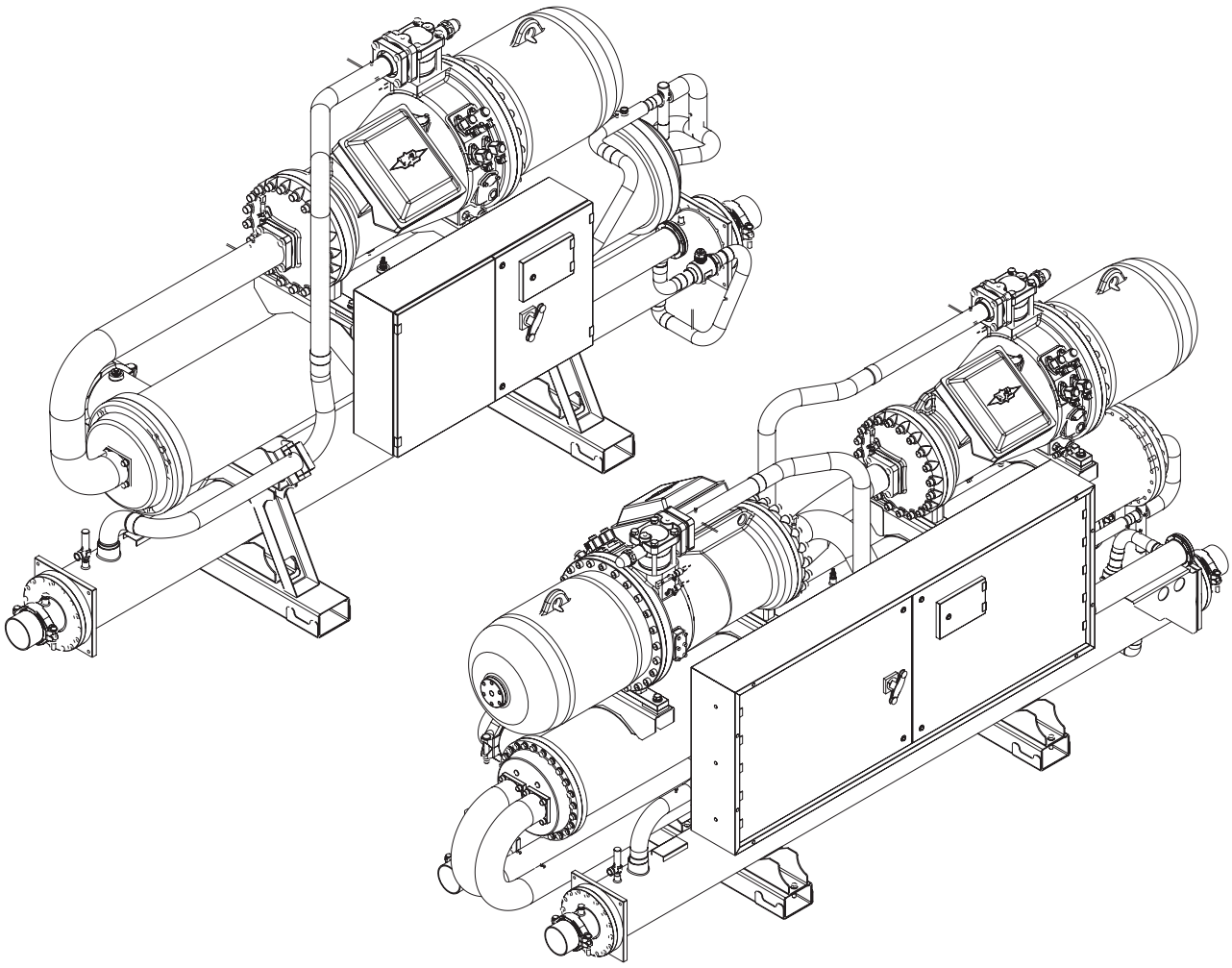
Ferroli

RVW

WATER-COOLED WATER CHILLERS

282 ÷ 1167 kW

ECO-FRIENDLY R134A REFRIGERANT GAS



CE

INSTALLATION MANUAL

Dear Customer,
Thank you for having purchased a FERROLI Idustrial coolers. It is the result of many years experience, particular research and has been made with top quality materials and higlly advanced technologies.The CE mark guaranteed thats the appliances meets European Machine Directive requirements regarding safety.
The qualitative level is kept under constant surveillance. FERROLI products therefore offer SAFETY, QUALITY and RELIABILITY.
Due to the continuous improvements in technologies and materials, the product specification as well as performances are subject to variations without prior notice.

Thank you once again for your preference.
FERROLI S.p.A

CE

GB **"CE" DECLARATION OF CONFORMITY**
We, the undersigned, hereby declare under our responsibility, that the machine in question complies with the provisions established by Directives :

DE **"EG" KONFORMITÄTSERKLÄRUNG**
Wir, die Unterzeichner dies er Erklärung, erklären unter unseren ausschlie ßlichen Verantworfung, daß die genannte Maschine den Bestimmungen der folgenden EG-Richtlinien entspricht :

FR **DECLARATION "CE" DE CONFORMITE**
Nous soussignés déclarons, sous notre entière responsabilité, que la machine en objet est conforme aux prescriptions des Directives :

IT **DICHIARAZIONE "CE" DI CONFORMITÀ**
Noi sottoscritti dichiariamo, sotto la nostra responsabilità, che la macchina in questione è conforme alle prescrizioni delle Direttive :

ES **DECLARACION "CE" DE CONFORMIDAD**
Quienes subscribimos la presente declaracion, declaramos, baio nuestra exclusiva responsabilidad, que la maquina en objeto respeta lo prescrito par las Directivas :

PT **DECLARAÇÃO "CE" DE CONFORMIDADE**
Nós, signatários da presente, declaramos sob a nassa exclusiva responsabilidade, que a má quina em questão está em conformidade com as prescrições das Directrizes :

NL **"EG" CONFORMITEITSVERKLARING**
Wij ondergetekenden verklaren hierbij op uitsluitend eigen verantwoording dat de bovengenoemde machine conform de voorschriften is van de Richtlijnen:

DK **"CE" OVERENSSTEMMELSESERKLERING**
Underfegnede forsikrer under eget ansvar al den ovennævnte maskine er i overensstemmelse med vilkårene i direktiveme :

SE **FÖRSÄKRAN OM "CE" ÖVERENSSTÄMMELSE**
Underfecknade försäkrar under eget ansvar alt ovannämnda maskinskinen er i overensstemmelse med vilkarene i direktivene :

NO **BEKREFTELSE OM ÆCEØ OVERENSSTEMMELSE**
Underfegnede forsikrer under eget ansvar al den ovennevnte maskinen er i overensstemmelse med vilkarene i direktivene :

FI **"CE" VAATIMUSTENMUKAISUUSVAKUUTUS**
Allekirjoittaneet vakuutamme omalla vastuullamme että yllämainittu kone noudattaa ehtoja direktiiveissä :

GR **ΔΗΛΩΣΗ ΣΥΜΒΑΤΟΤΗΤΑΣ "ΕΕ"**
Εμετς που υπογραφουμε την παρουσα, δηλωνουμε υπο την αποκλειστικη μας ευθυνη, οτι το μηχανημα συμμορφουται οτα οσ α ορτζουν οι Οδηγιες :

HR **IZJAVA O "CE" SUGLASNOSTI**
Mi niže potpisani izjavljujemo, pod našom odgovornošu, da ova Mašina odgovara zahtijevima iz Direktiva :

PL **DEKLARACJA ZGODNOŚCI "CE"**
My niżej podpisani oświadczamy z pełną odpowiedzialnością, że niżej wymienione urządzenie w pełni odpowiada postanowieniom przyjętym w następujących Dyrektywach:

2006/42/EC
97/23/EC
2004/108/EC
2006/95/EC

Il legale rappresentante
Dante Ferroli

TABLE OF CONTENTS

THIS MANUAL IS DIVIDED INTO SECTIONS. THEIR NAMES APPEAR IN THE HEADING OF EACH PAGE.

