6.01
Inlet temperature	°C	26.03
Outlet temperature	°C	31.04
Outlet temperature (Time averaged)	°C	**31.04**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	4732
Calculated Hydraulic power	W	2
Calculated global efficiency	η	0.14
Calculated Capacity correction	W	-12
Calculated Power correction	W	-14
Water Flow	m^3/s	0.000419

Detailed SCOP part load test results - low temperature application - colder climate – EN 14825

Detailed result for 'EN14825:2022' Colder Low (A) A -7 /W30		
Tested according to:		EN14511:2022 and EN14825:2022
Climate zone:		Colder
Temperature application:		Low
Condition name:		A
Condition temperature:	°C	-7
Part load:	%	61%
Chosen Tbivalent	°C	-15
Tdesign	°C	-22
Pdesign	kW	13.70
Heating demand:	kW	8.29
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Transient
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**8.383**
COP	-	**3.315**
Power consumption	kW	**2.529**
Measured		
Heating capacity	kW	8.386
COP	-	3.312
Power consumption	kW	2.532
During heating		
Air temperature dry bulb	°C	-6.91
Air temperature wet bulb	°C	-8.13
Inlet temperature	°C	25.01
Outlet temperature	°C	30.13
Outlet temperature (Time averaged)	°C	**30.13**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	694
Calculated Hydraulic power	W	0
Calculated global efficiency	η	0.12
Calculated Capacity correction	W	2
Calculated Power correction	W	2
Water Flow	m^3/s	0.000411

Detailed result for 'EN14825:2018' Colder Low (F and G) A -15 /W32		
Tested according to:		EN14825:2018
Climate zone:		Colder
Temperature application:		Low
Condition name:		F and G
Condition temperature:	°C	-15
Part load:	%	82%
Chosen Tbivalent	°C	-15
Tdesign	°C	-22
Pdesign	kW	13.70
Heating demand:	kW	11.18
CR:	-	1.0
Minimum flow reached:	-	No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**11.301**
COP	-	**2.497**
Power consumption	kW	**4.526**
Measured		
Heating capacity	kW	11.328
COP	-	2.484
Power consumption	kW	4.560
During heating		
Air temperature dry bulb	°C	-15.10
Air temperature wet bulb	°C	-14.89
Inlet temperature	°C	27.01
Outlet temperature	°C	32.09
Outlet temperature (Time averaged)	°C	**32.09**
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	12070
Calculated Hydraulic power	W	6
Calculated global efficiency	η	0.19
Calculated Capacity correction	W	27
Calculated Power correction	W	34
Water Flow	m^3/s	0.000536

Detailed COP test results - low temperature – EN 14511

Detailed result for 'EN14511:2022' A7/W35		
Tested according to:		EN14511:2022
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**15.707**
COP	-	**4.498**
Power consumption	kW	**3.492**
Measured		
Heating capacity	kW	15.749
COP	-	4.438
Power consumption	kW	3.549
During heating		
Air temperature dry bulb	°C	6.98
Air temperature wet bulb	°C	5.85
Inlet temperature	°C	29.99
Outlet temperature	°C	34.96
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	20390
Calculated Hydraulic power	W	16
Calculated global efficiency	η	0.27
Calculated Capacity correction	W	41
Calculated Power correction	W	57
Water Flow	m^3/s	0.000763

Detailed COP test results - medium temperature – EN 14511

Detailed result for 'EN14511:2022' A7/W55		
Tested according to:		EN14511:2022
Minimum flow reached:		No
Measurement type:		Steady State
Integrated circulation pump:		Yes
Included corrections (Final result)		
Heating capacity	kW	**16.139**
COP	-	**2.854**
Power consumption	kW	**5.654**
Measured		
Heating capacity	kW	16.152
COP	-	2.849
Power consumption	kW	5.669
During heating		
Air temperature dry bulb	°C	6.92
Air temperature wet bulb	°C	5.91
Inlet temperature	°C	47.01
Outlet temperature	°C	54.85
Circulation pump		
Measured: Static differential pressure, liquid pump	Pa	4062
Calculated Hydraulic power	W	2
Calculated global efficiency	η	0.14
Calculated Capacity correction	W	13
Calculated Power correction	W	15
Water Flow	m^3/s	0.000500

