

klimatix

User Manual HVAC Chiller

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Revision Description	Date	Change	Approval
-	-	-	-

ABOUT THE MANUAL

The purpose of this manual is to provide the necessary information for the installation, operation and maintenance, which are enough to ensure the operation of the equipment under the conditions for which it was designed.

Considering that technological advancements will occur, Mecalor reserves the right to change this manual and the design of the equipment without prior warning.

Words like DANGER, ATTENTION and INFORMATION are used in the course of the manual to show warning situations as shown below:

	DANGER	Warns about immediate danger that may cause serious injuries or death.
	ATTENTION	Warns about unsafe practices, which if not avoided, may cause personal damages or death.
	INFORMATION	Relevant information about the equipment or recommendation about good working practices.

MANUFACTURER

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	INFORMATION	Keep this manual in a place that is accessible to the user to consult in case of doubts. This manual cannot be reproduced whole or in part without the prior authorization from Mecalor.
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	INFORMATION	Do not perform any procedure on the equipment in case of doubts after reading this manual. This manual serves as a guide to operate the equipment safely and it does not have the purpose of informing all the variables of the system. Contact the technical support of Mecalor in case of doubts.
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1. General Description of the Product

1.1. Equipment Description

This equipment incorporates, in a single cabinet, all the components necessary for the continuous supply of process fluid in closed circuit, controlling the temperature accurately and adjusting its capacity according to the heat load variations of the process according to a pre-established temperature (*setpoint*).

Assembled in a compact carbon steel structure, powder-painted with thickness of 70 microns in olive green (RAL 6003), it was designed to work outdoors without having to shelter it in a covered area.

The basic operation is divided into three categories, according to application: refrigeration circuit, hydraulic circuit and control.

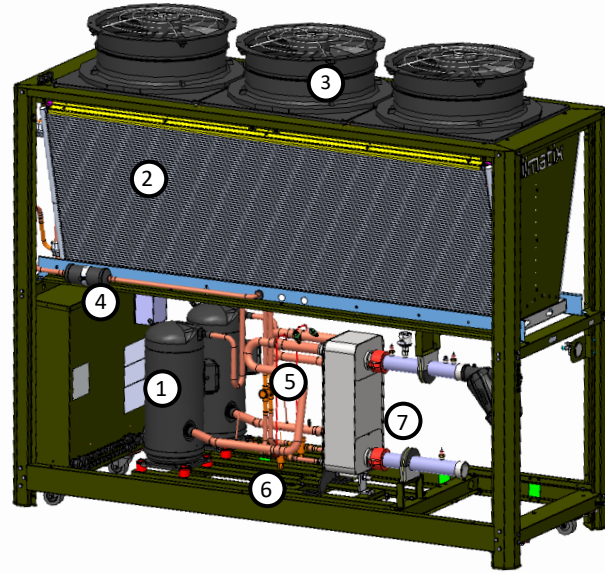
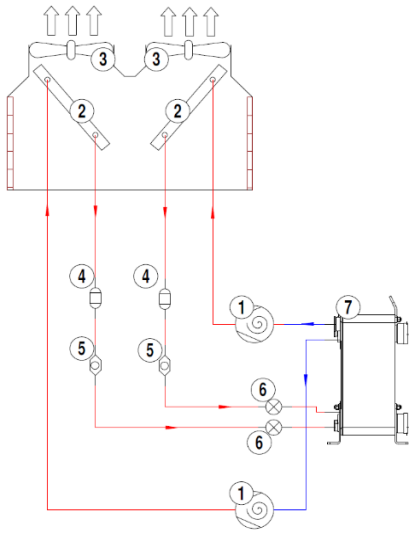
	INFORMATION	Design developed and built according to standards NR-10 (electrical safety) and NR-12 (operator protection).
	ATTENTION	Tampering with original components installed on the RLAC-S is not allowed. This practice may endanger the safety of the operator, the proper functioning of the equipment, and the loss of warranty.

a) Refrigeration circuit

The cooling system of the RLAC consists of a scroll hermetic compressor (1) that is responsible for continuously sending the refrigerant in the form of hot gas to the microchannel condenser (2); in this condenser the refrigerant changes from overheated steam to sub-cooled liquid, and through this change of state, the condensing air receives the enthalpy (raising its temperature) of the refrigerant, passing through the condenser with the aid of a fan (3) installed on the top part of the equipment or through a plate exchanger in which the brazed heat exchange fluid is water.

The refrigerant in the sub-cooled liquid condition passes through a filter drier (4), which is responsible for eliminating impurities and moisture present in the system. In addition to a liquid display (5), which is responsible for visually indicating the fluid situation inside the piping. When passing through the expansion valve (6), which can be mechanical or electronic, the refrigerant suffers a pressure drop, entering in the form of saturated liquid in the evaporator (7). Inside the evaporator the refrigerant fluid receives heat from the process water, going from the saturated liquid state to overheated steam, condition in which it can enter the compressor and restart the cooling cycle.

- Air condensation




Item	Description
1	Hermetic Scroll Compressor
2	Micro-channel (Air condensation) / Plate Condenser (water condensation)
3	Fan
4	Filter Drier
5	Liquid Display
6	Expansion Valve
7	Plate Evaporator



INFORMATION

A high pressure switch monitors the discharge pressure of the compressor and a low pressure switch monitors the suction pressure of the compressor, and these switch off the equipment in case the pressure reaches the maximum and minimum safety values.

	DANGER	<p>The compressors are equipments that operate with differential pressure between suction and discharge.</p> <p>In suction, according to the condition of use, the pressure and temperature are low, which may cause burns.</p> <p>In discharge, according to the condition of use, the pressure and temperature are high, which may cause burns.</p> <p>The interior of the equipment should only be accessed by qualified personnel and Personal Protective Equipment (PPE).</p>
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The capacity control of the Chiller models RLAC-S-25/30/40/50/60 is performed by turning off the compressor of one of the cooling circuits, and 2 equal compressors are applied in these equipment, one in each circuit, i.e., one compressor operating for 50% capacity and two compressors operating for 100% capacity.

In the RLAC-S-80/100/115/150 models, 4 compressors are used, 2 in each circuit, and in the 115 and 150 models they are all the same, modulating capacity by 25%, 50%, 75%, and 100%, and in the 80 and 100 models two tandems of compressors of different capacities are used, modulating capacity according to the quantities and models of the compressors in operation. In models RLAC-S-175/220, there is the application of 6 equal compressors, 3 per circuit and the modulation is as follows: 16%, 33%, 50%, 66%, 83% and 100%.

All the models also have time rotation between the compressors.

In addition, the HVAC Chiller RL is equipped with an electronic expansion valve from the RLAC-S-40-CA model that assists in capacity modulation, energy savings, and additional protection for the compressors.

b) Hydraulic circuit

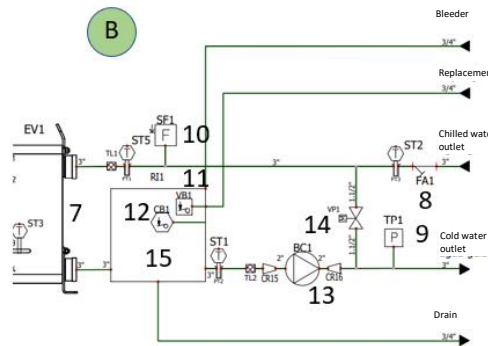
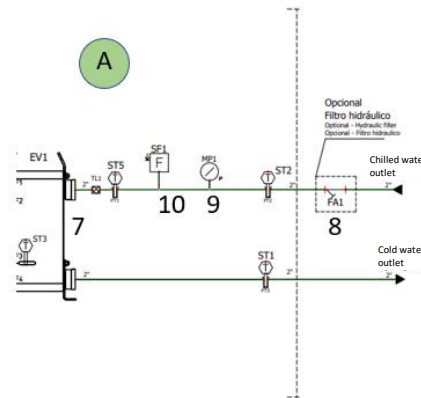
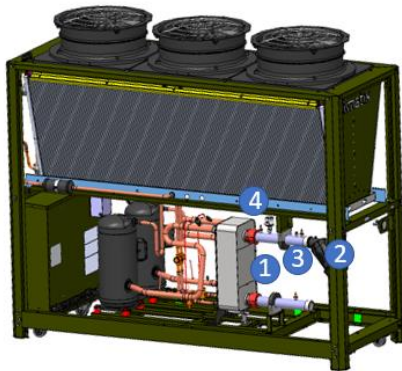
The process water circulates through the hydraulic circuit of the equipment as shown in picture A (open circuit). On customized machines the equipment can be supplied with an accumulation tank, as shown in picture B. The main items of A and B are shown below. The process water is cooled through the cooling circuit described above. In most cases, after losing heat to the refrigerant inside the evaporator (7), the water goes to an external accumulation tank, if not it goes straight to the process.

An external circulation pump has the function of transporting chilled water from the chiller to the process. On returning from the process, hotter, the water should pass through a filter (12) (supplied as optional) at the RLAC-S inlet that has the function of eliminating impurities returning to the plate exchanger, where the cycle begins again.

An electronic flow meter (14) is installed in the return pipe to interrupt the operation of the equipment after a pre-established period when it detects water flow below specification.

A pressure gauge(9), which can be a pressure transducer or a pressure gauge depending on the equipment, is installed at the chilled water outlet which indicates the pressure that is being supplied to the process. If the pressure gauge is a transducer, the pressure is shown on the HMI display, if not, it is shown on a pressure gauge display, and serves as a reference for the operator.

In equipment supplied with an internal accumulation tank (customized equipment), the RLAC-S has the function of maintaining the water temperature inside the internal tank. Similar to what was described above, the pump (13) of the RLAC-S has the function of transporting water from the internal tank to the process.



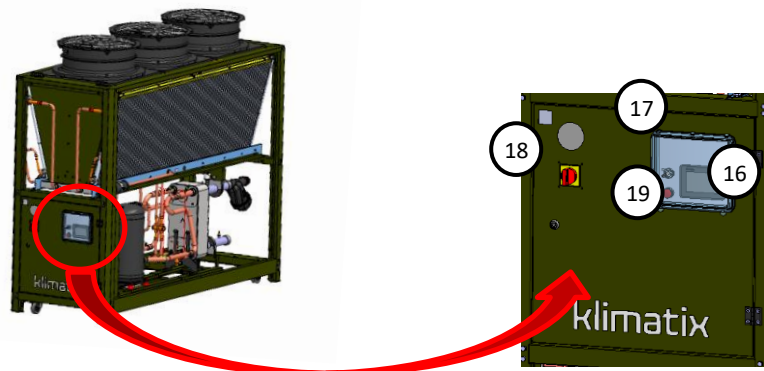
Item	Description
7	Heat Exchanger
8	Hydraulic Filter
9	Pressure Meter
10	Flow switch
11	Mechanical Float
12	Level Switch
13	Centrifugal pump
14	Proportional Valve
15	Tank

c) Control


All the electrical control and command components are installed inside the electrical panel (16), IP 54 protection, in the front part of the equipment.


The control is performed through the PLC installed inside the electrical panel, which is accessed by an MMI (16) with touch technology installed on the door of the electrical panel next to a commutator (17), which serves to switch on the equipment, both protected by an acrylic protection. This door also has a rotary handle (18) installed to activate the load switch in order to power up the equipment.

A sound signal is installed inside the electrical panel, which sounds in case of failure, and a light signal (19) indicates the failure and is located next to the commutator. It is possible to silence this alarm until the problem has been solved. The equipment cannot start operating while the alarm is not solved.



Item	Description
16	MMI
17	Commutator
18	Load switch
19	Light Signal


	INFORMATION	<p>NTC sensors are installed in the outlet and return pipe of the process water. Sensors and pressure transducers are installed at various points in the cooling circuit. They send analog signals to the PLC, which are converted into temperature and pressure indicated on the MMI screen. These signals are used as reference by the PLC to take action on the cooling system in order to control the capacity of the equipment.</p>
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	INFORMATION	<p>A phase sequence relay is installed inside the electrical panel of the RLAC, which protects the equipment against phase failure or phase inversion. In case it is inverted, the equipment will not turn on and the R and S phases must be inverted at the electric power inlet of the main switch.</p>
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1.2. Application Scope

The line of RLAC-S chillers is equipment designed for cooling water or solutions applied in processes and systems that require temperature and/or humidity control.

- Climate control for thermal comfort
- Air treatment
- Climate control for industrial processes
- Climate control for datacenters
- Climate control for telephone centers
- Climate control for electrical rooms

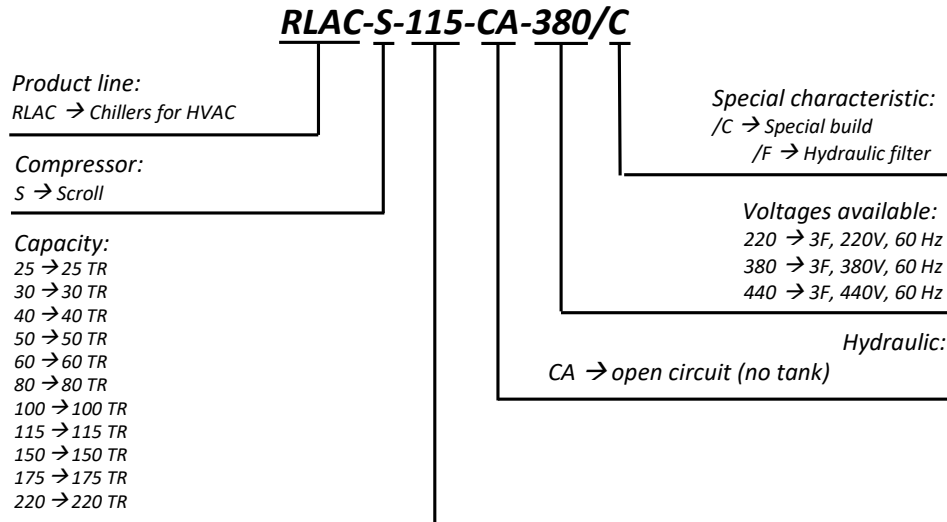
	ATTENTION	Applications different from those intended for the product may put at risk the safety of the operator, the performance and even the breakage of a component of the RLAC-S and the loss of warranty.
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1.3. Optional items installed at the factory and on the field

Item	Installed in Factory	Installed on Field
Hydraulic Filter	✓	✓

2. Technical Features

2.1. Nomenclature



	INFORMATION	<p>Check special documentation described in the annex to this manual for RLAC-S that has a special character (for example /B/C/E/T)</p> <p>Some data in this manual such as electrical data may not apply to the RLAC-S that has special characters..</p>
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2.2. Physical Information

- Air condensation


Model ⁽¹⁾	Rated Capacity ⁽²⁾	Operation Power ⁽³⁾	Efic. - Maximum Load ⁽⁴⁾	Efic. - IPLV ⁽⁵⁾	Dimensions in millimeters			Process Flow	Water reservoir	Condensation Air	Piping Diameter	Weight
		kW	-	-	Width	Comp.	Height	m ³ /h	Liters	m ³ /h	Process	kg
RLAC-S-25	23.6	29.3	COP=2.8 / EER=9.7	COP=3.5 / EER=12.1	825	2,274	1,945	14.5	110	26,274	2"	400
RLAC-S-30	27.9	33.7	COP=2.9 / EER=10.0	COP=3.5 / EER=12.1	825	2,779	2,233	17.0	110	32,460	3"	500
RLAC-S-40	35.0	41.2	COP=3.0 / EER=10.2	COP=3.8 / EER=12.9	1,123	2,603	2,619	22.0	290	35,030	3"	850
RLAC-S-50	46.4	51.9	COP=3.1 / EER=10.7	COP=3.6 / EER=12.4	1,873	2,751	2,279	28.0	160	64,920	3"	1350
RLAC-S-60	58.4	72.3	COP=2.8 / EER=9.7	COP=3.5 / EER=12.0	1,873	2,553	2,279	33.0	160	64,920	3"	1450
RLAC-S-80	76.5	95.1	COP=2.8 / EER=9.6	COP=4.1 / EER=14.3	2,521	2,623	2,759	46.5	420	70,060	4"	1300
RLAC-S-100	102.2	126.3	COP=2.8 / EER=9.7	COP=4.1 / EER=13.9	2,521	3,788	2,759	62.0	420	105,090	4"	1650
RLAC-S-115	112.1	144.9	COP=2.8 / EER=9.3	COP=4.2 / EER=14.0	2,521	3,788	2,759	68.0	420	105,090	4"	1750
RLAC-S-150	139.6	178	COP=2.8 / EER=9.4	COP=4.0 / EER=13.7	2,521	5,136	2,759	85.0	730	140,120	6"	1950
RLAC-S-175	172.0	213.2	COP=2.8 / EER=9.4	COP=4.2 / EER=14.3	2,521	6,301	2,759	105.0	730	175,150	6"	2600
RLAC-S-220	213.6	274.8	COP=2.7 / EER=9.3	COP=4.1 / EER=14.1	2,521	7,466	2,759	130.0	730	210,180	6"	3750


- All models of the RLAC-S line have a dual, independent cooling circuit.
- Considering 100% load, return temperature of 12°C, outlet temperature of 7°C, and ambient temperature of 35°C
- Active power with the chiller operating at 100% of the capacity with cold water at 7°C.
- COP= Coefficient of performance
- IPLV=Integrated part load value according to AHRI 550/590



INFORMATION

Refrigerant Used: R-410A

	INFORMATION	The power in regime is calculated based on the nominal operating condition of the equipment and it SHOULD NOT be used to size the protections of the RLAC-S, considering that the equipment may operate in conditions close to the maximum power of the equipment.
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	DANGER	The refrigerant R-410A has relative higher pressures than the R-22 normally used in the application of Chillers. No other refrigerants should be used in the RLAC-S refrigeration system. The meters applied should be suitable for operating with pressure fluid R-410A
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2.3. Identification plate attached to the RLAC-S

A Abbreviation of the model

B Voltage (V), phases and frequency (Hz)

C Cooling heat capacity

D Fluid for heat rejection in the condenser

E Flow rate (m³/h) of the process pump

F Special characteristics

G Month and year of manufacture

H Maximum electrical demand at full load (kVA)



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Modelo Model / Modelo	Fabricação Manufacturing Date / Fabricación	Nº. de série Serial Number / N.º. de Serie
A Alimentação elétrica Power Supply / Alimentación Eléctrica	G Potência instalada Installed Power / Potencia Instalada	L Corrente nominal Rated Current / Corriente Nominal
B Capacidade nominal Rated Capacity / Capacidad Nominal	H Refrigerante Coolant / Refrigerante	M Temp. de trabalho Working Temp. / Temp. de Operación
C Condensação Condensation / Condensación	I Temperatura Temperature / Temperatura	N Vazão requerida Required Flow / Caudal Requerido
D Bomba de processo Process Pump / Bomba de Proceso	J Peso (kg) Weight / Peso	O Aquecimento Heating / Calentamiento
E	K	P
F Observações e dados complementares Remarks and Complementary Data / Observaciones y Datos Adicionales		

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I Cooling fluid

J Maximum room temperature

K Weight (kg)

L Tracking number

M Maximum current consumed (A)

N Working temperature of the process fluid

O Air flow required by the fan

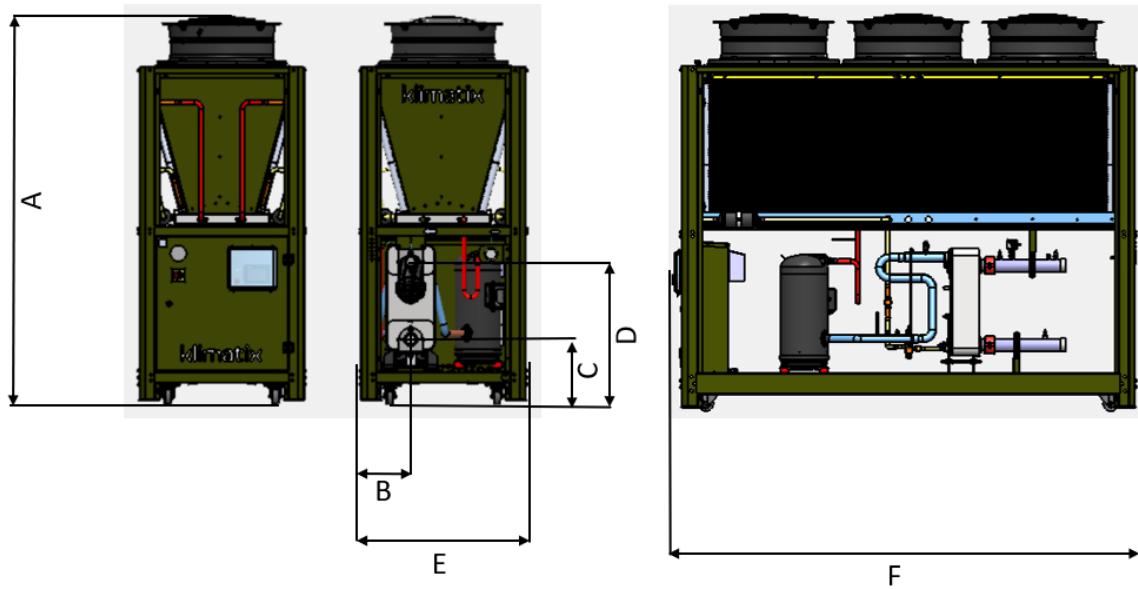
P Not applicable

2.4. Operating limits

Some operating limits are described below and must be observed for good performance and operation of the RLAC-S:

- Maximum room temperature up to 42°C.
In case the RLAC-S works with room temperature below 10°C it is recommended to install the optional condensation control, which automatically varies the rotation of the fans from 10 to 100% according to the condensation pressure, reducing the room temperature or heat load of the process.
- Outdoor operation
In case the installation site of the RLAC-S is covered, the installation of an air duct in the outlet of hot air from the fan must be provided in order to avoid the recirculation of hot air through the RLAC-S, causing the deactivation of the equipment.
- Supply of chilled water at temperatures between 5°C and 15°C
For the process water temperature and room temperature below 5°C, use anti-freeze additive mixed to the process water. Consult Mecalor for adjustments in the RLAC-S in case the equipment is not prepared for this purpose.
- Make sure that the installation site have the space indicated in this manual in order to ensure the circulation of air and the maintenance area around the equipment.
- The fan system should be inspected regularly, as the suspension of particles can cause imbalance of the propellers. The airflow area of the fan should be cleaned only with water and neutral soap, avoiding abrasives.
- Observe and avoid excess water near the electric system of the fan engine, thus ensuring the proper functioning and operation of the fan. After the cleaning procedure, it is recommended to operate the fans for about 2h, with its maximum rotation, in order to evaporate any water residue remaining from the cleaning.

2.5. Dimensions



*Image for illustration purposes only

Model	Dimensions in millimeters						Process Pipe Diameter
	A	B	C	D	E	F	
RLAC-S-25	1,945	249	325	715	825	2,274	2"
RLAC-S-30	2,233	249	353	743	825	2,779	3"
RLAC-S-40	2,619	321	441	831	1,123	2,603	3"
RLAC-S-50	2,279	313	356	746	1,873	2,751	3"
RLAC-S-60	2,279	313	356	746	1,873	2,553	3"
RLAC-S-80	2,759	1,302	372	762	2,521	2,623	4"
RLAC-S-100	2,759	1,389	373	963	2,521	3,788	4"
RLAC-S-115	2,759	1,389	372	967	2,521	3,788	4"
RLAC-S-150	2,759	1,389	383	978	2,521	5,136	6"
RLAC-S-175	2,759	1,389	382	983	2,521	6,301	6"
RLAC-S-220	2,759	1,389	432	1,027	2,521	7,466	6"




The dimensional drawing indicated is only a reference and it does not represent all the RLAC models

- ATTENTION: Some dimensions may be different from the models that have special characters in the nomenclature. In this case, consult the dimension applicable.


2.6. Electrical Data


The customer is responsible for laying the electric cable up to the equipment and it must be performed by a qualified person.

Check the electrical features of the RLAC-S on the identification plate attached to the equipment. The network voltage must be according to the voltage of the RLAC-S and within the limits shown in the electrical data table below.

	INFORMATION	A power supply point is not necessary for the command/control circuit, because it is powered by the internal transformer of the equipment.
	INFORMATION	Command/control circuit voltage of 24V according to standards NR10 and NR12. Components installed on the equipment door does not represent the risk of electric shock to the operator.
	ATTENTION	Consult the standards applicable to the electrical installation at the site so as to ensure that the installation of the RLAC-S is according to the specified standards and prerequisites. For installations in Brazil, consult standard NBR5410 "Low Voltage Electrical Installations"

Model	Voltage (V)			Power Supply Point		
	Nominal	Minimum	Maximum	Maximum Power (kVA)	Maximum Current (A)	Cable (mm ²)
RLAC-S-25	220	198	242	44.3	117.7	50
	380	342	418	44.7	68.8	25
	440	396	484	46.5	61.8	16
RLAC-S-30	220	198	242	54.1	143.4	70
	380	342	418	56.8	87.1	35
	440	396	484	56.9	75.4	25
RLAC-S-40	220	198	242	65.7	174	95
	380	342	418	65.8	100.9	50
	440	396	484	66	87.3	35
RLAC-S-50	220	198	242	81.5	215.3	150
	380	342	418	84.4	129.1	70
	440	396	484	84.4	111.5	50
RLAC-S-60	220	198	242	102.9	271.7	240
	380	342	418	107.2	163.8	95
	440	396	484	107.1	141.5	70
RLAC-S-80	220	198	242	139.1	367.1	400
	380	342	418	143.4	219.2	150
	440	396	484	143.4	189.3	120
RLAC-S-100	220	198	242	195.2	514.3	630
	380	342	418	202.8	309.4	240
	440	396	484	202.7	267.1	185
RLAC-S-115	220	198	242	205.2	541	630
	380	342	418	213.8	326.2	300
	440	396	484	213.7	281.7	240
RLAC-S-150	380	342	418	273.4	416.6	400
	440	396	484	275.5	362.6	400
RLAC-S-175	380	342	418	324.9	495.4	630
	440	396	484	324.7	427.6	500
RLAC-S-220	380	342	418	393.7	600	630
	440	396	484	413.2	543.7	630

	<p>ATTENTION</p>	<p>DO NOT USE the electrical data of the previous table to size the power supply point in RLAC-S models that have special characters (for example /B/C/E/T) Check the special documentation described in the annex of this manual for RLAC-S with special character..</p>
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	<p>ATTENTION</p>	<p>The maximum power informed on the electrical data table should be used to size the protections and cables. DO NOT USE the power in regime that was calculated based on the nominal operating condition of the equipment.</p>
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3. Receiving

The receiving and moving of the equipment should be performed by the customer.

3.1. Packaging

In the domestic market, the RLAC-S-25/30 models are shipped in an untreated wooden box, while the RLAC-S-40/50/60/80/100/115/150/175/220 models are covered by a raffia sheet designed for each model, exactly as they should be transported.

In foreign markets, the RLAC-S-25/30/40/50/60/80/100/115/150/175/220 models are shipped in a wooden box with phytosanitary treatment.



Canvas-type packaging



Wooden box type packaging

	ATTENTION	Do not place volumes over the equipment during the transport process.
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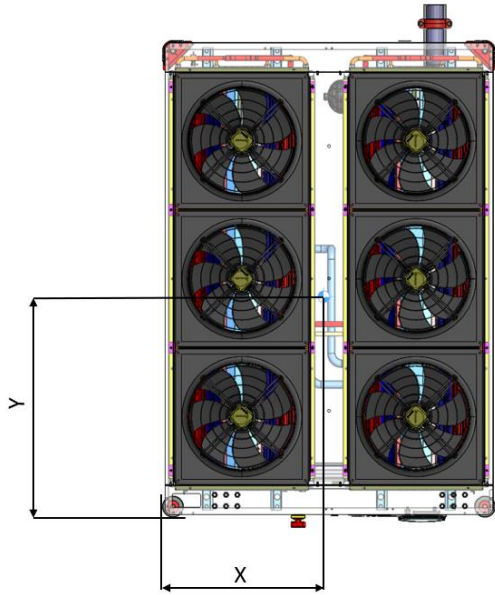
3.2. Unloading, Moving and Storage

As soon as the unit is received and before unloading, check to see if the package of the RLAC-S does not have any damages caused during transport.

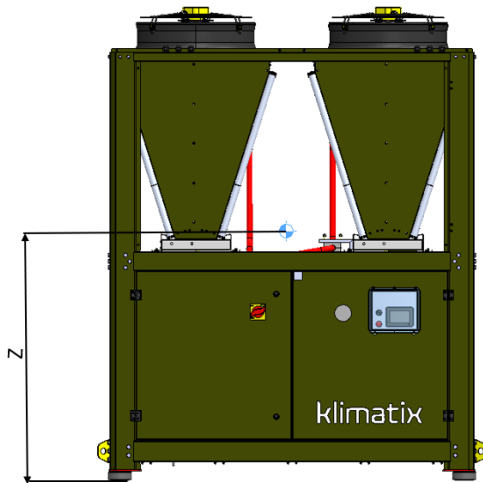
	INFORMATION	It is recommended to store the RLAC-S packaged in a dry place sheltered against dirt and bad weather in case the equipment remains unused for a long period of time before its installation and operation.
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	INFORMATION	Damages on the equipment caused during transport should be identified IMMEDIATELY after receiving Take pictures and immediately send them to the shipping company when damages are observed on the RLAC-S.
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Some unloading and moving methods are shown below. To avoid the RLAC-S from toppling over during transport, check the position of the center of gravity according to the RLAC-S model in the table below:



Model	Dimensions in millimeters		
	X	Y	Z
RLAC-S-25	405.0	879.6	582.5
RLAC-S-30	402.7	1004.6	710.4
RLAC-S-40	837.9	653.4	771.3
RLAC-S-50	831.9	1197.8	1155.4
RLAC-S-60	855.7	1335.7	1198.0
RLAC-S-80	1085.6	581.0	1040.1
RLAC-S-100	984.9	664.5	1904.6
RLAC-S-115	716.8	953.4	1902.0
RLAC-S-150	1313.9	1288.0	2025.1
RLAC-S-175	1276.7	1270.2	2546.8
RLAC-S-220	1311.0	994.2	3536.3




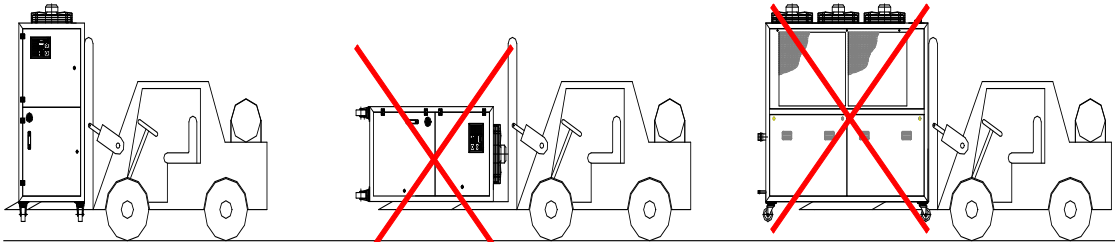
Images for illustration only


a) Forklift

The smaller capacity models can be unloaded using a forklift. Check the weight of the equipment to define the capacity of the forklift that will be used to unload the equipment.

Perform the transport with the equipment only in the vertical position.

	INFORMATION	Check the general condition of the equipment IMMEDIATELY after opening the package. In case any damage is observed, take a picture and send it to the shipping company.
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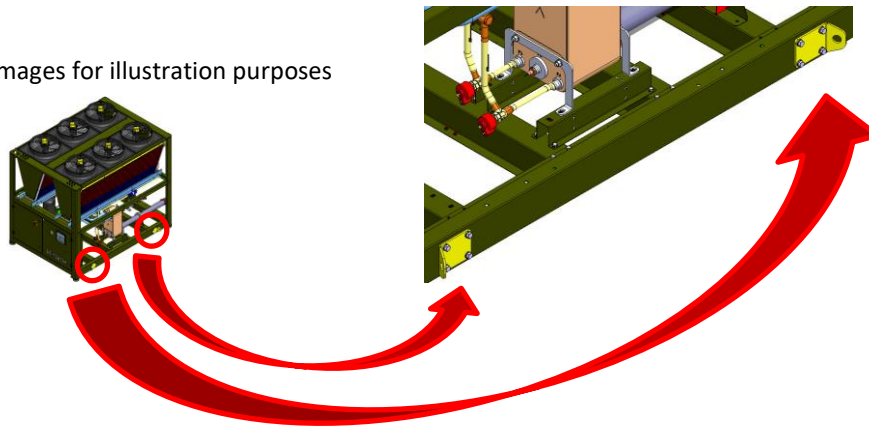
	ATTENTION	Do not topple the equipment to ship it; the RLAC-S should be shipped in the vertical position and by qualified people.
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b) Lifting

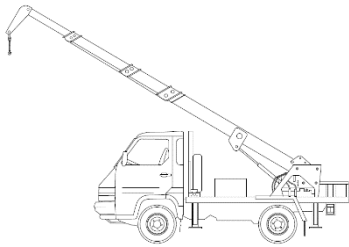
Unloading and moving can be carried out with a munck truck or a crane.

The lower part of the equipment structure has some points that should be used to lock the hooks, which should be used for tying and lifting the unit.

*Images for illustration purposes



	ATTENTION	Use rocker arm or support beam with canvas straps suitable for the weight to perform the lifting. NEVER use straps supported by a single point. Unsafe practices may cause accidents, therefore, this process should be carried out by qualified people and with the suitable safety equipments.
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4. Installation

The RLAC-S was designed contemplating the efficiency, durability and safety of the operator. However, safety must be guaranteed by proper installation, periodic preventive maintenance and operation within the design conditions.

	<p>ATTENTION</p>	<p>It is recommended for the installation of the equipment to be performed by Mecalor or by a qualified person. It is imperative for the installer to have a knowledge of local installation codes and regulations in order to ensure that the best mounting and safety practices are used.</p>
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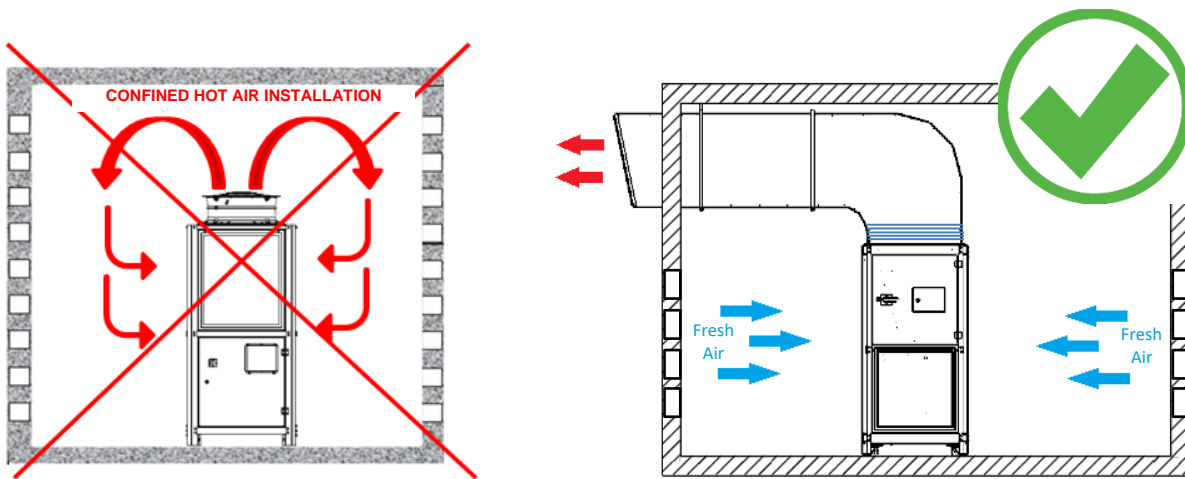
	<p>DANGER</p>	<p>The RLAC-S was not designed to work in an area classified as risk of explosion. If the use in these conditions is detected, the equipment will lose its warranty.</p>
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4.1. Installation site

The good operation of the RLAC-S depends mainly on the air flow that passes through the condenser; therefore, the equipment should be installed in an open place and with good air circulation around it. For models with water condensation, the space required around the equipment is intended for maintenance.

4.1.1. Air exhaust duct


When there is no suitable ventilation or when there is the possibility of air recirculation, a hot air exhaust duct should be installed for the RLAC-S models.




	INFORMATION	<p>The RLAC-S is equipped with an axial fan, which is not designed to be ducted. The exhaust duct to be installed is a grille and must have the smallest length possible in order to not cause excess load loss and consequently deactivate the equipment due to high pressure.</p>
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Follow the recommendations below for the correct sizing of the air exhaust duct:

- Maximum load loss in the duct: 20 Pa
- The length of the duct should not exceed 2.5 m
- The duct should be placed between the roof/wall in order not to overload the structure of the RLAC-S
- There should be a flexible canvas placed between the duct and the upper part of the fan in order to avoid the transmission of vibration to the roof/wall and enable maintenance of the fan
- The highest load loss of a duct is mostly on the very short radius curve ($\ll D/2$). Curves of bigger radiuses or close to $D/2$ avoid turbulent flow and excess load loss.

	INFORMATION	<p>In case of doubts, consult Mecalor or the ASHRAE criteria for the correct size of the hot air exhaust duct.</p>
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	INFORMATION	<p>Never restrict the air duct in the hot air outlet, this practice may cause the increase of load loss in the duct and deactivate the RLAC-S due to high pressure.</p>
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4.1.2. Base and required space

The base should be leveled to maintain the correct return of the compressor and hydraulic oil. In case of the installation of various equipments in parallel, the bases must be leveled in the same plane.

A way of checking if the base is leveled is by gauging using an instrument called *bubble level*.







Leave space around the equipment to enable easy access for maintenance, preferably with forklifts.

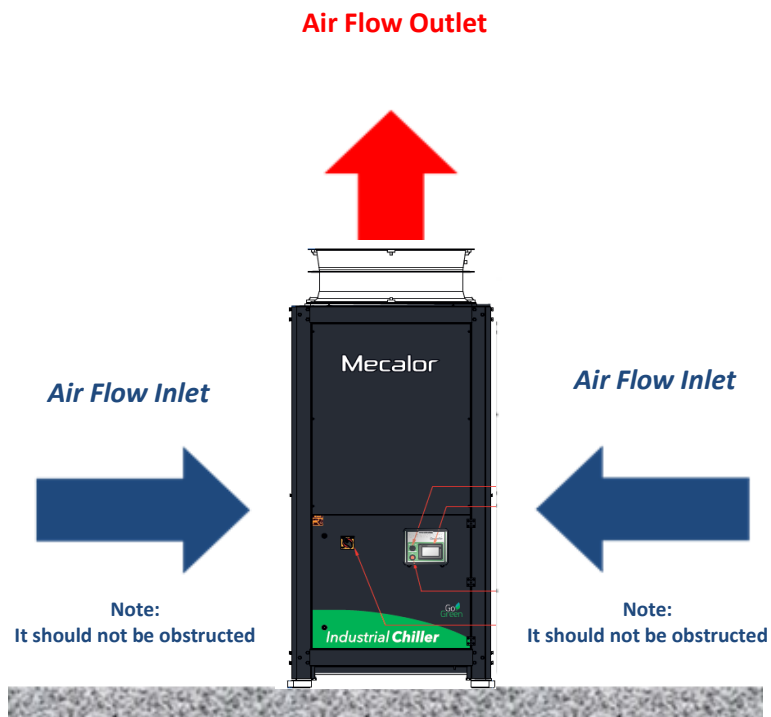
The site chosen for the installation must be as close as possible to the points of use, but, from the point of view of pressure flow and pressure loss, with well sized cold water network, there are no technical limitations for the distance between the RLAC-S and the points of use.

A rigid and leveled base should be provided to support the equipment.

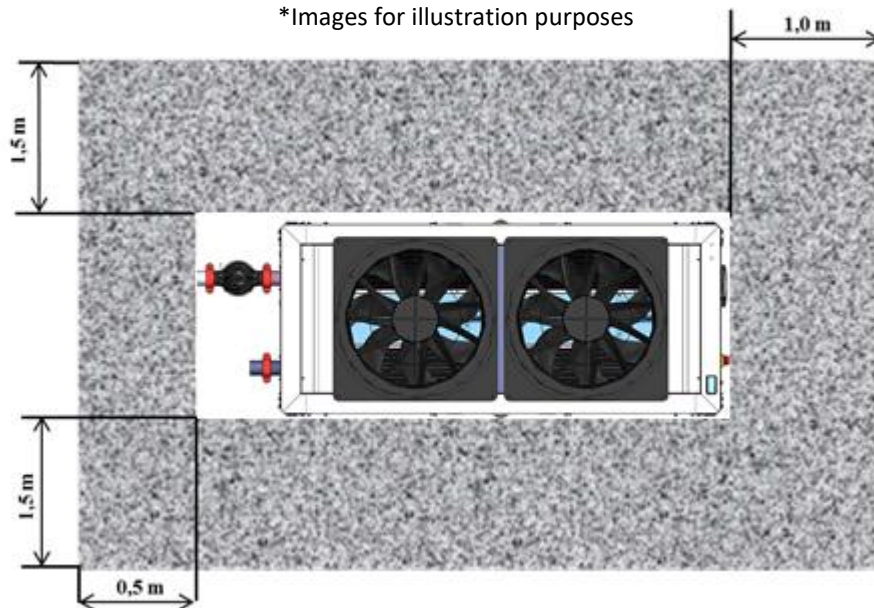
When a concrete base must be built to support the RLAC-S, use the reference table below. The minimum height should be 100 mm for solid ground.

	INFORMATION	It is recommended to install channels or a drain at the base where the RLAC-S will be placed in order to prevent water from accumulating around the equipment.
	INFORMATION	During installation, it is recommended to protect the RLAC-S in order to avoid dirt from surrounding works from being deposited on the protection screens of the condenser, blocking the air inlet. It is recommended to carry out general cleaning after installing the RLAC-S.
	INFORMATION	Avoid installing the RLAC-S in machining centers or in places with possible chips that may be deposited on the paint of the equipment. The chip deposited on the paint of the equipment may generate future problems of corrosion. In case it is not possible to install it in another place, clean the cabinet whenever the cutting process of metal parts is completed.
	INFORMATION	If around the RLAC-S base is a place with a lot of grass or sand, the application of gravel around the base is recommended to avoid the deposit of materials in the protection screens.

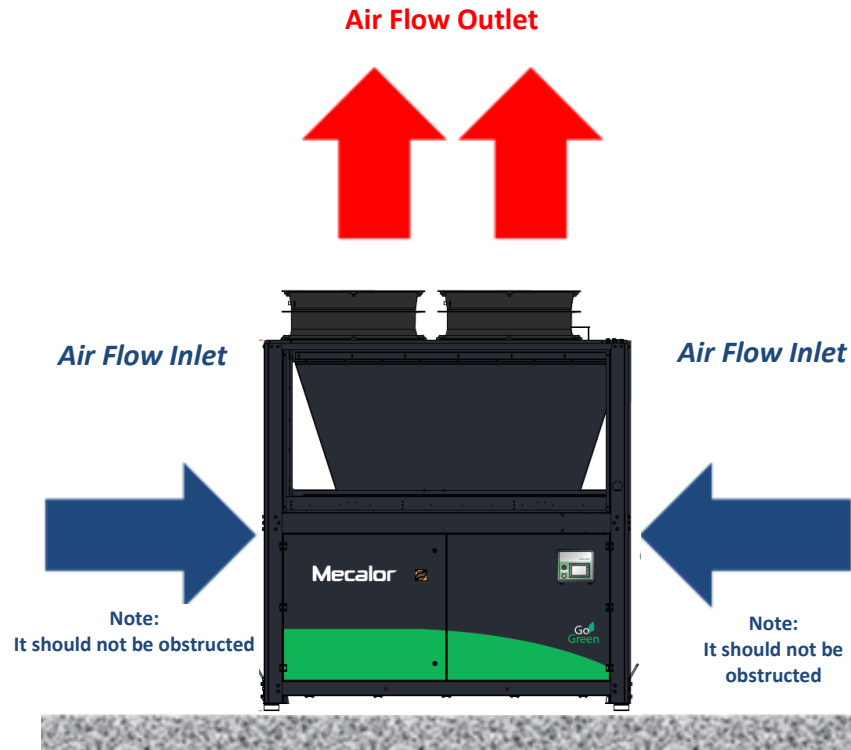
- Space required for RLAC-S-25/30/40 models



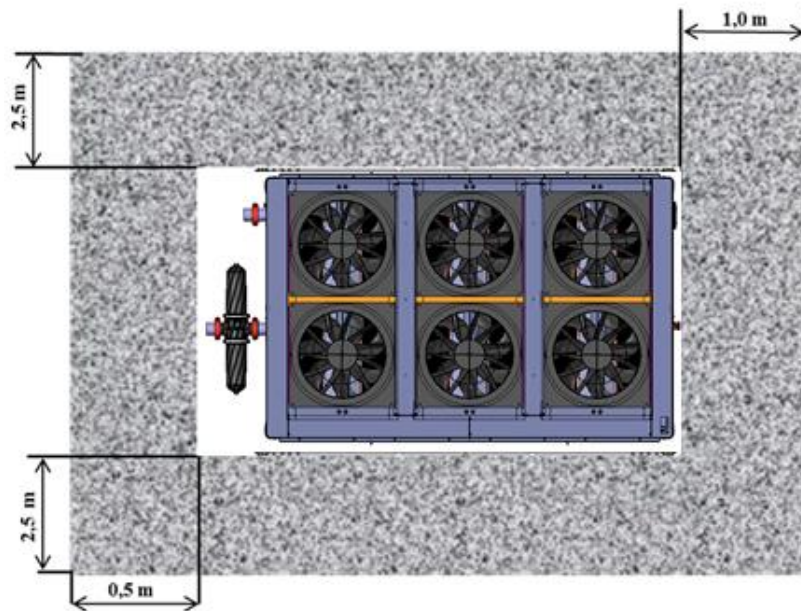
*Images for illustration purposes



- Space required for RLAC-S-50/60/80/100/115/150/175/220 models



*Images for illustration purposes



	<p>INFORMATION</p>	<p>An NTC safety sensor monitors the water temperature in the evaporator. It switches off the equipment in case the temperature remains close to the freezing point of water (0°C). Only after the water temperature normalizes will the equipment be cleared for operation.</p>
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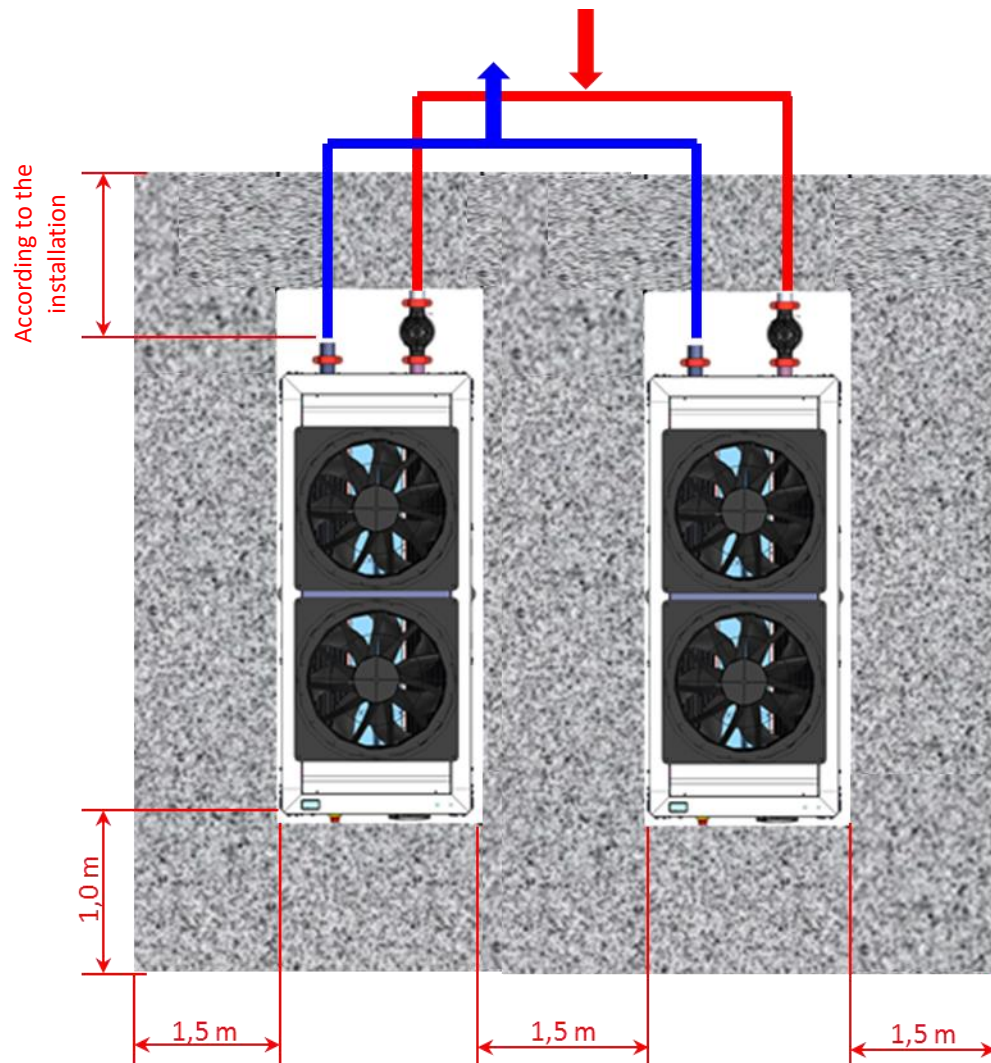
- **Space required for installation in parallel**

The required space will depend on the layout of the customer, the model of HVAC Chiller, the quantity of interconnected RLACs-S and the application concept (with tank, pumping station, filtration station, etc.), in cases where the customer hires, Mecalor designs the installation according to the layout it receives.

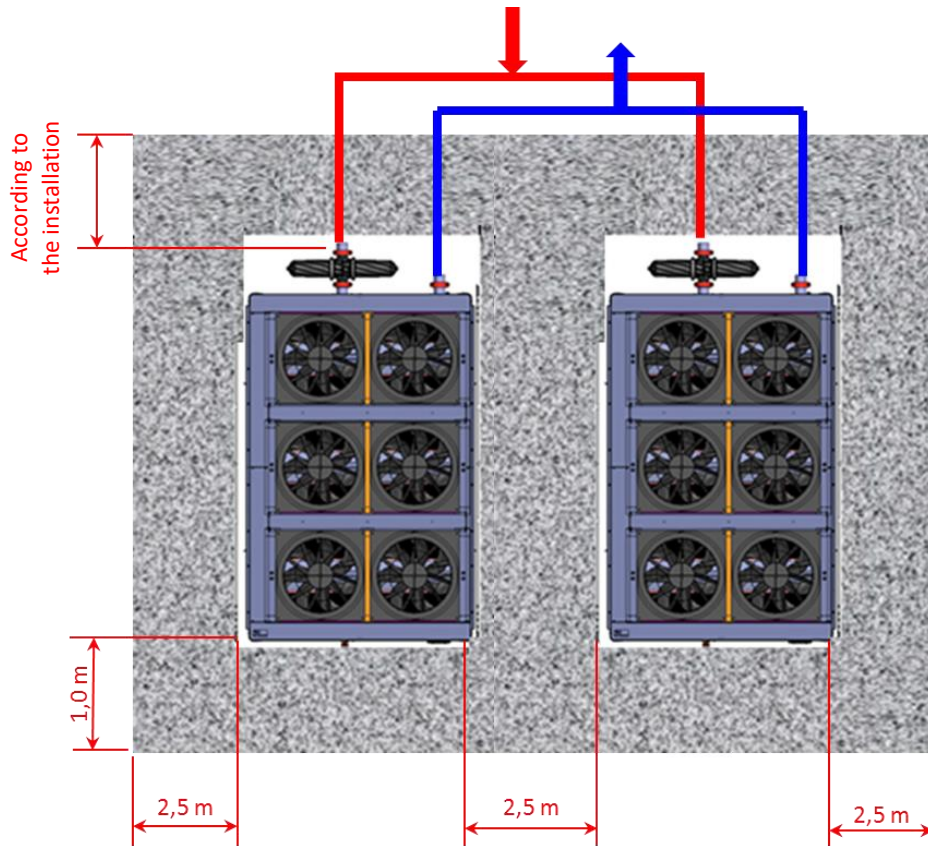
There are basically two parallel interconnection concepts: interconnection of RLACs-S with internal tank and interconnection of RLAC-S with external tank and pumping station.

In case the interconnection of the equipment is carried out by the customer, this should meet the following minimum space recommendations required for the operation and maintenance of the RLACs-S interconnected in parallel:

- **Space required for RLAC-S-25/30/40 models**

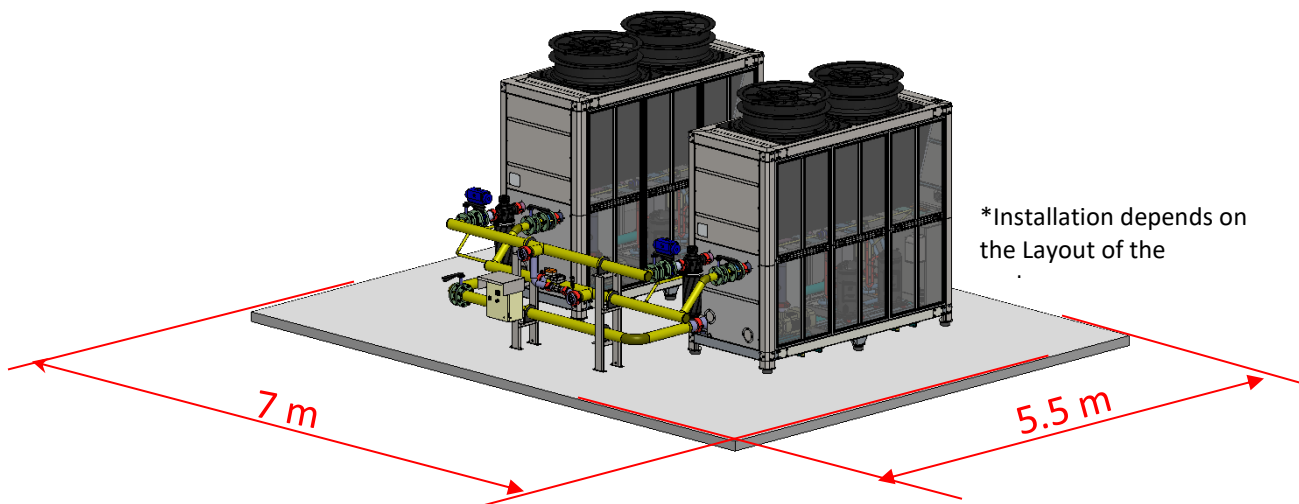


- Space required for RLAC-S-50/60/80/100/115/150/175/220 models

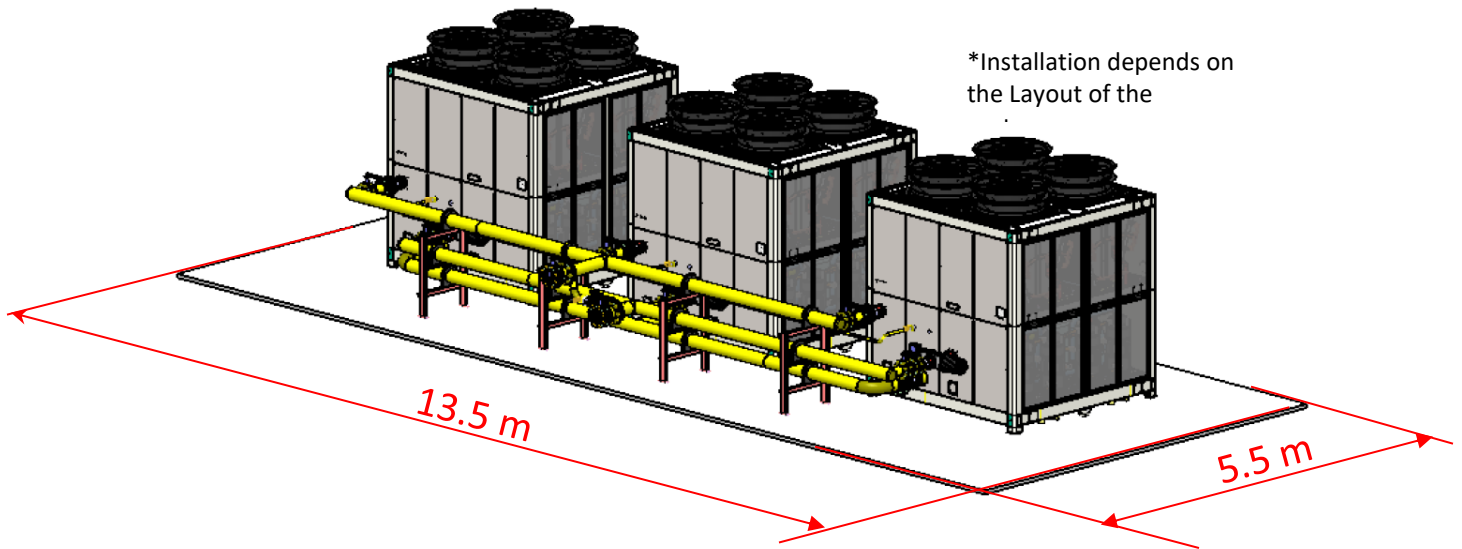


Some examples of interconnection will be shown below to provide a notion of the interconnection varieties designed by Mecalor.

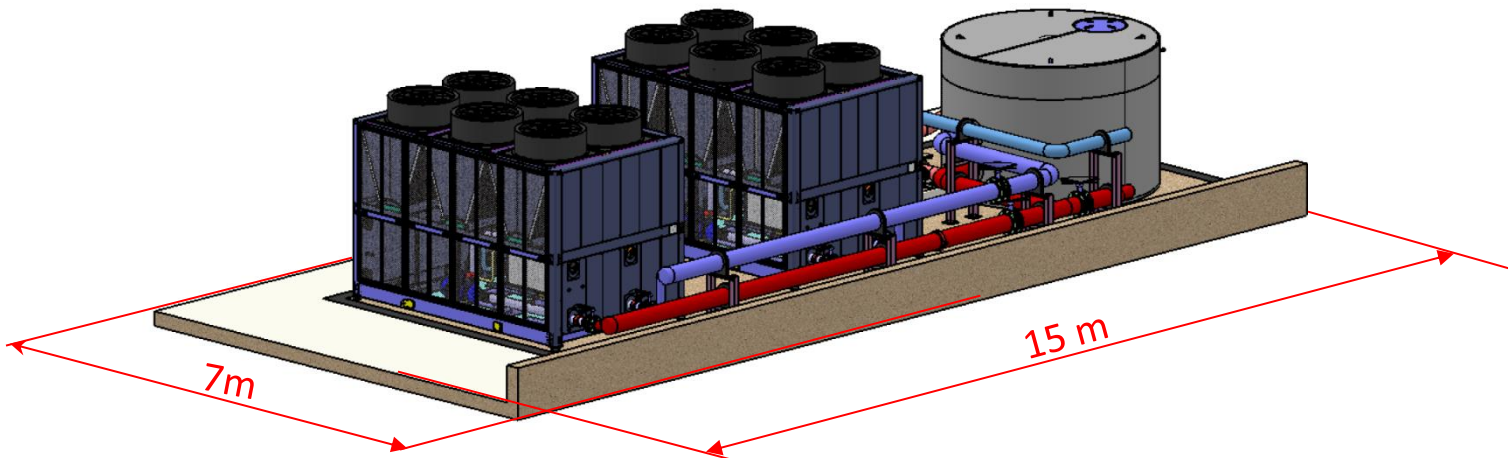
- Two independent RLAC-S-40-RI + By-pass in the line



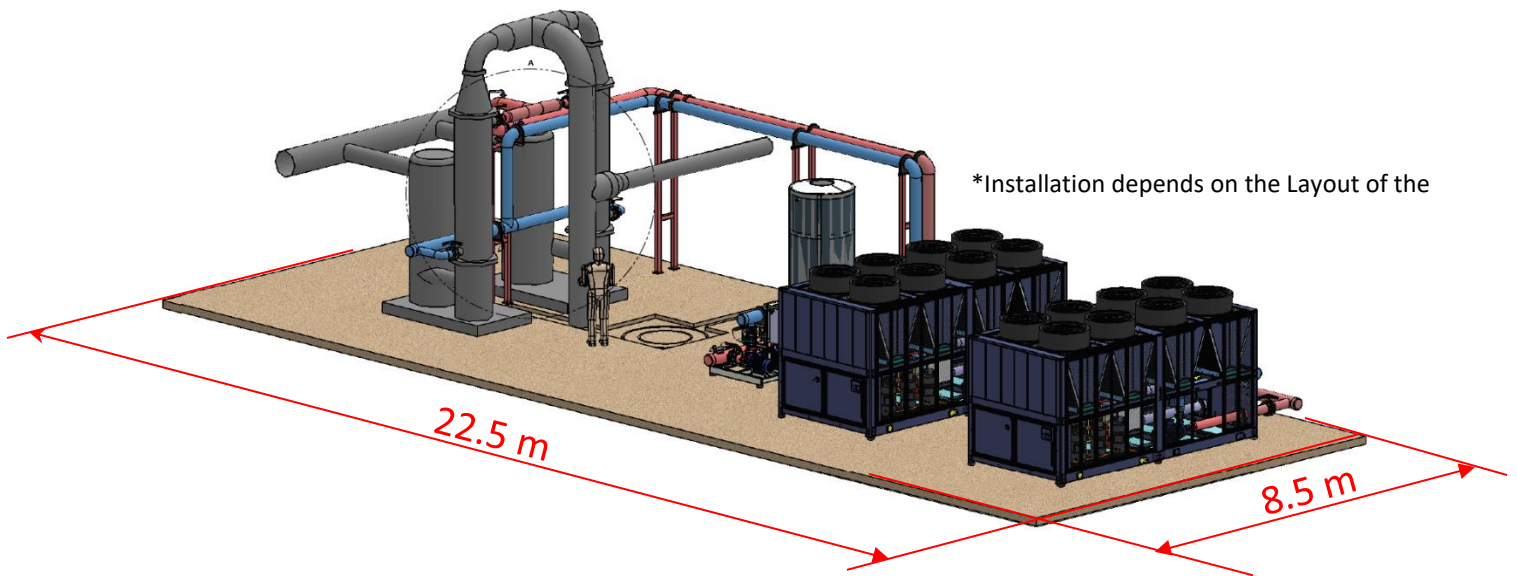
- Three independent RLAC-S-80-RI + By-pass in the line



- Two RLAC-S-115-CA + Pumping Station + Isolated Tank of 10,000 Liters




- Two RLAC-S-150-CA + Pumping Station + Stainless Steel Tank of 3,000 Liters + Customer Process



4.2. Electrical installation


The electrical installation from the main power point to the main switch of the RLAC-S is under the responsibility of the customer or the installer hired by him.


!	DANGER	Keep the master switch of the equipment off at all times when installing or performing maintenance on the RLAC-S. Failure to do so may result in personal injury or even death.
!	DANGER	High voltage in the connection box of the electrical panel, compressor, fan and pump. Risk of injury or death. Only qualified personal with suitable safety equipment can handle these components and with the prior authorization from Mecalor.
!	DANGER	Use non-tinned cables and with terminals at the points where the terminals are to be installed. Stripped cables can overheat, cause damage to equipment, personal injury and even death.


	<p>ATTENTION</p>	<p>Use blockades and warnings like <i>Equipment Under Maintenance</i> when the installation or intervention is occurring on the RLAC-S. Consult standard NR12 and local references for the correct signal of the equipment in case of installation or maintenance.</p>
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Use an exclusive disconnection device (breaker) for the equipment and disconnect the three phases.

The breaker and the power cable must comply with the electrical power requirements of the equipment, voltage and power described in the electrical data table in section 2.5 of this manual and support the current informed in it.

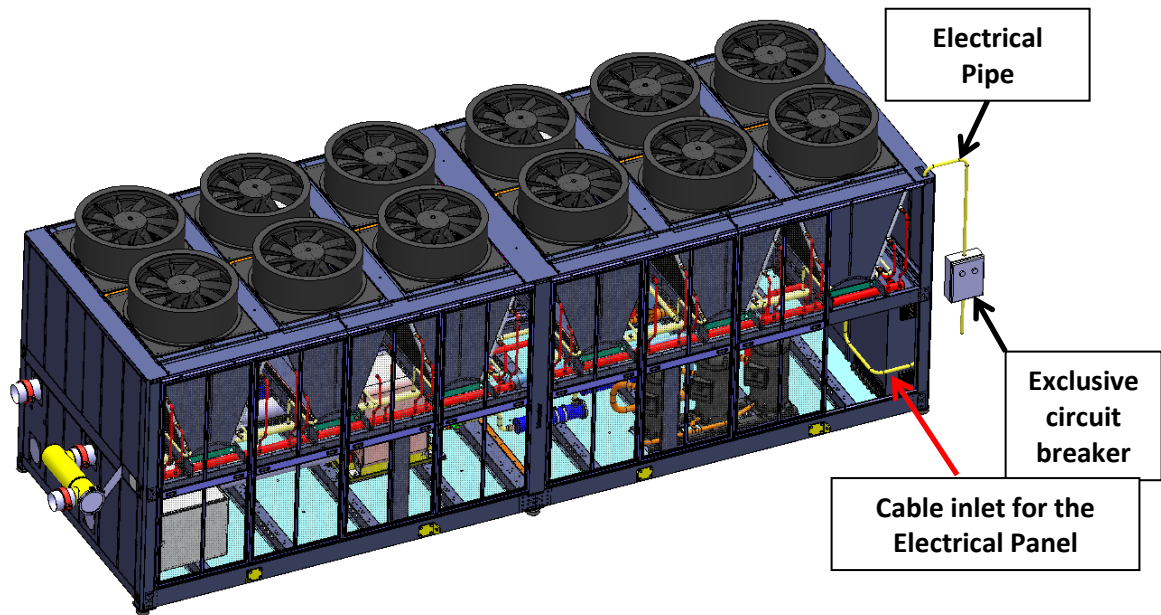
	<p>ATTENTION</p>	<p>Sizing and selection of the RLAC-S exclusive disconnect device is the responsibility of the customer. Improper sizing or sizing outside of local regulations can endanger the safety of the installation, damage the equipment and cause loss of warranty.</p>
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	<p>ATTENTION</p>	<p>DO NOT USE the power in regime to size the circuit breaker and power cable. The electric safety devices should always be sized according to the installed/maximum power of the RLAC-S.</p>
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	<p>ATTENTION</p>	<p>Consult the standards applicable to the electrical installation at the site so as to ensure that the installation of the RLAC-S is according to the specified standards and prerequisites. For installations in Brazil, consult standard NBR5410 "Low Voltage Electrical Installations"</p>
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The electrical power cables should enter through the back of the equipment and be laid up to the electrical panel through the indicated inlet.

The R, S and T phases should be connected in the main switch and the ground cable to the grounding screws inside the electrical panel.

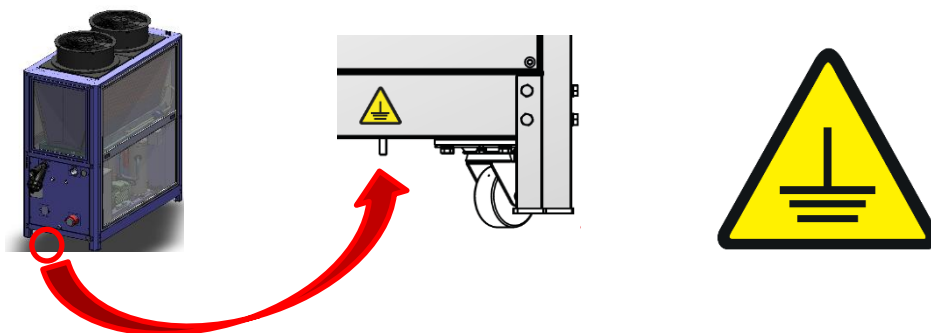


The pipe for laying the power cable shown in the figure is only an indication of the connection points and it is not planned for a specific installation.

The wiring and piping described in the figure are only an example of a general electrical installation and it does not consider the installation variables of the customer.

The electrical pipe should comply with the applicable local codes.

	<p>DANGER</p>	<p>The cabinet of the RLAC-S can be electrically charged. The non-grounding of the equipment may cause electric shocks, short circuits, personal damages or even death.</p> <p>Ground the RLAC-S through the point located on the lower part of the rear part of the equipment.</p>
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4.3. Hydraulic Installation

The hydraulic installation of the RLAC-S must be according to the engineering good practices and in agreement with the local regulations applicable to the standards of the industry.

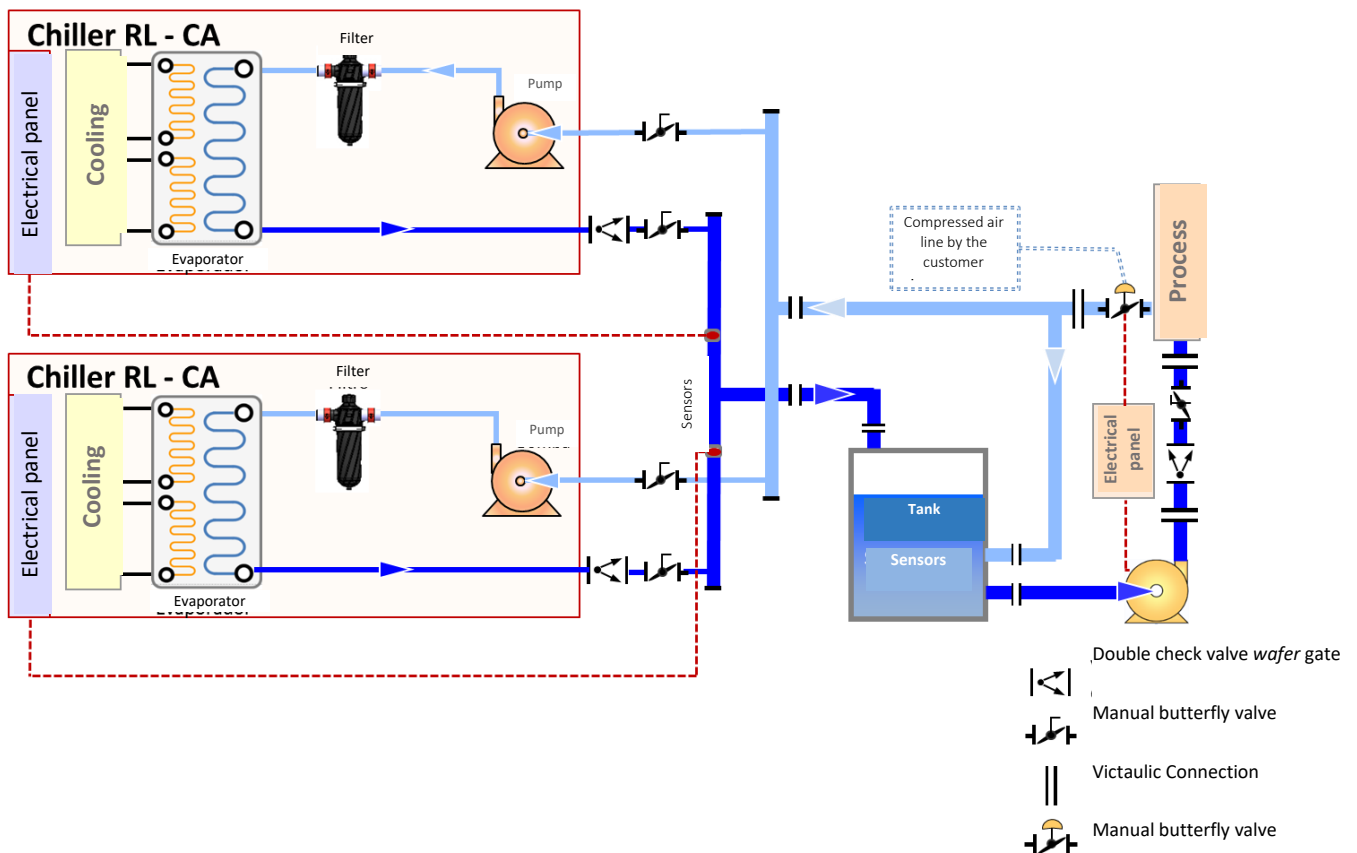
Mecalor does not impose strict criteria for the selection of the materials that should be used in the design of the hydraulic pipe, but it recommends the minimum necessary for the correct installation of the RLAC-S.

The RLAC-S can be interconnected in parallel with one or more RLAC-S. Consult Mecalor's application engineering to perform the project and execution of the interconnection of the process installation.

Shown below are two typical flowcharts of RLAC-S installation in parallel:

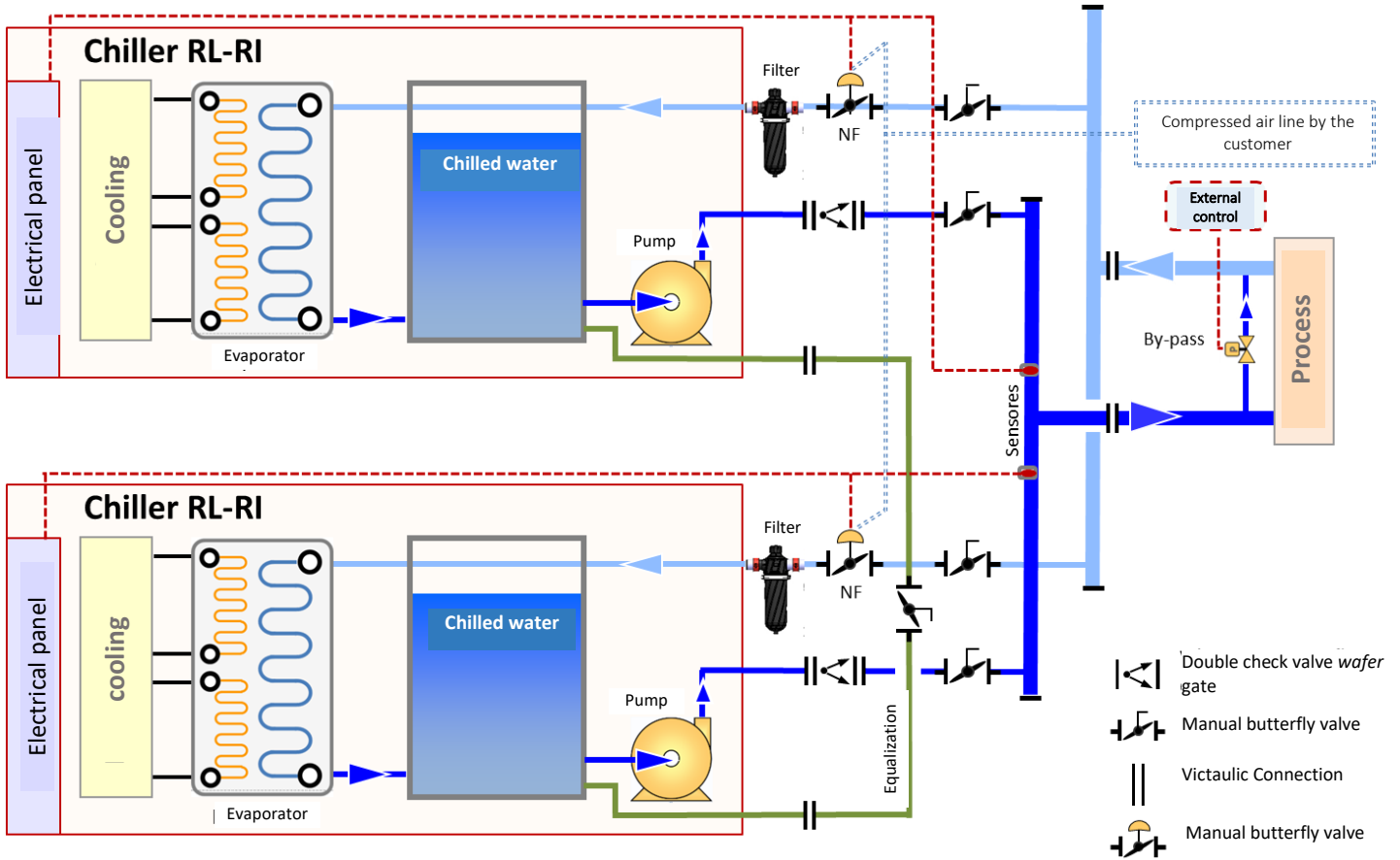
RL-CA in parallel operating with external tank and pumping station

- Pneumatic butterfly valve in the cold water return to avoid overflow of the tank
- Process sensors can be installed at the same point to obtain the same temperature and control reference value






RL-RI operando em paralelo com by-pass na linha de interligação

- Válvula borboleta pneumática no retorno de água gelada de cada RL para evitar transbordamento do reservatório
- Válvulas de retenção na descarga da bomba para evitar sentido de fluxo contrário
- Sensores do processo podem ser instalados no mesmo ponto para se obter o mesmo referencial de temperatura e controle



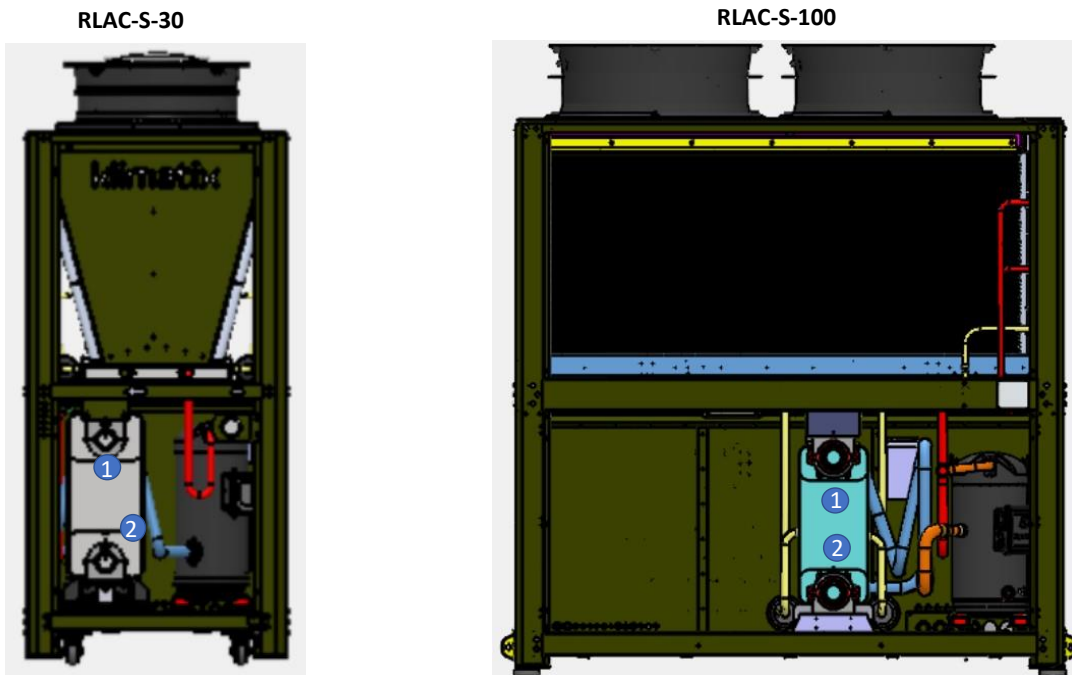
4.3.1. Material

The material used in the hydraulic pipe may be in increasing order of cost, PVC, carbon steel, galvanized steel, copper and stainless steel. The installation with copper pipes and welded Yorkshire fittings presents the best cost-effective. Galvanized steel pipes have reasonable protection against corrosion and must be mounted with thread. An installation with PVC pipes connected with glue is the most economic solution, but it has the disadvantage of having low mechanical strength, and the tendency to break and crack with time. In counterpart, they are resistant to corrosion and the installation (as well as repair) is quite simple.

	<p>INFORMATION</p>	<p>The internal pipe of the hydraulic circuit of the RLAC-S and it is fully manufactured in stainless steel. Mecalor recommends the use of stainless steel for the design of the hydraulic pipe of the RLAC-S.</p>
	<p>INFORMATION</p>	<p>Install heat insulation on the entire length of the pipe to prevent power consumption due to heat exchange of the pipe with the environment.</p>
	<p>INFORMATION</p>	<p>The RLAC-S can be designed to work in redundancy. It is recommended to predict the possible expansions in the installation in order to facilitate the future interconnection. Contact Mecalor for the correct sizing of the system.</p>

4.3.2. Interconnection Points


The RLAC-S points that should be interconnected are described below:





Item	Description ¹⁾
1	Victaulic cold water return connection
2	Victaulic cold water outlet connection


1) See *dimensions* table of section 2.5 of this manual to check measurements


* **The connection of the water filter is the external BSP thread**


	INFORMATION	We recommend the installation of the shut-off valves in the cold water return and outlet of the RLAC-S for future maintenance.
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	INFORMATION	Mecalor recommends the installation of automatic air traps at the highest point of the hydraulic pipe.
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	ATTENTION	It is expressly forbidden to restrict the RLAC-S pipe in the cold water return and outlet. This practice may cause undue load loss in the system and even the lack of water at the consumption point. The return and outlet pipe of the RLAC-S was designed thinking on minimum load loss of the system, speed and flow suitable for the smallest tube diameter possible.
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	INFORMATION	Do not use valves that “strangle” the pipe. This practice may deactivate the equipment due to lack of flow.
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	ATTENTION	Do not use the chilled water pipe of the RLAC-S to support tool boxes or lean objects. The pipe was not designed to support objects; this practice may result in the rupture of the pipe and the stresses may be transmitted to the RLAC-S, which may cause damages.
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	DANGER	Never climb on the RLAC-S pipe to carry out works at heights. The pipe was not designed to suffer specific overloads. This practice may result in the rupture of the pipe and consequent personal damages or even death.
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4.3.3. Need to add anti-freezing agent


Operating with process water and room temperatures below 5°C requires the use of antifreeze solutions to prevent the formation of ice in the equipment. We recommend the use of a solution of water and monoethylene-glycol, according to the table below. In some cases, to work with temperatures outside the standard range (5 to 15 °C) it is necessary to contact Mecalor to make adjustments to the equipment.

In case the process is directly connected to the food industry, it is necessary to use propylene glycol.

Monoethylene-glycol		
Operating Temperature (°C)	Volume %	Density at 20°C (g/ml)
4	10	1,013
0	15	1,022
-5	22	1,032
-10	30	1,045
-15	35	1,053
-20	40	1,060
-25	45	1,067
-30	50	1,073

Propylene glycol		
Operating Temperature (°C)	Volume %	Density at 20°C (g/ml)
4	10	1,010
0	15	1,014
-5	25	1,023
-10	33	1,030
-15	40	1,035
-20	45	1,039
-25	50	1,042
-30	54	1,044

	INFORMATION	In case another anti-freeze is used, care must be taken so that the freezing temperature of this solution is at least 5°C lower than the minimum working temperature.
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	INFORMATION	To specify the quantity of the antifreeze, remember to consider the volume of the hydraulic pipes and the process.
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To dose the antifreeze, use an areometer supplied with the RLAC-S prepared to operate at low temperatures.

After mixing the quantity of antifreeze in the water, collect a sample, put it in a container and insert the areometer in the mixture; add more anti-freeze if the density indicated is below specification and add water if the density is above specification.

Do not hesitate to contact Mecalor in case of any doubt as our Technical Support and Engineering departments are available for any clarifications.

4.3.4. Pipe Cleaning

After completing the hydraulic interconnection services between the RLAC-S and the process, make sure the cleaning of the pipe is performed before start-up of the equipment. This service should be performed to prevent fouling of small particles in the main components of the RLAC-S.

Both fouling with the existence of suspended solids reduces the flow capacity of the water and increases load loss in the pipe, able to cause an increase in power consumption. Also, fouling may even cause corrosion in the major components depending on the crusted material.

Cleaning should be performed after filling and purging the system, putting the equipment into operation and circulating water for a certain period of time. After this procedure, stop the circulation of water and clean the water filter. Remount the clean filter and carry out one more circulation of water in the system. Clean the filter again. Carry out this procedure until the water filter is clean.

After observing that the filter is clean, drain all the water from the system and fill it again, after which the system is ready for operation.

We recommend the daily cleaning of the water filter during the beginning of operations, gradually spacing the cleaning time to that recommended in the preventive maintenance.



INFORMATION

The equipment should not be switched on without prior authorization from Mecalor, under the penalty of suspension of the warranty.

4.4. Optional/customized installation

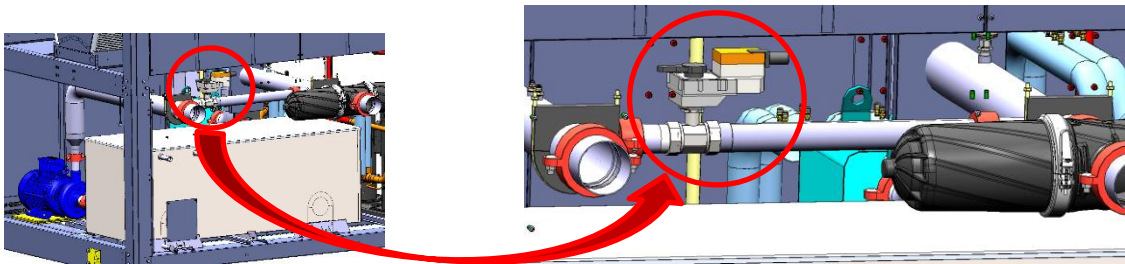
4.4.1. By-pass (customized)

Used to prevent sudden hydraulic blows in the hydraulic pipe, resulting from closing the automatic valves in the process and increasing the efficiency of the equipment enabling a minimum flow of water to pass through the evaporator.

The centrifugal pump of the equipment was sized to provide an ample supply of cold water to the process to be cooled. We recommend the installation of the By-Pass Kit if there is the possible occurrence of any of the situations below:

- Total obstruction of the circulation in the cold water line, with the equipment in operation, caused by the closing of the automatic or manual valves of the customer's installation.
- Possible temperature difference of more than 10 °C between the outlet and return of the process water.
- Flow required in the process is less than 60% of the nominal flow of the equipment.

The bypass in the RLAC-S consists of a proportional ball valve installed inside the equipment. The valve operates in accordance with the signal it receives from the pressure transducer installed in the discharge pipe of the pump. The objective of the control is to maintain the minimum flow necessary for the equipment to operate safely. The RLAC-S already comes with the by-pass installed at the factory.

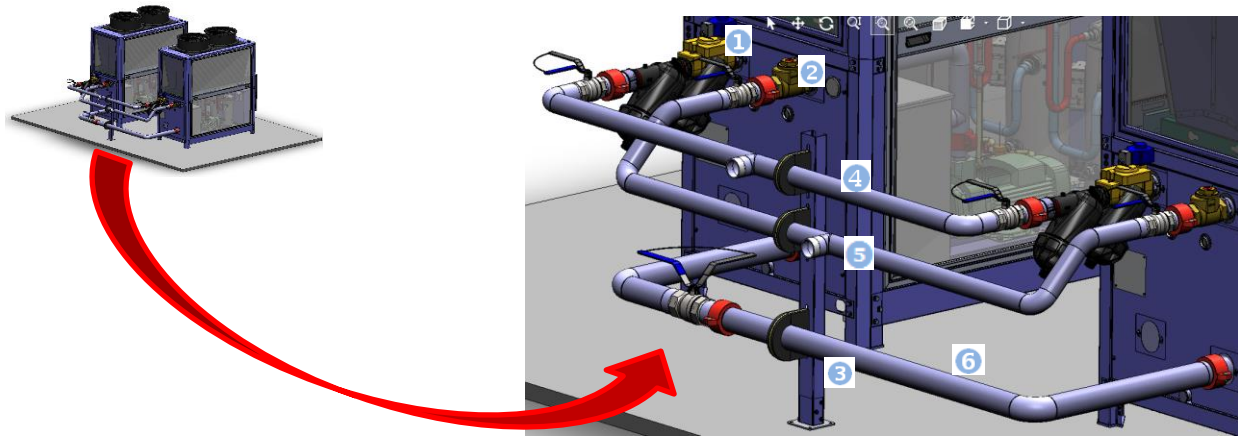


4.4.2. Interconnection for parallel operation (customized)

This option can be purchased separately and it is installed by the customer at the installation site.

The RLACs-S equipments that will operate in parallel are previously configured through the Standby parameter. This function determines the rotation time between the equipments (pre-established at 12 hours), the quantity of equipments that can be configured in the system (maximum of 5) and the quantity of equipments in operation in the system (maximum of 5).

This function enables the connection of the RLACs-S equipments to the network and the automatic rotation between them.



Item	Description	Installation
1	Solenoid Valve to block the return flow	Install the body on the filed coil on the rear side of the RLAC-S Carry out sealing and the connection of the valve in the cold water return The electrical connection of the coil is executed in the factory
2	Mechanical retention valve	Carry out sealing and the connection of the valve in the cold water outlet
3	Support of the pipes	Attach the support to the installation base of the RLACs-S through the bolts
4	Cold water return interconnection	Attach the pipe to the support and carry out the connections indicated in the sizing of interconnection according to the RLAC-S model Connections like stop valves and nipples are supplied with the optional interconnection.
5	Cold water outlet interconnection	
6	Equalization pipe of the tanks	

4.4.3. Water filter (optional)

The RLAC-S must, mandatorily, operate with a hydraulic filter in the process water return. Mecalor offers this item as an option for the entire HVAC Chiller line. If the customer wishes to install the filter themselves, it must have a minimum filtration grade of 400 microns.

The maintenance of the filter supplied by Mecalor is done by removing the filtering element through the opening of the clamp that gives access to the inside of the filter and washing the filtering elements with running water.



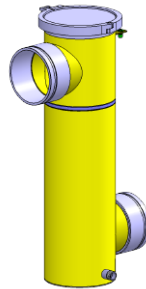
Hydraulic Filter RLAC-S-25



Hydraulic Filter RLAC-S-30/40/50/60

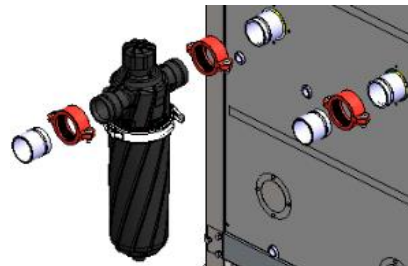
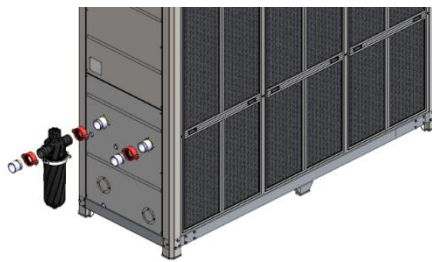


Hydraulic Filter RLAC-S-80/100/115



Hydraulic Filter RLAC-S-150/175/220

- Installation – Victaulic Connections



1



2




3



4

1. Mount the sealing ring on the fitting already installed on the RLAC-S. Use neutral detergent to make it easier to insert the ring into the fitting;
2. Install the connection supplied with the equipment at the fixed end of the RLAC-S;
3. Assemble and attach the clamp with the use of screws and nuts;
4. Apply the sample procedure in the filter connections.

	INFORMATION	Never put the RLAC-S into operation without water filter. This practice will leave the system vulnerable to obstruction or to damages and the equipment may lose the warranty.
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4.4.4. Remote Panel(optional)

The remote panel has the following functionalities:

- Show outlet temperature of the equipment;
- On and off the equipment remotely;
- Emit a sound alarm in case the RLAC-S experiences failure
- Rest sound alarms.

The remote panel is generally fixed in the control room in order to provide instant analysis of the process and, if necessary, switch off the RLAC-S.

➤ Items supplied

- Remote panel
- Electrical interconnection cable with length of 25 meters
- IHM Dixell



➤ Procedure for electrical connection

- The remote panel is connected directly to the terminal strip of the RLAC-S, dispensing the use of other power sources.
- Check the electric scheme to consult the number of the terminals
- Use 6x22AWG cable to carry out the electrical connection
- In case it is necessary to extend the sensor cable, use PP 2x1mm cable (up to 50m).

➤ Fixation Procedure

- Fix to the wall with the use of holes located on the back of the panel. Distance between holes of 150mm and diameter of 7 mm;
- Use M6 screws with bushings installed in the reinforcement of the drywall or, preferably, on the stone wall;
- Welding, gluing, splicing, finishing with plaster or any other means that does not allow the removal of the panel in case of maintenance is not allowed.

4.4.5. E-coating treatment for condensers (optional)

E-coating treatment is a surface treatment of the condenser, which protects against corrosion and other harmful effects that can be caused by the environment. Aggressive environment refers to places with chemical contamination or even saline (coastal) atmospheres.

4.5. Connection and communication in network

It is possible to monitor the RLAC - S via network communication through the Modbus TCP/IP communication - Ethernet physical medium or Modbus RTU - RS-485 physical medium. For Modbus TCP/IP communication, simply connect a network cable with RJ-45 connector in the portal located in the PLC inside the panel of the RLAC and for Modbus RTU, use the terminals indicated in the terminal strip found in the electrical panel of the RLAC-S.

The communication can be carried out through supervision or an MMI or at the discretion of the customer, and it requires the table below with the addresses of the variables of the equipment.

**INFORMATION**


A phase sequence relay is installed inside the electrical panel of the RLAC, which protects the equipment against phase failure or phase inversion. In case it is inverted, the equipment will not turn on and the R and S phases must be inverted at the electric power inlet of the main switch.


4.5.1. Modbus Addressing

Description	R/W	Data Type	Group	Address Hex	Address Dec
Inhibits Alarm	R/W	BOOL	Alarri	F0F1	61681
Reset of alarms	R/W	BOOL	Alarri	F0F0	61680
High Pressure 1	R	BOOL	Alarri	4036	16438
High Pressure 2	R	BOOL	Alarri	403B	16443
Low Pressure 1	R	BOOL	Alarri	4037	16439
Low Pressure 2	R	BOOL	Alarri	403C	16444
Low temperature alarm - Failure	R	BOOL	Alarri	4009	16393
Low temperature alarm - Low	R	BOOL	Alarri	400A	16394
Thermistor alarm of compressor 1	R	BOOL	Alarri	4039	16441
Thermistor alarm of compressor 2	R	BOOL	Alarri	403D	16445
Thermistor alarm of compressor 3	R	BOOL	Alarri	4042	16450
Thermistor alarm of compressor 4	R	BOOL	Alarri	4043	16451
Process Temperature Alarm	R	BOOL	Alarri	4001	16385
Process Temperature Alarm	R	BOOL	Alarri	4003	16387
Failure or phase sequence alarm	R	BOOL	Alarri	4032	16434
Flow Failure Protection	R	BOOL	Alarri	40EF	16623
High Condensation Temperature Protection 1	R	BOOL	Alarri	40F0	16624
High Condensation Temperature Protection 2	R	BOOL	Alarri	40F1	16625
Low Evaporation Temperature Protection 1	R	BOOL	Alarri	40F2	16626
Low Evaporation Temperature Protection 2	R	BOOL	Alarri	40F3	16627
Low Flow Protection	R	BOOL	Alarri	40F4	16628
Process Temperature Failure Protection	R	BOOL	Alarri	40F5	16629
Heat alarm of compressor 1	R	BOOL	Alarri	4035	16437
Heat alarm of compressor 2	R	BOOL	Alarri	403A	16442
Heat alarm of compressor 3	R	BOOL	Alarri	4040	16448
Heat alarm of compressor 4	R	BOOL	Alarri	4041	16449
Fan alarm group 1	R	BOOL	Alarri	4034	16436
Circulation pump alarm 1	R	BOOL	Alarri	4033	16435
Insufficient water alarm	R	BOOL	Alarri	4038	16440
Maximum Setpoint for modulation of the by-pass valve	R/W	DINT	ByPass	1202	4610
Minimum Setpoint for modulation of the by-pass valve	R/W	DINT	ByPass	1201	4609
Setpoint for modulation of the by-pass valve	R/W	DINT	ByPass	1200	4608
Outlet for modulation of the by-pass valve	R	DINT	AO	200	512

On / Off via network (Enabled via parameter)	R/W	BOOL	EnableChiller	1004	4100
Compressor status 1	R	BOOL	DO	400	1024
Compressor status 2	R	BOOL	DO	407	1031
Compressor status 3	R	BOOL	DO	40A	1034
Compressor status 4	R	BOOL	DO	40B	1035
Maximum cold water setpoint	R/W	DINT	Compressors	1319	4889
Minimum cold water setpoint	R/W	DINT	Compressors	1318	4888
Adjustment of the cold water temperature	R/W	DINT	Compressors	1317	4887
Current operating capacity	R	DINT	Compressors	1312	4882
Condensation fluid temperature	R	DINT	AI	106	262
Status of group 1 of fans	R	BOOL	DO	401	1025
Exchanger inlet temperature		DINT	AI	11E	286
Process water return temperature	R	DINT	AI	102	258
Low temperature of process cold water	R	DINT	AI	104	260
Outlet temperature of process cold water	R	DINT	AI	100	256
Process pump status 1	R	BOOL	DO	402	1026
Sound alarm status	R	BOOL	DO	404	1028
Alarm summary status	R	BOOL	DO	405	1029
System flow	R	DINT	AI	299	665
Process cold water pressure	R	DINT	AI	108	264

4.6. Final Inspection Checklist of the Installation Before Start-Up

	INFORMATION	After completion of the electric and hydraulic installation, fill the inspection checklist of the installation and request from the Technical Support department for execution of the start-up of the equipment with a minimum of 48 hours in advance.
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	INFORMATION	The equipment should not be switched on without prior authorization from Mecalor, under the penalty of suspension of the warranty.
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Final Inspection Checklist of the Installation Before Start-Up


Installation site	Hydraulic Installation
<input type="checkbox"/> Is the general state of the RLAC in perfect conditions to start operation?	<input type="checkbox"/> Was the interconnection between the RLAC and the process carried out?
<input type="checkbox"/> Is the installation base of the RLAC leveled?	<input type="checkbox"/> Is the pipe diameter according to the water inlet and outlet diameter of the RLAC?
<input type="checkbox"/> Does the base of the RLAC have channels or drain to drain out accumulated water?	<input type="checkbox"/> Was the water filter installed?
<input type="checkbox"/> Is the space required around the RLAC as specified in the manual?	<input type="checkbox"/> Were shut-off valves were installed in the inlet and outlet of the RLAC?
<input type="checkbox"/> Was the air exhaust duct sized correctly, without restrictions in the outlet?	<input type="checkbox"/> Was the interconnection carried out without diameter restriction along its entire length?
Electrical Installation	<input type="checkbox"/> Was an air trap installed at the highest point of the piping?
<input type="checkbox"/> Is the voltage and frequency the same as indicated on the plate of the RLAC?	<input type="checkbox"/> Was the replacement interconnection, bleeder and drain of the RLAC carried out?
<input type="checkbox"/> Was the exclusive circuit breaker sized correctly according to the maximum power and voltage of the RLAC?	<input type="checkbox"/> Were the Water Quality criteria met?
<input type="checkbox"/> Was the power cable correctly sized according tot the maximum power and voltage of the RLAC?	<input type="checkbox"/> Are there suitable supports attached to the entire length of the hydraulic pipe?
<input type="checkbox"/> Was the power cable laid up to the terminals of the electrical panel?	<input type="checkbox"/> Was the pipe duly insulated?
<input type="checkbox"/> Are the R, S and T phases connected correctly?	<input type="checkbox"/> Was the pipe cleaned?
<input type="checkbox"/> Was the RLAC grounded?	<input type="checkbox"/> Was the water filter cleaned?

5. Operation


Below is a set of instructions for the correct operation of the RLAC-S, as well as the change of the control temperature of the equipment and access to the alarm screens.


The operating actions do not require the use of PPEs unless the environment where the RLAC-S is located requires it. The customer is responsible for establishing which PPEs the operator must use.

The customer must provide suitable lighting for the environment where the RLAC-S is installed and where maintenance services will be performed, if necessary.

	ATTENTION	It is recommended for the operator to go through training before operating the equipment. The RLAC-S is easy to operate, but the operator must be qualified and have the minimum knowledge to operate the equipment safely.
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5.1. Start-up

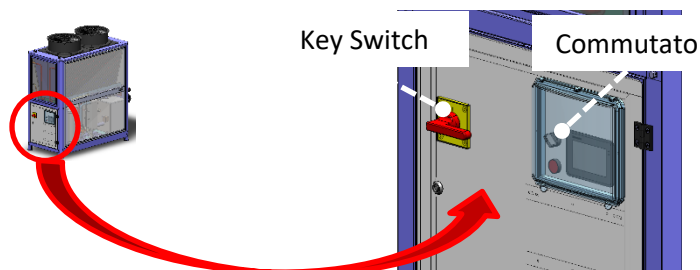
	INFORMATION	The equipment should not be switched on without prior authorization from Mecalor, under the penalty of suspension of the warranty.
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	INFORMATION	Fill out the <i>“Final inspection checklist of the installation before Start-up”</i> before contacting Mecalor’s Technical Support for startup of the RLAC-S.
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To start the equipment, turn the handle of the main switch located on the door of the equipment to the ON position.

To switch on the RLAC-S in local mode, turn the commutator to the “ON” position, the MMI should start and soon after the RLAC-S should start operating automatically. In case it does not start operating, check to see if voltage is reaching the inlet of the Main Switch and if there is no phase inversion failure. In case of failure, carry out the phase inversion to invert the RS phases.

To put the RLAC-S into operation through the remote command, turn the commutator of the command panel to the “REMOTE” position.

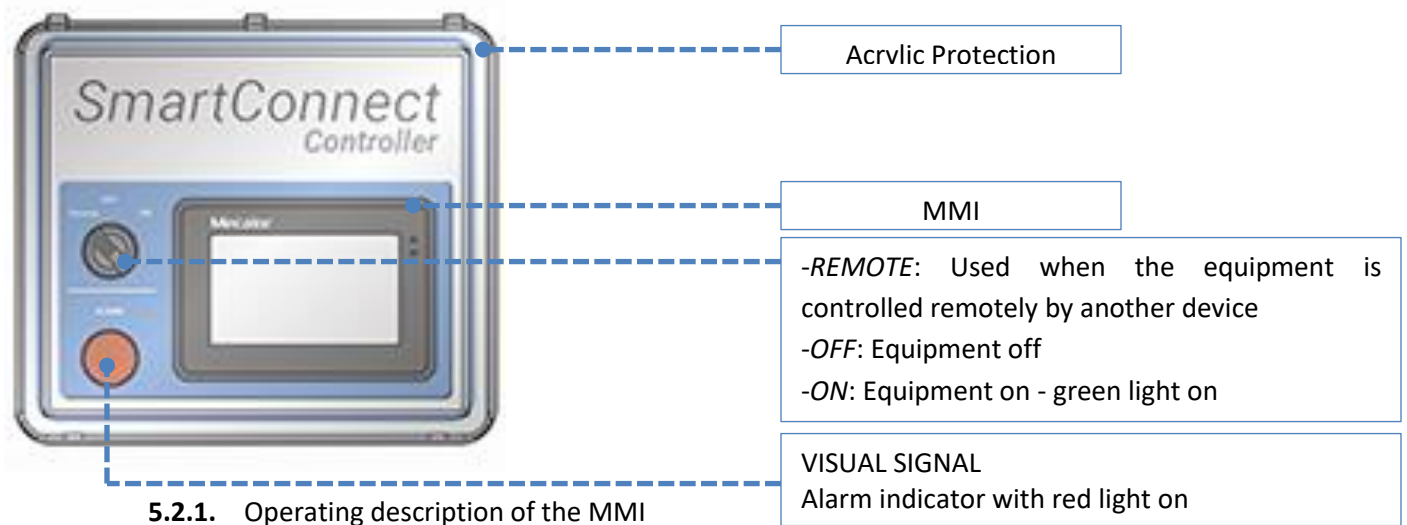


	INFORMATION	<p>Avoid wear in components. Use the main switch to turn off the RLAC-S power only in cases of maintenance.</p> <p>The control panel monitors the variables of the RLAC-S and it must be powered even with the commutator of the RLAC-S in the <i>OFF</i> position.</p>
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5.2. Command Panel

The Command Panel of the RLAC-S has a touch screen and is installed on the door of the electrical panel, together with a commutator button to on/off the equipment and the visual alarm signal that lights up in case of failure. In case of failure, the sound signal will emit a sound alarm.

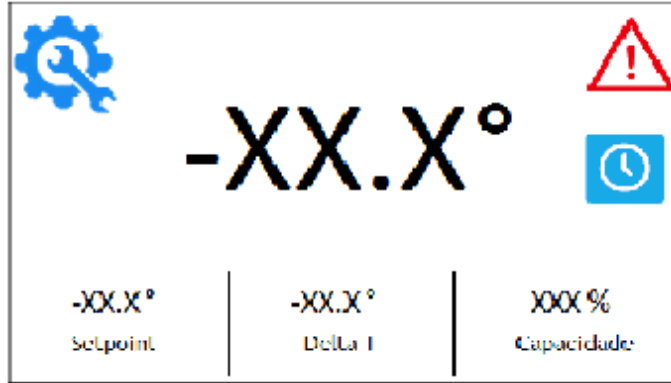
These components are protected by a mobile acrylic cover that has the purpose of protecting the components against rain and direct sunlight.



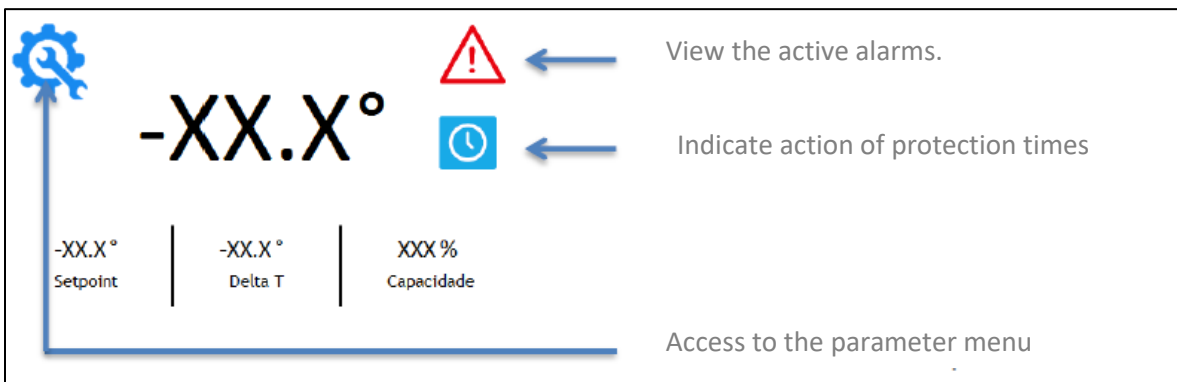
HMI MASK



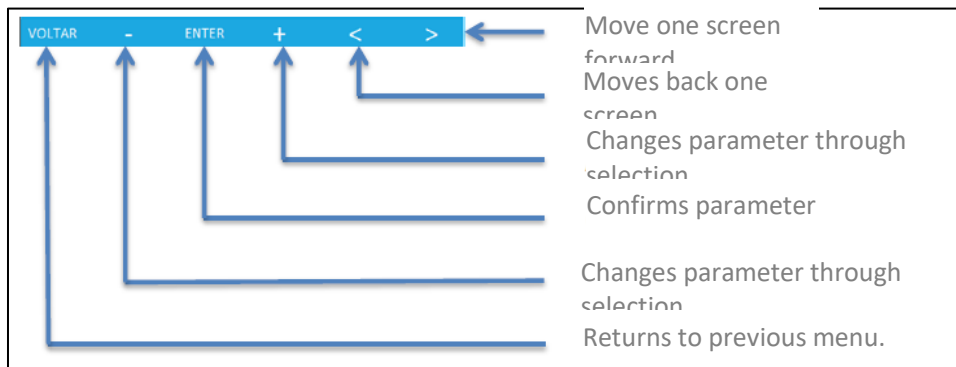
PRESENTATION SCREEN



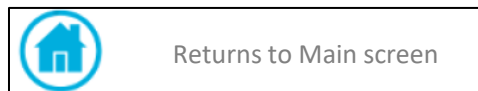
MAIN SCREEN – MAIN VARIABLES OF THE PROCESS



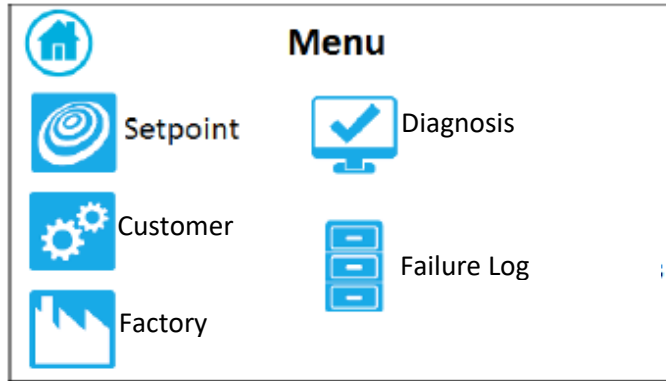
DESCRIPTION OF THE MAIN SCREEN



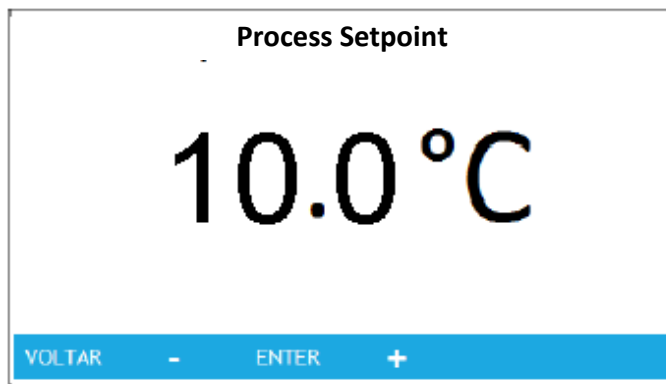
DESCRIPTION OF LOWER ICONS OF THE SCREEN



ICON DESCRIPTION



MENU SCREEN

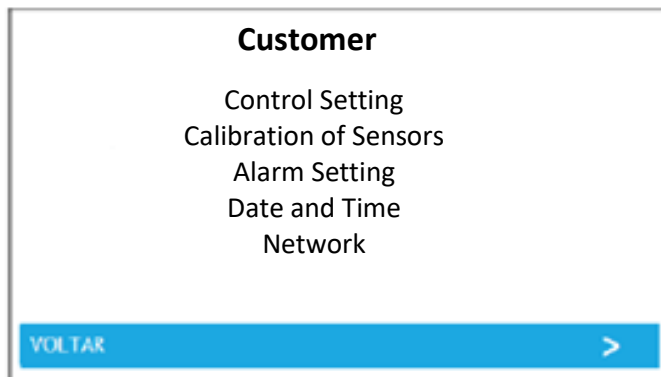


SETPOINT SCREEN

There are two ways of changing the setpoint of the water temperature:

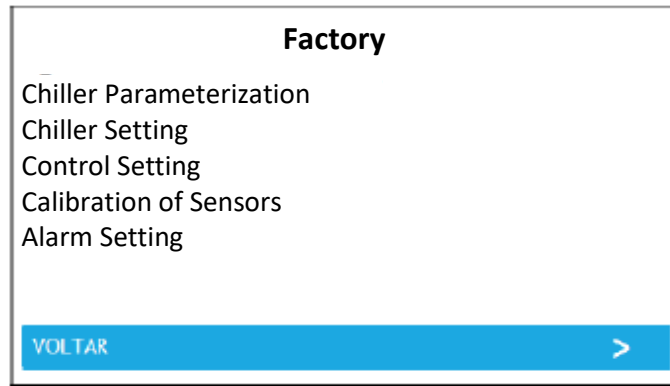
1 – Touch the screen and then on the value of the temperature, a virtual key will appear, type the value of the new temperature and confirm, or

2 – Touch the 'ENTER' icon located below the temperature value indicated on the screen, the temperature will be highlighted, then touch the icon "-" or "+" to change the value, later confirm by touching the 'ENTER' icon.




CUSTOMER SCREEN

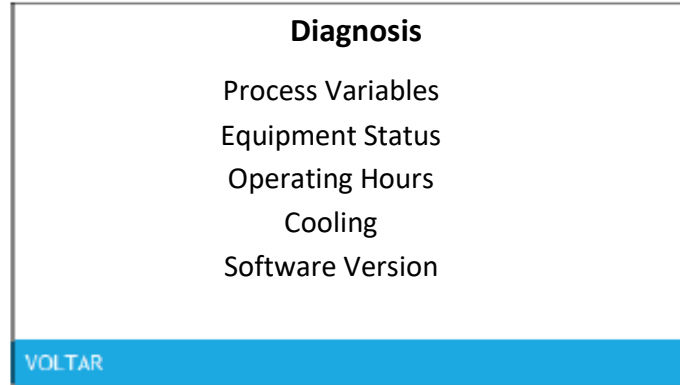
In the Customer icon it is possible to access the parameters to adjust the equipment at user level, but, for safety reasons, the access is only released when the user inserts a password that is provided by technical support. Adjustments on the equipment can only be carried out with the authorization and monitoring of Mecalor.



FACTORY SCREEN

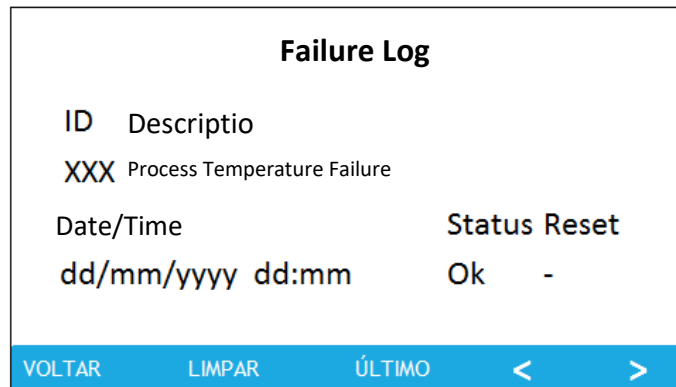
The 'Factory' screen allows access to the programming screens of the systems variables at supervisor level. A special password is necessary to access this area. This screen is accessed only by a qualified person, since the change of the parameters can put at risk the control and service life of the equipment.

	<p>DANGER</p>	<p>It is not allowed to change the software, parameters or operating conditions on the HMI screen in the factory menu. This practice can put at risk the operator and the operation of the equipment, able to cause loss of control of the process, breakage of the equipment and physical damages to the operator, in addition to loss of warranty.</p>
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DIAGNOSTICS SCREEN

The ‘*Diagnostics*’ screen allows the visualization of the variables of the process, equipment status, hours of operation of the equipment, variables of the cooling system and information on the version of the software installed.



FAILURE LOG SCREEN

In the ‘*Diagnostics*’ screen it is possible to see the failures that occurred on the equipment and the ones that are active. It is also possible to browse between the last failures.


After solving the failure, carry out its reset in order to operate the equipment again.

6. Maintenance

6.1. Corrective Maintenance – Failure Diagnostics

All the failures of the RLAC-S are indicated on the alarm screens of the MMI and depending on the type of failure, they are supplied with a sound alarm that can be silenced at the MMI. The failures of the RLAC-S are divided into two types: Warnings and Alarms.

In case a failure occurs on the RLAC-S, before applying the procedures described below, check the failure log as described in the previous session.

	ATTENTION	The procedures described below can only be performed by qualified people who have the knowledge on the operation of the equipment. Procedures performed by the layman may result in injuries or breakage of a component.
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6.1.1. Warnings and Protection Mode

The warnings, when indicated on the MMI screen, do not result in the activation of the sound alarm and do not interrupt the operation of the RLAC-S, but they are presented in the way that indicates that a failure that requires attention was indicated in the equipment. Warnings that are continuously ignored result in the shutdown of the equipment due to the occurrence of a subsequent alarm.

In addition to the failure indication function, some warnings also have the function of taking actions after the PLC detects a failure in the variables monitored in order to prevent the shutdown of the equipment, and this resource is called "protection mode".

The warnings are indicated as follows:



**Indicative Warning
Icon on the MMI**

Below is a table containing all the warnings that may be indicated in the MMI of the RLAC-S causes and procedures to be adopted when these are indicated. There is also another table explaining the warnings that have the "protection mode" function.

Warnings applicable to RLAC-S

Description of the Alarm	Cause	Procedure	Possible Alarm
High Process Temp (Setpoint + 6°C)	- Badly positioned sensor	- Check to see if the sensor is installed inside the well	-High Pressure 1 or 2 - Warning: High Cond Temp 1 or 2
	- Others Failure	- Check to see if there are no of other active warnings. Carry out the procedures applicable to other active alarms if existent	
	- Excess heat load	- Check to see that there is no heat load increase in the system	
	- High process water temperature	- Check to see if the equipment is not operating outside the working range	-High Pressure 1 or 2

High Cond Temp 1 or 2 (>= 55°C)	- Dirty water filter (Water condensation)	- Carry out cleaning of the filter ¹⁾	
	- Dirty air filter (Air condensation)	- Remove the screens and wash them with WAP ¹⁾	
	- Obstructed condenser (Air condensation)	- Remove the air filters (screens) and wash with WAP ¹⁾	
		- Wash the microchannel condenser using a WAP ¹⁾	
- Obstructed condenser (Water condensation)	- Hire a specialized company to clean the condenser through the accesses existing in the condensation pipe		
Low Condensation Fluid Temperature	- Low temperature of 15°C	- Air condensation: contact technical support to check the operation of the equipment	Low Pressure 1 or 2
		- Water condensation: check the operation of the cooling tower	
High Condensation Fluid Temperature	- Room air temperature above 42°C	- Check to see if there are no of obstacles preventing the circulation of air around the equipment	-High Pressure 1 or 2
		- Check to see if there is no recirculation of air from other equipments that dissipate heat around the Chiller	
		- Check if the required space criteria around the Chiller were met (according to section 4 of this manual)	
	- Temperature of condensation water above 35°C	- Check the operation of the cooling tower	
Low Water Pressure (optional)	- Low load loss in the system	- Check the load loss of the system	-Low Flow - Insufficient Water
	- Pump Cavitation	- Contact technical support	
High Water Pressure (optional)	- Possible obstruction in the process pipe	- Check to see if there are no restrictions in the diameter of the pipe along the water pipe	- Low Water Flow
		- Check to see if any stop valve in the system is closed	
		- In case of no obstructions, contact technical support to check the operation of the equipment	
Low Indirect Temperature (optional)	- Process temperature on customer side below pre-established value	- Process temperature on customer side below the established value	-
High Indirect Temp (optional)	- Process temperature on customer side above pre-established value	- Process temperature on customer side above the established value	-
Off	- Commutator in "off" position	- Turn equipment on	-
	- Commutator in "on" position	- Contact technical support to check the operation of the equipment	
	- Commutator in "Remote" position	- Check the physical interconnection with the remote panel and, if correct, contact technical	

		support to check the parameterization of the remote command	
CS _n Short Cycle Warning	- Excess start-ups of compressor with less than 3-minute operation within a period of 24 hours	- Contact technical support to check the operation of the equipment	- Compressor Thermistor CPn
Humidification System Failure (only in air equipment with adiabatic condenser cooling)	- Dirty humidification system pump tank	- Clean the pump tank	-
	- Pump locked or shorted	- Contact technical support to change the pump	
High Evaporator TD (temperature difference between inlet and outlet of the evaporator above 8°C)	- Low flow circulating through the evaporator	- Check for the existence of water flow, checking to see if the pressure indicated in the pressure gauge of the Chiller is the same or close to that indicated on the plate of the equipment	- Low water flow

Warnings with the "Protection Mode" resource

Description of the Alarm	Application	Antecedent Alarm	Possible Subsequent Alarm	Description
Process Temperature Failure Protection	All the Chillers	- Process Temperature Failure	-	- In case of failure of the process temperature sensor, the low temperature sensor will be used as reference until the defective sensor is replaced
Low Temperature Failure Protection	All the Chillers	- Low Temperature Failure	-	- In case of low temperature sensor failure, the process temperature, low evaporation temperature and low suction temperature will be used as cutting and deactivation criteria of the compressors
LOP Protection 1 or 2	Chillers with electronic expansion valve	-	- LOP Alarm 1 or 2 - Low Pressure 1 or 2	- Measures taken by the electronic expansion valve for 5 minutes to prevent the deactivation of the Chiller. If the problem persists, the Chiller will be deactivated.
MOP Protection 1 or 2	Chillers with electronic expansion valve	-	- MOP Alarm - High Pressure 1 or 2 (Hot days) - Warning: Room Temp. Cond. High (Hot days) - Low Pressure 1 or 2 (Cold days)	
Low SH Protection 1 or 2	Chillers with electronic expansion valve	-	- Low Pressure 1 or 2	

High Process Temperature Protection	Chiller with automatic by-pass	- Warning: High Process Temperature	- High Cond Fluid Temp - Safety Process Temp	- The pressure control valve of the water is forced to remain open. If the problem persists, the Chiller will be deactivated
Low Flow Protection	Chiller with automatic by-pass	- Warning: High Evaporator TD	- Low flow - Low pressure 1 or 2 - Low Temperature	
Flow Failure Protection	Chillers with electronic expansion valve and Automatic By-Pass	- Insufficient Water	-	- The Chiller remains in operation and the failure is disregarded if the Smart Connect observes that the pump is operating at nominal pressure and if the TD of the evaporator and the evaporation temperature are within the safety value, but the alarm continues to be active until the problem is solved
High Condensation Temperature Protection 1 or 2	Chillers with 4 and 6 compressors	- Warning: High Cond Temp 1 or 2	- High Pressure 1 or 2	- The compressors are turned off one by one every 5 minutes in the expectation that the problem will be resolved. At the limit, one of the compressors of each circuit will continue operating. The process temperature may be stabilized above the desired value, but the process will continue to be served, even if precariously. If the problem persists, the Chiller will be deactivated
Low Evap. Protection 1 or 2	Chillers with 4 and 6 compressors	- Warning: Low Evaporation Temperature	- Warning: LOP Protection 1 or 2 - Low pressure	

6.1.2. Alarms

All alarms come with a sound alarm and depending on the situation they deactivate the equipment partially or completely and require a diagnosis and immediate solution.

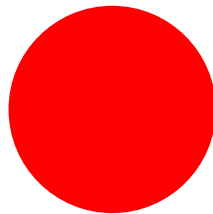
To inhibit the sound alarm, press the *Inhibit alarm* button on the current alarm screen and check if it is possible to reactivate the equipment as described below.

In case the failure cannot be corrected by following the procedure below, contact the Technical Support of Mecalor.

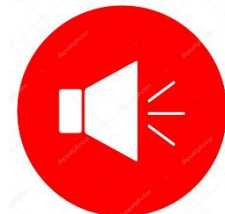
The warnings are indicated as follows:



**Indicative Warning
Icon on the MMI**



**Red Signal Alarm
Indication**



**Sound Alarm Alarm
Indication**



INFORMATION

Carry out failure diagnostics immediately after the occurrence of an alarm. The reset of the chiller is deactivated for 10 minutes in case 3 consecutive failure resets occur within a period of 2 minutes between them.



INFORMATION

Mecalor has access to the failure log of the RLAC-S and if it is observed that an eventual break or defect in the component was caused by continuous resets of the alarms the equipment will lose its warranty.

	Alarm Description	Component		Consequence	Rearm ¹⁾	Probable Cause	Procedure
		TAG	Description				
1	Failure or phase sequence	RSF1	Failure / Phase Sequence Relay	Switch off Chiller	Auto	- Failure or no phase in the electric power supply	- Check the electric power supply
						- Inversion between phases	- Check if the LED of sequence relay/phase failure in the electric panel is on. In case it is off, invert the phases
2	Low water flow	FS1	Flow Sensor	Turn Off Refrigeration 1 and 2	Switch off TMR	- Dirty water filter	- Carry out cleaning of the filter ⁵⁾
						- Flow below 50% of the nominal value	- Check to see if there are any valves obstructing the return of the process water
						- Malfunction of the by-pass	- Contact technical support to check the operation of the by-pass
						- Pump with obstruction	- Contact technical support to check the operation of the pump
3	Insufficient Water	R11 VB1 FS1	Tank Float valve Flow Sensor	Switch off Chiller	Switch off TMR	- Low level of water in the tank	- Check to see if the float meter is jammed or damaged
						- Insufficient replacement water	- Check to see if the water supply pipe is open
						- Failure of or dirty flow sensor	- Carry out cleaning of the flow sensor
4	High Pressure 1 or 2	PA1 or 2 CO _n VT _n	High pressure switch 1 or 2 Condenser Fan	Turn Off Refrigeration 1 or 2	Switch off TMR	- Low flow of condenser fluid (Air condensation)	- Check to see if there are no of obstacles preventing the circulation of air around the Chiller
							- Check to see if the fan is operating

							<ul style="list-style-type: none"> - Low flow of condenser fluid (Water condensation) - Dirty water filter (Water condensation) - Dirty air filter (Air condensation) - Obstructed condenser (Air condensation) - Obstructed condenser (Water condensation) - High temperature of the condensation fluid 	<ul style="list-style-type: none"> - Check to see if the cooling tower is providing the water flow required by the condenser as indicated in the Chiller nameplate - Carry out cleaning of the filter⁵⁾ - Remove the screens and wash them with WAP⁵⁾ - Remove the air filters (screens) and wash with WAP⁵⁾ - Wash the microchannel condenser using a WAP⁵⁾ - Hire a specialized company to clean the condenser through the accesses existing in the condensation pipe - Check to see if the room temperature of the installation site does not exceed the maximum temperature of 42°C - Check if the required space criteria around the Chiller were met (according to section 4 of this manual)
5	Low Pressure 1 or 2	PB1 or 2	Low pressure switch 1 or 2	Turn Off Refrigeration 1 or 2	Switch off TMR	- Lack / leak of refrigerant	- Contact technical support to check the operation of the refrigeration circuits	
6	Water Pressure Failure ⁴⁾	TP1	Pressure Transmitter	Loss of control ⁴⁾	Switch off TMR	- Failure of the pressure transmitter of the process water	- Contact technical support to change the pressure transmitter	
7	Process Temperature Failure	ST1	NTC Sensor	Turn Off Refrigeration 1 and 2	Switch off TMR	- Bad sensor connection contact	- Locate the sensor in the electrical panel through the TAG and check to see if the wires are not loose. The connection can be checked in the electrical scheme of the equipment	
- Defect in the sensor						- In a container with water, place the sensor with a calibrated sensor; if the difference or lack of measurement is observed contact		

							technical support to change the sensor
8	Safety Process Temperature	ST1	NTC Sensor	Switch off Chiller	Auto	- High process temperature ($\geq 50^{\circ}\text{C}$)	- Change the tank water, put the Chiller to operate on by-pass and check if the Chiller deactivates again
							- Check to see that there is no heat load increase in the system
9	Return Temperature Failure	ST2	NTC Sensor	None (Only referential)	Switch off TMR		- Bad sensor connection contact
							- Defect in the sensor
10	Low Temperature Failure ²⁾	ST3	NTC Sensor	Turn Off Refrigeration 1 and 2	Auto		- Bad sensor connection contact
							- Defect in the sensor
11	Low Temp	ST3	NTC Sensor	Turn Off Refrigeration 1 and 2	Auto		- Low circulation of water through the evaporator
							- Water temperature below the value indicated in the "low limit" parameter
							- In case of recurrent alarms during the time of the day the Chiller is in operation, contact the technical support of Mecalor
							- Check to see if the temperature adjustment in the MMI is below 5°C or below the minimum temperature indicated

							on the identification plate.
						- Incorrect measurement	- In a container with water, place the sensor with a calibrated sensor; if the difference or lack of measurement is observed contact technical support to change the sensor
12	Low Safety Temperature	ST3	NTC Sensor	Switch off Chiller	Switch off TMR	- Water safety temperature below the value indicated in the "low safety limit" parameter	- Contact the technical support of Mecalor to check the operation of the Chiller
13	Condensation Fluid Temperature Failure	ST4	NTC Sensor	None	Switch off TMR	- Bad sensor connection contact	- Locate the sensor in the electrical panel through the TAG and check to see if the wires are not loose. The connection can be checked in the electrical scheme of the equipment
						- Defect in the sensor	- In a container with water, place the sensor with a calibrated sensor; if the difference or lack of measurement is observed contact technical support to change the sensor
14	Indirect Temperature Failure (optional process control at the customer)	-	NTC Sensor	None	Switch off TMR	- Bad sensor connection contact	- Locate the sensor in the electrical panel through the TAG and check to see if the wires are not loose. The connection can be checked in the electrical scheme of the equipment
						- Defect in the sensor	- In a container with water, place the sensor with a calibrated sensor; if the difference or lack of measurement is observed contact technical support to change the sensor
15	Room Temp. Exchanger Failure	ST5	NTC Sensor	None	Switch off TMR	- Bad sensor connection contact	- Locate the sensor in the electrical panel through the TAG and check to see if the wires are not loose. The connection can be checked in the electrical scheme of the equipment

								- Defect in the sensor	- In a container with water, place the sensor with a calibrated sensor; if the difference or lack of measurement is observed contact technical support to change the sensor
16		Universal Input failure	-	NTC Sensor	None	-		- Bad contact in the component (sensor / transmitter, etc.)	- Locate the sensor in the electrical panel through the TAG and check to see if the wires are not loose. The connection can be checked in the electrical scheme of the equipment
								- Defect in the component (sensor / transmitter, etc.)	- In a container with water, place the sensor with a calibrated sensor; if the difference or lack of measurement is observed contact technical support to change the sensor
17	Engines	Heat Pump 1	FE9	Engine circuit breaker	Switch off Chiller	Switch off TMR		- Overcurrent in the pump engine	- Reset the circuit breaker and measure the electric current. Compare with the current indicated in the electrical data. The electric current of the cables should be less than that of the electrical data
									- Check the inlet and outlet voltage, voltage drop, temperature (< 50°C) and the current of the circuit breaker
									- In case of recurrent alarms during the time of the day the Chiller is in operation, contact the technical support of Mecalor
							- Working point not within the pump curve	- Check the pressure indicated on the pressure gauge of the Chiller The pressure should be within the curve of the pump	
									- Check the adjustment of the circuit breaker. The adjustment should be equal or higher than the nominal current (between 5 to a MAXIMUM of 10%)

18	Fan Heat VT _n (equipments with air condensation)	FE7 FE8	Engine circuit breaker	Switch off Refrigeration	Switch off TMR	- Overcurrent in the fan engine	- Reset the circuit breaker and measure the electric current. Compare with the current indicated in the electrical data. The electric current of the cables should be less than that of the electrical data
							- Check the inlet and outlet voltage, voltage drop, temperature (< 50°C) and the current of the circuit breaker
							- In case of recurrent alarms during the time of the day the Chiller is in operation, contact the technical support of Mecalor
19	Compressor Heat CPn	FE1 to 6	Engine circuit breaker	Turn Off Refrigeration 1 or 2	Switch off TMR	- Overcurrent in the compressor engine	- Reset the circuit breaker and measure the electric current. Compare with the current indicated in the electrical data. The electric current of the cables should be less than that of the electrical data
							- Check the inlet and outlet voltage, voltage drop, temperature (< 50°C) and the current of the circuit breaker
							- In case of recurrent alarms during the time of the day the Chiller is in operation, contact the technical support of Mecalor
						- Check for failure in the inverter or Soft Starter of the compressors	
						- Excess refrigerant	- Check to see if refrigerant load was not carried out in the refrigeration circuits as a result of maintenance
20	Compressor Thermistor CPn (Chillers with Thermistor)	TM _n	Thermistor	Turn Off Refrigeration 1 or 2	Switch off TMR	- Deactivated CPn compressor engine thermistor	- Check the value of the electrical voltage that is supplying the compressor contactors. There should be no +-10% variation in the nominal value
						- High temperature of the compressor engine	- Contact technical support to check if the

								circuit overheating is high
21	Chillers with CoreSense These failures appear alongside the failure of the thermistor as the cause	CS _n Loss of Communication / Offline	TM _n	CoreSense	Turn Off Refrigeration 1 or 2	Switch off TMR	- Bad contact of module connection	- Locate the module connection in the electrical panel through the TAG and check to see if the wires are not loose. The connection can be checked in the electrical scheme of the equipment
							- Defect in the module	- Contact technical support to change the module
22	Chillers with CoreSense These failures appear alongside the failure of the thermistor as the cause	CS _n Internal Thermistor Warning	TM _n	CoreSense	Turn Off Refrigeration 1 or 2	Switch off TMR	- Chiller temperature control oscillating	- Contact technical support to check the operation of the Chiller
							- CoreSense Configuration	- Contact technical support to reset the Coresense module
23	Chillers with CoreSense These failures appear alongside the failure of the thermistor as the cause	CS _n Low Voltage	TM _n	CoreSense	Turn Off Refrigeration 1 or 2	Switch off TMR	- Bad contact of module connection	- Locate the module connection in the electrical panel through the TAG and check to see if the wires are not loose. The connection can be checked in the electrical scheme of the equipment
							- Defect in the module	- Contact technical support to change the module
24	Chillers with CoreSense These failures appear alongside the failure of the thermistor as the cause	CS _n Internal High Temperature CS _n High Discharge Temperature CS _n Engine Shutdown Temperature	TM _n	CoreSense	Turn Off Refrigeration 1 or 2	Switch off TMR	- High overheating	- Contact technical support to check the cooling system
							- Defect in the internal compressor sensor	- Contact technical support to change the sensor
							- Defect in the module	- Contact technical support to change the module
25	Chillers with CoreSense These failures appear alongside the failure of the thermistor as the cause	CS _n Inverted Phase Shutdown CS _n Lack of Phase Shutdown	TM _n	Thermistor	Turn Off Refrigeration 1 or 2	Switch off TMR	- Bad contact in phase connection	- Locate the module connection in the electrical panel through the TAG and check to see if the wires are not loose. The connection can be checked in the electrical scheme of the equipment
							- Inversion between phases	- Check the connection between panel and compressor
							- Circuit breaker / contactor problems	- Check the inlet and outlet voltage, voltage drop, temperature (< 50°C) and the current of

								the circuit breaker / contactor
26	Chillers with Electronic Expansion Valve	LOP Alarm 1 or 2	DVE1DVE2	Expansion valve module	Turn Off Refrigeration 1 or 2	Switch off TMR	- Lack / leak of refrigerant	- Contact technical support to check the operation of the refrigeration circuits
							- Equipment operating outside the operating conditions	- Contact technical support to check the operation of the Chiller
27		MOP Alarm 1 or 2	DVE1 DVE2	Expansion valve module	Turn Off Refrigeration 1 or 2	Switch off TMR	- High process water temperature	- Contact technical support to check the operation of the Chiller
28		Low SH Alarm 1 or 2	DVE1 DVE2	Expansion valve module	Turn Off Refrigeration 1 or 2	Switch off TMR	- Liquid return to the compressor	- Contact technical support to check the operation of the Chiller
							- Reading problems on the pressure sensor and/or transmitter	- Check the electrical connection according to the electrical scheme of the Chiller
							- Defect in the module	- Contact technical support to change the module
29		EVD 1 or 2 Offline	DVE1 DVE2	Expansion valve module	Turn Off Refrigeration 1 or 2	Switch off TMR	- Controller of Expansion valve 1 or 2 disconnected	- Check the physical communication medium
30		EVD 1 or 2 Probe 1 EVD 1 or 2 Probe 2 EVD 1 or 2 Probe 3 ³⁾ EVD 1 or 2 Probe 4 ³⁾	DVE1 DVE2	Expansion valve module	Turn Off Refrigeration 1 or 2	Switch off TMR	- Bad sensor connection contact	- Locate the sensor in the electrical panel through the TAG and check to see if the wires are not loose. The connection can be checked in the electrical scheme of the equipment
							- Defect in the sensor	- Contact technical support to change the sensor
31		EVD 1 or 2 Engine Error	DVE1 DVE2	Expansion valve module	Turn Off Refrigeration 1 or 2	Switch off TMR	- Failure of the engine of the Expansion valve 1 or 2	- Check coil measurements of the expansion valve in failure and compare with that of the circuit in operation, they must be the same
							- Bad contact of module connection	- Locate the module connection in the electrical panel through the TAG and check to see if the wires are not loose. The connection can be checked in the electrical scheme of the equipment
							- Defect in the module	- Contact technical support to change the module

32		EVD 1 or 2 EEPROM Damaged	DVE1 DVE2	Expansion valve module	Turn Off Refrigeration 1 or 2	Switch off TMR	- Defect in the module	- Contact technical support to change the module
33	Communication	Chiller Standby Offline (Chillers interconnected in the network)	-	Physical communication medium	None	-	- Communication failure between the equipments	- Check the physical communication medium
								- Check the network configurations of the Chillers
34		IPX Offline (Chiller with 6 compressors or screw compressor)	-	Physical communication medium	None	-	- Communication failure with the expansion module	- Check the physical communication medium
								- Check the network configurations of the Chillers
35	Watchdog (For Serial Modbus RTU communication)	-	Physical communication medium	None	-	- Communication failure between the Chiller and the network master	- Check the physical communication medium	
							- Check the network configurations of the Chillers	

- 1) It is disabled for 10 minutes after the occurrence of the reset of 3 consecutive failures (time of 2 minutes between failures)
- 2) Active protection mode: the process temperature sensor is used as reference and the criterion for switching off the refrigeration becomes due to low evaporation and suction temperature
- 3) Chiller with condensation control: forces control signal to 100% until the sensor is changed. Low pressure failure may occur due to loss of control
- 4) Only in equipments with water pressure control Forces the control signal top open 50% of the valve until the transmitter is changed. Insufficient water failure may occur due to loss of control
- 5) See procedure in the preventive maintenance section

6.2. Preventive Maintenance

The correct Preventive Maintenance may avoid future breakdowns and shutdowns of the equipment.

For this, we recommend the procedures described below.

Preventive maintenance – general			
Item	Frequency	Procedure	Notes
Painted Structure	Annual	- Check the general condition of the cabinet painting and retouch if necessary	Color specifications: For RLAC-S cabinets: color OLIVE GREEN RAL 6003
Stainless Steel Structure	Monthly	- Clean the structure with water, neutral detergent diluted in water and a soft cloth or nylon sponge;	The structure is supplied in stainless steel. Cleaning is essential to protect the structure against impurities that may cause oxidation points

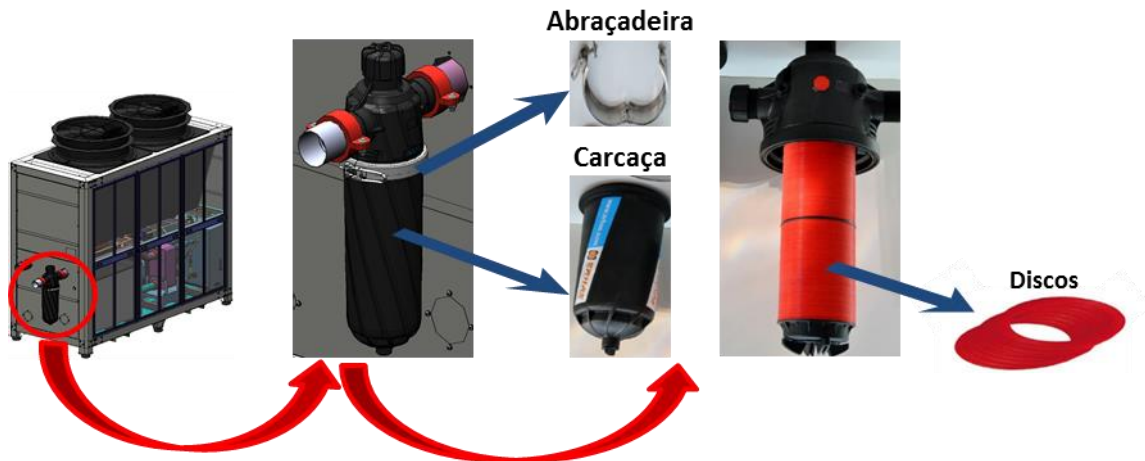
Insulation of the pipe	Every six months	Check the insulation conditions of the pipes and replace damaged insulations	Damaged insulations or insulations with excess moisture should be replaced.
Vibration	Every six months	Check for the existence of excess vibration in the Equipment	Check for possible cracks on welded points
		Place your hand on the body of the compressor and visually check the pipe; this procedure is necessary to obtain a reference standard in relation to the normal vibration of the equipment	
Fixations of the components	Every six months	Check the fixation of the engines: pump, compressor and fan	Retighten loose bolts
Air filter (side closing screens)	Monthly	Clean the side closing screens	It is recommended to increase the cleaning frequency in environments with high rate of suspended particles
		Check the condition of the closing screen	Replace it if damaged
Water leak	Monthly	Check if the hydraulic pipe/connections have water leakage	Retighten the connections
Electrical Panel Door	Monthly	Open and close the door	The door should be aligned and closed without difficulty
Locks of the Electrical Panel Door	Monthly	Close the door, lock it and then unlock it	There should be no interferences between the lock and the door. The door should be pressed against the rubber seal and not allow gaps
Alignment and closing of the set of Plates	Monthly	Check the alignment of the closing plates of the cabinet	They should be aligned and must not have any fixation bolts
Insulation of the electrical panel	Monthly	Check to see if the seal of the electrical panel door is well attached throughout the internal part of the electrical panel door. There should not be any detached points	Replace if damaged
Process water condition	Monthly	Check the appearance of the process water	It should be translucent and not have any solid particles
			If not, collect a sample and send to analysis
Preventive maintenance – mechanical			
Item	Frequency	Procedure	Notes
Condenser	Monthly	Clean the fins of the condenser with the use of a WAP (be careful not to dent the fins of the condenser)	It is recommended to increase the cleaning frequency in environments with high rate of suspended particles
		Check the room air temperature	The room temperature should not exceed 42°C
Pump	Monthly	Check for leaks in the mechanical seal	In case of leaks, the seal should be replaced
		Check the rotation direction of the pump	The engine must be turning according to the direction indicated on the pump
		Observe for abnormal noises in the pump	There may be air bubbles inside the pipe or cavitation
Compressor	Monthly	Check the oil level in compressors with oil display	With the compressor switched off, the oil level should at least be 1/4 and at most 3/4 of the display
Fan	Monthly	Check for the existence of excess vibration in the fan	Retighten the bolts
Refrigeration Pipe	Monthly	After 2 minutes of operation, check to see if the liquid display indicates the dark color and no bubbles	If the display indicates a light color, there is moisture in the system. If it shows bubbles, there is refrigerant leak

		Check for signs of oil leak in the pipe	The refrigerant gas leak should be corrected as quickly as possible Complete the refrigerant gas and oil load of the compressor, if necessary
Water filter	Monthly	Remove the filter element, wash and reinstall	It should not be mounted with missing discs
By-pass valve	Monthly	With the equipment operating, close the return valves of the customer's process for a few seconds and then open	The valve should open and allow the passing of water for the return. Then it should close when the process is opened. There should be no excessive liquid blow in the line when the process return is closed
			The equipment should not be deactivated by low water flow
Water reservoir	Quarterly	Check the cleaning of the water tank	It should be clean, without accumulated dirt and solid particles
Pressure Gauge	Monthly	With the Equipment in operation, check the conditions of the pressure gauge	It should not be locked. It should be oscillating according to the conditions of the pump
Preventive maintenance – electrical			
Item	Frequency	Procedure	Notes
Electrical panel	Every six months	Check for any loose components of the electrical panel	Retighten the terminals or bolts
Clean the electrical panel	Every six months	Clean inside the electrical panel	The electrical panel should be clean, without dust and fillings
Sealing of the through-holes of the Electrical Panel and cables gland	Monthly	Visually check to see if all the through-holes of cables are covered and the cables gland are duly tightened	There should be no holes open or cables not suitably tightened on the cable gland
Engine switch box	Every six months	Check to see if the terminals of the switch box of the engines (pump, compressor and fan) are loosening up	Retighten the terminals or bolts
Temperature sensors	Monthly	Check the calibration of the temperature sensors	Compare the process outlet and return temperatures with a calibrated standard thermometer
Terminal strips	Every six months	Check to see if all the electric cables are connected to their respective terminals	There should be no loose wires or "jumpers" inside the electrical panel
Pump	Monthly	Measure the current of phases R, S and T	Compare with the currents indicated in the electrical data of the equipment
		Check the voltage variation between phases	It should not exceed 10%
Fan	Monthly	Measure the current of phases R, S and T	Compare with the currents indicated in the electrical data of the equipment
		Check the voltage variation between phases	It should not exceed 10%
Compressor	Monthly	Measure the current of phases R, S and T	Compare with the currents indicated in the electrical data of the equipment
		Check the voltage variation between phases	It should not exceed 10%


6.2.1. Cleaning procedure for the water filter and micro-channel condenser.


a) Water Filter

To clean the polyamide housing water filter reinforced with fiberglass and disc filtering element, perform the following steps:

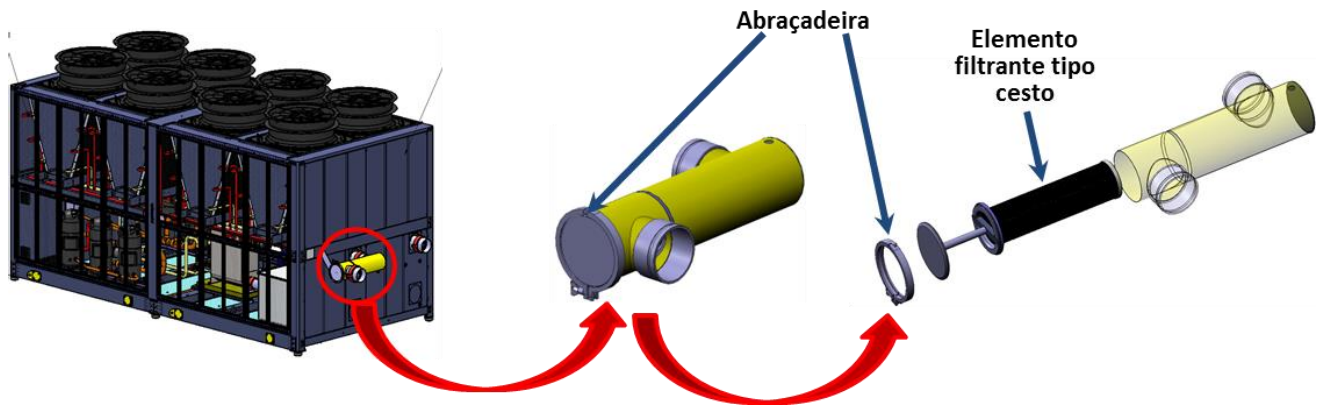


- I. Switch off the RLAC-S and close the stop valves;
- II. Release the fixation clamp of the casing and remove the filtration element;
- III. Slacken the bolt that keeps the discs attached to the body of the element;
- IV. Wash the discs with running water preferably with a high pressure washer;
- V. Retighten the nut and re-assemble the filtering element in the housing
- VI. Assemble the clamp in the filter housing

	INFORMATION	Leave a small gap between the discs when retightening the bolt of the filter element. Excess torque applied the torque will leave the filter element rigid and will compromise the filtration process.
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	INFORMATION	The use of the filter without the filter element or with a reduced number of discs compromises the efficiency of the filtration and the equipment and may result in the suspension of the warranty.
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To clean the stainless steel housing water filter with basket type filter element, perform the following steps:



- I. Switch off the RLAC-S and close the stop valves;
- II. Release the fixation clamp of the filter casing and remove the filtration element;
- III. Wash the basket with running water preferably with a high pressure washer;
- IV. Install the filter element in the filter housing again;
- V. Assemble the clamp in the filter housing.



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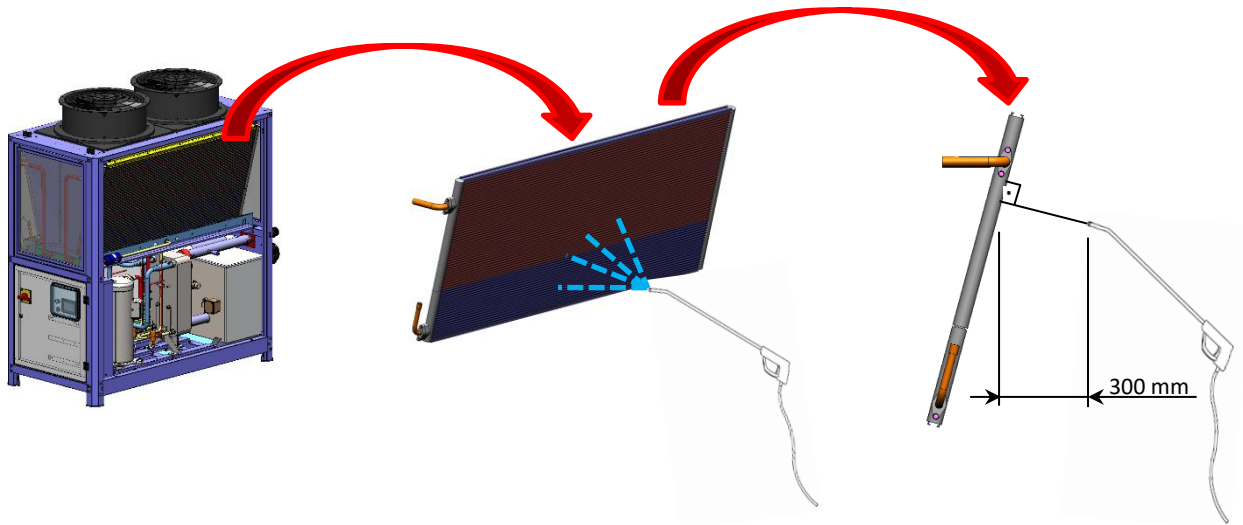
Never put the RLAC-S into operation without water filter. This practice will leave the system vulnerable to obstruction or to damages and the equipment may lose the warranty.

b) Microchannel condenser

It is extremely important for the cleaning of the microchannel condenser to be carried out periodically. In addition to extending the life of the condenser, this process prevents the occurrence of deactivations of the equipment due to obstructions caused by dirt, filings and dust that were not retained by the air filter.

The following precautions should be taken when cleaning the condenser:

- I. Remove the air filters from the sides of the structure of the equipment;
- II. Use a high pressure washer with spray nozzle to wash the condensers with clean water;
- III. The jet of water from the spray nozzle should be in the form of a fan and directed perpendicular to the surface of the condenser to prevent the fins from being dented.
- IV. The jet of water cannot be applied on a direct point of the surface of the condenser;
- V. Keep a distance of 300 mm between the spray nozzle and the surface of the condenser



	INFORMATION	<p>Do not direct the jets of water on the internal components of the MSA cabinet. Use the high pressure washer only in the sprinkling option in the shape of a fan directly on the condensers.</p>
	INFORMATION	<p>Do not use the water jet option to wash the condensers, this practice may dent the fins and increase the air load loss causing reduced performance and eventual deactivation of the equipment.</p>
	INFORMATION	<p>Do not use chemical products to clean the condensers. These products can cause corrosion of the surface of the condensers. In this case use ONLY neutral detergent and clean water.</p>

7. Technical Services

In addition to quality products, Mecalor offers its customers customized service through a specialized team up to date with the technological innovations and prepared to suggest suitable solutions for each issue. Contact the technical support team for further information.

7.1. Start-Up

Despite being a very simple procedure, it is important for the customer to contact Mecalor in order for the installation conditions to be checked and for the start-up to be authorized.

7.2. Preventive Maintenance Agreements

With aim to prevent failures, Mecalor offers customized preventive maintenance agreements. The agreements consist of the periodic visits of technicians who check, gauge and test the condition and performance of the equipments.

The Mecalor Preventive Maintenance Plan ensures a longer service life of the equipment and reduces the possibility of shutdowns due to failure.

7.3. Retrofitting (Reform of Equipments)

In many cases an equipment with outdated technology may be technologically updated through the application of modern techniques developed by Mecalor.

Mecalor Retrofitting Service consists of:

- Study of the current conditions of the equipment, evaluating whether retrofitting is worthwhile;
- Study of the adaptability of the equipment to the new technology;
- Execution of the scope;
- Try-out;
- Project Documentation.

7.4. Training

Mecalor conducts specific training to meet the most diverse preparation needs of the maintenance and operation teams. The trainings are provided according to the specific needs of each customer.

8. Disposal and the environment

The RLAC-S should be disposed at the end of its service life so as to reduce any negative impact on the environment. The following are recommended for such:

- Dismount the equipment according to all the safety recommendations applicable in the execution of the maintenance services.
- Reuse its components by applying it in other machines or in the production process, such as: reuse of the centrifugal pump, its electric motor, etc, etc.
- Separate materials that can be recycled and send them for recycling; for example: recycle carbon steel, stainless steel, bronze, plastics, etc.
- Separate non-reusable materials and components and dispose of them, observing the effective legal recommendations. Special attention should be given to batteries, lubricant oil and cooling gas.

In case there is leakage of the compressor oil of the RLAC-S, on any surface, immediate containment should be provided, pouring sawdust over the oil and then, after absorption, collect the sawdust and carry out complete cleaning of the affected area. This waste should be stored in an exclusive container for proper disposal afterwards.

During the replacement of the lubricant oil in the RLAC-S, the container and remaining excess oil should be stored in a suitable place to subsequently be sent to recycling.

In case cooling fluid leakage is detected in the equipment, the maintenance of the leak should be requested urgently.

Any mechanical or electric component that is replaced due to failure or upgrade should be disposed according to the recommendations and effective rules.

9. Warranty Term

1. OBJECT AND VALIDITY

- 1.1. The warranty includes repair and/or replacement of any faulty component, as long as it is due to fabrication defect.
- 1.2. The validity of the warranty of the equipments manufactured by Mecalor is 365 days counted from the date of issuance of the sales invoice of the product, of which there are 90 consecutive days of legal warranty and 275 consecutive days of complementary warranty, the latter provided by Mecalor as an additional benefit to the customer.
- 1.3. In case the equipment is purchased with extended warranty, this should be recorded in the official business proposal issued by Mecalor and it exclusively consists of the increase of the complementary warranty, being that the legal warranty will always be 90 consecutive days.
- 1.4. This warranty term is valid only for products sold and used in Brazil.

2. WARRANTY VALIDATION

- 2.1. The customer should inform Mecalor technical support in writing immediately after identification of the possible manufacturing defect.
- 2.2. Once the information of the possible defect is received, the technical support team of Mecalor should evaluate the possible causes and issue a technical opinion.
- 2.3. In case the manufacturing defect is confirmed, Mecalor must provide the replacement or repair of the defective component within the shortest period of time possible.
- 2.4. The Warranty period offered by Mecalor covers the costs for repair and replacement of parts with manufacturing defect, including expenses with the transport of technicians and tools, equipment freight or expenses with shipping of parts and components to the billing address of the equipment.
- 2.5. It is mandatory for the customer to return the defective components to Mecalor to confirm the failure at the supplier (if applicable), under the penalty of bearing the costs involved.
- 2.6. The warranty establishes the execution of services during business hours, with additional charge for extra hours of services provided outside this period and transport fee for services performed on the installations of third parties.

3. LOSS OF WARRANTY

- 3.1. The warranty will lose its validity in case it is confirmed through technical evaluation that the defect is as a result of failures during transport, installation, startup, maintenance or improper use by the customer or third parties.
- 3.2. Start-up of the equipment can only be performed by the customer with the written authorization form the technical support of Mecalor or with the presence of our authorized technicians, when this optional service is part of the Mecalor scope of supply, under the penalty of loss of warranty.
- 3.3. Incompatibility caused by products purchased from third parties and installed with Mecalor products or application in noncompliance with the information established in our technical and business proposal.
- 3.4. The warranty will lose its validity if the contracting party fails to comply with purchase and sales agreement, even if the agreement is tacit, including regarding the compliance of the equipment purchased.


4. GENERAL EXCLUSIONS AND LIMITATIONS

- 4.1. Once Mecalor provides technical support in warranty within the limits established by law and by the good service practices, we shall not be held responsible for direct or indirect costs or loss of revenue eventually supported by the customer as a result of eventual equipment defect.
- 4.2. The customer will be responsible for the expenses with eventual shipping of the equipment to the factory or to any authorized technical representative of Mecalor to carry out technical support.
- 4.3. The replacement of components due to use or natural wear of the equipment, such as seals, sensors, engines, contactors, circuit breakers, among others.
- 4.4. Normal operating adjustments, maintenance and application of the equipment, such as sending of technicians to check the safety alarms, parameterization and technical assistance to optimize the performance of the product.

Customer	Serial number	Warranty period

10. Attachments

The documents that complement this manual are described below and can be different from the standardized documents in case the nomenclature of the RLAC-S model has a special character.

	INFORMATION	Always use the complementary documents in case of special characters in the nomenclature of the RLAC-S as described in section 2.1.
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- Pump curve
- Dimensional
- Wiring diagram
- Flowchart
- List of Components
- Water Quality
- Setup
- Electrical Data Table