Engineering Data

King

CONTENTS

Part 1

General Information

1 System introduction

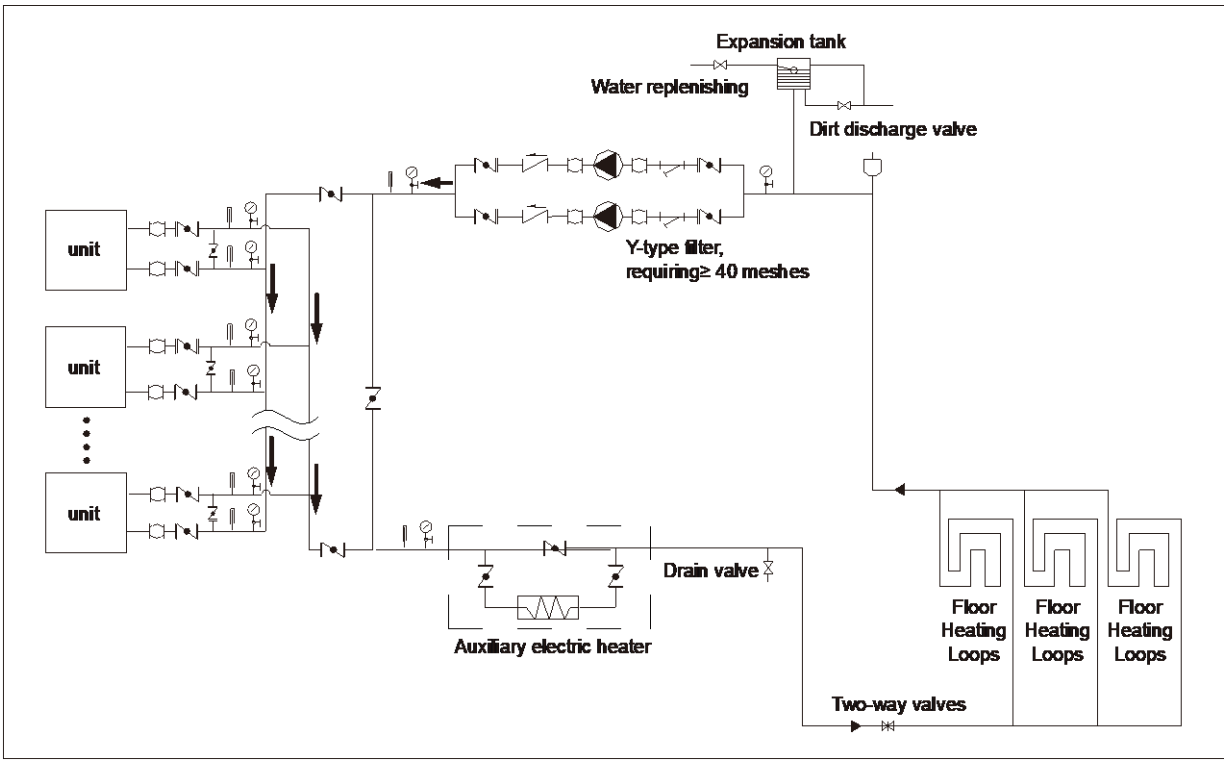
1.1 System Schematic

King is an integrated air-to-water space heating and space cooling heat pump system. The outdoor heat pump system extracts heat from the outdoor air and transfers this heat through refrigerant piping to the plate heat exchanger in the hydronic system. The heated water in the hydronic system circulates to low temperature heat emitters (floor heating loops or low temperature radiators) to provide space heating. The 4-way valve in the outdoor unit can reverse the refrigerant cycle so that the hydronic system can provide chilled water for cooling using fan coil units.

The heating capacity of heat pumps decreases with ambient temperature. King is reserved an auxiliary electric heater control port to provide additional heating capacity for use during extremely cold weather when the heat pump capacity is insufficient. The auxiliary electric heater also serves as a backup in case of heat pump malfunction and for anti-freeze protection of the outside water piping in winter.

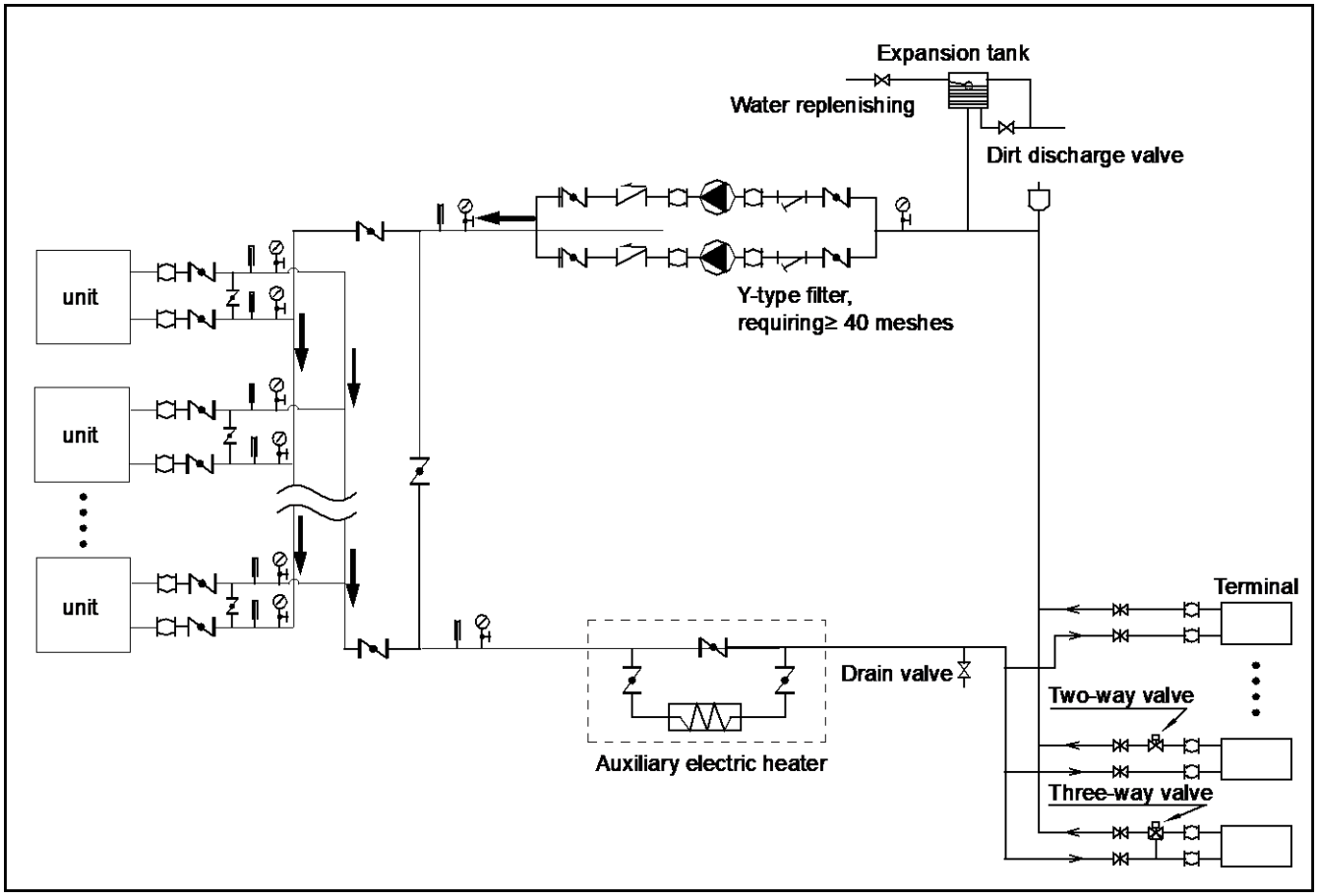
1.2 Typical Applications

1.2.1 Space Heating Through Floor Heating Loops



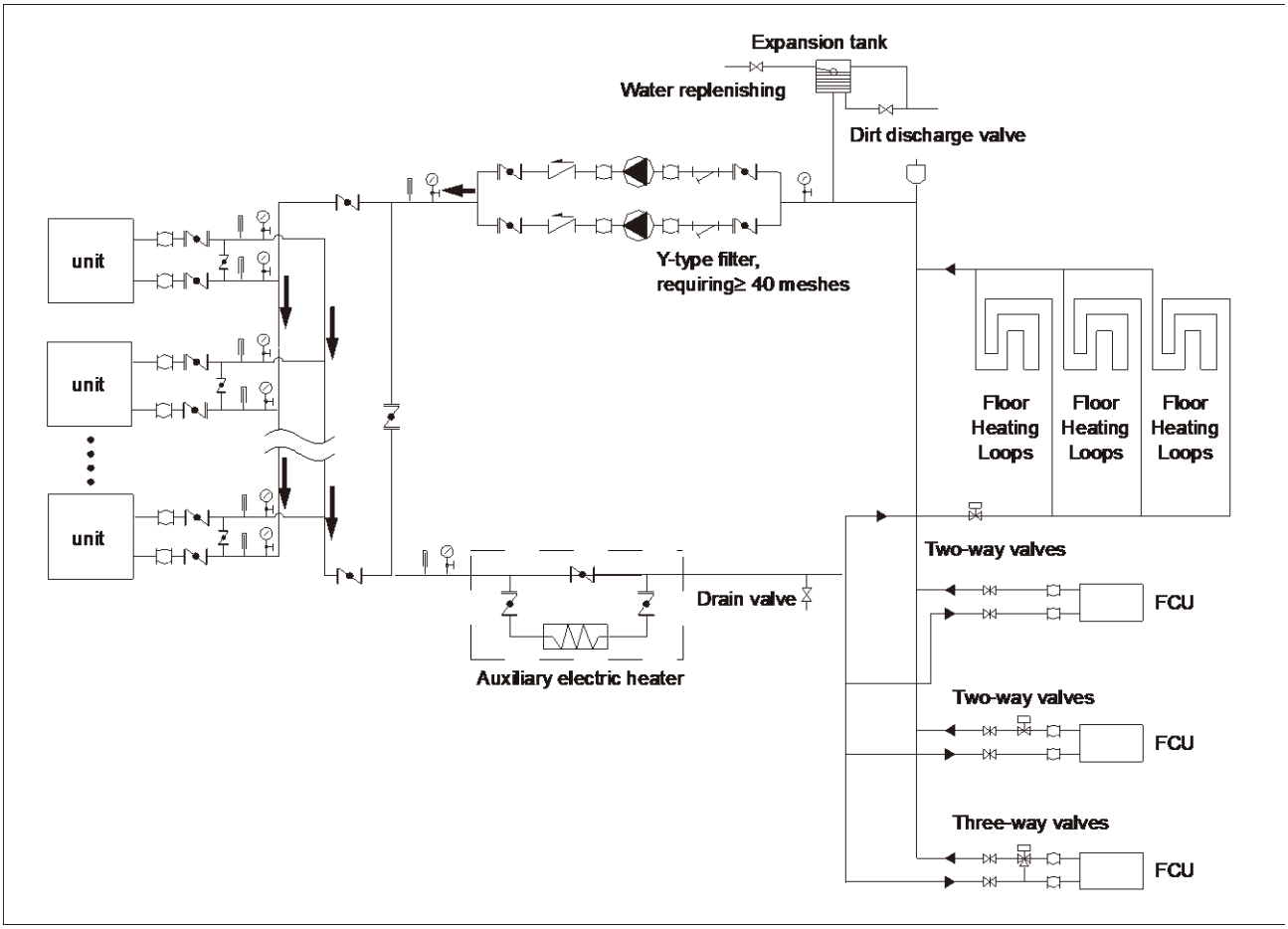
Legend				
Stop valve	Pressure gauge	Flexible joint	Gate valve	Automatic discharge valve
Y-shaped filter	Thermometer	Circulating pump	Check valve	

1.2.2 Space Cooling and Heating through Fan Coil Unit



Legend				
Stop valve	Pressure gauge	Flexible joint	Gate valve	Automatic discharge valve
Y-shaped filter	Thermometer	Circulating pump	Check valve	

