Installation, Operation and Maintenance Manual

IOM

Group: Chiller
Part number: CLIV IOM
Date: 29 May 2023

CLIV Series
Air-Cooled Scroll Compressor Chilled Water Chiller Unit

Model

3,5 and 10 RT

Refrigerant HFC-410A

50/60 Hz

Manufactured in an ISO 9001 certified facility

Pre-Start-Up Checklist - Scroll Compressor Chillers

Must be completed, signed and submitted to Comfort Flex at least 2 weeks prior to the requested start date.

Job name	
Place of installation	
Customer order number	
Model number(s)	
G.O. Number(s)	

Chilled water and condensing water for water-cooled chillers	Si	No	N/A	Iniciales
Complete piping				
Water strainer(s) installed in piping according to manual requirements				
Water system: flushing, filling and draining; water treatment in place				
Pumps installed and operational (rotation check, filter cleaning)				
Controls in operation (3-way valves, front/bypass gates, bypass valves, etc.)				
Water system operated and tested; flow meets unit design requirements (Not all units include it)				
Flow switch(es) -installed, wired and calibrated				
Ventilation installed on evaporator				
Electrical	**Si**	**No**	**N/A**	**Iniciales**
Building controls in operation				
* Power cables connected to power block or optional disconnect switch				
Power cables have been checked for proper phasing and voltage				
All interlock scripts are complete and meet unit specifications				
Power is applied at least 12 hours prior to start-up				
Oil heaters energized at least 12 hours prior to startup				
Cooler components (EXV sensor transducers) installed and wired properly				
*Wiring complies with National Electrical Code and local codes (See Notes)				
Various	**Si**	**No**	**N/A**	**Iniciales**
Unit control disconnects everything				
Factory check of remote evaporator/condenser lines				
Leak, evacuation and charge check of all refrigeration piping/components				
Thermometers, wells, gauges, control, etc., installed				
Minimum system load of 80% of available capacity to test/adjust controls				
Attachment: Technical breakdown of selection software				
Attachment: Acknowledgment of Receipt of Final Order				
Attachment: Remote Piping Approval				

Notes: The most common problems that delay start-up and affect the reliability of the unit are:
1. Compressor motor power cables installed in the field are too small. Questions: Contact your local Comfort Flex sales representative*. Indicate the size, number and type of conductors and conduits installed:
a. From power supply to chiller ____
*** Refer to NFPA 70-2017, Article 440.35**
2. Remote evaporator piping is incomplete or incorrect. Provide approved piping diagrams.
3. Items on this list have been incorrectly recognized, resulting in delayed start-up and possible additional expense for round trips.

Contractors' representative

Signature
Name ______________________
Company ______________________
Date ______________________
Phone / Mail ______________________

Comfort Flex Sales Representative

Signature
Name ______________________
Company ______________________
Date ______________________
Phone / Mail ______________________

This manual contains safety instructions that must be followed during installation and maintenance of the unit. Read this manual before installing or operating this unit.

NOTE: Installation and maintenance should be performed only by qualified personnel who are familiar with local codes and regulations and who have experience with this type of equipment.

⚠ DANGER ⚠
LOCK OUT/LABEL all power sources before starting, pressurizing, depressurizing or shutting down the chiller. Disconnect electrical power before servicing equipment. More than one disconnection may be required to deenergize the unit. Failure to follow this warning to the letter can result in serious injury or death. Be sure to read and understand the installation, operating and service instructions in this manual.
⚠ WARNING ⚠
Electric shock danger. Improper handling of this equipment can cause personal injury or equipment damage. This equipment must be properly grounded. Control panel connections and maintenance should be performed only by personnel knowledgeable in the operation of the equipment being controlled. Disconnect electrical power before servicing equipment. Be sure to install a earth leakage breaker. Failure to install a earth leakage breaker may result in electric shock or fire.
⚠ CAUTION ⚠
Static sensitive components. Static discharge during handling of the electronic circuit board can cause damage to components. Use a static strap before performing any service work. Never unplug any cables, circuit board terminal blocks, or power plugs while power is applied to the panel.
⚠ CAUTION ⚠
When moving refrigerant to/from the cooler using an auxiliary tank, a grounding strap should be used. An electrical charge builds up when halo-carbon refrigerant travels in a rubber hose. A grounding strap should be used between the auxiliary refrigerant tank and the cooler end sheet (ground to ground), which will safely carry the charge to ground. Failure to follow this procedure may result in damage to sensitive electronic components.
⚠ WARNING ⚠
If refrigerant leaks from the unit, there is a potential choking danger as the refrigerant will displace air in the immediate area. Be sure to follow all applicable published industry-related standards and local, state, and federal statutes, regulations, and codes if refrigerant is produced. Avoid exposing refrigerant to an open flame or other ignition source.
⚠ WARNING ⚠
Polyolester oil, commonly referred to as POE oil, is a synthetic oil used in many refrigeration systems and may be present in this Comfort Flex product. POE oil, if it ever comes in contact with PCV/CPVC, will coat the inside wall of the PVC/CPVC pipe and cause environmental stress fractures. Although there is no PCV/CPCV pipe in this product, keep this in mind when selecting piping materials for your application, as system failure and property damage could occur. Consult the pipe manufacturer's recommendations to determine appropriate pipe applications.

DANGER IDENTIFICATION INFORMATION

⚠ DANGER ⚠
Danger indicates a dangerous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING ⚠
Warning indicates a potentially dangerous situation which may result in property damage, personal injury or death if not avoided
⚠ CAUTION ⚠
Caution indicates a potentially dangerous situation which may result in minor injury or equipment damage if not avoided.

Notes: Indicate important details or clarifying statements for the information presented.

General Description

Comfort Flex's CLIV series air-cooled chilled water generators are complete, self-contained, automatic chillers designed for outdoor installation. The package units are fully assembled, factory wired, charged and tested.

The electrical control center includes all operating controls and equipment protection necessary for reliable automatic operation. Components housed in a weatherproof control panel.

NOMENCLATURE

CLIV-36-HD-C-1-A-N-D-F-M-M-N-N-1-1-S-N-D-N-4-P-0

FAMILY

CAPACITY (BTU)
036 - 36,000
060 - 60,000
120 - 120,000

AIR DISCHARGE
HD - Horizontal Discharge

OPERATION
C - Cooling Only
H - Heat Pump

UNITS
1 - Stand alone

CONDENSER FAN
A - Axial Fixed

ANTICORROSION
C - Coat in Condenser
I - Coat in Components
M - Total - Coating
N - None

VOLTAGE
C - 208-230 / 3 / 60
V - 208-230 / 1 / 60
D - 460 / 3 / 60

COMPRESSOR
F - Fixed
S - Two Stages

CONDENSER
M - Microchannel

PROTOCOL
M - Modbus
B - BACnet IP

HEAT RECOVERY
N - N/A

FREE COOLING
N - No

GRILLS
1 - Painted Grill

PIPE
1 - 1¼" NPT

ELECTRICAL CONNECTION
S - Single Point

HIDRAULIC CONNECTION
N - Not included

PACKAGING
D - Domestic
I - Internacional

SINGLE SKID
N - N/A

REFRIGERANT
4 - R410-A

CONTROL
P - Parametric
(Only standalone)
C - pCO / pGD

EXTRA
0 - TBD

Table 1. Limites De Funcionamiento Y Espera

Maximum standby ambient temperature	130°F (54°C)
Maximum operating ambient temperature	105°F (41°C)
Minimum operating ambient temperature (standard control)	32°F(0°)
Outgoing chilled water temperature	40°F A 65°F (4°C to 18°C)
Outgoing chilled fluid temperatures (with antifreeze) - Note that in cases of high ambient temperature, the lowest outgoing water temperature settings may be outside the chiller operating envelope.	15°F A 65°F (-9°C to 18°C)
Maximum evaporator inlet fluid temperature	81°F (27°C)
Maximum non-operating evaporator inlet fluid temperature	100°F (38°C)

NAMEPLATES

The unit nameplate is located on the outside of the unit power panel. Both the model number and serial number are located on the unit nameplates; the serial number is unique to the unit.

These numbers should be used to identify the unit in case of service, parts or warranty questions. This nameplate also contains the unit's refrigerant charge and electrical ratings. The evaporator nameplate is under the insulation and contains the serial number. The compressor nameplate is located on each compressor and provides pertinent electrical information.

⚠ WARNING ⚠

Installation should be performed by qualified personnel who are familiar with local codes and regulations.

INSPECTION

The equipment must be checked once it has arrived at its installation site for any damage. All components described in the delivery note must be inspected and checked. In case there is evidence of damage, do not remove or repair the damaged components and immediately report the severity and type of damage to the shipping company and your sales representative if possible send photographs that may help explain/detail the damage.

Any damage detected during transport must be reported and documented to the manufacturer prior to repair. Before installing the equipment, check that the model and voltage shown on the nameplate are correct. The manufacturer will not be responsible for any damage once the equipment has been accepted.

The correct space dedicated for the maintenance of the equipment will allow a better installation and maintenance, facilitating the access to the service points to the technical personnel. Refer to the schematics presented for unit dimensions. At least one (1) meter is required to service the compressor, allow sufficient space for opening control panel doors. Refer to Figure 2 for minimum clearances. In all cases, these precedents are noted for any need to comply with local regulations.

HANDLING

When transporting the unit, the use of a forklift or crane is recommended. All units are provided with lifting points. Only these points should be used for lifting the unit as shown in Fig. 1.

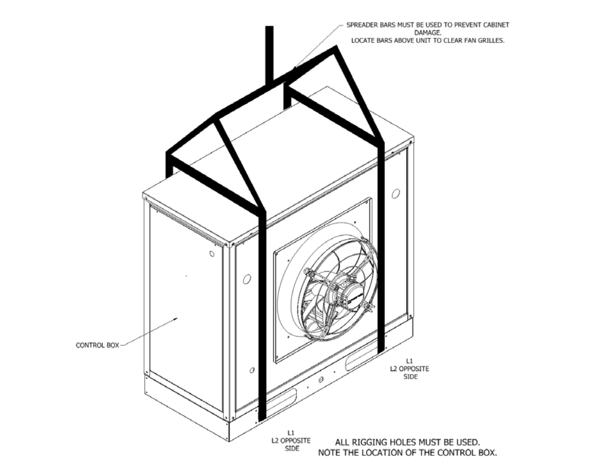
⚠ CAUTION ⚠

All lifting locations must be used to avoid damage to the unit.

⚠ DANGER ⚠

Improper rigging, lifting or moving of a unit can result in property damage, serious personal injury or death. Follow the rigging and moving instructions carefully. Do not stand under the unit while it is being lifted or installed.

Figure 1. Required elevation arrangement.



PLACEMENT OF THE UNIT

The equipment must be installed in accordance with national and local safety standards. If no local standards are applicable, installation must be in accordance with national standards.

AIR operating equipment is designed to be installed OUTDOOR. It is necessary for the equipment to have adequate ventilation, as well as a free air inlet to allow proper air circulation, and to provide access and space for equipment maintenance (see Figure 2).

For an optimal operation of the equipment, a correct connection to the hydraulic network and the minimum water flow per minute specified in the technical information sheet of the equipment is required. As well as a correct connection to the electrical power according to the electrical values of the technical information sheet of the system.

MOUNTING

Anti-vibration mounts must be installed between the frame of the unit and the concrete base of the steel beams; for such installation, use the dimensioning diagram attached in this installation manual.

The unit frame must be perfectly level during installation, if necessary insert shims under the anti-vibration mounts.

To ensure the optimum performance of the unit once installed, some instructions and precautions should be followed, such as:

- Ensure a strong and solid base to reduce noise and vibration.
- Avoid installing the equipment in areas that may be hazardous during equipment maintenance, such as platforms without guardrails, guide rails, or areas that do not meet the space requirements around the unit.
- The installer is responsible for calculating the best position for the unit. It is vitally important that the suggested clearances are respected in order to provide adequate ventilation for the condenser louvers.
- Avoid recirculation of hot air.
- Avoid lack of air supply to the air-cooled condenser. Failure to comply with these conditions can result in increased condenser pressure which in turn can lead to poor energy efficiency and cooling capacity.

The noise generated by the unit is mainly due to the rotation of fans and compressors. If the unit is properly installed, operated and regularly maintained, the noise levels do not require any special protective devices to work continuously and safely near the equipment. In case of an installation with special noise requirements, it may be necessary to install additional noise reduction devices.

CLEARANCE SERVICE

The control panels are located at the end of the chiller and require a minimum clearance of 1.2 meters in front of the panels. The compressor, filter-driers and line shutoff valves are accessible on each side or end of the unit. Do not block access to the sides or ends of the unit with piping or ductwork.

These areas must be open for service access. The minimum service distance is as follows:

A. <u>**Sides**</u>

- 4 fan models: Minimum of 1.2 m (4 ft.)
- 6 to 14 fan models: It is strongly recommended that a minimum of 8 ft (2.4 m) be left on one side to allow for coil replacement. Coils may be removed from the top, leaving a minimum of 4 ft (1.2 m) side clearance; however, unit performance may be diminished.

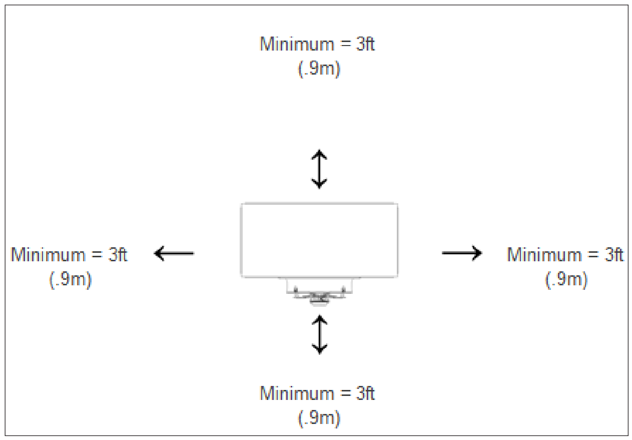
B. <u>**Control panel end**</u>

- All models: Minimum of 4 feet (1.2 meters).

C. <u>**Opposite end of control panel**</u>

- 4-fan models: Minimum 8 feet (2.4 m) to remove coil.
- 6- to 14-fan models: 8 ft (2.4 m) minimum. Clearance may be reduced to 4 ft (1.2 m) if side clearance is sufficient for evaporator service and removal.

Figure 2. Clearance service



OPERATING SPACE REQUIREMENTS

Sufficient distance must be maintained between the unit and adjacent walls or other units to allow the required airflow from the unit to reach the coils. Failure to do so will reduce capacity and increase energy consumption.

The clearance requirements shown are a general guide and cannot take into account all scenarios. Factors such as prevailing winds, additional equipment within the space, outside air temperature and many other factors may require more clearance than shown.

Additional clearances may be required under certain circumstances.

The graphs on the following pages indicate the minimum clearance for different types of installations and also the reduction in capacity and increase in power if a smaller space is used. The graphs are based on individual cases and should not be combined with other scenarios.

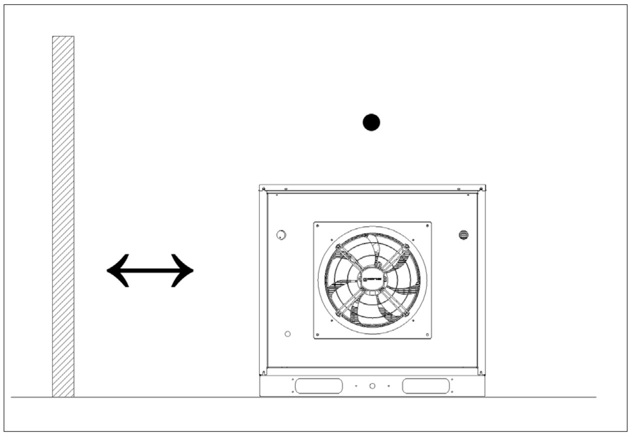
⚠ CAUTION ⚠

The performance of the unit may be affected if the operating clearance is not sufficient.

Case 1. Building or wall on one side of the unit.

NOTES: Assumes a solid height wall higher than the unit. Refer to case 4 for partial wall openings.

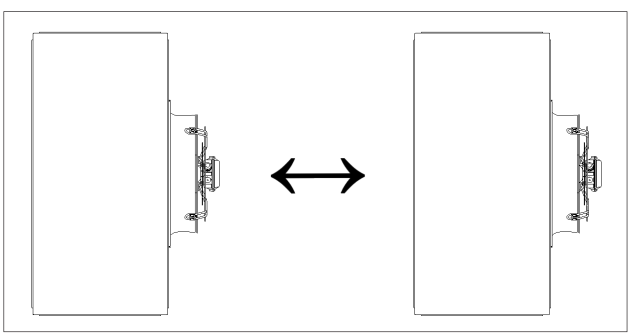
Figure 3. Building or wall on one side of the unit.



Case 2. Two units side by side.

For models 3-10 , there must be a minimum of 4 feet between two units placed side by side; however, performance may be affected at this distance. Assuming the requirement that one side have at least 8 feet of service clearance is met, the figures in Case 2 show the performance adjustments as the distance between two units increases.

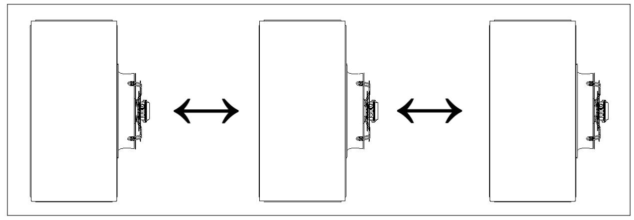
Figure 4. Two units side by side.



Case 3. Three or more units, side by side.

For all models, there must be a minimum distance between units placed side by side; however, performance may be affected at this distance.

Figure 5. Three or more units, side by side.



Case 4. Open protection walls.

Decorative walls are often used to help conceal a unit, either on the ground or on the roof. Whenever possible, design these walls so that the combination of their open area and distance to the unit does not require a performance adjustment.

If the percentage of wall openness is less than recommended for the distance to the unit, it should be considered a solid wall. The wall height is assumed to be equal to or less than the height of the unit when mounted on its base bracket.

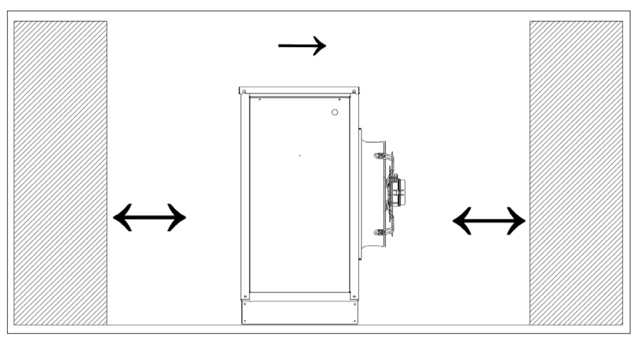
If the wall height is greater than the unit height, refer to Case 5: Pit Installation for performance adjustment factors. The distance from the sides of the unit to the side walls must be sufficient for service, such as opening the control panel doors.

In the case of uneven wall separation, the distance from the unit to each wall can be averaged as long as no distance is less than 4 feet. Values are based on walls on all four sides.

Case 5. Installation of the pit.

Pit installations can cause operating problems due to recirculation and air restriction and require that sufficient air separation be provided, safety requirements be met, and service access be provided.

A solid wall surrounding a unit is substantially a pit and this datum should be used. Sometimes a steel grating is used to cover a pit to prevent accidental falls or trips into the pit.



The grille material and installation design should be strong enough to prevent such accidents, but should provide plenty of open area to avoid recirculation problems.

Have the Comfort Flex sales representative review the installation of any pit prior to installation to ensure that it has sufficient airflow characteristics and is approved by the facility design engineer to avoid the risk of an accident.

⚠ CAUTION ⚠

To prevent damage to the evaporator and possible failure of the chiller, a supply filter is required in the inlet water piping that connects to this evaporator. This filter must be installed prior to operation of the chilled liquid pumps.

COLD WATER PIPES

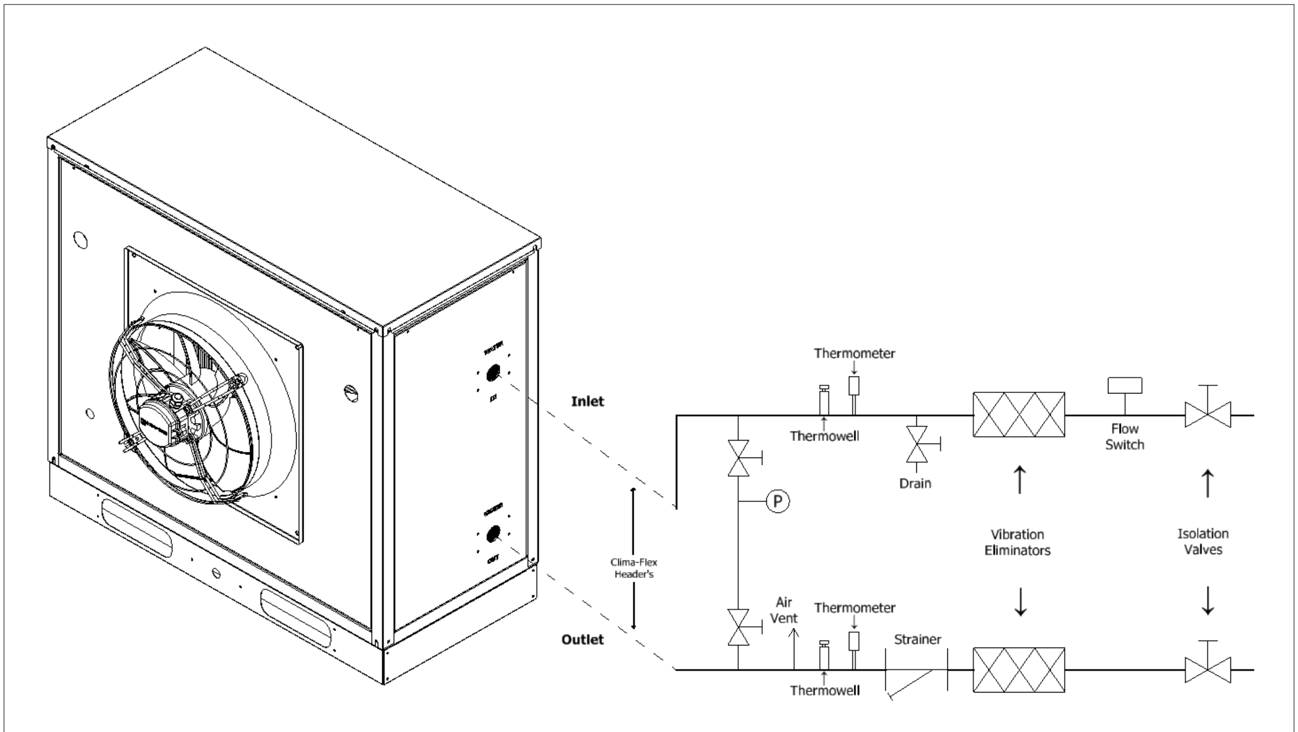
Field-installed water piping for the chiller should include:

- A cleanable filter installed at the water inlet to the evaporator to remove debris and impurities before they reach the evaporator. Install the cleanable filter within 1,500 mm tubing length from the evaporator inlet connection and downstream of any solder connections (no solder connections between the filter and evaporator).
- A water flow switch should be installed in the horizontal piping of the supply water line (evaporator outlet) to prevent evaporator freezing under low or no flow conditions. The flow switch can be ordered as a factory installed option, as a field installed kit, or can be supplied and installed in the field. See page 10 for more information.
- Piping for units with brazed plate evaporators must have a drain and vent connection at the bottom of the bottom connection piping and at the top of the top connection piping, respectively, see Figure 6.
- These evaporators do not have drain or vent connections due to their construction. Purge air from the water system prior to unit start-up to provide adequate flow through the evaporator.
- A suitable pipe support, separate from the unit, to eliminate weight and stress on fittings and connections.
- An expansion tank and regulating valve to maintain water pressure.
- Suitable mechanical connections. All evaporators have.
- OGS type grooved water connections (adhering to AWWA C606) optionally with flanges. PVC piping should not be used.

⚠ WARNING ⚠

Polyolester oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems and is present in this Comfort Flex product. POE oil, if it ever comes in contact with PVC/CPVC, will coat the inside wall of the PVC/CPVC pipe causing environmental stress fractures. Although there is no PVC/CPVC pipe in this product, keep this in mind when selecting piping materials for your application as system failure and property damage could occur. Consult the pipe manufacturer's recommendations to determine suitable pipe applications.

Figure 6. Tuberías típicas de un evaporador de placas soldadas, serie CLIV.



NOTE: Welded pipe connections between the strainer and evaporator are not allowed due to the possibility of slag entering the evaporator.

It is recommended that the field-installed water piping for the chiller include:

- Temperature sensors at evaporator inlet and outlet connections.
- Water pressure gauge connection taps and pressure gauges on evaporator inlet and outlet connections to measure water pressure drop.
- Shut-off valves to isolate the unit from piping during unit maintenance.
- Minimum bends and elevation changes to minimize pressure drop.
- Vibration eliminators on supply and return water lines to reduce transmissions to the building.
- Thorough flushing of system water piping prior to making connections to the unit evaporator.
- Insulation of piping, including a vapor barrier, helps prevent condensation and reduces heat loss.
- Periodic water analysis and chemical treatment of the evaporator loop water is recommended immediately after unit start-up.

