TITAN Sky FC

30÷150 kW

General
Free-cooling chillers with independent section. No-Glycol Free-Cooling options.

Configurations
Hi: chiller with inverter compressor

/SLN: super low noise version

NG: No-Glycol Free-Cooling options

Strengths

- Refrigerant R290 - GWP≈0.The refrigerant is a pure natural fluid.
- Reduced refrigerant charge
- Versatile application: water temperature from -15°C up to 20°C. Operation in a wide range of environmental conditions
- BlueThink advanced control with integrated web server. Multilogic function and Blueye® supervision system. (options)
- Flowzer: inverter driven pumps (options)

BlueBox by Swegon

APPLICATION AND OPERATING PRINCIPLE

Free cooling units meet growing demands for energy savings, since they have been designed to reduce the operating costs of refrigerating machines that work to serve process applications or in the IT field.

Free cooling is carried out when the outside air temperature is lower than the temperature of the water returning from the system. In these conditions, a suitably configured system allows chilled water to be obtained without the need for operation of the compressors and therefore almost cost free.

A cooling system that allows free cooling conditions to be exploited is made by placing an air liquid cooler (normally a dry-cooler) alongside a conventional chiller. The apparent simplicity of a system formed in this way hides a non-negligible pitfall: management.

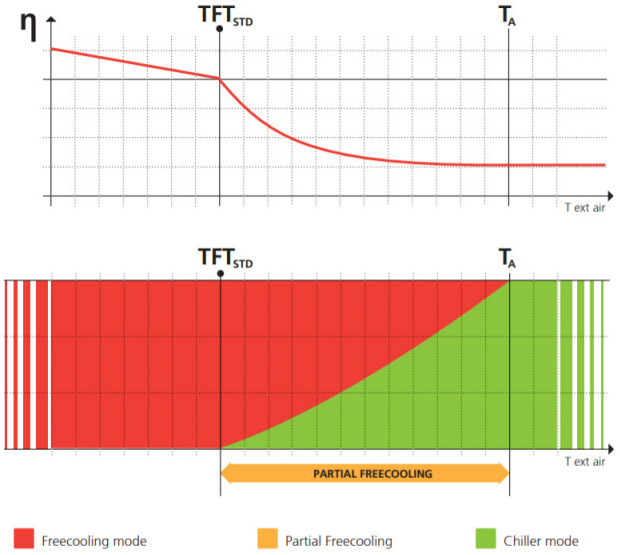
In fact, a system of this kind is normally controlled by a "manager" outside the chiller that, in order to limit the degree of complexity, usually manages everything with an ON/OFF free-cooling logic, that is, either only chiller or only free cooling.

A strong point of our free cooling units is certainly the control system that allows maximum use to be made of the free resource, consisting of outside air, so minimizing the energy used by the compressors. The controller of the unit activates the chiller section and the free cooling section, also in combined mode, based on the actual external air temperatures, the set point and the required load level.

The free cooling section is hydraulically in series with the evaporator and this allows a benefit to be obtained from its activation even when the outside air temperature is sufficient to carry out only a pre-cooling of the water. The missing amount of capacity, in any case lower than the total required, will be provided by the compressors.

As the outside air temperature goes down, the amount of capacity that the free cooling section will be able to transfer to the water will gradually increase. Consequently, the amount of capacity that will have to be covered by the compressors will always be lower.

When the TFT (Total Free-cooling Temperature) is reached, the free cooling section will be able to fully meet the cooling capacity requirement and therefore the compressors can be switched off. In this condition, the unit will be able to provide the system with a cooling capacity equal to that required at design conditions, but with current drawn by the fans alone.



An outside air temperature TA can be defined, below which the free-cooling section is activated even though it can provide only a small portion of the required cooling capacity. From this moment on, it is necessary to introduce the concept of machine efficiency η, which no longer coincides with the known EER because the cooling capacity that the unit can deliver no longer totally depends on the power consumed by the compressors as it also benefits from the component coming from free cooling.

In the same way, we define the Total Free-cooling Temperature (TFT) as the outside air temperature at which the capacity that can be obtained from free cooling is the same as that delivered by the refrigerant circuit under nominal conditions.

When the TFT is reached, the efficiency value η is extremely high because the power consumed by the system in this condition is the power consumed by just the pumps and the fans. So therefore the efficiency of the unit can easily reach values even higher than 15.

Modular free-cooling

With the free cooling system integrated into Titan SKY FC, the chiller section and the free-cooling section are completely independent and this allows important advantages to be obtained.

Also, since there are two separate fan sections, the unit controller will be able to manage them independently and therefore:

- the free-cooling section fans will operate at 100% to extract the maximum capacity from the air
- the chiller section fans will be modulated depending on the instant condensing pressure

Compared to other free cooling systems, such as for example the system with facing coils, the one used by Titan SKY FC allows:

- much more precise condensation control, which helps the stability of operation of the machine
- the use of a very simple refrigerant circuit (no capacity reduction of the coils), thereby favouring the reliability of the machine
- limitation of the refrigerant charge because it does not use the "flooding" condensation control, but allows the use of microchannel condensing coils

Principle of operation FC

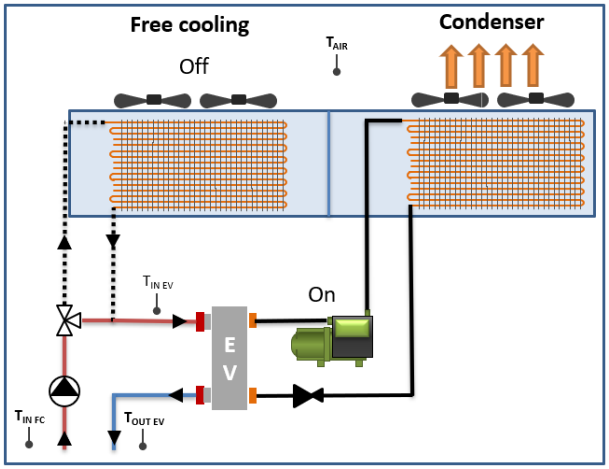
How the unit behaves in the various scenarios is explained briefly below.

Chiller only mode

When the ambient temperature is higher than the temperature of the water returning from the system, all the required cooling capacity must be produced by the compressors.

The total cooling capacity is generated by the compressors of the chiller section, and the free cooling coil and relevant fans remain inactive. The operation of the unit is that of a classic chiller.

The 3-way valve bypasses the free cooling coil (so preventing unnecessary head losses) and condensation control is done, when necessary, through fan speed modulation.

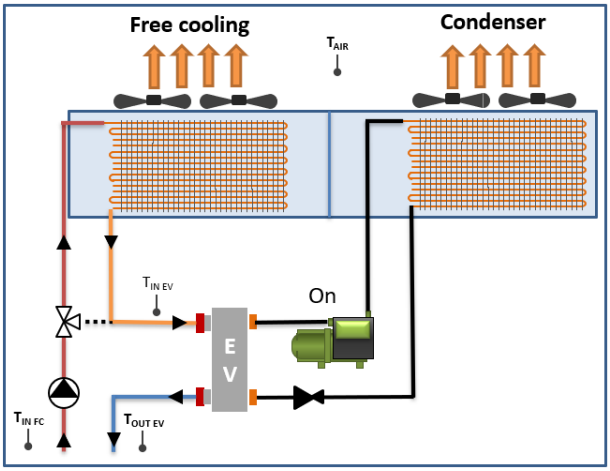


Mixed mode

When the ambient temperature is lower than the temperature of the water returning from the system, the controller activates the free cooling section.

The control switches over the 3-way valve to put the free cooling coil in series with the evaporator and with the free cooling section fans.

The water leaving the free cooling coil will be "pre-cooled" by the outside air (partial free cooling) and is sent to the evaporator inlet. Now the chiller section can operate in reduced capacity mode because it will have to produce only the amount needed to reach total cooling capacity.



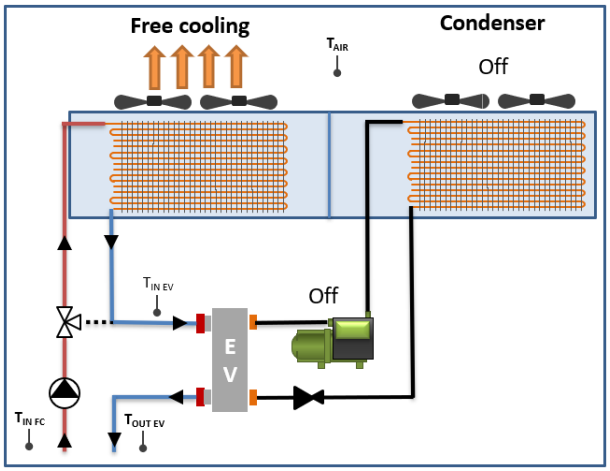
Free cooling only mode

For outside air temperatures lower than or equal to the TFT, the unit operates exclusively in free cooling mode.

The output capacity from the water coil fully meets the demand of the system, and therefore the condensing section fans are completely switched off and so are the compressors.

The fans of the free cooling section are usually managed with an on/off adjustment.

EC, standard or oversized fans are available as options for both sections.

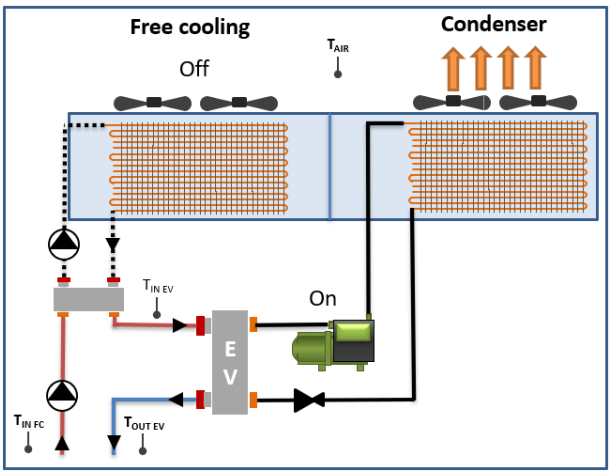


Principle of operation FC/NG

Chiller only mode

When the ambient temperature is higher than the temperature of the water returning from the system, all the required cooling capacity must be produced by the compressors.

The circulation pump on the free cooling circuit remains switched off, whereas condensation control is done, when necessary, through modulation of the fans.



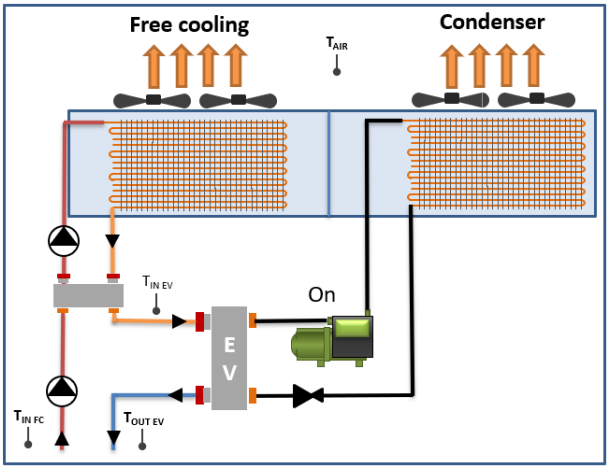
Mixed mode

When the ambient temperature is lower than the temperature of the water returning from the system, the controller activates the free cooling section.

The controller switches on the fans and the circulation pump of the free cooling circuit. This ensures the extraction of the maximum cooling power from the outside air.

The cooling capacity of the free cooling coil is transferred to the system water through a decoupling exchanger. This allows the glycol water circulating in the free cooling circuit to be separated from the system water that therefore does not need the addition of antifreeze.

The water leaving the decoupling exchanger will be the water that enters the evaporator. Since the water is "pre-cooled", the amount of capacity required of the chiller section will be lower and therefore this will be able to operate with reduced capacity.



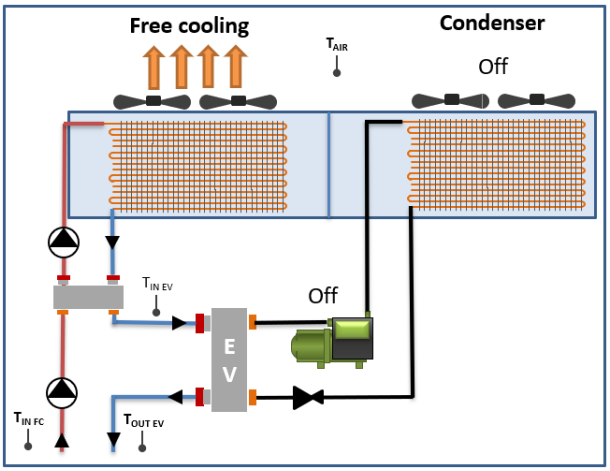
Free cooling only mode

Below a certain outside air temperature, the unit operates exclusively in free cooling mode.

The output capacity from the water coil fully meets the demand of the system, and therefore the condensing section fans are completely switched off and so are the compressors.

The fans of the free cooling section are usually managed with an on/off adjustment.

EC, standard or oversized fans are available as options for both sections.



TITAN SKY FC

Titan SKY FC is a wide range of chillers with an independent module for highly efficient free-cooling, ideal for both comfort and process applications. Units mount variable speed inverter compressors in order to maximize the seasonal efficiency and achieve stable thermodynamic regulation in any load condition. The free cooling section is hydraulically in series with the evaporator and this allows a benefit to be obtained from its activation even when the outside air temperature is sufficient to carry out only a pre-cooling of the water. The missing amount of capacity, in any case lower than the total required, will be provided by the compressors.

Refrigerant

Titan Sky units are available with R290 refrigerant.

The use of R290 refrigerant is indicated by acronym "R0", which indicates a GWP level close to 0.

Refrigerant R290 GWP(Global Warming Potential)≈ 0*

ODP (Ozone Depletion Potential) 0

The refrigerant is a pure natural fluid.

R290 is classified as group 1 fluid according to PED.

It is also classified as A3 according to ASHRAE standard 34:

- non-toxic;
- Highly flammable.

The excellent GWP value may be an advantage in projects where:

- min. targets are adopted for the containment of the environmental footprint;
- it is possible to receive incentives or other benefits that are applicable in some countries or are connected to specific plant design criteria.

(*) GWP (AR6), pursuant to IPCC VI, evaluated over a span of 100 years.

Structure

The structure of the unit is made of galvanized sheet-iron coated with polyester powder in RAL 5017/7035 at 180°C, which makes it highly resistant to weather conditions.

The structure is a load-bearing frame, with removable panelling lined with sound absorbing expanded polyurethane matting.

All screws and bolts are stainless steel.

Compressors

Compressors are semi-hermetics reciprocating in single or double circuit, with a inverter for each compressor that modulates the working frequency according to the load request. Compressor are optimized for use with propane. All compressors are equipped with crankcase heater, suction and delivery valves as standard.

The compressors are enclosed in a dedicated technical compartment which can be accessed by removing the panels.

Depending on the model, there are the following compressor configurations:

- the models with a single compressor (x.1) require the use of a single compressor with modulating inverter in a circuit.
- the models with two compressors (x.2) require the use of a compressor with modulating inverter for each circuit.

The speed of the modulating compressor is varied, depending on the total heat load, roughly between 30 and 105 rps. 30Hz and 65Hz.

This also has the following functions:

- management of acceleration and deceleration ramps
- management of the operating envelope of the modulating compressor
- management of the alarms and safety devices of the modulating compressor

The use of a modulating compressor allows the total inrush current to be reduced because it is always started with an acceleration ramp.

Source-side heat exchanger

The exchangers are made with microchannel aluminium coils. Finned pack coils with copper tubes and aluminium fins can be requested as accessory.

Thanks to continuous research in the alloys field, and sophisticated production methods, microchannel coils are made using specific aluminium alloys for the tubes and for the fins. This allows the effects of galvanic corrosion to be drastically reduced to always ensure protection of the tubes that confine the refrigerant. Tubes and fins are also subjected to SilFLUX coating processes (or equivalent) or have zinc added to further increase their corrosion resistance.

The use of microchannel coils, as opposed to conventional copper/aluminium coils, reduces the total weight of the unit and reduces the refrigerant charge.

Options are available for installation in environments with a particularly aggressive atmosphere or in coastal or highly industrialized areas. See section: "Description of accessories".

Free-Cooling heat exchanger

The exchangers are made with finned pack coils with copper tubes and aluminium fins.

Options are available for installation in environments with a particularly aggressive atmosphere or in coastal or highly industrialized areas. See section: "Description of accessories".

To protect the exchangers from corrosion and ensure optimal operation of the unit, we advise following the recommendations given in the user, installation and maintenance manual for cleaning the coils.

User-side heat exchanger

The exchanger is a braze-welded stainless steel plate heat exchanger, insulated with a shroud of closed-cell insulating material.

Models with two refrigerant circuits are fitted with dual circuit heat exchanger with a single hydraulic connection.

The exchanger is equipped with two temperature probes (one at the inlet and one at the outlet) for controlling the water temperature and the freeze protection.

Fans

The fans are axial fans, directly coupled to a three-phase 6-pole electric motor, with integrated thermal overload protection (Klixon®) and IP 54 protection rating.

The fan includes the shroud, designed to optimize its efficiency and reduce noise emission to a minimum, and the safety guard.

The fans of the chiller section are controlled as standard with phase cutting speed governor depending on the condensing pressure.

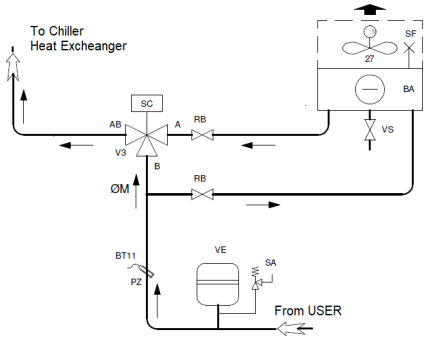
The fans of the free cooling section are usually managed with an on/off adjustment.

EC fans are available as accessory for both sections and, in this case, continuous fan speed modulation is managed for both sections.

Free-cooling circuit

The free cooling circuit consists of:

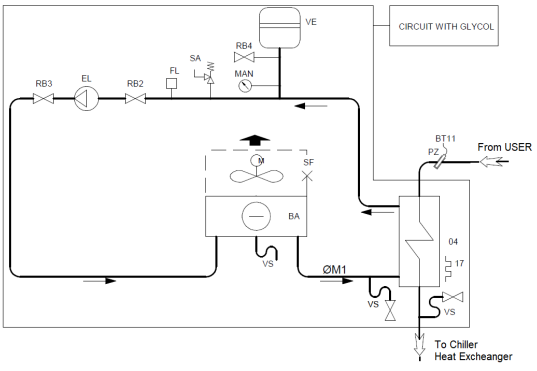
- the free cooling heat exchanger: this is made with finned pack coils with copper tubes and aluminium fins(BA)
- a servo controlled 3-way valve managed by the control(SC)
- water drain valve(VS)
- air valves (on each individual coil)(SF)
- expansion vessel(VE)
- safety valve(SA)
- two free cooling circuit shut-off gate valves. !da duplicazione!(RB)



Free-cooling circuit /NG: no glycol option

The free cooling circuit consists of:

- Plate heat exchanger !da duplicazione!
- free cooling coil(BA)
- water drain valve(VS)
- air valves (on each individual coil)(SF)
- expansion vessel(VE)
- safety valve(SA)
- shut-off gate valves(RB)
- free-cooling pump(EL)



Refrigerant circuit

Each refrigerant circuit of the basic unit comprises:

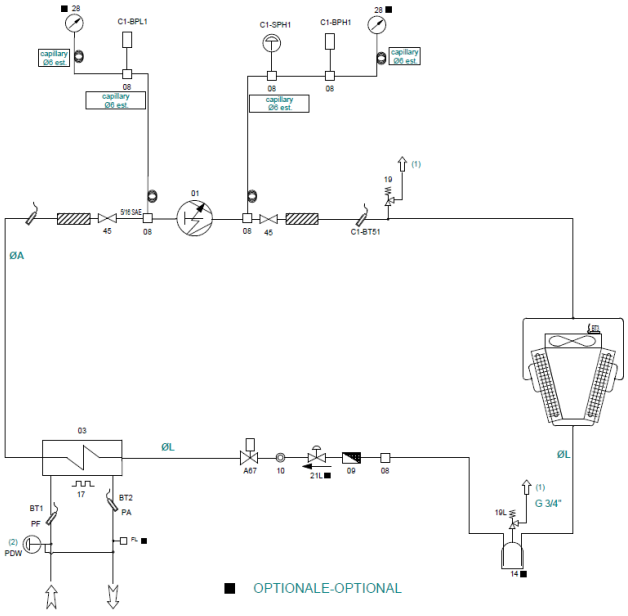
- compressor(01)
- delivery shut-off valve(45)
- safety valve(19)
- condenser
- liquid line valve(07)
- charging valves(08)
- dehydrating filter(09)
- liquid sight glass(10)
- electronically-controlled thermostatic expansion valve(A67)
- Plate heat exchanger !da duplicazione!(03)
- suction shut-off valve(45)
- pressure transducers for reading high and low pressure values(BPH) / (BPL)
- high pressure switch with manual reset(SPH)

The copper pipes are sized with increased thicknesses in order to ensure greater reliability and durability over time.

The pipes of the circuit and the exchanger are insulated with extruded closed-cell expanded elastomer.

The refrigeration circuit is enclosed in a compartment that contains an ATEX certified leak sensor and an ATEX certified extraction fan.

The hydronic module, if present, is also enclosed in the compartment that contains the ATEX certified leak sensor and the ATEX certified extraction fan.



Electrical control panel

The electrical control panel is made in a painted galvanized sheet-iron box with forced ventilation and IP54 protection rating.

The electrical panel is made following the EN60204-1 standard.

The electrical panel is separated from the compressor compartment.

The electrical control panel of the basic unit comprises:

- general disconnect switch three-phase line
- fuses to protect the compressors, fans and auxiliary circuits
- fan contactors
- phase-cutting fan speed adjuster
- thermal magnetic circuit breakers for pumps (if present)
- phase monitor
- potential-free general alarm contacts
- single potential free operating contacts for compressors, fans and pumps (when present)
- digital input for general ON/OFF
- summer/winter selection by digital input
- external air temperature probe
- microprocessor controller with display accessible from the outside

All the electrical cables inside the panel are numbered and the terminal board dedicated to the customer's connections is coloured orange so that it can be quickly identified in the panel.

The unit power supply is 400V/3~+N/ 50Hz for all models.

Control BlueThink

The unit is supplied as standard with an advanced controller.

The control allows the following functions:

- water temperature regulation, with outgoing water control;
- freeze protection
- compressor timings
- automatic rotation of compressor starting sequence
- recording of the log of all machine inputs, outputs and states
- automatic rotation of compressor starting sequence
- recording of the alarm log
- RS485 serial port with Modbus protocol
- Ethernet serial port with Modbus protocol and integrated web server preloaded web page
- digital input for general ON/OFF
- digital input for Summer/Winter selection

For further details on available functions and on displayed information, refer to the specific documentation of the controller.

By default, the serial connections present as standard are enabled only for reading from BMS. Enabling of writing from BMS is to be requested when ordering.

Main functions of the webserver

As standard, the Bluethink controller integrates a webserver with a preloaded web page that is accessed via password.