1.2.3 Space Heating Through Floor Heating Loops and Space Cooling Through Fan Coil Unit

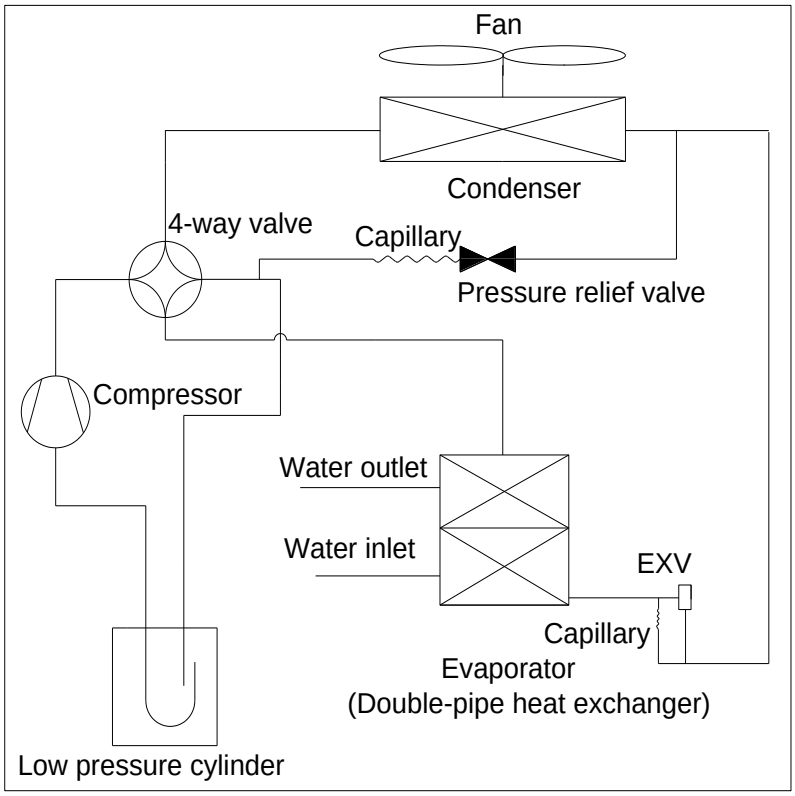


Legend				
Stop valve	Pressure gauge	Flexible joint	Gate valve	Automatic discharge valve
Y-shaped filter	Thermometer	Circulating pump	Check valve	

Note:

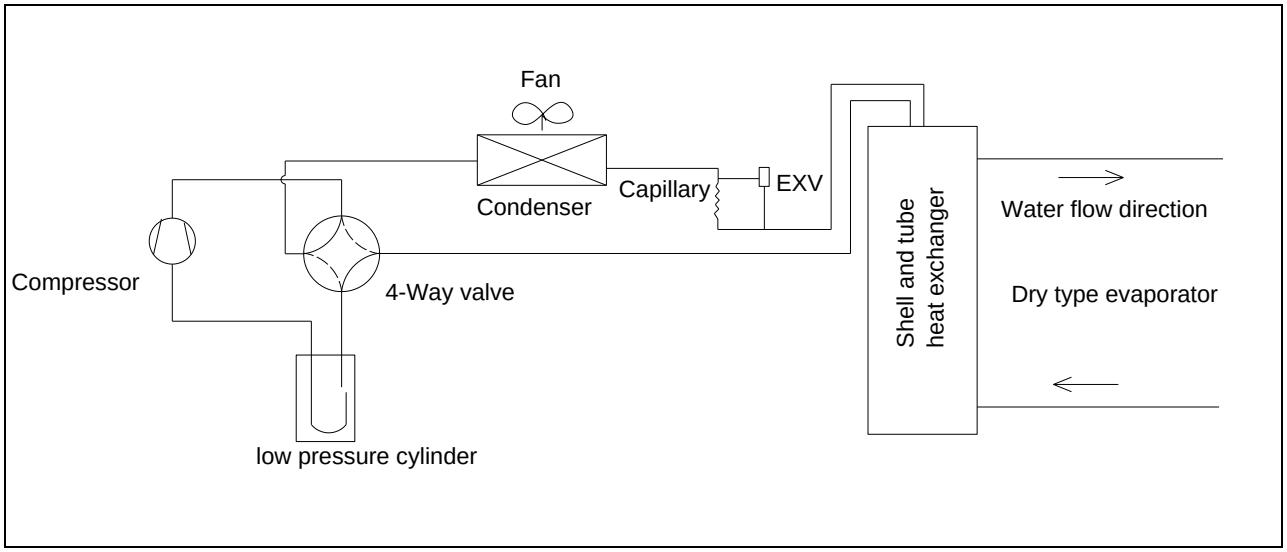
In space cooling mode, the 2-way valve on the floor heating branch circuit is closed to prevent cold water entering the floor heating loops.

1.3 Refrigeration System Sketch Drawing



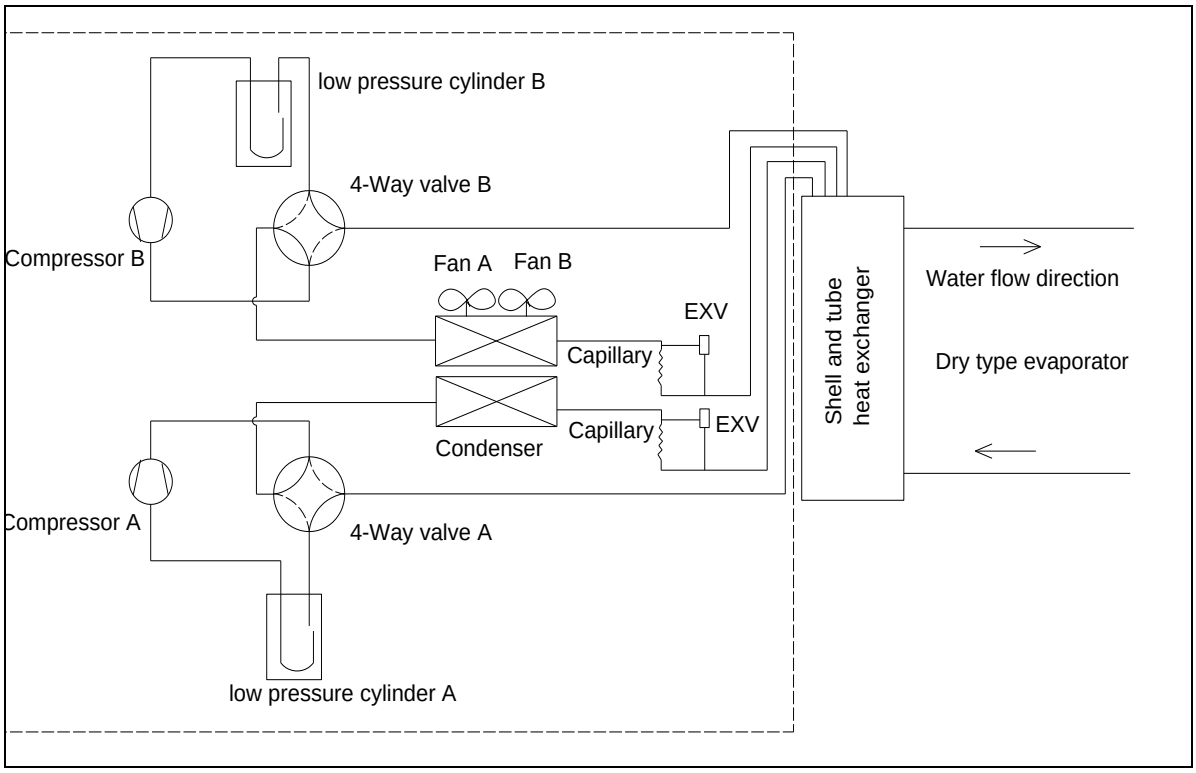
Each module has one compressor with one separate unit, one refrigerant system.

MDVM-35BR1-S



Each module has one compressor with one separate unit, one refrigerant system.

MDVM-65BR1-S



Each module has two compressors with one unit, one shell-tube evaporator for two refrigerant systems

MDVM-80BR1-S

2 Product lineup

Model	MDVM-35BR1-S	MDVM-65BR1-K
Power supply	380-415V-3N~50Hz	380-415V-3N~50Hz
Appearance		
Model	**MDVM-65BR1-S**	**MDVM-80BR1-S**
Power supply	380-415V-3N~50Hz	380-415V-3N~50Hz
Appearance		
Model	**MDVM-130BR1-K**	
Power supply	380-415V-3N~50Hz	
Appearance		

3 Nomenclature

MDV	M	-	null	130	null	null	B	R1	-	K
1	2		3	4	5	6	7	8		9

Legend		
No.	**Code**	**Remarks**
1	MDV	MDV Brand
2	M	Air cooled chiller
3	null	Compressor attribute code Null: Fixed speed V: Inverter System
4	130	130kW
5	null	Hydraulic module code null: Without hydraulic module M: With hydraulic module
6	null	Compressor and fan motor types null: Fixed speed compressor and fan D2: DC inverter compressor and fan
7	B	Power supply for ODU B: 380-415V 3N~ 50Hz
8	R1	Refrigerant R1: R410A
9	K	Series code KS: King

4 System Design and Unit Selection

4.1 Selection Procedure

Step 1: Total heat load calculation

Calculate conditioned surface area
Select the heat emitters (type, quantity, water temperature and heat load)

Step 2: System configuration

Decide whether to enable or disable auxiliary electric heater

Step 3: Selection of outdoor units

Determine required total heat load on outdoor units
Set capacity safety factor
Select power supply

Provisionally select Aqua thermal Series unit capacity[1] based on nominal capacity

Correct capacity of the outdoor units for the following items:
Outdoor air temperature / Outdoor humidity / Water outlet temperature2 / Altitude / Anti-freeze type

Is corrected capacity ≥ Required total heat load on outdoor units[3]

Yes

System selection is complete

No

Select a larger model or enable auxiliary electric heater operation

Notes:

1. Up to 16 units can be connected together, giving a system cooling/heating capacity range from 65 kW to 2080 kW.
2. If the required water temperatures of the heat emitters are not all the same, the outlet water temperature setting should be set at the highest of the heat emitter required water temperatures. If the water outlet design temperature falls between two temperatures listed in the outdoor unit's capacity table, calculate the corrected capacity by interpolation.
3. Select unit which satisfies both total heating and cooling load requirements.

4.2 Modular Chiller Leaving Water Temperature (LWT) Selection

The recommended design LTW ranges for different types of heat emitter are:

- For floor heating: 30 to 35°C
- For fan coil units: 30 to 45°C
- For low temperature radiators: 40 to 50°C

4.3 Optimizing System Design

To get the most comfort with the lowest energy consumption, it is important to take account of the following considerations:

- Choose heat emitters that allow the heat pump system to operate at as low a hot water temperature as possible whilst still providing sufficient heating.

Part 2

Engineering Data

1 Specifications

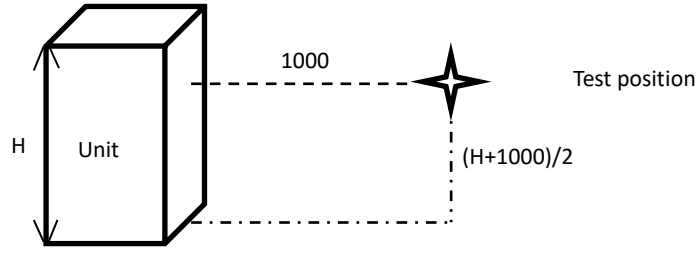
Model name			MDVM-35BR1-S	MDVM-65BR1-S	MDVM-65BR1-K
Power supply		V/Ph/Hz	380-415/3/50	380-415/3/50	380-415/3/50
Cooling [1]	Capacity	kW	35	65	65
	Rated input	kW	11.5	20.4	19.52
	EER		3.04	3.19	3.1
Heating[2]	Capacity	kW	37	69	71
	Rated input	kW	11.3	21.5	20.4
	COP		3.27	3.21	3.21
Air side heat exchanger	Type		Finned tube	Finned tube	Finned tube
	Fan motor type		AC Motor	AC Motor	Three Phase Asynchronous Motor
	Fan motor rated input	W	800	800*2	500
	Fan motor quantity		1	2	2
	Air flow rate	m^3/h	13500	27000	26500
Water side heat exchanger	Type		Double-pipe	Shell-tube	Shell-tube
	Volume	L	5.6	35	/
	Rated water flow	m^3/h	6	11.2	11.2
	Water flow range	m^3/h	/	/	9.0-13.4
	Water pressure	kPa	1	1	48
Refrigerant system	Refrigerant type		R410A	R410A	R410A
	Refrigerant charge	kg	6	10.5	11.5
	Throttle type		EXV	EXV	EXV
Sound pressure level(1m)[3]	Cooling[1]	dB(A)	/	/	69
	Heating[2]	dB(A)	/	/	70
Noise level		dB(A)	65	67	/
Net dimensions	mm		1020×1770×980	2000×1770×960	2000×1770×960
Packed dimensions	mm		1070×1900×1030	2090×1890×1030	2090×1890×1030
Net weight	kg		300	530	525
Gross weight	kg		310	590	560
Water pipe connections	mm		DN40	DN65	DN65
Water pressure range	MPa		1	1	1
Controller			Wired controller	Wired controller	KJRX-120D/BMKO
Operating temperature range	Cooling	°C	-10～46	-10～46	15~48
	Heating	°C	-15～24	-15～24	-15~24
Water outlet temperature range	Cooling[4]	°C	0～17	0～17	5-17
	Heating	°C	25～50	25～50	40-50

Note:

1. Outdoor ambient temperature 35°C DB. EWT 12°C, LWT 7°C;

2. Outdoor ambient temperature 7°C DB/6°C WB. EWT 40°C, LWT 45°C;

3. Sound pressure level is the test average measured in a semi-anechoic chamber. The test position is 1m right in front of the unit for four sides and (1+H)/2m (where H is the height of the unit) above the floor. During in-situ operation, sound pressure levels may be higher as a result of ambient noise.