GENERAL SPECIFICATIONS

Presentation of the unit

This new series of water-cooled water chillers is based on **12 models** with cooling capacity from **282 to 1167 kW** and has been designed to meet
the demands of global markets in the medium-big power industrial and commercial plants.,
Units are compact and highly configurable built to fit different types of plants so to meet the needs of highly qualified engineers.
The units are suitable for indoor installation and, as standard, are equipped with bearing structure made of adequately thick coated and galvanized sheet metal where are fastened the condensers, to these the evaporator, the electrical panel and the compressors. This layout allows an uniform weight distribution and an easy maintenance. The basement of the unit is designed and made to allow an easy and quick handling of the unit in order to minimise the cost for installation.
All fastening components are made of stainless and/or galvanized steel. When the units were designed, particular attention was also paid to sound emission in our endeavour to comply with the increasingly more restrictive laws governing acoustic pollution.
To further reduce the noise emission the units can be supplied in Low Noise Version, that is equipped with an acoustic box for the compressors: this device allows a noise reduction of 4-5 dB.
The units produce cold water from **5 to 15°C** and only for heat pump units hot water from **30 to 55°C.** They can be equipped with 1 or 2 independent refrigerant circuits, each of which has a semi-hermetic **TWINSCREW** compressor featuring a 25 to 100% control capacity device. They are equipped with an asynchronous threephase motor (400V-3-50Hz) with aluminium squirrel-cage rotor, pre-engineered for part-winding or star-delta starting (so as to reduce the current input during the starting phase to the minimum) and are protected by a chain of thermistors buried in the stator windings (controlled by an electronic module with the function to prevent the reverse rotation of the single compressors) and fuses housed in the electric panel. The standard outfit includes an efficient oil separator complete with electric heater (activated when the compressor stops).
To widen the field of application to an even greater extent, some models are equipped with a liquid injection system controlled by the electronic controller so that use only occurs when effectively necessary. As part of the standard supply, they are positioned on rubber vibration dampers to reduce the vibrations transmitted to the base of the unit.
As standard, the unit is equipped with a shell and tube evaporator optimized fof R134a with high efficiency grooved pipes;
it is insulated with 10mm flexible closed-cell foam that forms barrier to prevent the formation of condensation and heat exchanges towards the outside. Standard supply also includes a differential water pressure switch built into the water supply circuit to avoid the risk of freezing if the water flow is shut off for some reason and as standard is equipped with VICTAULIC water connections. The evaporator is feeded by an electronic expansion valve that allows the exploitation of the evaporator surface thus increasing the efficiency of the system in all working conditions so achieving the optimal seasonal energy efficiency. The equipment is completed with 1 or 2 shell and tube condensers (one per each refrigerant circuit) optimized for use with **R134a**, featuring high-efficiency grooved pipes (thermally insulated only for heat pump units); as standard is equipped with VICTAULIC water connections.
As standard, the units are equipped with electric panel for setting and controls with a door-locking main circuit-breaker, controller with microprocessor and display with 4 lines of 20 characters, refrigerant circuit made with copper pipes, complete with low and high pressure switch (automatic and manual reset), safety valves (according to PED), Dehydrator filter with replaceble core, discharge and liquid shutoff valves, low and high pressure transducers, compressor oil, charge of R134a environment-friendly refrigerant g gas.
All the units are accurately built and tested individually, thus only the electrical and wet connections need be made for installation.
The series is completed by a large and flexible of options and accessories.

General specifications

- This manual and the wiring diagram supplied with the unit must be kept in a dry place and ready to hand for future consultation when required.
- This manual has been compiled to ensure that the unit is installed in the correct way and to supply comprehensive information about how to correctly use and service the appliance. **Before proceeding with the installation phase, please carefully read all the information in this manual, which describes the procedures required to correctly install and use the unit.**
- Strictly comply with the instructions in this manual and conform to the current safety standards.
- The appliance must be installed in accordance with the laws in force in the country in which the unit is installed.
- Unauthorized tampering with the electrical and mechanical equipment will **VOID THE WARRANTY.**
- Check the electrical specifications on the identification plate before making the electrical connections. Read the instructions in the specific section where the electrical connections are described.
- If the unit must be repaired for any reason, this must only be done by a specialized assistance center recognized by the manufacturer and using geuine spare parts.
- The manufacturer also declines all liability for any damage to persons or property deriving from failure of the information in this manual to correspond to the actual machine in your possession.
- **Proper uses: this series of chillers is designed to produce cold or hot water for use in hydronic systems for conditioning/heating purposes. The units are not suitable for the production of domestic hot water.**
  Any use differing from this proper use or beyond the operating limits indicated in this manual is forbidden unless previously agreed with the manufacturer.
- **The prevention of the risk of fire at the installation site is the responsiblity of the end user.**

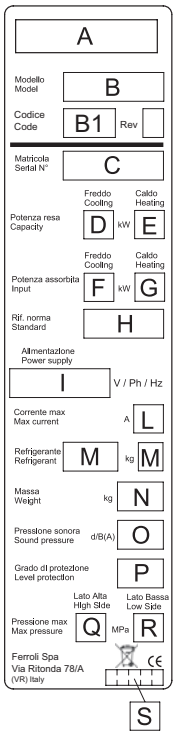
European Directives

The company hereby declares that the machine in question complies with the matters prescribed by the following Directives:

- Machinery directive **2006/42/EC**
- Pressurised equipment directive (PED) **97/23/EC**
- Electromagnetic compatibility directive (EMC) **2004/108/EC**
- Low voltage directive (LVD) **2006/95/EC**

GENERAL SPECIFICATIONS

Identification plate of the Unit



The figure on the left depicts the identification plate of the unit, affixed to the outer left-hand side of the Electric Panel.
A description of the data is given below:

Standard versions

A - Trademark
B - Model
B1- Code
C - Serial number
D - Cooling Capacity
E - Heating Capacity

F - Power input in COOLING mode
G - Power input in HEATING mode
H - Reference standard
I - Electric power supply
L - Maximum load current
M - Type of refrigerant and charge
N - Shipping weight of the unit
O - Sound pressure level at 1m
P - IP Level Protection
Q - Maximum pressure - High Side
R - Maximum pressure - Low Side
S - PED certification authority

Special versions

A - Trademark
B - Model
B1- Code
C - Serial number
D - Cooling Capacity (same as Standard Version of the unit)
E - Heating Capacity
for IR unit, VD version, Recovered Heating Capacity
for IP/IW unit, VD version, Heating Capacity / Recovered Heating Capacity
F - Power input in COOLING mode (same as Standard version of the unit)
G - Power input in HEATING mode
H - Reference standard
I - Electric power supply
L - Maximum load current
M - Type of refrigerant and charge
N - Shipping weight of the unit
O - Sound pressure level at 1m
P - IP Level Protection
Q - Maximum pressure - High Side
R - Maximum pressure - Low Side
S - PED certification authority

NOTE: The identification plate of the Brine Unit (BR - BW) is filled out as shown in the diagram for the Basic Version of the unit (VB).

Identification code of the unit

The codes that identify the units are listed below and include the sequences of letters that determine the meanings for the various versions and set-ups.

RVW - IR - 710.2 - VB - AB - 4 - T - 5

Unit type

IR- Unit for installation in an Hydronic system with operation as a Chiller.
IW- Unit for installation in an Hydronic system with operation as a Chiller and Heat Pump with the commutation between "COOL- HEAT" obtained by managing the hydraulic circuit.
BR - Water Chiller suitable for BRINE production from -8 to 5°C.
BW - Heat Pump with the commutation between "COOL- HEAT" obtained by managing the hydraulic circuit.Water Chiller suitable for BRINE production from -8 to 5°C (only in cooling mode).

Model of unit

N° compressors = 1/2

Version

VB - Basic Version
VD - Version with Desuperheater
VR - Version with Total heat recovery

Acoustic Version

AB - Basic Version

Refrigerant type

4 - R134a

Type of Power supply

5 - 400V-3ph~50Hz

Condenser Options

T- Cooling Tower
Units equpped with condensers with connections and water circuit suitable to wotk with cooling tower or dry cooler (DT=5K).
P- City Water
Units equpped with condensers with connections and water circuit suitable to wotk with city water (DT 15-20K).
S- For Sea water
Units equpped with condensers equipped with special pipes suitable to work with sea water.

Versions

The available unit versions are described below:
VD: Version with Desuperheater. Produces cold water as in the standard version plus hot water at a temperature from 40 to 50°C at the same time. This is achieved thanks to a water-refrigerant gas heat exchanger between the compressors and condenser that recovers part of the thermal power that would otherwise be dispersed in the ccoling water and increases the unit cooling capacity from 3 to 5%.
VR:Version with Total heat Recovery. Produces cold water as in the standard version plus hot water at a temperature from 35 to 55°C at the same time. This is achieved using a suitable heat exchanger that has a double water circuit: one for condensation and a second for heat recovery. In this way it is possible to recover the total thermal power that would otherwise be dispersed in the cooling water.

Acustic Versions

AB Basic Version. The compressors are installed on rubber vibration dampers
AS Low Noise Version. The compressors are installed on rubber vibration dampers and are enclosed in a Soundproofing Box made of hot galvanised steel sheet of adequate thickness, with internal acoustic insulation, and externally painted with polyester powders able to resist the atmospheric agents over time that allows a reduction of noise emission around 4/5 dB(A).

