Comfort Flex®
Air Conditioning
a member of DAIKIN group

Installation, Operation and Maintenance Manual

IOM

Group: Chiller
Part Number: CLIM LC IOM
Date: 21 June 2023

CLIM LC Series
Water Cooling Unit

Model

7.5 TR to 62.5 TR

Refrigerant HFC-410A

50/60 Hz

Table of Contents

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	
Installation Location	
Customer Order Number	
Model Number(s)	
G.O. Number(s)	

Chilled Water and Condenser Water for Water-cooled Chiller	**Yes**	**No**	**N/A**	**Initials**
Piping Complete				
Water strainer(s) installed in piping per manual requirements				
Water System - flushed, filled, and vented; Water treatment in place				
Cooling tower flushed, filled, vented; Water treatment in place (if applicable)				
Pumps installed and operational (rotation checked, strainers cleaned)				
Controls operational (3-way valves, face/bypass dampers, 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				
Vent installed on evaporator				
Electrical	**Yes**	**No**	**N/A**	**Initials**
Building controls operational				
*Power leads connected to power block or optional disconnect				
Power leads have been checked for proper phasing and voltage				
All interlock writing complete and compliant with unit specifications				
Power applied at least 12 hours before startup				
Oil heaters energized at least 12 hours before startup				
Chiller components (EXV Sensors Transducers) installed and wired properly				
*Wiring complies with National Electrical Code and local codes (See NOTES)				
Miscellaneous	**Yes**	**No**	**N/A**	**Initials**
Unit control switches all off				
Remote Evaporator / Condenser Piping factory reviewed				
All refrigerant components/piping leak tested, evacuated and charged				
Thermometers, wells, gauges, control, etc., installed				
Minimum system load of 80% capacity available for testing/ adjusting controls				
Document Attached: Technical Breakdown from Selection Software				
Document Attached: Final Order Acknowledgement				
Document Attached: Remote piping approval				

NOTES: The most common problems delaying start-up and affecting unit reliability are:
1. Field installed compressor motor power supply leads too small. Questions: Contact the local Comfort Flex sales representative*. State 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 incomplete or incorrect. Provide approved piping diagrams.
3. Items on this list incorrectly acknowledged resulting in delayed start and possible extra expenses incurred by return trips.

Contactor Representative

Singed
Name _____
Company _____
Date _____
Phone / Email _____

Comfort Flex Sales Representative

Signed
Name _____
Company _____
Date _____
Phone /Email _____

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

Our units are designed to effectively meet the HVAC needs of any project. Our units feature controls, logic routines and digital sensors that continuously monitor the system to adapt its operation to the level necessary to maintain optimal system conditions at all times, thus achieving maximum performance and energy savings in a system that is simple to operate and maintain.

NOMENCLATURE

CLIM-90-LC-C-1-N-N-D-F-N-M-N-N-0-2-S-N-D-N-4-C-0

FAMILY

CAPACITY (BTU)
090 - 90,000
120 - 120,000
150 - 150,000

TYPE
LC - Low Capacity

OPERATION
C - Cooling Only
H - Heat Pump

UNITS
1 - Stand alone
2 - 2 units
3 - 3 units
4 - 4 units
5 - 5 units

CONDENSER FAN
N - N/A

ANTICORROSION
M - Total Coating
N - None

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

COMPRESSOR
F - Fixed
V - Inverter
T - Tandem

CONDENSER
N - N/A

EXTRA
0 - TBD

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

REFRIGERANT
4 - R410-A

SKID
O - With skid
N - N/A

PACKAGING
D - Domestic
I - Internacional

HIDRAULIC CONNECTION
N - Not included
Y - Yes included

ELECTRICAL CONNECTION
M - Multipoint
S - Single Point

PIPE
2 -2½" Victaulic

GRILLS
0 - N/A

FREE COOLING
N - N/A

HEAT RECOVERY
N - N/A

PROTOCOL
M - Modbus
B - BACnet IP

EFFICIENCY

Our units are designed to efficiently meet the air conditioning needs of any project. Our units have controls, logic routines and digital sensors that continuously monitor the system to adapt its operation to the level necessary to maintain optimal system conditions at all times, thus achieving maximum performance and energy savings in a system that is simple to operate and maintain.

All temperature sensors are calibrated and adjusted at the factory prior to shipment.

The start-up of the equipment must be carried out by a qualified technician, during the initial start-up the unit will be adjusted to the local conditions and all operating points will be checked.

Once the unit has been properly installed, the operation is a matter of pressing the digital start and stop button, until making sure that the unit works properly, after this the unit will operate automatically, turning on by itself according to the demand of the system and local conditions.

FLEXIBILITY

Through intelligent processors and digital sensors, our equipment automatically modulates the operation of the system to maintain the water temperature at optimal operating conditions.

Our equipment was designed to be coupled with each other and to be combined to satisfy different load variations (Tandem Installation). Up to 8 modules can be combined in a single installation; these combinations can be made with Water Chiller Units of different capacities ranging from 3 to 30 tons of refrigeration.

The system capacity will then vary depending on the number and type of units installed in it.

SAFETY

The structures of our units are made of galvanized steel sheet, coated with baked electrostatic powder paint (meets the ASTM-B117 1500 hour salt spray test) to ensure long durability and absence of corrosion under any weather conditions, such as direct solar light, rain and wind.

All our units are designed to fit into a reduced installation space, thus eliminating large installation areas. We only use high-quality components to ensure durability and safety, even in harsh environmental conditions.

NOTE: For applications in highly corrosive climates our units can be coated inside and out with extra protection against corrosion. Ask your sales agent for more information.

Our units have AHRI performance and efficiency certifications, and ETL safety certifications, in addition to complying with all industry safety standards.

We are members of the American Society of Air Conditioning, Refrigeration and Heating Engineers (ASHRAE).

To show our commitment to our clients and stakeholders; our equipment has a 1-year warranty after commissioning and start up.

Our units use R410A refrigerant, which is harmless to the ozone layer and the most eco-friendly option possible.

All of our units are designed and manufactured with a focus on safety, performance and quality.

DESIGN

The work carried out by our Engineering and Development department has resulted in equipment with high design efficiency and optimum performance during operation. The selection of high quality main components, our quality processes and the control system during manufacturing, guarantee a high performance and safe unit.

All main components are rigorously tested and validated before being installed. Each designed unit has undergone long hours of rigorous testing to ensure the efficiency, safety, durability and quality of the entire system.

All external paint is baked and meets the strictest quality standards (1500 hour salt spray test ASTM-B117).

The selection of high-end compressors and heat exchangers ensure the capacity and high efficiency of the unit.

Optional water pumps* are specially designed to function properly with minimal vibration and noise.

All our units have a reduced footprint, which facilitates installation and maintenance maneuvers, by being able to use stairs, doors and service elevators to move them.

* Ask your sales rep about factory integrated pump options.

COMMUNICATION

The units can be controlled independently (Individual Mode) or they may be connected to a central control unit (Tandem mode).

The operation and user access will be done through a color touch screen *

Our units can be connected / integrated through different communication protocols; such as TCP / IP, ModBUS and BacNet **, the most common protocols used in the Air Conditioning industry.

Our units keep track of all programmable variables in real time, such as load monitoring in the system, specific alarms of the refrigeration cycle, water cycle and the electrical system. As well as detection of external factors such as fire or flood (optional sensors). The control system ensures the correct operation of the equipment by monitoring in real time the condition of the major components (high or low pressure of the refrigerant and conditions of the compressor, etc.).

In case of failure, the event alarm will be recorded for later analysis, facilitating the location of a possible failure and its solution.

* Depends on the type of control.

** The communication protocols available depend on the type of control.

INSTALLATION

The units have been designed for easy and simple installation. Victaulic type (grooved) fittings provide a simple and safe way to make water the pipe connections. These connections are located on both sides of the equipment, which provides great flexibility for water connections. The individual assembly of the equipment reduces the cost of installation, the units have a rigid base that balances the weight of the unit and allows easy installation.

MAINTENANCE

The simplicity in the design of the unit allows maximum ease when performing preventive / corrective maintenance on them. All major components are available to the maintenance personnel by simply opening the service panels. If an emergency stop occurs, the digital control of the unit will indicate in detail the cause of the alarm, helping to facilitate and speed up its solution.

TESTING

Before leaving the factory, our units are tested multiple times. Pressure and vacuum tests are performed to detect possible leaks. Once the unit is verified to be leak free, the refrigerant is charged accurately for proper operation based on customer installation conditions. All units are evaluated and tested at full load operation, with water flow, thermal load and line voltage under the current conditions in which the equipment operates in the field.

NOTE: The warranty policy requires that the commissioning be carried out by qualified personnel authorized by the company.

INSITUM ® CORROSION PROTECTION

Spray for coating hvac/r products

Coating is a flexible, water-based, water-reducible, synthetic polymer corrosion coating designed specifically for the protection of HVAC/R coils and components. Insitu® Spray Applied Coating contains ES2 (embedded stainless steel pigment) technology, an anti-corrosion coating specifically designed for the protection of coils mounted in corrosive areas.

HVAC/R coils, components and enclosures will have a permanent water-based synthetic coating with ES2 pigment applied to all areas of the coating surface with no bridging of material between fins. Therefore, ES2 pigments are suitable for even the most corrosive environments and will maintain their appearance after many years of exposure. UV degradation ES2 pigments form a multilayer structure throughout the paint film.

This creates a barrier layer that reflects sunlight away from the paint film preventing UV rays from penetrating. As a result, UV degradation of individual polymer molecules is eliminated, film integrity is maintained and the pigment particles remain well anchored to the substrate.

The resulting smooth, hard finish prevents dirt build-up. The multilayer structure of ES2 pigments delays the passage of water molecules into the film and acts as an effective moisture barrier.

Ideal applications for Insitu® spray-applied coatings.

- Mini-splits
- Packaged enclosures
- Condensing units
- Modular air handlers
- Air-cooled chillers
- Indoor and outdoor HVAC cabinets and copper tubing
- Heat exchange coils (water, condenser, evaporator, DX)

OPERATING AND STANDBY LIMITS

Modo De Operación	Fuente EWT		Carga EWT		Temperatura Ambiente	
	Min.	Max.	Min.	Max.	Min.	Max.
Refrigeración	50°F (10°C)	104°F (40°C)	53.6°F (12°C)	86°F (30°C)	59	86
Calefacción	23°F (-°5C)	86°F (30°C)	59°F (15°C)	122°F (50°C)	59	86

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.

HANDLE

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.

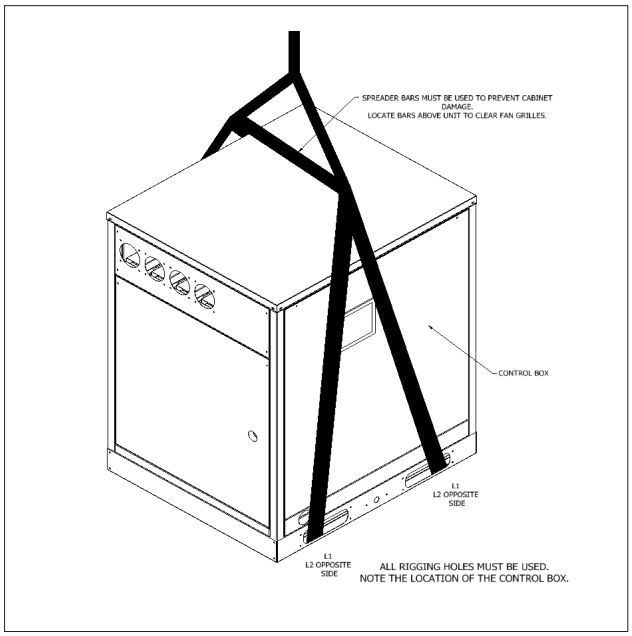
⚠ CAUTION ⚠

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.



MOUNTING

The CLIM LC series units are designed to be installed INDOORS. It is necessary that the units are installed with sufficient space around them for maintenance purposes (see figure 2). The units must be installed on a solid and well balanced base. In case it is installed on the floor, a solid cement base should be made, which slightly exceeds the area of the equipment. This base must be able to support the weight of the unit.

NOTE: The technical specification sheet of the equipment contains information on dimensions and weights per unit and tandem system.

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

The unit frame must be perfectly level during installation, if necessary insert shims under the anti-vibration mounts. If the unit will be installed in places easily accessible to people and/or animals, it is recommended to place a protection grid to prevent access.

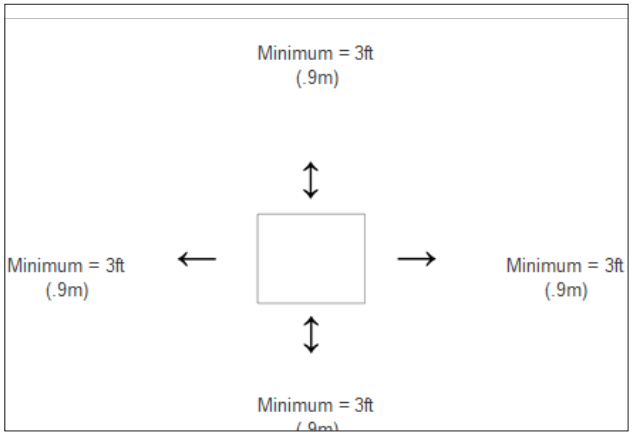
To ensure optimum performance of the unit once installed, some instructions and precautions should be followed such as:

- 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. Failure to comply with these conditions can result in increased condenser pressure which in turn can lead to poor energy efficiency and cooling capacity.

CLEANING SERVICE

The correct space dedicated for the maintenance of the equipment will allow a better installation and maintenance, facilitating the access to the service points for 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.

Figure 2. Cleaning service



⚠ CAUTION ⚠

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

COLD WATER PIPES

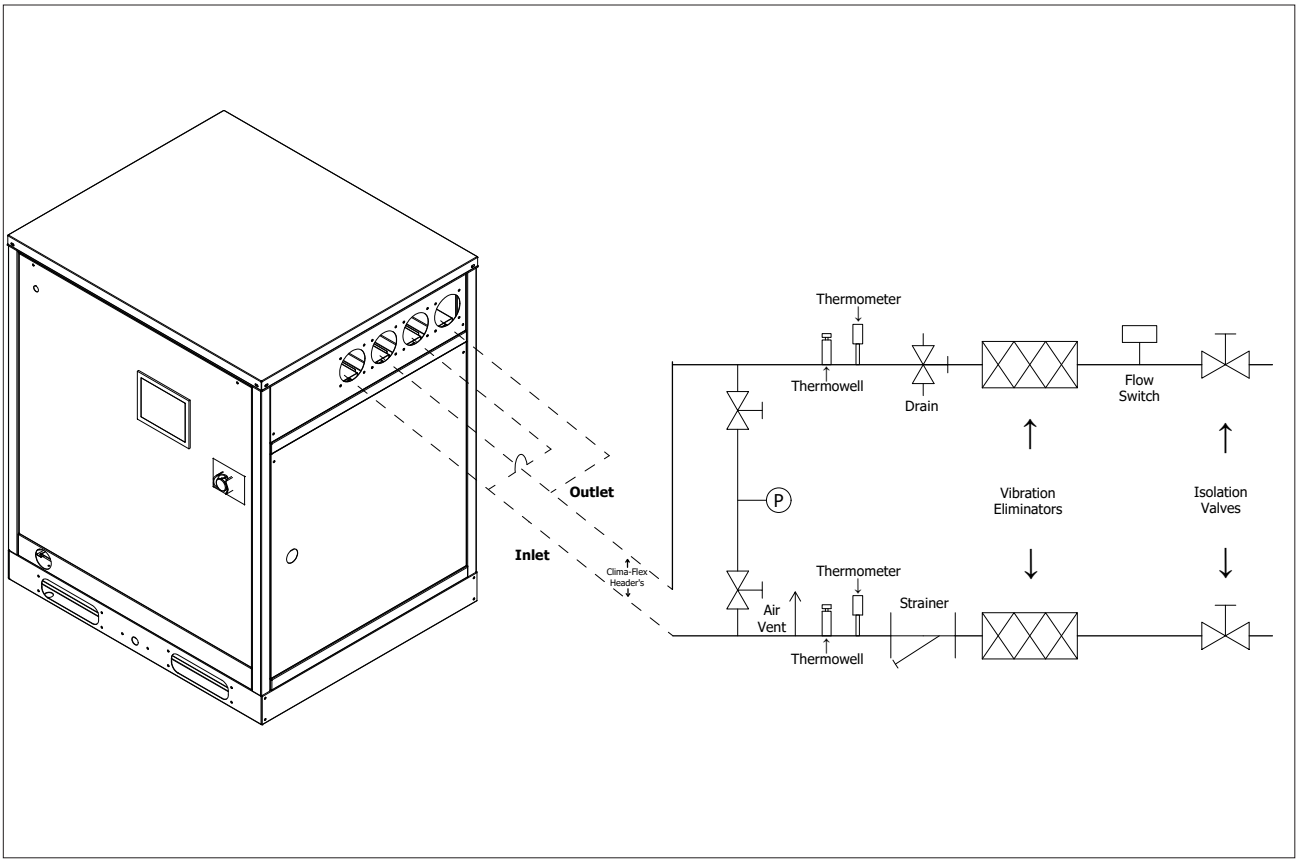
⚠ CAUTION ⚠

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.

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 on site.
- Piping for units with brazed plate evaporators should have a drain and vent connection at the bottom of the bottom connection pipe and at the top of the top connection pipe, respectively, (see Figure 3). 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 a regulating valve to maintain water pressure.
- An expansion tank and a regulating valve to maintain water pressure.
- OGS type grooved water connections (adhering to AWWA C606) optionally with flanges. PVC piping should not be used.

Figure 3. Typical piping of a brazed plate evaporator, series CLIM LC Tandem



⚠ 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.

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 the 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.

NOTE: Failure to comply with these measures may result in performance and reliability problems.

INPUT 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. A field supplied strainer that meets the specifications and installation requirements of this manual.

Strainer technical data

- **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 1⁄8⁄8 pressure gauges.**

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 may result in laminar flow leading to low pressure alarms, fouling and poor temperature control (See pressure drop on page 20).

Variable evaporator flow

Reducing evaporator flow rate in proportion to load can reduce system energy consumption. 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 chiller plant during the low-load period, and the desired cycle time for the compressors. Assuming there are no sudden loads and the chiller 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 hazard to 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. Testing and water 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.

COLD WATER PUMP

It is important that the chilled water pumps are connected to and controlled by the chiller’s microprocessor. The controller will activate the pump whenever at least one chiller circuit is enabled for operation.

This helps ensure proper start-up sequence 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 starting on page 20+.

⚠ 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 freezing temperatures or contain glycol, the chiller may be subject to catastrophic evaporator failure due to freezing.

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 20 through page 25. 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 switch that is 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 NOTE 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.

⚠ CAUTION ⚠

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

Refrigeration Schematics

Figure 4. Refrigeration schematic.

