LG AIR-TO-WATER HEAT PUMP MONOBLOC ENGINEERING MANUAL

KPHTC411M (41,000 Btu/h)
KPHTC481M (48,000 Btu/h)
KPHTC551M (55,000 Btu/h)

PROPRIETARY DATA NOTICE

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A summary list of safety precautions is on page 4.

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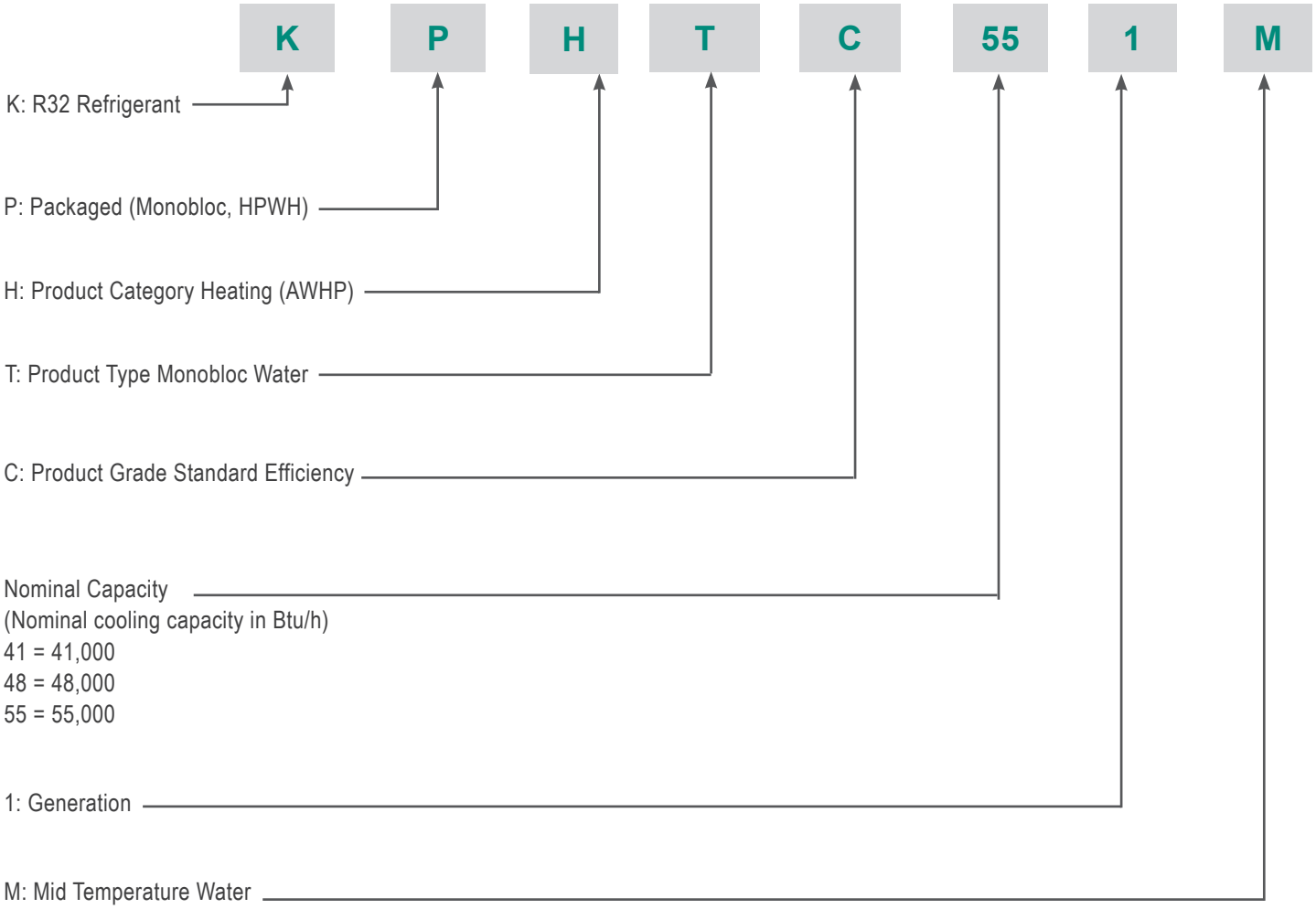
TABLE OF SYMBOLS

⚠ **DANGER**	*This symbol indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.*
⚠ **WARNING**	*This symbol indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.*
⚠ **CAUTION**	*This symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.*
Note:	*This symbol indicates situations that may result in equipment or property damage accidents only.*
⃠	*This symbol indicates an action that must not be performed.*

UNIT NOMENCLATURE



LATS (LG Air Conditioner Technical Solution) AWHP Program

A properly designed and installed refrigerant piping system is critical to the optimal performance of LG air-conditioning systems. To assist engineers, LG offers, free of charge, LG Air Conditioner Technical Solution (LATS) software—a total design solution for LG air conditioning systems. Contact your LG Rep for the best software program for your application.

LATS AWHP program is the Air-to-Water Heat Pump Model Selection program. This program can provide Monthly Heating Energy Consumption, Annual Heating Energy Consumption, System Comparison, Payback, CO2 Emission data. Therefore, by using the LATS AWHP program, a designer can have the Heating Energy Consumption Data.

Note:

To reduce the risk of designing an improper applied system or one that will not operate correctly, LG requires that LATS software be used on all projects.

GENERAL DATA / SPECIFICATIONS

Nominal Capacity Specifications

Table 1: Monobloc General Data.

Nominal Capacity and Nominal Input		Outdoor Temp. DB / WB (°F)	Leaving Water Temp. (°F)	KPHTC411M	KPHTC481M	KPHTC551M
Capacity[1]	Cooling (Btu/h)	95 / 75.2	64.4	41,000	48,000	55,000
	Heating (Btu/h)	44.6 / 42.8	95	41,000	48,000	55,000
		35.6 / 33.8	95	37,500	41,000	47,100
Power Input	Cooling (kW)	95 / 75.2	64.4	2.53	3.26	4.00
	Heating (kW)	44.6 / 42.8	95	3.64	4.24	3.40
		35.6 / 33.8	95	3.01	3.31	3.83
EER	Cooling (Btu/Wh)	95 / 75.2	64.4	16.21	14.73	13.75
COP	Heating (W/W)	44.6 / 42.8	95	4.90	4.80	4.70
		35.6 / 33.8	95	3.65	3.63	3.60
Rated Water Flow Rate at Leaving Water Temp. 95ºF (GPM)				9.1	10.6	12.2

1. Performances values indicated above are in accordance with EN14511.

Electrical Specifications

Table 2: Monobloc Electrical Data.

Electrical Specifications		KPHTC411M	KPHTC481M	KPHTC551M
Power Supply (V/ Ø/ Hz)		220-240 / 1 / 60		
Peak Control Running Current (A)		23.0	24.0	25.0
Rated Running Current[2]	Cooling (A)	11.2	14.4	17.7
	Heating (A)	10.9	12.9	15.1
Circuit breaker (A)[3]		40	40	40
Power Wiring Connections[4]	Power Supply Cable (included Earth, H07RN-F)	6.0 Mm2 (10 AWG) x 3 cores		
Voltage Range (Min. to Max.)		198 - 264		

2. Rated running currents are based on the declared values under the following conditions.
• Cooling : Outdoor Temp. 44.6°F DB / 42.8°F WB Leaving Water Temp. 95°F
• Heating : Outdoor Temp. 95°F DB / 75.2°F WB, Leaving Water Temp. 64.4°F
3. All installation sites must be equipped with an earth leakage circuit breaker (ELCB).
4. Wiring cable size must comply with the applicable local and national codes. .

Unit Data

Table 3: Monobloc Unit Data.

Unit Data			KPHTC411M	KPHTC481M	KPHTC551M
Sound Power Levels[1]	Heating	Daytime Max.	65	66	66
		Rated	60	61	61
		Low Noise	56	57	57
Sound Pressure Levels[2]	Heating	Daytime Max.	57	58	58
		Rated	52	53	53
		Low Noise	48	49	49
Dimensions	Net Dimensions (W x H x D, in.)		48-51/64 x 54-21/64 x 12-63/64	48-51/64 x 54-21/64 x 12-63/64	48-51/64 x 54-21/64 x 12-63/64
	Shipping Dimensions (W x H x D, in.)		53-45/64 x 60-7/64 x 17-41/64	53-45/64 x 60-7/64 x 17-41/64	53-45/64 x 60-7/64 x 17-41/64
Weight	Net Weight (lbs.)		262.6	262.6	262.6
	Shipping Weight (lbs.)		295.6	295.6	295.6
Exterior	Color		Warm Gray	Warm Gray	Warm Gray
	RAL Code		RAL 7044	RAL 7044	RAL 7044

1. Sound power level is measured in accordance with ISO 9614.
• Rated : This mode is measured on the rated condition in the semi-anechoic rooms. Therefore, these values may vary depending on operation conditions.
• Daytime Max : This mode is measured based on max. fan RPM and max. compressor Hz. that can be reached under outdoor air temperature of 35.6 °F.
• Low Noise : This mode lowers noise by limiting the compressor Hz. and fan RPM, and thus the performance may be limited.
2. Sound pressure level is converted value at 1m distance from sound power level based on tonality penalty of 0dB and installation in free-field.

$SPL = SWL - 20\log(r) + K_t + K_o - 11$

r: distance, K_t (Add-on tonality): 0dB, K_o (Solid Angle for installation condition): 3dB for free-field

GENERAL DATA / SPECIFICATIONS

Water Specifications

Table 4: Monobloc Water Data.

Water Specifications			KPHTC411M	KPHTC481M	KPHTC551M
Operation Range (Leaving Water Temp.)	Cooling Min. ~ Max. (°F)		41 ~ 80.6	41 ~ 80.6	41 ~ 80.6
	Heating Min. ~ Max. (°F)		59 ~ 149	59 ~ 149	59 ~ 149
	DHW[1] Min. ~ Max. (°F)		59 ~ 176	59 ~ 176	59 ~ 176
Water Pump	Type		Canned type for hot water circulation		
	Model		UPML 20-105 CHBL / GRUNDFOS		
	Motor Type		BLDC		
	Steps of Pumping Performance		Variable speed 10% to 100%		
	Power input (W) Min. / Rated (100% Capacity)		3.5 / 125	3.5 / 135	3.5 / 140
	Water Flow Rate Min. / Rated (GPM)		0 / 12.15	0 / 12.15	0 / 12.15
Expansion Vessel	Volume Max. (gal)		2.1	2.1	2.1
	Water pressure (PSI)	Max.	43.5	43.5	43.5
		Pre-charged	14.5	14.5	14.5
Flow Sensor	Model		SIKA VVXC9SNBUC00242P		
	Measuring range Min. ~ Max.(GPM)		1.3~21.1	1.3~21.1	1.3~21.1
	Flow (Trigger point) Min. (GPM)		3.96	3.96	3.96
Water Pressure sensor	Model		SENSATA 2HMP3-1		
	Measuring range Min. ~ Max.(PSI(G))		0~290	0~290	0~290
Piping Connections	Inlet (inch)		Male PT 1" according to ISO 7-1 (tapered pipe threads)		
	Outlet (inch)		Male PT 1" according to ISO 7-1 (tapered pipe threads)		
Strainer	Mesh size (inch)		30 mesh	30 mesh	30 mesh
	Max. particle size (inch)		1-3/16	1-3/16	1-3/16
	Material		Stainless Steel	Stainless Steel	Stainless Steel
Relief Valve	Pressure Limit (Upper) (PSI)		43.5	43.5	43.5
Devices for Water Circuit			Relief valve / Flow Sensor		
			Drain hose		
			Pressure Sensor / Air vent		

1. Domestic Hot Water (DHW) 131 ~ 176 °F operation range is available only when the booster heater is operating.

Refrigerant Specifications

Table 5: Monobloc Refrigerant Data.

Refrigerant Specifications			KPHTC411M	KPHTC481M	KPHTC551M
Operation Range (Outdoor Temp.)	Cooling Min. ~ Max (°F DB)		41 to 118.4		
	Heating Min. ~ Max (°F DB)		-13 to 95		
Compressor	Type		Hermetic Sealed Scroll		
	Model x No.		RJB036MAA × 1		
	Motor Type		BLDC		
	Displacement		1.93 in ^3/Rev.		
Refrigerant[1]	Type		R32		
	GWP (Global Warming Potential)		675	675	675
	Precharged Amount		4.41 lbs		
	t-CO2 eq.		1.35	1.35	1.35
	Control		Electronic Expansion Valve		
Refrigerant Oil	Type		FW68D	FW68D	FW68D
	Charged Volume cc × No.		1,100	1,100	1,100
Heat Exchanger	Type		Fin & Tube		
	Quantity		2	2	2
	Specification	Row EA	32	32	32
		Column EA	2	2	2
		FPI EA	18	18	18
Fan	Type		Propeller		
	Air Flow Rate Rated CFM × No		2119 x 2		
Fan Motor	Type		BLDC		
	Output W × No.		124 × 2	124 × 2	124 × 2