GENERAL SPECIFICATIONS

Description of the components

1. Electric control and monitoring panel.
It is housed in a cabinet made of adequately thick painted sheet metal suitable for outdoor installation (protection degree IP 54). The panel comprises the following main components:
- Main door-locking circuit-breaker.
- Contactors to control and manage the part-winding or star-delta starting mechanism of each compressor.
- Fuse holders with protection fuses for each compressor.
- Fuse holders with protection fuses for the oil heaters of the compressors.
- Insulating and safety transformer to power the auxiliaries, protected with fuses.
- Basic monitoring board with microprocessor:
- Electronic expansion valve controller

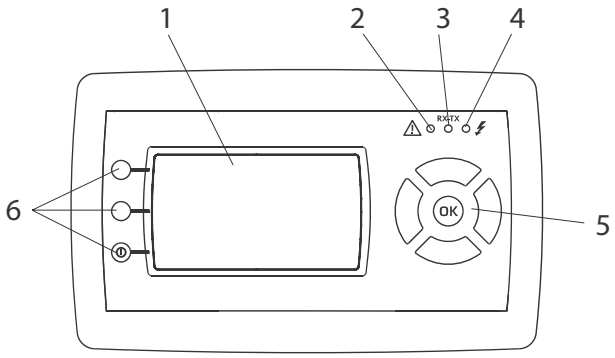
The main functions of the monitoring system are:
Temperature regulation of the water produced by the unit, operating hour counting for compressors and pump/s, operating hour, balancing for compressors and pumps, start-up timing, parameter entry digitized via the keyboard, alarm diagnosis.
Functions associated with the digital inputs: low and high pressure, high discharge temperature, correct electric power phase presence-sequence, thermal protection for compressors, evaporator and Condenser WATER differential pressure / paddle flow switch, thermal protection for evaporator and condenser, remote controlled ON/OFF commands, switching mode (summer-winter) (only for IW) Heat recovery mode enabling via digital input (only for VR), Heat Recovery WATER differential pressure / paddle flow switch (only for VR), heat recovery pump thermal protection (only for VR).
Functions associated with the digital outputs: compressor control, solenoid valves for compressor control capacity, liquid injection solenoid valve control, water pump/s control, general alarm (can be remote controlled), heat recovery water pumps management (only for VR).
Functions associated with the analog inputs: evaporator water inlet and outlet temperatures, condenser water outlet temperature (only for IW units) discharge temperature. Suction and discharge pressure, discharge temperature probe, heat recovery water probe (only for VR).
Functions associated with the analog outputs: 4-20 mA to manage 3 way valves for condesing pressure control.
Moreover the controller allows
- Alarm history (max 50m alarms managed with FIFO logic)
- Time scheduling (daily and weekly)
- Precise control of the water leaving temperature
- Prevention of the block of the unit: In case of critical conditions the machine does not stop but is able to regulate itself and provide the maximum power that can be generated in those conditions with the compressors working inside the admissible limits.
-Demand Limit by Digital Input and/or by Analog Input (4-20mA)
-Dinamic Setpoint by Analog Input (4-20mA): for instance by an outdoor temperature probe for the climate control
-Second Set Point by Digital Input
-Connection to BMS (supervision systems) through serial port RS 485 and MODBUS protocol

2. User interfacing terminal with display.
Control panel: composed of the instrument's front panel, equipped with an LCD display, three indicator LEDs, and one joystick buttons and three function button, it enables viewing and/or checking the operating mode and parameters, resources and complete alarm diagnostics.
In particular, it enables:

· Managing alarm situations
· Checking the status of resources.

KEY

1.Display
2. Alarms LED
3. LED for communication between the motherboard governing the unit a the keypad
4. Power supply LED
5. Joystick Menu Button
6. Function Button



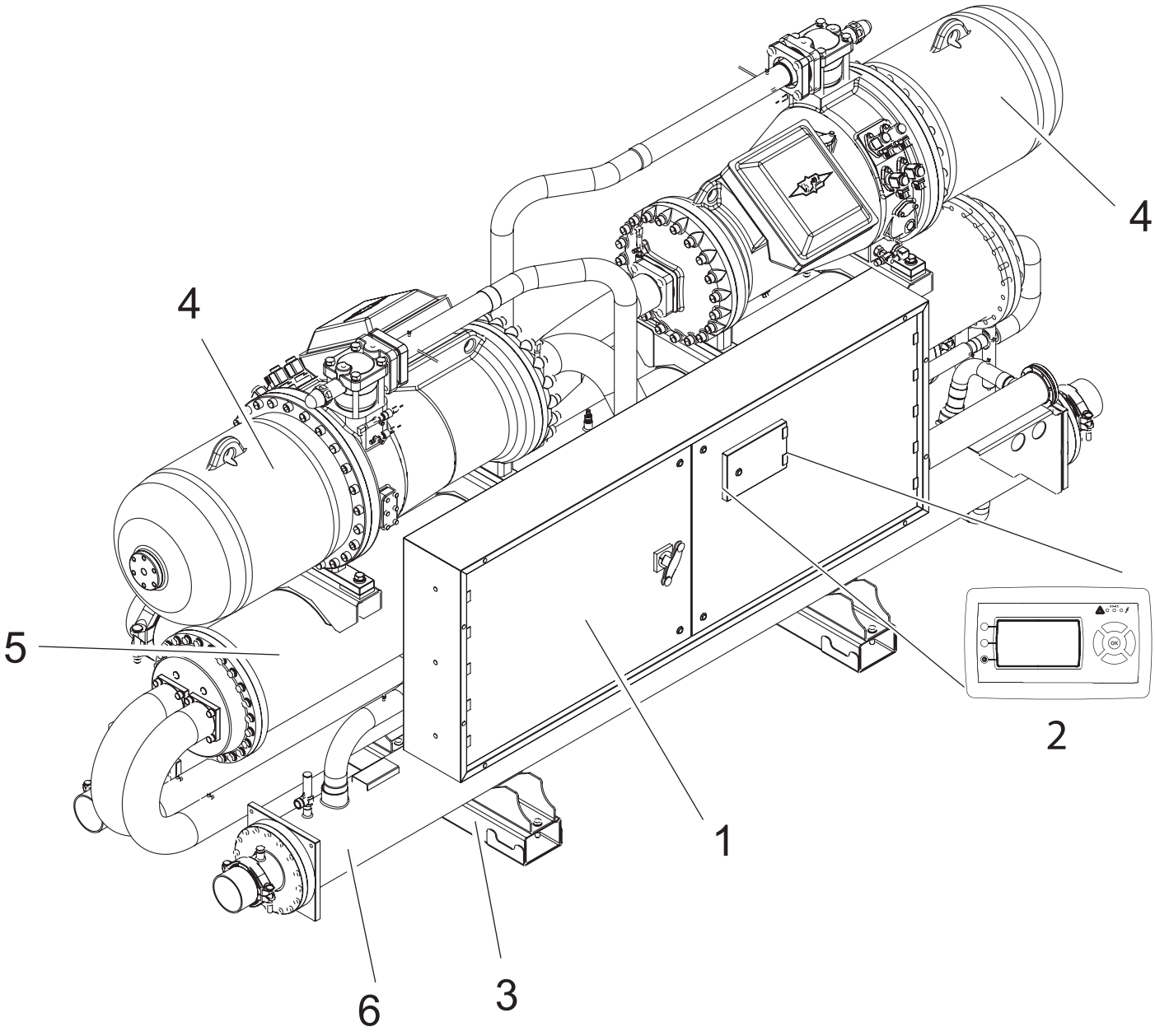
GENERAL SPECIFICATIONS

3. Bearing structure made of galvanized sheet metal coated to ensure good protection against adverse weather conditions.

4. Compressors. Suitable for outdoor installation. They are the TWIN-SCREW type with 25 to 100% control capacity: in conjunction with accurate assembly, this technical solution allows the refrigerant to compress and the axial thrusts on the bearings (amongst the most critical components of the compressor) to be perfectly balanced, thus guaranteeing long life.
They are equipped with an asynchronous threephase motor (400V-3-50Hz) with aluminium squirrel-cage rotor, pre-engineered for part-winding or star-delta starting (so as to reduce the current input during the starting phase to the minimum) and are protected by a chain of thermostors buried in the stator windings (controlled by an electronic module) and fuses housed in the electric panel. The standard outfit includes an efficient oil separator complete with electric heater (activated when the compressor stops). To widen the field of application to an even greater extent, some models are equipped with a liquid injection system controlled by the electronic controller so that use only occurs when effectively necessary.
As part of the standard supply, they are positioned on rubber vibration dampers to reduce the vibrations transmitted to the base of the unit.

5. Evaporator of the shell and tube heat exchanger type, made of carbon steel and optimized for operation with R134a. Features high-efficiency grooved pipes and also achieves low losses on the wet side.
As standard, the evaporator is insulated with 10mm flexible closed-cell foam that forms barrier to prevent the formation of condensation and heat exchanges towards the outside. Standard supply also includes a differential water pressure switch built into the water supply circuit to avoid the risk of freezing if the water flow is shut off for some reason. Also ensures that mechanical stress is absorbed to a good degree. As accessory it can be supplied with Water flow switch FA.