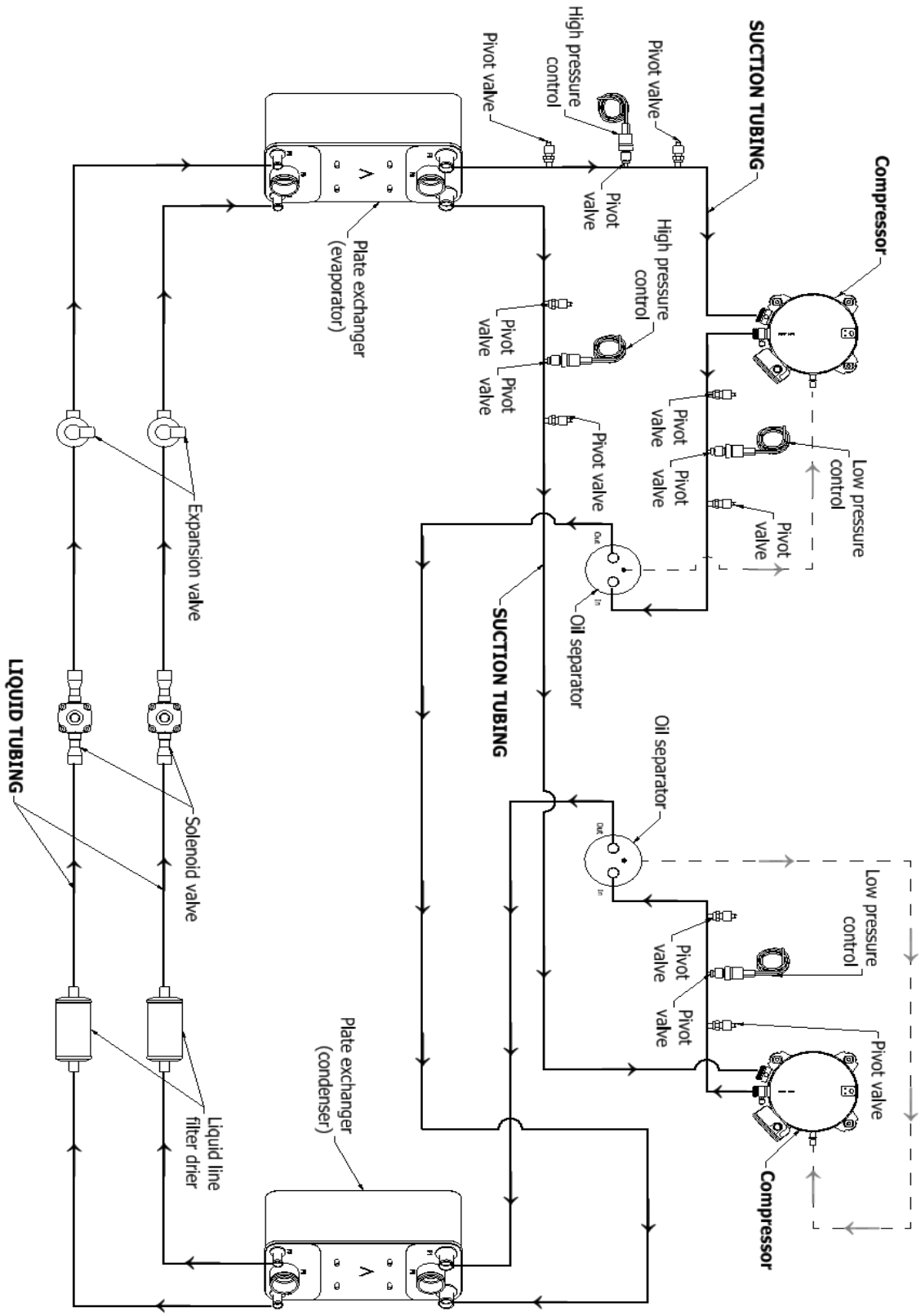
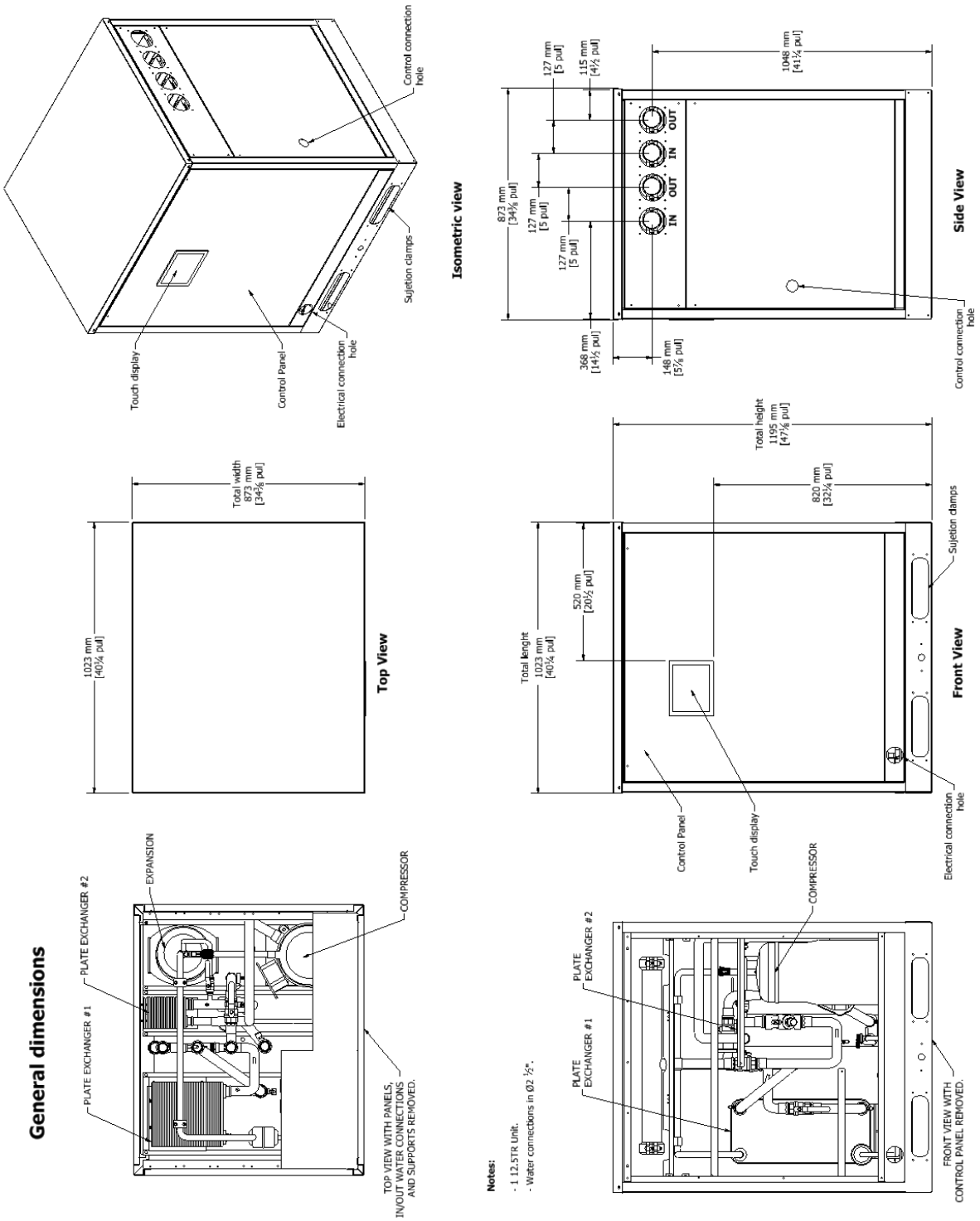
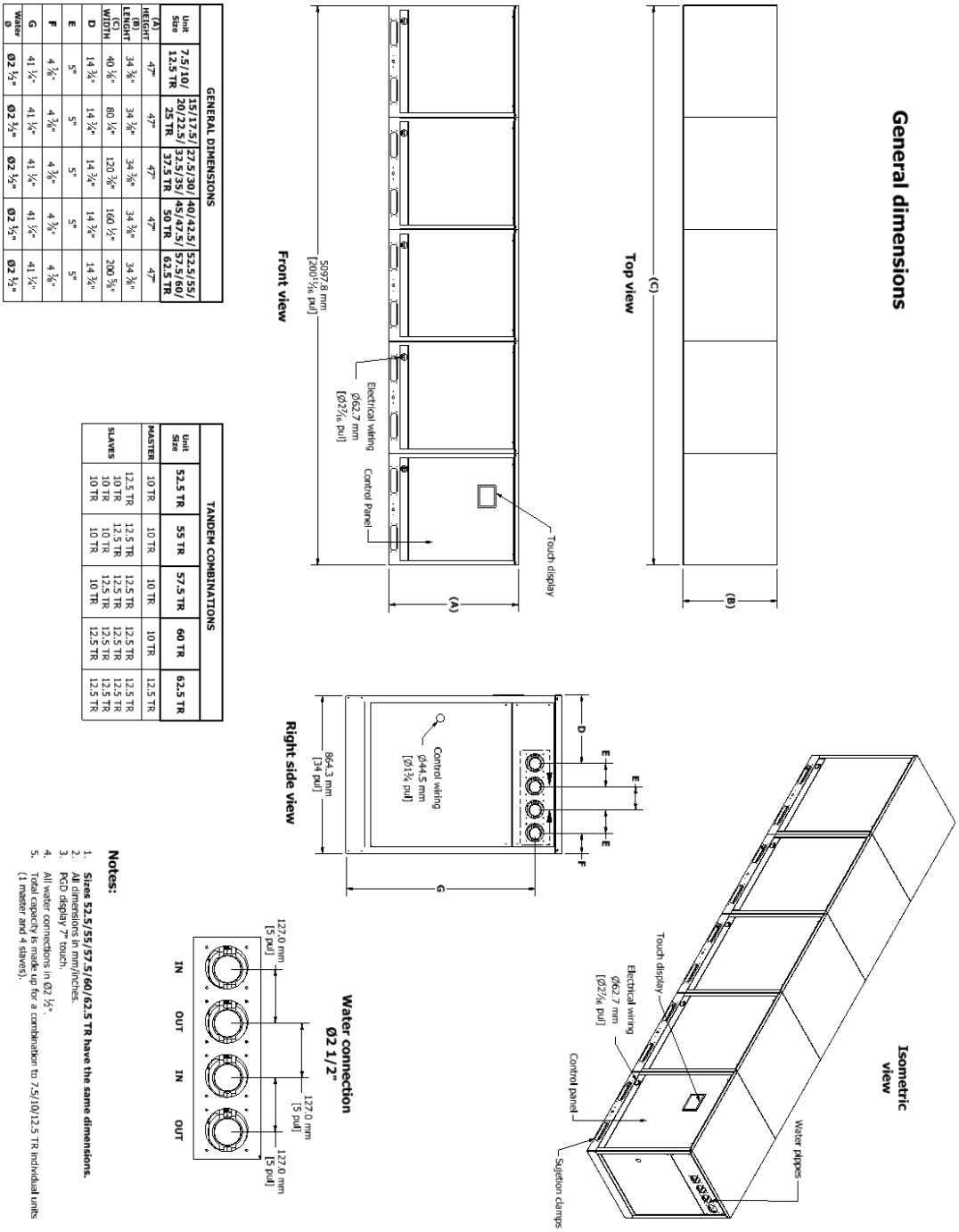


Figure 5. Dimensional configuration of the unit.



DIMENSIONS AND WEIGHTS - PACKAGED UNITS

Figure 6. Dimensional configuration of the tandem unit.



GENERAL DIMENSIONS							
Unit Size	7.5/10/ 12.5 TR	15/17.5/ 20/22.5/ 25 TR	27.5/30/ 32.5/35/ 37.5 TR	40/42.5/ 45/47.5/ 50 TR	52.5/55/ 57.5/60/ 62.5 TR		
(A) HEIGHT	47"	47"	47"	47"	47"		
(B) LENGHT	34 ⅜"	34 ⅜"	34 ⅜"	34 ⅜"	34 ⅜"		
(C) WIDTH	40 ⅛"	80 ⅛"	120 ⅜"	160 ½"	200 ⅝"		
D	14 ¾"	14 ¾"	14 ¾"	14 ¾"	14 ¾"		
E	5"	5"	5"	5"	5"		
F	4 ⅜"	4 ⅜"	4 ⅜"	4 ⅜"	4 ⅜"		
G	41 ¼"	41 ¼"	41 ¼"	41 ¼"	41 ¼"		
Water Ø	Ø2 ½"	Ø2 ½"	Ø2 ½"	Ø2 ½"	Ø2 ½"		

TANDEM COMBINATIONS					
Unit Size	52.5 TR	55 TR	57.5 TR	60 TR	62.5 TR
MASTER	10 TR	10 TR	10 TR	10 TR	12.5 TR
SLAVES	12.5 TR 10 TR 10 TR 10 TR	12.5 TR 12.5 TR 10 TR 10 TR	12.5 TR 12.5 TR 12.5 TR 10 TR	12.5 TR 12.5 TR 12.5 TR 12.5 TR	12.5 TR 12.5 TR 12.5 TR 12.5 TR

Notes:

1. **Sizes 52.5/55/57.5/60/62.5 TR have the same dimensions.**
2. All dimensions in mm/inches.
3. PCD display 7" touch.
4. All water connections in Ø2 ½".
5. Total capacity is made up for a combination to 7.5/10/12.5 TR individual units (1 master and 4 slaves).

VACUUM AND REFRIGERANT GAS CHARGING PROCEDURE

Anysystemthathasbeenexposedtotheatmospheremustbeproperly 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 pressure side (suction line) and the high pressure 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, the system can be evacuated.

This 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. After reaching 500 mice, isolate the vacuum pump and open register 3, letting the Nitrogen pass through to break the vacuum.
3. 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 microns should be obtained.

⚠ WARNING ⚠

Never disconnect the copper tube from register 3, simply loosen the connection to expurge the Nitrogen.

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 mice per minute in a single evacuation. Follow these instructions:

1. Switch on the vacuum pump and then open register 1 (Fig. 8). Subsequently, isolate the vacuum pump and open register 2.

2. When a value of less than 200 mice per second 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 (Fig. 8) 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 discharge 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 charging procedure is complete.

REFRIGERANT GAS RECOVERY

If for any reason there is a need to remove/lose the 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 vents on the condensing unit.
2. Close 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 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.

Refrigerant Charge

Table 1. Refrigerant charge.

FAMILY	RT	REFRIGERANT CHARGE		PRESSURE RANGES	
		R410A (LBS)	R410A (KG)	HIGH PRESSURE	LOW PRESSURE
CLIM LC	7.5	6	2.72	280 - 320 psi	100 - 120 psi
CLIM LC	10	7.71	3.49	280 - 320 psi	100 - 120 psi

Figure 7. Diagram to obtain vacuum and refrigerant charge.

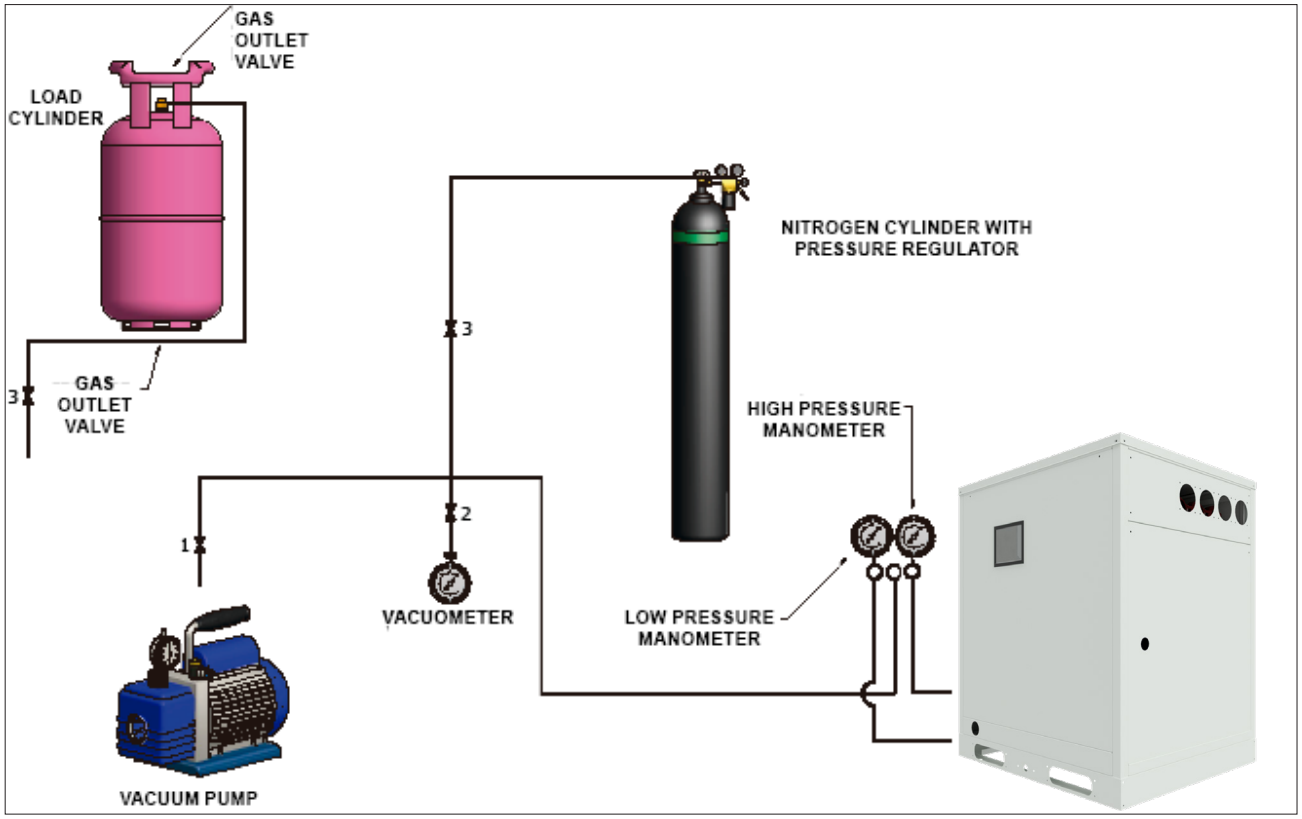
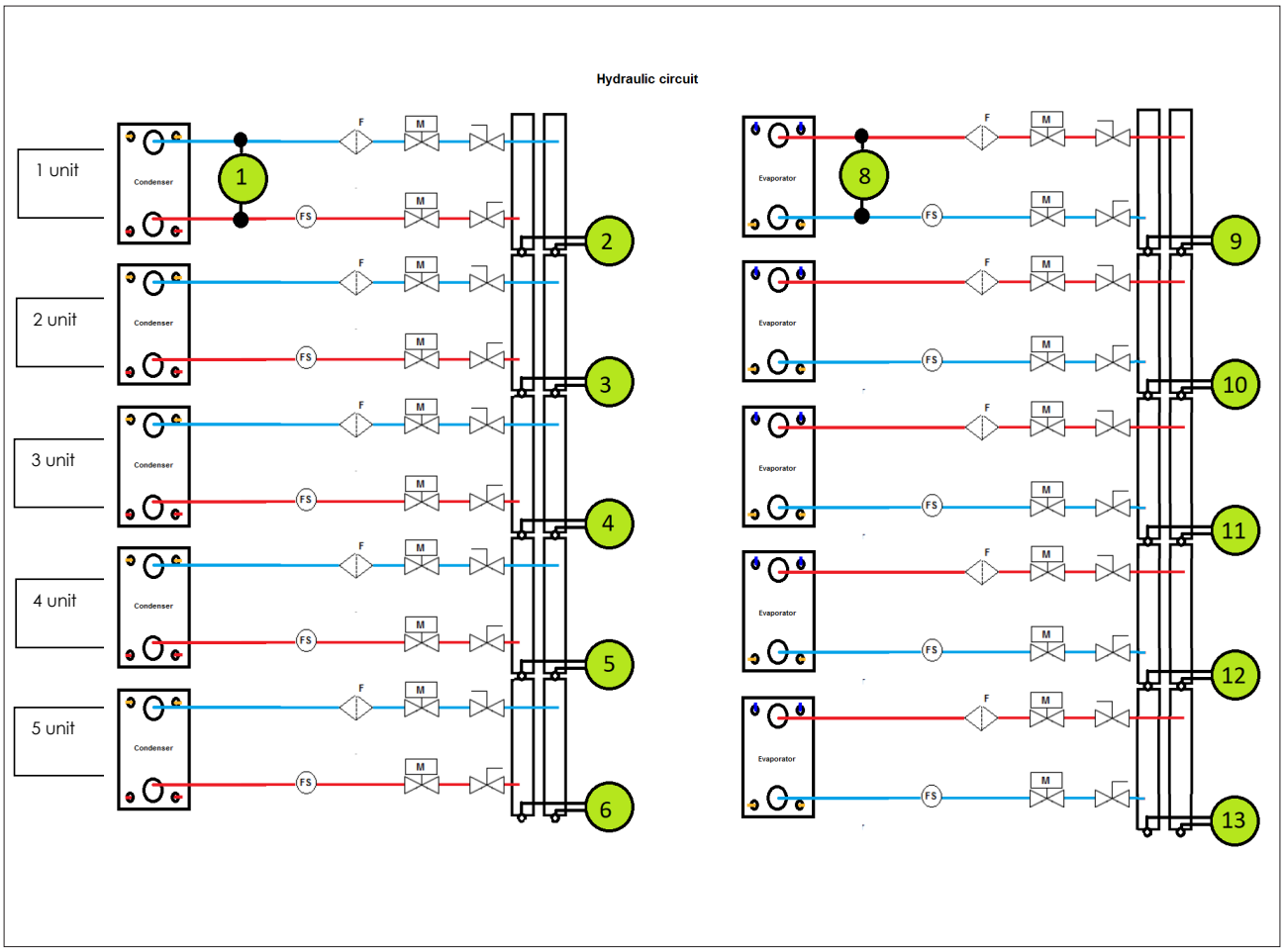


Table 2. Pressure drop data.