Detailed test results of sound power measurement – Test N#1

ilac-MRA DANAK TEST Reg. nr. 300

Sound power levels according to ISO 3743-1:2010

TEKNOLOGISK INSTITUT

Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms

Client:	Midea
Date of test:	18-01-2024
Object:	Type: Mono Air to water heat pump, Model: MHC-V16W/D2RN8-BER90
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration insulatores and placed on four pices of concrete tiles (20x20x2.5 cm). All of these are placed in a water drop dray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.
Operating conditions:	A7/W35, Compressor speed: 64[Hz], Fan speed: 730[rpm], Pump speed: 80 [%], EXV1(P): 138, Heating capacity: 15.7 [kW], Power_input: 3.49 [kW], Water flow rate: 2720 [l/h]

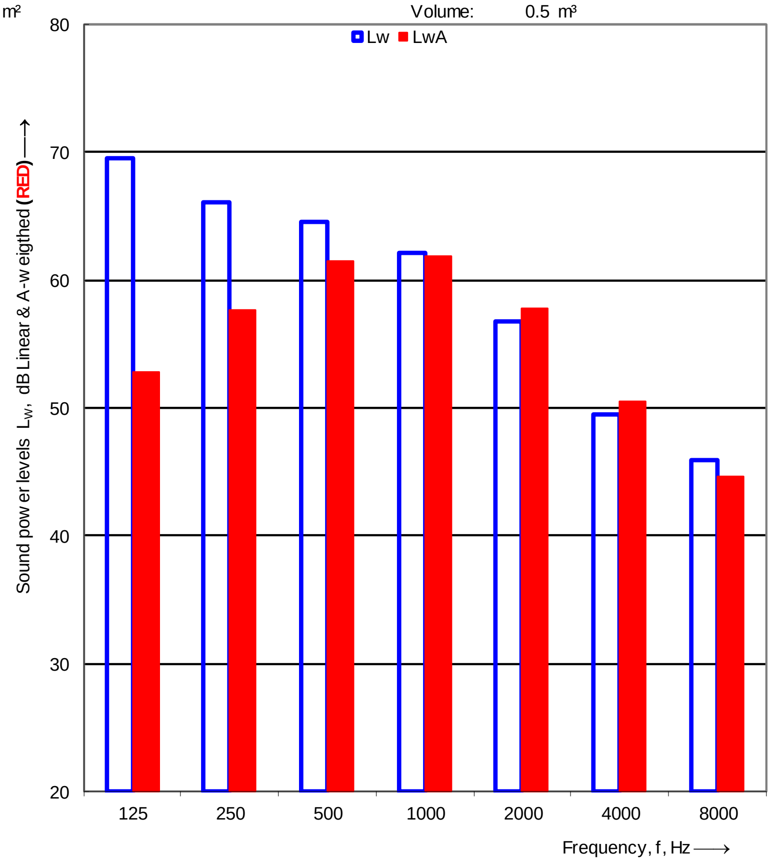
Static pressure:	995	hPa
Air temperature:	7.0	°C
Relative air humidity:	84.0	%
Test room volume:	102.8	m³
Area, S, of test room:	138.9	m²

Room: Room 2

Reference box:

L1:	1.4	m
L2:	0.4	m
L3:	0.9	m
Volume:	0.5	m³

Frequency f [Hz]	L_W 1/3 octave [dB]	1/1 oct [dB]
100	67.3	
125	62.7	69.5
160	62.4	
200	61.6	
250	61.3	66.0
315	60.9	
400	59.8	
500	59.3	64.5
630	60.1	
800	59.5	
1000	56.5	62.2
1250	54.9	
1600	53.6	
2000	51.8	56.7
2500	49.4	
3150	46.6	
4000	44.4	49.4
5000	41.7	
6300	40.4	
8000	41.1	45.9
10000	41.7	