The web page allows the following functions to be carried out (some of these are available only for users with advanced level rights):

- display of the main functions of the unit such as unit serial n°, size, refrigerant
- display of the general status of the machine: water inlet and outlet temperatures, external air temperature, mode (chiller or heat pump), evaporating and condensing pressures, suction and discharge temperatures
- display of the status of compressors, pumps, expansion valves
- display in real time of the graphs of the main quantities
- display of the graphs of logged quantities
- display of alarm log
- management of users on several levels
- remote ON/OFF
- remote set point change
- remote time band change
- remote summer winter mode selection

Human-Machine Interface

The control has a graphic display that allows the following information to be displayed:

- water inlet and outlet temperature
- set temperature and differential set points
- description of alarms
- hour meter of operation and number of start-ups of the unit, the compressors and the pumps (if present)
- high and low pressure values, and relevant condensing and evaporating temperatures
- external air temperature
- superheating at compressor suction.

Options

/HAT: unit for high external air temperatures

The HAT option is designed to expand the work range of the unit.

The unit fitted with this accessory adopts an electrical control panel made using specific components to withstand high temperatures, special cables and oversize protection parts.

For certain sizes this option requires a larger inverter.

The accessory enables the unit to work with external air temperatures of over 45°C as indicated in the section on operating limits.

With this accessory, operation is guaranteed with external air temperature up to 52°C.

/SLN: super low noise unit

The standard unit requires all compressors to be enclosed within a fully acoustically insulated compartment with sound-absorbing material with interposed sound-proofing material.

The SLN version units use fans with speed regulators with reduced air flow in chiller operation. The speed reduction of the fans is such that, under nominal operating conditions, the air flow rate and noise level are lower than those of the basic version of the unit.

In any case, the use of the speed adjuster to reduce the air flow rate allows rotation of the fans at maximum speed when external air temperature conditions are particularly critical and therefore guarantees the same operating limits as the high efficiency version.

Hydraulic modules

All units can be fitted with hydraulic module in various configurations:

- /1P: hydraulic module with one pump
- /2P: hydraulic module with two pumps
- /1PS: hydraulic module with one pump and buffer tank
- /2PS: hydraulic module with two pumps and buffer tank

All the above-mentioned modules have pumps with standard discharge head.

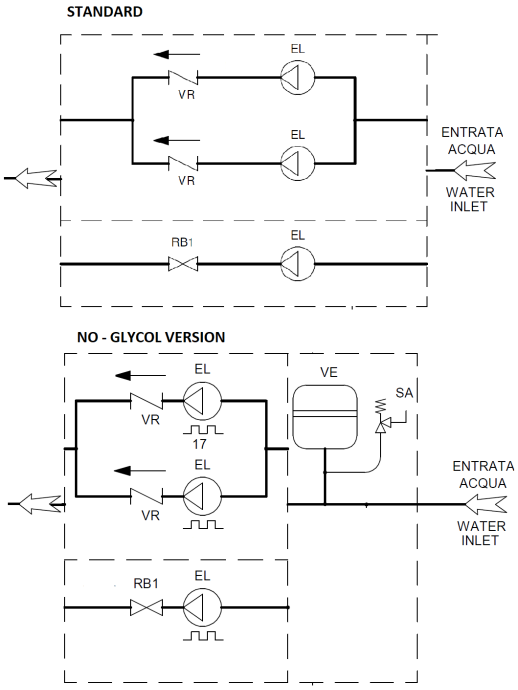
Hydraulic modules with one pump have:

- one pump(EL)
- a gate valve on the delivery side of the pump(VR)
- an expansion vessel(VE)
- water-side safety valve(SA)

Hydraulic modules with two pumps have:

- two pumps(EL)
- a check valve on the delivery side of each pump(VR)
- an expansion vessel(VE)
- water-side safety valve(SA)

In the version with 2 pumps, these are always with one on standby while the other is working. Switching over between the pumps is automatic and is done by time (to balance the hours of operation of each one) or in the event of failure.



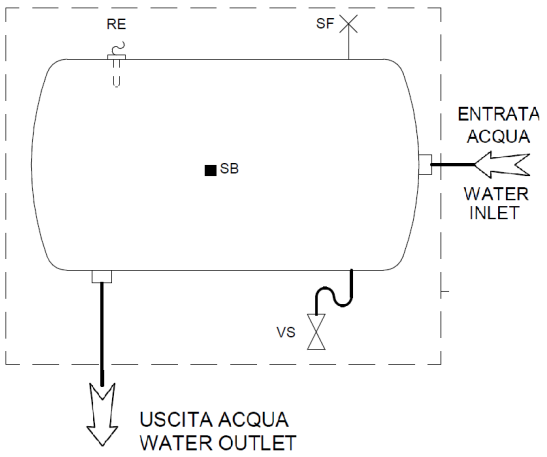
Hydraulic modules with tank also have:

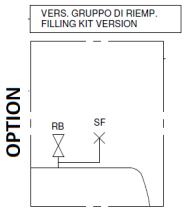
- a tank with drain valve and air valve (SB) / (VS) / (SF)

Refer to the table of configurations that are not possible to check for availability of specific set-ups.

All the hydraulic circuit components are fully insulated, except for:

- drain valves
- venting valves
- tank plugs
- safety valves
- expansion vessel
- probe pockets





Controls and safety devices

All the units are fitted with the following control and safety components:

- user-side water temperature probe
- antifreeze probe on the user side heat exchanger
- high pressure switch with manual reset
- low pressure safety device with automatic reset, for a limited number of occurrences, managed by the controller
- compressor overtemperature protection
- fan overtemperature protection
- differential flow switch
- ATEX certified leakage sensor
- ATEX certified extraction fan

In the event that the leak detector identifies a gas leak, the following safety procedures are implemented:

- immediate shutdown of the unit
- interruption of the three-phase main power supply
- activation of the extraction fan
- activation of the ventilation fans of the electrical panel

Testing

All the units are factory-tested and supplied complete with oil and refrigerant.

Packaging

The unit is made and shipped on a wooden pallet that allows the unit to be handled using a forklift truck.

Certifications and reference standards

The manufacturer has implemented and keeps the Management Systems listed below and it is certified against them:

- Quality Management System according to standard UNI EN ISO 9000;
- Environmental Management System according to standard UNI EN ISO 14000;
- Health and Safety Management System according to standard BS OHSAS 18000 (as converted into UNI EN ISO 45000).

These management systems ensure that the company puts in place any and all actions and initiatives to define and monitor the standards defined by its Management, which are stated in its Quality, Environmental and Safety policies.

To meet the safety requirements, the unit was designed and manufactured in compliance with the directives and product regulations below:

- PED Directive: safety criteria to be followed when designing pressure equipment;
- Machinery Directive: safety criteria to be followed when designing machinery;
- Low Voltage Directive: safety criteria to be followed when designing electrical machine parts;
- Electromagnetic Compatibility Directive: electromagnetic compatibility criteria to be followed when designing electrical machine parts;
- WEEE Directive: criteria for product management at the end of its life cycle as waste with a view to environmental protection.

The units are manufactured, tested and checked with reference to the European standards specified in the Declaration of CE Conformity, in accordance with the requirements and procedures of our Quality System.

The transport, installation, use and storage of units with flammable refrigerants (A3 according to ASHRAE 34 standard) must meet European standards and regulations and local regulations where applicable.

For further details, please refer to the "Instruction manual for operation and maintenance".

Responsibilities and obligations exclusive to the installer:

- to carry out a specific risk assessment according to the European regulations/standards above and/or the local laws in order to define the necessary measures for conformity;
- to comply with the requirements and to take the measures resulting from the outcomes of the risk assessment, pursuant to the relevant regulations and standards.

DESCRIPTION OF ACCESSORIES

Some accessories may be incompatible with each other even if not expressly indicated.

Refrigerant circuit accessories

RG **Condensation control with fan speed adjuster**

This option is standard.

The control manages the speed of the fans through a phase cutting speed adjuster, in order to optimize the operating conditions and efficiency of the unit.

This control also has the effect of reducing the noise level of the unit: in fact, the typical conditions under which the control will be modulating the speed of the fans are those of the night, spring and autumn.

For units equipped with EC fans, the same function is carried out using the electronically commutated motor of the fans and is supplied as standard.

MAFR **Pressure gauges**

The operating pressures of each circuit of the unit can be displayed on the control by accessing the relevant screens. Also, the machine can be fitted with pressure gauges (two for each circuit) installed in a clearly visible position. These allow reading in real time of the working pressures of the refrigerant gas on the low pressure side and on the high pressure side of each refrigerant circuit.

DVS **Double safety valve**

With this accessory, instead of each individual safety valve per circuit, there is a "candelabrum" with two safety valves and a diverter valve for choosing the valve in operation. This allows the safety valves to be replaced without having to drain the machine.

RUB **Compressor suction and delivery valves**

This option is standard.

The valves situated on the delivery side and on the suction side of the compressors allow the compressor to be isolated from the rest of the refrigerant circuit, so making the maintenance operations quicker and less invasive

VTE **Electronic expansion valve**

This option is standard.

The use of this component is particularly advisable on units operating in very variable heat load or operating mode conditions, as in the case of joint management of air conditioning and high temperature water production. The use of an electronic thermostatic valve allows you to:

- maximize heat exchange at the evaporator
- minimize response times to changes in load and operating conditions
- optimize control of overheating
- ensure maximum energy efficiency

VS **Liquid line solenoid valve**

This accessory prevents refrigerant migration that could damage the compressor on starting.

RPR **Refrigerant leak detector**

This option is standard.

A refrigerant leak detector with an infrared sensor is installed on the units.The device immediately identifies any refrigerant leaks. When 10% of the LFL is exceeded the detector activates the ventilation of the technical compartment, the ventilation of the electrical panel (if not activated already), switches on the red lamp on the door of the electrical panel, closes a clean contact, with a specific remote control, cuts off the power supply to the electrical panel, except for the power supply connections to the detector and of the extractor fan.

RIC **Liquid receiver**

The adoption of this accessory always guarantees correct feeding of the expansion valve even when the unit is subjected to wide external air temperature ranges.

BK **Brine Kit**

This accessory is compulsory if a water temperature set point lower than +5°C is used (if the unit is provided with double set point or variable set point, the lower set point is considered).

The accessory consists of increased insulation and suitable sizing and calibration of some components.

The inlet and outlet temperatures of the user-side exchanger must be given on ordering to allow correct setting of the alarm parameters and verification of the sizing of the expansion valve.

The cooling set point can then be changed by the customer in an interval that, compared to the set point given on ordering, ranges from -1K up to the maximum temperature allowed by the above-stated operating limits.

The unit will be optimized to work at the set point temperature given on ordering. For different set points, the cooling capacity provided and the level of efficiency of the machine could decrease and move away from these conditions.

Fan accessories

VEC **EC fans**

With this accessory, EC fans, with electronically commutated brushless motor, are used for the ventilating section. These guarantee very high efficiency levels for all working conditions and allow a 15% saving on the power absorbed by each fan working at full capacity.

Also, through a 0-10V analogue signal sent to each fan, the microprocessor carries out condensation/evaporation control by continuous adjustment of the air flow rate as the external air temperature changes, with a further reduction in electrical absorption and noise emission.

For further details, see the dedicated chapter: "Aeraulic head losses and options available for the fan section".

VEM **Oversize EC fans**

The increased EC fans allow to obtain the same benefits as EC fans and in addition allow to have a residual useful head of about 100Pa.

For further details, see the dedicated chapter: "Aeraulic head losses and options available for the fan section".

RECP **Pressure recuperator**

Normally, the air ejected by the fan has a high speed and this manifests itself as kinetic energy that is dissipated into the environment.

The pressure recuperator is a passive element situated on the ejection duct of each individual fan designed to allow better conversion of kinetic energy into static pressure, which manifests itself as a higher pressure generated by the fan.

This higher pressure can have at least two possible applications:

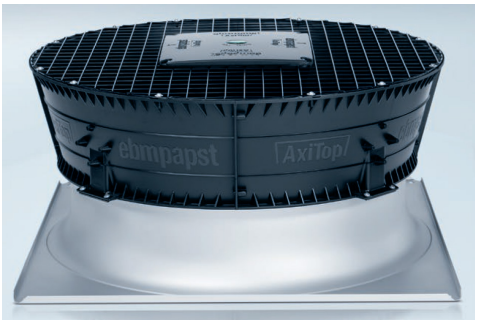
- For the same fan speed, the pressure recuperator allows an increase of about 50Pa in the available pressure of the ventilating section to be obtained. This can be useful for overcoming the head losses that may be present in specific installations. The increase in available pressure is to be considered in addition to the increase that can already be obtained with the application of oversize EC fans
- for the same pressure differential on the air, the pressure recuperator allows the same air flow rate to be obtained with a lower number of revolutions of the fan. This automatically produces a reduction of up to 3 dB(A) in the noise emission of the unit and a reduction in the absorption of the fan, with an immediate increase in the overall efficiency of the unit.

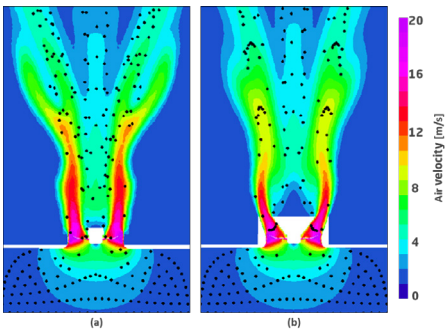
The reduction in total sound power varies depending on the model and version of the unit as it is related to the incidence of noise generated only by the fan section on the total noise emitted by the unit.

For SLN units, which already work with a reduced air flow rate, application of the pressure recuperator has a limited or negligible noise reduction effect.

To allow optimization of the performance of the accessory, combination with the speed adjuster or EC fans is necessary. In this last case, the higher efficiency of the EC fans (especially when operating at low speed) is added to the performance improvement generated by the pressure recuperator.

The accessory is supplied separately from the unit on one or more pallets and it must compulsorily be installed (by the customer) before the first start-up of the machine.





(a) fan only;

(b) fan with pressure recuperator

Hydraulic circuit accessories

V3M **3-way modulating valve**

This option is standard.

This accessory is useful in applications where fan management alone is not sufficient to regulate the capacity given by the free cooling coil. This can happen in applications where the load is very variable or when the outside air temperature can fall many degrees below zero.

IVPO **Soundproofed pump compartment**

This option is standard.

With this accessory, the motor and the impeller of the pumps are enclosed in a compartment that is fully soundproofed with sound absorbing material and soundproofing material.

RA **Antifreeze heater no-glycol execution**

These electric heaters are fitted on the pumps and in the tank (depending on the configuration of the machine) to prevent damage to the hydraulic components due to ice formation during periods when the machine is inactive.

Based on normal operating conditions and the percentage of glycol in the system, an appropriate "antifreeze alarm" temperature is set in the control. When a temperature that is 1K higher than the antifreeze alarm threshold is detected at the outlet from the exchanger, the pump (if present) and the antifreeze heaters are switched on. If the temperature of the outgoing water reaches the antifreeze alarm threshold, the compressors are stopped, keeping the heaters and the pumps active, and the general alarm contact of the machine is activated.

The antifreeze heater is present as standard on both heat exchangers.

VSIW **Water-side safety valve**

This option is standard.

With this accessory, a safety valve is inserted in the hydraulic circuit of the unit: when the calibration pressure is reached, the valve opens and, by discharging (to be routed by the customer), prevents the system pressure from reaching limits that are dangerous for the components present in the system. The valves have positive action, that is, performance is guaranteed even if the diaphragm deteriorates or breaks.

CORM **Connection for manual filling**

This accessory allows the system filling procedure to be carried out directly from the unit: on the fan holder cover, there is a 1'' filling valve and a 1/2'' air valve. Near the filling valve, there is also a pressure gauge for displaying the pressure in the hydraulic circuit. This accessory can be combined only with units provided with tank.

FLUS **Flow switch (instead of the water differential pressure switch)**

As an alternative to the differential pressure switch (standard flow sensor), it is possible to request the paddle flow switch as accessory. This detects when there is no water flow to the user-side exchanger and sends a signal to the control of the unit that will stop the compressors to prevent damage to the exchangers.

Application of this accessory is compulsory for units that use non-glycol water and work with a yearly cycle where external air temperatures are zero or below.

The flow switch is supplied loose (installation by the customer) and replaces the water differential pressure switch (standard).

FW **Water filter**

To protect the elements of the hydraulic circuit (in particular, the exchangers), there are Y filters that can stop and settle the particles that are normally present in the water flow and would otherwise settle in the more delicate parts of the hydraulic circuit and damage its heat exchange capacity.

Installation of the water filter is mandatory even when it is not supplied as an accessory.

Accessory supplied loose.

Flowzer options

Our range of Flowzer options offers flexible and scalable solutions to set the speed of pumps in the system with a view to optimising and reducing energy consumption.Different types of control modes are offered based on the system and application type:

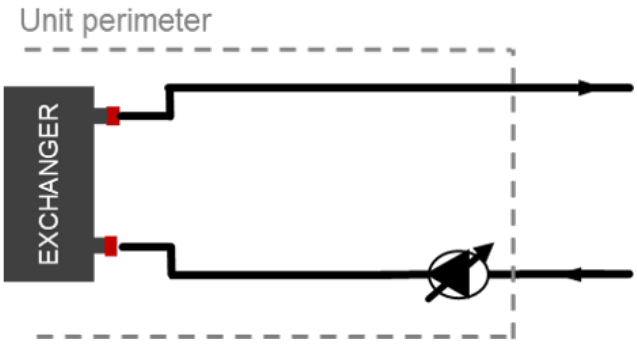
- FLOWZER VP - Inverter for manual pump adjustment
- FLOWZER VD - control of available pump discharge head for variable flow systems without monitoring the flow rate limits;
- FLOWZER VDE - flow rate control to keep the flow rate constant as the external working conditions of the system change;
- FLOWZER VDT - flow rate control with constant TD (difference between input and output temperature in the heat exchanger on the user side) in variable flow pumps, without monitoring the flow rate limits;
- FLOWZER VFPP - automatic management of variable flow rate in systems with one single primary circuit and a bypass valve;
- FLOWZER VPS - automatic management of variable flow rate, including balancing of flow rates between primary and secondary circuits;
- flowzer vps with TD-based control - automatic management of variable flow rate, including control with constant TD (difference between input and output temperature in the heat exchanger on the user side) in systems featuring both the primary and secondary circuits.

The tables below summarise the main system diagrams and show the application type and advantages/disadvantages offered by each solution. Each individual option is illustrated and explained individually in the next pages.

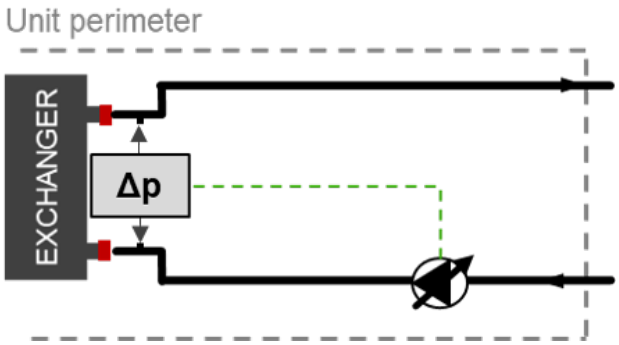
The hydraulic diagrams in this document are for exemplification purposes only and their main function is to help the reader understand the type of machines and devices the controller can manage.For a more technical evaluation of the system, please refer to the dedicated manual.

Constant flow system			
	Application	Advantages	Disadvantages
Flowzer VP	Ideal for constant flow systems The option is given to set two different speeds: one for heating and one for cooling mode or one for chiller and one for FC mode. This solution replaces the 2-way regulating valve.	- Increased efficiency: increased “REAL” EER of the unit installed, considering the power consumption of the pumps in real installation conditions and in real operating conditions. - Reduced installation times and costs: quick setup of water flow using the display.	This solution doesn't allow to save energy in the pump under part load conditions, due to the possibility to only set two frequency values in the inverter.
Flowzer VDE	Ideal for constant flow systems to keep the water flow to the heat exchanger constant under all conditions	- Plug&Play: provides for easy and flexible implementation as it is not supplied with options to be fitted therefore allows for quick commissioning.	This solution is less efficient as losses in the heat exchanger are kept constant under all conditions (including in cases when they may be reduced).

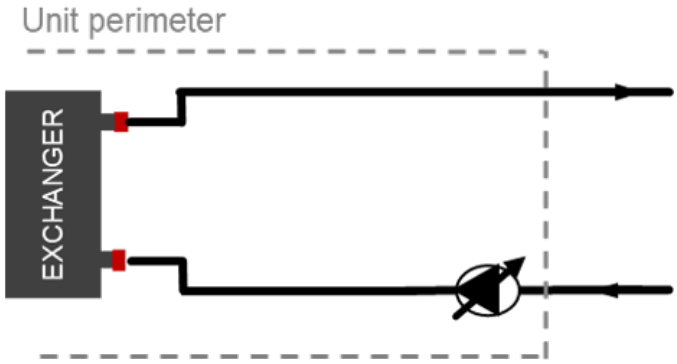
FLOWZER VP



FLOWZER VDE



FVP FLOWZER VP - Inverter for manual pump adjustment



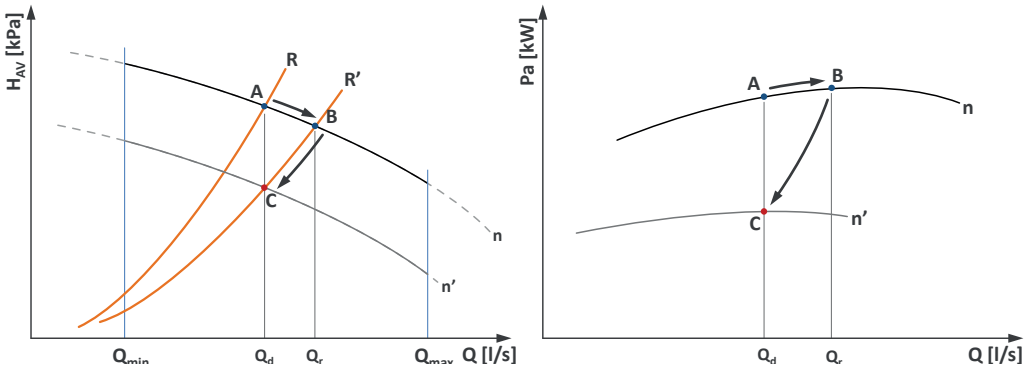
The accessory consists of inserting an inverter in the machine to manually adjust the speed of the pump (or pumps) in order to calibrate the pump flow rate on the head losses of the system.

This accessory is to be combined with one of the integrated hydraulic modules that can be selected for the unit.

Units equipped with integrated hydraulic module allow a certain level of available discharge head (point A) to be obtained under nominal flow rate conditions Qd.

But the actual head loss level of the system (e.g. characteristic curve R') normally causes the pump to find a different equilibrium point (point B), with a flow rate Qr higher than Qd.

In this condition, in addition to having a different flow from the nominal one (therefore also a different temperature jump), there is also a greater absorption of electric power from the pump itself.

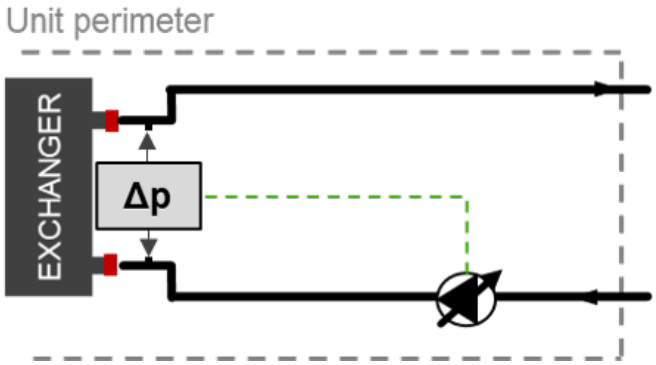


The use of the Flowzer allows the pump speed to be set manually (e.g. at speed n' instead of n) to obtain the design water flow rate and thermal gradient (point C). Once the adjustment procedure has been carried out, the pump will always work at a fixed flow rate.

