



Air Cooled Water Chillers & Heat Pumps

Cooling capacity: 39.7 kW - 168.2 kW
Heating capacity : 45.6 kW - 190.9kW

MKAC
MKAH

R410a



Outdoor Installation



2019

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1. General Description



Air Cooled Water Chillers & Heat Pumps



The Klimalco MKAC - MKAH medium capacity series are packaged air cooled water heat pumps for cooling and heating applications and outdoor installation. They are available in 3 series with 8 models with nominal capacities ranging from 39,7 to 168,2 kW for cooling and 45,6 to 190,9 kW in heating.

This series is ideal in combination with residences, offices, hotels, hospitals, shopping malls, shops, restaurants, etc., or for supplying water for industrial applications.

Optimized design for R410a refrigerant.

Casing: Galvanized steel plate with polyesteric powder coating.

Assembly: Fully bolted/welding free.

Compressor: Hermetically sealed scroll type.

Air heat exchanger: Cross fin coil. Internally grooved copper tubes and louvered aluminium fins.

Direct drive propeler fan: Low rpm, quiet operation.

Water heat exchanger: Shell and tube type.

Free cooling coil: Hydromodule.

Safety and functional devices:

- High/low pressure switch.
- Phase sequence - phase failure - reverse phase and voltage monitoring device.
- Evaporator low water temperature protection.
- Electronic microprocessor control with digital display.
- Differential water pressure switch.
- Linear fan speed regulation according to coil temperature or circuit pressure.
- High and low pressure manometers.

2. Technical Description

General

The MKAC - MKAH series air-cooled water heat pumps consists of 8 models covering capacities from 39,7 up to 168,2 kW in cooling and 45,6 up to 190,9kW in heating. It is the end result of a thorough study, and accurate design by experienced Klimallco research and development teams, to develop a mid size chiller/heat pump series with compact shape, high performance, and reliability of the highest quality standards. This series meets the highest levels of aesthetic and technical requirements using the latest technological innovations including environmentally friendly R410a refrigerant that is Chlorine-free and has zero ozone depletion potential. MKAC - MKAH units are therefore ideal for installation in urban environments due to their elegant design, selected materials and low operating sound levels.

Casing

All units use metal parts that are fabricated from heavy gauge galvanized steel sheets, formed to ensure maximum rigidity that guarantees and preserves the units operation during the years. After fabrication these are degreased, phosphatised, and electrostatically powder coated with an epoxy-polyester RAL 7042 coating of a thickness of 60-70 µ. This fully automatic process ensures superior corrosion resistance against the most aggressive ambient conditions. The treatment can successfully withstand a salt spray test of 500 hours, according to ASTM B-117. All components are assembled together using bolts thus avoiding the need for welding which may harm the galvanization of the steel, and ensures that the whole assembly can fully withstand adverse weather conditions. The compact footprint of the unit arises from detailed study and design by our engineering teams and results in a machine, which fits easily in restricted areas and is simple and easy to install and maintain, and has been designed with special fittings for easy transport and lifting. Removable side panels with special locks are used to permit access only to authorized personnel to internal components of the unit for inspection and maintenance. Electrical and electronic equipment and components for proper unit operation are located in a weather proof (IP 55) electrical panel with access via a special key.

Compressor

All units use low-noise, maintenance free, Hermetic Scroll compressors with low vibration levels, specially optimized for

use with R410a refrigerant, selected from world class suppliers. They are equipped with a crankcase electrical heater for the oil and are internally protected against potential overloading or electrical spikes. The compressors are mounted on special antivibration rubber mounts to eliminate vibration from the unit's operation. Air heat exchanger coil All unit air heat exchangers are manufactured from high quality seamless inner grooved copper tubes according to ASTM B-280, having an outside diameter of 9,52 mm (3/8"). The fins are manufactured from aluminium and form the secondary extended heat transfer surface. The fins are continuous across the heat exchanger and are fabricated in high precision dedicated press lines. The fin surface is waffle formed, so as to increase the fin rigidity, and have special louvers that help increase heat transfer. The combination of internally grooved Copper-tubing and louvered fins has resulted in a heat transfer performance 30% superior to that of a conventional coil for this particular application. The assembly of the finned pack is achieved by mechanical expansion of the tubes in such a way as to form a perfect mechanical bond with the fins. For this purpose, the fin holes have a peripheral extrusion (collar) of adjustable height. This extrusion serves to define the distance between fins (and consequently the total heat transfer surface) and to ensure perfect contact of the fins to the tubes. Alternative fin materials are available upon request such as epoxy coated aluminium or copper for applications in especially aggressive environments.

Water heat exchanger

All units are equipped with a HP Shell and Tube water direct expansion type evaporator that has two separate cooling circuits, one for each compressor. The casing is of steel and the internal tubes are of copper. There is an air vent valve, drain valve, probes for water temperature sensors, differential pressure switch and the whole heat exchanger is wrapped in a heavy insulation material appropriate for external installation.

Air heat exchanger fans

All unit fans are of the axial type, single phase, 6 poles, internally protected against potential overheating, silent and suitable for outdoor installation. Due to the sophisticated aerodynamic design of the blades and inlet cones, as well as the perfect static and dynamic balancing, their operation is completely vibration-free. The fan motor assembly has a protective grid against accidental contact with moving parts, which is designed according to ISO regulations. Fan motors are of the external rotor type, aerodynamically shaped so as not to interfere with the airflow, and have permanently lubricated bearings that do not require servicing. Continuous linear fan speed regulation control is achieved according to coil temperature including fan silent mode operation. This standard feature for Klimalco MKAC - MKAH units saves energy and reduces sound levels dramatically, optimizing capacity.

Microprocessor controller

All units are equipped with a sophisticated controller that combines intelligence with operating simplicity. The controller constantly monitors all machine parameters and precisely manages among others:

- Automatic compressor control function through return water temperature.
- Continuous fan speed control based on coil heat exchanger temperature. Defrost control.

- Hydraulic circuit pump control.
- Compressor starting order control to reduce starting current.
- Compressor operation control based on running time.
- Compressor start up time delay function.
- Compressor running time records.
- Water pump running time records.
- Over 150 programmable parameters.
- Fan motor overload protection
- Auto diagnostic stop function due to low water circulation, high/low operating pressures, and compressor/pump thermal overload.
- Auto diagnostic function and digital display of approximately 30 possible error codes including thermistor faults.
- Digital displays of inlet / outlet water as well as coil temperatures of each circuit.
- Remote Cool/Heat selector switch.
- Remote on/ off switch.
- Remote alarm indication capability.
- Phase sequence - phase failure - reverse phase and voltage monitoring.
- Many optional control capabilities (listed in optional accessories).

Refrigerant circuit

Each Unit is equipped with two refrigerant circuits. Each circuit includes : thermostatic expansion valve, liquid line filter dryer with replaceable (029 - 046) or fixed (010 - 019) core and schrader service valves.

Heat pump units (MKAH) equipped additionally with suction accumulators, check valves, liquid receivers and 4-way reversing valves.

To protect the refrigerant circuit following devices are installed : manual reset high pressure switch, automatic reset low pressure switch, antifreeze NTC probe and heat

exchanger flow switch.

Optional accessories

- Microprocessor controller options
- Remote keyboard.
- Dynamic set point program via a 4-20ma proportional signal.
- BMS module interface kit for Modbus connection.
- Parallel chiller operation with optional controller.
- Microprocessor parameter reprogramming card.

Other unit accessories

- Reciprocating, scroll, or tandem scroll compressor availability based on specification.
- R407c refrigerant.
- Condenser fins made of copper or prepainted aluminum, and Blygold treatment for corrosion protection.
- Glycol application for chilled water low temperature down to 5°C.
- Pressure relief valve on compressor discharge.
- A-meter, V-meter.
- Hydraulic module with out buffer tank.
- Water heat exchanger antifreezing electrical heater.
- Compressor shut-off valves.
- Compressors soft starters.
- Power factor correction through capacitors.
- Compressor chamber noise reduction kit.
- Compressor noise reduction jacket.
- Liquid line sight glass.
- Hydronic module with buffer tank (HD series)
- Free cooling water coil with pump and 3-way valve (FC series)
- Two pumps (one stand by).
- Axial Fans with EC motors

3. Technical Specifications

MKAH 010 - 046 HEAT PUMPS

Type		Í ÍMEGÉČĆ	MKAH-013	MKAH-015	MKAH-019	MKAH-023	MKAH-029	MKAH-037	MKAH-046
Nominal cooling capacity R410A	kw	39,7	46,4	54,4	67,8	80,0	103,1	129,9	168,2
	RT	11,3	13,2	15,4	19,3	22,7	29,3	36,9	47,8
	BTU/H	135.331	158.311	185.305	231.266	272.850	351.641	442.834	573.423
Nominal heating capacity R410A	kw	45,6	52,9	61,8	77,3	91,0	117,3	147,9	190,9
	kcal/h	39.201	45.458	53.188	66.438	78.217	100.854	127.172	164.164
Construction	Material	Galvanized steel							
	Color	Grey - (RAL 7042)							
Compressor		SCROLL							
Quantity		2	2	2	2	2	2	2	2
Capacity steps		2	2	2	2	2	2	2	2
Absorbed power (cooling/heating)	kW	12,3/13,7	14,2/15,9	16,6/18,5	20,8/23,2	24,4/27,0	31,6/35,2	39,8/44,2	51,0/56,6
Nominal operating current	A	22,2/23,5	27,2/29,2	32,0/34,3	36,0/39,4	46,4/50,1	55,6/60,3	69,2/74,6	87,6/95,8
Maximum operating current	A	32,4	36,4	43,2	62,0	68,0	80,0	97,0	130,8
Air heat exchanger		High capacity cross finned coil with internally finned tubes and louver fins							
Water heat exchanger		Shell and Tube							
Quantity		1							
Water content	L	11,0	11,0	15,0	16,0	20,0	22,0	29,0	38,0
Maximum operating pressure bar	Water side	10							
	Refrigerant side	45							
FÖÖNNPÖÖDE		1 1/2"	2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	3"	3"
Nominal water flow	L/h	6.828	7.987	9.349	11.668	13.766	17.741	22.342	28.931
Water pressure drop	kpa	26,0	32,0	30,0	43,0	45,0	59,0	56,0	38,0
Minimum system water content	L	238	279	326	407	480	619	779	1009
Fan		AXIAL TYPE							
Quantity		2	2	2	3	3	4	6	6
Speed	rpm	900							
Total air flow	m³/h	17.400	17.400	17.400	26.100	26.100	34.800	52.200	52.200
Absorbed power	kW	1,2	1,2	1,2	1,8	1,8	2,4	3,5	3,5
Nominal operating current	A	5,4	5,4	5,4	8,1	8,1	10,8	16,2	16,2
Maximum operating current	A	6,0	6,0	6,0	9,0	9,0	12,0	18,0	18,0
Electrical characteristics		Electric network 400 V/3 Ø/50 Hz							
Total absorbed power (cooling/heating)	kW	13,5/14,9	15,4/17,1	17,8/19,7	22,6/25,0	26,2/28,8	34,0/37,6	43,3/47,7	54,5/60,1
Nominal operating current	A	27,6/28,9	32,6/34,6	37,4/39,7	44,1/47,5	54,5/58,2	66,4/71,1	85,4/90,8	103,8/112,0
Maximum operating current	A	38,4	42,4	49,2	71,0	77,0	92,0	115,0	148,8
Compressor carter resistance power	kW	0,14	0,14	0,14	0,14	0,14	0,18	0,18	0,18
Power cables cross section	mm²	16	16	16	35	35	50	70	95
Fuses		3x50	3x50	3x63	3x80	3x80	3x100	3x160	3x160
Voltage operating limits	V	360-440 V							
Refrigerant circuit		Thermal Expansion Valves							
Number of circuits		2	2	2	2	2	2	2	2
Expansion device		R 410A							
Refrigerant type		R 410A							
Noise level at 5 m	dbA	52	53	53	55	56	67	68	69
Dimensions	Width	mm	1100	1100	1100	1100	1653	1653	1653
	Length	mm	2768	2768	2768	3168	3006	3409	3409
	Height	mm	1382	1382	1382	1382	1500	1800	1800
Shipping weight	kg	710	770	780	810	890	1.300	1.500	1.600

MKAC 010 - 023 COOLING ONLY

Type		HE FÄČĆ	MKAC-013	MKAC-015	MKAC-019	MKAC-023	MKAC-029	MKAC-037	MKAC-046	
Nominal cooling capacity R407C	kw	39,7	46,4	54,4	67,8	80,0	103,1	129,9	168,2	
	RT	11,3	13,2	15,4	19,3	22,7	29,3	36,9	47,8	
	BTU/H	135.331	158.311	185.305	231.266	272.850	351.641	442.834	573.423	
Construction	Material	Galvanized steel								
	Color	Grey - (RAL 7042)								
Compressor		SCROLL								
Quantity		2	2	2	2	2	2	2	2	
Capacity steps		2	2	2	2	2	2	2	2	
Absorbed power (cooling/heating)	kW	12,3	14,2	16,6	20,8	24,4	31,6	39,8	51	
Nominal operating current	A	22	27,2	32	36	46,4	55,6	69,2	87,6	
Maximum operating current	A	32,4	36,4	43,2	62,0	68,0	80,0	97,0	130,8	
Air heat exchanger		High capacity cross finned coil with internally finned tubes and louver fins								
Water heat exchanger		Shell and Tube								
Quantity		1								
Water content	L	11,0	11,0	15,0	16,0	20,0	22,0	29,0	38,0	
Maximum operating pressure bar	Water side	10								
	Refrigerant side	45								
Connections		1 1/2"	2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	3"	3"	
Nominal water flow	L/h	6.828	7.987	9.349	11.668	13.766	17.741	22.342	28.931	
Water pressure drop	kpa	26,0	32,0	30,0	43,0	45,0	59,0	56,0	38,0	
Minimum system water content	L	238	279	326	407	480	619	779	1009	
Fan		tří Héj Kříž								
Quantity		2	2	2	3	3	4	6	6	
Speed	rpm	900								
Total air flow	m³/h	17.400	17.400	17.400	26.100	26.100	34.800	52.200	52.200	
Absorbed power	kW	1,2	1,2	1,2	1,8	1,8	2,4	3,5	3,5	
Nominal operating current	A	5,4	5,4	5,4	8,1	8,1	10,8	16,2	16,2	
Maximum operating current	A	6,0	6,0	6,0	9,0	9,0	12,0	18,0	18,0	
Electrical characteristics		Electric network 400 V/3 Φ/50 Hz								
Total absorbed power	kW	13,5	15,4	17,8	22,6	26,2	34,0	43,3	54,5	
Nominal operating current	A	27,4	32,6	37,4	44,1	54,5	66,4	85,4	103,8	
Maximum operating current	A	38,4	42,4	49,2	71,0	77,0	92,0	115,0	148,8	
Compressor carter resistance power	kW	0,14	0,14	0,14	0,14	0,14	0,18	0,18	0,18	
Power cables cross section	mm²	16	16	16	35	35	50	70	95	
Fuses		3x50	3x50	3x63	3x80	3x80	3x100	3x160	3x160	
Voltage operating limits	V	360-440 V								
Refrigerant circuit		Thermal Expansion Valves								
Number of circuits		2	2	2	2	2	2	2	2	
Expansion device		R 410A								
Refrigerant type		R 410A								
Noise level at 5 m	dbA	52	53	53	55	56	67	68	69	
Dimensions	Width mm	1100	1100	1100	1100	1100	1653	1653	1653	
	Length mm	2768	2768	2768	3168	3168	3006	3409	3409	
	Height mm	1382	1382	1382	1382	1382	1500	1800	1800	
Shipping weight	kg	680	740	750	770	850	1.260	1.440	1.540	

Notes

Cooling mode: water temperature 12/7°C, ambient 35°CDB.

Heating mode: water temperature 40°/45°C, ambient 7°CDB

4. Capacity Tables



Cooling capacity table for MKAC - MKAH 010-046

Type	Water outlet °C	ÉÖ NÖÖPPNÖ ÖVAMPÖÄF														
		25			30			35			40			44		
		Cooling capacity kw	Absorbed power kw	Current A	Cooling capacity kw	Absorbed power kw	Current A	Cooling capacity kw	Absorbed power kw	Current A	Cooling capacity kw	Absorbed power kw	Current A	Cooling capacity kw	Absorbed power kw	Current A
MKAC-010	5	42,0	9,9	19,4	39,5	11,1	20,5	36,8	12,3	21,9	33,9	13,8	23,5	31,4	15,0	24,9
	7	45,2	9,9	19,5	42,5	11,1	20,6	39,7	12,3	22,0	36,5	13,8	23,7	33,9	15,0	25,0
	10	50,3	9,9	19,6	47,1	11,1	20,8	44,1	12,3	22,0	40,8	13,8	23,8	37,9	15,0	25,2
MKAC-013	5	49,1	11,6	24,1	46,2	13,0	25,5	43,1	14,3	27,2	39,6	16,1	29,2	36,7	17,5	30,9
	7	52,8	11,5	24,1	49,6	12,8	25,5	46,4	14,2	27,2	42,6	15,9	29,2	39,7	17,3	30,9
	10	58,8	11,5	24,1	55,1	12,8	25,5	51,6	14,2	27,0	47,7	15,9	29,2	44,3	17,3	30,9
MKAC-015	5	57,6	13,4	28,4	54,2	15,0	30,0	50,5	16,6	32,0	46,5	18,6	34,4	43,0	20,2	36,4
	7	61,9	13,4	28,4	58,2	15,0	30,0	54,4	16,6	32,0	50,0	18,6	34,4	46,5	20,2	36,4
	10	68,9	13,4	28,4	64,6	15,0	30,0	60,5	16,6	31,8	55,9	18,6	34,4	52,0	20,2	36,4
MKAC-019	5	71,8	16,8	32,0	67,5	18,8	33,8	62,9	20,8	36,0	57,9	23,3	38,7	53,6	25,3	41,0
	7	77,1	16,8	32,0	72,5	18,8	33,8	67,8	20,8	36,0	62,3	23,3	38,7	58,0	25,3	41,0
	10	85,9	16,8	32,0	80,5	18,8	33,9	75,4	20,8	35,9	69,7	23,3	38,8	64,8	25,3	41,1
MKAC-023	5	85,4	19,7	41,2	80,4	22,0	43,5	74,9	24,4	46,4	69,0	27,3	49,9	63,8	29,7	52,8
	7	91,0	19,7	41,2	85,6	22,0	43,5	80,0	24,4	46,4	73,5	27,3	49,9	68,4	29,7	52,8
	10	101,3	19,7	41,2	95,0	22,0	43,5	89,0	24,4	46,4	82,2	27,3	50,2	76,5	29,7	53,1
MKAC-029	5	109,1	25,7	49,2	102,7	28,7	51,9	95,7	31,8	55,4	88,1	35,6	59,6	81,5	38,7	63,0
	7	117,3	25,5	49,3	110,3	28,7	51,9	103,1	31,6	55,6	94,8	35,4	59,8	88,1	38,5	63,2
	10	130,6	25,5	49,3	122,4	28,7	51,9	114,6	31,6	55,6	105,9	35,4	60,1	98,5	38,5	63,6
MKAC-037	5	137,5	32,1	61,3	129,4	36,0	64,8	120,5	39,8	69,1	111,0	44,6	74,3	102,6	48,4	78,6
	7	147,8	32,1	61,3	139,0	36,0	64,9	129,9	39,8	69,2	119,4	44,6	74,4	111,0	48,4	78,7
	10	164,5	32,1	63,0	154,2	36,0	65,3	144,4	39,8	69,2	133,0	44,6	74,9	123,7	48,4	79,2
MKAC-046	5	178,0	41,2	77,7	167,5	46,1	82,0	156,1	51,0	87,5	143,7	57,1	94,1	132,9	62,1	99,5
	7	191,4	41,2	77,7	179,9	46,1	82,0	168,2	51,0	87,6	154,6	57,1	94,2	143,8	62,1	99,6
	10	213,0	41,2	78,2	199,7	46,1	82,0	187,0	51,0	87,6	172,8	57,1	94,8	160,8	62,1	100,3

Heating capacity table for MKAH 010-046

Type	Water outlet °C	Ambient temperature °C														
		-5			0			2			7			10		
		Heating capacity kw	Absorbed power kw	Current A	Heating capacity kw	Absorbed power kw	Current A	Heating capacity kw	Absorbed power kw	Current A	Heating capacity kw	Absorbed power kw	Current A	Heating capacity kw	Absorbed power kw	Current A
MKAH-010	35	32,2	11,0	19,4	39,0	11,0	19,6	40,9	11,0	19,6	48,1	11,2	19,8	46,7	17,2	28,2
	40				38,4	12,3	21,0	39,8	12,4	21,2	46,8	12,5	21,4	48,0	15,4	25,7
	45							38,8	13,6	23,3	45,6	13,7	23,5	49,4	13,7	23,6
MKAH-013	35	38,9	12,7	25,4	45,2	12,5	25,3	47,4	12,5	25,3	55,8	12,8	25,6	54,2	19,9	35,1
	40				44,5	13,9	26,7	46,2	14,1	26,9	54,3	14,2	27,2	55,7	17,9	32,0
	45							45,0	15,7	28,9	52,9	15,9	29,2	57,3	15,9	29,3
MKAH-015	35	45,7	14,4	29,4	52,9	14,5	0,0	56,2	14,5	29,7	65,3	14,8	30,0	63,3	23,2	41,2
	40				52,2	16,3	0,0	54,7	16,4	31,7	63,6	16,6	32,0	65,0	20,8	37,5
	45							53,1	18,3	34,0	61,8	18,5	34,3	66,9	18,5	34,5
MKAH-019	35	57,6	18,2	32,6	67,2	18,4	32,8	71,2	18,4	32,8	82,1	18,6	33,0	89,6	18,7	33,2
	40				65,5	20,4	35,6	69,3	20,6	35,8	79,8	20,8	36,0	86,7	20,8	36,0
	45							67,2	23,0	39,2	77,3	23,2	39,4	83,7	23,2	39,6
MKAH-023	35	67,6	21,4	42,1	79,1	21,4	42,0	83,9	21,4	42,0	96,5	21,8	43,0	105,5	21,8	42,6
	40				77,1	23,9	45,6	81,7	24,0	45,9	93,7	24,2	46,2	102,1	24,2	46,1
	45							81,5	26,8	50,2	91,0	27,0	50,5	98,5	27,0	50,8
MKAH-029	35	86,9	27,6	50,2	100,5	27,6	50,7	107,9	27,7	49,7	124,1	28,2	51,2	120,2	44,1	72,4
	40				98,8	30,8	54,3	105,1	31,1	54,8	120,5	31,4	55,4	123,4	39,6	66,0
	45							105,0	34,9	59,7	117,3	35,2	60,3	127,0	35,2	60,6
MKAH-037	35	109,8	35,1	63,4	127,1	35,1	63,4	136,5	35,2	62,1	156,9	35,8	64,0	151,6	55,4	89,6
	40				125,0	39,0	67,8	132,9	39,4	68,5	152,4	39,8	69,2	155,7	49,8	81,6
	45							132,4	43,8	73,9	147,9	44,2	74,6	160,1	44,2	75,0
MKAH-046	35	141,5	44,7	79,4	163,8	44,7	79,4	175,9	44,8	77,8	202,2	45,6	80,2	195,7	71,0	115,1
	40				161,0	49,8	85,7	171,2	50,3	86,5	196,4	50,8	87,4	200,9	63,7	104,8
	45							170,9	56,1	94,8	190,9	56,6	95,8	206,7	56,6	96,3

Notes

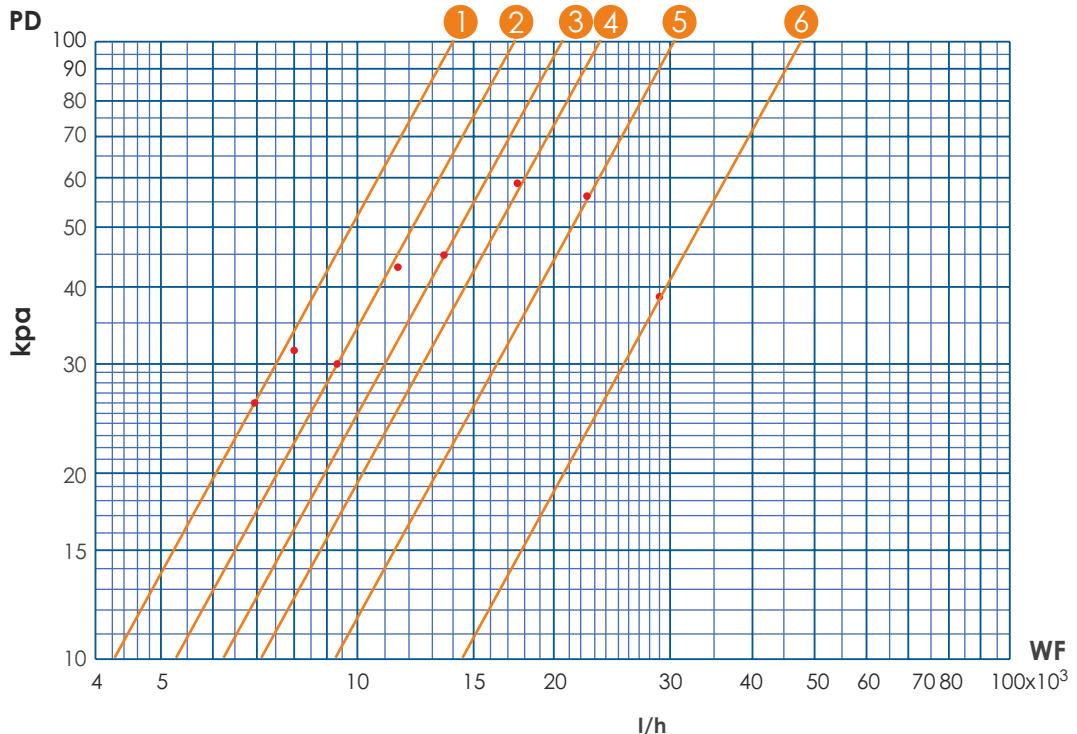
Bold values show nominal cooling/heating capacities.

Absorbed power and current refers to the compressor. Above figures are valid for water $\Delta t = 5^\circ\text{C}$.

5. Water Pressure Drop



MKAC - MKAH 010-046



Notes

- PD : Pressure Drop
- WF : Water Flow Rate
- 1. MKAC - MKAH 010 - 013
- 2. MKAC - MKAH 015 - 019

- 3. MKAC - MKAH 023
- 4. MKAC - MKAH 029
- 5. MKAC - MKAH 037
- 6. MKAC - MKAH 046

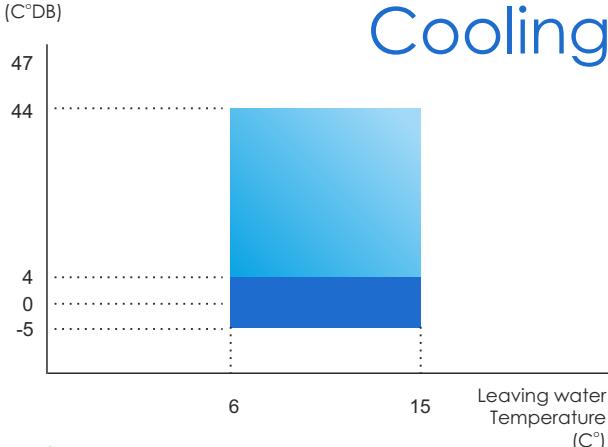
Ethylene Glycol Correction Factors

% Ethylene Glycol by volume	Unit	10	20	30	40
Freezing point	°C	-4	-9	-15	-23
Output duty	KW	0,99	0,98	0,97	0,96
Input power	KW	0,99	0,98	0,98	0,97
Equivalent Flow rate	L/H	1,02	1,04	1,08	1,13
Equivalent pressure drop	kPa	1,06	1,12	1,18	1,25

6. Operation Range

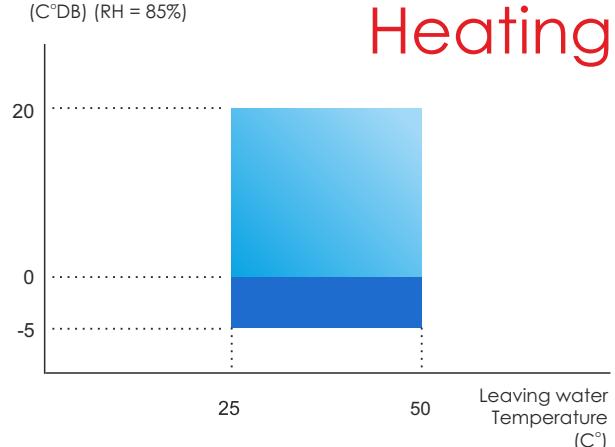


Outdoor Temperature
(C°DB)



Cooling

Outdoor Temperature
(C°DB) (RH = 85%)



Heating

Notes

Protect the water circuit against freezing

- The accompanying operating limits are for general guidance only. It may be possible for certain units to operate outside the confines of the graph. Please contact Klimallco if further clarification is required.

For operation with leaving water temperature below 6°C it is required to confirm with Klimallco at the time of order and the addition of glycol into the system.

7. Sound Data



Type		dB(A)	Octave band center frequency (Hz)							
			63	125	250	500	1000	2000	4000	8000
010	Power	74	78	70	71	71	71	64	56	47
	Pressure @1 m	66	70	62	63	63	63	56	48	39
	Pressure @10 m	46	50	42	43	43	43	36	28	19
013	Power	75	78	70	72	72	72	65	58	49
	Pressure @1 m	67	70	62	64	64	64	57	50	41
	Pressure @10 m	47	50	42	44	44	44	37	30	21
015	Power	75	78	70	72	72	72	65	58	49
	Pressure @1 m	67	70	62	64	64	64	57	50	41
	Pressure @10 m	47	50	42	44	44	44	37	30	21
019	Power	77	79	72	72	73	72	66	58	50
	Pressure @1 m	69	71	64	64	65	64	58	50	42
	Pressure @10 m	49	51	44	44	45	44	38	30	22
023	Power	78	79	73	72	73	72	65	59	50
	Pressure @1 m	70	71	65	64	65	64	57	51	42
	Pressure @10 m	50	51	45	44	45	44	37	31	22
029	Power	89	80	83	79	79	85	79	74	66
	Pressure @1 m	81	72	75	71	71	77	71	66	58
	Pressure @10 m	61	52	55	51	51	57	51	46	38
037	Power	90	81	84	80	79	86	80	74	67
	Pressure @1 m	82	73	76	72	71	78	72	66	59
	Pressure @10 m	62	53	56	52	51	58	52	46	39
046	Power	91	81	85	81	81	87	81	74	66
	Pressure @1 m	83	73	77	73	73	79	73	66	58
	Pressure @10 m	63	53	57	53	53	59	53	46	38

8. Free Cooling Capacity Tables



Free cooling capacity table for MKAC - MKAH FC

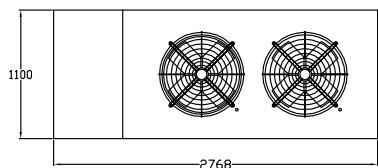
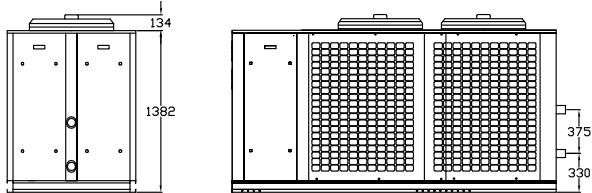
AMBIENT TEMPERATURE °C	GÖGGÍTHÉFÉFHAKÁRÁ							
	BRINE INLET 12°C							
ČČ GF	13 FC	15 FC	19 FC	23 FC	29 FC	37 FC	46 FC	
14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
13	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
10	2,20	2,80	2,80	3,30	3,80	4,30	6,50	7,30
9	4,99	5,98	6,32	7,41	8,60	9,64	14,33	16,26
8	7,73	9,10	9,78	11,43	13,30	14,86	22,01	25,04
7	10,41	12,16	13,16	15,37	18,20	19,98	29,53	33,64
6	13,03	15,16	16,46	19,23	24,79	25,00	36,89	42,06
5	15,60	18,10	19,70	23,00	28,50	29,90	44,10	50,30
4	18,11	20,98	22,86	26,69	32,19	34,70	51,15	58,36
3	20,57	23,80	25,96	30,29	35,87	39,38	58,05	66,24
2	22,97	26,56	28,98	33,81	39,53	43,96	64,79	73,94
1	25,31	29,26	31,92	37,25	43,17	48,44	71,37	81,46
0	27,60	31,90	34,80	40,60	46,80	52,80	77,80	88,80
-1	29,83	34,48	37,60	43,87	50,41	57,06	84,07	95,96
-2	32,01	37,00	40,34	47,05	54,01	61,20	90,19	102,94
-3	34,13	39,46	43,00	50,15	57,59	65,24	96,15	109,74
-4	36,19	41,86	45,58	53,17	61,15	69,18	101,95	116,36
-5	38,20	44,20	48,10	56,10	64,70	73,00	107,60	122,80
-6	40,15	46,48	50,54	58,95	68,23	76,72	113,09	129,06
-7	42,05	48,70	52,92	61,71	71,75	80,32	118,43	135,14
-8	43,89	50,86	55,22	64,39	75,25	83,82	123,61	141,04
-9	45,67	52,96	57,44	66,99	78,73	87,22	128,63	146,76
-10	47,40	55,00	59,60	69,50	82,20	90,50	133,50	152,30
-11	49,07	56,98	61,68	71,93	85,65	93,68	138,21	157,66
-12	50,69	58,90	63,70	74,27	89,09	96,74	142,77	162,84
-13	52,25	60,76	65,64	76,53	92,51	99,70	147,17	167,84
-14	53,75	62,56	67,50	78,71	95,91	102,56	151,41	172,66
-15	55,20	64,30	69,30	80,80	99,30	105,30	155,50	177,30

AMBIENT TEMPERATURE °C	FREE COOLING CAPACITY (Kw)							
	BRINE INLET 15°C							
10 FC	13 FC	15 FC	19 FC	23 FC	29 FC	37 FC	46 FC	
14	2,30	2,66	2,90	3,38	3,90	4,40	6,48	7,40
13	4,60	5,32	5,80	6,76	7,80	8,80	12,96	14,80
12	6,90	7,98	8,70	10,14	11,70	13,20	19,44	22,20
11	9,20	10,64	11,60	13,52	15,60	17,60	25,92	29,60
10	11,50	13,30	14,50	16,90	19,50	22,00	32,40	37,00
9	13,80	15,96	17,40	20,28	23,40	26,40	38,88	44,40
8	16,10	18,62	20,30	23,66	27,30	30,80	45,36	51,80
7	18,40	21,28	23,20	27,04	31,20	35,20	51,84	59,20
6	20,70	23,94	26,10	30,42	35,10	39,60	58,32	66,60
5	23,00	26,60	29,00	33,80	39,00	44,00	64,80	74,00
4	25,30	29,26	31,90	37,18	42,90	48,40	71,28	81,40
3	27,60	31,92	34,80	40,56	46,80	52,80	77,76	88,80
2	29,90	34,58	37,70	43,94	50,70	57,20	84,24	96,20
1	32,20	37,24	40,60	47,32	54,60	61,60	90,72	103,60
0	34,50	39,90	43,50	50,70	58,50	66,00	97,20	111,00
-1	36,80	42,56	46,40	54,08	62,40	70,40	103,68	118,40
-2	39,10	45,22	49,30	57,46	66,30	74,80	110,16	125,80
-3	41,40	47,88	52,20	60,84	70,20	79,20	116,64	133,20
-4	43,70	50,54	55,10	64,22	74,10	83,60	123,12	140,60
-5	46,00	53,20	58,00	67,60	78,00	88,00	129,60	148,00
-6	48,30	55,86	60,90	70,98	81,90	92,40	136,08	155,40
-7	50,60	58,52	63,80	74,36	85,80	96,80	142,56	162,80
-8	52,90	61,18	66,70	77,74	89,70	101,20	149,04	170,20
-9	55,20	63,84	69,60	81,12	93,60	105,60	155,52	177,60
-10	57,50	66,50	72,50	84,50	97,50	110,00	162,00	185,00
-11	59,80	69,16	75,40	87,88	101,40	114,40	168,48	192,40
-12	62,10	71,82	78,30	91,26	105,30	118,80	174,96	199,80
-13	64,40	74,48	81,20	94,64	109,20	123,20	181,44	207,20
-14	66,70	77,14	84,10	98,02	113,10	127,60	187,92	214,60
-15	69,00	79,80	87,00	101,40	117,00	132,00	194,40	222,00

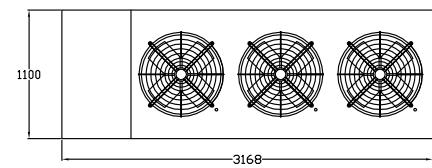
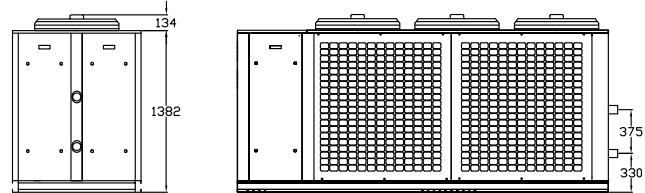
9. Outlook Drawings



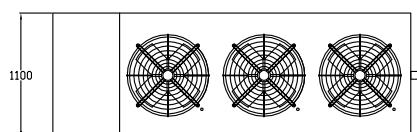
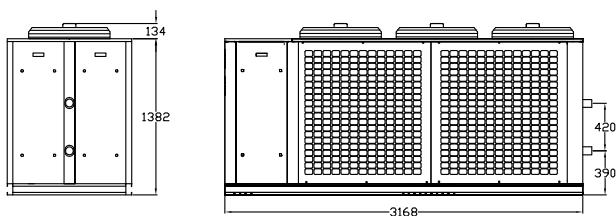
MKAC - MKAH 010-015 HD/FC



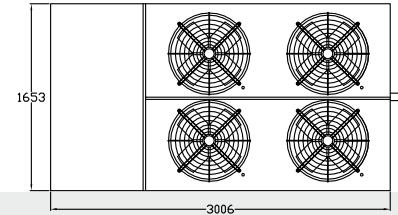
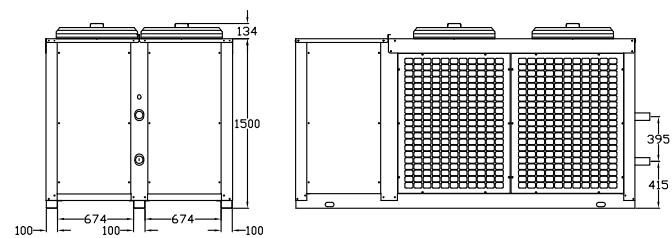
MKAC - MKAH 019 HD/FC



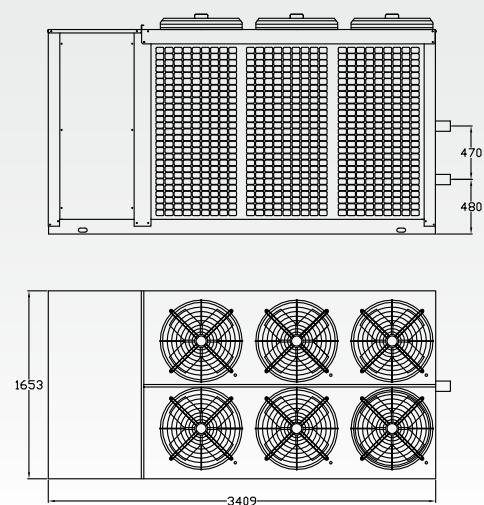
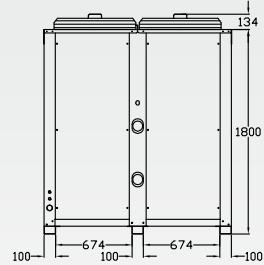
MKAC - MKAH 023 HD/FC



MKAC - MKAH 029 HD/FC



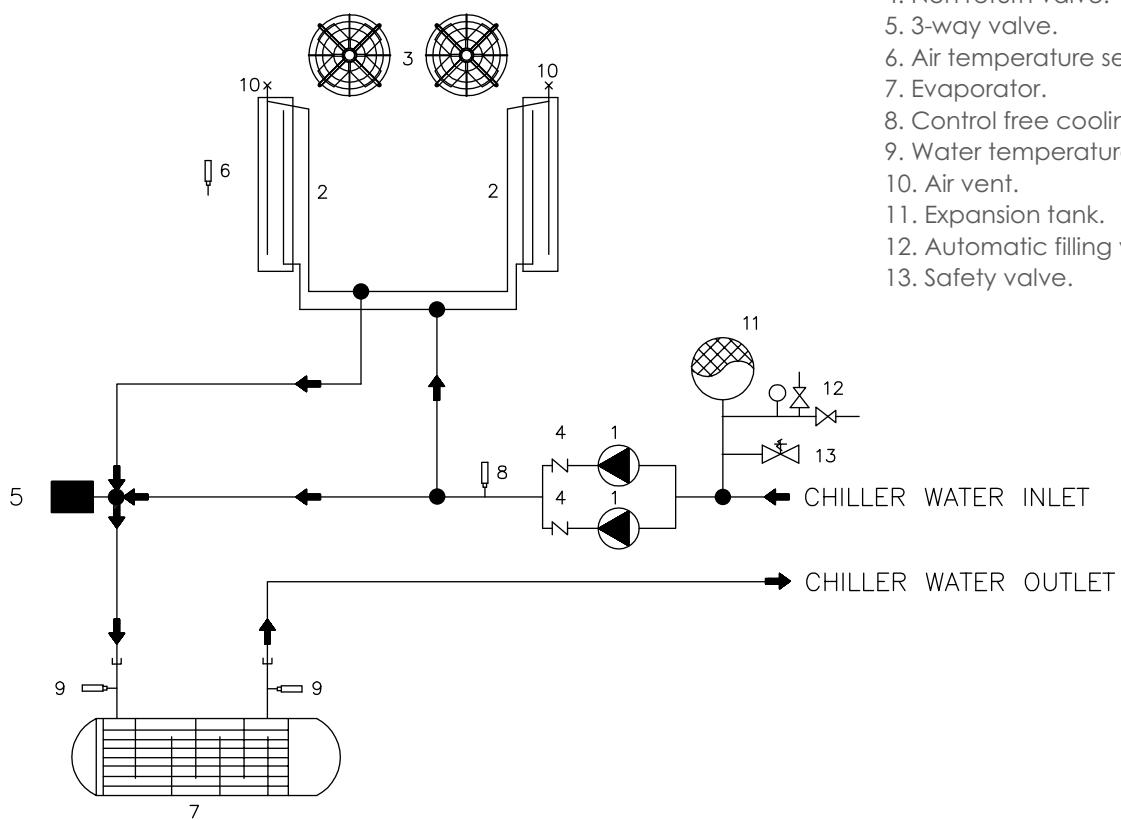
MKAC - MKAH 037-046 HD/FC



10. Hydraulic Circuit

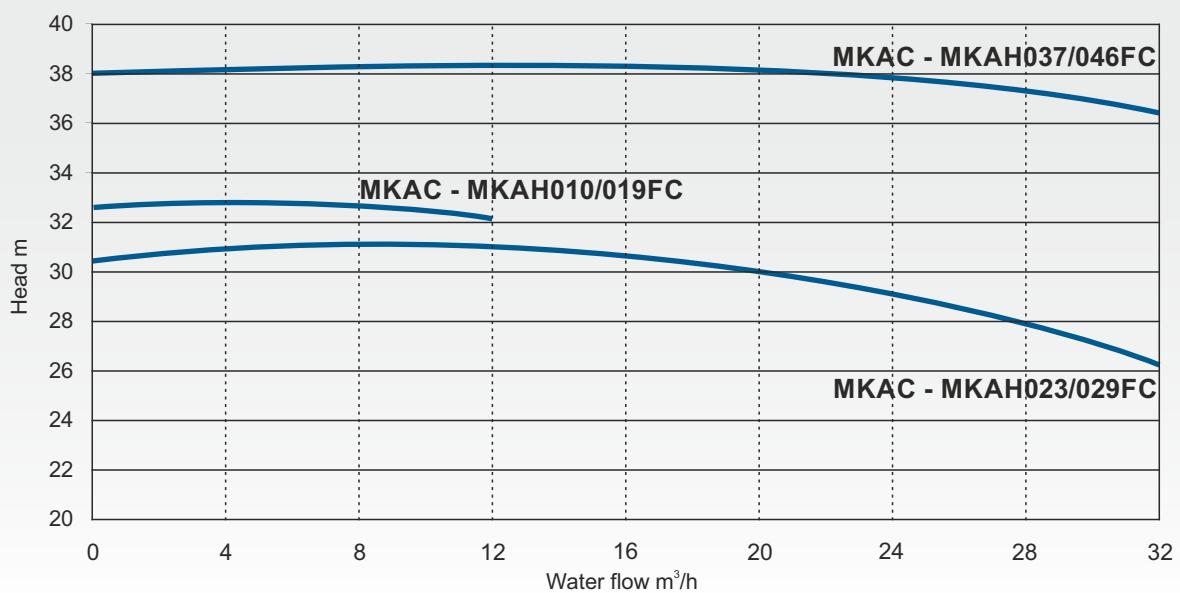


MKAC - MKAH with Free Cooling

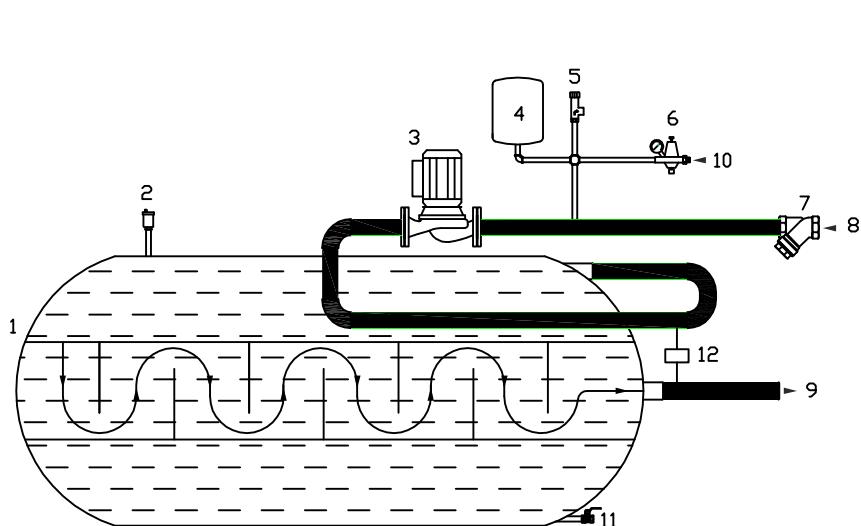


Notes

1. Water Pump.
2. Free Cooling coil.
3. Axial fan.
4. Non return valve.
5. 3-way valve.
6. Air temperature sensor.
7. Evaporator.
8. Control free cooling sensor.
9. Water temperature sensor.
10. Air vent.
11. Expansion tank.
12. Automatic filling valve with manometer.
13. Safety valve.