1. This product contains Fluorinated greenhouse gases.

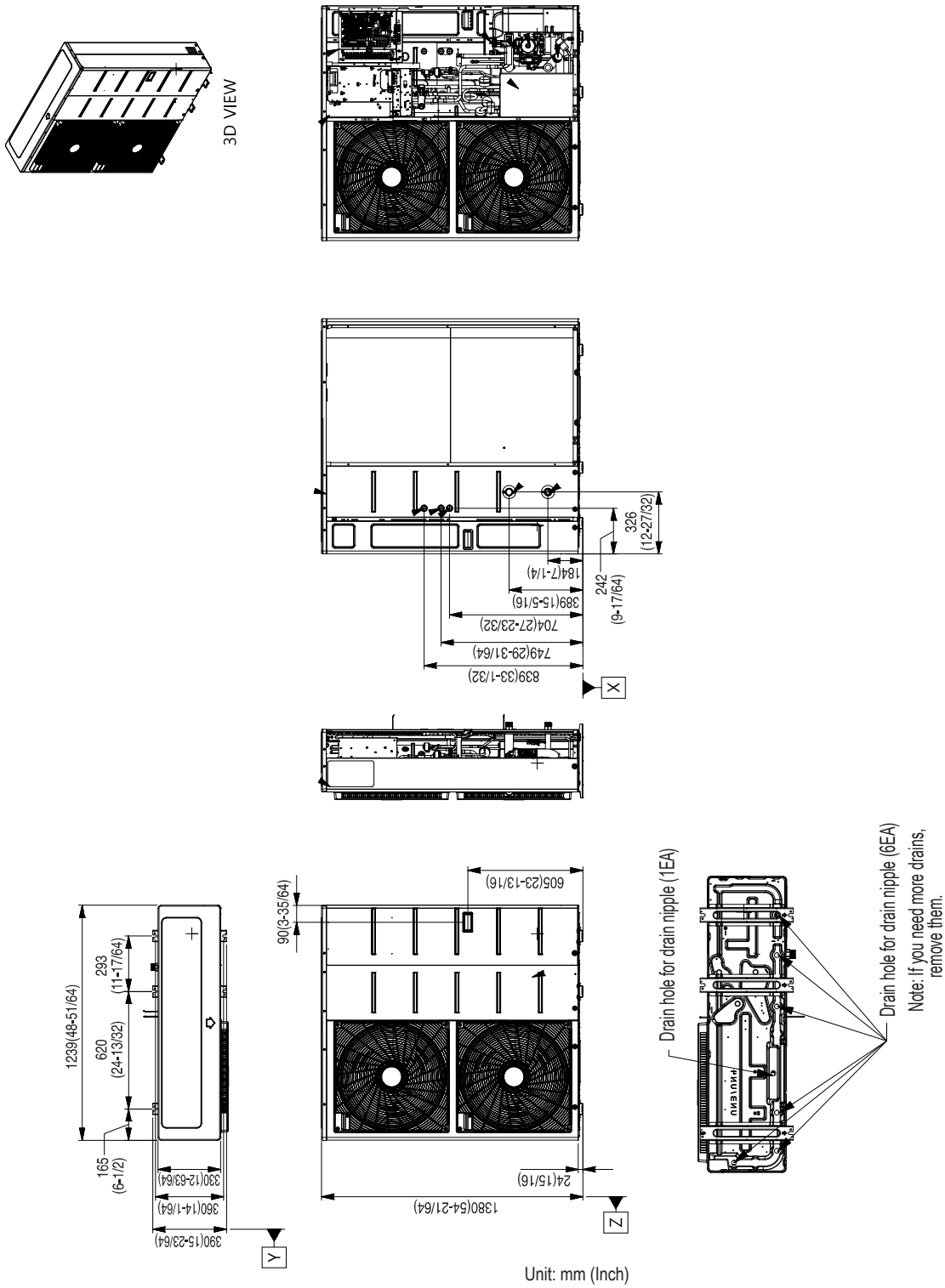
ACCESSORIES

Accessories for KPHTC411M, KPHTC481M, KPHTC551M

Category	Description	Model
Sensors	Remote temperature sensor	PQRSTA0
	Thermistor for 2nd Circuit or E/Heater	PRSTAT5K10
	Domestic Hot Water (DHW) Sensor	PHRSTA0
Control Accessories	Wired Remote Control Cable Assembly	PZCWRC1
	Extension cable for Wi-Fi Modem	PWYREW000
	Wi-Fi Module	PWFMDD200
Central Controller	AC Smart 5	PACS5A000
	ACP 5	PACP5A000
Dry Contact	Simple Dry Contact	PDRYCB100
	Dry Contact with Smart Logic for 3rd Party Thermostat	PDRYCB320
Gateway	PI-485 Gateway	PP485A00T
Interface between IDU and Meter	Meter Interface Module	PENKTH000

Dimensions for KPHTC411M, KPHTC481M, KPHTC551M

Figure 3: Dimensions.



Unit: mm (Inch)

Note

1.Unit must be installed in compliance with the installation manual in the product box.

2.Unit must be grounded in accordance with the local regulations or applicable national codes.

ACOUSTIC DATA

Sound Power Levels

Data is valid at diffuse field condition.

Reference acoustic intensity 0dB = 10E-6μW/m2

Sound power level is measured on the rated condition in the reverberation rooms. Refer to the Model Specifications for nominal conditions (Power source, Ambient temperature, etc).

Sound levels can be increased in accordance with installation and operating conditions.

Sound level will vary depending on a range of factors such as the construction (acoustic absorption coefficient) of particular installed place in which the equipment in installed.

Sound power level is measured in accordance with ISO 9614.

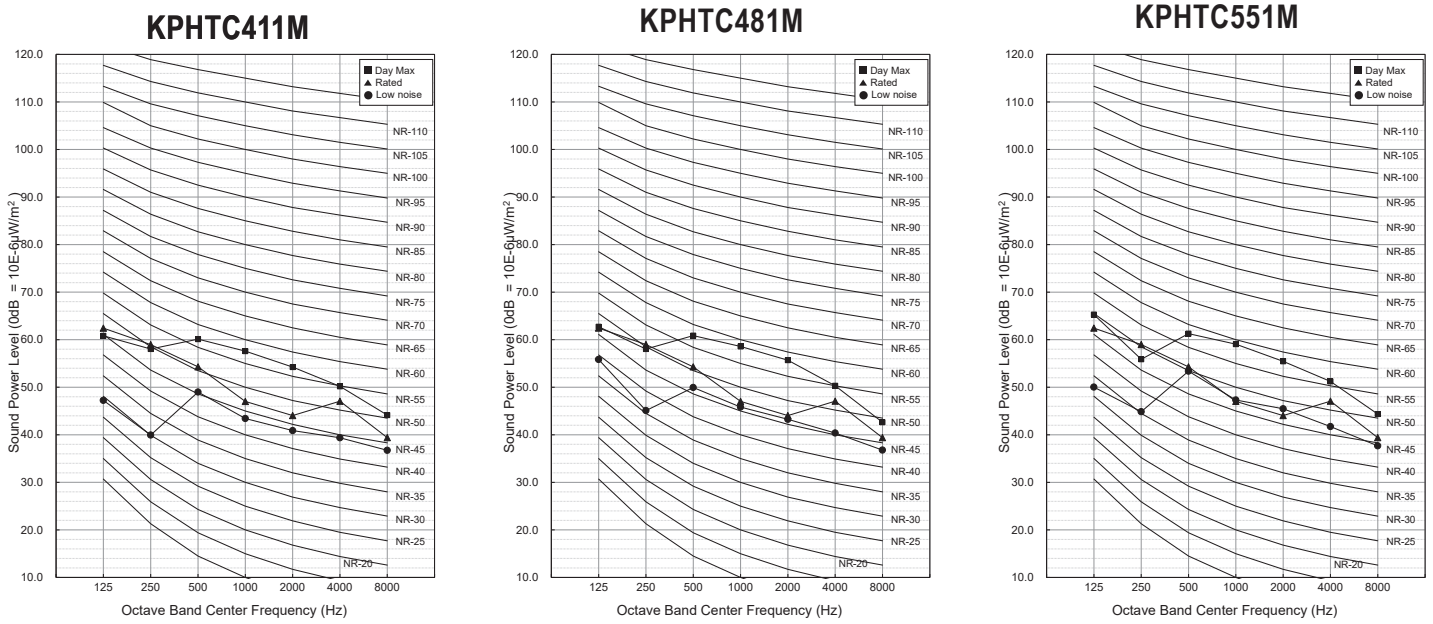
- Rated: This mode is measured on the rated condition in the semi-anechoic rooms. Therefore, these values may vary depending on operation conditions.
- Daytime max: This mode is measured based on max. fan RPM and max. compressor Hz. that can be reached under outdoor air temperature of 35.6°F.
- Low noise: This mode lowers noise by limiting the compressor Hz. and fan RPM, and thus the performance may be limited.

Table 6: Sound Power Levels (dB[A]).

Model	Heating[dB(A)]		
	Daytime max	Rated	Low noise
KPHTC411M	65	60	56
KPHTC481M	66	61	57
KPHTC551M	66	61	57

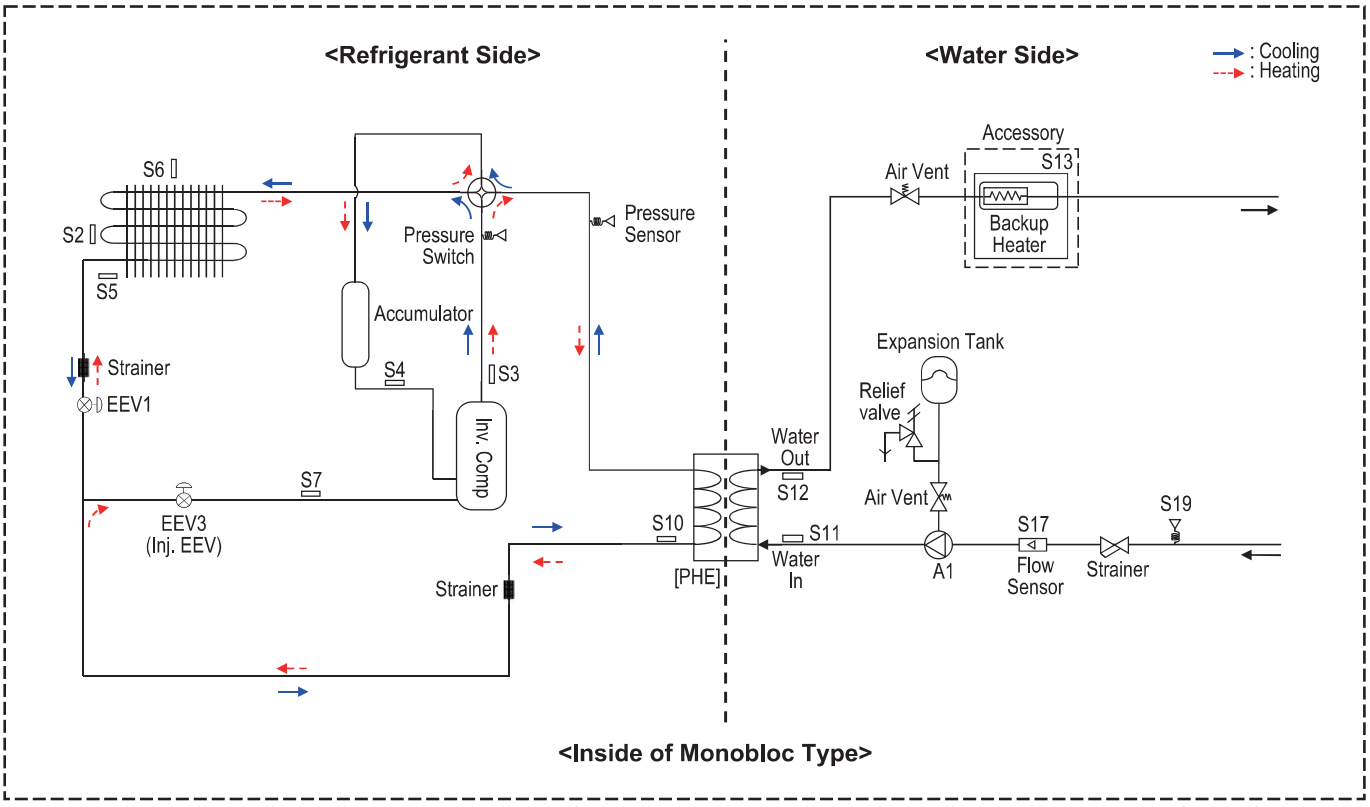
Sound Power Graphs

Figure 4: Sound Power Graphs.



Refrigerant Flow Diagram for KPHTC411M, KPHTC481M, KPHTC551M

Figure 5: Refrigerant Flow Diagram.



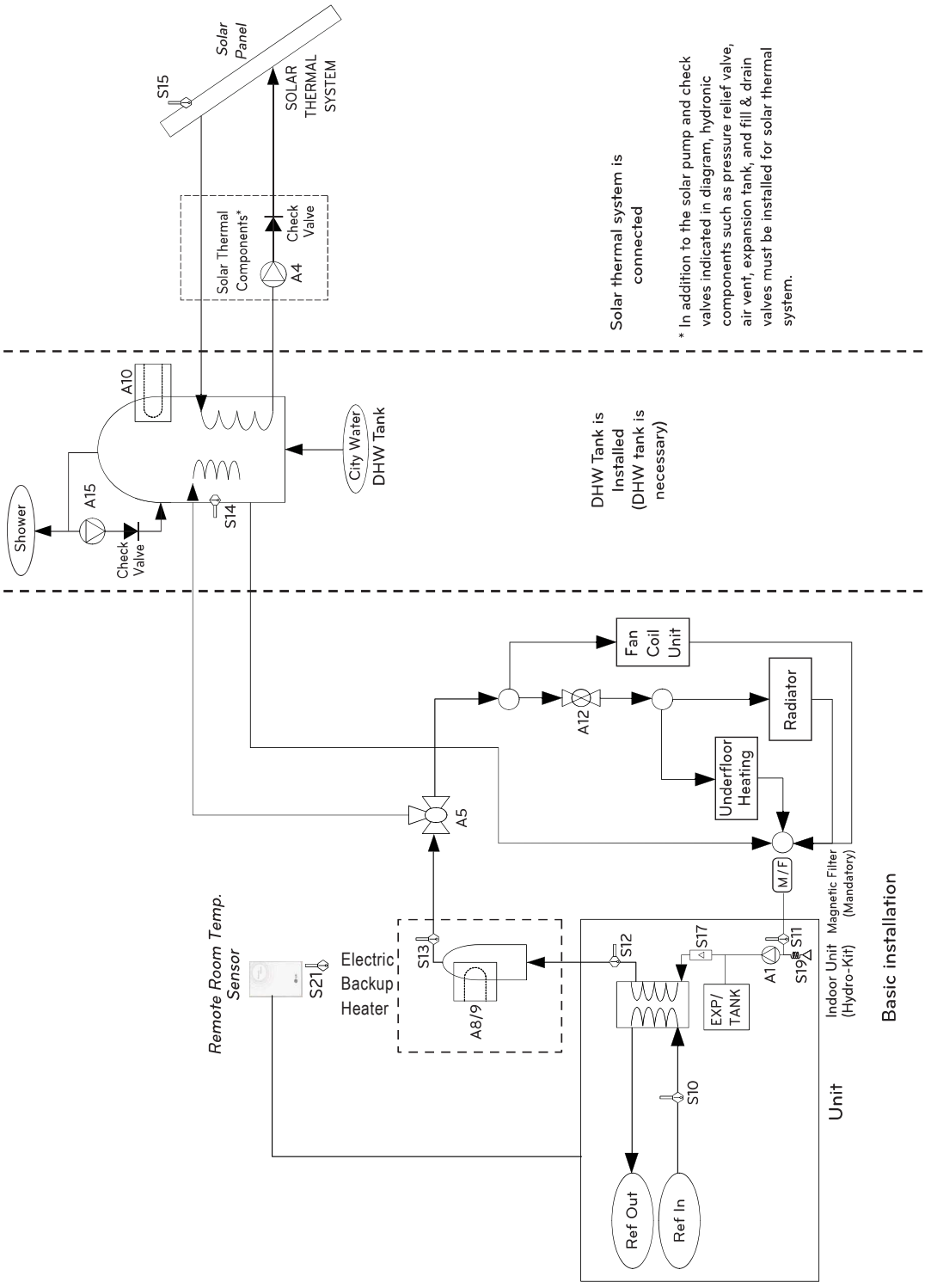
Category	Symbol	Meaning	PCB Connector
Refrigerant side	S10	PHEX liquid temp. sensor	CN_PIPE/IN
	S7	Compressor-injection pipe temperature sensor	CN_VI_IN
	S3	Compressor-discharge pipe temperature sensor	CN_DISCHA
	S4	Compressor-suction pipe temperature sensor	CN_SUCTION
	S2	Outdoor-HEX middle temp. sensor	CN_MID
	S5	Outdoor-HEX temp. sensor	CN_C_PIPE
	S6	Outdoor air temperature sensor	CN_AIR
	EEV1	Electronic Expansion Valve (Heating&Cooling)	CN_EEV1(WH)
	EEV3	Electronic Expansion Valve (Injection)	CN_EEV3(YL)
Water Side	S11	Inlet water temperature sensor	CN_TH3
	S12	Outlet water temperature sensor	
	S13	Electric backup heater outlet (Third party accessory)	
	S17	Flow sensor	CN_F_SENSOR
	S19	Water pressure sensor	CN_H20_PRESS
	A1	Main Water Pump	CN_PUMP_A1

WATER CYCLE DIAGRAM

Water Cycle Diagram for KPHTC411M, KPHTC481M, KPHTC551M

Figure 6: Water Cycle Diagram.