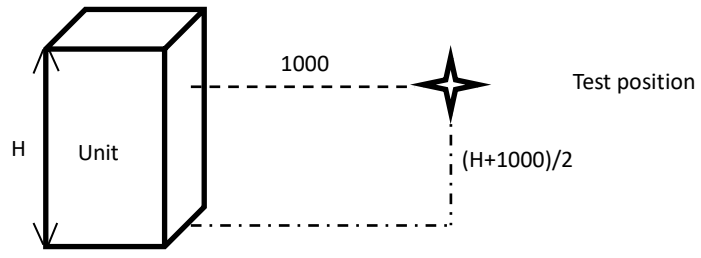
Model name			MDVM-80BR1-S	MDVM-130BR1-K
Power supply		V/Ph/Hz	380-415/3/50	380-415V/3P/50Hz
Cooling [1]	Capacity	kW	80	130
	Rated input	kW	25.8	39.16
	EER		3.1	3.32
Heating[2]	Capacity	kW	85	142
	Rated input	kW	26.5	40.80
	COP		3.21	3.48
Air side heat exchanger	Type		Finned tube	Finned tube
	Fan motor type		AC Motor	Three Phase Asynchronous Motor
	Fan motor rated input	W	800*2	900
	Fan motor quantity		2	2
	Air flow rate	m^3/h	27000	39000
Water side heat exchanger	Type		Shell- tube	Shell- tube
	Volume	L	47.5	Tube side: 12L
	Rated water flow	m^3/h	13.8	22.4
	Water flow range	m^3/h	/	17.9-26.9
	Water pressure drop	kPa	1	60
Refrigerant system	Refrigerant type		R410A	R410A
	Refrigerant charge	kg	13	20
	Throttle type		EXV	EXV
Sound pressure level(1m)[3]	Cooling[1]	dB(A)	/	71
	Heating[2]	dB(A)	/	71
Noise level		dB(A)	67	/
Net dimensions (W×H×D)	mm		2000×1770×960	2300*2200*1120
Packed dimensions (W×H×D)	mm		2090×1890×1030	2445*2250*1180
Net weight	kg		645	825
Gross weight	kg		710	938
Water pipe connections	mm		DN65	DN65
Water pressure range	MPa		1.0	1.0
Controller			KJRM-120D/BMK-E	KJRX-120D/BMKO
Operating temperature range	Cooling	°C	-10～46	15~48
	Heating	°C	-15～24	-15~24
Water outlet temperature range	Cooling[4]	°C	0～17	5-17
	Heating	°C	25～50	40-50

Note:

1. Outdoor ambient temperature 35°C DB. EWT 12°C, LWT 7°C;

2. Outdoor ambient temperature 7°C DB/6°C WB. EWT 40°C, LWT 45°C;

3. Sound pressure level is the test average measured in a semi-anechoic chamber. The test position is 1m right in front of the unit for four sides and (1+H)/2m (where H is the height of the unit) above the floor. During in-situ operation, sound pressure levels may be higher as a result of ambient noise.



2 Electrical Characteristics

System	Outdoor unit				Power current				Compressor			Fan	
	Voltage	Hz	Min.	Max.	MCA	MOP	TOCA	MFA	MSC	LRA	RLA	kW	FLA
	(V)		(V)	(V)	(A)	(A)	(A)	(A)	(A)	(A)	(A)		(A)
MDVM-35BR1-S	380-415	50	342	456	/	/	27	36	/	147	21.4	0.8	3.7
MDVM-65BR1-K	380-415	50	323	433	150	200	/	/	62	/	/	0.5	3.3
MDVM-65BR1-S	380-415	50	342	456	/	/	54.5	100	/	260	44.3	0.8	3.7
MDVM-80BR1-S	380-415	50	342	456	/	/	65	100	/	197	27.6	0.8(×2)	3.7(×2)
MDVM-130BR1-K	380-415	50	323	433	150	200	/	/	62	/	/	0.9	3.1

Note:

MCA: Min. Circuit Amps. (A)

MOP: Maximum overcurrent protector (A)

MSC : Max. Starting Amps. (A)

RLA: In nominal cooling or heating test condition, the input Amps of compressor where MAX. Hz can operate Rated Load Amps. (A)

kW: Rated Motor Output

FLA: Full Load Amps. (A)

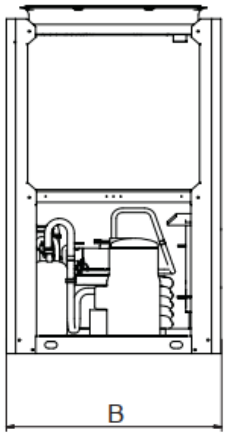
TOCA: Total Over-current Amps. (A)

MFA: Max. Fuse Amps. (A)

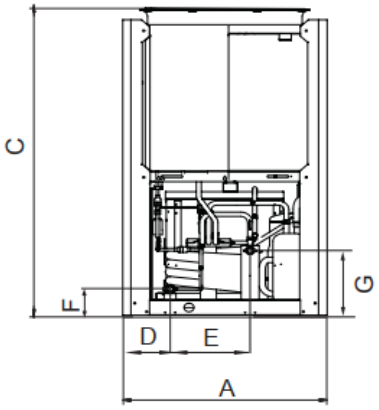
LRA: Locked Rotor Amps. (A)

3 Dimensions and Center of Gravity

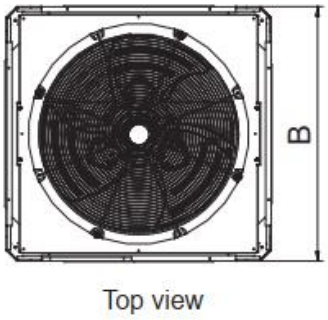
MDVM-35BR1-S



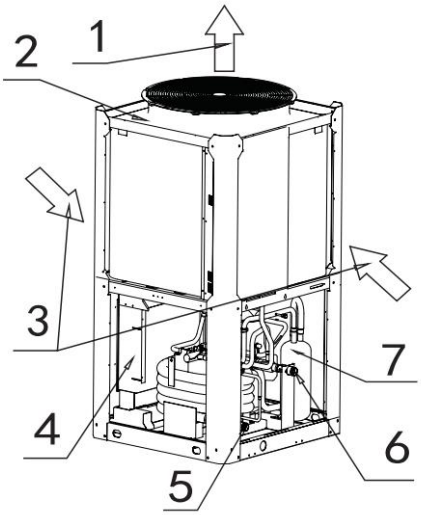
Front view



Left view



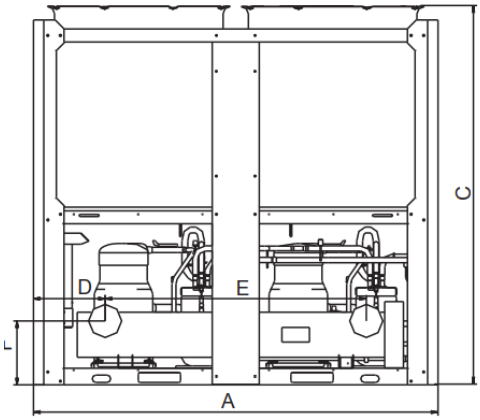
Top view



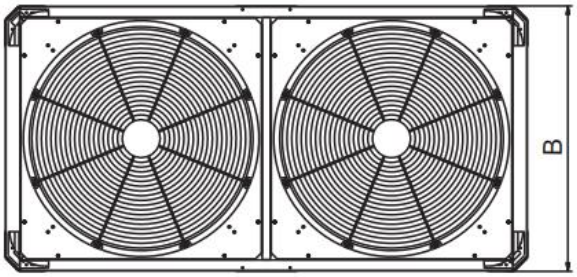
Model	unit	A	B	C	D	E	F	G
MDVM-35BR1-S	mm	1020	980	1770	237	400	152	377

No.	Name	No.	Name
1	Air outlet	5	Water outlet
2	Top cover	6	Water inlet
3	Air inlet	7	Compressor
4	Electric control box		

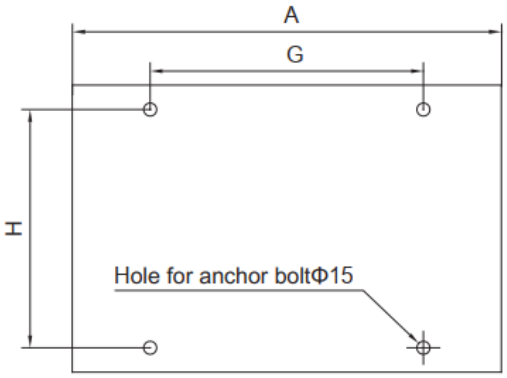
MDVM-65BR1-K



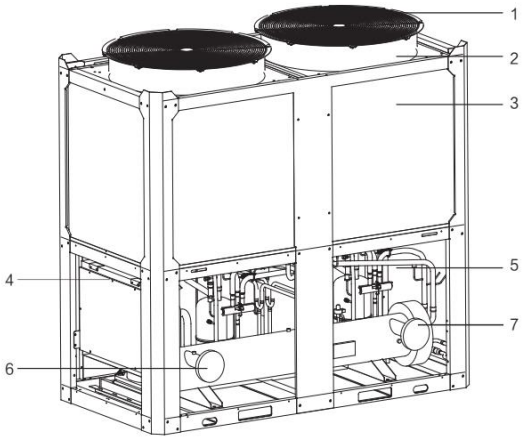
Front view



Top view

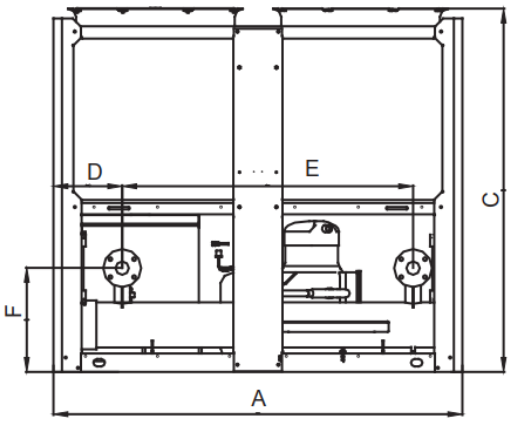


Bottom view

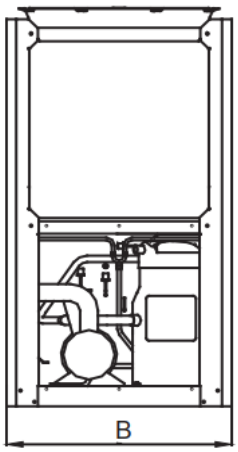


Model	unit	A	B	C	D	E	F	G	H
MDVM-65BR1-K	mm	2000	960	1770	239	1420	502	1550	862

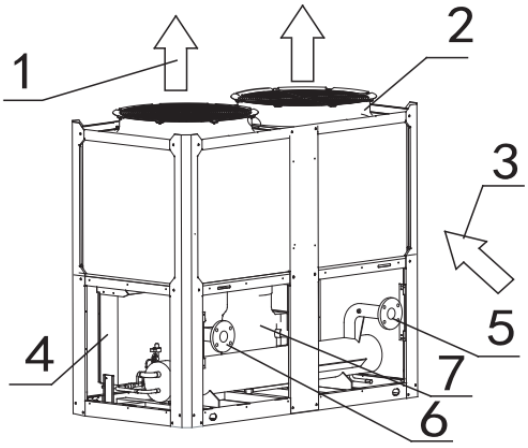
No.	Name	No.	Name
1	Air outlet	5	Compressor
2	Top cover	6	Water outlet
3	Air inlet	7	Water inlet
4	Electric control box		



Front view



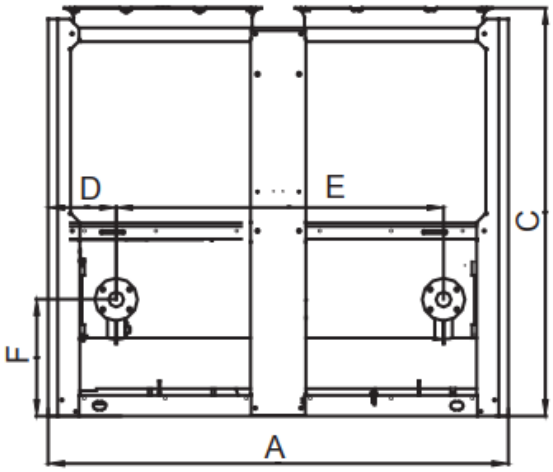
Left view



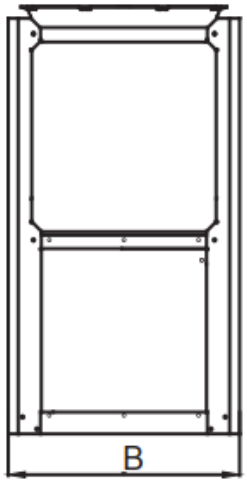
Model	unit	A	B	C	D	E	F
MDVM-65BR1-S	mm	2000	960	1770	336	1420	506

No.	Name	No.	Name
1	Air outlet	5	Water outlet
2	Top cover	6	Water inlet
3	Air inlet	7	Compressor
4	Electric control box		

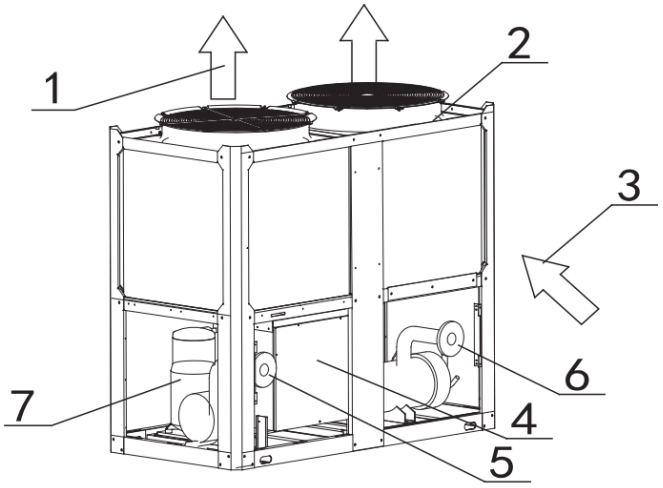
MDVM-80BR1-S



Front view



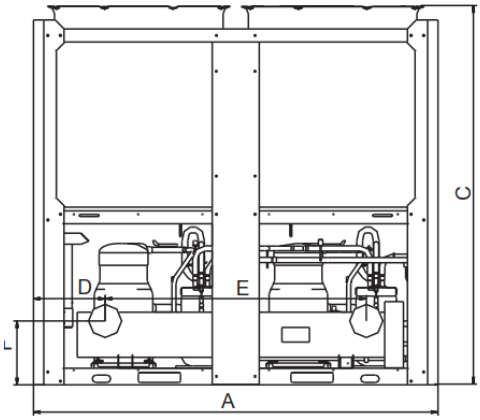
Left view



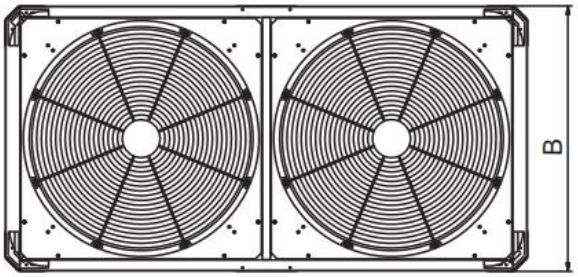
Model	unit	A	B	C	D	E	F
MDVM-80BR1-S	mm	2000	960	1770	240	1420	506

No.	Name	No.	Name
1	Air outlet	5	Water outlet
2	Top cover	6	Water inlet
3	Air inlet	7	Compressor
4	Electric control box		

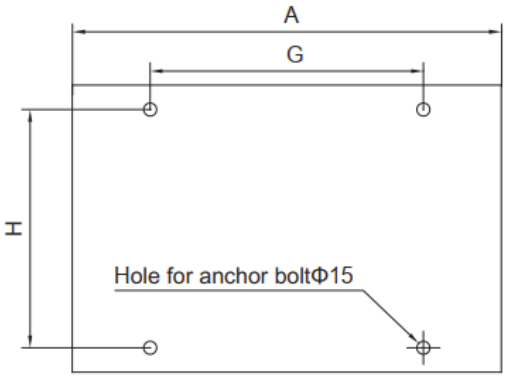
MDVM-130BR1-K



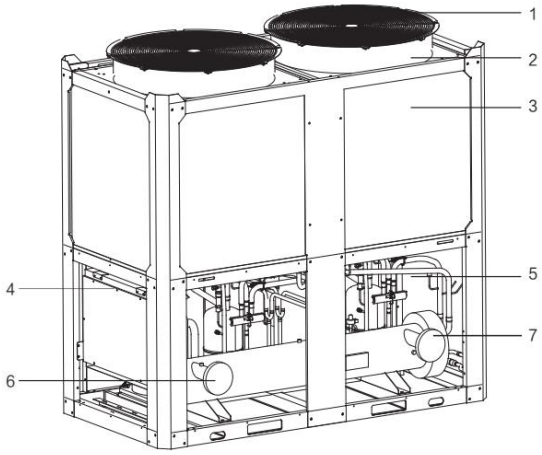
Front view



Top view



Bottom view



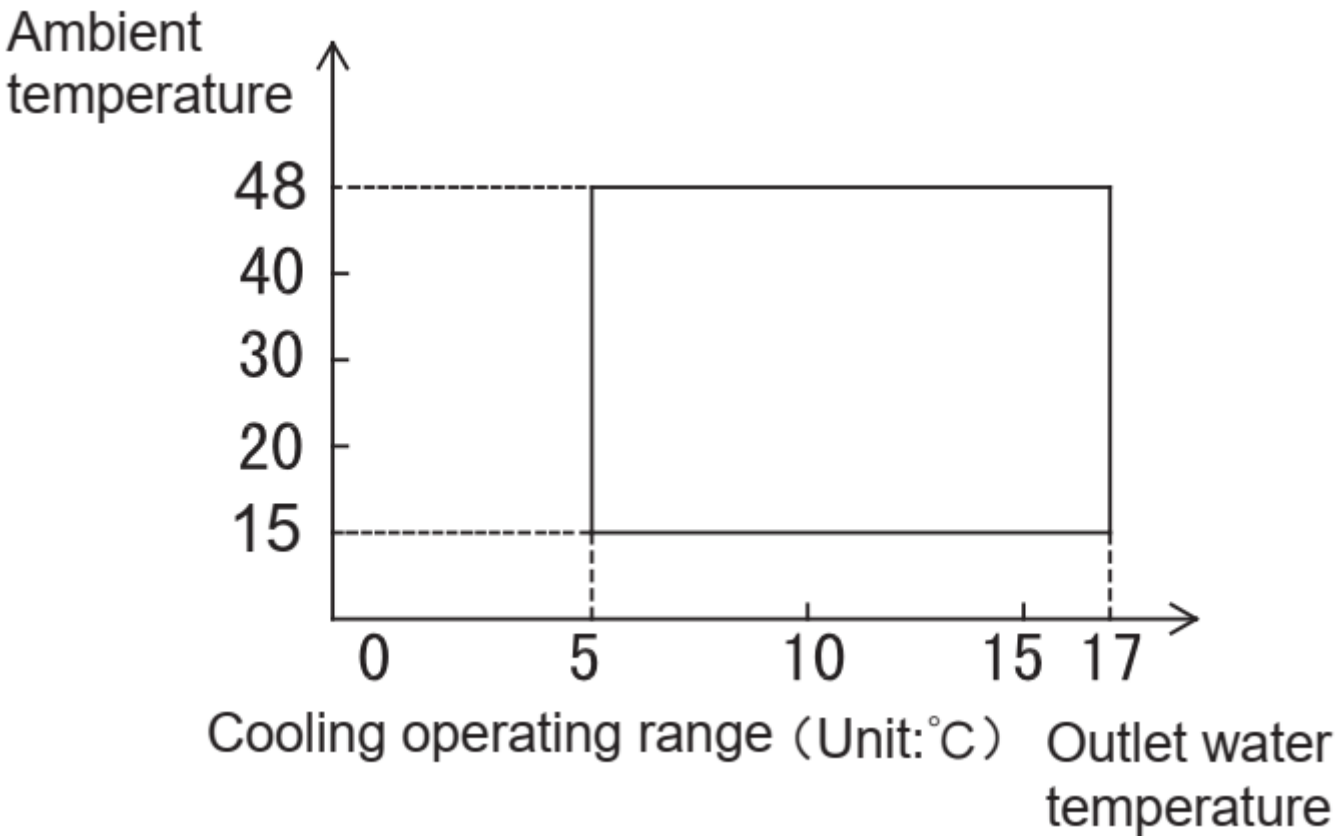
Model	unit	A	B	C	D	E	F	G	H
MDVM-130BR1-K	mm	2200	1120	2315	390	1420	350	1460	1017

No.	Name	No.	Name
1	Air outlet	5	Compressor
2	Top cover	6	Water outlet
3	Air inlet	7	Water inlet
4	Electric control box		

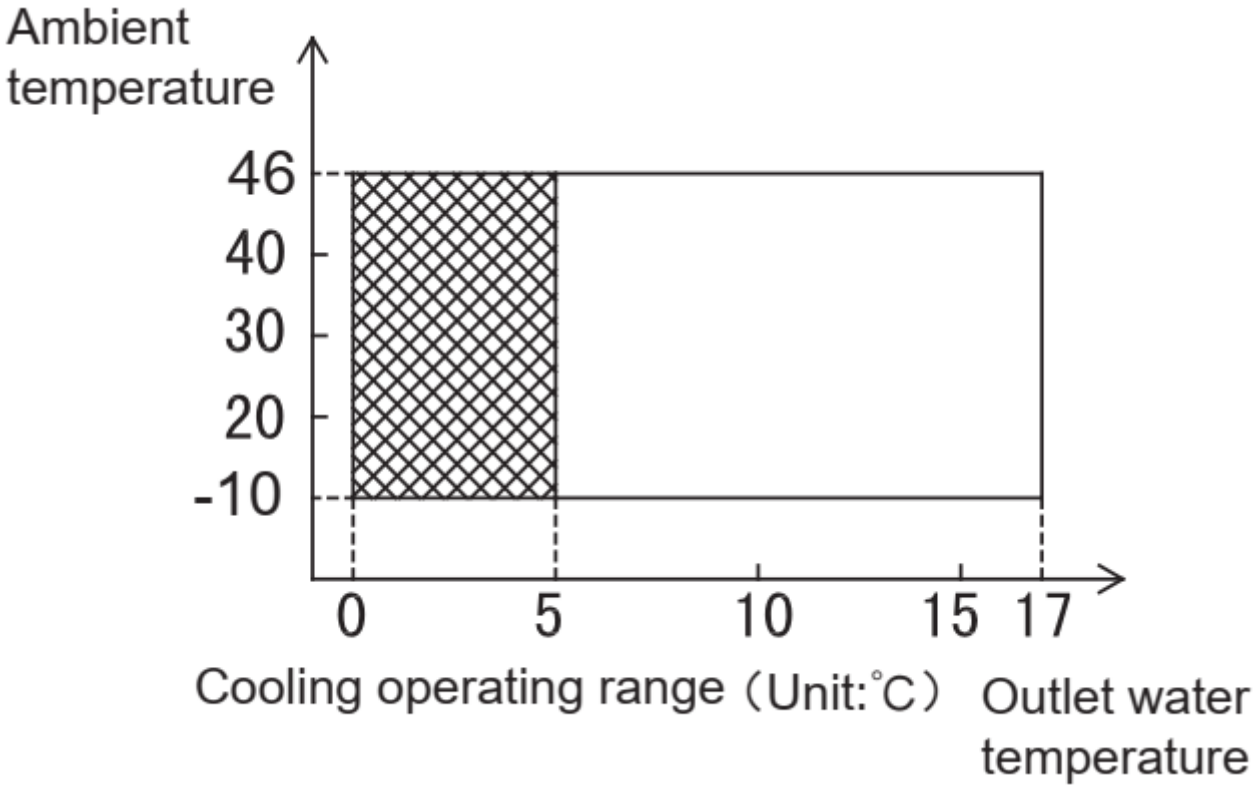
4 Operating Limits

4.1 Cooling operating range

MDVM-130BR1-K/ MDVM-65BR1-K

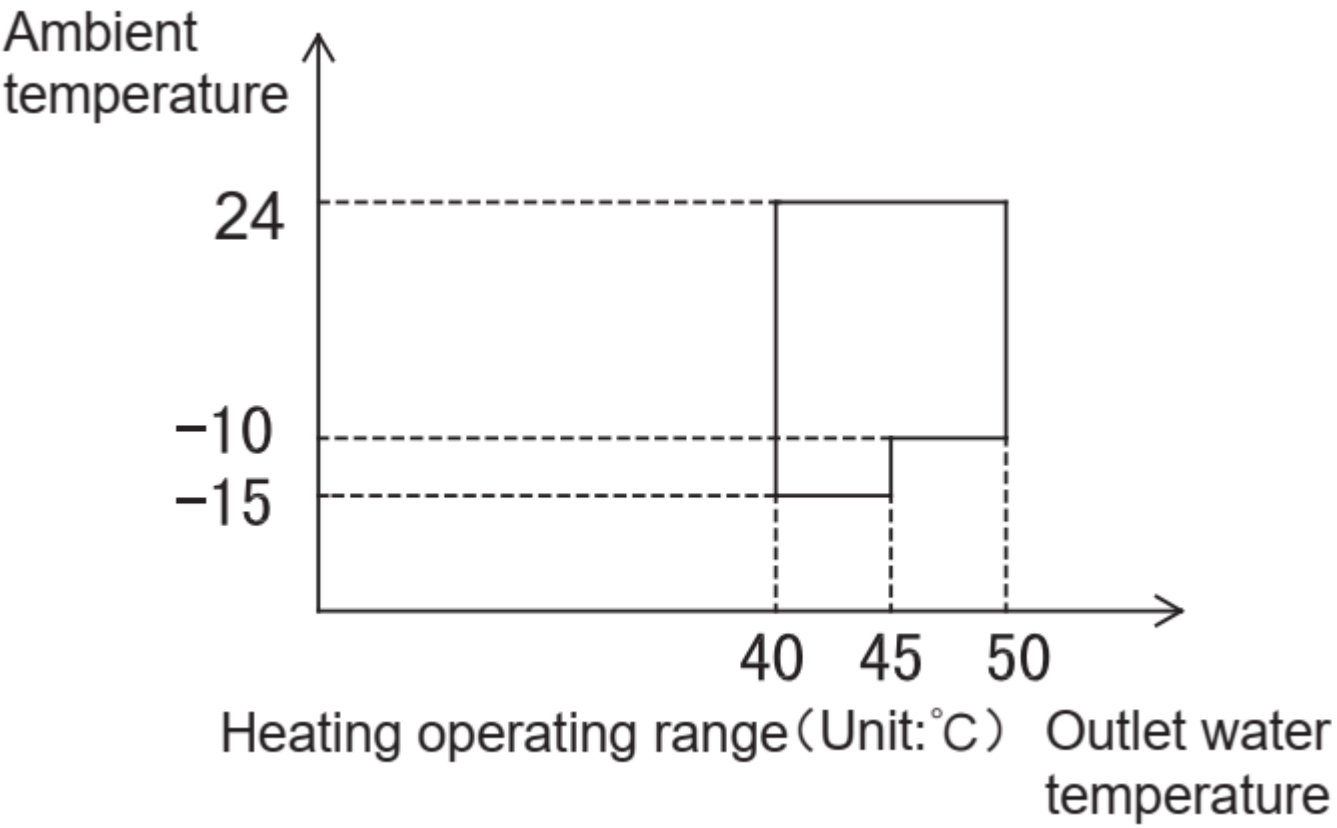


MDVM-35BR1-S & MDVM-65BR1-S & MDVM-80BR1-S

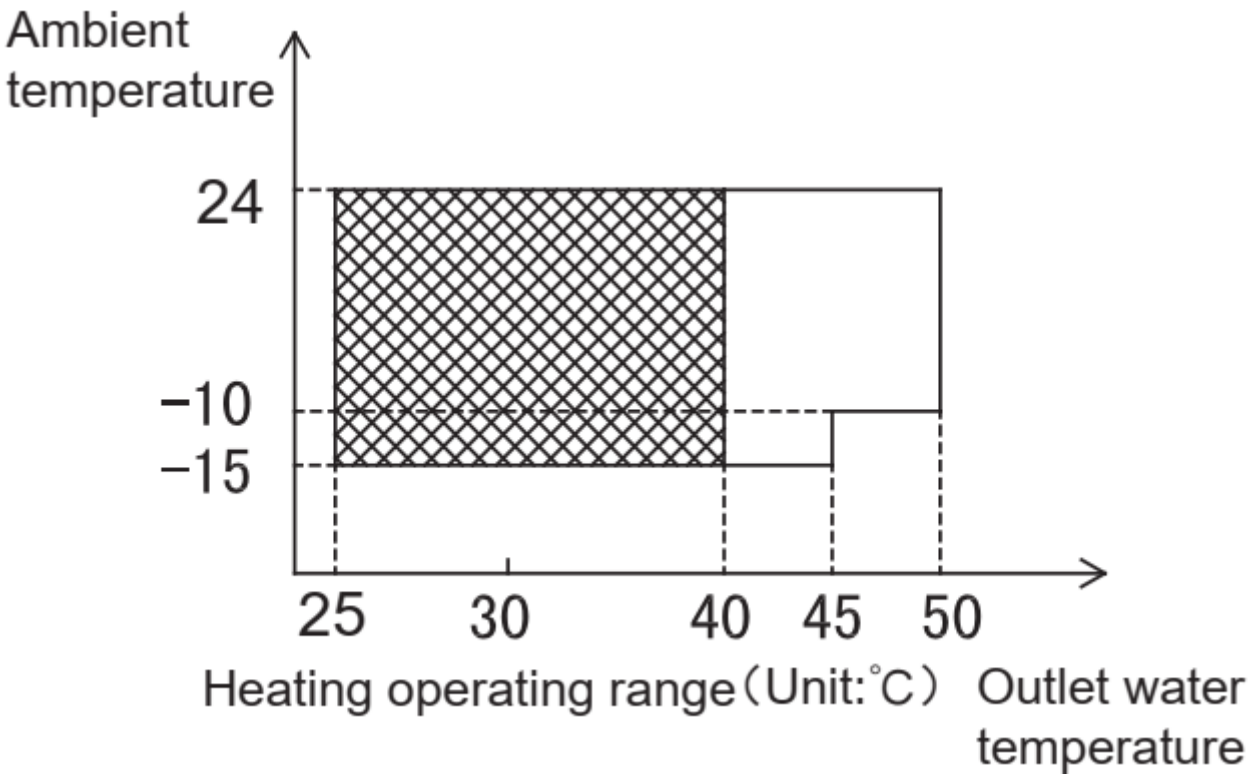


4.2 Heating operating range

MDVM-130BR1-K/ MDVM-65BR1-K



MDVM-35BR1-S & MDVM-65BR1-S & MDVM-80BR1-S



5 Capacity Tables

5.1 Heating Capacity Tables

MDVM-35BR1-S

Hot water outlet temp.	Ambient temp.(℃)													
	-10		-6		-2		2		7		10		13	
	HC	PI	HC	PI	HC	PI	HC	PI	HC	PI	HC	PI	HC	PI
(℃)	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
40	22.95	7.07	28.69	8.03	33.75	8.93	37.51	9.7	40.77	10.21	45.66	10.83	52.51	11.69
41	22.23	7.21	27.82	8.2	32.76	9.11	36.44	9.9	39.66	10.42	44.34	11.05	50.9	11.93
42	21.58	7.36	27.05	8.37	31.89	9.3	35.52	10.1	38.69	10.64	43.18	11.27	49.48	12.18
43	21.06	7.51	26.43	8.54	31.2	9.49	34.78	10.31	37.93	10.85	42.25	11.5	48.34	12.42
44	20.65	7.67	25.95	8.71	30.67	9.68	34.23	10.52	37.37	11.07	41.56	11.74	47.46	12.68
45	20.35	7.82	25.6	8.89	30.3	9.88	33.86	10.74	37	11.3	41.07	11.98	46.82	12.94
46	19.96	7.9	25.13	8.98	29.78	9.97	33.31	10.84	36.45	11.41	40.38	12.1	45.95	13.07
47	19.37	8.06	24.42	9.16	28.97	10.17	32.44	11.06	35.53	11.64	39.3	12.34	44.65	13.33
48	18.6	8.3	23.49	9.43	27.9	10.48	31.27	11.39	34.29	11.99	37.86	12.71	42.93	13.73
49	17.59	8.63	22.24	9.81	26.44	10.9	29.68	11.85	32.58	12.47	35.9	13.22	40.64	14.28
50	16.46	9.06	20.83	10.3	24.8	11.44	27.87	12.44	30.62	13.09	33.68	13.88	38.06	14.99

The inlet/outlet water temperature difference is 5℃.
DB: Dry-bulb temperature for outdoor air temperature (°C)
LWT: Leaving water temperature (°C)
HC: Total heating capacity (kW)
PI: Power input (kW)
Performance specifications measured with water pump operating at rated water flow rate.

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Hot water outlet temp.	Ambient temp.(℃)													
	-10		-6		-2		2		7		10		13	
	HC	PI	HC	PI	HC	PI	HC	PI	HC	PI	HC	PI	HC	PI
(℃)	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
40	42.8	13.45	53.51	15.29	62.95	16.99	69.94	18.46	76.02	19.43	85.15	20.6	97.92	22.25
41	41.45	13.73	51.87	15.6	61.1	17.33	67.96	18.84	73.95	19.83	82.68	21.02	94.92	22.7
42	40.25	14.01	50.44	15.92	59.48	17.69	66.23	19.22	72.15	20.24	80.52	21.45	92.28	23.17
43	39.28	14.29	49.28	16.24	58.18	18.05	64.86	19.62	70.74	20.65	78.8	21.89	90.15	23.64
44	38.52	14.58	48.39	16.57	57.2	18.42	63.84	20.02	69.69	21.07	77.5	22.33	88.5	24.12
45	37.96	14.88	47.75	16.91	56.51	18.79	63.14	20.43	69	21.5	76.59	22.79	87.31	24.61
46	37.22	15.03	46.87	17.08	55.54	18.98	62.12	20.63	67.97	21.72	75.31	23.02	85.7	24.86
47	36.12	15.33	45.54	17.42	54.03	19.36	60.5	21.04	66.27	22.15	73.29	23.48	83.26	25.36
48	34.69	15.79	43.8	17.95	52.02	19.94	58.32	21.67	63.95	22.81	70.6	24.18	80.06	26.12
49	32.8	16.42	41.47	18.66	49.31	20.74	55.34	22.54	60.75	23.73	66.95	25.15	75.78	27.16
50	30.69	17.24	38.85	19.6	46.25	21.77	51.96	23.67	57.1	24.91	62.81	26.41	70.98	28.52

The inlet/outlet water temperature difference is 5℃.
DB: Dry-bulb temperature for outdoor air temperature (°C)
LWT: Leaving water temperature (°C)
HC: Total heating capacity (kW)
PI: Power input (kW)
Performance specifications measured with water pump operating at rated water flow rate.

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LWT ℃	DB ℃							
	24		20		15		7	
	HC	PI	HC	PI	HC	PI	HC	PI
40	116.1	18.7	107.5	18.7	91.3	18.2	75.2	17.5
45	110.5	21.4	102.3	21.4	87.0	20.8	71.6	20.5
50	105.0	23.9	97.2	23.9	82.6	23.2	68.1	22.4

LWT ℃	DB ℃							
	2		-7		-10		-15	
	HC	PI	HC	PI	HC	PI	HC	PI
40	56.3	19.4	44.8	19.0	40.3	19.4	36	20.6
45	53.6	20.3	42.6	19.9	38.4	20.3	35	21.5
50	50.9	24.2	40.5	23.6	36.5	23.8	/	/

DB: Dry-bulb temperature for outdoor air temperature (°C)
LWT: Leaving water temperature (°C)
HC: Total heating capacity (kW)
PI: Power input (kW)
Performance specifications measured with water pump operating at rated water flow rate.

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Hot water outlet temp.	Ambient temp.(℃)													
	-10		-6		-2		2		7		10		13	
	HC	PI	HC	PI	HC	PI	HC	PI	HC	PI	HC	PI	HC	PI
(℃)	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
40	52.73	16.58	65.91	18.84	77.55	20.94	86.16	22.76	93.65	23.95	104.89	25.39	120.63	27.42
41	51.06	16.92	63.9	19.23	75.27	21.36	83.72	23.22	91.1	24.44	101.85	25.91	116.93	27.98
42	49.58	17.26	62.13	19.62	73.27	21.8	81.59	23.69	88.88	24.94	99.19	26.44	113.67	28.55
43	48.38	17.62	60.71	20.02	71.68	22.24	79.91	24.18	87.14	25.45	97.07	26.98	111.05	29.14
44	47.45	17.98	59.61	20.43	70.46	22.7	78.64	24.67	85.85	25.97	95.47	27.53	109.02	29.73
45	46.76	18.34	58.82	20.84	69.61	23.16	77.78	25.18	85	26.5	94.35	28.09	107.56	30.34
46	45.85	18.53	57.74	21.05	68.41	23.39	76.52	25.43	83.73	26.77	92.77	28.37	105.57	30.64
47	44.49	18.9	56.11	21.47	66.56	23.86	74.53	25.94	81.63	27.3	90.28	28.94	102.56	31.25
48	42.74	19.46	53.96	22.12	64.08	24.58	71.84	26.71	78.77	28.12	86.97	29.81	98.62	32.19
49	40.41	20.24	51.09	23	60.74	25.56	68.18	27.78	74.84	29.24	82.47	31	93.36	33.48
50	37.81	21.26	47.86	24.15	56.97	26.84	64.01	29.17	70.35	30.71	77.38	32.55	87.44	35.15

The inlet/outlet water temperature difference is 5℃.
DB: Dry-bulb temperature for outdoor air temperature (°C)
LWT: Leaving water temperature (°C)
HC: Total heating capacity (kW)
PI: Power input (kW)
Performance specifications measured with water pump operating at rated water flow rate.

MDVM-130BR1-K

LWT ℃	DB ℃							
	24		20		15		7	
	HC	PI	HC	PI	HC	PI	HC	PI
40	229.8	37.4	212.8	37.4	180.9	36.4	148.9	35.1
45	218.9	42.8	202.6	42.8	172.2	41.6	141.8	40.6
50	207.9	47.8	192.5	47.8	163.6	46.5	134.8	44.8

LWT ℃	DB ℃							
	2		-7		-10		-15	
	HC	PI	HC	PI	HC	PI	HC	PI
40	111.4	38.8	88.6	38.0	79.8	38.8	72	41.1
45	106.1	40.7	84.4	39.8	76.0	40.7	68	43.1
50	100.8	48.3	80.2	47.2	72.2	47.7	/	/

DB: Dry-bulb temperature for outdoor air temperature (°C)
LWT: Leaving water temperature (°C)
HC: Total heating capacity (kW)
PI: Power input (kW)
Performance specifications measured with water pump operating at rated water flow rate.

5.2 Cooling Capacity Tables

MDVM-35BR1-S

Chilled water outlet temp.	Ambient temp.(℃)											
	21		25		30		35		40		46	
	CC	PI	CC	PI	CC	PI	CC	PI	CC	PI	CC	PI
(℃)	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
5	39.18	10.13	36.9	10.44	34.81	10.76	32.9	11.1	30.83	11.32	28.36	11.5
6	40.51	10.29	38.11	10.6	35.92	10.93	33.92	11.27	31.81	11.5	29.3	11.68
7	41.92	10.5	39.4	10.82	37.1	11.16	35	11.5	32.87	11.77	30.5	11.98
8	43.22	10.81	40.58	11.14	38.17	11.49	35.98	11.85	33.82	12.09	31.22	12.28
9	44.44	10.92	41.68	11.25	39.18	11.6	36.89	11.96	34.71	12.2	32.08	12.4
10	46.12	11.08	43.22	11.42	40.59	11.78	38.18	12.14	35.97	12.38	33.27	12.58
11	47.41	11.19	44.39	11.53	41.64	11.89	39.14	12.26	36.9	12.51	34.17	12.71
12	48.49	11.35	45.36	11.7	42.51	12.07	39.92	12.44	37.68	12.69	34.93	12.89
13	49.36	11.44	46.13	11.8	43.19	12.16	40.52	12.54	38.29	12.79	35.53	12.99
14	50.58	11.52	47.23	11.88	44.18	12.25	41.41	12.62	39.17	12.88	36.39	13.08
15	51.23	11.58	47.79	11.94	44.67	12.31	41.82	12.69	39.61	12.95	36.83	13.15
16	52.51	11.7	48.94	12.06	45.69	12.43	42.74	12.81	40.52	13.07	37.72	13.28
17	53.18	11.75	49.52	12.12	46.19	12.49	43.17	12.88	40.97	13.14	38.18	13.35

Note:
The inlet/outlet water temperature difference is 5℃.
DB: Dry-bulb temperature for outdoor air temperature (°C)
LWT: Leaving water temperature (°C)
CC: Total cooling capacity (kW)
PI: Power input (kW)
Performance specifications measured with water pump operating at rated water flow rate.

MDVM-65BR1-S

Chilled water outlet temp.	Ambient temp.(℃)											
	21		25		30		35		40		46	
	CC	PI	CC	PI	CC	PI	CC	PI	CC	PI	CC	PI
(℃)	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
5	72.77	17.97	68.52	18.52	64.64	19.1	61.1	19.69	57.25	20.67	52.67	21.7
6	75.23	18.25	70.77	18.81	66.7	19.39	62.99	19.99	59.08	20.99	54.41	22.04
7	77.85	18.62	73.17	19.19	68.9	19.79	65	20.4	61.04	21.42	56.27	22.49
8	80.26	19.18	75.36	19.77	70.9	20.38	66.82	21.01	62.81	22.06	57.97	23.17
9	82.52	19.36	77.41	19.96	72.76	20.58	68.51	21.22	64.47	22.28	59.57	23.39
10	85.65	19.65	80.27	20.26	75.38	20.89	70.91	21.53	66.8	22.61	61.79	23.74
11	88.04	19.85	82.44	20.46	77.33	21.09	72.68	21.75	68.54	22.83	63.47	23.98
12	90.06	20.14	84.24	20.76	78.95	21.4	74.13	22.06	69.98	23.17	64.87	24.33
13	91.66	20.3	85.67	20.93	80.21	21.57	75.25	22.24	71.11	23.35	65.99	24.52
14	93.94	20.44	87.72	21.07	82.05	21.72	76.9	22.4	72.75	23.52	67.58	24.69
15	95.15	20.54	88.76	21.18	82.95	21.83	77.67	22.51	73.55	23.63	68.41	24.81
16	97.52	20.75	90.88	21.39	84.86	22.05	79.38	22.73	75.25	23.87	70.06	25.06
17	98.77	20.85	91.96	21.49	85.79	22.16	80.17	22.84	76.08	23.99	70.91	25.18

Note:
The inlet/outlet water temperature difference is 5℃.
DB: Dry-bulb temperature for outdoor air temperature (°C)
LWT: Leaving water temperature (°C)
CC: Total cooling capacity (kW)
PI: Power input (kW)
Performance specifications measured with water pump operating at rated water flow rate.

MDVM-65BR1-K

LWT ℃	DB ℃							
	25		28		30		32	
	CC	PI	CC	PI	CC	PI	CC	PI
5	74.84	16.45	71.18	16.96	67.80	17.48	64.84	18.02
7	77.71	17.04	73.55	17.57	70.05	18.11	67.16	18.05
9	81.77	17.73	77.29	18.27	73.61	18.84	70.78	19.42
12	85.04	18.44	80.38	19.01	76.55	19.59	73.61	20.20
15	87.59	18.80	82.79	19.39	78.85	19.98	75.82	20.60

LWT ℃	DB ℃							
	35		38		40		46	
	CC	PI	CC	PI	CC	PI	CC	PI
5	62.39	18.58	60.79	19.32	58.60	20.29	55.70	21.30
7	65.11	19.49	63.27	20.51	61.31	21.02	58.06	22.07
9	68.25	20.02	66.55	20.82	64.22	21.86	61.01	22.96
12	70.98	20.82	69.21	21.66	66.79	22.74	63.45	23.88
15	73.11	21.24	71.28	22.09	68.79	23.19	65.35	24.35

Abbreviations:
DB: Dry-bulb temperature for outdoor air temperature (°C)
LWT: Leaving water temperature (°C)
CC: Total cooling capacity (kW)
PI: Power input (kW)
Performance specifications measured with water pump operating at rated water flow rate.

MDVM-80BR1-S

Chilled water outlet temp.	Ambient temp.(℃)											
	21		25		30		35		40		46	
	CC	PI	CC	PI	CC	PI	CC	PI	CC	PI	CC	PI
(℃)	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
5	89.56	22.72	84.34	23.43	79.56	24.15	75.2	24.9	70.46	26.14	64.83	27.45
6	92.59	23.08	87.1	23.79	82.09	24.53	77.52	25.28	72.71	26.55	66.97	27.88
7	95.82	23.55	90.06	24.28	84.8	25.03	80	25.8	75.12	27.09	69.26	28.44
8	98.78	24.25	92.75	25	87.26	25.78	82.24	26.57	77.31	27.9	71.35	29.3
9	101.57	24.49	95.28	25.25	89.55	26.03	84.32	26.83	79.35	28.17	73.31	29.58
10	105.42	24.86	98.8	25.62	92.77	26.42	87.27	27.23	82.21	28.6	76.04	30.03
11	108.36	25.1	101.46	25.88	95.18	26.68	89.45	27.5	84.35	28.88	78.11	30.32
12	110.84	25.47	103.68	26.26	97.17	27.07	91.24	27.91	86.13	29.3	79.84	30.77
13	112.82	25.67	105.44	26.47	98.72	27.28	92.61	28.13	87.52	29.53	81.22	31.01
14	115.62	25.85	107.96	26.65	100.99	27.47	94.65	28.32	89.54	29.74	83.18	31.23
15	117.11	25.98	109.24	26.78	102.1	27.61	95.59	28.46	90.53	29.89	84.19	31.38
16	120.02	26.24	111.85	27.05	104.44	27.89	97.7	28.75	92.62	30.19	86.23	31.7
17	121.56	26.37	113.18	27.18	105.58	28.02	98.67	28.89	93.64	30.33	87.27	31.85

Note:
The inlet/outlet water temperature difference is 5℃.
DB: Dry-bulb temperature for outdoor air temperature (°C)
LWT: Leaving water temperature (°C)
CC: Total cooling capacity (kW)
PI: Power input (kW)
Performance specifications measured with water pump operating at rated water flow rate.

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LWT ℃	DB ℃							
	25		28		30		32	
	CC	PI	CC	PI	CC	PI	CC	PI
5	149.68	32.89	142.36	33.91	135.6	34.96	129.68	36.04
7	155.42	34.08	147.1	35.14	140.1	36.22	134.32	36.11
9	163.54	35.45	154.57	36.54	147.21	37.67	141.55	38.84
12	170.08	36.87	160.76	38.01	153.1	39.18	147.21	40.39
15	175.18	37.6	165.58	38.77	157.69	39.96	151.63	41.2

LWT ℃	DB ℃							
	35		38		40		46	
	CC	PI	CC	PI	CC	PI	CC	PI
5	124.78	37.15	121.58	38.64	117.2	40.57	111.4	42.6
7	130.21	38.99	126.54	41.02	122.61	42.04	116.12	44.14
9	136.5	40.04	133.09	41.64	128.43	43.72	122.01	45.91
12	141.96	41.64	138.41	43.31	133.57	45.47	126.89	47.75
15	146.22	42.47	142.56	44.17	137.57	46.38	130.69	48.7

DB: Dry-bulb temperature for outdoor air temperature (°C)
LWT: Leaving water temperature (°C)
CC: Total cooling capacity (kW)
PI: Power input (kW)
Performance specifications measured with water pump operating at rated water flow rate.

6 Performance Adjustment Factors

6.1 Ethylene and Propylene Glycol factors

The antifreeze must be required according to anyone condition as following:

- The ambient temperature is below 0 °C;
- Don't start up the unit for a long time.
- The power supply was cut off and needn't change the water in system.

A glycol solution is required when the unit with condition as mentioned. The use of glycol will reduce the performance of the unit depending on concentration.

Concentration of ethylene glycol (%)	Modification coefficient				Freezing point (°C)
	Cooling capacity	Power input	Water resistance	Water flow	
0	1.000	1.000	1.000	1.000	0
10	0.993	0.997	1.013	1.034	-3
20	0.984	0.994	1.149	1.051	-8
30	0.975	0.984	1.343	1.075	-14.1
40	0.969	0.981	1.623	1.110	-23.3
50	0.961	0.978	2.026	1.150	-33.8

Concentration of propylene glycol (%)	Modification coefficient				Freezing point (°C)
	Cooling capacity	Power input	Water resistance	Water flow	
0	1.000	1.000	1.000	1.000	0
10	0.987	0.992	1.071	1.006	-3
20	0.975	0.985	1.121	1.009	-7
30	0.962	0.978	1.420	1.020	-13
40	0.946	0.971	1.716	1.036	-22
50	0.929	0.929	2.223	1.061	-35

6.2 Evaporator temperature drop factors

Performance tables are based on a 5°C temperature drop through the evaporator. Temperature drops outside this range can affect the control system's capability to maintain acceptable control and are not recommended.

6.3 Altitude correction factors

Performance tables are based at sea level. Elevations other than sea level affect the performance of the unit. The decreased air density will reduce condenser capacity and reduce the unit's performance. Maximum allowable altitude is 1800 meters.

6.4 Fouling factor

Fouling refers to the accumulation of unwanted material on solid surfaces, most often in an aquatic environment. The fouling material can consist of either living organisms (biofouling) or a non-living substance (inorganic or organic). Fouling is usually distinguished from other surface-growth phenomena in that it occurs on a surface of a component, system or plant performing a defined and useful function, and that the fouling process impedes or interferes with this function.

Other terms used in the literature to describe fouling include: deposit formation, encrustation, crudding, deposition, scaling, scale formation, slagging, and sludge formation. The last six terms have a more narrow meaning than fouling within the scope of the

fouling science and technology, and they also have meanings outside of this scope; therefore, they should be used with caution.

Fouling phenomena are common and diverse, ranging from fouling of ship hulls, natural surfaces in the marine environment (marine fouling), fouling of heat-transfer components through ingredients contained in the cooling water or gases, and even the development of plaque or calculus on teeth, or deposits on solar panels on Mars, among other examples.

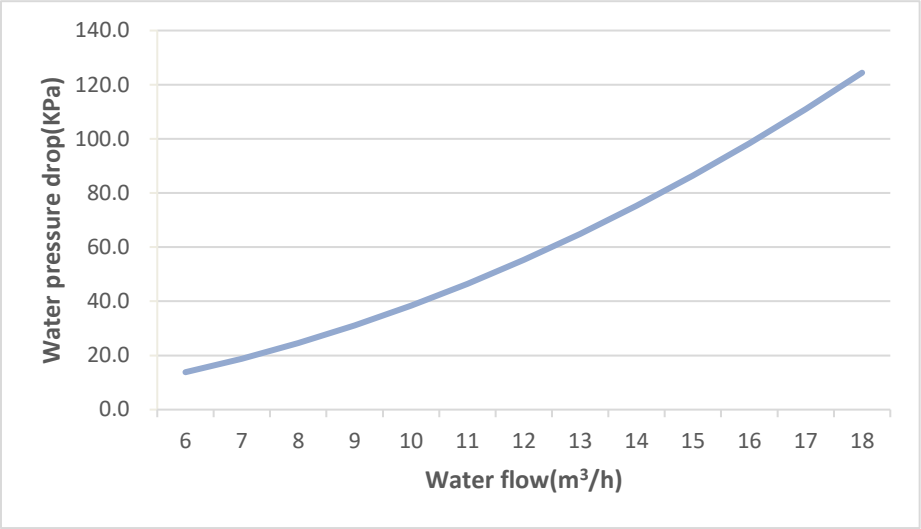
Foreign matter in the chilled water system will adversely affect the heat transfer capability of the evaporator, and could increase the pressure drop and reduce the water flow. To provide optimum unit operation, proper water treatment must be maintained. Refer to the able as following.

ALTITUDE (m)	Difference of water inlet and outlet temp. (°C)	Fouling Factor							
		0.018 m2. °C /kW		0.044 m2. °C /kW		0.086 m2. °C /kW		0.172 m2. °C /kW	
		C	P	C	P	C	P	C	P
Sea level	3	1.036	1.077	1.019	1.076	0.991	0.975	0.963	0.983
	4	1.039	1.101	1.022	1.080	0.994	0.996	0.971	0.984
	5	1.045	1.105	1.028	1.086	1.000	1.000	0.977	0.989
	6	1.051	1.109	1.034	1.093	1.006	1.004	0.983	0.994
600	3	1.024	1.087	1.008	1.064	0.980	0.984	0.951	0.991
	4	1.027	1.111	1.011	1.068	0.983	1.005	0.959	0.992
	5	1.034	1.115	1.017	1.074	0.989	1.009	0.965	0.997
	6	1.043	1.115	1.026	1.084	0.998	1.009	0.973	0.999
1200	3	1.013	1.117	0.996	1.052	0.969	1.011	0.942	1.002
	4	1.015	1.118	0.998	1.055	0.971	1.012	0.948	1.003
	5	1.023	1.122	1.006	1.063	0.979	1.015	0.955	1.005
	6	1.031	1.125	1.015	1.072	0.987	1.018	0.962	1.007
1800	3	1.002	1.128	0.986	1.042	0.959	1.021	0.935	1.007
	4	1.005	1.129	0.989	1.045	0.962	1.022	0.941	1.010
	5	1.012	1.132	0.995	1.051	0.968	1.024	0.945	1.012
	6	1.018	1.134	1.001	1.058	0.974	1.026	0.949	1.014

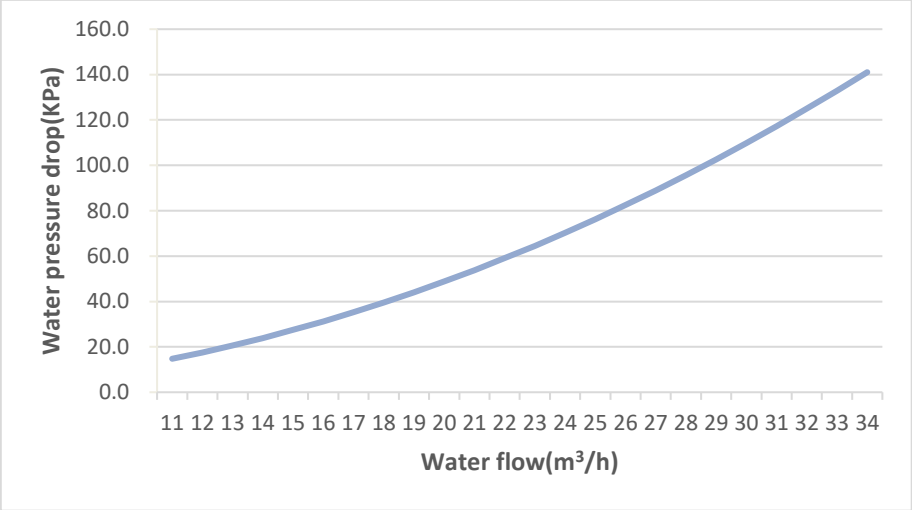
Abbreviations:
C: Cooling capacity
P: Power input