Sound power level L_W(A): 66.5 dB [re 1pW], Uncertainty σtot: 1.6 dB

Name of test institute:	DTI	Date:	18-01-2024
No. of test report:	300-KLAB-23-039		

Measurements are in full conformity with ISO 3743-1

Detailed test results of sound power measurement – Test N#2

Sound power levels according to ISO 3743-1:2010

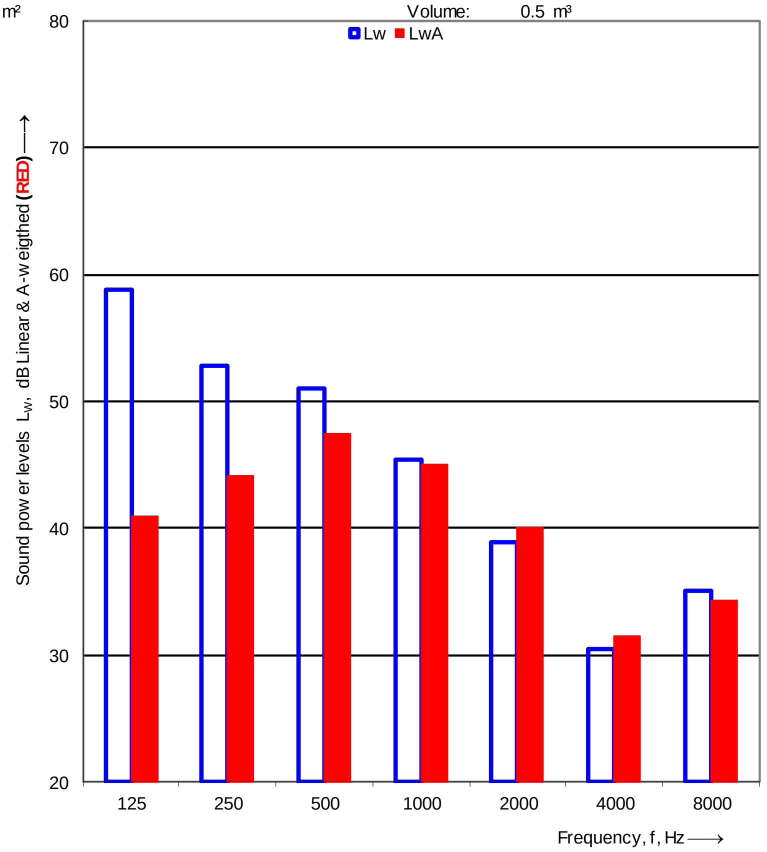
TEKNOLOGISK INSTITUT

Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms

Client:	Midea	Date of test:	18-01-2024
Object:	Type: Mono Air to water heat pump, Model: MHC-V16W/D2RN8-BER90		
Mounting conditions:	The outdoor unit is mounted on the supporting metal support frame using six vibration insulatores and placed on four pices of concrete tiles (20x20x2.5 cm). All of these are placed in a water drop dray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.		
Operating conditions:	A7/W35, Compressor speed: 24[Hz], Fan speed: 400[rpm], Pump speed: 50 [%], EXV1(P): 94, Heating capacity: 5.67 [kW], Power_input: 1.16 [kW], Water flow rate: 980 [l/h]		

				Reference box:	
Static pressure:	995 hPa				
Air temperature:	7.0 °C			L1:	1.4 m
Relative air humidity:	84.0 %			L2:	0.4 m
Test room volume:	102.8 m³	Room:	Room 2	L3:	0.9 m
Area, S, of test room:	138.9 m²			Volume:	0.5 m³