Water cycle



Water Cycle Diagram Legend

Category	Symbol	Meaning	PCB Connector	Remarks
Unit	S9	Refrigerant temperature sensor (Gas side)	CN_PIPE_OUT	- Meaning is expressed based on Cooling mode.
	S10	Refrigerant temperature sensor (Liquid side)	CN_PIPE_IN	
	S11	Water temperature sensor (Water In)	Water _IN	
	S12	Water temperature sensor (Water Out)	Water _OUT	
	A1	Internal water pump	CN_PUMP_A1 CN_MOTOR1	- Power is supplied via CN_PUMP_A1 - PWM signal is supplied via CN_MOTOR1
	S17	Flow Sensor	CN_F_SENSOR	- To monitor water flow rate
	EXP/TANK	Expansion Tank	(no connector)	- Absorb volume change of heated water,
	S21	Remote Air temperature sensor	CN_ROOM	- Optional accessory (sold separately) - Model : PQRSTA0
	CTR/PNL	Remote Controller	CN_REMO	
	A12	To control water flow for Fan Coil Unit	CN_2WAY(A)	- 3rd party accessory and Field installation (sold separately) - 2 wire NO or NC type 2way valve is supported.
	M / F	Magnetic Filter	(No connector)	- 3rd party accessory and Field installation (sold separately) - It is Mandatory to install an additional filter on the heating water circuit.
Electric Heater	A8 / A9	Electric Backup Heater	TB_HEAT_CONTACT	- 3rd party accessory and Field installation (sold separately) - Provides a 2-step control communication contact point.
	S13	Backup heater outlet temperature sensor	CN_TH3	
Domestic hot water circuit	W/TANK	DHW Tank	(no connector)	- 3rd party accessory and Field installation (sold separately) - Generating and storing DHW by AWHP or built-in electric heater
	A10	Booster heater(in DHW tank)	CN_TANK_HEATER	- 3rd party accessory and Field installation (usually built-in at W/TANK) - Supplying additional water heating capacity.
	A5	- Flow control for water which is leaving from unit. - Flow direction switching between underfloor and water tank	CN_3WAY(A)	- 3rd party accessory and Field installation (sold separately) - SPDT type 3way valve is supported.
	A15	Recirculation pump	CN_PUMP A15	
	CITY WATER	Water to be heated by Indoor unit and B/HT of W/TANK	(no connector)	- Field installation
	SHOWER	Water supplied to end-user	(no connector)	- Field installation
	S14	W/TANK water temperature sensor	CN_TH4	- Optional accessory (sold separately) - Model : PQRSTA0
Solar thermal circuit	S15	Solar collector sensor	TB_SENSOR (SOLAR)	- 3rd party accessory and Field installation (sold separately) - PT1000
	3WAY Valve_2	- Flow control for water which is heated and circulated by SOLAR THERMAL SYSTEM. - Flow direction switching between SOLAR THERMAL SYSTEM and W/TANK	CN_3WAY(B)	- 3rd party accessory and Field installation (sold separately) - SPDT type 3way valve is supported.
	A4	External Water Pump	CN_W/PUMP(B)	- 3rd party accessory and Field installation (sold separately) - If water pump of SOLAR THERMAL SYSTEM is incapable of circulation,external water pump can be used.
	SOLAR THERMAL SYSTEM	Solar thermal equipment such as collector, solar pump, sensor, solar heat-exchanger	(no connector)	- 3rd party accessory and Field installation (sold separately)

HYDRAULIC PERFORMANCE

The water pump is variable type which is capable to change flow rate, so it may be required to change default water pump capacity in case of noise by water flow. In most cases, however, it is strongly recommended to set capacity as Maximum.

Pressure Drop

Table 7: Pressure Drop.

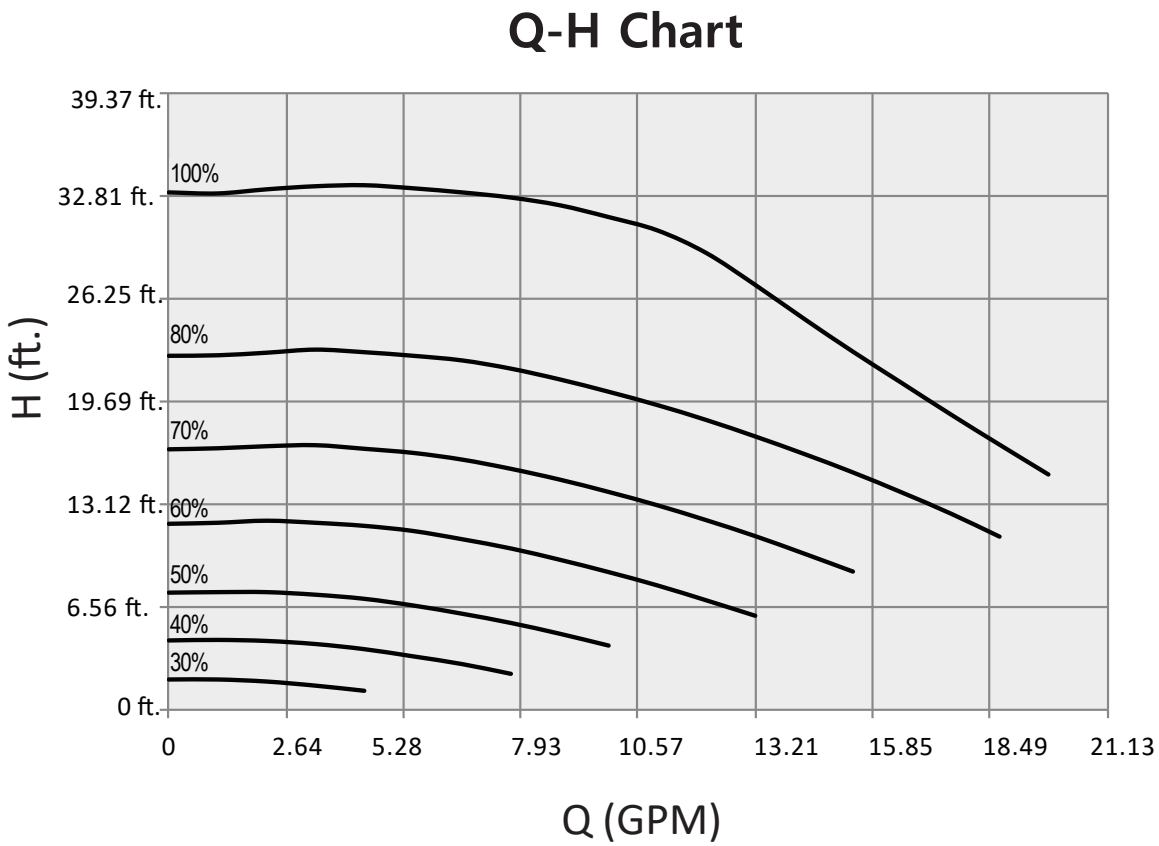
Capacity Btu/h	Rated flow-rate [LPM(GPM)]	Pump Head [m(ft)] (at rated flow- rate)	Product pressure drop [m(ft)] (Plate heat exchanger)	Serviceable Head [m(ft)]	Min. flow-rate [LPM(GPM)] (Recommend)
41,000	34.5(9.11)	9.8(32.15)	0.8(2.62)	9(29.53)	20(5.28)
48,000	40.3(10.65)	9.3(30.51)	1.1(3.61)	8.2(26.90)	
55,000	46.0(12.15)	9(29.53)	1.4(4.59)	7.6(24.93)	

Note:

- *To secure enough water flow rate, do not set water pump capacity as Minimum. It can lead to unexpected flow rate error CH14.*
- *When installing the product, install additional pump in consideration of the pressure loss and pump performance.*
- *If flow-rate is low, overloading of product can occur.*

GRUNDFOS Water Pump (UPML 20 - 105 CHBL) (41,000, 48,000, 58,000 Btu/h)

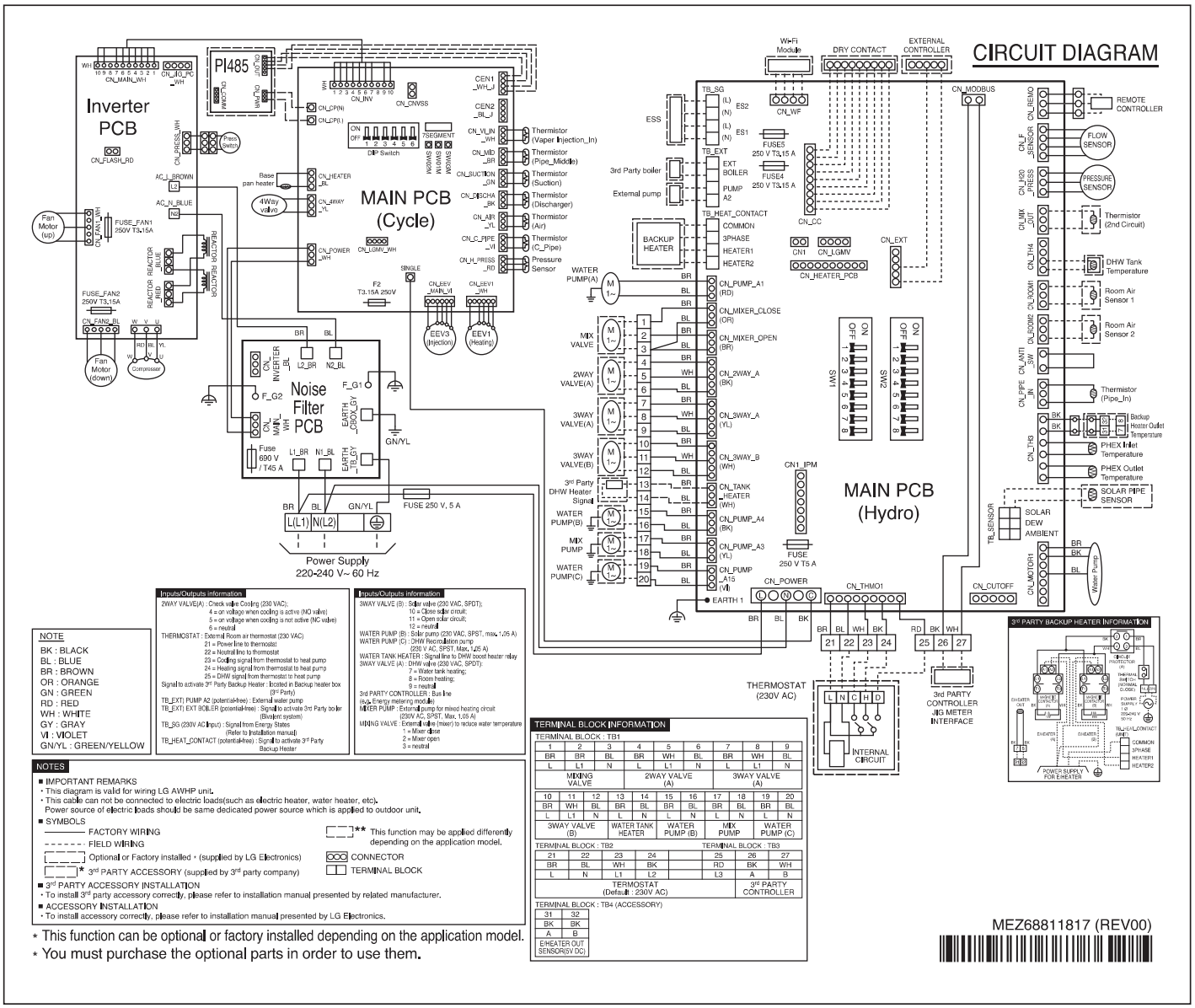
Figure 7: Water Q-H chart.



Performance test based on standard ISO 9906 with pre-pressure 2.0 bar (PSI 29) and liquid temperature 68°F.

Wiring Diagram for KPHTC411M, KPHTC481M, KPHTC551M

Figure 8: Wiring Diagram.



ELECTRICAL CONNECTIONS

Electrical Data

Outdoor Unit	Hertz	Voltage	Voltage range (Min. to Max.)	MCA	MOP	Compressor Quantity	Compressor Motor RLA (Heating)	Other Motor
KPHTC411M	60	220-240	198 - 264	35	40	1	24.3	Fan Motor 2EA: 0.6 Water Pump: 1.1
KPHTC481M								
KPHTC551M								

General Power Wiring / Communications Cable Guidelines

- Follow manufacturer's circuit diagrams displayed on the inside of the control box cover.
- Have a separate power supply for the indoor units.
- Provide a circuit breaker switch between the power source and the indoor unit.
- Confirm power source specifications.
- Properly ground the outdoor unit and the indoor unit per NEC and local codes.
- Connect the wiring firmly so that the wires cannot be easily pulled out.
- Confirm that the electrical capacity is sufficient.
- Power supply to the outdoor unit must be selected based on NEC and local codes. Maximum allowable voltage fluctuation ±10% or name-plate rated value.
- It is recommended that a circuit breaker is installed, especially if conditions could become wet or moist.
- Include a disconnect in the power wiring system. Add an air gap contact separation of at least 1/8 inch in each active (phase) conductor.
- Any openings where the field wiring enters the cabinet must be completely sealed.

⃠ Do not install power wiring to the outdoor unit and the communication / connection (power) cable to the indoor unit in the same conduit. Use separate conduits.

- Consider ambient conditions (ambient temperature,direct sunlight, rain liquid,etc.) when proceeding with the wiring and connections.
- The wire size is the minimum value for metal conduit wiring. The power cord size must be 1 rank thicker taking into account the line voltage drops. Make sure the power-supply voltage does not drop more than 10%.
- Comply with local codes for wiring requirements.
- Power supply cords of parts of appliances for outdoor use should not be lighter than polychloroprene sheathed flexible cord.
- Use the appropriate type of overcurrent protection switch. Note that generated overcurrent may include some amount of direct current.
- ⃠ Don't install an individual switch or electrical outlet to disconnect each of indoor unit separately from the power supply.

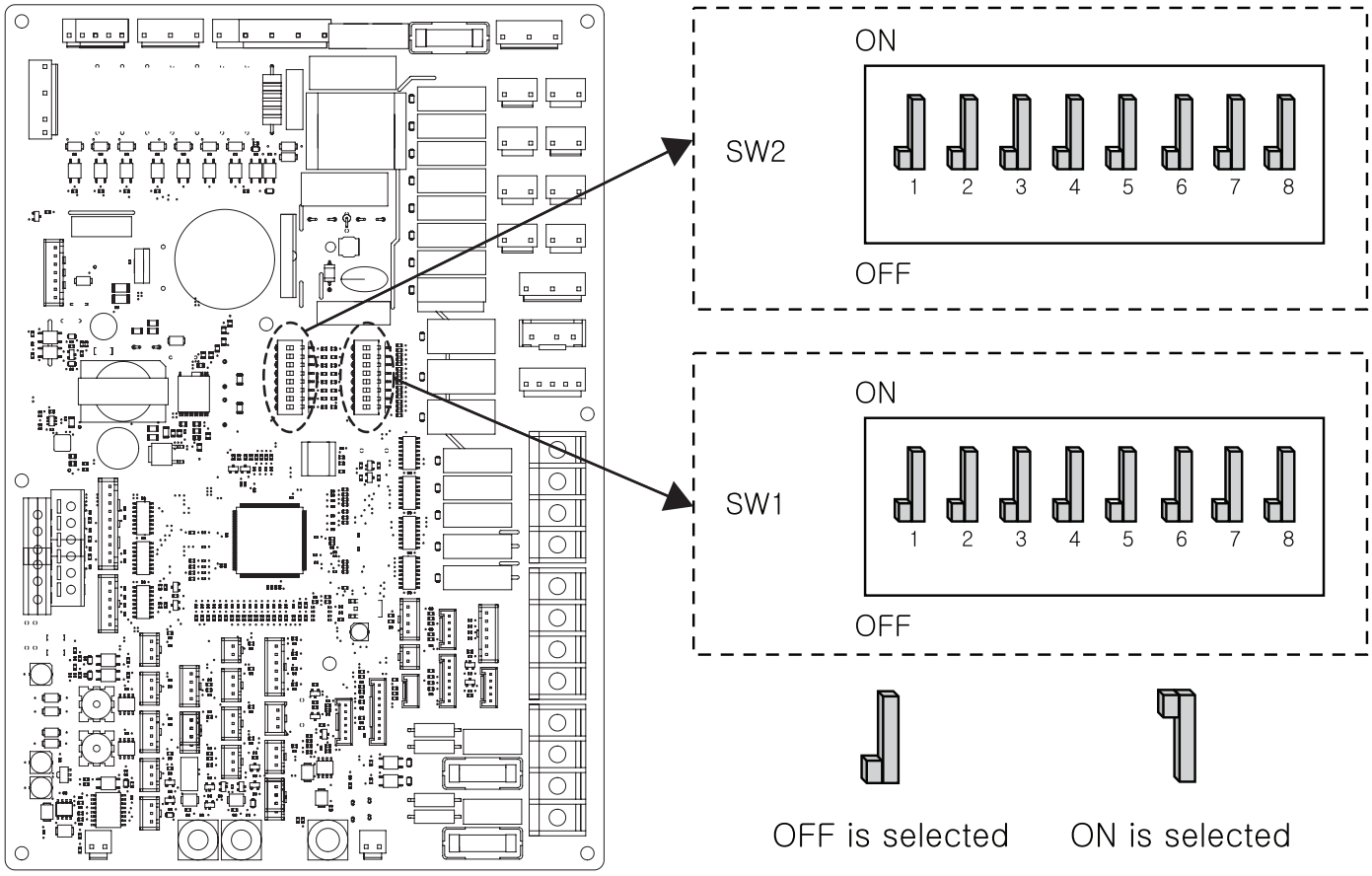
⚠ WARNING

- *Separately wire the high and low voltage lines. There is a risk of electric shock, physical injury, or death.*
- *Use heat-proof electrical wire capable of withstanding temperatures up to 167°F to avoid wiring malfunction and electrical shock, which may cause physical injury or death.*
- *Ensure you connect the wire firmly. Loose wiring may cause unit malfunction, the wires to burnout or the terminal to overheat and catch fire. There is a risk of electric shock, physical injury or death.*
- *Use outdoor and waterproof connection cable rated up to 300V for the connection between the indoor and outdoor unit to avoid electrical shock, which may cause physical injury or death.*
- *Terminal screws may become loose during transport. Properly tighten the terminal connections during installation or risk electric shock, physical injury, or death.*
- *Loose wiring may cause unit to malfunction, overheat, and catch fire, resulting in severe injury or death.*
- *Installation site must have an attachment of an earth leakage breaker. If no earth leakage breaker is installed, it may cause an electric shock.*
- ⃠ *Do not use anything other than breaker and fuse with correct capacity. Using fuse and wire or copper wire with too large capacity may cause a fire.*

⚠ WARNING

Turn off electric power supply before setting DIP switches.
There is risk of electric shock, physical injury or death.

Figure 9: Dip Switch Settings.



Option switch 1

Figure 10: Dip Switch 1.

Dip switch SW1

Description	Setting		Default
MODBUS Communication Type	1	As Main (LG extension modules)	1
	1	As Sub (3rd party controller)	
MODBUS Function	2	Special protocol (REGIN)	2
	2	Unified Open Protocol	
Antifreeze Agent	8	Antifreeze agent is not used	8
	8	Antifreeze agent is used *	

Note

* Possibility to allow colder water temperature by setting.

Bridge at CN_ANTI_SW on indoor PCB must be disconnected to enable setting.

DIP SWITCH SETTINGS

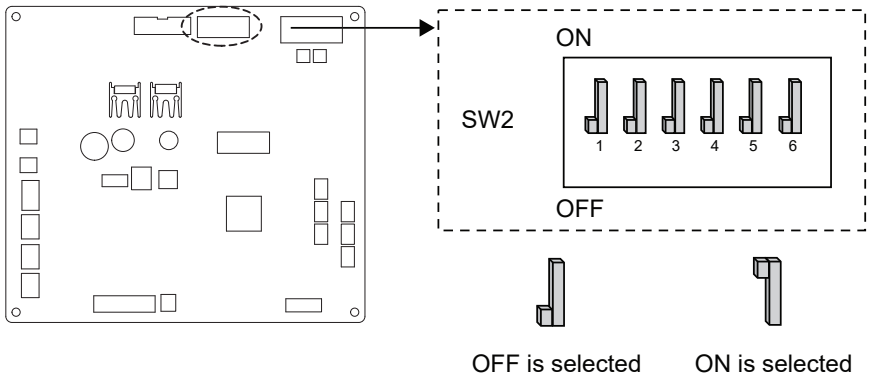
Dip Switch SW2

Figure 11: Dip Switch 2.

Description	Setting		Default
Accessory installation information	2 3	Heat pump is installed (Heating(Cooling) circuit only)	2 3
	2 3	Heat pump + DHW tank is installed	
	2 3	Heat pump + DHW tank + Solar thermal system is installed	
Cycle	4	Heating Only	4
	4	Heating & Cooling	
Room Air Sensor	5	Room Air Sensor is not installed	5
	5	Room Air Sensor is installed	
Selecting electric heater capacity	6 7	Electric heater is not used	6 7
	6 7	Half capacity is used only for HA061M(AHEH066A)	
	6 7	Full capacity is used	
Thermostat installation information	8	Thermostat is NOT installed	8
	8	Thermostat is installed	

Outdoor PCB

Figure 12: Outdoor PCB



Dip Switch Information

Description	Setting		Default
Low Noise Mode	2	Normal Low Noise Mode	2
	2	Limited Low Noise Mode	
Peak Control	3 4	Max Mode	3 4
	3 4	Peak Control Step 1 - To limit maximum current (Power saving)	
	3 4	Peak Control Step 2 - To limit maximum current (Power saving)	

- Dip switches no. 2, 3, and 4 are available.
- When setting the Partial Mode, Mode can be exited to secure capacity after operating for a certain time.

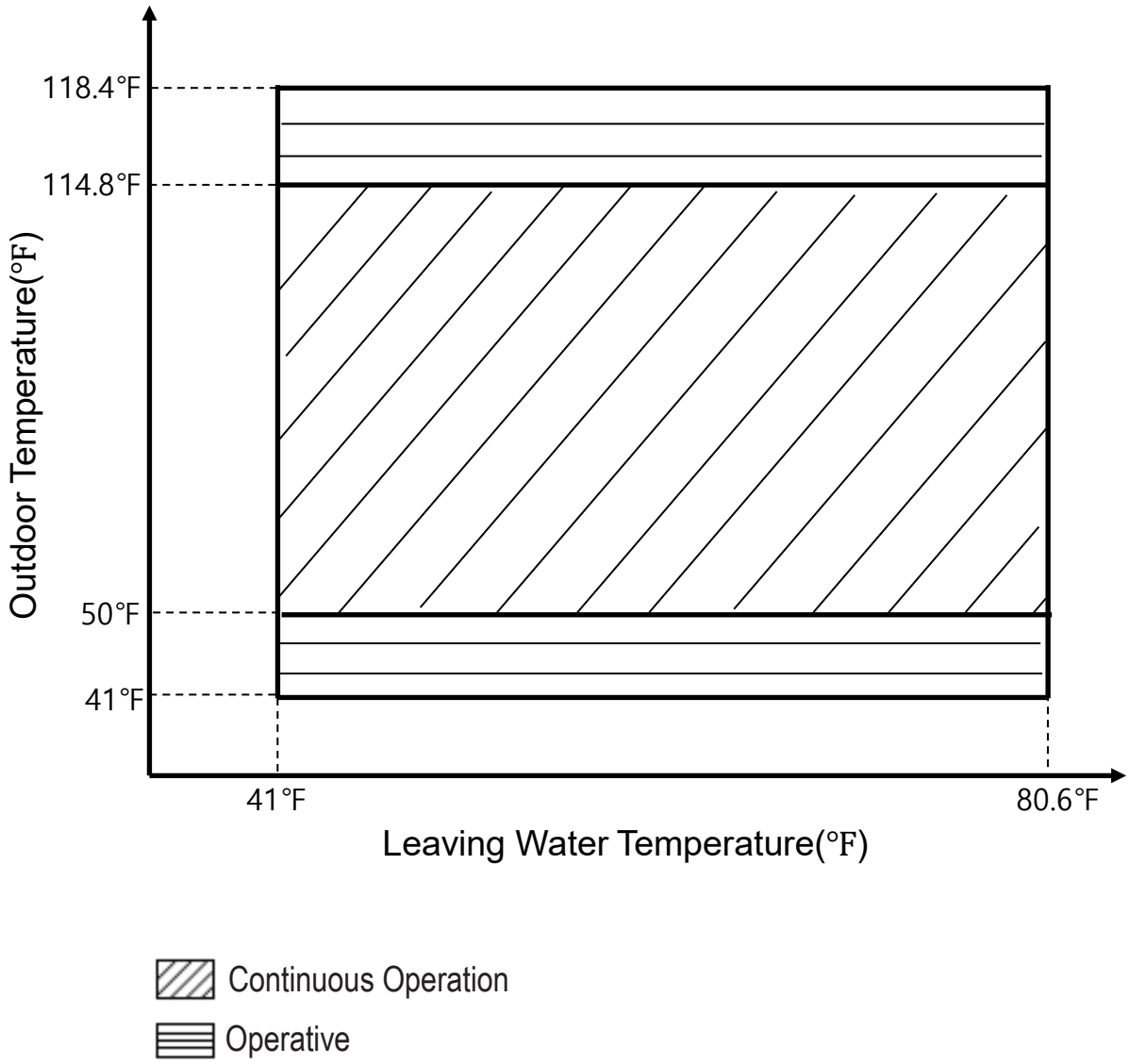
Peak Control Mode Running Current (A)

Input current value can be limited by Dip switch operation

Peak Control Mode Running Current (A)		
Capacity (Btu/h)	1 Step	2 Step
41,000	23	20
48,000	24	21
55,000	25	22

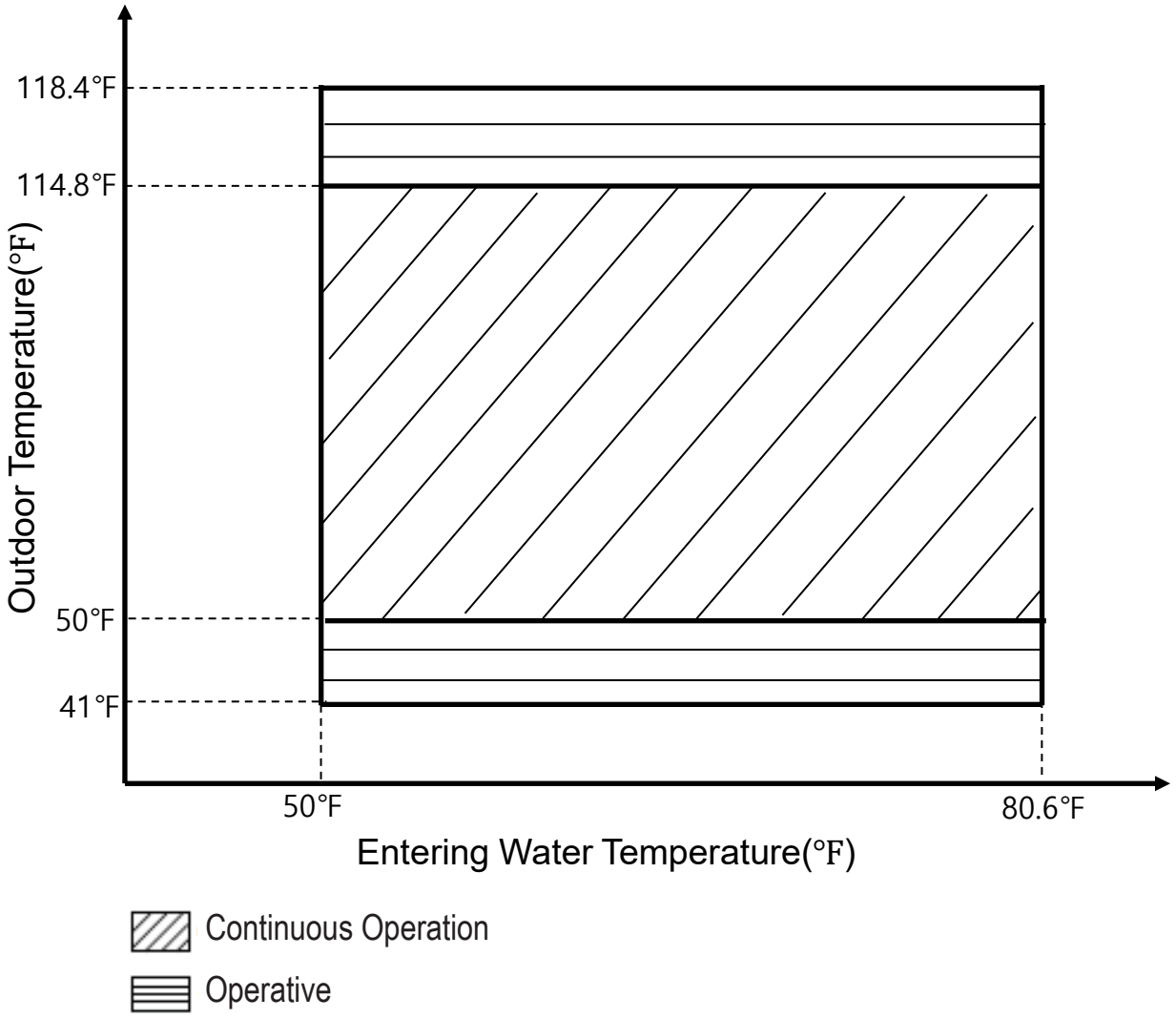
OPERATION RANGE

Cooling Operation Range: Outlet Temp. Control with Fan Coil Unit



- Continuous Operation: Operation is guranteed.
- Operative Operation: Continuous operation is not guaranteed.
- Capacity and efficiency may vary depending on installation conditions or usage conditions.