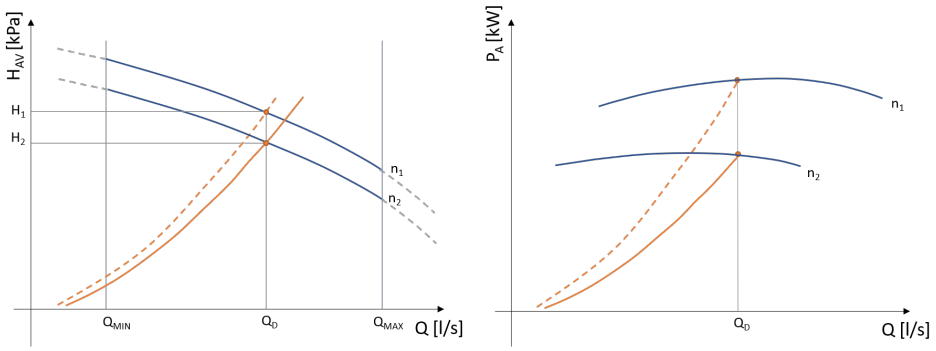
The adoption of the VP Flowzer allows to considerably reduce the electrical power consumption of the pump with a consequent energy saving. By way of example, a reduction in the flow rate of 10% leads to a reduction in power consumption of around 27%.

For the freecooling units the Flowzer VP is able to manage two different speeds of the pump automatically compensating the pressure drops of the water coil.

FVDE **FLOWZER VDE - flow rate control to keep the flow rate constant as the external working conditions of the system change;**



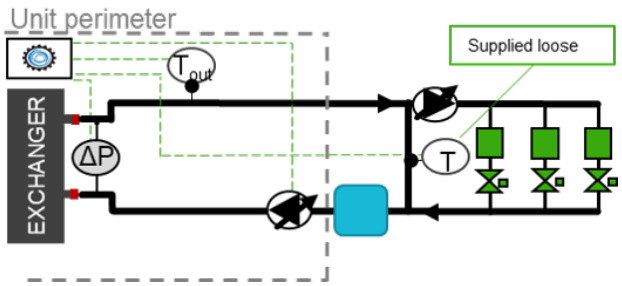
Flowzer VDE requires a differential pressure transducer to be installed in the machine. Through this transducer, the inverter can gauge the actual pressure at the ends of the heat exchanger installed in the machine and it can automatically adapt the pump speed for a constant flow value under all conditions. Flowzer VDE must be combined with Flowzer VP.



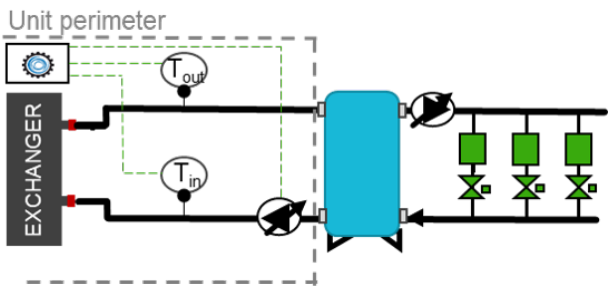
Flowzer VDE is used to automatically adjust the pump speed. As the graph shows, the inverter trips and increases the pump speed if a different condition occurs which would cause an undesired drop in the flow rate (e.g. operation of an external dry cooler). This is a more accurate solution than the VP option alone as it always provides for the water flow (Qd) required by the design conditions.

Variable flow system featuring primary and secondary circuits			
	Application	Advantages	Disadvantages
Flowzer VPS	Ideal for all systems featuring a primary and a secondary circuit divided by a hydraulic bypass branch	- Energy saving: the energy consumption during pumping operations can be cut down to 55% if compared with a traditional system - Enhanced comfort: correct balancing between primary and secondary loop	Only recommended in systems featuring a primary and a secondary circuit divided by a bypass pipe; not flexible for other applications
Flowzer VDT	Ideal for systems featuring similar users or users with similar operating conditions It is recommended in structured systems in which the client has third-party systems to control the min. and max. flow rate.	- Plug&Play: provides for easy and flexible implementation as it is not supplied with options to be fitted and for quick commissioning.	Risk of over- or underflow for some of the users in the secondary circuit if they have different operating conditions (same temperature difference) A control is required by third-party equipment to ensure compliance with the unit flow limits.
FLOWZER VPS with TD-based control	Ideal for systems featuring similar users or users with similar operating conditions Ideal for systems featuring a primary and a secondary circuits physically divided from the heat exchanger or a tank with multiple connections.	- Plug&Play: provides for easy and flexible implementation as it is not supplied with options to be fitted and for quick commissioning.	Risk of over- or underflow for some of the users in the secondary circuit if their temperature difference is not the same due to the existing operating conditions

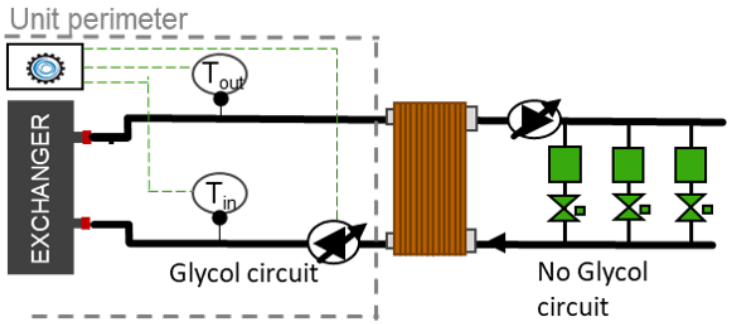
FLOWZER VPS



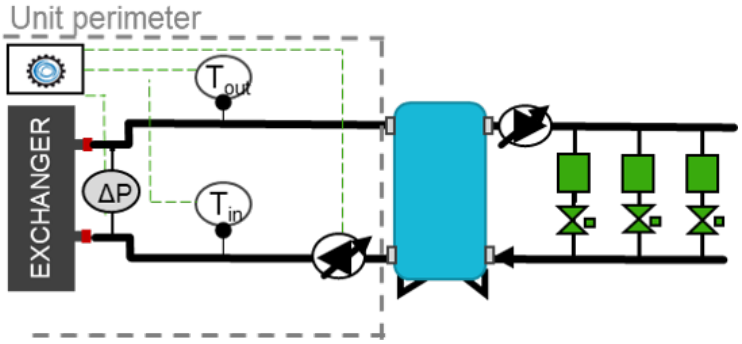
FLOWZER VDT



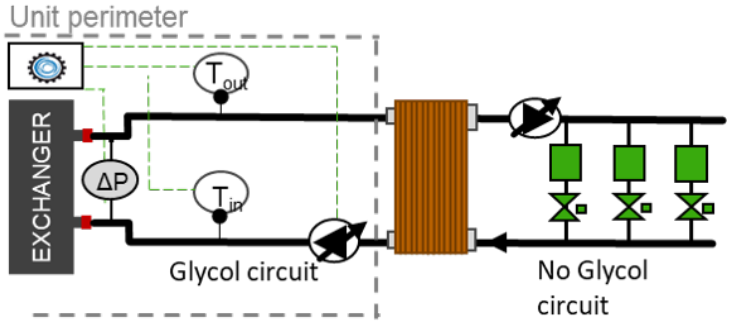
FLOWZER VDT



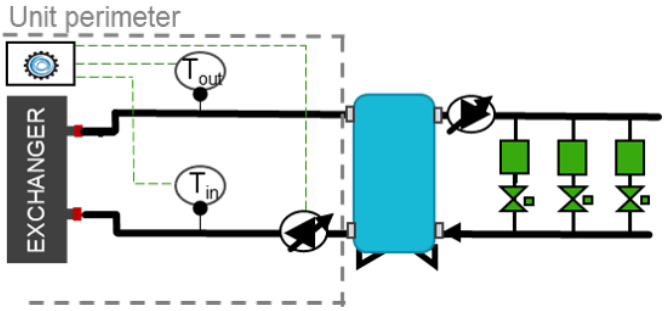
FLOWZER VPS with DT-based control



FLOWZER VPS with DT-based control



FVDT **FLOWZER VDT - flow rate control with constant TD (difference between input and output temperature in the heat exchanger on the user side) in variable flow pumps, without monitoring the flow rate limits;**



Flowzer VDT uses the temperature sensors installed at the inlet and outlet of the heat exchanger to automatically adjust the pump speed, thus keeping the T delta difference setpoint constant.

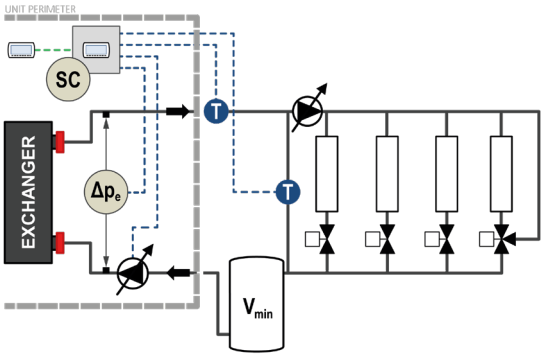
The option is not compatible with the Multilogic version. Please refer to the HYZER solutions for the compatibility between variable flow systems and multi-machine systems.

The unit must include the advanced Bluethink controller and just one heat exchanger on the user side.

With the Flowzer VDT, the customer can set, directly on the display, the available delta T value that the unit must maintain. The customer will have to check that, in minimum flow rate conditions (that is, with the maximum number of user points closed), this is always higher than or equal to the minimum flow rate allowed by the unit.

This option is specifically designed for systems in which the system users have similar operating conditions (same temperature difference).

FVPS FLOWZER VPS - automatic management of variable flow rate, including balancing of flow rates between primary and secondary circuits;



Bluethink solution for a variable flow rate system, consisting of a primary circuit plus secondary circuit.

Flowzer VPS includes:

- a differential pressure transducer, installed at the factory at the ends of the user-side heat exchanger of the unit (Δpe)
- a dedicated control system, installed at the factory in the electrical control panel of the unit (Sc)
- two system temperature sensors (T) - supplied separately; installation by the customer

Bluethink solution for a variable flow rate system, consisting of a primary circuit plus secondary circuit.

It is obligatory for the option to be combined with the Flowzer VP (inverter) and with one of the hydraulic modules that can be selected for the unit. The accessory is not compatible with Multilogic. Please contact our sales department for further details.

For single-circuit units in case of low system load (indicatively less than 50% of the nominal capacity of the unit at the given condition), the use of the variable flow rate may result in a greater oscillation of the supply water temperature than to a fixed flow management.

The option offers a complete default package to guarantee simple selection, purchasing and commissioning.

Flowzer VPS has the advantage of:

- being ideal for renovations of existing systems, especially for comfort applications
- achieving a complete variable flow system, with maximum energy saving
- implementing a flexible design, e.g. for scalable or multi-zone systems

The maximum energy saving is achieved thanks to the advanced algorithm, which prevents hunting by the inverter and balances the pump speed and the recirculation flow rate to a minimum.

With refurbishments, the system's capex is limited to the unit and its commissioning.

The dimensions of the inverter of the unit and of the pump module can be favoured by the low design discharge head of the primary circuit.

The operating principle can be summarized as follows:

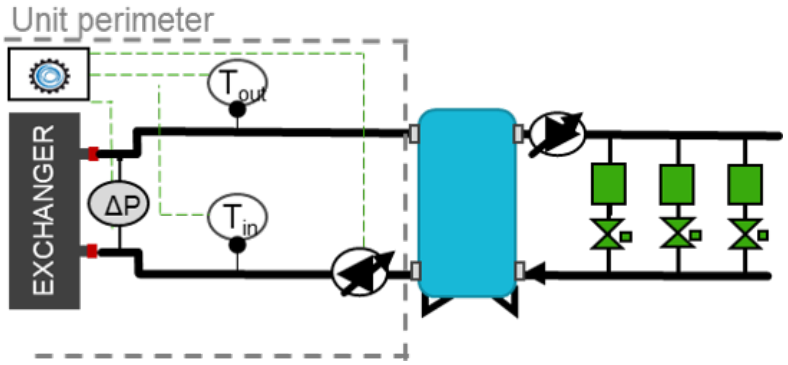
- Flowzer VPS performs a smart check of the flow rate in the primary circuit and balances it with the flow rate in the secondary circuit.
- the system controller modulates the pump speed according to the condition detected by the system sensors T
- if the system terminals are switched off, the flow rate of the secondary circuit will decrease; therefore the direction of flow is detected indirectly as temperature difference by the system sensors through the separator or the bypass pipe
- The check thus contributes to reducing the speed of the primary pump until the min. flow threshold in the heat exchanger of the unit is exceeded.
- this flow rate is indirectly monitored through the losses detected by the differential pressure transducer Δpe

In the required minimum load condition (that is, with all system terminals switched off) the necessary minimum volume (Vmin) must be ensured by the relevant tank to be installed between the unit and the separator or the bypass pipe.

The temperature sensors of the system T provide a 4-20 mA signal and require 1/2" female fittings.

Further details can be found in the relevant manual.

FVPD **FLOWZER VPS with TD-based control - automatic management of the variable flow rate, including control with constant temperature difference (TD) in the heat exchanger on the user side in systems featuring both the primary and secondary circuits.**



Bluethink solution for variable flow systems - ideal for systems featuring a primary and a secondary circuit physically divided by a heat exchanger or a tank with multiple connections.

flowzer vps with TD-based control includes:

- a differential pressure transducer, installed at the factory at the ends of the user-side heat exchanger of the unit (Δpe)

The option must be necessarily combined with the Flowzer VP (inverter) and with one of the hydraulic modules that can be selected for the unit. The option is not compatible with the Multilogic version. Please refer to the HYZER solutions for the compatibility between variable flow systems and multi-machine systems.

For single-circuit units in case of low system load (indicatively less than 50% of the nominal capacity of the unit at the given condition), the use of the variable flow rate may result in a greater oscillation of the supply water temperature than to a fixed flow management.

The option offers a complete default package to guarantee simple selection, purchasing and commissioning.

flowzer vps with TD-based control offers the following advantages:

- a full package that is easy to install as all the regulating devices are pre-assembled and pre-wired in the unit;
- achieving a complete variable flow system, with maximum energy saving
- the ideal solution to refurbish existing systems where the T different must be kept constant in the system, especially in comfort applications;

The maximum energy saving is achieved thanks to the advanced algorithm, which prevents hunting by the inverter and balances the pump speed and the recirculation flow rate to a minimum.

The dimensions of the inverter of the unit and of the pump module can be favoured by the low design discharge head of the primary circuit.

The operating principle can be summarized as follows:

- flowzer vps with TD-based control performs smart monitoring of the flow rate in the primary circuit, keeping the T difference constant in the heat exchanger;
- the system controller modulates the pump speed according to the condition detected by the temperature sensors (T) in the system, which are installed at the inlet and outlet of the heat exchanger on the user side;
- the difference in the water temperature (T) and flow rate are inversely proportional, which is why if the T difference is reduced at the same performance level, the water flow exceeds the flow required by the system and the pump speed is reduced in order to save energy;

on the other hand, when the load increases, the T difference increases in the system and the pump speed is increased accordingly.

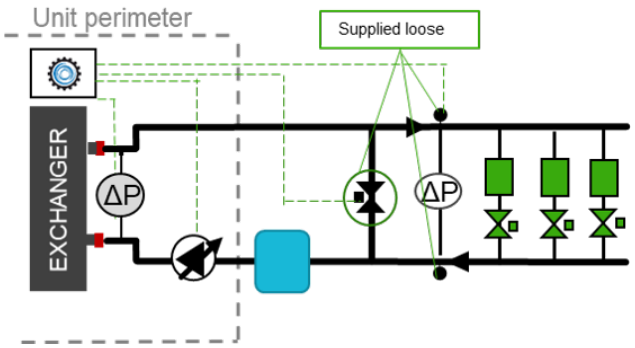
- The check contributes to reducing/increasing the speed of the pump in the primary circuit until the min./max. flow threshold admitted in the heat exchanger of the unit is exceeded.
- this flow rate is indirectly monitored through the losses detected by the differential pressure transducer Δpe

The temperature sensors of the system output a 4-20 mA signal.

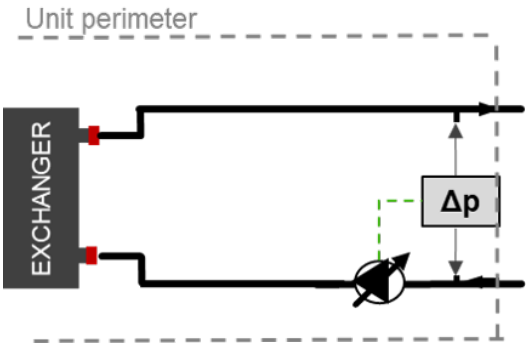
Further details can be found in the relevant manual.

Variable flow system featuring primary circuit only			
	Application	Advantages	Disadvantages
Flowzer VFPP	Ideal for new systems intended to reduce installation costs	- Energy saving: the energy consumption during pumping operations can be cut down to 50% if compared with a traditional system Lower CAPEX thanks to reduced installation costs and smaller number of components (one pump less)	Requires some testing to correctly set the pressure available in the system and to correctly position the two transducers, based on the system layout and devices.
Flowzer VD	Ideal for systems fitted with changing users according to the season. Ideal for industrial processes, such as injection moulding, in order for each terminal to operate with the correct discharge head. It is recommended in structured systems in which the client has third-party systems to control the min. and max. flow rate.	- Plug&Play: provides for easy and flexible implementation as it is not supplied with options to be fitted therefore allows for quick commissioning.	A control is required by third-party equipment to ensure compliance with the unit flow limits.

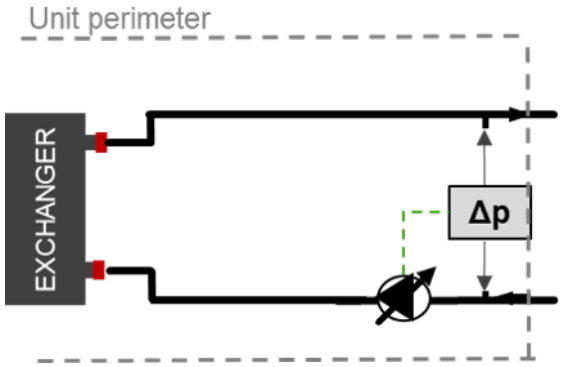
Flowzer VFPP



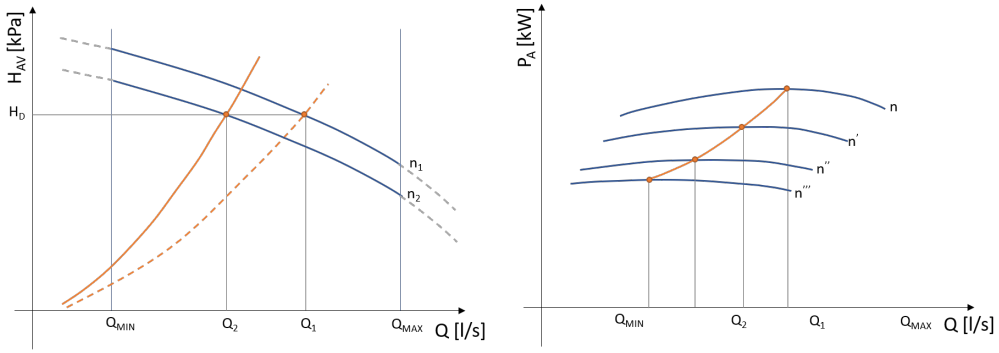
Flowzer VD



FVD FLOWZER VD - control of available pump discharge head for variable flow systems without monitoring the flow rate limits;



Flowzer VD requires two pressure transducers to be installed in the machine. Through these transducers, the inverter can gauge the actual pressure at the ends of the system and it can automatically adapt the pump speed to obtain a set available discharge head value. Flowzer VD must be combined with Flowzer VP. This accessory therefore allows a constant pressure system to be achieved.



With the Flowzer VD, the customer can set, directly on the display, the available discharge head value (Hd) that the unit must maintain. As can be seen from the graph as the user request decreases, the resistant curve of the plant moves to the left, consequently the inverter reduces the speed of the pump in order to maintain the useful head necessary for the unit. With this system a significant reduction in electrical power is achieved. The customer will have to check that, in minimum flow rate conditions (that is, with the maximum number of user points closed), this is always higher than or equal to the minimum flow rate allowed by the unit.

This accessory is useful when the total head losses of the circuit are slightly variable or when they change depending on the seasons (for example, some user points are active only during summer operation and not during winter operation).

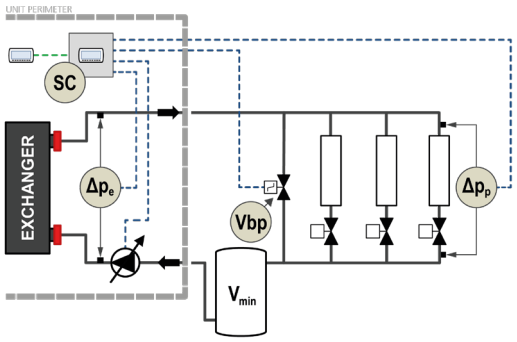
The use of this accessory also allows the pump speed to be adapted to possible fouling of the filter on the hydraulic circuit.

FVF **FLOWZER VFPP - automatic management of variable flow rate in systems with one single primary circuit and a bypass valve;**

Bluethink solution for a variable flow rate system, consisting solely of a user-side primary circuit.

Flowzer VFPP includes:

- a pressure transducer installed at the ends of the user-side exchanger (Δpe)
- a dedicated control system, installed at the factory in the electrical control panel of the unit (Sc)
- a modulating bypass valve with servo-motor supplied separately with it (Vbp), supplied loose (installation by the customer)
- two system pressure transducers (Δpp) supplied separately (installation by the customer)



It is obligatory for the option to be combined with the Flowzer VP (inverter) and with one of the hydraulic modules that can be selected for the unit. The accessory is not compatible with Multilogic. Please contact our sales department for further details.

For single-circuit units in case of low system load (indicatively less than 50% of the nominal capacity of the unit at the given condition), the use of the variable flow rate may result in a greater oscillation of the supply water temperature than to a fixed flow management.

The option offers a complete default package to guarantee simple selection, purchasing and commissioning.

Flowzer VFPP has the advantage of:

- implementing an innovative design, which is alternative to the classic system based on fixed flow-rate primary circuit plus secondary circuit
- being ideal for new or entirely redesigned systems, especially for comfort applications
- having a variable flow system, with maximum energy saving
- simplifying the layout of the user circuit
- limiting the capex of the system
- performing a reliable check

The Flowzer VFPP system controller uses an advanced algorithm that enables prevention of unnecessary waste of energy and hunting by the inverter and the bypass valve.