Frequency f [Hz]	L_W 1/3 octave [dB]	1/1 oct [dB]
100	57.9	
125	49.8	58.8
160	47.2	
200	48.9	
250	47.8	52.7
315	47.0	
400	47.4	
500	46.2	50.9
630	44.4	
800	43.1	
1000	39.5	45.4
1250	37.1	
1600	36.0	
2000	34.2	38.9
2500	30.5	
3150	27.2	
4000	25.5	30.4
5000	23.5	
6300	31.4	
8000	31.4	35.0
10000	26.3	



Sound power level L_W(A): 51.5 dB [re 1pW], Uncertainty σtot: 1.6 dB

Name of test institute:	DTI	Date:	18-01-2024
No. of test report:	300-KLAB-23-039		

Measurements are in full conformity with ISO 3743-1

Detailed test results of sound power measurement – Test N°3

ilac-MRA DANAK TEST Reg. nr. 300

Sound power levels according to ISO 3743-1:2010

TEKNOLOGISK INSTITUT

Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms

Client: Midea — Date of test: 18-01-2024

Object: Type: Mono Air to water heat pump, Model: MHC-V16W/D2RN8-BER90

Mounting conditions: The outdoor unit is mounted on the supporting metal support frame using six vibration insulatores and placed on four pices of concrete tiles (20x20x2.5 cm). All of these are placed in a water drop dray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.

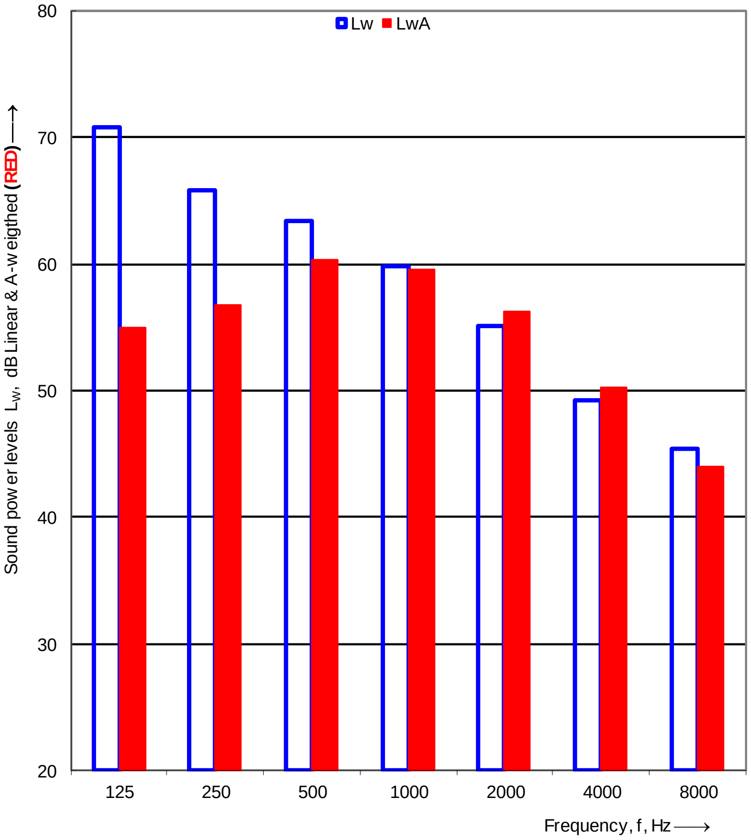
Operating conditions: A7/W55, Compressor speed: 72[Hz], Fan speed: 650[rpm], Pump speed: 50 [%], EXV1(P): 128, Heating capacity: 16.14 [kW], Power_input: 5.65 [kW], Water flow rate: 1790 [l/h]

Static pressure:	996 hPa		
Air temperature:	7.0 °C		
Relative air humidity:	84.0 %		
Test room volume:	102.8 m³	Room:	Room 2
Area, S, of test room:	138.9 m²		

Reference box:

L1:	1.4 m
L2:	0.4 m
L3:	0.9 m
Volume:	0.5 m³

Frequency f [Hz]	L_W 1/3 octave [dB]	1/1 oct [dB]
100	67.3	
125	64.4	70.8
160	66.0	
200	63.1	
250	59.5	65.8
315	59.2	
400	58.6	
500	57.4	63.4
630	59.6	
800	57.1	
1000	54.4	59.8
1250	52.4	
1600	51.6	
2000	49.8	55.1
2500	49.1	
3150	46.3	
4000	44.9	49.2
5000	39.9	
6300	38.9	
8000	40.7	45.4
10000	41.7	



Sound power level L_W(A): 65.2 dB [re 1pW], Uncertainty σtot: 1.6 dB

Name of test institute: DTI — Date: 18-01-2024

No. of test report: 300-KLAB-23-039

Measurements are in full conformity with ISO 3743-1

Detailed test results of sound power measurement – Test N#4

Sound power levels according to ISO 3743-1:2010

TEKNOLOGISK INSTITUT

Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms

Client: Midea — Date of test: 18-01-2024

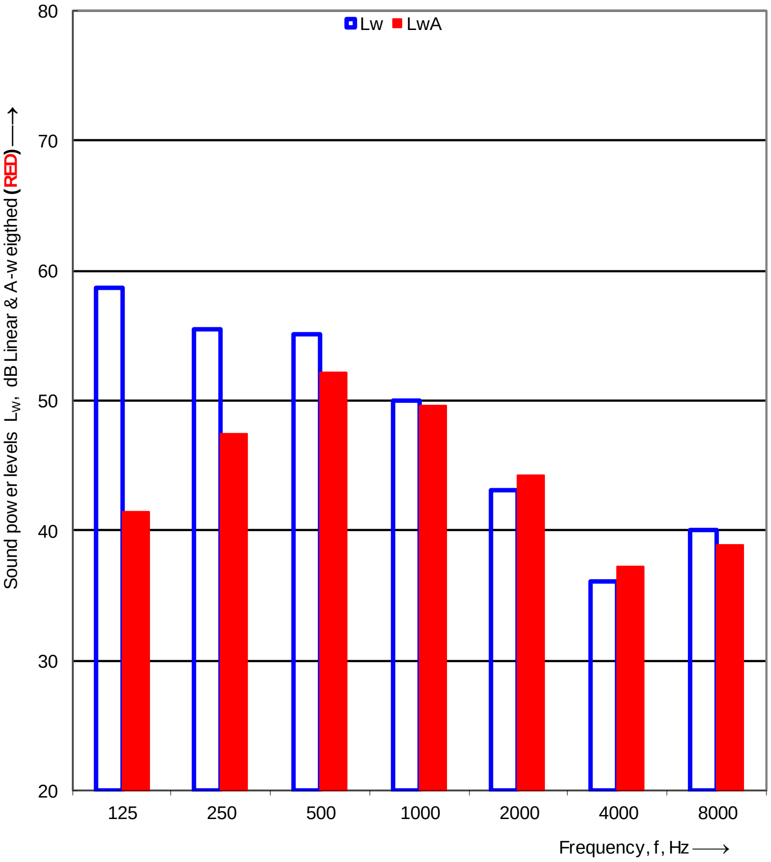
Object: Type: Mono Air to water heat pump, Model: MHC-V16W/D2RN8-BER90

Mounting conditions: The outdoor unit is mounted on the supporting metal support frame using six vibration insulatores and placed on four pices of concrete tiles (20x20x2.5 cm). All of these are placed in a water drop dray on two pieces of heavy concrete tiles (90x90x10cm) laying on a vibration damping mat on the floor. The noise radiated by the outdoor unit has been measured in Test room 2.