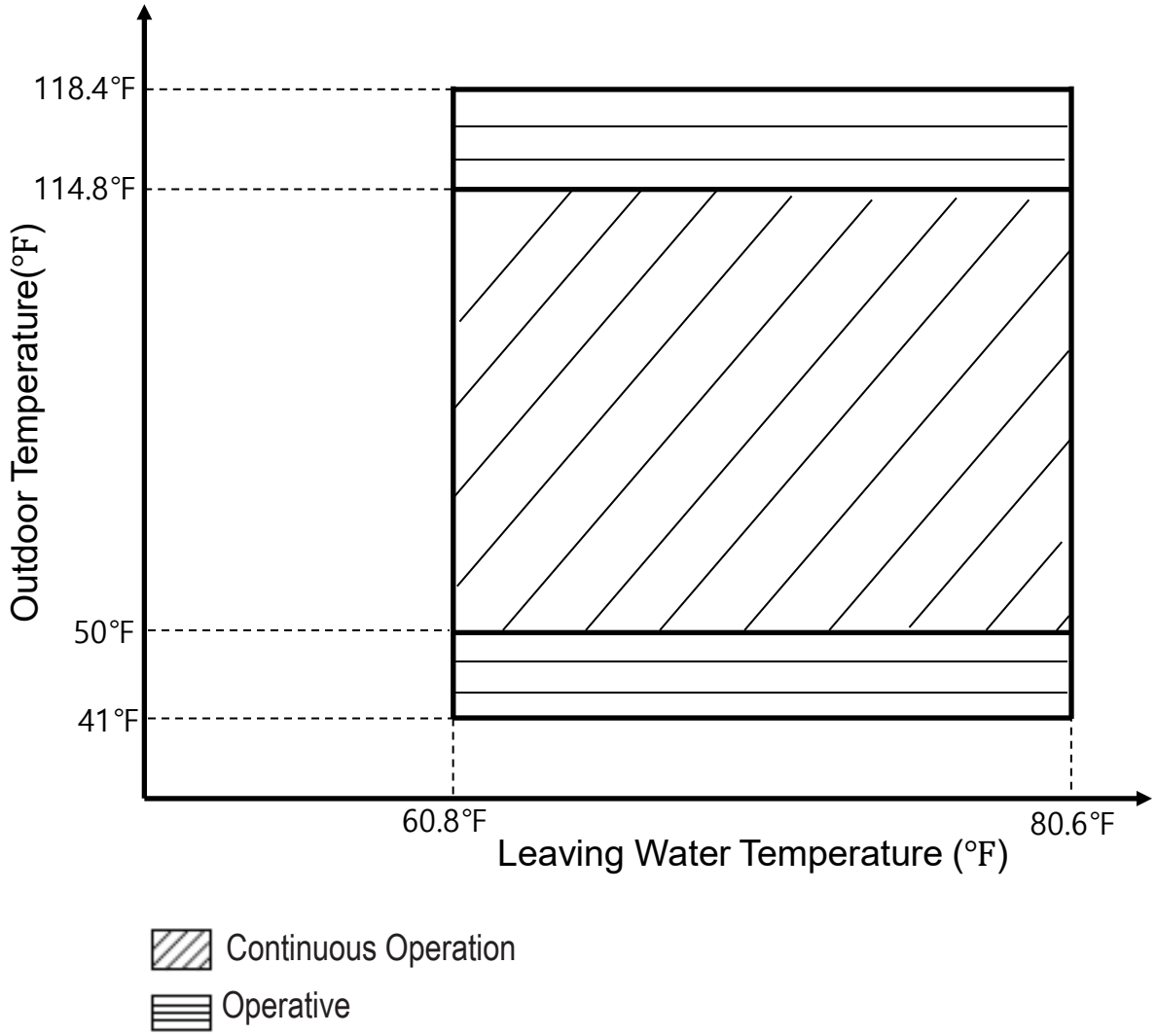
Cooling Operation Range: Inlet Temp. control with Fan Coil Unit



- Continuous Operation: Operation is guranteed.
- Operative Operation: Continuous operation is not guaranteed.
- Capacity and efficiency may vary depending on installation conditions or usage conditions.

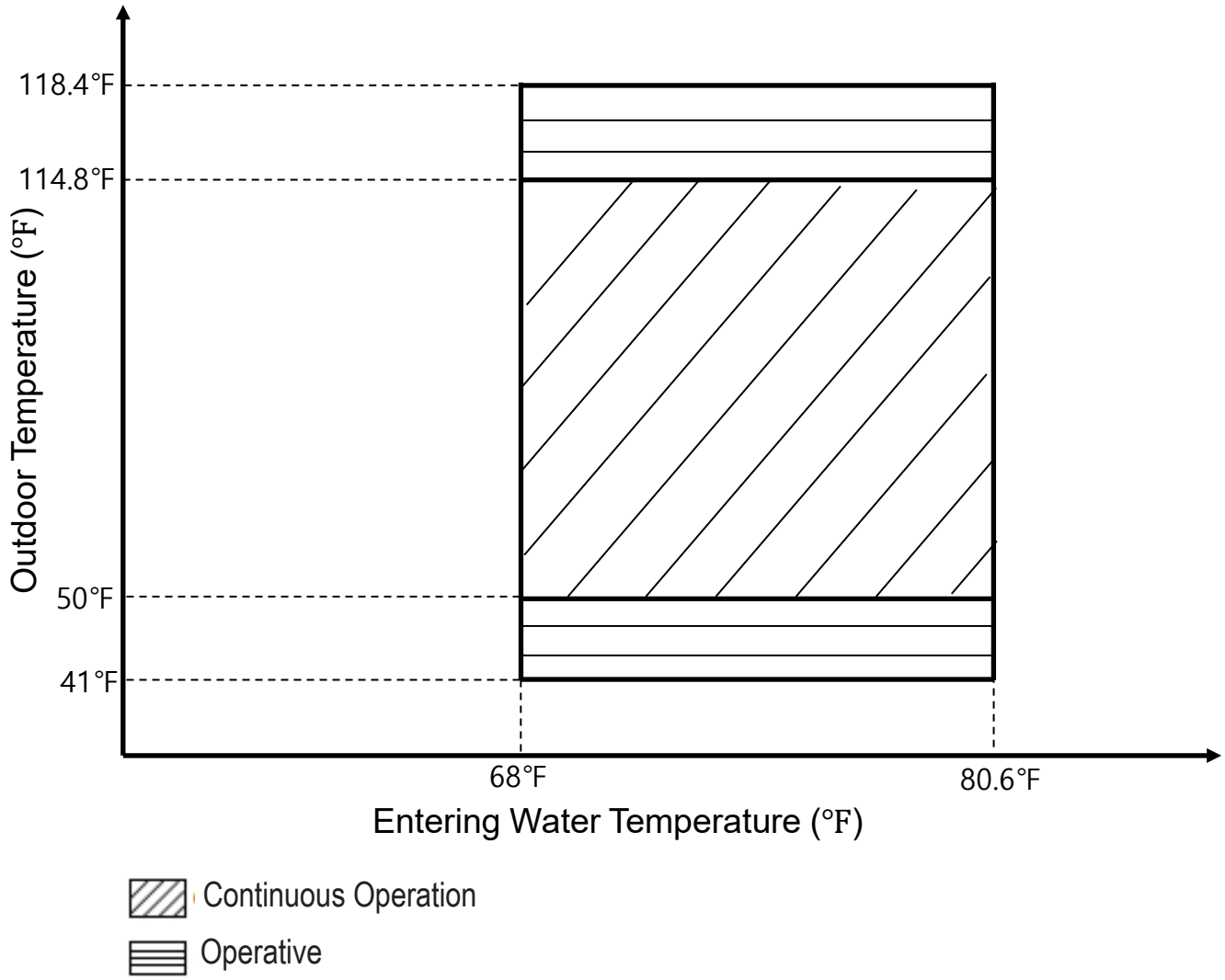
OPERATION RANGE

Cooling Operation Range: Outlet temp. control without Fan Coil Unit



- Continuous Operation: Operation is guranteed.
- Operative Operation: Continuous operation is not guaranteed.
- Capacity and efficiency may vary depending on installation conditions or usage conditions.

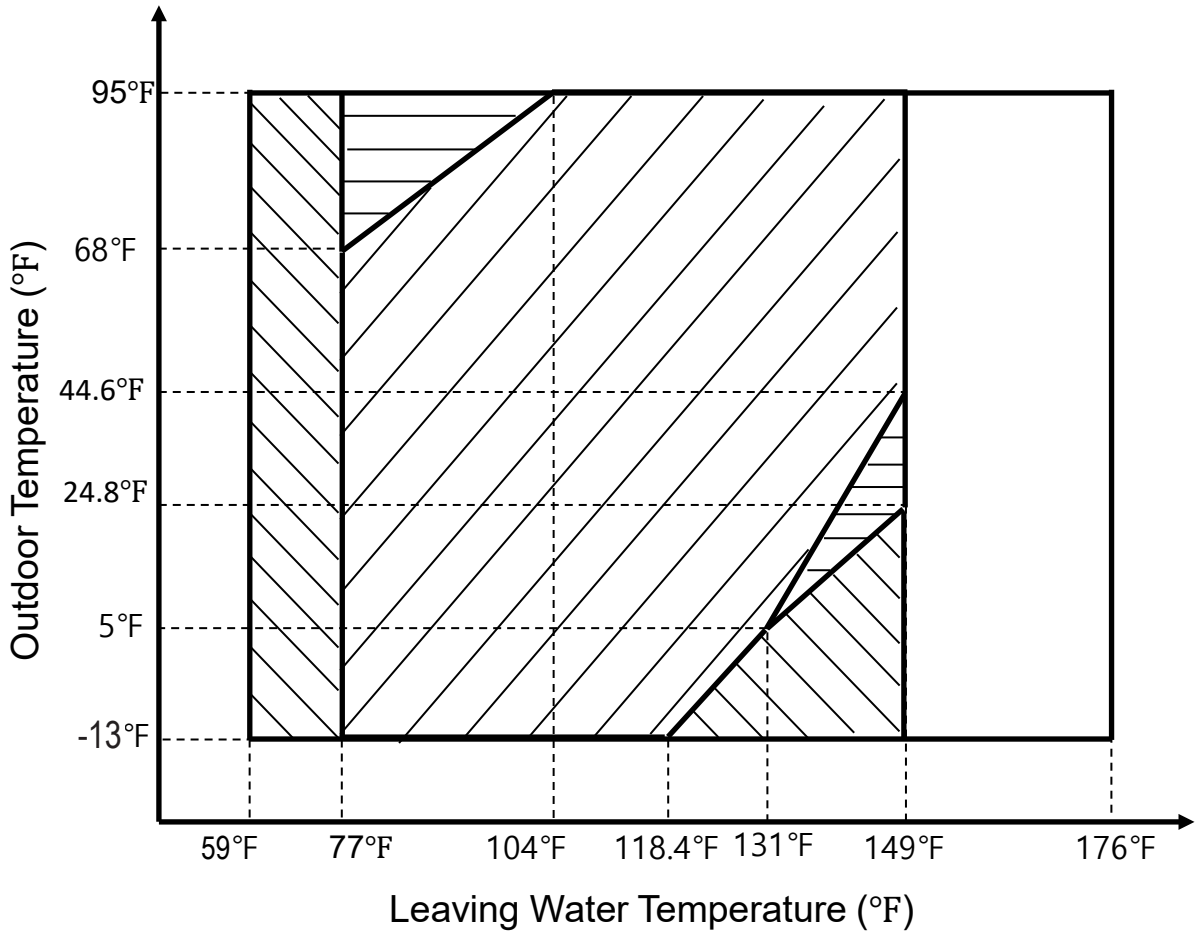
Cooling Operation Range: Inlet Temp. control without Fan Coil Unit



- Continuous Operation: Operation is guranteed.
- Operative Operation: Continuous operation is not guaranteed.
- Capacity and efficiency may vary depending on installation conditions or usage conditions.

OPERATION RANGE

Heating Operation Range: Outlet Temp. Control



DHW heat pump operation: Max. 131°F
DHW operation with booster heater: Max. 176°F

Continuous Operation

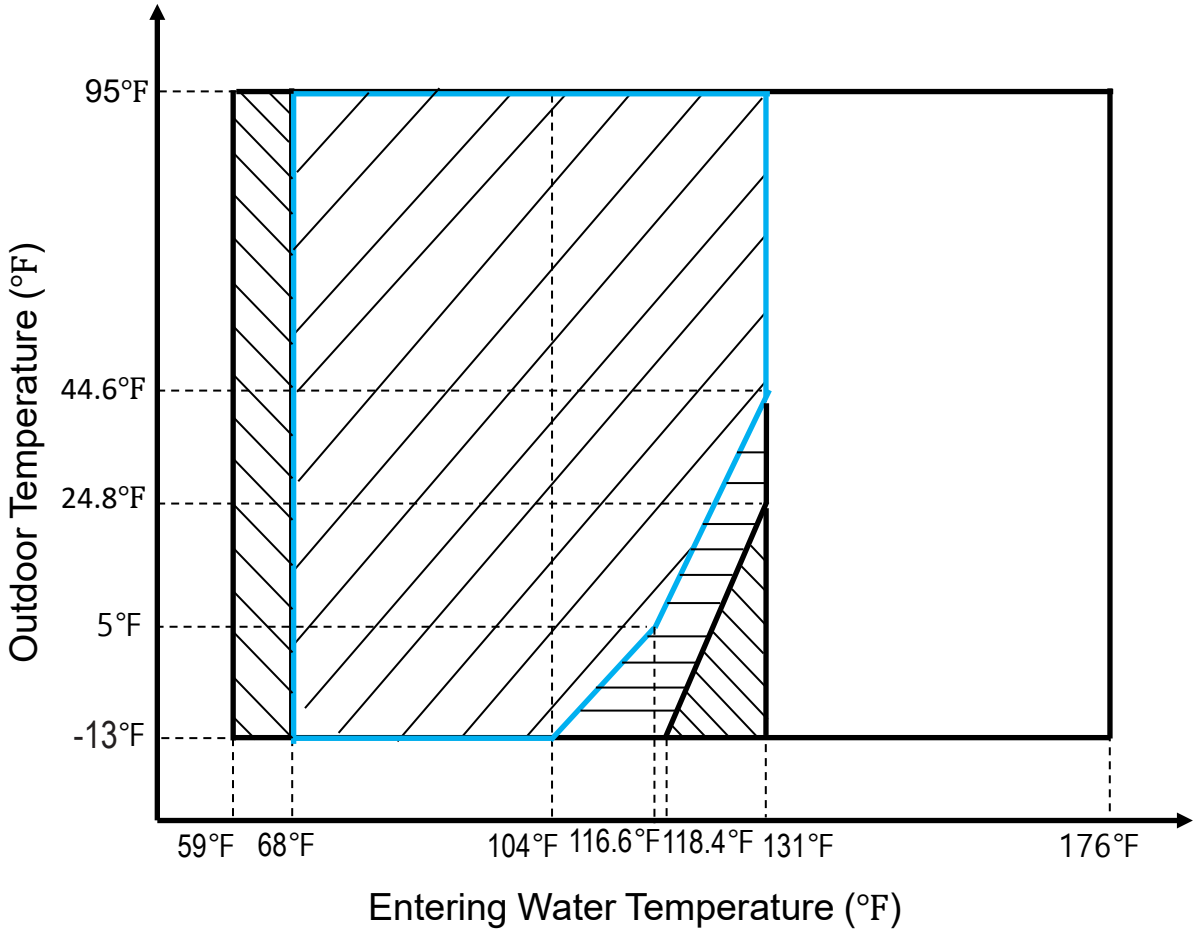
Operative

Booster heater operation only (DHW)

Backup heater operation only (Accessory)

- Continuous Operation: Operation is guranteed.
- Operative Operation: Continuous operation is not guaranteed.
- Capacity and efficiency may vary depending on installation conditions or usage conditions.

Heating Operation Range: Inlet Temp. Control



Continuous Operation

Operative

Booster heater operation only

Backup heater operation only (Accessory)

DHW heat pump operation: Max. 131°F
DHW operation with booster heater: Max. 176°F

- Continuous Operation: Operation is guranteed.
- Operative Operation: Continuous operation is not guaranteed.
- Capacity and efficiency may vary depending on installation conditions or usage conditions.

PERFORMANCE DATA

Maximum Cooling Capacity Tables

Maximum Cooling Capacity Table for KPHTC411M

Table 8: Max. Cooling Capacity Table.

Outdoor Temp.	Water flow rate 9.11 GPM													
	LWT 44.6°F		LWT 50°F		LWT 55.4°F		LWT 59°F		LWT 64.4°F		LWT 68°F		LWT 71.6°F	
	Capacity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh	Capac-ity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh
50.0°F DB	40,946	17.81	40,946	19.11	40,946	20.03	40,946	20.78	40,946	21.91	40,946	22.66	40,946	23.37
68.0°F DB	40,946	15.18	40,946	16.31	40,946	17.13	40,946	17.74	40,946	18.73	40,946	19.35	40,946	20.00
86.0°F DB	40,946	12.56	40,946	13.51	40,946	14.19	40,946	14.74	40,946	15.53	40,946	16.07	40,946	16.62
95.0°F DB	40,946	11.26	40,946	12.11	40,946	12.73	40,946	13.20	40,946	16.21	40,946	14.43	40,946	14.95
104.0°F DB	37,704	9.59	38,182	10.44	38,660	11.02	39,001	11.50	39,478	12.22	39,820	12.69	40,127	13.14
113.0°F DB	34,463	7.95	35,384	8.77	36,305	9.32	36,953	9.76	37,875	10.48	38,489	10.92	39,103	11.36

Maximum Cooling Capacity Table for KPHTC481M

Table 9: Max. Cooling Capacity Table.

Outdoor Temp.	Water flow rate 10.64 GPM													
	LWT 44.6°F		LWT 50°F		LWT 55.4°F		LWT 59°F		LWT 64.4°F		LWT 68°F		LWT 71.6°F	
	Capacity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh	Capacity (BTU/h)	EER - Btu/Wh
50.0°F DB	42,652	16.82	43,675	18.19	44,699	19.14	45,381	19.93	46,405	21.09	47,088	21.84	47,770	22.62
68.0°F DB	47,770	14.60	47,770	15.73	47,770	16.51	47,770	17.16	47,770	18.12	47,770	18.77	47,770	19.42
86.0°F DB	47,770	12.39	47,770	13.27	47,770	13.92	47,770	14.43	47,770	15.18	47,770	15.70	47,770	16.21
95.0°F DB	47,770	11.26	47,770	12.04	47,770	12.59	47,770	13.03	47,770	14.67	47,770	14.16	47,770	14.60
104.0°F DB	42,140	9.59	42,993	10.37	43,812	10.92	44,392	11.33	45,245	12.01	45,791	12.42	46,371	12.86
113.0°F DB	36,476	7.92	38,182	8.67	39,888	9.21	41,014	9.62	42,686	10.27	43,812	10.71	44,938	11.12

1. DB : Dry bulb temperature(°F), LWT: Leaving water temperature(°F), GPM: gallon per minute (gal/min)
2. EER: Energy efficiency ratio(BTU/Wh), COP: Coefficient of performance (W/W)
3. Direct interpolation is permissible. Do not extrapolate.
4. Measuring procedure follows EN14511.
   - Rated values are based on standard conditions, see specifications for details.
   - Above table values may not be matched according to installation condition. Except for rated value, the performance is not guaranteed.
   - In accordance with the test standard(or nations), the results may vary.
5. Shaded areas: Continuous operation is not guaranteed.

Maximum Cooling Capacity Table for KPHTC551M

Table 10: Max. Cooling Capacity Table.

Outdoor Temp.	Water flow rate 12.14 GPM													
	LWT 44.6°F		LWT 50°F		LWT 55.4°F		LWT 59°F		LWT 64.4°F		LWT 68°F		LWT 71.6°F	
	Capacity (BTU/h)	EER - Btu/ Wh	Capacity (BTU/h)	EER - Btu/ Wh	Capacity (BTU/h)	EER - Btu/ Wh	Capacity (BTU/h)	EER - Btu/ Wh	Capacity (BTU/h)	EER - Btu/ Wh	Capacity (BTU/h)	EER - Btu/ Wh	Capacity (BTU/h)	EER - Btu/Wh
50.0°F DB	44,358	15.83	46,405	17.23	48,452	18.25	49,817	19.04	51,865	20.27	53,229	21.05	54,594	21.87
68.0°F DB	54,594	13.72	54,594	14.91	54,594	15.73	54,594	16.41	54,594	17.40	54,594	18.08	54,594	18.77
86.0°F DB	54,594	11.64	54,594	12.56	54,594	13.24	54,594	13.75	54,594	14.57	54,594	15.08	54,594	15.63
95.0°F DB	54,594	10.58	54,594	11.40	54,594	11.98	54,594	12.45	54,594	13.65	54,594	13.61	54,594	14.06
104.0°F DB	46,405	9.21	47,634	9.96	48,862	10.51	49,681	10.92	50,909	11.57	51,728	12.01	52,547	12.42
113.0°F DB	38,216	7.81	40,127	8.53	42,038	9.01	43,300	9.42	45,211	10.00	46,473	10.41	47,770	10.78

1. DB: Dry bulb temperature(°F), LWT: Leaving water temperature(°F), GPM: gallon per minute (gal/min)
2. EER: Energy efficiency ratio(BTU/Wh), COP: Coefficient of performance (W/W)
3. Direct interpolation is permissible. Do not extrapolate.
4. Measuring procedure follows EN14511.
   - Rated values are based on standard conditions, see specifications for details.
   - Above table values may not be matched according to installation condition. Except for rated value, the performance is not guaranteed.
   - In accordance with the test standard(or nations), the results may vary.
5. Shaded areas: Continuous operation is not guaranteed.

PERFORMANCE DATA

Maximum Heating Capacity Tables

Maximum Heating Capacity Table for KPHTC411M (includes defrost effect)

Table 11: Max. Heating Capacity Table.

Outdoor Temp.	Water flow rate 9.11 GPM								Water flow rate 5.70 GPM				Water flow rate 4.57 GPM			
	LWT 86°F		LWT 95°F		LWT 104°F		LWT 113°F		LWT 122°F		LWT 131°F		LWT 140°F		LWT 149°F	
	Capac-ity (BTU/h)	COP (W/W)	Capa city (BTU/h)	COP	Capac-ity (BTU/h)	COP (W/W)	Capac-ity (BTU/h)	COP	Capac-ity (BTU/h)	COP (W/W)	Capac-ity (BTU/h)	COP (W/W)	Capac-ity (BTU/h)	COP (W/W)	Capac-ity (BTU/h)	COP (W/W)
-13.0°F DB	32,415	2.13	32,415	1.97	32,415	1.81	32,415	1.65								
-4.0°F DB	36,681	2.68	36,681	2.47	36,681	2.27	36,681	2.07	34,838	1.87						
5.0°F DB	40,946	2.90	40,946	2.55	40,946	2.52	40,946	2.49	39,240	2.24	39,240	2.00				
19.4°F DB	40,946	3.69	40,946	3.40	40,946	3.28	40,946	3.16	40,946	2.85	40,946	2.53	40,946	2.24		
24.8°F DB	40,946	3.98	40,946	3.73	40,946	3.57	40,946	3.41	40,946	3.07	40,946	2.74	40,946	2.40	40,946	2.06
28.4°F DB	40,946	4.18	40,946	3.78	40,946	3.68	40,946	3.58	40,946	3.22	40,946	2.87	40,946	2.51	40,946	2.16
35.6°F DB	40,946	4.57	40,946	4.19	40,946	4.05	40,946	3.91	40,946	3.52	40,946	3.14	40,946	2.75	40,946	2.36
44.6°F DB	40,946	5.34	40,946	4.90	40,946	4.62	40,946	4.33	40,946	3.90	40,946	3.47	40,946	3.04	40,946	2.61
50.0°F DB	40,946	5.95	40,946	5.50	40,946	5.04	40,946	4.58	40,946	4.13	40,946	3.67	40,946	3.21	40,946	2.76
59.0°F DB	40,946	6.50	40,946	6.00	40,946	5.50	40,946	5.00	40,946	4.50	40,946	4.00	40,946	3.50	40,946	3.01
64.4°F DB	40,946	6.83	40,946	6.30	40,946	5.78	40,946	5.25	40,946	4.73	40,946	4.20	40,946	3.68	40,946	3.15
68.0°F DB	40,946	7.04	40,946	6.50	40,946	5.96	40,946	5.42	40,946	4.88	40,946	4.34	40,946	3.80	40,946	3.25
95.0°F DB	40,946	8.68	40,946	8.01	40,946	7.34	40,946	6.68	40,946	6.01	40,946	5.34	40,946	4.67	40,946	4.00

1. DB : Dry bulb temperature(°F), LWT: Leaving water temperature(°F), GPM: gallon per minute (gal/min)
2. EER: Energy efficiency ratio(BTU/Wh), COP: Coefficient of performance (W/W)
3. Direct interpolation is permissible. Do not extrapolate.
4. Measuring procedure follows EN14511.
   - Rated values are based on standard conditions, see specifications for details.
   - Above table values may not be matched according to installation condition. Except for rated value, the performance is not guaranteed.
   - In accordance with the test standard(or nations), the results may vary.
5. Shaded areas: Continuous operation is not guaranteed.

Maximum Heating Capacity Table for KPHTC481M (includes defrost effect)

Table 12: Max. Heating Capacity Table.

Outdoor Temp.	Water flow rate 10.63 GPM								Water flow rate 6.65 GPM				Water flow rate 5.31 GPM			
	LWT 86°F		LWT 95°F		LWT 104°F		LWT 113°F		LWT 122°F		LWT 131°F		LWT 140°F		LWT 149°F	
	Capacity (BTU/h)	COP (W/W)	Capacity (BTU/h)	COP (W/W)	Capacity (BTU/h)	COP (W/W)	Capacity (BTU/h)	COP (W/W)	Capacity (BTU/h)	COP (W/W)	Capacity (BTU/h)	COP (W/W)	Capacity (BTU/h)	COP (W/W)	Capacity (BTU/h)	COP (W/W)
-13.0°F DB	34,121	2.09	34,121	1.93	34,121	1.78	34,121	1.62								
-4.0°F DB	40,946	2.62	40,946	2.42	40,946	2.23	40,946	2.03	38,898	1.83						
5.0°F DB	47,770	2.84	47,770	2.50	47,770	2.47	47,770	2.44	45,381	2.19	45,381	1.95				
19.4°F DB	47,770	3.61	47,770	3.34	47,770	3.21	47,770	3.09	47,770	2.78	47,770	2.47	47,770	2.16		
24.8°F DB	47,770	3.90	47,770	3.65	47,770	3.49	47,770	3.33	47,770	3.00	47,770	2.67	47,770	2.33	47,770	2.00
28.4°F DB	47,770	4.09	47,770	3.86	47,770	3.68	47,770	3.50	47,770	3.15	47,770	2.80	47,770	2.45	47,770	2.10
35.6°F DB	47,770	4.73	47,770	4.28	47,770	4.05	47,770	3.83	47,770	3.45	47,770	3.06	47,770	2.68	47,770	2.30
44.6°F DB	47,770	5.24	47,770	4.80	47,770	4.52	47,770	4.24	47,770	3.82	47,770	3.40	47,770	2.97	47,770	2.55
50.0°F DB	47,770	5.83	47,770	5.39	47,770	4.94	47,770	4.49	47,770	4.04	47,770	3.60	47,770	3.15	47,770	2.70
59.0°F DB	47,770	6.37	47,770	5.88	47,770	5.39	47,770	4.90	47,770	4.42	47,770	3.93	47,770	3.44	47,770	2.95
64.4°F DB	47,770	6.69	47,770	6.18	47,770	5.67	47,770	5.15	47,770	4.64	47,770	4.13	47,770	3.61	47,770	3.10
68.0°F DB	47,770	6.91	47,770	6.38	47,770	5.85	47,770	5.32	47,770	4.79	47,770	4.26	47,770	3.73	47,770	3.20
95.0°F DB	47,770	8.52	47,770	7.86	47,770	7.21	47,770	6.56	47,770	5.91	47,770	5.25	47,770	4.60	47,770	3.95

1. DB : Dry bulb temperature(°F), LWT: Leaving water temperature(°F), GPM: gallon per minute (gal/min)
2. EER: Energy efficiency ratio(BTU/Wh), COP : Coefficient of performance (W/W)
3. Direct interpolation is permissible. Do not extrapolate.
4. Measuring procedure follows EN14511.
   - Rated values are based on standard conditions, see specifications for details.
   - Above table values may not be matched according to installation condition. Except for rated value, the performance is not guaranteed.
   - In accordance with the test standard(or nations), the results may vary.
5. Shaded areas: Continuous operation not guaranteed.

PERFORMANCE DATA
Maximum Heating Capacity Tables

Maximum Heating Capacity Table for KPHTC551M (includes defrost effect)

Table 13: Max. Heating Capacity Table.

Out-door Temp.	Water flow rate 12.14 GPM								Water flow rate 7.60 GPM				Water flow rate 6.07 GPM			
	LWT 86°F		LWT 95°F		LWT 104°F		LWT 113°F		LWT 122°F		LWT 131°F		LWT 140°F		LWT 149°F	
	Capa-city (BTU/h)	COP (W/W)	Capa-city (BTU/h)	COP (W/W)	Capa-city (BTU/h)	COP (W/W)	Capac-ity (BTU/h)	COP (W/W)	Capa-city (BTU/h)	COP (W/W)	Capac-ity (BTU/h)	COP (W/W)	Capac-ity (BTU/h)	COP (W/W)	Capac-ity (BTU/h)	COP (W/W)
-13.0°F DB	35,827	1.96	35,827	1.84	35,827	1.72	35,827	1.60								
-4.0°F DB	45,211	2.48	45,211	2.32	45,211	2.15	45,211	1.98	42,959	1.82						
5.0°F DB	54,594	2.71	49,135	2.45	49,135	2.41	49,135	2.37	46,678	2.16	46,678	1.94				
19.4°F DB	54,594	3.46	54,594	3.27	54,594	3.13	54,594	2.98	54,594	2.70	54,594	2.41	54,594	2.12		
24.8°F DB	54,594	3.75	54,594	3.58	54,594	3.40	54,594	3.22	54,594	2.90	54,594	2.58	54,594	2.27	54,594	1.95
28.4°F DB	54,594	4.16	54,594	3.78	54,594	3.58	54,594	3.38	54,594	3.05	54,594	2.72	54,594	2.38	54,594	2.05
35.6°F DB	54,594	4.57	54,594	4.19	54,594	3.95	54,594	3.71	54,594	3.35	54,594	2.98	54,594	2.62	54,594	2.25
44.6°F DB	54,594	5.08	54,594	4.70	54,594	4.41	54,594	4.13	54,594	3.72	54,594	3.31	54,594	2.91	54,594	2.50
50.0°F DB	54,594	5.67	54,594	5.24	54,594	4.80	54,594	4.37	54,594	3.94	54,594	3.51	54,594	3.08	54,594	2.65
59.0°F DB	54,594	6.20	54,594	5.73	54,594	5.26	54,594	4.79	54,594	4.32	54,594	3.84	54,594	3.37	54,594	2.90
64.4°F DB	54,594	6.52	54,594	6.03	54,594	5.53	54,594	5.04	54,594	4.54	54,594	4.04	54,594	3.55	54,594	3.05
68.0°F DB	54,594	6.74	54,594	6.23	54,594	5.71	54,594	5.20	54,594	4.69	54,594	4.18	54,594	3.66	54,594	3.15
95.0°F DB	54,594	8.35	54,594	7.71	54,594	7.08	54,594	6.44	54,594	5.81	54,594	5.17	54,594	4.54	54,594	3.90

1. DB : Dry bulb temperature(°F), LWT: Leaving water temperature(°F), GPM: gallon per minute (gal/min)
2. EER: Energy efficiency ratio(BTU/Wh), COP: Coefficient of performance (W/W)
3. Direct interpolation is permissible. Do not extrapolate.
4. Measuring procedure follows EN14511.
   - Rated values are based on standard conditions, see specifications for details.
   - Above table values may not be matched according to installation condition. Except for rated value, the performance is not guaranteed.
   - In accordance with the test standard(or nations), the results may vary.
5. Shaded areas: Continuous operation is not guaranteed.

Selecting the Best Location for the Unit

⚠DANGER

⃠ Do not install the unit in an area where combustible gas may generate, flow, stagnate, or leak. These conditions can cause a fire, resulting in bodily injury or death.

- *⃠ Do not install the unit in a location where acidic solution and spray (sulfur) are often used as it can cause bodily injury or death.*
- *⃠ Do not use the unit in environments where oil, steam, or sulfuric gas are present as it can cause bodily injury or death.*

⚠WARNING

When deciding on a location to place the unit, be sure to choose an area where run-off from defrost will not accumulate and freeze on sidewalks or driveways, which may create unsafe conditions. Properly install and insulate any drain hoses to prevent the hose from freezing, cracking, leaking, and causing unsafe conditions from frozen condensate.

Install a fence to prevent vermin from crawling into the unit or unauthorized individuals from accessing it.

Select a location for installing the outdoor unit that will meet the following conditions:

- Where there is enough strength to bear the weight of the outdoor unit.
- A location that allows for optimum air flow and is easily accessible for inspection, maintenance, and service.
- Where piping between the outdoor unit and indoor unit(s) are within allowable limits.
- Include space for drainage to ensure condensate flows properly out of the unit when it is in heating mode. Avoid placing the outdoor unit in a low-lying area where water could accumulate.
- If the outdoor unit is installed in a highly humid environment (near an ocean, lake, etc.), ensure that the site is well-ventilated and has a lot of natural light (Example: Install on a rooftop).

⃠ Don’ts

- *Where it will be subjected to direct thermal radiation from other heat sources, or an area that would expose the outdoor unit to heat or steam like discharge from boiler stacks, chimneys, steam relief ports, other air conditioning units, kitchen vents, plumbing vents, and other sources of extreme temperatures.*
- *Where high-frequency electrical noise / electromagnetic waves will not affect operation.*
- *Where operating sound from the unit will disturb inhabitants of surrounding buildings.*
- *Where the unit will be exposed to direct, strong winds.*
- *Where the discharge of one outdoor unit will blow into the inlet side of an adjacent unit (when installing multiple outdoor units).*

Note:

The unit may take longer to provide heat, or heating performance will be reduced in winter if the unit is installed:

1. *In a narrow, shady location.*
2. *Near a location that has a lot of ground moisture.*
3. *In a highly humid environment.*
4. *In an area in which condensate does not drain properly.*

Wind Protection

If the unit is placed on a roof, or in a place that is constantly exposed to a strong wind, secure a normal fan operation by using a duct or a wind shield.

- Install the unit so that its discharge port faces the wall of the building. Keep a distance of 11.81 inches or more between the unit and the wall surface.

Note:

Choose an area where run-off from defrost mode will not accumulate and freeze on sidewalks or driveways. Properly install and insulate any drain hoses to prevent the hose from freezing, cracking, leaking, and damaging the outdoor unit.

PLACEMENT CONSIDERATIONS

Installation

This product must be installed outdoors.

Condensate Drain Piping

Outdoor unit requires condensate drain piping. Condensate drain pipe is constructed with materials approved by local code.

⚠CAUTION

When deciding on a location to place the outdoor unit, be sure to choose an area where run-off from defrost will not accumulate and freeze on sidewalks or driveways, which may create unsafe conditions.

Planning for Snow and Ice

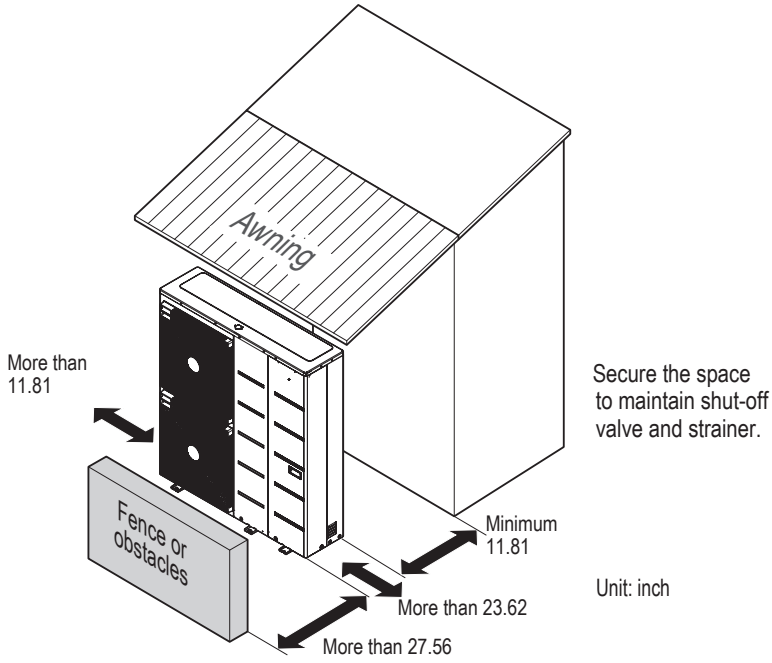
To ensure the outdoor unit operates properly, certain measures are required in locations where there is a possibility of heavy snowfall or severe windchill or cold:

1. Prepare for severe winter wind chills and heavy snowfall, even in areas of the country where these are unusual phenomena.
2. Position the outdoor unit so that its airflow fans are not buried by direct, heavy snowfall. If snow piles up and blocks the airflow, the system may malfunction.
3. Remove any snow that has accumulated four (4) inches or more on the top of the outdoor unit.
4. In climates that may experience significant snow buildup, mount the outdoor unit on a raised, field-provided platform or stand. The raised support platform must be high enough to allow the unit to remain above possible snow drifts, and must be higher than the maximum anticipated snowfall for the location.
5. Design the mounting base to prevent snow accumulation on the platform in front or back of the unit frame.
6. Provide a field fabricated snow protection hood to keep snow and ice and/or drifting snow from accumulating on the coil surfaces.
7. Consider tie-down requirements in case of high winds or where required by local codes.

Clearances

If an awning is built over the unit to prevent direct sunlight or rain exposure, make sure that heat radiation from the condenser is not restricted. Secure the space, considering field installation of the shut-off valve and strainer.

Figure 11: Clearances



Transporting / Lifting

When lifting the unit, use lifting straps and place around the unit as shown. When carrying the suspended unit, pass the ropes under the unit and use the two suspension points each at the front and rear.

- Always lift the unit using properly sized lifting straps rated to carry the unit weight.
- Ensure the straps are long enough to maintain a maximum of a 40° angle as shown.
- Use only accessories and parts which are of the designated specification when installing.

⚠ WARNING

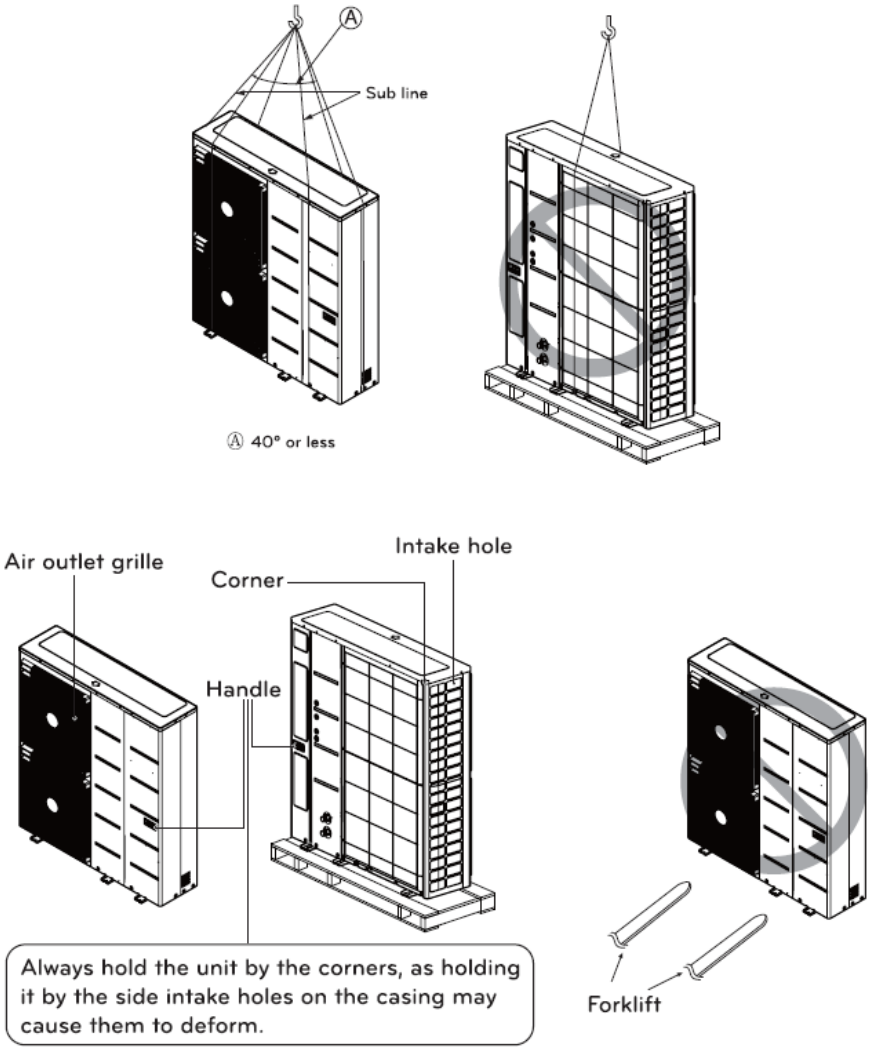
- *Use appropriate moving equipment to transport each frame; ensure the equipment is capable of supporting the weights listed above. If the equipment is not properly secured, it may result in an accident that causes physical injury or death.*
- *Wear protective gloves when handling equipment. Sharp edges may cause personal injury.*
- *Some products include polypropylene bands around the unit for packaging. ⃠ Do not use polypropylene bands to lift the unit. There is a risk of the product falling and causing physical injury.*
- *Tear apart and throw away plastic packaging bags so that children may not play with them and risk suffocation and death.*
- *Consider the unit's center of gravity before lifting. Hoist the unit with the center of gravity centered among the lifting straps. There is a risk of the product falling and causing physical injury.*
- *Lift the water source unit from the base at specified locations. Support the unit at a minimum of six (6) points to avoid slippage from the rigging apparatus, and use a minimum of three (3) lifting straps. There is a risk of the product falling and causing physical injury.*
- *Use caution when using a forklift to transport an unpackaged unit. ⃠ Do not drop the unit when carrying it with a forklift. There is a risk of the product falling and causing physical injury.*

Note:

Place a protective cloth or other soft material at the locations where the casing comes in contact with the lifting straps to prevent damage to painted surfaces.

TRANSPORTING / LIFTING

Figure 12: Moving requirements.



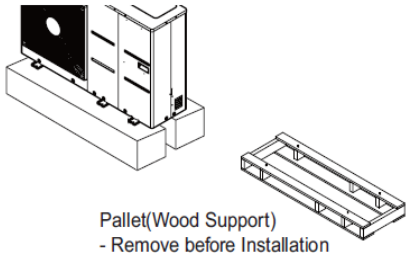
Note:

- *All referenced materials are to be field-supplied.*
- *Images are not to scale.*

General Mounting

- The underlying structure or foundation must be designed to support the weight of the unit, and avoid placing the outdoor unit in a low lying area where water may accumulate.
- Refer to installation manual, and follow the applicable local code for clearance, mounting, anchor, and vibration attenuation requirements.
- Check the strength and level of the installation ground so that the unit does not cause any operating vibration or noise after installation.
- Remove the Pallet (Wood Support) from the bottom of the outdoor unit Base Pan before bolting the unit.
- Fix the unit securely with foundation bolts. Prepare 4 sets of M12 foundation bolts, nuts and washers.
- Screw in each foundation bolt until the length is 25/32 inch from the foundation surface.

Figure 14: Bolting requirements.



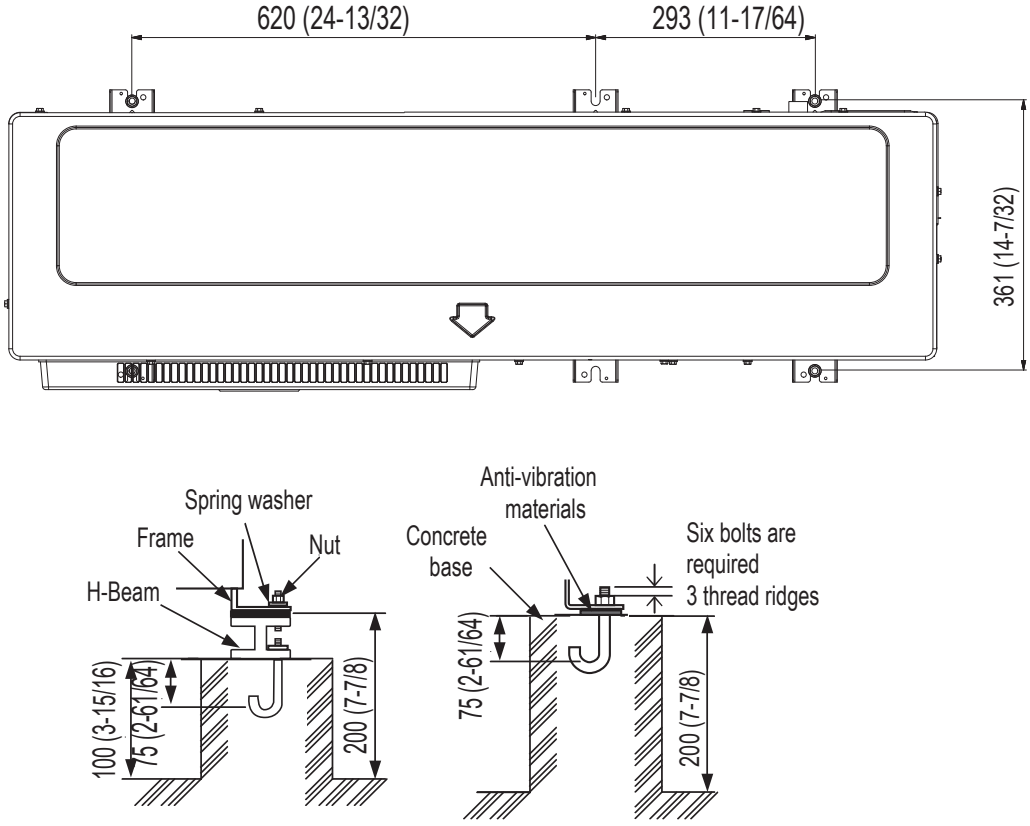
⚠ WARNING

- *Ensure that the floor / chosen location has enough strength to support the weight of the unit(s). If it does not have sufficient strength, the unit may fall and cause physical injury or death.*
- *Remove the Pallet (Wood Support) of the bottom side of the outdoor unit before welding. Not removing Pallet (Wood Support) can cause fire hazard during welding that can result in bodily injury or death.*

Note:

Remove the Pallet (Wood Support) from the bottom of the outdoor unit Base Pan before bolting the unit. Otherwise, it may make the outdoor unit unstable and cause freezing of the heat exchanger, resulting in abnormal operations.

Figure 13: Bolting requirements.



(Unit : mm(inch))

Foundation bolt executing method

WATER CONTROL

Water Quality

Water quality must comply with EN 98/83 EC Directives. See table below for detailed guide.

Note:

- *If the product is installed at existing hydraulic water loop, it is important to clean hydraulic pipes to remove sludge and scale.*
- *Installing sludge strainer in the water loop is very important to prevent performance degradation.*
- *Chemical treatment to prevent rust must be performed by installer.*
- *It is strongly recommended to install an additional filter on the heating water circuit. To remove metallic particles from the heating piping, it is strongly recommended to use a magnetic or cyclone filter, which can remove small particles. Small particles may damage the unit and will NOT be removed by the standard filter of the heat pump system.*
- *Water quality check must be implemented before completing the installation of system.*

Table 14: Water quality Specifications.

Water contents	Value			
pH	7.5 ~ 9.0			
Conductivity	10 ~ 500 uS/cm			
TDS (Total dissolved solids)	8 ~ 400 ppm			
Alkalinity (HCO3-)	60 ~ 300 (mg/L)			
Total hardness	4 ~ 8.5 °dH			
	71.4 ~ 151.7 (mg/L)			
Iron (Fe)	≤ 0.2 (mg/L)			
Sulphate (SO42-)	≤ 100 (mg/L)			
Nitrite (NO3-)	≤ 100 (mg/L)			
Free chlorine (Cl2)	≤ 1 (mg/L)			
Chlorides (Cl-)	ppm		STS316	STS304
	pH7	59°F	3,000	180
		104°F	500	50
		140°F	200	30
		176°F	125	20
	pH9	59°F	18,000	700
		104°F	2,600	250
		140°F	1,000	170
		176°F	550	130

Frost protection

In areas of the country where entering water temperatures drop below 32°F, the water pipe must be protected by using an approved anti-freeze solution. Consult your heat pump unit supplier for locally approved solutions in your area.

Calculate the approximate volume of water in the system. Then add the water volume contained in the heat pump to this total volume.

Table 15: Frost protection.

Antifreeze type	Antifreeze mixing ratio					
	32°F	23°F	14°F	5°F	-4°F	-13°F
Ethylene glycol	0%	12%	20%	30%	-	-
Propylene glycol	0%	17%	25%	33%	-	-
Methanol	0%	6%	12%	16%	24%	30%

Note:

- *Use only one of the above antifreeze types.*
- *If approved antifreeze is not used, pressure drop and capability degradation of the system can occur.*
- *To prevent corrosion, add corrosion inhibitor.*
- *Check the concentration of the antifreeze periodically to keep same concentration.*
- *When antifreeze is used (for installation or operation), do not touch the antifreeze.*
- *Follow all local and national laws about antifreeze usage.*

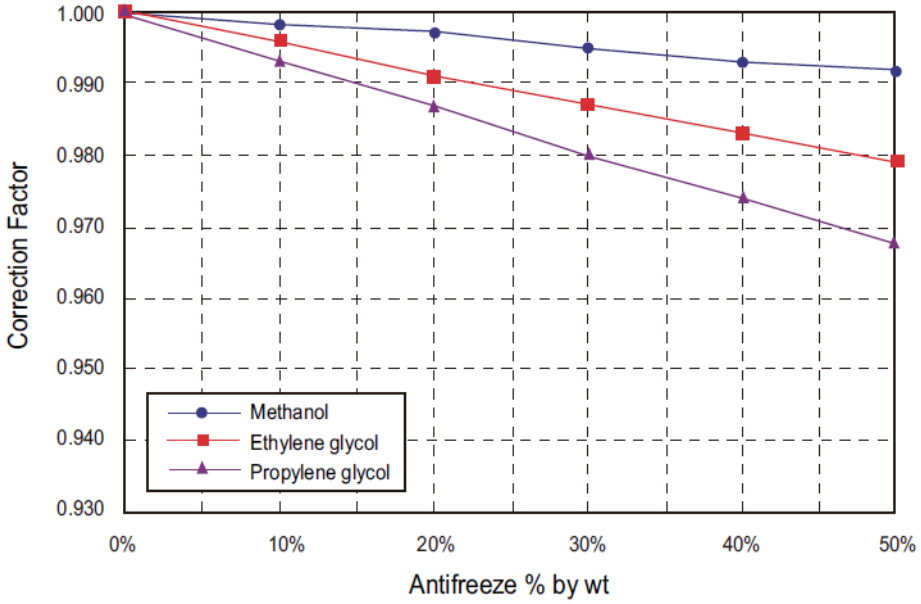
Capacity correction factor by antifreeze

Figure 15: Capacity correction factor by antifreeze.

Antifreeze Type	Item	Antifreeze % by wt				
		10%	20%	30%	40%	50%
Methanol	Cooling	0.998	0.997	0.995	0.993	0.992
	Heating	0.995	0.990	0.985	0.979	0.974
	Pressure Drop	1.023	1.057	1.091	1.122	1.160
Ethylene glycol	Cooling	0.996	0.991	0.987	0.983	0.979
	Heating	0.993	0.985	0.977	0.969	0.961
	Pressure Drop	1.024	1.068	1.124	1.188	1.263
Propylene glycol	Cooling	0.993	0.987	0.980	0.974	0.968
	Heating	0.966	0.973	0.960	0.948	0.935
	Pressure Drop	1.040	1.098	1.174	1.273	1.405

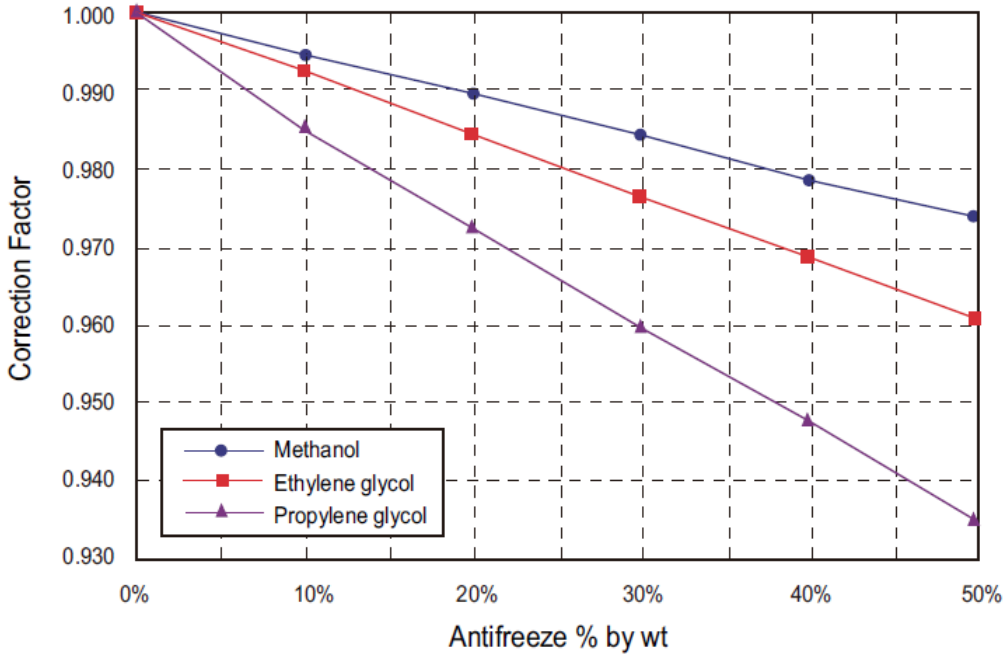
Correction factor of cooling capacity

Figure 16: Correction factor of cooling capacity diagram.



Correction factor of heating capacity

Figure 17: Correction factor of heating capacity diagram.



Water Piping and Water Circuit Connection Guidelines

Water Piping and water Circuit Connection General considerations

Following must be considered before beginning water circuit connection.

- Service space must be secured.
- Water pipes and connections must be cleaned using water.
- Space for installing external water pump must be provided if internal water pump capacity is not enough for installation field.
- ⃠ Do not connect electric power while proceeding water charging.

Water piping and water circuit connection

- Water piping: Installing pipes where water is flowing inside the pipe.
- Water circuit connecting : Making connection between the unit and water pipes or between pipes and pipes. Connecting valves or elbows are, for example, in this category.
- A buffer tank must be installed to reduce sudden load fluctuations. (Refer to the product installation manual.)

While installing water pipes, consider the following:

- While inserting or putting water pipes, close the end of the pipe with pipe cap to avoid dust entering.
- When cutting or welding the pipe, always be careful that inner section of the pipe should not be defective. For example, no weldments or no burrs are found inside the pipe.
- Drain piping should be provided in case of water discharge by the operation of the safety valve. This situation can happen when the internal pressure is over 3.0 bar and water inside the unit will be discharged to drain hose.

While connecting water pipes, consider the following:

- Pipe fittings (e.g. L-shape elbow, T-shape tee, diameter reducer, etc) must be tightened strongly to be free from water leakage.
- Connected sections must be leakage-proof treatment by applying teflon tape, rubber bushing, sealant solution, etc.
- Use appropriate tools and tooling methods to prevent mechanical breakage of the connections.
- Operation time of flow control valve (e.g. 3way valve or 2way valve) to be less than 90 seconds.
- Connect drain hose with drain piping

Water condensation on the floor

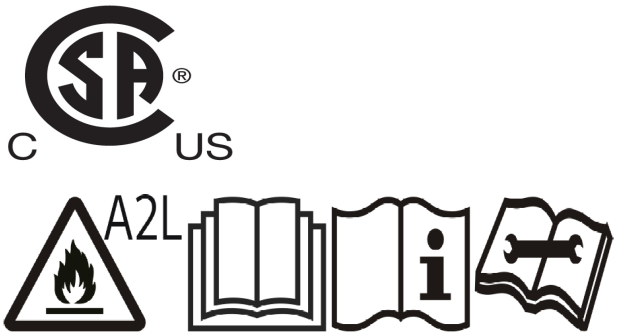
If underfloor cooling is performed, it is very important to keep leaving water temperature higher than 60.8°F. Otherwise, dew condensation can occur on the floor. If floor is in humid environment, do not set leaving water temperature below 64.4°F.

Water condensation on the radiator

In cooling operation, cold water may not flow to the radiator. If cold water enters the radiator, there can be dew generation on the surface of the radiator. Use 2 way-valve to block circuits from cooling operation.

Drainage

While cooling operation, condensed dew can drop down to the bottom of the unit. The condensing water must be sufficiently drained from the unit and dissipated frost-free.



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