The capex of the system is also reduced thanks to:

- single inverter + pumping module, integrated in the unit
- small internal footprint, due to the simplified layout

The operating principle can be summarized as follows:

- Flowzer VFPP carries out constant control of the discharge head
- the controller modulates the pump speed according to the signal detected by the system transducers Δpp
- as the demand from the system goes down, the pump speed will be reduced.
- the pump speed can be reduced until it reaches the minimum allowed flow rate on the heat exchanger of the unit
- this flow rate is indirectly monitored through the losses detected by the differential pressure transducer Δpe
- When the minimum allowed flow rate threshold is exceeded, the control system will open the bypass valve Vbp to recirculate the flow rate that is not required by the system, but is necessary to guarantee the minimum flow rate to the heat exchanger.

In the required minimum load condition (that is, with all system terminals switched off) the necessary minimum volume (Vmin) must be ensured by the relevant tank to be installed between the unit and the separator or the bypass pipe.

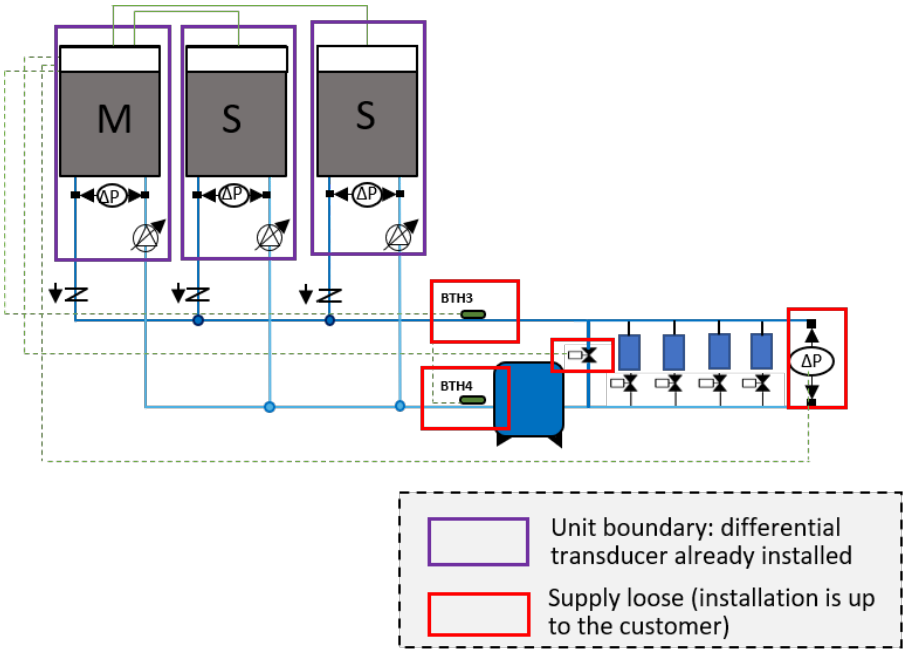
The bypass valve Vbp is controlled through a 0-10 V signal and must therefore be installed within 30 m of the unit.

The pressure transducers of the system Δpp provide a 4-20 mA signal and require two 1/4" female fittings. These transducers must be installed within 200 m of the unit, near the system terminal that is affected by the highest line head losses or in any case in a position where it is possible to measure an adequate pressure value.

Further details can be found in the relevant manual.

HFx HYZER E VFPP function

The HYZER E VFPP function combines the Multilogic function, which is designed to manage multi-machine systems, with the FLOWZER VFPP control for variable flow systems.



It is obligatory for the option to be combined with the Flowzer VP (inverter) and with one of the hydraulic modules that can be selected for the unit.

The unit must include the advanced Bluethink controller, just one heat exchanger on the user side and a minimum capacity step of 25% or less.

Units operate according to the Master/Slave logic that is typical of a Multilogic system. For additional details, please refer to the FMx option.

The HYZER E function requested with the unit can be:

- **HF0:** HYZER E VFPP function for Slave units;
- **HF2:** HYZER E VFPP function for the Master unit in order to manage up to 2 Slave units;
- **HF6:** HYZER E VFPP function for the Master unit in order to manage up to 6 Slave units.

If you need to connect more than 6 slaves (up to 31), you can ask for a quotation from our sales department.

For the slave units, the accessory requires:

- programming of the unit as slave of a system of machines in Multilogic network

For the master units, the accessory requires:

- programming of the unit as master of a system of machines in Multilogic network
- entering of the parameters necessary for connection with the individual slave units
- installation in the electrical control panel of a network switch to allow the units to be connected in a LAN network.
- the supply of 2 temperature probes to be positioned on the delivery and return manifold for system thermoregulation (supplied with the system - installation and wiring by the customer);
- the supply of two pressure transducers (supplied with the system - installation and wiring by the customer) to be installed near the system terminal that is affected by the highest head losses in the line or in any case in a position where it is possible to measure an adequate pressure value.
- The option also includes the supply of a bypass valve controlled by a 0-10 V signal, which must be selected in function of the system capacity. Please refer to the VBx options for correct selection.

The connection between the master unit and the slave units made with a CAT cable. 5E/UTP (prepared by the customer) with RJ45 connectors. Maximum cable length 100m.

For further details, please refer to the controller manual.

VBx VFPP bypass valve for HYZER E

The option is supplied with the bypass valve, which is selected according to the system capacity.

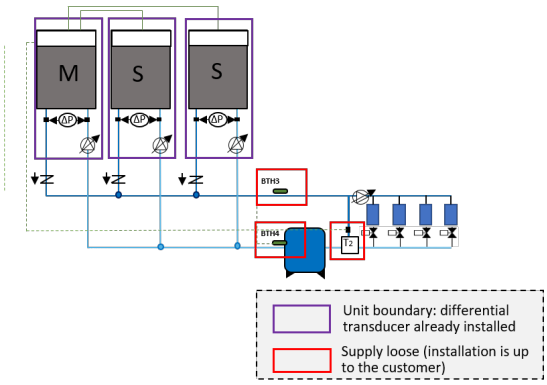
This option must be selected with either the "HYZER E VFPP function for Master unit to manage up to 2 Slave units" or "HYZER E VFPP function for Master unit to manage up to 6 Slave units".

	System capacity range**	Quantity	Diameter	Qmax**
	kW	-	in	m³/h
S_A	<240	1	2 1/2"	41.3
S_B	240÷335	1	3"	57.6
S_C	335÷570	1	4"	98
S_D	570÷850	1	5"	146.2
S_E	850÷1250	1	6"	215
S_F	1250÷1700	2	2 x 5''	2 x 146.2
S_G	1700÷2500	2	2 x 6''	2 x 215

** values based on a 5 °C temperature difference between the delivery and the return temperature

HSx HYZER E VPS function

The HYZER E VPS function combines the Multilogic function, which is used to manage multi-machine systems, with the FLOWZER VPS control for variable flow systems.



It is obligatory for the option to be combined with the Flowzer VP (inverter) and with one of the hydraulic modules that can be selected for the unit.

The unit must include the advanced Bluethink controller, just one heat exchanger on the user side and a minimum capacity step of 25% or less.

Units operate according to the Master/Slave logic that is typical of a Multilogic system. For additional details, please refer to the FMx option.

VPS control requires the installation on the machine of a differential transducer at the ends of the user-side heat exchanger in order to keep the flow rate in the system within a specific min. value allowed.

For additional details on the FLOWZER VPS logic, please refer to the dedicated FVPS option.

The networked units may be of different types, and the same observations as for the Multilogic option apply:

- if there are both chiller units and heat pumps in the network, the Master unit must obligatorily be one of the HP units;
- if there are both free-cooling and non free-cooling units in the network, the Master unit must obligatorily be one of the free-cooling units.

The HYZER E function requested with the unit can be:

- **HS0:** HYZER E VPS function for Slave units;
- **HS2:** HYZER E VPS function for the Master unit in order to manage up to 2 Slave units;
- **HS6:** HYZER E VPS function for the Master unit in order to manage up to 6 Slave units.

If you need to connect more than 6 slaves (up to 31), you can ask for a quotation from our sales department.

For the slave units, the accessory requires:

- programming of the unit as slave of a system of machines in Multilogic network

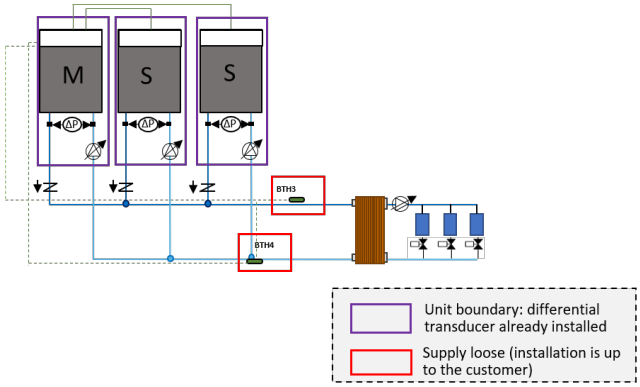
For the master units, the accessory requires:

- programming of the unit as master of a system of machines in Multilogic network
- entering of the parameters necessary for connection with the individual slave units
- installation in the electrical control panel of a network switch to allow the units to be connected in a LAN network.
- the supply of 2 temperature probes to be installed on the delivery manifold and on the bypass branch, which are typical of VPS control (supplied with the system - installation and wiring by the customer).

The connection between the master unit and the slave units made with a CAT cable. 5E/UTP (prepared by the customer) with RJ45 connectors. Maximum cable length 100m.

For further details, please refer to the controller manual.

HDx HYZER E VPS with DT-based control function



The HYZER E VPS with TD-based control function combines the Multilogic function, which is used to manage multi-machine systems, with the FLOWZER VPS with DT-based control control for variable flow systems.

It is obligatory for the option to be combined with the Flowzer VP (inverter) and with one of the hydraulic modules that can be selected for the unit.

The unit must include the advanced Bluethink controller, just one heat exchanger on the user side and a minimum capacity step of 25% or less.

Units operate according to the Master/Slave logic that is typical of a Multilogic system. For additional details, please refer to the FMx option.

VPS with DT-based control control requires the installation on the machine of a differential transducer at the ends of the user-side heat exchanger in order to keep the flow rate in the system within a specific min. value allowed.

For additional details on the FLOWZER VPS with TD-based control logic, please refer to the dedicated FVPS with DT-based control option.

The networked units may be of different types, and the same observations as for the Multilogic option apply:

- if there are both chiller units and heat pumps in the network, the Master unit must obligatorily be one of the HP units;
- if there are both free-cooling and non free-cooling units in the network, the Master unit must obligatorily be one of the free-cooling units.

The HYZER E function requested with the unit can be:

- **HD0:** HYZER E VPS with TD-based control function for Slave units;
- **HD2:** HYZER E VPS with TD-based control function for the Master unit in order to manage up to 2 Slave units;
- **HD6:** HYZER E VPS with TD-based control function for the Master unit in order to manage up to 6 Slave units.

If you need to connect more than 6 slaves (up to 31), you can ask for a quotation from our sales department.

For the slave units, the accessory requires:

- programming of the unit as slave of a system of machines in Multilogic network

For the master units, the accessory requires:

- programming of the unit as master of a system of machines in Multilogic network
- entering of the parameters necessary for connection with the individual slave units
- installation in the electrical control panel of a network switch to allow the units to be connected in a LAN network.

The connection between the master unit and the slave units made with a CAT cable. 5E/UTP (prepared by the customer) with RJ45 connectors. Maximum cable length 100m.

For further details, please refer to the controller manual.

PVX **Variable flow setup for HYZER X**

The dedicated HYZER X controller is designed to manage the different units, devices and components that make up a hydronic system.

Systems featuring this controller require that the PVX option be installed at the ends of the user-side heat exchanger of a differential pressure transducer so that the machine is set up for variable flow rate control.

This option is mandatory in all units making up the system.

For additional information on the product HYZER X, please refer to the specific technical catalogue.

VIX **Shut-off valves for systems with external pumps for HYZER X**

Systems featuring the HYZER X controller enable the selection of the shut-off valve used in systems that have an external pumping unit.

The option is always supplied separately from the unit and is for installation by the customer.

FLMX **User-side flow meter for HYZER X**

Systems featuring the HYZER X controller enable the selection of the flow meter option to calculate the flow rate and the performances of the units.

The option is supplied with the system for installation on the user side (installation by customer).

Electrical accessories

Some accessories may be incompatible with each other even if not expressly indicated.

CA **Advanced control**
The unit is supplied as standard with an advanced controller.

A43N **Power supply 400/3+N/50**
The standard power supply of the unit

COTW **Outgoing water temperature control**
With this accessory, outgoing instead of incoming water temperature control is used.

SETD **Double set point from digital input**
The accessory allows you to preset two different operating set points and manage the change from one to the other through a digital signal.
The set point temperatures must be specified when ordering. For optimization of the unit, reference will be made to the lower set point in chiller mode and the higher set point in heat pump mode.
Unless otherwise specified in the order, the controller will be set at the factory with the following temperatures:
- in chiller mode, set point 1 to 7°C and set point 2 to 12°C

SETV **Variable set point with remote signal**
The accessory allows the set point to be varied continuously between two preset values, a maximum and a minimum, depending on an external signal that can be of the 0-1V, 0-10V or 4-20mA type.
The set point temperatures and the type of signal to use for the adjustment must be specified when ordering. For optimization of the unit, reference will be made to the lower set point in chiller mode and the higher set point in heat pump mode.
Unless otherwise specified in the order, the controller will be set at the factory with 0-10V analogue input and with the following temperatures:
- in chiller mode, 0V will correspond to a set point of 7°C and 10V will correspond to a set point of 12°C

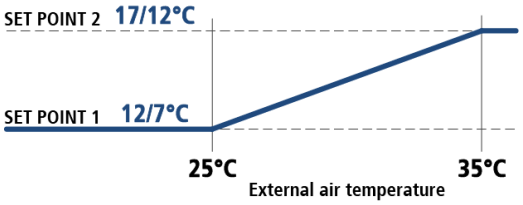
CP **Single potential free operating contacts**
This option is standard.
For units fitted with this accessory, there are clean contacts available on the terminal board inside the electrical box from which the customer can acquire signals that show the status of the unit's components (compressors, fans, pumps, alarms).

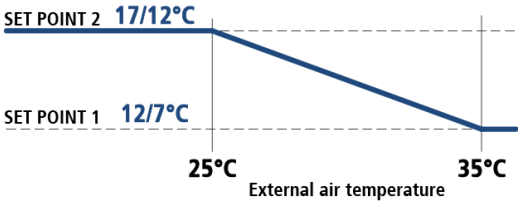
LIID **Limitation of the current absorbed by digital input**
When this accessory is requested, a digital input is prepared in the terminal board to activate the forced capacity reduction of the unit to a set fixed level.
This accessory is useful when there is a need to necessarily limit the power absorbed by the unit as regards particular conditions.
We point out that, in some conditions (for example, during defrosting, oil return cycles or hourly compressor rotation procedures), the controller could force the unit to operate at full capacity for limited periods of time.

CSP **Set point compensation depending on external air temperature**

For units fitted with this accessory, the set point of the unit is set so that it can vary between two values, a maximum and a minimum, depending on the external air temperature. The compensation ramp and the maximum and minimum values of the set point can be changed by the user.

Unless otherwise specified in the order, the controller will be set to implement a positive compensation logic according to the temperatures shown in the following diagrams:





TERM **Remote-controlled user terminal panel**

This accessory allows the terminal normally situated on the machine to be replicated on a support situated at a distance. It is particularly suitable when the unit is placed in an area that is not easily accessible.

The accessory is supplied loose and is to be installed by the customer at a maximum distance of 120m from the unit. We advise using a cable of the following type: "TECO O.R. FE 2x2xAWG24 SN/ST/PUR".

For this accessory, there is a dedicated serial port.

RE1P **Relay for management of 1 external pump**

This accessory can be requested for units without pumps and allows a pump outside the machine to be controlled.

RE2P **Relay for management of 2 external pumps**

This accessory can be requested for units without pumps and allows two pumps outside the machine to be controlled with a running/stand-by logic by implementing a rotation on the hours of operation.

The two pumps are controlled by two separate relays.

IACV **Automatic circuit breakers**

With this accessory, automatic circuit breakers are installed instead of fuses for the protection of auxiliary loads. Also, the same accessory uses automatic circuit breakers with adjustable thermal overload protection to protect the compressors.

SQE **Heater for electrical control panel**

Electric heaters are positioned inside the electrical control panel and these prevent the formation of ice or condensation inside it.

ENM **Energy meter**

The accessory allows the main electrical quantities (including voltage, current, power) to be read on the three phases, via current transformer.

This accessory communicates with the BlueThink controller to supervise the monitored data. The values measured are then made available through the unit display and the web server.

ENML **Energy meter with current limiter**

The accessory allows the main electrical quantities (including voltage, current, power) to be read on the three phases, via current transformer.

This accessory communicates with the BlueThink controller to supervise the monitored data. The values measured are then made available through the unit display and the web server.

This accessory is designed to limit the maximum current the unit can absorb. The controller instantly checks the absorption levels and, where necessary, it applies a forced capacity reduction that keeps the absorbed current value below the stored threshold.

SUN **Heaters for operation with air below -25°C**

If the operating temperatures of the unit can extend below -25°C, specific measures must be adopted to guarantee correct operation of the unit and the reliability of critical components.

Depending on the limit temperature it is necessary to reach, use will be made of suitably positioned heaters and additional thermal protection up to adoption of special electrical conductors.

Network accessories

PBA **BACnet protocol over IP (Ethernet)**

The controller is set for use, in read and write mode, of the BACnet port on IP protocol.

By default, the programming gives read-only access to the control of the unit. Reading / writing access is activable on field with a service level.

PSN **SNMP protocol**

The accessory consists of a gateway that allows Ethernet connection to a SNMP manager supervision system.

The use of this accessory causes the RS485 serial port to be unavailable.

GLO **Modbus Lonworks Gateway**

With this accessory, a RS485/Lon gateway is installed inside the electrical control panel.

By default, the programming gives read-only access to the control of the unit. Reading / writing access is activable on field with a service level.

SMAR **Smartlink function predisposition**

This accessory makes it possible to connect the controller of the unit with the controller of a Swegon GOLD™ air handling unit via a simple serial cable, so allowing their operating logics to be merged into a single consciousness that pursues the maximum energy efficiency of the system. The RS485 serial interface is already included and dedicated to connection with Swegon units.

The option is incompatible with:

- double set point
- variable set point with remote signal
- summer/winter selection by digital input
- set point compensation depending on external air temperature
- multilogic
- all communication protocols.

SMAP **Setup of Smartlink+ functions**

This option is used to connect the controller in the unit with the controller of a Swegon GOLD™ air handling unit via the Ethernet port TCP/IP, so allowing the operating logics of hydronic and ventilation systems to be merged into a single logic for the achievement of maximum energy efficiency and comfort. This option is only available for units featuring an advanced controller and it is compatible with Multilogic and Hyzer systems only if the machine is the Master.

The option is incompatible with:

- double set point
- variable set point with remote signal
- set point compensation depending on external air temperature
- all communication protocols.

FMx Multilogic Function

The Multilogic function allows management of up to 32 units equipped with advanced Bluethink controller and connected in hydraulic parallel with each other.

On the basis of the information recorded by the temperature probes installed on the delivery and return manifolds of the system, with the master unit, a capacity request is generated that is distributed among the units connected in the Multilogic network according to settable priority and optimization logics.

If communication between the units fails or if the master is off-line, the slave units can continue to work according to the set thermoregulation parameters.

The connected units can be different from each other, in terms of capacity and set-up, provided the following rule is complied with: if there are both free cooling and non free-cooling units in the Multilogic network, the Master unit must obligatorily be one of the free-cooling units.

The Multilogic function that can be requested with the unit can be:

- **FM0:** Multilogic function for Slave unit
- **FM2:** Multilogic function for Master unit for managing up to 2 Slaves
- **FM6:** Multilogic function for Master unit for managing up to 6 Slaves

If you need to connect more than 6 slaves (up to 31), you can ask for a quotation from our sales department.

For the slave units, the accessory requires:

- programming of the unit as slave of a system of machines in Multilogic network

For the master units, the accessory requires:

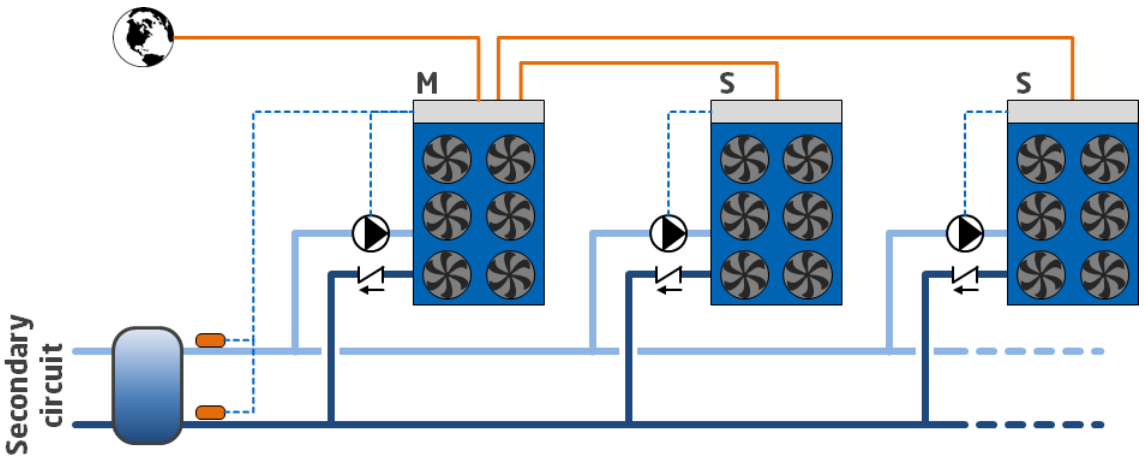
- programming of the unit as master of a system of machines in Multilogic network
- entering of the parameters necessary for connection with the individual slave units
- installation in the electrical control panel of a network switch to allow the units to be connected in a LAN network.
- the supply of 2 temperature probes to be positioned on the delivery and return manifold of the system (supplied separately with it, installation and wiring by the customer)

The connection between the master unit and the slave units made with a CAT cable. 5E/UTP (prepared by the customer) with RJ45 connectors. Maximum cable length 100m.

When other free cooling units are present, besides the master, in the same network of machines, it is possible to activate the Multifree function: this function allows the master to activate the free cooling sections of all the units in the network, even those whose compressors are off.

The Multifree function therefore makes it possible to have a free cooling section equivalent to the sum of the individual sections, thereby obtaining a reduction in the Total Free-cooling Temperature, an increase in the free cooling capacity and therefore less use of the compressors with consequent saving of absorbed energy.

For further details, please refer to the controller manual.



BEET Blueye® via Ethernet

Blueye® is a supervision platform that enables remote monitoring of one or more units in the same system interconnected through a network with Modbus protocol.

This accessory features the Blueye device, as already installed and wired in the unit.

The critical variables to be monitored over time are identified for each connected device. These variables are sampled and saved to the cloud so that they are accessible at all times through a web portal or a mobile APP (available for Android and iOS).

The following options can be selected for connection to the internet:

- a LAN (Ethernet) connection - available in the system;
- a connection to a mobile network - at least 3G. The data SIM card is not included.

Three different types of contracts can be signed.

Blueye® Cloud Basic:

- to monitor a max. of 20 variables in total over max. 5 units/peripherals;
- to set a min. sampling frequency of 60 seconds.

Blueye® Cloud Advanced:

- to monitor a max. of 200 variables in total over max. 10 units/peripherals;
- to set a min. sampling frequency of 5 seconds.

Blueye® Connect:

- To monitor up to 10 units/peripherals.

