LCA

Installation, use and maintenance

GB

CE

COMPANY
WITH QUALITY SYSTEM
CERTIFIED BY DNV
=ISO 9001/2000=

Galletti
AIR CONDITIONING

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CE

Declaration of conformity

Galletti S.p.A., whose main office is at n°12/a Via Romagnoli, 40010 Bentivoglio (BO) - Italy, hereby declares, under its sole responsibility, that the LCA water chillers, devices for air conditioning systems, conform to the specifications of EEC Directives 73/23, 89/392, 91/368, 93/44, 93/68, 97/23, 89/336.

Bologna, 22/01/2002

Luigi Galletti
President

THE SERIES

The LCA series of chillers with fluid heat pumps covers a power range from 44.8 to 234 kW.

FIELD OF APPLICATION

These machines are designed to cool-heat water and solutions containing up to 30% glycol (percentage by weight) in civil, industrial and technological air-conditioning systems.
They must be used in observance of the operating limits specified in this manual; failure to comply with said limits will invalidate the warranties provided in the contract of sale.

GENERALITIES

- When installing or servicing the chiller, you must strictly follow the rules provided in this manual, comply with the directions on the units and take all such precautions as are necessary.

- The fluids under pressure in the cooling circuit and the presence of electrical components may cause hazardous situations during installation and maintenance work.

Therefore, only qualified personnel may perform any kind of work on the unit.

- Failure to comply with the rules provided in this manual or any modification made to the unit without prior authorisation will result in the immediate invalidation of the warranty.

Warning: Before performing any kind of work on the unit, make sure it has been disconnected from the power supply.

INSPECTION, CONVEYANCE, SITING

INSPECTION

On receiving the unit, check that it is perfectly intact: the machine left the factory in perfect conditions; immediately report any signs of damage to the carrier and note them on the Delivery Slip before signing it.
Galletti S.p.A. or its Agent must be promptly notified of the entity of the damage.
The Customer must submit a written report describing every significant sign of damage.

LIFTING AND CONVEYANCE

While the unit is being unloaded and positioned, utmost care must be taken to avoid abrupt or violent manoeuvres. The unit must be handled carefully and gently: avoid using machine components as anchorages when lifting or moving it.
The unit must be lifted using steel pipes inserted through the eyebolts provided on the base frame.
Prior to being lifted, the unit should be harnessed as shown in the figure below: use ropes or belts of adequate length and spacer bars to avoid damaging the sides and top of the unit.

Warning: In all lifting operations make sure that the unit is securely anchored in order to prevent accidental falls or overturning.

UNPACKING

The packing must be carefully removed to avoid the risk of damaging the unit. Different packing materials are used: wood, cardboard, nylon etc.
It is recommended to keep them separately and deliver them to suitable waste disposal or recycling facilities in order to minimise their environmental impact.

SITING

You should bear in mind the following aspects when choosing the best site for installing the unit and the relative connections:
- size and origin of water pipes;
- location of power supply;
- accessibility for maintenance or repairs;
- solidity of the supporting surface;
- ventilation of the air-cooled condenser and necessary clearance;
- direction of prevalent winds: avoid positioning the unit in such a way that the prevalent winds favour the backflow of air to the condenser coils; a speed of 8 m/s (28.8 km/h) already generates a sufficient stagnation pressure to guarantee 60% of the nominal air flow rate.[In situations where the action of air currents is inevitable and there is a simultaneous presence of temperatures below – 5°C, the control of condensation for low outdoor temperatures must be of the flooding type or with a device for choking the condensing exchanger -contact the technical department for further details]
- possible reverberation of sound waves.

All models belonging to the LCA series are designed and built for outdoor installation: avoid covering them with roof structures or positioning them near plants (even if they only partly cover the unit) which may interfere with the regular ventilation of the unit condenser.
It is a good idea to create a base of adequate dimensions to support the unit. This precaution becomes essential when the unit is to be sited on unstable ground (various types of soil, gardens, etc.).

It is advisable to place a rigid rubber strip between the base frame and the supporting surface.
Whenever more effective insulation is required, it is recommended to use vibrating-damping spring supports.

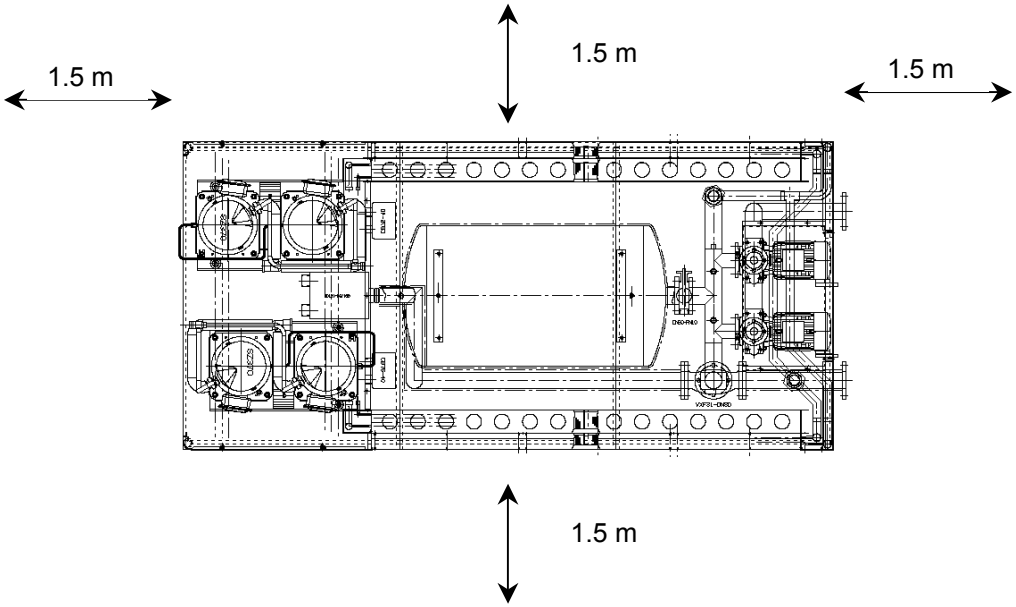
In the case of installation on roofs or intermediate storeys, the unit and pipes must be insulated from walls and ceilings by placing rigid rubber joints in between and using supports that are not rigidly anchored to the walls.
If the unit is to be installed in proximity to private offices, bedrooms or areas where noise levels must be kept down, it is advisable to conduct a thorough analysis of the sound field generated and verify its compatibility with the local laws in force.

INSTALLATION

INSTALLATION CLEARANCE REQUIREMENTS

It is of fundamental importance to ensure an adequate volume of air both on the intake and outlet sides of the condenser coils; it is highly important to prevent the air delivered from being re-aspirated as this may impair the performance of the unit or even cause an interruption in normal operation. For this reason it is necessary to guarantee the following clearances (see figure on this page):

- rear side/plumbing connections: min. 1.5 metres to guarantee access to plumbing connections and/or for any necessary maintenance on the pumps, reservoir, expansion tank and flow switch.
- electric control board side: min. 1.5 metres to guarantee access for inspection and/or maintenance of cooling components
- coil side: min. 1.5 metres to ensure proper air circulation and access to the compressor compartment, also from the side.
- top side: there must be no obstacle to expulsion.



GENERAL GUIDELINES FOR PLUMBING CONNECTIONS

When you are getting ready to set up the water circuit for the evaporator you should follow the directions below and in any case make sure you comply with national or local regulations (use the diagrams included in this manual as your reference).

