



AIR-COOLED REVERSIBLE HEAT PUMP - Installation manual

REVERSIBLE HEAT PUMPS

- INDOOR UNIT / OUTDOOR UNIT
- HIGH EFFICIENCIES
- PRODUCTION OF HOT WATER UP TO 60 °C

CL 050- 150



EN



Dear Customer,

Thank you for choosing an AERMEC product. This product is the result of many years of experience and in-depth engineering research, and it is built using top quality materials and advanced technologies. In addition, the CE mark guarantees that our appliances fully comply with the requirements of the European Machinery Directive in terms of safety. We constantly monitor the quality level, and as a result AERMEC products are synonymous with Safety, Quality, and Reliability.

The data may be subject to modifications deemed necessary for improving the product at any time and without forewarning.

Thank you again.
AERMEC S.p.A

AERMEC S.p.A. reserves the right to make any modifications considered necessary to improve its products at any moment and is not obliged to add these modifications to machines that have already been manufactured, delivered or are under construction.



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CL

SERIAL NUMBER

DECLARATION OF CONFORMITY

We, the undersigned, hereby declare under our own responsibility that the assembly in question, defined as follows:

NAME CL
TYPE AIR/WATER REVERSIBLE HEAT PUMP
MODEL

To which this declaration refers, complies with the following harmonised standards:

IEC EN 60335-2-40	Safety standard regarding electrical heat pumps, air conditioners and dehumidifiers.
IEC EN 61000-6-1	Immunity and electromagnetic emissions for residential environments.
IEC EN 61000-6-3	
IEC EN 61000-6-2	Immunity and electromagnetic emissions for industrial environments
IEC EN 61000-6-4	
EN378	Refrigerating system and heat pumps - Safety and environmental requirements.
UNI EN 12735	Seamless, round copper pipes for air conditioning and refrigeration.
UNI EN 14276	Pressurised equipment for cooling systems and heat pumps.

Thereby, compliant with the essential requirements of the following directives:

- LVD Directive: 2006/95/CE
- Electromagnetic Compatibility Directive 2004/108/CE.
- Machinery Directive 2006/42/CE
- PED Directive regarding pressurised devices 97/23/CE (Form A: CL050-090)

The product, in agreement with Directive 97/23/EC, satisfies the Total quality Guarantee procedure (form H for size 100 - 150) with certificate no. 06/270-QT3664 Rev. 6 issued by the notified body n.1131 CEC via Pisacane 46 Legnano (MI) - Italy

The person authorised to constitute the technical file is: Massimiliano Sfragara - 37040 Bavilacqua (VR) Italy - Roma, 996

Bevilacqua

23/12/2011

Marketing Manager
 Signature

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**Standards complied with
WHEN DESIGNING and MANUFACTURING the unit:**

SAFETY

1. Machinery Directive 2006/42/CE
2. Low Voltage Directive LVD 2006/95/CE
3. Electromagnetic Compatibility Directive EMC 2004/108/EC
4. Directive regarding pressurised devices PED 97/23/CE, EN 378, UNI12735, UNI14276

ELECTRIC PART

1. IEC EN 60335-2-40,
2. IEC EN 61000-6-1/2/3/4

ACOUSTIC PART

1. ISO DIS 9614/2 (intensimetric method)

FAN

1. EUROPEAN RULES N. 327/2011 DIRETTIVA 2009/125/EC

PROTECTION RATING

IP24

CERTIFICATION

1. EUROVENT

REFRIGERANT GAS

This unit contains fluoride gases with greenhouse effect covered by the Kyoto Protocol. Maintenance and disposal must only be performed by qualified staff, in compliance with standards in force.

ATTENTION

1. The refrigerant fluid circuit is pressurised. Interventions must only be performed on the appliance by ATS (Authorised Technical Service) or a qualified technician.
2. **GAS R410A**
The chiller is delivered with a sufficient amount of R410A refrigerant fluid for operation. It is a chlorine-free refrigerant fluid that does not damage the ozone layer. R410A is not inflammable. However, all maintenance must be performed exclusively by a specialised technician with suitable protective equipment.
3. **Danger of electric shock!**
The appliance must be disconnected from the mains power supply before the chiller is opened.

1. GENERAL WARNINGS FOR THE INSTALLER

AERMEC CL are constructed according to the acknowledged technical standards and safety regulations. They have been designed for air conditioning and the production of domestic hot water (DHW) and must be used compatibility with their technical features. Any contractual or extracontractual liability of the Company is excluded for injury/damage to persons, animals or objects owing to installation, regulation and maintenance errors or improper use. All uses not expressly indicated in this manual are prohibited.

1.1. PRESERVATION OF THE DOCUMENTATION

1. The instructions and all related documentation must be given to the user of the system, who is responsible for preserving the same so that they are always on hand when required.
2. Read this file carefully; the execution of all jobs must be performed by qualified staff, according to the Standards in force on this subject in the different countries.
3. The appliance warranty does not cover the costs for ladders, scaffolding, or other elevation systems that may become necessary for carrying out servicing under warranty.
4. Do not modify or tamper with the appliance as dangerous situations can be created and the manufacturer will not be liable for any damage caused. The warranty shall be become null and void if the above-mentioned indications are not respected.

1.2. WARNINGS REGARDING SAFETY AND INSTALLATION STANDARDS

1. The appliance must be installed by a qualified and suitably trained technician, in compliance with the national legislation in force in the country of destination. AERMEC will not assume any liability for damage if these instructions are not respected.
2. Before beginning any operation, **READ THESE INSTRUCTIONS CAREFULLY AND CARRY OUT THE SAFETY CHECKS IN ORDER TO REDUCE ALL HAZARDS TO MINIMUM.** All the staff involved must have thorough knowledge of the operations and any dangers that may arise at the moment in which the installation operations are carried out.

2. SELECTION AND PLACE OF INSTALLATION

Before beginning the installation process, decide with the customer where the appliance is to be installed, whilst paying attention to the following:

1. the support surface must be capable of supporting the unit weight;
2. the safety differences between the unit and other appliances or structures must be scrupulously respected so that the inlet and outlet air from the fans is free to circulate;
3. the unit must be installed by an enabled technician in compliance with the national legislation in force in the country of destination, respecting the minimum technical spaces in order to allow maintenance.

3. POSITIONING

Before handling the unit, verify the lifting capacity of the machines used, respecting the indications given on the packaging.

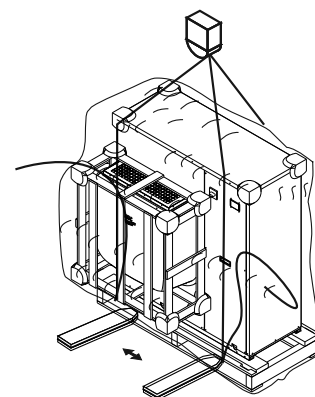
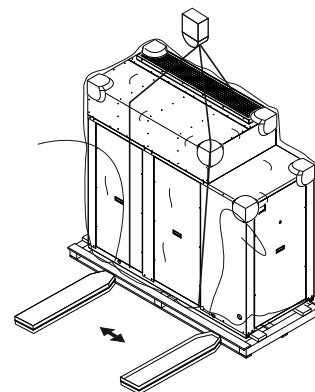
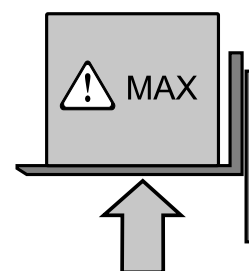
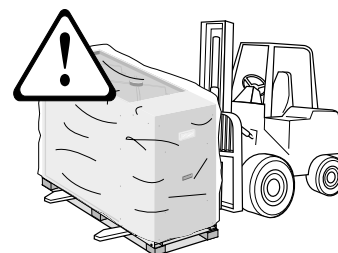
To handle the machine on horizontal surfaces, use fork lift trucks or similar in the most appropriate manner, paying attention to the distribution of the unit weight.

Position the unit in the place indicated by the customer, placing a rubber covering between the base and the support (min. thickness 10 mm.) or alternatively anti-vibration feet (ACCESSORIES).

For further information, refer to the dimensional tables

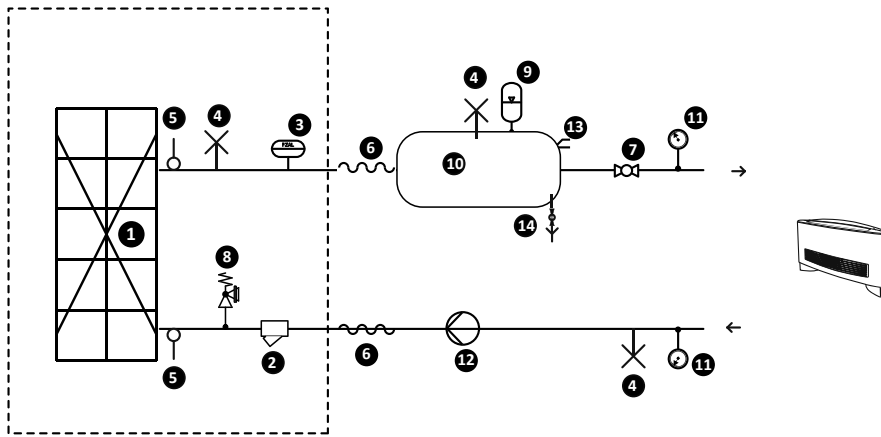
Fix the unit checking that it is level. Make sure that the hydraulic and electric part can be easily reached.

HANDLING EXAMPLE



4. MAIN HYDRAULIC CIRCUITS

4.1. INTERNAL AND EXTERNAL HYDRAULIC CIRCUIT TO CL ° / H / L



STANDARD CL COMPONENTS SUPPLIED AS PER STANDARD

1	Plate exchanger
2	Water filter
3	Flow switch
4	Air vent valve
5	Water temperature probes (IN/OUT)
8	Safety valve (not available for the sizes 100-150)

RECOMMENDED COMPONENTS NOT SUPPLIED FOR WHICH INSTALLER IS RESPONSIBLE

6	Anti-vibration joints
7	Cut-off cocks
9	Expansion vessel
10	System storage tank (installation recommended whenever the system water content is less than that indicated in TAB. 1)
11	Manometer
12	Pump
13	Resistance
14	Drain cock

MINIMUM WATER CONTENT		025	030	040	050	070	080	090	100	150	200
Number of compressors	n°	1	1	1	1	1	1	1	1	1	1
Recommended minimum water content		Model "o" - "L"									
	l/kW	4	4	4	4	4	4	4	4	4	4
		Model "H"									
	l/kW	10	10	10	10	10	10	10	10	10	10

TAB. 1

PH	6-8
Electric conductivity	Less than 200 mV/cm (25°C)
Chloride ions	Less than 50 ppm
Sulphuric acid ions	Less than 50 ppm
Total iron	Less than 0.3 ppm
Alkalinity M	Less than 50 ppm
Total hardness	Less than 50 ppm
Sulphur ions	None
Ammonia ions	None
Silicone ions	Less than 30 ppm



ATTENTION

The choice and installation of components outside the unit is the installer's responsibility, who must operate according to the code of practice and in compliance with the Standard in force in the country of destination.



ATTENTION

The hydraulic connection pipes to the appliance must be suitably dimensioned for the effective water flow rate requested by the system when running. The water flow rate to the heat exchanger must always be constant.



ATTENTION

Wash the system thoroughly before connecting the unit. This cleaning operation will eliminate any residues such as welding drips, scale, rust, or other impurities from the piping. These substances can also deposit inside and cause appliance malfunctioning. The connection piping must be adequately supported so that its weight is not borne by the appliance.