Subscribing to any of the **Blueye® Cloud** enables:

- viewing the history of the monitored variables, in the form of both numerical values and graphs;
- downloading the history of variables in CSV format;
- the creation of automatic reports;
- setting notifications (via APP or mail) with settable thresholds for each variable;
- switching the unit ON/OFF remotely;;
- changing the set point remotely;
- selection of SUMMER/WINTER mode remotely (for reversible units only).

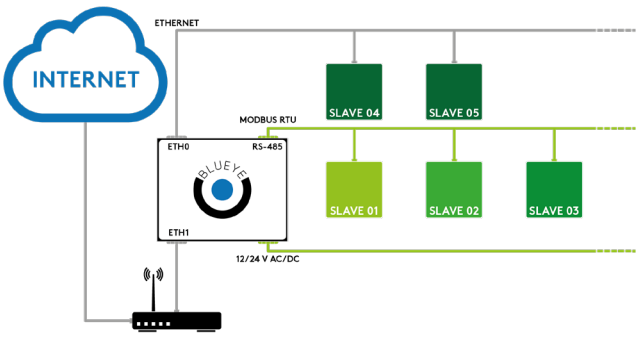
The subscription to the **Blueye® Connect** service offers the advantages below:

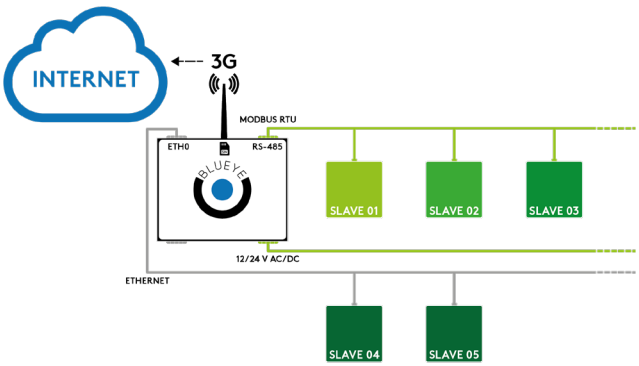
- a safe connection (tunnelling) between the user and the remote unit through the Blueye® portal;
- full access to the remote controller;
- real time monitoring;
- software upgrading.

Blueye® via Ethernet is only available for units supplied with an advanced controller and does not include any type of service. This service must be purchased separately based on the number of units/devices to be connected and the number of variables to be monitored. In order to connect multiple units to **Blueye® device, the network switch is required (this accessory is sold separately).**

Units can also be connected to the Blueye device through the RS485 network featuring a Modbus RTU protocol (for this option, refer to BERS accessory).

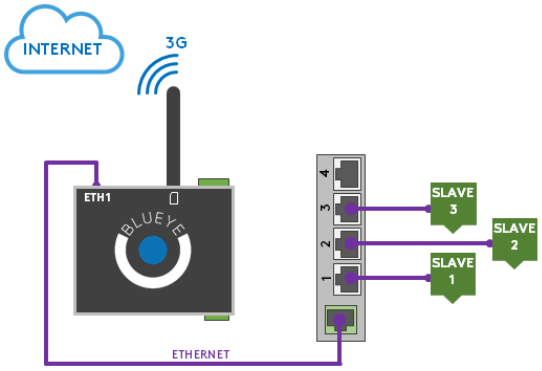
For further details, refer to the specific Blueye® documentation.





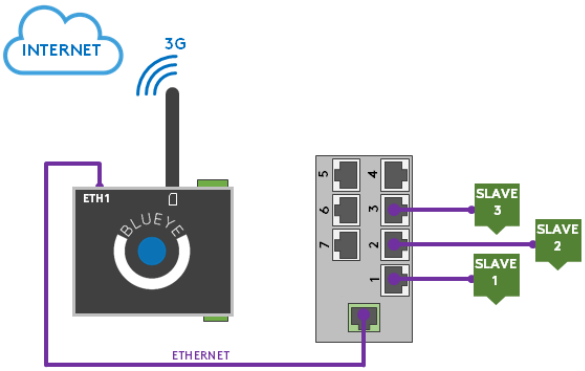
SW4P **Network switch with 4 ports**

The accessory includes installation in DIN rail of a professional 4-port network switch.Requires Blueye via Ethernet.



SW8P **Network switch with 8 ports**

The accessory includes installation in DIN rail of a professional 8-port network switch.
Requires Blueye via Ethernet.



WIFI **Wi-Fi**

The accessory includes the supply of a Hot Spot WiFi already installed, wired and configured, complete with antenna.This accessory requires the Ethernet port of the controller to be available or, alternatively, a network switch with at least one available port to be present in the machine.

Other accessories

AG **Rubber anti-vibration mounts**
These allow you to reduce the vibrations transmitted from the unit to the surface it is standing on.
Accessory supplied loose.

AM **Spring anti-vibration mounts**
These allow you to reduce the vibrations transmitted from the unit to the surface it is standing on.
Accessory supplied loose.

RAT **Anti-intrusion nets**
Specific option for condensing coil.
An arc-welded, painted net (RAL colour 7035) is installed to close off the external openings so as to prevent access to the technical compartment by unauthorized personnel.

RETE **Coil protection mesh with metal filter**
Coil protection mesh with hail-proof metal filter

SLIT **Special pallet/skid for container shipment**
The unit is placed on a skid that makes the container loading and unloading operations easier.
The accessory is mandatory if shipping by container is required

STL **Brackets for transport over long distances**
The accessory consists of adding reinforcing bars to the structural metalwork. This allows the strength of the structure to be increased for long distance road transport.

MCHE **E-coated microchannel coil**
The e-coated microchannel coils are treated by immersion of the whole exchanger in an emulsion of organic resins, solvents, ionic stabilisers and deionised water. This is all subjected to a suitable electric field that causes the formation of a solid, uniform deposit on the exchanger. The function of this deposit will be to protect the aluminium from corrosion without penalising its thermophysical properties.
Protective treatment of the exchanger is strongly recommended if at least one of the points below is verified:

- there are obvious signs of corrosion of the exposed metal surfaces in the installation area
- the installation is located close to the sea coast
- the prevailing winds come from the sea towards the unit
- the environment is industrial with a significant concentration of pollutants
- the environment is urban with a high population density
- the environment is rural with the presence of organic discharges and effluents.

With reference to the protection criteria to follow, especially for installations close to the coast, refer to the section titled "Installations that require the use of treated coils".

RAAL Cu/Al coils

This accessory uses finned pack coils with copper tubes and aluminium fins instead of microchannel coils.

ALPR Pre-painted aluminium coil

This option uses finned pack coils with copper tubes and pre-painted aluminium fins.

BFAP Pre-painted aluminium free-cooling coil

The treatment is applied exclusively to finned pack coils and aluminium fins for the free-cooling part.

ANTC Coil treated with anti-corrosion paints

The treatment is applied to the finned pack coils with copper pipes and aluminum fins and consists in the passivation of the aluminum with a polyurethane base through a procedure of immersion and then of a spray application of the coating that guarantees a double protection of the finning all over the exposure to the most aggressive environmental conditions even for more particular (or niche) process applications.

Specifically, the immersion process guarantees complete coverage of galvanic corrosion while the application of the spray protects the ends of the fins which represent the critical point for the initiation of the corrosion phenomenon.

BFAN Free cooling coil treated with anti-corrosion paints

Specific option for free-cooling coils.

The treatment is applied to the finned pack coils with copper pipes and aluminum fins and consists in the passivation of the aluminum with a polyurethane base through a procedure of immersion and then of a spray application of the coating that guarantees a double protection of the finning all over the exposure to the most aggressive environmental conditions even for more particular (or niche) process applications.

Specifically, the immersion process guarantees complete coverage of galvanic corrosion while the application of the spray protects the ends of the fins which represent the critical point for the initiation of the corrosion phenomenon.

The cross observation criterion is the most valid method of selection currently available without having to carry out preliminary tests or measurements with instruments.

Protective treatment of the exchanger is strongly recommended if at least one of the points below is verified:

- the presence of corrosive phenomena on the metal surfaces exposed in the installation area is evident
- the installation is located close to the sea coast
- the prevailing winds come from the sea towards the unit
- the installation is located close to the sea coast
- the environment is industrial with a significant concentration of pollutants
- the environment is urban with a high population density
- the environment is rural with the presence of organic discharges and effluents

With reference to the protection criteria to follow, especially for installations close to the coast, refer to the section titled "Installations that require the use of treated coils".

TECHNICAL SPECIFICATIONS

Titan SKY Hi R0 FC

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
Cooling											
Refrigeration capacity	(1)	kW	36.5	45.9	59.8	73.7	80.8	92.3	107.3	119	149.1
Total absorbed power	(1)	kW	11.3	13	17.8	25.1	23.5	27.2	33.6	35.8	50.1
EER	(1)		3.2	3.5	3.4	2.9	3.4		3.2	3.3	3
Free-Cooling											
Refrigeration capacity	(2)	kW	25.7	46	53.3	56	57.2	82.8	93.1	97.6	104.2
Amount of free cooling	(2)	%	71	100	89	76	71	90	87	82	70
TFT - Total Free-cooling Temperature		°C	0.5	5	3.8	1.8	0.8	3.8	3.5	2.8	0.7
Compressors											
Compressors/Circuits		n°	1							2	
Minimum capacity reduction step	(7)	%	46							23	
Refrigerant charge CH (MCHX)	(3)	kg	2.1	4	4.1	4.2	5.5	5.6	5.7	8.2	8.5
Refrigerant charge CH (Cu/Al)	(3)	kg	2.5	4.8	4.9	5	6.9	7	7.1	9.5	9.8
Fans											
Quantity		n°	2	1			2				
Total air flow rate CH (MCHX)		m³/h	11200	20500			41000				
Fans FC											
Quantity		n°	2	1				2			
Total air flow rate		m³/h	11200	20500				41000			
User side											
Number of heat exchangers		n°	1								
Water flow rate CH	(1)	m³/h	6.9	8.7	11.4	14	15.4	17.5	20.4	22.6	28.3
Total load losses with FC ON	(1)	kPa	94	113	145	125	148	134	127	144	192
Total load losses with FC OFF	(1)	kPa	66	75	71	81	90	104	82	89	111
Total internal volume	(1)	l	22	44	49	59	51	69	71	79	81
Noise levels											
Sound power level cooling	(4)	dB(A)	83		84	86		88			89
Sound pressure level cooling	(6)	dB(A)	51		52	54		56			57
Dimensions and weight											
Length		mm	2205	4150			4750	5350		5841	
Depth		mm	1130								
Height		mm	2038	2136						2400	
Operating weight		kg	-								

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

(1) Outside air temperature 30°C; inlet/outlet temperature of ethylene glycol 30% 15/10°C

(2) Outside air temperature 5°C; inlet/outlet temperature of ethylene glycol 30% 15/x°C

(3) Volume of water contained in the unit when it is working in free cooling mode. If present, the volume contained in the tank should also be considered.

(4) Unit operating at nominal operating capacity, without any accessories, with external air temperature of 30°C and user-side heat exchanger water inlet-outlet temperature of 15-10°C. Binding values. Values obtained from measures taken according to standard ISO 3744.

(5) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.

(6) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.

(7) The indicated refrigerant charge is calculated. The refrigerant charge can vary according to different versions/accessories and product updates.

** Basic unit without included accessories

Titan SKY Hi R0 FC SLN

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
Cooling											
Refrigeration capacity	(1)	kW	34.7	44.3	57	70.5	78.4	90.3	104	117.2	142.5
Total absorbed power	(1)	kW	11.8	13.2	18.3	26.1	23.9	27.6	34.2	36.1	52.2
EER	(1)		2.9	3.3	3.1	2.7	3.3		3	3.3	2.7
Free-Cooling											
Refrigeration capacity	(2)	kW	25.7	46	53.3	56	57.2	82.8	93.1	97.6	104.2
Amount of free cooling	(2)	%	74	104	94	79	73	92	89	83	73
TFT - Total Free-cooling Temperature		°C	0.5	5	3.8	1.8	0.8	3.8	3.5	2.8	0.7
Compressors											
Compressors/Circuits		n°	1							2	
Minimum capacity reduction step	(7)	%	46							23	
Refrigerant charge CH (MCHX)	(3)	kg	2.1	4	4.1	4.2	5.5	5.6	5.7	8.2	8.5
Refrigerant charge CH (Cu/Al)	(3)	kg	2.5	4.8	4.9	5	6.9	7	7.1	9.5	9.8
Fans											
Quantity		n°	2	1			2				
Total air flow rate CH (MCHX)		m³/h	7910	16000			32000				
Fans FC											
Quantity		n°	2	1				2			
Total air flow rate		m³/h	11200	20500				41000			
User side											
Number of heat exchangers		n°	1								
Water flow rate CH	(1)	m³/h	6.6	8.4	10.8	13.4	14.9	17.1	19.7	22.3	27.1
Total load losses with FC ON	(1)	kPa	94	113	145	125	148	134	127	144	192
Total load losses with FC OFF	(1)	kPa	66	75	71	81	90	104	82	89	111
Total internal volume	(1)	l	22	44	49	59	51	69	71	79	81
Noise levels											
Sound power level cooling	(4)	dB(A)	81		82	84			86		87
Sound pressure level cooling	(6)	dB(A)	49		50	52			54		55
Dimensions and weight											
Length		mm	2200	4150			4750	5350		5841	
Depth		mm	1130								
Height		mm	2136							2400	
Operating weight		kg	-								

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils
(1) Outside air temperature 30°C; inlet/outlet temperature of ethylene glycol 30% 15/10°C
(2) Outside air temperature 5°C; inlet/outlet temperature of ethylene glycol 30% 15/x°C
(3) Volume of water contained in the unit when it is working in free cooling mode. If present, the volume contained in the tank should also be considered.
(4) Unit operating at nominal operating capacity, without any accessories, with external air temperature of 30°C and user-side heat exchanger water inlet-outlet temperature of 15-10°C. Binding values. Values obtained from measures taken according to standard ISO 3744.
(5) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
(6) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
(7) The indicated refrigerant charge is calculated. The refrigerant charge can vary according to different versions/accessories and product updates.
** Basic unit without included accessories

Titan SKY Hi R0 FC NG

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
Cooling											
Refrigeration capacity	(1)	kW	37.4	47.2	61.5	75.7	82.9	94.8	110.2	120.9	151.4
Total absorbed power	(1)	kW	11.3	13	17.9	25.2	23.6	27.3	33.7	35.8	50
EER	(1)		3.3	3.6	3.4	3	3.5		3.3	3.4	3
Free-Cooling											
Refrigeration capacity	(2)	kW	18.5	32.6	39.5	41	43.6	61.4	68.7	71.4	76.1
Amount of free cooling	(2)	%	49	69	64	54	52	65	62	59	50
TFT - Total Free-cooling Temperature		°C	-2.6	1.6	0.9	-1.2	-2	0.7	0.5	-0.1	-2.5
Compressors											
Compressors/Circuits		n°	1							2	
Minimum capacity reduction step	(7)	%	46							23	
Refrigerant charge CH (MCHX)	(3)	kg	2.1	4	4.1	4.2	5.5	5.6	5.7	8.2	8.5
Refrigerant charge CH (Cu/Al)	(3)	kg	2.5	4.8	4.9	5	6.9	7	7.1	9.5	9.8
Fans											
Quantity		n°	2	1			2				
Total air flow rate CH (MCHX)		m³/h	11200	20500			41000				
Fans FC											
Quantity		n°	2	1				2			
Total air flow rate		m³/h	11200	20500				41000			
User side											
Number of heat exchangers		n°	1+1								
Water flow rate CH	(1)	m³/h	6.4	8.1	10.6	13	14.3	16.3	19	20.8	26.1
Total load losses with FC ON	(1)	kPa	78	87		99	71	75	92	101	93
Total internal volume	(1)	l	22	44	49	59	51	69	71	79	81
Noise levels											
Sound power level cooling	(4)	dB(A)	83		84	86		88			89
Sound pressure level cooling	(6)	dB(A)	51		52	54		56			57
Dimensions and weight											
Length		mm	2200	4150			4750	5350		5841	
Depth		mm	1130								
Height		mm	2136							2405	
Operating weight		kg	-								

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils
(1) Outside air temperature 30°C; inlet/outlet temperature of ethylene glycol 30% 15/10°C
(2) Outside air temperature 5°C; inlet/outlet temperature of ethylene glycol 30% 15/x°C
(3) Volume of water contained in the unit when it is working in free cooling mode. If present, the volume contained in the tank should also be considered.
(4) Unit operating at nominal operating capacity, without any accessories, with external air temperature of 30°C and user-side heat exchanger water inlet-outlet temperature of 15-10°C. Binding values. Values obtained from measures taken according to standard ISO 3744.
(5) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
(6) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
(7) The indicated refrigerant charge is calculated. The refrigerant charge can vary according to different versions/accessories and product updates.
** Basic unit without included accessories

Titan SKY Hi R0 FC NG SLN

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
Cooling											
Refrigeration capacity	(1)	kW	35.5	45.5	58.4	72	80.5	92.5	106.8	119.1	143.9
Total absorbed power	(1)	kW	11.9	13.3	18.5	26.4	23.9	27.7	34.4	36.1	52.5
EER	(1)		3	3.4	3.2	2.7	3.4	3.3	3.1	3.3	2.7
Free-Cooling											
Refrigeration capacity	(2)	kW	18.5	32.6	39.5	41	43.6	61.4	68.7	71.4	76.1
Amount of free cooling	(2)	%	52	71	68	57	54	66	64	60	53
TFT - Total Free-cooling Temperature		°C	-2.6	1.6	0.9	-1.2	-2	0.7	0.5	-0.1	-2.5
Compressors											
Compressors/Circuits		n°	1							2	
Minimum capacity reduction step	(7)	%	46							23	
Refrigerant charge CH (MCHX)	(3)	kg	2.1	4	4.1	4.2	5.5	5.6	5.7	8.2	8.5
Refrigerant charge CH (Cu/Al)	(3)	kg	2.5	4.8	4.9	5	6.9	7	7.1	9.5	9.8
Fans											
Quantity		n°	2	1			2				
Total air flow rate CH (MCHX)		m³/h	7910	16000			32000				
EC fans											
Quantity		n°	2	1				2			
Total air flow rate		m³/h	11200	20500				41000			
User side											
Number of heat exchangers		n°	1+1								
Water flow rate CH	(1)	m³/h	6.1	7.8	10.1	12.4	13.9	15.9	18.4	20.5	24.8
Total load losses with FC ON	(1)	kPa	78	87		99	71	75	92	101	93
Total internal volume	(1)	l	22	44	49	59	51	69	71	79	81
Noise levels											
Sound power level cooling	(4)	dB(A)	81		82	84		86			87
Sound pressure level cooling	(6)	dB(A)	50	49	50	52		54			55
Dimensions and weight											
Length		mm	2200	4150			4750	5350		5841	
Depth		mm	1130								
Height		mm	2136							2405	
Operating weight		kg	-								

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils
(1) Outside air temperature 30°C; inlet/outlet temperature of ethylene glycol 30% 15/10°C
(2) Outside air temperature 5°C; inlet/outlet temperature of ethylene glycol 30% 15/x°C
(3) Volume of water contained in the unit when it is working in free cooling mode. If present, the volume contained in the tank should also be considered.
(4) Unit operating at nominal operating capacity, without any accessories, with external air temperature of 30°C and user-side heat exchanger water inlet-outlet temperature of 15-10°C. Binding values. Values obtained from measures taken according to standard ISO 3744.
(5) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
(6) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
(7) The indicated refrigerant charge is calculated. The refrigerant charge can vary according to different versions/accessories and product updates.
** Basic unit without included accessories

ECODESIGN

INTRODUCTION

The Ecodesign/ErP Directive (2009/125/EC) lays down new standards for more efficient energy use.

The Directive contains various regulations; as regards chiller products and heat pumps, the regulations of interest are the following:

- Regulation 2013/813, for small heat pumps (Pdesign ≤ 400 kW)
- Regulation 2016/2281, for chillers and heat pumps with Pdesign > 400 kW
- Regulation 2013/811, for heat pumps with Pdesign ≤ 70 kW.

The last-mentioned regulation (2013/811) regards the labelling (Ecolabel certification) of small heat pumps.

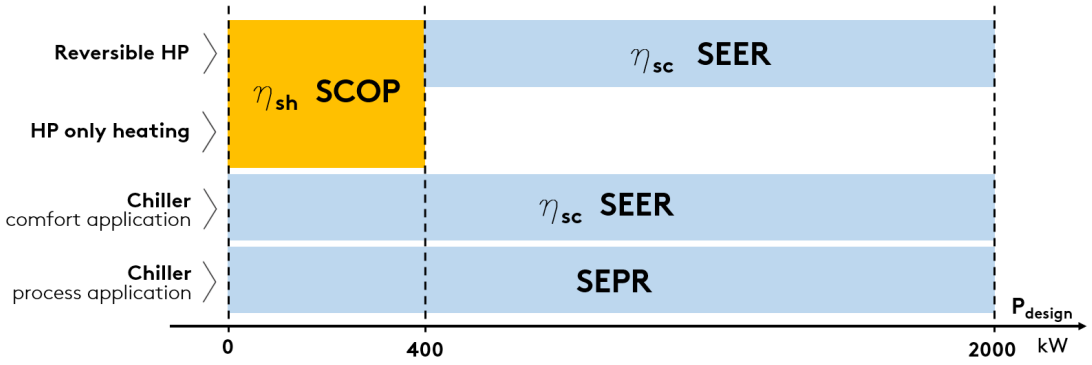
The other two regulations (2013/813 and 2016/2281) set seasonal efficiency targets that the products must comply with to be sold and installed in the European Union (essential requirement for CE marking).

These efficiency limits are defined through ratios, which are respectively:

- ηsh (SCOP), with reference to regulation 2013/813
- ηsc (SEER) for comfort applications and SEPR for process applications, with reference to regulation 2016/2281.

As regards regulation 2016/2281, with effect from 1st January 2021, the required minimum efficiency limit will be raised (Tier 2) from the current threshold (Tier 1).

The figure below schematically illustrates the correspondence between product and reference energy ratio.



Some notes and clarifications:

For comfort applications, regulation 2016/2281 sets the ηsc (SEER) ratio in two different operating conditions:

- SEER calculated with machine inlet/outlet water temperature of 12/7°C (low temperature application),
- SEER calculated with machine inlet/outlet water temperature of 23/18°C (medium temperature application).

The minimum efficiency requirement is the same, but can be met at condition 12/7°C or at condition 23/18°C, depending on the application envisaged for the machine.

Regulation 2013/813 distinguishes two different types: at low temperature and at medium temperature.

The following refer to the application at low temperature: (low temperature application) all heat pumps whose maximum delivery temperature for heating purposes is lower than 52°C with source at temperature of -7°C and -8°C wet bulb (air-water unit) or inlet 10°C (water-water unit), at the reference design conditions for an average climate.For these, the efficiency ratio is "low temperature application" (outlet water temperature 35°C).

For all the other heat pumps, the efficiency ratio is related to "medium temperature application" (outlet water temperature 55°C).

The ratios must be calculated according to the reference European heating season in average climatic conditions.

The minimum efficiency requirements set by the regulations are indicated below.

REGULATION 2016/2281, comfort application

TYPE OF UNIT		MINIMUM REQUIREMENT			
		Tier 1		Tier 2 (2021)	
SOURCE	Pdesign	ηsc [%]	SEER	ηsc [%]	SEER
air	< 400kW	149	3,8	161	4,1
air	≥ 400kW	161	4,1	179	4,55
water	< 400kW	196	4,975	200	5,075
water	≥ 400kW and < 1500kW	227	5,75	252	6,375
water	≥ 1500kW	245	6,2	272	6,875

REGULATION 2016/2281, process application

TYPE OF UNIT		MINIMUM REQUIREMENT	
		Tier 1	Tier 2 (2021)
SOURCE	Pdesign	SEPR	SEPR
air	< 400kW	4,5	5
air	≥ 400kW	5	5,5
water	< 400kW	6,5	7
water	≥ 400kW and < 1500kW	7,5	8
water	≥ 1500kW	8	8,5

REGULATION 2013/813

SOURCE	APPLICATION	MINIMUM REQUIREMENT	
		ηsh [%]	SCOP
air	low temperature application	125	3,2
water	low temperature application	125	3,325
air	medium temperature application	110	2,825
water	medium temperature application	110	2,95

The conformity of the product must be checked according to the type of application, whether comfort or process, and at the required outlet water temperature.

The two schematic tables below, respectively for comfort application and for process application, indicate the reference of the required conformity according to the type of product and the set point temperature (reference to regulations 2016/2281 and 2013/813).

Important note: for mixed comfort and process applications, the reference application for conformity is the comfort application.

COMFORT APPLICATION

PRODUCT	OUTLET WATER TEMPERATURE	COMPLIANCE INDEX	REGULATION
Chiller	< 18°C	SEER/ηsc low temperature application	2016/2281
	≥ 18°C	SEER/ηsc medium temperature application	2016/2281
Heat pumps (reversible and only heating) Pdesign≤400kW		SCOP/ηsh	2013/813
Reversible heat pumps Pdesign>400kW	< 18°C	SEER/ηsc low temperature application	2016/2281
	≥ 18°C	SEER/ηsc medium temperature application	2016/2281
Heat pumps only heating Pdesign>400kW		-	-

- = exemption from Ecodesign

PROCESS APPLICATION

PRODUCT	OUTLET WATER TEMPERATURE	COMPLIANCE INDEX	REGULATION
Chiller	≥ +2°C , ≤ 12°C	SEPR	2016/2281
	> 12°C	-	-
	> -8°C , < +2°C	-	-

- = exemption from Ecodesign

Some specifications and notes follow.

EC fans:

The only option that positively affects the performance of the unit, by increasing its seasonal energy efficiency ratio, is the VEC accessory.

A unit equipped with EC fans has a higher SEER (ηsc) than the configuration with standard fans.

A unit equipped with EC fans has a higher SCOP (ηsh) than the configuration with standard fans.

RANGE - TITAN SKY

As regards, specifically, the Titan SKY range, here below the regulations of interest for the different units in the different configurations.

- chiller version: regulation 2016/2281

The tables below give information on the conformity of the units and the seasonal energy performance ratios with regard to the reference regulation.

Titan SKY Hi R0 FC

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
REGULATION 2016-2281											
COMFORT											
Standard Unit											
ηsc	(1)	%	161.4	164.2	162.2	161.4	163	163.8	162.2	166.6	161.4
SEER	(1)		4.11	4.18	4.13	4.11	4.15	4.17	4.13	4.24	4.11
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y	Y	Y	Y	Y
Unit with EC fans (VEC)											
ηsc	(1)	%	162.4	170.9	171.2	164.2	167.9	174.1	171.5	171.5	167.9
SEER	(1)		4.13	4,35	4.35	4,18	4.27	4,43	4.36	4.36	4.27
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y	Y	Y	Y	Y
PROCESS											
SEPR	(2)		5.73	5.79	5.55	5.39	5.55	5.28	5.22	5.4	5.19
Compliance Tier 2 (2021)	(2)		Y	Y	Y	Y	Y	Y	Y	Y	Y

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.
(1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.
(2) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

Titan SKY Hi R0 FC SLN

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
REGULATION 2016-2281											
COMFORT											
Standard Unit											
ηsc	(1)	%	161	161.8	161	161	161	162.6	161	165	161
SEER	(1)		4.1	4.12	4.1	4.1	4.1	4.14	4.1	4.2	4.1
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y	Y	Y	Y	Y
Unit with EC fans (VEC)											
ηsc	(1)	%	161,6	164,7	162,7	162,2	162,6	168,4	166,8	166,9	163,6
SEER	(1)		4.12	4.19	4.17	4.13	4.14	4.29	4.25	4.25	4.17
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y	Y	Y	Y	Y
PROCESS											
SEPR	(2)		5.57	5.77	5.51	5.39	5.47	5.2	5.18	5.26	5.11
Compliance Tier 2 (2021)	(2)		Y	Y	Y	Y	Y	Y	Y	Y	Y

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.
(1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.
(2) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

ELECTRICAL SPECIFICATIONS

TitanSky Hi R0 FC

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
General electrical specifications											
Max. absorbed power (FLI)	(1)	kW	12.8	17.9	24.9		26.4	35.8	42.8	49.8	
Max. absorbed current	(1)	A	33.4	39.8	51.8		55.2	75.6	86.6	103.6	
Nominal current (Inom)	(2)	A	19.1	21.4	29.3	40.3	43.3	46	55.5	58.6	80.8
cosφ standard unit	(2)		>0,95	>0,94	>0,95	>0,96	>0,95				>0,96
Maximum inrush current (MIC)	(3)	A	18.4	16.8			20.2	23.6		46.1	
Power supply		V/ph/Hz	400/3~+N/50								
Power supply for auxiliary circuits		mm²	230-24/1~/50								
Suggested line section	(5)	mm²	5G10 FG16OR16	4G16 FG16OR16	4G16 FG16OR15		4G16 FG16OR16	3x35+1G25 FG16OR16		3x50+1G25 FG16OR16	3x50+1G25 FG16OR15
Suggested line protection	(6)		CH14gG 40A	NH00gG 50A	NH00gG 63A			NH00gG 100A		NH00gG 125A	
Electrical specifications for fans											
Rated power of standard fan	(1)	n° x kW	4 x 0,5	2 x 1,5			3 x 1,5	4 x 1,5			
Rated current of standard fan	(1)	n° x A	4 x 2,1	2 x 3,4			3 x 3,4	4 x 3,4			
Rated power of EC fan	(2)	n° x kW	4 x 0,3	2 x 1,3			3 x 1,3	4 x 1,3			
Rated current of EC fan	(2)	n° x A	4 x 2,2	2 x 1,9			3 x 1,9	4 x 1,9			
Rated power of oversize EC fan	(2)	n° x kW	4 x 0,5	2 x 2,9			3 x 2,9	4 x 2,9			
Rated current of oversized EC fan	(2)	n° x A	4 x 2,2	2 x 4,4			3 x 4,4	4 x 4,4			

TitanSky Hi R0 FC SLN

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
General electrical specifications											
Max. absorbed power (FLI)	(1)	kW	12.8	17.9	24.9		26.4	35.8	42.8	49.8	
Max. absorbed current	(1)	A	33.4	39.8	51.8		55.2	75.6	86.6	103.6	
Nominal current (Inom)	(2)	A	19.1	21.4	29.3	40.3	43.3	46	55.5	58.6	80.8
cosφ standard unit	(2)		>0,95	>0,94	>0,95	>0,96	>0,95				>0,96
Maximum inrush current (MIC)	(3)	A	18.4	16.8			20.2	23.6		46.1	
Power supply		V/ph/Hz	400/3~+N/50								
Power supply for auxiliary circuits		mm²	230-24/1~/50								
Suggested line section	(5)	mm²	5G10 FG16OR16	4G16 FG16OR16	4G16 FG16OR15		4G16 FG16OR16	3x35+1G25 FG16OR16		3x50+1G25 FG16OR16	3x50+1G25 FG16OR15
Suggested line protection	(6)		CH14gG 40A	NH00gG 50A	NH00gG 63A			NH00gG 100A		NH00gG 125A	
Electrical specifications for fans											
Rated power of standard fan	(1)	n° x kW	4 x 0,5	2 x 1,5			3 x 1,5	4 x 1,5			
Rated current of standard fan	(1)	n° x A	4 x 2,1	2 x 3,4			3 x 3,4	4 x 3,4			
Rated power of EC fan	(2)	n° x kW	4 x 0,3	2 x 1,3			3 x 1,3	4 x 1,3			
Rated current of EC fan	(2)	n° x A	4 x 2,2	2 x 1,9			3 x 1,9	4 x 1,9			
Rated power of oversize EC fan	(2)	n° x kW	4 x 0,5	2 x 2,9			3 x 2,9	4 x 2,9			
Rated current of oversized EC fan	(2)	n° x A	4 x 2,2	2 x 4,4			3 x 4,4	4 x 4,4			

(1) Data regarding the unit without accessories working in maximum power absorption conditions
(2) Datum related to the unit without accessories working in standard conditions (A35°C; W12-7°C)
(3) Maximum effective RMS value of the current when the last compressor starts (FLA of the entire unit - FLA of the largest compressor + LRA of the largest compressor)
(4) Maximum effective RMS value of the current when the last compressor starts (FLA of the entire unit - FLA of the largest compressor + 0.6 x LRA of the largest compressor)
(5) These values are determined for cables with operating temperature of 40°C, EPR insulation and a line with a maximum length of 50m. The line section must be determined by a qualified technician based on the protection devices, the length of the line, the type of cable used and the type of installation.
(6) The correct line protection part must be determined by a qualified technician based on the length of the line, the type of cable used and the type of installation.

TitanSky Hi R0 FC NG

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
General electrical specifications											
Max. absorbed power (FLI)	(1)	kW	12.8	17.9	24.9		26.4	35.8	42.8	49.8	
Max. absorbed current	(1)	A	33.4	39.8	51.8		55.2	75.6	86.6	103.6	
Nominal current (Inom)	(2)	A	19.1	21.4	29.3	40.3	43.3	46	55.5	58.6	80.8
cosφ standard unit	(2)		>0,95	>0,94	>0,95	>0,96	>0,95				>0,96
Maximum inrush current (MIC)	(3)	A	18.4	16.8			20.2	23.6		46.1	
Power supply		V/ph/Hz	400/3~+N/50								
Power supply for auxiliary circuits		mm²	230-24/1~/50								
Suggested line section	(5)	mm²	5G10 FG16OR16	4G16 FG16OR16	4G16 FG16OR15		4G16 FG16OR16	3x35+1G25 FG16OR16		3x50+1G25 FG16OR16	3x50+1G25 FG16OR15
Suggested line protection	(6)		CH14gG 40A	NH00gG 50A	NH00gG 63A			NH00gG 100A		NH00gG 125A	
Electrical specifications for fans											
Rated power of standard fan	(1)	n° x kW	4 x 0,5	2 x 1,5			3 x 1,5	4 x 1,5			
Rated current of standard fan	(1)	n° x A	4 x 2,1	2 x 3,4			3 x 3,4	4 x 3,4			
Rated power of EC fan	(2)	n° x kW	4 x 0,3	2 x 1,3			3 x 1,3	4 x 1,3			
Rated current of EC fan	(2)	n° x A	4 x 2,2	2 x 1,9			3 x 1,9	4 x 1,9			
Rated power of oversize EC fan	(2)	n° x kW	4 x 0,5	2 x 2,9			3 x 2,9	4 x 2,9			
Rated current of oversized EC fan	(2)	n° x A	4 x 2,2	2 x 4,4			3 x 4,4	4 x 4,4			

TitanSky Hi R0 FC SLN

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
General electrical specifications											
Max. absorbed power (FLI)	(1)	kW	12.8	17.9	24.9		26.4	35.8	42.8	49.8	
Max. absorbed current	(1)	A	33.4	39.8	51.8		55.2	75.6	86.6	103.6	
Nominal current (Inom)	(2)	A	19.1	21.4	29.3	40.3	43.3	46	55.5	58.6	80.8
cosφ standard unit	(2)		>0,95	>0,94	>0,95	>0,96	>0,95				>0,96
Maximum inrush current (MIC)	(3)	A	18.4	16.8			20.2	23.6		46.1	
Power supply		V/ph/Hz	400/3~+N/50								
Power supply for auxiliary circuits		mm²	230-24/1~/50								
Suggested line section	(5)	mm²	5G10 FG16OR16	4G16 FG16OR16	4G16 FG16OR15		4G16 FG16OR16	3x35+1G25 FG16OR16		3x50+1G25 FG16OR16	3x50+1G25 FG16OR15
Suggested line protection	(6)		CH14gG 40A	NH00gG 50A	NH00gG 63A			NH00gG 100A		NH00gG 125A	
Electrical specifications for fans											
Rated power of standard fan	(1)	n° x kW	4 x 0,5	2 x 1,5			3 x 1,5	4 x 1,5			
Rated current of standard fan	(1)	n° x A	4 x 2,1	2 x 3,4			3 x 3,4	4 x 3,4			
Rated power of EC fan	(2)	n° x kW	4 x 0,3	2 x 1,3			3 x 1,3	4 x 1,3			
Rated current of EC fan	(2)	n° x A	4 x 2,2	2 x 1,9			3 x 1,9	4 x 1,9			
Rated power of oversize EC fan	(2)	n° x kW	4 x 0,5	2 x 2,9			3 x 2,9	4 x 2,9			
Rated current of oversized EC fan	(2)	n° x A	4 x 2,2	2 x 4,4			3 x 4,4	4 x 4,4			

(1) Data regarding the unit without accessories working in maximum power absorption conditions
(2) Datum related to the unit without accessories working in standard conditions (A35°C; W12-7°C)
(3) Maximum effective RMS value of the current when the last compressor starts (FLA of the entire unit - FLA of the largest compressor + LRA of the largest compressor)
(4) Maximum effective RMS value of the current when the last compressor starts (FLA of the entire unit - FLA of the largest compressor + 0.6 x LRA of the largest compressor)
(5) These values are determined for cables with operating temperature of 40°C, EPR insulation and a line with a maximum length of 50m. The line section must be determined by a qualified technician based on the protection devices, the length of the line, the type of cable used and the type of installation.
(6) The correct line protection part must be determined by a qualified technician based on the length of the line, the type of cable used and the type of installation.

HYDRAULIC MODULES

TITAN SKY Hi R0 FC - TITAN SKY Hi R0 FC SLN

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
Volume of the expansion vessel		l	5								
Volume of the buffer tank CH		l	-	180							
Standard pumps											
Pump model 1P, 2P			P3	P6	P7		P11			P14	P15
Available head 1P FC OFF	(1)	kPa	163	172	201	179	189	166	176	177	216
Available head 2P FC OFF	(1)	kPa	149	154	188	161	169	139	142	162	192
Available head 1P FC ON	(1)	kPa	135	134	127	135	131	136	131	122	135
Available head 2P FC ON	(1)	kPa	121	116	114	117	112	109	97	107	111

(1) External air temperature 35°C, user-side heat exchanger water inlet/outlet temperature 12/7°C. Values in accordance with EN 14511.

TITAN SKY Hi R0 FC NG- TITAN SKY Hi R0 FC NG SLN

			3.1	4.1	5.1	6.1	7.1	8.1	10.1	12.2	13.2
Volume of the expansion vessel		l	5								
Volume of the buffer tank CH		l	-	180							
Standard pumps											
Pump model 1P, 2P			P3		P7			P11		P14	P15
Available head 1P FC ON	(1)	kPa	175	126	191	168	185	194	166	173	246
Available head 2P FC ON	(1)	kPa	164	110	180	153	168	173	137	159	228

(1) External air temperature 35°C, user-side heat exchanger water inlet/outlet temperature 12/7°C. Values in accordance with EN 14511.

Model	Rated power	Rated current	Min. flow rate	Max. flow rate
	kW	A	m³/h	m³/h
P3	0,9	2,37	3,6	9,6
P6	1,5	3,15	7	18
P7	1,85	4,24	7	18
P9	1,5	3,43	12	28,8
P11	3	5,86	12	31,2
P14	3	6,1	12	42
P15	4	8,7	12	42

USER-SIDE EXCHANGER FLOW RATE FIELDS

The units are sized and optimized for the following nominal conditions: external air 30°C, inlet-outlet of the user-side heat exchanger 15/10°C.

The units can work at design conditions different from nominal conditions, provided that:

- the design condition falls within the operating limits specified below
- the unit is equipped with all the accessories necessary for operation of the unit (e.g. brine kit, fan speed adjuster, HAT)
- the flow rate at design conditions (that is, of the specific application) must always come within the allowed flow rate ranges specified below. If the design conditions require a water flow rate that does not come within the allowed operating range, you must contact our sales department that will identify the most suitable solution for the specific application.

Titan SKY Hi R0 FC

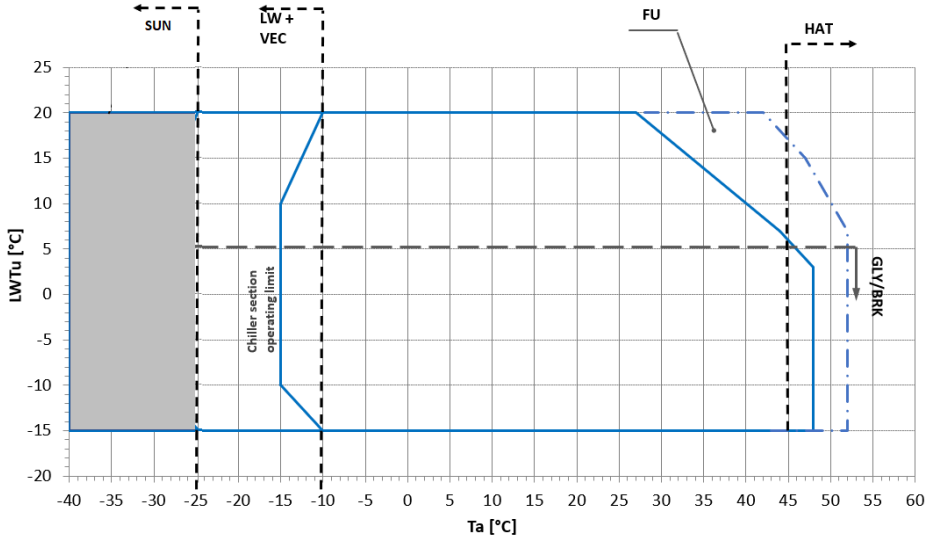
	Qmin	Qmax
	m³/h	m³/h
3.1	3,5	10,4
4.1	4,4	13,1
5.1	5,7	17
6,1	7	21
7.1	7,7	23
8.1	8,8	26,3
10.1	10,2	30,6
12.2	11,3	33,9
13.2	14,2	42,5

Titan SKY Hi R0 FC NG

	Qmin	Qmax
	m³/h	m³/h
3.1	3,3	9,9
4.1	4,2	12,6
5.1	5,4	16,2
6,1	6,7	20,1
7.1	7,5	22,4
8.1	8,6	25,7
10.1	9,9	29,6
12.2	11,1	33,4
13.2	13,5	40,6

OPERATING LIMITS

COOLING



Ta: external air temperature

LWTu: water outlet temperature from the user-side heat exchanger

LW: in the indicated area, the unit can work only where there is no wind

/VEC or /VEM: in the indicated area, the unit can work only if fitted with the accessory /VEC or /VEM

FU: in the area indicated, the control could implement a forced partialization of the compressors in order to avoid the intervention of the safety devices.

/HAT: in the indicated area, the unit can work only if fitted with the accessory /HAT

GLY: For LWTu below +5°C, it is compulsory to use suitable percentages of antifreeze additives (glycols) to prevent ice formation in the exchanger.

/BK: in the indicated area, the unit can work only if fitted with the accessory /BK

/SUN: in the specified area the unit can only operate if it is supplied with the SUN option "Heaters for unit operation at air temperature below -25°C". /SUN

The inlet and outlet temperatures of the user-side exchanger must be given on ordering to allow correct setting of the alarm parameters and verification of the sizing of the expansion valve.

The cooling set point can then be changed by the customer in an interval that, compared to the set point given on ordering, ranges from -1K up to the maximum temperature allowed by the above-stated operating limits.

The unit will be optimized to work at the set point temperatures given on ordering. For different set points, the cooling capacity provided and the level of efficiency of the machine could decrease and move away from these conditions.

NOISE LEVELS

Titan SKY Hi R0 FC - Titan SKY Hi R0 FC NG

Octave bands [dB] **Total**

	63 Hz		125 Hz		250 Hz		500 Hz		1000 Hz		2000 Hz		4000 Hz		8000 Hz		[dB(A)]	
	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp
3.1	84	52	96	64	85	53	80	48	73	41	64	32	61	29	57	25	**83**	**51**
4.1	84	52	96	64	85	53	80	48	73	41	64	32	61	29	57	25	**83**	**51**
5.1	85	53	97	65	86	54	81	49	74	42	65	33	62	30	58	26	**84**	**52**
6.1	87	55	99	67	88	56	83	51	76	44	67	35	64	32	60	28	**86**	**54**
7.1	87	55	99	67	88	56	83	51	76	44	67	35	64	32	60	28	**86**	**54**
8.1	89	57	101	69	90	58	85	53	78	46	69	37	66	34	62	30	**88**	**56**
10.1	89	57	101	69	90	58	85	53	78	46	69	37	66	34	62	30	**88**	**56**
12.2	89	57	101	69	90	58	85	53	78	46	69	37	66	34	62	30	**88**	**56**
13.2	90	58	102	70	91	59	86	54	79	47	70	38	67	35	63	31	**89**	**57**

Reference conditions: outside air temperature 35°C; input/output water temperature into/from user-side heat exchanger 12/7°C; unit operating at rated capacity, without any option.
Lw: sound power levels.Values obtained from measures taken according to standard ISO 3744.Lw_tot is the only binding value.
Lp: sound pressure levels.Binding values starting from noise power levels referred to a distance of 10 m from the unit; source installed on a reflective surface and in ideal free field conditions with directivity factor Q=2. Non-binding values
The acoustic data are related to standard conditions in referable and reproducible operating conditions. All data with the exception of Lw_tot are provided for illustrative purposes only and can not be used for forecasting purposes or for the verification of binding limits.With special reference to noise emissions, the Manufacturer takes liability for their conformity, limited to the declared Lw_tot value. Any and all other Manufacturer's liability for the impact of such emissions in relation to the location of the machine and other conditions related to machine installation is excluded. The environment and the installation conditions, as well as the operating modes, can alter the sound emissions. Any assessment concerning these conditions falls within the area of competence of the plant designer and/or the fitter.

Titan SKY Hi R0 FC SLN - Titan SKY Hi R0 FC NG SLN

Octave bands [dB] **Total**

	63 Hz		125 Hz		250 Hz		500 Hz		1000 Hz		2000 Hz		4000 Hz		8000 Hz		[dB(A)]	
	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp	Lw	Lp
3.1	82	50	94	62	83	51	78	46	71	39	62	30	59	27	55	23	**81**	**49**
4.1	82	50	94	62	83	51	78	46	71	39	62	30	59	27	55	23	**81**	**49**
5.1	83	51	95	63	84	52	79	47	72	40	63	31	60	28	56	24	**82**	**50**
6.1	85	53	97	65	86	54	81	49	74	42	65	33	62	30	58	26	**84**	**52**
7.1	85	53	97	65	86	54	81	49	74	42	65	33	62	30	58	26	**84**	**52**
8.1	87	55	99	67	88	56	83	51	76	44	67	35	64	32	60	28	**86**	**54**
10.1	87	55	99	67	88	56	83	51	76	44	67	35	64	32	60	28	**86**	**54**
12.2	87	55	99	67	88	56	83	51	76	44	67	35	64	32	60	28	**86**	**54**
13.2	88	56	100	68	89	57	84	52	77	45	68	36	65	33	61	29	**87**	**55**

Reference conditions: outside air temperature 35°C; input/output water temperature into/from user-side heat exchanger 12/7°C; unit operating at rated capacity, without any option.
Lw: sound power levels.Values obtained from measures taken according to standard ISO 3744.Lw_tot is the only binding value.
Lp: sound pressure levels.Binding values starting from noise power levels referred to a distance of 10 m from the unit; source installed on a reflective surface and in ideal free field conditions with directivity factor Q=2. Non-binding values
The acoustic data are related to standard conditions in referable and reproducible operating conditions. All data with the exception of Lw_tot are provided for illustrative purposes only and can not be used for forecasting purposes or for the verification of binding limits.With special reference to noise emissions, the Manufacturer takes liability for their conformity, limited to the declared Lw_tot value. Any and all other Manufacturer's liability for the impact of such emissions in relation to the location of the machine and other conditions related to machine installation is excluded. The environment and the installation conditions, as well as the operating modes, can alter the sound emissions. Any assessment concerning these conditions falls within the area of competence of the plant designer and/or the fitter.

INSTALLATION ADVICE

The units described in this document are, by nature, strongly affected by the characteristics of the system, the working conditions and the installation site.

Remember that the unit must be installed by a qualified and skilled technician, and in compliance with the national legislation in force in the destination country.

The installation must be done in such a way that it will be possible to carry out all routine and non-routine maintenance operations.

Before starting any work, you must carefully read the "Installation, operation and maintenance manual" of the machine and do the necessary safety checks to prevent any malfunctioning or hazards.

We give some advice below that will allow you to increase the efficiency and reliability of the unit and therefore of the system into which it is inserted.

Water characteristics

To preserve the life of the exchangers, the water is required to comply with some quality parameters and it is therefore necessary to make sure its values fall within the ranges indicated in the following table:

Total hardness	2,0 ÷ 6,0 °f
	1,2 ÷ 3,4 °d
Langelier index	- 0,4 ÷ 0,4
pH	7,5 ÷ 8,5
Electrical conductivity	10÷500 µS/cm
Organic elements	-
Hydrogen carbonate (HCO3-)	70 ÷ 300 ppm
Sulphates (SO42-)	< 50 ppm
Hydrogen carbonate / Sulphates (HCO3-/SO42-)	> 1
Chlorides (Cl-)	< 50 ppm
Nitrates (NO3-)	< 50 ppm
Hydrogen sulphide (H2S)	< 0,05 ppm
Ammonia (NH3)	< 0,05 ppm
Sulphites (SO3), free chlorine (Cl2)	< 1 ppm
Carbon dioxide (CO2)	< 5 ppm
Metal cations	< 0,2 ppm
Manganese ions (Mn++)	< 0,2 ppm
Iron ions (Fe2+ , Fe3+)	< 0,2 ppm
Iron + Manganese	< 0,4 ppm
Phosphates (PO43-)	< 2 ppm
Oxygen	< 0,1 ppm

Installation of water filters on all the hydraulic circuits is obligatory.

The supply of the most suitable filters for the unit can be requested as accessory. In this case, the filters are supplied loose and must be installed by the customer following the instructions given in the installation, operation and maintenance manual.

Glycol mixtures

With temperatures below 5°C, it is mandatory to work with water and anti-freeze mixtures, and also change the safety devices (anti-freeze, etc.), which must be carried out by qualified authorised personnel or by the manufacturer.

Liquid outlet temperature or minimum ambient temperature	°C	0	-5	-10	-15	-20	-25	-30	-35	-40
Freezing point	°C	-5	-10	-15	-20	-25	-30	-35	-40	-45
Ethylene glycol	%	6	22	30	36	41	46	50	53	56
Propylene glycol	%	15	25	33	39	44	48	51	54	57

The quantity of antifreeze should be considered as % on weight

Minimum water content in the system

For correct operation of the unit, it is necessary to ensure a buffering on the system such as to comply with the minimum operating time considering the greater between the minimum OFF time and the minimum ON time. In short, these contribute to limiting the number of times the compressors are switched on per hour and to preventing undesired deviations from the set point of the delivered water temperature.

Larger amounts of water are in any case always preferable, because they allow a smaller number of starts and switch-offs of the compressors, less wear of them and an increase in the efficiency of the system as a consequence of a reduction in the number of transients.

It should also be pointed out that, for air-water units working in heat pump mode, the minimum amount of water must consider the need of the unit to carry out defrosting. Having an adequate buffering volume will allow prevention of too high drifts of the delivered water temperature at the end of the defrost cycle.

The following experimental formula allows to calculate the minimum water volume of the plant. The formula only refers to the operation of the unit in cooling mode.

$$V_{min} = \frac{P_{tot} \cdot 1.000}{N} \cdot \frac{300}{\Delta T \cdot \rho \cdot c_p} + P_{tot} \cdot 0{,}8$$

where

Vmin is the minimum water content of the system [l]

Ptot is the total cooling capacity of the machine [kW]

N: number of capacity reduction steps

ΔT: differential allowed on the water temperature. Unless otherwise specified, this value is considered to be 2.5K

ρ: density of the heat-carrying fluid. Unless otherwise specified, the density of water is considered

cp: specific heat of the heat-carrying fluid. Unless otherwise specified, the specific heat of water is considered

Considering the use of water and grouping together some terms, the formula can be re-written as follows:

$$V_{min} = \frac{P_{tot}}{N} \cdot 28{,}66 + P_{tot} \cdot 0{,}8$$

For the N values, consider the following convention:

- for units with 1 compressor N = 4
- for units with 2 compressors N = 8

Installation site

To determine the best installation site for the unit and its orientation, you should pay attention to the following points:

- compliance with the clearance spaces indicated in the official dimensional drawing of the unit must be guaranteed so as to ensure accessibility for routine and non-routine maintenance operations
- compliance with the respect spaces indicated in the installation, use and maintenance manual must be guaranteed, in relation to units with highly flammable A3 refrigerant
- you should consider the origin of the hydraulic pipes and their diameters because these affect the radiuses of curvature and therefore the spaces needed for installing them
- you should consider the position of the cable inlet on the electrical control panel of the unit as regards the origin of the power supply
- if the installation includes several units side by side, you should consider the position and dimensions of the manifolds of the user-side exchangers and of any recovery exchangers
- if the installation includes several units side by side, you should consider that the minimum distance between units is 3 metres
- you should avoid all obstructions that can limit air circulation to the source-side exchanger or that can cause recirculation between air supply and intake
- you should consider the orientation of the unit to limit, as far as possible, exposure of the source-side exchanger to solar radiation
- if the installation area is particularly windy, the orientation and positioning of the unit must be such as to avoid air recirculation on the coils. If necessary, we advise making windbreak barriers in order to prevent malfunctioning.

Once the best position for the unit has been identified, you must check that the support slab has the following characteristics:

- its dimensions must be proportionate to those of the unit: if possible, longer and wider than the unit by at least 30 cm and 15/20cm higher than the surrounding surface
- it must be able to bear at least 4 times the operating weight of the unit
- it must allow level installation of the unit: although the unit is installed on a horizontal base, make slopes in the support surface to convey rain water or defrost water to drains, wells or in any case to places where it cannot generate an accident hazard due to ice formation. All heat pump version units are equipped with discharge manifolds for the condensed water; these can be manifolded to facilitate condensate discharge.

The units are designed and built to reduce to a minimum the level of vibration transmitted to the ground, but it is in any case advisable to use rubber or spring anti-vibration mounts, which are available as accessory and should be requested when ordering.

The anti-vibration mounts must be fixed on before positioning the unit on the ground.

In the event of installation on roofs or intermediate floors, the pipes must be isolated from the walls and ceilings.

It is advisable to avoid installation in cramped places, to prevent reverberations, reflections, resonances and acoustic interactions with elements outside the unit.

It is essential that any work done to soundproof the unit does not affect its correct installation or correct operation and, in particular, does not reduce the air flow rate to the source-side exchanger.

Installation types

Generally, an air conditioning unit is installed in rooms that are normally occupied by people, in general-purpose rooms or in dedicated technical room such as **machinery rooms**. Another possible option is unit installation **outdoors, in the open air**. Also, several access categories are defined for each installation. The type of installation and access category determine the maximum permitted refrigerant charge for the installation, depending on the type of refrigerant in use.

This guide specifically addresses:

- hydronic climate control units; chillers and heat pumps for **Class III outdoor** installations (open space installations). In the case of Class III installation in open field where all the standard and manufacturer's standards relating to the installation of the unit are respected, there is no restriction on the amount of charge of the installed unit if the access category and type "c" (authorized access).

For further information regarding installation classes, access categories and the charge limit, consult the Standard EN378-1.

Compliance with class III is also linked to the fact that the hydraulic system that carries the fluid that is heated or cooled by the unit to the various users complies with the requirements defined by EN 378-1 in section 5.5. 2 to avoid the possibility of a leak of refrigerant flowing into occupied rooms. See the section "Hydraulic Connections" for a description of the various solutions that are applicable to our types of unit.

Failure to comply with the provisions regarding the hydraulic system will result in the installation being downgraded to Class I or Class II, in which case the refrigerant charge limits are lower than in Class III (Ref. EN 378-1, Annex C).

In general, **the person in charge of the installation** (generally the designer), must ensure compliance with the standard requirements by carrying out a risk assessment mainly according to the manufacturer's instructions and standards, such as EN378-1, EN378-3, or IEC 60335-2-40:2018 when applicable. All other considerations aside, the installation must also conform with the applicable local or national regulations.

The installation technician must install the units as defined in the project. Before starting to install the units, the installation technician must carry out his/her own assessment, within the limits of his/her technical qualifications and issue the Declaration of Conformity once the work is complete.

The installation supervisor is responsibility for guaranteeing the conformity of the system.

We strongly recommend that a consultant/qualified third-party body be involved in the installation conformity assessment process, based on the type and quantity of refrigerant used.

In order to ensure complete safety of the application, it is fundamentally important to respect the type of installation the unit has been designed for.

Where more stringent than the provisions set out in the applicable regulations, the installation shall conform to the local/national regulations.

Definitions

For reasons of clarity, it has been deemed helpful to introduce a series of additional definitions; This section simply lists the additional definitions that have been introduced, which are important when conducting the risk assessment.
The technical handbook contains further information about the various components used.

- **User terminal side heat exchanger/Desuperheater**

This type of heat exchanger is used to transfer heat from or to the hydraulic circuit vector fluid and, hence, heat or cool the climate controlled environments. The desuperheater is a dedicated heat exchanger used to heat a specific hydraulic circuit. Such units normally consist of a brazed plate heat exchanger. Other types of heat exchanger may be used.

- **Source-side heat exchanger**

This type of heat exchanger is used to transfer the heat extracted from/yielded to the user terminal side hydraulic circuit vector fluid towards the outdoor air when cooling/heating the climate controlled environments. Usually, finned or micro-channel coils. Other types of heat exchanger may be used. For example, in the case of water dissipation type source units, either brazed plate or tube bundle heat exchangers may be used.

- **Refrigerant leaks**

Refrigerant gas escaping from the container/object used to store it; in the case of Chillers or Heat Pumps, the gas will escape from the refrigerating circuit or one of its components. As the refrigerants in question are flammable, under certain circumstances gas leaks may result in the formation of flammable or explosive atmospheres. Such instances include, but are not limited to:

refrigerant gas leaks from the unit refrigerating circuit due to one of its components malfunctioning or being damaged;

refrigerant gas leaks caused by the unit safety valve being activated;

refrigerant gas leaks caused by the unit heat exchanger or finned battery being damaged;

accidental release of refrigerant gas from the refrigerating circuit, or cylinders used to store the gas, during maintenance activities.

- **Installation Class (Ref EN378-1)**:

The Standard defines for Installation Classes.

- **Access Category (Ref EN378-1)**:

a = public; **b =** restricted or supervised; **c =** controlled or authorised.

- **Charge Limit (Ref EN378-1)**:

The Standard defines maximum refrigerant charge limits, depending on the installation class, access category and type of refrigerant in use.

- **LFL (Rif EN378-1)**:

The lowest percentage of a substance in air that can lead to flame propagation.

- **The safety class or category of a refrigerant fluid (EN 378-1)**:

categorization of a substance as flammable or non-flammable, toxic or non-toxic.

- #B#ATEX Zone 2 (Ref. EN 60079-10-1 and IOM) and Safety Zone (Ref IOM):

see section: "Class III hydronic unit installations in open air environments".

- **Ignition Sources (Ref EN378-2)**:

External sources that could lead to flame propagation in a combustible atmosphere.

- **Installation**:

Installation is defined as the unit positioned and installed correctly and operational as set out in the IOM manual. This definition **does not** include the activities involved in preparing the installation (construction of the hydraulic and electrical systems, realising the infrastructure, etc.)In addition to the reference standards, further information may be found in the Appendix to this document.

- **Electrical control panel**

Electrical control panel QE. For further details, see the dedicated chapter.

- **Technical compartment**

Technical compartment VT. The refrigeration circuit is enclosed in a compartment that contains an ATEX certified leak sensor and an ATEX certified extraction fan.

Class III hydronic unit installations in open air environments

In order for the outdoor installation of units containing flammable and non-toxic refrigerant to be considered class III, the following are some of the additional assessments that the **responsible for the installation (customer, installer, consultant, ...)# bb#, must do to ensure that any gas leak does not generate dangerous situations [note**1 **] .**

1. The units must be positioned so as to prevent any refrigerant leaks from reaching the enclosed spaces, creating temporarily flammable zones or harming persons or property. Leaks must be prevented from flowing into manholes and storm drains and directly onto personnel and must not be directed towards air vents designated to serve enclosed spaces. Leaks must also be kept away from fresh air intakes, doors or similar openings, as well as ignition sources as defined by the Standard EN378-1. here is an obligation to convey the discharge of the safety valves via piping compliant with national and/or European directives, the area of which the refrigerant escapes must comply with the same requirements described above valid in the event of a leak.

The installation, use and maintenance manual and the dedicated documentation offer a detailed explanation of how the drainage channel must be created and calculated and any identification requirements required, but it must be remembered that the responsibility falls in any case on the person in charge of the installation.

Standard EN13136:2019 should be referenced for the calculation and sizing of the safety valve exhaust.

The conveying must be done with a pipe whose diameter must be at least that of the valve outlet, and the weight of the pipe must not be borne by the valve.When positioning the safety valve discharge line, it should be taken into account that the Atex Zone 2 (note2**) generated by the emissions from a safety valve differs from the Atex Zone 2 defined for the unit.**

Zone 2 forming from the emissions of a safety valve may extend horizontally up to 10 metres and vertically up to 11 metres.

The assessment of the risk areas is the responsibility of the installation supervisor.

Exhausted material must not be conveyed close to ignition sources, as defined in standard EN378-2.

Where the existing local regulations are more stringent, these should be taken as reference.

Always use the appropriate type of fire extinguishers for the refrigerant in use in proximity to the unit.

Notes

1 **For further details and a complete list of requirements, refer to EN378-3: Paragraph 4.2, Paragraph 6.2.14 and Annex K. Paragraphs 4.3, 5.1 and 5.14 in the case of leaks as indicated in point 2 below (leaks underground or inside cavities). In addition, national directives, if any, must always be observed.**

2 **Zone 2 according to the Atex directive is an area in which the formation of an explosive atmosphere of air and flammable substances in the form of gas, vapor or mist is not likely during normal activities and, if it occurs, it is only of short duration.**

2. If the refrigerant leak can stagnate, for example, underground or inside cavities, the installation must comply with the requirements for gas detection and ventilation of engine rooms and where applicable , also compliant with the requirements for ignition sources as defined by EN378-2.Reference to the section on machinery rooms in standard EN 378-3 should be made in this case.

3. Where the unit is installed in the open air, but under a shelter, ventilation must be guaranteed.

4. If the unit installed is inside a room, where at least one of the longest walls is open to outside air for at least 80% of the wall area (or equivalent if more of a wall must be outdoors) and covered by slats/grids with at least 75% free area, is considered as an outdoor installation.

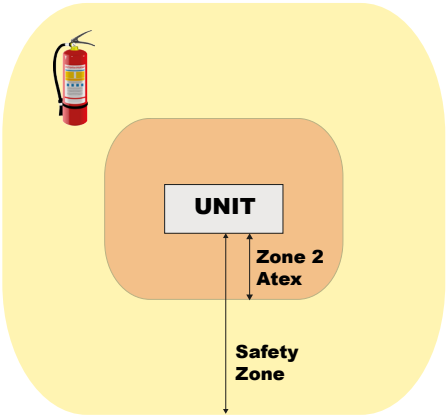
5. When conducting the risk assessment, the installation supervisor must also take the following indications into account.

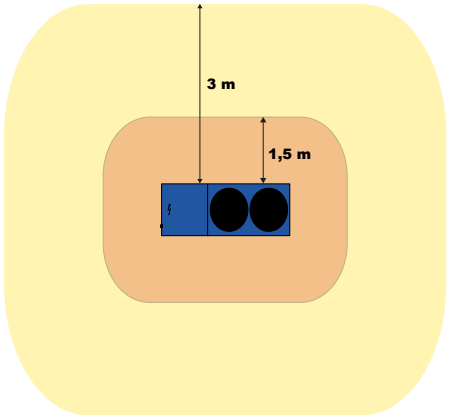
- In the event of leaks, the unit gives rise to an Atex "zone 2" classified environment around the machine.
- Based on the above, the designation of a safety "zone/area" around the machine is deemed to be appropriate.

In a "zone 2":

- installation of equipment unsuitable for use in such potentially explosive zones must be avoided (the minimum equipment requirements are: 3G IIB T4);
- naked flames, sparks and hot work must be avoided;
- sources of ignition that are due to processes must be avoided, since they are likely to give way to remote ignition (ionizing and non-ionizing radiation);
- direct and indirect effects of electrocution must be avoided;
- electrostatic charges must be avoided;
- interference must be avoided with elements that may be hazardous, including sewage systems, openings towards stone retaining walls, underground spaces, power lines, flammable material warehouses, railways, motorways, etc.

In the safety "zone/area", storage of refrigerant bags must be avoided in spaces such as sewage systems, manholes, water traps, openings towards stone retaining walls, underground spaces, etc.
Refer to national or local regulations on this issue, where applicable.





For further details, please refer to the "Instruction manual for operation and maintenance".

6. Confirm that noise barriers or other protection systems, if any, cannot create areas where leaks can stagnate.

7. Also take into account the possible leaks that can occur on parts of the circuit that are normally closed, for example from panels that can be removed or from doors that can be left open during maintenance activities.

To guarantee the correct functioning of the unit, it is mandatory to guarantee the clearances specified in the dimensional drawings. Always check the Atex Zone 2 and the respect/safety zone and any installation limitations in the Installation, Use and Maintenance manual.

Access restriction is part of correct installation to eliminate residual risks during normal operation.

Hydraulic Connections

The chillers and heat pumps are normally used to heat and/or cool a closed water circuit connected to system terminals such as fan coils, etc., which are usually located in occupied spaces. The plumbing then connects the building utilities with the refrigeration machine, so in Class III installations, for compliance to occur, the installer must take extra precautions to prevent a refrigerant leak into the hydraulic circuit through the heat exchanger then flows inside occupied rooms and or generates a flammable mixture, as required by EN 378-1 and EN378-3.

- The hydraulic system must be protected against accidental damage.
- There must be a vent system using suitably calibrated safety valves, so that any refrigerant is discharged outdoors in compliance with all the prescriptions relating to refrigerant discharge already indicated in the section "Class III outdoor installations for hydronic units" . The calibration setting must take into account the operating pressure of the hydraulic circuit, the altitude and the type of refrigerant fluid. All safety requirements applicable to sources of leakage from the unit also apply to the hydraulic system.
- Hydraulic components, accumulator tanks and any other open type components or elements that could release refrigerant as a consequence of a leak from the heat exchanger must be installed outdoors. The same safety precautions must be implemented as for any other potential source of leaks from the unit. If it is not possible to install such elements outdoors, they must be replaced with equivalent, watertight components.
- If there is a hydraulic decoupling device installed between the primary and secondary circuits, assess whether it is sufficient to implement the above precautions to the primary circuit only.

In the event that the installation solutions defined in the previous points are not possible but these devices are confined within a machine room, it is the duty of the installation manager to carry out a flammability assessment and classification of the danger area for the room technical as required by the EN378-3 standard".

The precautions implemented on the desuperheater hydraulic circuit must be the same as those adopted for the main heat exchanger.

Guidelines for the risk assessment

The purpose of this section is to provide all elements specific to the Swegon Operations S.r.L. production units. with A2, A2L and A3 refrigerants to allow the installation manager to carry out the risk assessment associated with the installation and, consequently, to determine the prevention, protection and management measures to be adopted to pursue the following safety objectives:

- minimise the causes of fires or explosions;
- guarantee the stability of the supporting structures for a predetermined period of time;
- limit the instance and spread of fires inside the building;
- limit the spread of fires to adjacent buildings;
- limit the effects of explosions;
- ensure that occupants are able to leave the building unassisted or receive assistance in other ways;
- ensure that emergency services are able to intervene in conditions of safety.

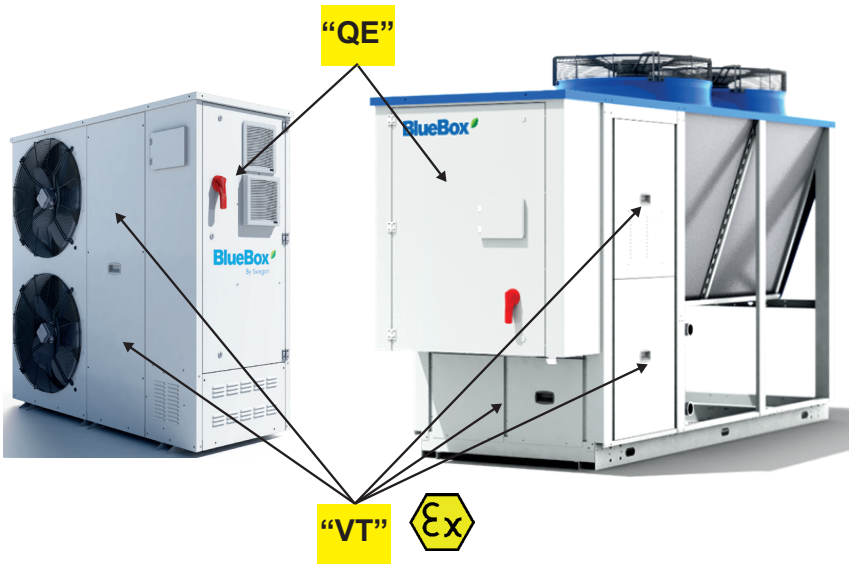
The installation supervisor is responsible for compiling the installation risk assessment.

The information is in accordance with the European standard EN378 with particular reference to the effects on the environment and on the safety of people and things in the context linked to the installation of Swegon Operations S.r.L. production units. containing refrigerants classified A2L, A2 and A3.

The Technical Handbook includes information regarding the manufacturing specifications, technical and performance data, available accessories and all the other elements necessary for a full understanding of the units.

The Installation, Operating and Maintenance manual contains the information necessary to install, operate and service the units.