- Connect the pipes to the chiller using flexible couplings to prevent the transmission of vibrations and to compensate thermal expansions.
- It is recommended to install the following components on the pipes:
  - temperature and pressure indicators for routine maintenance and monitoring of the unit. Checking the pressure on the water side will enable you to verify whether the expansion tank is working efficiently and to promptly detect any water leaks within the equipment.
  - traps on incoming and outgoing pipes for temperature measurements, which can provide a direct reading of the operating temperatures. Temperature readings can in any case be obtained from the microprocessor installed on the unit.
  - regulating valves (gate valves) for isolating the unit from the water circuit.
  - metal mesh filter (incoming pipes), with a mesh not to exceed 1 mm, to protect the exchanger from scale or impurities present in the pipes.
  - air vent valves, to be placed at the highest points of the water circuit for the purpose of bleeding air. [The internal pipes of the unit are fitted with small air vent valves for bleeding the unit itself: **this operation may only be carried out when the unit is disconnected from the power supply**]
  - drainage valve and, where necessary, a drainage tank for emptying out the equipment for maintenance purposes or when the unit is taken out of service at the end of the season. [A 1" drainage valve is provided on the optional water storage reservoir: **this operation may only be carried out when the unit is disconnected from the power supply**]

WATER CONNECTION TO THE EVAPORATOR

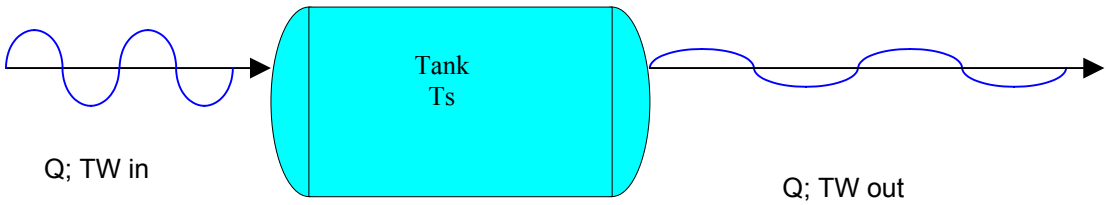
It is of fundamental importance that the incoming water supply is hooked up to the connection marked "Water Inlet"

Otherwise the evaporator would be exposed to the risk of freezing since the antifreeze thermostat would not be able to perform its function; moreover the reverse cycle would not be respected in the cooling mode, resulting in additional risks of malfunctioning
The dimensions and position of plumbing connections are shown in the dimension tables at the back of the manual.

The water circuit must be set up in such a way as to guarantee that the nominal flow rate of the water supplied to the evaporator remains constant (+/- 15%) in all operating conditions.

The compressors often work intermittently, since the chilling requirements of the user generally do not coincide with the compressor output. In systems containing little water, where the thermal inertia of the water itself is lower, it is a good idea to check that the water content in the section delivering to users satisfies the condition below:

V	= water content in user section	[m3]
Sh	= specific heat of the fluid	[J/(kg/°C)]
ρ	= fluid density	[kg/m3]
Dτ	= minimum time lapse between 2 compressor restarts	[s]
DT	= allowed water T differential	[°C]
Cc	= Cooling capacity	[W]
Ns	= N° of choking steps	



A **standard** feature of LCA units is a device for controlling the flow rate (flow switch or differential pressure switch) in the water circuit in the immediate vicinity of the evaporator. Frame 3, 4, 5 units include a blade-type flow switch positioned in the ventilation compartment.

Any tampering with said device will immediately invalidate the warranty.

It is advisable to install a metal mesh filter on the inlet water pipe.

It is strongly recommended to install a safety valve in the water circuit. In the event of serious equipment faults (e.g. fire) it will enable water to be drained from the system, thereby preventing possible bursts. Always connect the drain outlet to a pipe with a diameter at least as large as that of the valve opening and direct it toward an area where the discharge of water cannot harm people. This is a standard feature of units equipped with the optional storage reservoir.

Warning: When making the plumbing connections, make sure there are no open flames in proximity to or inside the unit.

SAFETY VALVE DRAIN PIPES

Safety valves are fitted in each refrigerant circuit: some regulations provide that the refrigerant drained from the valves be conveyed to the outside by means of a suitable pipe with a diameter at least matching that of the valve drainage outlet; the valve must not be made to bear the weight of the pipe.
The valves positioned on the compressor outlet only discharge hot saturated gas; those on the liquid receivers, despite being positioned in the top part of the latter, may discharge saturated liquid and pose a greater hazard of burns due to the strong dehydrating effect caused by the sudden evaporation of refrigerant fluid in contact with bodies having a T > -41 °C.

Warning: Always direct the drain pipe toward an area where the discharge cannot harm people.

ELECTRICAL CONNECTIONS

GENERALITIES

Before carrying out any job on electrical parts, make sure the power supply is disconnected.

Check that the mains electricity supply is compatible with the specifications (voltage, number of phases, frequency) shown on the unit rating plate.
The connection to the power supply should be made with a three-pole + neutral cable and earthing wire.

The size of the cable and line protections must conform to the specifications provided in the wiring diagram.

The supply voltage may not undergo fluctuations exceeding ±5% and the unbalance between phases must always be below 2%.

The above operating conditions must always be complied with: failure to ensure said conditions will result in the immediate invalidation of the warranty.

The electrical connections must be made in accordance with the information shown in the wiring diagram provided with the unit and current regulations.
An earth connection is required by law. The installer must connect the earthing wire using the earthing terminal situated on the electric control board (yellow and green wire).
The power supply to the control circuit is shunted from the power line through an insulating transformer situated on the electric control board.
The control circuit is protected by suitable fuses.

ELECTRIC CONNECTIONS OF FLOW SWITCH OR DIFFERENTIAL WATER PRESSURE SWITCH

It is pre-wired in all LCA units. Frame 1, 2, 3 units feature a differential pressure switch that detects pressure drops upstream and downstream from the evaporator (outgoing – returning water in the case of units equipped with a pump system) ; Frame 4, 5 units have a blade-type flow switch installed in series with water circuit.

ELECTRIC CONNECTIONS OF THE CIRCULATION PUMP

If selected on ordering, it/they is/are supplied pre-wired with all LCA units.

The pump must be started before the chiller and stopped after the latter (minimum recommended delay: 60 seconds). If included as an option, this function is already performed by the electric control board on the unit.

REMOTE CONTROLS

If you wish to include a remote control for switching the unit on and off, you must remove the bridge between the contacts indicated in the wiring diagram and connect the remote ON/OFF control to the terminals themselves [see annexed wiring diagram].

All remote controls work with a very low voltage (24 Vac) supplied by the insulating transformer on the electric control board.

REMOTE SUMMER-WINTER SWITCHING

If you wish to include a remote control for switching the unit between the summer and winter operating modes, you must remove the bridge between the contacts indicated in the wiring diagram and connect the remote switching control to the terminals themselves [see annexed wiring diagram].

STARTING UP

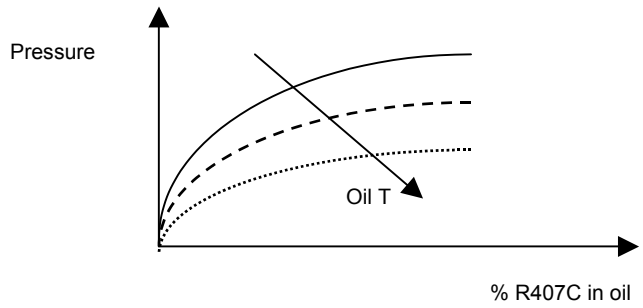
PRELIMINARY CHECKS

- Check that all the valves in the cooling circuit are open (liquid line).
- Check that the electrical connections have been made properly and that all the terminals **are securely tightened**. This check should also be included in a periodic six-month inspection.
- Check that the voltage at the RST terminals is 400 V ± 5% and **make sure** the yellow indicator light of the phase sequence relay is on. The phase sequence relay is positioned in the middle right part of the electric control board; if the sequence is not duly observed, it will not enable the machine to start.
- Make sure there are no refrigerant leaks that may have been caused by accidental impacts during transport and/or installation.

- Check that the crankcase heating elements are properly connected to the power supply.

The heating elements must be turned on at least 12 hours before the unit is started. Their function is to raise the T of the oil in the sump and limit the quantity of refrigerant dissolved in it.

To verify whether the heating elements are working properly, check the lower part of the compressors: it should be warm or in any case at a temperature 10 - 15 °C higher than the ambient temperature.



The diagram above illustrates a specific property [Charles' Law] of gases, which are more soluble in liquids as the pressure increases but less soluble as the temperature increases: if the oil in the sump is held at a constant pressure, an increase in temperature will significantly reduce the amount of refrigerant dissolved in it, thus ensuring that the lubricating function desired is maintained.

- Check that the plumbing connections have been properly made according to the indications given on the plates to be found on the unit itself (proper inlet and outlet connections).

- Make sure that the water circuit is duly bled to completely eliminate the presence of air: load the circuit gradually and open the air vent valves on the top part, which the installer should have set in place.

STARTING OPERATION

Before starting the chiller, turn the main switch off, select the operating mode desired from the control panel [red button = heating, green button = cooling] and press the "ON" button on the control panel.