POINT	CONDENSER	POINT	EVAPORATOR
	DP (FT WG)		DP (FT WG)
1	6.93	8	7.1
2	31.5	9	31.65
3	31.8	10	31.8
4	32.6	11	32.59
5	34.1	12	34.08
6	36.5	13	36.48

Figure 8. Hydraulic circuit configuration.



ELECTRICAL CONNECTION

CLIM LC units can be ordered with standard multi-point power connections or with optional single-point connections and with various disconnection and circuit breaker options. The wiring inside the unit is dimensioned according to NEC®.

The required field wiring varies depending on the configuration of the unit. Refer to page 20-29 for wiring diagram information. Voltage limitations are:

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

⚠ DANGER ⚠

Wiring must be carried out by qualified and licensed electricians. There is a danger of electric shock which can cause serious injury or death.

⚠ DANGER ⚠

LOCK OUT / DISCONNECT all power sources before starting, pressurising, depressurising or shutting down the chiller. Disconnect electrical power before servicing equipment, including condenser fan motors or compressors. More than one disconnection may be required to de-energize 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 either copper or aluminium 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 aluminium 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 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 be fused or use a circuit breaker.
4. All field wiring terminal range values listed in the unit selection report apply to 75°C wire per NEC.
5. Must be grounded in accordance with national and local electrical codes.

⚠ CAUTION ⚠

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

ON-SITE GENERATOR USE

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 synchronised 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 necessary to reconnect the generator power to the mains 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 synchronised 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 ⚠

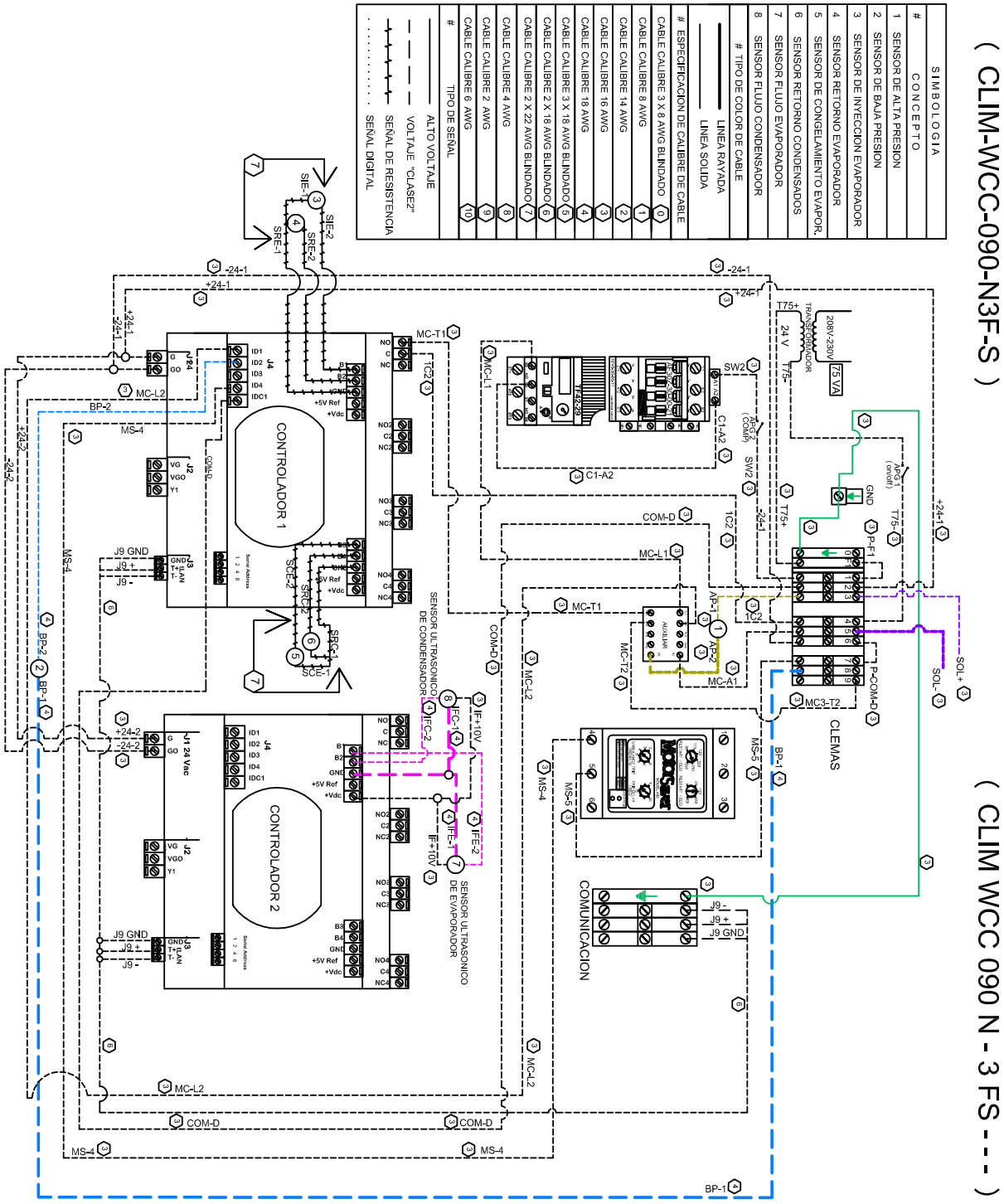
Electric shock hazard. Improper handling of this equipment can cause personal injury or damage to the equipment. This equipment must be properly grounded. Connections and servicing of the control panel should be performed only by personnel knowledgeable in the operation of the equipment being controlled. Disconnect electrical power before servicing the equipment. Be sure to install a residual current circuit breaker. Failure to install a residual current circuit breaker may result in electric shock or fire.

⚠ WARNING ⚠

Al instalar el protector diferencial asegúrese de que es compatible con el inversor (resistente al ruido eléctrico de alta frecuencia) para evitar la apertura innecesaria del protector de tierra.

ELECTRICAL DATA

Figure 9. Typical field wiring diagram of CLIM LC 7.5 TR 220V unit (multi-drop connection with all options shown)



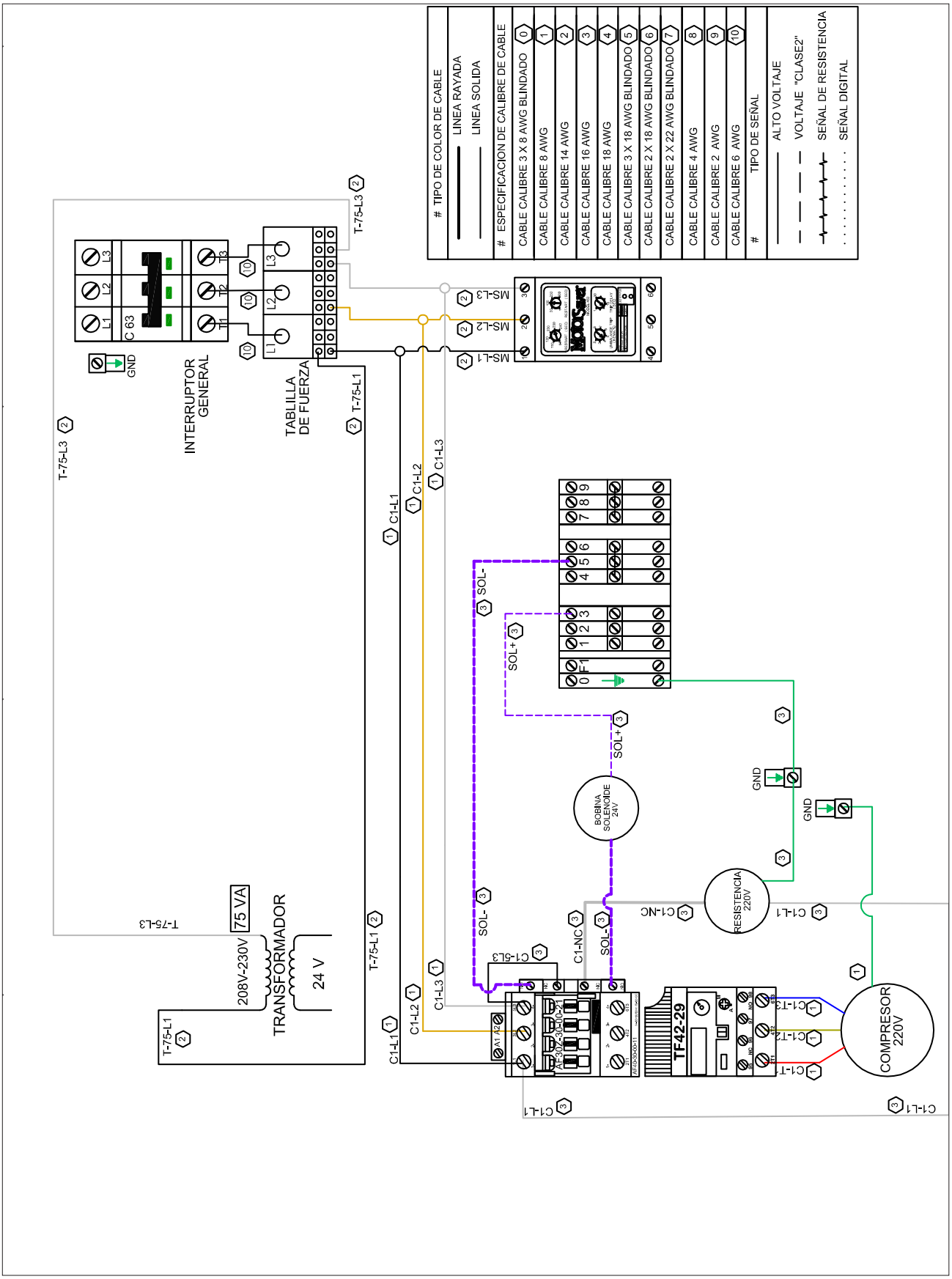
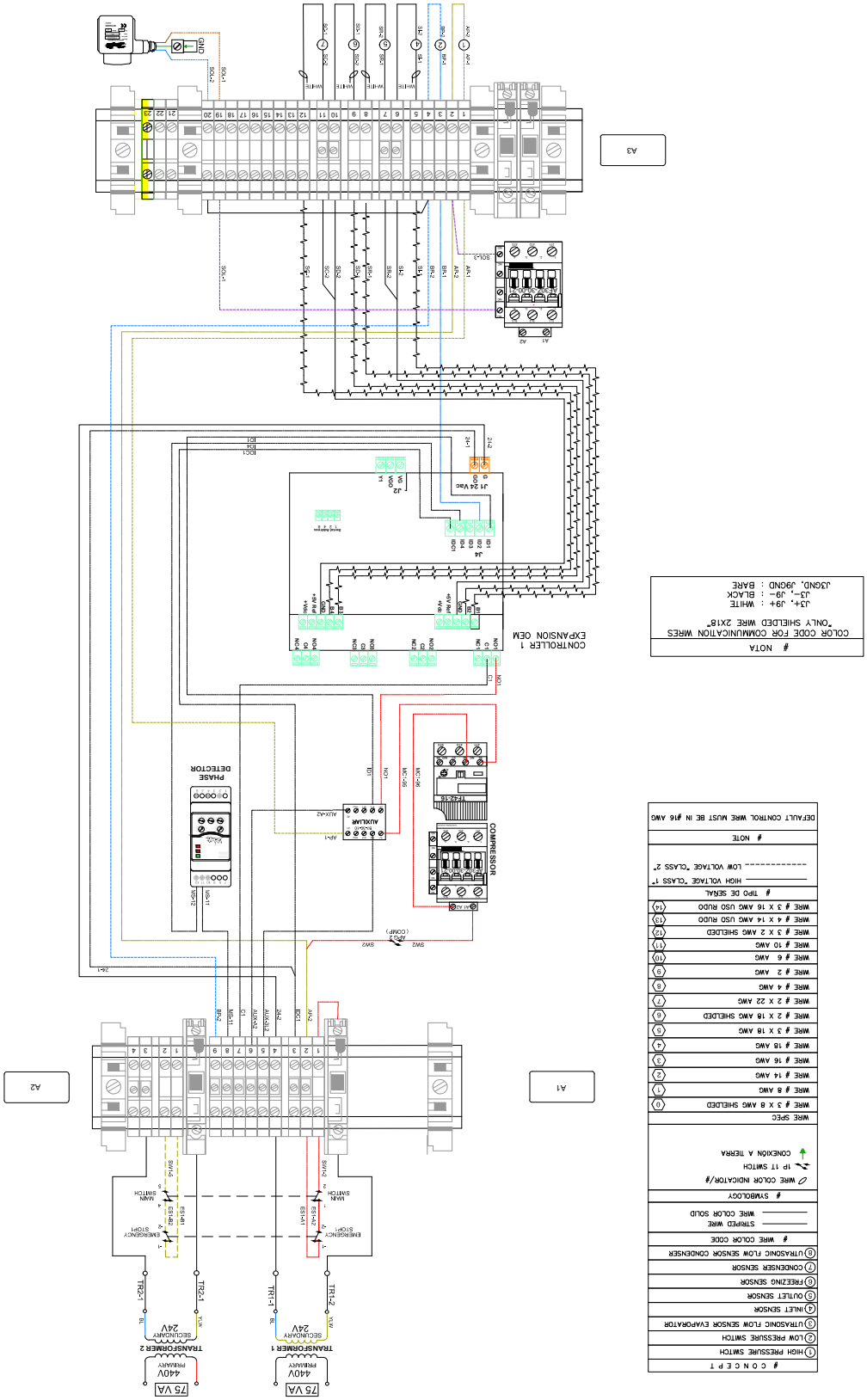
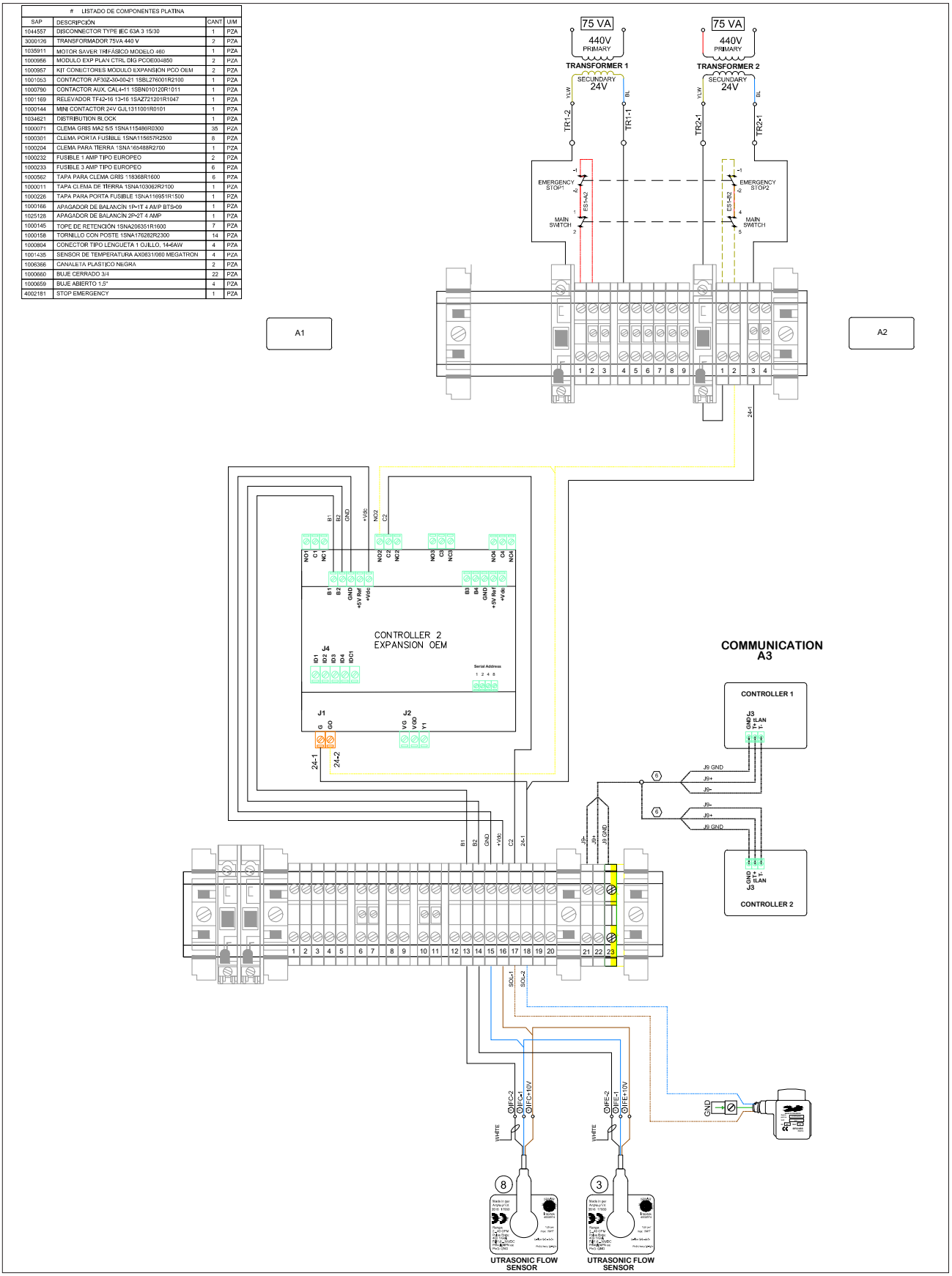

TIPO DE COLOR DE CABLE
LINEA RAYADA
LINEA SOLIDA
ESPECIFICACION DE CALIBRE DE CABLE
0 CABLE CALIBRE 3 X 8 AWG BLINDADO
1 CABLE CALIBRE 8 AWG
2 CABLE CALIBRE 14 AWG
3 CABLE CALIBRE 16 AWG
4 CABLE CALIBRE 18 AWG
5 CABLE CALIBRE 3 X 18 AWG BLINDADO
6 CABLE CALIBRE 2 X 18 AWG BLINDADO
7 CABLE CALIBRE 2 X 22 AWG BLINDADO
8 CABLE CALIBRE 4 AWG
9 CABLE CALIBRE 2 AWG
10 CABLE CALIBRE 6 AWG
TIPO DE SEÑAL
ALTO VOLTAJE
VOLTAJE "CLASE2"
SEÑAL DE RESISTENCIA
SEÑAL DIGITAL
T-75-L3
T-75-L1
INTERRUPTOR GENERAL
C 63
GND
TABLILLA DE FUERZA
MS-L3
MS-L2
MS-L1
C1-L1
C1-L2
C1-L3
SOL-
SOL+
BOBINA SOLENOIDE 24V
C1-NC
C1-5L3
RESISTENCIA 220V
C1-L1
C1-T3
C1-T2
C1-T1
TF42-29
COMPRESOR 220V
TRANSFORMADOR
75 VA
208V-230V
24 V

Figure 10. Typical field wiring diagram of CLIM LC 7.5 TR son 440V (multi-drop connection with all options shown)