INLET STRAINER GUIDELINES

An inlet water filter kit must be installed in the cold water piping upstream of the evaporator inlet. There are several ways available to meet this requirement:

1. Factory-installed option available - models 3 through 10.
2. A field installation kit shipped loose with the unit is available for all unit sizes and consists of:
3. Y-type area strainer with 304 stainless steel perforated basket, slotted pipe connections and strainer cover.
4. A field supplied strainer meeting the specifications and installation requirements of this manual.

TECHNICAL DATA OF THE STRAINER

- **Head and neck nut:** Brass
- **Filter element:** Polyamide body coated with nylon mesh
- **Filter cup:** Trogamid T 5000 (virtually impact resistant, pressure wave resistant, permanently transparent, stress resistant).
- **(Brass cup available on request).**
- **Working pressure:** PN 16
- **Test pressure:** 25 bar
- **Maximum water temperature:** 30° C
- **Mesh size:** 95-140 µm.
- **Available with and without Rp 1⁄8 pressure gauges.**

Table 2. Flow rates according to DVGW test

DN 20	Rp 3⁄4	5,0 m3/h
DN 35	Rp 1	7,9 m3/h
DN 32	Rp 1 1⁄4	12,0 m3/h
DN 40	Rp 1 1⁄2	11.9 m3/h
DN 50	Rp 2	14,9 m3/h

Δp = 0,2 bar:

WATER FLOW LIMITATIONS

Constant evaporator flow

Maximum flow rate and pressure drop are based on a 6°F temperature drop. Flow rates above the maximum values will result in unacceptable pressure drops and may cause excessive erosion, which could lead to failure.

The minimum flow rate and pressure drop are based on a full load evaporator temperature drop of 16°F. Evaporator flow rates below the minimum values can result in laminar flow leading to low pressure alarms, fouling and poor temperature control.

Variable evaporator flow

Reducing the evaporator flow rate in proportion to the load can reduce the energy consumption of the system. The rate of flow change should be a maximum of 10 percent of the flow per minute.

For example, if the maximum design flow rate is 200 gpm and is to be reduced to a flow rate of 140 gpm, the flow change is 60 gpm. Ten percent of 200 gpm equals a change of 20 gpm per minute, or a minimum of three minutes to go from the maximum flow to the desired flow.

If the flow rate falls below the minimum allowable, large reductions in heat transfer can occur. If the flow rate exceeds the maximum, excessive pressure drop and tube erosion can occur.

System water considerations

All chilled water systems need adequate time to recognize a load change, respond to the change and stabilize to avoid undesirable compressor short cycling or loss of temperature control.

In air conditioning systems, the potential for short cycling often occurs when the building load drops below the minimum capacity of the chiller plant or in tightly coupled systems with very small water volumes.

Some of the aspects that the designer should consider when studying water volume are the minimum cooling load, the minimum capacity of the refrigeration plant during the low load period and the desired cycle time for the compressors.

Assuming there are no sudden loads and the cooling plant has a reasonable drawdown, the rule of thumb of “water volume in gallons equals two to three times the chilled water flow rate in gpm” is often used. A storage tank may have to be added to the system to achieve the recommended volume.

The quality of water supplied by the owner/occupant/operator/user to a cooling system should minimize corrosion, scale buildup, erosion, and biological growth to achieve optimum efficiency of HVAC equipment without creating a DANGER for operating personnel or the environment.

Filters should be used to protect cooling systems from waterborne debris. Comfort Flex is not responsible for damage caused by waterborne debris or damage to chiller heat exchangers due to improper water treatment.

Water systems must be cleaned and flushed prior to chiller installation. Water testing and treatment should be verified during initial chiller installation/commissioning and should be maintained on an ongoing basis by water treatment professionals.

⚠ CAUTION ⚠

Improper use of detergents, chemicals and additives in the cooling system water can adversely affect the performance of the chiller and potentially result in repair costs not covered under warranty. Any decision to use these products is at the discretion of the owner/occupant/operator/user, and the owner/occupant/operator/user assumes full responsibility for any damage that may occur due to their use.

EVAPORATOR FREEZE PROTECTION

Evaporator freezing can be a problem in the application of air-cooled water chillers in sub-zero temperature areas. To protect against freezing, the evaporator comes with insulation and an electric heater.

Although the evaporator is equipped with freeze protection, it does not protect the water piping external to the unit or the evaporator itself if there is a power failure or the heater burns out, or if the chiller cannot control the chilled water pumps. Use one of the following recommendations for additional freeze protection:

1. If the unit will not operate during the winter, drain the evaporator and cold water lines and flush them with glycol.
2. Add a glycol solution to the chilled water system. Breakage protection should be approximately 10°F below the minimum design ambient temperature.
3. Insulate exposed piping.
4. Add thermostatically controlled heat by wrapping lines with heat tape.
5. When glycol is added to the water system for freeze protection, the refrigerant suction pressure will be lower, the cooling performance will be lower, and the water side pressure drop will be higher.

COLD WATER PUMP

It is important that the chilled water pumps are connected to and controlled by the chiller microprocessor. The controller will activate the pump whenever at least one chiller circuit is enabled for operation, whether there is a call for cooling or not.

This helps ensure proper start-up sequencing of the unit. The pump will also turn on when the water temperature is below the freeze set point for longer than the specified time to help prevent evaporator freeze-up. Connection points are shown in the field wiring diagram beginning on page 21+.

⚠ CAUTION ⚠

Adding glycol or draining the system is the recommended method of freeze protection. If the chiller does not have the ability to control the pumps and the water system is not drained or does not have adequate glycol at subfreezing temperatures, catastrophic evaporator failure can occur.

If the chiller is not allowed to control the pump, the following problems may occur:

1. if the chiller attempts to start without first starting the pump, the chiller will lock out with the no flow alarm and require a manual restart.
2. If the chiller evaporator water temperature drops below the “freezing set point”, the chiller will attempt to start the water pumps to prevent the evaporator from freezing.
3. If the chiller does not have the ability to start the pumps, the chiller will alarm for lack of water flow.
4. If the chiller does not have the ability to control the pumps and the water system must not be drained in sub-zero temperatures or contain glycol, the chiller may be subject to catastrophic evaporator failure due to freezing. The evaporator freeze-up rate is based on the evaporator heater and pump operation. The external brazed plate heater alone may not be able to adequately protect the evaporator from freezing without water circulation.

FLOW SWITCH

All chillers require a chilled water flow switch to verify that there is adequate water flow through the evaporator and to shut down the unit if necessary to prevent evaporator freeze-up under low or no flow conditions.

A factory-installed thermal dispersion flow switch will be installed on packaged models. On remote evaporator models, the flow switch can be supplied separately in the field, or optionally shipped loose for field installation.

Terminals for field mounting and wiring of the water flow switch are provided in the unit control center.

Wire from the Y and R terminals on the switch to the terminals on the unit control panel shown in the field wiring diagrams, page 21 through page 26. Mount the flow switch on the outlet water line to shut off the unit when water flow is interrupted. A flow switch is an equipment protection control and should never be used to cycle the unit.

Installation should be in accordance with the manufacturer’s instructions included with the switch. Flow switches should be calibrated to shut the unit off when operating below the minimum flow rate.

There is also a set of paddle switch contacts on the switch that can be used for an indicator light or alarm to indicate when a “no flow” condition exists. Protect any flow switches that are installed outdoors from freezing. It is not recommended that differential pressure switches be installed outdoors. They may freeze and not indicate a no-flow condition.

GLYCOL SOLUTIONS

The use of glycol can affect system performance depending on its concentration and should be taken into account during initial system design. When glycol is added to the chilled water system to protect against freezing, it should be noted that the refrigerant suction pressure will be lower, the cooling performance will be lower and the water side pressure drop will be higher. The reduction in performance depends on the glycol concentration and temperature. Test the coolant with a clean and accurate glycol refractometer to determine the freezing point.

⚠ CAUTION ⚠

The installed glycol level must match the nominal glycol percentage indicated on the submitted chiller technical data sheet. Failure to meet the nominal glycol percentage may result in damage to the unit and loss of unit warranty.

CONDENSER COIL OPTIONS AND COATING

Considerations

The standard CLIV Series chiller coils have an aluminum alloy microchannel design with a series of flat tubes containing multiple parallel flow microchannels placed between the coolant manifolds. The microchannel coils are designed to withstand the synthetic acidified seawater acidified (SWAAT) mist test of over 1000 hours (ASTM G85-02) at 120°F (49°C) with 0% loss and without developing leaks.

Epoxy coating: is an extremely flexible and durable water-based polymer coating that is uniformly applied to all coil surfaces by a multi-step electrostatic submerged coating process. Epoxy-coated coils offer ASTM B117-90 salt spray resistance of more than 10,000 hours, applied to both the coil and the coil heads. Epoxy-coated coils also receive a UV-resistant urethane topcoat to provide superior resistance to degradation from direct sunlight.

⚠ CAUTION ⚠

Do not use automotive grade antifreeze. Industrial grade glycols should be used. Automotive antifreeze contains inhibitors that will cause plaque formation on the copper tubes of the cooler evaporator. The type and handling of the glycol used should be consistent with local codes.

Table 3. Coil and coating selection matrix.

Coil Option	Non-corrosive[1]	Unpolluted marine[2].	Industrial[3]	Combined marine-industrial[4].
Standard Microchannel	+++	-	-	-
Epoxy Coated coils	+++	+++	+++	++

Notes:

1. **Non-corrosive environments can be estimated by the appearance of existing equipment in the immediate area where the chiller is to be placed.**
2. **Marine environments should take into account the proximity to the coast, as well as the prevailing wind direction.**
3. **Industrial contaminants can be general or localized, depending on the immediate source of contamination (e.g. diesel fumes due to proximity to a loading dock).**
4. **The marine-industrial combination is influenced by proximity to the coast, prevailing winds, and general and localized sources of pollution.**

Figure 7. Refrigeration Schematics cooling only.

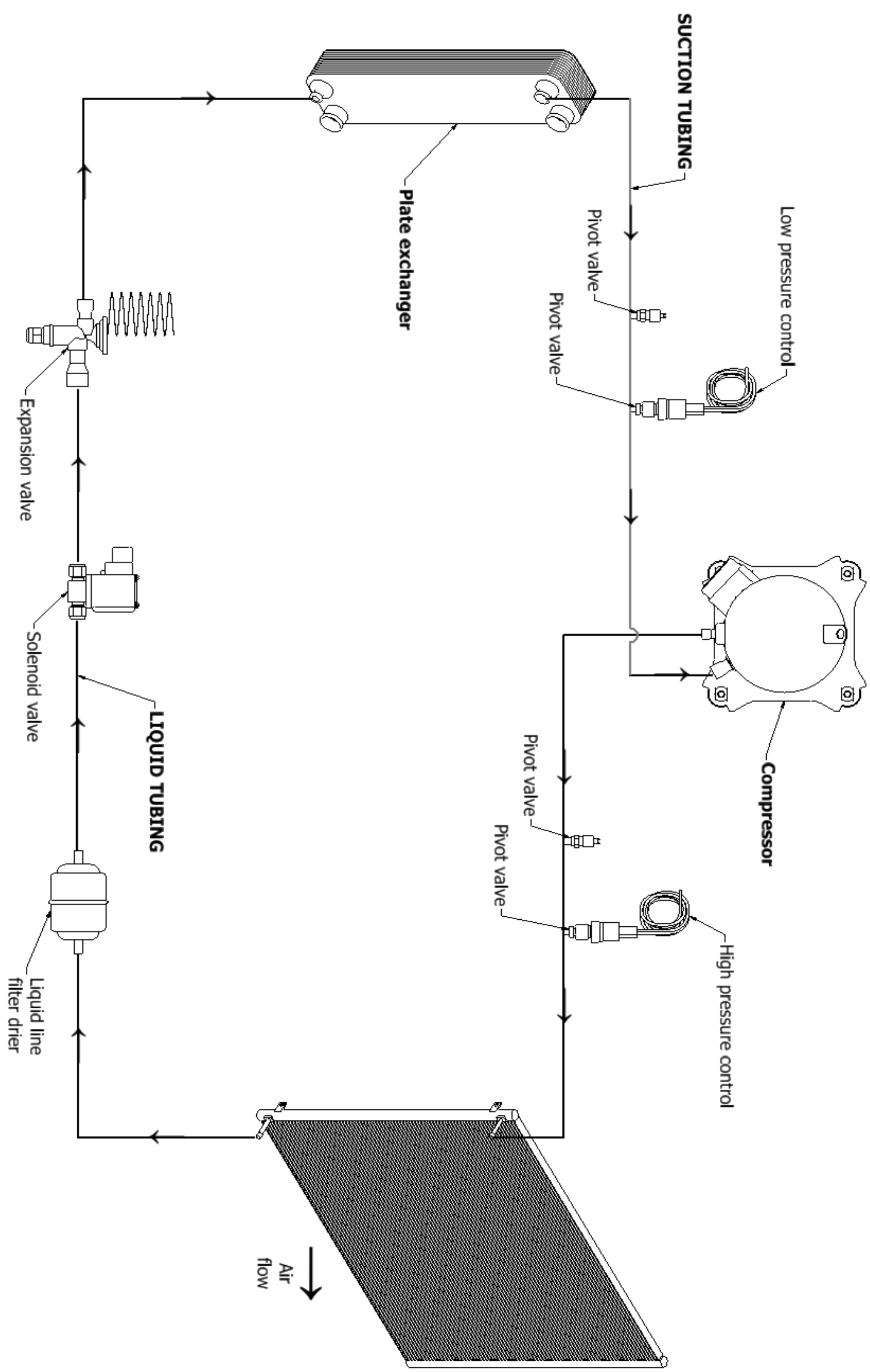
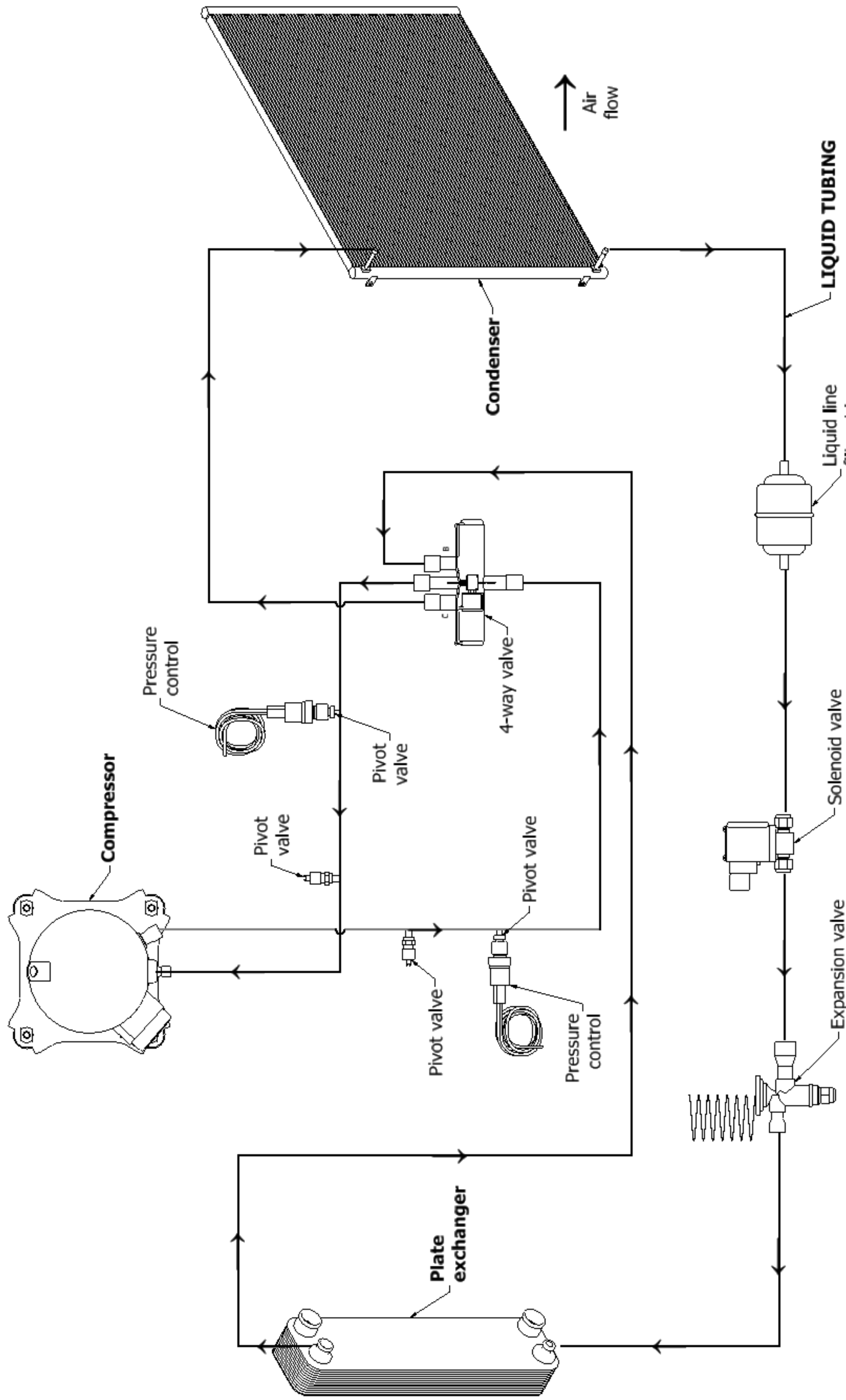


Figure 8. Refrigeration Schematics heat pump.



Dimensions and Weights - Packaged Units

Figure 9. Cooling only unit dimensional configuration 3-5 RT.

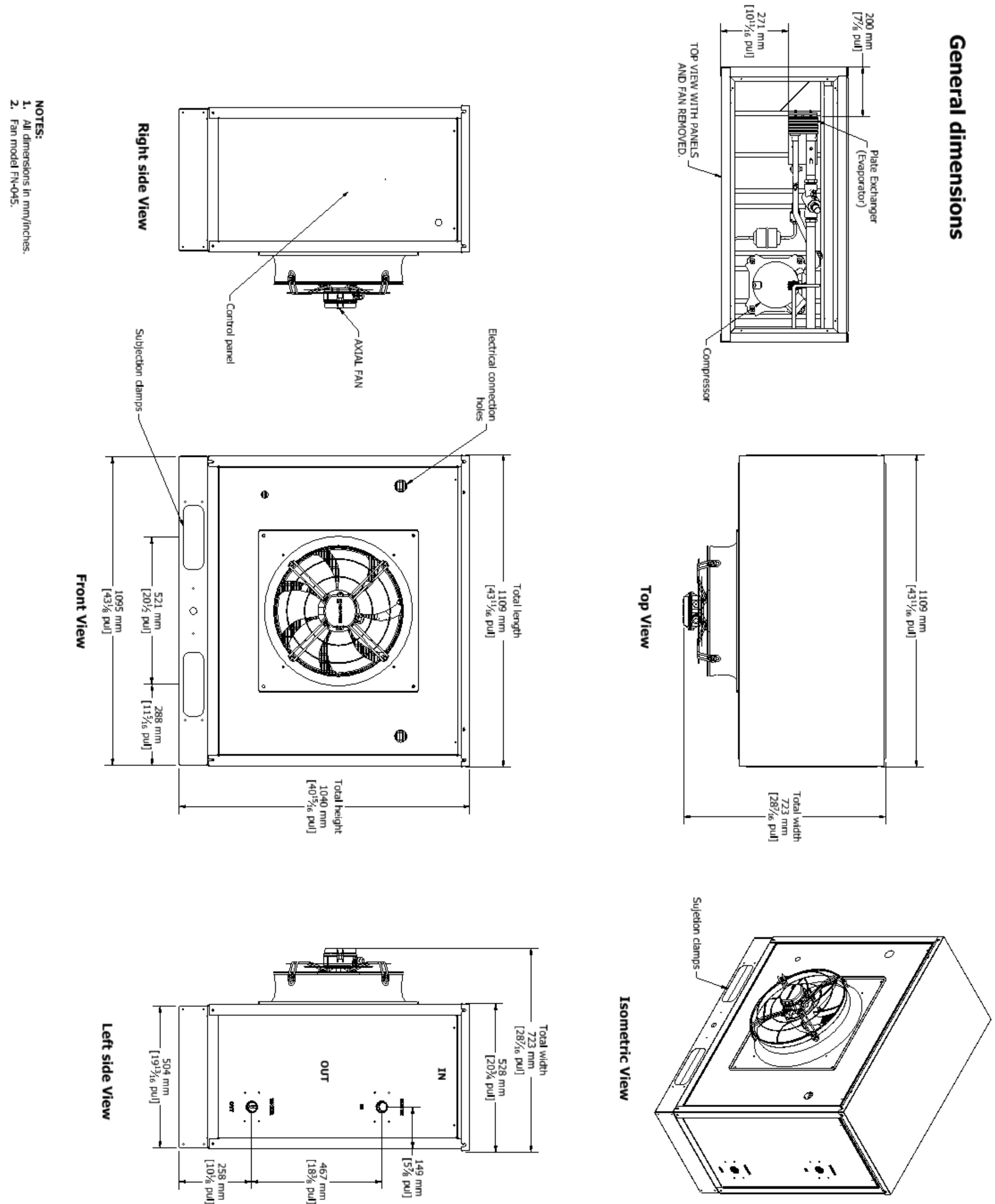
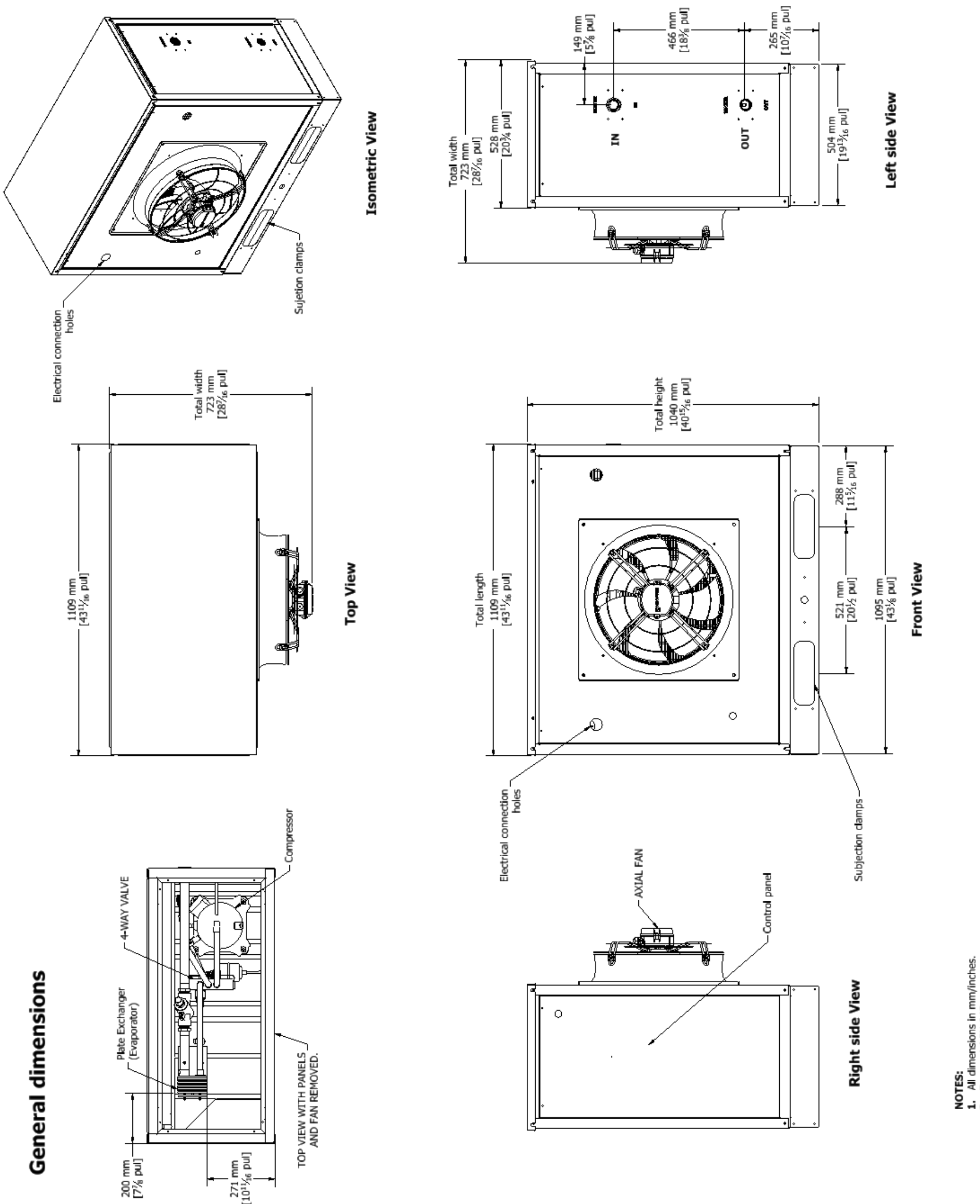
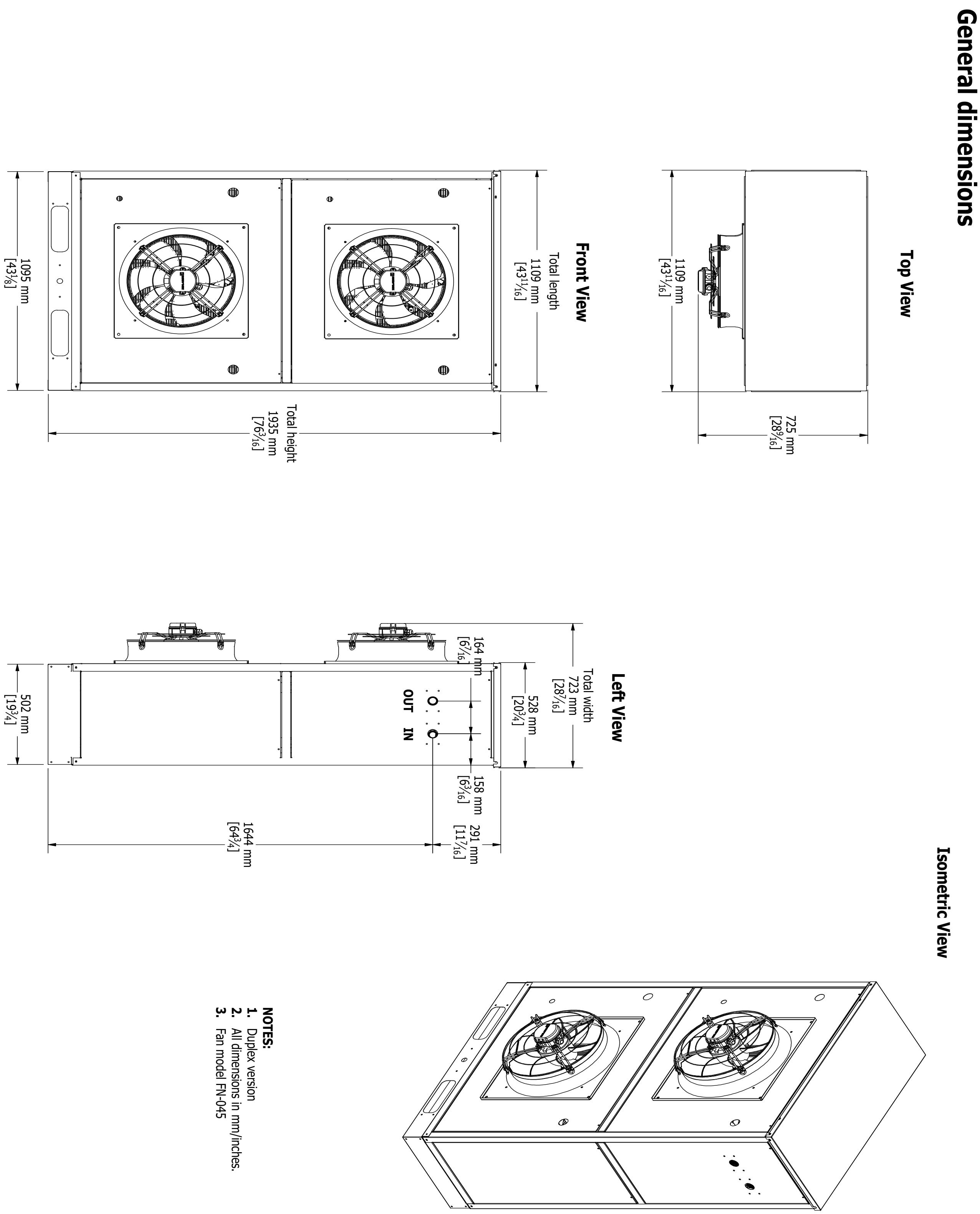


Figure 10. Heat pump unit dimensional configuration 3-5 RT.