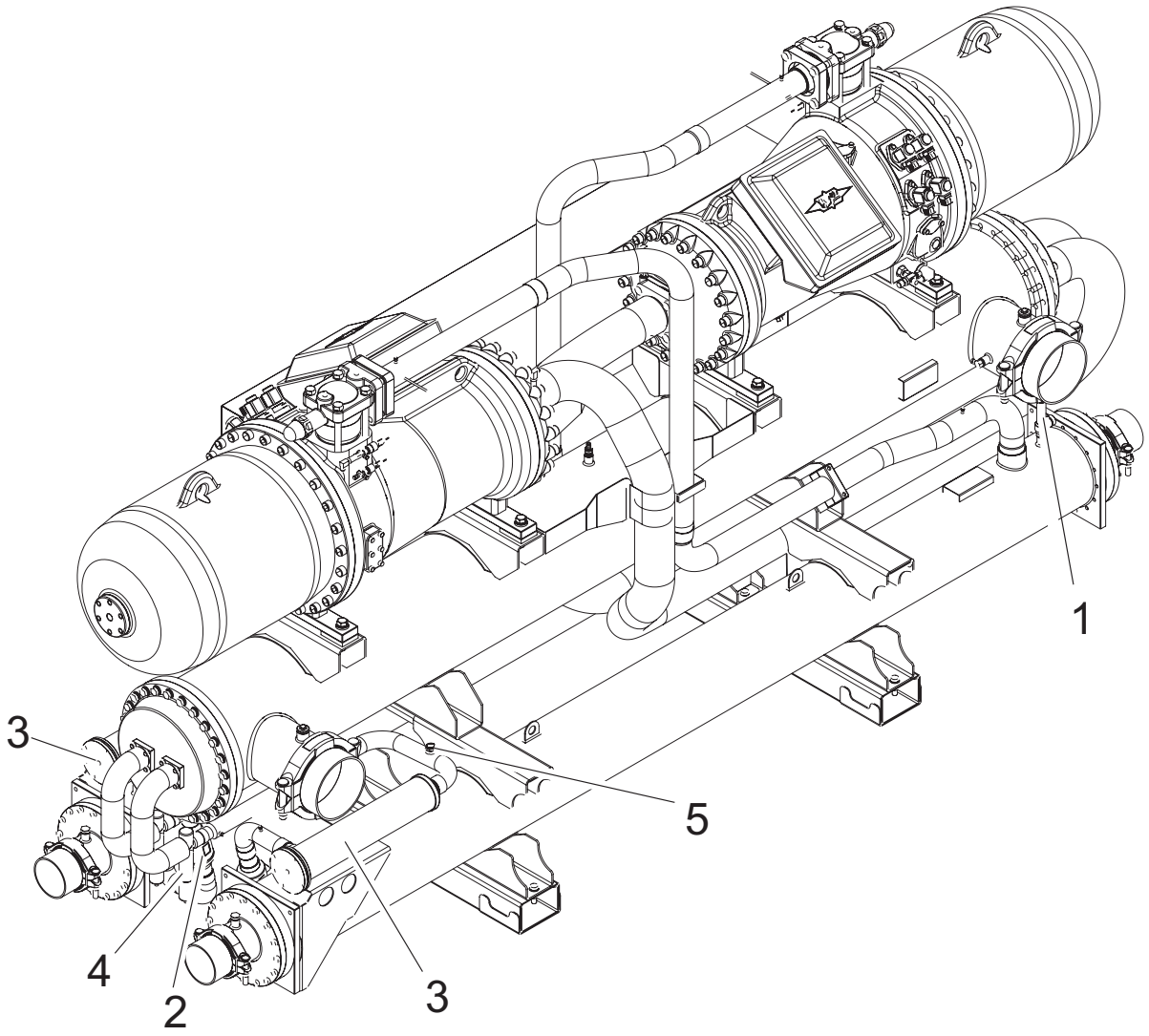
6. Condenser/Heat Recovery shell and tube type; the shell is made by carbon steel and is optimized to work with R134a. It is equipped with grooved pipes and allows very low water pressure drop.



GENERAL SPECIFICATIONS

Hydraulic and refrigerant circuit components

1. Refrigerant safety valve. (Conforms to the Directive governing pressurized equipments - PED). Installed on the delivery pipe of the compressors. It acts if critical service faults should occur.
2. Liquid cock - Gas cock. Allow all the refrigerant in the coils to be pumped and then stored so as to carry out servicing work or to replace all the components of the chilling circuit without having to drain it.
3. Dehydrator filter. Of the removable cartridge type. Retains impurities and traces of moisture in the circuit.
4. Electronic expansion valve. It has the task of correctly feeding the evaporator insuring a steady superheat. The valve is managed by a dedicated electronic board. It has also the function to stop the liquid when the compressor is off, so avoiding the refrigerant migration from the coils to the evaporator and to the compressor.
5. Liquid and moisture sight glass. Signals when liquid passes through the circuit, indicating that the refrigerant charge is correct. The liquid indicator also changes colour to show the amount of moisture in the refrigerant.
- Compressor delivery probe. One per compressor, installed on the delivery pipe to protect the compressor if the end of compression temperature exceeds the established limits.
- Pressure taps: 1/4 " SAE (7/16" UNF) (schraeder). Allow the operating pressure of both the circuits to be measured in 3 main points of each refrigerant circuit: compressor discharge, thermostatic valve inlet, compressor suction.
- High pressure switch. With fixed setting. It is installed on the delivery pipe and blocks the compressor of the circuit if the operating pressures exceed the tolerated values. If it activates, the circuit will block and can only be restarted by resetting via the user interface terminal.
- Oil crankcase heater to heat the compressor oil. One per compressor. Activated when the compressor switches off. Their task is to keep the temperature of the oil sufficiently high so as to prevent refrigerant from migrating during these pauses.
- Low pressure switch. With fixed setting. It is installed on the suction pipe and blocks the compressors if the operating pressures drop below the tolerated values. Automatically resets as the pressure increases. If it activates frequently, the unit will block and can only be restarted by resetting via the user interface terminal.



ACCESSORIES AND OPTIONAL EQUIPMENT

Mechanical accessories

AVG (F) - Rubber vibration dampers. Consisting of 4 rubber vibration dampers, they reduce the mechanical vibrations generated by the compressor during their normal operation, that are then transmitted to the bearing surface of the machine. The insulation degree provided by the vibration dampers is about 90%.

MAP (F) - Storage and Pumping Module (Storage on the Delivery or Storage on Return). The purpose of the storage and pumping module is to lower the number of compressor surges, increasing the amount of water in the system and, thus, its thermal inertia. It consists of a base made of galvanized and painted sheet metal and aluminium sheet panelling suitable for outdoor installation. Designed for connection alongside the chiller, the accessory comprises an insulated carbon steel tank, a single or double centrifugal pump with on-off valves, an electric power panel, expansion tank, safety valve, air vent, pressure gauge and filling and draining valves.

Mechanical options

GM (M) - Pressure gauge unit. This consists of low pressure gauges and high pressure gauges (one low and one high pressure gauge for each circuit).

RA (M) - Compressor suction shut-off valve. Allows a quick replacement of the compressor.

IEM (M) - High thickness evaporator insulation with 19mm flexible closed ceel foam.

Electrical accessories

CSF (M / F) - Voltage monitor and sequence meter. The device enables control of the correct sequence of power phases and the lack of any phases. It also ensures that the unit works within ± 10% the rated voltage (MIN=360 V - RATED=400V - MAX=440V). It blocks the unit if the voltage is outside the limits provided for the condensation pressure inside the correct operating limits.

INT (M) - RS485 Serial interface, for communication with the MODBUS protocol To connect to BMS (Building Management System). Via serial port it is possible to manage the ON/OFF of the unit, to modify the set point, to read and store the main parameters of the refrigerant and water circuits (analogue input) and to acquire the main alarms (digit<l input).

OP (F) - Programmer Clock, applied to the remote ON/OFF function.

FLS (F) - Flow switch. Paddle flow switch that can be installed on evaporator water circuit to avoid the risk of freezing if the water flow is shut off for some reason., and/or on condenser water circuit to avoid high pressure alarms caused by an insufficient water flow rate.

CR (F) - Remote Control. Repeats the functions of the control system installed in the unit, thus allowing this latter to be controlled at a distance (up to 100 m) from the unit.

RAG-MAP (F*) - Antifreeze heating element for Pumping Module Water tank. keeps the water at a temperature able to prevent ice from forming when the tank remains idle during the winter

Electrical options

FLE (M) - Flow switch. Paddle flow switch installed on the **evaporator** water circuit to avoid the risk of freezing if the water flow is shut off for some reason.

RAG (M) - Antifreeze heating element for the evaporator, keeps the water at a temperature able to prevent ice from forming when the unit remains idle during the winter

MTC (M) - Magnetothermic switch. Magnetothermic switch on all loads in place of fuses**.**

SS (M) - Soft Starter. Soft starter on compressors riduce the inrush current and reduce the vibrations transmitted to the pipes and basic frame during the start-up phase.

On request unit can be supplied:

- suitable for outdoor installation with components and electrical panel with minimum degree of protection IP54.
- Other voltage power supply

NOTE: The accessories can be of the following type:
(M): only installed in the factory.
(F): supplied for installation by the customer.