Operating conditions: A7/W55, Compressor speed: 32[Hz], Fan speed: 450[rpm], Pump speed: 30 [%], EXV1(P): 92, Heating capacity: 7.1 [kW], Power_input: 2.34 [kW], Water flow rate: 765 [l/h]

Static pressure:	996 hPa		Reference box:	
Air temperature:	7.0 °C		L1:	1.4 m
Relative air humidity:	84.0 %		L2:	0.4 m
Test room volume:	102.8 m³	Room: Room 2	L3:	0.9 m
Area, S, of test room:	138.9 m²		Volume:	0.5 m³

Frequency f [Hz]	L_W 1/3 octave [dB]	1/1 oct [dB]
100	56.7	
125	52.6	58.6
160	49.0	
200	49.5	
250	51.4	55.5
315	51.1	
400	50.1	
500	48.9	55.1
630	51.5	
800	47.8	
1000	44.0	50.0
1250	41.7	
1600	40.2	
2000	38.5	43.1
2500	34.5	
3150	33.5	
4000	30.9	36.1
5000	27.9	
6300	35.1	
8000	35.7	40.0
10000	35.0	



Sound power level L_W(A): 55.6 dB [re 1pW], Uncertainty σtot: 1.6 dB

Name of test institute: DTI — Date: 18-01-2024

No. of test report: 300-KLAB-23-039

Measurements are in full conformity with ISO 3743-1

Appendix 1

Unit specification

Type of unit: Mono air to water heat pump
Manufacturer: Midea
Size of the heat pump: 0.4 x 0.9 x 1.3m (W x L x H)
Year of production: n/a.