#	LISTADO DE COMPONENTES PLATINA		
SAP	DESCRIPCIÓN	CANT	U/M
1044557	DISCONNECTOR TYPE IEC 63A 3 15/30	1	PZA
3000126	TRANSFORMADOR 75VA 440 V	2	PZA
1035911	MOTOR SAVER TRIFÁSICO MODELO 460	1	PZA
1000956	MODULO EXP PLAN CTRL DIG PCOE004850	2	PZA
1000957	KIT CONECTORES MODULO EXPANSION PCO OEM	2	PZA
1001053	CONTACTOR AF30Z-30-00-21 1SBL276001R2100	1	PZA
1000790	CONTACTOR AUX. CAL4-11 1SBN010120R1011	1	PZA
1001169	RELEVADOR TF42-16 13-16 1SAZ721201R1047	1	PZA
1000144	MINI CONTACTOR 24V GJL1311001R0101	1	PZA
1034621	DISTRIBUTION BLOCK	1	PZA
1000071	CLEMA GRIS MA2 5/5 1SNA115486R0300	35	PZA
1000301	CLEMA PORTA FUSIBLE 1SNA115657R2500	8	PZA
1000204	CLEMA PARA TIERRA 1SNA165488R2700	1	PZA
1000232	FUSIBLE 1 AMP TIPO EUROPEO	2	PZA
1000233	FUSIBLE 3 AMP TIPO EUROPEO	6	PZA
1000562	TAPA PARA CLEMA GRIS 1?8368R1600	6	PZA
1000011	TAPA CLEMA DE TIERRA 1SNA103062R2100	1	PZA
1000226	TAPA PARA PORTA FUSIBLE 1SNA116951R1500	1	PZA
1000166	APAGADOR DE BALANCÍN 1P-1T 4 AMP BTS-09	1	PZA
1025128	APAGADOR DE BALANCÍN 2P-2T 4 AMP	1	PZA
1000145	TOPE DE RETENCIÓN 1SNA206351R1600	7	PZA
1000158	TORNILLO CON POSTE 1SNA176282R2300	14	PZA
1000804	CONECTOR TIPO LENGUETA 1 OJILLO, 14-6AW	4	PZA
1001435	SENSOR DE TEMPERATURA AX0831/080 MEGATRON	4	PZA
1006366	CANALETA PLASTICO NEGRA	2	PZA
1000660	BUJE CERRADO 3/4	22	PZA
1000659	BUJE ABIERTO 1.5"	4	PZA
4002181	STOP EMERGENCY	1	PZA



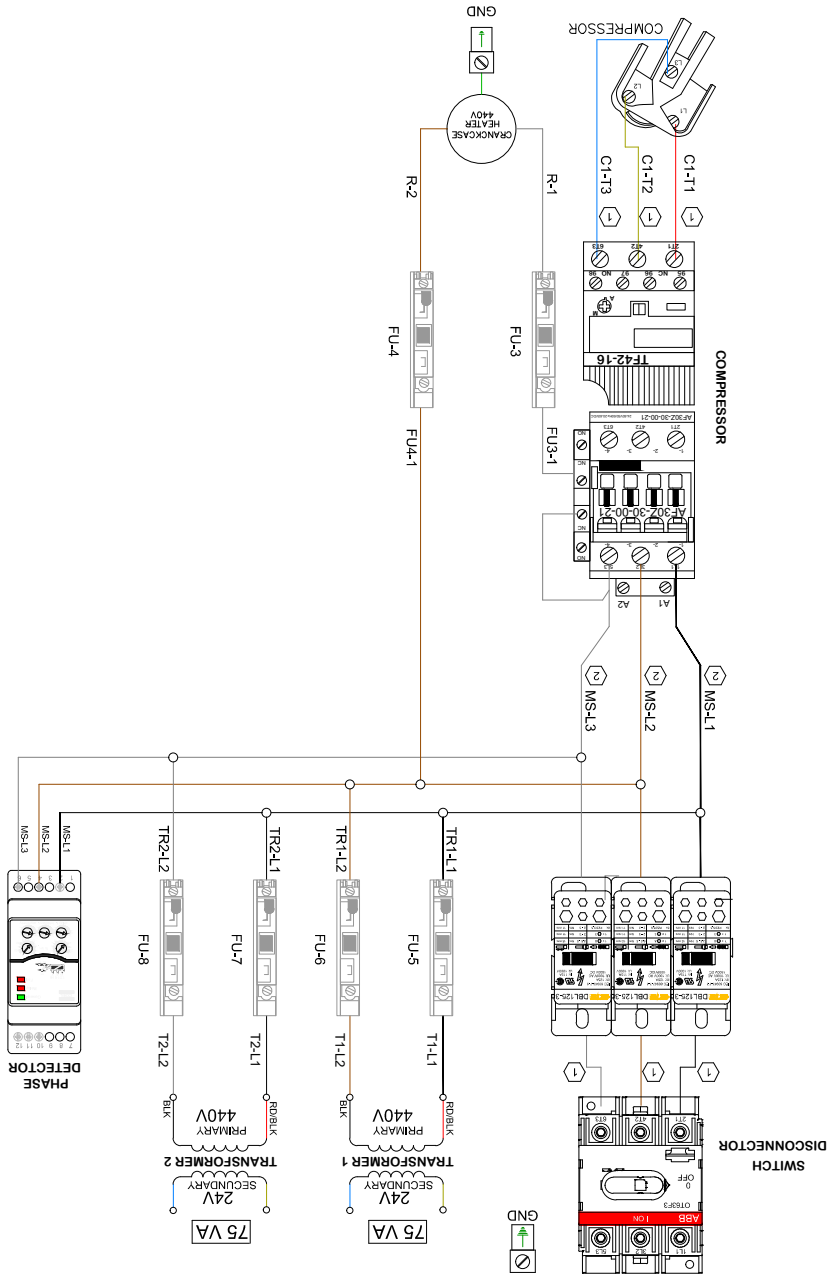
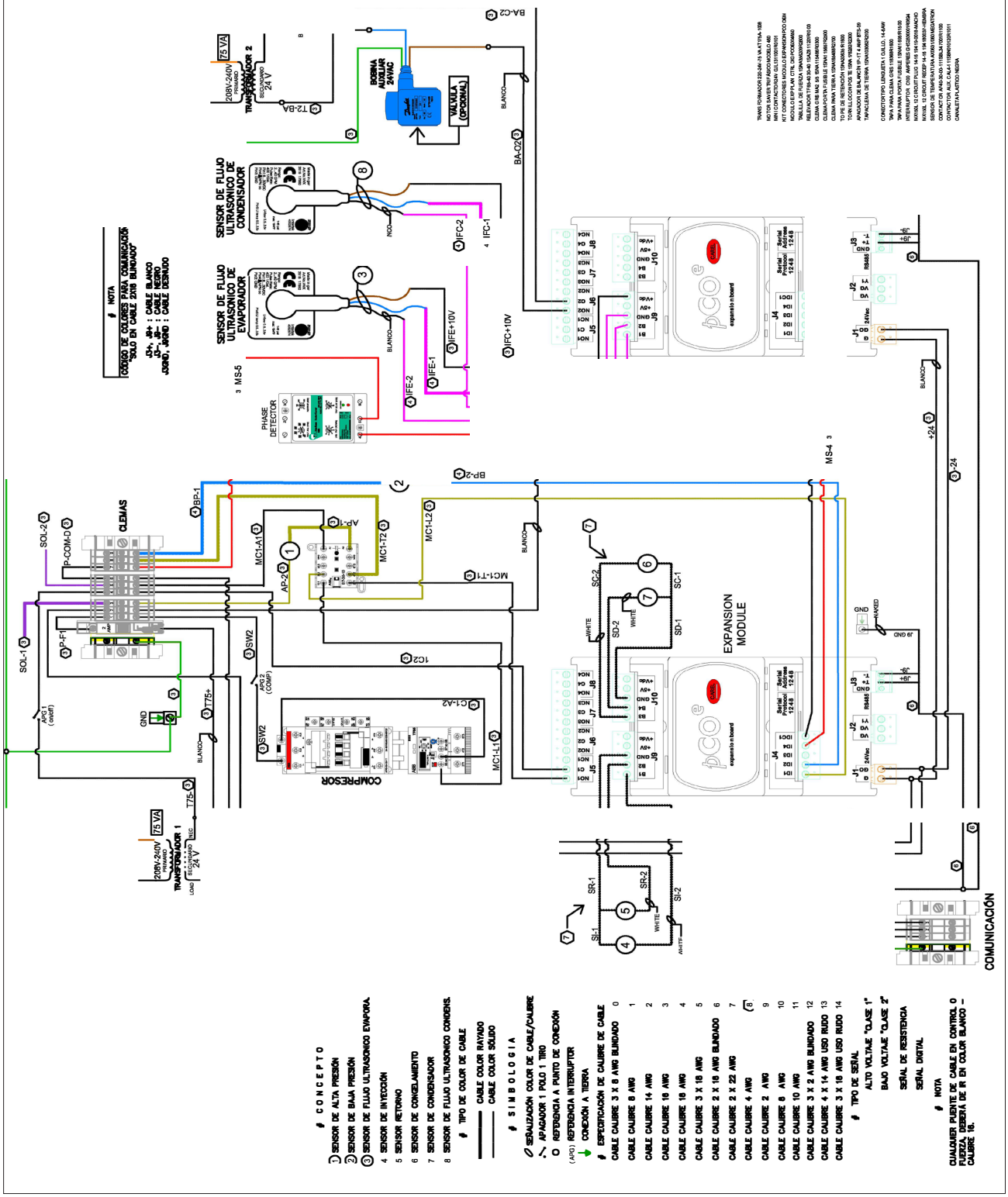

GND
COMPRESSOR
CRANCKCASE HEATER 440V
R-2
R-1
C1-T3
C1-T2
C1-T1
FU-4
FU-3
TF42-16
COMPRESSOR
FU4-1
FU3-1
A2
A1
MS-L3
MS-L2
MS-L1
PHASE DETECTOR
TR2-L2
TR2-L1
TR1-L2
TR1-L1
FU-8
FU-7
FU-6
FU-5
T2-L2
T2-L1
T1-L2
T1-L1
BLK
RD/BLK
PRIMARY 440V
SECUNDARY 24V
TRANSFORMER 2
TRANSFORMER 1
75 VA
75 VA
GND
DISCONNECTOR SWITCH

Figure 11. Typical field wiring diagram for CLIM LC 10 TR son 220V (multi-drop connection with all options shown)



ELECTRICAL DATA

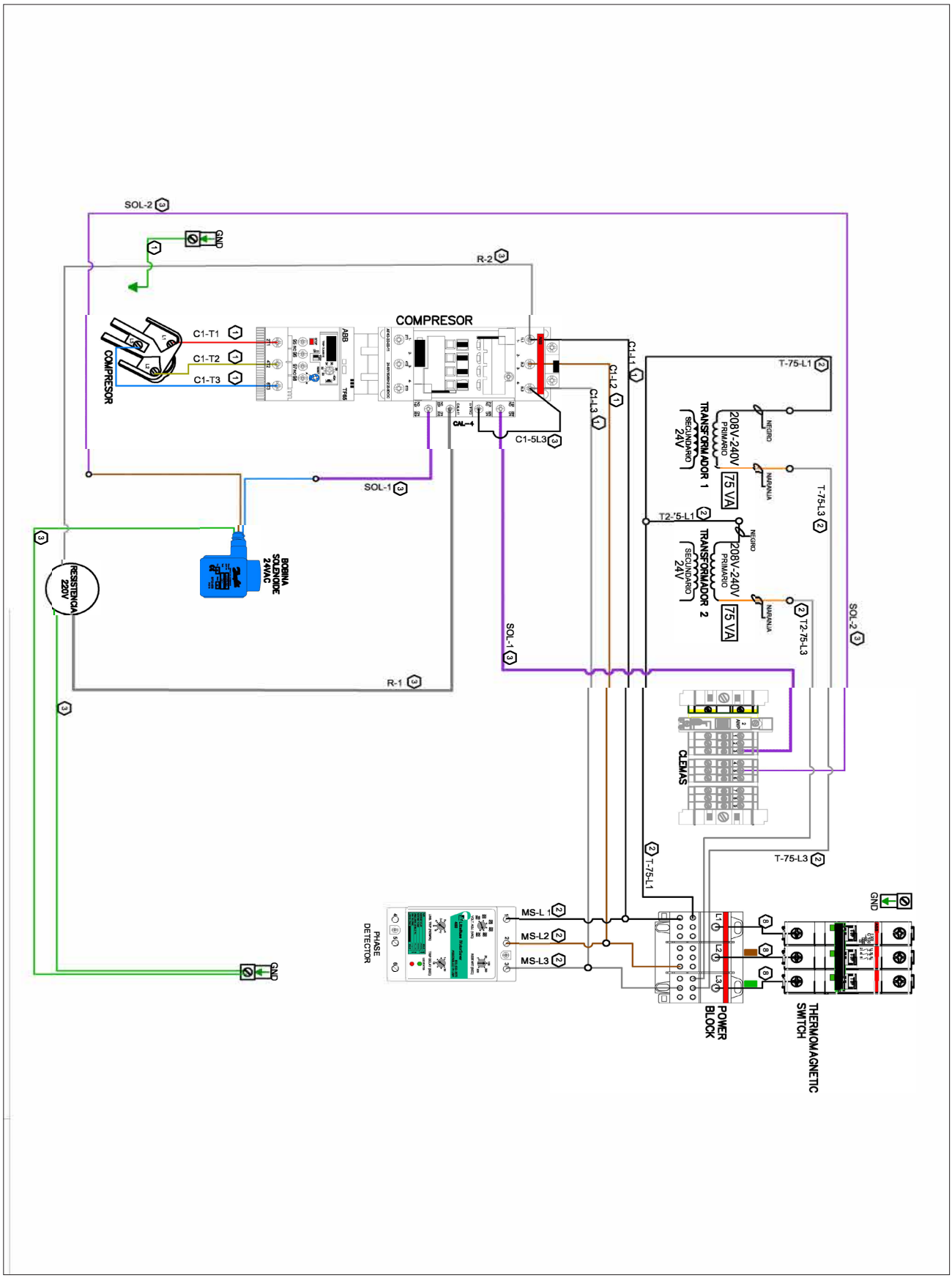
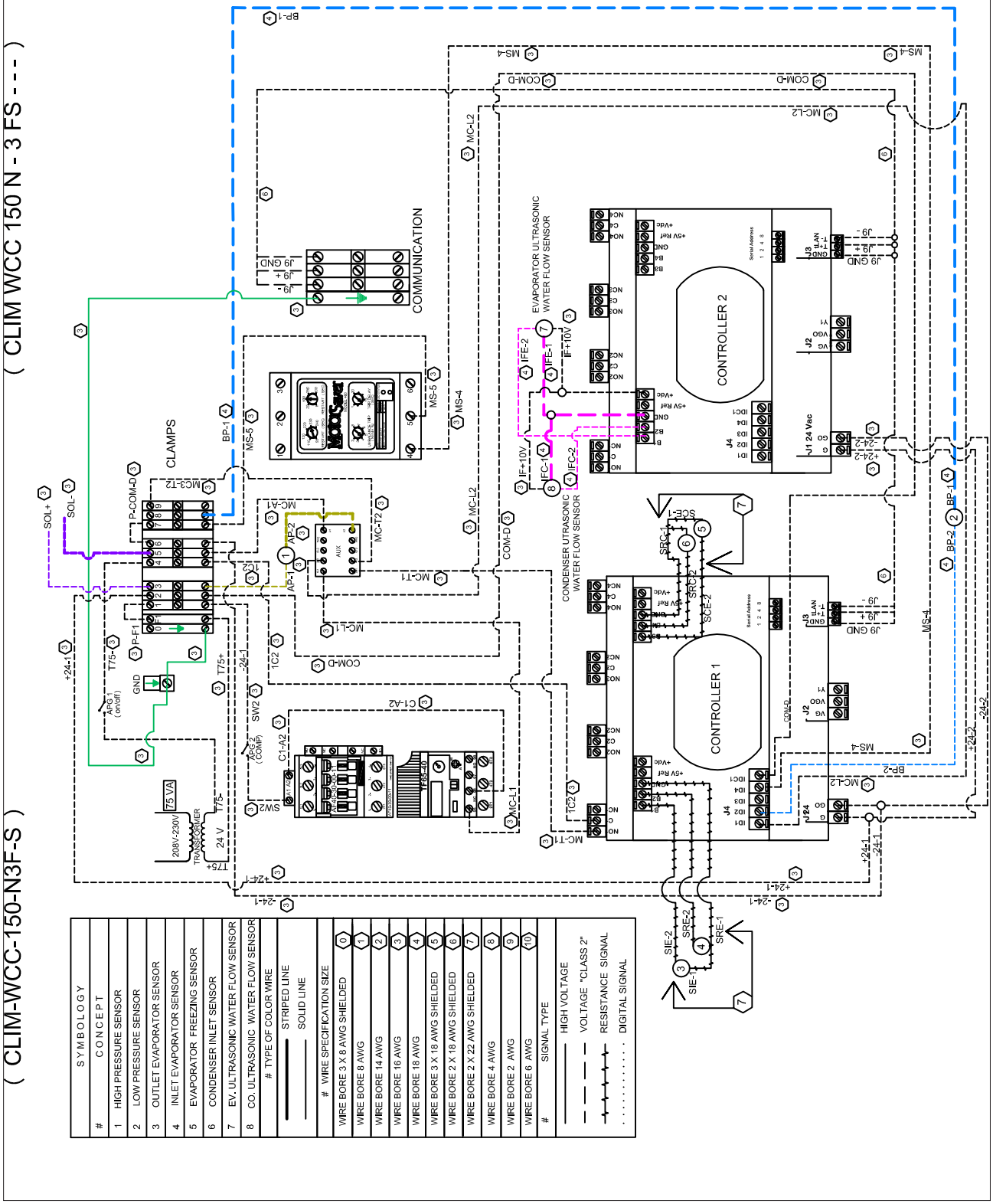
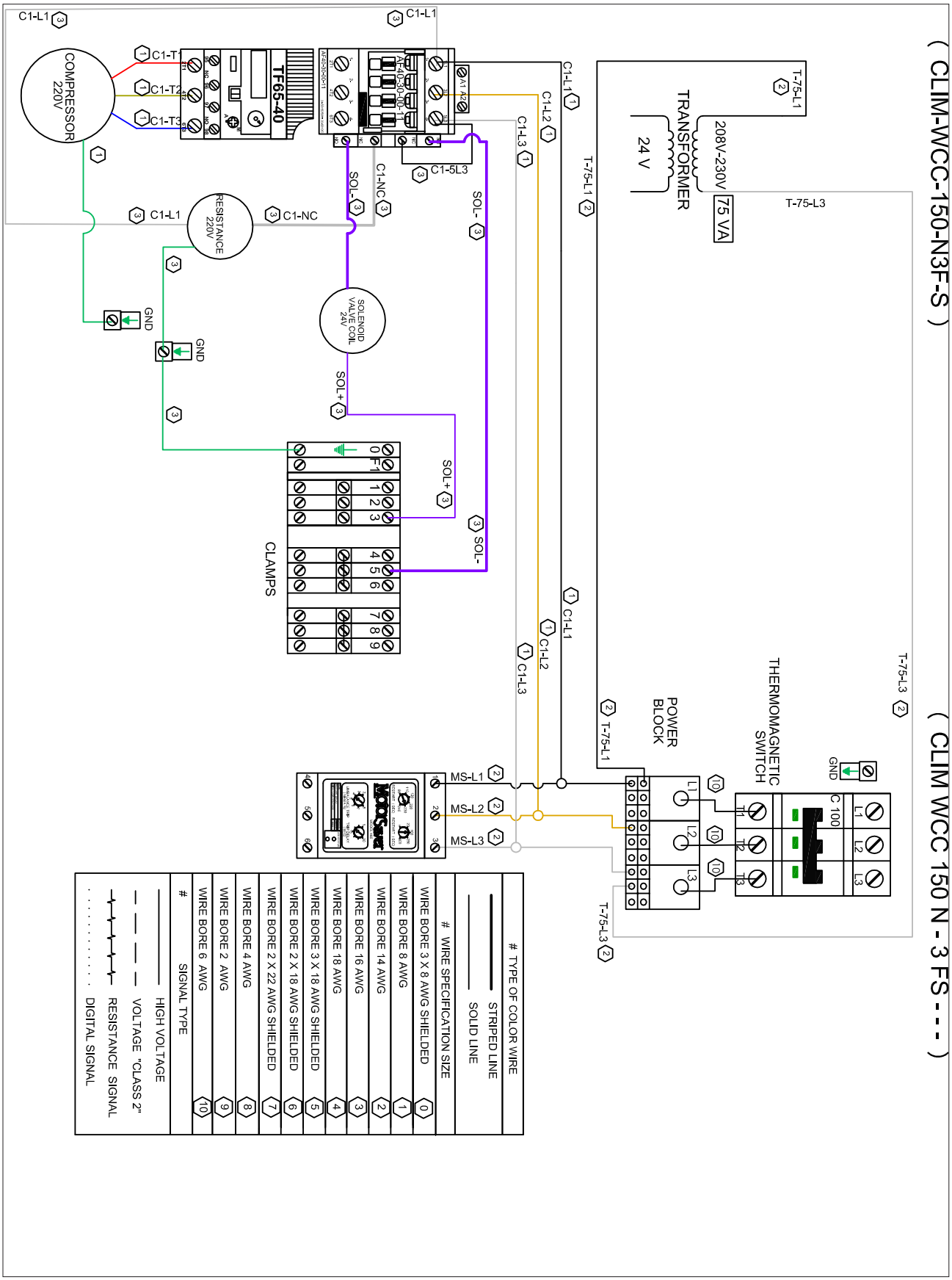


Figure 12. Typical field wiring diagram of CLIM LC 12.5 TR son220V unit (multi-drop connection with all options shown)



ELECTRICAL DATA



GENERAL DESCRIPTION

The pCOOEM+ is an electronically programmable microprocessor-based controller that is fully compatible (software and hardware) with the pCO family of products and systems that include programmable controllers, user terminals, gateways, communication devices and remote device management.

These devices represent a powerful control system that can be easily linked with the vast majority of Building Management Systems (BSM) available on the market.

The controller's menu can be accessed from a touch screen that has all the parameters and the operating status of the equipment. The pCOOEM+ continuously performs pre-fault scans of the equipment status to prevent damage to parts and components if a fault occurs.

The controller menu contains different screens and submenus that provide the operator or service technician with a complete overview of:

1.- User.
2.- Maintenance.

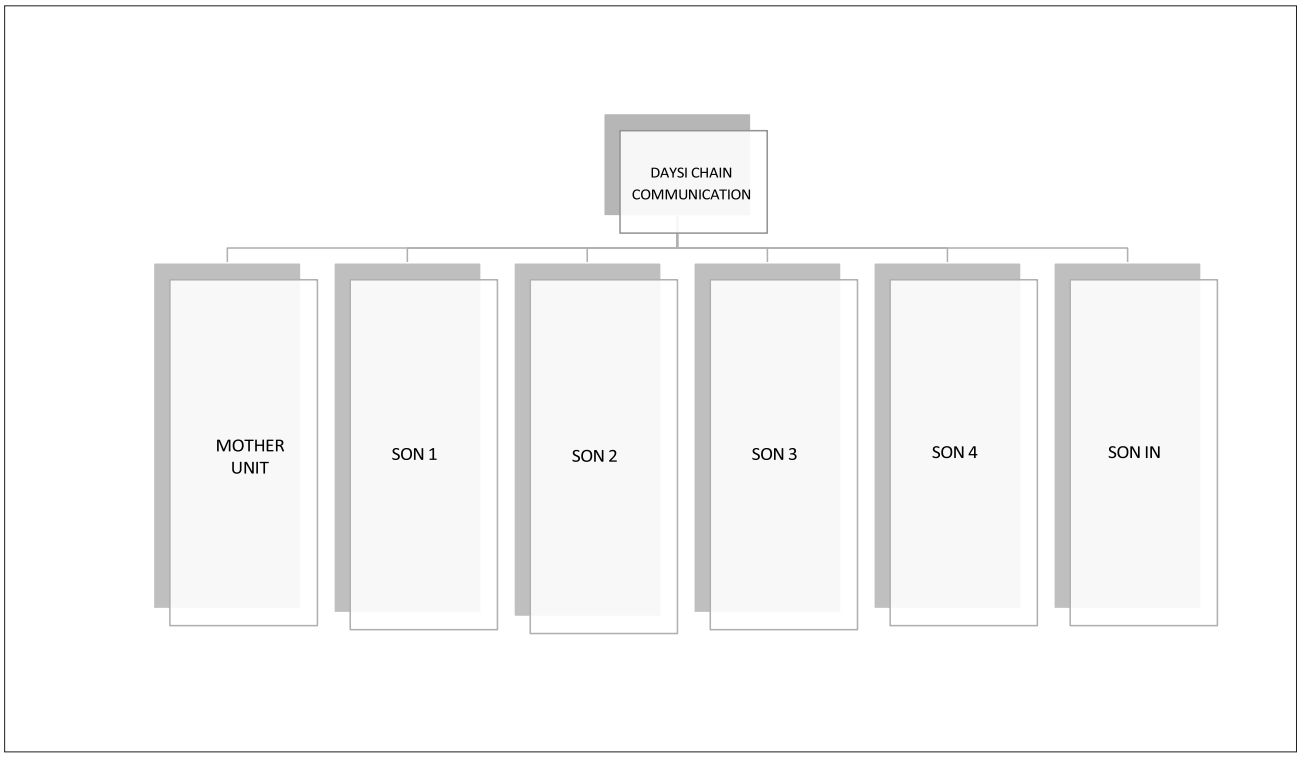
SYSTEM ARCHITECTURE

The general architecture of the controls uses the following:

- A pCOOEM+ unit controller.
- I/O extension modules as required depending on the configuration of the unit.
- Communications interface son modules.
- The devices in the architecture have a configuration based on a mother unit and the unit's I/O sons, these children can be connected via Modbus serial rs485 and can be configured from the configuration screen.

All 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 mother module as the main unit.

Figure 13. System Architecture



INPUTS AND OUTPUTS

The configuration of the inputs and outputs depends on the initial configuration of the system.
The tables in this section show the inputs and outputs assigned to each type of configuration as well as the port used for the “Mother” unit (whose capacity is regulated by an inverter or an unloader) and the “Son ” units.

Key: CO is for Cooling only and HP is for Heat Pump.

Table 3. Analogue inputs of the pCo (Mother Unit)

PORT	CO AIR	HP AIR	CO WATER	HP WATER	TYPE
U1	Injection	Injection	Injection	Injection	NTC
U2	Return	Return	Return	Return	NTC
U3	Freezing	Freezing	Freezing	Freezing	NTC
U4	Main return	Main return	Main return	Main return	NTC
U5	Main injection	Main injection	Main injection	Main injection	NTC
U6	Tem.Cond	Tem. Cond	Cond injection	Cond injection	NTC
U7	-	-	-	Cond return	NTC

Figure 14. pCo (Mother Unit) digital inputs

PORT	CO AIR	HP AIR	CO WATER	HP WATER
U9	-	Selector	-	Selector
ID1	High pressure	High pressure	High pressure	High pressure
ID2	Low pressure	Low pressure	Low pressure	Low pressure
ID3	Remote start	Remote start	Remote start	Remote start
ID4	Motor Saver	Motor Saver	Motor Saver	Motor Saver

Table 4. pCo analogue inputs 0.5-3.5 Vdc (Mother Unit)

PORT	CO AIR	HP AIR	CO WATER	HP WATER
U8	Evaporator flow	Evaporator flow	Evaporator flow	Evaporator flow
U8	-	-	Condenser flow	Condenser flow
NO7	Second stage	Second stage	-	-
NO8	-	Reversible valve	-	Reversible valve

Table 5. pCo digital outputs (Mother Unit)

PORT	CO AIR	HP AIR	CO WATER	HP WATER
NO1	Compressor	Compressor	Compressor	Compressor
NO6	Pump	Pump	Pump	Pump
NO7	Fan	Fan	-	-
NO8	-	Reversible valve	-	Reversible valve

Table 6. Analogue outputs of the pCo (Mother Unit)

PORT	CO AIR	HP AIR	CO WATER	HP WATER	TYPE
Y1	Inverter/SSR	Inverter/SSR	Inverter/SSR	Inverter/SSR	0-10 V
Y2	Inverter fan	Inverter fan	Inverter fan	Inverter fan	0-10 V

Table 7. Entradas análogas del pCo (Modulo de Expansión Hijo)

PORT	CO AIR	HP AIR	CO WATER	HP WATER	TYPE
B1	Injection	Injection	Injection	Injection	NTC
B2	Return	Return	Return	Return	NTC
B3	Freezing	Freezing	Freezing	Freezing	NTC
B4	Condenser	Condenser	Condenser injection	Condenser injection	NTC

Table 8. Analogue inputs of the pCo (Auxiliary Son Expansion Module)

PORT	CO AIR	HP AIR	CO WATER	HP WATER	TYPE
B1	Evaporator flow	Evaporator flow	Evaporator flow	Evaporator flow	5-3.5 VCD
B2	Condenser flow	Condenser flow	Condenser flow	Condenser flow	5-3.5 VCD
B3	Condenser return	Condenser return	Condenser return	Condenser return	NTC
DI4	Motor saver	Motor saver	-	-	

Table 9. Digital inputs of the pCo (Expansion Module Son)

PORT	CO AIR	HP AIR	CO WATER	HP WATER
DI1	High pressure	High pressure	High pressure	High pressure
DI2	Low pressure	Low pressure	Low pressure	Low pressure
DI3	Evaporation flow	Evaporation flow	Evaporation flow	Evaporation flow
DI4	*Motor Saver	*Motor Saver	*Motor Saver	*Motor Saver

NOTE: Digital motor protector inputs on “Sons” units are optional and their consideration depends on the initial configuration of the system, on the other hand motor protection input on “Mother” units is indispensable.

Table 10. Digital outputs of pCo (Expansion Module Son)

PORT	CO AIR	HP AIR	CO WATER	HP WATER
NO1	Compressor	Compressor	Compressor	Compressor
NO2	**Pump	**Pump	**Pump	**Pump
NO3	Fan	Fan	Fan	Fan
NO4		Reversible valve	-	Reversible valve

NOTE: The digital output pump in “Son ” units depends on the initial configuration of the system. It is not possible to use it if the system is configured with only one “Mother” pump (pCO unit).

START-UP

24 V

- Place the Control switch in the ON position to activate the 24 VAC control.
- After the control is turned on, it will take 2 minutes for the unit to come online.

Compressor

- Place the switch in the ON position, this allows the compressor to switch ON and OFF according to the status.

NOTE: Once the pump is turned on, it will take a few seconds until a steady flow of water is detected, at the end of this delay, the flow switch will be monitored. If the switch is on, it commands the pump to turn off (5 attempts within 10 seconds). If a uniform water flow is detected, the unit will begin operation.

Under normal conditions, the unit will turn on and off the cooling circuit of the unit, according to its needs. When alarms are present in the system, they will always be indicated on the user interface.

The digital control will start compressor operation according to the logic set in the control.

On/off (reset)

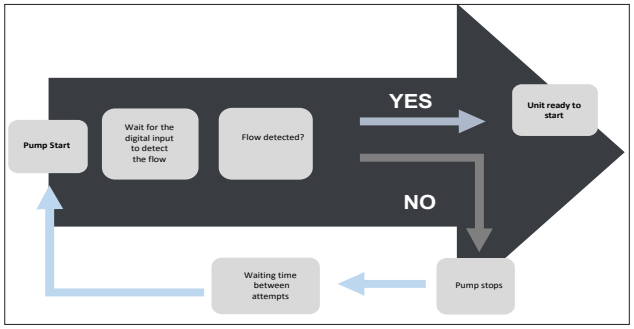
The operating sequence starts with a check of all pre-programmed safety check points, if the necessary conditions are met, the unit is ready for operation. To start operation of the unit, turn the switch to the ON position.

After a few seconds the computer will computer will send power to the water pump. If the computer detects water flow it will command the start of the unit's internal control sequence.

Control logic pump start-up

When the unit is switched on, if all safety measures are correct (vacuum pressure, discharge, phase monitor), the pumps of all enabled units will start. Fig. 15 shows the pump start flow diagram.

Figure 15. Pump start-up control flow chart (applies to any unit)

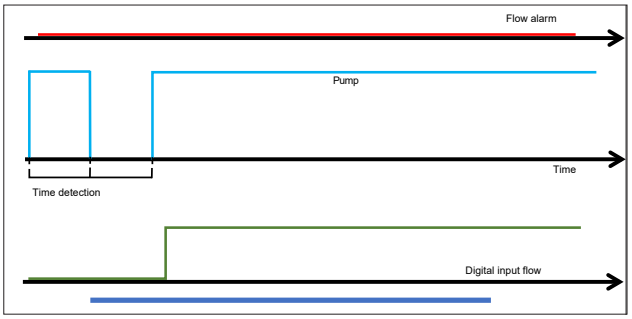


NOTE: If the number of pump start attempts is exceeded, the general flow alarm will be activated, this will stop all operations on that unit until the alarm is reset.

Pump start-up

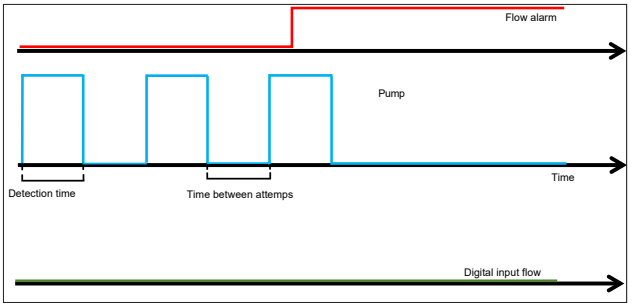
The pumps in the units are always working independently of the thermal demand, the flow detection is also constantly monitored. If after a pause in the flow detection a change in the status of the digital outputs is detected, the on-demand start is activated in the unit in question. Figure 16 shows an example of this case.

Figure 16. Example of the pump start-up cycle, where the flow was detected on the second attempt.



If the flow detection fails after the period allocated for digital input detection, it is necessary to switch off the pump and restart it to make an attempt after the time delay between lapses has elapsed. If after a certain number of attempts the flow is still not detected, the "no constant flow" alarm will be activated and the unit in question will be suspended, as illustrated in Fig.17 on the next page.

Figure 17. Example of pump start-up cycle where the flow has not been detected, after 3 attempts the flow alarm has been activated.



NOTE: The system may have a paddle flow sensor with digital signal of "1" or "0"; or ultrasonic sensor with analogue signal showing the flow rate on the display.

REGULATION

The temperature control can be implemented in different ways, always taking into account the configuration of the system. If there are “Son” units, the temperature can be set in “Tandem” mode (all units are coordinated by the “Mother” unit, which calculates the total demand) or each unit can work in “Independent” mode, where each unit calculates the local demand of its respective temperature injection sensor (in case the main injection sensor fails).

In “Tandem” mode, the temperature control is the reading received from the main head sensor. With this reading the total demand is calculated. Fig. 18 shows an example of the calculated demand when the control is set to “Proportional”.

If the units are in “Independent” mode, each unit calculates its local demand based on its temperature injection sensor. The local demand for the “Mother” unit is generated by the same PID control equations, while the demand for the “Son” units is a constant reset cycle, as shown in Fig. 19.

The choice between cooling and heating (when the system was configured with a heat pump), can be set by the digital input “Selector” or can be made by the user. All units in a “Tandem” mode will always work under the same mode.

Figure 18. Example of the proportional control cycle, for cases of total demand or demand for the “Mother” unit.

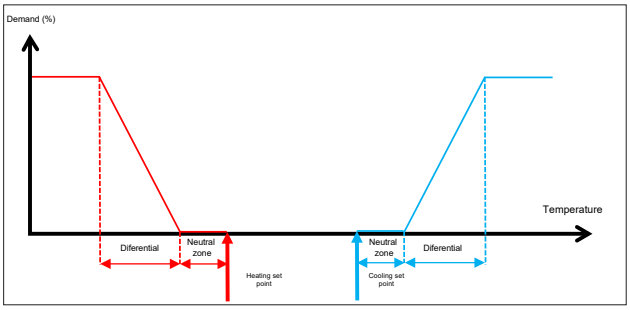


Figure 19. Example of a proportional control cycle for local demand on each “Son” unit.

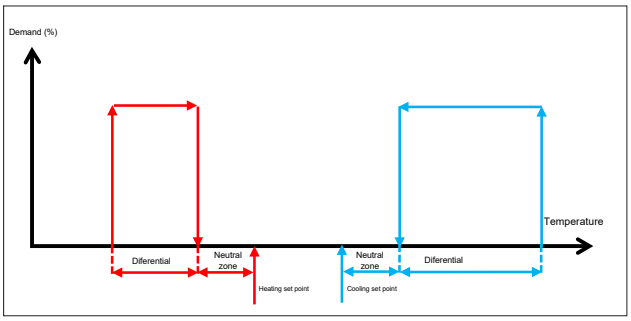
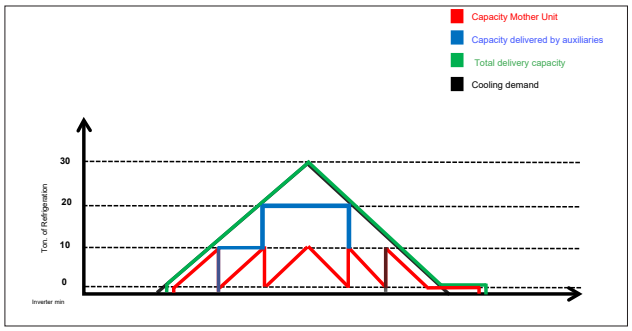


Figure 20. Example of capacity delivered according to demand, for a “Mother” unit and 2 “ Sons” units of 10 TR cooling each.



UNIT ROTATION

When the system is operating in “Tandem” mode, the total demand is calculated as mentioned in the previous section, depending on how many units are operating, the system will request the activation or suspension of the units in order to meet the demand.

In any configuration, the “Mother” compressor (whose capacity is controlled by an inverter or a flow valve) is the first to start and the last to stop. An example of global demand management by starting and stopping units is shown in fig. 20.

When demand requests start or stop units, and the system is working in “Tandem” mode, it can rotate the units in order to ensure equal wear between all units.

The types of rotation that can be performed are:

- FIFO: The first unit to power up will be the first to shut down/ suspend.
- LIFO: The first unit to start will be the last to shut down/ suspend.
- Cumulative Operating Time: The unit with the lowest cumulative operating time is always started first, and the first unit to shut down/suspend will be the one with the highest cumulative time.
- Customised: You assign the start-up and shutdown/suspend priorities for each unit.

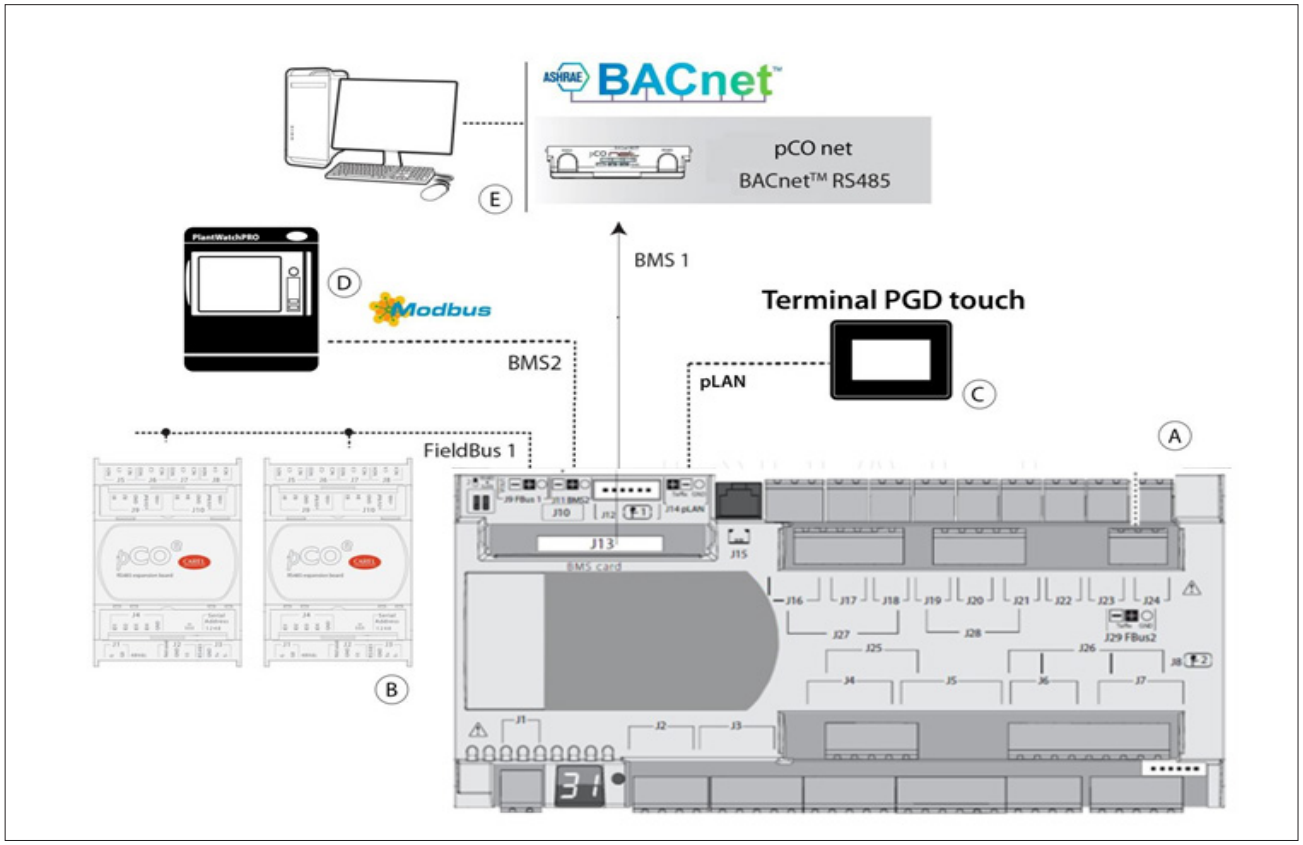
NOTE: Regardless of the type of unit rotation set, the drive or unloaded unit will be the first to start and the last to shut down/suspend.

NOTE: If a unit is active and working and stops due to some situation (such as an alarm), it will be replaced by the next available unit according to the rotation algorithm.

COMMUNICATION PROTOCOL

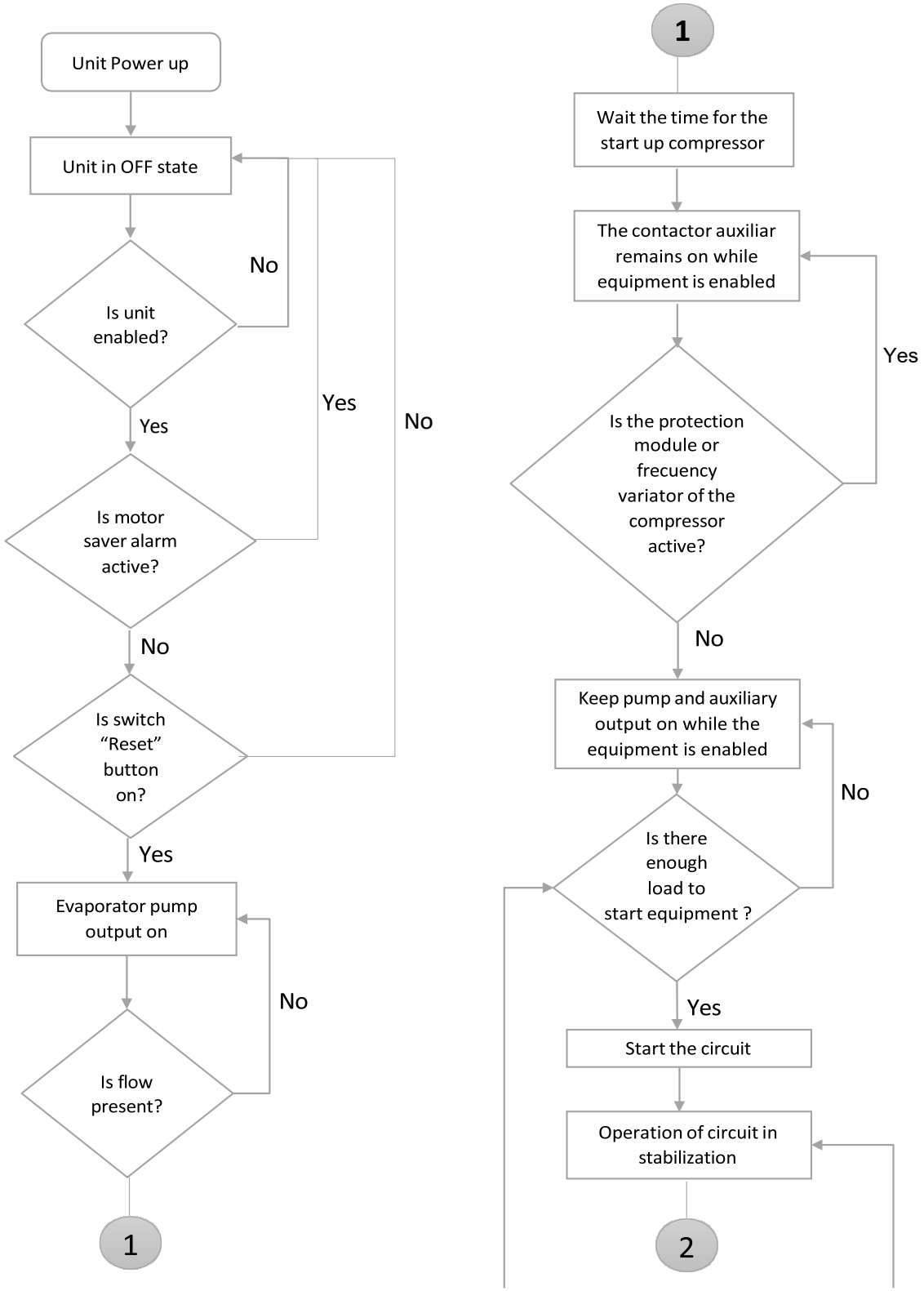
The pCO has 4 independent communication ports configured as follows:

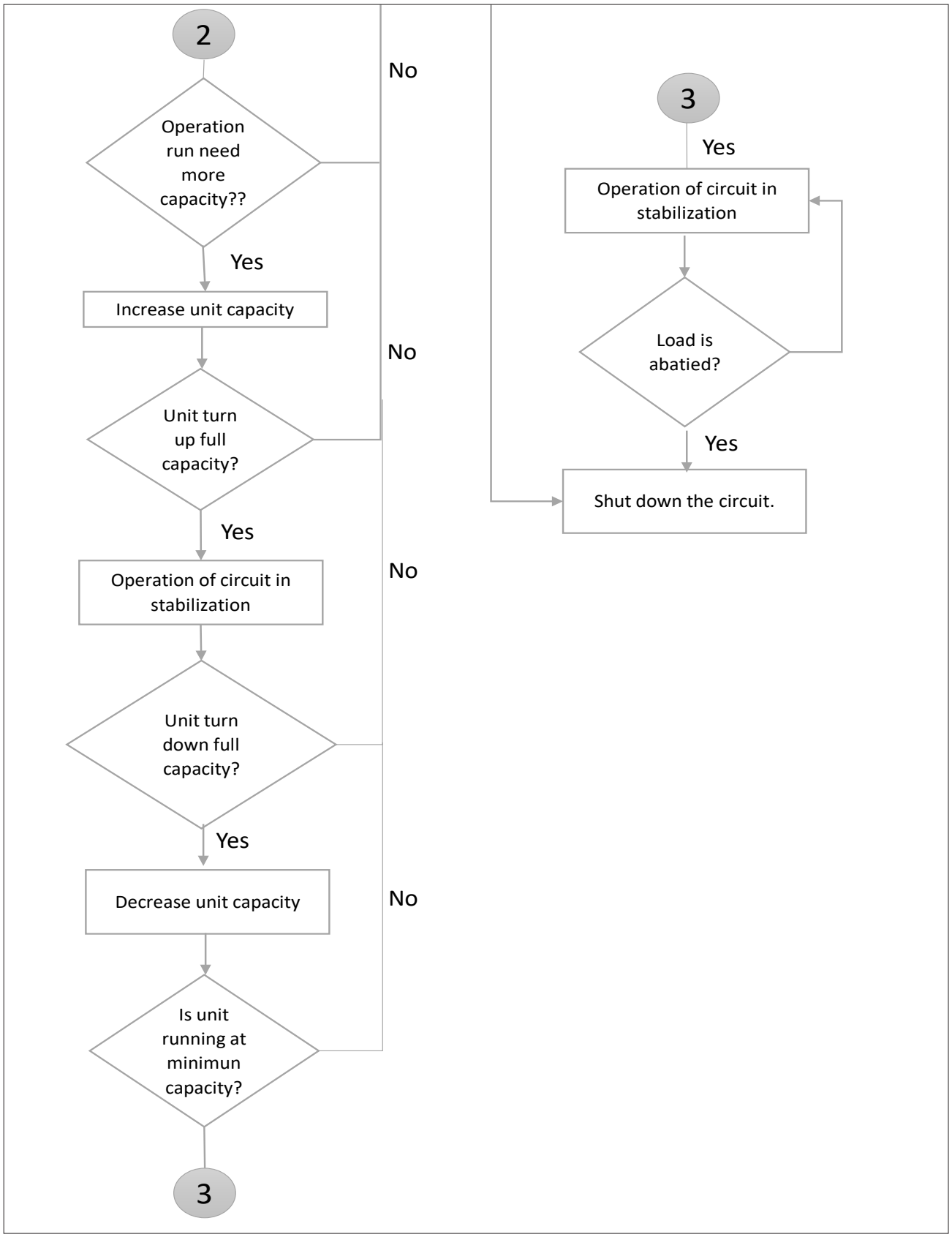
- **pLAN:** Communicates with the pGD touch terminal using the Modbus RTU protocol Son
- **Fieldbus 1:** It communicates with the Expansion Modules (located in the “Son” units) via the Modbus “Mother” protocol.
- **BMS1:** Communicates with a supervisory system using the BACnet* protocol.
- **BMS2**: It communicates with an external monitoring system such as PlanWatch Pro using the Modbus RTU “Son” protocol.



NOTE: The BMS1 port requires a communication card (pCOnet to BACnet MS/TP or pCOweb to BACnet IP). The programming of the logic packet in the toggle protocol is also necessary. An FLG-Modbus can also be connected to connect a BACnet MS/TP.

Figure 21. 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?
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 incoming water minus the outgoing water through all circuits..

LWT PENDING

The slope of LWT is calculated so 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 decreasing. The rate of decline is calculated by inverting 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

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

CALCULATIONS PER CONTROLLER

Coolant saturation temperature

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

Evaporator approach

The evaporator approach shall be calculated for each circuit.
The equation is as follows
Evaporator approach = LWT - Evaporator saturated temperature.

Condenser approach

The capacitor approach shall be calculated for each circuit. The equation is as follows
Capacitor approach = 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:

- The circuit breaker is closed.
- No circuit alarms are active.
- The circuit mode setpoint is set to Enable.
- At least one compressor is enabled to start (according to the enable setpoints).

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 -No cycle timers are active for the compressor.
- The compressor is enabled via the enable set points.
- The compressor is not running.

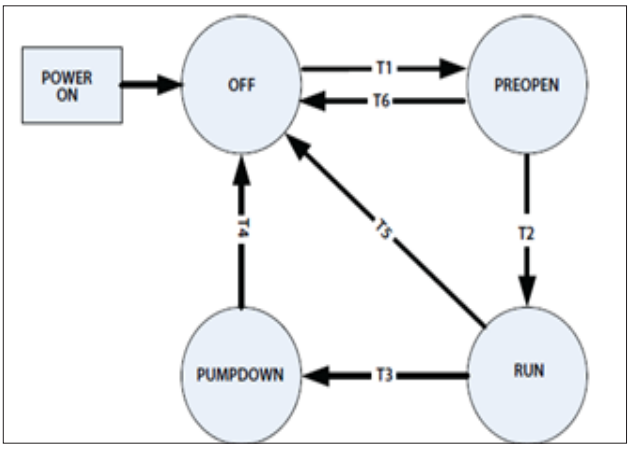
STATES OF THE CIRCUITS

The circuit will always be in one of the four states:

- Off - Circuit is not running
- Pre-open - Circuit is preparing to start up
- Running - Circuit is running
- Pump off - Circuit is performing a normal shutdown

The transitions between these states are shown in the diagram on the next page.

Figure 22. Circuit states



T1 - Pre-opening

- No compressor is running and any compressor in the circuit is commanded to start (see unit capacity control).

T2 - Pre-open to run

- 5 seconds have elapsed in pre-opening state.

T3 - Run to pump it 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
- 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
- Circuit mode is disabled
- Circuit Quick Stop Alarm is on
- Pumping alarm is activated

COMPRESSOR CONTROL

Compressors should only operate when the circuit is in an operating or pumping state. They shall 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 capacity control logic commands the unit to shut down.
- An unload alarm occurs and sequencing requires this compressor to be the next compressor to shut down.
- Circuit status is pumping and sequencing requires this compressor to shut down next.

CALCULATIONS PER CONTROLLER

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

OVERHEATING CONTROL STATUS OPERATION

Operation of the TXV

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.

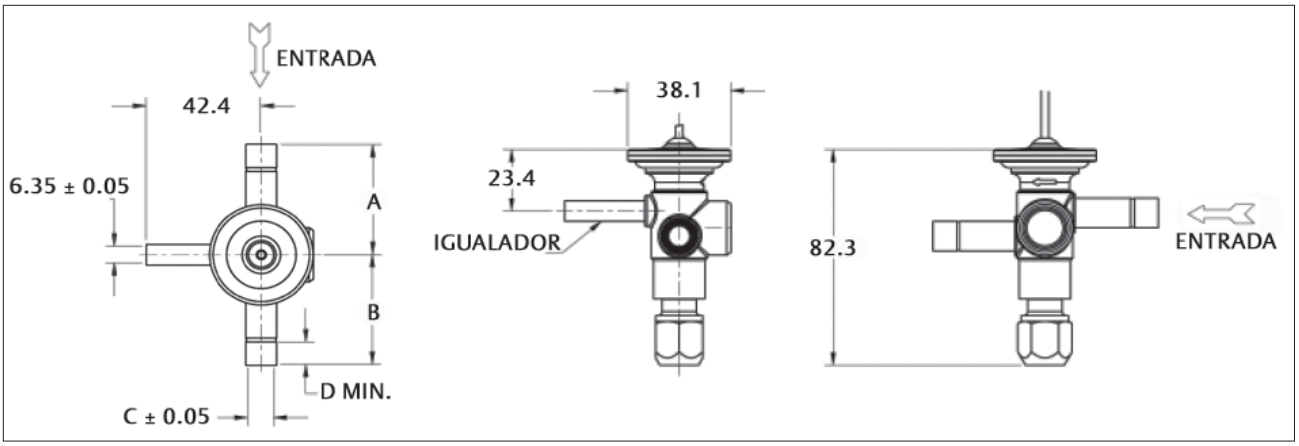
The TXV does this by keeping the coil supplied with enough refrigerant to maintain the correct superheat of the suction gas leaving the evaporator coil. The TXV regulates the flow in response to the superheat of the charge.

If it is suspected that a TXV is not working 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 is considered normal. The following are some “tips” to help in detecting and fixing TXV performance faults:

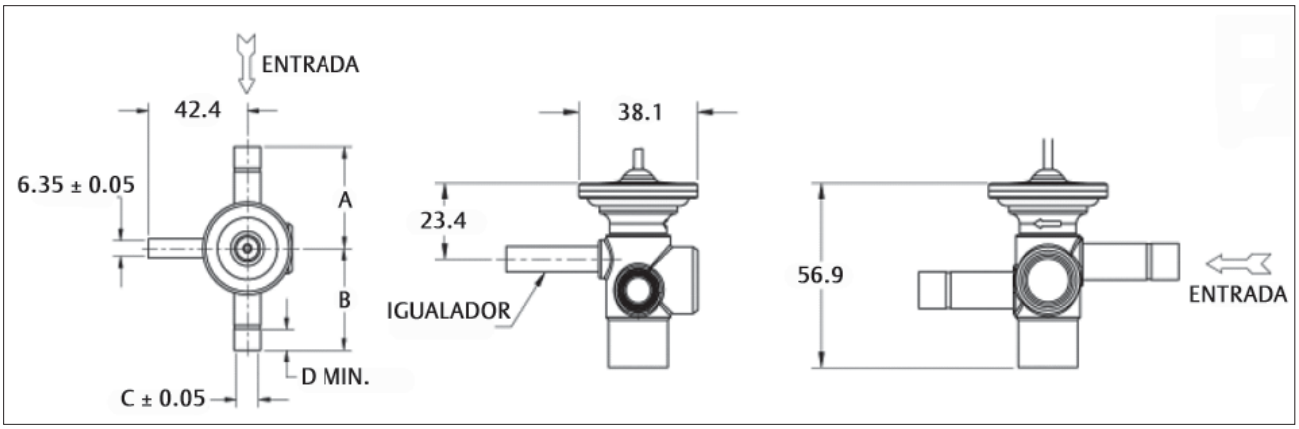
- Check the bulb to make sure it is properly connected to the suction line. If you can move the bulb manually, it is not properly secured.
- The bulb must be perfectly insulated to protect against the effects of a draft.
- Check the equalizer line for restrictions (kinks) or signs of frost. A frosted equalizer line indicates internal leakage 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 the flow of liquid refrigerant. If the refrigerant at the valve inlet contains sudden gas, the capacity of the valve will be reduced. Ensure that the system is correctly charged and that there is some subcooling at the valve inlet before discarding the TXV.

Dimensions (Mm)



Adjustable - ODF connections with 1/4” EQ



Non-adjustable - Odf connections with 1/4” EQ

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

ALARMS

The alarms that may occur, depending on the initial configuration are:

ALARM TYPE	DESCRIPTION
Sensor Fault Alarms	If a sensor is detected as disconnected or broken, the algorithm being used will be disabled. If it is the head injection sensor that was detected, the units will work in “Stand-alone” mode automatically.
Phase Fault Alarm	Activated by a digital input. Motor protection is a high priority alarm and stops all machine functions. It is reset manually.
No Flow Alarm	This alarm is a high priority and stops all machine functions. It is manually resettable.
Freeze Alarm	If the sensor temperature is below the programmed threshold, this alarm will be activated. This condition stops all functions of the equipment in question. This alarm automatically resets once the temperature exceeds the reset value and will keep the unit in reset mode (No power for operation for the programmed time.
Water Freeze Alarm	Same case as the freeze-up alarm, but in this alarm, the reading of the injection sensor is considered.
High Pressure Alarm	It is triggered by a Digital input. This alarm is a high priority event and stops compressor operation, however it does not disable the pump. It is a manual reset alarm. To restart, keep the unit on high performance, the compressor will not start until the programmed time has elapsed.
Low Pressure Alarm	It is triggered by a digital input. This alarm stops the compressor of the unit in question. It resets automatically, however it keeps the unit in a low performance mode.
Shutdown Alarm	If the system contains any "Son" units and any of these units are disconnected, this alarm will be activated.
Lack of Refrigerant Alarm	This alarm is triggered when a start command is sent due to cooling demand, and the injection temperature sensor detects a change in temperature over a period of time. This alarm does not take Control actions and can be disabled by the user.

USER INTERFACE

When the equipment is factory reset or in case the default parameters are required, the controller will start the configuration from 0, which has the purpose of selecting the most suitable parameters for the equipment as shown in Fig.23.

When the equipment is factory reset or a factory set-up is required, the first screen that starts is the language selection. Two languages are available in this section, in case an additional language is required, it is recommended to contact the manufacturer for additional language options.

Figure 23. Factory installation screen.

To perform this procedure, simply press the screen for menu selection, as it has a 7" touch screen.

Once you have selected the language, click on the image with the arrow to the right as shown in Fig. 24.

Figure 24. Next screen button.

After pressing the key to the right the menu will change to the machine type selection as shown in the following picture.

For the selection of this machine, the menu **"Machine type"** must be selected. In this menu the water-water selection will be applied; obviously this selection has to be according to the machine type.

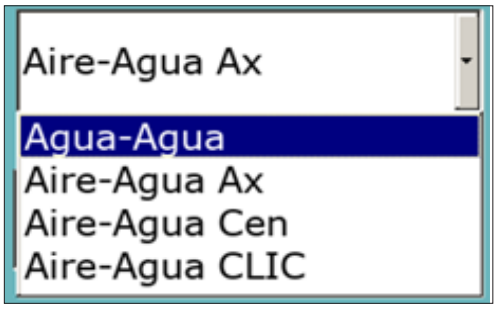


Figure 25. Selection of machine type.

Once the machine type has been selected, the type of operation of the equipment will be selected, the CLIM equipment can work in two ways: either in cooling mode only or, failing that, having both options available, cooling mode and heating mode. In order to make this selection in the second line and the second selection with the description "Type of machine" select the desired option depending on the requirement of the equipment as shown below.

After having selected the type of work of the machine, we will proceed to select the capacity control of the unit. This option allows us to select how the equipment will divide the thermal load for the work of each compressor, in this case for the selection of each of these options will have to be selected by a professional, depending on the installation of the equipment and the needs required by the equipment, in this case the **inverter** option will be used.

Once the configuration has been completed on this screen, you will see at the bottom of the screen that there are two icons with the description of an arrow, one to the right and the other to the left, these icons, when pressed, allow you to scroll between screens. In this case, it is possible to scroll through the installation screens, so care must be taken when selecting the configuration of the equipment so as not to skip important configurations.

Once the configuration of the type of work of the unit has been completed, the selection of how many children will be available for the unit will be made. In this case, the CLIM unit has the capacity to manage up to 7 units. Depending on the commercial selection of the equipment, the number of children can be selected as shown in the following image.

After selecting the number of children of the equipment, the date and time of the equipment will be configured, this is important because the display has the ability to store certain records and events to which the locking is also linked in order to schedule system start-up events.

Once the previous configurations have been made, a screen will appear on which the current information of the equipment will be available as shown in the following image, values will not be shown, so the type of units in which the temperature values are to be shown must be selected first. To do this, press the centigrade or fahrenheit icon, depending on the desired selection.

MAIN SCREEN

Configured devices shall display this screen by default as the main system screen with the following information:

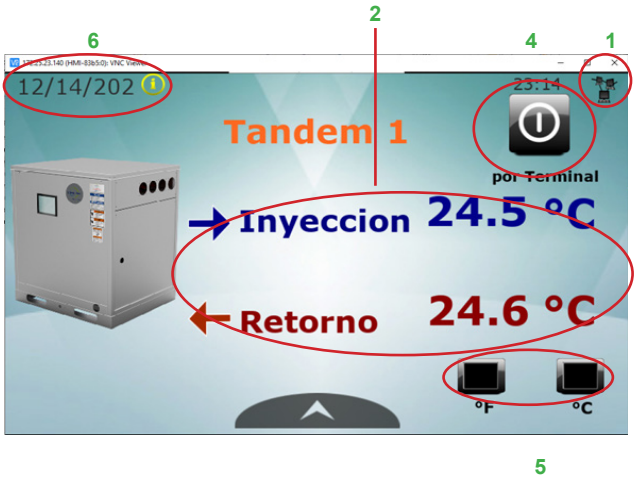
1. Icon of the working system mode, either in “tandem” or “stand-alone” mode.

2. Main unit injection and return temperature, if the system is in “tandem” mode or “mother” unit injection and return temperature, if in “stand-alone” mode 3.

3. Control status, can be activated, deactivated by a digital input or deactivated by the terminal (pGDTouch).

4. Selection of temperature measurement units (Fahrenheit or Celsius).

5. Date.



SCREEN ICONS

The Navigation bar is found on all screens of the system. It appears and disappears automatically when you press the tab at the bottom, as shown in Fig. 26.

Figure 26. On-screen navigation bar

When the tab is pressed the navigation menu will be displayed, as in Fig. 27.

Figure 27. Example of navigation bar on the main screen

The navigation menu changes the access icons depending on the context where the user is within the system. Potential navigation buttons are shown below.

ICON	DESCRIPTION
	From this icon you can access the equipment trends option. These graphs show the behaviour of the temperatures in the equipment throughout the course of its operation.
	This icon is intended to show alarms occurring on the equipment; in the event of an alarm occurring, this icon will change from opaque to red with an indicator on the main screen indicating that an alarm is present.
	Displays the summary of the equipment in functional status together with the information of the functional children.
	The purpose of this icon is to enter the equipment sub configuration menu where you can change the time, language, equipment temperature setpoint and access to equipment maintenance.

Pressing the end icon of the table will bring up a new submenu as shown in Fig.28.

Figure 28. Menú de subconfiguraciones.

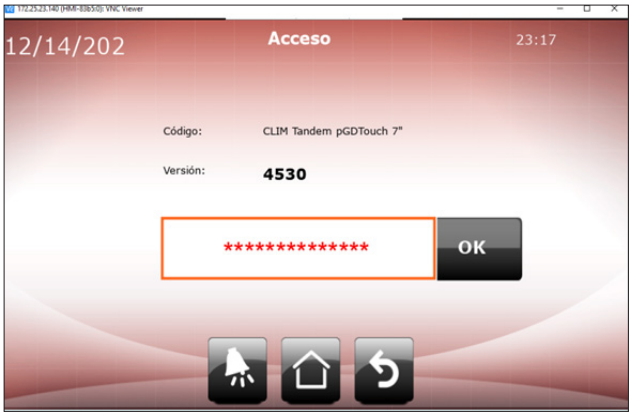
	From this icon you can access the language configuration screen for this specific device, you can select between Spanish or English.
	From this icon you can change the date and time settings.
	From this icon you can access the working hours of each compressor and the equipment's alarm history.
	From this icon you can access the current status of the equipment in which you can see the water temperatures, amount of water gallonage and operation of components in general.
	From this icon it is possible to access the planning or the equipment's calendar in order to schedule times or dates when the equipment needs to be activated.
	By means of this icon you can access the setpoint selection of the equipment, from here you can select the operating point in cold mode or hot mode depending on the configuration that has been selected from the start of operation of the equipment.
	From this icon you can access the equipment's maintenance mode parameters. In order to access this menu, a password will be required, which at the moment of accessing will show a submenu that should only be manipulated by qualified personnel.

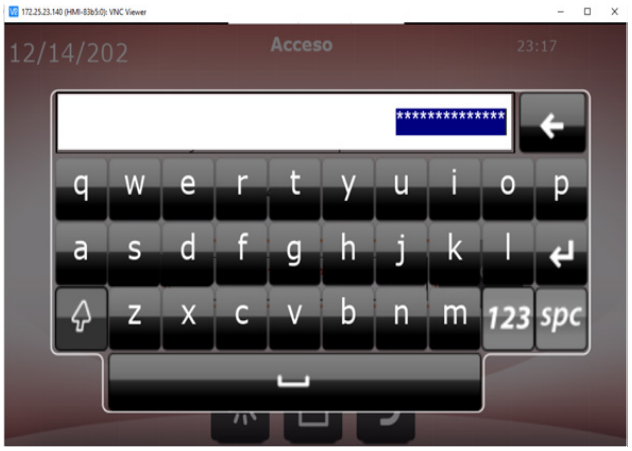
Pressing the working hours icon will take you to the unit's operating information, which will show the number of compressor start-ups, the number of compressor working hours, how many low and high pressure alarms the unit has had, and how many compressor alarms the unit has had.

Pressing **the scheduler** icon will take you to the scheduler menu as shown in the image below, which has the purpose of setting timers on the equipment to turn it on and off whenever you want.

From the **regulation** icon you can access the machine's working setpoint selection menu. In this case, we have the example of the machine that is working in cold mode, so the heat mode regulation does not appear, however, when the heat mode selection is made when the equipment is initially started up, this menu will change and the heat mode regulation will be displayed.

By pressing access you will be able to access the maintenance parameters submenu as shown in the following images. In order to access this menu, a password will be required so that only qualified personnel can manipulate the internal parameters of the equipment. In the event that these parameters need to be manipulated without qualified personnel, request technical assistance by telephone in order to attend to parameterisation requirements.





When the maintenance submenu of the equipment is accessed, a blue arrow will appear to the right, which will allow you to move the necessary parameters in order to access their parameterisation.

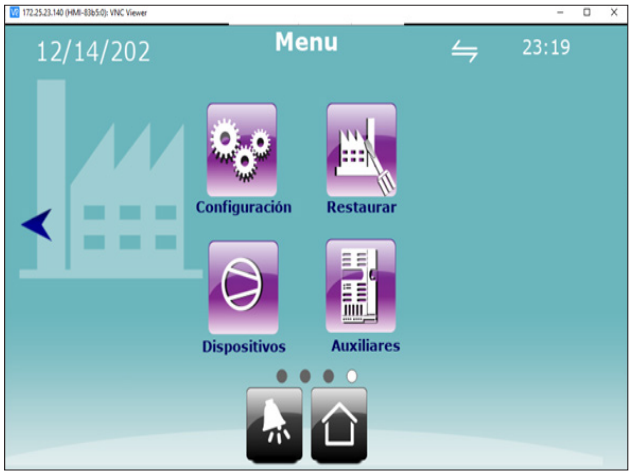
The following is a description of each of the maintenance submenus and the parameters they contain in order to be able to parameterise the machine according to operating needs.

Pressing this menu will give access to the display of the inputs and outputs of the machine.

The following screen shows a menu where you can find the configuration, parameter settings and calibration of the machine, each of the menus contained in this page will be described below.

ICON	DESCRIPTION
	From the settings menu it is possible to configure the behaviour of the equipment with the thermal load of the work and the ranges at which the setpoint can start working.
	From the calibration menu you can modify the reading values of the analogue sensors and if necessary adjust the analogue outputs.
	From the export menu you can download the alarms of the events that occur in the equipment.
	From the delete logs menu you can delete the saved events occurred in the equipment, it is worth mentioning that if these logs are deleted, the events occurred in the equipment will be definitively lost.

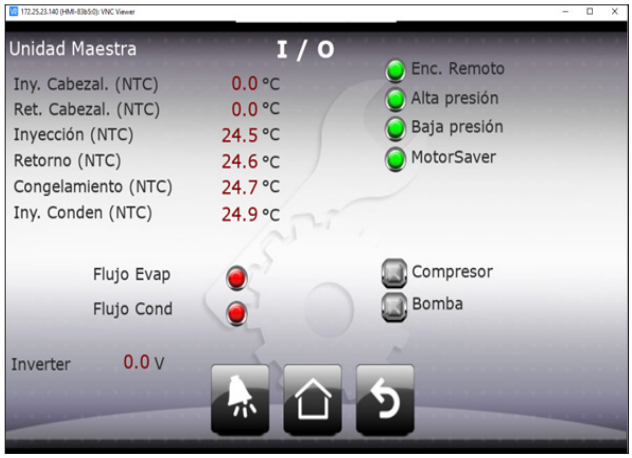
Una vez realizados los ajustes necesarios en la página anterior para poder continuar con la configuración necesaria del equipo se tiene que presionar la tecla hacia la derecha de la pantalla, esto cambiara la página y un menú extra aparecerá como se muestra a continuación.



ICON	DESCRIPTION
	From the configuration menu you can modify the equipment startup and the setpoint limits of the equipment, you can also activate the vnc of the screen; this will allow a remote connection with the equipment, it is worth mentioning that in the new version of the screen this option is no longer available since in the version of the new screens this configuration comes by default. ***To activate it is a different procedure. Consult with the display version which the machine has from the beginning.***
	From the restore menu, the default parameters of the equipment can be reset, it should be taken into account that this procedure requires trained personnel. ***Consult the manufacturer.***

	The alarms and alarm times of the machine can be configured from the devices menu, and to move these parameters, please consult with qualified personnel.
	El menú auxiliares contiene opciones extras con las que puede contar el equipo. Para poder configurar estas opciones consultar con personal capacitado para confirmar si el equipo cuenta con estas opciones extras.

From this screen you can monitor the inputs and outputs of the machine.



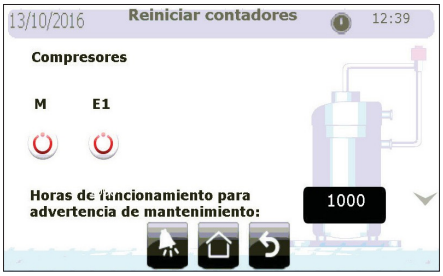
When you enter the summary menu you can see the current status of the system and general operation as shown in the following image, this page will show the icons of the equipment that will be in operation. For this example, only one device is selected, so if more devices are selected in the initial configuration, they will be shown on this screen.

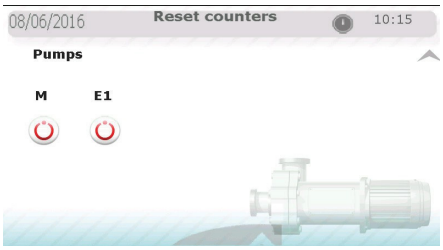
In order to enter the description it is necessary to click on the compressor icon.

Pressing the above icon will take you to the general description of the unit's operation, from here you can see the status of the main operating inputs of the unit, as well as the system temperatures and the water flow measurement in the system.

RESETTING OF THE WORKING HOURS COUNTER

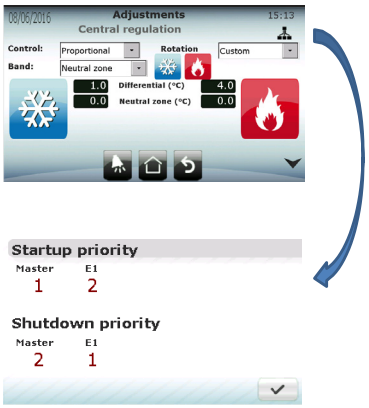
In this section, accessible with level 1 password, the user is given the option to reset the counters via buttons for each section. The counter reset button resets the count of the number of times the compressor was started, the number of hours worked and the number of times the pressure suction and discharge digital inputs were activated. The pump reset button resets the number of times the pump has been started and the number of hours worked by the pump.





SETTINGS

In the settings section, password protected level 2, the parameters for the control and management of the cooling demand (and heating for systems configured as heat pump) are displayed.



The parameters for Central Control ("Tandem" mode) are completely independent of the type of regulation in "Stand-alone" mode, with the exception of the cooling and heating set points, as well as the option to clear the accumulated integral errors when the set point is reached.

NOTE: Even if a customised rotation mode was selected, the drive with frequency converter or unloader ("Mother" drive) will always be the first to be switched on and the last to be switched off, regardless of the assigned priority.

CONTROL CENTRAL O TANDEM

The control parameters in the central regulation mode or "Tandem" using the control temperature as the main unit temperature are:

Central Control or Tandem mode parameters:

- Control type (P, PI or PID).
- Remove integral control when set point is reached to avoid fluctuations inherent in integral control
- Rotation Type
- Differential (Water Chiller Unit and heat pump)
- Neutral Zones (Water Chiller Unit and heat pump)
- Integral time
- Derivative time

NOTE: To configure PD control, select PID and set the integral time to 0.

INDEPENDENT CONTROL

The "Independent Control" calculates all the parameters that regulate the demand control in each unit independently using the injection temperature as the main parameter.

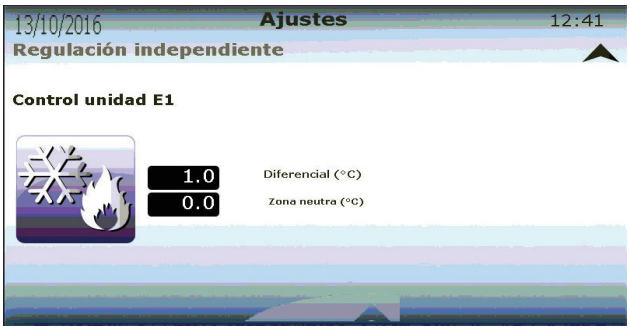
As the "Mother" unit can regulate its capacity, it has a unique proportional control algorithm, P+I or PID with parameters independent of the central control. If PD control is desired, the user must select PID and set the integral time to 0 sec.

Parameter mode o Separate central control for the "Mother" unit

- Control type (P, PI or PID)
- Remove integral error when set point is reached to avoid fluctuations inherent in integral control
- Differential (Water Chiller Unit and Heat Pump)
- Neutral Zone (Water Chiller Unit and Heat Pump)
- Integral Time
- Derivative Time

Individual control in "Son" units only requires the following parameters:

- Differential (Water Chiller Unit and Heat Pump)
- Neutral Zone (Water Chiller Unit and Heat Pump)



CONTROL DE HISTÉRESIS

The unit has the option to configure the respective ON and OFF from the set point, both for cooling and heating mode, in "General" the ON differential will have the value of ON and the OFF differential will have the value of OFF, always with respect to the set point of the unit.

Example
ON differential = 5
Differential OFF = 0
Set Point = 50

The unit will turn on at setpoint +5 (55) and turn off at setpoint -0 (55).

Furthermore in the “Son” section it is possible to configure the switching on and off of the same, this configuration is a prevention to avoid the freezing or cold water alarm in “Tandem” mode, this function is the same as in “General” and respective to the set point.

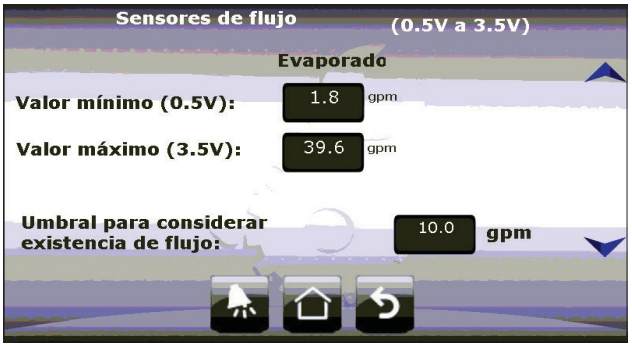
NOTE: The ON differential on both “General” and “Son” units must always be >0, otherwise the unit will never be configured.

CALIBRATION

In the Level 2 password protected “Calibration” section, the user can adjust the readings of the sensors connected to the units to match the readings on a measurement standard. Additionally, it is possible to set the logical operation of the digital inputs; these can be “Regularly Open” (NO) or “Regularly Closed” (NC).

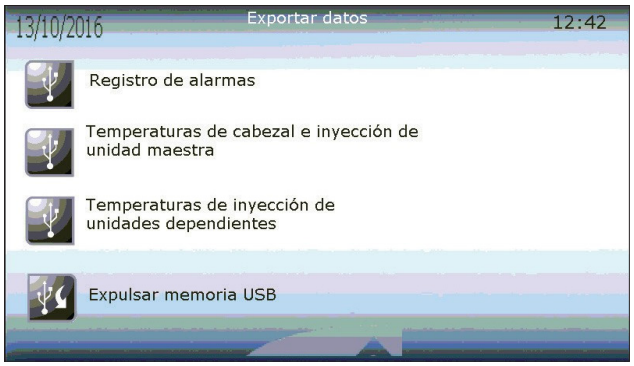
In addition it is possible to calibrate the minimum flow rate allowed to turn on the system, the system unit needs 2.4 gallons/min per Ton. If you have a 10 Ton unit you will need 24 gallons/min.
If the hydraulic installation cannot provide this flow, it is possible to operate the unit at 80% of the required flow to avoid flow alarms, be cautious if you go below 80% as this can cause serious problems with your system such as inefficiency and lack of rated capacity.

For water-source heat pumps you can see the condenser sensor, do not change the maximum and minimum values, these must be set in the installation.



This type of sensor cannot measure more than 39.6 gal/min, in case you get a value higher than this, the display will show 295.6 approx. Check your hydraulic system to regulate the flow, the value considered as acceptable will be the same for the evaporator sensor.

EXPORT OF RECORDS



The user can export to a USB Flash Drive all the information stored in the unit as a comma separated file (CSV). The user can export 3 different files with different information:

- The Alarm Log
- The injection temperature of the “Mother” unit and, if available, the temperatures of the Mother unit.
- The injection temperature of the “Son” units (if any are present in the system).

DELETION OF RECORDS

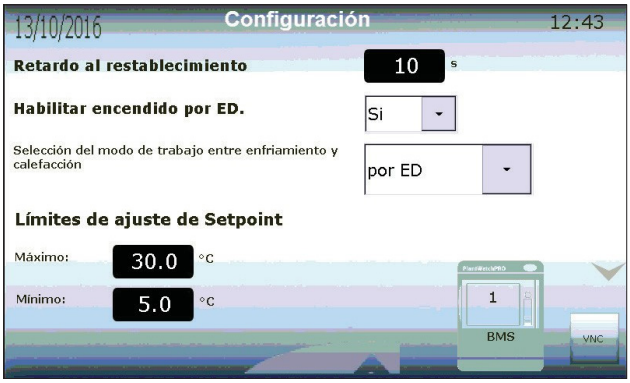
In the last part of Level 2 of the Navigation Menu, the user can delete the historical graphs and alarm logs from the internal memory of the pGD Touch terminal.

NOTE: If records are deleted, it is NOT possible to recover them later.

SETTINGS

The Global system configuration is protected with the Level 3 password. In the “Configuration” section you will find the global parameters of the system. These are separated into 3 categories.

- Restart Delay: If the control is off, when the controller is restarted it will wait for this time before starting the dimming process.
- Enable unit start-up via digital input
- Select operating mode
- Setpoint safety limits



NETWORK COMMUNICATION

The BMS2 control port can be used to monitor the entire system remotely with an external supervisor via the Modbus RTU protocol.

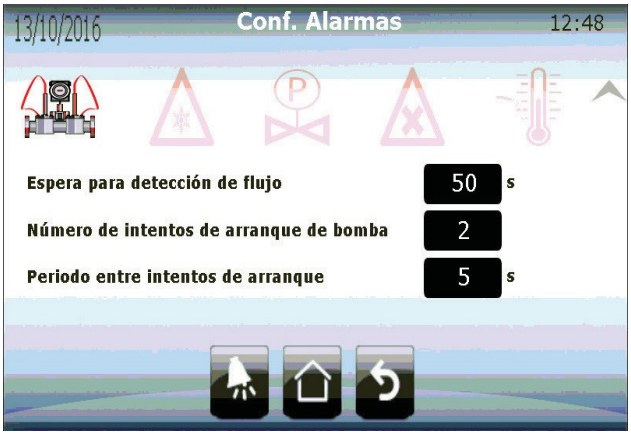
In this screen the user sets the parameters of the communication protocol to be connected to an external device. These parameters are:

- Address
- Speed (Baud per second)
- Stop bits
- Parity

FLOW ALARM

The detection processes for water flow are explained in the “Pump Start” section. The parameters to be assigned by the user are:

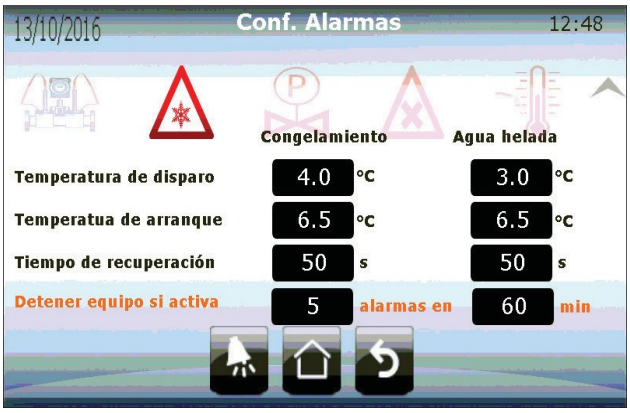
- Waiting time for digital input detection after the pump has been switched on.
- Number of attempts to start the pump in case of digital input flow detection failure.
- Waiting time between attempts to start the pump.



FREEZE AND COLD WATER ALARM

The freezing and cold water logic is the same, except that one considers the freezing sensor and the other the injection sensor as the main source of information. For each of the alarms, an activation value, a reset time and a recovery time (where the unit with an active alarm will not be reset) must be set.

Each unit has an internal counter that keeps track of how many times a freeze or cold water alarm has been activated. If the unit exceeds a certain number of alarms in a certain amount of time, the continuous freeze alarm will be activated, which will disable the unit until the user resets it.



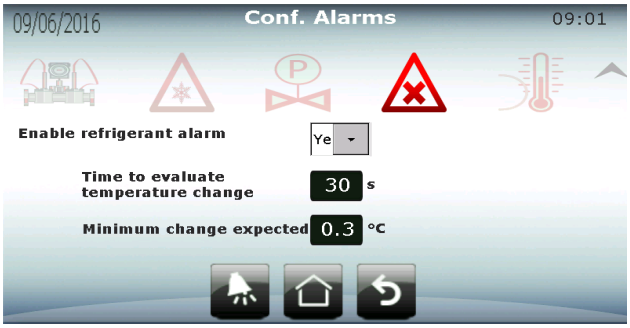
HIGH AND LOW PRESSURE ALARM

The high and low pressure alarms are activated immediately after a change in the digital input is detected. Both alarms stop compressor operation immediately.

The high pressure alarm is not automatically reset, the user must perform this operation manually. The low pressure alarm is automatically reset once a change is detected at the corresponding digital input. When the alarm is reset, the compressor will be disabled for the recovery time set by the user in this section.

REFRIGERANT ALARM

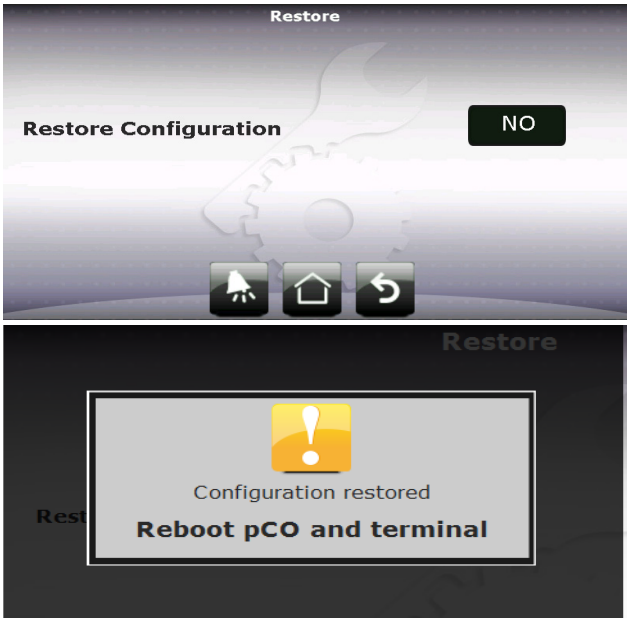
The refrigerant alarm is a user-enabled warning that evaluates the change in the injection temperature sensor when the compressor starts running. If the sensor detects any change within the set time, the alarm is activated. This alarm will not stop any control process. In this section the user can enable and disable the alarm, and if applicable, set the minimum detection range and the maximum time this change must occur in order not to activate the alarm.



RESTAURATION

In the last section that can be accessed with the Level 3 password, there is the option to reset the unit to factory settings. System Restore allows the user to reconfigure the system as a completely new installation and reset the initial settings. Resetting resets the parameters of the initial system configuration, but does not change any of the other values stored in the controller's memory (setpoints, differential, alarms, etc.)

It is the user's responsibility to properly configure the system with the new settings for the correct operation of the units.



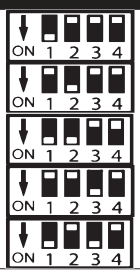
Note : When the system is reset, the user must restart both the controller (pCO) and the terminal (pGD Touch).

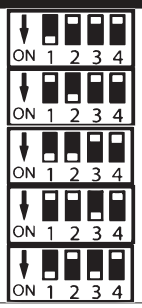
SERIAL ADDRESS OF EXPANSION MODULES

Each “Son” unit uses an expansion module that communicates via Modbus with the parent controller (pCO) via the Fieldbus1 port of the controller. Consequently, the units need to be configured with the correct serial address. To avoid errors, the address is set and fixed when the controller is programmed and cannot be changed. The only task to be performed by the user is to set the physical address of the expansion modules by combining 4 “switches” on each expansion module.

The address on the “switches” is set by the 4-bit binary number they represent.
The lower position of the “switches” has a value of “1” and the opposite is “0”.

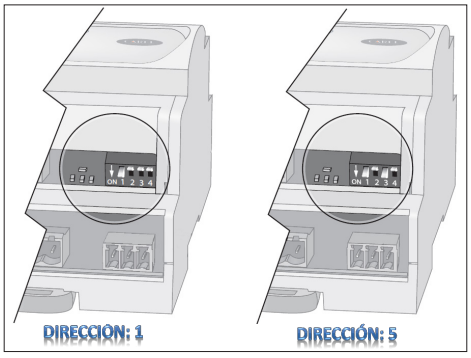
The addresses to assign are:

EXPANSION MODULE PCOE	SERIAL DIRECTION	PCOE SWITCHES
SON UNIT 1	1	
SON UNIT 2	2	
SON UNIT 3	3	
SON UNIT 4	4	

EXPANSION MODULE PCOE	SERIAL DIRECTION	PCOE SWITCHES
SON UNIT 1	9	
SON UNIT 2	10	
SON UNIT 3	11	
SON UNIT 4	12	

No other serial address will be recognised, the “expansion module disconnected” alarm will be triggered if a wrong address is used..

Example:



NOTE: It is important that the addresses are not repeated, or the entire instrument network on that port may collapse.

START-UP AND SHUT-DOWN PROCEDURES

⚠ WARNING ⚠

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

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.	

NOTE: Accessories such as thermometers, pressure gauges, measuring ports, etc., 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

Units require model-specific electrical power with physical grounding, check the electrical specification on the nameplate of the equipment.

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 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 control panel of the unit has a ventilation duct, and must not be obstructed in any way.

NOTE: The units are factory set, however the power supply may vary in each installation and due to this imbalance must be adjusted before starting up the system 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.	
The unbalance phase should be less than 2% of the average.	
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. Place the switch on the CONTROL UNIT in the ON position to power the control panel with 24 volts.

MAINTENANCE

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.

Service or maintenance of this equipment 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 panels located on the front and side of the unit, service and maintenance of the unit can be performed easily.

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

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 that the cooling capacity is adequate and therefore the efficient operation of the equipment. 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 cleaning.

The internal water circuit does not require major maintenance or service, except for water pump failure (if applicable). 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 manufacturer 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.

COMPRESSOR MAINTENANCE

The internal pressure and surface temperature of the compressor are hazards 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:

- Clean the compressor housing, make sure it is free of debris and dirt.
- Check the electrical/power connection between the unit and the compressor, make sure the power cable is tight and that there is no debris of any kind between the connections.
- Check the oil level and color in the oil sight glass (NOTE: Not all compressor models have sight glass).
- Inspect and verify compressor suspension brackets, they should not be cracked or broken.
- Verify that safety devices are operational and properly set.
- Make sure the system is airtight.
- Check the compressor current consumption.
- Confirm that the system is operating in a consistent manner, review 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 vibrations can cause the connections to loosen, thus causing arcing.

For servicing electrical components:

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

NOTE: Each unit is packaged with complete wiring.
Have diagrams available when making connections. The electrical connections required at the time of installation are: Supply power line to the power inlet and control wiring for and the control wiring for the remote control.

⚠ WARNING ⚠

Do not wire the control with high voltage wires. High voltage may interfere with control signals and/or may cause erratic or low performance.

⚠ WARNING ⚠

Risk of electric shock, can cause injury and death. Disconnect all sources of electrical power 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.

⚠ WARNING ⚠

Dust, dirt and debris should be removed regularly to avoid accumulation that will hinder the regular operation of the unit.

FILTER DRIER

Any particles or debris in the cooling circuit are swept by the coolant into the coolant line and trapped by the filter drier.
It is recommended that the filter drier be replaced whenever any repairs are made to the cooling line.

EXPANSION VALVE

The function of the expansion valve is to maintain an adequate supply of refrigerant to the Heat Exchanger/Evaporator. This is in order to satisfy the charge conditions.
Before adjusting the superheat, check that the unit charge is correct and that the liquid line is completely full and bubble free, and that the circuit is operating under stable load conditions.
The suction superheat for the suction discharge of the heat exchanger/evaporator 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 any connections on refrigerant or electrical lines until the compressor has been depressurized on both sides.

ANNUAL MAINTENANCE SCHEDULE

Before performing any work on the unit, make sure that you have the proper Personal Safety Equipment (PPE) and that the unit is turned off and at rest.

It is recommended to energize the unit 6 hours* before the first start-up to warm up the compressor oil.

NOTE: If a component change or repair has been made to the refrigeration circuit, it is recommended that the filter drier be changed.

*Depending on conditions, you may wish to energize the unit longer in advance.

HYDRAULIC CIRCUIT MAINTENANCE

- **Hydraulic Filter:** Inspection, cleaning, replacement if necessary. Monthly
- **Hydraulic Circuit:** Inspection for leaks and corrosion in piping, welds, joints and other components. Monthly
- **Hydraulic Circuit:** Replacement of water in the circuit. Quarterly

REFRIGERATION CIRCUIT MAINTENANCE

- **Compressor:** Compressor and compressor oil inspection. Monthly
- **Filter Drier:** Inspection and replacement if necessary. Monthly
- **Cooling Circuit:** Inspection for leaks and corrosion in piping, welds, joints and other components. Monthly
- **Refrigeration Circuit:** Check refrigerant pressure. Quarterly

ELECTRICAL MAINTENANCE

- **Electrical Components:** Tighten connectors and terminals on electrical panel, control parts, power and junction boxes. Quarterly
- **Electrical Panel:** General cleaning, remove dirt and foreign objects. Monthly
- **Electrical Panel:** Physical inspection of all connectors, components and relays. Monthly
- **Electric Motors:** Review amperage of all electric motors and compare them according to the equipment nameplate to detect abnormalities. Quarterly
- **Electrical Connections:** Physically inspect for false contacts, corrosion or burns. Monthly
- **Electrical Protections:** Verify the adjustment and condition of electrical protections and fuses; these must be in accordance with the manufacturer's specifications. Bimonthly

PHYSICAL INSPECTION

- **Structure: General** overhaul and cleaning. Bimonthly
- **Energy:** Review and compare the unit's energy consumption with previous months to detect any anomalies in performance.
- **Control:** Check alarm history. Monthly
- **Drain Line*:** Check that it is not clogged and that water is flowing properly. Monthly

It may not be on your computer.

NOTE: If any component has been replaced or the cooling circuit has been repaired, it is recommended to change the filter drier.

TROUBLESHOOTING CHART

When a fault is detected in the unit, it is necessary to completely shut down the equipment before proceeding with any of the procedures listed here.
The following tips are suggestions for resolving common equipment faults. If a fault occurs that is not listed here, please contact your nearest distributor. Under no circumstances should you attempt to solve the problem yourself.

Problem	Possible causes	Possible corrective actions
Compressor does not run.	Main or compressor disconnect switch open.	Circuit breaker 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 fault.
	Thermal overloads have tripped.	Overloads are self-resetting. Check supply voltage, operating amps, cycle times and mechanical operations. Allow time for automatic reset.
	Faulty 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.
	No cooling required.	Wait until the unit calls for cooling.
	Liquid line solenoid does not open.	Repair or replace the solenoid. Check wiring.
	Motor electrical problems.	Check for open, shorted or bubbled motor.
	Loose wiring.	Check all wire connections and tighten all terminal screws.
Compressor makes noise or vibrates	Compressor running in reverse.	Check that the unit and compressor are on the correct phase of the line voltage.
	Inadequate piping or supports on suction or discharge.	Reposition, add or remove hangers.
	Worn compressor insulator bushing.	Replace.
	Compressor mechanical failure.	Check for possible problem in compressor failure and replace.
	Low oil level.	Check the possible problem before it damages the compressor.
High Pressure / High Pressure Alarm.	Non-condensable gases in the system.	Remove non-condensable gases / Replace refrigerant charge.
	Circuit overloaded with refrigerant.	Remove excess refrigerant.
	Optional discharge off, valve not open.	Open valve.
	On.	Check and correct electrical connection.
	Condenser coil dirty, clogged.	Clean and/or clear coil of obstructions.

Problem	Possible causes	Possible corrective actions
Low Pressure / Low Pressure Alarm.	Rapid load changes in the system.	Stabilize the system.
	Refrigerant leakage.	Check for refrigerant leaks, repair and add refrigerant.
	Lack of refrigerant.	Add refrigerant according to normal charging process.
	Dirty filter drier.	Check the pressure drop across the filter drier. Replace filter if necessary.
	Expansion valve malfunction.	Adjust, Repair or Replace expansion valve. Adjust for proper superheat.
	Condensing temperature too low.	Outside temperature below design parameters.
	Compressor does not start properly.	Check corrective steps.
	Compressor start intervals too long low / slow.	If system has excess oil, recover and adjust by observing liquid sight glass on compressor.
	Insufficient water flow.	Correct the water flow to the minimum required by the system.
	Excess oil or use of wrong oil in Compressor.	Remove and/or change compressor oil.
	Dirty heat exchanger.	Check the pressure drop across the heat exchanger. Clean or replace if necessary.
	High condenser temperature.	See corrective steps for high discharge pressure.
Compressor thermal protection switch open.	System operating beyond design conditions.	Correct conditions to be within system design limits.
	Discharge valve not open.	Open discharge valve.
	Cycling too fast.	Stabilize load or control settings. Allow time for system to stabilize.
	Incorrect voltage range or unbalance.	Check and correct.
	Overheating in electrical connections.	Verify that components have proper thermal protection ratings for the system. Replace if necessary.
Compressor oil level too high or too low.	Coolant / oil leakage.	Inspect the cooling system for leaks. Correct and recharge coolant.
	Low oil level.	Check overheat temperature, add oil.
	Oil line loose / improperly tightened.	Inspect, check, adjust or replace oil line.
	Oil level too high with compressor operating.	Check overheat temperature, remove oil.
	Insufficient water flow. Oil level too high.	Correct water flow. Check overheat temperature.
	Excessive liquid in crankcase. Too high oil level.	Check crankcase heater. Check solenoid valve fluid line operation.
	Short cycling.	Stabilize load or correct control settings for application.
	Compressor mechanical failure.	Inspect and replace compressor if necessary.
	Incorrect oil type.	Check oil type. Replace if necessary.

Troubleshooting Chart

Problem	Possible causes	Possible corrective actions
Motor relay overload or circuit breakers open.	Improper voltage.	Check voltage and correct.
	Voltage unbalance or out of range.	Check and adjust voltage balancing.
	Faulty motor wiring or grounding.	Inspect and if necessary replace compressor.
	Loose power wiring or burned connectors.	Check all connections and tighten them, replace connectors.
The unit does not turn on.	High condenser temperature.	Check correction steps for high condenser pressure.
	Equipment does not have enough refrigerant.	Check data sheet and check 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.
	Inadequate voltage.	Check voltage and correct it.
	No water flow in the system.	Check for proper water flow to the system.
	Presence of air bubbles in the system.	Remove air from hydraulic circuit.
	Water flow is reversed.	Check and correct water flow / pumping.
	Error in electrical connection.	Verify electrical connection and presence of power on site.
The unit turns on but does not cool sufficiently.	Injection temperature value is incorrectly set.	Check and adjust injection temperature.
	Dirty / clogged condenser.	Clean / release condensers.
	Air suction and discharge is clogged.	Inspect, clean, clear, remove any possible obstructions or objects.
	Not enough refrigerant in the system.	Check refrigerant circuit pressures. If necessary add refrigerant to the system.
	Insufficient water flow in the system.	Verify that the water flow meets the minimum required by the system. Correct water flow / flow rate.
	Water in the system is dirty or with residue.	Drain dirty or debris water and replace with clean water.
Water pump will not start	No electrical power.	Check electrical connection (False contacts) and correct.
	Pump damaged.	Inspect and replace if necessary.
	Pumping system.	Check the operation and configuration of the pumping system.

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Air Conditioning

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