ATTENTION

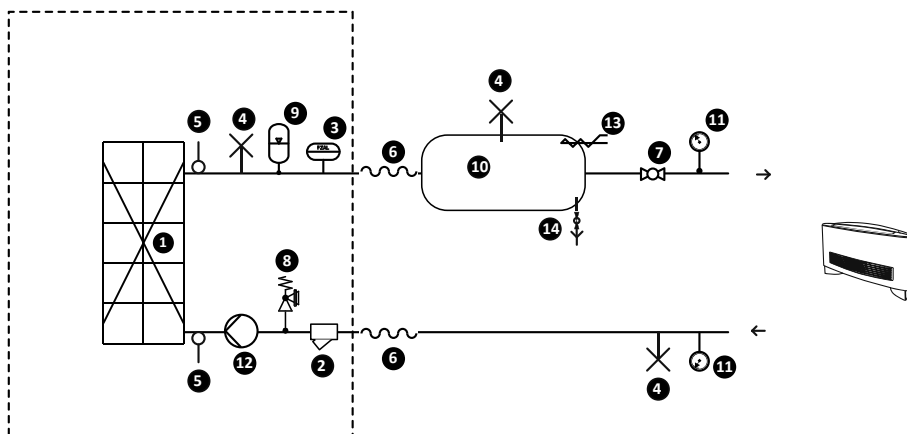
SYSTEM DRAINING

If the system should stop during the winter period, the water present in the exchanger may freeze, causing irreparable damage to the exchanger itself.

There are three solutions possible for the prevention of freezing:

- 1. Drain the water from the appliance completely.**
- 2. Operation with glycolated water,** with a percentage of glycol selected on the basis of the minimum external temperature envisioned.
- 3. Use of resistances.** In this case, the resistances must be live for the entire period that freezing may occur (machine in stand-by).

4.2. INTERNAL AND EXTERNAL HYDRAULIC CIRCUIT TO CL P / HP / LP



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The choice and installation of components outside the unit is the installer's responsibility, who must operate according to the code of practice and in compliance with the Standard in force in the country of destination.



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The hydraulic connection pipes to the appliance must be suitably dimensioned for the effective water flow rate requested by the system when running. The water flow rate to the heat exchanger must always be constant.



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2. **Operation with glycolated water**, with a percentage of glycol selected on the basis of the minimum external temperature envisioned.
3. **Use of resistances.**

In this case, the resistances must be live for the entire period that freezing may occur (machine in stand-by).

STANDARD CL COMPONENTS SUPPLIED AS PER STANDARD

1	Plate exchanger
2	Water filter
3	Flow switch
4	Air vent valve
5	Water temperature probes (IN/OUT)
8	Safety valve (not available for the sizes 100-150)
9	Expansion vessel
12	Pump

RECOMMENDED COMPONENTS NOT SUPPLIED FOR WHICH INSTALLER IS RESPONSIBLE

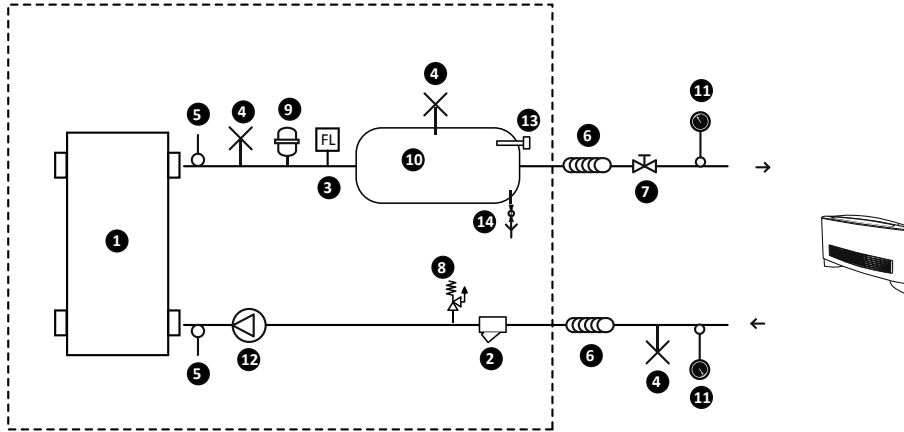
6	Anti-vibration joints
7	Cut-off cocks
10	System storage tank (installation recommended whenever the system water content is less than that indicated in TAB.1)
11	Manometer
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MINIMUM WATER CONTENT		025	030	040	050	070	080	090	100	150	200
Number of compressors	n°	1	1	1	1	1	1	1	1	1	1
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	I/kW	4	4	4	4	4	4	4	4	4	4
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	I/kW	10	10	10	10	10	10	10	10	10	10

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Total iron	Less than 0.3 ppm
Alkalinity M	Less than 50 ppm
Total hardness	Less than 50 ppm
Sulphur ions	None
Ammonia ions	None
Silicone ions	Less than 30 ppm

4.3. INTERNAL AND EXTERNAL HYDRAULIC CIRCUIT TO CL A / HA / LA



STANDARD CL COMPONENTS SUPPLIED AS PER STANDARD

1	Plate exchanger
2	Water filter
3	Flow switch
4	Air vent valve
5	Water temperature probes (IN/OUT)
8	Safety valve
9	Expansion vessel
10	System storage tank
12	Pump
13	200 W resistance antifreeze
14	Drain cock

RECOMMENDED COMPONENTS NOT SUPPLIED FOR WHICH INSTALLER IS RESPONSIBLE

6	Anti-vibration joints
7	Cut-off cocks
11	Manometer

MINIMUM WATER CONTENT		025	030	040	050	070	080	090	100	150	200
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ATTENTION

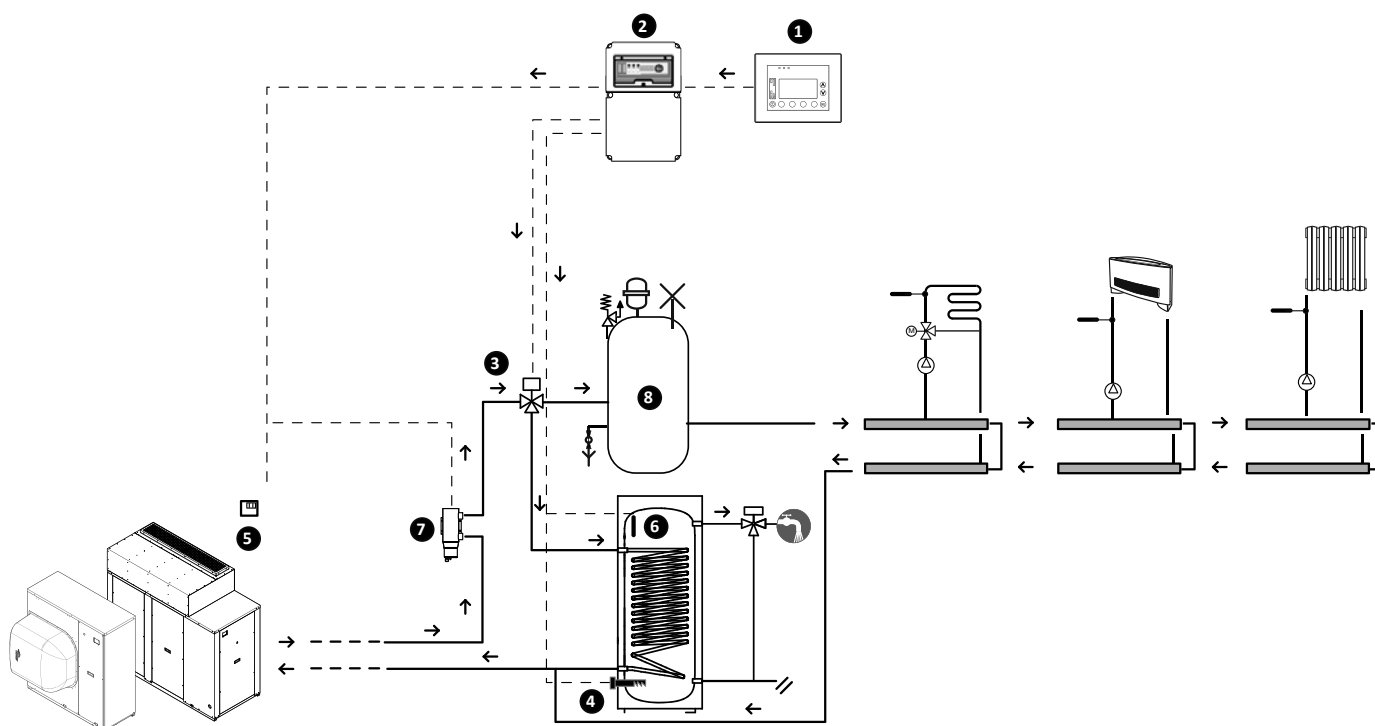
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- 3. Use of resistances.** In this case, the resistances must be live for the entire period that freezing may occur (machine in stand-by).

5. EXAMPLE OF CL SYSTEM WITH DHW PRODUCTION with VMF-DHW ACCESSORY



CL	
VMF SYSTEM FOR THE PRODUCTION AND MANAGEMENT OF THE HOT WATER AND DHW (accessory) ⁹	
1	E5 (black and white) VMF-ACS3KTN 6KTN 8KTN
2	- 3-way valve (not supplied) - DHW temperature probe (supplied) - Resistance for DHW storage tank (anti-legionella cycle management)
3	3-way valve (not supplied)
4	Electrical resistance for DHW storage tank (not supplied) (anti-legionella cycle management)
5	RS-485 MOD-BUS interface (MODU-485A ACCESSORY)
6	DHW storage tank (not supplied)
7	Electrical resistance (BSKW ACCESSORY)
8	System storage tank (not supplied)

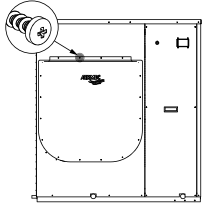
9 For further information regarding the VMF system, refer to the documentation available on the website: www.aermec.com

10 The accessory is necessary for the VMF system to communicate with the heat pump.

6. DISCHARGE HOOD POSSIBLE CONFIGURATIONS (SITE MODIFIED)

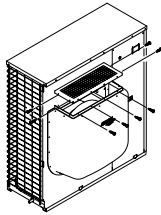
TECHNICAL SECTION
INSTALLER SECTION

CL 050 - 070 - 080 - 090

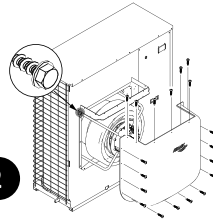


Default position

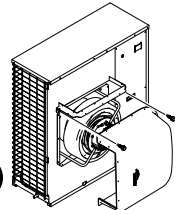
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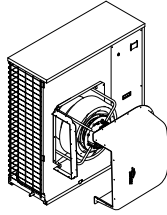
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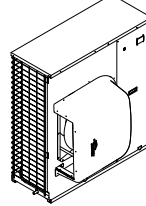
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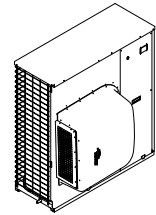
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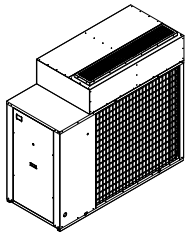


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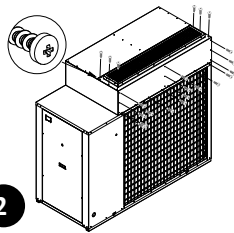
CL 100 - 150

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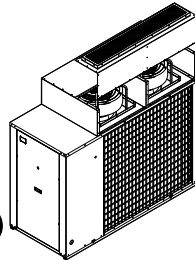


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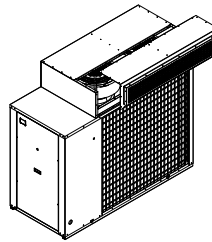
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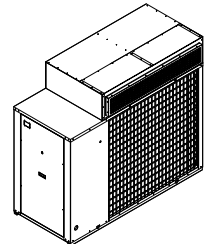
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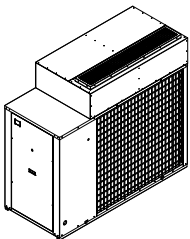


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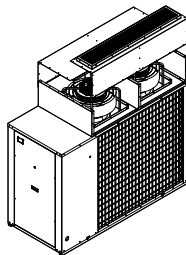
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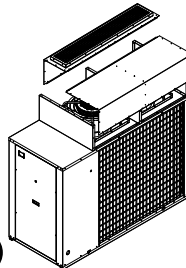


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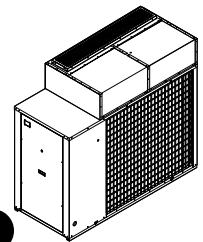
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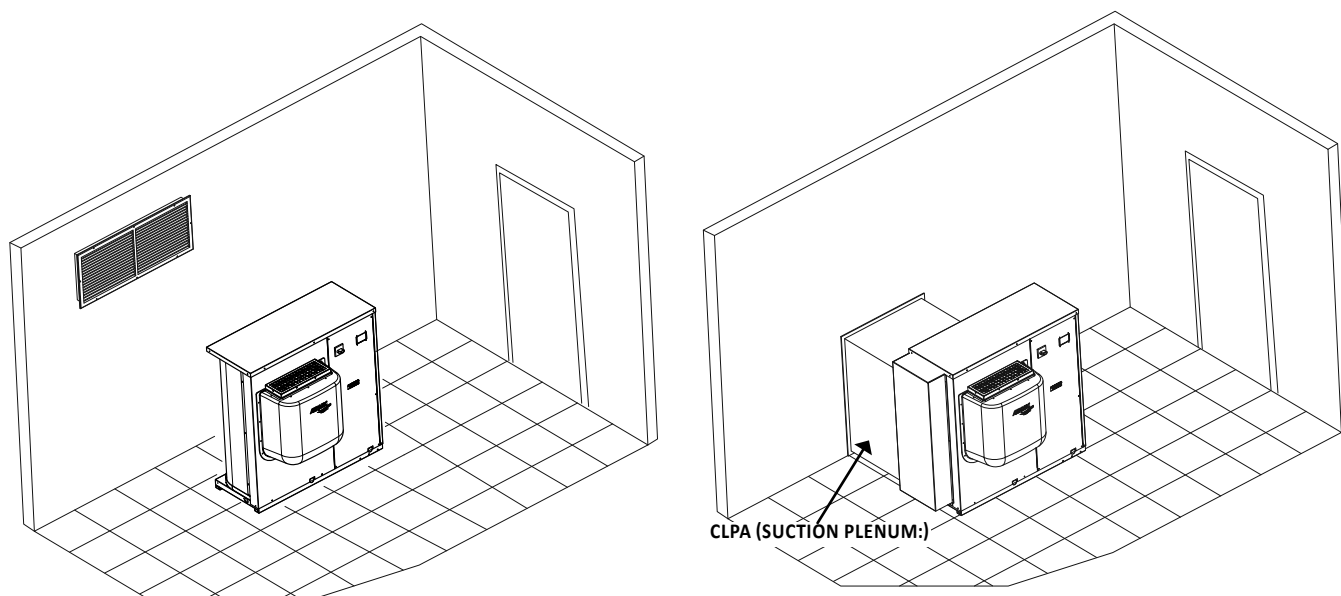
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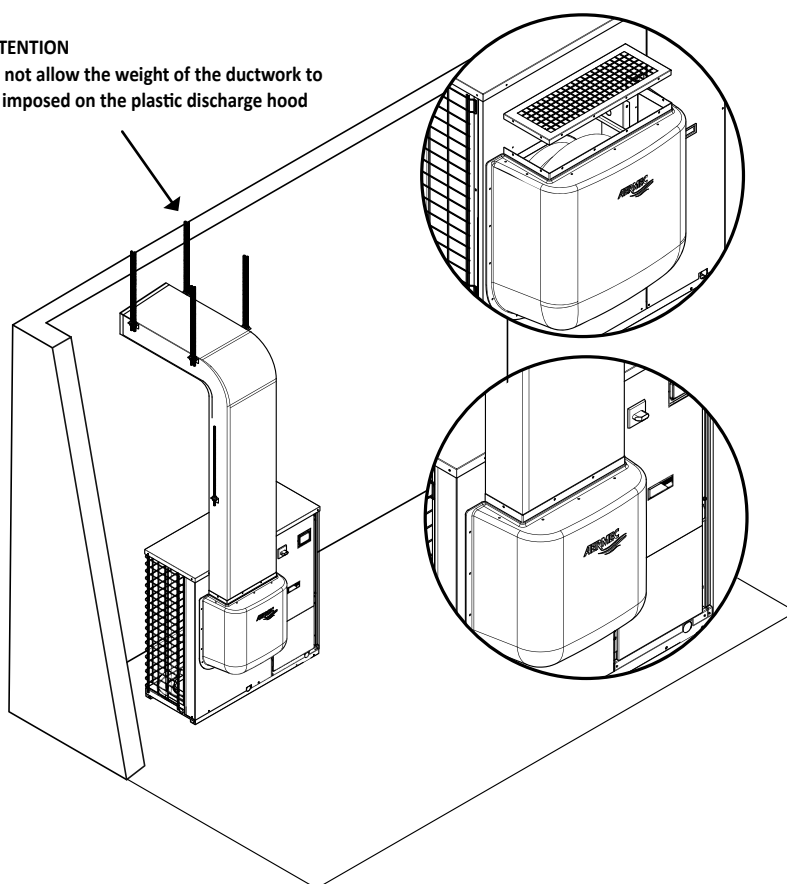
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DUCTING EXAMPLE

**ATTENTION**

Do not allow the weight of the ductwork to be imposed on the plastic discharge hood

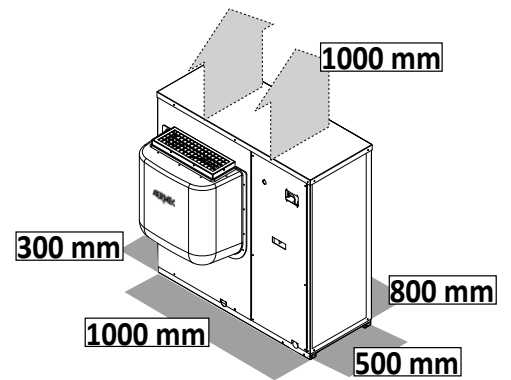
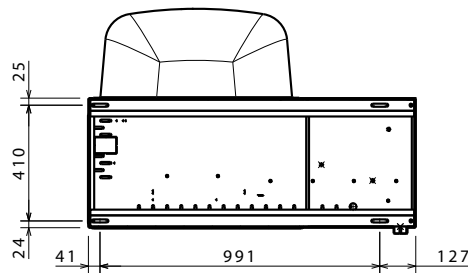
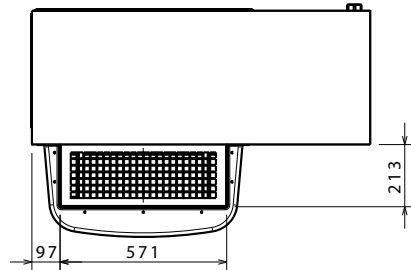
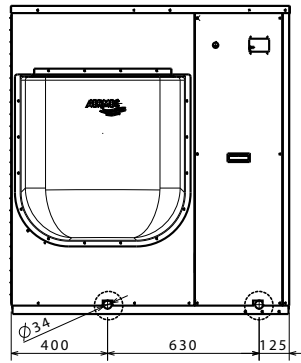
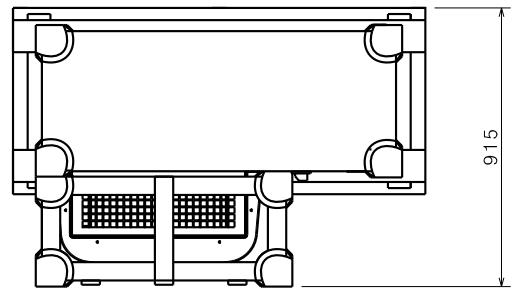
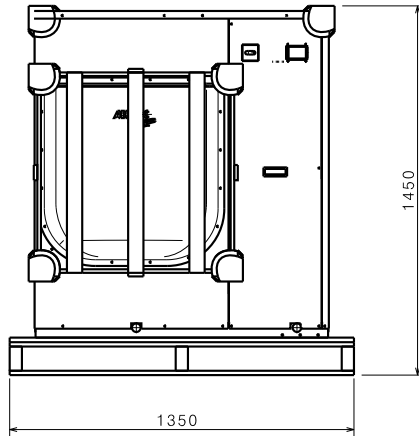
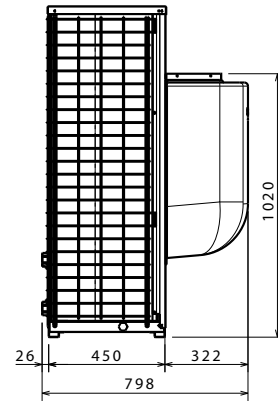
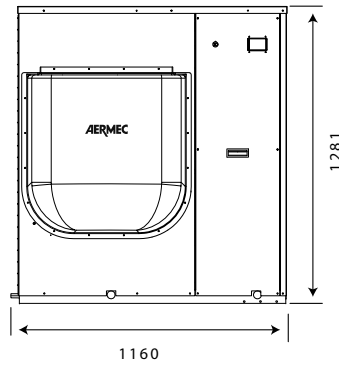


7. DIMENSIONS

CL 050-090

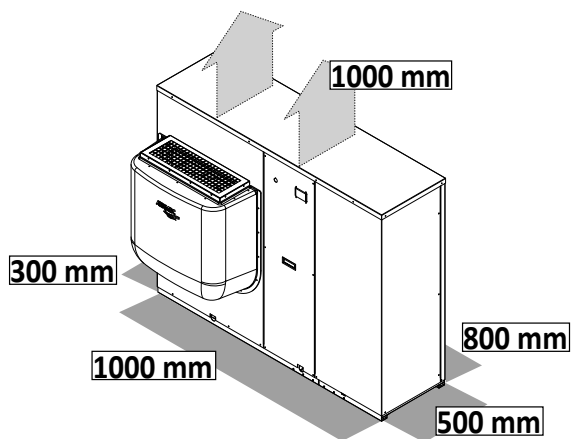
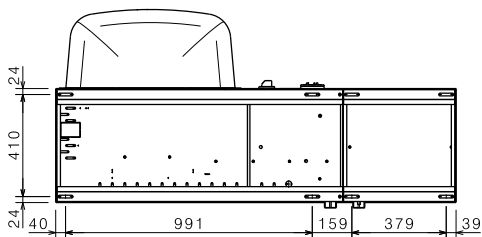
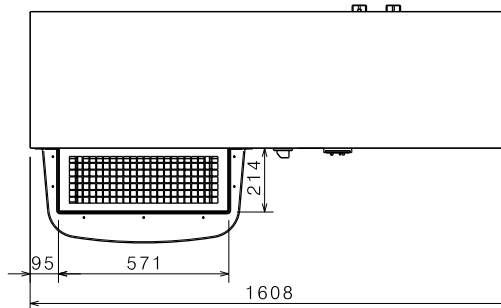
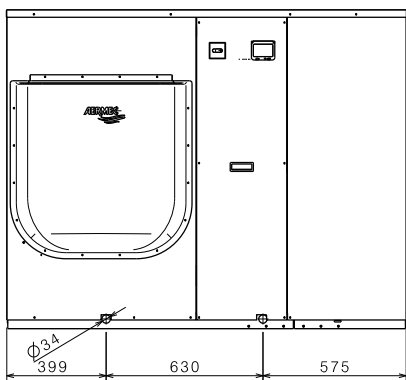
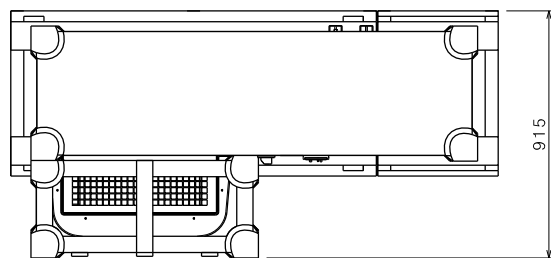
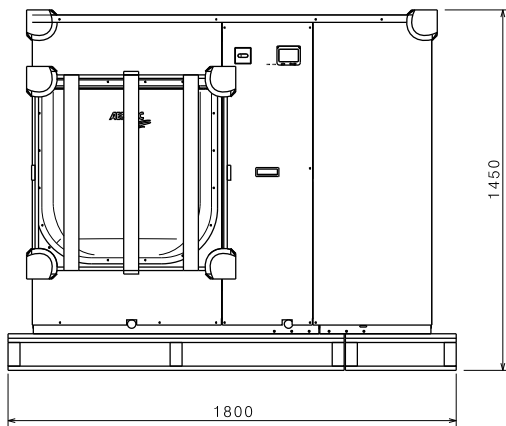
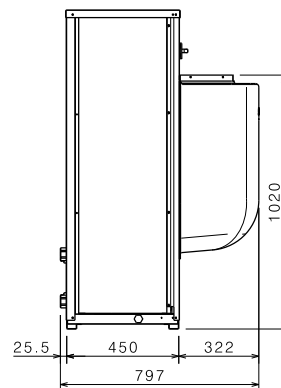
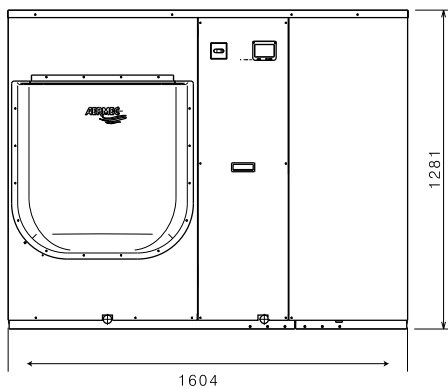
VERSION: STANDARD[™]

VERSION: WITH PUMP "P"



CL 050-090

VERSION: WITH STORAGE TANK AND PUMP "A "

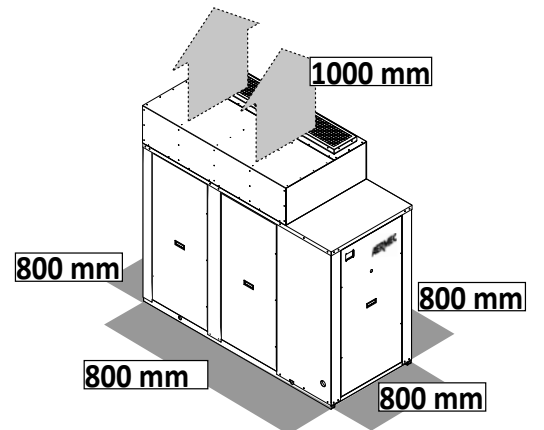
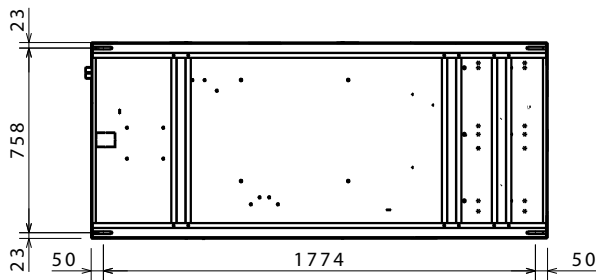
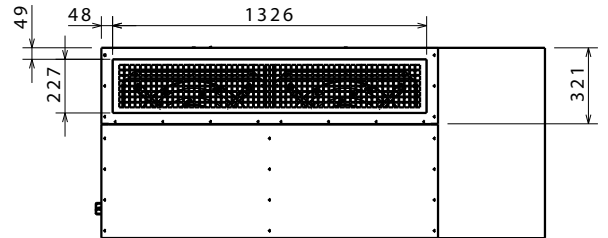
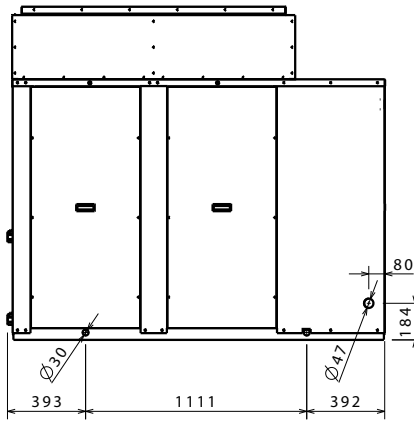
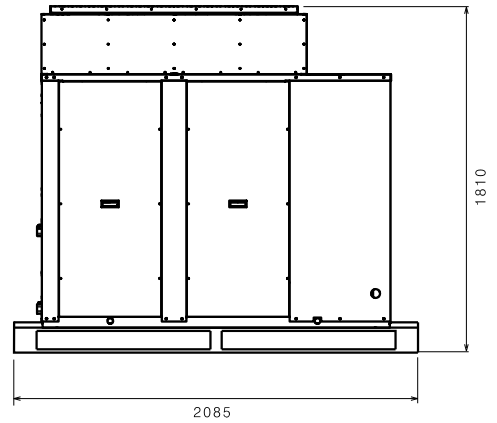
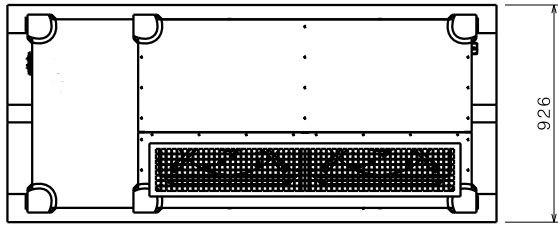
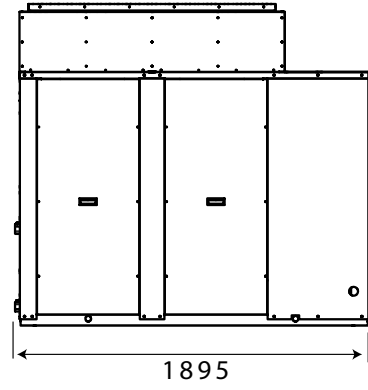
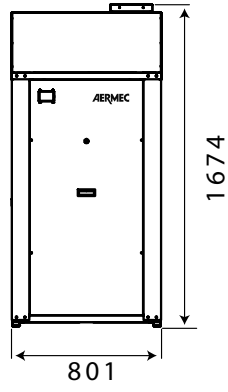


TECHNICAL SECTION

INSTALLER SECTION

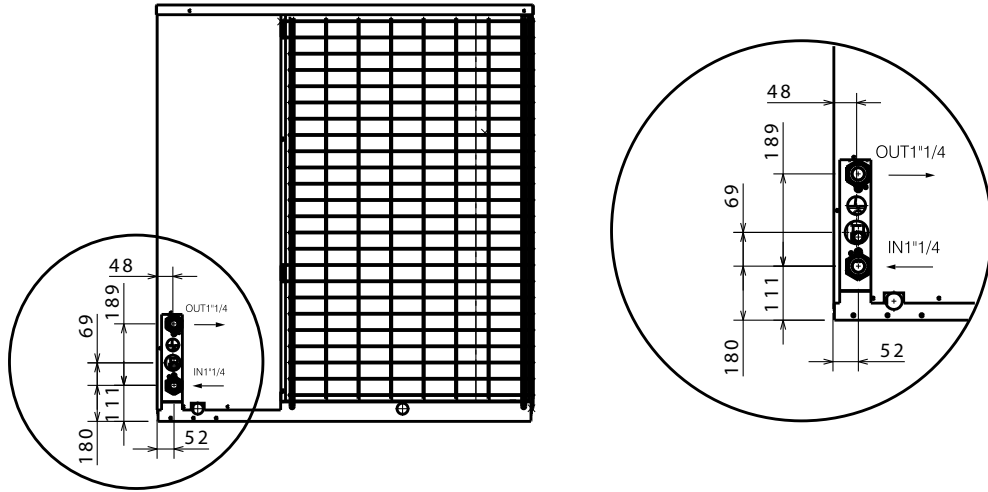
USER SECTION

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 VERSION: WITH "P"
 VERSION: WITH STORAGE TANK AND PUMP "A"

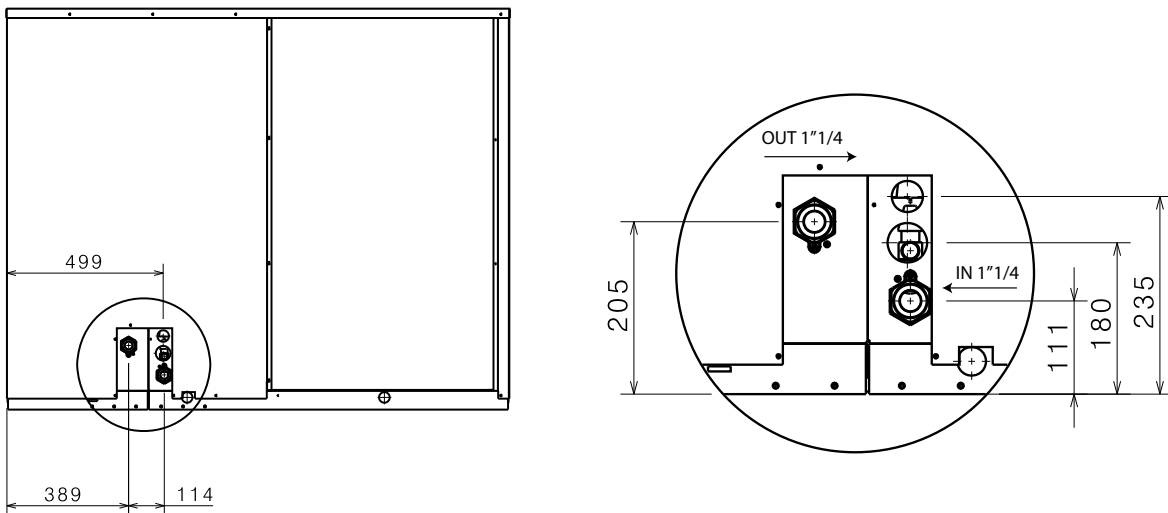


8. POSITION OF HYDRAULIC CONNECTIONS

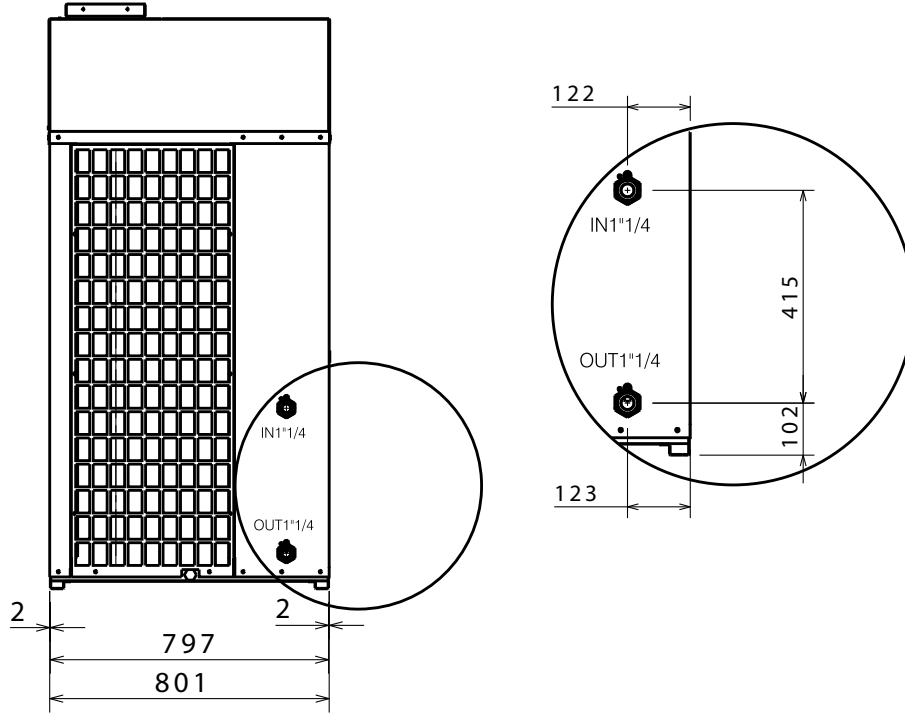
CL 050-090
 VERSION: STANDARD "0"
 VERSION: WITH PUMP "P"



CL 050-090
 VERSION: WITH STORAGE TANK AND PUMP "A"

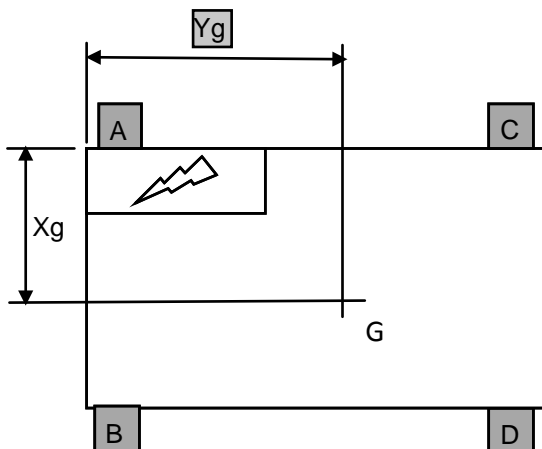


CL 100-150
 VERSION: STANDARD¹⁰⁰
 VERSION: WITH PUMP "P"
 VERSION: WITH SOTRAGE TANK AND PUMP "A"

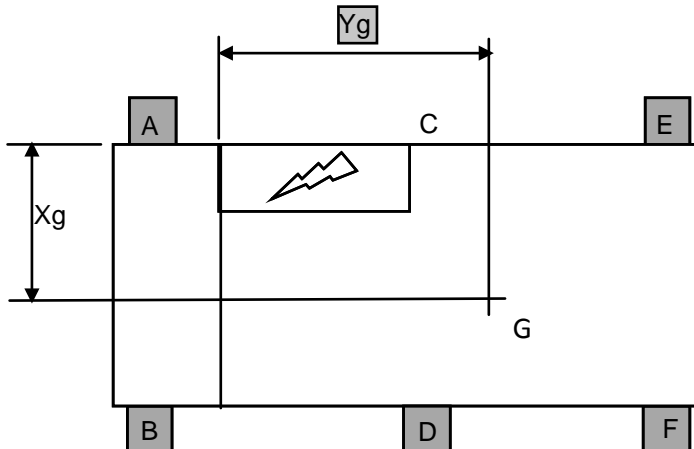


9. WEIGHT DISTRIBUTION ON SUPPORTS (%) (WEIGHT OF UNITS WHEN EMPTY)

4 SUPPORTS



6 SUPPORTS



CL	VERSION	WEIGHT UNIT	BARYCENTRE		WEIGHT DISTRIBUTION ON SUPPORTS (%)						KIT VT
			Gx	Gy	A	B	C	D	E	F	
MODEL COOLING ONLY "°" AND SILENCED MODE "L" - VERSION STANDARD "°"											
050	°	208	171	487	35.8%	21.9%	26.3%	16.0%	-	-	-
070	°	210	172	486	35.7%	22.0%	26.1%	16.1%	-	-	-
080											
090	°	212	173	483	35.7%	22.3%	25.9%	16.1%	-	-	-
100	°	469	462	887	22.2%	30.4%	20.0%	27.4%	-	-	-
150	°	471	458	879	22.6%	30.3%	20.1%	26.9%	-	-	-
MODEL COOLING ONLY "°" AND SILENCED MODE "L" - VERSION WITH PUMP "°P"											
050	°P	217	171	474	36.4%	22.4%	25.5%	15.7%	-	-	-
070	°P	225	176	469	36.0%	23.2%	24.8%	16.0%	-	-	-
080											
090	°P	221	173	470	36.3%	22.8%	25.1%	15.8%	-	-	-
100	°P	482	454	906	22.3%	29.3%	20.9%	27.5%	-	-	-
150	°P	487	452	903	22.5%	29.2%	21.0%	27.3%	-	-	-
MODEL COOLING ONLY "°" AND SILENCED MODE "L" - VERSION WITH STORAGE TANK AND PUMP "°A"											
050	°A	252	196	816	7.7%	5.9%	20.3%	15.7%	28.4%	22.0%	-
070	°A	260	201	816	7.1%	5.7%	20.7%	16.7%	27.6%	22.2%	-
080											
090	°A	256	198	815	7.4%	5.8%	20.6%	16.2%	28.0%	22.0%	-
100	°A	532	447	925	22.3%	28.2%	21.9%	27.6%	-	-	-
150	°A	537	446	929	22.3%	28.0%	22.0%	27.7%	-	-	-

CL	VERSION	WEIGHT UNIT	BARYCENTRE		WEIGHT DISTRIBUTION ON SUPPORTS (%)						KIT VT
			Gx	Gy	A	B	C	D	E	F	
MODEL HEATING PUMP "H" - VERSION STANDARD "00"											
050	H	229	180	496	34.1%	22.8%	25.8%	17.3%	-	-	-
070	H	240	179	479	35.1%	23.2%	25.1%	16.6%	-	-	-
080											
090	H	234	180	489	34.5%	23.0%	25.5%	17.0%	-	-	-
100	H	504	457	885	22.6%	30.1%	20.3%	27.0%	-	-	-
150	H	527	448	845	24.1%	30.7%	19.9%	25.3%	-	-	-
MODEL HEATING PUMP "H" - VERSION WITH PUMP "P"											
050	HP	239	181	483	34.7%	23.3%	25.2%	16.9%	-	-	-
070	HP	250	180	468	35.6%	23.7%	24.4%	16.2%	-	-	-
080											
090	HP	243	180	477	35.1%	23.4%	24.9%	16.6%	-	-	-
100	HP	517	450	902	22.6%	29.1%	21.1%	27.1%	-	-	-
150	HP	543	443	868	23.9%	29.7%	20.7%	25.7%	-	-	-
MODEL HEATING PUMP "H" - VERSION WITH STORAGE TANK AND PUMP "A"											
050	HA	274	204	833	6.9%	5.7%	19.2%	15.9%	28.6%	23.7%	-
070	HA	284	203	825	6.6%	5.4%	20.6%	16.9%	27.7%	22.8%	-
080											
090	HA	279	204	830	6.7%	5.6%	19.8%	16.3%	28.2%	23.3%	-
100	HA	567	443	921	22.6%	28.1%	22.0%	27.3%	-	-	-
150	HA	593	441	899	23.3%	28.6%	21.6%	26.5%	-	-	-

10. ELECTRIC POWER CONNECTION TO THE ELECTRICAL MAINS

The CL heat pumps are completely wired at the factory and only require connection to the electrical mains, downstream from a unit switch, according to that envisioned by the Standards in force on this subject in the country of installation.

It is also advised to check that:

the electrical mains features are suitable for the absorption values indicated in the electrical data table.

The unit must only be powered when installation has been completed (hydraulic and electric).

Respect the connection indications of the phase and earth wires.

The power supply line must have a relevant protection against short circuits mounted upstream and dispersions to earth, which isolate the system with respect to other utilities.

The voltage must be within a tolerance of $\pm 10\%$ of the nominal power supply voltage of the machine (for unbalanced three-phase unit max 3% between the phases). Whenever these parameters are not respected, contact the electric energy public body.

For electric connections, use the cables with double isolation according to the Standards in force on this subject in the different countries.

THE FOLLOWING ARE MANDATORY

The use of an omnipolar magnet circuit breaker switch is mandatory, in compliance with the IEC-EN Standards (contact opening at least 3 mm), with suitable cut-off power and differential protection on the basis of the electric data table shown below, installed as near as possible to the appliance.

It is mandatory to make an effective earth connection. The manufacturer is not liable for any damage caused by the lack of or ineffective appliance earth connection.

For units with three-phase power supply, check the correct connection of the phases.

The cable sections shown in the table are recommen-



All the electrical operations must be carried out by **STAFF IN POSSESSION OF THE NECESSARY QUALIFICATIONS BY LAW**, suitably trained and informed on the risks related to these operations.



The features of the electrical lines and of the related components must be determined by **STAFF QUALIFIED TO DESIGN ELECTRICAL SYSTEMS**, in compliance with the international and national regulations of the place of installation of the unit and in compliance with the regulations in force at the time of installation.



For the installation requirements refer only to the wiring diagram supplied with the appliance. The wiring diagram along with the manuals must be kept in good condition and **ALWAYS BE AVAILABLE FOR ANY FUTURE INTERVENTIONS ON THE UNIT**.



It is mandatory to verify that the machine is watertight before making the electrical connections and it must only be powered after the hydraulic and electrical works have been completed.

ded for maximum lengths of 50 m.

For longer lengths or different cable laying, it is up to the **DESIGN ENGINEER** to dimension the appropriate line switch, the power supply line as well as the connection to the earth wire and connection cables depending on:

the length;

the type of cable;

the absorption of the unit and the physical location and also the environment temperature.

10.1. ELECTRIC CONNECTIONS

Before connecting the unit to the power supply mains, make sure that the isolating switch is open.

Open the front panel

Use the holes in the lower part of the framework for the main electric power supply cable and the cables of the other external connections under the responsibility of the installer.

It is prohibited to access positions not specifically envisioned in this manual with electric cables.

Avoid direct contact with non-insulated copper piping and with the compressor.

Identify the clamps for the electric connection and always refer exclusively to the wiring diagram supplied



ATTENTION

It is prohibited to use the water pipes to earth the appliance.



ATTENTION

Check the tightness of all power wire clamps on commissioning and after 30 days from start-up. Successively check them every six months.

Loose terminals can cause overheating of the cables and components.



ATTENTION

FOR THE MODEL 230V/1/50Hz:

The unit is equipped with a compressor starting device for the reduction of the starting current. This device contains capacitors that could overheat in case of close repeated starts. In case power supply to the unit is removed, wait at least 3 minutes before restoring it again.

ELECTRIC DATA TABLE*

Size	Vers	Power supply	Compressors [n°]	Fans [n°]	TOTAL ABSORPTION		RECOMMENDED CABLE SECTION x 50 mt. max. length						
					L.R.A.:	F.L.A.:	phases [n°]	cables for single phase [n°]	SEC. A Cable section [mm²]	Total cables [n°]	SEC. B [mm²]	EARTH (PE) [mm²]	IL [A]
					[A]	[A]							
050	° / L	400V/3N/50Hz	1	1	77,2	13,7	3 + N	4	4 mm²	4	1,5 mm²	4 mm²	16
	H				64,2	13,5							
070	° / L		77,2	15,4	3 + N	4	4 mm²	4	1,5 mm²	4 mm²	25		
	H		74,2	14,7									
080	° / L		77,2	17,0	3 + N	4	6 mm²	4	1,5 mm²	6 mm²	25		
	H		94,2	15,2									
090	° / L / H		1	1	105,2	20,4	3 + N	4	6 mm²	4	1,5 mm²	6 mm²	25
100	° / L		2	2	90,9	27,4	3 + N	4	10 mm²	4	1,5 mm²	10 mm²	40
	H				77,7	27,0							
150	° / L		2	2	92,6	30,8	3 + N	4	16 mm²	4	1,5 mm²	16 mm²	40
	H				109,3	30,3							

*Data refer to th version "" standard, without pump

KEY

F.L.I.: Maximum input power

F.L.A.: Maximum input current

L.R.A.: Peak current

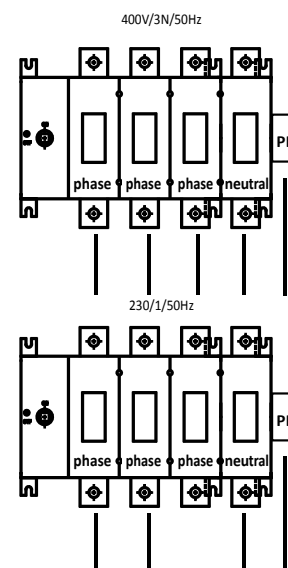
Sec A: Power supply

3+N: 3 phases + neutral

Sec B: Controls and safety device connection

EARTH: Earth wire to connect to unit

IL: Master switch



with the unit.

For the operational connection of the unit, take the power supply cable to the electric control board inside the unit and connect it to the U-N and PE clamps, respecting (U) phase, (N) neutral, (PE) earth in the event of single-phase power supply (230V/50Hz),

U-V-W as phases N as neutral and PE as earth in the event of three-phase power supply (400V/3N/50Hz). Re-position the inspection panels.

Ensure that all protections removed for the electric connection have been restored before powering the unit electrically.

Position the system master switch (outside the appliance) at "ON".

10.1.1. AUXILIARY CONNECTIONS UNDER THE RESPONSIBILITY OF THE USER/INSTALLER

All clamps to which reference is made in the following explanations are part of the 13 POLE removable terminal board situated inside the electric control board and connected to the MODUCONTROL.

10.1.2. SUMMER/WINTER REMOTE CONTROL (C/F)

To prepare a remote summer/winter switch-over device, connect the device contact to clamps 3 and 5 of the 13 POLE terminal board.

10.1.3. ON/OFF CONTROL (IA)

To prepare a remote ON/OFF switch-over device, connect the device contact to clamps 4 and 5 of the 13 POLE terminal board.

10.1.4. REMOTE ALARM (AE)

If it should be necessary to display the machine block in a remote point due to operating anomaly, clamps 6 and 7 of the 13 POLE terminal board can be used to connect a visual or acoustic alarm signal.

10.1.5. REMOTE PANEL (TRA)

To prepare a remote ON/OFF switch-over device, connect the device contact to clamps 8 and 9 of the 13 POLE terminal board.

10.1.6. CONTACT FOR THERMOSTATING DOMESTIC HOT WATER DHW (TWS)

To prepare a stand-alone thermostating device, connect to clamps 10 and 11 of the 13 POLE terminal board.

10.1.7. CONTACT FOR BOILER CONTROL

To prepare a boiler control, connect to clamps 12 and 13 of the 13 POLE terminal board.

10.1.8. PR3 CONNECTION (ACCESSORY)

If you should have the PR3 accessory, always connect it to the 13 POLE terminal board as shown in the wiring diagram. Remember that the maximum distance accepted is 150 mt. **REMEMBER THAT THE PR3 AS WELL AS BEING CONNECTED MUST BE ENABLED (see subsequent pages).**

11. CONTROL AND COMMISSIONING

11.1. PREPARATION FOR COMMISSIONING

Please note that, on request by the Aermec customer or the legitimate owner of the machine, the units in this series can be started up by the Aermec After-Sales Service in your area (valid only on ITALIAN territory). The start of operation must be scheduled in advance agreed on the basis of the time frame regarding the realisation of the system. Prior to the intervention, all other works (electrical and hydraulic connections, priming and bleeding of air from the system) must have been completed.

commissioning

Preliminary operations to be performed with no voltage present

Control:

All safety conditions have been respected.

The unit is correctly fixed to the support surface.

The minimum technical spaces have been respected.

That the main power supply cables have appropriate cross-section, which can support the total absorption of the unit. (see electric data sections) and that the unit has been duly connected to earth.

That all the electrical connections have been made correctly and all the clamps adequately tightened.



ATTENTION FOR THE MODEL 230V/1/50Hz:

The unit is equipped with a compressor starting device for the reduction of the starting current. This device contains capacitors that could overheat in case of close repeated starts. In case power supply to the unit is removed, wait at least 3 minutes before restoring it again.

The following operations are to be carried out when the unit is live.

Supply power to the unit by turning the master switch to the ON position. The display will switch on a few seconds after voltage has been supplied; check that the operating status is on OFF.(OFF BY KEY B on lower side of the display).

Use a tester to verify that the value of the power supply voltage to the U.V.W. phases is equal to 400V $\pm 10\%$; also verify that the unbalance between phases is no greater than 3%.

Check that the connections made by the installer are in compliance with the documentation.

Verify that the compressor sump resistance/s is/are operating by measuring the increase in temperature of the oil pan. The resistance/s must function for at least 12 hours before start-up of the compressor and in any event, the temperature of the oil pan must be 10-15°C higher than room temperature.

HYDRAULIC CIRCUIT

Check that all hydraulic connections are made correctly, that the plate indications are complied with and that a mechanical filter has been installed at the

evaporator inlet. (Mandatory component for warranty to be valid).

Make sure that the circulation pump/s is/are operating and that the water flow rate is sufficient to close the flow switch contact.

Check the water flow rate, measuring the pressure difference between evaporator inlet and outlet and calculate the flow rate using the evaporator pressure drop diagram present in this documentation.

Check correct operation of the flow switches, if installed; on closing the cut-off valve at the heat exchanger outlet, the unit must display the block. Finally, open the valve and rearm the block.

Machine COMMISSIONING

The unit can be used after all of the above-mentioned controls have been performed.

Close the electric control board hatch.

Position the appliance master switch at ON.

Press the ON key for \odot 3 sec to switch the machine on.

By pressing the ON key \odot , the display will show the temperature of the water and the type of machine operation. Check the operating parameters set (set-point) and reset any alarms present. The unit will begin operating after a few minutes.

With the machine on, check

COOLING CIRCUIT CHECK:

- That the compressor input current is lower than the maximum indicated in the technical data table.
- That in models with three-phase power supply, the compressor noise level is not abnormal, symptom of inverse rotation. If this is the case, invert a phase.
- That the voltage value lies within the pre-fixed limits and that unbalance between the three phases (three-phase power supply) is not above 3%.
- The presence of any refrigerant GAS leaks, particularly in correspondence with the manometers pressure transducers and pressure switches pressure points. (vibrations during transportation could loosen the fittings).
- Overheating
 - Comparing the temperature read using a contact thermostat positioned on the compressor intake with the temperature shown on the low pressure manometer (saturation temperature corresponding to the evaporation pressure). The difference between these two temperatures gives the overheating value. Optimal values are between 4 and 8°C.
 - Pressing line temperature. If the subcooling and overheating values are regular, the temperature measured in the pressing line pipe at the outlet of the compressor must be 30/40°C above the condensation temperature.

Control and safety devices

CHECK:

- The manual reset high pressure switch. That stops the compressor, generating the respective alarm, when the flow pressure exceeds the set-point value. Its correct operation can be controlled

by closing the air intake to the exchanger (in cooling mode) and keeping the high pressure manometer under control, check the intervention in correspondence of the calibration value. Attention: if there is no intervention at the calibration value, stop the compressor immediately and check the cause. Reset is manual and can only take place when the pressure drops below the differential value. (For the set and differential values, consult the technical manual).

- The anti-freeze control

The anti-freeze control managed by electronic regulation and by the temperature probe located at the evaporator outlet is to prevent the formation of ice when the water flow rate is too low. Correct operation can be checked by progressively increasing the anti-freeze set-point until it exceeds the outlet water temperature and keeping the water temperature controlled with a high precision thermometer. Verify that the unit is off and generates the respective alarm. After this operation, take the anti-freeze set-point back to its original value.

11.2. SEASON CHANGEOVER

11.3. SEASON CHANGEOVER ON MACHINE

Access the **SET USER** list using the key and conform the password 000 using the same key.

Use the arrow keys to display the **STA** parameter 0 index of the menu, select it using the key and set it using the arrow keys on the desired value, **VALUE 0** operating in cooling mode **VALUE 1** operating in heating mode.

Confirm the selection using the key and exit the

menu using the key.

Season changeover from PR3 (accessory)

If in possession of the PR3, it must be enabled after electric connection.

11.4. ENABLING OF REMOTE PANEL

Access the **INSTALLER SET** list using the .key, enter the password for access to the menu:

installer password 030.

Use the arrow keys to display the **PAN** parameter index 9 of the menu, select it using the..key, set it using the arrow keys on the desired value:

VALUE 1:

SEASON CHANGE piloted by the appliance.

ON/OFF CONTROL from PR3

VALUE 2:

SEASON CHANGE piloted from PR3

ON/OFF CONTROL from the appliance

VALUE 3:

SEASON CHANGE piloted from PR3

ON/OFF CONTROL piloted from PR3

Confirm the selection using the key and exit the menu using the key.

Once the PR3 remote panel is enabled, just operate directly on the switch to change the season (fig.1). The machine will switch off automatically and switch back on with the operating mode selected.

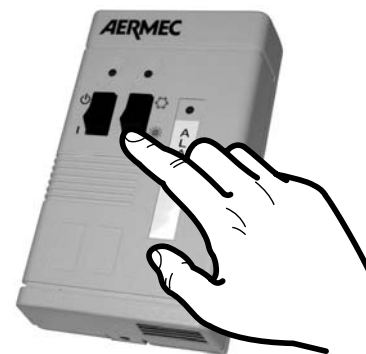
For further information refer to the USER MANUAL



ATTENTION

Commissioning must be performed with standard settings. Only when the inspection has been completed can the operating Set-Point values be changed.

Before start-up, power the unit for at least 12 hours, positioning the magnet circuit breaker switch and the door lock isolating switch at ON



(fig.1)

12. CALIBRATIONS OF SAFETY AND CONTROL PARAMETERS

Size	Vers	Power supply	Compressors [n°]	Fans [n°]	"Taratura magnetotermici compressori"	"Taratura magnetotermici ventilatori"	AP	TAP	TBP
					(A)	(A)	(bar)	(bar)	(bar)
050	° / L	400V/3N/50Hz	1	1	10,0	Fisso 6	42	39	4
	H				9,5			40	2
070	° / L		1	1	12,5	Fisso 6	42	39	4
	H				10,5			40	2
080	° / L		1	1	15,0	Fisso 6	42	39	4
	H				11,0			40	2
090	° / L		1	1	16,0	Fisso 6	42	39	4
	H				16,0			40	2
100	° / L		2	2	10,0	Fisso 10	42	39	4
	H				9,5			40	2
150	° / L		2	2	12,5	Fisso 10	42	39	4
	H				11,0			40	2

AP MANUAL RESET HIGH PRESSURE SWITCH

TAP HIGH PRESSURE TRANSDUCER

TBP LOW PRESSURE TRANSDUCER

13. OPERATING FEATURES

13.1. SET-POINT IN COOLING MODE

(Factory set) = 7°C, $\Delta t = 5^\circ\text{C}$.

13.2. SET-POINT IN HEATING MODE

(Factory set) = 45°C, $\Delta t = 5^\circ\text{C}$.

If the unit power supply is restored after a temporary interruption, the mode set will be kept in the memory.

13.3. COMPRESSOR START-UP DELAY

Two functions have been set-up to prevent compressor start-ups that are too close.

- Minimum time from last switch-off 60 seconds in cooling mode.
- Minimum time from last switch-on 300 seconds in heating mode.

13.4. CIRCULATION PUMPS

The circuit board envisions outputs for the management of the circulation pumps.

The utilities side pump starts immediately and after the first 30 seconds of operating, when the water flow rate has gone into normal working conditions, the differential pressure switch/flow switch control functions are activated.

Whenever alarms do not occur, the appliance starts.

13.7. SETTING MAXIMUM VOLTS DCP

SET DEFAULT VOLT MAX DCP	U.M.	Vers.	CL 050	CL 070	CL 080	CL 090	CL 100	CL 150
Max volt DCP (psw 84; param 4)	(V)	° / H	5,0	5,0	5,0	5,5	4,5	5,4
		L	3,5	3,5	3,5	4,0	3,0	4,0
Available nominal static pressure		° / H / L	80	80	80	80	80	100

13.5. ANTI-FREEZE ALARM

The alarm is always active even in stand-by mode. In order to prevent damage to the plate heat exchanger due to the water it contains freezing, on reaching a water temperature value below the minimum anti-freeze set of 3°C, the unit will be switched off immediately and the relative alarm is given. The unit can only re-start after manual reset and the anti-freeze probe measures a water temperature over 4°C. With the unit off and with water temperature below 4°C, the heat exchanger anti-freeze electric resistance, mounted as per standard, is activated. It is switched off when the water temperature exceeds 5°C. The water pump is always active.

13.6. WATER FLOW RATE ALARM

The unit manages a water flow rate alarm controlled by a differential pressure switch or flow switch, installed as per standard on the machine. This type of safety device can intervene after the first 30 seconds of pump operation, if the water flow rate is not sufficient. The intervention of this alarm determines compressor and pump block



ATTENTION

Anti-freeze set temperature can only be varied by an authorised after-sales centre and only after having checked that there is a suitable % anti-freeze solution in the hydraulic circuit.

Whenever this alarm intervenes, call an authorised after-sales service immediately.



ATTENTION

FOR THE MODEL 230V/1/50Hz:

The unit is equipped with a compressor starting device for the reduction of the starting current. This device contains capacitors that could overheat in case of close repeated starts. In case power supply to the unit is removed, wait at least 3 minutes before restoring it again.

**ATTENTION**

In the 230V/1/50Hz versions with soft-start, in the event of a power cut due to technical problems or for maintenance, in order to preserve good operation of the appliance it is mandatory to wait 5 minutes before re-applying voltage to the heat pump.

**ATTENTION**

In the cooling circuit it is prohibited to use oxygen or acetylene or other inflammable or poisonous gases because they are a cause of explosions or intoxication. We recommend to envision a machine book (not supplied, but the user's responsibility), which allows to keep track of the interventions performed on the unit. In this way it will be easy to suitably organise the interventions making research and the prevention of any machine breakdowns easier. Use the date to record date, type of intervention made (routine maintenance, inspection or repairs), description of the intervention, measures actuated...

**ATTENTION**

It is forbidden to **LOAD** the cooling circuit with a refrigerant different to that indicated. Using a different refrigerant gas can cause serious damage to the unit.

**ATTENTION****FOR THE MODEL 230V/1/50Hz:**

The unit is equipped with a compressor starting device for the reduction of the starting current. This device contains capacitors that could overheat in case of close repeated starts. In case power supply to the unit is removed, wait at least 3 minutes before restoring it again.

14. ROUTINE MAINTENANCE

All cleaning is prohibited until the unit has been disconnected from the electric power supply mains ¹. Make sure there is no voltage present before operating. Periodic maintenance is fundamental to keep the unit perfectly efficient under an operational and energy point of view.

It is therefore essential to carry out periodic yearly controls on the:

14.1. HYDRAULIC CIRCUIT

CHECK:

1. Water circuit filling.
2. Water filter cleaning.
3. Pressure switch or flow switch control.
4. The absence of air in the circuit (bleeding).
5. That the water flow rate to the evaporator is constant.
6. The thermal insulation of the hydraulic piping.
7. The percentage of glycol, when envisioned.

14.2. ELECTRIC CIRCUIT

CHECK:

8. Safety device efficiency.
9. The electric power supply voltage.
10. Electrical absorption.
11. Connections tightness.
12. The operation of the compressor guard resistance.

14.3. COOLING CIRCUIT

CHECK:

13. State of compressor.
14. Plate exchanger resistance efficiency.
15. Work pressure.
16. Leak test for water tightness control of the cooling circuit.
17. Operation of high and low pressure switches.
18. Carry out the appropriate checks on the filter dryer to check efficiency.

14.4. MECHANICAL CHECKS

CHECK:

1. **The tightening of the screws**, the compressors and the electrical box, as well as the exterior panelling of the unit. Bad fixing can cause abnormal noises and vibrations.
2. The state of the structure and the integrity of the discharge air hood in plastic. If there are any oxidised parts, treat with paint suitable to eliminate or reduce oxidation.

15. EXTRAORDINARY MAINTENANCE

the CL are filled with R410A gas and are inspected at the factory. Under normal conditions they do not require Technical Assistance related to control of refrigerant gas. Through time gas leakage may be generated, causing refrigerant to escape and discharge the circuit, causing appliance malfunctioning. In these cases the refrigerant leakage points must be detected, repaired and the refrigerant load is to be replenished, respecting Law n°549 law dated 28 December 1993.

16. DISPOSAL

Envisions that disposal of the unit is carried out in conformity with the Standards in force in the different countries

17. PROCEDURE FOR SELECTION OF THE TYPE OF SYSTEM

Some parameters in the MODUCONTROL board must be set appropriately on the basis of the type of system in which the unit is installed.

These modifications, performed by the installer, are summarised and organised in the following guided procedures, with which to correctly set the unit circuit board parameters.

17.1. HOW TO MODIFY A PARAMETER FROM THE USER MENU

To access the **USER SET** list, press the **▲** key and confirm the password 000 using the same key. The index of the **USER** parameter is displayed along with a string of three characters that identifies it; the string remains displayed for one second, after which it is replaced by the value relative to the parameter itself.

To pass to the next parameter, use the arrow keys **▲**/**▼**. To modify a parameter, just select it by pressing the **▲** key, modify the value assigned via the arrow keys **▲**/**▼** and confirm the modification using the **▶** key. To exit the menu, press the **■** key.

17.2. HOW TO MODIFY A PARAMETER FROM THE INSTALLER MENU

To enter and modify the **INSTALLER** menu, follow the same procedure as for the user menu.

Installer menu password: 030

QUESTION	ANSWER	WHAT TO DO
(1) What type of system terminals are used in the heating circuit?	<ul style="list-style-type: none"> The unit is a cooling only model 	<ul style="list-style-type: none"> Go to question 2
	<ul style="list-style-type: none"> Radiant panels 	<ul style="list-style-type: none"> Set the parameter StC (index 3 USER menu) with the value of 35 °C
	<ul style="list-style-type: none"> Low temperature fan coils or radiators 	<ul style="list-style-type: none"> Set the StC parameter (index 3 USER menu) with the value of 45°C (default value)
	<ul style="list-style-type: none"> Other applications 	<ul style="list-style-type: none"> Set the parameter StC (index 3 USER menu) with the value of 55 °C
(2) Is the remote panel accessory installed (PR3) ?	<ul style="list-style-type: none"> Not installed 	<ul style="list-style-type: none"> Go to question 3
	<ul style="list-style-type: none"> Installed 	<ul style="list-style-type: none"> Set the PAN parameter (index 9 INSTALLER menu) with the appropriate value: Value (1): <ul style="list-style-type: none"> Season control piloted from the circuit board ON/OFF control enabled from PR3 Value (2): <ul style="list-style-type: none"> Season control enabled from PR3 ON/OFF control from panel on machine Value (3): <ul style="list-style-type: none"> Season control enabled from PR3 ON/OFF control enabled from PR3
(3) Is the production of DHW envisioned?	<ul style="list-style-type: none"> Not envisioned Envisioned 	<ul style="list-style-type: none"> Go to question 5 Set the ASA parameter (INSTALLER MENU) with the value (1)
(4) Is a 3-way diverter valve envisioned in the DHW production circuit?	<ul style="list-style-type: none"> Not envisioned Envisioned 	<ul style="list-style-type: none"> Go to question 5 Set the AAS parameter (index C INSTALLER menu) with the appropriate value (in seconds). This parameter indicates the stand-by time for inversion of the 3-way diverter valve on the DHW production system.
(5) Is a room thermostat installed?	<ul style="list-style-type: none"> Not envisioned 	<ul style="list-style-type: none"> No operation
	<ul style="list-style-type: none"> Envisioned 	<ul style="list-style-type: none"> This parameter enables a digital clamp ID (indicated on the circuit board with the code TRA) to which a room thermostat must be connected, used to disable the compressors and the integrative resistances. Set the trA parameter (index D INSTALLER menu), with the appropriate value, selecting from: <ol style="list-style-type: none"> Value (1 or 2): ENABLED Value (0 or 3): DISABLED Remember that the OPEN state on the clamp represents: <ul style="list-style-type: none"> the compressors and resistances block operation if the parameter is set at 1 the compressors, pumps and resistances block operation if the parameter is set at 2 represents the pump alarm (as in the previous software version), if the parameter is set at the value 3