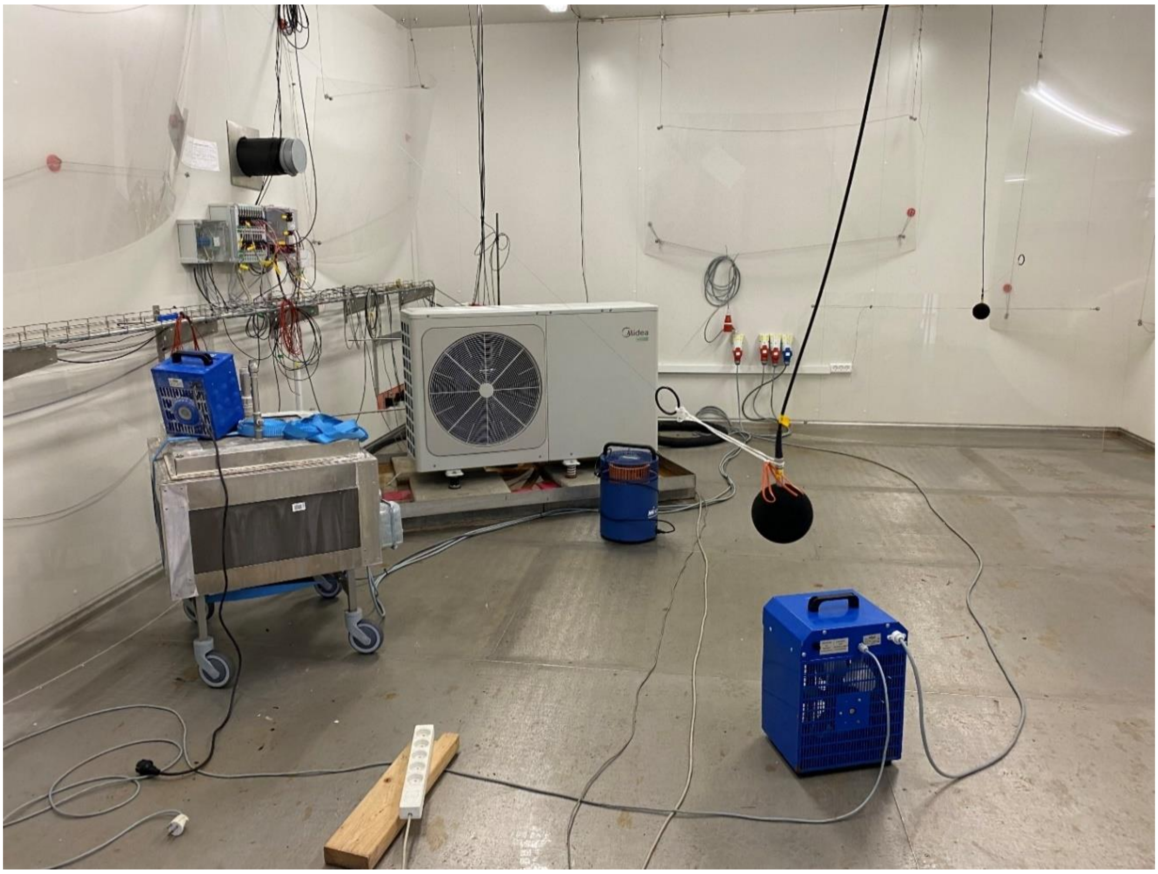
Operating conditions and environment

The operating conditions of the unit under test fulfill the requirements for Class A.

The acoustic test chamber is a hard wall reverberant room (103 m^3 and equipped with relevant sound diffusing reflector panels. The acoustical test chamber fulfils the requirements of ISO3743-1 accuracy grade 2 (engineering grade).

The measurements of the average sound pressure levels in 1/3 octave frequency bands are carried out using three microphones in the test chamber. During the measurements, the microphones are traversed up and down for one meter in the arc of a quarter circle.

The picture below shows the installation of the unit during test, position of microphones, sound diffusing reflector panels, and the reference sound source.



Measurement instruments

Id nr.	Manufacturer	Description	Calibration company
100864	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 1	Norsonic A/S, Norway
100865	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 1	Norsonic A/S, Norway
100866	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 1	Norsonic A/S, Norway
100867*	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 2	Norsonic A/S, Norway
100868*	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 2	Norsonic A/S, Norway
100869*	GRAS	Gras 40AE_26CA, ½" free field microphone, Room 2	Norsonic A/S, Norway
100870	GRAS	Gras 40AE_26CA, ½" free field microphone, Roof monitor	Norsonic A/S, Norway
100873*	Brüel & Kjær	Acoustical calibrator, Brüel & Kjær 4231	Element Metech, Denmark
100859	Norsonic	Reference sound source, Norsonic Nor278 Room 1	RISE, Sweden
100872*	Norsonic	Reference sound source, Norsonic Nor278 Room 2	RISE, Sweden
100620*	Norsonic	Multi-channel measurement system Nor850	Norsonic A/S, Norway

*Instruments are used for the actual measurements for the calculation of the test results.

The other instruments are used for control measurements.
All microphones are equipped with windshields.

Test Procedure

The measurements of the emitted sound power level from the heat pump are carried out according to the following standard:

- DS/EN 14511:2022
- EN 12102-1:2022
- ISO/EN 3743-1:2010

The basic acoustic measurement standard DS/EN 3743-1 is a comparison method using a calibrated reference sound source. Two series of sound pressure measurements are made under exactly the same acoustic conditions, e.g., the same microphone positions, temperature and air humidity. The calibrated sound power levels are known for the reference sound source at each frequency band, and they are used in the estimation of the acoustical correction factor for the calculation of the sound power emitted from the unit under test. The background noise levels are measured and used for relevant corrections.

The final total A-weighted sound power level is based on measurements and calculations in 1/3-octave levels, which then are summed into 1/1-octave levels. The A-weighted total sound power level is determined for the measured frequency range from 100 Hz to 10 kHz.

The actual microphone positions and correction values are saved in data files linked to the complete project documentation according to the DANAK-accreditation.

The complete measurement system is documented and regularly calibrated according to DANAK.

The detailed description of the measurement method is given in Danish in the quality database system “QA Web” at Danish Technological Institute, which is accessible by DANAK.