Dimensions and Weights - Packaged Units

Figure 11. Unit dimensional configuration 10 RT (Duplex)



EMPTYING PROCEDURE

Any system that has been exposed to the atmosphere must be properly dehydrated. This is achieved with a proper vacuum procedure.
To achieve a proper vacuum, a **vacuum pump** (not a compressor) and a **vacuometer** are required.

The procedure is as follows:

- First of all, the access points to the system must be defined. For both the low side (suction line) and the high side (liquid line), use the existing service valves on the condensing unit, i.e. the high pressure switch, connected to the smaller diameter pipe, and the low pressure switch, connected to the larger diameter pipe.
- Once this is done, you are ready to evacuate the system.

Basically, it can be done in two ways:

Dilution method

1. Turn on the vacuum pump and build up vacuum in the pump (register 1 closed).
2. Open register 1 and let the system evacuate until it reaches at least 500 mcron. To obtain the measurement, close register 1 and open register 2 and make the vacuum gauge feel the system pressure.
3. After reaching 500 mice, isolate the vacuum pump and open register 3, letting the Nitrogen pass through to break the vacuum. Isolate the Nitrogen tube.
4. Vent the Nitrogen through the connection between the copper line and register 3.
5. Repeat the operation at least twice, making the third evacuation in the last phase. At the end at least 200 mice should be obtained.

⚠ WARNING ⚠

Never disconnect the copper tubing from register 3, simply loosen the connection to purge the nitrogen.

NOTE: To obtain an accurate vacuum value, isolate the vacuum pump from the system by closing register 1 and waiting about 5 minutes for an accurate measurement. If the value does not hold, the system still has moisture or there is a leak. Always check all connections (points 1, 3 and valves).

High vacuum method

It is applied with a vacuum pump capable of achieving a vacuum of less than 200 microns in a single evacuation. Proceed as follows:

1. Turn on the vacuum pump and then open the register1 (Fig. 11).
2. Subsequently, isolate the vacuum pump and open the register 2.
3. When a value of less than 200 mecrons is obtained (try to reach the lowest possible value), the vacuum procedure is finished.

⚠ WARNING ⚠

The pump oil should be changed periodically to ensure vacuum efficiency.

REFRIGERANT CHARGE

After evacuating the system properly, close the manifold registers and isolate the vacuum pump, vacuum gauge and nitrogen tube.

To make the refrigerant gas charge, replace the Nitrogen tube (Figure 11) with a refrigerant gas tube. Purge the hose connecting the tube to the service valve.

Open the service valve that provides access to the refrigerant gas tube and then the manifold high register.
To properly charge the system, check the unit identification labels for the amount of refrigerant gas to be added to the system.

With the system stopped, charge the liquid refrigerant gas through the liquid line service valve (smaller diameter). To assist you, use a scale (if a graduated tube is not used). Wait at least 10 minutes before turning on the equipment.

Close the manifold discharge register, open the suction register and with the system running complete the charge with refrigerant gas in gas form (5% to 20% of the total). Check on the scale the weight of the refrigerant gas that was added to the system. If the charge is complete close the manifold suction register, disconnect the suction and discharge hoses and close the pipe register.
The loading procedure is completed.

REFRIGERANT GAS RECOVERY

If for any reason there is a need to remove/lose refrigerant gas, the service valves on these units allow the refrigerant gas to be collected from the system inside the condensing unit.

Procedure:

1. Connect the manifold hoses to the service valve ports of the condensing unit.
2. Close the 1/4” liquid line service valve.
3. Turn the unit on cool down observing that the system pressures reach 2 psi.

At this time close the 3/8” suction line service valve to allow the refrigerant gas to be collected.

NOTE: The refrigerant must be adjusted by 20% to reach the evaporating temperature. You can check the charge on the next page.

Table 4. Refrigerant Charge.

FAMILY	RT	R410A (Lb)	R410A (Kg)
CLIV	3 RT	3.56	1.61
	5 RT	3.52	1.60
	10 RT	3.52	1.66

Figure 12. Diagram to obtain the vacuum and for the Refrigerant Charge.

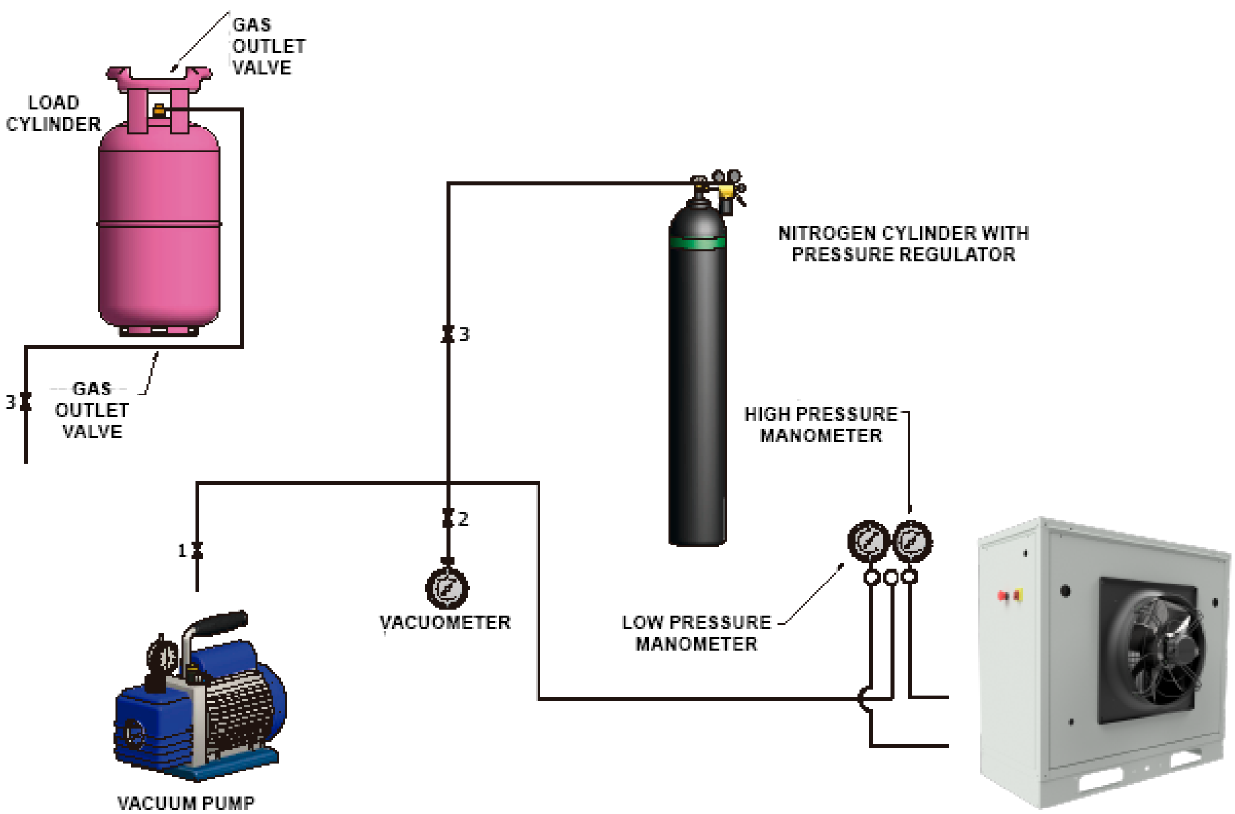


Table 5. Evaporator Pressure Drop Data.

CAPACITY	MODULE	EVAPORATOR DROP	TOTAL DROP
		DP (FT WG)	DP (FT WG)
3	UNIT	16.7	32
5	UNIT	16.7	32
10	DUPLEX	16.7	32

ELECTRICAL CONNECTION

CLIV units can be ordered with standard multi-point power connections or with optional single-point connections and various disconnect and circuit breaker options. Wiring inside the unit is sized in accordance with the NEC®.

The required field wiring varies depending on the configuration of the unit.
Voltage limitations are:

1. Within 10 percent of nameplate rating.
2. Voltage unbalance must not exceed 2 percent. Since a voltage unbalance of 2 percent can cause a current unbalance of 6 to 10 times the voltage unbalance per NEMA MG-1, it is important that phase-to-phase unbalance be kept to a minimum.

⚠ DANGER ⚠

Qualified and licensed electricians must perform wiring. There is an electrical shock hazard that can cause serious injury or death.

⚠ DANGER ⚠

LOCK OUT / DISCONNECT all power sources before starting, pressurizing, depressurizing or shutting down the chiller. Disconnect electrical power before servicing equipment, including condenser fan motors or compressors. More than one disconnect may be required to deenergize the unit. Failure to comply with this warning can result in serious injury or death. Be sure to read and understand the installation, operating and service instructions in this manual.

Chiller electrical wiring connections may be made with copper wiring, provided the size and number of wires match the chiller terminals. All wiring must be in accordance with applicable local and national codes, including NECA/AA 10402012 for installation of aluminum wiring in buildings (ANSI).

1. The control transformer is supplied and no separate 115V power is required. For single and multipoint power connections, the control transformer is on circuit #1 with control power wired from there to circuit #2. For multipoint power, disconnecting power from circuit #1 disconnects the control power from the unit.
2. The size of the wiring supplied to the control panel shall be in accordance with the field wiring diagram.
3. The single point power supply requires a single disconnect to supply electrical power to the unit. This power supply must have a fuse or use a circuit breaker.
4. All field wiring terminal range values listed in the unit selection report apply to 75°C cable per NEC.
5. It must be grounded per national and local electrical codes.

⚠ CAUTION ⚠

Static discharge during handling of the circuit boards can cause damage to the components. Use an antistatic strap before performing any maintenance work. Never unplug cables, circuit board terminal blocks or plugs while the panel is powered.

Use with on-site generators

Switching from site mains to generator power and vice versa requires the chiller to be off or the power to be disconnected for more than five seconds to avoid sending out-of-phase voltage to the chiller. A properly installed and fully synchronized automatic transfer switch must be used to transfer power if the chiller is operating under load.

Generator sizing

⚠ WARNING ⚠

The generator should be sized by an electrical engineer familiar with generator applications.

Transfer back to the grid

Proper transfer of power from the standby generator to the grid is essential to prevent damage to the chiller and must be used to ensure proper operation of the unit.

⚠ WARNING ⚠
Stop the chiller before transferring power from the generator to the mains. Transferring power while the chiller is running can cause serious damage to the chiller.

The procedure required to reconnect generator power to the grid is as follows:

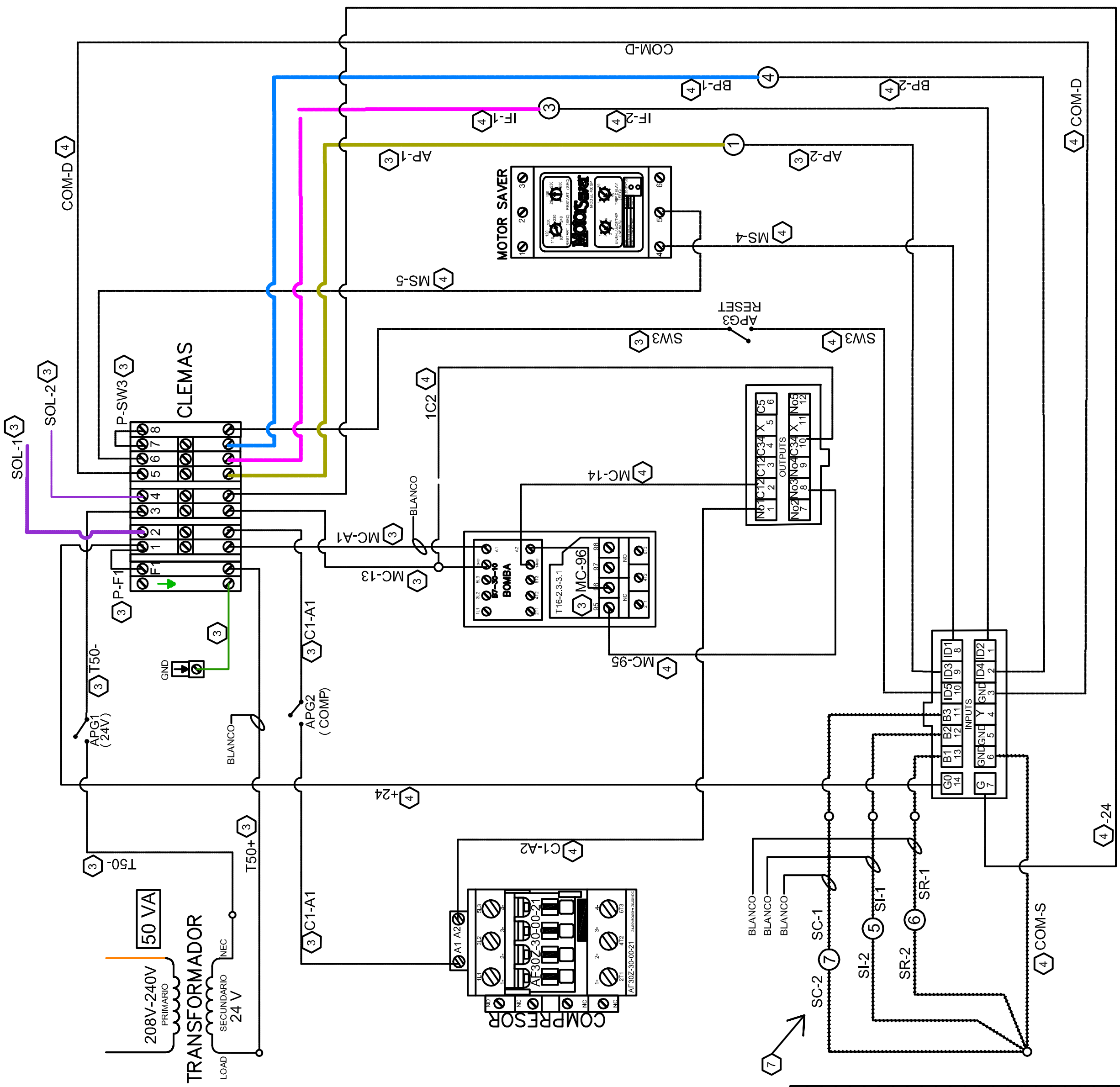
1. Set the generator to always run five minutes longer than the unit start timer, which can be set from two to sixty minutes, while keeping the chiller powered by the generator until the fully synchronized Automatic Transfer Switch properly delivers chiller power from the site.
2. Set the transfer switch supplied with the generator to automatically shut down the chiller before the transfer is made. The automatic shutdown function can be accomplished through a BAS interface or with the “remote on/off” wiring connection shown in the field wiring diagrams.

A start signal can be given at any time after the stop signal, as the three-minute start timer will be in effect.

⚠ WARNING ⚠
Electric shock danger. Improper handling of this equipment can cause personal injury or equipment damage. This equipment must be properly grounded. Control panel connections and maintenance should be performed only by personnel knowledgeable in the operation of the equipment being controlled. Disconnect electrical power before servicing equipment. Be sure to install a earth leakage breaker. Failure to install a earth leakage breaker may result in electric shock or fire.

⚠ WARNING ⚠
When installing the earth leakage protector make sure that it is compatible with the inverter (resistant to high frequency electrical noise) to avoid unnecessary opening of the earth leakage protector.ra.

Figure 13. Typical field wiring diagram of the 220V unit (son)



CONCEPTO
(1) SENSOR DE ALTA PRESIÓN
(2) SENSOR DE PALETA PARA FLUJO
(3) SENSOR DE BAJA PRESIÓN
(4) SENSOR DE INYECCIÓN
(5) SENSOR RETORNO
(6) SENSOR DE CONGELAMIENTO

TIPO DE COLOR DE CABLE
CABLE COLOR RAYADO
CABLE COLOR SÓLIDO

SIMBOLOGIA
SEÑALIZACIÓN COLOR DE CABLE/CALIBRE
APAGADOR 1 POLO 1 TIRO
REFERENCIA A PUNTO DE CONEXIÓN
(APG) REFERENCIA INTERRUPTOR
CONEXIÓN A TIERRA

# ESPECIFICACIÓN DE CALIBRE DE CABLE	
CABLE CALIBRE 3 X 8 AWG BLINDADO	0
CABLE CALIBRE 8 AWG	1
CABLE CALIBRE 14 AWG	2
CABLE CALIBRE 16 AWG	3
CABLE CALIBRE 18 AWG	4
CABLE CALIBRE 3 X 18 AWG	5
CABLE CALIBRE 2 X 18 AWG BLINDADO	6
CABLE CALIBRE 2 X 22 AWG	7
CABLE CALIBRE 4 AWG	8
CABLE CALIBRE 2 AWG	9
CABLE CALIBRE 6 AWG	10
CABLE CALIBRE 10 AWG	11
CABLE CALIBRE 3 X 2 AWG BLINDADO	12
CABLE CALIBRE 4 X 14 AWG USO RUDO	13
CABLE CALIBRE 3 X 16 AWG USO RUDO	14

TIPO DE SEÑAL
ALTO VOLTAJE "CLASE 1"
BAJO VOLTAJE "CLASE 2"
SEÑAL DE RESISTENCIA
SEÑAL DIGITAL

NOTA
CUALQUIER PUENTE DE CABLE EN CONTROL O FUERZA, DEBERÁ DE IR EN COLOR BLANCO – CALIBRE 16.

LISTADO DE COMPONENTES

SAP	DESCRIPCIÓN	CANT	U/M
3000041	TRANSFORMADOR 220-24V-50 VA AT150A-1007	1	PZA
1000086	MOTOR SAVER TRIFÁSICO MODELO 460	1	PZA
1000144	MINI CONTACTOR 24V GJL1311001R0101	1	PZA
1000073	TABLILLA DE FUERZA 1SNA356209R2600	1	PZA
1000166	APAGADOR DE BALANCÍN 1P-1T 4 AMP BTS-09	3	PZA
1000804	CONECTOR TIPO LENGUETA 1 OJILLO, 14-6AW	3	PZA
1000790	CONTACTOR AUX. CAL4-11 1SBN010120R1011	1	PZA
1001053	CONTACTOR AF30Z-30-00-21 1SBL276001R2100	1	PZA
1001185	RELEVADOR T16-3.1 1SAZ711201R1033	1	PZA
1000774	INTERRUPTOR DE 63 AMPERES 2CDS253001R063	1	PZA
1000071	CLEMA GRIS MA2 5/5 1SNA115486R0300	8	PZA
1000562	TAPA PARA CLEMA GRIS 118368R1600	3	PZA
1000301	CLEMA PORTA FUSIBLE 1SNA115657R2500	1	PZA
1000226	TAPA PARA PORTAFUSIBLE 1SNA116951R1500	1	PZA
1000145	TOPE DE RETENCION 1SNA206351R1600	2	PZA
1000011	TAPA CLEMA DE TIERRA 1SNA103062R2100	1	PZA
1000204	CLEMA PARA TIERRA 1SNA165488R2700	1	PZA
1000158	TORNILLO CON POSTE 1SNA176282R2300	7	PZA
1001435	SENSOR DE TEMPERATURA AX0631/060	3	PZA
1000837	KIT DE CABLE	1	PZA
1000836	CONTROLADOR BAROMÉTRICO MICROCHILER SE	1	PZA
1000271	MOLDED PLUG	1	PZA
1000900	RESISTENCIA COMPRESOR DE 240V 40W 5.5"	1	PZA
1000912	MOL 19418 0019 CONECTOR 4 PINES HEMBRA	1	PZA
1000913	MOL 19419 0004 CONECTOR 4 PINES MACHO	1	PZA