ATTENTION

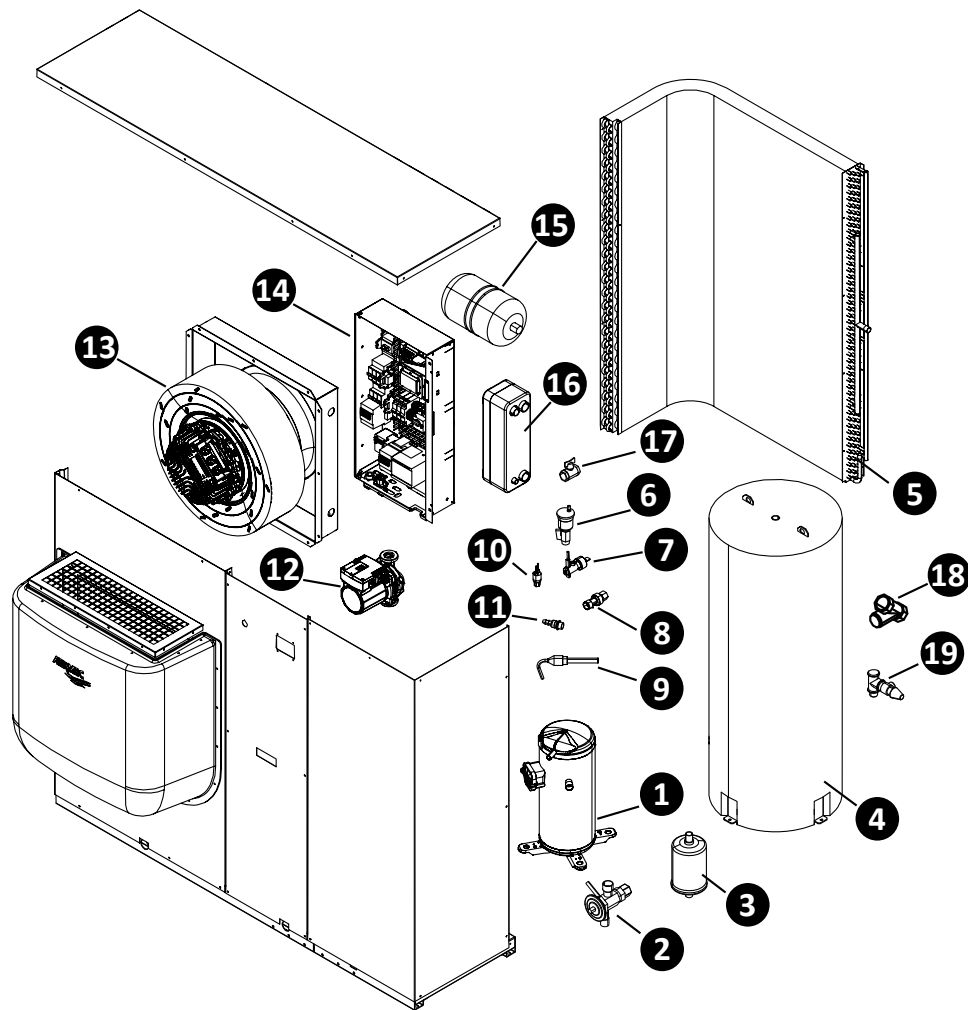
For further information, refer to the **USER manual** supplied with the chiller and also available on www.aermec.com

18. TROUBLESHOOTING

ANOMALY	CAUSE	REMEDY
The unit does not start	<ul style="list-style-type: none"> No electric voltage 	<ul style="list-style-type: none"> Check the presence of voltage Check the safety systems upstream from the appliance
	<ul style="list-style-type: none"> Master switch at OFF Remote switch at OFF (if present) Control panel at OFF Main switch at OFF Compressor magnet circuit breaker at OFF 	<ul style="list-style-type: none"> Position at ON
	<ul style="list-style-type: none"> Power supply voltage too low 	<ul style="list-style-type: none"> Check power supply line
	<ul style="list-style-type: none"> Remote control switch coil broken Circuit board broken Peak condenser broken Compressor broken 	<ul style="list-style-type: none"> Replace the component
Insufficient yield	<ul style="list-style-type: none"> No refrigerant Dirty coils Water filter clogged Appliance dimensioning Operation outside of operational limits 	<ul style="list-style-type: none"> Check the load and any leaks Clean the coils Clean the filter Check performance Check the operational limits using the graphics
Noisy compressor	<ul style="list-style-type: none"> Liquid return to the compressor Inadequate fixing 	<ul style="list-style-type: none"> Check
	<ul style="list-style-type: none"> Inverted phase 	<ul style="list-style-type: none"> Invert a phase (400V/3N/50Hz)
Noise and vibrations	<ul style="list-style-type: none"> Contacts between metal bodies 	<ul style="list-style-type: none"> Check
	<ul style="list-style-type: none"> Weak support 	<ul style="list-style-type: none"> Strengthen
	<ul style="list-style-type: none"> Loose screws 	<ul style="list-style-type: none"> Tighten the screws
The compressor stops due to intervention of the protections	<ul style="list-style-type: none"> Excessive flow pressure Low intake pressure Low power supply voltage Electric connections fastened badly Operation outside of operational limits 	<ul style="list-style-type: none"> Check the operational limits using the graphics
	<ul style="list-style-type: none"> Pressure switch malfunctioning 	<ul style="list-style-type: none"> Replace the component
	<ul style="list-style-type: none"> Circuit breaker protection intervention 	<ul style="list-style-type: none"> Check power supply voltage and calibration Check electric isolation of the windings
Compressor high discharge pressure	<ul style="list-style-type: none"> High external air temperature High utility inlet water temperature 	<ul style="list-style-type: none"> Check the operational limits using the graphics
	<ul style="list-style-type: none"> Insufficient air flow Insufficient water flow 	<ul style="list-style-type: none"> Check: <ol style="list-style-type: none"> Fan operation Cleanliness of the coils Pump operation (speed) Filter cleanliness
	<ul style="list-style-type: none"> Fan regulation anomalous operation 	<ul style="list-style-type: none"> Check or replace if broken
	<ul style="list-style-type: none"> Air in the hydraulic system 	<ul style="list-style-type: none"> Bleed the circuit
	<ul style="list-style-type: none"> Excessive refrigerant gas load 	<ul style="list-style-type: none"> Restore the correct load
Low discharge pressure	<ul style="list-style-type: none"> Low external air temperature Low input water temperature 	<ul style="list-style-type: none"> Check the operational limits using the graphics, as above
	<ul style="list-style-type: none"> Humidity in the cooling circuit 	<ul style="list-style-type: none"> Empty and restore the gas load
	<ul style="list-style-type: none"> Air in the hydraulic system 	<ul style="list-style-type: none"> Bleed the circuit
	<ul style="list-style-type: none"> Insufficient gas load 	<ul style="list-style-type: none"> Restore the correct load
High intake pressure	<ul style="list-style-type: none"> High external air temperature High utility inlet water temperature Thermostatic expansion valve too open or damaged 	<ul style="list-style-type: none"> Check the operational limits using the graphics Adjust or replace if damaged
Low intake pressure	<ul style="list-style-type: none"> Low utility water inlet temperature Low external air temperature Thermostatic expansion valve damaged or blocked 	<ul style="list-style-type: none"> Check the operational limits using the graphics Adjust or replace if damaged
	<ul style="list-style-type: none"> Insufficient water flow Insufficient air flow 	<ul style="list-style-type: none"> Check: <ol style="list-style-type: none"> Fan operation Cleanliness of the coils Pump operation (speed) Filter cleanliness

19. SPARE PARTS

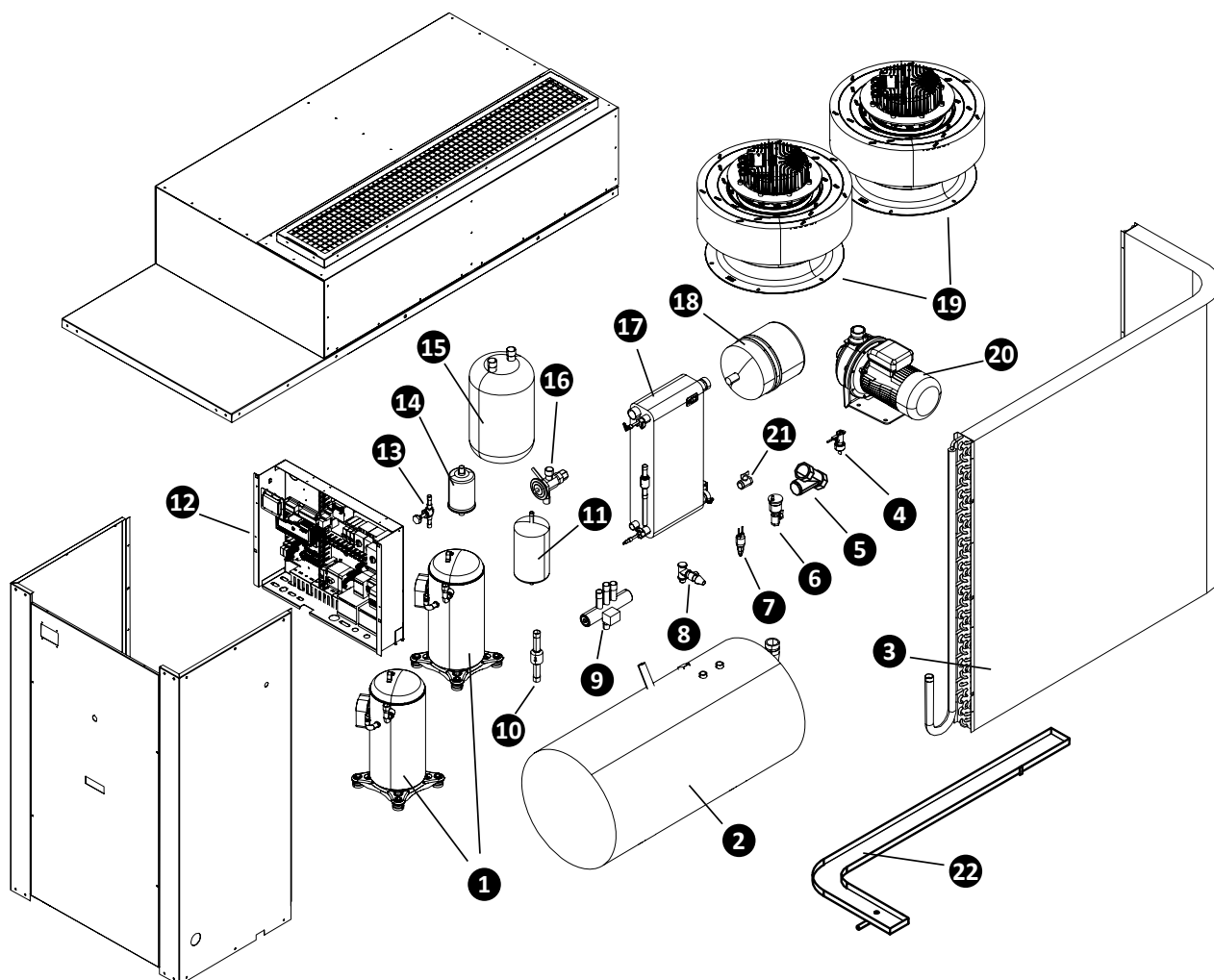
CL MODEL ""COOLING ONLY - VERSION "A" WITH STORAGE TANK AND PUMP



KEY

1	Compressors scroll
2	Thermostatic valve
3	Dehydrator filter
4	System storage tank
5	Finned exchanger
6	Cut-off vent valve
7	Flow switch
8	High pressure switch
9	200 W resistance antifreeze
10	Pressure trasducer
11	Water drain
12	Pump
13	Plug fans with EC Inverter motors
14	Electrical box
15	Expansion vessel
16	Plate exchanger
17	Cut-off valve
18	Water filter
19	Safety valve

CL MODEL "H" HEATING PUMP - VERSION "A" WITH STORAGE TANK AND PUMP



KEY

1	Compressors scroll
2	System storage tank
3	Finned exchanger
4	Flow switch
5	Water filter
6	Cut-off vent valve
7	Pressure trasducer
8	Safety valve (6 bar)
9	Cycle reversing valve
10	One-way valves
11	Liquid separator
12	Electrical box
13	Cut-off valve
14	Dehydrator fi lter
15	Liquid storage tank
16	Thermostatic valve
17	Plate exchanger
18	Expansion vessel
19	Plug fans with EC Inverter motors
20	Pump
21	Cut-off valve
22	Condensate tray



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The technical data given in this documentation is not binding. Aermec reserves the right to make all modifications deemed necessary for improving the product at any time.