7 Hydronic Performance

MDVM-65BR1-K



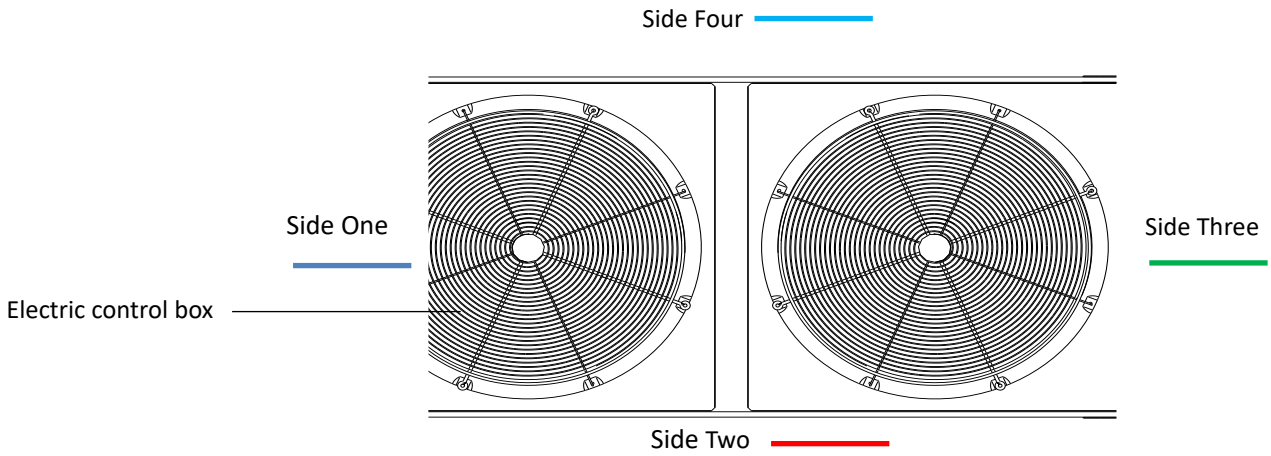
MDVM-130BR1-K



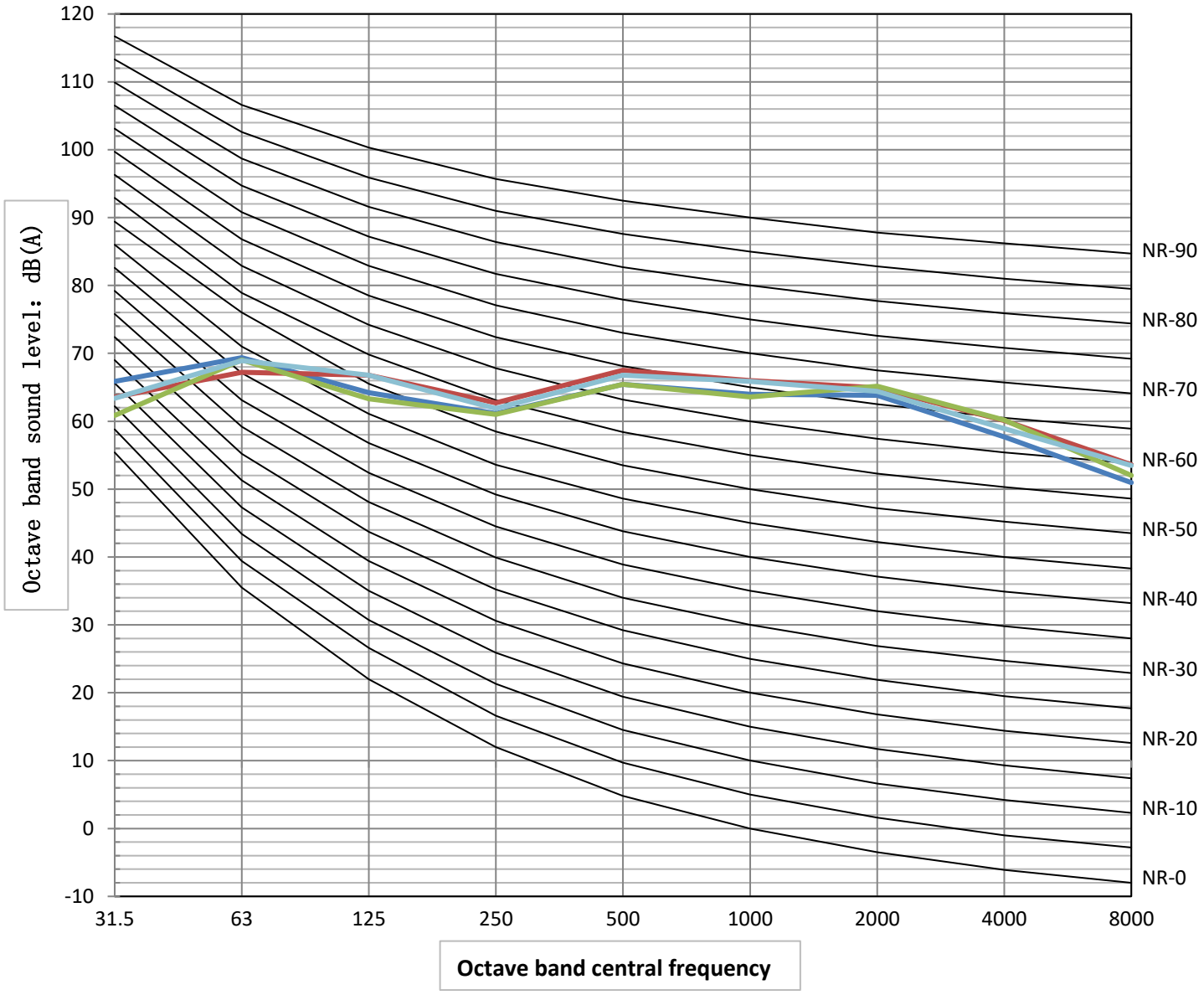
8 Octave Band Levels

MDVM-130BR1-K

Test bearing

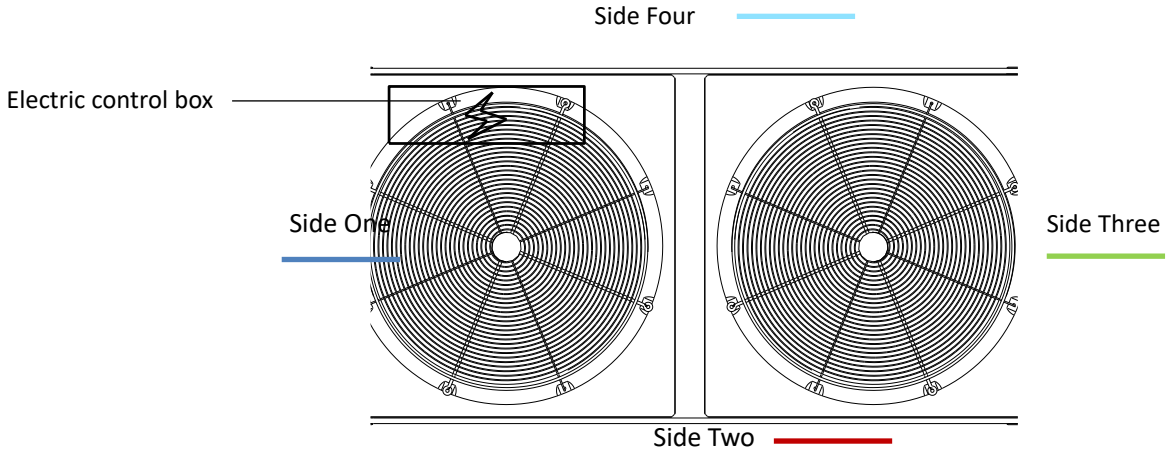


Test condition：Outdoor ambient temperature 35°C DB. EWT 12°C, LWT 7°C

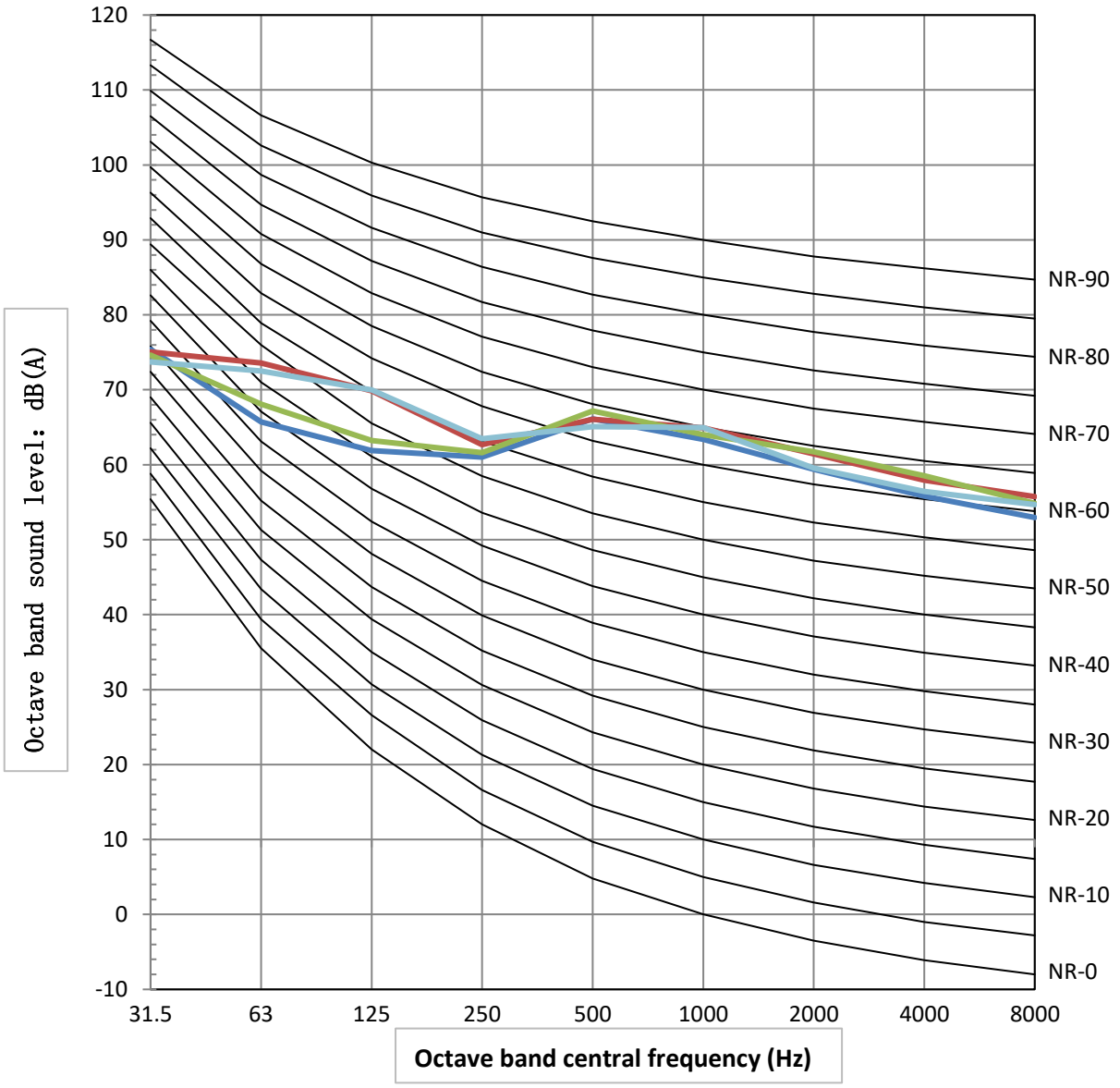


MDVM-65BR1-K

Test bearing



Test condition：Outdoor ambient temperature 35°C DB. EWT 12°C, LWT 7°C



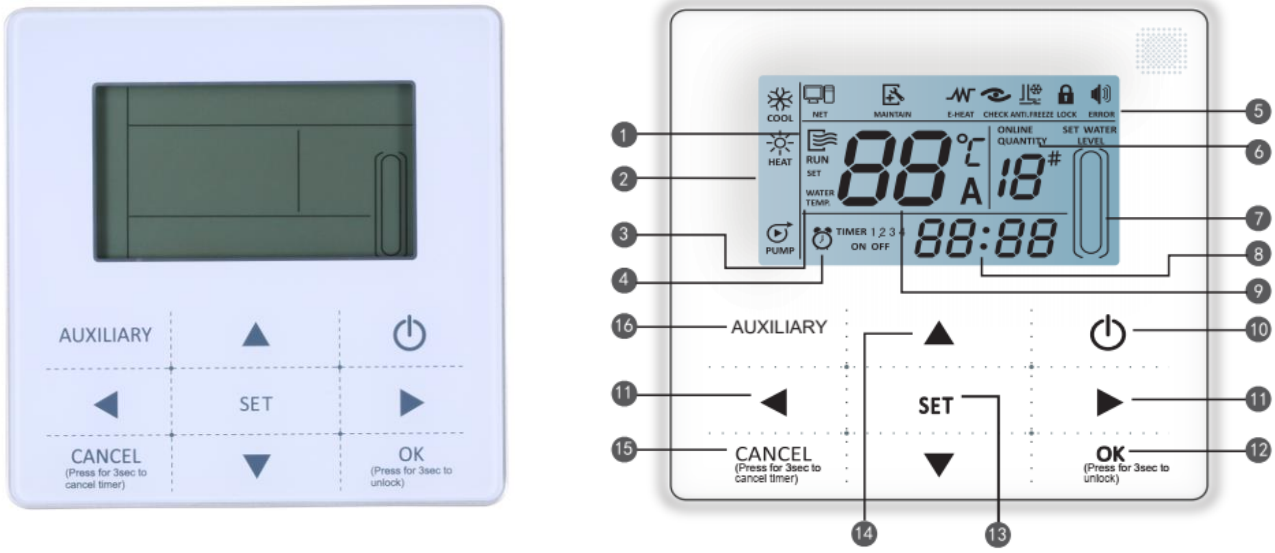
Part 3

Wired Controller

1. Specifications

Model	KJRM-120D/BMK-E(Modbus)	KJRM-120D/BMK-E
Adaptation model	MDVM-130BR1-K/MDVM-65BR1-K	MDVM-35BR1-S/ MDVM-65BR1-KL/ MDVM-80BR1-S
Input Voltage	10V	10V
Operating environment temperature	-10ºC~+43ºC	-10ºC~+43ºC
Operating RH of wired controller	RH 40%~RH90%	RH 40%~RH90%

2. Introduction of function buttons



① **Operation icon (RUN):** Indicate the ON and OFF status; when it is ON, it will display; when it is OFF, it will disappear.

② **Mode area:** Indicate the main unit operating mode;.

③ **Setting temperature:** 2 statuses can be displayed - WATER TEMP. / SET WATER TEMP..

④ **Timing ON/OFF indication (TIMER 1 2 3):** Indicate the timing information.

⑤ **Function icon:**

- ✧ NET : Display when unit connects to Modbus network.
- ✧ MAINTAIN : Displays when unit maintenance is needed. Press and hold '**AUXILIARY**' key for 3 seconds to cancel the icon and timing will restart until next maintenance.
- ✧ E-HEAT : Displays when electric auxiliary heating function is on.
- ✧ CHECK : Displays when check function is on.

- ANTI.FREEZE: Displays when ambient temperature is below 2ºC which means the main unit need anti-freezing action.
- LOCK : Displays when no key operation for 2 minutes and all keys are locked. Press and hold '**OK**' key for 3 seconds to unlock.
- ERROR : Displays when error or protection occurs and means the unit need maintenance by professionals.

⑥ **Online quantity indication:** Under normal status display the quantity of units connected to the wired controller; under check status display the device serial number.

⑦ **Reserved**

⑧ **Clock:** Under normal status displays clock; under timing setting displays the setting timing.

⑨ **Water temperature:** Under normal status display water temperature; under water temperature setting status displays the setting value; under check status displays check parameter.

⑩ **ON/OFF key (⏻):** Turn on and turn off functions.

⑪ **Right and left key (◄ and ►):** Press these keys to check setting water temperature, setting timing etc; press right key to shift to the next step setting under timing setting status. Press these keys to turn over the unit parameter information under check status.

⑫**OK key:** Press this key to confirm settings. Press and hold this key for 3 seconds to unlock under locking status.

⑬**Setting key:** Setting water temperature, timing and mode, etc. Press and hold this key for 3 seconds to enter check status.

⑭**Add and Reduce key (▲ and ▼):** Move up or move down values of temperature, timing, etc. Turn over #0~#15 units under check status.

⑮**Cancel key:** Press this key to cancel parameter setting under setting status; press and hold this key for 3 seconds to cancel timing when timing is valid.

⑯**Reserved**

3. Normal Operating Parameters

Unit in normal cooling mode operating parameters

Outdoor ambient temperature	℃	< -10	-10~0	0~15	15~30	30~43	43~48	48~52	> 52
Discharge temperature	℃	60~85	65~95	68~95	70~95	74~98	78~96	78~100	80~104
Discharge superheat	℃	22~30	27~42	28~42	27~40	28~40	22~35	18~36	18~50
Discharge pressure	Mpa	2.2~3.0	2.2~3.2	2.3~3.2	2.5~3.3	2.7~3.6	3.4~3.8	3.7~4.1	3.9~4.2
Suction pressure	Mpa	0.5~0.7	0.5~0.8	0.6~0.8	0.6~0.9	0.6~0.9	0.7~1.0	0.8~1.2	0.9~1.2
AC inverter compressor current	A	56~68	65~82	70~88	70~90	70~90	76~95	80~98	88~105

Unit in normal heating mode operating parameters

Outdoor ambient temperature	℃	< -10	-10to0	0to5	5to10	10to17	17to24	> 24
Discharge temperature	℃	66-105	70-100	70-90	74-85	70-100	68-100	65-100
Discharge superheat	℃	30-59	30-49	27-37	26-32	19-44	16-41	12-39
Discharge pressure	Mpa	2.1-2.7	2.3-3.0	2.4-3.2	2.8-3.2	3.0-3.4	3.1-3.6	3.2-3.8
Suction pressure	Mpa	0.2-0.5	0.3-0.5	0.4-0.6	0.5-0.7	0.5-0.8	0.6-0.9	0.7-1.0
AC inverter compressor current	A	54-68	60-75	68-80	70-85	78-92	83-96	86-100

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Note: Product specifications change from time to time as product improvements and developments are released and may vary from those in this document.