ELECTRICAL DATA

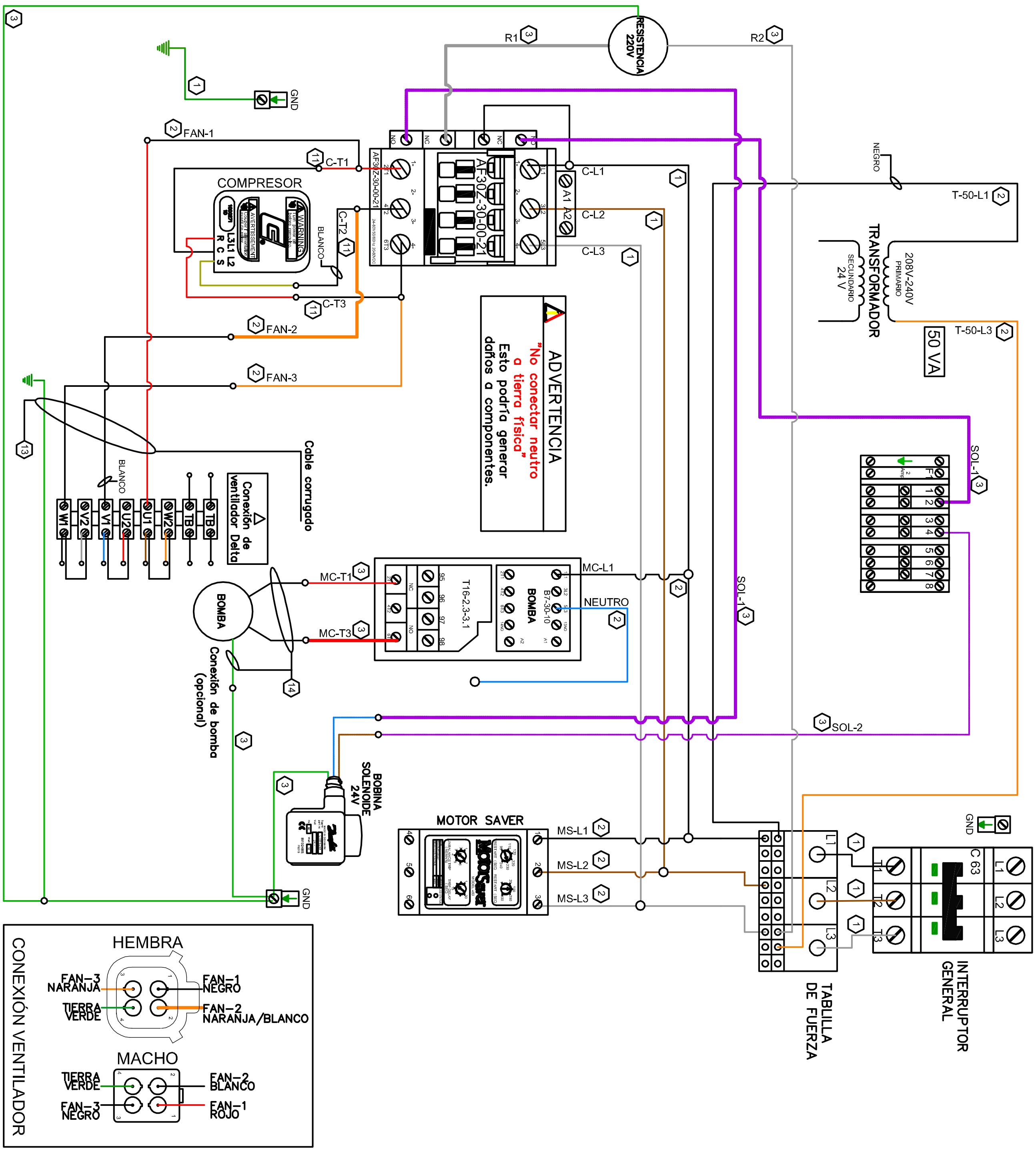
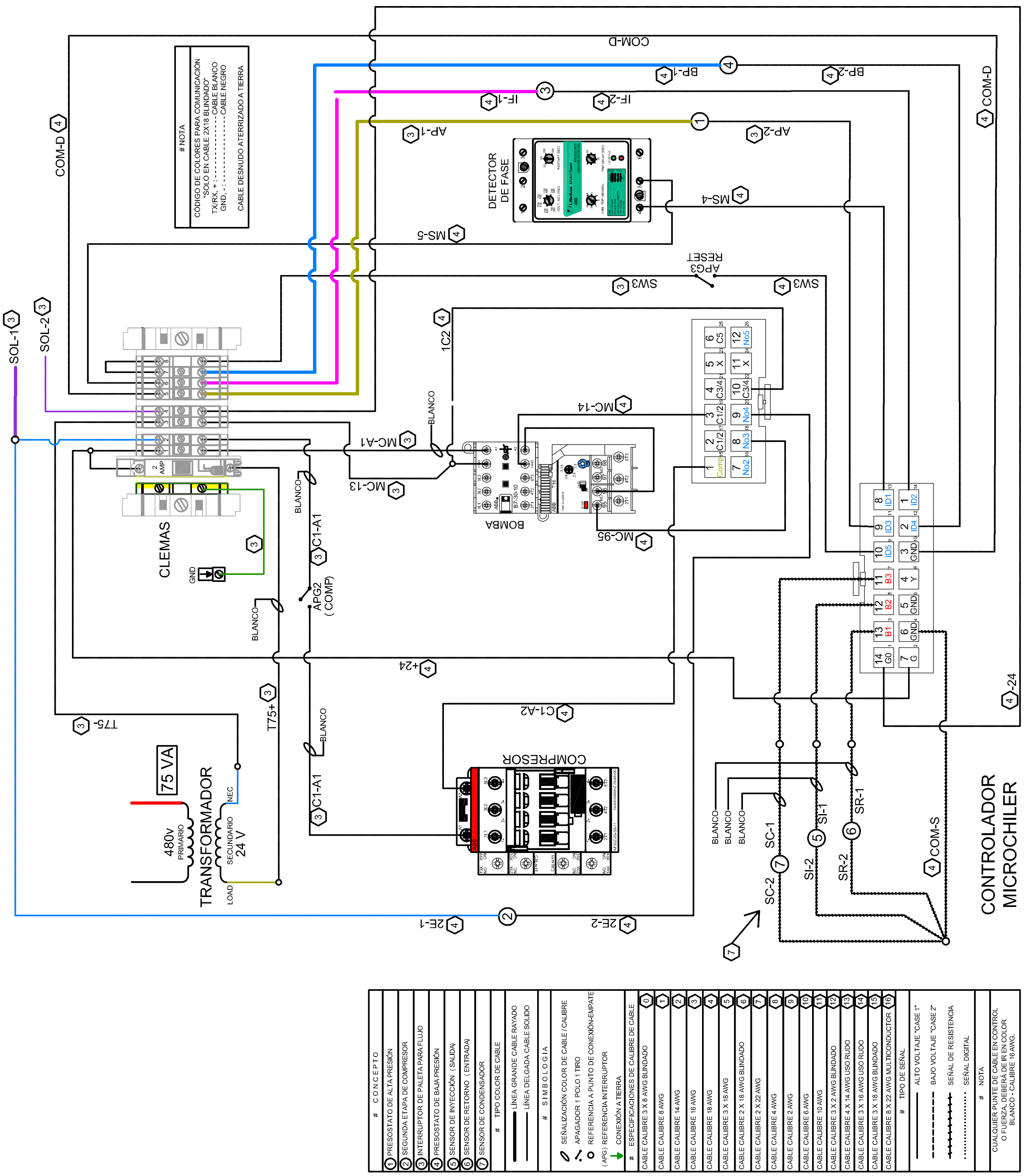


Figure 14. Typical field wiring diagram of 440V unit (son)



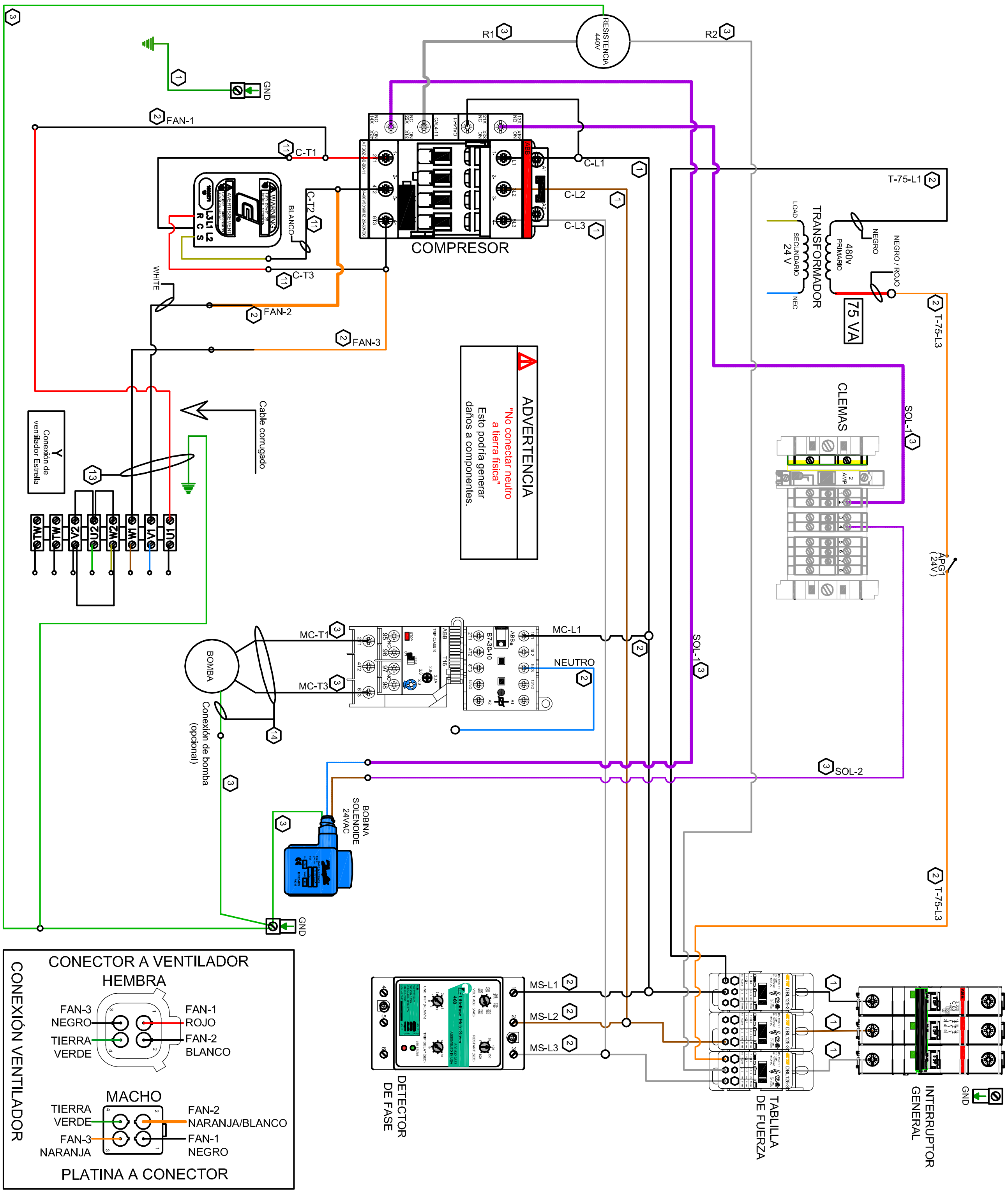
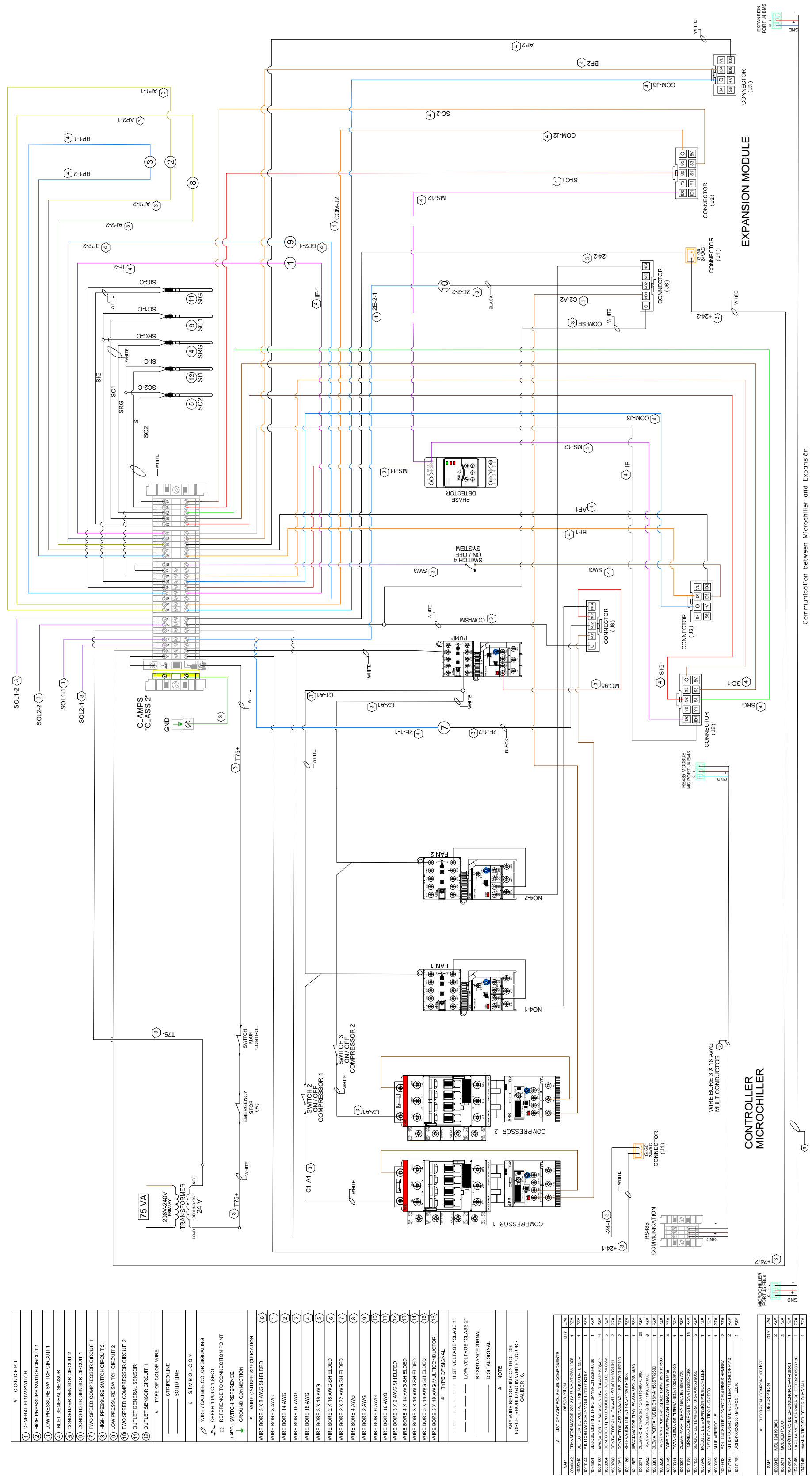
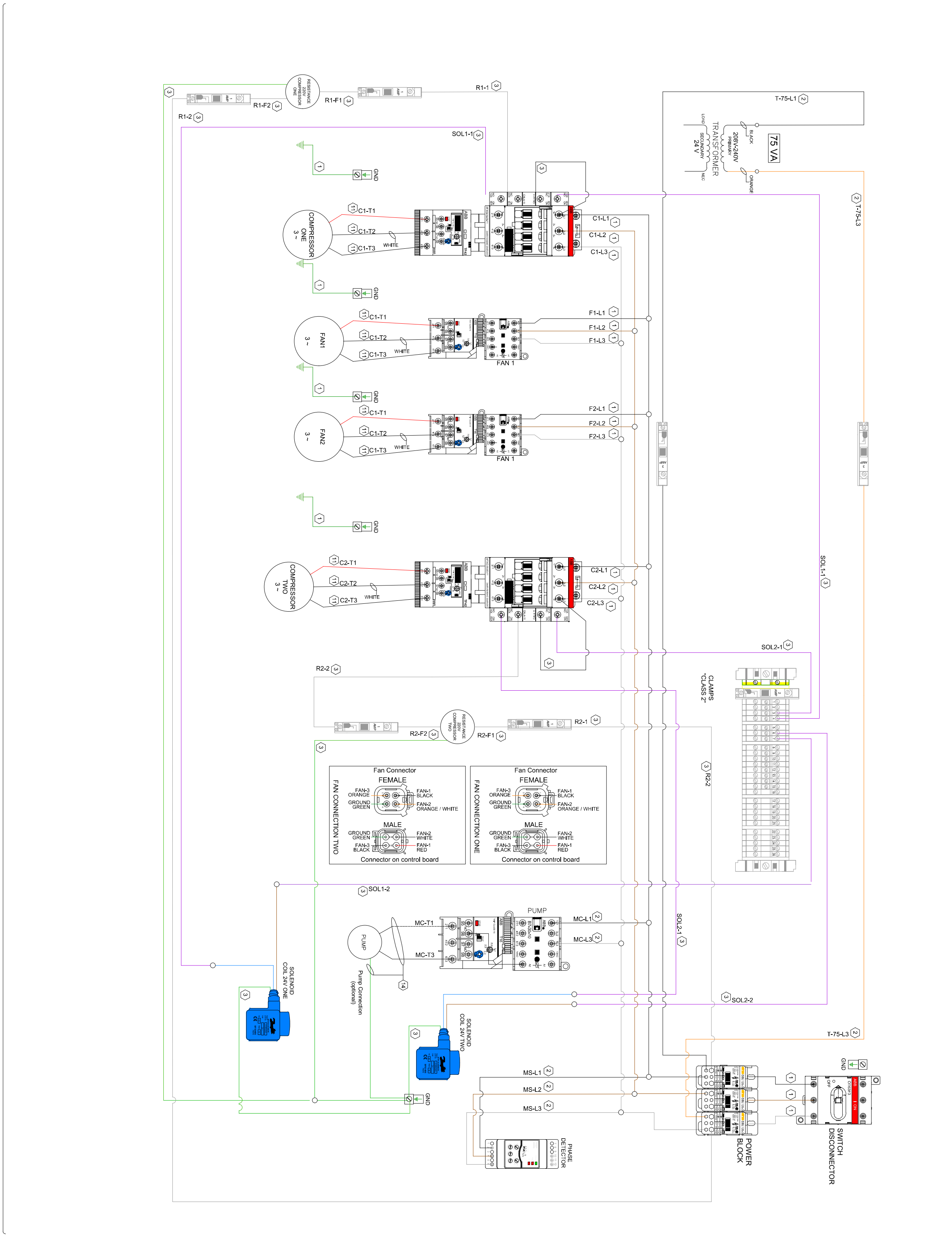

RESISTENCIA 440V
R1
R2
GND
FAN-1
C-T1
C-T2
C-T3
C-L1
C-L2
C-L3
BLANCO
WHITE
FAN-2
FAN-3
COMPRESOR
T-75-L1
T-75-L3
TRANSFORMADOR
480v PRIMARIO
SECUNDARIO 24 V
NEGRO
NEGRO / ROJO
LOAD
75 VA
ADVERTENCIA
"No conectar neutro a tierra física"
Esto podría generar daños a componentes.
CLEMAS
SOL-1
SOL-2
APC (24V)
Cable corrugado
Y Conexión de ventilador Estrella
U1 V1 W1 W2 U2 V2 W L1
MC-L1
MC-T1
MC-T3
NEUTRO
BOMBA
Conexión de bomba (opcional)
BOBINA SOLENOIDE 24VAC
MS-L1
MS-L2
MS-L3
DETECTOR DE FASE
TABLILLA DE FUERZA
INTERRUPTOR GENERAL
CONEXIÓN VENTILADOR
CONECTOR A VENTILADOR
HEMBRA
FAN-3 NEGRO
FAN-1 ROJO
TIERRA VERDE
FAN-2 BLANCO
MACHO
TIERRA VERDE
FAN-2 NARANJA/BLANCO
FAN-3 NARANJA
FAN-1 NEGRO
PLATINA A CONECTOR

Figure 15. Typical field wiring diagram of 220V unit (Duplex)




R1-1
R1-F1
R1-F2
R1-2
SOL1-1
T-75-L1
75 VA
TRANSFORMER
GND
C1-T1
C1-T2
C1-T3
WHITE
C1-L1
C1-L2
C1-L3
F1-L1
F1-L2
F1-L3
FAN 1
F2-L1
F2-L2
F2-L3
C2-T1
C2-T2
C2-T3
C2-L1
C2-L2
C2-L3
SOL2-1
R2-2
R2-F2
R2-F1
R2-1
Fan Connector
FEMALE
FAN-3 ORANGE
GROUND GREEN
FAN-1 BLACK
FAN-2 ORANGE / WHITE
MALE
FAN-2 WHITE
FAN-3 BLACK
FAN-1 RED
Connector on control board
FAN CONNECTION TWO
FAN CONNECTION ONE
SOL1-2
PUMP
MC-T1
MC-T3
MC-L1
MC-L3
SOL2-2
T-75-L3
MS-L1
MS-L2
MS-L3
PHASE DETECTOR
POWER BLOCK
SWITCH DISCONNECTOR

GENERAL DESCRIPTION

µChiller is Carel's solution for the complete management of chiller units, air-to-water heat pumps, water-to-water heat pumps and motor condensing units. In addition, this solution allows the field replacement of µchiller2 and µchiller2 SE with the new product (hereinafter referred to as Legacy model).

The maximum configuration manages 2 compressors per circuit (*)1 and up to a maximum of 2 circuits (thanks to the use of an expansion card for circuit 2).
The distinctive element of µChiller is the complete control of high efficiency units thanks to the integrated management of the electronic valve (ExV) and BLDC brushless compressors, ensuring increased compressor protection and reliability and high unit efficiency.

The user terminal allows wireless connectivity with mobile devices and is integrated on panel-mounted models and purchased separately on DIN rail-mounted models.

The CAREL "APPLICA" app, available on Google Play for the Android operating system, facilitates parameter configuration and unit commissioning operations in the field.

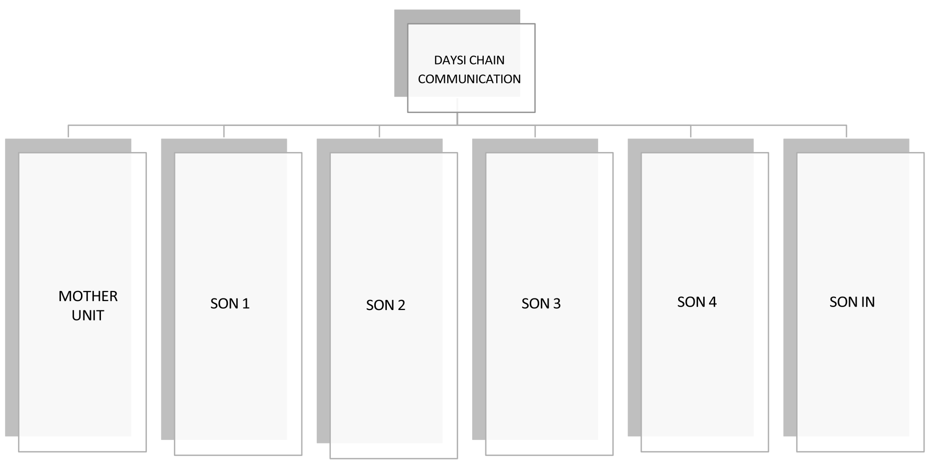
SYSTEM ARCHITECTURE

The general architecture of the controls uses the following:

- A unit controller.
- I/O extension modules as required based on unit configuration.
- Communications interface son modules.
- The architecture units have a configuration based on a mother unit and unit I/O sons , these sons can be connected via rs485 serial Modbus and can be configured from the configuration screen.

Tll I/O son modules can be connected directly or via a wiring harness.
The order of connection of the sons can be from left to right or from right to left, always respecting the master as the main unit.

Figure 16. System Architecture



INPUTS AND OUTPUTS

Tabla 6. Analog inputs

Physical address	Electrical diagram label	Name
S1	SR	Return Sensor
S2	SI	Injection Sensor
S3	SC	Condenser Sensor

Tabla 7. Digital inputs

Physical address	Electrical diagram label	Name
ID1	IF	Flow sensor
ID2	C/H	Heating / cooling switch
ID3	AP	High pressure switch
ID4	BP	Low pressure switch
ID5	System	Cliv unit on/off switch

Tabla 8. Digital outputs

Physical address	Electrical diagram label	Name
NO1	C1-A2	Compressor 1
NO2	2-E2	Compressor 2
NO3	MC-95	Water pump
NO4	B-24V2	4-way valve
NO5	Output available for alarm connection	-

SET POINTS

When we start configuring the unit for the first time all the preload parameters have a default value, these values are stored in permanent memory but can be changed depending on the application of the unit.

Values can be changed from the display and submenus require a password if values are to be changed; if an option is not included in the display menu the data is only an internal value in the controller and will be visible only if that mode is selected.

Operating parameters:

PARAMETER	VALUE
U077	0
S068	0
U076	0
C046	1
C047	0
S065	0
S064	0
Hc31	7
Hc32	8

Hc14	1
Hc15	2
Hc06	9
Hc07	4
U006	5.0
U007	20.0
U008	30.0
U009	45.0
Hc013	1

LOYTEC PARAMETERS SITE

From this page you can change parameters which are also referenced in this manual in the CLIV unit control parameters section.