11. Hydronic Circuit Diagram

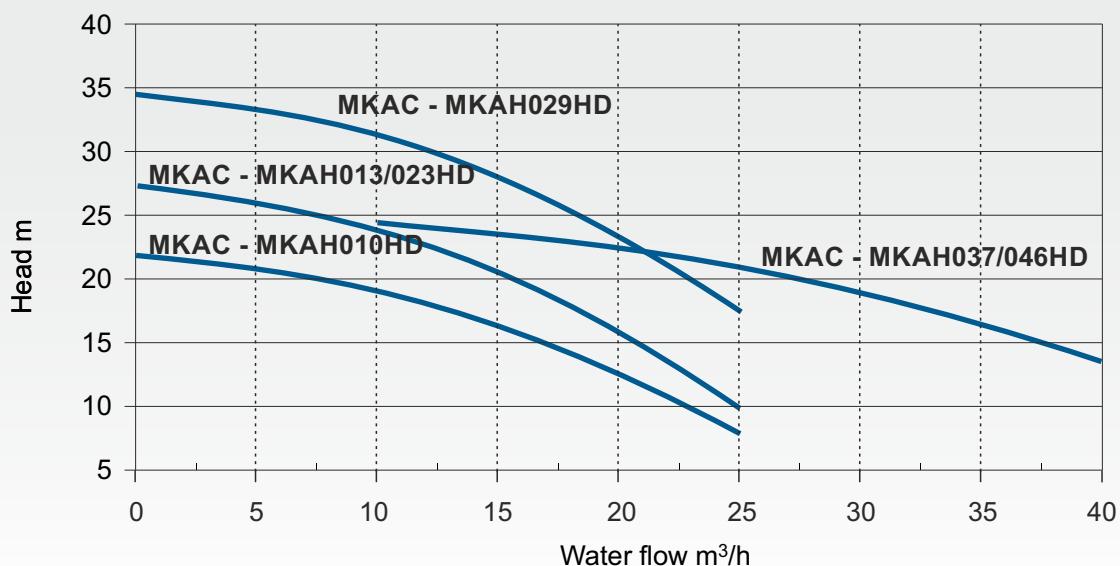


Notes

1. Tank with heat exchanger.
2. Air vent.
3. Pump.
4. Expansion tank.
5. Safety valve.
6. Auto filling.
7. Filter.
8. Inlet water.
9. Outlet water.
10. Filling water.
11. Drain valve.
12. Differential pressure switch.

í ÖNNO	10HD	13HD	15HD	19HD	23HD	29HD	37HD	46HD
Tank volume Ö³	190	190	190	190	290	290	660	660
Pump abs. powerkW	1.1	1.5	1.5	1.5	1.5	2.2	2.2	2.2
Water inlet	2"	2"	2"	2"	2"	2"	6"	6"
Water outlet	2"	2"	2"	2"	2"	2"	6"	6"

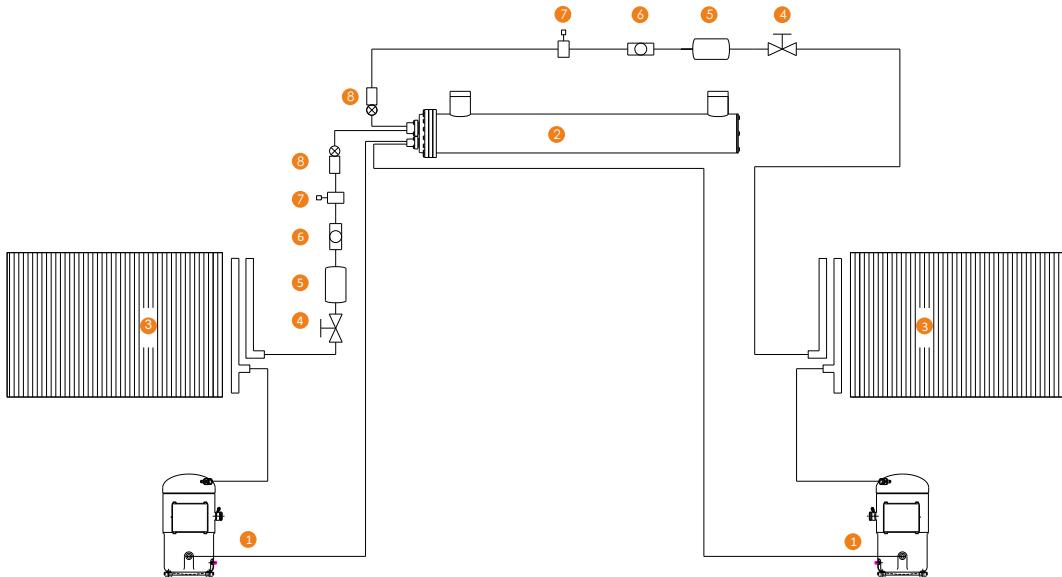
8.4 Control circuit diagram



12. Refrigerant Circuit Diagramms



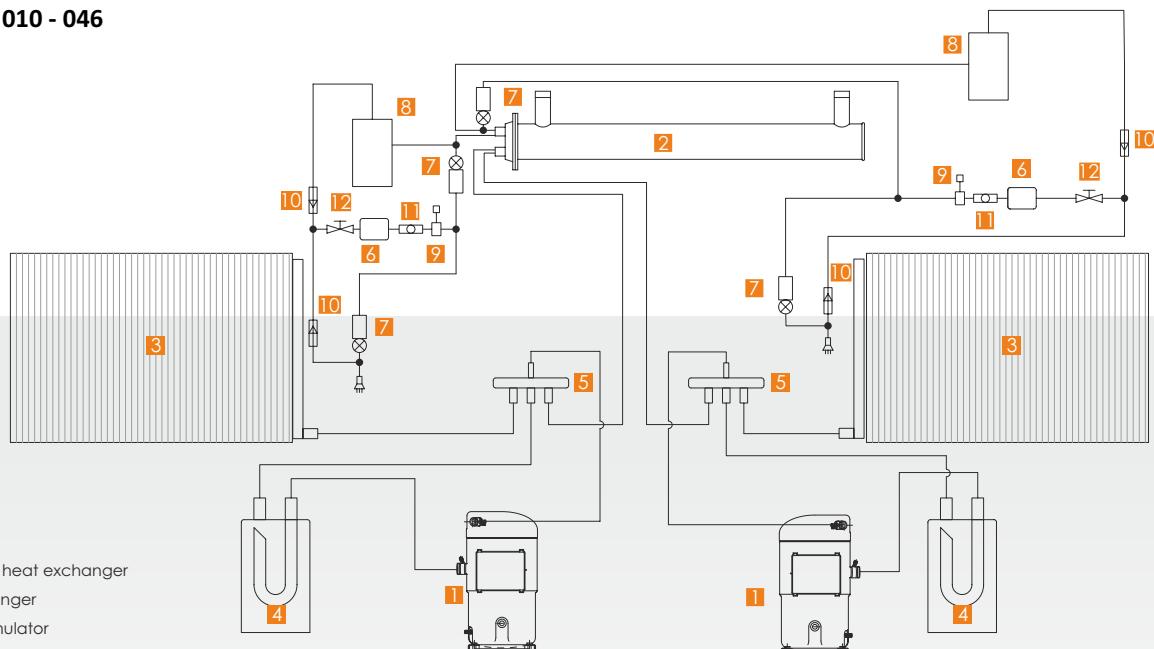
11.1 MKAC 010 - 046.



Notes

1. Compressor
2. Air Heat exchanger
3. Shell and tube heat exchanger
4. Shut off valve
5. Filter dryer
6. Sight glass
7. Solenoid valve
8. Expansion device (Thermal expansion valve)

11.2 MKAH 010 - 046



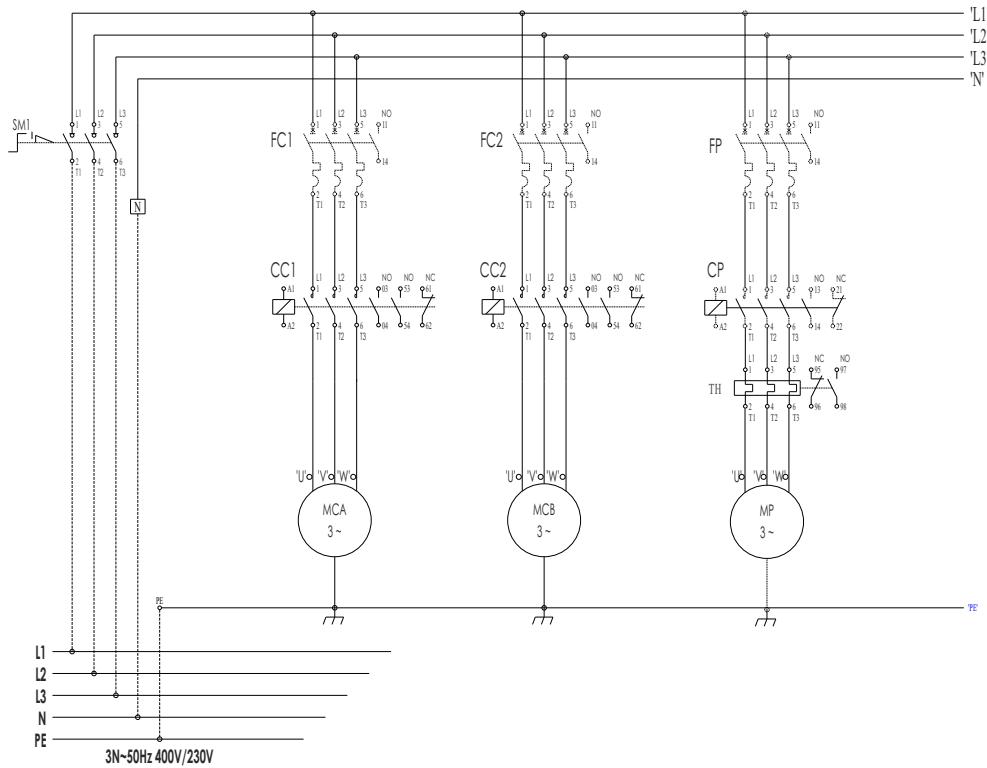
Notes

1. Compressor
2. Shell and tube heat exchanger
3. Air heat exchanger
4. Suction accumulator
5. 4-way reversing valve
6. Filter dryer
7. Expansion device (Thermal expansion valve)
8. Liquid receiver
9. Solenoid valve
10. Check valve
11. Sight glass
12. Shut off valve

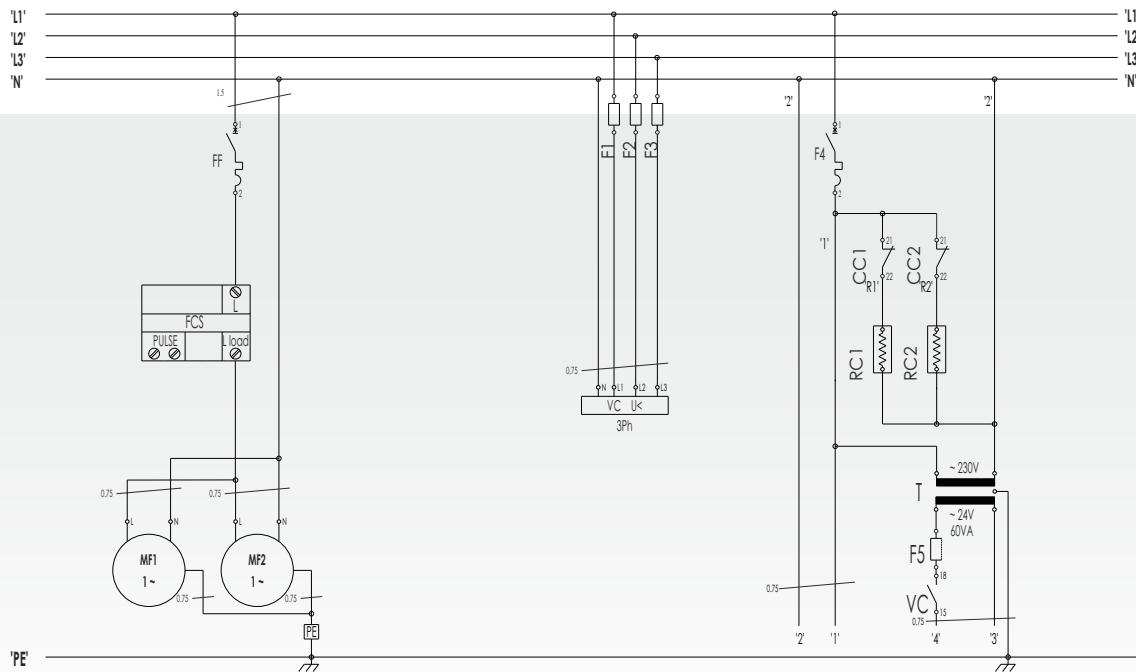
13. Wiring Diagramms



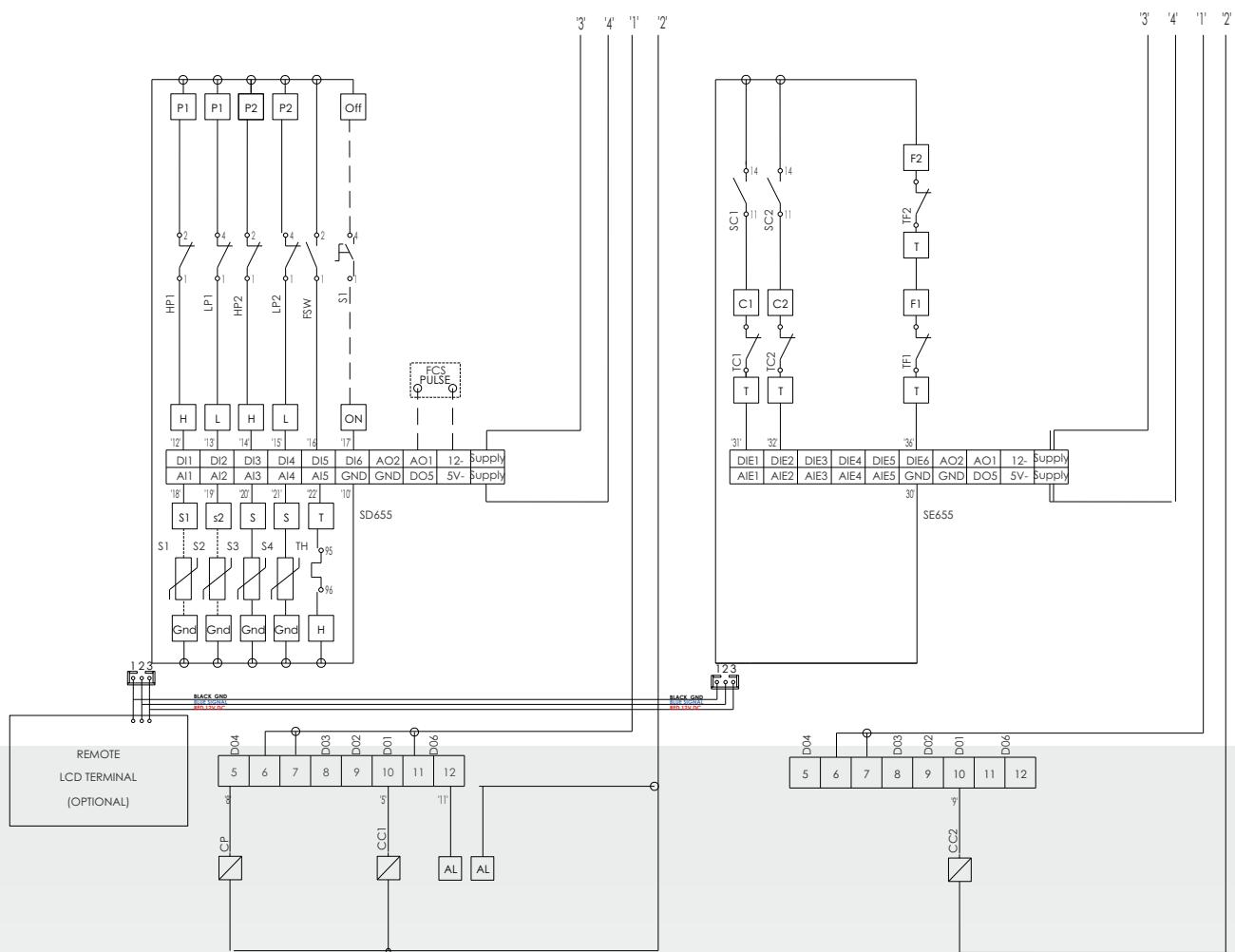
13.1 Power Circuit



13.2 Control Circuit



13.4 Remote Control



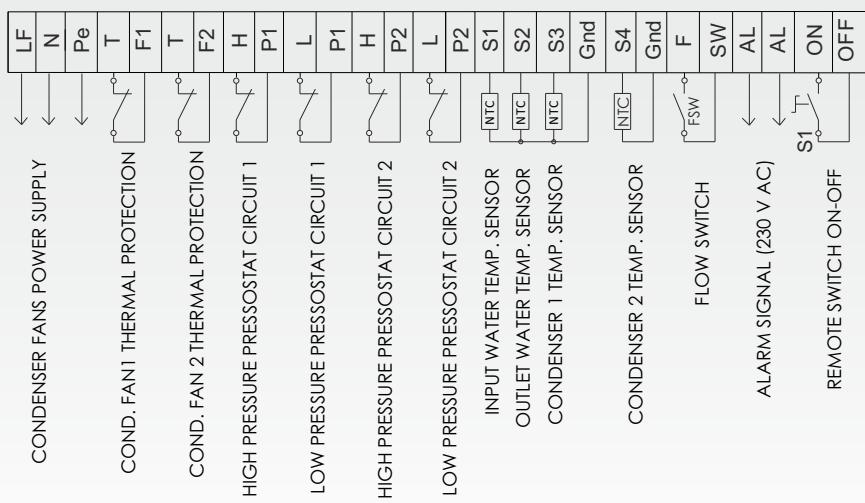
13.4 Symbols

SM1	Main switch-disconnector
FC	Compressor's circuit breaker
CC	Compressor's contactor
TC	Compressor's thermal overload protection
FF	Condenser fans' circuit breaker
FCS	Condenser fans' speed controller
TF	Condenser fan's thermistor
F	Fuse
VC	3 phase voltage surveyor
RC	Compressor's crankcase heater
T	Transformer 230VAC / 24VAC
MC	Compressor's motor
MF	Condenser fan's motor
MP	Pump motor
HP	High pressure switch
LP	Low pressure switch
T.IN(S1)	Water inlet temperature NTC probe
T.OUT(S2)	Water outlet temperature NTC probe
T.COND_(S3,S4)	Condenser temperature NTC probe
FS	Flow switch
TH	Pump motor thermal protection
CP	Pump motor contactor
FP	Pump motor circuit breaker

Main Alarm Table	
ER01	High pressure switch circuit 1
ER02	High pressure switch circuit 2
ER05	Low pressure switch circuit 1
ER06	Low pressure switch circuit 2
ER10	Compressor 1 circuit breaker
ER11	Compressor 2 circuit breaker
ER21	Water pump motor thermal protection / circuit breaker
ER41	Circuit 1 condenser fan thermal protection
ER42	Circuit 2 condenser fan thermal protection
ER60	Inlet water temp.sensor (S1)
ER61	Outlet water temp. sensor (S2)
ER62	Condenser temp. sensor (S3-S4)

Field Connections	
AL-AL ON-OFF	ALARM SIGNAL (230V AC) REMOTE ON OFF SWITCH DRY CONTACT (S1)

13.4 Field Connections



14. Installation



14.1 Selection of location - service space

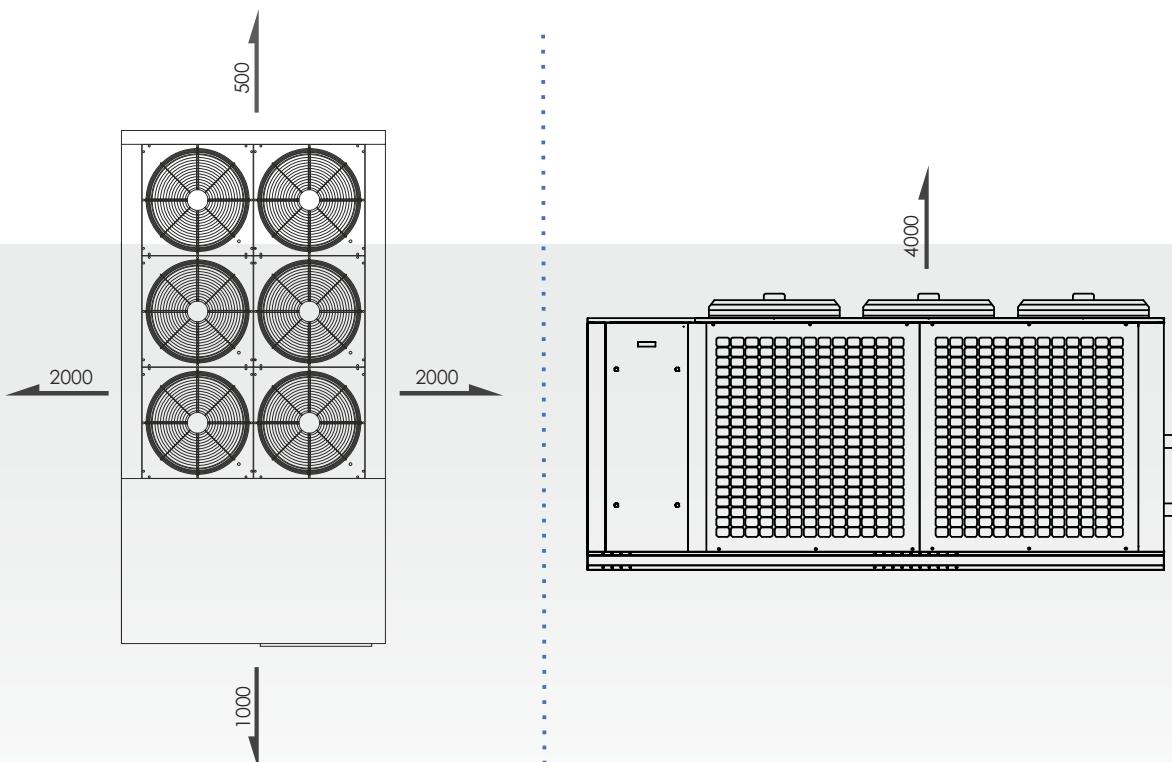
The MKAC - MKAH unit should be installed in a location that meets the following requirements:

1. The foundation is strong enough to support the weight of the unit, and the floor is flat to prevent vibration and noise generation.
2. The space around the unit is adequate for servicing and the minimum space air inlet and air outlet is available. If several units are being installed side by side in parallel, the minimum service space between them must be taken into account.
3. There is no danger of fire due to leakage of inflammable gas.
4. Ensure that water cannot cause any damage to the location in case it drips out the unit.
5. Make sure that the air inlet and outlet of the unit are not

positioned towards the main wind direction. Frontal wind shall disturb the operation of the unit. If necessary, use a windscreens to block the wind.

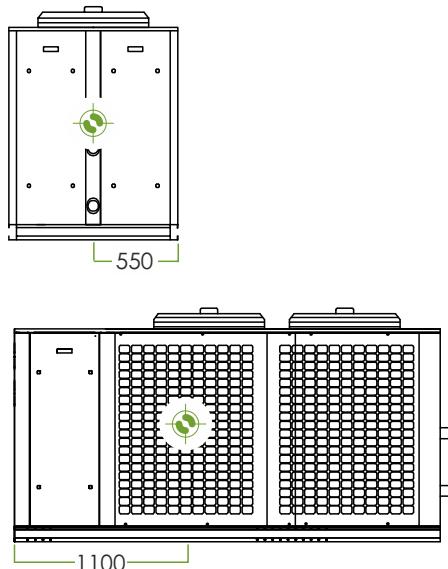
6. In heavy snowfall areas, select an installation site where snow shall not affect operation of the unit.
7. Make sure that the unit can be fixed directly on concrete.
8. In order to avoid the transmission of vibration from the operating unit to its carrying structure, the use of antivibration material to install under the supports of the unit is recommended. It is suggested to install a rubber pad between the points of support and the base of the unit, or spring antivibration mounts under each point of support of the unit.

Installation Distances (mm)

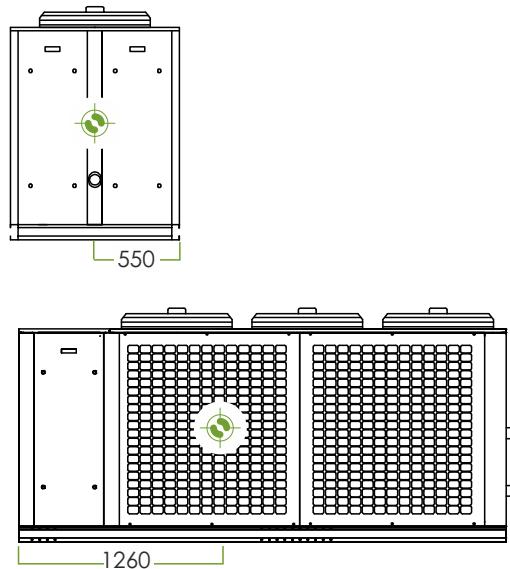


14.2 Centre of gravity

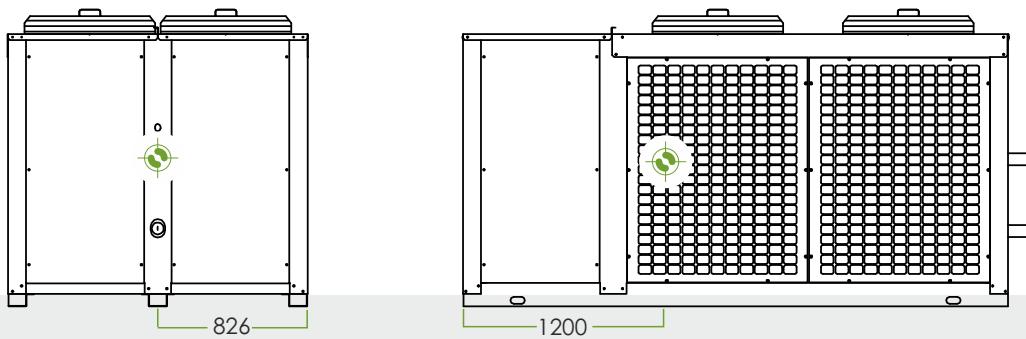
MKAC / MKAH 010-015 HD/FC



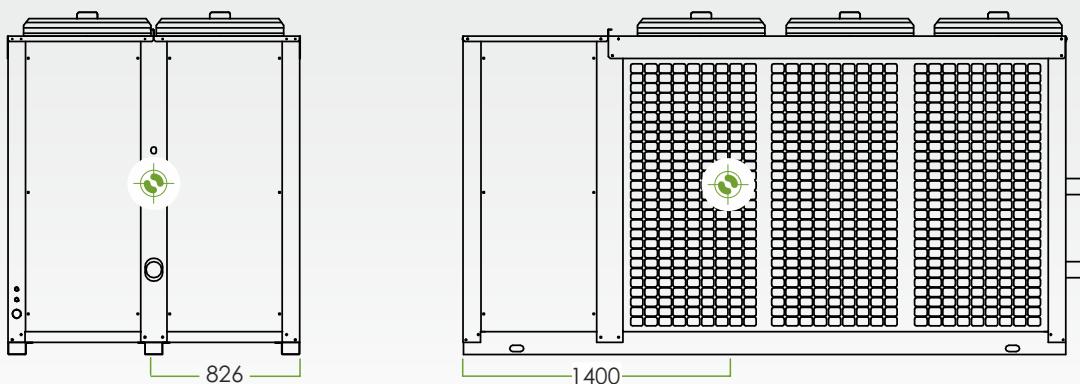
MKAC / MKAH 019-023 HD/FC



MKAC / MKAH 029 HD/FC



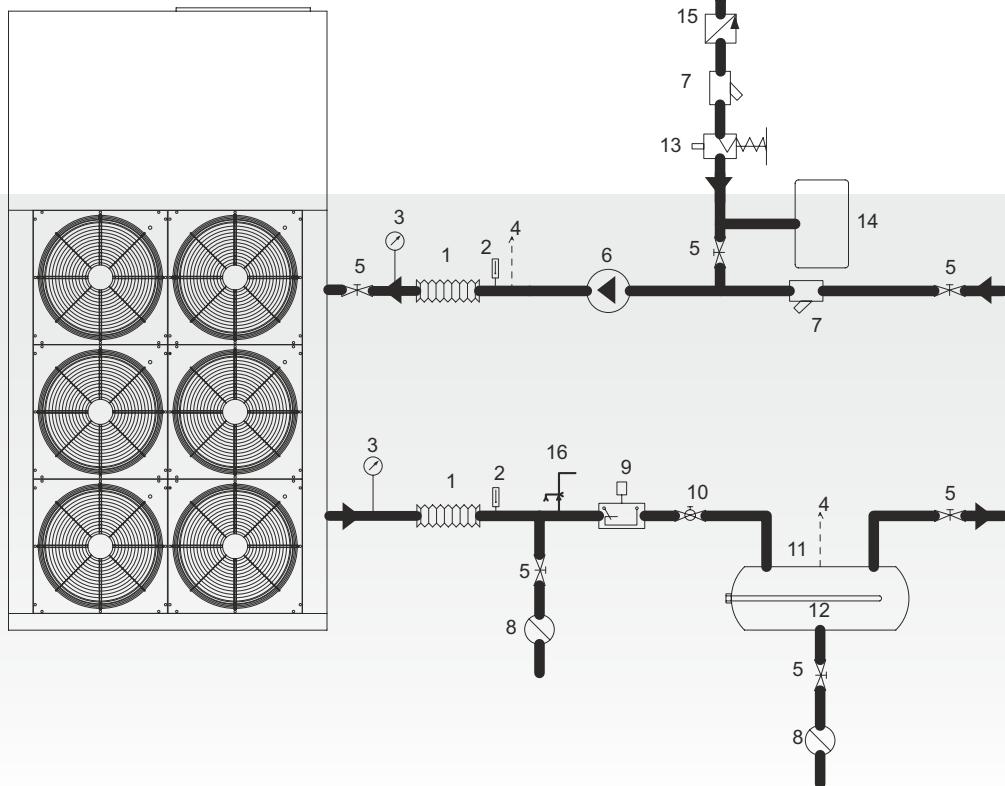
MKAC / MKAH 037-046 HD/FC



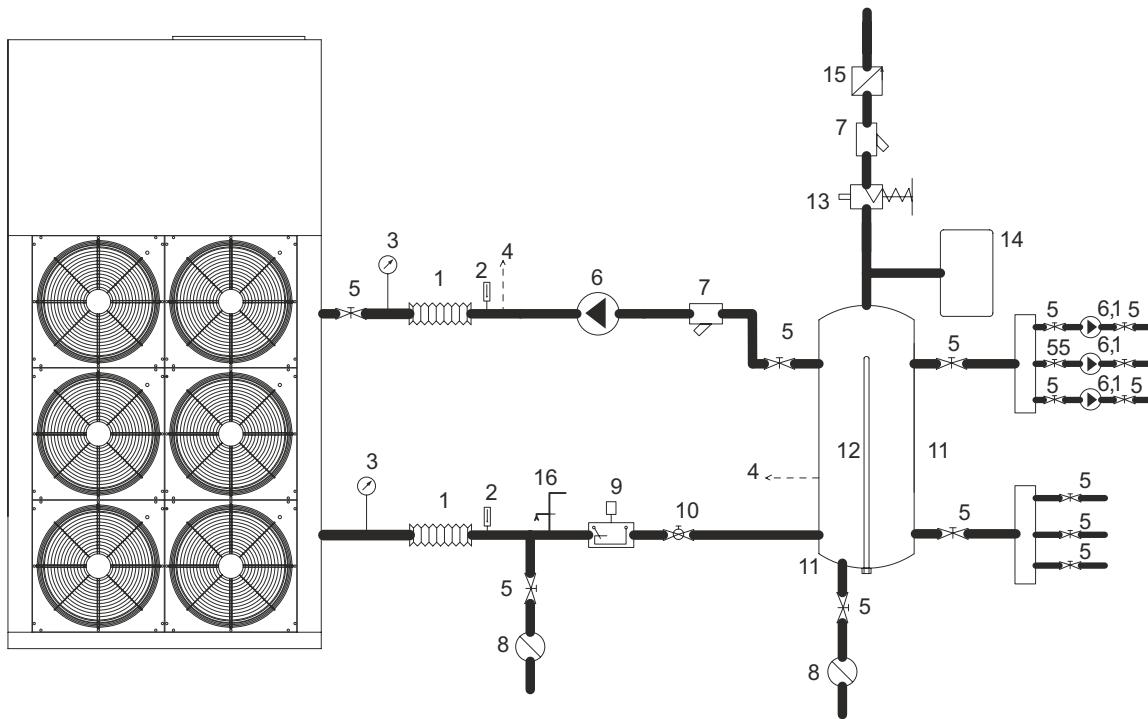
14.3 Recommendations concerning the hydraulic circuit

- All field connections must be carried out by a licensed technician and must comply with the applicable local and national codes.
- Evaporator water connections should be made in accordance with the unit outlook respecting the water inlet and outlets.
- Water piping to be arranged so that the circulating pump discharges directly into the evaporator.
- Install a flow switch or water differential pressostat (standard component) in the water outlet piping to prevent the unit from operating at a water flow, which is too low. A terminal is provided in the switch box for the electrical connection of the flow switch in the control circuit.
- To avoid erosion, it is recommended to install a filter in the water inlet pipe.
- It is essential to install a thermometer in the water inlet/ outlet pipe to check temperatures.
- Provide heat insulation with suitable vapour barrier around the chilled water piping to prevent condensation and capacity loss.
- Provide drain connections at all low points of the system to permit complete drainage for maintenance and/ or shutdown.
- Air vents should be provided at all high points in the system located where they are easily accessible for servicing. The water inlet pipe is specially designed to obtain a complete air purge of the evaporator.
- Install an expansion tank on the suction side of the water pump so that the water pressure on the pump suction shall be positive.
- To avoid frequent on off operation of the compressor, a minimum water volume is required in the system (table 10.4).
- To assure proper operation of the unit, the water flow through the evaporator must be within the specified limits in (table 10.4).