TECHNICAL SPECIFICATIONS - STANDARD UNIT (IR-IW)

General technical specifications Unit

Model	280.1	320.1	360.1	420.1	480.1	540.1	600.1	710.2	820.2	950.2	1100.2	1200.2	UM
Cooling capacity (1)(E)	282	317	356	412	478	536	592	704	818	935	1066	1167	kW
Total power input (1)(E)	59	67	75	86	100	114	125	150	172	200	228	249	kW
EER(1)(E)	4.78	4.73	4.75	4.79	4.78	4.7	4.74	4.69	4.75	4.68	4.67	4.69	W/W
ESEER (1)(E)	5.55	5.49	5.50	5.56	5.56	5.50	5.56	5.54	5.63	5.55	5.58	5.60	W/W
Heat capacity (2)(E)	299	338	381	435	512	569	634	754	870	1010	1133	1253	kW
Total power input (2)(E)	69	79	90	101	121	133	149	179	204	243	265	298	kW
COP (2)(E)	4.3	4.25	4.23	4.33	4.25	4.29	4.24	4.2	4.26	4.16	4.27	4.21	W/W

Compressor specifications

Type	TWIN-SCREW												-
Quantity	1							2					N°
Capacity control	25-100 %												%
Starting type	PART WINDING			STAR-DELTA				PW	STAR-DELTA				-

Evaporator data

Type	SHELLAND TUBE HEAT EXCHANGER												-
Quantity	1												N°
Maximum pressure on wet side	1000												kPa
Total water capacity	109	106	103	159	153	148	261	194	342	334	314	306	l
Water flow rate (1)	13.5	15.1	17	19.7	22.8	25.6	28.3	33.6	39.1	44.7	50.9	55.8	l/s
Water pressure drop (1)(E)	46	37	46	44	55	43	54	52	45	57	59	45	kPa
Water flow rate (2)	11	12.3	13.9	16	18.7	20.9	23.1	27.5	31.8	36.7	41.5	45.6	l/s
Water pressure drop (2)(E)	30	25	31	29	37	29	36	35	30	38	39	30	kPa

Condenser data

Model	280.1	320.1	360.1	420.1	480.1	540.1	600.1	710.2	820.2	950.2	1100.2	1200.2	UM
Type	SHELLAND TUBE HEAT EXCHANGER												-
Quantity	1							2					N°
Maximum pressure on wet side	1600												kPa
Total water capacity	32	32	34	37	37	53	59	68	74	74	106	118	l
Water flow rate (1)	16.3	18.3	20.6	23.8	27.6	31.1	34.3	40.8	47.3	54.2	61.8	67.7	l/s
Water pressure drop (1)(E)	29	25	26	28	38	27	25	26	28	38	27	25	kPa
Water flow rate (2)	14.3	16.1	18.2	20.8	24.5	27.2	30.3	36	41.6	48.3	54.1	59.8	l/s
Water pressure drop (2)(E)	22	19	20	21	30	21	20	20	22	30	21	20	kPa

Electrical specifications

Electric power supply	400 (±10%) / 3 / 50	V/ph/Hz

Note:

(1): Cooling Mode The data refer to: Evaporator Water temperature: inlet: 12°C - outlet: 7°C,
Condenser Water temperature: inlet: 30°C - outlet: 35°C,

(2): (only for IW unit)
Heating Mode The data refer to: Evaporator Water temperature: inlet: 10°C - outlet: 5°C,
Condenser Water temperature: inlet: 40°C - outlet: 45°C,

(E): Data declared according to **EUROVENT LCP** certification programme. The values are for units without options and accessories.

Correction factor for the use of glycol CONDENSER side

ETHYLENE GLYCOL with water produced between 30 ÷ 55 ° C.

percentage Of glycol in mass / volume	0 / 0	10 / 8.9	20 / 18.1	30 / 27.7	40 / 37.5
freezing point [°C]	0	-3.2	-8	-14	-22
Cooling capacity CCPF	1.000	0.995	0.985	0.975	0.970
Power input CCPA	1.000	1.010	1.015	1.020	1.030
Water flow rate CCQA	1.000	1.038	1.062	1.091	1.127
Water pressure drop CCDP	1.000	1.026	1.051	1.077	1.103

PROPYLENE GLYCOL with water produced between 30 ÷ 55 ° C.

percentage Of glycol in mass / volume	0 / 0	10 / 9.6	20 / 19.4	30 / 29.4	40 / 39.6
freezing point [°C]	0	-3.3	-7	-13	-21
Cooling capacity CCPF	1	0.99	0.975	0.965	0.955
Power input CCPA	1	1.01	1.02	1.03	1.04
Water flow rate CCQA	1	1.018	1.032	1.053	1.082
Water pressure drop CCDP	1	1.026	1.051	1.077	1.103

Based on leaving water temperatures of the condenser and evaporators (DESIGN CONDITIONS) from the table “performances” extract Cooling Capacity (kWf) and Compressors Power Input (kWa).
Based on type and percentage of glycol extract CCPF, CCPA, CCQA, CCDP.
Then calculate.

Pf_brine = kWf x CCPF

Pass_CP_brine = kWa x CCPA

Then calculate Thermal Power of the condenser:

Pt_brine = Pf_brine+Pass_CP_brine

Then calculate brine flow rate:

*Q_brine_cond [l/s]=CCQA x (Pt_brine [kW]*0.86/∆T_brine)/3.6*

where ∆T_brine is the difference outlet-intlet condenser water temperature:

∆T_brine=Twoutcond_brine-Twin_cond_brine .

With this brine flow rate enter in abscissa on the water pressure drop of the condenser then you have Dp_app.
Finally you can calculate the actual pressure drop of the brine on condenser side:

Dp_cond_brine =CCDP x Dp_app

Correction factor for the use of glycol EVAPORATOR side

ETHYLENE GLYCOL with water produced between 5÷20ºC.

percentage Of glycol in mass / volume	0 / 0	10 / 8.9	20 / 18.1	30 / 27.7	40 / 37.5
freezing point [°C]	0	-3.2	-8	-14	-22
Cooling capacity CCPF	1	0.99	0.98	0.97	0.95
Power input CCPA	1	1	0.99	0.99	0.98
Water flow rate CCQA	1	1.04	1.08	1.12	1.16
Water pressure drop CCDP	1	1.08	1.16	1.25	1.35

PROPYLENE GLYCOL with water produced between 5÷20ºC.

percentage Of glycol in mass / volume	0 / 0	10 / 9.6	20 / 19.4	30 / 29.4	40 / 39.6
freezing point [°C]	0	-3.3	-7	-13	-21
Cooling capacity CCPF	1	0.98	0.96	0.94	0.92
Power input CCPA	1	0.99	0.98	0.95	0.93
Water flow rate CCQA	1	1.01	1.03	1.06	1.09
Water pressure drop CCDP	1	1.05	1.11	1.22	1.38

Based on leaving water temperatures of the condenser and evaporators (DESIGN CONDITIONS) from the table “performances” extract Cooling Capacity (kWf) and Compressors Power Input (kWa).
Based on type and percentage of glycol extract CCPF, CCPA, CCQA, CCDP.
Then calculate.

Pf_brine = kWf x CCPF

Pass_CP_brine = kWa x CCPA

Then calculate brine flow rate:

*Q_brine_evap [l/s]=CCQA x (Pf_brine [kW]*0.86/∆T_brine)/3.6*

where ∆T_brine is the difference inlet-outlet evaporator water temperature:

∆T_brine=Twin_evap_brine-Twout_evap_brine

With this brine flow rate enter in abscissa on the water pressure drop of the evaporator then you have Dp_app.
Finally you can calculate the actual pressure drop of the brine on evaporator side:

Dp_evap_brine =CCDP x Dp_app

Correction factor for the use city water

For use of city water for condenser apply the correction factors reported on the following table.

∆t condenser water [°C]	5	10	15	20
Cooling capacity CCPF	1.000	1.025	1.030	1.035
Power input CCPA	1.000	0.960	0.955	0.950

Based on leaving water temperatures of the condenser and evaporators (DESIGN CONDITIONS) from the table “performances” extract Cooling Capacity (kWf) and Compressors Power Input (kWa).
Based on ∆Tcond equal to the difference outlet-inlet condenser water temperature you extract CCPF and CCPA so you can calculate

Pf = kWf x CCPF

Pass_CP = kWa x CCPA

Then you calculate the thermal power to be cooled by the condenser:

Pt = Pf+Pass_CP

Then you calculate the evaporator and condenser water flow rate :

*Q_evap [l/s]=(Pf [kW]*0.86/ ∆Tevap)/3.6:*

*Q_cond [l/s]=(Pt [kW]*0.86/ ∆Tcondensatore)/3.6:*

With Q_evap you can enter on abscissa on water pressure drop graph of the evaporator and extract the evaporator pressure drop.
With Q_cond you can enter on abscissa on water pressure drop graph of the condenser city water and extract the condenser pressure drop.

Fouling factors

The performances supplied with the tables are referred to a fouling factory = 0.44×10^{-4} m² K/W . For different values of the fouling factory, use the reduction coefficients reported in the following table.

Fouling factory		Evaporator		Condenser / Recuperator	
		F.c. PF	F.c. PA	F.c. PF	F.c. PA
(m² K / W)	0.44×10^{-4}	1	1	1	1
(m² K / W)	0.86×10^{-4}	0.98	0.99	0.98	1.025
(m² K / W)	1.72×10^{-4}	0.93	0.98	0.95	1.06

F.c. PF: Correction Factor for Cooling capacity
F.c. PA: Correction Factor for Power Input

TECHNICAL SPECIFICATIONS - STANDARD UNIT (IR-IW)

Performances

Mod. 280.1÷420.1

MOD.	TW_E	TW_C / TW_R - CONDENSER / RECOVERED WATER TEMPERATURE (°C)																	
		30			35			40			45			50			55		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
280.1	5	275	53	326	262	58	317	249	63	308	233	69	299	216	77	289	199	84	279
	6	285	54	336	272	58	327	258	64	318	242	70	308	225	77	298	207	85	288
	7	296	54	347	**282**	**59**	**338**	267	64	328	251	70	318	234	78	308	216	86	297
	8	306	55	358	292	59	348	277	65	339	260	71	328	243	78	318	225	86	307
	9	317	55	369	303	60	359	287	66	349	270	72	339	252	79	327	233	87	316
	10	327	56	380	313	60	370	297	66	359	280	73	349	261	79	337	242	87	325
	11	338	56	392	323	61	381	307	66	370	289	73	359	270	80	346	251	88	335
	12	348	57	402	332	62	391	315	67	379	298	74	368	279	81	355	259	89	344
	13	358	58	413	342	62	401	324	68	389	307	74	378	287	81	364	268	90	353
	14	369	58	424	351	63	411	334	69	399	316	75	388	295	82	373	276	90	362
	15	380	59	436	361	64	422	343	69	409	326	76	398	304	83	383	285	91	372
320.1	5	310	60	367	295	65	357	279	72	347	262	79	338	244	87	327	225	96	317
	6	321	61	379	306	66	369	290	72	358	272	80	348	254	88	337	235	97	327
	7	333	61	391	**317**	**67**	**381**	300	73	370	283	80	359	264	89	348	244	98	337
	8	344	62	403	328	67	392	311	74	382	293	81	370	274	89	359	254	99	348
	9	356	62	415	340	68	404	322	74	393	304	82	382	284	90	370	264	100	358
	10	368	63	428	351	69	416	334	75	405	315	83	393	295	91	381	273	100	368
	11	380	64	441	363	69	429	345	76	417	325	83	405	305	91	391	283	101	379
	12	391	65	453	373	70	440	355	77	427	335	84	415	313	92	401	292	102	389
	13	402	65	465	384	71	451	365	77	438	345	85	425	322	93	411	301	103	399
	14	414	66	477	394	72	462	375	78	450	355	86	436	332	94	421	311	103	409
	15	426	67	489	405	72	474	386	79	461	365	86	447	341	95	431	321	104	420
360.1	5	349	67	412	331	73	400	314	80	390	295	90	381	277	98	370	256	109	360
	6	361	68	425	343	74	414	326	81	403	307	90	393	287	99	382	267	110	371
	7	374	69	439	**356**	**75**	**427**	337	82	415	319	90	404	298	100	393	277	111	383
	8	386	70	453	369	76	441	350	83	429	330	91	417	310	101	406	288	113	395
	9	400	70	467	382	76	454	362	83	441	342	92	430	321	102	418	299	114	407
	10	413	71	480	394	77	468	375	84	455	354	93	443	332	102	430	310	114	418
	11	427	72	495	407	78	481	387	85	468	366	94	455	343	103	441	321	115	429
	12	439	72	508	418	79	493	399	86	481	376	95	466	353	104	452	330	116	440
	13	451	73	521	430	79	505	410	87	493	387	95	477	362	105	462	340	117	451
	14	464	74	534	441	80	517	422	88	506	398	96	489	372	106	473	350	118	462
	15	477	74	548	453	81	530	434	89	519	409	97	501	382	108	485	360	119	473
420.1	5	402	78	476	383	84	463	363	92	450	340	101	435	314	111	420	289	122	405
	6	417	78	491	397	85	478	376	93	464	353	101	449	327	112	434	301	123	418
	7	432	78	507	**412**	**86**	**494**	390	94	479	366	102	464	341	113	448	314	124	431
	8	447	79	522	427	86	508	404	95	494	380	103	478	355	113	462	326	125	445
	9	463	80	539	442	87	525	419	96	510	395	104	494	367	114	476	339	126	458
	10	478	81	555	457	88	540	433	96	524	408	105	508	381	115	490	352	127	472
	11	495	82	573	472	89	557	448	97	540	423	106	524	395	116	505	365	128	487
	12	509	83	588	486	90	571	461	98	553	436	107	537	407	117	518	378	129	500
	13	524	84	604	500	91	586	474	99	567	449	108	552	419	118	531	390	130	513
	14	539	85	620	514	92	602	487	100	582	463	109	566	432	119	545	403	130	527
	15	555	86	637	529	93	617	501	101	597	477	110	581	445	120	559	417	131	542

TW_E= Evaporator outlet water temperature (°C)
TW_C / TW_R= Condenser / recovered water temperature (°C)
TW_D = Desuperheater water temperature outlet (°C)
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).

The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchangers. Has also been considered A 0.44 x 10^{-4} m^2 K/W fouling factor.

TECHNICAL SPECIFICATIONS - STANDARD UNIT (IR-IW)

Mod. 480.1÷710.2

MOD.	TW_E	TW_C / TW_R - CONDENSER / RECOVERED WATER TEMPERATURE (°C)																	
		30			35			40			45			50			55		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
480.1	5	275	53	326	262	58	317	249	63	308	233	69	299	216	77	289	199	84	279
	6	285	54	336	272	58	327	258	64	318	242	70	308	225	77	298	207	85	288
	7	296	54	347	**282**	**59**	**338**	267	64	328	251	70	318	234	78	308	216	86	297
	8	306	55	358	292	59	348	277	65	339	260	71	328	243	78	318	225	86	307
	9	317	55	369	303	60	359	287	66	349	270	72	339	252	79	327	233	87	316
	10	327	56	380	313	60	370	297	66	359	280	73	349	261	79	337	242	87	325
	11	338	56	392	323	61	381	307	66	370	289	73	359	270	80	346	251	88	335
	12	348	57	402	332	62	391	315	67	379	298	74	368	279	81	355	259	89	344
	13	358	58	413	342	62	401	324	68	389	307	74	378	287	81	364	268	90	353
	14	369	58	424	351	63	411	334	69	399	316	75	388	295	82	373	276	90	362
	15	380	59	436	361	64	422	343	69	409	326	76	398	304	83	383	285	91	372
540.1	5	310	60	367	295	65	357	279	72	347	262	79	338	244	87	327	225	96	317
	6	321	61	379	306	66	369	290	72	358	272	80	348	254	88	337	235	97	327
	7	333	61	391	**317**	**67**	**381**	300	73	370	283	80	359	264	89	348	244	98	337
	8	344	62	403	328	67	392	311	74	382	293	81	370	274	89	359	254	99	348
	9	356	62	415	340	68	404	322	74	393	304	82	382	284	90	370	264	100	358
	10	368	63	428	351	69	416	334	75	405	315	83	393	295	91	381	273	100	368
	11	380	64	441	363	69	429	345	76	417	325	83	405	305	91	391	283	101	379
	12	391	65	453	373	70	440	355	77	427	335	84	415	313	92	401	292	102	389
	13	402	65	465	384	71	451	365	77	438	345	85	425	322	93	411	301	103	399
	14	414	66	477	394	72	462	375	78	450	355	86	436	332	94	421	311	103	409
	15	426	67	489	405	72	474	386	79	461	365	86	447	341	95	431	321	104	420
600.1	5	349	67	412	331	73	400	314	80	390	295	90	381	277	98	370	256	109	360
	6	361	68	425	343	74	414	326	81	403	307	90	393	287	99	382	267	110	371
	7	374	69	439	**356**	**75**	**427**	337	82	415	319	90	404	298	100	393	277	111	383
	8	386	70	453	369	76	441	350	83	429	330	91	417	310	101	406	288	113	395
	9	400	70	467	382	76	454	362	83	441	342	92	430	321	102	418	299	114	407
	10	413	71	480	394	77	468	375	84	455	354	93	443	332	102	430	310	114	418
	11	427	72	495	407	78	481	387	85	468	366	94	455	343	103	441	321	115	429
	12	439	72	508	418	79	493	399	86	481	376	95	466	353	104	452	330	116	440
	13	451	73	521	430	79	505	410	87	493	387	95	477	362	105	462	340	117	451
	14	464	74	534	441	80	517	422	88	506	398	96	489	372	106	473	350	118	462
	15	477	74	548	453	81	530	434	89	519	409	97	501	382	108	485	360	119	473
710.2	5	402	78	476	383	84	463	363	92	450	340	101	435	314	111	420	289	122	405
	6	417	78	491	397	85	478	376	93	464	353	101	449	327	112	434	301	123	418
	7	432	78	507	**412**	**86**	**494**	390	94	479	366	102	464	341	113	448	314	124	431
	8	447	79	522	427	86	508	404	95	494	380	103	478	355	113	462	326	125	445
	9	463	80	539	442	87	525	419	96	510	395	104	494	367	114	476	339	126	458
	10	478	81	555	457	88	540	433	96	524	408	105	508	381	115	490	352	127	472
	11	495	82	573	472	89	557	448	97	540	423	106	524	395	116	505	365	128	487
	12	509	83	588	486	90	571	461	98	553	436	107	537	407	117	518	378	129	500
	13	524	84	604	500	91	586	474	99	567	449	108	552	419	118	531	390	130	513
	14	539	85	620	514	92	602	487	100	582	463	109	566	432	119	545	403	130	527
	15	555	86	637	529	93	617	501	101	597	477	110	581	445	120	559	417	131	542

TW_E= Evaporator outlet water temperature (°C)
TW_C / TW_R= Condenser / recovered water temperature (°C)
TW_D = Desuperheater water temperature outlet (°C)
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).

The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchangers. Has also been considered A 0.44×10^{-4} m^2 K/W fouling factor.

TECHNICAL SPECIFICATIONS - STANDARD UNIT (IR-IW)

Mod. 820.2÷1200.2

MOD.	TW_E	TW_C / TW_R - CONDENSER / RECOVERED WATER TEMPERATURE (°C)																	
		30			35			40			45			50			55		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
820.2	5	275	53	326	262	58	317	249	63	308	233	69	299	216	77	289	199	84	279
	6	285	54	336	272	58	327	258	64	318	242	70	308	225	77	298	207	85	288
	7	296	54	347	**282**	**59**	**338**	267	64	328	251	70	318	234	78	308	216	86	297
	8	306	55	358	292	59	348	277	65	339	260	71	328	243	78	318	225	86	307
	9	317	55	369	303	60	359	287	66	349	270	72	339	252	79	327	233	87	316
	10	327	56	380	313	60	370	297	66	359	280	73	349	261	79	337	242	87	325
	11	338	56	392	323	61	381	307	66	370	289	73	359	270	80	346	251	88	335
	12	348	57	402	332	62	391	315	67	379	298	74	368	279	81	355	259	89	344
	13	358	58	413	342	62	401	324	68	389	307	74	378	287	81	364	268	90	353
	14	369	58	424	351	63	411	334	69	399	316	75	388	295	82	373	276	90	362
	15	380	59	436	361	64	422	343	69	409	326	76	398	304	83	383	285	91	372
950.2	5	310	60	367	295	65	357	279	72	347	262	79	338	244	87	327	225	96	317
	6	321	61	379	306	66	369	290	72	358	272	80	348	254	88	337	235	97	327
	7	333	61	391	**317**	**67**	**381**	300	73	370	283	80	359	264	89	348	244	98	337
	8	344	62	403	328	67	392	311	74	382	293	81	370	274	89	359	254	99	348
	9	356	62	415	340	68	404	322	74	393	304	82	382	284	90	370	264	100	358
	10	368	63	428	351	69	416	334	75	405	315	83	393	295	91	381	273	100	368
	11	380	64	441	363	69	429	345	76	417	325	83	405	305	91	391	283	101	379
	12	391	65	453	373	70	440	355	77	427	335	84	415	313	92	401	292	102	389
	13	402	65	465	384	71	451	365	77	438	345	85	425	322	93	411	301	103	399
	14	414	66	477	394	72	462	375	78	450	355	86	436	332	94	421	311	103	409
	15	426	67	489	405	72	474	386	79	461	365	86	447	341	95	431	321	104	420
1100.2	5	349	67	412	331	73	400	314	80	390	295	90	381	277	98	370	256	109	360
	6	361	68	425	343	74	414	326	81	403	307	90	393	287	99	382	267	110	371
	7	374	69	439	**356**	**75**	**427**	337	82	415	319	90	404	298	100	393	277	111	383
	8	386	70	453	369	76	441	350	83	429	330	91	417	310	101	406	288	113	395
	9	400	70	467	382	76	454	362	83	441	342	92	430	321	102	418	299	114	407
	10	413	71	480	394	77	468	375	84	455	354	93	443	332	102	430	310	114	418
	11	427	72	495	407	78	481	387	85	468	366	94	455	343	103	441	321	115	429
	12	439	72	508	418	79	493	399	86	481	376	95	466	353	104	452	330	116	440
	13	451	73	521	430	79	505	410	87	493	387	95	477	362	105	462	340	117	451
	14	464	74	534	441	80	517	422	88	506	398	96	489	372	106	473	350	118	462
	15	477	74	548	453	81	530	434	89	519	409	97	501	382	108	485	360	119	473
1200.2	5	402	78	476	383	84	463	363	92	450	340	101	435	314	111	420	289	122	405
	6	417	78	491	397	85	478	376	93	464	353	101	449	327	112	434	301	123	418
	7	432	78	507	**412**	**86**	**494**	390	94	479	366	102	464	341	113	448	314	124	431
	8	447	79	522	427	86	508	404	95	494	380	103	478	355	113	462	326	125	445
	9	463	80	539	442	87	525	419	96	510	395	104	494	367	114	476	339	126	458
	10	478	81	555	457	88	540	433	96	524	408	105	508	381	115	490	352	127	472
	11	495	82	573	472	89	557	448	97	540	423	106	524	395	116	505	365	128	487
	12	509	83	588	486	90	571	461	98	553	436	107	537	407	117	518	378	129	500
	13	524	84	604	500	91	586	474	99	567	449	108	552	419	118	531	390	130	513
	14	539	85	620	514	92	602	487	100	582	463	109	566	432	119	545	403	130	527
	15	555	86	637	529	93	617	501	101	597	477	110	581	445	120	559	417	131	542

TW_E= Evaporator outlet water temperature (°C)
TW_C / TW_R= Condenser / recovered water temperature (°C)
TW_D = Desuperheater water temperature outlet (°C)
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).

The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchangers. Has also been considered A 0.44×10^{-4} m^2 K/W fouling factor.

Brine Unit (BR - BW)

Correction factors to apply to the basic version data

ETHYLENE GLYCOL

percentage of glycol in mass / volume	20 / 18.1						
freezing point [°C]	-8						
Produced water temperature	4	2	0	-2	-4	-6	-8
Cooling capacity CCPF	0.912	0.855	0.798	0.738	0.683	-	-
Power input CCPA	0.967	0.957	0.947	0.927	0.897	-	-
Water flow rate CCQA	1.071	1.072	1.073	1.075	1.076	-	-
Water pressure drop CCDP	1.090	1.095	1.100	1.110	1.120	-	-

percentage of glycol in mass / volume	30 / 27.7						
freezing point [°C]	-14						
Produced water temperature	4	2	0	-2	-4	-6	-8
Cooling capacity CCPF	0.899	0.842	0.785	0.725	0.670	0.613	0.562
Power input CCPA	0.960	0.950	0.940	0.920	0.890	0.870	0.840
Water flow rate CCQA	1.106	1.107	1.108	1.109	1.110	1.111	1.112
Water pressure drop CCDP	1.140	1.145	1.150	1.155	1.160	1.175	1.190

percentage of glycol in mass / volume	40 / 37.5						
freezing point [°C]	-22						
Produced water temperature	4	2	0	-2	-4	-6	-8
Cooling capacity CCPF	0.884	0.827	0.770	0.710	0.655	0.598	0.547
Power input CCPA	0.880	0.870	0.860	0.840	0.810	0.790	0.760
Water flow rate CCQA	1.150	1.151	1.153	1.154	1.155	1.157	1.158
Water pressure drop CCDP	1.190	1.195	1.200	1.210	1.220	1.235	1.250

PROPYLENE GLYCOL

percentage of glycol in mass / volume	20 / 19.4						
freezing point [°C]	-8						
Produced water temperature	4	2	0	-2	-4	-6	-8
Cooling capacity CCPF	0.874	0.807	0.740	0.690	0.641	-	-
Power input CCPA	0.945	0.935	0.925	0.900	0.875	-	-
Water flow rate CCQA	1.037	1.038	1.039	1.039	1.040	-	-
Water pressure drop CCDP	1.110	1.115	1.120	1.130	1.140	-	-

percentage of glycol in mass / volume	30 / 29.4						
freezing point [°C]	-14						
Produced water temperature	4	2	0	-2	-4	-6	-8
Cooling capacity CCPF	0.869	0.799	0.729	0.680	0.630	0.583	0.536
Power input CCPA	0.935	0.923	0.910	0.888	0.865	0.838	0.810
Water flow rate CCQA	1.072	1.071	1.070	1.069	1.069	1.068	1.067
Water pressure drop CCDP	1.160	1.175	1.190	1.200	1.210	1.255	1.300

percentage of glycol in mass / volume	40 / 39.6						
freezing point [°C]	-22						
Produced water temperature	4	2	0	-2	-4	-6	-8
Cooling capacity CCPF	0.848	0.784	0.719	0.670	0.620	0.570	0.520
Power input CCPA	0.865	0.855	0.845	0.820	0.795	0.773	0.750
Water flow rate CCQA	1.116	1.114	1.112	1.110	1.108	1.107	1.105
Water pressure drop CCDP	1.230	1.275	1.320	1.375	1.430	1.500	1.570

Based on leaving water temperature of the condenser and evaporator water leaving temperature = 7°C from the table “performances” extract Cooling Capacity (kWf) and Compressors Power Input (kWa).
Based on type and percentage of glycol extract CCPF, CCPA, CCQA, CCDP.
Then calculate.

Pf_brine = kWf x CCPF

Pass_CP_brine = kWa x CCPA

Then calculate brine flow rate:

*Q_brine_evap [l/s]=CCQA x (Pf_brine [kW]*0.86/∆T_brine)/3.6*

where ∆T_brine is the difference between inlet-outlet evaporator water temperature:

∆T_brine=Twin_evap_brine-Twout_evap_brine

With this brine flow rate enter in abscissa on the water pressure drop of the evaporator then you have Dp_app.
Finally you can calculate the actual pressure drop of the brine on evaporator side:

Dp_evap_brine =CCDP x Dp_app

TECHNICAL SPECIFICATIONS FOR DESUPERHEATER VERSION (VD)

Version with Desuperheater VD

Model	280.1	320.1	360.1	420.1	480.1	540.1	600.1	710.2	820.2	950.2	1100.2	1200.2	UM
Recovered heating capacity	54	62	69	79	92	105	115	138	158	184	210	229	kW
Recovered water flow rate	2,6	2,9	3,3	3,8	4,4	5,0	5,5	6,6	7,6	8,8	10,0	11,0	l/s
Recovered water pressure drop	6	8	7	10	9	7	9	7	10	9	7	9	kPa
Type of recovery exchanger	STAINLESS STEEL BRAZE PLATES												-
Quantity	1							2					N°
Max. operating pressure on wet side	1000												kPa
Total water content of recovery exchangers	5	5	7	7	9	10	14	13	13	18	20	28	l

Notes:
The data refer to: Water temperature: evaporator inlet : **12°C** - evaporator outlet: **7°C.**
Water temperature: recovery inlet : **40°C** - recovery outlet: **45°C**.
Water temperature: condenser inlet : **30°C** - condenser outlet: **35°C**.