The unit will start up if enabled:
- by the safety devices of the water circulation pump/s
- by the flow switch (or differential pressure switch)
- by the T sensor measuring the temperature of the water returning from the system [chiller inlet]

and no alarms have been triggered

If the unit fails to start up, check whether the service thermostat has been set according to the nominal values provided

You should not disconnect the unit from the power supply during periods when it is inoperative but only when it is to be taken out of service for a prolonged period (e.g. at the end of the season). To turn off the unit temporarily follow the directions provided in the section "Stopping the Unit"

CHECKS DURING OPERATION

- Check the phase sequence relay on the control board to verify whether the phases occur in the correct sequence: if they do not, disconnect the unit from power supply and invert two phases of the incoming three-pole cable. Never attempt to modify internal electrical connections: any undue modifications will render the warranty null and void.

All the three-phase devices on the unit, compressor, water pump and fans have a set direction of rotation and were harmonized in the factory.

- Check that the temperature of the water entering the evaporator is close to the value set on the service thermostat.

CHECKING THE REFRIGERANT LEVEL

- After a few hours of operation, check whether the liquid level indicator has a green crown: a yellow colour indicates the presence of humidity in the circuit. In such a case the circuit must be dehumidified by qualified personnel.

- Large quantities of bubbles should not appear through the liquid level indicator. A constant passage of numerous bubbles may indicate that the refrigerant level is low and needs to be topped up. The presence of a few bubbles is however allowed, especially in the case of high-glide ternary mixtures such as HFC R407C

- A few minutes after the compressors have started up, check that the end-of-condensation temperature shown on the pressure gauge (refer to the pressure gauge scale for the refrigerant R407C, marked with the initials B.P. - Bubble Point) is about 19÷22 °C higher than the temperature of the air entering the condenser with the fans driven at top speed.
- Also check that the end-of-evaporation temperature shown on the pressure gauge (refer to the pressure gauge scale for the refrigerant R407C, marked with the initials D.P. - Dew Point) is about 5÷6 °C lower than the temperature of the water leaving the evaporator.

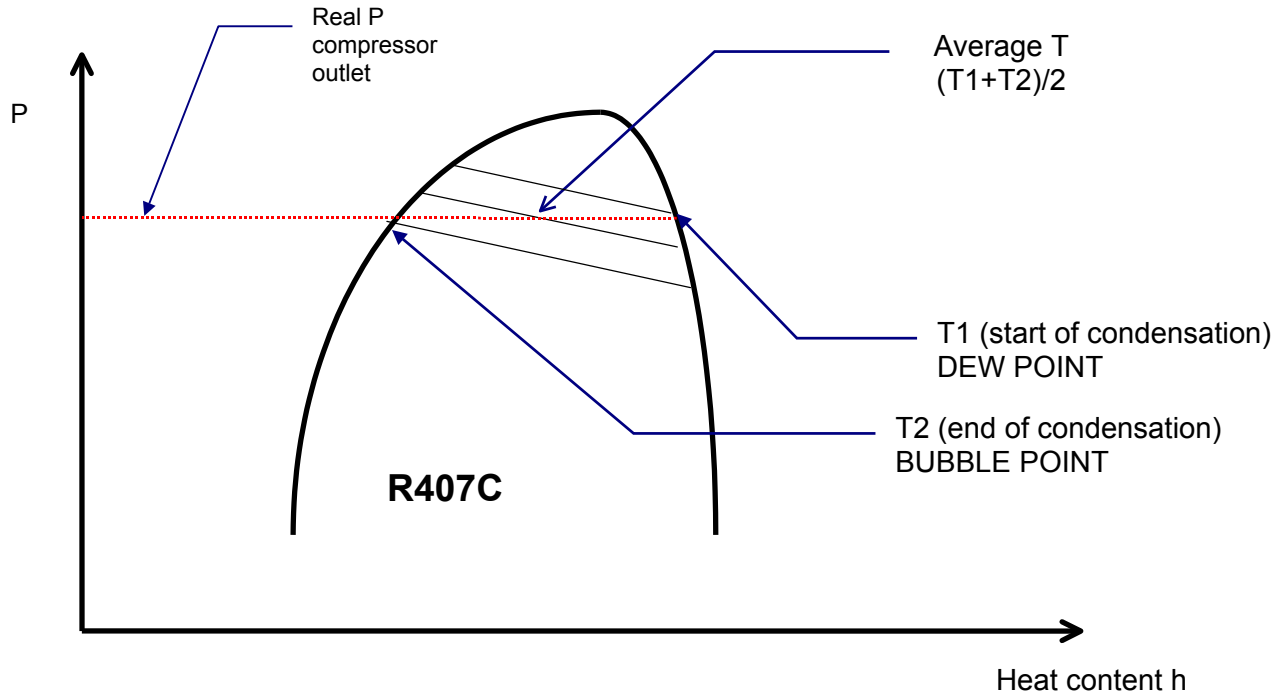
- Make sure the overheating of the cooling fluid is limited to between 5 and 8 °C: to this end:
  1) read the temperature indicated by a contact thermometer placed on the compressor intake pipe;
  2) read the temperature indicated on the scale of a pressure gauge likewise connected to the intake side; refer to the pressure gauge scale for the refrigerant R407C, marked with the initials D.P. (Dew Point).
     The degree of overheating is given by the difference between the temperatures thus determined.

- Make sure that the undercooling of the cooling fluid is limited to between 4 and 6°C: to this end:
  1) read the temperature indicated by a contact thermometer placed on the condenser outlet pipe;
  2) read the temperature indicated on the scale of a pressure gauge connected to the liquid inlet at the condenser outlet; refer to the pressure gauge scale for the refrigerant R407C, marked with the initials B.P. (Bubble Point).

The degree of undercooling is given by the difference between the temperatures thus determined.

Warning: all LCA units are charged with R407C: any top-ups must be made by specialised personnel using the same type of refrigerant, exclusively in the liquid phase.

Warning: the refrigerant R407C requires "POE" polyolester oil of a type approved by the compressor manufacturer.
For no reason should a mineral oil be introduced into the oil circuit.



- The difference between the Dew Point and Bubble Point is known as "GLIDE" and this is a characteristic property of refrigerant mixtures. If pure fluids are used, the phase change occurs at a constant T and thus the glide is equal to zero.

STOPPING THE UNIT

To stop the unit press the "OFF" unit on the front panel.

Warning: do not stop the unit using the main switch: the latter device serves to disconnect the unit from the electricity supply when there is no passage of current, i.e. when the unit is already turned OFF.
Moreover, if you completely disconnect the unit from the electricity supply, the crankcase heating elements will receive no power, thereby jeopardising the integrity of the compressor the next time the unit is started.

OPERATING LIMITS

Operating limits of LCA chillers in relation to the outlet water temperature and outdoor air temperature:

	Min.	Max.
Temperature of water leaving evaporator [°C]:	**5 (30)**	**12 (45)**
Outdoor air temperature [°C]:	**-10**	**45**

WATER FLOW TO EVAPORATOR

The nominal flow rate is based on a thermal differential of 5° C between inlet and outlet water, in relation to the cooling capacity provided at the nominal water (12/7 °C) and air (35°C) temperatures.

The maximum allowed flow rate is associated with a thermal differential of 3 °C: higher flow rates, though admissible, cause pointless, high drops in pressure.

The minimum allowed flow rate is associated with a thermal differential of 8 °C or a minimum pressure drop of 10 kPa: lower flow rates cause a reduction in heat exchange coefficients and excessively low evaporation temperatures, which may trigger the safety devices and cause the unit to stop.

CHILLED WATER TEMPERATURES

The minimum temperature of the water leaving the evaporator is 5 °C: lower temperatures are possible, but for such applications the Manufacturer should be consulted at the time the order is placed.
The maximum temperature of the water entering the evaporator is 20 °C. To allow higher temperatures specific equipment solutions must be adapted (split circuits, three-way valves, bypasses, storage reservoirs): contact the Manufacturer.

OUTDOOR AIR TEMPERATURE

The units are designed and built to work with outdoor temperatures ranging from -10 (with condensation control) to 45 °C. Contact the Manufacturer in the event of outdoor temperatures beyond this range.
On request, the units may be equipped with an electric heating element serving to heat the evaporator in cases where the unit is exposed to rigid temperatures during wintertime periods of quiescence.
The heating element is activated whenever the temperature of the water leaving the evaporator falls below the temperature set on the antifreeze heating element.

OPERATION WITH WATER AT LOW TEMPERATURES

The standard units are not designed to work with chilled water temperatures below 5 °C at the evaporator outlet. In order to work below this limit, the unit requires specific technical adjustments: in such cases contact the Manufacturer.

CONTROL DEVICE SETTINGS

GENERALITIES

All the control devices are set and tested in the factory before the unit is dispatched. However, after the unit has been in service for a reasonable period of time you can perform a check on the operating and safety devices. The settings are shown in Tables II and III.

The control devices may be serviced SOLELY BY QUALIFIED TECHNICIANS: incorrect settings may cause serious damage to the unit and injury to persons.

Many of the operating parameters and system settings are configured by means of the microprocessor control and are protected by passwords.

TABLE II - SETTING OF CONTROL DEVICES

CONTROL DEVICE		SET POINT	DIFFERENTIAL
Service thermostat [C]	°C	12	2
Service thermostat [H]	°C	40	2

TABLE III - SETTING OF SAFETY - CONTROL DEVICES

CONTROL DEVICE		ACTIVATION	DIFFERENTIAL	RESETTING
Antifreeze thermostat	°C	+4	2	Automatic
Safety maximum pressure switch	bars	28	4	Manual
High pressure relief valve	bars	29	-	-
Minimum pressure switch	bars	2	1.5	Automatic
Modulating condensation control device	bars	14	7	
Time lapse between two starts of the same compressor	s	480	-	-
Delay in flow switch alarm	s	20	-	-
Delay in low pressure alarm	s	120	-	-
Pump rotation [optional]	h	24		
End-of-defrost pressure	bars	19	-	-
Maximum defrost time	s	360	-	-
Minimum time lapse between two defrosting operations	s	1800	-	-

MAXIMUM PRESSURE SWITCH

The high pressure switch is of the manually reset type and classifiable as category IV under EEC 97/23. It directly stops the compressor when the discharge pressure exceeds the set value.

Warning: do not attempt to change the setting of the pressure switch: should the latter fail to trip in the event of a pressure increase, the pressure relief valve will open!

To verify its efficiency, while the compressors are running, close off the passage of air into the condensers and check by referring to the compressor outlet pressure gauge (previously installed) whether the pressure switch trips (i.e. the compressors stop) when the set value is reached.

Warning: while you are carrying out this check, you should be ready to shut off the unit as directed in the section "Stopping the Unit" in case the safety device fails to trip.

The high pressure switch must be **manually rest**; this is possible only when the pressure falls below the set differential (see Table III).

MINIMUM PRESSURE SWITCH

The low pressure switch stops the compressor when the intake pressure falls below the set value for more than 180 seconds.

The switch is automatically reset when the pressure rises above the set differential (see Table III); however, the unit will not resume operation until the alarm memory on the microprocessor control is cleared.

SERVICE THERMOSTAT

The function of this device is to start and stop the compressors according to the demand for chilled water, as determined by a sensor placed at the evaporator inlet [water returning from the circuit]
This device is a function included in the microprocessor control and works with a proportional bandwidth that may be set as desired.

ANTIFREEZE THERMOSTAT

The antifreeze sensor situated at the evaporator outlet detects the presence of excessively low temperatures and stops the unit. Together with the flow switch and low pressure switch, this device protects the evaporator from the risk of freezing as a result of faults in the water circuit.
This device is a function included in the microprocessor control.

ANTI-RECYCLE TIMER

The function of the timer is to prevent excessively frequent compressor starts and stops.
This device is a function included in the microprocessor control.
It imposes a minimum time lapse of 300 seconds between two successive starts.

Never attempt to change the delay set in the factory: wrong settings could cause serious damage to the unit.

OIL DIFFERENTIAL PRESSURE SWITCH

LCA units are equipped with spinning scroll compressors; these compressors do not have a lubricant pump and therefore no oil differential pressure switch is provided.

ROUTINE MAINTENANCE AND CHECKS

WARNINGS

All the operations described in this chapter MUST ALWAYS BE PERFORMED BY QUALIFIED PERSONNEL.

Before carrying out any work on the unit or accessing internal parts, make sure you have disconnected it from the mains electricity supply.

The upper part and outlet pipe of the compressor may reach temperatures as high as 110°C. Be especially careful when working in the surrounding area while the unit is running.

Be especially careful when working in proximity to finned coils since the 0.11 mm-thick aluminium fins can cause superficial injuries due to cuts.

After completing maintenance jobs, always replace the panels enclosing the units and secure them with the fastening screws provided.

GENERALITIES

It is a good idea to carry out periodic checks to ensure that the unit is working properly:

- Check the efficiency of all the control and safety devices as previously described.
- Check the terminals on the electric control board and compressor terminal boards to ensure that they are securely tightened. The movable and fixed contacts of the circuit breakers must be periodically cleaned and replaced whenever they show signs of deterioration.
- Check the refrigerant level by means of the liquid level indicator (every 6 months).
- Check the oil levels through the windows provided on the compressor crankcases (every 6 months).
- Check the water circuit for leaks (every 6 months).
- If the unit is to remain out of service for a long time, drain the water from the pipes and heat exchanger. This is indispensable if during the period of quiescence the ambient temperature is expected to fall below the freezing point of the fluid used (routine seasonal operation).
- Check whether the water in the circuit needs to be replenished. .
- Check the efficiency of the flow switch or differential pressure switch
- Check the heating elements, where present, of the compressor crankcases.
- Clean the metal mesh filters mounted externally on the water pipes.
- Check the humidity indicator on the liquid level indicator (green=dry, yellow=humid); if the indicator is not green as shown on the indicator sticker, replace the filter (every 6 months).
- Check that the noise emissions of the unit are regular (every 6 months) and more specifically that no vibrations and/or knocking can be detected.

REPAIRING THE COOLING CIRCUIT

Warning: while performing repairs on the cooling circuit or maintenance work on the compressors, make sure the circuit is left open for as little time as possible. Even if briefly exposed to air, ester oils tend to absorb large amounts of humidity, which results in the formation of weak acids.

If the cooling circuit has undergone any repairs, the following operations must be carried out:

- tightness test;
- emptying and drying of the cooling circuit;
- charging with refrigerant.

If the system has to be drained, always recover the refrigerant present in the circuit using suitable equipment; the refrigerant should be handled exclusively in the liquid phase.

TIGHTNESS TEST

Fill the circuit with anhydrous nitrogen supplied from a tank with a pressure-reducing valve until the pressure rises to 10 bars.

During the pressurisation phase, do not exceed the pressure setting of the safety valves; otherwise you will cause the latter to open.

The presence of any leaks must be determined using special leak detectors. Should any leaks be detected during the test, empty out the circuit before repairing the leaks with suitable alloys.

Do not use oxygen in the place of nitrogen as a test agent, since this could cause a risk of explosion as well as the certainty of extensive oxidisation in high-temperature areas.

HARD VACUUM AND DRYING OF THE COOLING CIRCUIT

To achieve a hard vacuum in the cooling circuit it is necessary to use a pump capable of generating a high degree of vacuum, i.e. 15 Pa of absolute pressure.
If there is no suitable vacuum pump available, or whenever the circuit has remained open for long periods of time, you are strongly recommended to adopt the triple evacuation method. This method is also recommended when there is a presence of humidity within the circuit.
The vacuum pump should be connected to the inlets.
The procedure to be carried out is as follows:

- Evacuate the circuit until you reach an absolute pressure of at least 35 Pa: at this point inject nitrogen into the circuit until you reach a relative pressure of about 1 bar.

- Repeat the step described above.

- Carry out the step described above for the third time, but in this case attempting to reach the hardest vacuum possible.

Using this procedure you can easily remove up to 99% of pollutants.

CHARGING WITH R407C REFRIGERANT

- Connect the cylinder of refrigerant gas to the male 1/4 SAE inlet situated on the liquid line after discharging a little gas to eliminate air in the connection pipe.

- **Carry out the charging operation with the refrigerant in liquid form** until you reach 75% of the total charge.

- Then connect to the inlet on the intake line and complete the charging process with the refrigerant **in liquid form** until no more bubbles can be seen on the liquid level indicator and the operating parameters specified in the section "Checking the refrigerant level" have been reached.

Since R407C is a ternary mixture, charging must take place exclusively with liquid refrigerant to ensure the correct percentages of the three constituents.
Introduce refrigerant through the inlet in the liquid line.

A unit that was originally charged with R407C in the factory cannot be charged with R22 or other refrigerants.

ENVIRONMENTAL PROTECTION

The law implementing the regulations [reg. EEC 2037/00] which govern the use of ozone-depleting substances and greenhouse gases bans the dispersal of refrigerant gases in the environment and requires whoever is in their possession to recover them and, at the end of their useful life, either to return them to the dealer or take them to a suitable waste disposal facility.
The refrigerant HFC R407C is not harmful to the ozone layer but is included among the substances responsible for the greenhouse effect and thus falls within the scope of the aforesaid regulations.

Therefore, special care should be taken when carrying out maintenance work to minimise refrigerant leaks.

RETIRING THE UNIT

When the unit has reached the end of its working life and needs to removed and replaced, a series of operations should be carried out:
- the refrigerant gas it contains should be recovered by specialised personnel and sent to a waste collection facility;
- the lubricating oil in the compressors should also be recovered and sent to a waste collection facility;
- if they cannot be reused, the framework and components should be scrapped and separated according to the type of material: this applies especially for the considerable quantities of copper and aluminium present in the unit.

This will make the job of waste collection, disposal and recycling facilities easier and minimise the environmental impact of such processes.

TROUBLESHOOTING

On the next pages you will find a list of the most common causes that may cause the chilling unit to fail or malfunction. These causes are broken down according to easily identifiable symptoms.

You should be extremely careful when attempting to implement any of the possible remedies suggested: overconfidence can result in injuries, even serious ones, to inexpert individuals. Therefore, once the cause has been identified, you are advised to contact the manufacturer or a qualified technician for help.

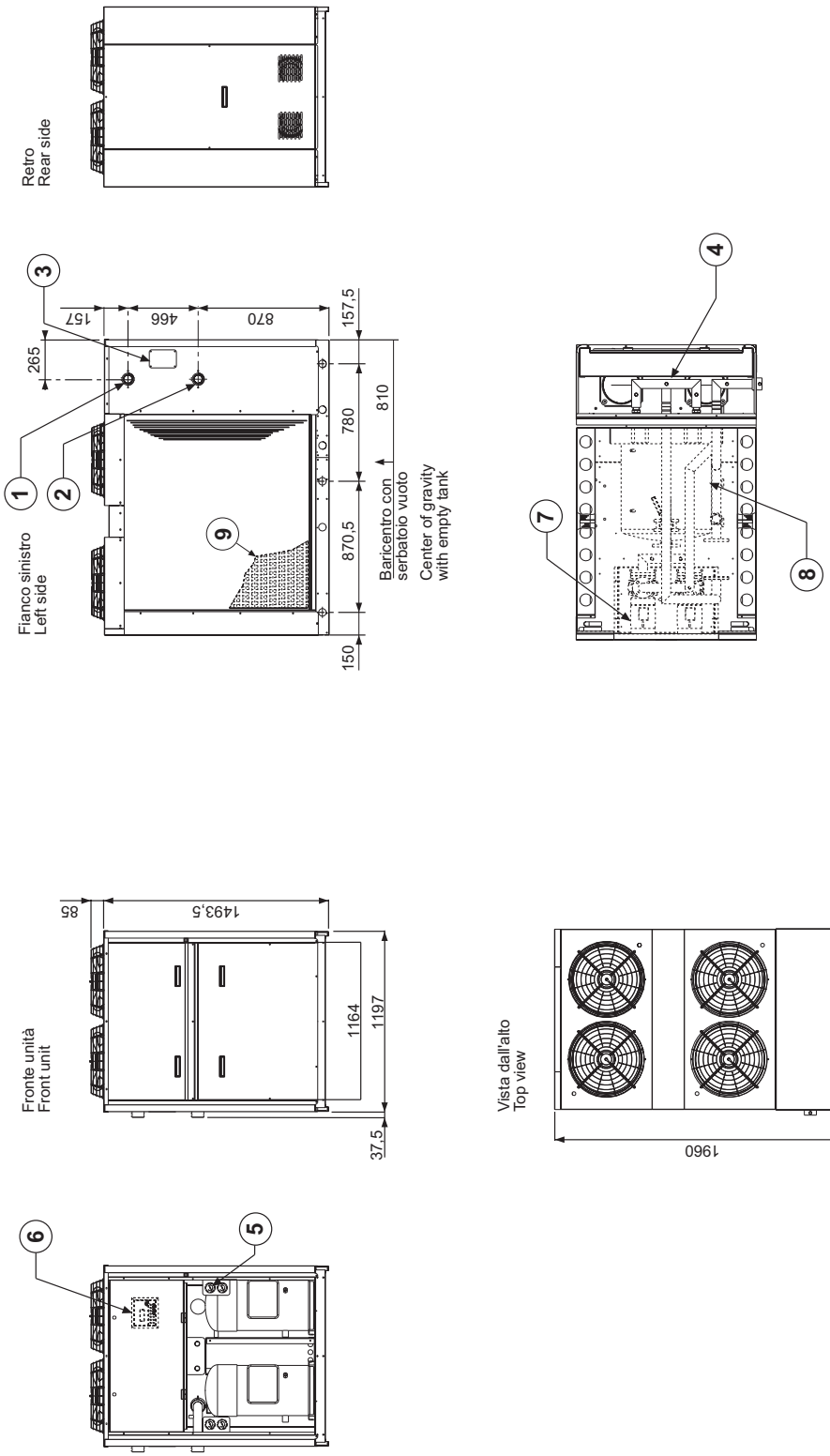
FAULT	Possible causes	Corrective actions
The unit does not start	No power supply	Check that power is being supplied both to the primary and auxiliary circuits.
	The electronic card is cut off from the power supply	Check the fuses
	Alarms have been triggered	Check whether any alarms are signalled on the microprocessor control panel, eliminate the causes and restart the unit.
	The phase sequence is wrong	Invert two phases in the primary power line after disconnecting them upstream from the unit
The compressor is noisy	The compressor is rotating in the wrong direction	Check the phase sequence relay. Invert the phases on the terminal board after disconnecting the unit and contact the manufacturer.
Presence of abnormally high pressure	Insufficient flow of air to the condenser	Check whether all the fans are turning properly
		Check the air T at the condenser inlet and make sure no back suction occurs
		Check whether the effective RMS voltage to the fans is the maximum. If necessary, check the pressure transducers controlling the revolution regulator, where present [optional]
		Check the cleanliness of the finned coils
	Presence of air in the refrigerant circuit, as revealed by the presence of bubbles in the flow indicator also with undercooling values exceeding 5 °C	Drain and pressurise the circuit and check for leaks. Generate a slow vacuum [longer than 3 hours] until reaching a pressure of 15 Pa and then recharge in the liquid phase
	Unit overcharged, as revealed by an undercooling of more than 8 °C	Drain the circuit
	Thermostatic valve and/or filter obstructed. These symptoms may also occur in the presence of an abnormally low pressure.	Check the temperatures upstream and downstream from the valve and filter and replace them if necessary.
	Insufficient flow of water in the case of heat pump operation	Check the water circuit for pressure drops and/or whether the pump is working properly [direction of rotation]. Check the outgoing water T and make sure it less than or equal to 45°C

FAULT	Possible causes	Corrective actions
Low condensation pressure	Transducer fault	Check the transducers and the efficiency of the needle pusher on the schrader valves they are connected to
	Outdoor T too low and/or presence of strong winds	Install the condensation control device and/or protect the unit from prevalent winds
	Low water T, in the case of heat pump operation	Check whether the thermal load is compatible with the unit's potential.
Low evaporation pressure	Insufficient flow of water	Check whether the pumps are rotating in the right direction. Check the water system for pressure drops. Check the efficiency of the pump system check valve (optional)
	Malfunctioning of thermostatic valve	Warming the bulb with your hand, check whether the valve opens and adjust it if necessary. If it does not respond, replace it.
	Filter clogged	Pressure drops upstream and downstream from the filter should not exceed 2°C. If they do, replace the filter.
	Low condensation T	Check the efficiency of the condensation control device [where present]
	Low level of refrigerant	Check the refrigerant level by measuring the degree of undercooling; if it is below 2°C replenish the charge
	Coil covered with frost, in the case of heat pump operation	Check whether the defrost parameters have been properly set. Check the efficiency of the 4-way valve.
	Low outdoor T, if the unit is operating with the heat pump on	Check compliance with the operating limits and eliminate any bypasses and back flow of air.
The compressor does not start	The internal thermal protection device has tripped	In the case of compressors equipped with a protection module, check the thermal contact. Identify the causes after restarting.
	The circuit breakers or line fuses have been tripped by a short circuit	Pinpoint the cause by measuring the resistance of the individual windings and the insulation from the casing before restoring power.
	One of the high or low pressure switches has tripped	Check on the microprocessor, eliminate the causes.
	The phases have been inverted in the distribution compartment	Check the phase sequence relay.

FAULT	Possible causes	Corrective actions
High evaporation pressure	Water T too high	Check the thermal load and/or efficiency of the thermostat function.
		Check the efficiency of the thermostatic valve
Defrosting absent or incomplete	Error in parameter settings	Check the setting of the start and end defrost parameters on the microprocessor
		Check whether defrosting water is properly drained from the coils
		Check the uniformity of the refrigerant circuit outlet temperatures at the top and bottom of the coils: the maximum thermal differential allowed is 10 °C. Check the refrigerant level
	The 4-way valve has failed to work	Check whether it is regularly energized and deenergized.

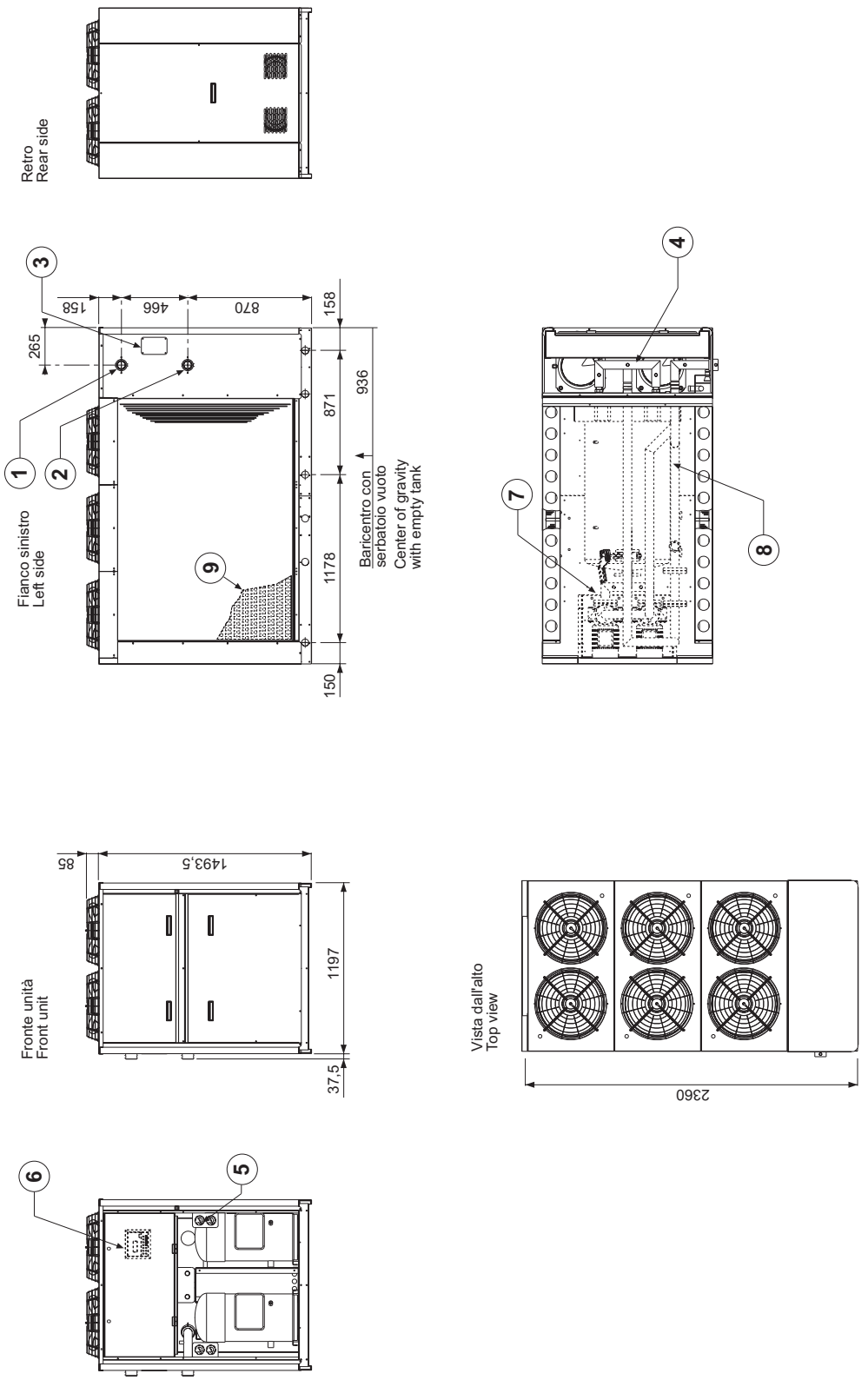
13 DRAWINGS SHOWING OVERALL DIMENSIONS

LCA 045 - 050



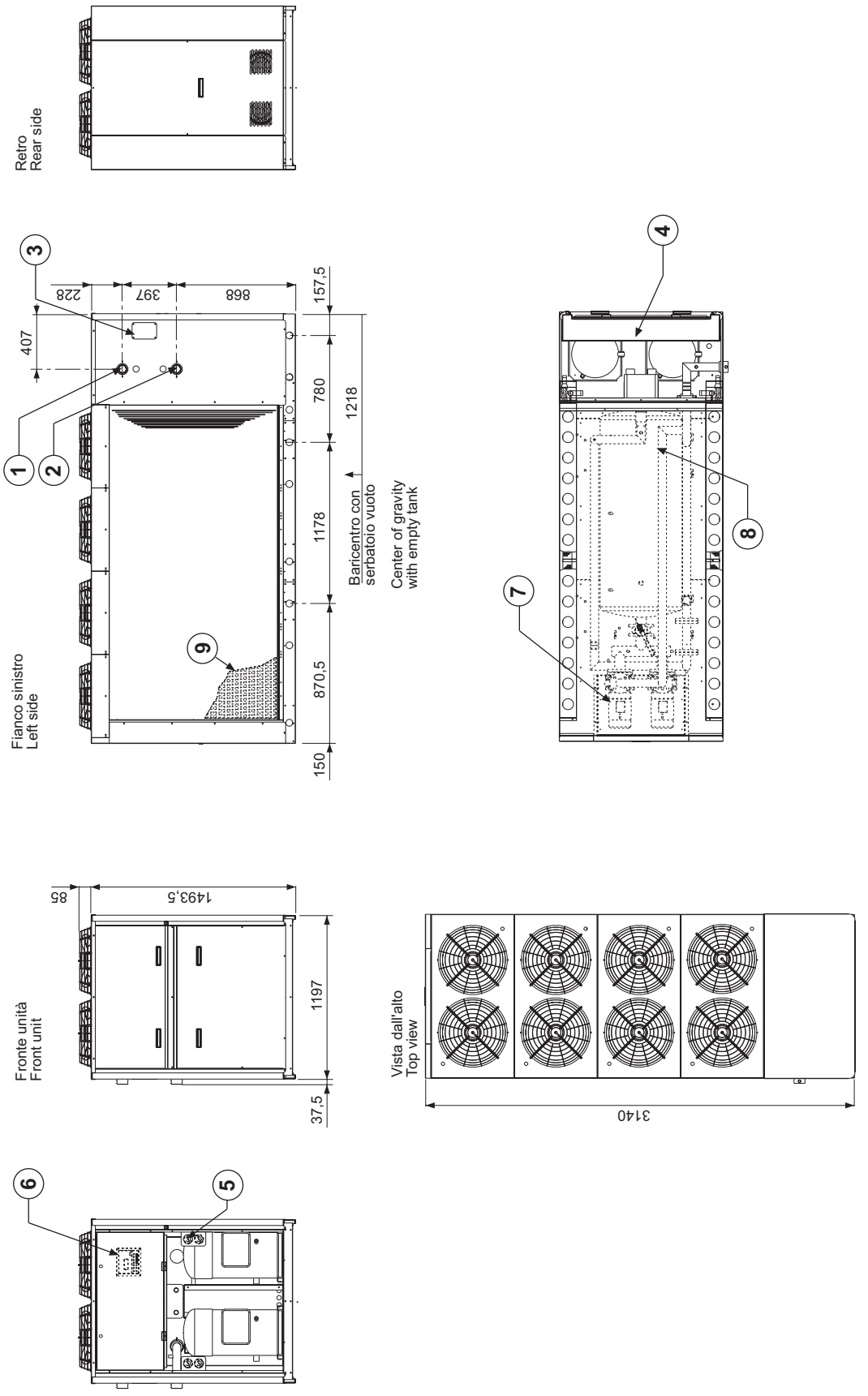
1 Water inlet (2" gas)
2 Water outlet (2" gas)
3 Power supply input
4 Electric control board
5 Refrigerant pressure gauges (optional)
6 Advanced control microprocessor (optional)
7 pump system (optional)
8 Inertial storage reservoir (optional)
9 Condenser protection grilles (optional)

LCA 060 – 070 - 080



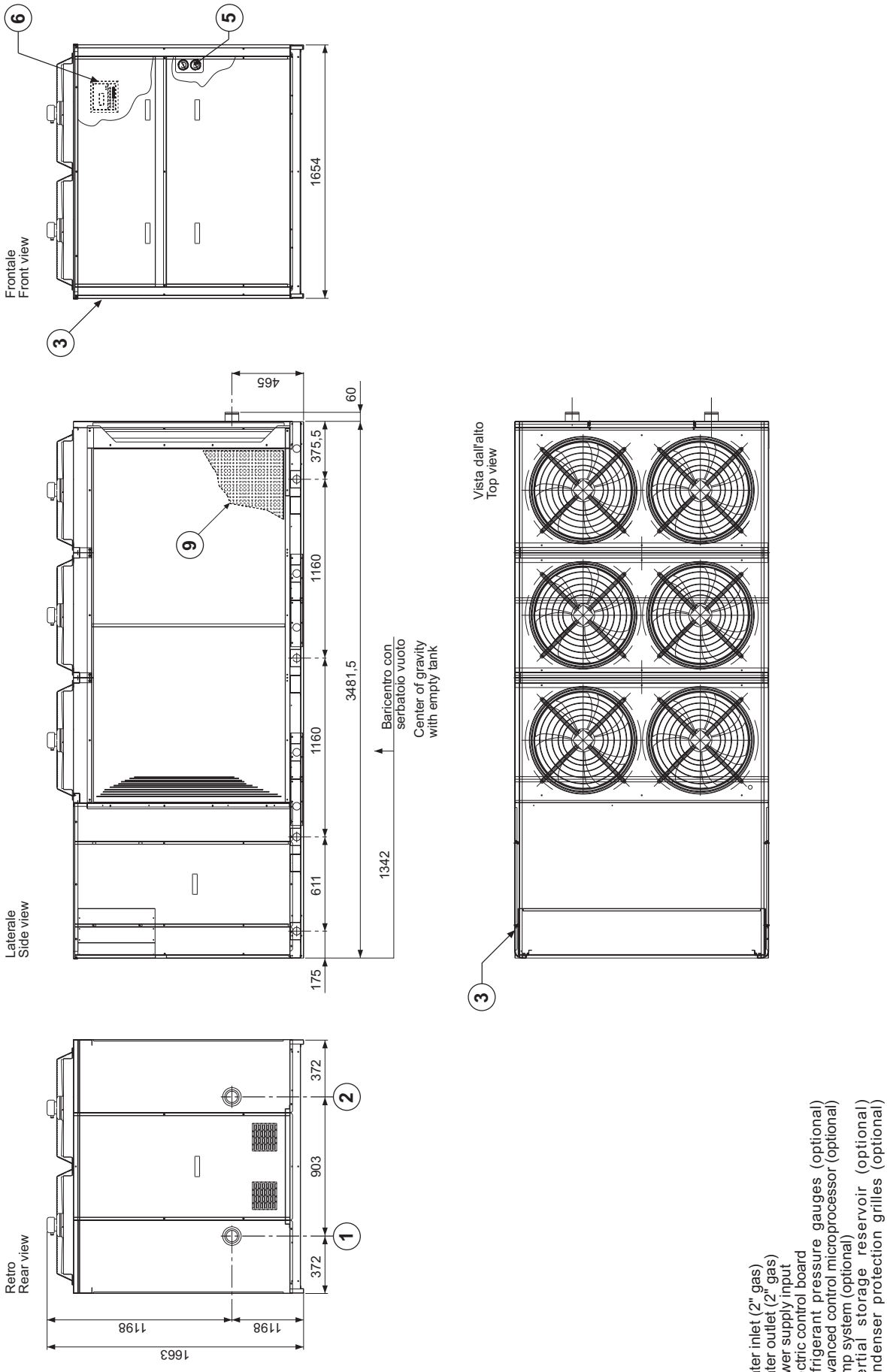
1 Water inlet (2" gas)
2 Water outlet (2" gas)
3 Power supply input
4 Electric control board
5 Refrigerant pressure gauges (optional)
6 Advanced control microprocessor (optional)
7 pump system (optional)
8 Inertial storage reservoir (optional)
9 Condenser protection grilles (optional)

LCA 090 - 105



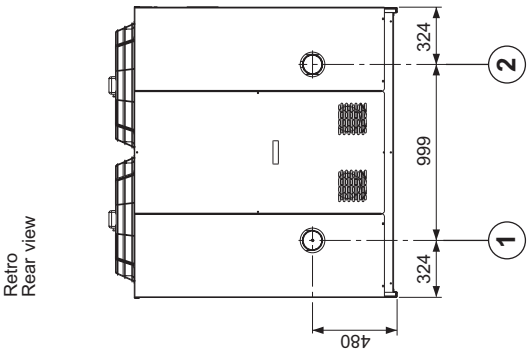
1 Water inlet (2" gas)
2 Water outlet (2" gas)
3 Power supply input
4 Electric control board
5 Refrigerant pressure gauges (optional)
6 Advanced control microprocessor (optional)
7 pump system (optional)
8 Inertial storage reservoir (optional)
9 Condenser protection grilles (optional)

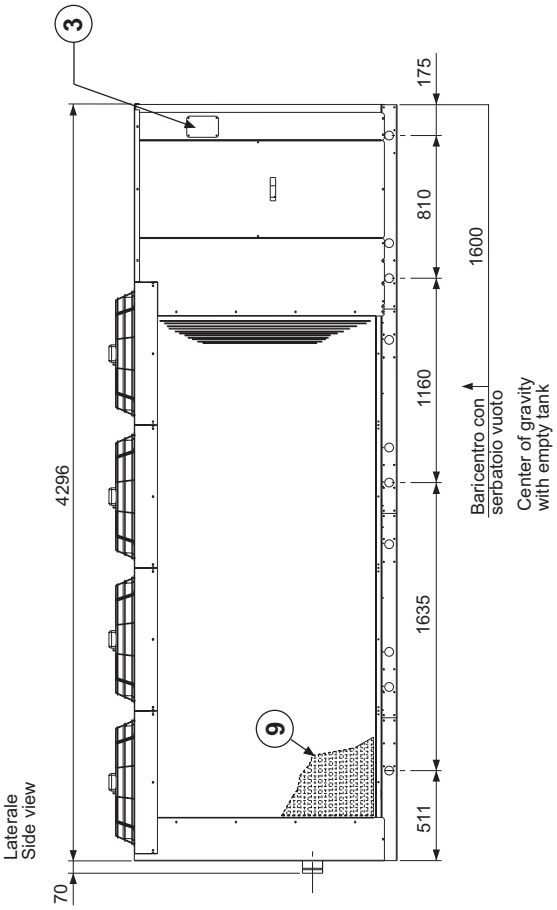
LCA 115 - 130 - 150 - 180

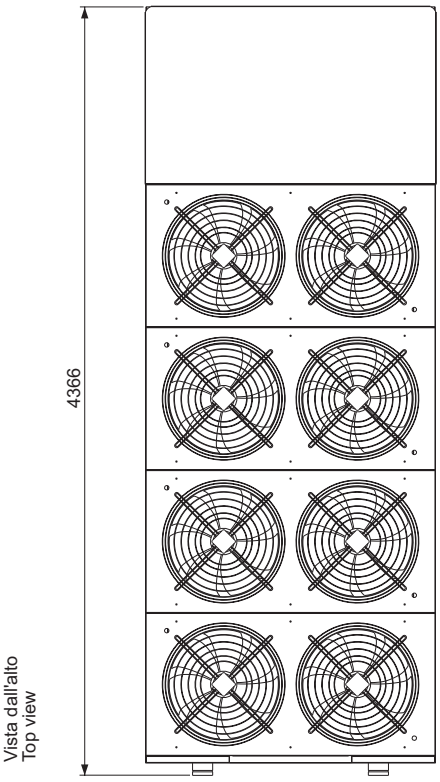


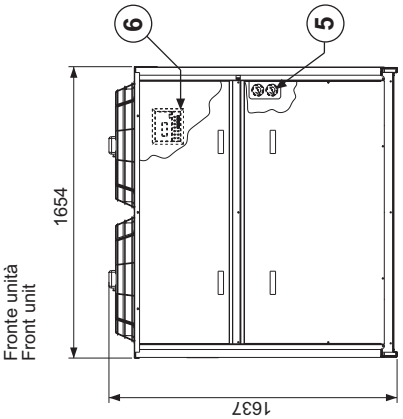
1 Water inlet (2" gas)
2 Water outlet (2" gas)
3 Power supply input
4 Electric control board
5 Refrigerant pressure gauges (optional)
6 Advanced control microprocessor (optional)
7 pump system (optional)
8 Inertial storage reservoir (optional)
9 Condenser protection grilles (optional)