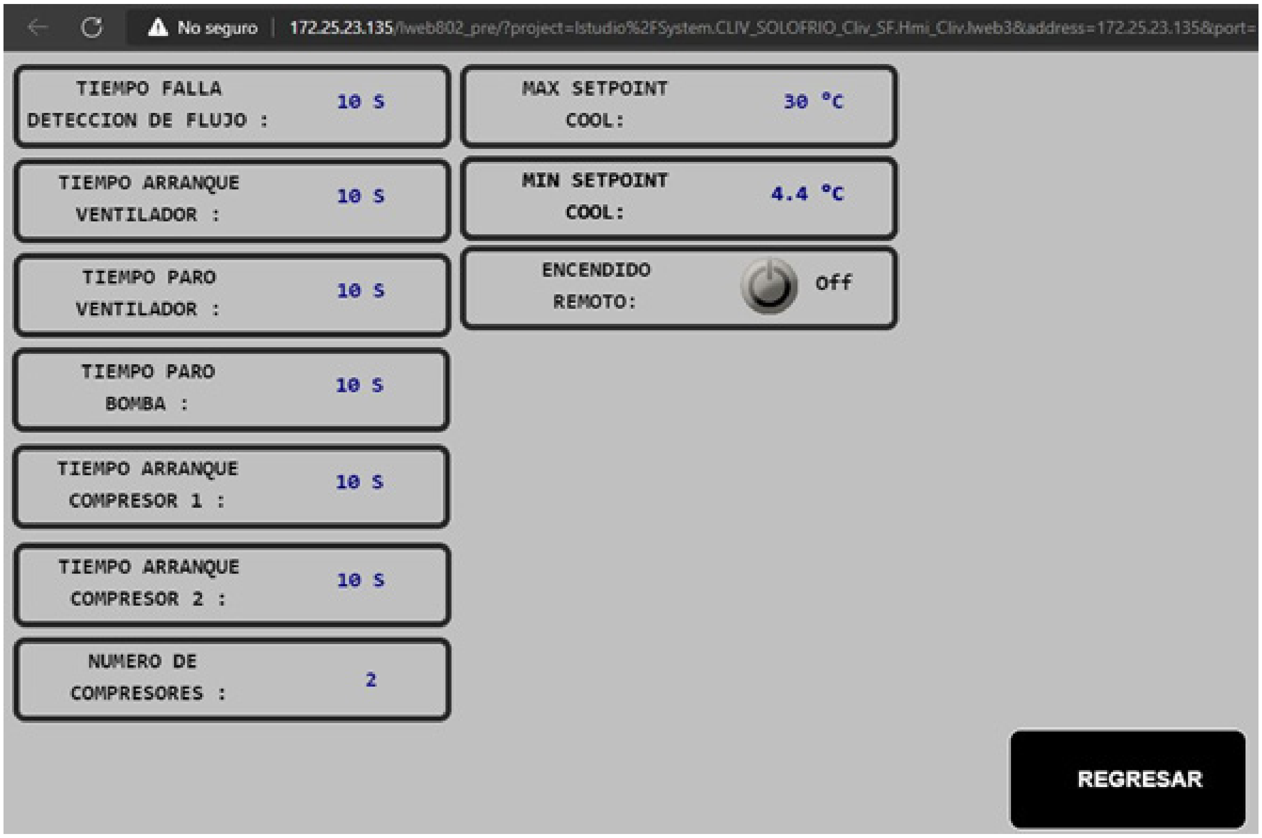


Tabla de supervisión de registros modbus

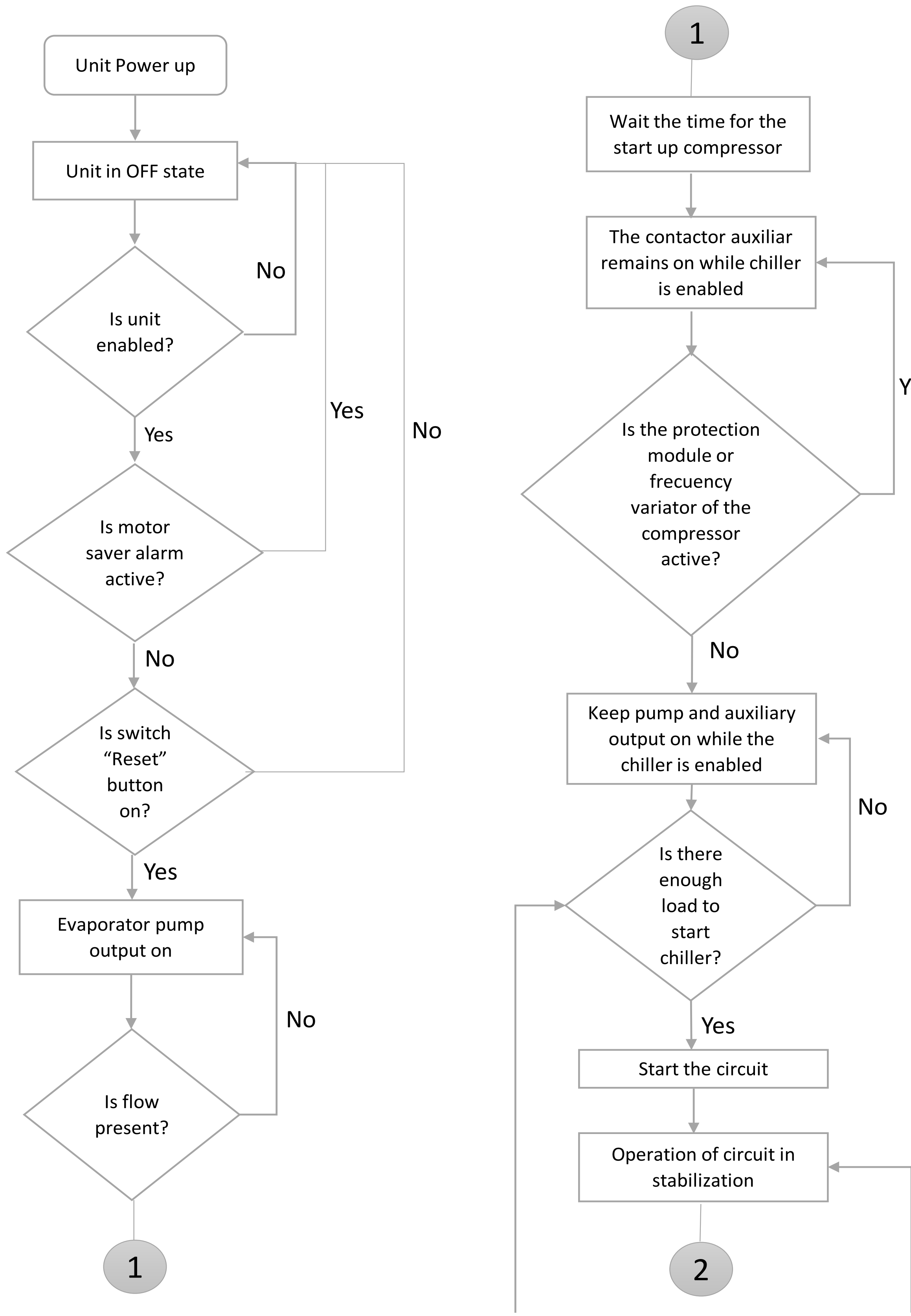
Variable name	Holding Write Read	Direction
Timer_On_System_Before_Pump	x	0
Timer_Flow_Detection_Pump	x	2
Timer_Start_Fan	x	4
Timer_Step_Compressor_on	x	6
Ton_Stage_1	x	8
Timer_Stop_Compressor_By_SW	x	10
Timer_Step_Compressor_off	x	12
Timer_stop_fan	x	14
Timer_Stop_Pump	x	16
Min_Setpoint_cool	x	18
Max_Setpoint_Cool	x	20

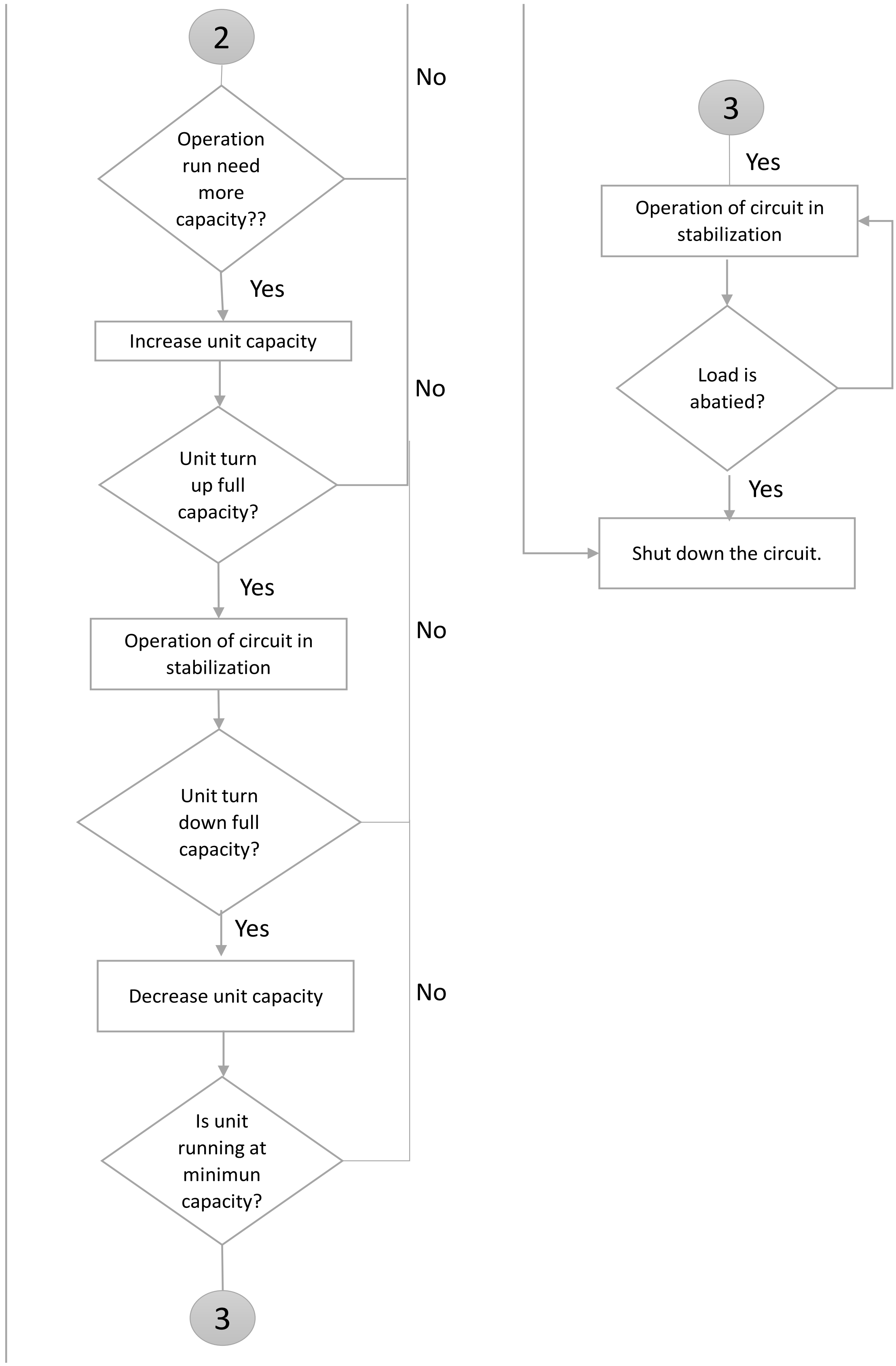
Setpoint_cool	x	22
Number_Stages	x	24
Ton_Stage_2	x	26
Ton_Off_Fan	x	28
Diff_Tmp	x	30
Setpoint_Cold_Water	x	32

Variable name	**Holding Write Read**	**Direction**
Alarm_Indicator	x	0
Switch_OnOff_Value	x	1
Switch_LowPressure_Value	x	2
Switch_HighPressure_Value	x	3
Switch_FlowWater_Value	x	4
Demand_Percent	x	5
Water_Inyection_Value	x	7
Water_Return_Value	x	9
Status_Compressor_1	x	11
Status_Compressor_2	x	12
Status_WaterPump	x	13
Status_Fan	x	14

Variable name	**Holding Write Read**	**Direction**
Reset_Alarm	x	0
Switch_OnOff_Logical	x	1
Switch_LowPressure_Logical	x	2
Switch_HighPressure_Logical	x	3
Switch_FlowWater_Logical	x	4
Remote_Enabled	x	5
Remote_OnOff	x	6

Figure 17. Sequence of operation of the unit




2
Operation run need more capacity??
No
Yes
Increase unit capacity
Unit turn up full capacity?
No
Yes
Operation of circuit in stabilization
Unit turn down full capacity?
No
Yes
Decrease unit capacity
Is unit running at minimun capacity?
No
3
3
Yes
Operation of circuit in stabilization
Load is abatied?
Yes
Shut down the circuit.

The calculations in this section are used in unit-level control logic or all-circuit control logic.

EVAPORATOR DELTA T

The Delta T of the evaporator water is calculated as the temperature of the water entering minus that leaving through all circuits.

PENDING LWT

The slope of LWT is calculated such that the slope represents the estimated change in LWT is immediately.

RATE OF DECLINE

The slope value calculated above will be a negative value as the water temperature is dropping. The rate of descent is calculated by pouring the slope value and imitating it at a minimum value of 4°C/sec.

LWT ERROR

The LWT error is calculated as LWT - target LWT.

UNIT CAPACITY

Unit capacity is the Delta T of the unit operating for GPM of water.

CONTROLLER CALCULATIONS

Refrigerant saturation temperature

The saturated coolant temperature will be calculated from the pressure sensor readings for each circuit.

Evaporator approach

The evaporator approximation will be calculated for each circuit. The equation is as follows

Evaporator approximation = LWT - Evaporator saturated temperature.

Condenser approach

The capacitor approximation will be calculated for each circuit. The equation is as follows

Capacitor approximation = Capacitor saturated temperature- OAT.

Suction reheating

The suction superheat shall be calculated for each circuit using the following equation:

Suction superheat = Suction temperature - Evaporator saturated temperature.

Pumping pressure

The pressure at which a circuit will pump down is based on the low pressure set point of the evaporator. The equation is as follows

Pump down pressure = Evaporator low pressure set point - 103KPA (15 PSI)

CIRCUIT LOGIC CONTROL

Circuit enablement

A circuit must be enabled to start if the following conditions are met:

- Circuit breaker is closed
- No circuit alarms are active
- Circuit mode setpoint is set to enable
- At least one compressor is enabled to start (according to enable set points)

COMPRESSOR AVAILABILITY

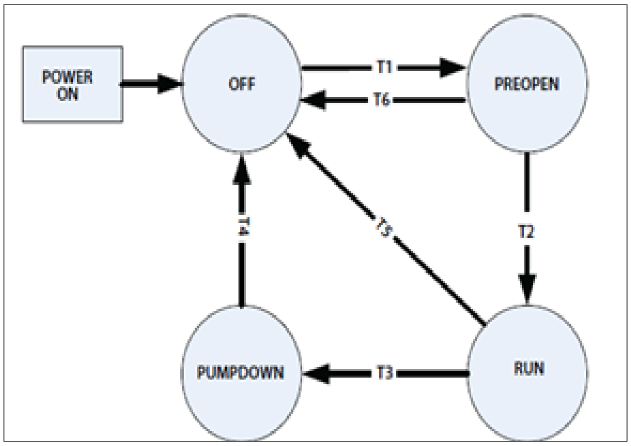
A compressor is considered to be available to start if all of the following are met:

- The corresponding circuit is enabled.
- The corresponding circuit is not in pumping stop.
- No cycle timers are active for the compressor.
- The corresponding circuit is not in pump-down stop state
- Compressor is enabled through the enable set points.
- Compressor is not running.

CIRCUIT STATES

The circuit will always be in one of four states:
Off - The circuit is not running.
Pre-open - The circuit is preparing to start up
Running - The circuit is running
Pump off - The circuit is performing a normal shutdown.
The transitions between these states are shown in the following diagram.

Figure 18. Circuit states.



T1 - At pre-opening

- No compressor is running and any compressor in the circuit is commanded to start.

T2 - Pre-open to run

- 5 seconds have elapsed in pre-opening state.

T3 - Run to pump down

Any of the following is required:

- Last compressor in the circuit is commanded to stop.
- Unit status = Pump stopped.
- Circuit breaker is open.
- Circuit mode is disabled.
- Circuit breaker is open -Circuit mode is disabled -Pump down alarm is active.

T4 – Pumping down on Off

Any of the following is required:

- Evaporator pressure < Pump downstream pressure value.
- Unit status = Off.
- Unit status = Off -Quick circuit shutdown alarm active.

T5 - Run to Off

Any of the following is required:

- Unit status = Off.
- Fast circuit shutdown alarm is active.
- A low temperature start attempt failed.

T6 - Pre-open to Off

Any of the following is required:

- Unit status = Off.
- Unit status = Pump off.
- Circuit breaker is open.
- The circuit mode is deactivated.
- The circuit quick stop alarm is activated.
- The pumping alarm is activated.

COMPRESSOR CONTROL

Compressors should operate only when the circuit is in the operating or pumping state. They should not operate when the circuit is in any other state.

Compressor start-up

A compressor must start if it receives a start command from the unit capacity control logic.

Compressor shutdown

A compressor must be shut down if any of the following situations occur:

- The unit's capacity control logic commands it to shut down.
- A discharge alarm occurs and sequencing requires this compressor to be the next compressor to shut down.
- The circuit status is pumping and sequencing requires this compressor to be the next compressor to shut down.

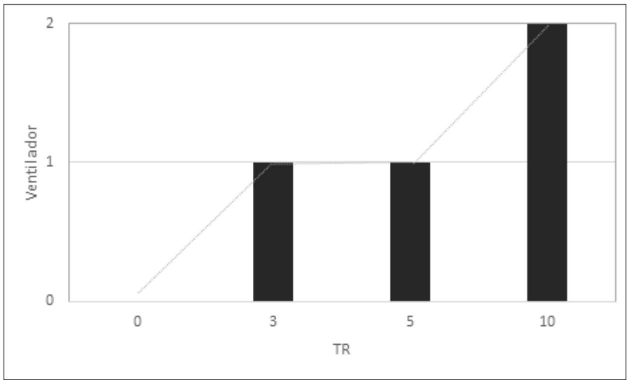
CONTROLLER CALCULATIONS

A minimum time between compressor starts and a minimum time between compressor stop and compressor start will apply. The time values are determined by the start timer and stop timer set points. These cycle timers should not be applied by power cycling the chiller. This means that if the power is cut off, the cycle timers should not be active. These timers can be cleared by a setting on the controller.

CONDENSER FAN CONTROL

The condenser fan control shall start the fans as required whenever the compressors are running in the circuit.
All fans and solenoid valves shall be off when the circuit is in the off and pre-open state.
The digital outputs of the condenser fans will turn on or off immediately for condenser stage changes.
The outputs of the capacitor solenoid valves will turn on immediately when a step-up stage requires the output to turn on, but will have a delay to turn off during a step-down stage.
This delay is 20 seconds. If the circuit is turned off, the capacitor solenoid valve outputs will turn off without delay.

Figure 19. Fan sequence according to capacity.



OVERHEATING CONTROL STATUS OPERATION

TXV Operation

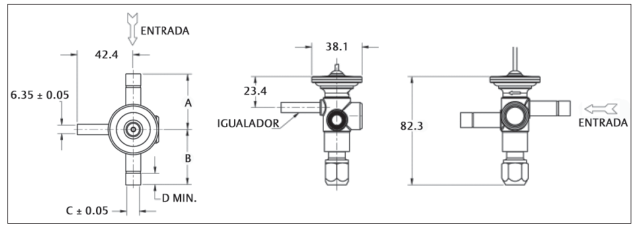
The measurement of refrigerant flow to the evaporator is the exclusive function of a TXV. It must measure this flow at precisely the same rate at which the refrigerant is evaporated by the heat charge.
The TXV does this by maintaining the coil with enough refrigerant to maintain the correct superheat of the suction gas leaving the evaporator coil.
The TXV regulates the flow in response to the superheat of the charge.

If it is suspected that a TXV is not operating properly, checking for overheating is the only way to be sure. Do this with precision instrumentation to obtain meaningful results.
Operating overheat of 8°F to 12°F are considered normal. Here are some "tips" to help in detecting and fixing performance failures in a TXV:

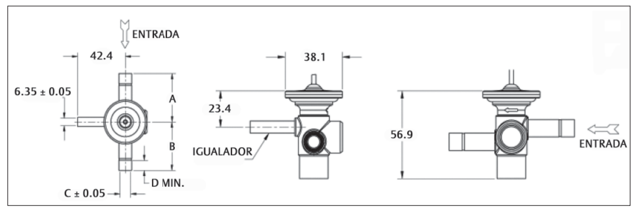
- Check the bulb to make sure it is properly connected to the suction line. If you can move the bulb manually, it is not properly secured.
- The bulb must be perfectly insulated to protect it against the effects of a draft.
- Check the equalizer line for restrictions (kinks) or signs of frost. A frosted equalizer line indicates internal leaks and will require valve replacement. Repair or replacement of a bent equalizer will be necessary for the valve to operate properly.

TXVs are designed to measure liquid refrigerant flow. If the refrigerant at the valve inlet contains flash gas, the valve capacity will be reduced. Make sure that the system is properly charged and that there is some subcooling at the valve inlet before discarding the TXV.

Dimensions (Mm)



Adjustable - ODF connections with 1/4" equalizer



Non-adjustable - Odf connections with 1/4" equalizer

Connections	Dimensions			
	A	B	C	D
3/8 ODF	41.9	41.9	9.6 (3/8)	8.6
1/2 ODF	41.9	41.9	12.8 (1/2)	12.2
5/8 ODF	54.6	54.6	16.0 (5/8)	19.0
7/8 ODF	54.6	54.6	22.3 (7/8)	19.0
1-1/8 ODF	61.0	61.0	28.7 (1-1/8)	23.1

EXV Operation

The electronic valve is intended for installation in refrigeration circuits as an expansion device for the refrigerant fluid, using the superheat calculated by means of a pressure probe and a temperature probe, both installed at the evaporator outlet, as a control signal.

An adequate subcooling of the fluid at the inlet is necessary to prevent the valve from working in the presence of gas bubbles. It is possible that the valve will increase its noise level if the Refrigerant Charge is insufficient or if there are relevant water charge losses upstream of the valve.

ALARMS

Alarms that require technical assistance intervention indicate the request on the display by the flashing of the key icon. The lit key icon indicates that a device has reached the programmed threshold of the number of operating hours, and a maintenance intervention is required (the alarm code indicates which device is concerned).

The reset of some alarms can be configured through a parameter. The configurable alarms are:

- High pressure switch.
- Low pressure switch.
- Anti-freeze alarm.

Presence of alarms

The display provides access only to the active alarms without password or, with password, to those dedicated to the initialization of the unit and its optimization.

The presence of an alarm is signaled by activation of the buzzer and the flashing alarm icon. Pressing Alarm silences the buzzer and displays the alarm code (on the top line) and any additional information (on the bottom line).

The alarm activation is recorded in the alarm log. If the alarm is automatically reset, the alarm key is turned off, the alarm code disappears from the list and the alarm termination event is recorded in the alarm log.

Procedure (alarm acknowledgement):

1. Press Alarm: the buzzer is silenced, the alarm code appears on the display;
2. Press UP/DOWN to scroll through the alarm list;
3. When the display is finished, select Esc and press PRG to exit.

In the presence of an alarm, the buzzer is activated and the Alarm key is illuminated.

Pressing the Alarm key silences the buzzer and displays the alarm code. Pressing UP/DOWN scrolls through the list of other possible alarms.

If you reach the end of the alarm list, “ESC” appears: press the PRG key to exit the alarm list.

Pressing the Alarm key for more than 3 s resets the alarms: the text noAL indicates that there are no more active alarms. Pressing the PRG key exits the alarm list.

An alarm can be reset by pressing Alarm for more than 3 seconds. If the condition that generated the alarm still exists, the alarm is reactivated.

The alarm log can be cancelled by means of the ClrH parameter, which can be accessed from the Service level from the terminal or from APPLICA via smartphone, with BLE connection, through the specific command on the alarms page (it is necessary to access the “Assistance” level).

The same operations can be performed by acting from APPLICA via smartphone through the specific commands on the alarms page (BLE connection is required by accessing the “Assistance” level).

Next, some of the alarms that are active in the control will be mentioned.

These alarms will depend on the electrical configuration and the model of the equipment and depending on these configurations the alarms shown below may or may not depend on the general configuration (see next page).

Alarm	Description
A05	This alarm indicates when the water return sensor or water return probe is damaged or broken.
A06	This alarm indicates when the water injection sensor is damaged or broken.
A10	This alarm indicates when there is a census or water flow problem.
A12	This alarm usually appears together with the A10 alarm as it depends on the configuration at which the pump was commissioned, otherwise the current equipment containing this controller simply has a pump configured in this case this alarm goes together with the current pump configuration.
A15	This alarm usually appears when the water temperature does not drop due to the current cooling process. This alarm is more of a WARNING than a serious alarm since it is simply an indicator that the equipment is not cooling and therefore the water temperature is not dropping.
A20	This alarm indicates when the condenser temperature probe is broken or disconnected.
A21	This alarm indicates when the suction temperature sensor is broken or disconnected.
A25	This alarm indicates when the high pressure switch has suffered a change in its signal.
A29	This alarm indicates when the low pressure switch is active.
A49	When the controller has a son unit this alarm will be present if the son is disconnected.

LOYTEC SYSTEM ALARMS

The following is a description of the alarms that are enabled in the Cliv equipment.

High Pressure:

This alarm will be present when the high pressure switch is in inactive mode, to review this alarm check in the parameters section to see the current status of the switch.

Alarm number 40 check in this document the parameters menu section for present alarms.

Low Pressure:

This alarm will be present when the low pressure switch is in inactive mode in order to check this alarm check in the parameters section to see the current status of the switch.

Alarm number 30 check in this document the parameters menu section for present alarms.

Lack of Water Flow in the system:

This alarm will be present when the water flow switch is in inactive mode to review this alarm check in the parameter section to be able to observe the current status of the switch.

Alarm number 10 and 20 check in this document the parameters menu section alarms present.

Freezing Water:

This alarm will be active when the water temperature is below the cold water setpoint threshold in this case check the parameter section to observe and be able to change this value.

Alarm number 50 check in this document the parameters menu section for present alarms.

Broken or disconnected injection probe:

This alarm will be active when a temperature probe is broken or disconnected, in order to evaluate this alarm check the present alarms parameter section.

Broken or disconnected return probe:

This alarm will be active when a temperature probe is broken or disconnected in order to evaluate this alarm review the present alarms parameter section.

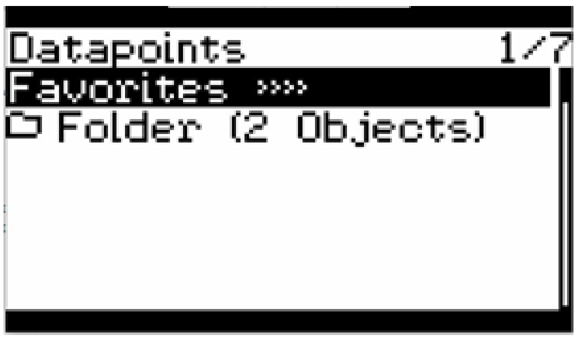
Alarm number 70, see in this document the present alarms parameters menu section.