Example with one central pump



Example with internal loop pump and external zone pumps



Notes

1. Flexible
2. Thermometer
3. Manometer
4. Air vent
5. Shut off valve
6. Pump (primary circuit)
- 6.1 Pump (secondary circuit)
7. Water filter
8. Drainage
9. Flow switch (optional)
10. Balancing valve
11. Buffer tank
12. Electric resistance
13. Automatic make up water valve
14. Expansion membrane
15. Check valve
16. Safety valve

14.4 Watercharge, flow and quality

To ensure proper operation of the unit, a minimum water volume is required in the system and the water flow must be within the operation range as specified in the table.

MKAC / MKAH	Minimum water volume (l)	Minimum water flow volume (l/h)	Nominal water flow volume (l/h)	Maximum water flow volume (l/h)
010	230	3137	6605	8256
013	280	3815	8032	10041
015	324	4412	9288	11610
019	397	5409	11386	14233
023	485	6610	13915	17394
029	644	8766	18456	23070
037	802	10915	22979	28724
046	992	13505	28432	35540

Be sure the water quality is in accordance with the specifications below.

Items	Evaporator Water		Heated Water		Tendency if out of critiria
	FÖDÖMÖNY	MIN°C	Supply Water	Circulating Water 20-60°C	
Items to be controlled					
PH at 20°C	6.8 - 8.0	6.8 - 8.0	7.0 - 8.0	7.0 - 8.0	corrosion + scale
Electrical Conduct (mS/m) at 25°C	bellow 30	bellow 30	bellow 30	bellow 30	corrosion + scale
Chloride Ion (mg Cl/l)	bellow 50	bellow 200	bellow 30	bellow 30	corrosion
Sulfate Ion (mg So 2/4/l)	bellow 50	bellow 50	bellow 30	bellow 30	corrosion
M-alkalinity (ph 4.8) (mgSO3/l)	bellow 50	bellow 50	bellow 50	bellow 50	corrosion
Total Hardness (CaCO3/l)	bellow 70	bellow 70	bellow 70	bellow 70	corrosion
Total Hardness (mg CaCO3/l)	bellow 50	bellow 50	bellow 50	bellow 50	corrosion
Silica Ion (mg SiO2/l)	bellow 30	bellow 30	bellow 30	bellow 30	corrosion
Items to be referred to :					
Iron (mg Fe/l)	bellow 1.0	bellow 0.3	bellow 1.0	bellow 0.3	corrosion + scale
Copper (mg Cu/l)	bellow 1.0	bellow 0.1	bellow 1.0	bellow 0.1	corrosion
Sulfide Ion (mg S2/l)	Not detectable	Not detectable	Not detectable	Not detectable	corrosion
Amonium Ion (mg NH4/l)	bellow 0.3	bellow 0.1	bellow 0.1	bellow 0.1	corrosion
Remaining Chloride (mg Cl/l)	bellow 0.25	bellow 0.3	bellow 0.1	bellow 0.3	corrosion
Free Carbide(mg SO2/l)	bellow 0.4	bellow 4.0	bellow 0.4	bellow 4.0	corrosion
Stability Index	-	-	-	-	corrosion + scale

NOTES

The above tables are purely indicative and non-binding

14.5 Operating pressure of the refrigerant circuit.

It is important to check the high and low pressure of the refrigerant circuit to ensure the proper operation of the unit and to guarantee that the rated output shall be obtained.

Attention:

The pressures measured shall vary between a maximum and minimum value, depending on the water and ambient temperatures at the moment of measurement.

Cooling Mode (region)	Minimum (outdoor temp. 20°C DB) (leaving water temp. 6°C)	Nominal (outdoor temp. 35°C DB) (leaving water temp. 7°C)	Maximum (outdoor temp. 40°C DB) (leaving water temp. 15°C)
Low pressure	7,0 - 7,3 bar	7,1 - 7,8 bar	9,5 - 10 bar
High pressure	19 - 21 bar	24 - 28 bar	31 - 34 bar

Heating Mode (region)	Minimum (outdoor temp. -5°C DB) (leaving water temp. 45°C)	Nominal (outdoor temp. 7°C DB) (leaving water temp. 45°C)	Maximum (outdoor temp. 15°C DB) (leaving water temp. 45°C)
Low pressure	5,4 - 5,6 bar	7 - 7,2 bar	9,2 - 9,6 bar
High pressure	34-36 bar	29 - 31 bar	30 - 32 bar

14.6 Digital controller

User interface MKAC - MKAH 010-046

The interface on the front panel can be used to carry out all the operations connected to the use of the instrument and in particular to:

Set operating mode

Check the state of resources

Respond to alarm situations



14.6.1 Keys

mode

Selects operating mode by pressing continuously for 3 seconds:

If the heating mode is enabled, each time the key is pressed the following sequence occurs:

Stand-by Cooling Heating Stand by

If cooling mode is enabled:

Heating Stand by Cooling Heating Stand by

In menu mode, this key acts as QUIT without saving new settings.



Hold down the key for 3 seconds to turn the instrument from on to off or vice versa. When it is off, the word OFF appears on the display. In menu mode this key acts as a SCROLL DOWN or DOWN key (decreasing value).



Hold down the key for 3 seconds, the machine turns to defrost activation. In menu mode this key acts as a SCROLL UP or UP key (decreasing value).



Hold down the key for 3 seconds, the machine turns to main display section. In menu mode this key confirms the new values, the new settings and moves to next level.



UP and DOWN keys combination: The alarm code appears on the display. If you press UP and DOWN keys at the same time you shall reset the alarm.



Esc and Set keys combination:
Open programming menu.

14.6.2 Displays

14.6.2.1 Display

Normal display shows:

Regulation temperature in tenths of degrees Celsius with a decimal point.

The alarm code, if at least one alarm is active. If multiple alarms are active, the one with greater priority shall be displayed, according to the Table of Alarms.

When in menu mode, the display depends on the current position; labels and codes are used to help the user identify the current function.

Decimal point: when displaying hours of operation, indicates that the value must be multiplied x 100.

14.6.2.2 Led

Led 1 compressor 1.



ON if compressor 1 is active

OFF if compressor 1 is off

Rapid BLINK if safety timing is in progress

Slow BLINK if compressor is currently set to defrost (heat pump version)

Led 2 compressor 1



ON if power step 2 is active

OFF if power step 2 is not active

Rapid BLINK if safety timing is in progress

low BLINK if step 2 is currently defrosting

Led 3 compressor 2



ON if power step 3 is active (compressor2).

OFF if power step 3 is not active

Rapid BLINK if safety timing is in progress

Slow BLINK if step 3 is defrosting

Led 4 compressor 2



ON if power step 4 is active

OFF if power step 4 is not active

Rapid BLINK if safety timing is in progress

Slow BLINK if step 4 is defrosting

- ⚠ Active alarm led.**
(when more than one alarm occurs at the same time, the one with the lowest number will be shown).
- 💡 Heating led (heat pump version)**
ON if the device is in heating mode
- ❄ Cooling led.**
ON if the controller is in cooling mode.
- 🌐 Standby led.**
If the led is permanently on, Local STAND BY mode.
(from keyboard)
If the led is blinking, remote STAND BY mode.
- ❄ Defrost led (heat pump version).**
If the led is permanently on, the defrost mode is active.
If the led is blinking, the manual defrost mode is activated.
- ⌚ Economy mode**
- ⌚ Clock led**
Shows current time
- °C Degrees centigrade**

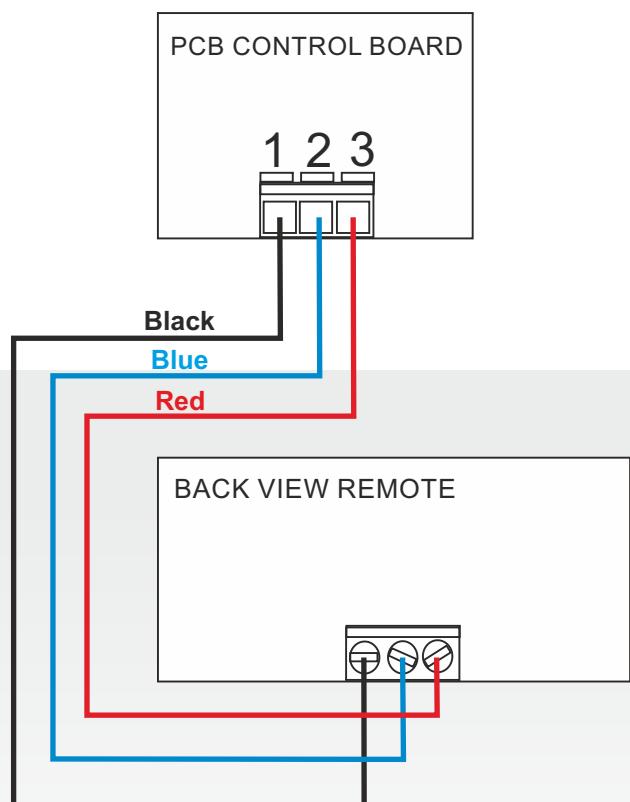
13.7 Remote keyboard

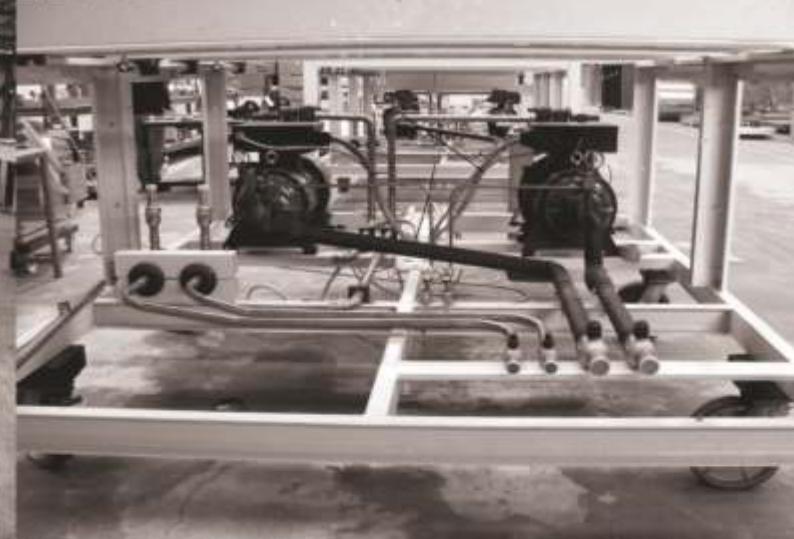
The remote keyboard on the display is an exact copy of the information displayed on the instrument, with the same leds;



It performs exactly the same functions as those described in the display section.

Connection with the controller is illustrated below:





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KLIMALLCO's units comply with the European regulations, that guarantee the safety of the product.

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KLIMALLCO's quality management system is certified according to
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2019

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