LCA 205 – 220 – 235 LCA 180 CL







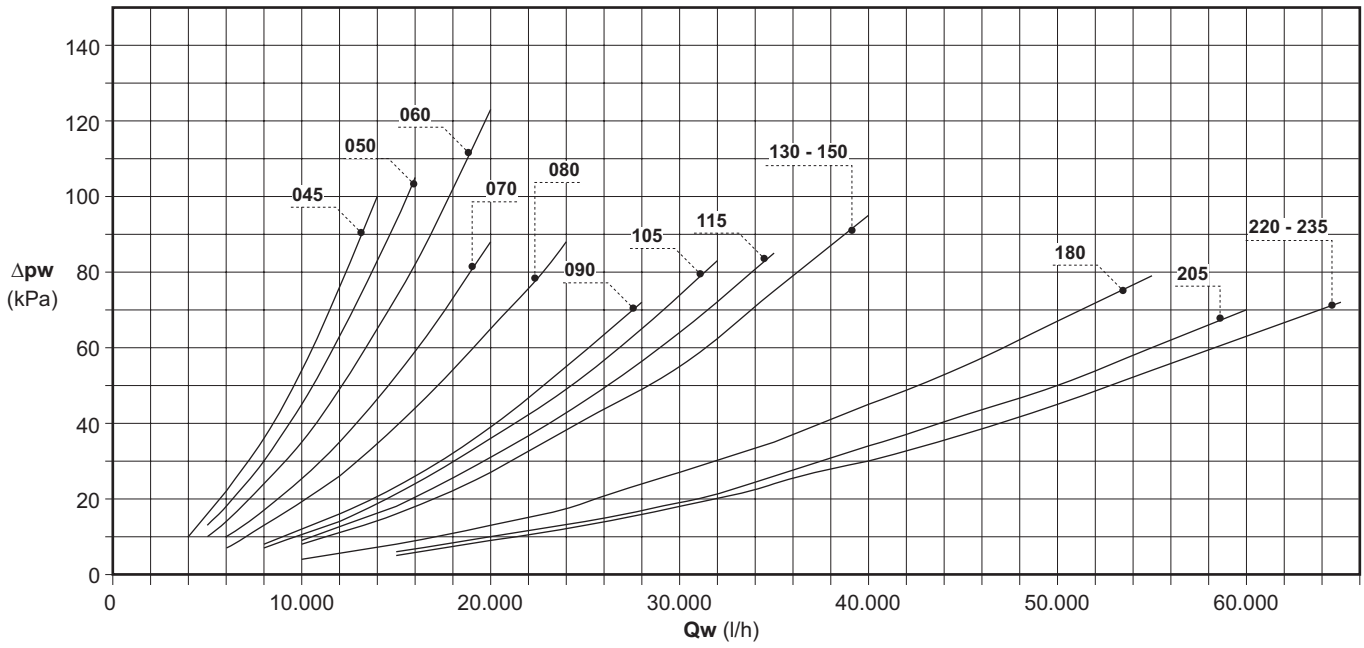


1 Water inlet (2" gas)
2 Water outlet (2" gas)
3 Power supply input
4 Electric control board
5 Refrigerant pressure gauges (optional)
6 Advanced control microprocessor (optional)
7 pump system (optional)
8 Inertial storage reservoir (optional)
9 Condenser protection grilles (optional)

14 – WATER PRESSURE DROPS

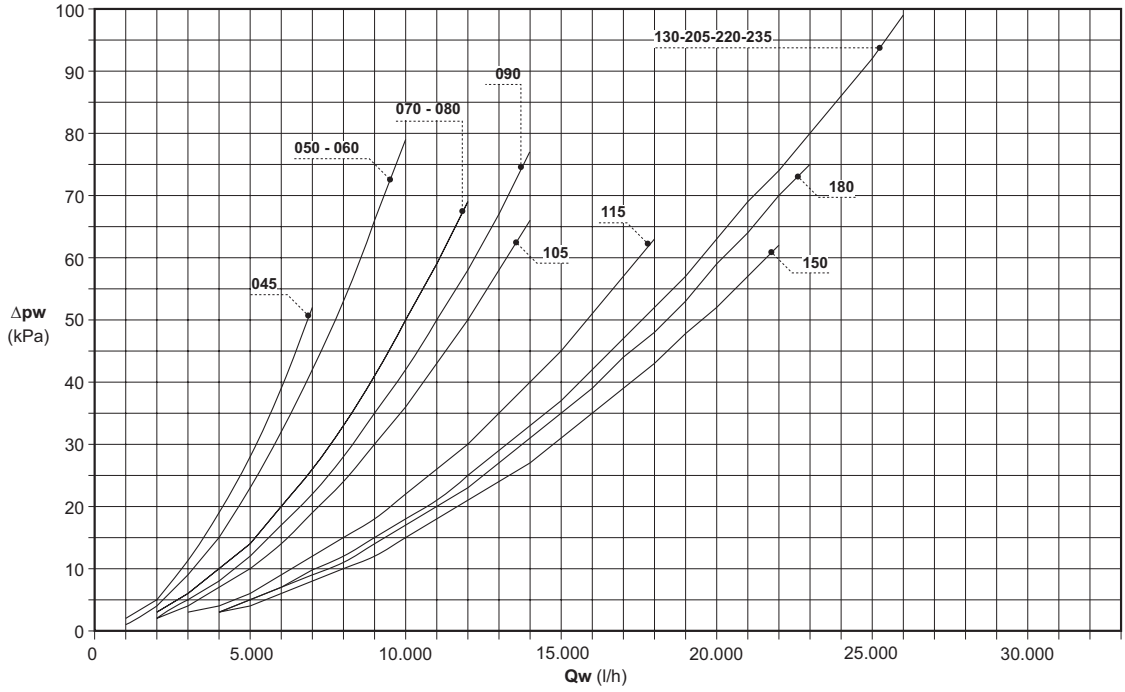
14.1 EVAPORATOR PRESSURE DROPS

The diagram shows the pressure drops on the water side (Dpw) as a function of the water flow rate (Qw), assuming an average water temperature of 10°C



14.2 RECUPERATOR PRESSURE DROPS

The diagram shows the pressure drops on the water side (Dpw) as a function of the water flow rate (Qw), assuming an average water temperature of 42.5°C



14.3 WATER PUMPING AND STORAGE SYSTEMS

LCA units may be equipped with 4 types of pumping systems, complete with expansion tank, and inertial storage reservoirs:
- single standard pump
- single uprated pump
- standard pump and back-up pump
- uprated pump and back-up pump.

In the case of pump systems including a back-up pump, the microprocessor controls the pumps in such a way as to equally divide the hours of operation, changing over the pumps in the event of a fault.

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LCA		**045**	**050**	**060**	**070**	**080**	**090**
Standard pump type		A	A	B	B	B	C
Available head, LCA with standard pump (nominal flow rate)	kPa	79	74	123	117	116	159
Rated electrical output, standard pump	kW	0,55	0,55	0,75	0,75	0,75	1,50
Operating current, standard pump	A	1,7	1,7	2,3	2,3	2,3	4,3
Uprated pump type	kW	C	C	D	D	D	E
Available head, LCA with uprated pump (nominal flow rate)	kPa	183	178	138	224	221	229
Rated electrical output, uprated pump	kW	1,50	1,50	2,20	2,20	2,20	3,00
Operating current, uprated pump	A	4,3	4,3	5,3	5,3	5,3	6,6
Inertial storage reservoir capacity	dm^3	218	218	315	315	315	485
Expansion tank	dm^3	8	8	8	8	8	12
LCA		**115**	**130**	**150**	**180**	**205**	**220**
Standard pump type		C	C	D	D	E	E
Available head, LCA with standard pump (nominal flow rate)	kPa	131	126	143	138	146	139
Rated electrical output, standard pump	kW	1,50	1,50	2,20	2,20	3,00	3,00
Operating current, standard pump	A	4,3	4,3	5,3	5,3	6,6	6,6
Uprated pump type (see diagram)	kW	F	F	F	G	G	G
Available head, LCA with uprated pump (nominal flow rate)	kPa	264	258	238	279	281	278
Rated electrical output, uprated pump	kW	4,00	4,00	4,00	7,50	7,50	7,50
Operating current, uprated pump	A	9,6	9,6	9,6	16,0	16,0	16,0
Inertial storage reservoir capacity	dm^3	600	600	600	600	850	850
Expansion tank	dm^3	20	20	20	20	20	20

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