PRESENT ALARMS PARAMETER MENU

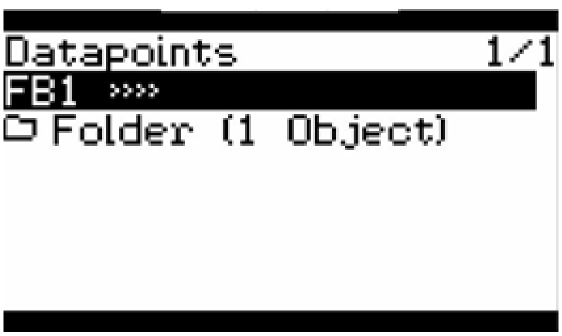
When an alarm occurs within the CLIV equipment the controller does not have the ability to show directly on the display the alarm that is present, however this alarm can be checked from a parameter which by means of a numeric value indicates the meaning of this alarm within this manual and within the alarm section you can consult the alarm that is present and to diagnose what the problem is which does not allow the system to turn on.

This section will show how to enter this parameter and view the value of the fault that is currently present.

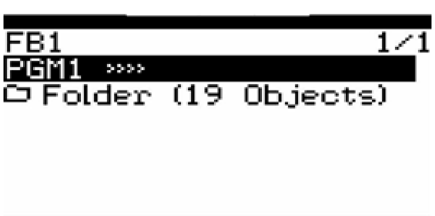
To access the alarm parameter menu follow the steps in this manual in the example section of menu navigation within the controller, once these steps are done you must enter the next screen where you select the favorite menu, then press the dial to access the next menu and get to the root parameters.



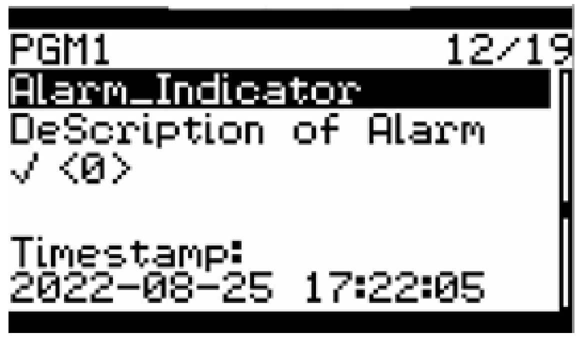
Once the above is done, select the FB1 menu and then press the dial to enter the root parameters as shown below.



After that, select the PGM1 menu and then press the dial to enter the root parameters.



After the previous step, turn the dial to the right to find parameter number 12.



In the previous image this parameter indicates the alarms that are active; when there is no alarm inside the equipment the parameter will show a zero and depending on the alarms that exist inside the system when one of them is activated the system will mark the priority alarm after that when the alarm is reset and there is another alarm present it will be shown in this parameter.

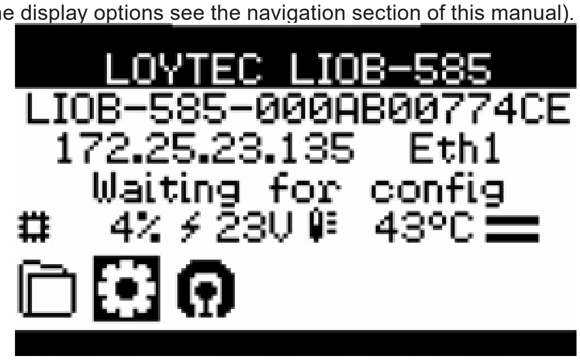
Refer to the control parameters section to select the alarm reset parameter from the menu.

WEB CONNECTION FOR PARAMETER DISPLAY

The Cliv device has a web interface that allows a more detailed view of the parameters for manipulation and visualization, and a brief introduction to configure this interface and visualize it if necessary through a PC.

To be able to make a connection to an ethernet network can be done in two ways either by connecting the device to a local network or connecting it to an internet network for either of the two cases you have to enter the parameters menu to access the address of the device, the steps to perform this procedure are shown below.

In the main screen you have to select the configuration menu as shown in the following screen (to know how to navigate through the display options see the navigation section of this manual).

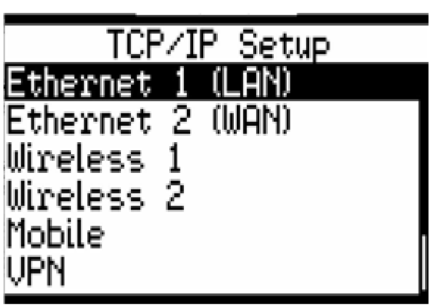


After pressing the dial to enter the communications icon configuration, pin access will be required.

The default password to enter the communication configuration is: **1234** to enter the password simply turn the dial to the right to increase the value or turn the dial to the left to decrease the value (for more details on this procedure refer to the example navigation section within the controller menu); once this step is done and the PIN is entered correctly, a screen like the one shown below will appear and turn the dial until the Device Management option is selected.

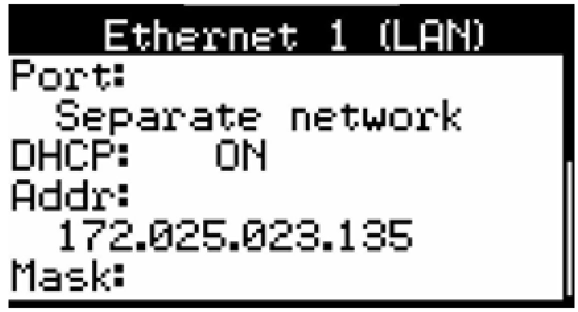
After selecting this option press the dial to access the communications configuration submenu and select the TCP/IP Setup option and then press the dial to access the submenu option.

After completing the previous step, select the Ethernet 1 menu selection option.

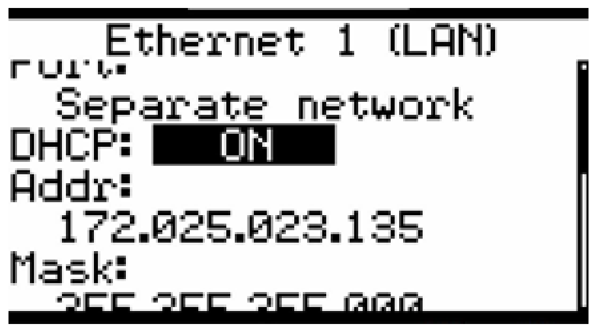


Once the above menu is selected, the network address of the device can be accessed. There are different options to which the device has to be adapted depending on the required network installation needs or remote monitoring requirements either from the device itself or a third party device such as PC'S, Tablets, or mobile devices.

The following is a brief explanation of the options offered by this menu for a quick configuration of visualization through the device.

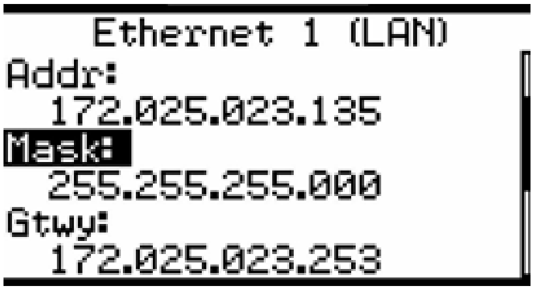


The following screen shows that selecting the DHCP option in ON mode means that the device can connect to a router that can provide an automatic IP address, depending on whether this router has an internet connection the device acquires the IP that the router or internet connection provides.



Selecting the DHCP option in OFF mode means that the device can be configured with a manual address which means that the address can be assigned by a user or network administrator so that the device is visible within the connection.

Once the previous steps have been taken and depending on the desired selection to be able to connect the device to the needs of the network to which it is required to connect, the following options will be verified; these options are found by turning the dial to select them as shown in the following image.



ADDR: This is the IP address of the device to which the address is assigned depending on the automatic or manual selection.

MASK: This is the network mask assigned to the device depending on the automatic or manual selection.

GTWY: This is the subnet mask assigned to the device and the selection can be automatic or manual.

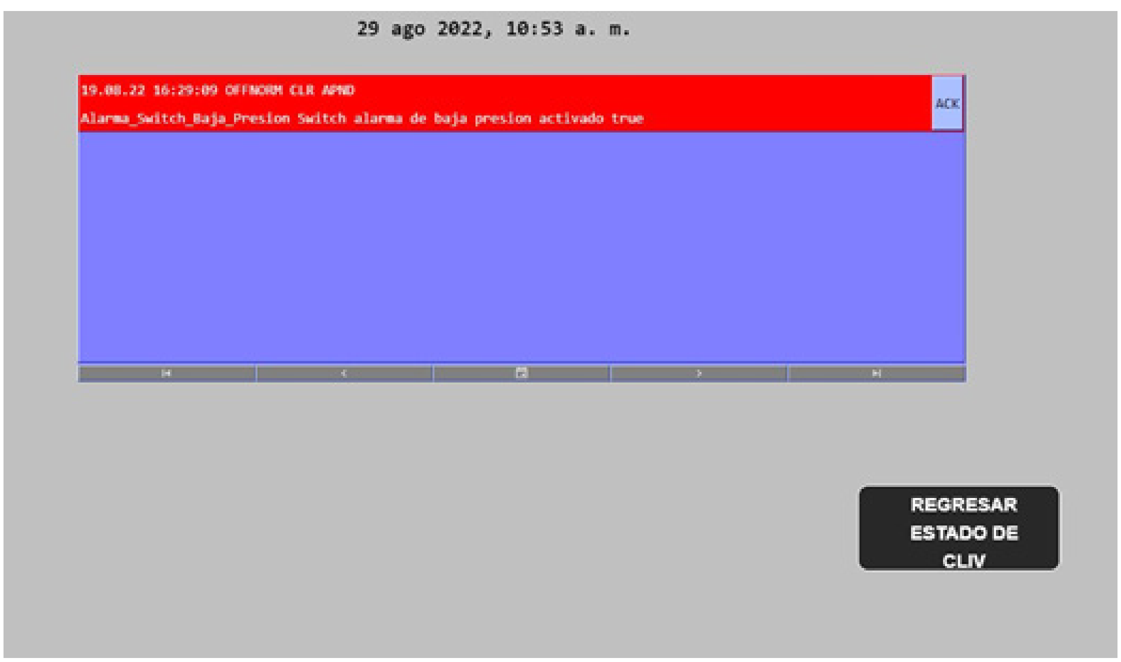
Once the above steps have been performed and the previous information has been verified, the device information will be saved by selecting the following menu. Once this step has been performed, the device will restart showing the device's network address on the main screen as shown in the image.

Once the previous steps have been taken and the IP address has been verified, the connection will be made through a PC web application so that the device data can be monitored through a browser and, at the same time, the necessary parameters can be manipulated depending on the adaptation that needs to be made to the equipment, all this configuration must be performed by trained personnel.

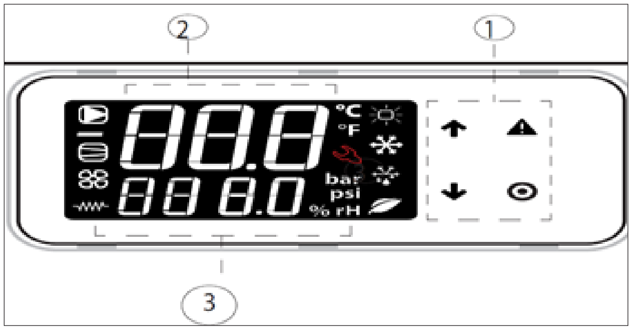
SYSTEM ALARMS

The CLIV system has an alarm section which indicates when there is a normal behavior within the equipment as shown in the following image in the part of the section where it shows no active alarms when an abnormality occurs within the equipment this legend changes to active alarms along with an alarm icon.

Pressing the alarm icon will take you to a screen which shows the history and the type of alarm that is active in this issue, when updating the alarm it can be deleted or left in the history.



DISPLAY



Legend	
1	Keyboard
2	Main field
3	Device status and operating mode icons

The display only allows access to some User and Support level parameters: to access all the Support and Manufacturer parameters it is necessary to use the Carel Applica app or the configuration and commissioning tool.

KEYBOARD

KEY	FUNCTION
↑	• In navigation: Access to the previous parameter • In programming: Value increment
↓	• In navigation: Access to the next parameter. • In programming: Value reduction. • Short press: Display of the main screen of the unit. • Prolonged pressure (3 s): Access to User level parameters (set point, on-off unit,...).
⚠	• Short press: display of active alarms and silencing of the buzzer. • Long press (3 s): alarm reset.
⊙	• In navigation: access to parameter programming. • Short press: Confirmation of the value. • Long press (3s): return to the main menu.

ICONS

The icons indicate the operating status of the devices and the operating mode, as shown in the following table.

Icon	Description	Status	Mode of operation
	System pump	Activate	Manual operation
	Status Source devices (pump / fan)	Active	Manual operation
	Compressor status	Active	Manual operation (with ExV)
	Anti-Icing Resistance	Active	-
	Mode of operation	Heating	-
		Cooling	High tem. Water
		Defrosting	Dripping after defrosting
		Free cooling	-
	Support	Demand for exceeding the operating hours threshold	Serious alarm, request for intervention by qualified personnel

STANDARD DISPLAY OF THE DISPLAY

At startup, the user terminal briefly displays the text “NFC”, indicating the presence on the user terminal of the NFC interface for communication with mobile devices, and then the standard display. The standard display shows:

- In the top row: the flow water temperature;
- In the bottom row, with the unit switched on, the return water temperature. With the unit switched off, the “OFF” status. during “Bluetooth” communication, the text “bLE” flashes on the display.

Main screen

From the main menu, press DOWN to access information on the status of the devices and on the values of temperature, overheating, etc. of the two circuits:

- Unit “OFF” and cause of shutdown:
- “diSP” by keypad;
- “dI” for remote contact (via digital input);
- “Schd” for time slot (scheduler);
- “bMS” for BMS;
- “ChnG” for change of operating mode (heating/cooling);
- “AlrM” for alarm.
- “CM” for compressors;
- “AFC1” supply water temperature circuit 1;
- “AFC2” source water temperature circuit 2;
- “EuP1” evaporating temperature circuit 1;
- “SSH1” circuit 1 overheating;
- “Cnd1” condensing temperature circuit 1;
- “dSt1” compressor discharge temperature BLDC circuit 1;
- “ESC” to exit the main screen.
- “EuP2” evaporating temperature circuit 2;
- “SSH2” circuit 2 overheating;
- “Cnd2” condensing temperature circuit 2;
- “dSt2” compressor discharge temperature BLDC circuit 2; and if the access level is “Assistance”:
- “Hd00” supervisory address (BMS);
- “Hd01” BMS baud rate;
- “Hd02” BMS communication parameters;
- “ESC” to exit the main screen.

Go to the standard display.

Press DOWN: CMP indicates that compressor 1 is on (o) and compressor 2 is off (_).

Press DOWN: EuP1 indicates the evaporating temperature of circuit 1 (3.8°C).

Press DOWN: Cnd1 indicates the condensing temperature of circuit 1 (40.8°C).

To return to the standard display, press PRG (which corresponds to ESC).

SHORTCUT FUNCTIONS

Only basic configuration parameters such as direct commands and active alarms can be accessed through the user terminal without password, or with password to those dedicated to unit configuration and optimization.

Press DOWN for 3 s to access the direct access functions:

- Set point;
- Switching the unit on and off;
- Change of the operating mode (cooling/heating, only on reversible units);
- Selection of the units of measurement.

In programming mode, the lower line indicates the parameter code and the upper line the value.

Go to the standard display

Press DOWN for 3 s: the current set point (SEtA) is displayed - read only.

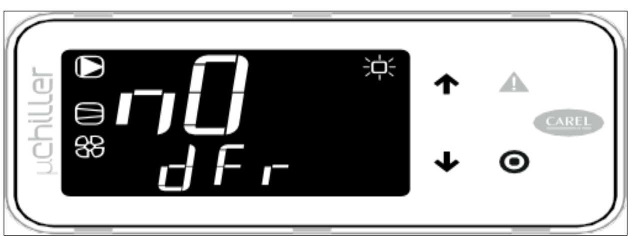
Press DOWN: the cooling set point (SEtC) is displayed.

Press PGR: the value flashes, press UP/DOWN PRsGolf for heat pump units, confirm.

Press DOWN to display the heating set point (SEtH).

Press DOWN: the unit on/off command (UnSt) appears.

Press DOWN: the command to change the cooling mode so(Clo) /at Assistance level and for A/W reversible units appears. heating (H) (ModE) - only for heat pump units.



Press DOWN: the manual defrost command (dFr) appears.

Press DOWN: the command to cancel the alarm log (ClrH) appears - Assistance level only.

Press DOWN: the selection of units of measurement (UoM) appears.

- Once you have finished the modifications, you can exit in two ways:
- At category level select ESC and press PRG;
- Press PRG for 3 s

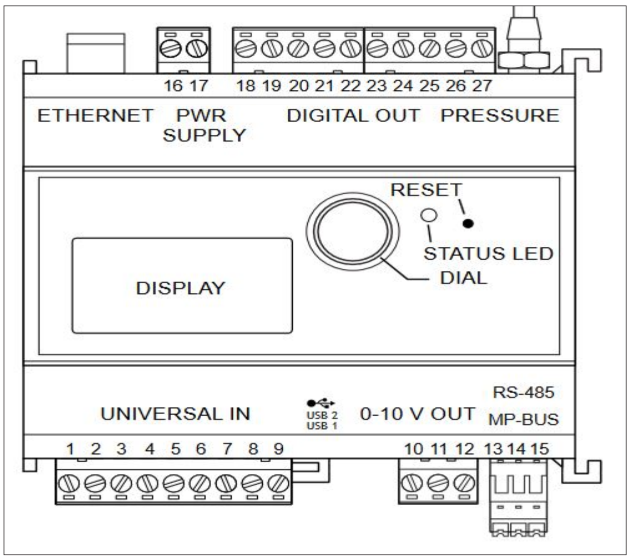
⚠ WARNING ⚠

The installer must take these procedures into account; his personnel must be qualified and certified to perform the installation in order to comply with all specifications and good practices to ensure proper operation of the unit.

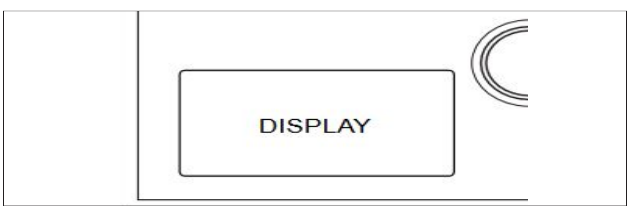
LOYTEC CONTROLLER

The purpose of this manual is to specify the use of the CLIV equipment with loytec controller, then the use of the main control, the alarms and the operation of the equipment in general will be discussed.

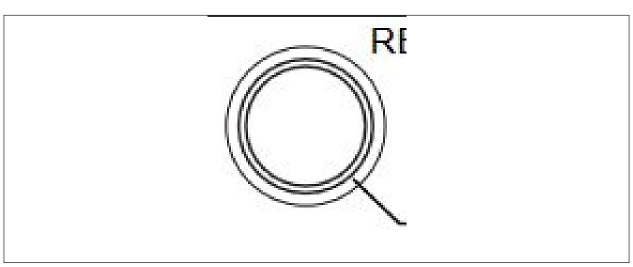
As shown in the following image, the loytec controller contains a display interface, which also contains a web interface. From the 2 interfaces you can control the equipment depending on the current configuration and the parameters it contains according to the operating equipment.



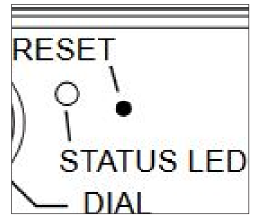
Next is the display, which shows the current status of the controller. In this case it can show a serial number of the controller, the current communication configuration, percentage of memory usage, current internal voltage of the controller.



The dial has the purpose of being able to enter and exit menus, in this case as a practical example the dial can be manipulated by turning the knob to the right or to the left; to enter a menu simply press the dial as a simple button and in this way the desired menu can be accessed.



The status LED is intended to send a current status of the controller. This LED does not always mean that there is an error inside the controller but it has 2 statuses:



Color the color green:

Means that the controller is in a healthy state according to the correct settings programmed to it.

Red LED:
It will indicate if there is any failure in terms of configurations or hardware problem, in many cases this led does not imply a failure as such, however this red led indicates a warning which has to be checked thoroughly in the controller portal.

EXAMPLE OF NAVIGATION WITHIN THE CONTROLLER MENU.

The following is an example of navigation within the controller, which is intended to make the use of the dial for menu selection within the controller more sensitive.
Step number 1: depending on the menu where you are, take the knob with your index finger and thumb and turn it to the right or to the left at that moment you will see that the icons or the menu to which the day is pointing will take a black background.

Example:

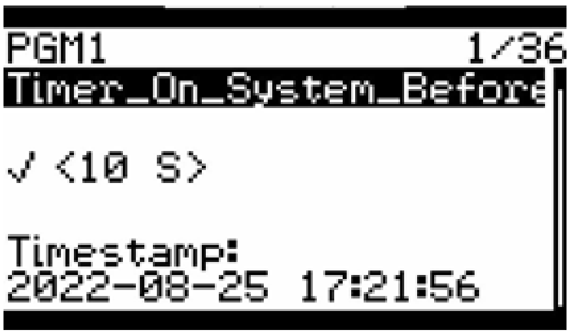
This is the main menu on the controller screen, for this practical example we are going to select the folder icon as you can see, currently the folder icon is on a white background in this case it has not been selected and therefore the dial for the folder icon selection has not been moved.

Taking the above mentioned, turn the dial to the right and the folder icon will take on a black background color, which means that the dial has moved to the folder icon and therefore it can be selected.

Once the folder icon is selected, press the dial and you will be able to access the content of that icon and the content of the menus inside it.
To access more configurations, simply repeat the above, so that you can navigate between icons or menus.

Example of parameter modification.

In order to modify the parameters, simply press the dial on the pointer of the parameter to be modified. A small example is shown below.
As shown, this parameter can be modified in question; before modifying the parameter you must verify that the pointer or black background that is in the description of the parameter must be selected, once the parameter is selected all you have to do is press the dial.



Once the dial is pressed, the following image will appear in that parameter where the <10 S> symbols will change to >10 S< and indicate that the parameter is ready to be modified.

After this step simply turn the dial either clockwise or counterclockwise increasing or decreasing the desired value, then press the dial again and you will see that the <10 S> symbols as shown in the previous image will return to their normal state, from here the value has already been modified.

ACCESSING FOLDER ICON MENUS

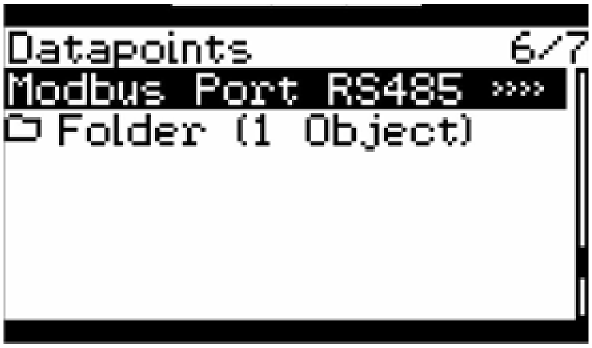
In this section we will take the menus contained in the folder icon and at the same time explain how to access these icons in order to modify the equipment's operating parameters.

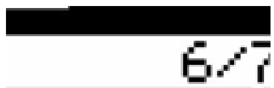
To access these parameters, first select the folder icon and once this icon is selected, press the dial to access the parameters it contains.

Next, it will ask for the access pin to be able to enter to modify the parameters. To enter the password, simply turn the dial to the right or left, observing that the numerical value increases or decreases, where the default password is: **1234.**

After pressing the dial the Datapoints menu can be accessed as shown in the following image and as can be seen, the Datapoint menu is shaded black which means that the dial is currently pointing to that menu.

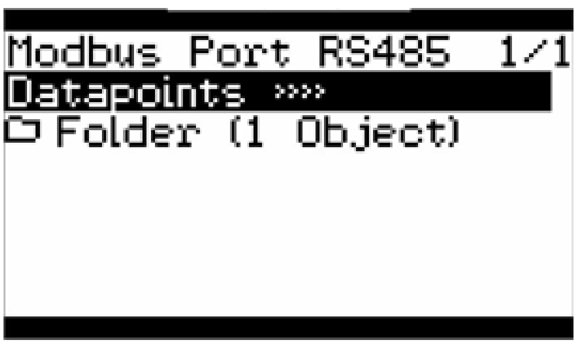
By moving the dial to the right or to the left the pointer can be moved either to the top of the menu or to the menu to be selected as shown in the following screen; in this case in order to access the parameters of time or shutdown configuration for the equipment it is necessary to move to the modbus menu.
Once this menu has been selected by the pointer, press the dial and you will be able to access the menu that will guide you to the parameters.



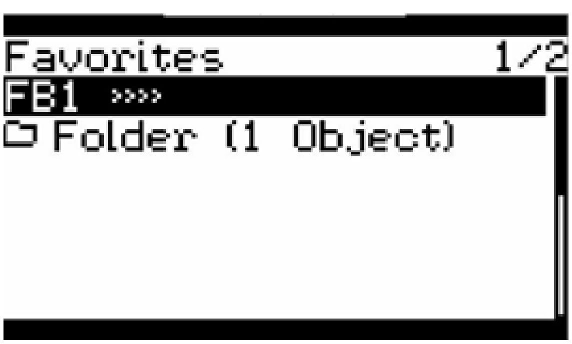


As you can see each menu has a number at the top of the screen, this number indicates the position of the menu that you want to access, in this case the parameters that you want to access for times and stops and alarm reset is number 6.