Measurement uncertainty

The uncertainty of sound power level in decibel is determined in accordance with ISO 3743-1, equation 22 $\sigma_{tot} = \sqrt{\sigma_{RO}{}^2 + \sigma_{omc}{}^2}$ where:

- σ_{RO} is the standard deviation of the reproducibility of the method
- σ_{omc} is the standard deviation describing the uncertainty associated with the instability of the operating and mounting conditions for the particular noise source during test.

σ_{RO} expresses the uncertainty in test results delivered by the different accredited test laboratories due to different instrumentation and implementation of measurement procedure as well different radiation characteristics of the noise source during test.

σ_{omc} expresses the uncertainty associated with the instability of the operating and mounting conditions for the particular noise source during test. The mounting and installation conditions in two DTI acoustical test chambers are well defined in the test procedure. Possible instability of the operating conditions is monitored and assessed prior to each noise test.

The test uncertainty σ_{omc} is calculated according to ISO3743-1 Annex C formula C.1 and is typically below 0.5dB. However, the uncertainty is rounded up to the nearest 0.5dB increment in the report. As pr. Table C.1 (accuracy grade 2), the uncertainty σ_{RO} is set to 1.5.

The expanded uncertainty U is calculated according to ISO 3743-1 equation 23:
$U = k\,\sigma_{tot}$ where k = 2 for 95% confidence.

EXAMPLE: $\sigma_{tot}: \sqrt{1.5^2 + 0.5^2} = 1.6\ dB$ and $U(95\%) = 3.2\ dB$

Note: The expanded uncertainty does not include the standard deviation of production which is used in ISO4871 for the purpose of making noise declaration for batches of machines.

Appendix 2

EU Declaration of Consistency

Product: Air source heat pump

Brand: IMMERGAS

Manufacturer' s Name: GD Midea HEATING&VENTILATING Equipment Co.,Ltd.

Manufacturer' s Address: Midea Industrial City, Shunde, Foshan, Guangdong, P.R. China

Importer' s Name: IMMERGAS S.P.A

Importer' s Address: 42041 Brescello(RE)-Italy

We, GD Midea Heating & Ventilating Equipment Co., Ltd, hereby declare that the following Heat Pump

we produced for IMMERGAS S.P.A are identical to our following models,

Midea Model Name	IMMERGAS Model
MHC-V4W/D2N8-B	MAGIS M4
MHC-V6W/D2N8-B	MAGIS M6
MHC-V8W/D2N8-B	MAGIS M8
MHC-V10W/D2N8-B	MAGIS M10
MHC-V12W/D2N8-B	MAGIS M12
MHC-V14W/D2N8-B	MAGIS M14
MHC-V16W/D2N8-B	MAGIS M16
MHC-V12W/D2RN8-B	MAGIS M12 T
MHC-V14W/D2RN8-B	MAGIS M14 T
MHC-V16W/D2RN8-B	MAGIS M16 T
MHC-V4W/D2N8-BE30	MAGIS M4 EH3
MHC-V6W/D2N8-BE30	MAGIS M6 EH3
MHC-V8W/D2N8-BE30	MAGIS M8 EH3
MHC-V12W/D2RN8-BER90	MAGIS M12 T EH9
MHC-V14W/D2RN8-BER90	MAGIS M14 T EH9
MHC-V16W/D2RN8-BER90	MAGIS M16 T EH9

广东美的暖通设备有限公司 GD Midea Heating & Ventilating Equipment Co. , Ltd.
地址：中国广东省佛山市顺德区北滘镇美的工业城 邮编：528311
Address: Midea Industrial City, Beijiao, Shunde, Foshan, Guangdong, P.R. China Postcode: 528311
电话 Tel: +86-757-26338495 传真 Fax: +86-757-22390205 网址 Website: http://www.midea.com http://cac.midea.com

Note: This declaration becomes invalid if technical or operational modifications are introduced without the manufacturer’s consent.

Production year: 2020

Year of affixing CE Marking: 2020

Address: Midea Industrial City, Beijiao, Shunde, Foshan, Guangdong, P.R.C.

Date : 25/03/2024

Authorization: