clausius

the heatpump specialists

HP Technical manual

clausius
the heatpump specialists

1. Clausius HEAT PUMP

1.1 GENERAL INFORMATION

We would like to welcome you and we appreciate that you have trusted the products commercialised by CEO2 Green. We hope that they fulfil your requirements.

This manual describes the heat pump models available, as well as the procedures and considerations for their installation and commissioning.

Read this manual carefully to guarantee a correct instalation and utilisation of your heat pump.

CLAUSIUS heat pumps must be installed by trained personnel, following this manual and the applicable standards.

An improper use or installation of the unit could damage not only the heat pump, but also the people using it.

Throughout this manual, you will find graphical boxes with important information for the user or installer. This information is classified into three categories of importance related with the potential effect on the unit and/or the people manipulating it.

DANGER. Includes information that should be taken into account to avoid damage to the heat pump and/or the people manipulating it.

WARNING. Includes information about advisable and not advisable practices to guarantee a proper performance of the unit.

NOTE. Includes additional information that may be useful for the heat pump user/installer.

1.2 DESCRIPTION

Clausius heat pumps are latest-generation ground-source heat pumps that allow meeting all the heating, refrigeration and DHW loads with a single unit. Clausius heat pumps have been conceived with an innovative modular structure, i.e. each heat pump consists of a refrigerant unit, a hydraulic unit and an electrical cabinet. In addition, the heat pump allows two configurations: Classic, which allows to couple with external DHW tank and Elite, with integrated DHW tank.

R410A is the refrigerant used in all Clausius heat pumps.

R410A is a chlorine-free refrigerant and does not contribute to ozone layer depletion.

R410A is non-toxic nor flammable under normal conditions. Special precautions should be taken for manipulation and/or in case of leakage (see section 6).

1.3 PRODUCT RECEPTION

Clausius heat pumps are distributed properly packed and labeled for protection during transportation and product identification. Inside the packaging, the technical manual with the installation and commissioning sheets are provided as well as the heat pump. These sheets must be covered and forwarded to CEO2 Green by the installer.

After the product reception, it is recommended carry out a detailed visual inspection, notifying any damage or deficiency observed.

All Clausius heat pumps include a set of flexible hoses to connect with the hydraulic installation and the accessories for the drain valves located in the bottom of the heat pump.

A hydraulic safety group (elite configuration), control terminal and internet connection could be included upon request.

1.4 CONTROL PANEL

Clausius heat pumps have a control panel with monochrome screen and 6 keys with different functions, as shown in Figure 1.

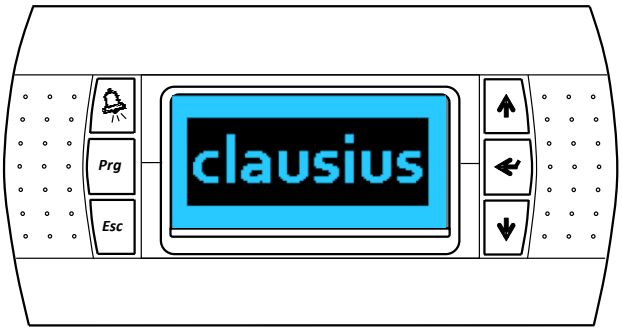


Figure 1. Clausius heat pumps control panel.

Symbol	Function
	Provides access to ALARM MENU.
Prg	Provides access to USER MENU.
Esc	Allows accessing the previous level of the menu.
	Allows moving among the menú options and modifying the values of the configurable variables.
	Allows selecting the options in the menus and confirming any data introduced.

1.5 MAIN SCREEN

The control panel turns on when the external breaker of the heat pump is activated. While the software is loading, the Clausius logo appears (Figure 1). Afterwards, if selected in the installer menu, comes up the language selection screen. Otherwise, it accesses the main screen of the heat pump control software (Figure 2).

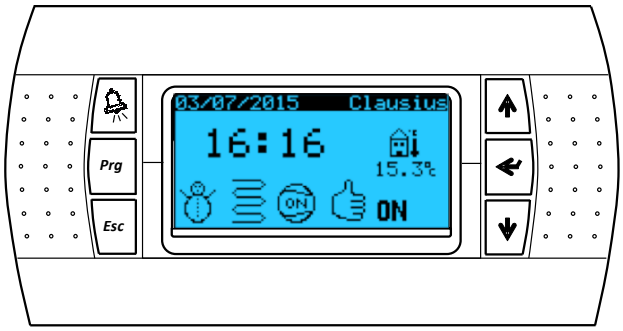


Figure 2. Main screen of the Clausius heat pump control software.

If activated the language selection option, the access to the main screen occurs after a 60-second delay or by pressing the key ***[Esc]***.

The heat pump main screen shows information about its operation. At the top, it shows the date, and beneath, the system time and the temperature registered by the outdoor temperature probe (with the corresponding symbol).

Symbol	Function
	Outdoor temperature

Different parameters concerning the status of the heat pump and the active operation modes appear at the bottom part of the screen.

1.6 PROGRAMS

Clausius heat pumps have two different programs, WINTER program and SUMMER program, and an additional option, named AUTOMATIC program, which chooses between the first two as a function of the climatic conditions. WINTER and SUMMER programs determine the heat pump operation, changing the available operation modes and control strategies to adapt to the user needs.

The program symbol is shown in the first place of the bottom row in the main screen.

Symbol	Program
	WINTER program
	SUMMER program
AUTO	AUTOMATIC program

The program selection process is explained in section 1.

1.7 OPERATION MODES

Clausius heat pumps allow selecting seven operation modes shown below.

Symbol	Operation mode
	DHW mode
	HEATING mode
	COOLING mode
	POOL mode
	ANTI-LEGIONELLA mode
	FLOOR DRYING mode
	FAULT mode

The first four modes, DHW, HEATING, COOLING and POOL, are considered principal modes. The availability of these depends on the heat pump model and on the program chosen.

NOTE **With WINTER program, COOLING is unavailable and with SUMMER program, HEATING is disabled.**

From these four modes, the heat pump prioritises DHW, even when other simultaneous demands occur.

Besides these four main operation modes, Clausius heat pumps have specific modes for ANTI-LEGIONELLA or FLOOR DRYING processes.

ANTI-LEGIONELLA mode, if activated by the installer, performs weekly treatments to prevent legionella from multiplying in the DHW tank. FLOOR DRYING mode carries out a controlled drying process of the underfloor heating system. Finally, in case any fault occurs, an alarm is activated and the FAULT mode allows DHW production with the electric resistance.

NOTE **This operation mode does not work in case of an error in the DHW tank probe.**

Principal modes and ANTI-LEGIONELLA mode symbols are shown in the second position of the bottom row in the main screen. However, FLOOR DRYING mode shows a specific screen and the FAULT mode symbol is shown in the four place of the bottom row (see section 1.8).

1.8 HEAT PUMP STATUSES

In the heat pump main screen, there is also information concerning its status, which is shown with the three last symbols of the bottom row (Figure 3).

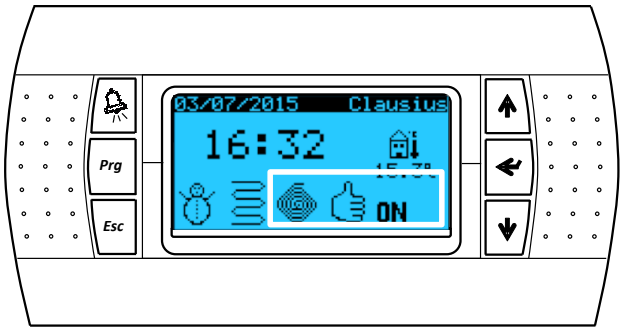


Figure 3. Status symbols of the heat pump.

The first symbol indicates active process at each time. There are up to 6 possible statuses, as shown in the following table.

Symbol	Status
	Compressor on
	Compressor turning off process
	Compressor turning on process
321	Waiting process with active demand
	Waiting process without active demand
OK	Demands satisfied

The second symbol details if the heat pump is operational or not. If completed the commissioning by the installer and no faults occur, the screen shows a SYSTEM OK symbol.

Symbol	Status
	System OK

In case a fault impedes the proper operation of the unit, the symbol SYSTEM OK disappears. The FAULT mode symbol comes up if a DHW demand occurs.

The last symbol concerning the heat pump status indicates whether the heat pump is ON or OFF. If is in OFF status, the symbol gives additional information about the turning off type. The possible turning of types are: OFF by CONTROL PANEL, OFF by CALENDAR, OFF by DIGITAL INPUT or OFF by ALARM.

Symbol	Status
	OFF by control panel
	OFF by calendar
	OFF by digital input
	OFF by alarm

If the electric resistance is active, due to normal operation or due to FAULT mode, the status section shows the word ON and the pertinent symbol.

Symbol	Status
	Electric resistance is active

1.9 EXTERNAL CONTROL

Different external devices can be used to realize a basic control of Clausius heat pumps without the utilization of the own control panel. The control devices allowed are: a home automation logic station, a control terminal th-Tune and an internet access from a device, PC, tablet or smartphone with a browser installed.

The available functionalities regarding configuration and parameter visualization are different depending on the control device employed, just like it is detailed in this manual.

2. USER MENU

The control panel ***[Prg]*** key provides access to the user menu.

NOTE **Access to the user menu is enabled if an operation diagram has been previously selected in the installer menu.**

NOTE **A correct heat pump performance is only achieved after its proper configuration in the installer menu.**

The user menu encloses every function for the heat pump control. In addition, it allows modifying the user configurable operation parameters and their visualisation.

In the user menu, it is possible to select the different submenus described in the following paragraphs. The submenus shown depend on the heat pump model selected and on its configuration in the installer menu (Figure 4).

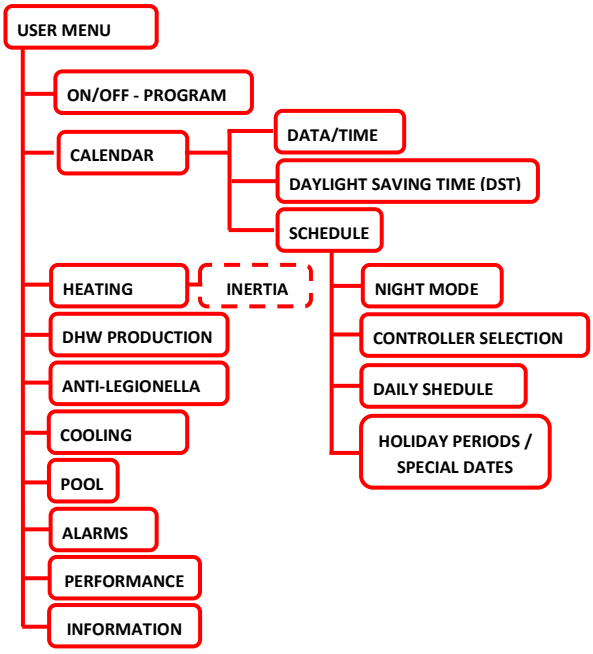


Figure 4. User menu options.

2.1 ON/OFF

Symbol	Name	Function
⏻	ON/OFF	Allows turning on the heat pump by control panel and choosing the program.

The first submenu of the user menu is ON/OFF. It allows choosing the heat pump status between ON and OFF (by control panel) and the program between WINTER, SUMMER and AUTOMATIC.

NOTE **The ON status of the heat pump does not necessarily mean that the compressor is active. A demand is also needed to turn the compressor on.**

NOTE **ON/OFF statuses of the heat pump are also modified by calendar, digital input or alarm.**

NOTE **Operation schedule can be selected by control panel, home automation logic, th-Tune or via internet from a PC or a smartphone.**

2.2 CALENDAR

Symbol	Name	Function
LMM 123 891	Calendar	Allows the user to modify different calendar settings of the heat pump.

CALENDAR submenu allows the user to modify different calendar settings of the heat pump. Among these settings, it is possible to adjust the date and time of the heat pump controller, to program the Daylight-Saving Time (DST) and to adjust operation time slots by CALENDAR.

2.2.1 Date/Time

Allows the user to modify the date and time of the heat pump controller.

2.2.2 Daylight Saving Time (DST)

Allows the user to enable and disable the automatic DST option and to modify the DST process configuration.

NOTE **The automatic DST follows the procedure used in the EU and most industrialised countries. Thus, it should not be changed.**

2.2.3 Schedule

Allows the user to program the operation of the heat pump with time slots. Each slot has a starting time and operation conditions.

2.2.3.1 Night mode

This option allows introducing a time slot at which the heat pump compressor rotational speed is superiorly limited in order to reduce the acoustic emissions when the heat pump may disturb the inhabitants (NIGHT MODE).

This submenu allows the user to enable and disable this mode, as well as to select its starting and finishing times (Figure 5).

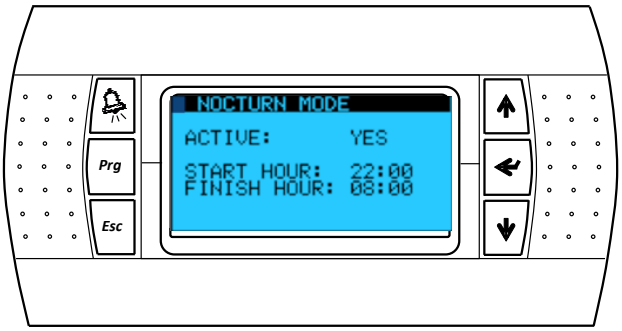


Figure 5. Night mode programming screen.

NOTE **NIGHT MODE option should be enabled in the INSTALLER MENU to access NIGHT MODE in the USER MENU.**

NOTE **The maximum compressor rotational speed for the NIGHT MODE is configured in the INSTALLER MENU.**

If the NIGHT MODE is active, its symbol substitutes the outdoor temperature symbol in the main screen.

Symbol	Name	Function
	NIGHT MODE	Time slot with the compressor rotational speed limited to reduce the acoustic emissions.

2.2.3.2 Controller selection

Every Clausius heat pump allows the SCHEDULE with the HEAT PUMP CONTROLLER, as well as with a TH-TUNE controller, if available.

NOTE **th-Tune is a control terminal compatible with CLAUSIUS heat pumps, distributed as an optional device, that optimises the heat pump performance.**

This screen allows the user to choose among HEAT PUMP CONTROLLER, TH-TUNE or NOT CONFIGURED.

Symbol	Control system
	Heat pump controller
	th-Tune

NOTE **th-Tune needs to be selected as inner terminal in the installer menu to allow the schedule with th-Tune.**

2.2.3.3 Daily schedule

The daily schedule procedure depends on the selected controller.

If th-Tune is not available, the only daily schedule option is with HEAT PUMP CONTROLLER. It permits selecting two time slots, defined with the starting and finishing times. Thus, in those time slots, the heat pumps is enabled to satify the different demands (Figure 6).

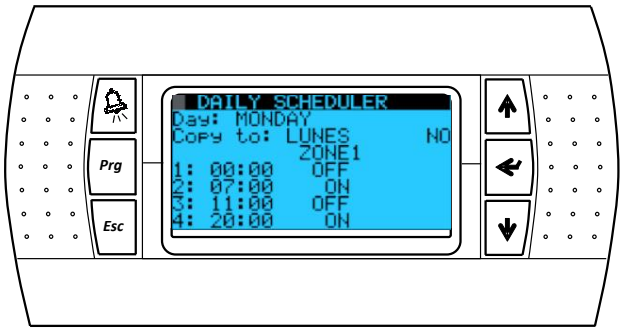


Figure 6. Screen for the daily schedule configuration with heat pump controller (installations without th-Tune).

NOTE **It is necessary to program, at least, a starting and finishing condition to guarantee the heat pump correct operation.**

NOTE **At the end of the day, the heat pump turns off automatically, unless a new time slot is programmed at 00:00 of the following day.**

Out of the operation time slots, the heat pump is enabled to produce DHW and ANTI-LEGIONELLA treatments.

The controller permits copying the daily schedule from one day to another, or even to the whole week, to facilitate the process.

The schedule process is also applicable to installations with buffer tanks and allows establishing up to two time slots per day during which the heat pump heats the buffer tank if the set point is not satisfied ot there is DHW demand. If there is a th-Tune controller, the daily schedule can be performed with HEAT PUMP CONTROLLER or with TH-TUNE.

If selected the option of HEAT PUMP CONTROLLER, the software enables two new screens to define set points and to configure the operation time slots.

The first screen allows selecting two temperature setpoints (dwelling goal temperature) for heating (WINTER program) and two temperature setpoints for cooling (SUMMER program in HC models). These set points can be assigned to any operation time slot (Figure 7).

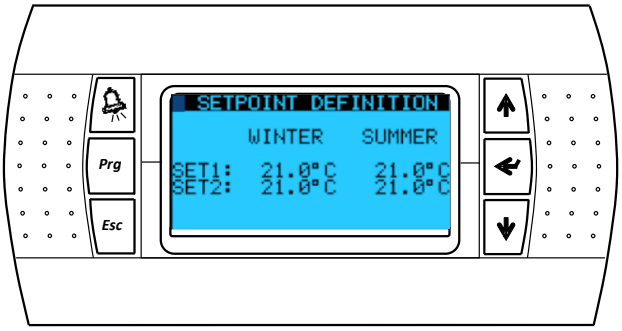


Figure 7. Screen for the definition of set points for the daily schedule configuration with heat pump controller (installations with th-Tune).

The second screen permits programming up to four operating time slots for each day of the week (Figure 8). Each time slot has a starting time and a set point temperature, or an OFF condition.

As happens in the daily schedule without th-Tune, the controller permits copying the schedule from one day to another, or even to the whole week, to facilitate the process.

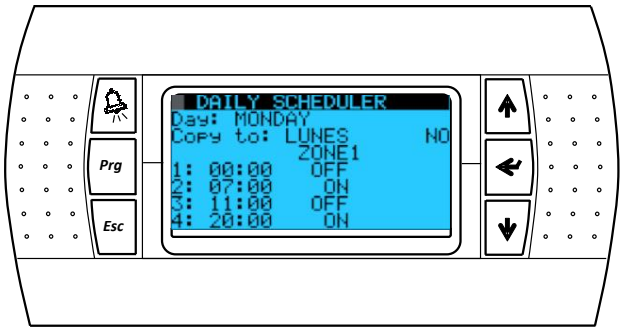


Figure 8. Screen for the daily schedule configuration with heat pump controller (installations with th-Tune).

It is necessary to program, at least, a starting and finishing condition to guarantee the heat pump correct operation.

At the end of the day, the heat pump turns off automatically, unless a new time slot is programmed at 00:00 of the following day.

Out of the operation time slots, the heat pump is enabled to produce DHW and ANTI-LEGIONELLA treatments.

2.2.3.4 Holiday periods and special dates

In addition to the DAILY SCHEDULE, it is possible to define up to three HOLIDAY PERIODS (Figure 9) and up to six SPECIAL DATES (Figure 10). On the one hand, a starting and finishing date define each holiday period. On the other hand, special dates apply to a complete day. The user may choose a condition of on or off if there is no th-Tune, or among the two setpoint or off with th-Tune.

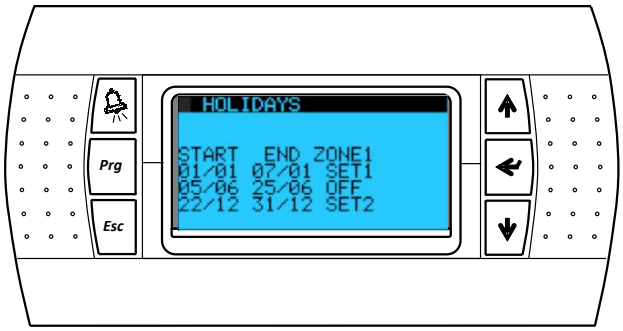


Figure 9. Screen for programming holiday periods.

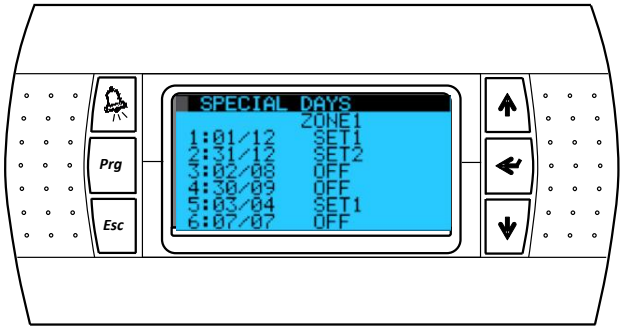


Figure 10. Screen for programming special dates.

All operation modes are disabled during holidays, including DHW production.

If a TWO-ZONE operation diagram is used, the three programming methods, DAILY SCHEDULE, HOLIDAY PERIODS and SPECIAL DATES, can be applied to each zone independently (the number of time slots remains unchanged).

If selected the option of TH-TUNE, the schedule programming is done following the th-Tune specific manual.

2.3 HEATING

Symbol	Name	Function
	Heating	Allows the user to visualise and modify the parameters related to the operation in HEATING mode.

The heating menu permits a slight adjustment of the heating outlet temperature, obtained with the heating curve, by means of a three-level selector (Figure 11). The greater the level, the greater the heating outlet temperature.

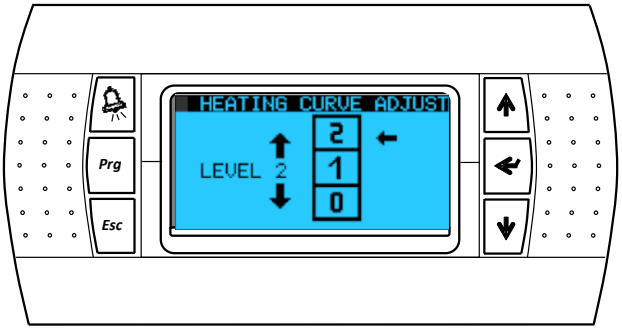


Figure 11. Screen for the adjustment of the heating outlet temperature calculated with the heating curve.

The adjustment obtained with this system is limited. The installer must define the heating curve properly.

The outlet temperature can be adjusted from control panel or via internet in a PC or smartphone.

CLAUSIUS heat pumps does not allow to desactivate HEATING mode, therefore

2.4 BUFFER TANK

It is necessary to define an operation diagram with BUFFER TANK in the INSTALLER MENU to permit the access to this submenu.

This menu allows adjusting the temperature setpoint of the buffer tank. If selected a diagram with BUFFER TANK + COOLING in the INSTALLER MENU, a second screen is available to enable or disable the cooling option and to establish the temperature setpoint of that buffer tank.

CLAUSIUS heat pumps are designed to work with independent buffer tanks for cooling and heating or with a single tank.

2.5 DHW PRODUCTION

Symbol	Name	Function
	DHW production	Allows the user to visualise and modify the parameters related to the DHW production.

This submenu allows the user to establish the temperature setpoint of the DHW tank and to visualise the temperature measured by the temperature probe in the DHW tank.

It is necessary to enable this option in the FUNCTION ENABLE screen in the INSTALLER MENU to permit the access to this submenu.

The DHW set temperature can be configured using control panel or via internet from a PC or smartphone.

2.6 ANTI-LEGIONELLA

Symbol	Name	Function
	Anti-legionella	Allows the user to visualise and modify the parameters related to ANTI-LEGIONELLA treatments.

This submenu permits the user to configure the day of the week and starting time of the ANTI-LEGIONELLA treatment. Besides, it is possible to visualise its temperature setpoint.

It is necessary to enable this option in the FUNCTION ENABLE screen in the INSTALLER MENU to permit the access to this submenu.

ANTI-LEGIONELLA treatments start at the established day and time, except if the DHW tank reached the setpoint in the 7 days prior to the treatment beginning.

2.7 COOLING

HC models of Clausius heat pumps have two cooling modes, named ACTIVE COOLING and PASSIVE COOLING. The former cools by reversing the refrigerant cycle (compressor ON) and the latter by exchanging heat with the ground (compressor OFF). Besides, Clausius heat pumps have an AUTOMATIC COOLING mode that selects the cooling mode as a function of the different operation parameters.

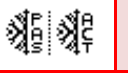
With AUTOMATIC COOLING mode, the heat pump starts with PASSIVE COOLING and moves to ACTIVE COOLING only if the former does not reach the cooling outlet temperature needed.

The default time to move from PASSIVE COOLING to ACTIVE COOLING (AUTOMATIC COOLING) is 60 minutes and it can be modified by the installer.

The COOLING submenu allows activating the cooling production and selecting between the refrigeration modes.

ACTIVE COOLING mode is faster and more accurate and PASSIVE COOLING mode is moderate but inexpensive.

The heat pump needs to be OFF and without active alarms to choose the cooling mode.

Symbol	Name	Function
	ACTIVE COOLING	The heat pump working with reversing cycle cools down the dwelling.
	PASSIVE COOLING	Allows freshening the dwelling by transferring heat from the indoor circuit to the geothermal source.
	AUTOMATIC COOLING	The heat pump selects the cooling mode as a function of the different conditions.

If the selected mode is either ACTIVE COOLING or AUTOMATIC COOLING, there is no th-Tune terminal and the indoor emission system is an underfloor heating, the user needs to select the cooling outlet temperature to this underfloor heating. In other cases, the controller selects automatically this temperature depending on the installation and the TEMPERATURE option in the COOLING submenu shows the message AUTO.

An incorrect selection of the cooling outlet temperature to the underfloor heating systems may lead to condensations on the floor.

CLAUSIUS heat pumps do not allow enabling any cooling mode with conventional radiators as emission systems.

Cooling outlet temperatures lower than 14 ºC are not recommended. This limitation may be insufficient depending on the humidity.

2.8 POOL

Symbol	Name	Function
	Pool	Allows the user to visualise and modify the parameters related to the POOL operation mode.

This submenu starts with the POOL ENABLE option. If enabled, a second screen comes up to introduce the temperature setpoint to control the pool heating, which can be configured in the range from 15 ºC to 32 ºC. It is also possible to select up to three time slots that give priority to POOL mode over HEATING or COOLING.

The heat pump correct operation is not guaranteed if the pool temperature setpoint differs from that adjusted in the control thermostat.

It is necessary to enable this option in the INSTALLER MENU to permit the access to this submenu.

2.9 ALARMS

Clausius heat pumps have an alarm management system to avoid any damage to the unit. If an alarm occurs, the controller turns off the heat pump and turns on the control panel alarm key. Besides, the SYSTEM OK symbol disappears of the main screen and at the bottom right corner appears the OFF by ALARM symbol.

Symbol	Name	Function
	Alarm	Allows the user to check the active alarms and the alarm log and to reset them.

The submenu ALARMS has three screens that show, in this order, the active alarms, the option of alarm reset and the alarm log.

Symbol	Name	Function
	VISUALISATION	Shows the active alarms.
	RESET	Allows the user to reset the active alarms.
	LOG	Shows the log of alarms, indicating the time and date when they occurred.

NOTE **ALARM RESET option eliminates the active alarms. The alarm log can only be reset by the installer.**

NOTE **The access to the alarms submenu can be performed with the ALARM key of the control panel.**

2.10 PERFORMANCE

Symbol	Name	Function
	Performance	Shows the instantaneous and historic consumption and performance values of the heat pump.

This submenu includes information about the instantaneous (Figure 12) and accumulated operation of the heat pump. The values shown are the electric power consumed, the useful thermal energy and the heat pump performance.

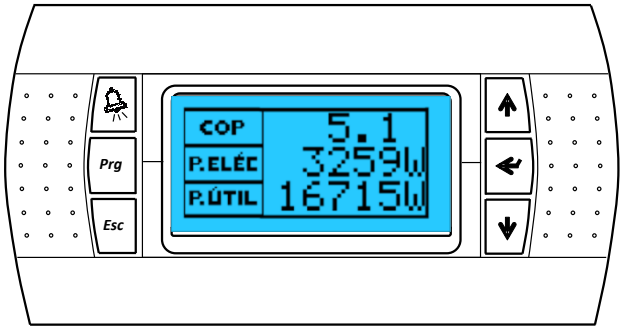


Figure 12. Instantenous information about the operation of the heat pump.

NOTE **The instantaneous performance is the COP, unless with cooling modes that it is the EER.**

NOTE **Electric power consumed and useful thermal energy are estimated from working conditions with an maximum error of 5 and 10%, respectively.**

2.11 INFORMATION

Symbol	Name	Function
	Information	Allows the user to visualise the configuration parameters and the operation status of the heat pump.

This submenu summarises the information about the heat pump behaviour, including those parameters configured by the user and/or installer as well as data of its operation.

NOTE **The information shown in this submenu varies slightly depending on the heat pump model and on the its configuration.**

The first screens show information about the heat pump operation, following this order:

OUTDOOR TEMPERATURE

This screen shows the outdoor temperature measured with the outdoor temperature probe.

DHW TANK TEMPERATURE

This screen shows the temperature inside the DHW tank. Additionaly, it shows the DHW tank temperature setpoint and the temperature offset under the setpoint that leads to a new DHW production process.

HEATING BUFFER TANK

This screen shows the temperature in the buffer tank of installations with this device. Additionaly, it shows the buffer tank temperature setpoint and the temperature offset under the setpoint that leads to a heating process.

COOLING BUFFER TANK

This screen shows the temperature in the buffer tank of installations with this device and with units that allow reversing the cycle (HC models). Additionaly, it shows the buffer tank temperature setpoint and the temperature offset over the setpoint that leads to a cooling process.

BRINE/INDOOR TEMPERATURES (Figure 13)

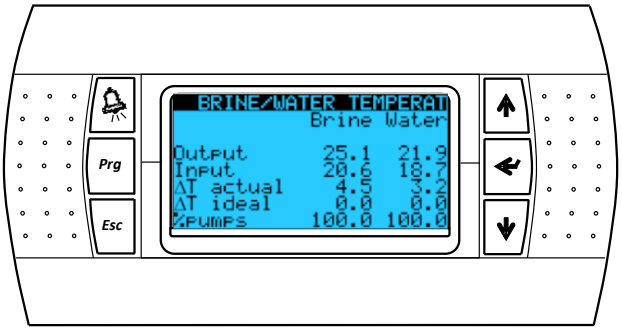


Figure 13. Information about the inlet and outlet temperatures of the brine and indoor circuits.

This screen shows the inlet and outlet temperatures, from the heat pump point of view, of the brine and indoor circuits. Moreover, it shows the actual and ideal temperature differences between them for each circuit, as well as the percentage of regulation of each circulation pump.

NOTE **The ideal temperature difference of each circuit depends on the operation mode.**

NOTE **During DHW production, the inlet temperature of the DHW production circuit matches the indoor inlet temperature.**

INDOOR CIRCUIT PRESSURE

This screen shows the pressure of the indoor circuit.

BRINE CIRCUIT PRESSURE

This screen shows the pressure of the brine circuit.

COMPRESSOR OPERATION DATA

This screen encloses data on the compressor operation. These data are the refrigerant pressures and temperatures at the compressor suction and discharge. Additionaly, it shows its accumulated operation hours.

NOTE **The compressor discharge temperature is only shown when the compressor is working and a value of 0 ºC is shown if the compressor is off.**

INVERTER TEMPERATURE

This screen shows the temperature of the inverter, the device that controls the compressor rotational speed.

EXPANSION VALVE DATA

This screen shows information about the operation of the electronic expansion valve. The main magnitudes included are the evaporation pressure and temperature, the superheating degree and its opening degree.

GENERAL

These six screens show data on the heat pump operation and configuration. The information about configuration includes, for instance, the heat pump model, the operation diagram, the different operation modes, the type of schedule programmed, the functions enabled in the installer menu or the compressor rotational speed limitations (Figure 14).

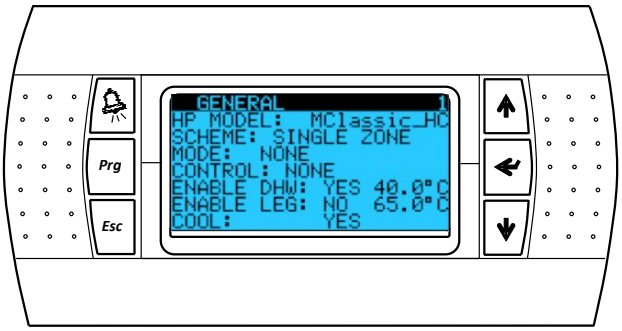


Figure 14. Main screen of the heat pump general information.

There is also information about the software version installed in the heat pump controller (Figure 15).

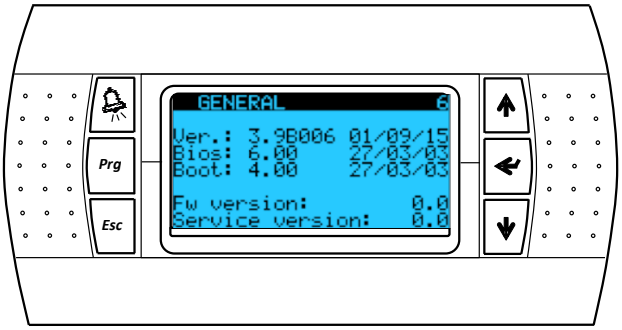


Figure 15. Screen with the software version information.

3. INSTALLER MENU

The installer menu encloses those parameters to be configured during the heat pump commissioning for its correct operation, as well as functions to check its behaviour.

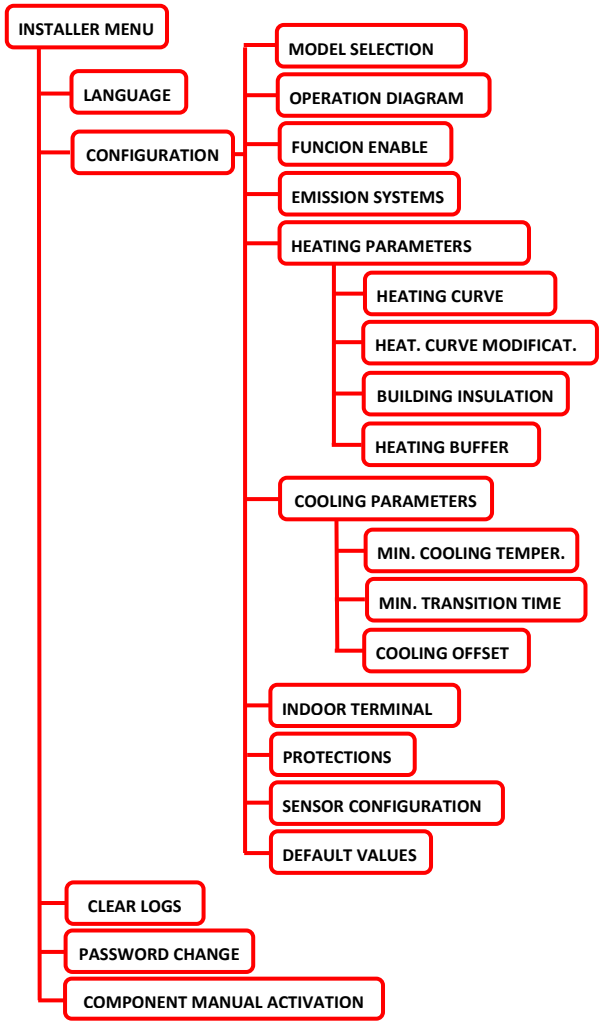


Figure 16. Installer menu options.

To access the installer menu, press simultaneously the control panel keys ***[Prg]*** + **[←]** for 5 seconds. After this, a screen that asks for the installer menu password comes up (Figure 17).

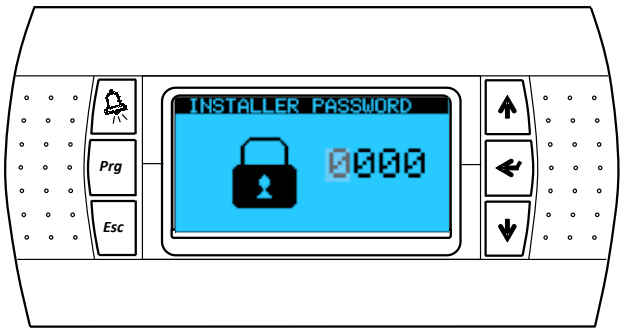


Figure 17. Screen for the installer password introduction.

Introducing the installer password unblocks the access for a period of 10 minutes. The password is not requested during this period.

Introduce the installer password digits using the displacement arrows **[↑]** and **[↓]**, and the selection key **[←]** to confirm. Return to a previous digit with the key ***[Esc]***.

In the installer menu, it is possible to select the different submenus described in the following paragraphs.

3.1 LANGUAGE

In this submenu, the installer enables or disables the option of choosing the language whenever the heat pump is started.

NOTE **The languages availables in CLAUSIUS heat pumps are Spanish, English, Italian and Danish.**

3.2 CONFIGURATION

In this submenu, the installer configures the Clausius heat pump as a function of the heat pump model and the installation characteristics, and verifies the operation of the different components.

NOTE **It is important to follow the order indicated in this manual to guarantee a correct configuration, since the available options depend on the previous selections.**

CLAUSIUS recommends reseting the controller after a configuration process or after its modification to achieve a proper heat pump operation.

In this submenu appear the screens listed next.

3.2.1 Model selection

In this submenu, the installer selects the heat pump model and its heat capacity range from the options available.

3.2.2 Operation diagram

In this submenu, the installer chooses the operation diagram for the installation from the options available.

NOTE **CLAUSIUS heat pumps do not have any default operation diagram.**

Funtion	Description
SINGLE-ZONE	The heat pump works with one zone, i.e. with one temperature setpoint.
SINGLE-ZONE TWO-SYSTEM	The heat pump works with one zone and uses different emission systems for heating and cooling.
SINGLE-ZONE MULTI-EMISSION	The heat pump works with one zone and uses two kinds of emission systems simultaneously.
TWO-ZONE	The heat pump works with two zones, i.e. with two temperature setpoints.
TWO-ZONE TWO-SYSTEM	The heat pump works with two zones and uses different emission systems for heating and cooling.

BUFFER	The heat pump works with a buffer tank for heating and/or pool demands. An independent DHW tank may exist.
BUFFER + COOLING	The heat pump works with a buffer tank system for heating and/or pool demands + cooling demand. An independent DHW tank may exist.

The heat pump is disabled unless an operation diagram different to UNDEFINED exists.

Installations with buffer tank for heating and cooling can operate with a single tank or with independent tanks. Besides, an installation with single tank configuration is allowed to operate with independent temperature probes for heating and cooling or with a single temperature probe. Therefore, if selected a BUFFER + COOLING operation diagram, it is necessary to indicate the number of temperature probes used to control it. A new screen comes up with BUFFER + COOLING that allows this selection with the displacement arrows **[↑]** and **[↓]** (Figure 18).

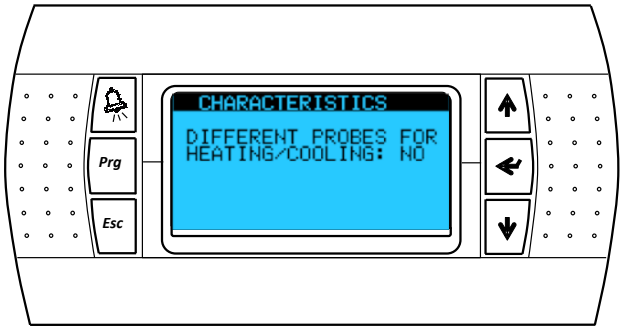


Figure 18. Screen for selecting the number of temperature probes with the operation diagram BUFFER + COOLING.

Installations with independent buffer tanks for heating and cooling must have a temperature probe in each of them.

Installing a single tank with one temperature probe for heating and cooling is only recommended with tanks of small size.

3.2.3 Function enable

In this submenu, the installer enables and disables different operation modes of the heat pump (DHW, ANTI-LEGIONELLA, FLOOR DRYING and TEST) depending on the installation (Figure 19).

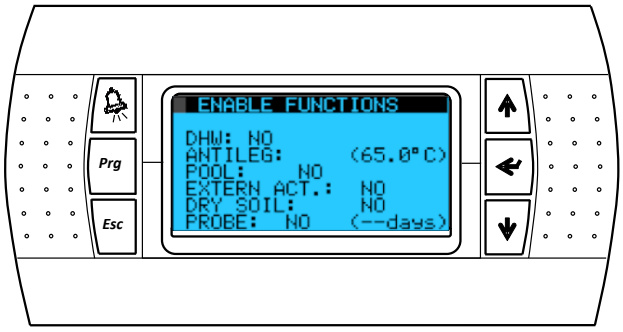


Figure 19. Screen for enabling heat pump functions.

Function	Description
DHW	Enables the DHW production.
Anti-Legionella	Enables Anti-Legionella treatments.
Pool	Enables the pool operation mode.
External activation	Enables the digital input that allows the external activation of the heat pump.
Floor Drying	Enables the floor drying operation mode.
Test	Enables the test operation mode.

After enabling DHW, EXTERNAL ACTIVATION, POOL or FLOOR DRYING operation modes, specific screens are available for their configuration. The access to these new screens is done with the displacement arrows **[↑]** y **[↓]**.

If the DHW production or pool heating are performed with a buffer tank, these options must be disabled in FUNCTION ENABLE submenu.

3.2.3.1 DHW

In this option, it is possible to enable and disable the DHW operation mode and to set the minimum temperature difference (DHW OFFSET) that must exist between the DHW temperature setpoint and the real temperature in the tank in order to turn on the heat pump. DHW OFFSET prevents unreasonable starting and stopping cycles.

The DHW setpoint is chosen in the USER MENU.

The innovative technology employed by the Elite model of Clausius heat pumps allows achieving temperatures in the DHW tank considerably greater than the setpoint temperature, without electric resistances. Thus, these units have a thermostat inside the electrical cabinet that limits the maximum temperature in the tank. This limit has a default value, but may be modified by the installer to adapt it to the installation characteristics.

In Elite model CLAUSIUS heat pumps, the DHW temperature setpoint fixed in the user menu is the minimum temperature guaranteed by the heat pump.

The high DHW temperature in the tank requires the use of DHW consumption control systems to prevent any injuries due to scalding.

Take preventive measures during maintenance to prevent burns and scalding.

3.2.3.2 Anti-legionella

In this option, it is possible to enable and disable the Anti-Legionella operation mode.

The default temperature of Anti-Legionella treatments is 65 ºC and it cannot be modified neither by the installer nor by the user.

NOTE The date and starting time of Anti-Legionella treatments is modified in the the USER MENU.

NOTE Anti-Legionella treatments start at the established day and time, except if the DHW tank reached its setpoint in the 7 days prior to the treatment beginning.

NOTE The DHW operation mode must be enabled to activate the option of ANTI-LEGIONELLA operation mode.

3.2.3.3 Pool

In this option, it is possible to choose, the control logic between normally open (NO) and normally closed (NC). Moreover, the installer must introduce a parameter named POOL OFFSET, necessary to calculate the heating outlet temperature of the heat pump. This value is the result of adding the pool temperature setpoint, set in the USER MENU, and the POOL OFFSET up.

The thermostats used with the heat pump must be volt free.

An improper selection of the thermostat control logic leads to an incorrect operation of the heat pump.

3.2.3.4 External activation

Clausius heat pumps can be activated by an external control (HOME AUTOMATION LOGIC) if the option EXTERNAL ACTIVATON is enabled. The digital input for that purpose, DI6 in the controller, is activated and a new screen comes up to select the control logic between normally open (NO) and normally closed (NC).

The control digital inputs must be volt free.

An improper selection of the thermostat control logic may lead to an incorrect operation of the heat pump.

If the heat pump is activated by external activation (HOME AUTOMATION LOGIC), it will operate following the PROGRAM chosen. PROGRAM can be selected by control panel or by external activation, employing the digital input DI7. It is necessary to select this option in the EXTERNAL ACTIVATION menu previously. Once activated DI7 a new screen, where the logic of this input can be modified, is enabled. The logic which may be indicated in this screen corresponds to WINTER program.

NOTE The digital input DI7 do not allow to select AUTOMATIC program (only SUMMER or WINTER).

NOTE DHW and ANTI-LEGIONELLA operation modes are independent of this external activation.

3.2.3.5 Floor drying

Clausius heat pumps have a floor drying mode that carries out a controlled drying process of the underfloor heating mortar.

Once this option is enabled in the FUNCTION ENABLE submenu (section 3.2.3), a new screen shows the information related to the floor drying process (Figure 20).

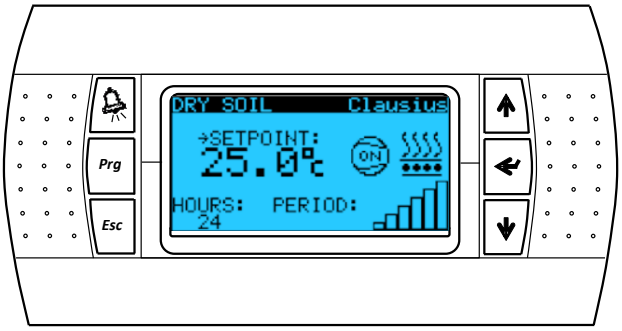


Figure 20. Screen with information about the floor drying process.

From this information screen, it is possible to access the floor drying programming menu with the key **[*Prg*]** (Figure 21). This menu consists of an ON/OFF option to activate the floor drying operation mode, a PROGRAMMING option and an ALARM submenu.

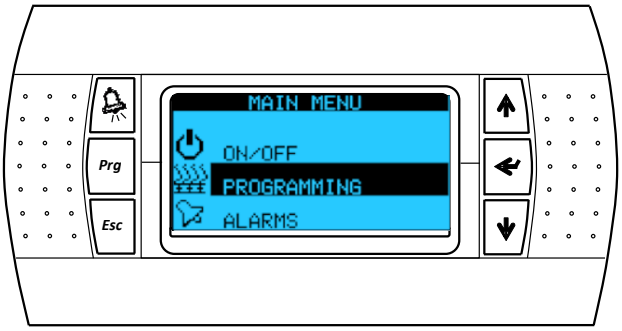


Figure 21. Main menu for the floor drying operation mode.

The floor drying PROGRAMMING submenu allows setting up to 6 different periods for the floor drying process. (Figure 22). Each period needs a temperature setpoint between 15 ºC and 45 ºC and an operation time between 1 and 99 hours.

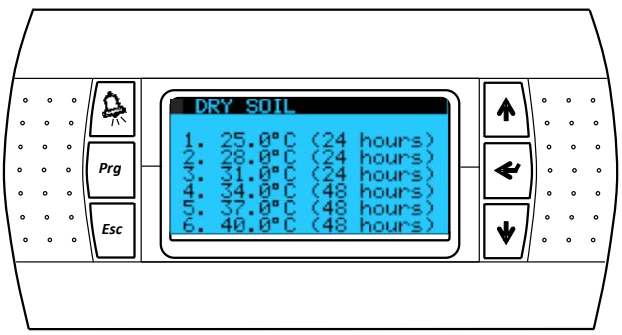


Figure 22. Screen for programming the floor drying process.

NOTE The heat pump model needs to be selected to guarantee a proper configuration of the floor drying process.

NOTE It is unnecessary to program every slot, but it is recommendable not to leave gaps in between programmed slots.

NOTE Meanwhile the floor drying option is enabled, no other operation mode is available.

During a FLOOR DRYING process, the top part of the floor drying main screen (Figure 20) shows, following this order, the heating outlet temperature programmed for the active period, the compressor status and the floor dyring symbol. The bottom part shows the duration and the number of the active period.

NOTE In order to exit the FLOOR DRYING operation mode, access the FUNCTION ENABLE menu and disable the option FLOOR DRYING.

3.2.3.6 Test

In this option, it is possible to configure a test period for the heat pump between 1 and 90 days.

3.2.4 Emission systems

In this submenu, the installer selects the type of emission systems used in the installation among RADIANT FLOOR, FAN COIL UNITS and RADIATORS. The selection process depends on the operation diagram (section 3.2.2).

If the operation diagram is SINGLE-ZONE (section 9.1.1), the installer selects a single emission system both for heating (WINTER PROGRAM) and for cooling in HC models (SUMMER PROGRAM).

NOTE CLAUSIUS heat pumps do not allow using radiators as emission systems for cooling applications.

If the operation diagram is SINGLE-ZONE TWO-SYSTEM (section 0), the installer selects an emission system for heating and another for cooling.

If the operation diagram is SINGLE-ZONE MULTI-EMISSION (section 9.1.4), the installer selects two different emission systems. One works as MAIN EMISSION SYSTEM and another as SECONDARY EMISSION SYSTEM. Both types can be used for heating and for cooling.

NOTE If there are more than one type of emission systems, the main one should be that with the greatest operation temperature (section 3.2.5.2).

If the operation diagram is TWO-ZONE (section 9.1.3), the installer selects an emission system for each zone.

NOTE The ZONE 1 emission system in TWO-ZONE operation diagrams is that with the greatest operation temperature (section 3.2.5.2).

If the operation diagram is TWO-ZONE TWO-SYSTEM, the installer selects an emission system for each zone and heating (WINTER PROGRAM) and an emission system for each zone and cooling (SUMMER PROGRAM).

If the operation diagram is BUFFER (section 9.1.6), it is unnecessary to configure emission systems.

BUFFER systems need an external management of the different demands and must be taken into account during the design stage.

3.2.5 Heating parameters

In this submenu, the installer should configure the parameters related to the heating operation mode.

NOTE The options and menus that come up depend on the operation diagram chosen.

3.2.5.1 Heating curve

Clausius heat pumps select the heating outlet temperature as a function of the outdoor conditions and indoor conditions (if there is th-Tune), of the emission system chosen and of the building insulation level.

The heating outlet temperature is calculated with the installation HEATING CURVE, which is determined with the OUTDOOR DESIGN POINT and BALANCE POINT and different corrections that take into account the indoor temperature (if there is th-Tune), the emission system and the building insulation level.

An indoor design temperature and the corresponding heating outlet temperature define the BALANCE POINT. An outdoor temperature below which the heating outlet temperature is maximum and the value of this maximum temperature define the OUTDOOR DESIGN POINT.

NOTE The heating curve default configuration considers a standard installation, but the installer can modify it to adapt it for each case.

The points considered for the heating curve calculation appear in the first screen of the submenu (Figure 23).

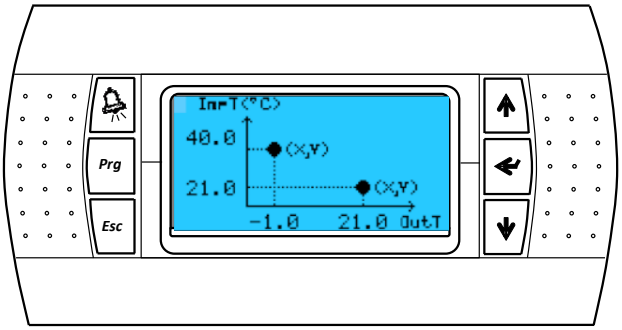


Figure 23. Screen with the general information for the heating curve calculation.

3.2.5.2 Heating curve modification

The modification of the default heating curve is performed by enabling the option HEATING CURVE MODIFICATION in the second screen. After this, a new screen allows introducing the new values for the design points.

In this new screen, the installer sets the indoor design temperature and the program selects the same

temperature as heating outlet temperature of the balance point.

NOTE **An indoor design temperature between 21 ºC and 23 ºC is recommended.**

Concerning the outdoor design point, the installer selects both the temperature below which the heating outlet temperature is maximum and the value of this maximum temperature.

NOTE **The outdoor design temperature depends on the location (UNE 100001:2001) meanwhile the maximum heating temperature depends on the emission system.**

Recommended values of the maximum heating outlet temperature are shown in the next table.

Emission system	Heating outlet temperature
UNDERFLOOR HEATING	30-35 ºC
FAN COIL UNITS	40-45 ºC
RADIATORS	45-50 ºC

The option HEATING CURVE MODIFICATION must remain enabled to keep the modifications introduced.

NOTE **It is possible to return to the heating curve default values by disabling the HEATING CURVE MODIFICATION option.ç**

An improper configuration of the heating curve may lead to an incorrect operation of the heat pump.

NOTE **Only one heating curve is defined with TWO-ZONE systems, but the heating outlet temperature of each zone depends on the emission system.**

3.2.5.3 Heating cut-out temperature

Clausius heat pumps allow the HEATING operation mode only with the WINTER PROGRAM and when the outdoor temperature is lower than another value called HEATING CUT-OUT TEMPERATURE.

The installer can configure the cut-out temperature value in a range between 10 ºC and 28 ºC.

3.2.5.4 Heating offset

In this screen, the installer can set the temperature difference, HEATING OFFSET, that should exist between the setpoint (goal indoor temperature) and the actual indoor temperature to turn on and off the HEATING operation mode. This prevents unreasonable starting and stopping cycles.

NOTE **It is possible to work with the HEATING OFFSET only if a th-Tune indoor terminal is available.**

3.2.5.5 Building insulation

In this option, the installer defines the building insulation level, choosing among GOOD, AVERAGE and POOR, to adjust the heating curve better.

3.2.5.6 Buffer tank heating

If the installation uses buffer tank, the heating menu is different.

When accessing the HEATING PARAMETERS menu in BUFFER operation diagrams, there is a specific screen (Figure 24) where the installer selects whether the control is with fixed TEMPERATURE SETPOINT or with HEATING CURVE. In this screen, the installer sets the minimum temperature difference, BUFFER OFFSET, that should exist between the buffer tank temperature setpoint and its actual temperature to turn on and off the HEATING operation mode. This prevents unreasonable starting and stopping cycles.

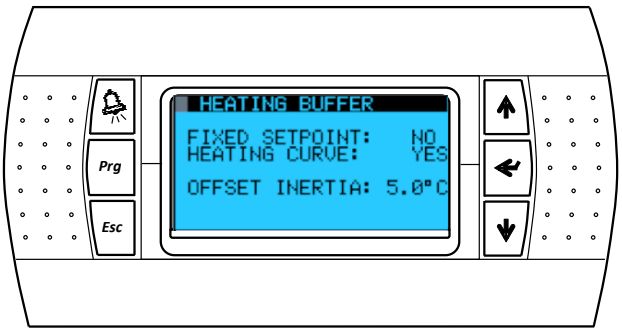


Figure 24. Heating configuration in buffer systems.

If chosen the control with fixed temperature setpoint, the heat pump works considering that goal temperature. If chosen the control with heating curve, the heating outlet temperature to the buffer tank depends on the conditions. In addition, the heating curve may be modified following the explanation from section 3.2.5.2.

NOTE **If disabled DHW in FUNCTION ENABLE menu, the fixed temperature setpoint must be chosen to guarantee the DHW production from the buffer tank.**

3.2.6 Cooling parameters

NOTE **This menu shows the message "MODEL UNABLE TO PRODUCE COOLING" when the model chosen is different from HC.**

Clausius heat pumps select the cooling outlet temperature as a function of the emission system (fan coil units or underfloor heating) and of the control with or without th-Tune.

NOTE **The cooling outlet temperature is independent of the cooling operation mode, either ACTIVE COOLING or PASSIVE COOLING.**

NOTE **With PASSIVE COOLING, it is possible that the system is unable to achieve the temperature goal. In that case, the outlet temperature would be the minimium possible.**

In cooling applications, when fan coil units are used as emission systems, it is possible to set a fixed outlet

temperature of 8 ºC. When underfloor heating is used, this temperature ranges from 14 ºC to 25 ºC. This temperature selection is automatic, in systems with th-Tune, and manual (section 1), without it.

An incorrect selection of the cooling outlet temperature with underfloor heating may lead to condensations on the floor.

3.2.6.1 Minimum cooling outlet temperature

In addition to the cooling outlet temperatures calculated for the different situations, the installer is allowed to introduce in the first screen of this menu, manually, an additional limitation for each cooling operation mode (Figure 25). Consequently, the heat pump selects as cooling outlet temperature the maximum between the minimum cooling outlet temperature and the outlet temperature calculated.

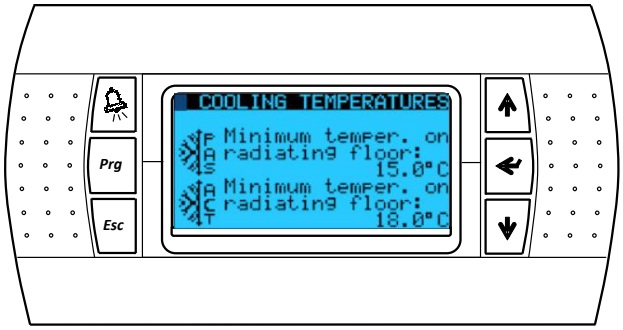


Figure 25. Minimum cooling outlet temperatures.

3.2.6.2 Minimum transition time

In the second screen of the cooling parameters menu (Figure 26), it is possible to select the minimum time that the heat pumps has to be in PASSIVE COOLING prior to changing to ACTIVE COOLING when it works in AUTOMATIC COOLING mode.

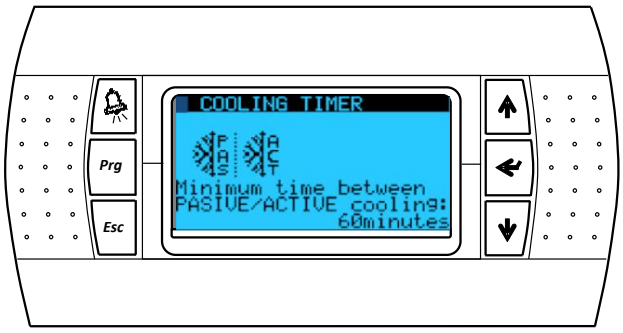


Figure 26. Minimum transition time in PASSIVE COOLING in the AUTOMATIC COOLING MODE.

The installer can set the minimum transition time in a range from 60 minutes to 300 minutes (1 hour to 5 hours). After this period, the controller checks if the PASSIVE COOLING mode achieves the cooling outlet temperature. If affirmative, the system stays in PASSIVE COOLING and the countdown starts again. If negative, it changes automatically to ACTIVE COOLING.

3.2.6.3 Cooling offset

As happened with the heating configuration, the installer can set a minimum temperature difference, COOLING OFFSET, that should exist between the setpoint (goal indoor temperature) and the actual indoor temperature to turn on and off the COOLING operation mode. This prevents unreasonable starting and stopping cycles.

NOTE **It is possible to work with the COOLING OFFSET only if a th-Tune indoor terminal is available.**

3.2.7 Indoor terminal

In this submenu, the installer introduces the element used to control the starting and stopping of the heat pump. It is possible to choose control with THERMOSTAT, with TH-TUNE or with both simulatenously.

Except HOME AUTOMATION LOGIC, it is necessary to choose and configure almost one tupe of indoor terminal (Not applicable to buffer installations).

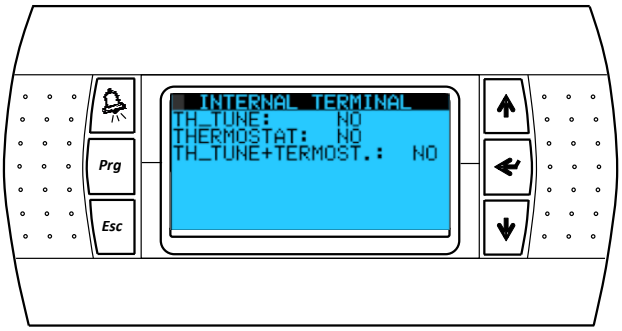


Figure 27. Indoor terminal selection.

If selected control with THERMOSTATS, it is necessary to choose their logic between normally open (NO) and normally closed (NC) both heating and cooling modes.

NOTE **CLAUSIUS heat pumps allow setting an independent control logic to each thermostat input.**

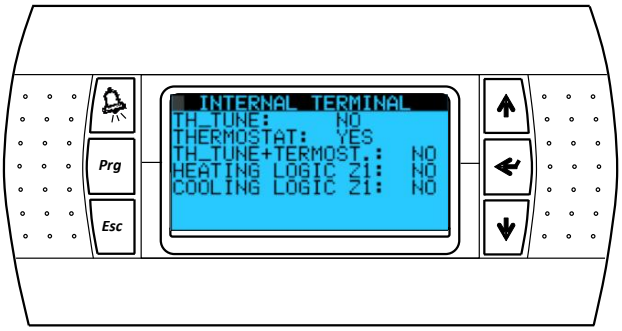


Figure 28. Thermostat logical selection.

An improper configuration of the thermostat logic may lead to an incorrect operation of the heat pump.

The thermostats used with the heat pump must be volt free.

If selected control with TH-TUNE, it is necessary to configure the BMS port of the heat pump controller in an

additional screen. Besides, the installer should configure the th-Tune terminal.

NOTE **CLAUSIUS heat pumps have a default configuration for th-Tune terminals and it is unnecessary to configure the BMS port.**

NOTE **The th-Tune terminals distributed with the heat pump are prepared for their installation and need no additional configuration.**

NOTE **Additional information about th-Tune terminals is available in the corresponding manual.**

The th-Tune indoor terminals for TWO-ZONE installations need an appropriate and independent configuration.

NOTE **Each th-Tune distributed with the heat pump has a number that indicates the zone. This order must be respected to guarantee a good operation.**

If selected a simultaneous control with TH-TUNE and THERMOSTATS, the heat pump starts when at least one of the devices detects an active demand. The indoor outlet temperature calculation is done with the indoor temperature measured by the th-Tune.

3.2.8 Protections

In this submenu, the installer introduces the operation limits and protections to guarantee a correct performance of the installation.

Clausius heat pumps allow setting a compressor rotation speed limit, different for heating/cooling and for DHW, as well as a general limit that will never be surpassed.

NOTE **The rotation speed limits adapt the maximum heat pump consumption to the electrical capacity hired and to limit the heating capacity with oversized units.**

NOTE **The aim of limiting the rotation speed for DHW production is to avoid sizing the tank heat exchanger for the maximum heat capacity.**

Besides, the installer has the possibility of limiting some other parameters to protect the heat pump. These parameters are the brine minimum temperature, the evaporation minimum temperature (that depends on the brine minimum temperature) and the brine maximum temperature.

NOTE **The default protection values will be used unless the installer configures them.**

NOTE **The brine minimum temperature depends on the type and concentration of antifreeze fluid.**

The difference between the brine minimum temperature and the evaporation minimum temperature should range from 12 ºC to 15 ºC.

Additionally, the heat pump controller allows a limitation of the compressor rotation speed for a certain time slot, to reduce its acoustic emissions in those cases that it may cause disturbance, particularly at night (section 2.2.3.1. The installer can enable this option and set the rotation speed limit (Figure 29). The activation and time programming of this mode depends on the user (Figure 5).

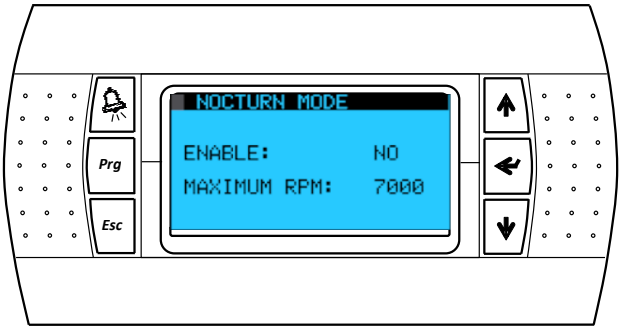


Figure 29. Screen for the night mode programming in the installer menu.

NOTE **If the night mode limitation is greater than the general limitation, the heat pump considers the general limitation for the night mode.**

3.2.9 Sensor configuration

In this submenu, the installer can set slight corrections to the values measured by the different sensors, if needed. The screen (Figure 30) includes the terminals at which each sensor is connected. The installer is allowed to move from one screen to another and to access the configuration of the sensors with the displacement arrows **[↑]** and **[↓]**.

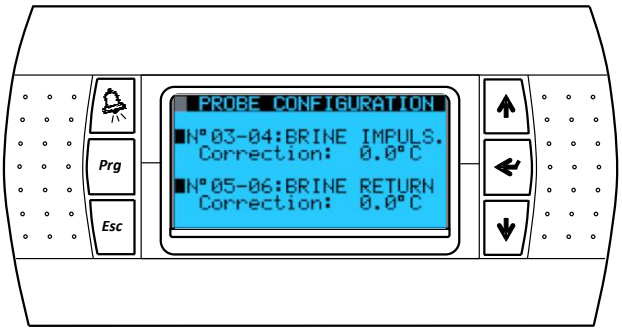


Figure 30. Screen for the correction of some temperature probes of the heat pump.

Corrections should only be applied in case of detect a deviation in the measurement and guaranteeing that the heat pump performance is not affected by it.

3.2.10 Default values

In this submenu, the installer is able to restore the default values of the parameters configured.

NOTE **This function restores the parameters configured both in the installer menu and in the user menu.**

3.3 CLEAR LOGS

In this submenu, the installer can clear the alarm log, as well as the heat pump consumption and performance logs.

NOTE **The alarm reset option in the USER MENU clears only the active alarms, but they remain in the general log.**

3.4 PASSWORD CHANGE

In this submenu, the installer is allowed to modify the password to access the INSTALLER MENU.

If changed the password, the installer should take careful note of the new one for future access.

3.5 COMPONENT MANUAL ACTIVATION

In this menu, the installer has the possibility of activating different components to check their correct operation. The components that can be tested are shown next.

The options available in the COMPONENT MANUAL ACTIVATION depend on the heat pump and on the operation diagram chosen.

Name	Description
Brine	Activation/Regulation of the brine circuit circulation pump.
Indoor	Activation/Regulation of the indoor circuit circulation pump.
Mixing group	Activation/Regulation of the mixing group
Inverter	Activation of the inverter/compressor contactor.
Elect. Resist.	Activation of the DHW tank electric resistance contactor.
Alarm system	Activation of the alarm signal output.
VDHW	Activation of the 3-way valve to select DHW or heating/cooling production.
VPC	Activation of the 3-way valve to allow PASSIVE COOLING operation.
V4W	Activation of the 4-way valve to allow reversing the cycle.
VZ1	Activation of the zone 1 valve.
VZ2	Activation of the zone 2 valve.
VPOOL	Activation of the pool valve.
V2SyS	Activation of the two-system valve.
VBUFF+COOL	Activation of the valve that controls cooling with buffer operation diagram.

With the circulation pumps and the mixing group, it is possible not only to activate them, but also to regulate their operation percentage (Figure 31).

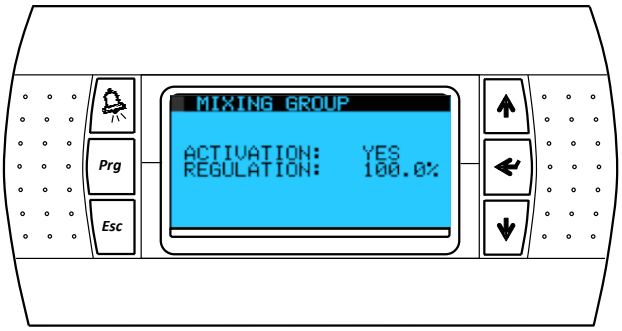


Figure 31. Screen for the manual activation and regulation of the mixing group.

In order to avoid damage on the electrical resistance, check that the DHW tank is full of water prior to test the electrical resistance contactor.

Check that the circuits are full of fluid and the shut-off valves open prior to testing the circulation pumps.

For those components without regulation, the tests consist in activating the relays of each of them (Figure 32).

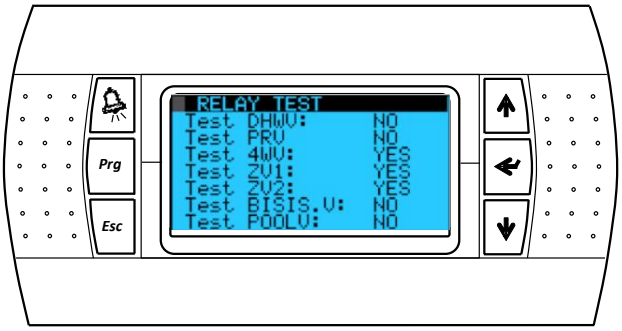


Figure 32. Screen for the manual activation of the relays that energise the different components.

Once checked a component, the installer should reset the initial value to prevent operation errors.

Some components in the COMPONENT MANUAL ACTIVATION menu deactivate automatically after 30 seconds for safety reasons.

4. INSTALLATION

4.1 INSTALLATION

Clausius heat pumps must be installed by trained personnel, following the instructions and recommendations enclosed in this manual.

An incorrect manipulation of this heat pumps may lead to damage to the unit and/or people handling it.

Taking into account its weight and size, a minimum of two people should perform transportation and installation operations, employing suitable equipment.

During transportation and installation, heat pumps must remain as vertical as possible, with a maximum inclination with the vertical of 45º.

An excessive inclination of the heat pump during transportation and installation may lead to its incorrect operation.

The heat pump has threaded connections that allow attaching handles or similar systems to facilitate the heat pump installation (Figure 33).

Installing handling systems inappropriate for the size and weight of the heat pump may lead to important damage to the unit and/or people manipulating it.

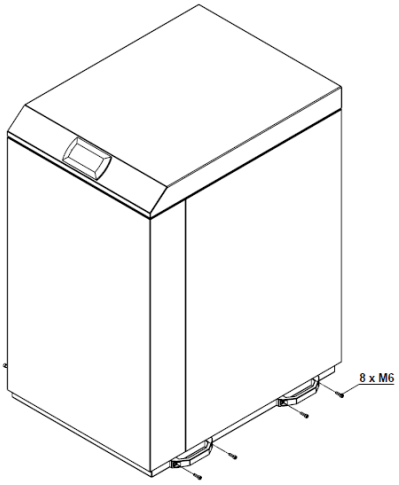


Figure 33. Assembly of handling elements.

4.2 LOCATION

Clausius heat pumps must be installed on a stable and levelled base, indoor and protected from weather events. Moreover, it is important to avoid dangerous locations, exposed to impacts, water projections, humidity, dust or other elements that can affect the unit.

4.3 DIMENSIONS

The external dimensions of Clausius heat pumps depend on the configuration (Classic or Elite) only and are independent of the heating capacity or the refrigeration and hydraulic unit. Figure 34 shows the external dimensions of Clausius heat pumps.

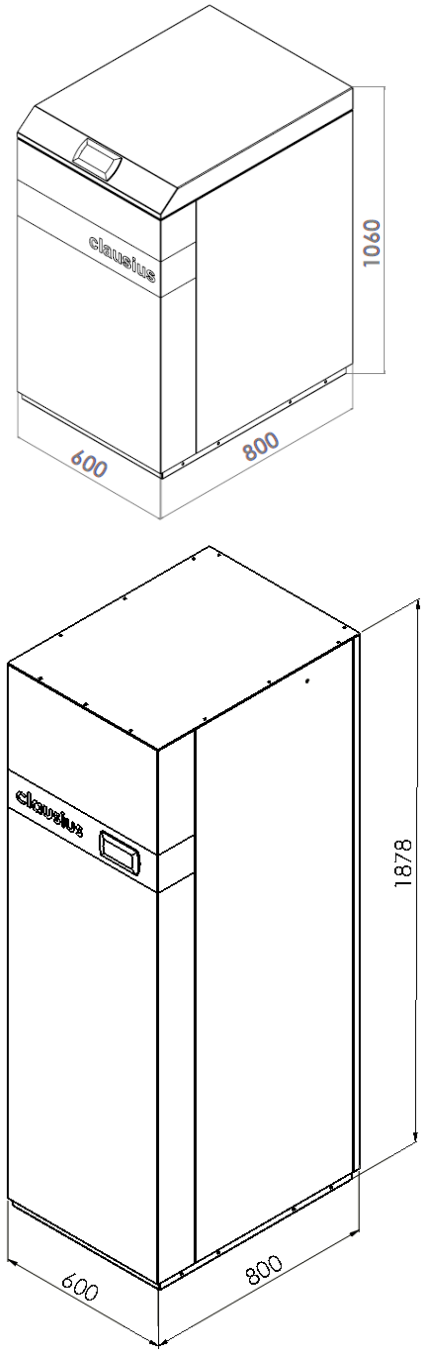


Figure 34. External dimensions of Clausius heat pumps.

The weight of Clausius heat pumps depends on the configuration (Classic or Elite), on the hydraulic and refrigeration unit, and on the heating capacity.

Model	Configuration	Heating capacity	Weight 1Ph / 3Ph (kg)
Classic	H	3-15	163 / --
	HC	3-15	174 / --
	H	5-25	168 / 173
	HC	5-25	179 / 184
Elite	H	3-15	243 / --
	HC	3-15	254 / --
	H	5-25	248 / 253
	HC	5-25	259 / 264

4.4 OPERATION AREA

For installation and maintenance operations, it is advisable to leave a free area around the heat pump of dimensions equal to or greater than those indicated in Figure 35.

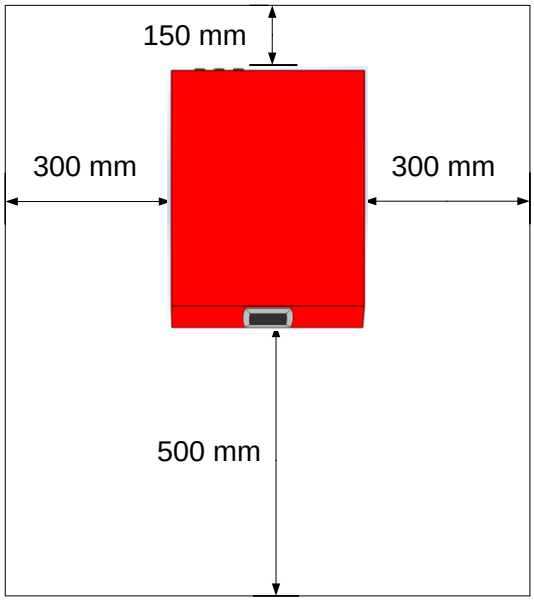


Figure 35. Minimum operation area around the heat pump for installation and maintenance.

4.5 COMMISSIONING

For the commissioning of Clausius heat pumps, the installer must perform the electric connections and the hydraulic circuit preparation, following the explanations of the next sections.

Once completed the heat pump installation, the installer must configure it and check the proper operation of each component with the option COMPONENT MANUAL ACTIVATION (section 3.5) in the INSTALLER MENU.

Once configured the heat pump and checked the proper operation of each element, the leakage thightness and the purge of the different circutis, it is possible to start the unit.

5. HYDRAULIC CONNECTION

5.1 GENERAL CONSIDERATIONS

The hydraulic connection of CLAUSIUS heat pumps must be performed by trained personnel.

The electrical cabinet of the heat pump must be closed and protected during the connection of the hydraulic circuits.

The installer should distinguish between Clausius heat pumps with Elite configuration (with integrated DHW tank) and with Classic configuration (without integrated DHW tank) when connecting the hydraulic circuits. The reason is that, even though the brine and indoor connections are equal, the DHW circuit differs between configurations.

Figure 36 and Figure 37 shows a sketch of the hydraulic connections of Clausius heat pumps with Elite and Classic configurations, respectively.

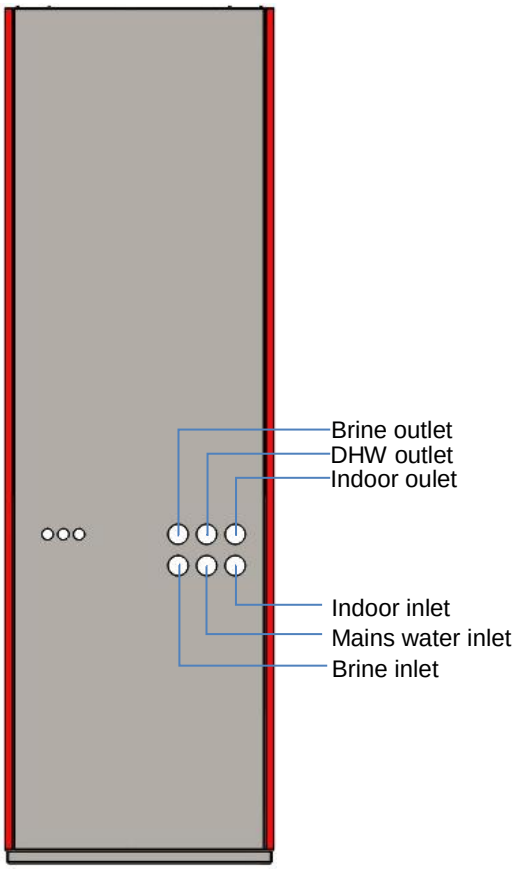


Figure 36. Hydraulic connections of Clausius heat pumps with Elite configuration.

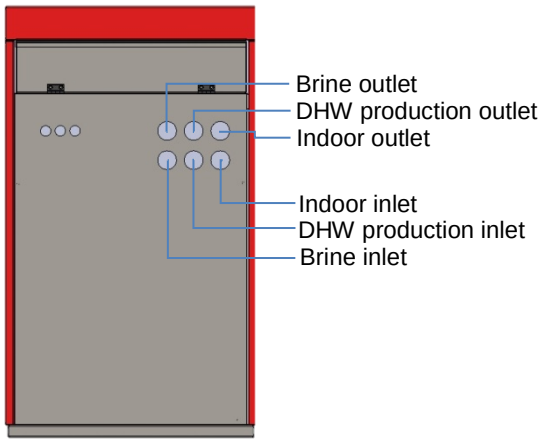


Figure 37. Hydraulic connections of Clausius heat pumps with Classic configuration.

The DHW connections have different functions depending on the configuration. In Classic configurations, they connect the heat pump and the external DHW tank and are used for the production of DHW. In Elite configurations, they are direct connections to DHW consumption and to mains water.

In Classic configurations, it is not possible to connect, directly, the DHW outlet and inlet to the DHW consumption and mains water, respectively.

In Classic configuration heat pumps, all the connections are 1” male threads. Besides, the heat pumps enclose 6 flexible hoses of 600 mm of length with 1” female sliding nut at one end and 1” male thread at the other.

Figure 38 shows an image of the hydraulic connections in Classic configuration heat pumps.

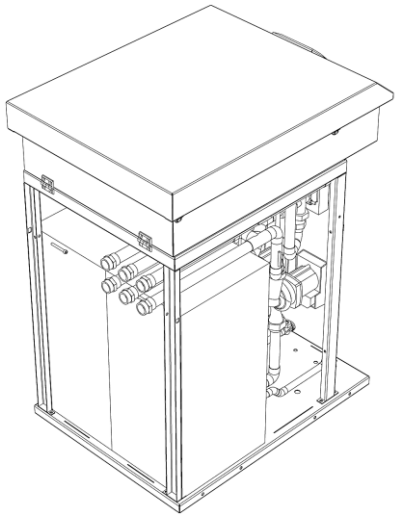


Figure 38. Image of the hydraulic connections.

In Elite configuration heat pumps, the connections to the brine and indoor circuits are also 1” male threaded and to the DHW circuit they are ¾” male threaded.

The position of the hydraulic connections and the electric wiring inlets are identical for both configurations, measured from the heat pump base, as shown in Figure 39.

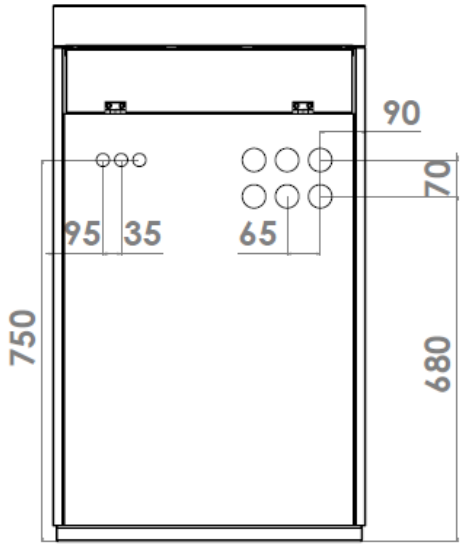


Figure 39. Positions of the hydraulic connections and of the electric wiring inlets.

5.2 BRINE CIRCUIT

Clausius heat pumps can operate with conventional geothermal collectors, as well as with underfloor water. If used the latter, an additional heat exchanger should be installed to avoid fouling in the evaporator and to reduce the risk of freezing of underfloor water inside it.

The size of the geothermal collector should be appropriate for the capacity of the heat pump selected.

All Clausius heat pump models have a circulation pump in the brine circuit, a 5-litre expansion vessel and a 6-bar safety valve. Besides, a drain valve installed at the bottom of the circuit allows removing the fluid from the heat pump.

Every installation needs filling and pressurising connections in the brine circuit to set its pressure in the operation range of the heat pump.

NOTE **The brine circuit pressure must be in the range from the minimum pressure allowed by the controller and the maximum pressure of the safety valve.**

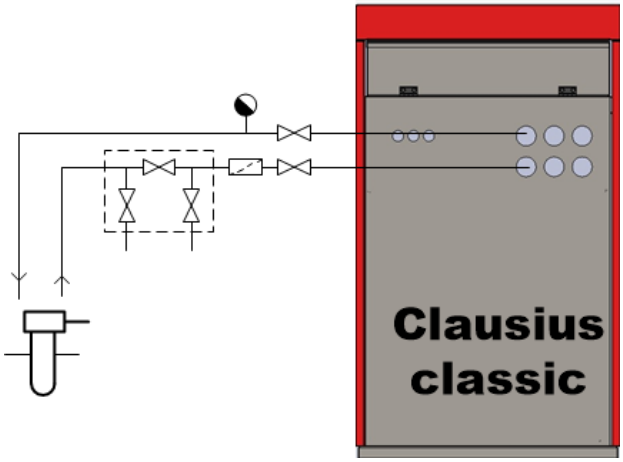
NOTE **The recommended operation pressure is 1.5 – 2 bar.**

NOTE **To assure the proper filling and emptying of the circuit, the 3-way valves must be open manually (section 3.5).**

A filter should be installed in the brine circuit to prevent dirt from reaching the evaporator. The installer should anticipate a system to allow cleaning the filter with the minimum fluid loss possible.

Shut-off valves should be installed at the inlet and outlet of the brine circuit, as close as possible to the heat pump, in order to minimise fluid losses during maintenance operations. The connection of air vents at the highest parts of the circuit is also recommended to avoid air traps.

Figure 40 shows a typical connection diagram of a brine circuit with convectional geothermal collectors. It is is identical for both configurations, Classic and Elite.



Symbol	Description
	Geothermal collector system
	Filling system
	Air vent
	Shut-off valve
	Filter

Figure 40. Brine circuit connection diagram with conventional geothermal collectors.

The connection between the heat pump and the brine circuit is at the back part of the heat pump. The diagrams shown in Figure 36 and Figure 37 should be followed and the flexible hoses delivered with the heat pump should be used to avoid vibration transmission to the installation.

In case of installing shut-off valves in the brine circuit, undertake measures to avoid their accidental closing.

Depending on the location, type and size of the geothermal collectors, and of the heat pump capacity, temperatures lower than 0 ºC may occur in the evaporator. Thus, a water solution with antifreezing product should be used. The selection of its concentration is crucial.

An improper concentration of antifreezing in the solution may lead to its freezing, cause the evaporator breaking and unrepairable damage to the unit.

To prevent from freezing, the protection of minimum brine outlet temperature (section 3.2.8) must be appropriate for the fluid used.

The installer should insulate the connections between the heat pump and the brine circuit to avoid condensations and/or heat losses.

After connected the brine circuit and filled with the corresponding fluid, the installer must check that it is leakage-free and must conduct the venting process using the brine circuit circulation pump (see section 3.5).

NOTE **A correct venting process needs several hours, depending on the complexity of the installation and on the number and position of the air vents.**

An incorrect venting process of the brine circuit may lead to an improper operation of the heat pump after its commissioning.

5.3 INDOOR CIRCUIT

Clausius heat pumps can operate with different emission systems, both for heating and for cooling.

The emission systems must be sized taking into account the capacity of the heat pump selected.

All Clausius heat pump models have a circulation pump in the indoor circuit, a 10-litre expansion vessel and a 3-bar safety valve. Besides, a drain valve installed at the bottom of the circuit allows removing the fluid from the heat pump.

NOTE **To assure the proper filling and emptying of the circuit, the 3-way valves must be open manually (section 3.5).**

Every installation needs filling and pressurising connections in the indoor circuit to set its pressure in the operation range of the heat pump.

NOTE **The indoor circuit pressure must be in the range from the minimum pressure allowed by the controller and the maximum pressure of the safety valve.**

NOTE **The recommended operation pressure is 1.5 – 2 bar.**

A filter should be installed in the indoor circuit to prevent dirt from reaching the condenser. The installer should anticipate a system to allow cleaning the filter with the minimum fluid loss possible.

Shut-off valves should be installed at the inlet and outlet of the indoor circuit, as close as possible to the heat pump, in order to minimise fluid losses during maintenance operations. The connection of air vents at the highest parts of the circuit is also recommended to avoid air traps.

In case of installing shut-off valves in the indoor circuit, undertake measures to avoid their accidental closing.

If the installer considers it appropriate, the safety valve outlet can be channelled out of the heat pump by two pre-drilled areas under the expansion vessels.

The connection between the heat pump and the indoor circuit is at the back part of the heat pump. The diagrams shown in Figure 36 and Figure 37 should be followed and the flexible hoses delivered with the heat pump should be used to avoid vibration transmission to the installation.

The installer should insulate the connections between the heat pump and the indoor circuit to avoid condensations and/or heat losses.

Depending on the characteristics of the installation, a simultaneous closure of all the emission systems could occur and the installer should undertake measures to guarantee the water circulation through the indoor circuit. The most typical solutions are **differential pressure valves** (pass-by the indoor circuit inlet and outlet as a function of the differential pressure between both points) and **hydraulic separator** (separate the heat pump and the rest of the installation and guarantee the flow through the condenser).

Installations with hydraulic separator require additional circulation pumps from the hydraulic separator to the different indoor circuits (Figure 41).

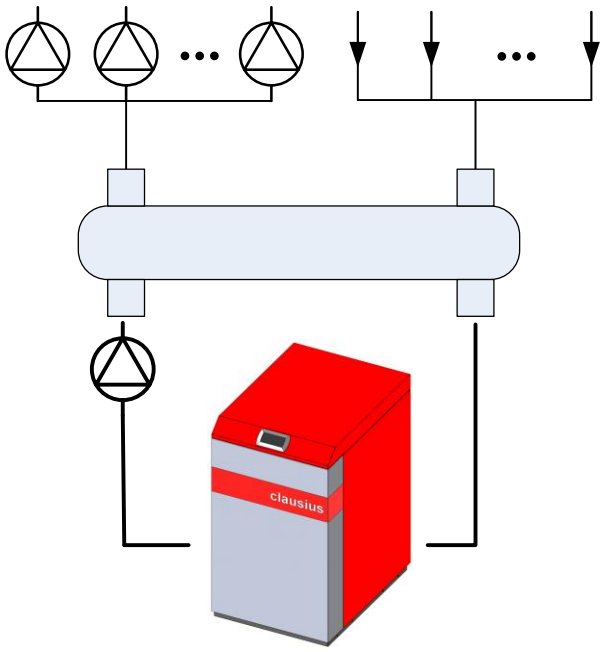
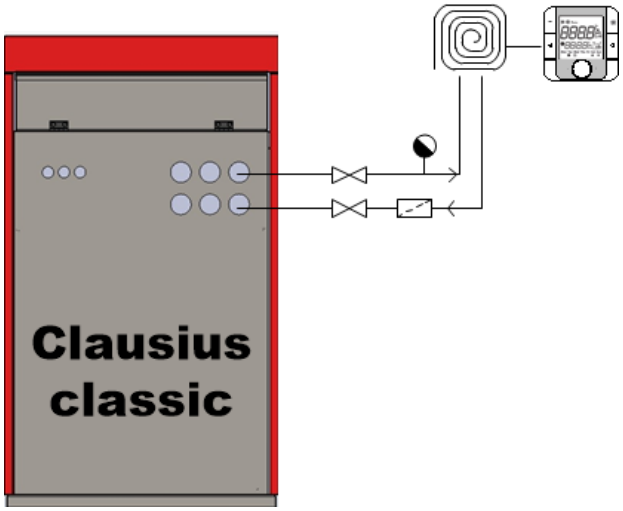


Figure 41. Connection diagram with hydraulic separator.

The sum of the maximum flow rate of the pumps located after the hydraulic separator must not surpass the maximum flow rate of indoor circuit pump.

Figure 42 shows a typical connection diagram of an indoor circuit with emission systems. Complex configuration are detailed in section 9.3.



Symbol	Description
	Indoor ambient terminal
	Emission system
	Air vent
	Shut-off valve
	Filter

Figure 42. Basic connection diagram of an indoor circuit.

After connected the indoor circuit and filled with the corresponding fluid, the installer must check that it is leakage-free and must conduct the venting process using the indoor circuit circulation pump (see section 3.5).

NOTE **A correct venting process needs several hours, depending on the complexity of the installation and on the number and position of the air vents.**

An incorrect venting process of the indoor circuit may lead to an improper operation of the heat pump after its commissioning.

5.4 DHW CIRCUIT

The connection of the DHW circuit of Clausius heat pumps differs between Classic configuration units, without integrated DHW tank, and Elite configuration units, with integrated DHW tank.

5.4.1 *Classic* configuration

Clausius heat pumps with Classic configuration need an external tank to produce DHW.

NOTE **CLAUSIUS heat pumps cannot be used for the instantaneous production of DHW.**

If the installation does not use a DHW tank, the connections of the DHW circuit (Figure 37) must be conveniently capped.

The most typical DHW production system is the use of tanks with internal helical coils, but other tanks are also possible. The size of the heat exchange surface of the DHW production system must be appropriate for the heat pump capacity.

An insufficient heat exchange surface of the DHW production system may lead to an incorrect operation of the heat pump.

For DHW tanks with internal helical coils, the heat exchange surface must be, at least, 2.5 m^2.

The DHW tanks used with Clausius heat pumps must have, at least, a pocket for the installation of a DHW temperature probe and an electric resistance.

The electric resistance can be employed to support the DHW production at high temperatures, to perform anti-legionella treatments and to produce DHW with fault operation mode.

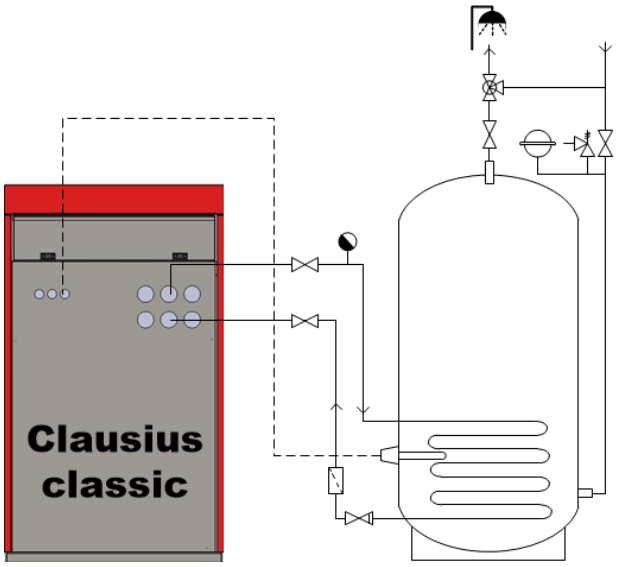
NOTE **The DHW temperature probe is included with the heat pump.**

The temperature probe must be placed above the electric resistance to guarantee a correct operation of the heat pump.

The electric resistance of DHW tanks connected to Classic heat pumps must be compatible with the contactor used for that purpose.

The connection between the heat pump and the DHW production system is at the back part of the heat pump. The diagram shown in Figure 37 should be followed and the flexible hoses delivered with the heat pump should be used to avoid vibration transmission to the installation. Besides, the installer must connect the tank to the dwelling DHW circuit.

Figure 43 shows a basic connection diagram of a DHW tank to a Clausius heat pump with Classic configuration.



Symbol	Description
	DHW consumption
	Electric resistance
	Mixing valve
	Safety group
	Shut-off valve
	Filter
	Check valve
	Air vent

Figure 43. Connection diagram of a DHW tank to a Clausius heat pump with Classic configuration.

A filter should be installed in the DHW production circuit to prevent dirt from reaching the condenser. The installer should anticipate a system to allow cleaning the filter with the minimum fluid loss possible.

Shut-off valves should be installed at the inlet and outlet of the DHW production circuit, as close as possible to the heat pump, in order to minimise fluid losses during maintenance operations. The connection of air vents at the highest parts of the circuit is also recommended to avoid air traps. Besides, a check valve should be also connected as proposed in Figure 43.

The filling process of the DHW production cycle must be performed simultaneously with the indoor circuit, changing manually and several times the position of the DHW 3-way valve (see section 3.5).

An incorrect venting process of the DHW production circuit may lead to an improper operation of the heat pump.

A thermostatic mixing valve is needed, connecting the DHW consumption circuit and the mains water. Besides, a safety group, consisting of an expansion vessel of appropriate size and a safety valve, should be installed to avoid possible overpressure.

Elements that limit the connection between the tank and the safety valve may lead to personal injury and/or material damage.

Finally, shut-off valves should be installed at the inlet and outlet of the DHW consumption circuit, as close as possible to the tank, in order to minimise fluid losses during maintenance operations; as well as a mains water pressure reducing valve.

The installer should insulate the connections between the heat pump and the DHW tank to avoid heat losses.

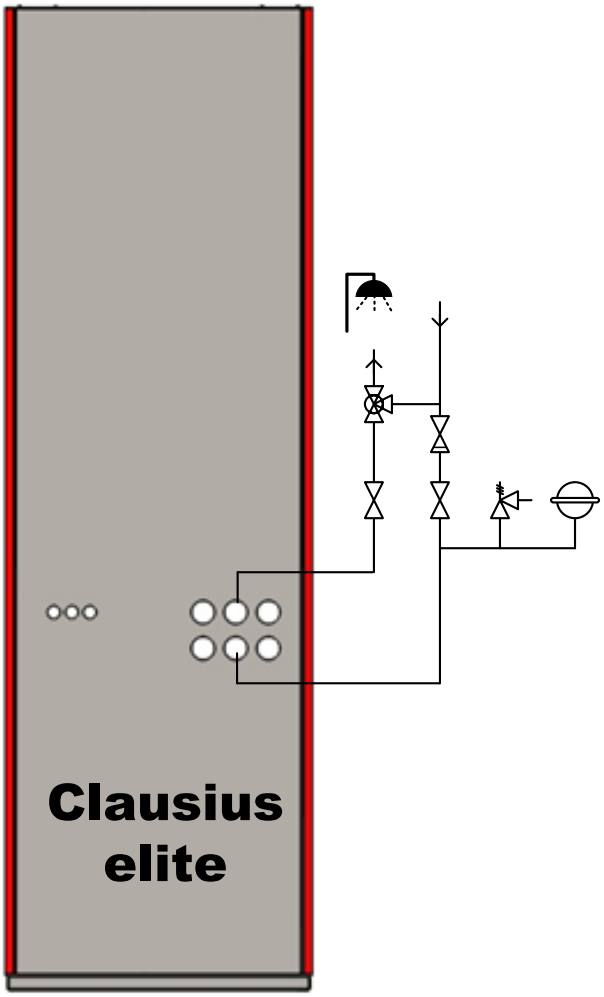
5.4.2 Configuración *Elite*

Clausius heat pumps with Elite configuration have an integrated DHW tank and, thus, only the DHW consumption circuit needs to be connected. The information concerning this circuit connection and explained for Classic configuration heat pumps is applicable in this case. That is, the circuit should have a safety group, consisting of an expansion vessel of appropriate size and a safety valve, to avoid possible overpressure; a thermostatic mixing valve is needed connecting the DHW consumption circuit and the mains water, shut-off valves at the inlet and outlet of the DHW consumption circuit, as close as possible to the heat pump, in order to minimise fluid losses during maintenance operations; and a mains water pressure reducing valve.

Elite configuration heat pumps do not include an expansion vessel or safety valve for the DHW consumption circuit. It should be installed externally.

Elements that limit the connection between the tank and the safety valve may lead to personal injury and/or material damage.

Figure 44 shows a basic connection diagram the DHW consumption circuit of Clausius heat pumps with Elite configuration.



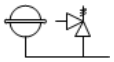
Symbol	Description
	DHW consumption
	Mixing valve
	Safety group
	Shut-off valve
	Check valve

Figure 44. Connection diagram of the DHW consumption circuit of Clausius heat pumps with Elite configuration.

6. CONEXIONADO ELÉCTRICO

Trained personnel, following this manual and the applicable standards, must perform the electrical connection of CLAUSIUS heat pumps.

Disconnect the heat pump from the electric power supply before conducting any operation the electrical cabinet.

Clausius heat pumps have an electrical cabinet that comprises the control components of the heat pump, as well as the terminal boards for the different components and sensors (Figure 45).

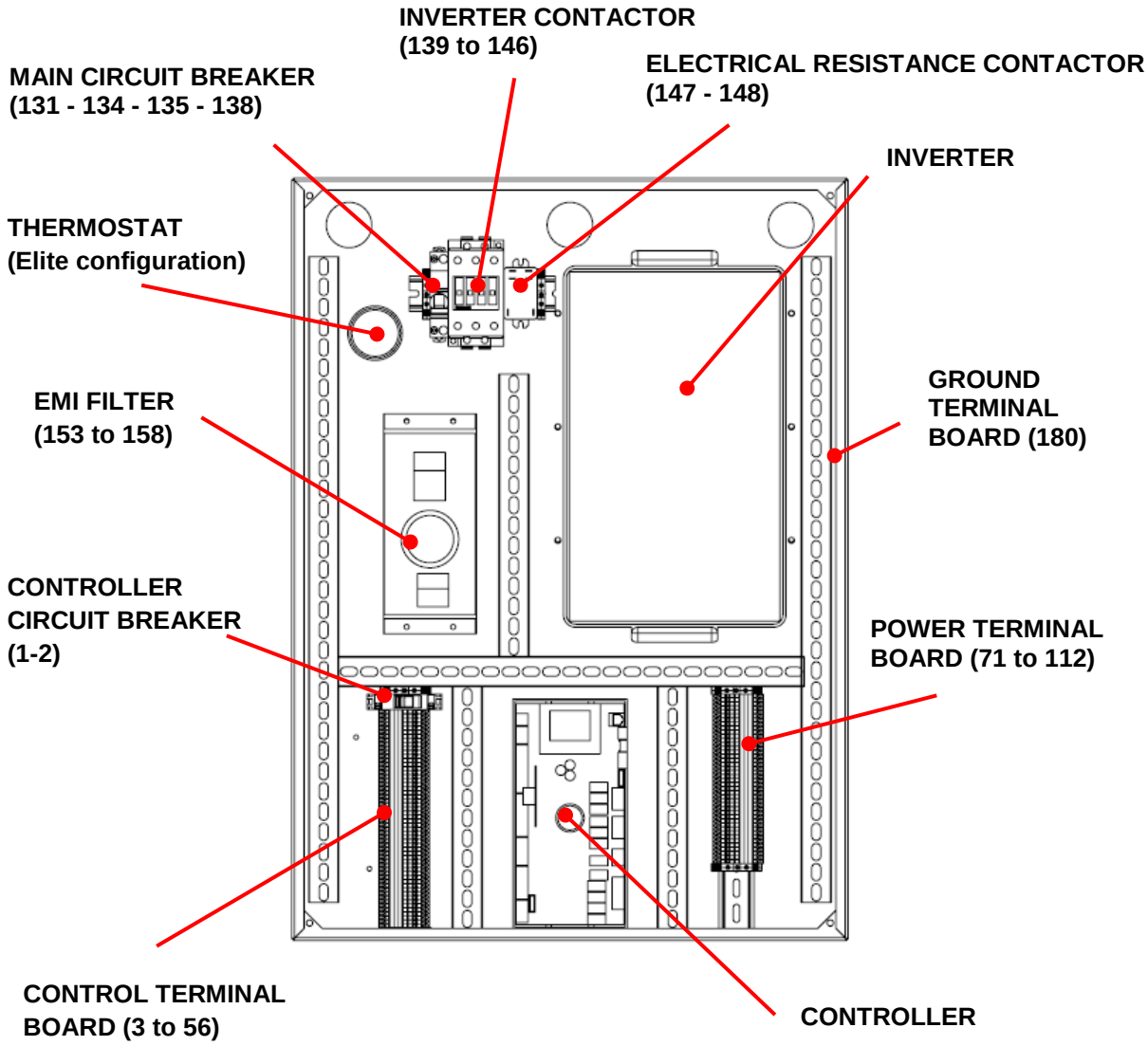


Figure 45. General view of the electrical cabinet in 1Ph Clausius heat pumps.

Inverter. Controls the compressor rotation speed.
EMI Filter. Filters the inverter input current.
Controller. Controls the heat pump operation.
Main circuit breaker. Allows disconnecting the heat pump from the power supply.
Controller circuit breaker. Allows disconnecting the controller from the power supply.
Inverter contactor. Controls the power supply to the inverter.
Electric resistance contactor. Activates/deactivates the electric resistance.
Control terminal board. Terminal board for the connection of the different sensors and control connections.
Power terminal board. Terminal board for the connection of the different heat pump components.
Thermostat (Elite configuration). Controls the maximum temperature in the integrated DHW tank.

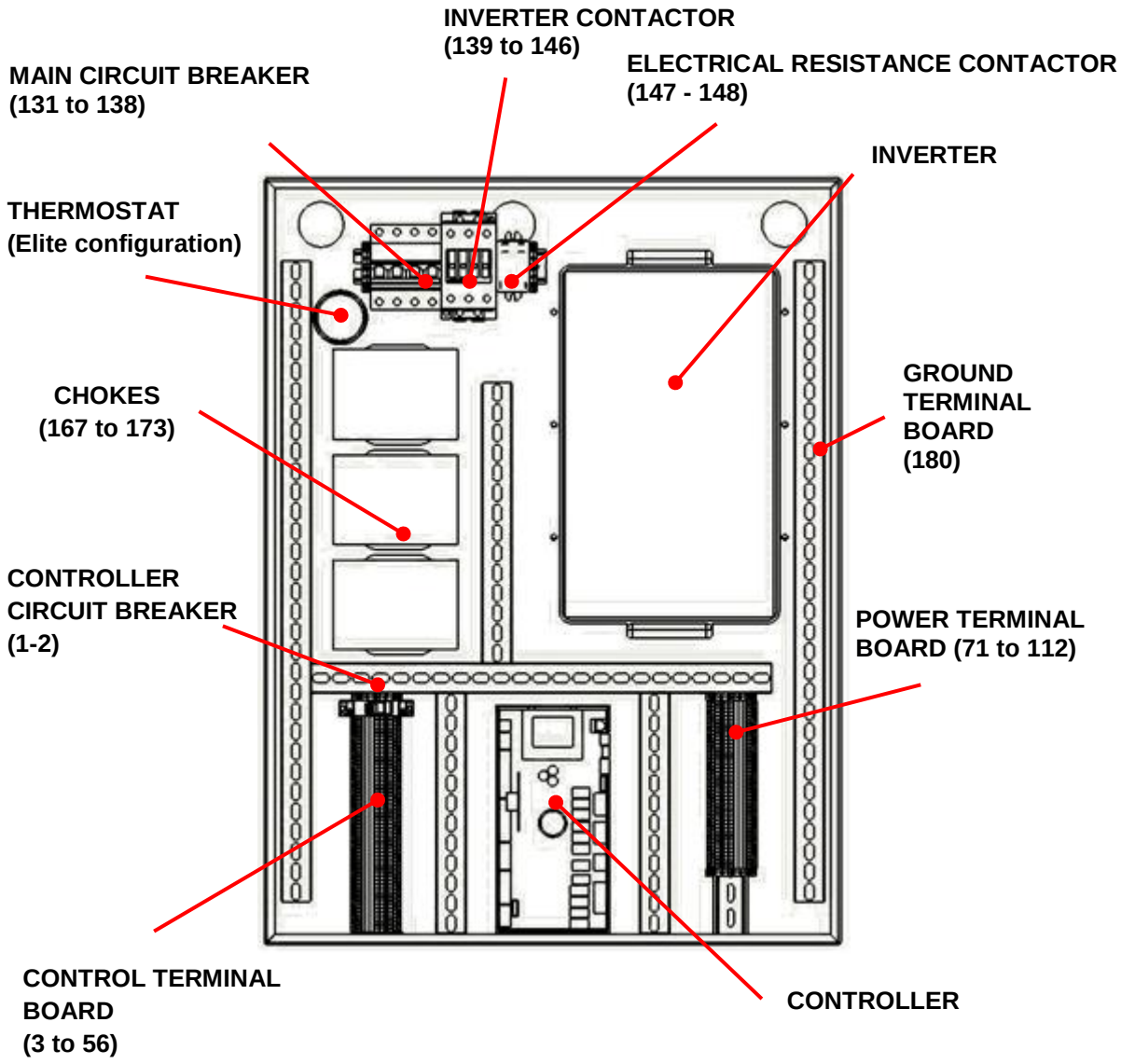


Figure 46. General view of the electrical cabinet in 3Ph Clausius heat pumps.

Inverter. Controls the compressor rotation speed.
Chokes. Current tranformers at the inverter input.
Controller. Controls the heat pump operation.
Main circuit breaker. Allows disconnecting the heat pump from the power supply.
Controller circuit breaker. Allows disconnecting the controller from the power supply.
Inverter contactor. Controls the power supply to the inverter.
Electric resistance contactor. Activates/deactivates the electric resistance.
Control terminal board. Terminal board for the connection of the different sensors and control connections.
Power terminal board. Terminal board for the connection of the different heat pump components.
Thermostat (Elite configuration). Controls the maximum temperature in the integrated DHW tank.

The disassembly process shown in section 7 must be followed to access the electrical cabined and connections.

Clausius heat pumps are availables in both single-phase and three-phase supply versions.

NOTA **The three-phase supply version is only available in 5-25 kW heat pump models.**

6.1 ELECTRIC POWER SUPPLY

A circuit breaker or electrical isolating switch should be installed outside the heat pump to allow an easy disconnections of the electric power supply.

NOTA **The power supply wire is not distributed with the heat pump.**

All Clausius heat pump models have an integrated main circuit breaker of 32 A and 40 A for the 3-15 kW heat pump and 5-25 kW heat pump, respectively.

The minimum section of the power supply wire depends on the heat pump capacity, being 6 mm^2 for the 3-15 kW models and 10 mm^2 for the 5-25 kW models.

Model	3-15 kW	5-25 kW (1-phase)	5-25 kW (3-phase)
Circuit breaker	32 A	40 A	16 A
Minimum section	6 mm^2	10 mm^2	4 mm^2

An improper selection of the power supply section may lead to an incorrect operation of the heat pump.

The heat pump electric power supply in single-phase models must be connected following the diagram in Figure 47 to the main circuit breaker and ground terminal in Figure 48 (see Figure 43 and APPENDIX).

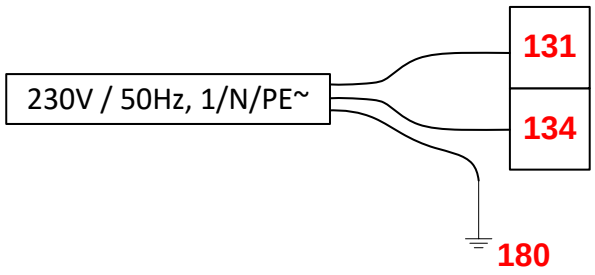


Figure 47. Connection diagram of electric power supply with single-phase heat pumps.

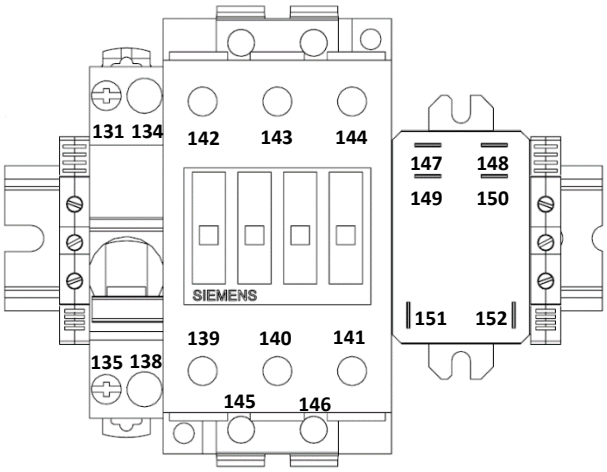


Figure 48. Detail of the power supply board of single-phase Clausius heat pumps.

The heat pump electric power supply in three-phase models must be connected following the diagram in Figure 49 to the main circuit breaker and ground terminal in Figure 53 (see Figure 46 and APPENDIX).

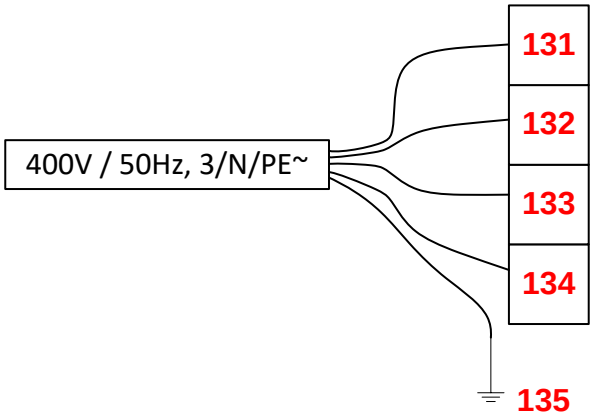


Figure 49. Connection diagram of electric power supply with three-phase heat pumps.

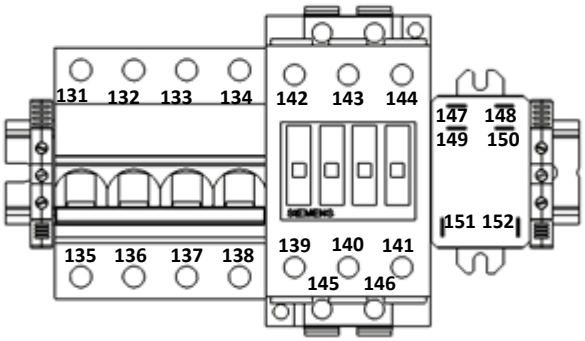


Figure 50. Detail of the power supply board of three-phase Clausius heat pumps

The installer must introduce the power supply wire through the electric wiring inlets (see Figure 39) and the holes drilled at the back of the electrical cabinet (Figure 43).

6.2 OUTDOOR TEMPERATURE PROBE

The outdoor temperature probe must be installed outside the dwelling, in a ventilated zone and protected from solar radiation, wind, rain or heat sources that might affect the measured value. Figure 51 shows a diagram of possible locations for the outdoor temperature probe.

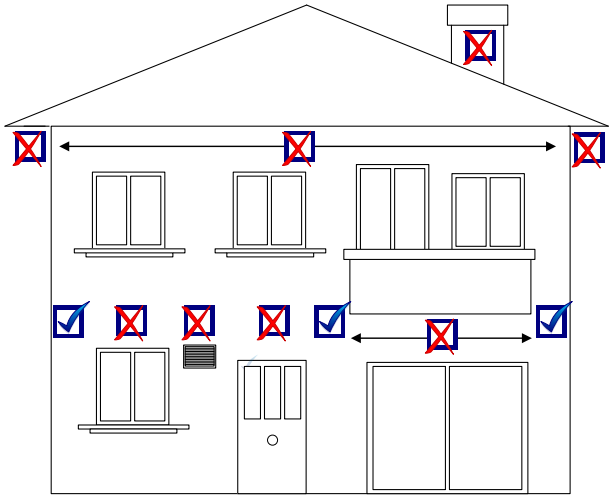


Figure 51. Diagram of possible locations for the outdoor temperature probe.

NOTE **A NTC temperature probe with 1.5 m of length is distributed with CLAUSIUS heat pumps.**

Figure 52 shows the connection diagram of the outdoor temperature probe. For wires shorter than 50 m, the minimum section recommended is 0,75 mm^2. For longer wires (up to 120 m), the section should be 1,5 mm^2.

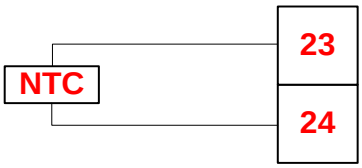


Figure 52. Connection diagram of the outdoor temperature probe.

6.3 DHW TANK CONNECTION

The installer needs to connect the DHW temperature probe and electric resistance with Classic configuration Clausius heat pumps.

NOTE **A NTC temperature probe with 1.5 m of length is distributed with CLAUSIUS heat pumps.**

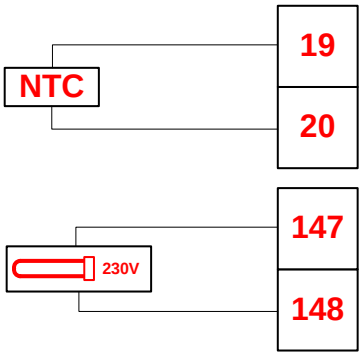


Figure 53. Connection diagram of the DHW tank connection.

Figure 53 shows the connection diagram of the DHW temperature probe and of the electric resistance (electric resistance contactor in Figure 45). For wires shorter than 50 m, the minimum section recommended is 0,75 mm^2. For longer wires (up to 120 m), the section should be 1,5 mm^2.

NOTE **The faston terminals for the contactor are included in the heat pump.**

Elite configuration units have both components already connected.

6.4 INDOOR AMBIENT TERMINAL

Figure 54 shows the connection board in th-Tune terminals. It consists of electric power supply terminals and communication terminals.

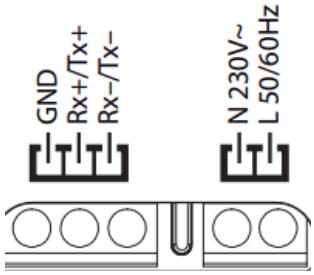


Figure 54. Connection board in th-Tune terminals.

The connection between the heat pump and the th-Tune communication board of two ambient terminals th-Tune is shown in Figure 55.

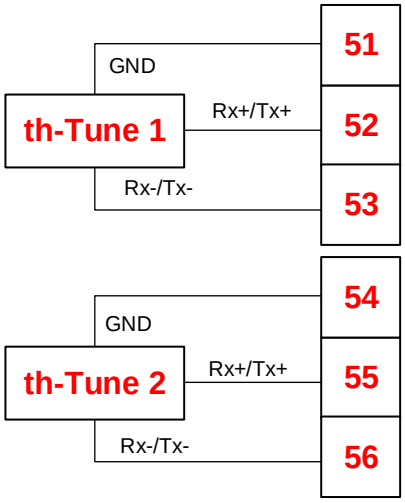


Figure 55. Connection diagram between the th-Tune terminals and the heat pump control terminal board.

NOTE **CLAUSIUS heat pumps do not have specific connectors for energising th-Tunes.**

An incorrect venting process of the DHW production circuit may lead to an improper operation of the heat pump.

NOTE **Additional information on the operation of th-Tune terminals is in the th-Tune Manual.**

6.5 RELAY INDOOR TERMINALS

Clausius heat pumps allow the indoor temperature control using relay thermostats. In SINGLE-ZONE systems, a controller digital input manages heating demands and another input manages cooling demands. In TWO-ZONE systems, two controller digital inputs manage heating demands and two more manage cooling demands.

NOTE **The thermostats used with the heat pump must be volt free.**

Two or more thermostats can be connected in parallel to the same digital input. Thus, if at least one of them is activated, the heat pump receives the cooling or heating demand, depending on the case.

Figure 56 shows the connection diagram of relay thermostats to the control board terminal.

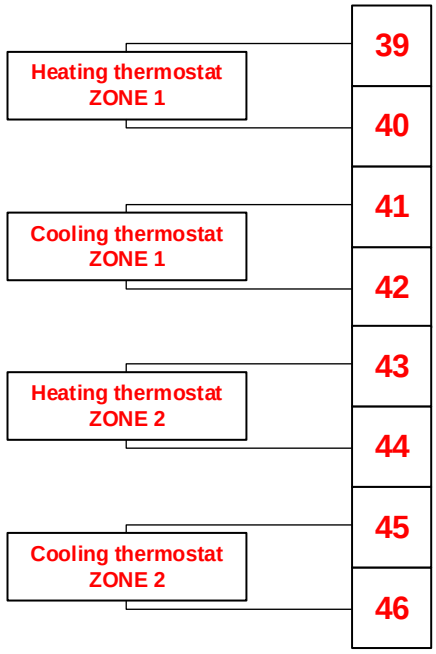


Figure 56. Connection diagram of relay thermostats for indoor temperature control.

NOTE **CLAUSIUS heat pumps allow to work with relay and th-TUNE simultaneously.**

6.6 TWO-SYSTEM VALVE

Installations with TWO-SYSTEM operation diagrams, i.e. with different emission systems for heating and for cooling (diagram 9.3.4), need a 3-way 2-position valve that is to be connected as shown in Figure 57.

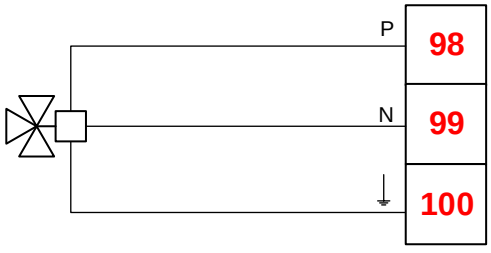


Figure 57. Connection diagram of the TWO-SYSTEM valve.

NOTE **The TWO-SYSTEM valve is not included with the heat pump.**

6.7 POOL

Figure 58 shows the connection diagram of the thermostat or time programmer that activates pool mode.

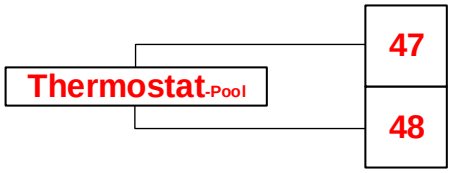


Figure 58. Connection diagram of the POOL mode control logic.

Besides, a 3-way valve diverts the hot water produced in the heat pump to the pool heat exchanger. The water from the pool is circulated through the heat exchanger by means of a pump, which can be directly connected tho the power terminal board if its electric consumption is compatible with the controller outputs limit.

The electric current limit of each group of outputs of the controller is 1 A.

For the electric consumption evaluation, the installer should take into account all the elements that use the same group of outputs.

Connecting pumps with electric consumptions greater than the controller limit may lead to damage to the heat pump.

Figure 59 shows the connection diagram of the pool valve and of the circulation pump with direct power supply.

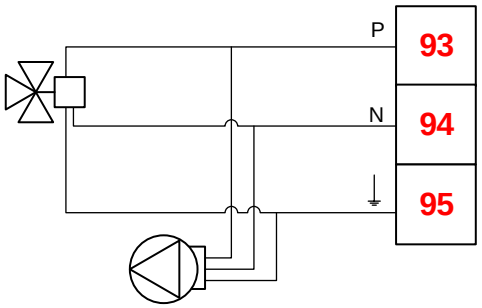


Figure 59. Connection diagram of the pool valve and of the circulation pump with direct power supply.

If the circulation pump electric consumption is unsuitable for the controller outputs, a relay is used. The connection diagram is shown in Figure 60.

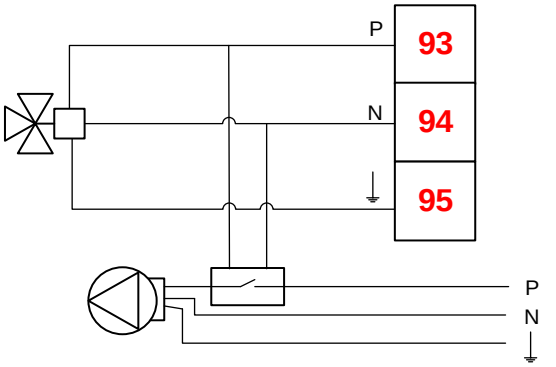


Figure 60. Connection diagram of the pool valve and of the circulation pump with intermediate relay.

NOTE **The pool valve, the circulation pump and the pool heat exchanger are not included with the heat pump.**

6.8 TWO-ZONE SYSTEM

Installations with TWO-ZONE operation diagrams need an automatic valve to close ZONE 1 and a mixing group for the control of the ZONE 2 outlet temperature.

Figure 61 shows the connection diagram of the ZONE 1 shut-off valve to the power terminal board.

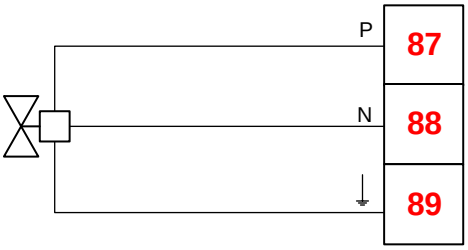


Figure 61. Connection diagram of the ZONE 1 shut-off valve.

The mixing group must have a 3-way modulating valve, energised from the power terminal board and with a 0-10 V control from the heat pump controller. Taking into account that most servo motors for these valves have 24 V electric voltage input, and additional system needs to be installed (Figure 62). For 24 V_{ac} servo motors, a 230 Vac / 24 V_{ac} must be used. For 24 V_{dc} servo motors, a power supply unit must be used.

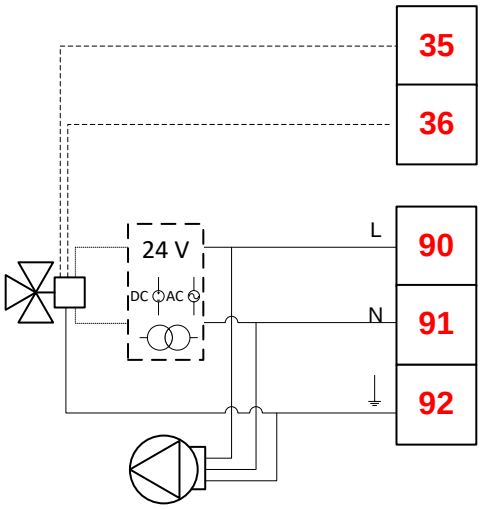


Figure 62. Connection diagram of the mixing group with circulation pump (direct power supply).

NOTE **The ZONE 1 valve and the mixing group are not distributed with the heat pump.**

NOTE **The transformer or the power supply unit to energise the servo motor is not distributed with the heat pump.**

The mixing group allows mixing the inlet water from ZONE 2 with the outlet water from the heat pump in order to obtain the optimal outlet temperature to ZONE 2. A NTC temperature probe is required to control the outlet temperature of the water to ZONE 2 (Figure 63).

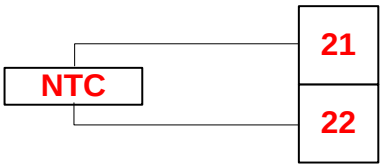


Figure 63. Connection diagram of the temperature probe that controls the ZONE 2 mixing group.

The electric current limit of each group of outputs of the controller is 1 A. If the electric consumption of the mixing group circulation pump is unsuitable for the controller outputs, a relay is used. The connection diagram is shown in Figure 64.

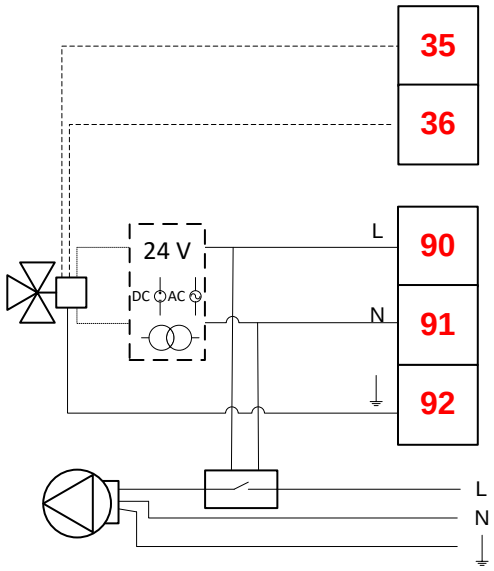


Figure 64. Connection diagram of the mixing group with circulation pump and intermediate relay.

For the electric consumption evaluation, the installer should take into account all the elements that use the same group of outputs.

Connecting pumps with electric consumptions greater than the controller limit may lead to damage to the heat pump.

6.9 MULTI-EMISSION SYSTEM

Installations with different emission systems for the same zone (same temperature control) need a mixing group similar to that used in TWO-ZONE systems.

The mixing group must have a 3-way modulating valve, energised from the power terminal board and with a 0-10 V control from the heat pump controller (Figure 62). Besides, a NTC temperature probe is required to control the outlet temperature of the water to the second emission system, in a similar way to that from Figure 63.For 24 V_{ac} servo motors, a 230 V_{ac} / 24 V_{ac} must be used. For 24 V_{dc} servo motors, a power supply unit must be used.

NOTE **The mixing group is not distributed with the heat pump.**

NOTE **The transformer or the power supply unit to energise the servo motor is not distributed with the heat pump.**

NOTE **In contrast with TWO-ZONE systems, MULTI-EMISSION systems cannot disable the main emission system.**

The electric current limit of each group of outputs of the controller is 1 A. If the electric consumption of the mixing group circulation pump is unsuitable for the controller outputs, a relay is used. The connection diagram is shown in Figure 64.

Connecting pumps with electric consumptions greater than the controller limit may lead to damage to the heat pump.

6.10 BUFFER TANK CONNECTION

Buffer tank systems must have a temperature probe in the buffer tank. The connection of this NTC temperature probe is shown in Figure 65.

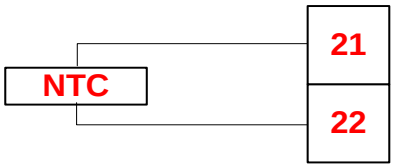


Figure 65. Connection diagram of the temperature probe in the BUFFER tank.

In case there are independent buffer tanks for heating and cooling, apart from the temperature probe in the heating tank (Figure 65), another must be placed in the cooling tank. Figure 66 shows the connection diagram of the temperature probe of the cooling buffer tank.

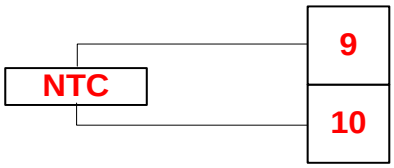


Figure 66. Connection diagram of the temperature probe place in the cooling buffer tank.

NOTE **The installer must remove the wires connected to those terminals in order to install the temperature probe of the cooling buffer tank.**

The wires of the disconnected temperature probe must be properly protected to prevent any contact with other electrical devices.

In case there is a single buffer tank for heating and cooling, the heat pump can operate controlling it with one probe, connecting it as in Figure 65; or with two probes, connecting the probe for cooling purposes as in Figure 66.

NOTE **Installing a single tank with one temperature probe for heating and cooling is only recommended with tanks of small size.**

In case there are two independent buffer tanks for heating and cooling, a 3-way 2-position valve must be installed in the outlet of the indoor circuit. Figure 67 shows the connection diagram of this valve.

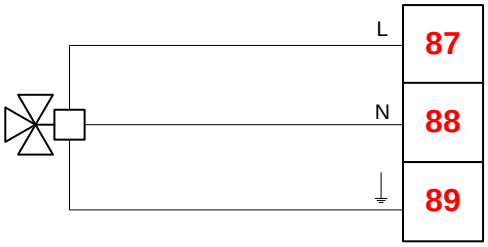


Figure 67. Connection diagram of the 3-way valve used with independent tanks for heating and cooling.

NOTE **The 3-way valves used in BUFFER systems are not distributed with the heat pump.**

In case there is a single buffer tank for heating and cooling, four 3-way 2-position valves are needed. The connection to the power terminal board is shown in Figure 68. Two of the them will redirect the fluids in the charge circuits of the buffer tank and the other ones will redirect the fluids in the consumption circuits.

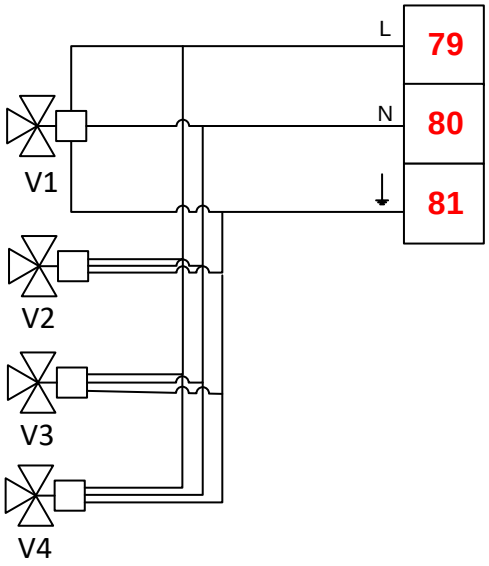


Figure 68. Connection diagram of the 3-way valves used with a single buffer tank for heating and cooling.

NOTE **The four 3-way valves used in BUFFER systems for heating and cooling with a single tank can be substituted by two 4-way valves.**

The 3-way valves must be installed taking into account that the non-energised position corresponds to the heating buffer tank layout.

6.11 HOUSE AUTOMATION

Clausius heat pumps can be controlled with an external logic from a HOUSE AUTOMATION control device, and its connection should follow .

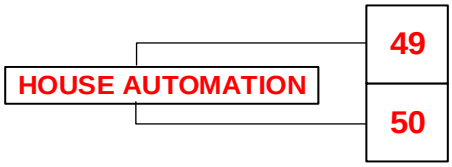


Figure 69. Connection diagram of the house automation control.

NOTE **House automation input should be enabled in the INSTALLER MENU to allow this control logic (section 3.2.3.4).**

NOTE **DI7 input is not default wired in the control terminal board. It must be directly connected to the controller (APPENDIX VI).**

6.12 INTERNET ACCESS

Clausius heat pumps allow communication via internet using a PC or a smartphone. Prior to connect the heat pump to the network it is neccessary to installed a pCO Web device and a router, as well as to have been subscribed to the service.

NOTE **All the necessary devices for internet connection are distributed on request with the heat pump, as well as the subscription to the service.**

6.13 DHW THERMOSTAT (Elite configuration)

The innovative technology of Clausius heat pumps with Elite configuration allows increasing considerably the DHW tank temperature without using electric resistances. A control thermostat is used to limit the maximum temperature that can be achieved in the DHW tank, as shown in Figure 45.

The maximum temperature in the DHW thermostat must be greater than the DHW temperature setpoint to guarantee a correct operation of the heat pump.

NOTE **The maximum temperature set in the thermostat should range from 65 ºC to 85 ºC.**

7. COMPONENTS

7.1 REFRIGERATION UNITS

7.1.1 General description

Two refrigeration units are available for Clausius heat pumps, depending on whether the unit allows reversing the refrigerant cycle to produce cooling or not. Moreover, both models have slight differences as a function of the configuration, Classic or Elite. The following table encloses the models available and their characteristics.

Type	Configuration	Applications
RU-H	Classic	HEATING + DHW EXTERNAL TANK
	Elite	HEATING + DHW INTEGRATED TANK
RU-HC	Classic	HEATING + ACTIVE COOLING + DHW EXTERNAL TANK
	Elite	HEATING + ACTIVE COOLING + DHW INTEGRATED TANK

The refrigeration units of Clausius heat pumps are placed inside an acoustic insulation container to reduce the acoustic emissions to the dwelling (Figure 70).

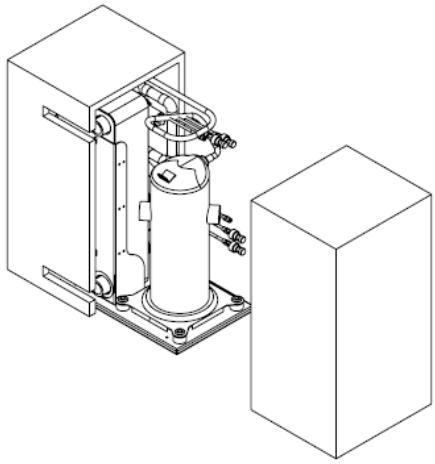


Figure 70. Image of the acoustic insulation used for the refrigeration units.

7.1.2 Technical and safety issues

The refrigeration units have the refrigerant R410A charge needed for its correct operation. Except in case of leakage, no maintenance of the refrigerant is needed.

NOTE **R410A is a chlorine-free refrigerant and does not contribute to ozone layer depletion.**

NOTE **R410A is non-toxic nor flammable under normal conditions. However, special precautions should be taken during manipulation and/or in case of leakage.**

Refrigeration unit repair should be performed by trained personnel and after the authorisation of the manufacturer.

Avoid touching pipes and elements of the refrigeration unit during or immediately after the heat pump is on, as there is burn hazard.

Remove first the lateral covers of the heat pump casing and, afterwards, the pieces that form the acoustic installation container (section 7) to access the refrigeration unit. If needed, it is possible to remove the whole refrigeration unit through a side, after disconnecting it from the hydraulic unit and electrical cabinet, as well as from the integrated DHW tank (Elite configuration).

In case a maintenance operation needs removing the refrigerant, it must be recovered and stored for its processing in an approved plant.

Never release the refrigerant of the refrigeration unit directly to the ambient.

In case of refrigerant leak, avoid breathing in any gas and, if needed, abandon and ventilate the room.

Avoid direct contact with the refrigerant in case of an accidental release due to severe freezing hazard.

If needed a new refrigerant charge, it must be of the amount indicated in the technical specifications and always in liquid phase, to guarantee its composition. For the same reason, if detected a leakage, the refrigerant must be recovered, the leakage repaired, and new refrigerant charged.

NOTE **R410A is a zoetropic mixture. Thus, its composition differs between gas and liquid phase.**

Prior to any refrigerant charge, a vacuum process must be conducted to guarantee that no humidity exists in the refrigeration unit.

The existence of humidity in the refrigeration unit may lead to an incorrect operation of the heat pump and even to important damage to it.

The same procedure of refrigerant recovery must be performed prior to recycling the heat pump.

7.2 HYDRAULIC UNITS

7.2.1 General description

Two hydraulic units are available for Clausius heat pumps, depending on whether the unit allows producing cooling or not. Moreover, both models have slight differences as a function of the configuration, Classic or Elite. The following table encloses the models available and their characteristics.

Type	Configuration	Applications
HU-H	Classic	HEATING + DHW EXTERNAL TANK
	Elite	HEATING + DHW INTEGRATED TANK
HU-HC	Classic	HEATING + PASSIVE COOLING + DHW EXTERNAL TANK
	Elite	HEATING + PASSIVE COOLING + DHW INTEGRATED TANK

NOTE **The hydraulic units HU-H and HU-HC are only sold with the refrigeraiont units RU-H y RU-HC, respectively (section 6).**

The main difference between the hydraulic units in Classic configuration and Elite configuration lies in the DHW production method. The former uses hot water from the condenser to heat the DHW in the external tank (section 5.4.1). In contrast, the latter has an integrated DHW tank and its production takes place in the heat pump (section 5.4.2).

8. ACCESS TO THE INTERIOR

This section details the procedure to access the interior of Clausius heat pumps.

Once removed, covers must be carefully manipulated and stored to avoid any damage due to blows or scratches.

Collect the screws in a safe place during maintenance operations to assure a proper assembly of the covers.

8.1 CLASSIC CONFIGURATION

The first step to access the interior of Clausius heat pumps with Classic configuration is removing the top cover. A quick clamping system holds it, and it can be easily removed by pulling upwards (Figure 71).

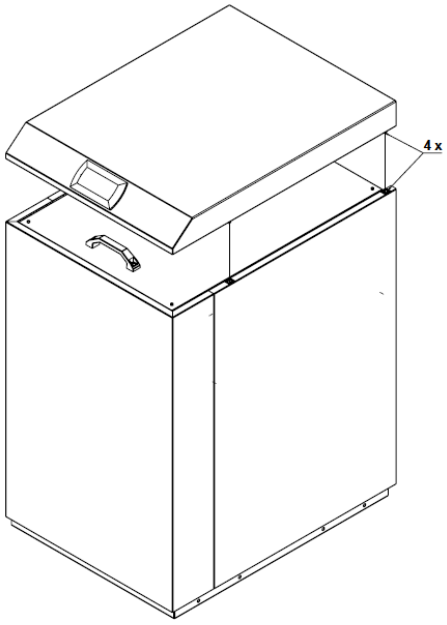


Figure 71. Disassembly process for the top cover of Clausius heat pumps with Classic configuration.

Take special care in case of employing any lever system during the disassembly process.

NOTE **The installer must disconnect the wire connecting the control panel and the controller to remove, completely, the heat pump covers.**

Once removed the top cover, it is possible to access the electrical cabinet and the hydraulic and refrigeration units.

8.1.1 Electrical cabinet

The installer must unscrew the 4 screws placed at the electrical cabinet corner to remove its cover (Figure 72).

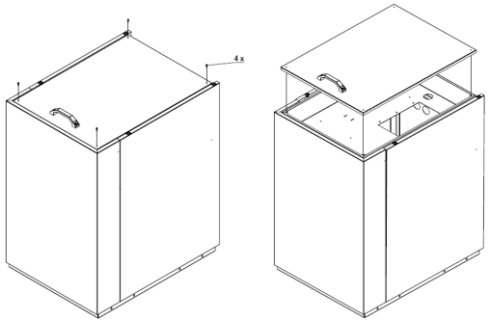


Figure 72. Disassembly process for the electrical cabinet cover of Clausius heat pumps with Classic configuration.

NOTE **There is a handle attached to the electrical cabinet cover to facilitate its removal.**

An innovative system with hinge allows lifting the electrical cabinet and allows a comfortable access to the heat pump interior for maintenance operations. A support structure, such as that shown in Figure 73, is included to keep the cabinet lifted.

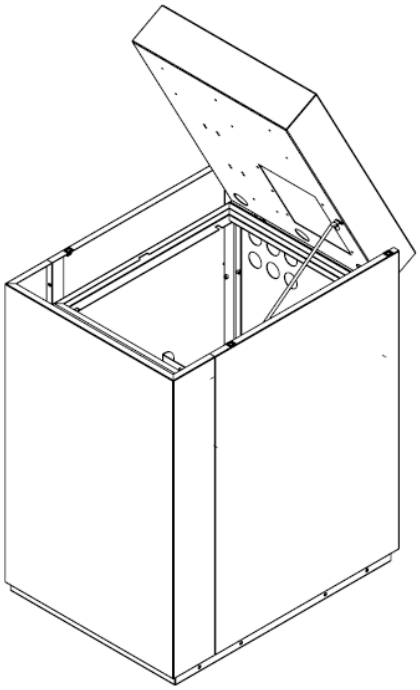


Figure 73. Electrical cabinet hinge system and support structure.

NOTE **Check that the handle of the electrical cabinet cover is properly screwed prior to lifting the cabinet with it.**

Lift the electrical cabinet carefully, paying special attention to avoid tensions in the wires that may lead to their disconnection or breaking.

The electrical cabinet must be properly supported when lifted to prevent any damage to the heat pump and/or the people manipulating it.

8.1.2 Hydraulic unit

The desing of Clausius heat pumps with Classic configuration allows reaching most of the components of the hydraulic unit, such as the circulation pumps, the 3-way valves, the drain valves and connections, the expansion vessels, the safety valves and the pressure transducers of the brine and indoor circuits, removing the front cover only.

The clamping system to hold the front cover consists of two flanges that are introduced in two slots placed at the base of the heat pump, and two screws at the top that hold it against the lateral covers. Thus, the installer must, first, unscrew both screws and, then, lift and release both flanges from the slots (see Figure 74).

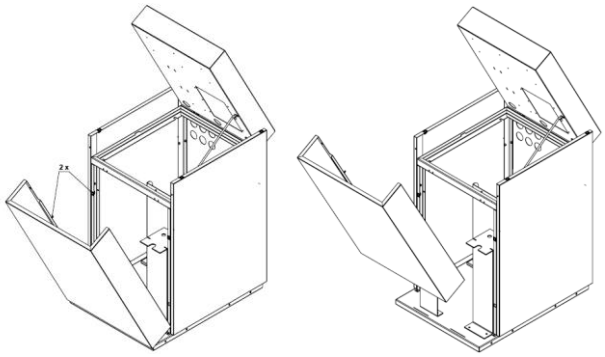


Figure 74. Disassembly process of the front cover of Clausius heat pumps with Classic configuration.

NOTE **It is necessary to remove the top cover before removing the front one in CLAUSIUS heat pumps with Classic configuration.**

NOTE **The installer must remove the front cover carefully in HC (cooling) heat pumps to avoid any damage to the passive cooling heat exchanger insulation.**

8.1.3 Refrigeration unit

The installer must remove the lateral covers of the heat pump to access the refrigeration unit or the connections between it and the hydraulic unit.

To remove each lateral cover, it is necessary to unscrew the screws that hold it to the structure. Besides, the lateral covers have a positioning system with two flanges that are introduced in two slots placed at the base of the heat pump. The installer must release both flanges by lifting the cover. The process for their removal is shown in Figure 75.

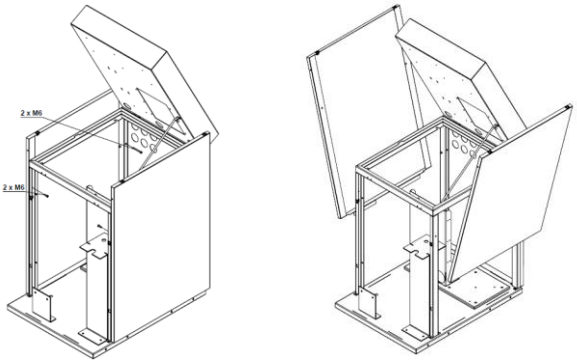


Figure 75. Disassembly process of the lateral covers of Clausius heat pumps with Classic configuration.

NOTE **It is necessary to remove the front cover before removing the lateral covers in CLAUSIUS heat pumps with Classic configuration.**

NOTE **CLAUSIUS heat pumps have been designed to allow any maintenance operation without removing the back cover.**

The refrigeration units of Clausius heat pumps are placed inside an acoustic insulation container to reduce the acoustic emissions to the dwelling.

The acoustic insulation container consists of two halves and each can be removed through each side. Pressure switches, pressure transducers, compressor connections, charge valves and the solenoid valve are accessible from the right side (seen from the front). The expansion valve and the reversing valve in HC models (cooling) are accessible from the left side (seen from the front).

In case of complex fault, it is possible to remove the whole refrigeration unit through a side, after disconnecting it from the hydraulic unit and electrical cabinet.

8.2 ELITE CONFIGURATION

The first step to access the interior of Clausius heat pumps with Elite configuration is removing the top cover, which is attached to the front, back and lateral covers by two screws each.

Once unscrewed the top cover, the front cover can be removed. The front cover has a positioning system with two flanges that are introduced in two slots placed at the base of the heat pump. The installer must release both flanges by lifting the cover. Moreover, two bolts at the lateral covers are positioners of the front cover. The process to remove the cover is shown in Figure 76.

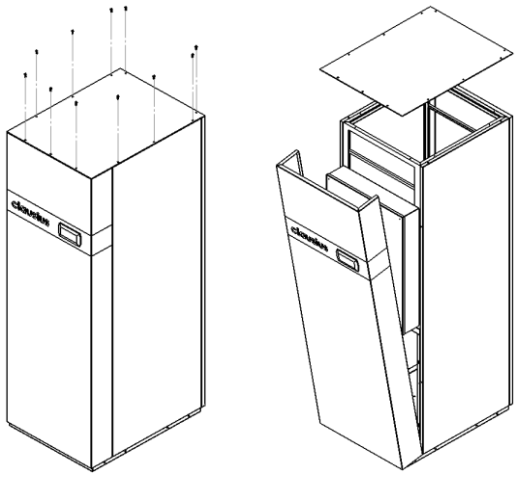


Figure 76. Disassembly process of the front cover of Clausius heat pumps with Elite configuration.

NOTE The installer must disconnect the wire connecting the control panel and the controller to remove, completely, the front cover.

NOTE The installer must remove the front cover carefully in HC (cooling) heat pumps to avoid any damage to the passive cooling heat exchanger insulation.

Once unscrewed the screws between the top and the front covers, take special precautions because the latter could fall.

Once removed the front cover, it is possible to access the hydraulic unit and the electrical cabinet.

8.2.1 Electrical cabinet

The installer must unscrew the 4 screws placed at the electrical cabinet corner to remove its cover and access its interior.

NOTE In CLAUSIUS heat pumps with Elite configuration, it is necessary to remove the front cover before removing the electrical cabinet cover.

During the assembly/disassembly process of the electrical cabinet cover, take care to prevent it from falling, avoiding any damage to the unit and/or people.

8.2.2 Hydraulic unit

The desing of Clausius heat pumps with Elite configuration allows reaching most of the components of the hydraulic unit, such as the circulation pumps, the 3-way valves, the drain valves and connections, the expansion vessels, the safety valves and the pressure transducers of the brine and indoor circuits, removing the front cover only.

8.2.3 Refrigeration unit

The installer must remove the lateral covers of the heat pump to access the refrigeration unit or the connections between it and the hydraulic unit.

NOTE It is necessary to remove the front and top covers before removing the lateral covers in CLAUSIUS heat pumps with Elite configuration.

The clamping system of each lateral cover of Clausius heat pumps with Elite configuration consists of two screws to hold it to the structure, two positioners with the back cover and two flanges introduced in slots at the base of the heat pump. To remove each lateral cover, it is necessary to unscrew it first from the structure, then pull to the front to free the cover from the positioners and, finally, to lift it to release both flanges. The process to remove the cover is shown in Figure 77.

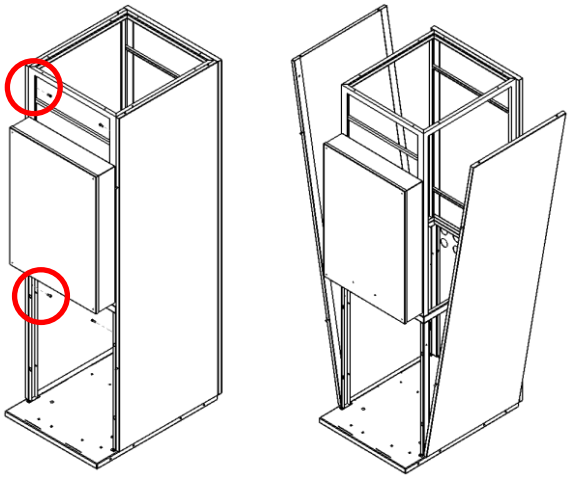


Figure 77. Disassembly process of the lateral covers of Clausius heat pumps with Elite configuration.

NOTE CLAUSIUS heat pumps have been designed to allow any maintenance operation without removing the back cover.

The refrigeration units of Clausius heat pumps are placed inside an acoustic insulation container to reduce the acoustic emissions to the dwelling.

The acoustic insulation container consists of two halves and each can be removed through each side. Pressure switches, pressure transducers, compressor connections, charge valves and the solenoid valve are accessible from the right side (seen from the front). The expansion valve and the reversing valve in HC models (cooling) are accessible from the left side (seen from the front).

9. TYPICAL INSTALLATIONS

This section encloses guidelines of different installation diagrams with Clausius heat pump. These diagrams are for typical cases and modifications may be required for each specific situation. Additional installations, not considered in this manual, may exist and must be conveniently designed, taking into account their particularities.

Besides, this section explains, succinctly, the characteristics of typical installations combined with Clausius heat pumps, and the considerations to take into account for their design and execution.

The installations here detailed employ the same configuration of collector system (see section 5.2), and the same DHW production system for heat pumps with Classic configuration (see section 5.4.1) and another for heat pumps with Elite configuration (see section 5.4.2). The only difference between systems lies in the indoor circuit (heating/cooling production).

9.1 DEFINITIONS

9.1.1 SINGLE-ZONE system

A heat pump in a SINGLE-ZONE system controls a single outlet temperature to the indoor circuit, both for heating and for cooling (depending on the heat pump model).

The general case is that with a single emission system (DIAGRAMS 9.3.1 and 9.3.2).

A modification of the SINGLE-ZONE system consists in combining indoor terminals th-Tune with thermostats in specific rooms (DIAGRAM 9.3.3). The heat pump operates as with a standard SINGLE-ZONE system and each thermostat controls a shut-off valve that allows the heating/cooling water from the heat pump inside the emission systems of each room.

This system meets the demand of the specific room only when there is a demand in the main zone of the installation.

Another possibility of SINGLE-ZONE system with indoor terminals th-Tune and thermostats is that for which the heat pump will operate in case any of these systems detects a demand.

9.1.2 SINGLE-ZONE TWO-SYSTEM system

The SINGLE-ZONE TWO-SYSTEM system is a particular case of SINGLE-ZONE system that uses a different emission system for heating and for cooling.

In this configuration, there is an additional 3-way valve at the outlet to the indoor circuit, controlled by the heat pump. Depending on the program selected, the heat pump diverges the fluid to one emission system or to the other (DIAGRAM 9.3.4).

The 3-way valve for the emission system selection is connected directly to the power terminal board of the heat pump, as indicated in section 6.6.

The 3-way valve for the emission system selection is not included with the heat pump.

9.1.3 TWO-ZONE system

A heat pump in a TWO-ZONE system controls two outlet temperatures to the indoor circuit. The first is the outlet temperature straight from the heat pump and the second is a result of a mixing process. The mixing process is performed with a mixing group, controlled with a 0-10 V logic from the controller. It mixes the fluid from the second zone of the indoor circuit with that from the outlet to the main zone of the indoor circuit. As a result, the fluid temperature at the outlet to the second zone is lower than that to the main zone.

Generally, this system uses two circuits with independent thermal control and it is possible to set different temperature setpoints for each zone. Thus, there is a ZONE 1, which should have the highest operation temperature for heating, and a ZONE 2.

The emission system used in ZONE 1 must be that with the highest operation temperature for heating to guarantee a correct performance (section 3.2.5.2).

In TWO-ZONE systems and heating operation mode, the controller calculates an outlet temperature to the indoor circuit of each zone as a function of the outdoor conditions, emission system, insulation of the dwelling and indoor ambient temperature (if using indoor terminals th-Tune). Then, it selects the maximum outlet temperature and checks its compatibility with the emission systems used.

If the outlet temperature to the indoor circuit of ZONE 1 is the highest, the heat pump produces heating water at that temperature and the outlet temperature to the indoor circuit of ZONE 2 is achieved with the mixing group. In case the outlet temperature to the indoor circuit of ZONE 2 is the greatest, the heat pump produces heating water at that temperature, the mixing group is completely closed and the outlet temperature is identical for both ZONE 1 and ZONE 2, and greater than that calculated for ZONE 1.

In TWO-ZONE systems and cooling operation mode, the controller calculates the outlet temperature to the indoor circuit of ZONE 1 as a function of the emission system and the ambient humidity (if using indoor terminals th-Tune). The heat pump produces cooling water at that temperature. In case the outlet temperature to the indoor circuit of ZONE 1 is the lowest, the outlet temperature to the indoor circuit of ZONE 2 is achieved with the mixing group.

Both for heating and for cooling, if there is only demand in ZONE 1, the heat pump produces heating water at the temperature calculated for that zone, turns off the pump of ZONE 2 and positions the mixing valve in a way that it

disconnects the heat pump outlet to the indoor circuit and the ZONE 2 circuit. If the demand is only in ZONE 2, the heat pump feeds that zone and keeps the ZONE 1 shut-off valve closed.

NOTE **The ZONE 1 valve and the ZONE 2 mixing group are not included with the heat pump.**

9.1.4 MULTI-EMISSION system

These installations employ two kinds of emission systems for the same zone and with one thermal control device. The management of both emission systems is analogous to that of TWO-ZONE systems. The emission system with the highest operation temperature corresponds to EMISSION SYSTEM 1 and the other to EMISSION SYSTEM 2. The control strategy is that shown in section 9.1.3 (DIAGRAM 9.3.6).

The main difference with a TWO-ZONE system is that it is not possible to disable one of the emission systems.

9.1.5 POOL systems

In addition to the installations shown, the heat pump allows heating a POOL. For this, it is necessary to install a 3-way 2-position valve to divert the heating water to a heat exchanger where the water from pool is heated.

Besides, the installer must connect a control element (thermostat or time programmer) that indicates the existence of a POOL heating demand and a pump to circulate the water from the pool through the heat exchanger aforementioned (see section 6.7).

DIAGRAM 9.3.8 shows an example of the elements needed in a SINGLE-ZONE system with a Clausius heat pump of Classic configuration and with POOL heating.

9.1.6 BUFFER systems

The most general case of system with BUFFER tank is that using this tank for storing hot water. This hot water meets the different demands, including DHW production. Thus, it is only possible with Classic configuration heat pumps, since the DHW production in Elite configuration heat pumps is always independent of the BUFFER tank. The heat pump control depends only on a temperature probe placed inside the tank.

NOTE **If the DHW and POOL heating occurs from the BUFFER tank, the installer must disable these options in the INSTALLER MENU (section 3.2.3).**

In case of choosing this option, the demand management is independent of the heat pump and must be taken into account at the desing stage.

The first alternative to the basic installation is that with independent DHW production. In this case, the heat pump priority is heating the DHW tank and, then, keeping the BUFFER tank at the temperature setpoint. The heat pump control depends on the temperature probes in the DHW tank and in the BUFFER tank.

For those units that allow producing cooling and heating, the heat pump control is different depending on the BUFFER tanks used: independent tanks for heating and cooling or a single tank.

Systems with two tanks need a 3-way 2-position valve that diverts the fluid from the heat pump outlet to the corresponding BUFFER tank. These systems require an independent temperature probe for each tank.

Systems with a single BUFFER tank for heating and cooling can be also classified into two, attending to the complexity of the system. Simple systems do not take into account stratification and the tank inlet and outlet are the same for heating and cooling. A more complex system is the one that selects different inlet and outlet for heating and cooling by means of four 3-way 2-position valves or two 4-way 2-position valves.

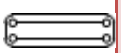
NOTE **BUFFER systems with one tank and no control of stratification are only recommended for small installations with low heating/cooling capacity.**

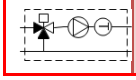
In the first case, the heating and cooling inlet must be in the same connection, meanwhile in the second case, inlets and oulets must be inverted by means of a four on/off 3-ways valves system or two 4-ways valves when switching from heating to cooling.

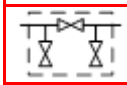
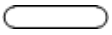
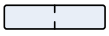
NOTE **The 3-way or 4-way valves for the stratification control are not included with the heat pump.**

9.2 LEGEND

The following table includes the description and numbering of the different symbols used in section 9.3.

Symbol	No.	Description
	1	Heat pump
	2	DHW tank
	3	BUFFER tank
	4	Geothermal collector system
	5	Emission system I
	6	Emission system II
	7	DHW consumption
	8	Pool
	9	Pool heat exchanger
	10	Temperature probe

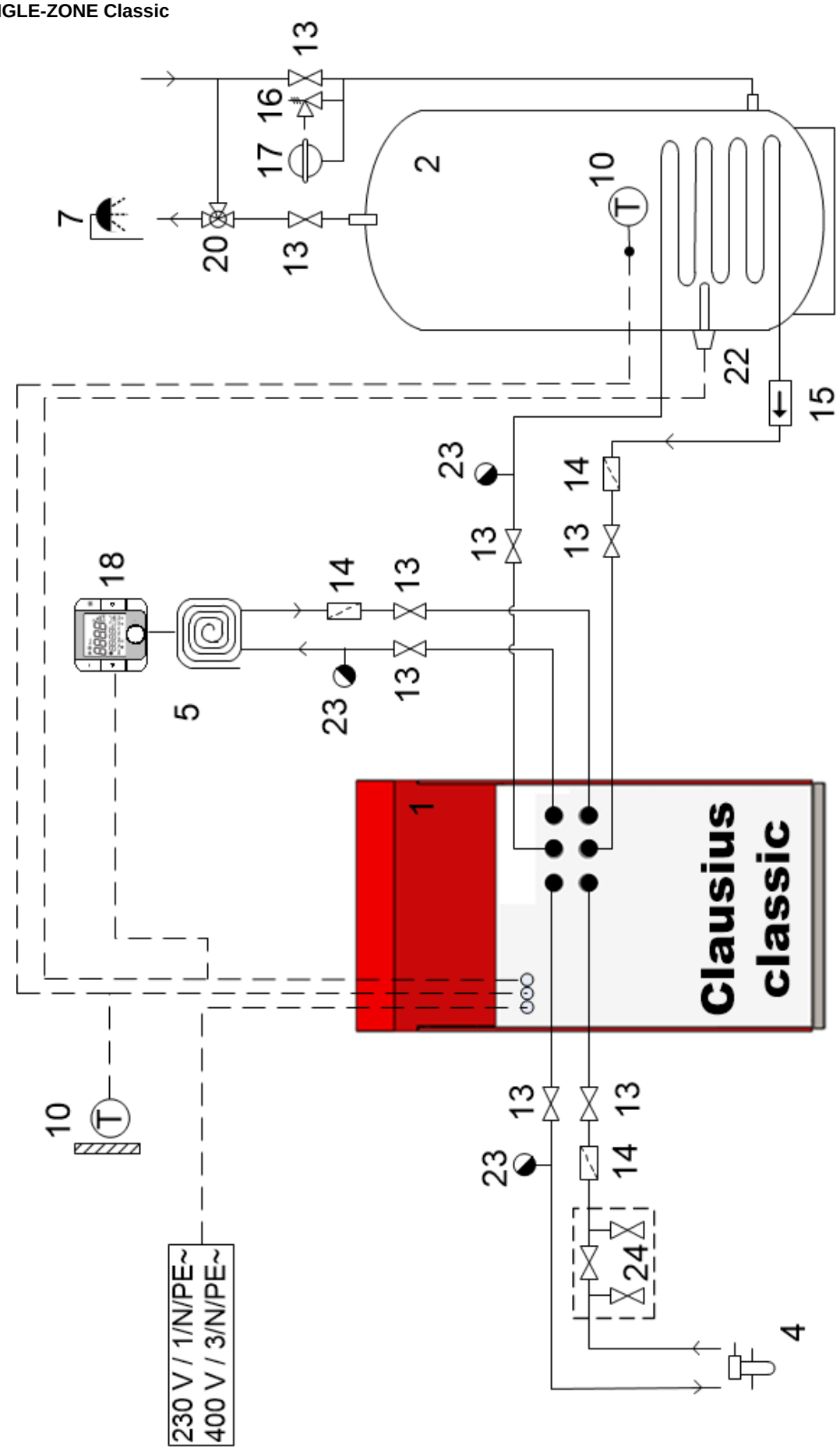
	11	Thermostat
	12	Pump
	13	Manual shut-off valve
	14	Filter
	15	Check valve
	16	Safety valve
	17	Expansion vessel
	18	Indoor ambient terminal
	19	Ambient thermostat
	20	Mixing valve
	21	Mixing group

	22	Electric resistance
	23	Air vent
	24	Filling system
	25	Automatic zone valve
	26	Automatic 3-way valve
	27	Flow meter
	28	Collectors
	29	Hydraulic separator

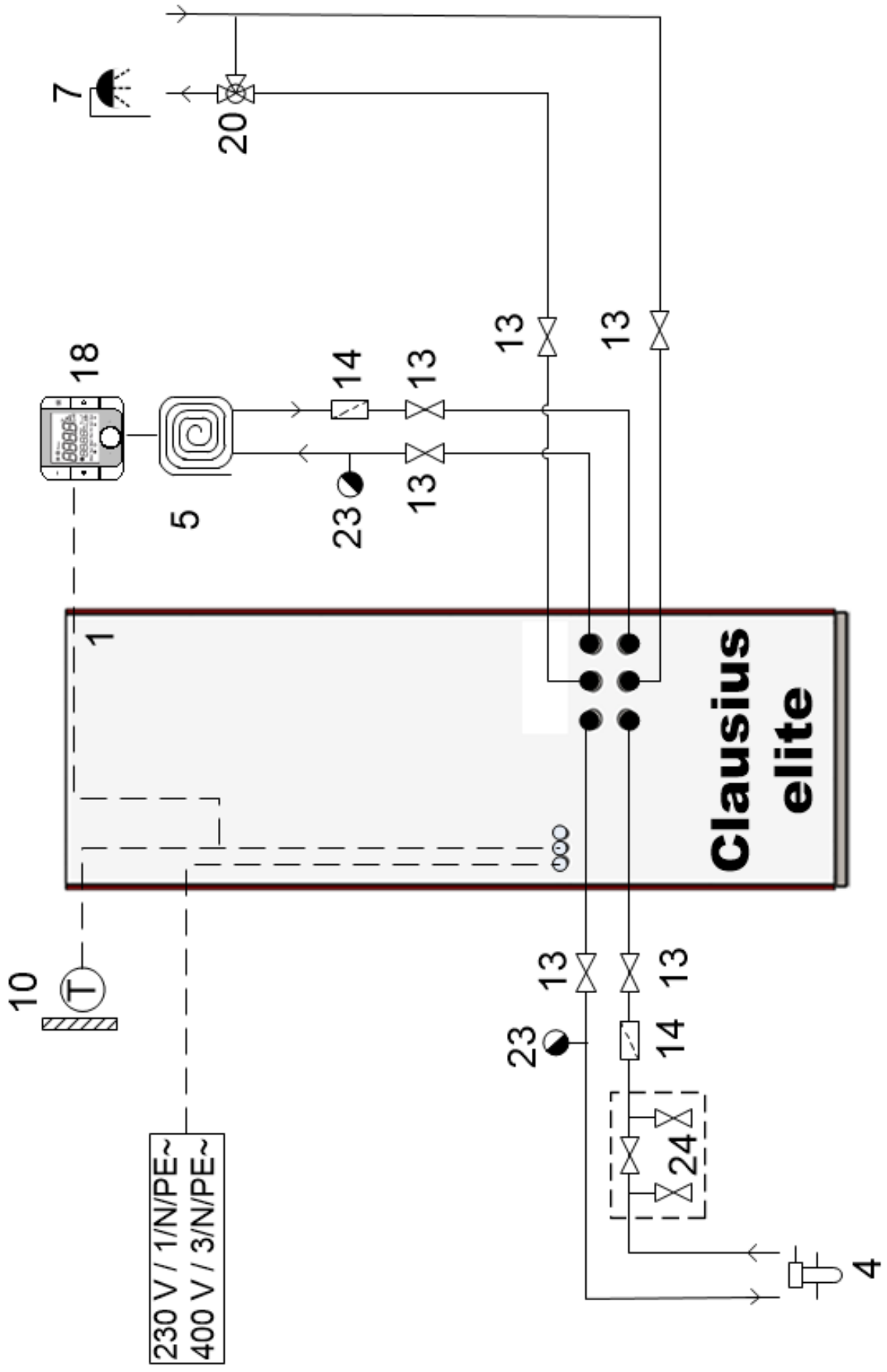
9.3 EXAMPLES OF INSTALLATIONS

The following diagrams show examples of typical installations, indicating the elements that should be installed for a correct operation of the heat pump.

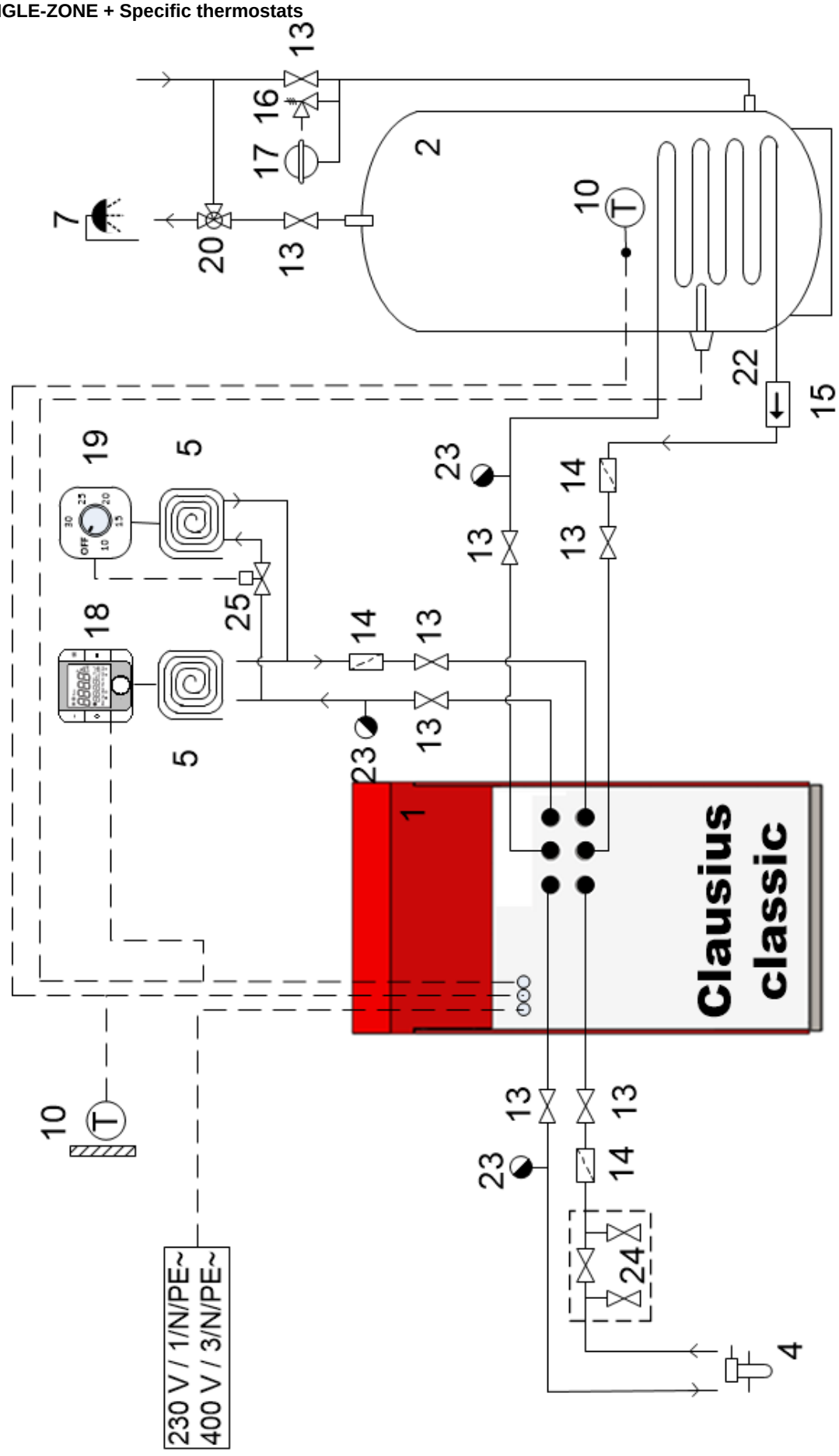
9.3.1 SINGLE-ZONE Classic



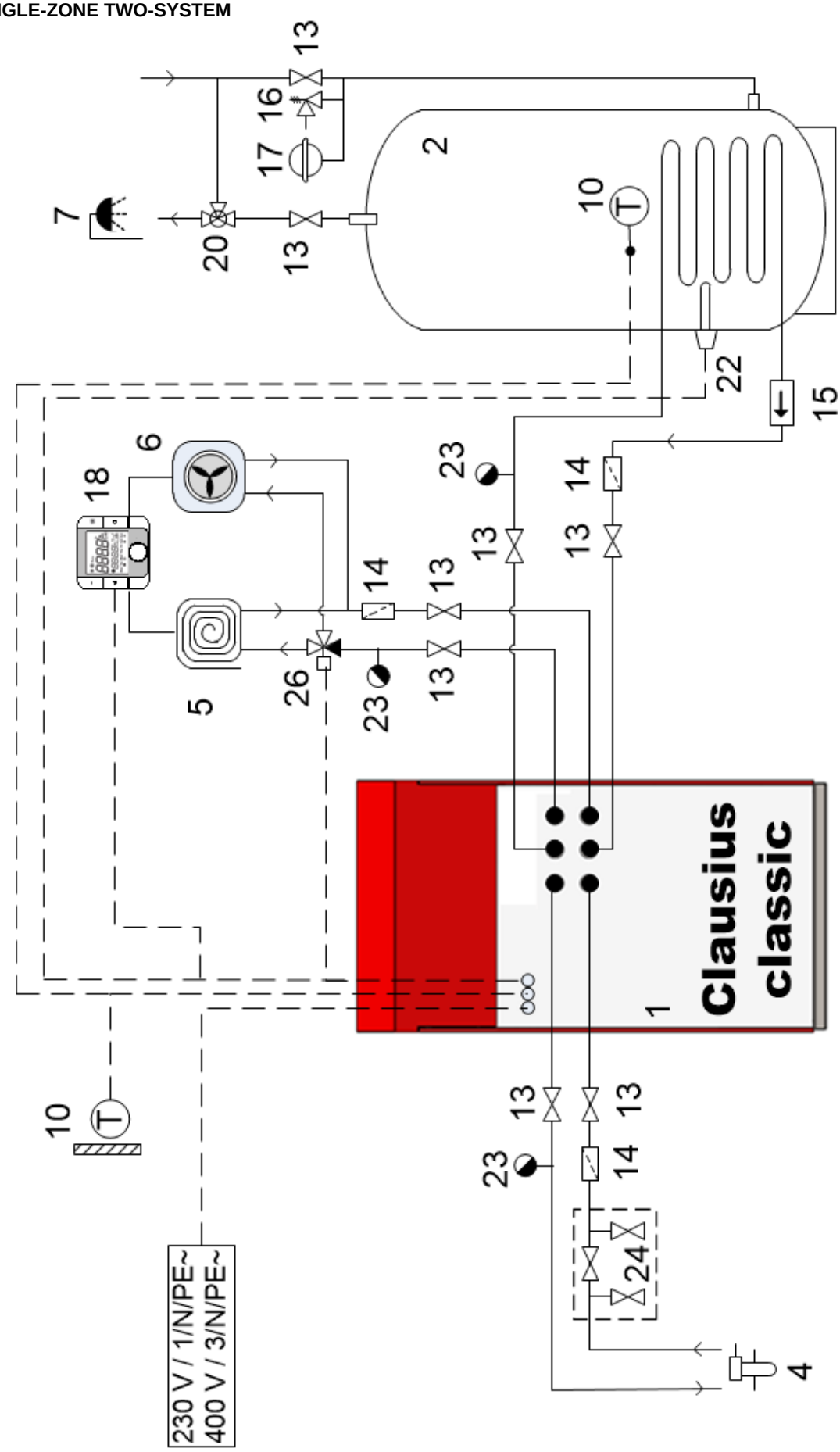
9.3.2 SINGLE-ZONE Elite



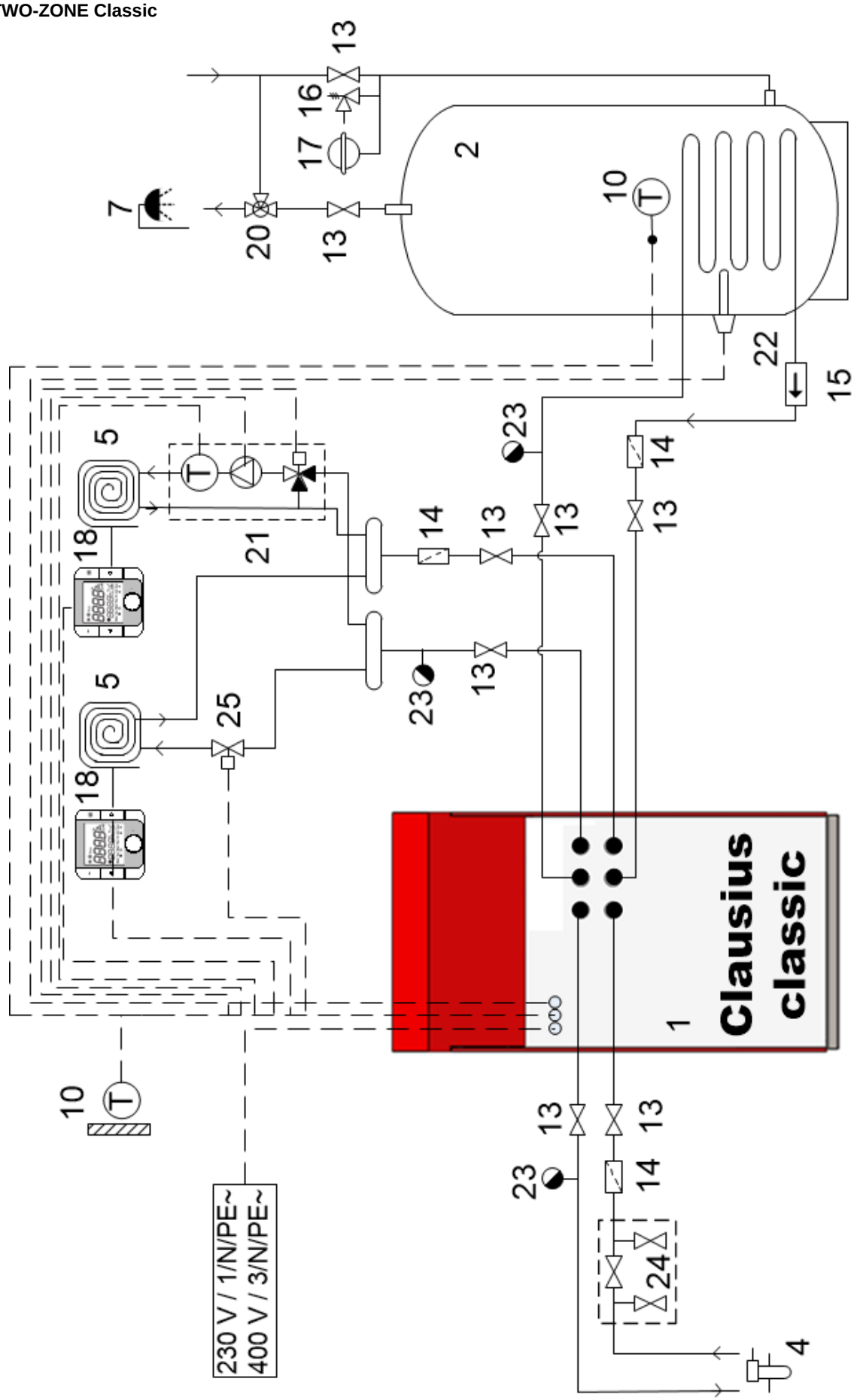
9.3.3 SINGLE-ZONE + Specific thermostats



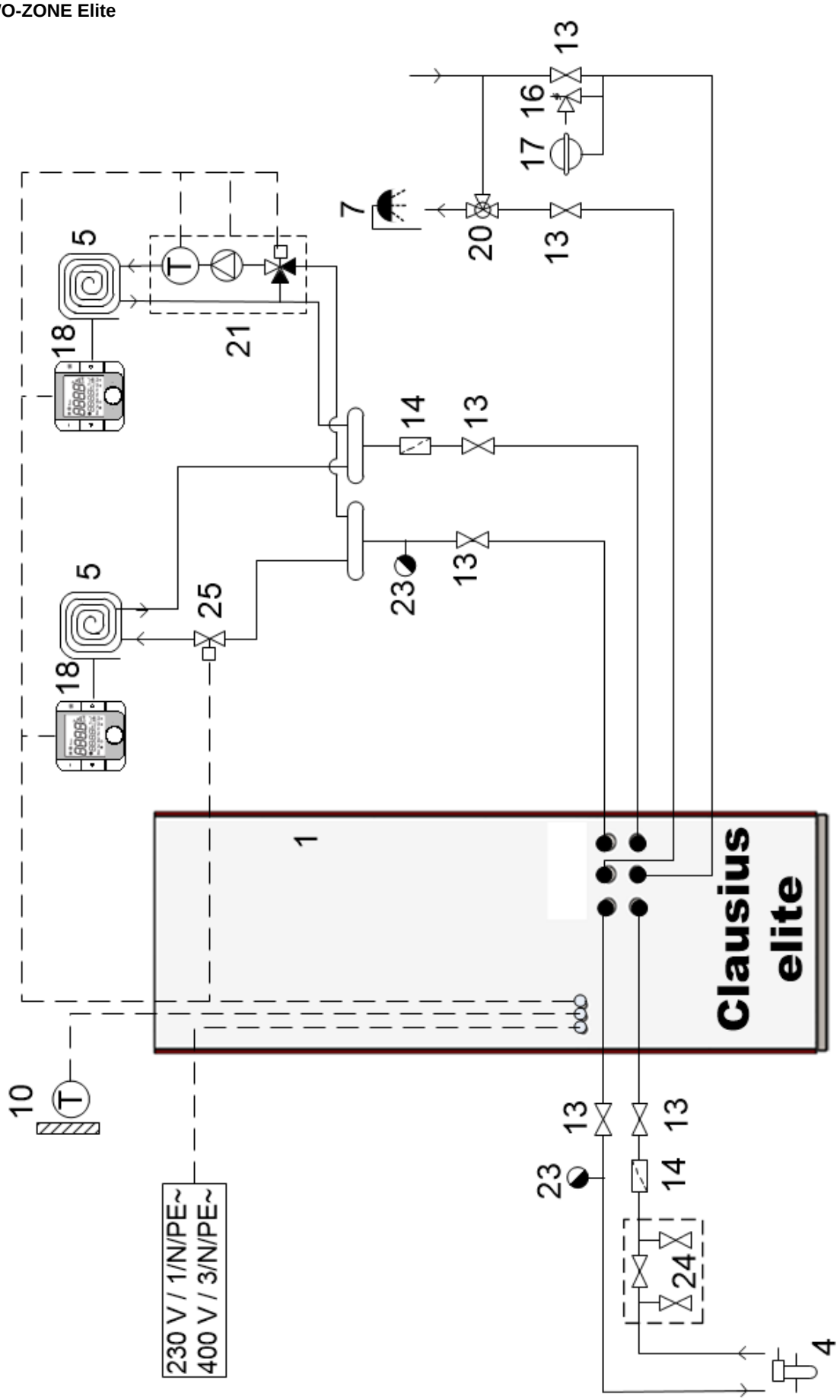
9.3.4 SINGLE-ZONE TWO-SYSTEM



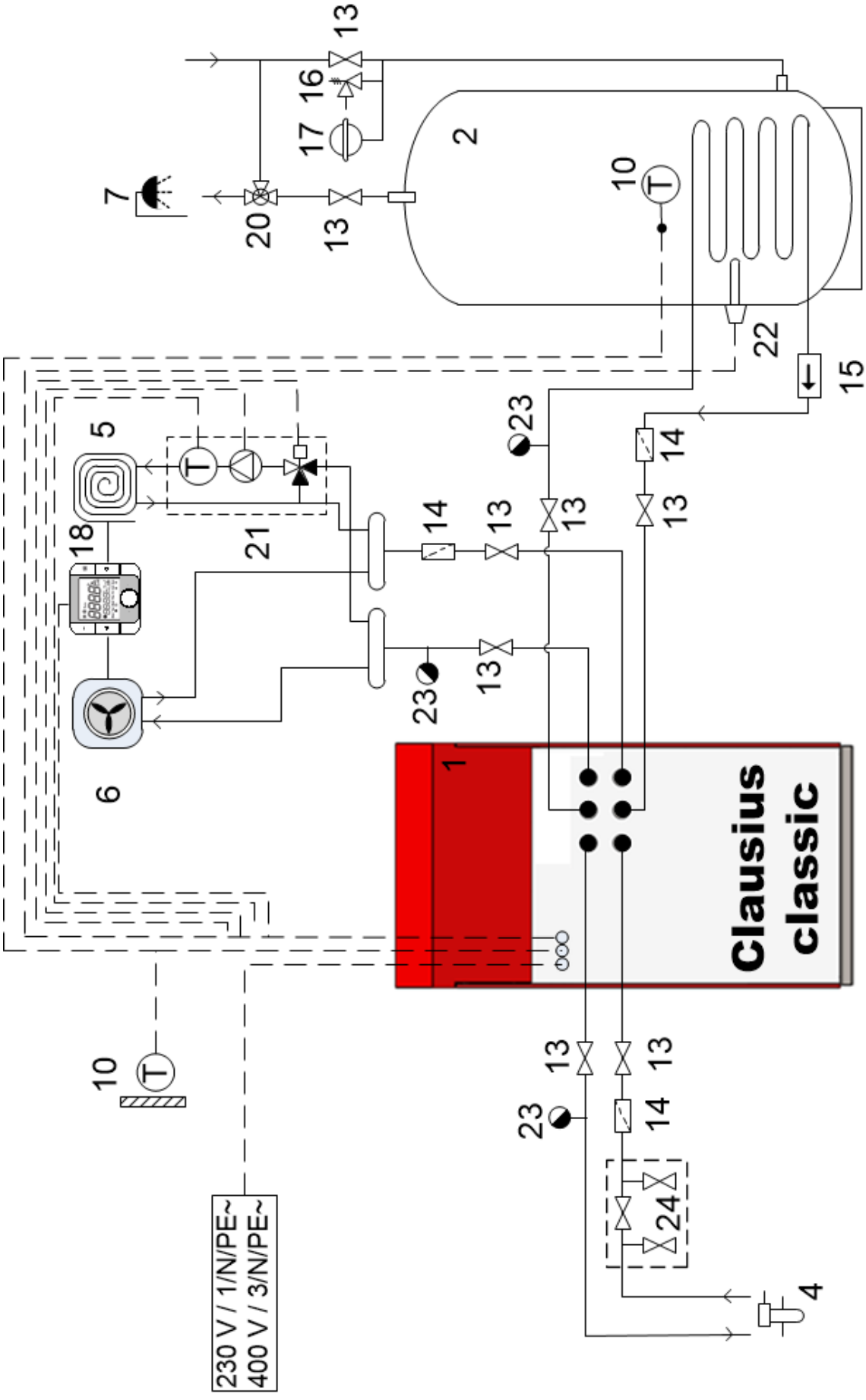
9.3.5 TWO-ZONE Classic



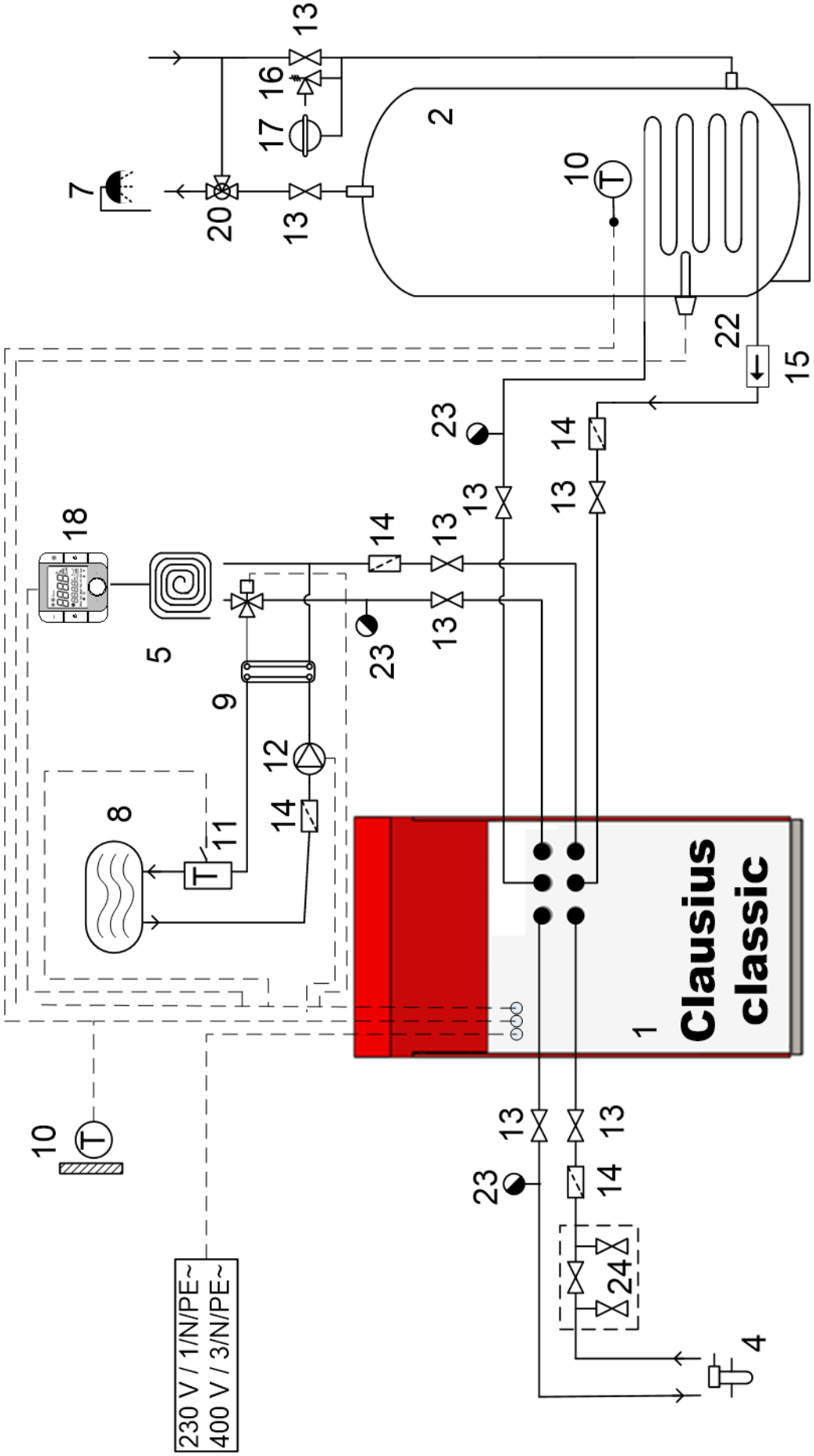
9.3.6 TWO-ZONE Elite



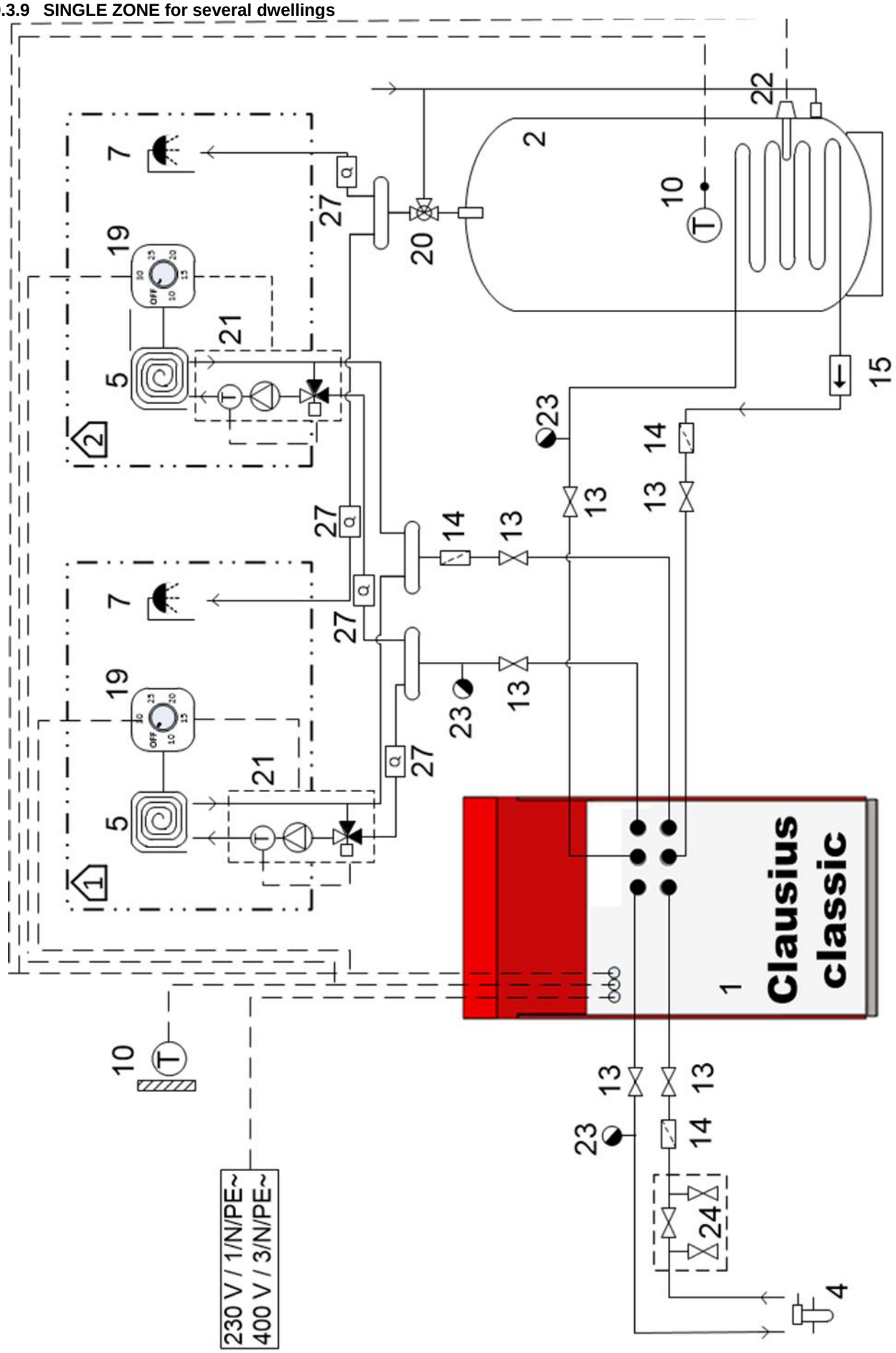
9.3.7 MULTI-EMISSION



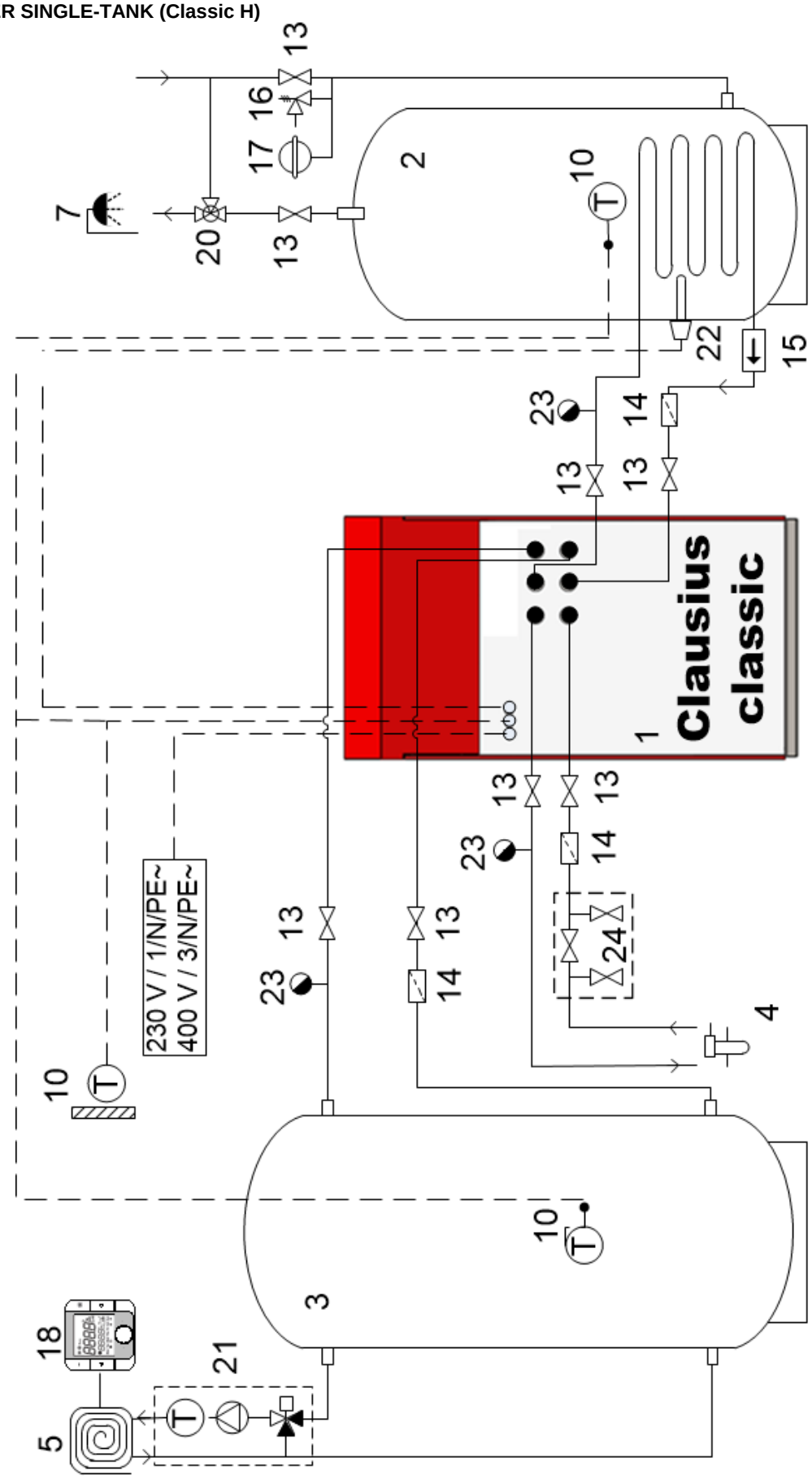
9.3.8 SINGLE-ZONE Classic + POOL



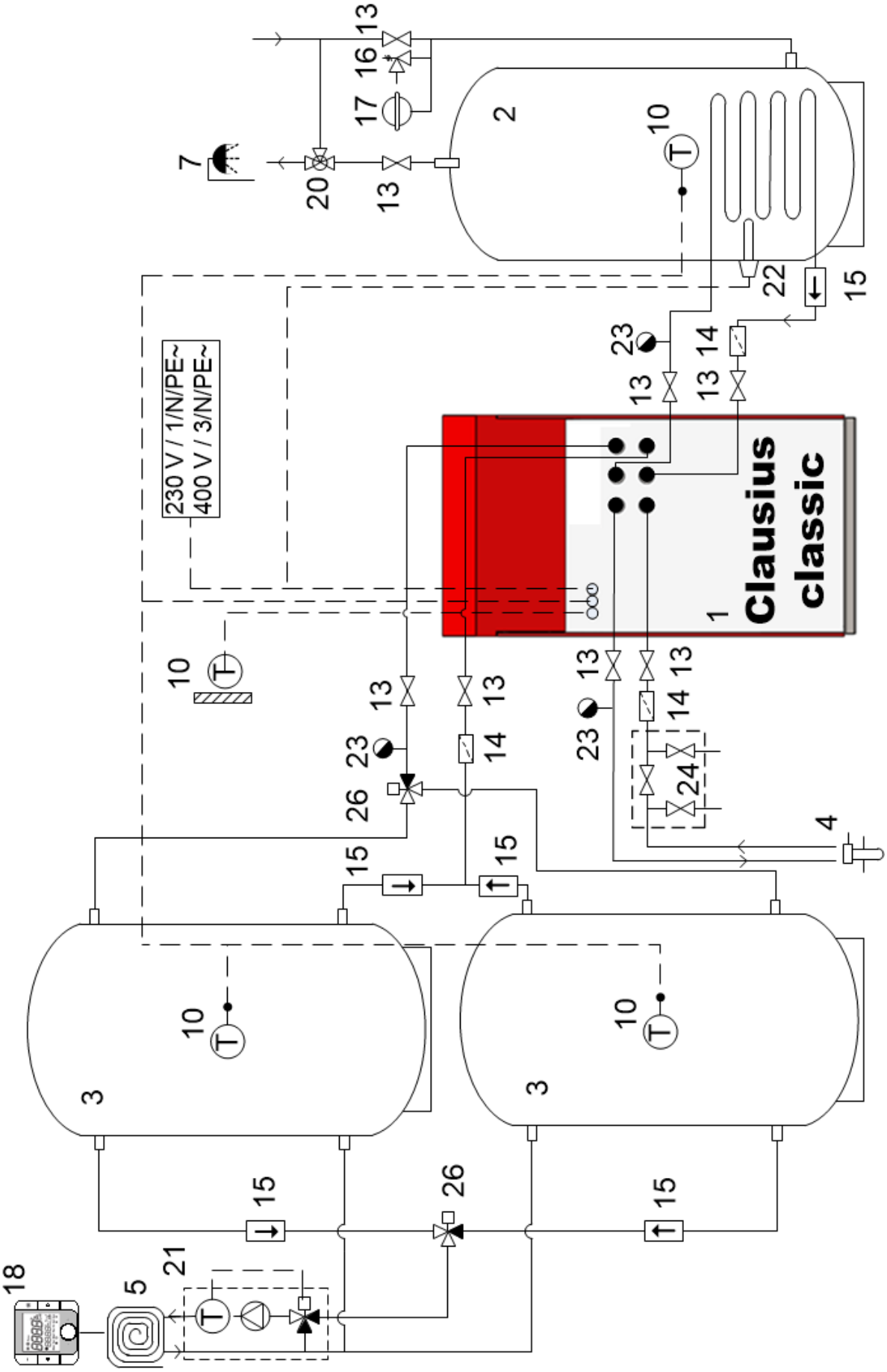
9.3.9 SINGLE ZONE for several dwellings



9.3.10 BUFFER SINGLE-TANK (Classic H)



9.3.11 BUFFER WITH TWO-TANKS



10. TECHNICAL SPECIFICATIONS

10.1 GENERAL CHARACTERISTICS

Models available

Model		Clausius H 3-15	Clausius HC 3-15	Clausius H 5-25	Clausius HC 5-25
Components	Refrigeration unit	RU-H 3-15	RU-HC 3-15	RU-H 5-25	RU-HC 5-25
	Hydraulic unit	HU-H	HU-HC	HU-H	HU-HC
	Configuration	*Classic / Elite*	*Classic / Elite*	*Classic / Elite*	*Classic / Elite*
Applications	Heating and DHW	√	√	√	√
	Passive cooling		√		√
	Active cooling		√		√
Capacity (kW)	Heating capacity [1]	3 - 15	3 - 15	5 - 25	5 - 25
	Cooling capacity [2]		4 – 16.5		7 - 30
Performance	COP[1]	4.61	4.61	5.01	5.01
	EER[2]		6.8		6.8
Weight (kg)		163/243	174/254	168/248	179/259
Acoustic level (dB) (3)		42	42	42	42

[1] In accordance with standard EN14511, under conditions 0/-3 °C y 30/35 °C.*
[2] In accordance with standard EN14511, under conditions 7/12 °C y 30/35 °C.*
[3] In accordance with standard EN12102.*
* Certificated by Austrian Institute of technology (AIT).

Refrigerant units

Model		RU-H 3-15	RU-HC 3-15	RU-H 5-25	RU-HC 5-25
Components	Inverter scroll compresor Copeland	√	√	√	√
	Brazed plate condenser Alfa Laval	√	√	√	√
	Brazed plate evaporator Alfa Laval	√	√	√	√
	Electronic expansion valve Carel	√	√	√	√
	Reversing valve		√		√
	DHW solenoid valve	√*	√*	√*	√*
Refrigerant	Type	R410A			
	Charge (Classic / Elite) kg	1.5 / 1.75	1.5 / 1.75	1.8 / 2.1	1.8 / 2.1
Maximum pressure (bar)		42			
Acoustic insulation	Expanded polystyrene container	√	√	√	√
Size (mm)	(Height x Width x Length)	650 x 540 x 340			
Weight (kg)		65	69	70	74

* Only with Elite configuration

Hydraulic units

Model		HU-H	HU-HC
Components	Variable speed pumps Wilo (A class)	√	√
	Brine circuit expansion vessel (5 litres)	√	√
	Indoor circuit expansion vessel (10 litres)	√	√
	Passive cooling 3-way valves Honeywell		√
	DHW production 3-way valves Honeywell	√	√
Conections	DHW production outlet / inlet (Classic)	Male – 1”	
	Mains water inlet / DHW consumption (Elite)	Male – ¾”	
	Indoor circuit outlet / inlet	Male – 1”	
	Brine circuit outlet / inlet	Male – 1”	
Maximum pressure (bar)	DHW production circuit	3	
	Brine circuit	3	
	Indoor circuit	3	
Size (mm)	(Height x Width x Length)	800 x 570 x 378	
Weight (kg)		28	35

Configuration

Model		*Classic*	*Elite*
Tank capacity		…	200 L

Size (mm)	(Height x Width x Length)	1020 x 600 x 800	1878 x 600 x 800
Weight (kg)		55	135*

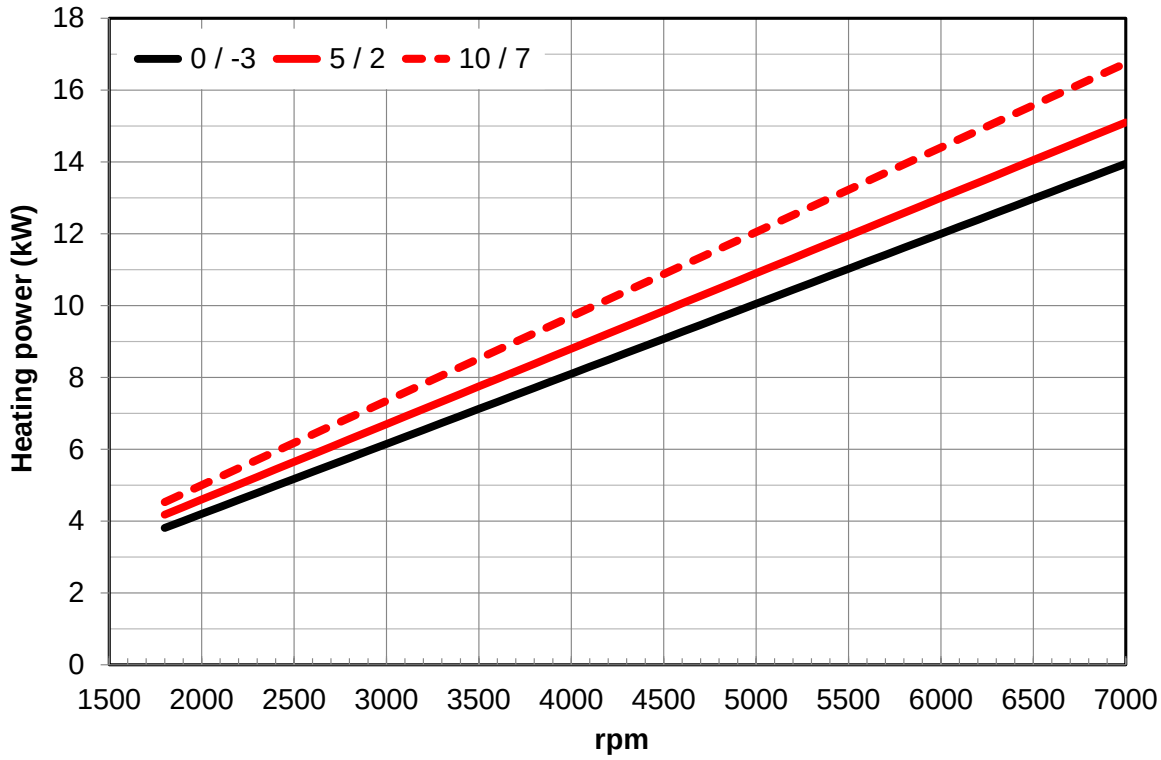
* Including DHW tank

10.2 CHARACTERISTIC CURVES

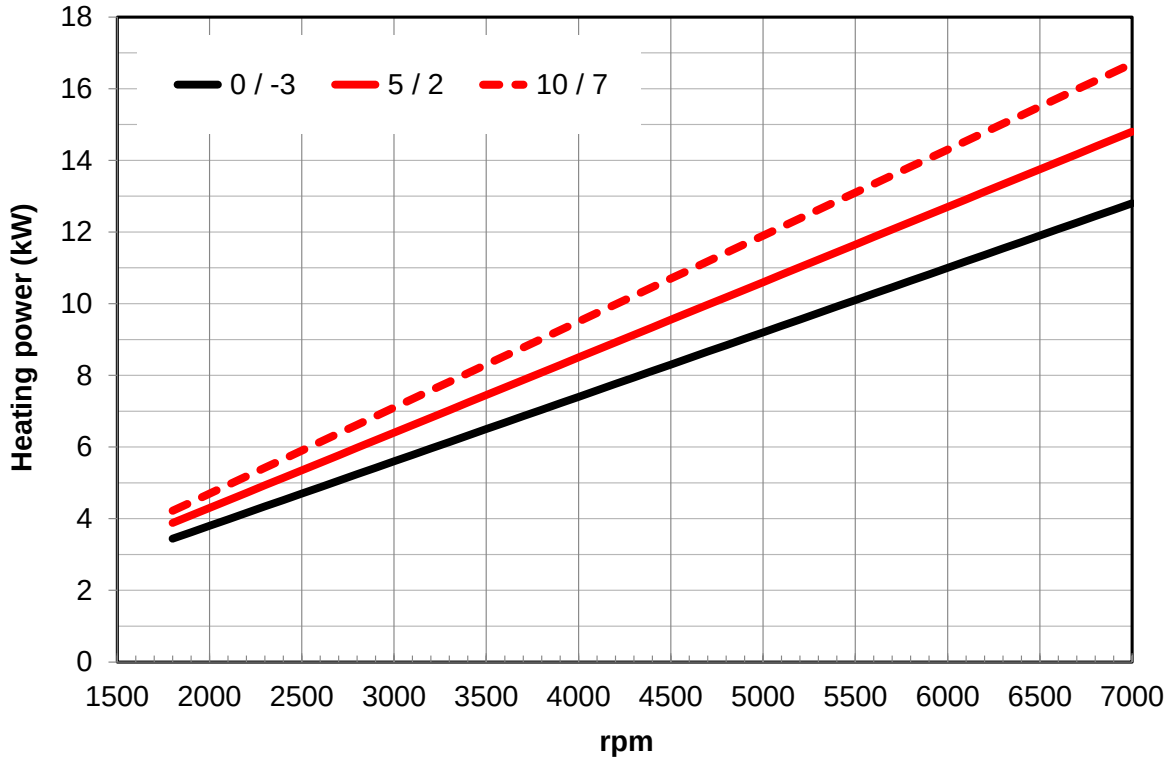
This section encloses the characteristic curves of Clausius heat pumps as a function of the different operation parameters.

10.2.1 Characteristic curves Classic/Elite 3-15

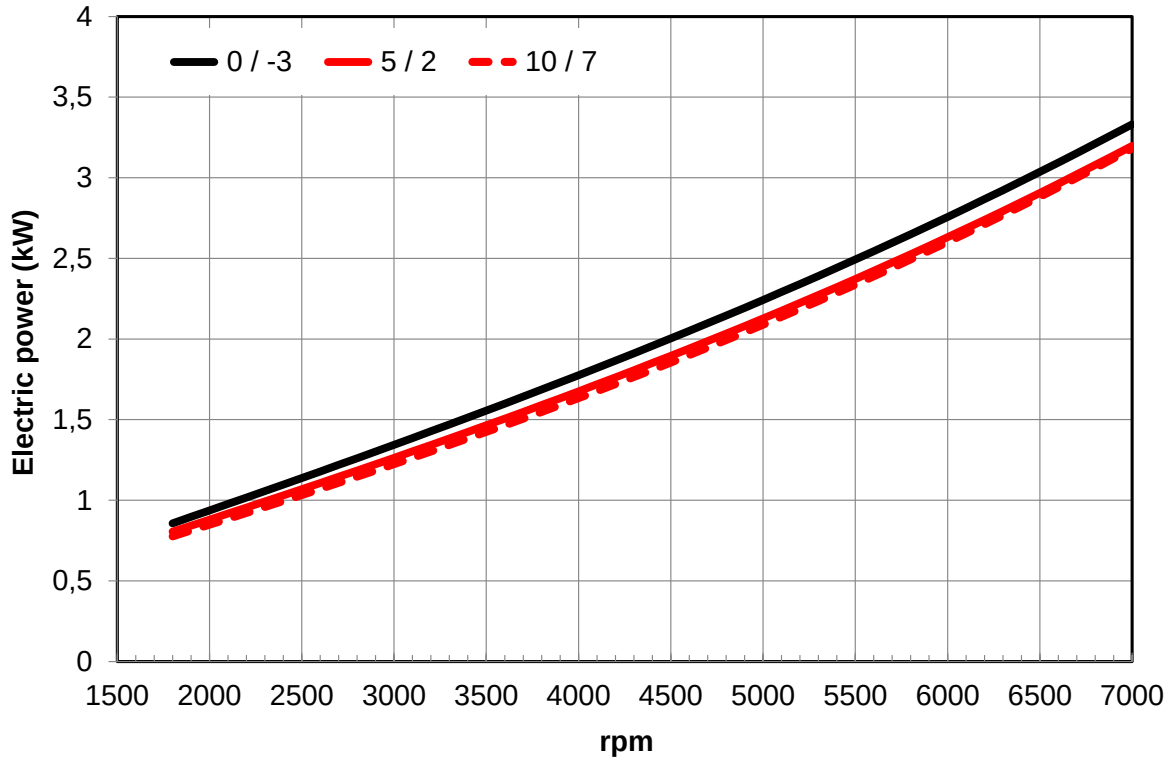
HEATING POWER. Heating, 30/35 ºC. Brine, 0/-3, 5/2 and 10/7.



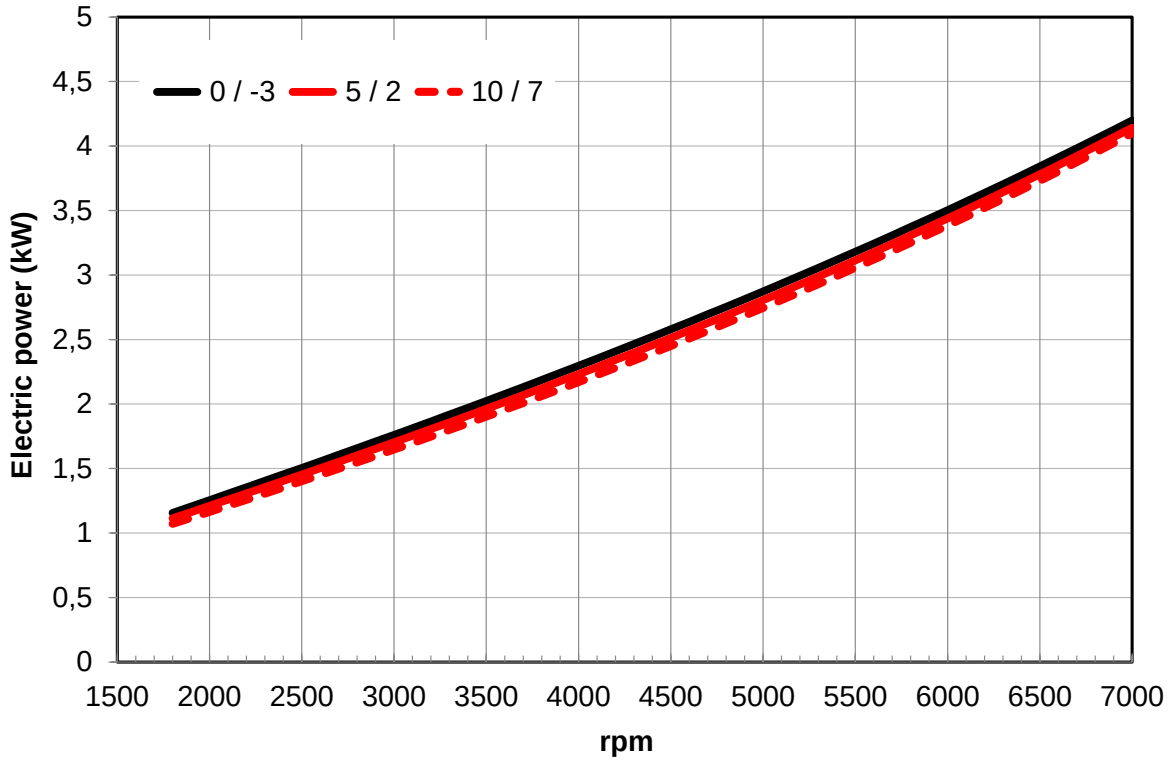
HEATING POWER. Heating, 40/45 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



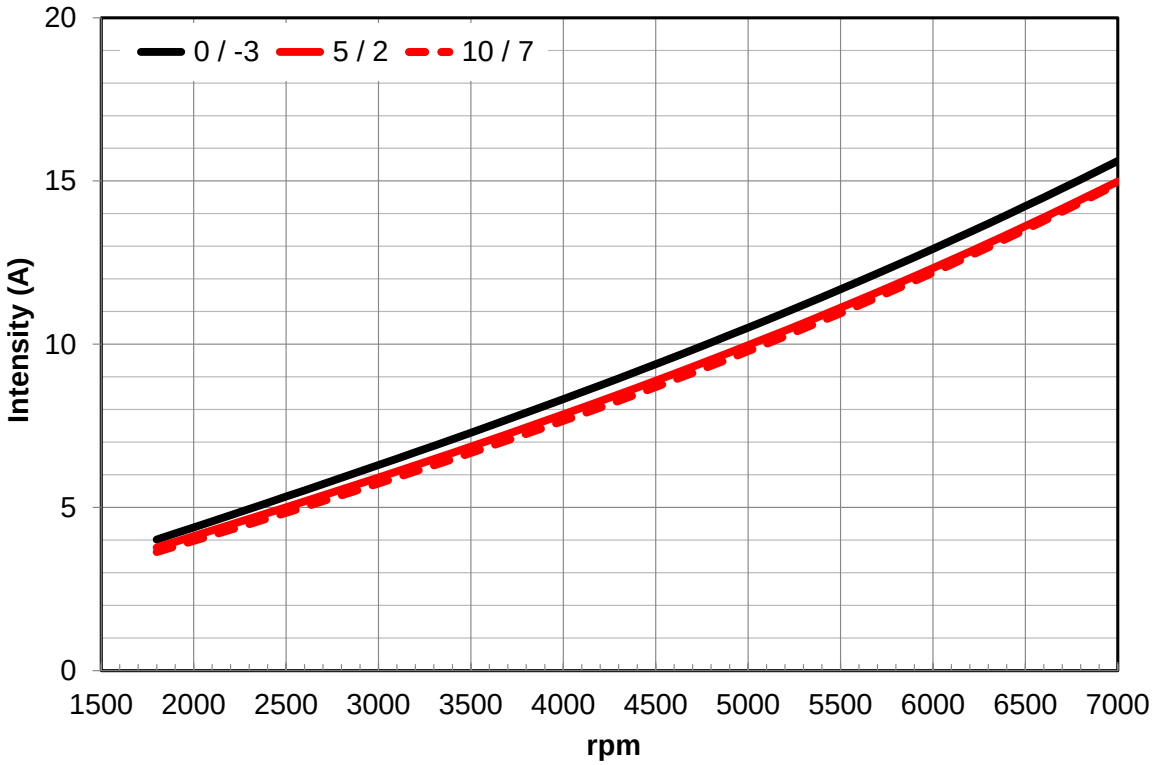
ELECTRIC POWER. Heating, 30/35 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



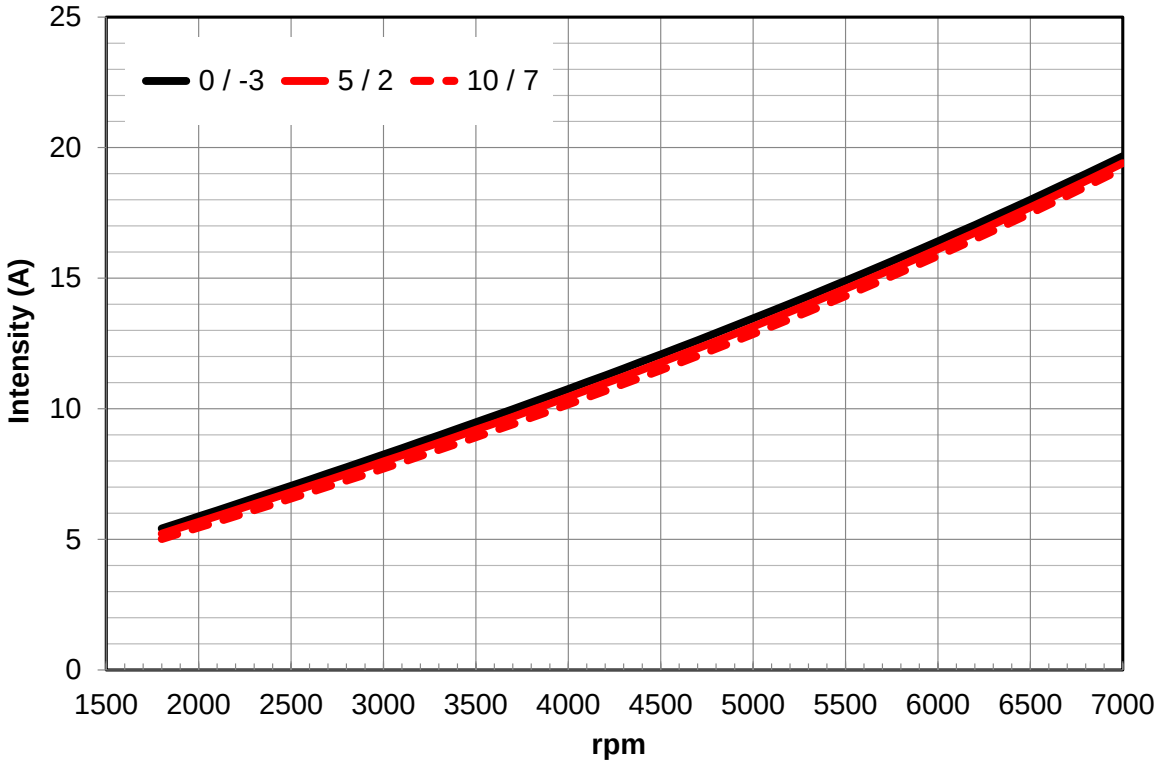
ELECTRIC POWER. Heating, 40/45 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



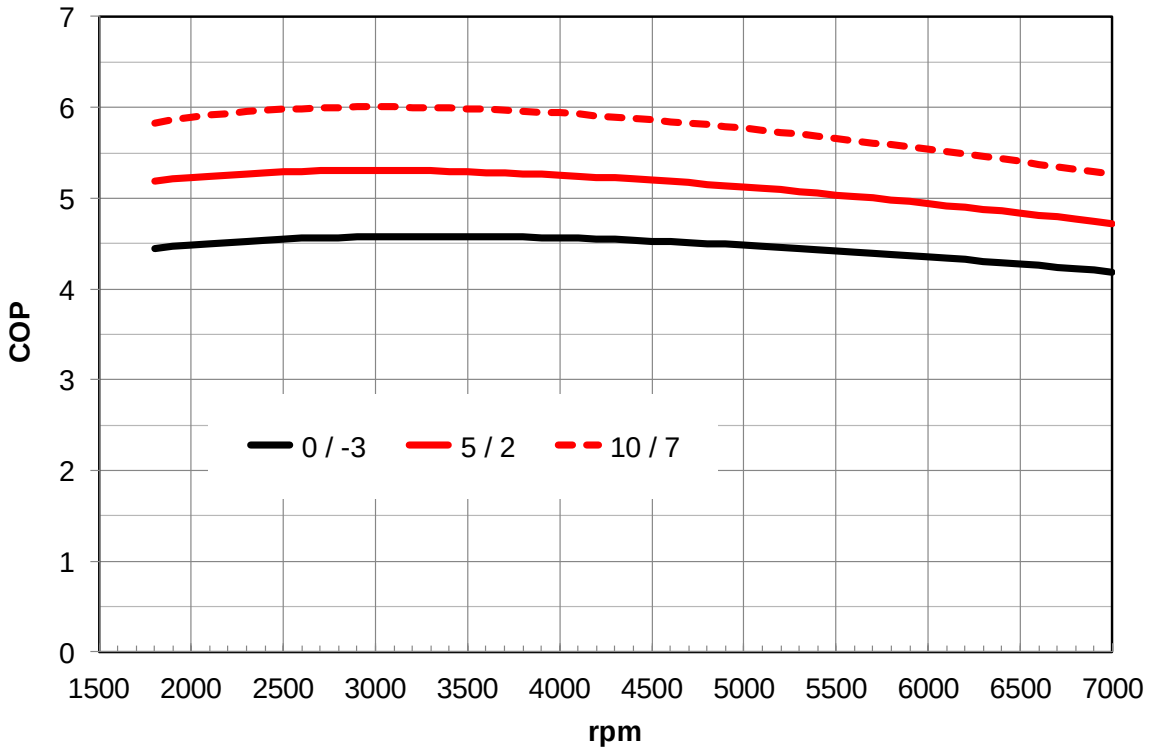
INTENSITY (220 V /1/N/PE~). Heating, 30/35 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



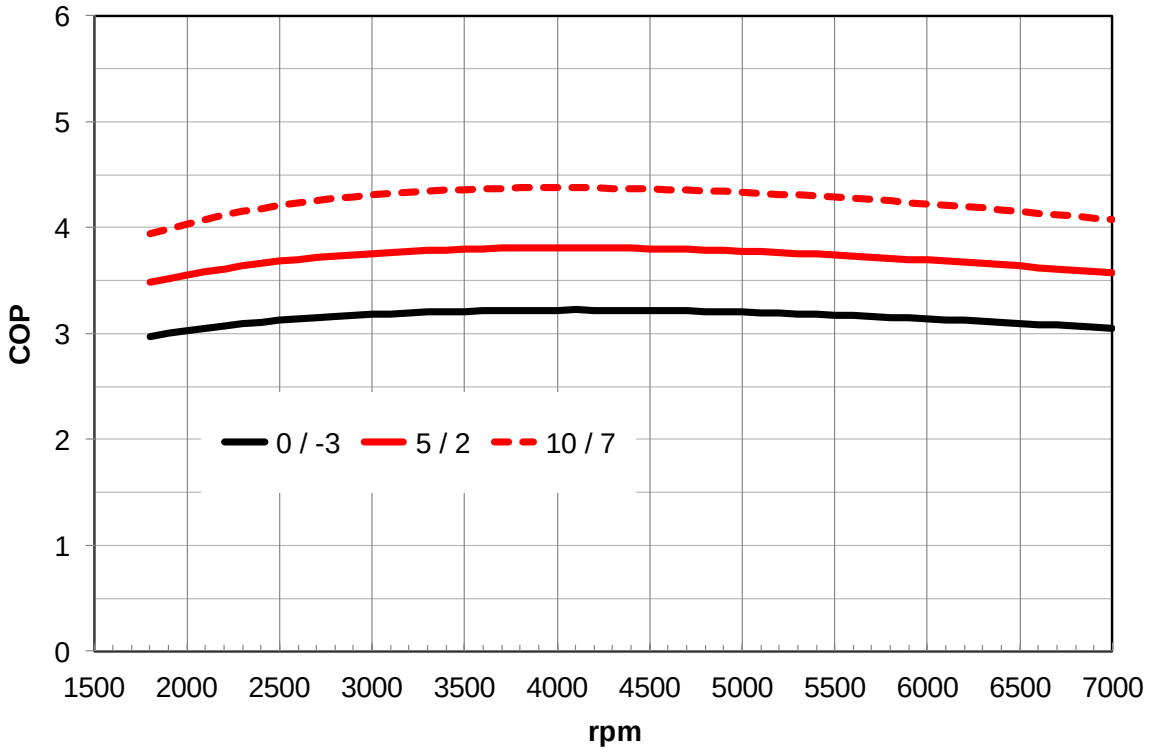
INTENSITY (220 V /1/N/PE~). Heating, 40/45 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



COP. Heating, 30/35 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.

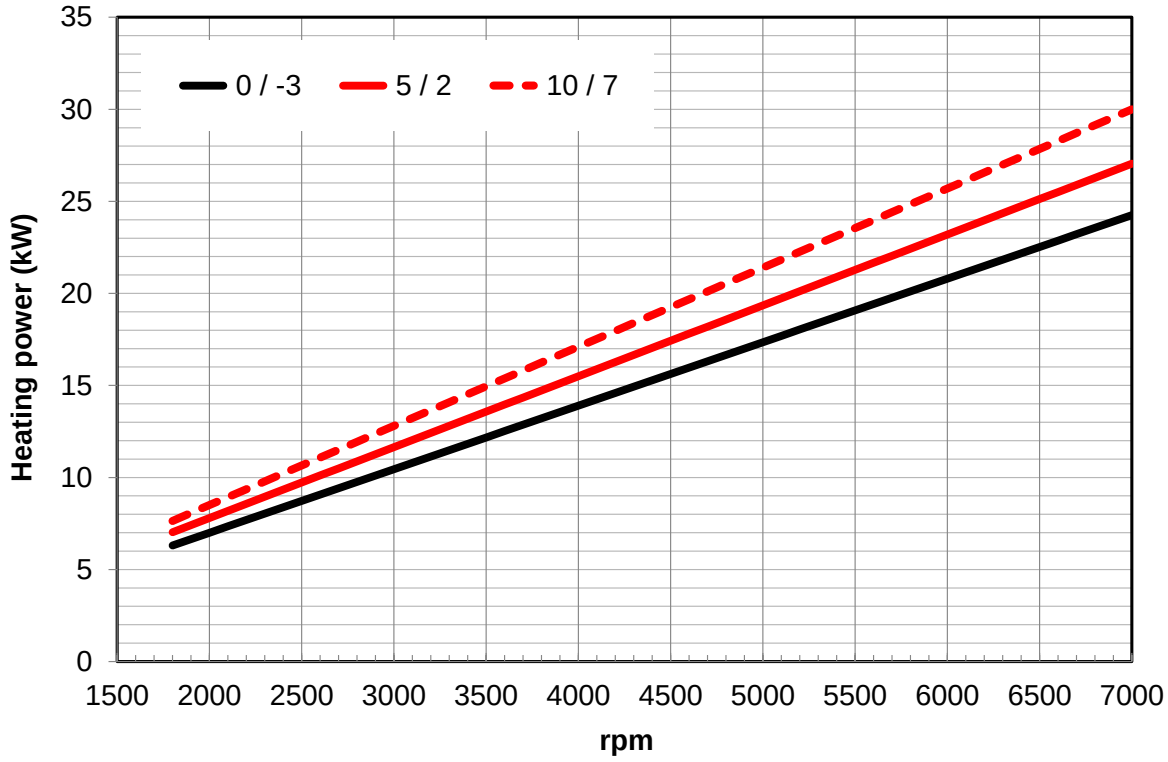


COP. Heating, 40/45 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.

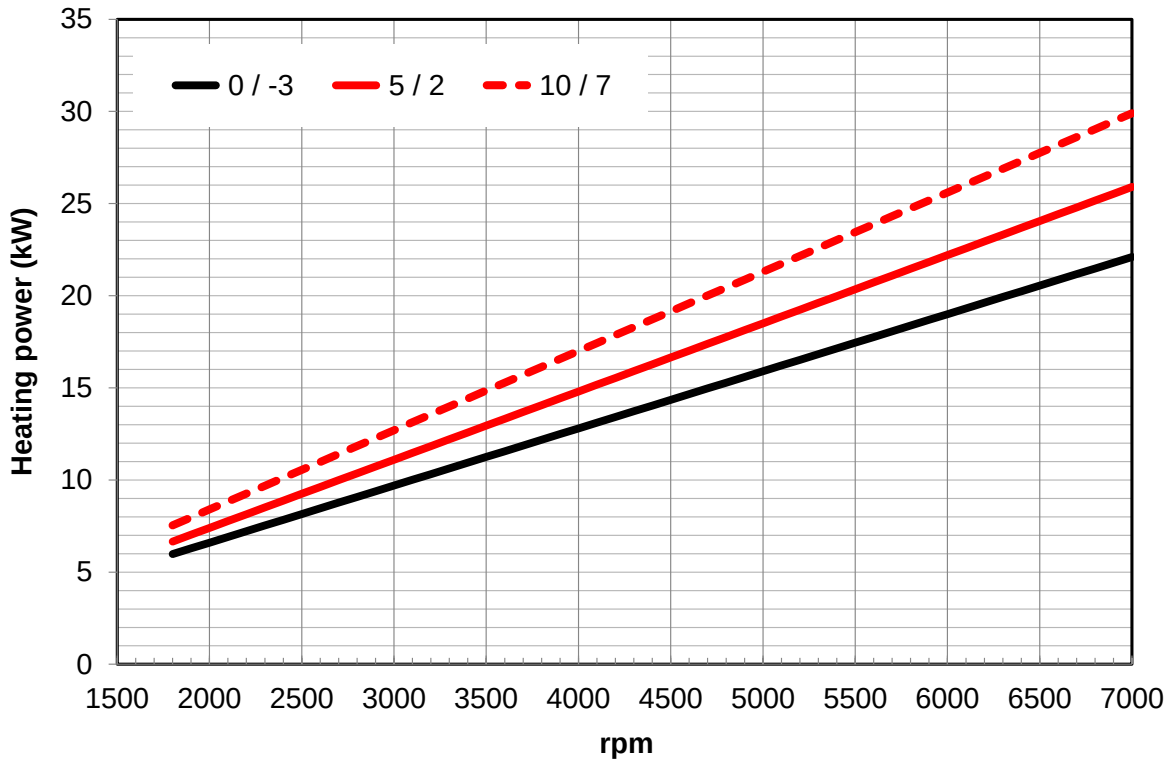


10.2.2 Characteristic curves Classic/Elite 5-25

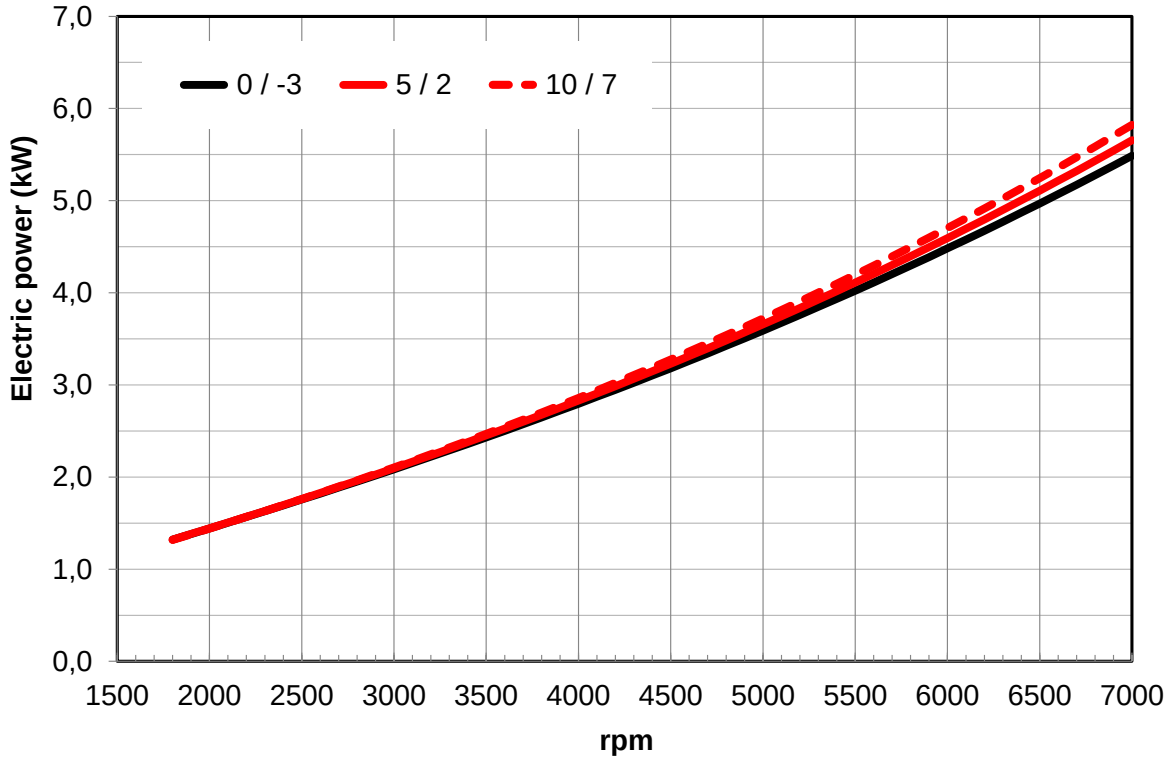
HEATING POWER. Heating, 30/35 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



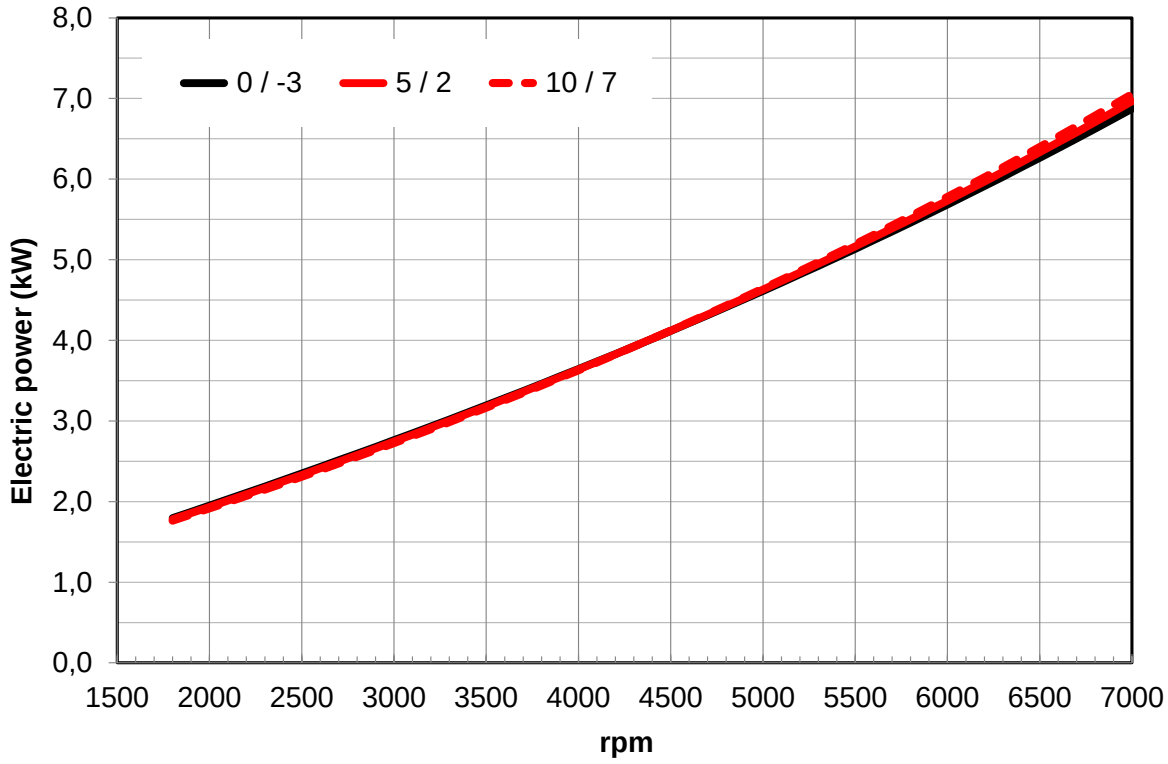
HEATING POWER. Heating, 40/45 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



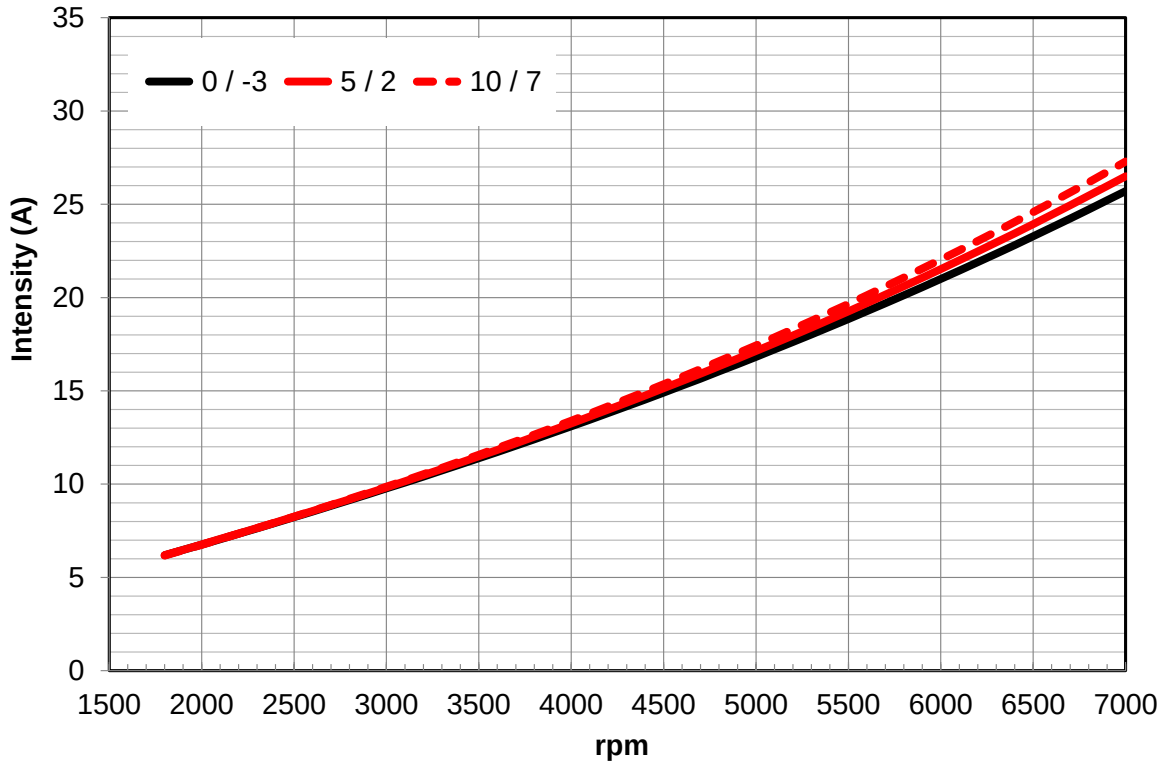
ELECTRIC POWER (220 V /1/N/PE~). Heating, 30/35 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



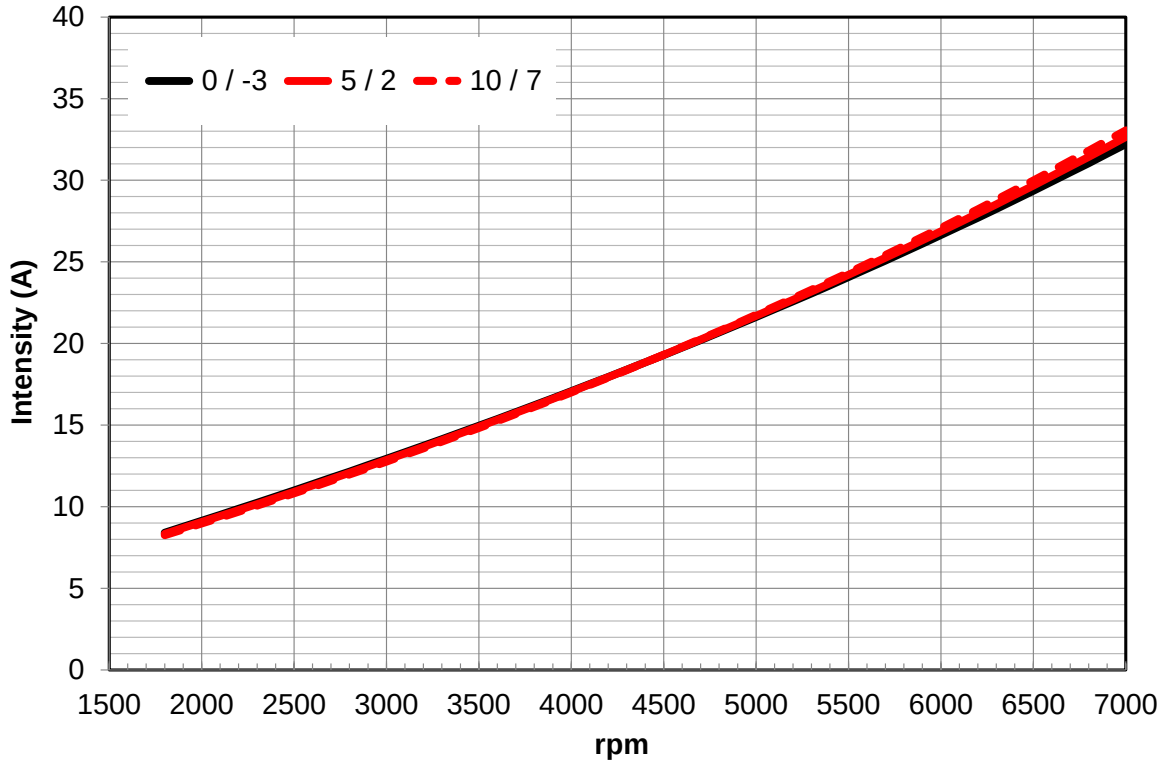
ELECTRIC POWER (220 V /1/N/PE~). Heating, 40/45 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



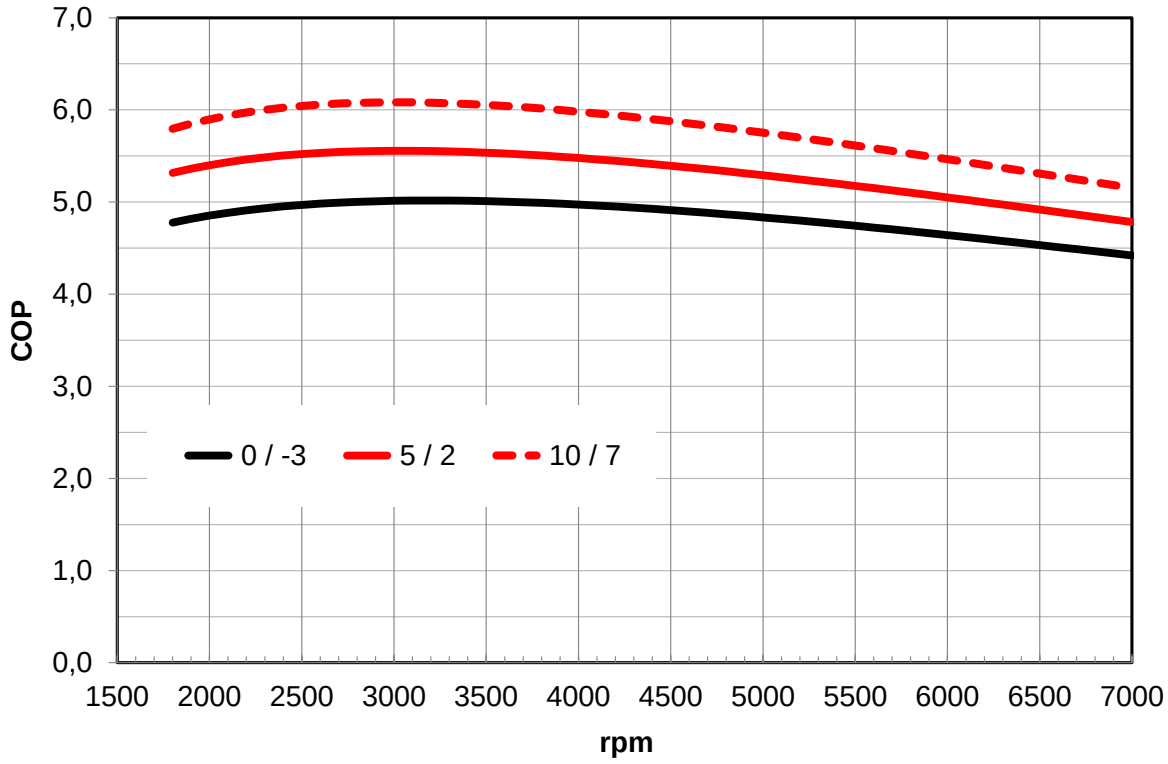
INTENSITY (220 V /1/N/PE~). Heating, 30/35 ºC. Brine, 0/-3, 5/2 and 10/7.



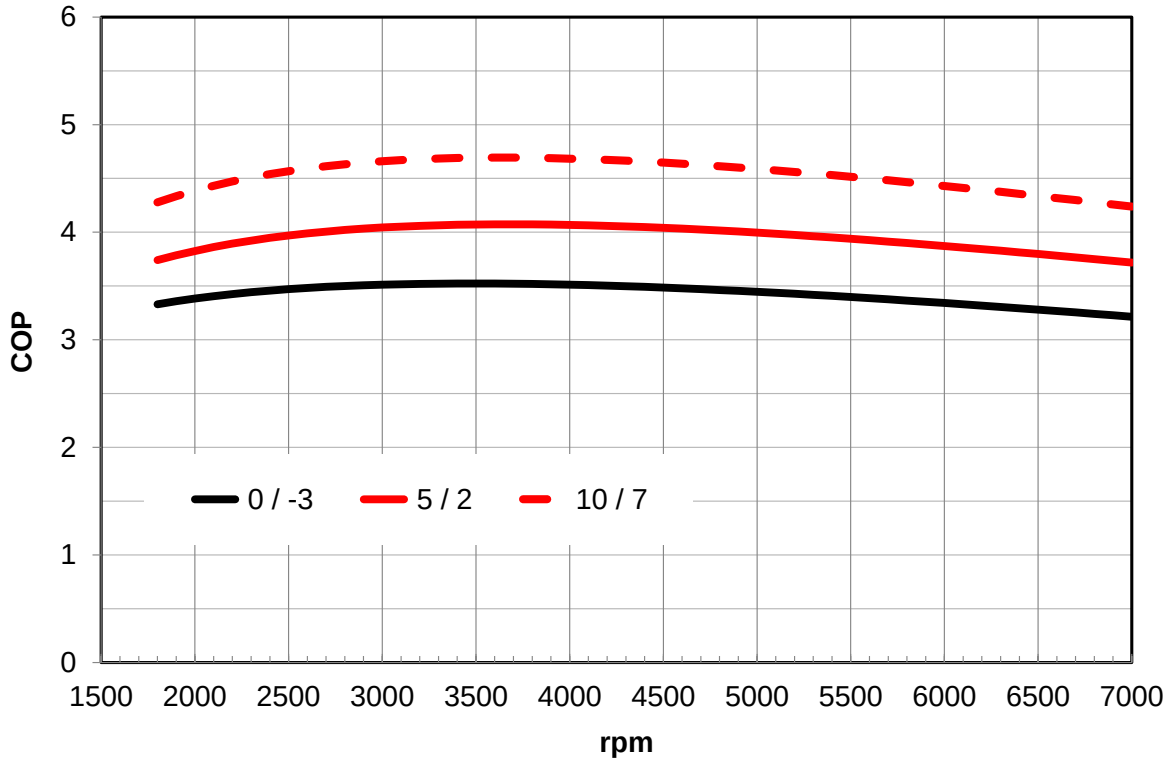
INTENSITY (220 V /1/N/PE~). Heating, 40/45 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



COP. Heating, 30/35 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.



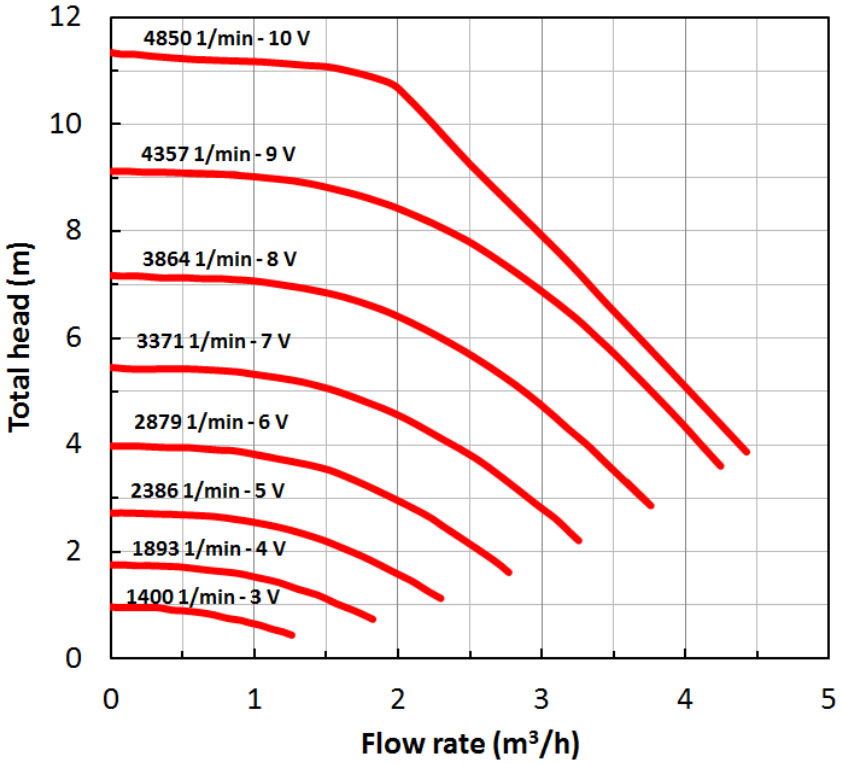
COP. Heating, 40/45 ºC. Brine, 0/-3, 5/2 and 10/7 ºC.

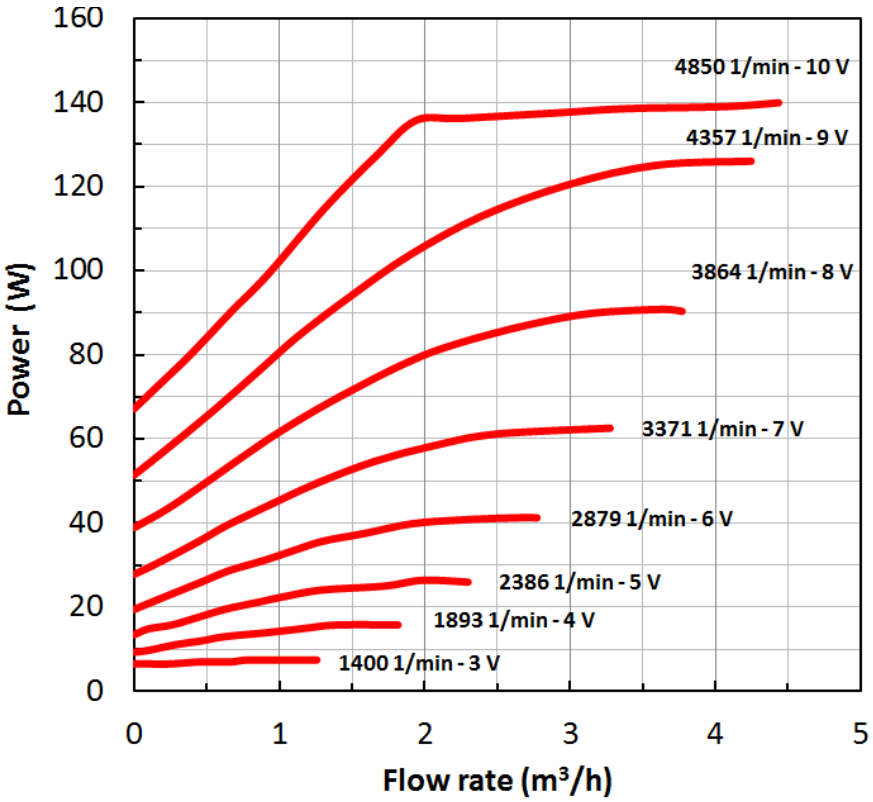

COP
6
5
4
3
2
1
0
0 / -3
5 / 2
10 / 7
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
rpm

10.3 HYDRAULIC PARAMETERS

In this section are shown values of internal pressure drop and available pressure both in brine circuit and indoor climatization circuit. Moreover data for the free cooling circuit are presented.

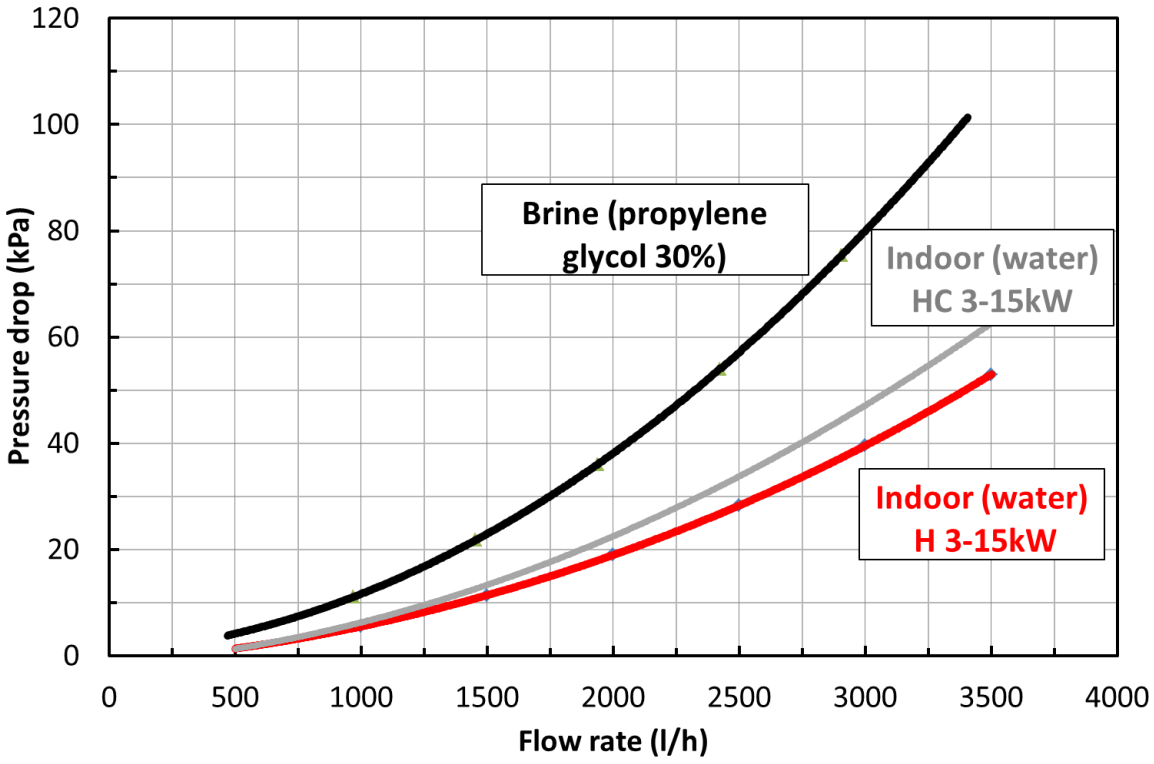
10.3.1 Characteristic curves Wilo Stratos Para 25/1 – 11



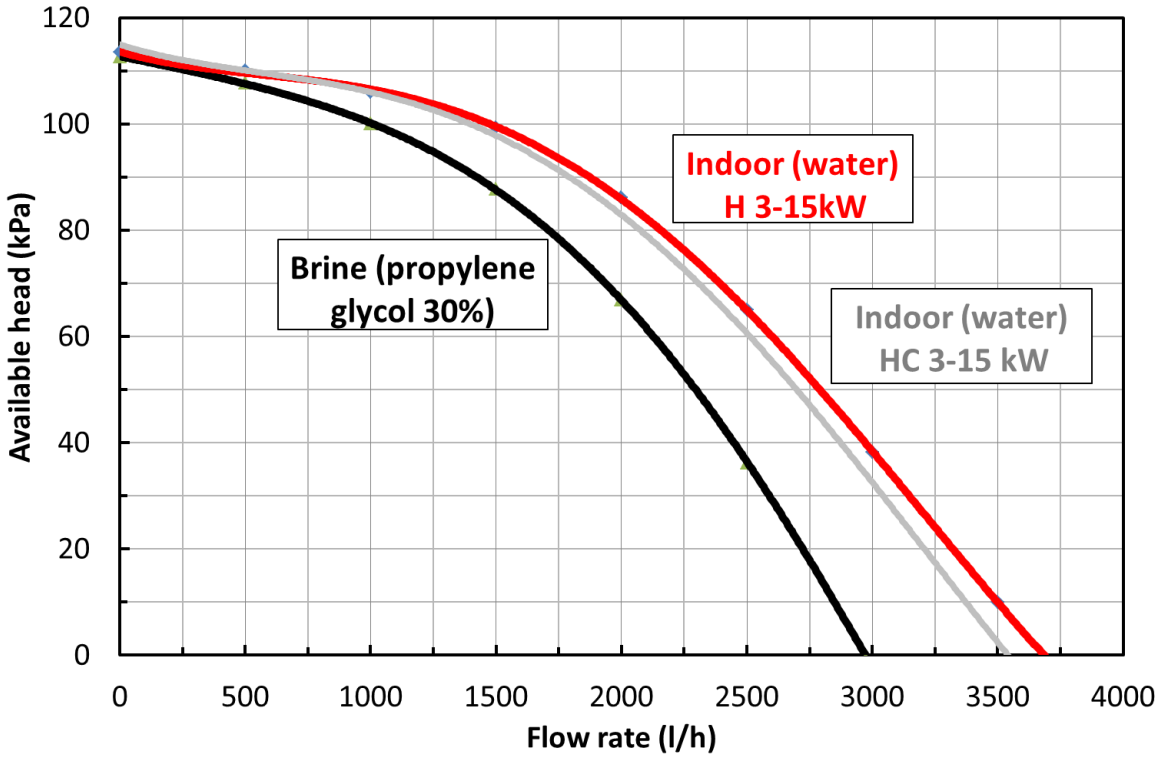


10.3.2 Pressure drop and available head Classic/Elite 3-15

PRESSURE DROP

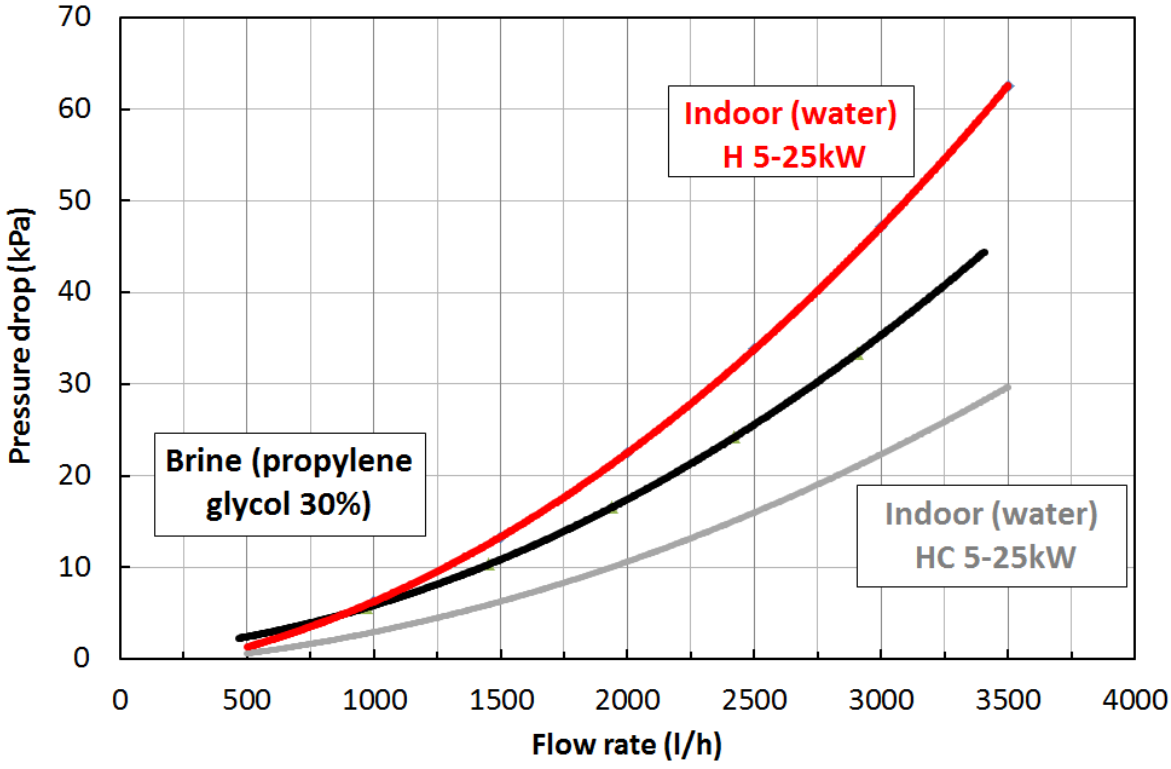


AVAILABLE PRESSURE

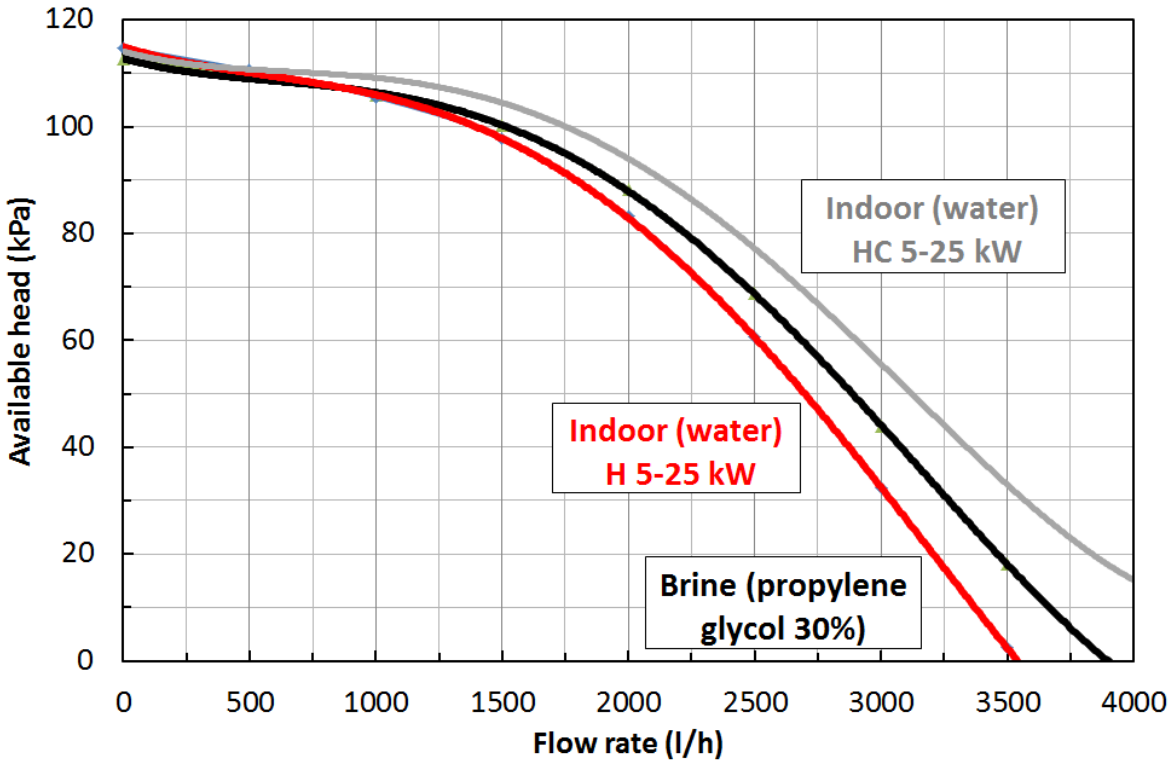


10.3.3 Pressure drop and available head Classic/Elite 5-25

PRESSURE DROP



AVAILABLE PRESSURE

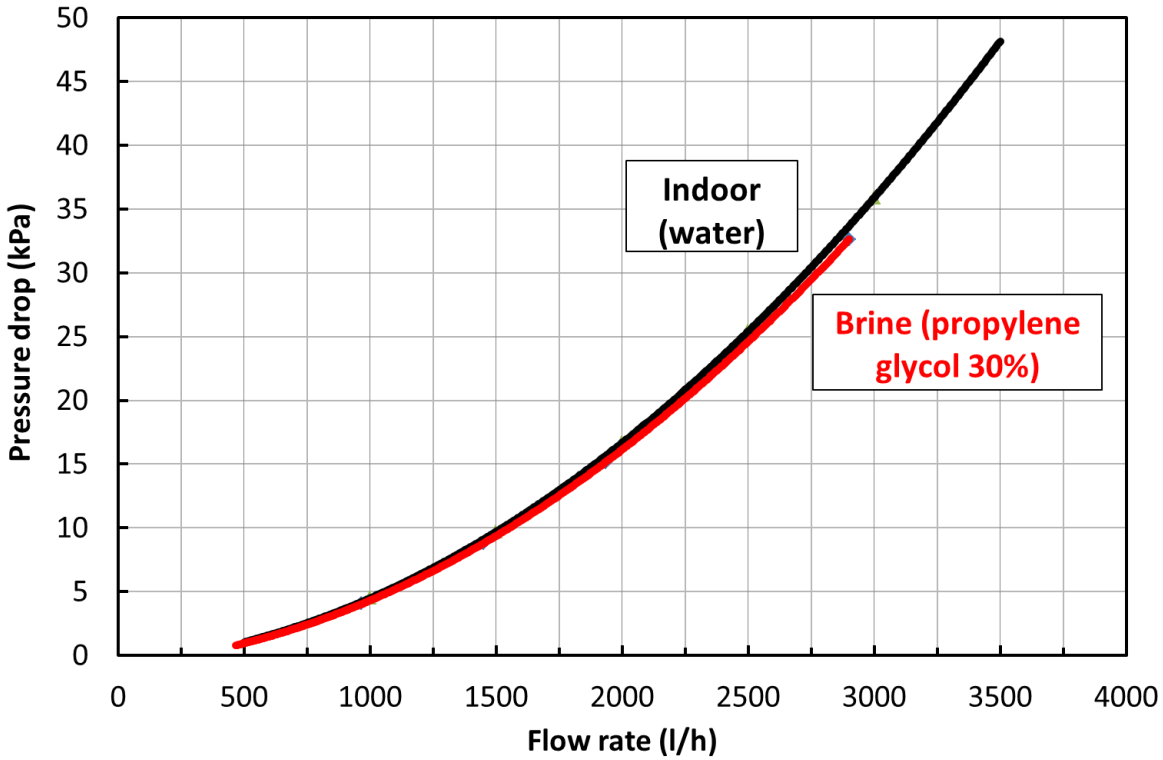


10.3.4 Pressure drop and available head free cooling

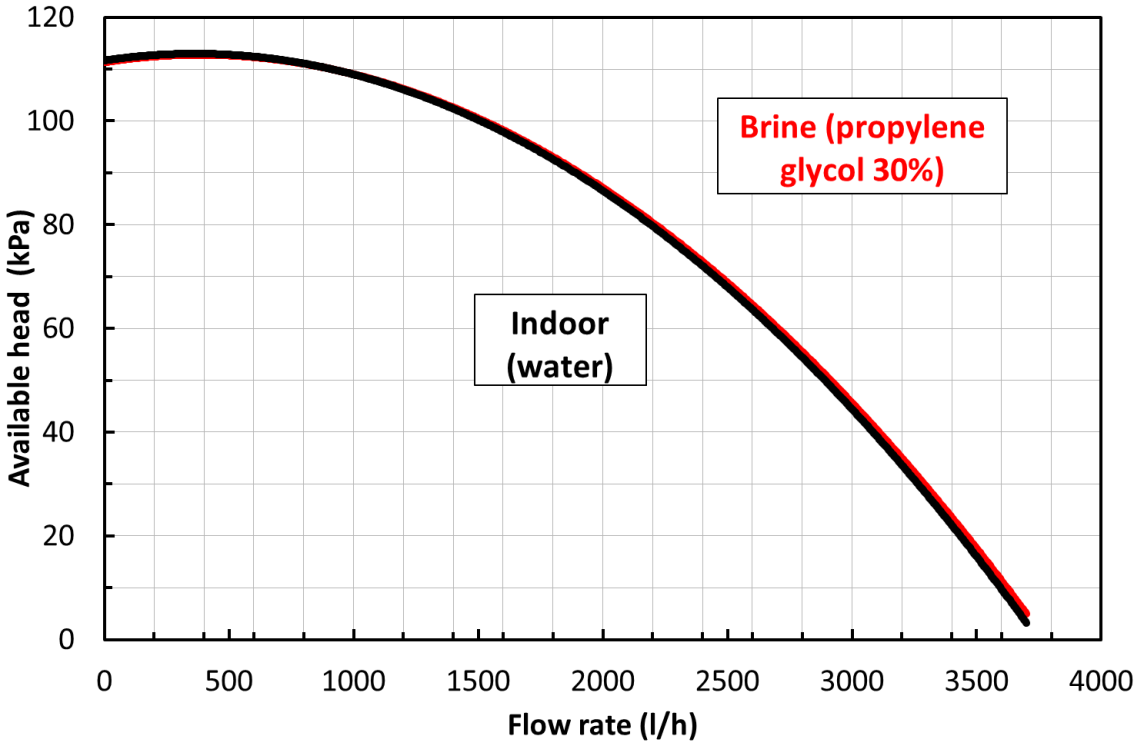
In this section are shown pressure drop and available pressure values in free cooling mode, both in brine and indoor circuits. These values were obtained by using a 30% propylene glycol solution and water as working fluids.

NOTE **Values of pressure drop and available head shown in this section are appliyed both for 3-15 kW and 5-25 kW models.**

PRESSURE DROP



AVAILABLE PRESSURE



11. ALARMS LIST

Alarm	Posible cause	Posible solution
Clock Board fault or not conected	- Controller error.	- Replace the CR24 3V button cell in the controller (switch off the supply previously).
Low brine inlet temperature	- Minimum brine temperature protection too high. - Poorly sized of geothermal system. - Low brine flow rate (filters obstruction, shut-off valves, pumps). - Inlet brine temperature probe broken or desconnected.	- Increase the glycol concentration or reduce the minimum brine temperature protection value. - Check posible obstructions in the brine circuit. - Check brine pump performance. - Set a lower compressor rotation speed limit. - Check inlet brine temperature probe.
Low brine outlet temperature	- Minimum brine temperature protection too high. - Poorly sized of geothermal system. - Low brine flow rate (filters obstruction, shut-off valves, pumps). - Inlet brine temperature probe broken or disconnected.	- Increase the glycol concentration or reduce the minimum brine temperature protection value. - Check posible obstructions in the brine circuit. - Check brine pump performance. - Set a lower compressor rotation speed limit. - Check inlet brine temperature probe.
High water outlet temperature	- Low indoor flow rate (filters obstruction, shut-off valves, pumps). - Poorly sized of emission system. - Malfunction of emission system (fancoils off, underfloor heating blending valves clossed, etc).	- Check indoor pump performance. - Check emission system performance. - Check posible obstructions in the indorr circuit. - Set a lower compressor rotation speed limit.
Low water outlet temperature	- Poorly sized of emission system. - Low indoor flow rate (filters obstruction, shut-off valves, pumps). - Malfunction of emission system (fancoils off, underfloor heating blending valves clossed, etc). - Outlet indoor temperature broken or disconneted.	- Check indoor pump performance. - Check emission system performance. - Check posible obstructions in the indoor circuit. - Set a lower compressor rotation speed limit. - Check outlet indoor temperature probe.
High outlet brine temperature	- Low brine flow rate (filters obstruction, shut-off valves, pumps). - Poorly sized of geothermal system. - Maximum brine temperature wrongly selected.	- Check brine pump performance. - Set a lower compressor rotation speed limit. - Check if the maximum brine temperature is suitable for the geothermal collector.
Evaporation pressure too low DANGER OF EVAPORATION FREEZING!	- Lack of brine flow rate (filters obstruction, shut-off valves, pumps, circuit freezed). - Minimum brine temperature setted in protections does not fit with actual freezing temperature.	- Check brine pump performance. - Check posible obstructions in the brine circuit. - Check if the minimum brine temperature fits with the actual freezing temperature.
Evaporation pressure too low DANGER OF EVAPORATION FREEZING!**	- Lack of indoor flow rate (filters obstruction, shut-off valves, pumps, circuit freezed).	- Check indoor pump performance. - Check posible obstructions in the indoor circuit.
High inverter temperature	- Poor inverter dissipation.	- Check inverter dissipation connection (folded tubes in classic configuration). - Set a lower compressor rotation speed limit.
High discharge temperature	- Working conditions out of compressor range. - Lack of heat exchange in the secondary fluid circuit of the condenser.	- Check circulator pump performance. - Set a lower compressor rotation speed limit.
High discharge pressure	- Working conditions out of compressor range. - Lack of heat exchange in the secondary fluid circuit of the condenser.	- Check circulator pump performance. - Set a lower compressor rotation speed limit.
Low suction pressure	- Lack of heat exchange in the secondary fluid circuit of the evaporator.	- Check circulator pump performance. - Set a lower compressor rotation speed limit.
Low brine circuit pressure	- Leakage in the brine circuit. - Drop pressure by venting. - Error in brine pressure probe.	- Detect and reparir leakages. - Check brine pressure probe connection. - Fill the brine circuit.

Low water circuit pressure	- Leakage in the indoor circuit. - Drop pressure by venting. - Error in indoor pressure probe.	- Detect and reparir leakages. - Check indoor pressure probe connection. - Fill the indoor circuit.
Probe B01 fault or disconnected	- Bad connection of the outlet brine temperature probe in the control terminal board. - Outlet brine temperature probe fault.	- Check the connection in the control terminal board. - Replace the outlet brine temperature probe.
Probe B02 fault or disconnected	- Bad connection of the inlet brine temperature probe in the control terminal board. - Inlet brine temperature probe fault.	- Check the connection in the control terminal board. - Replace the inlet brine temperature probe.
Probe B03 fault or disconnected	- Bad connection of the outlet indoor temperature probe in the control terminal board. - Outlet indoor temperature probe fault.	- Check the connection in the control terminal board. - Replace the outlet indoor temperature probe.
Probe B04 fault or disconnected	- Bad connection of the inlet indoor temperature probe in the control terminal board. - Inlet indoor temperature probe fault.	- Check the connection in the control terminal board. - Replace the inlet indoor temperature probe.
Probe B07 fault or disconnected	- Bad connection of the compressor discharge pressure probe. - Compressor discharge pressure probe fault.	- Check the connection in the control terminal board and in the probe head. - Replace the compressor discharge pressure probe.
Probe B08 fault or disconnected	- Bad connection of the DHW probe. - DHW probe fault.	- Check the connection in the control terminal board. - Replace the DHW probe.
Probe B09 fault or disconnected	- Bad connection of the buffer / zone 2 / indoor temperature probe (depending on configuration). Buffer / zone 2 / indoor temperature probe fault (depending on configuration).	- Check the connection in the control terminal board. - Replace the buffer / zone 2 / indoor temperature probe.
Probe B10 fault or disconnected	- Bad connection of the outdoor temperature probe. - Outdoor temperature probe fault.	- Check the connection in the control terminal board. - Replace the outdoor temperature probe (depending on configuration).
Probe B11 fault or disconnected	- Bad connection of the brine circuit pressure probe. - Brine circuit pressure probe fault.	- Check the connection in the control terminal board. - Replace the brine circuit pressure probe.
Probe B12 fault or disconnected	- Bad connection of the indoor circuit pressure probe. - Indoor circuit pressure probe fault.	- Check the connection in the control terminal board. - Replace the indoor circuit pressure probe.
Suction pressure probe (B6): YES/NO Suction temperature probe (B5): YES/NO	- Anomalous suction conditions detected by the own compressor sensors.	
Low superheat (LowSH)	- Punctual anomalous superheat value.	- Informative note (NOT MANAGED AS AN ALARM).
Low evaporation temperature (LOP)	- Low evaporation temperature registered by the suction valve control.	
High evaporation temperature (MOP)	- High evaporation temperature registered by the suction valve control.	
High condensing temperature (HiTcond)	- High condensing temperature registered by the suction valve control.	
Low suction temperature	- Low suction temperature registered by the suction valve control.	
Autotune	- Expansion valve error.	
ThTune 1 / 2 offline	- Th-TUNE 1 / 2 communication error.	- Check th-TUNE 1 / 2 communication wires. - Check th-TUNE 1 / 2 configuration (P_In = 1).

ThTune 1 / 2 Temperature probe broken or not working	- Internal th-TUNE 1 / 2 temperature probe error.	- Replace th-Tune.
ThTune 1 / 2 Humidity probe broken or not working	- Internal th-TUNE 1 / 2 humidity probe error.	- Replace th-Tune.
ThTune 1 /2 Clock board Fault	- Internal th-TUNE 1 / 2 error.	- Replace th-Tune.

12. WARRANTY

Clausius heat pumps have a warranty of 2 years, counting from the buying date, against manufacturing and material faults. For the DHW tanks, the warranty is of 5 years.

CEO2 Green S.L. warranty covers those faults associated with the unit. The company is not responsible of the problems due to an improper installation or manipulation of the unit or due to any operation not following the indications and procedures described in this manual and in applicable general or local regulations.

Clausius heat pumps must be installed by trained and authorised personnel, assuming all the responsibility for guaranteeing its correct installation. Besides, it is responsibility of the installer to perform the verification tests of the installation once completed and it should not be given to the customer until fully checked.

This warranty is valid only for the heat pump buyer und cannot be transferred.

The condition to fulfil the right for this warranty is the following:

- The buyer must send, in a term of 30 days from the buying date, the warranty document with the invoice sealed by an authorised distributor.

The following are excluded from the warranty:

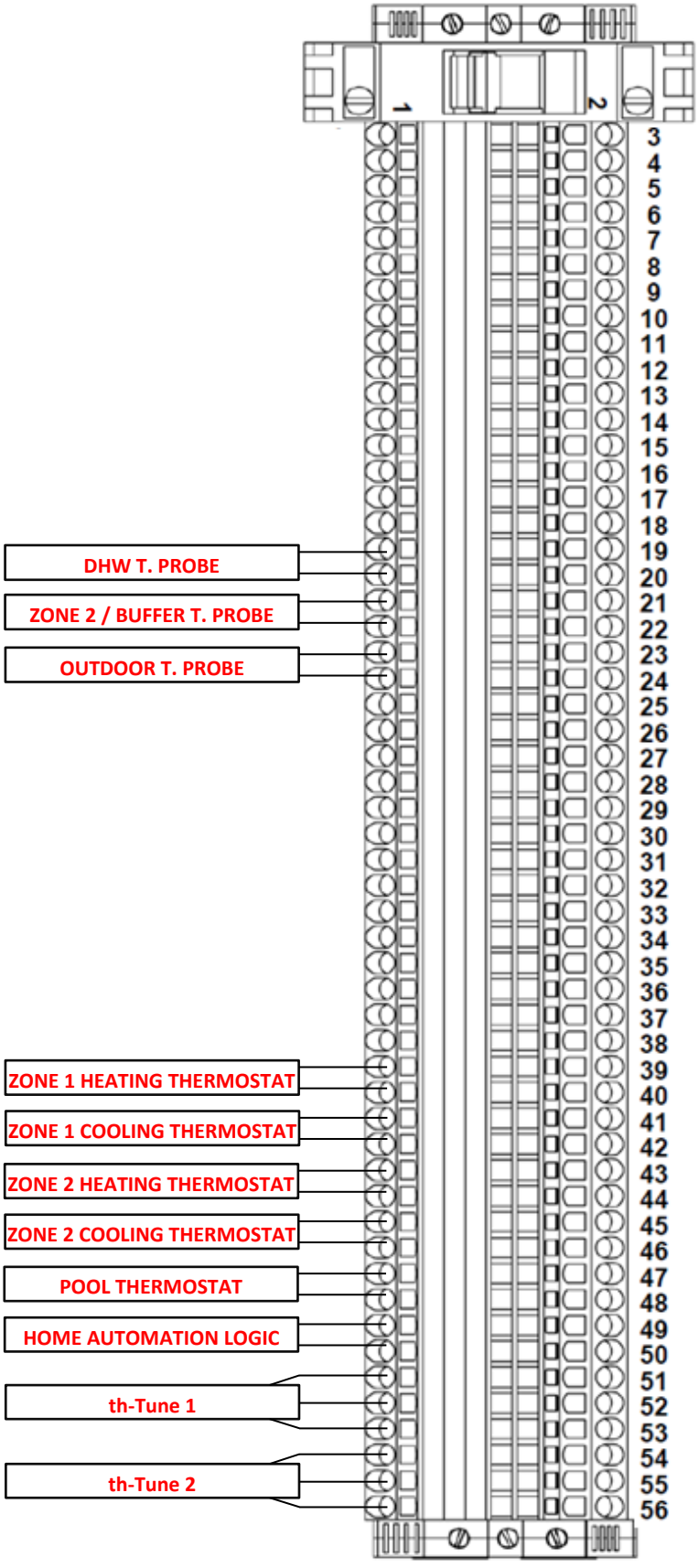
- Any damage to the unit due to an improper desing, sizing or maintenance of the installation, as well as due to any use different to those indicated in this manual
- Any element different from the original ones distributed with Clausius heat pumps.
- Any component exposed to excesive wear due to its own operation, except in case it is caused due to a manufacturing fault.
- Any damage during transportation of the units. To avoid any problem related to transportation, verify the goods acquired at the reception time. Indicate in the transportation delivery note any incidence observed that can be useful in a future claim, which will be forwarded to the distributor and/or transportation company.

Any claim must be processed directly through the distributor or installer in charge of the sale.

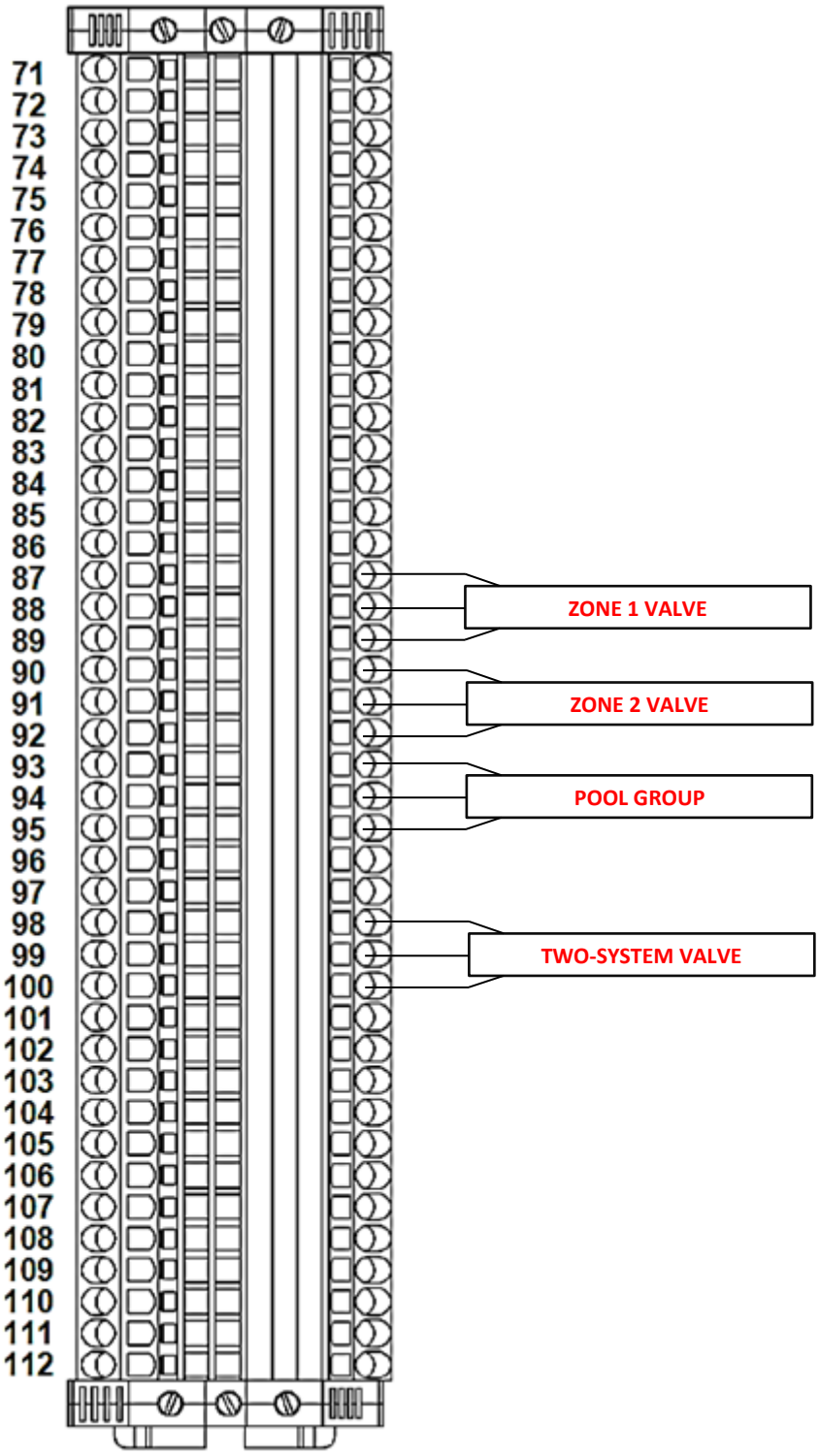
Any product returned must be previously accepted and documented by CEO2 Green S.L. and must follow the conditions specified by CEO2 Green S.L. regarding the packaging, transportation fee and product documentation.

13. APPENDIX

APPENDIX I. Control terminal board number scheme



APPENDIX II. Power terminal board number scheme



APPENDIX III. Control terminal board number scheme

No. terminal	Colour*	Function	Component
3	White	Signal	Outlet temperature probe to brine circuit
4	Black	Ground	
5	White	Signal	Inlet temperature probe from brine circuit
6	Black	Ground	
7	White	Signal	Outlet temperature probe to indoor circuit
8	Black	Ground	
9	White	Signal	Inlet from indoor circuit / Cooling buffer tank temperature probe
10	Black	Ground	
11	White	Signal	Compressor suction temperature probe
12	Black	Ground	
13	White	Signal	Compressor suction pressure transducer
14	Green	Ground	
15	Black	+5 Vdc ref	
16	White	Signal	Compressor discharge pressure transducer
17	Green	Ground	
18	Black	+5 Vdc ref	
19	White	Signal	DHW tank temperature probe
20	Black	Ground	
21	White	Signal	Buffer tank / ZONE 2 circuit temperature probe
22	Black	Ground	
23	White	Signal	Outdoor temperature probe
24	Black	Ground	
25	White	Signal	Brine circuit pressure transducer
26	Green	Ground	
27	Brown	+5 Vdc ref	
28	White	Signal	Indoor circuit pressure transducer
29	Green	Ground	
30	Brown	+5 Vdc ref	
31	White	Signal	Brine circuit pump regulation
32	Brown	Ground	
33	White	Signal	Indoor circuit pump regulation
34	Brown	Ground	
35	White	Signal	ZONE 2 mixing group regulation
36	Brown	Ground	
37	White	Signal	Additional regulation
38	Brown	Ground	
39	White		ZONE 1 heating thermostat digital input
40	Black		
41	White		ZONE 1 cooling thermostat digital input
42	Black		
43	White		ZONE 2 heating thermostat digital input
44	Black		
45	White		ZONE 2 cooling thermostat digital input
46	Black		
47	White		Pool thermostat digital input
48	Black		
49	White		Home automation logic digital input
50	Black		
51		GND	th-Tune 1
52		Rx+/Tx+	
53		Rx-/Tx-	
54		GND	th-Tune 2
55		Rx+/Tx+	
56		Rx-/Tx-	

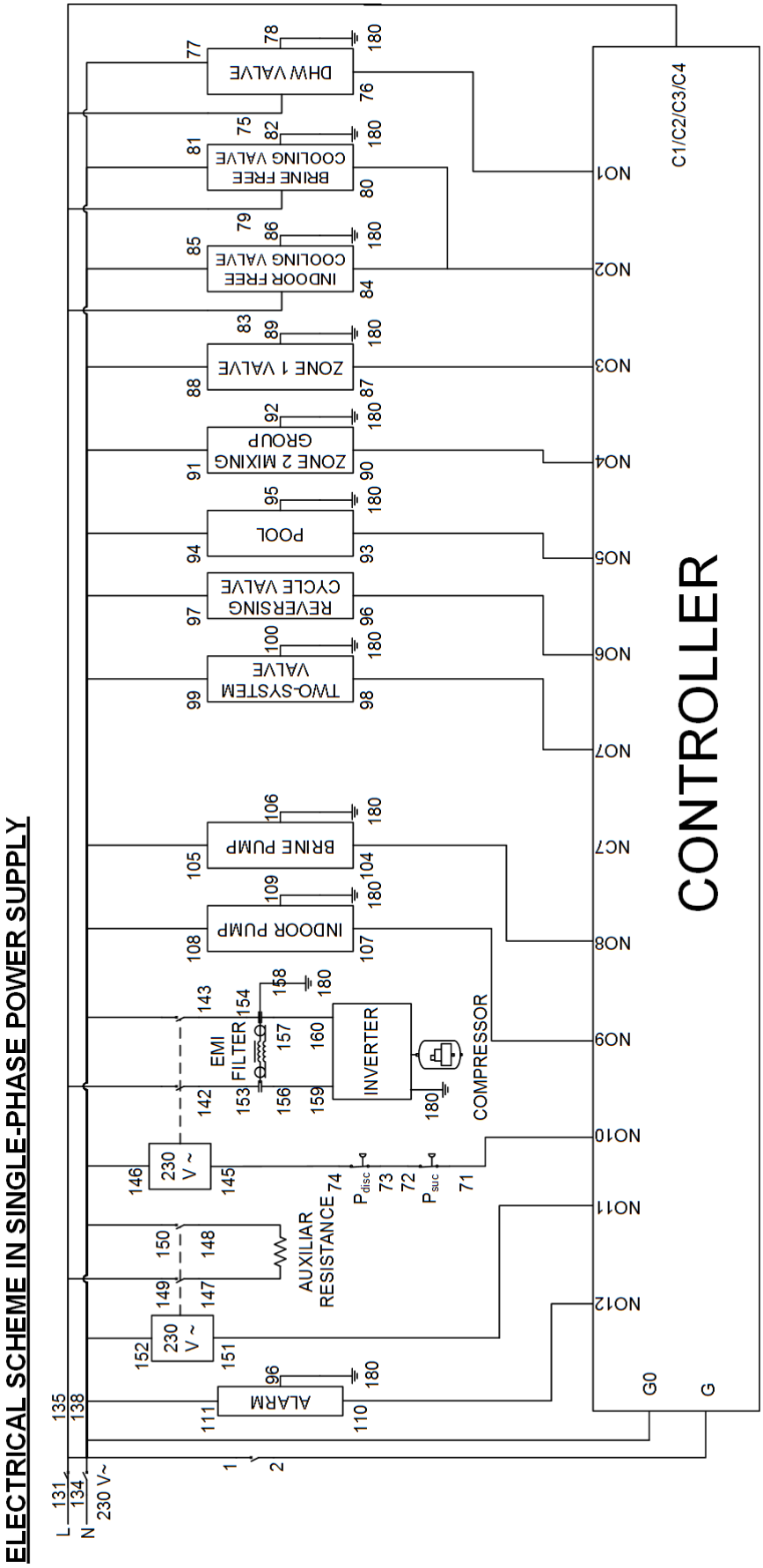
*The colours indicated correspond to the manufacturing standard. The installer may choose any other colour for the wires needed for the installation.

APPENDIX IV. Power terminal board number scheme

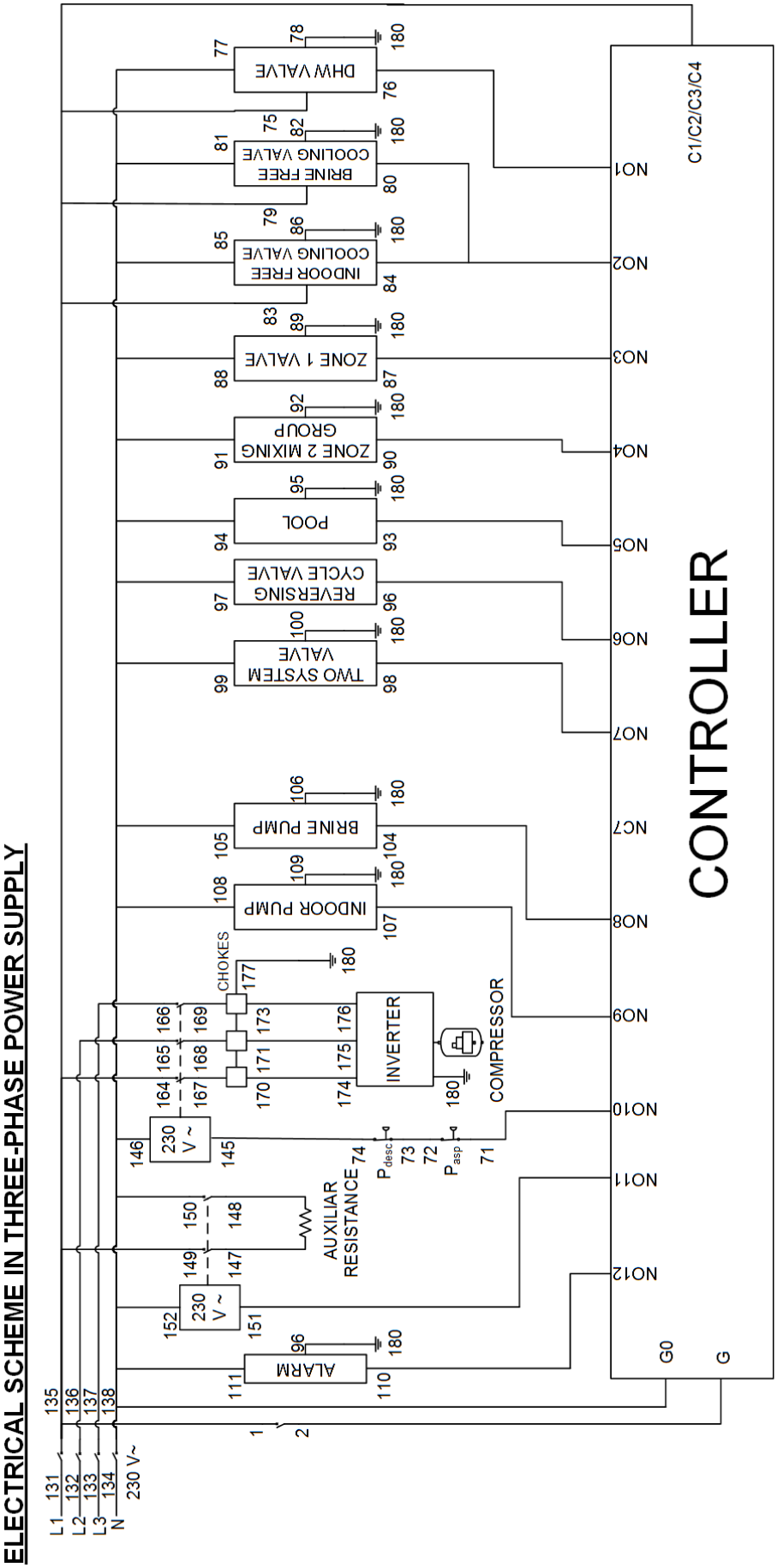
No. terminal	Colour*	Function	Component
71	Black	Signal	Low pressure switch
72	Black	Ground	
73	Black	Signal	High pressure switch
74	Black	Ground	
75	Brown	Phase 230V	DHW valve
76	Black	Control NO1	
77	Blue	Neutral	
78	Green / Yellow	Ground	
79	Brown	Phase 230V	Passive cooling valve (Brine circuit)
80	Black	Control NO2	
81	Blue	Neutral	
82	Green / Yellow	Ground	
83	Brown	Phase 230V	Passive cooling valve (Indoor circuit)
84	Black	Control NO2	
85	Blue	Neutral	
86	Green / Yellow	Ground	
87	Brown	Control NO3	ZONE 1 valve / Buffer selection 1
88	Blue	Neutral	
89	Green / Yellow	Ground	
90	Brown	Control NO4	ZONE 2 mixing group / Buffer selection 2
91	Blue	Neutral	
92	Green / Yellow	Ground	
93	Brown	Control NO5	Pool group
94	Blue	Neutral	
95	Green / Yellow	Ground	
96	Black	Control NO6	Reversing valve
97	Blue	Neutral	
98	Brown	Control NO7	Two-system valve
99	Blue	Neutral	
100	Green / Yellow	Ground	
101	Brown	Phase	Heating solenoid valve
102	Blue	Neutral	
103	Green / Yellow	Groundl	
104	Brown	Control NO8	Brine circuit pump
105	Blue	Neutral	
106	Green / Yellow	Ground	
107	Brown	Control NO9	Indoor circuit pump
108	Blue	Neutral	
109	Green / Yellow	Ground	
110	Brown	Control NO12	Alarm system
111	Blue	Neutral	
112	Green / Yellow	Ground	

* The colours indicated correspond to the manufacturing standard. The installer may choose any other colour for the wires needed for the installation.

APPENDIX V. Power circuit electric diagram (single-phase)

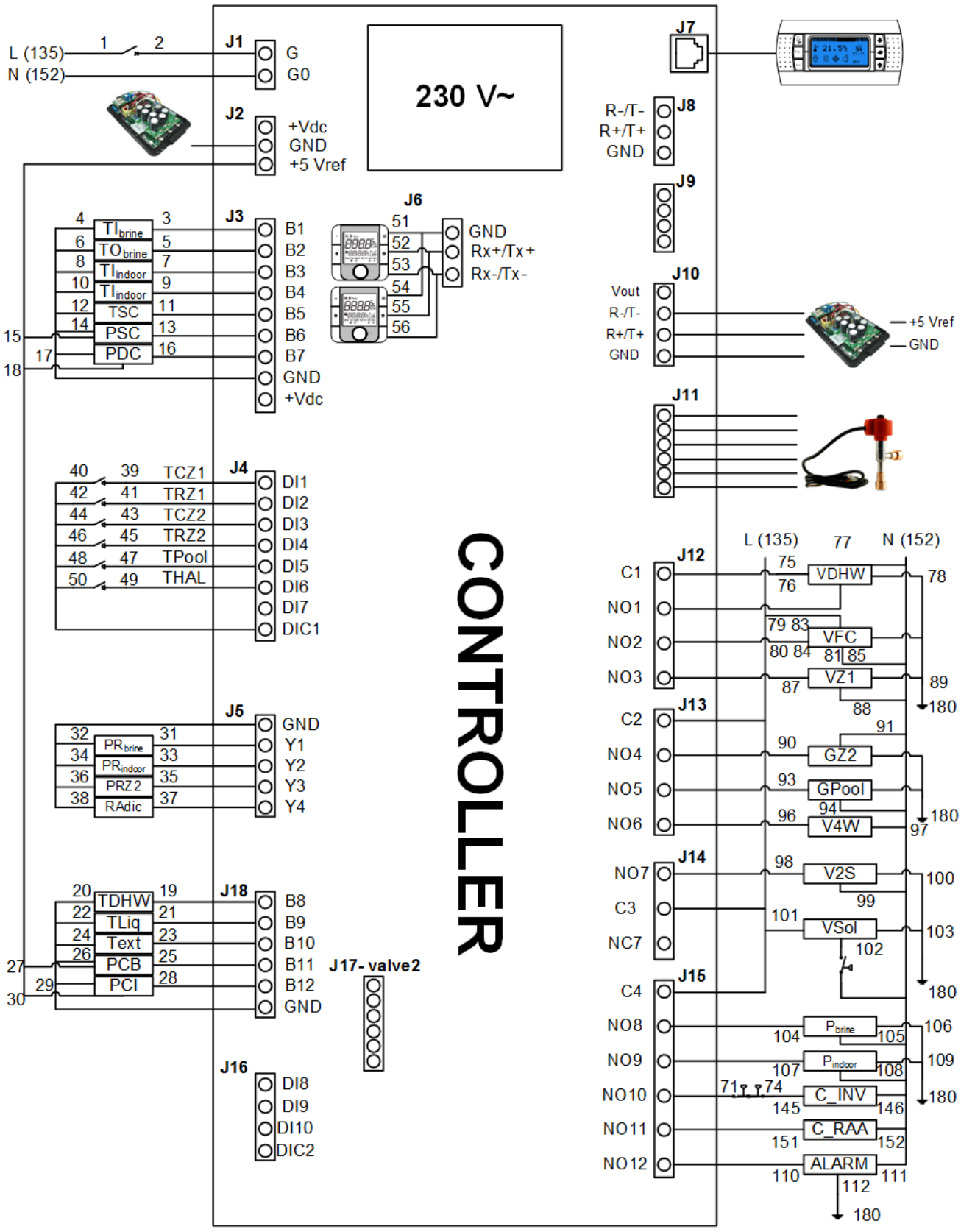


APPENDIX VI. Power circuit electric diagram (three-phase)



APPENDIX VII. Controller connections diagram

SCHEME OF CONTROLLER CONNECTIONS



Clausius — Verification test: INSTALLATION

MODEL	INSTALLER
SERIAL NUMBER	IDENTIFICATION
COMMISIONING DATE	/ /

ceo2 green
ceo2green.com - info@ceo2green.com
Telf.: 986 120 435 Telf.: 606 283 606
Edificio CITEXVI, Local 25
Campus Universitario. 36310 Vigo

PRODUCT APPEARANCE

☐ Packaging conditions ☐ Heat pump appearance ☐ Connecting sleeves + joint pack ☐ Handgrips ☐ Heat pump manual ☐ Warranty sheets ☐ Commisioning sheet ☐ th-Tune (optinal) ☐ th-Tune manual ☐ Internet conection kit (optional	*OBSERVATIONS*

INSTALLATION LOCATION

ADDRESS	
ZONE	COUNTRY
POSTAL CODE	PHONE NUMBER

COLLECTOR SYSTEM

☐ Vertical borehole collectors — Boreholes number ☐ — Length per borehole ☐
☐ Horizontal ground collectors — Occupied area ☐
☐ Ground water system

EMISSION SYSTEM

EMISSION SYSTEM ZONE1/ZONE2			*OBSERVATIONS*
	☐ Heating floor	☐ Heating floor	
	☐ Fancoils	☐ Fancoils	
	☐ Radiators	☐ Radiators	

INSTALLATION SCHEME

☐ Buffer ☐ Buffer+Cooling ☐ Single-zone ☐ Single-zone / Two-system
☐ Single-zone / Multi-emission ☐ Two-zone ☐ Two-zone / Two-system ☐ Two-zone / Multi-emission

WORKING AREA

☐ Recommended working area
☐ There are nearby equipment that may interfere with the performance of the heat pump
☐ Electrical installation complies with existing requirements in the manual of the heat pump

Clausius — Verification test: STARTING UP

MODEL	INSTALLER
SERIAL NUMBER	IDENTIFICATION
COMMISIONING DATE	/ /

ceo2 green
ceo2green.com - info@ceo2green.com
Telf.: 986 120 435 Telf.: 606 283 606
Edificio CITEXVI, Local 25
Campus Universitario. 36310 Vigo

CONFIGURATION PARAMETERS OF Clausius HEAT PUMPS

MODEL OF HEAT PUMP

☐ Classic_H ☐ Classic_HC ☐ Elite_H ☐ Elite_HC

HEATING CAPACITY

☐ 3-15 kW ☐ 5-25 kW

INSTALLATION SCHEME

☐ Buffer ☐ Buffer+Cooling ☐ Single-zone ☐ Single-zone/Two-systems
☐ Single-zone/Multi-emission ☐ Two-zones ☐ Two-zones/Two-systems ☐ Two-zones/Multi-emission

ACTIVE FUNCTIONS

☐ DHW ☐ Anti-legionella ☐ Pool ☐ External control

EMISION SYSTEM ZONE1/ZONE2			***MAXIMUN EXTERNAL TEMPERATURE FOR HEATING***	***MINIMUN EXTERNAL TEMPERATURE FOR COOLING***
	☐ Heating floor	☐ Heating floor		
	☐ Fancoils	☐ Fancoils		
	☐ Radiators	☐ Radiators		

CONFIGURATION PROTECTIONS OF Clausius HEAT PUMPS

LIMIT SPEED	rpm compressor	rpm climatization	rpm DHW

LIMIT GLYCOL TEMPERATURE		
	MINIMUM	
	MAXIMUM	

COMPONENT MANUAL ACTIVATION

☐ Collection system pump
☐ Emission system pump
☐ Mixing group
☐ Inverter contactor
☐ Electrical heater contactor
☐ Alarm system
☐ DHW valve
☐ Passive cooling valve (collection)
☐ Passive cooling valve (emission)
☐ 4-ways valve
☐ ZONE 1 valve
☐ ZONE 2 valve
☐ Two-systems valve
☐ Pool valve
☐ Regulation pump of collection system
☐ Regulation pump of emission system
☐ Regulation of mixing group

WATERTIGHTNESS			
☐ Visual inspection of leaks			
☐ Correct purged of the circuits			
PRESSURE MEASURMENTS IN CIRCUITS	1ª READING (0h)	2ª READING (1h)	3ª READING(2h)
OPERATION OF THE HEAT PUMP			
☐ First start up			

clausius
the heatpump specialists

Tel: 0330 1243-903| Web: clausius.uk

Unit 23 Coxleigh Barton, Shirwell Barnstaple, Devon, EX31 4JL.

CLAUSIUS UK Ltd registered in England and Wales with Company No. 11181993.

Registered Office: Millennium House, Brannam Crescent, Roundswell Business Park, Barnstaple, Devon, United Kingdom, EX31 3TD.