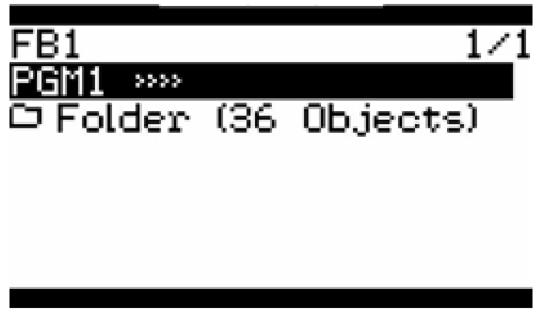
After having pressed the dial as mentioned in the previous step and as shown below, you can access the Modbus parameters menu, inside this menu it is necessary to turn the dial and select the Dapoints folder, once the datapoints folder is selected, it is necessary to press the dial to access it.



Once the dial is pressed as mentioned in the previous step, a menu will be accessed again and the same step of turning the dial and selecting FB1 and pressing the dial will be repeated to access the root.



Once the previous step has been performed, a menu will be accessed again and the same step of turning the dial to the right and selecting PGM1 will be repeated and pressing the dial to access the root.



ACCESSING CLIV EQUIPMENT CONTROL AND OPERATION PARAMETERS.

Los siguientes parámetros tienen la finalidad de poder modificar el comportamiento del equipo dependiendo de la necesidad a la cual se tenga que ajustar en sitio estos parámetros ya vienen pre ajustados de fábrica y sólo deben ser modificados por personal calificado para poder realizar la modificación de este parámetro consultar la sección de modificación de parámetros en este manual.

Parameter number 1:

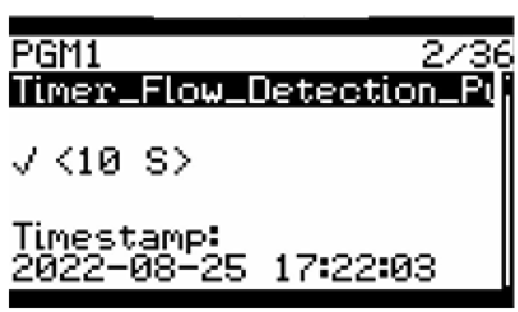
Timer_On_System_Before_Pump:

This parameter is intended to modify the system startup time.

Parameter number 2:

Timer_Flow_Detection_Pump:

The purpose of this parameter is to modify the water flow detection time when the system is at start-up.



Número de parámetro 3:

Timer_Start_Fan:

The purpose of this parameter is to modify the fan start-up time when the system is at start-up.

Parameter number 4:

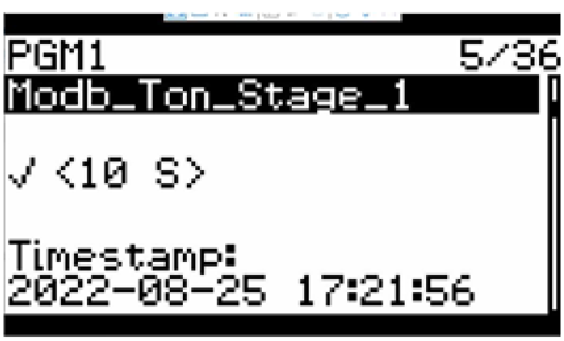
Timer_Step_Compressor_On:

This parameter is intended to modify the start-up calculation time for the temperature to which the system has to be set before starting the compressor.

Parameter number 5:

Timer_Ton_Stage_1:

The purpose of this parameter is to modify the time at which the compressor will turn on whether 1 or 2 stages are configured.



Parameter number 6:

Timer_Stop_Compressor_By_Switch:

The purpose of this parameter is to modify the time it takes for the power button to initiate the shutdown sequence after switching off.

Parameter number 7:

Timer_Step_Compressor_Off:

With this parameter you can modify the stop time of the compressor after the power button has been pressed off.

Parameter number 8:

Timer_Stop_Fan:

With this parameter you can modify the fan off time after the power off button has been activated to completely stop the system.

Parameter number 9:

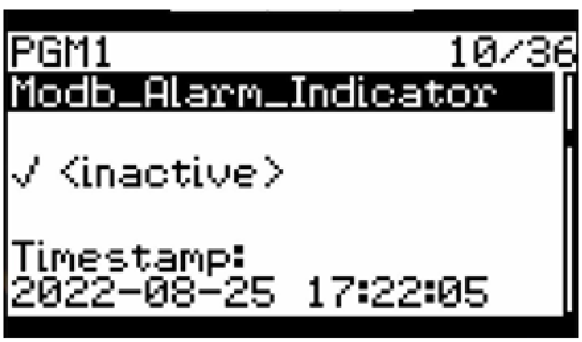
Timer_Stop_Pump:

This parameter is intended to modify the water pump shutdown time after the power off button has been activated to completely stop the system.

Parameter number 10:

Alarm_Indicator:

The purpose of this parameter is to indicate if there is an active alarm, in this case the value of this alarm is currently set to deactivated, but at any time an alarm occurs it will change to activated.



Parameter number 11:

Reset_Alarm:

This parameter has the purpose of deleting the alarms that are active, for this case it is currently deactivated to activate it simply press the dial and turn it clockwise to change it to active mode, after it changes to active mode press the dial again and turn it counterclockwise to change it to inactive mode.

It must be considered that in case an alarm is present and has not been deleted this procedure will not work, so you will have to check in the alarms section the alarm number that the system presents so that it can be deleted.

Parameter number 12:

Switch_OnOff_Logical:

With this parameter you can change the N.O or N.C direction of the power switch located on the front of the panel to change the value of this parameter simply press the dial and turn the dial to the right until the active value changes or in case you want to deactivate the parameter simply turn the dial to the left and you have to change the value to inactive in any of the two values you want simply press the dial to save the value.

Parameter number 13:

Switch_LowPressure_Logical:

This parameter has the purpose of changing the N.O or N.C direction of the low pressure switch, to change the value of this parameter simply press the dial and turn the dial to the right until the active value changes or in case you want to deactivate the parameter simply turn the dial to the left and change the value to inactive in any of the two values you want simply press the dial so that the value is saved.

Parameter number 14:

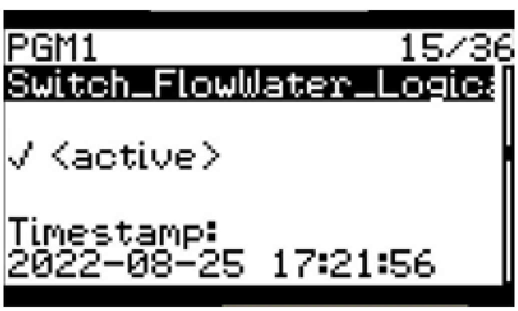
Switch_HighPressure_Logical:

This parameter has the purpose of changing the N.O or N.C direction of the high pressure switch, to change the value of this parameter simply press the dial and turn the dial to the right until the active value changes or in case you want to deactivate the parameter simply turn the dial to the left and change the value to inactive in any of the two values you want simply press the dial so that the value is saved.

Parameter number 15:

Switch_FlowWater_Logical:

The purpose of this parameter is to change the N.O or N.C direction of the water flow switch, to change the value of this parameter simply press the dial and turn the dial to the right until the active value changes or in case you want to deactivate the parameter simply turn the dial to the left and change the value to inactive in any of the two values you want simply press the dial so that the value is saved.



Parametr numbre 16:

Switch_OnOff_Value:

With this parameter you can see the current value of the on/off switch input of the system.

Parameter number 17:

Switch_LowPressure_Value:

This parameter shows the current value of the low pressure switch input.

Parameter number 18:

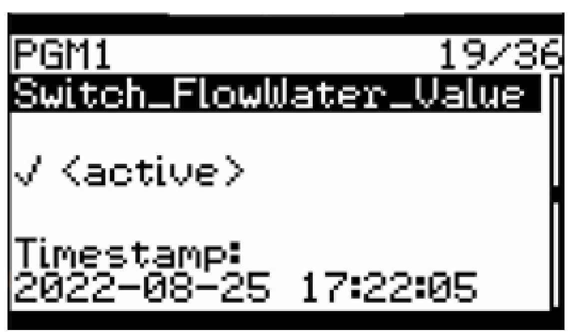
Switch_HighPressure_Value:

This parameter shows the current value of the high pressure switch input.

Parameter number 19:

Switch_FlowWater_Value:

This parameter shows the current value of the water flow switch input.



Parameter number 20:

Switch_Min_Setpoint_Cool_Value:

This parameter allows changing the minimum system cooling setpoint.

Parameter number 21:

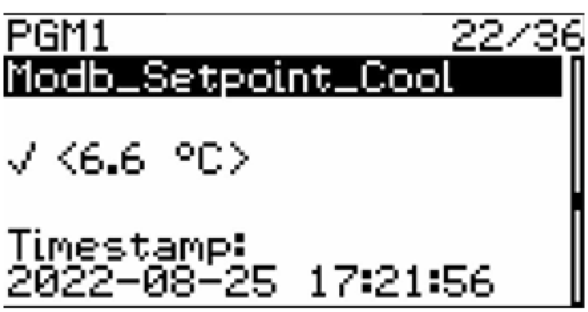
Switch_Max_Setpoint_Cool_Value:

This parameter allows changing the maximum system cooling setpoint.

Parmeter number 22:

Switch_Setpoint_Cool_Value:

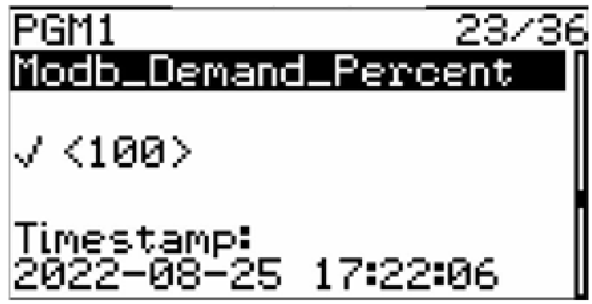
This parameter allows changing the system cooling setpoint.



Parameter number 23:

Demand_Percent:

This parameter shows the current workload capacity of the compressor in its default is handled from zero to 100 in case the system is with a 2-stage compressor this will calculate the percentage at which the first and second compressor should turn on their due stages.



Parameter number 24:

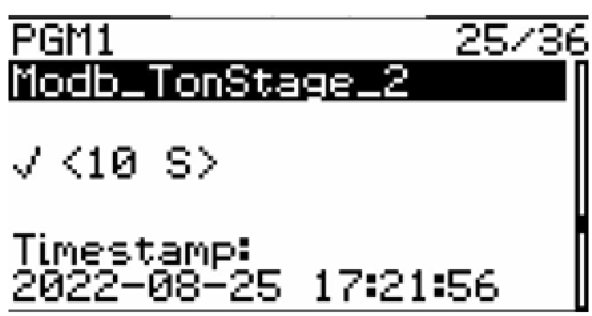
Number_Stages:

This parameter allows you to change the configuration as the system will work depending on the number of compressors in this case Cliv equipment has a two-stage compressor for which the parameter is with a value of 2.

Parameter number 25:

Ton_Stage2:

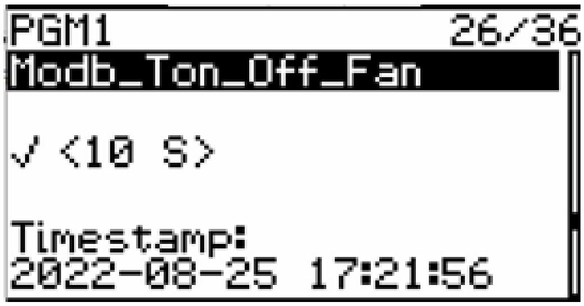
The purpose of this parameter is to modify the time at which the compressor will turn on whether 1 or 2 stages are configured.



Parameter number 26:

Ton_Off_Fan:

This parameter is used to change the fan off time during the compressor operation.



Parameter number 27:

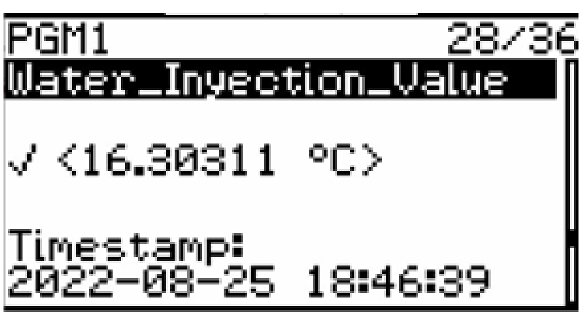
Diff_Temp:

This parameter allows changing the temperature band at which the system will be working.

Paramter number 28:

Water_Inyection_Value:

This parameter is used to display the temperature at which the injection temperature sensor is registering.



Parameter number 29:

Water_Return_Value:

This parameter is used to display the temperature at which the Return temperature sensor is registering.

Parameter number 30:

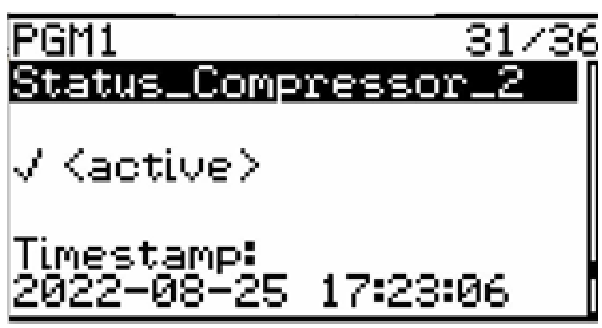
Status_Compressor_1:

This parameter is used to display the status of compressor 1.

Parameter number 31:

Status_Compressor_2:

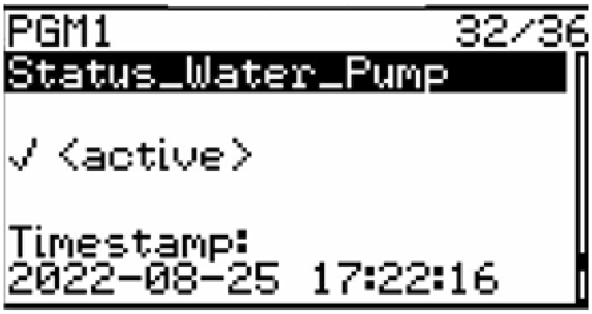
This parameter is used to display the status of compressor 2.



Parameter number 32:

Status_Water_Pump:

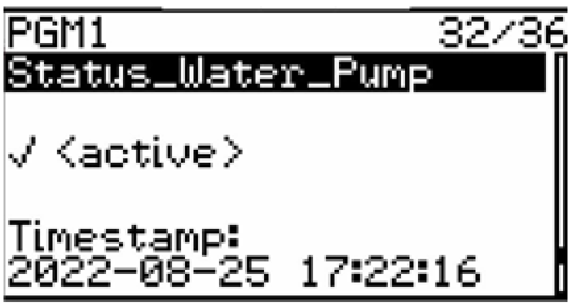
This parameter is used to display the status of the water pump.



Parameter number 33:

Status_Fan:

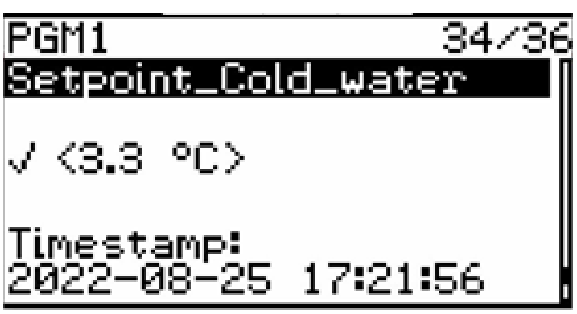
This parameter is used to display the status of the fan.



Parameter number 34:

Setpoinr_Cold_Water:

This parameter is used to change the setpoint of the ice water alarm.



Parameter number 35:

Remote_Enabled:

The parameter allows enabling remote power-up in case an external communication with another controller is required.

Parameter number 36:

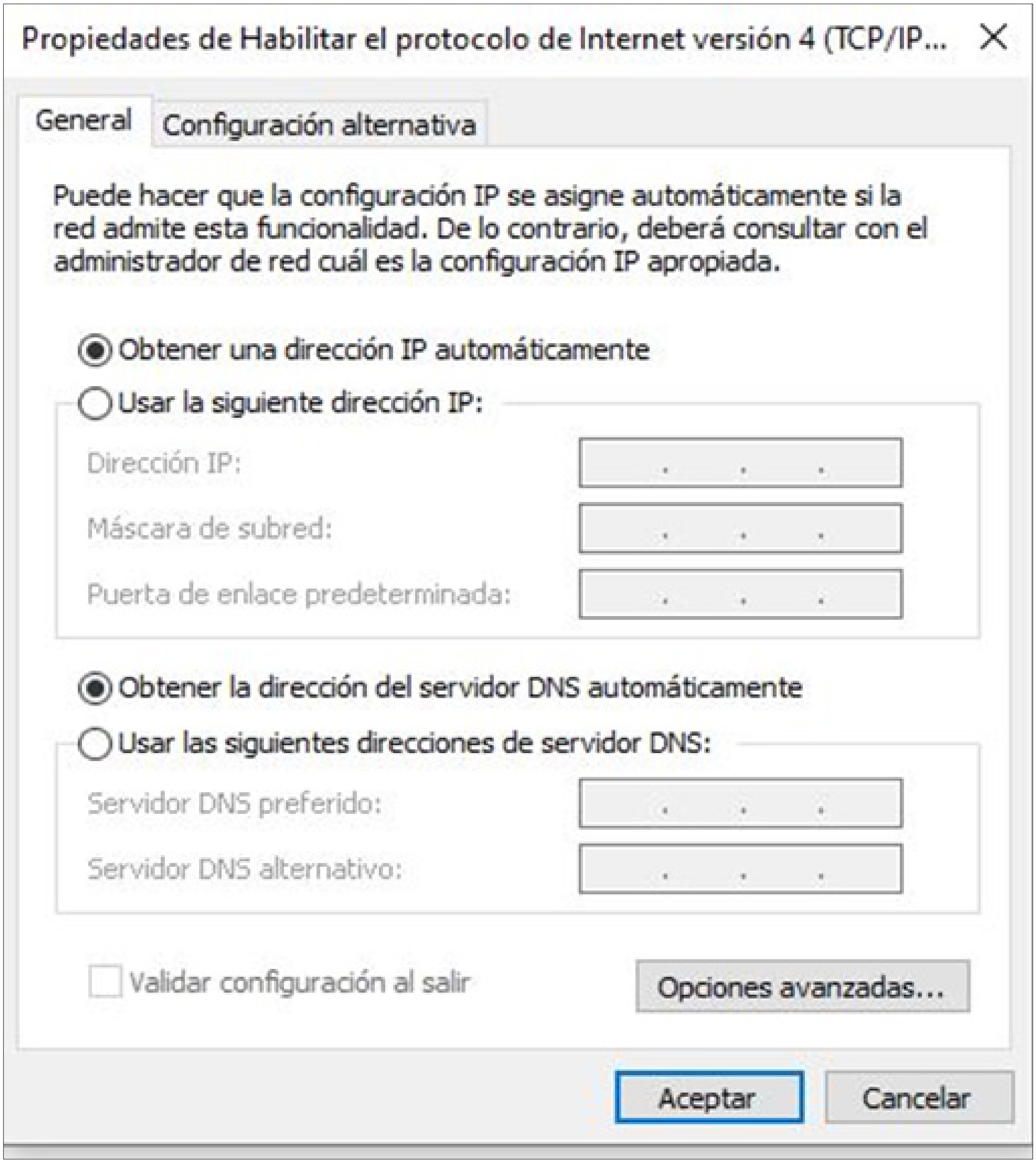
Remote_OnOff:

This parameter allows the equipment to be switched on from a remote communication signal.

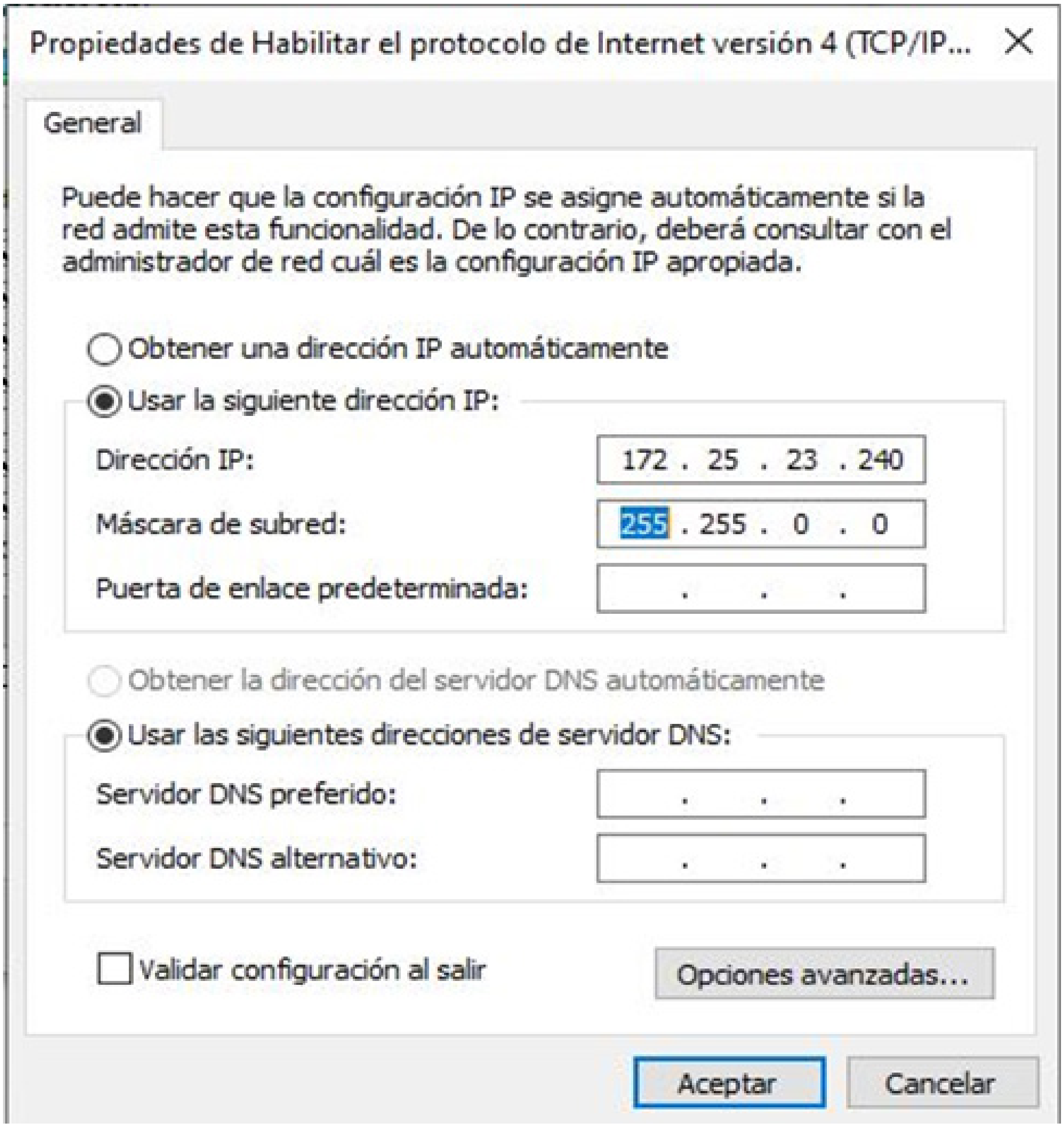
CONNECTION TO THE LOYECT DEVICE WHEN ASSIGNING A MANUAL ADDRESS

This example will show how to make a local connection to the loytec controller in order to make a direct connection to the controller through an ethernet port.

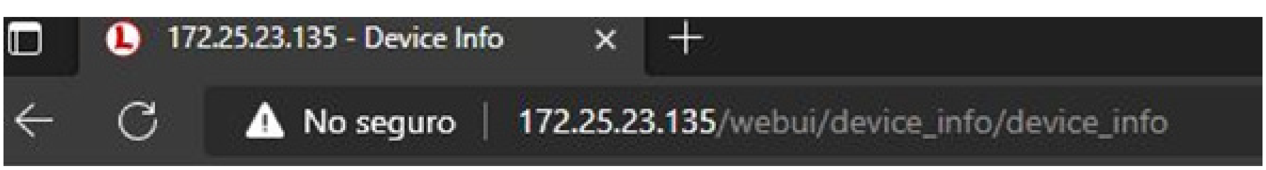
The first thing to do is to verify the address that contains the controller, this address can be seen in the main screen.
After having checked this address we proceed to configure the IP address of the computer or device to which you want to connect to the controller for this you have to go to the start menu and then control panel and access the network settings of the device as shown in the following image.



From here you have to change the IP address and once this procedure is done, you will be able to open a web browser, either Firefox, Internet Explorer or another favorite search engine.

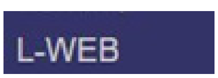


Once the web browser is opened, the address containing the controller is typed in the address bar. To do this, simply observe the address of the controller on the main screen and then type it in the navigation bar as shown in the image.