The technical data label, the additional labels, the wiring diagram, the refrigeration diagram, the hydraulic diagram, the dimensional diagram, the instructions concerning handling and the accompanying documentation show technical data, dimensions, clearances, data and electrical characteristics and hydraulics, utility connections, handling information and much more.



Thus, when defining the project and conducting the risk assessment, it is necessary to take various situations into account, including:

- how to properly convey any gas exhausted by the safety valves and how any leakage from the coils or any exhaust from the technical compartment (VT) may be made to flow to the safe area, as described above;
- a check that any leak in the “VT” is sensed by the refrigerant sensor a the time when the concentration exceeds 10% the LFL. The three-phase power supply is cut out and the unit consequently switches off. The extraction fan in the “VT” is started so that the air-refrigerant mix is expelled to the outside. The fans in the electric panel (QE) are switched on, if they are not already. The rest of the unit is off and the safety device chain only is active. The unit reports the leak condition by means of a light indicator and through a potential-free contact. After the leak is cleared safely, the sensor requires resetting, which is done by cutting out power to the sensor. When the sensor is energised again, a “warm-up” procedure gets started. A reading test is recommended after a leak has been identified;
- where a leak external to the “VT”, originating from the unit batteries, is not detected by the refrigerant sensor but is prevented from entering the “QE” due to it being isolated. If the leak were to reach the axial fans, the speed of the air and effect of dilution would cause it to be dispersed. If the leaking gas manages to access the “VT”, the previous case applies;
- if the sensor experiences a malfunction or power to it is cut out, but the unit is energised, the system basically starts the same actions listed for any leakage detected inside the “VT”. Dedicated warning lights/messages are activated in this case, which are different from those relating to a leak;
- a blackout of the three-phase line switches the entire unit off, safety device chain included;
- a short blackout does not normally require an inspection by a qualified technician before the power line is restored;
- if the power failure lasts for a long time, we strongly recommend that a skilled technician be asked to test the unit for leaks on site: this evaluation must be part of the risk analysis;
- in any case, as soon as power is restored, the sensor runs the warm-up procedure, at the end of which an OK signal is output, where no leaks are identified, to restore power to the rest of the unit.

Despite the requirements adopted in units containing A3 flammable refrigerants, and although some components may be ATEX compliant, Swegon Operations units containing A3 **refrigerants are not suitable** to be installed in explosive environments as required by the ATEX directive.

Applicable standards and regulations and reference documents

The main regulatory framework is given by the complete EN378, while for a complete regulatory framework it is useful to refer to the final part of the Swegon guides on flammable refrigerants.

EN378: refrigerating systems and heat pumps

- EN378-1: Basic requirements, definitions, classification and selection criteria.
- EN378-2: Design, construction, testing, marking and documentation.
- EN378-3: Installation site and personal protection.
- EN378-4: Operation, maintenance, repair and recovery.

It is also useful to include a list of the principal reference documents that should be adopted when drawing up the risk assessment (complete with the respective abbreviations).

The following documents constitute an integral part of the machine documentation. The documents are indicated by the abbreviations used to refer to them in the risk assessment.

- **IOM**: Installation, Operating and Maintenance manual This is the document where it is possible to find information relating to product safety and the correct way of operating, information on installation, Atex zone 2, safety zone and on the specific prescriptions relating to flammable refrigerant, start-up and maintenance of the units, as well as information on the competent personnel who may operate. This document is essential for personnel assigned install and operate the unit.
- **DimDiag**: The dimensions diagram illustrates the physical dimensions of the unit and the respective operating spaces.
- **ELDiag**: The electrical circuit diagram includes all the information regarding the unit electrical connections and the external connections to the unit.
- **Declaration of Conformity**: this document indicates the various EEC Directives and Regulations the unit conforms to.
- **PDoc**: an assessment conducted by the installation technician or other personnel responsible for the installation site.
- **TH**: Technical handbook or catalogueThis document covers the technical and electrical data, the hydronic units and pumps; it includes the unit operating limits and various other information. This document is essential when designing a unit installation, especially in the case of projects that include units containing flammable refrigerants.

It is important to recall that, when installing units containing A3 classified refrigerants, it may be necessary to obtain permission from the relevant Authority.

Installation risk assessment

Transport, positioning and storage are not included in the scope of the installation risk assessment. The section "Reception, handling and storage of units containing flammable refrigerants" of this document provides information of performing these phases correctly and as safely as possible.

The residual risks described in the Installation, Operating and Maintenance manual must also be taken into account when conducting the risk assessment.

The following table contains a series of indications designed to assist the installation supervisor in conducting the risk assessment, and in minimising the risks themselves.

How to minimise fire risks in the installation.

Installing the unit	The unit must be installed in a workmanlike manner, by a certified and titled company, respecting the manufacturer's specific instructions given in the IUM manual and adopting all the necessary fire prevention, protection and management measures. The unit must be installed outdoors in such a way as to prevent any refrigerant leaks from reaching the enclosed spaces, creating temporarily flammable zones or harming persons or property. Suitable fire extinguishing systems, corresponding to the type of refrigerant in use, must be installed in the vicinity of the unit.
Ignition sources	There **must not** be any ignition sources present **inside** the Atex Zone 2 of the unit, if such a zone is defined for the unit/installation being assessed. If no Atex Zone 2 is defined, the installation supervisor is responsible for assessing the presence/vicinity or otherwise of ignition sources, depending on the type of unit, the refrigerant in use, the installation, etc.
Refrigerant stagnation areas	There **must not** be any refrigerant stagnation areas, where refrigerant could be trapped in the event of a leak, present **inside** the unit safety zone.

Refrigerant leaks

From the unit refrigerating circuit.

The unit refrigerating circuit, which is housed inside the technical compartment, is fitted with a refrigerant detector that is tripped if the concentration exceeds 10% of the LFL. The technical compartment is purged by expelling the refrigerant, which mainly builds up under the finned coils. The refrigerant is expelled by means of Atex fans. **The Atex Zone 2 and Safety zone must be respected.**

From the source side heat exchanger.

The leak is external to the unit and, if it does not enter the technical compartment, the unit continues to operate. In this case, the electrical components in the technical compartment are not affected by the leak. The leak cannot reach the electrical panel if the installations specifications have been respected. It should be taken into account the fact that, if the installation is located nearby marine environments or in the presence of aggressive atmospheres, and the coils are not treated accordingly, there is a greater chance of leaks. **If defined, the Atex Zone 2 and Safety zone must be respected.**

From the user terminal side heat exchanger.

The refrigerant leak flows from the refrigerating circuit towards the hydraulic system via the heat exchanger. The leak is not detected and the unit continues to operate. It **is obligatory** to respect the provisions relating to the hydraulic system. If the installation includes vents or deaerators, the risk assessment may also involve defining specific Atex 2 zones.

From the safety valve vent.

Correct discharge of the refrigerant vented by the safety valves plays a **fundamental** role in minimising fire risks. Such leaks must be routed as set out in the IOM manual, taking into account the fact that the outlet of the discharge line gives rise to an additional **Atex 2 Zone, which must also be respected**

External to the unit but not deriving from it

The unit is not suitable for use in flammable atmospheres. The leak must be detected as set out in the applicable standards and the unit made safe; for example, the unit must be completely isolated from its electrical power supply until the fault has been corrected and the flammable atmosphere eliminated.

#B#Main procedures that should be adopted:

- The use of either forced or natural ventilation helps to dilute the refrigerant and dissipate it in the surrounding air more rapidly.
- The electrical power supply to all devices not designed to be operated in flammable atmospheres should be interrupted if they are affected by the leak.
- All potential ignition sources that may be affected by the leak must be removed, if present.
- Avoid creating areas where build ups of refrigerant may accumulate, resulting in localised zones where flammable atmospheres may be present.
- Refrigerant must be prevented from reaching closed or occupied spaces, fresh air intakes, windows and other openings.
- The refrigerant Propane-R290 is heavier than air, which means that it tends to build up close to ground level.
- Additional safety procedures may be implemented, depending on the specifics of the individual installation site.

Unit refrigerant detector fault

When a detector fault is identified, the unit enters safe mode, disconnecting all the electrical components not designed to be operated in flammable atmospheres from their power supply. The unit stops working. Only the technical compartment extractor fans, the electrical panel cooling fans and the leak sensor remain energised. This is **not** a leak condition, but it is necessary to check the refrigerant detector and restore correct operation as soon as possible.

Generic unit fault

A generic fault does not give rise to a refrigerant leak. A fault that does give rise to a leak falls with the description provided above.

Fault on the extractor fan

The unit handles a potential refrigerant leak in safe mode, as described above, disconnecting all the electrical components not designed to be operated in flammable atmospheres from their power supply. Refrigerant leaks from the technical compartment are slower, but spread to all parts of the compartment, rather than being concentrated mainly under the finned coil.**If defined, the Atex Zone 2 and Safety zone must be respected.**

Electrical power supply absent

Since it is not energised, the unit is safe, meaning that any leaks that may occur in this condition cannot come into contact with potential ignition sources. In this condition, the refrigerant sensor and the Atex extractor fan are deactivated. When the unit is switched on again, check there is no refrigerant present before supplying the rest of the unit. **If defined, the Atex Zone 2 and Safety zone must be respected.**

Presence of flammable material

The presence of flammable material is prohibited within the Safety zone. Check the refrigerant safety data sheet to assess which other substances may represent a hazard if they come into contact with the refrigerant.

Suggestions for conducting and drawing up the risk assessment

This section contains an example that highlights the possible requirements to be complied with and the minimum information that must be filled in by the installation manager when drafting the risk assessment for a typical installation.

The abbreviations describe the contents to be inserted in the various columns.

- **App.** = applicability of the provision (complete the empty fields according to the type of installation).
- **A** = the provision is applicable. It is possible to indicate a limit, a threshold, a distance, etc. that must be respected. If no indications are present, the provision is applicable but it is not necessary to respect any limits. For example, if an Atex zone 2 is defined, there is a minimum distance to respect and this is the limit to indicate, while in the case of the presence of fire extinguishers, it is sufficient that the fire extinguishers are present, therefore there is no limit to indicate. **Attention:** where they are more stringent, always refer to the local regulations for clarification regarding the applicability of the provisions. Since they are applicable for this type of installation, certain provisions are already indicated as applicable in the following example.
- **Conf.** = prescription compliance. Indicate whether the prescription is complied with or not. All non-conformities must be described in detail in the list at the bottom of the table, in correspondence with the number of the note specified when assigning responsibility for the non-conformity.
- **Doc.** = prescription reference document (fill in the empty fields in accordance with the assessment specifying any additional documents).
- **Note** = indicate a note reference, to be included in the footer list with explanation of the item, if necessary. It is also possible to insert a brief description in the case of applicability and conformity.

The risk assessment must include the following fields:

- Name of the installation site.
- Town/City.
- Address.
- Proprietor.
- Intended use.
- Person responsible for the risk assessment.
- Date.

So the risk assessment could be drafted as follows and contain, for example, the following information:

Unit model:	App.	Doc.	Conf.		Notes
Serial No.: SB.....			**Yes**	**No**	
Type of Refrigerant:					
Quantity of refrigerant (kg):					
Circuit 1 = ...					
Circuit 2 = ...					
Circuit 3 = ...					
Circuit 4 = ...					
Classification (A2L, A3, Other):					
Installation specifications.					
Operative clearance spaces - single unit.	A	SchDI			
Operative clearance spaces - adjacent units.	A	IOM			
ATEX 2 Zone Refrigerant leak - refrigerating circuit.	A	IOM			
ATEX 2 Zone Safety valves discharge: horizontal.	A	IOM			
ATEX 2 Zone Safety valves discharge: vertical.	A	IOM			
Safety zone.	A	IOM			
Type of installation (indicate class and access category).	A	IOM			
Charge limit (indicate charge limit value).	A	EN378-1			
Access to the area around the unit is restricted to qualified personnel only.	A	IOM			
Fire extinguishers suitable for use on Propane in the vicinity of the unit.	A	IOM EN378-3			
Ventilation guaranteed.	A	IOM EN378-3			
It is forbidden to smoke or carry out any activities that involve introducing ignition sources into the Atex 2 zone.	A	IOM EN378-3			
Presence of one or more emergency circuit breakers for interrupting the power supply to the unit.		EN378-3			
Presence of refrigerant detectors in the installation (indicate trip setting level and area covered).					
Refrigerant leaks must not occur in the vicinity of ignition sources, fresh air inlets, closed and/or occupied spaces, doors or similar openings, manholes, storm drains or any other opening that could contain the refrigerant.		IOM EN378-3			
The installation site conforms to the fire prevention directives (indicate reference document).					
The escape routes must conform to the requirements of the fire prevention directive (indicate reference document).					
Other, depending on the characteristics of the installation.					
Unit safety valves.					
Safety valve discharge line.	A	Pdoc			

Unit model: ……..……..	App.	Doc.	Conf.		Notes
Serial No.: SB……			**Yes**	**No**	
i. Manufactured according to IUM, dimensional scheme and national directives.	A	IOM			
ii. Inner diameter not less than the diameter of the safety valve outlet.	A	SchDI			
iii. The weight of the pipe must not weigh on the safety valve.	A	IOM			
iv. Sealed from the surrounding environment.	A	IOM			
	A	EN378			
v. There must be no sources of ignition inside the exhaust pipe.	A	IOM			
	A	EN378			
vi. Calculation and sizing of the drain.	A	EN13136:			
	A	2013			
vii. Escaping refrigerant must not be in the vicinity of sources of ignition, fresh air intakes, confined and/or occupied spaces, doors or similar openings of drains, manhole covers and any other openings which may contain refrigerant.	A	IOM			
		EN378-3			
viii. The drain must not cause damage to people or things.	A	IOM			
		EN378-3			
Unit equipment.					
Installing accessories.					
• Accessories suitable for use in flammable atmospheres.		Pdoc			
• Accessories not suitable for use in flammable atmospheres.		Pdoc			
• Other, according to unit configuration.					
Unit equipped with refrigerant leak sensor.	A	IOM			
• Read/run check at start up.	A	IOM			
• Periodic reading/operation check.	A	IOM			"e.g.(2)"
Unit equipped with ATEX cable glands.	A	IOM			
• Start-up tightening check.	A	IOM			
• Periodic tightening check.	A	IOM			

Unit model: ……..……..	App.	Doc.	Conf.		Notes
Serial No.: SB……			**Yes**	**No**	
Hydraulic circuits 1					
Hydraulic circuit in conformity with EN378-32.	A	IOM EN378-3			
• It is compulsory to use systems in the hydraulic system capable of eliminating the presence of refrigerant gas in the event of a leak (vents, safety valves, degassers, other). These systems must be outside or safely conveyed outside according to requirements similar to points **iv, v, vii and viii** of the item "safety valve discharge".	A	IOM EN378-3			
• The conveying pipe, if present, must be correctly sized and made according to the indications of the reference standard.	A	Pdoc			
• Open-type components connected to the plumbing system must be installed outdoors or replaced by sealed equivalents.	A	IOM EN378-3			
• Comply with the Atex zone 2 of the vents or safety valves of the hydraulic system (indicate the Atex Zone 2 limit).	A	Pdoc			
• Respect zone 2 Atex open components of the hydraulic system installed outdoors (indicate Zone 2 Atex limit).	A	Pdoc			
• Comply with Atex Zone 2 due to loss of refrigerant from the hydraulic system (indicate Atex Zone 2 limit).	A	Pdoc			
• Other, according to the characteristics of the hydraulic system.	A	Pdoc			
Electrical connections.					
The electrical connections must be realised in a professional manner by operators who are qualified to design and install electrical systems, in accordance with applicable international and national standards.	A	IOM			
The system must be connected to earth.	A	IOM SchEL			
Power supply voltage and frequency corresponding to the electrical data specified for the unit (indicate nominal values).	A A	IOM SchEL			
The weight of the cables must not be borne by the electrical connection system.	A	IOM			
The cross-section of the cable and the line protection devices must correspond to those indicated in the wiring diagram.	A A	IOM SchEL			
The passage of any cable from the outside to the inside of the electrical panel must only take place using cable glands suitable for the diameter of the cable; any free cable glands available in the electrical panel are suitable. Do not insert more than one cable per gland; do not use sheaths inside the cable glands.	A	IOM			
The electrical panel must not be drilled, modified or tampered with in any way; do not leave any apertures.	A	IOM			
Additional provisions regarding the installation site					
…					
Other					
…					

Installations that require the use of treated coils

If the unit has to be installed in an environment with a particularly aggressive atmosphere, coils with special treatments are available as options.

- e-coated microchannel coils for condensing section
- coils with anti-corrosion treatment for condensing section (option available only for Cu/Al coil)
- Coil treated with anti-corrosion paints for freecooling section

A description of the individual accessories is available in the "Description of accessories" section.

The type of coil treatment should be chosen with regard to the environment in which the unit is to be installed, through observation of other structures and machinery with exposed metal surfaces present in the destination environment.

The cross observation criterion is the most valid method of selection currently available without having to carry out preliminary tests or measurements with instruments. The identified reference environments are:

- coastal/marine
- industrial
- urban with a high housing density
- rural

Please note that in cases where different conditions co-exist, even for short periods, the choice must be suitable for preserving the exchanger in the harsher environmental conditions and not in conditions between the worst and best situation.

Particular attention must be given in cases where an environment that is not particularly aggressive becomes aggressive as a consequence of a concomitant cause, for example, the presence of a flue outlet or an extraction fan.

We strongly suggest choosing one of the treatment options if at least one of the points listed below is verified:

- there are obvious signs of corrosion of the exposed metal surfaces in the installation area
- the prevailing winds come from the sea towards the unit
- the environment is industrial with a significant concentration of pollutants
- the environment is urban with a high population density
- the environment is rural with the presence of organic discharges and effluents

In particular, for installations near the coast, the following instructions apply:

- For units with a microchannel coil for the condensing section to be installed between 1 and 20 km from the coast, the use of the option "E-coated microchannel coils" and the option "Coil treated with anti-corrosion paints" for freecooling section is strongly recommended.
- For units with Cu/Al coils to be installed between 1 and 20 km from the coast, the use of the option "Coil treated with anti-corrosion paints" for both the condensing and the freecooling sections is strongly recommended.
- for distances within one kilometer from the coast it is strongly recommended to use the "Battery treated with anti-corrosion paints" accessory both for the condensing section and for the freecooling section

To protect the exchangers from corrosion and ensure optimal operation of the unit, we advise following the recommendations given in the user, installation and maintenance manual for cleaning the coils.

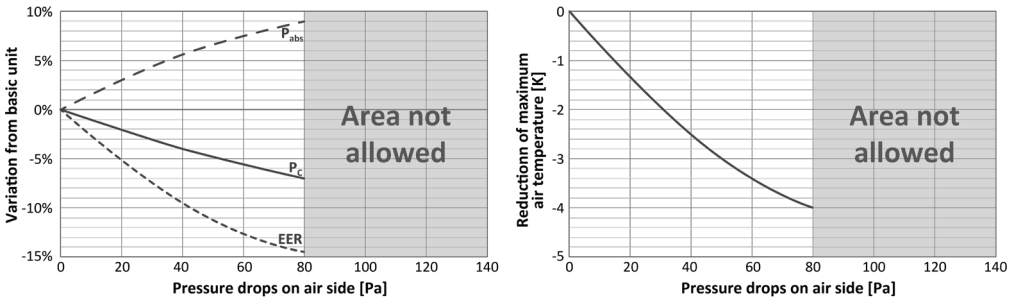
Aeraulic head losses and options available for the ventilating section

With the exception of units for which oversize fans are required, as standard, the units are designed considering that, at the nominal air flow rate, the fans work with null available pressure.

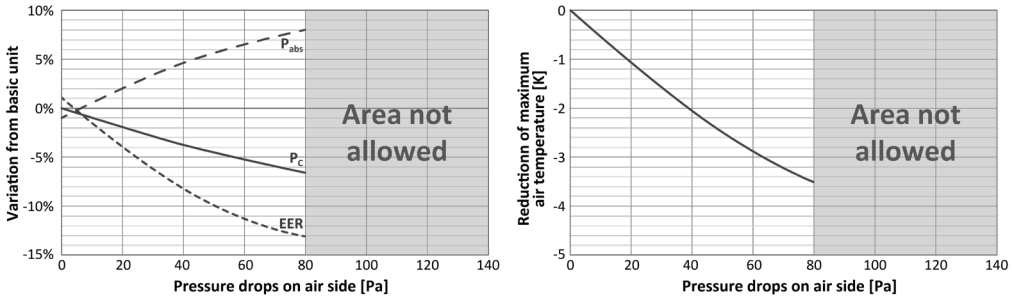
If there are obstacles to free air flow, you should consider the additional aeraulic head losses that will cause a reduction of the air flow rate and a consequent deterioration of performance.

The following diagrams show the trend of cooling capacity (PC), EER, total absorbed power (Pabs) and reduction of the maximum external air temperature in chiller operating mode, depending on the aeraulic head losses that the fans will have to overcome.

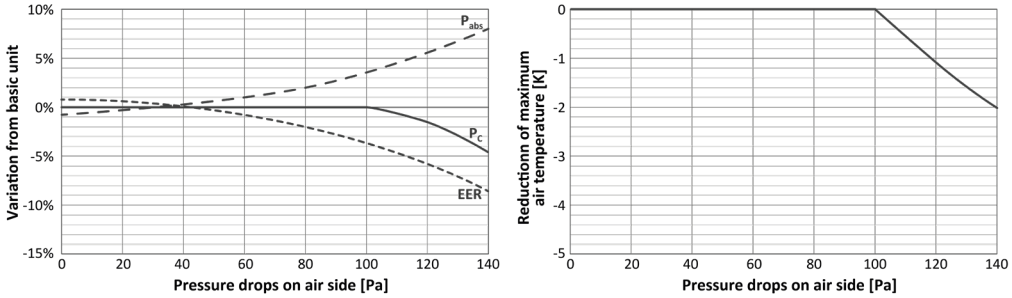
AC fans (Ø 800)



EC fans (Ø 800)



Oversize EC fans (Ø 800)



The indicated values are for the standard machine, without accessories, with AC fans and in any case in the absence of air recirculation.

Example: supposing you expect there to be obstacles that will generate an estimated aeraulic head loss of 60Pa. In this case, there are 3 possibilities:

- use the unit with standard AC fans: compared to ideal conditions, the output power will be reduced by about 5.5%, the total absorbed power will increase by about 7.5%, the EER will be reduced by about 12.5% and the maximum allowed external air temperature for operation at 100% will be reduced by about 3.4K compared to the nominal limit
- use the unit with EC fans: compared to the unit with AC fans working in ideal conditions, the output power will be reduced by about 5%, the total absorbed power will increase by about 6.5%, the EER will be reduced by about 11.5% and the maximum allowed external air temperature for operation at 100% will be reduced by about 2.8K compared to the nominal limit
- use the unit with oversize EC fans: compared to the unit with AC fans working in ideal conditions, the output power of the unit will be unchanged, the total absorbed power will increase by about 1%, the EER will be reduced by about 2% and the maximum external air temperature will remain the one shown in the diagram of the operating limits.

TC_0000_TitanSkyFC_EN_Rev01_20230518

Swegon Operations s.r.l.
Via Valletta, 5 - 30010
Cantarana di Cona, (VE) Italy - T. +39 0426 921111 - F. +39 0426 302222
www.blueboxcooling.com - info@bluebox.it

BlueBox by Swegon

Swegon Operations s.r.l. a socio unico - P.IVA 02481290282
Company directed and coordinated by Investment Latour (Sweden)