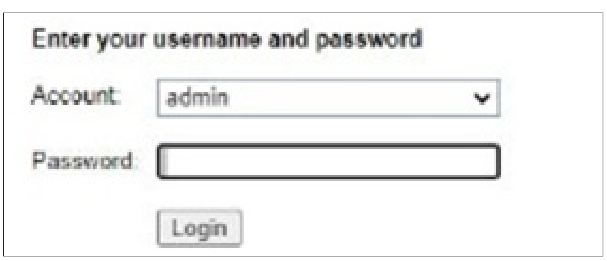


Once the previous step has been completed, a page with the following menus will appear in the web browser as shown in the following image.

Viewing the page we access the LWEB menu.



After clicking on the LWEB option a user and password selection menu will appear, to access this submenu the user is: operator and the password: operator and click on login.



Next, it will ask again for the user: operator and password: operator.

From here you will be able to access the diagnostic page of the unit, within this manual a brief explanation of the components of the unit's work and diagnostic visualization page will be given.

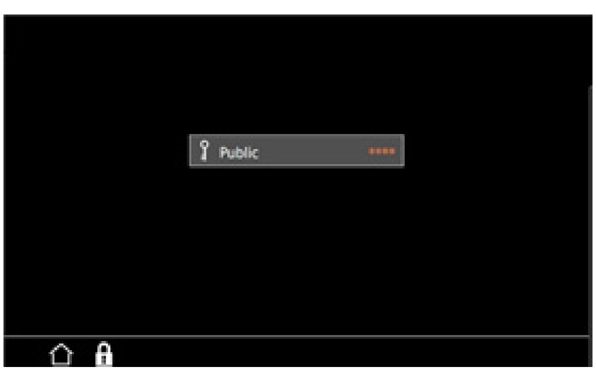
Después de acceder por medio del usuario y la contraseña dar click a siguiente icono.

USE OF LWEB DIAGNOSTIC INTERFACE FOR CLIV EQUIPMENT

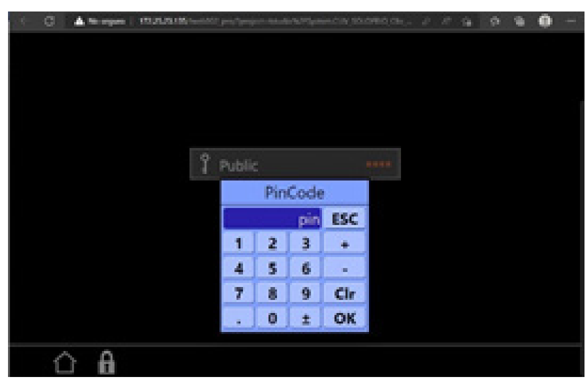
The interface that contains the CLIV equipment has the objective to see more detailed temperatures and operation of the equipment in inputs and outputs.
Once the previous steps have been completed, a home screen will appear with the equipment description and an access button to enter the equipment monitoring.

Pressing the button as shown in the image “Go to Controls Page” will take you to a login menu.

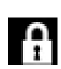
Once the previous step has been completed, access will be requested to enter the Cliv equipment control monitoring page.



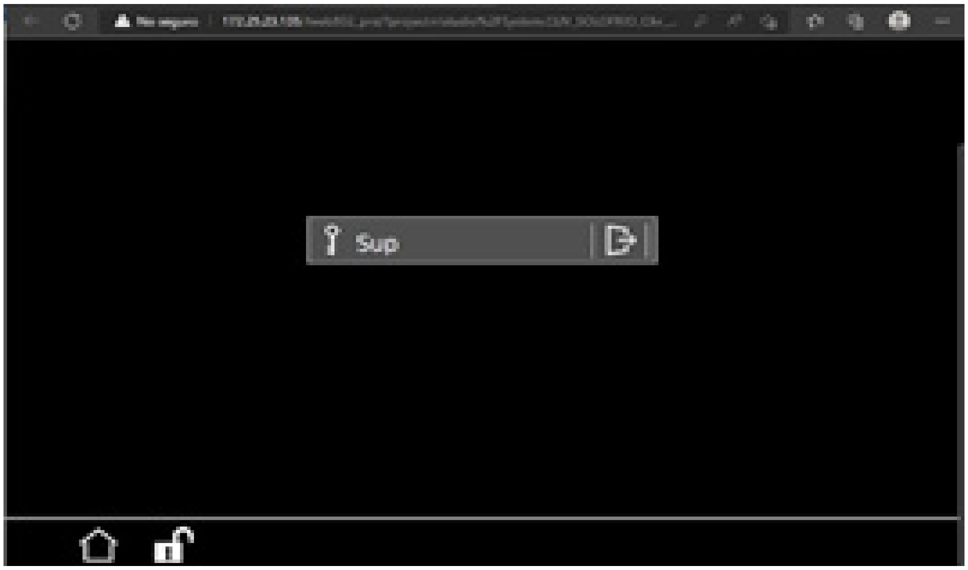
By clicking on the key logo you will be able to access a virtual keyboard which will ask for access to enter the controls page as shown in the following image, the access to the equipment is: **1234.**



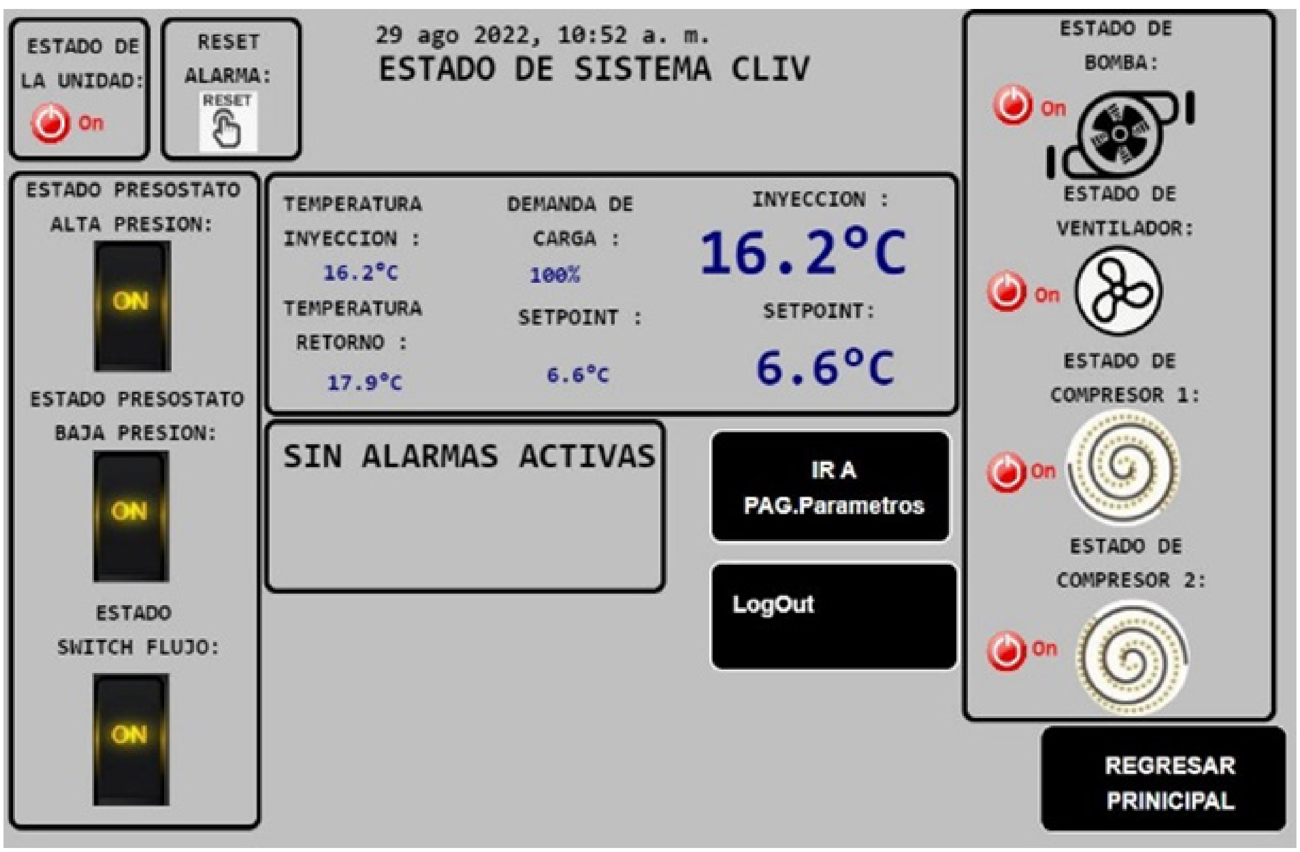
Once the access pin is set, the closed padlock icon will change to an open padlock icon if the pin does not correspond to the correct pin it will not change.

 Closed padlock icon.  Open padlock icon.

Once the above procedure is completed, click on the open padlock icon, once this icon is clicked, the controls screen will start.



Once the previous step is completed, the system status control screen can be accessed. This screen includes controls such as digital input status, digital output status and the current temperatures at which the system is working, in this case the controls here are merely representative and serve as information about the system status.



PRE-START-UP CHECKLIST

The following data should be checked before putting the unit into operation.

Date:	
Place of Work:	
Location:	
Installing Contractor:	
Technician/Company:	
Unit Commissioning:	
Unit model:	
Serial number:	

PHYSICAL INSPECTION (BEFORE ELECTRICAL CONNECTION)

Check that the unit has not been damaged by handling or transport.	
Visually check for refrigerant leaks.	
Open the unit for hydraulic installation only. Do not remove the connection guards until the hydraulic circuit is closed.	
Check for foreign objects in the fan discharge.	
Check that the air inlet is not obstructed and has the suggested clearance.	

NOTE: Accessories such as thermometers, pressure gauges, measuring ports, etc., are recommended but not necessary for the operation of the unit. Are recommended but not necessary for the operation of the unit.

INSPECTION OF THE HYDRAULIC CIRCUIT

Date:	
Place of Work:	
Location:	
Installing Contractor:	
Technician/Company:	
Unit Commissioning:	
Unit model:	
Serial number:	

It is necessary to install a water filter in all hydraulic circuits to prevent the entry of solid particles, these must be installed on the return side of the circuit and must be cleaned once the initial system load is finished.

Check that the water filter is clean.	
Check that all service valves are open.	
Check the correct structure of the water supply.	
Check that all pipes are filled with water and that air has been evacuated.	
Check thermometers (not included from factory).	
Check the pressure gauges (not included in the delivery).	

⚠ WARNING ⚠
If the hydraulic circuit contains air, it may compromise the operation of the unit.

CHECKING THE ELECTRICAL SOURCE

Verify that the circuit breaker is of the correct rating for the unit.	
Check that all electrical connections are secure.	
Check for false ground contacts as well as all wiring.	
Check the internal control and power connections.	
Measure voltage on all units, ground, neutral and 3-phase line.	
Check that motor overload protection conforms to design requirements and is in automatic mode.	
Check voltage (*Motor save), which is set to supply the correct supply voltage for the unit.	

* The percentage of unbalance of the power supply must be calculated with the following formula, and adjusted with the UNBALANCE command.

UNBALANCE PERCENTAGE = [(MAXIMUM AVERAGE DEVIATION) / (AVERAGE)] X (100)

DIAGNOSTIC LIGHT INDICATORS (LED STATUS)	
Regular operation	Evergreen
Delayed start	Flashing green
Reverse phase	Flashing red
Phase unbalance	Red in lapses
High/low voltage	Constant red

NOTE: The units are factory set, however the power supply may vary in each installation and due to this imbalance must be adjusted prior to start-up in order to protect the motors and electrical components of all units.

INSPECTION OF THE CONTROL PANEL

Check that the control panel is free of foreign objects.	
Power supply unit with three-phase electrical current.	
Phase unbalance should be less than 2% of average.	
Turn on each fan to ensure proper rotation.	
Turn on the water pump (if applicable) to make sure it is running.	

After completing the inspection of the above installation points and ensuring that all elements of the unit are correct, the unit can be powered up. Turn the switch on the CONTROL UNIT to the ON position to power the control unit with 24 volts.

START-UP

After powering up the controller, wait 5 minutes for the unit to be ready to operate.
The operating sequence will begin by checking all pre-programmed safety points on the unit. If all required conditions are correct, the unit will be ready to start operations.

UNIT CONTROL

To start operations, turn the ON/OFF switch to the ON position.
After 6 seconds, the control will command the pump to start.
If water flow is detected in the piping, the internal sequence of the unit will start.

NOTE : After completing the inspection of the above installation points and making sure that all elements of the unit are correct, the unit can be turned on. Turn the switch on the CONTROL UNIT to the ON position to power the control panel with 24 volts.

UNIT CONTROL	• To start operations, turn the ON/OFF switch to the ON position.
	• After 6 seconds, the control will command the pump to start.
	• If water flow is detected in the piping, the internal sequence of the unit will start.
ON / OFF	• On / Off

MAINTENANCE

Service or maintenance of these units should be performed by experienced personnel with specific refrigeration training. Safety devices should be checked repeatedly and cycling control components should be analyzed and corrected before resetting is initiated.

The simplified design of the refrigeration circuit totally eliminates potential problems during regular operation of the unit. No maintenance is required on the refrigeration circuit as long as the unit is operated on a regular basis.

Ease of maintenance has been considered during the design phase; thus, the unit is easily accessible for service and maintenance. By accessing the panel located on the front of the unit, service and maintenance of the unit can be performed easily.

The electrical components are located in the terminal box on the top of the front panel, which allows easy access to them.

Under normal circumstances, this water chiller only requires a check and cleaning of the air inlet through the coil surface. This can be done on a monthly or quarterly basis depending on the environment in which the units are installed.

When the environment is constantly invaded with grease or dust particles, the coils should be cleaned by an air conditioning service technician on a regular basis to ensure adequate cooling capacity and therefore efficient operation of the unit. The regular life span of the unit can be shortened if proper service is not performed.

For consistent durability and performance of the unit, proper maintenance should always be performed on a regular basis.

During extended periods of operation, the heat exchanger will become fouled, impairing the effectiveness and reducing the units performance. Consult your local supplier regarding the cleaning of the heat exchanger.

The internal water circuit does not require major maintenance or service, except for water pump failure. It is recommended that the water filter be checked regularly and replaced if it is dirty or clogged.

Always check the water level in the system to protect the moving components in the hydraulic kit from overheating and excessive wear.

NOTE: The company is not responsible for the malfunction of the unit if the main cause is lack of maintenance or the operating conditions of the unit do not correspond to those recommended in this manual.

GENERAL

Routine checks and maintenance should be performed during initial operation as well as periodically during start-up. These include verification of liquid lines, condensation and suction pressure measurements, as well as checking the unit for normal overheating and undercooling. A maintenance schedule is recommended at the end of this section.

COMPRESSOR MAINTENANCE

The internal pressure and surface temperature of the compressor are DANGERs and can cause permanent injury.

Operators, installers and maintenance personnel require proper skills and tools.

Tube temperatures can exceed 100°C and cause severe burns.

Perform periodic service inspections to ensure system reliability.

To avoid system-related compressor problems, periodic maintenance is recommended:

- Verify that safety devices are operational and properly configured.
- Make sure that the system is airtight.
- Verify compressor current consumption.
- Confirm that the system is operating in a consistent manner, check previous maintenance records and environmental conditions.
- Verify that all electrical connections are properly tightened.
- Keep the compressor clean and verify the absence of rust and oxidation on the compressor, frame, tubing and electrical connections.

ELECTRICAL TERMINALS

Electrical connections should be inspected and tightened if necessary. Heat and vibration can cause connections to loosen and fall out, thus causing arc flash stress.

For servicing electrical components:

- Disconnect main power lines before repairing or replacing any components or cables.
- Tighten all wire connections attached to the terminal block and/or components.
- Check connectors, cables and/or components for burn marks, frayed wires, etc. If any of them present these conditions, they should be repaired. or replaced.
- The voltage on the equipment should be checked with a meter periodically to ensure adequate power supply.

NOTE: Each unit comes with complete wiring. Have the diagrams handy when making connections. Electrical connections required at the time of installation are: Power line to power inlet and control wiring for the remote control. Do not wire the remote control with high voltage wires. High voltage may interfere with the control signals and/ or may cause erratic or poor operation.

⚠ WARNING ⚠

Risk of electric shock, can cause injury and death.

Disconnect all power sources before inspecting the fan.

Disconnect all electrical power sources when working inside the unit. Potentially lethal voltages exist within the equipment during operation.

Review all cautions and WARNINGs contained in this manual. Only qualified personnel should service this unit.

CONDENSER

Maintenance consists mainly of removing dirt and debris from the outer surface of the fins and repairing any damage to them. For units installed in corrosive environments, cleaning of the fins should be part of the regular maintenance program.
In this type of installation, dust and debris should be removed promptly to avoid build-up that will interfere with the regular operation of the unit.

⚠ WARNING ⚠

Risk of electric shock, may cause injury and death.

Risk of serious injury. Fan may start up and cause injury. Disconnect all power sources before inspecting the fan.

FILTER DRIER

Any particles from the condenser piping, compressor or various components are swept by the refrigerant into the liquid line and trapped by the filter drier.
It is recommended that the filter drier be replaced each time a refrigerant line repair is performed.

EXPANSION VALVE

The function of the expansion valve is to maintain adequate supply of refrigerant to the evaporator. This is in order to satisfy the charge conditions.
Before adjusting the superheat, verify that the unit charge is correct and that the liquid line is completely full and free of bubbles, and that the circuit is operating under stable load conditions The superheat suction for the evaporator suction discharge is factory set for 10°F.

⚠ WARNING ⚠

Risk of explosive discharge of refrigerant at high pressure. This can cause personal injury or equipment damage. Never loosen refrigerant or electrical line connections until the compressor has been depressurized on both sides.

ANNUAL MAINTENANCE SCHEDULE

Before performing any work on the unit, make sure you have the proper Personal Safety Equipment (EPS), and that the unit is turned off and idle. It is also recommended that the unit be turned on 24 hours prior to first start-up to begin warming up the compressor crankcase.

HYDRAULIC MAINTENANCE													
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cleaning of the hydronic circuit filter, if present.	Plan	x	x	x	x	x	x	x	x	x	x	x	x
	Real												
Visual inspection of all water pipes for leaks.	Plan	x	x	x	x	x	x	x	x	x	x	x	x
	Real												
Replacing the water in the hydronic circuit.	Plan	x	x	x	x	x	x	x	x	x	x	x	x
	Real												

ELECTRICAL MAINTENANCE													
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Re-tighten connectors and terminals on the electrical panel, control parts, power and junction boxes (quarterly).	Plan	x			x			x			x		
	Real												
Physical inspection of all electrical panel connectors and relays (monthly).	Plan	x	x	x	x	x	x	x	x	x	x	x	x
	Real												
Check amperage of all electric motors, compare them according to the equipment nameplate for anomalies (quarterly).	Plan	x			x			x			x		
	Real												
Physically check for false contacts (Monthly).	Plan	x	x	x	x	x	x	x	x	x	x	x	x
	Real												
Check the adjustment and condition of electrical protections and fuses; these must be under the manufacturer's specifications (Twice a month).	Plan	x		x		x		x		x		x	
	Real												
Cleaning of the electrical panel (monthly).	Plan	x	x	x	x	x	x	x	x	x	x	x	x
	Real												

PHYSICAL INSPECTION													
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cleaning the condenser with pressurized water (twice a month).	Plan	x		x		x		x		x		x	
	Real												
Check refrigerant pressure (quarterly).	Plan	x			x			x			x		
	Real												
Inspection of fan blades, cleaning of blades (Quarterly).	Plan	x			x			x			x		
	Real												
Compressor power consumption check to determine refrigerant loss (quarterly).	Plan	x		x		x		x		x		x	
	Real												
Compressor oil inspection (monthly).	Plan	x	x	x	x	x	x	x	x	x	x	x	x
	Real												
Review and cleaning of equipment interior (Bimonthly).	Plan	x		x		x		x		x		x	
	Real												
Review of the condensate drain line, it must not be obstructed (Quarterly).	Plan	x			x			x			x		
	Real												
Review of alarm history (monthly)	Plan	x	x	x	x	x	x	x	x	x	x	x	x
	Real												

Problem	Possible causes	Possible corrective actions
The compressor does not work.	Main or compressor disconnect switch open.	Switch closed.
	Damaged fuse, open circuit brakes.	Check the electrical circuit and possible short circuit, line to ground, loss of connections or motor windings causing the failure. Replace the fuse and reset the compressor brakes, only after detecting and correcting the cause of the failure.
	Thermal overloads have skyrocketed.	Overloads are self-resetting. Check supply voltage, operating amps, cycle times and mechanical operations. Allow time for automatic reset.
	Defective contactor or coil.	Replace.
	System shutdown by equipment protection devices.	Determine the type and cause of the shutdown and correct it before restarting the equipment. For example, low or high pressure, water freezing, etc.
	Does not require refrigeration.	Wait until the unit calls for cooling.
	Liquid line solenoid does not open.	Reparar o sustituir el solenoide.
	Motor electrical problems.	Check if the motor is open, shorted or bubbling.
	Loose wiring.	Check all cable joints and tighten all terminal screws.
The compressor is noisy or vibrates	Compressor running in reverse.	Check that the unit and compressor are on the correct phase of the power line.
	Inadequate piping or supports at suction or discharge.	Reposition, add or remove hangers.
	Compressor insulator bushing worn.	Replace.
	Compressor mechanical failure.	Check for possible problem in compressor failure and replace compressor.
	Low oil level.	Check the possible problem before it damages the compressor.
Alta presión de descarga.	Condenser coil dirty.	Clean the coil.
	Fan does not work.	Check the electrical circuit and the fan motor.
	Fan failure.	Check the electrical circuit and possible problems before replacing the fan motor.
	Fan motor runs in reverse.	Check that the unit and fan motor are properly supplanted by the line voltage.
	No or failed condenser caps.	Check or replace the condenser caps on the front and rear of the unit.
	No condensables in system.	Remove the non-condensables in the system and replace the charge.
Low suction pressure.	Dirty evaporator.	Backwash or chemical cleaning.
	Lack of refrigerant.	Check for leaks, repair and add necessary charge. Check liquid sight glass.
	Low water flow.	Adjust the water flow required for the equipment.
	Expansion valve malfunction or failure.	Check or replace (if necessary) valve and set proper superheat.
	Solenoid value not open.	Check circuit and possible problem of solenoid valve not opening, if necessary replace.
	Liquid line filter drier fouled.	Check pressure drop or temperature for diagnostics.
	Condensing temperature too low.	Check means of regulating condenser temperature.
	Excess oil used.	If the system has excess oil, recover and adjust by observing the sight glass on the compressor.

Troubleshooting Chart

Problem	Possible causes	Possible corrective actions
Motor overload relays or circuit breakers open.	Voltage unbalance or out of range.	Correct power supply.
	Faulty or grounded wiring on motor.	Check the electrical circuit for possible problems. Then re-place the compressor.
	Loose power wiring or faulty contactors.	Check all connections and tighten them, if necessary replace contactors.
	High condenser temperature.	See corrective steps for high discharge pressure.
Compressor thermal protection switch open.	Operation beyond design conditions.	Correct to bring conditions within allowable limits.
	Voltage range or unbalance.	Check and correct.
	High superheat.	Set correct superheat.
	Compressor mechanical failure.	Check for possible problem. Then replace the compressor.
	Short cycling.	Check and stabilize load or correct control settings for the application.
Compressor oil level too high or too low.	Low oil level.	Check superheat, if necessary add oil.
	Insufficient water flow - level too high.	Correct the flow, check the superheat.
	Solenoid valve return oil not open.	Check circuit, if necessary replace solenoid valve.
	Short cycling.	Check and stabilize load and correct control settings for application.
	Excess liquid in crankcase - level too high.	Check crankcase heater. Check operation of liquid line solenoid value.
	Level too high with compressor operation.	Confirm superheat is correct, remove oil.
	Operation or selection of expansion value.	Confirm superheat at minimum and maximum load conditions.
	Compressor mechanical problems.	Check for possible problem. Then replace compressor.
	Incorrect oil for application.	Check.
	Oil collapse in remote piping.	Check refrigerant piping if correction is necessary.
	Loose fitting in oil line.	Repair.
Compressor stag-ing intervals too short.	The control band is not properly adjusted.	Adjust the driver settings for the application.
	Water temperature sensor failure.	Replace.
	Insufficient water flow.	Correct flow.
	Rapid temperature or flow changes.	Stabilize load.
	Oversized equipment.	Evaluate equipment selection.
	Light loads.	Check and adjust load.
The unit will not operate.	Inadequate voltage.	Check the voltage and correct it.
	Reset switch is off.	Switch on.
	No water flow in the system.	Purge the system.
	Water flow is reversed.	Check water direction.
Equipment runs, but does not cool sufficiently.	The set temperature value is an incorrect setting.	Establish values.
	Equipment does not have enough refrigerant.	Check the data sheet and check the system for leaks.
	High condensing temperature.	Check condenser and repair.
	Equipment does not have sufficient water flow.	Check technical data, check filter in water line and adjust flow if necessary.
The fan does not work.	No supply voltage.	Check electrical circuit (line down).
	Motor defective.	Contact the manufacturer.
	Motor thermal protection switch open.	Check operating conditions, if necessary contact the manufacturer.

Air Conditioning
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