Recovery heat exchanger specifications Version with Desuperheater VD

MOD.	TW_D	CONDENSER WATER TEMPERATURE (°C TW_C)					
		30	35	40	45	50	55
		kWt_r = RECOVERED HEATING CAPACITY [Kw]					
280.1	40	47	56	63	69	76	83
	45	45	**54**	60	66	73	80
	50	44	52	58	64	71	77
320.1	40	54	64	72	79	88	95
	45	52	**62**	69	76	84	92
	50	50	60	67	73	81	88
360.1	40	60	72	80	88	98	106
	45	58	**69**	77	85	94	102
	50	56	66	74	81	90	98
420.1	40	69	82	92	101	112	122
	45	66	**79**	88	97	107	117
	50	64	76	85	93	103	112
480.1	40	80	96	107	118	130	142
	45	77	**92**	103	113	125	136
	50	74	88	99	109	120	131
540.1	40	92	109	122	134	149	162
	45	88	**105**	118	129	143	155
	50	85	101	113	124	137	149
600.1	40	100	120	134	147	163	177
	45	97	**115**	129	141	156	170
	50	93	110	124	136	150	163
710.1	40	121	144	161	177	195	212
	45	116	**138**	155	170	188	204
	50	111	132	148	163	180	196
820.2	40	138	164	184	202	223	243
	45	133	**158**	177	194	215	234
	50	127	152	170	187	206	224
950.2	40	161	191	214	235	260	283
	45	155	**184**	206	226	250	272
	50	148	177	198	217	240	261
1100.2	40	183	218	245	269	297	323
	45	176	**210**	235	258	286	311
	50	169	202	226	248	274	298
1200.2	40	200	238	267	293	324	352
	45	192	**229**	256	282	311	339
	50	185	220	246	270	299	325

TW_D = Desuperheater water temperature outlet (°C)
TW_C = Condenser water temperature outlet (°C)
The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchanger. Has also been considered A 0.44 x 10^{-4} m2 K/W fouling factor.

TECHNICAL SPECIFICATIONS FOR TOTAL RECOVERY VERSION (VR)

Version with total recovery on all circuits VR

Model	**280.1**	**320.1**	**360.1**	**420.1**	**480.1**	**540.1**	**600.1**	**710.2**	**820.2**	**950.2**	**1100.2**	**1200.2**	UM
Recovered heating capacity	318	359	404	464	546	607	674	801	925	1072	1208	1332	kW
Recovered water flow rate	15,2	17,2	19,3	22,2	26,1	29,0	32,2	38,3	44,2	51,2	57,7	63,6	l/s
Recovered water pressure drop	25	22	23	24	34	24	22	23	24	34	24	22	kPa
Type of recovery exchanger	SHELLAND TUBE HEAT EXCHANGER												-
Quantity	1							2					N°
Max. operating pressure on wet side	1600												kPa
Total water content of recovery exchangers	27	31	34	37	37	53	59	68	74	74	106	118	l

Notes:
The data refer to: Water temperature: evaporator inlet : **12°C** - evaporator outlet: **7°C**.
The data refer to: Water temperature: recovery inlet : **40°C** - recovery outlet: **45°C**.

FOR THE PERFORMANCES OF THE HEAT RECOVERY VERSION REFER TO THE VALUES REPORTED IN THE TABLES "PERFORMANCES" FOR BASIC VERSION (kWt).

NOISE LEVELS

The noise levels refer to units operating in the nominal conditions (water temperature: inlet: 12°C - outlet: 7°C, Condenser water temperature: inlet: 30°C - outlet: 8°C).
The acoustic pressure levels are measured 1/ 5 / 10 meters away from the outer surface of the unit operating in the free field and resting on a reflecting surface (directional factor of 2).

SWL = Sound power levels, with reference to $1x10^{-12}$ W.
The Total sound power level in dB(A) measured in compliance with ISO 9614 standards, which is therefore the only binding acoustic specification (the values of the Octave bands in the table are indicative).

SPL = Sound pressure levels, with reference to $2x10^{-5}$ Pa.
The sound pressure levels are values calculated by applying the **ISO-3744 relation (Eurovent 8/1)** and refer to a distance of 1 meter away from the external surface of units operating in the open field with directivity factor 2 and the units operating in nominal conditions in the cooling mode.

Standard Unit AB

MOD.	SWL (dB)										SPL [dB(A)		
	Octave bands (Hz)								Total				
	63	125	250	500	1000	2000	4000	8000	dB	dB(A)	1	5	10
280.1	94	93	91	92	92	91	86	79	**100**	**97**	79	70	65
320.1	94	93	91	92	92	91	86	79	**100**	**97**	79	70	65
360.1	94	93	91	92	92	91	86	79	**100**	**97**	79	70	65
420.1	96	95	94	93	94	92	88	82	**102**	**98**	80	72	67
480.1	96	95	94	93	94	92	88	82	**102**	**98**	80	72	67
540.1	96	95	94	93	94	92	88	82	**102**	**98**	80	72	67
600.1	96	95	94	93	94	92	88	82	**102**	**98**	80	71	66
710.2	98	97	95	93	94	94	88	82	**103**	**99**	80	72	67
820.2	100	98	97	95	96	94	90	84	**105**	**100**	81	73	68
950.2	100	98	97	95	96	94	90	84	**105**	**100**	81	73	68
1100.2	100	98	97	95	96	94	90	84	**105**	**100**	81	73	68
1200.2	100	98	97	95	96	94	90	84	**105**	**100**	81	73	68

Low noise Unit AS

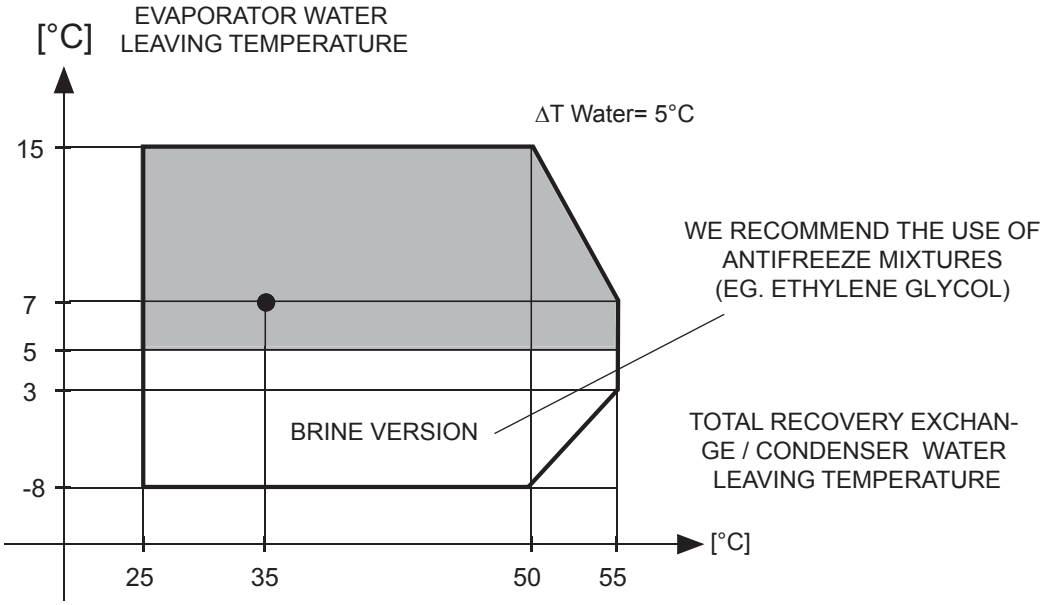
MOD.	SWL (dB)										SPL [dB(A)		
	Octave bands (Hz)								Total				
	63	125	250	500	1000	2000	4000	8000	dB	dB(A)	1	5	10
280.1	93	90	88	87	86	88	80	76	**97**	**92**	74	65	60
320.1	93	90	88	87	86	88	80	76	**97**	**93**	75	66	61
360.1	93	90	88	87	86	88	80	76	**97**	**92**	74	65	60
420.1	94	91	89	87	86	89	82	78	**98**	**93**	75	66	61
480.1	94	91	89	87	86	89	82	78	**98**	**93**	75	66	61
540.1	95	92	90	89	87	90	83	80	**99**	**94**	76	67	62
600.1	95	92	90	89	87	90	83	80	**99**	**94**	76	67	62
710.2	96	94	91	89	89	88	84	80	**100**	**94**	75	67	62
820.2	97	93	92	89	88	91	86	80	**101**	**95**	76	68	63
950.2	97	93	92	89	88	91	86	80	**101**	**95**	76	68	63
1100.2	97	95	94	90	89	92	86	80	**102**	**96**	77	69	64
1200.2	97	95	94	90	89	92	86	80	**102**	**96**	77	69	64

OPERATING RANGE

Operating range Basic Version

The graph indicates the admissible working envelope of the unit.
The use of the unit in conditions outside the envelope will avoid the warranty.
Here under are reported the limits of water differential temperature for the heat exchangers of the unit.

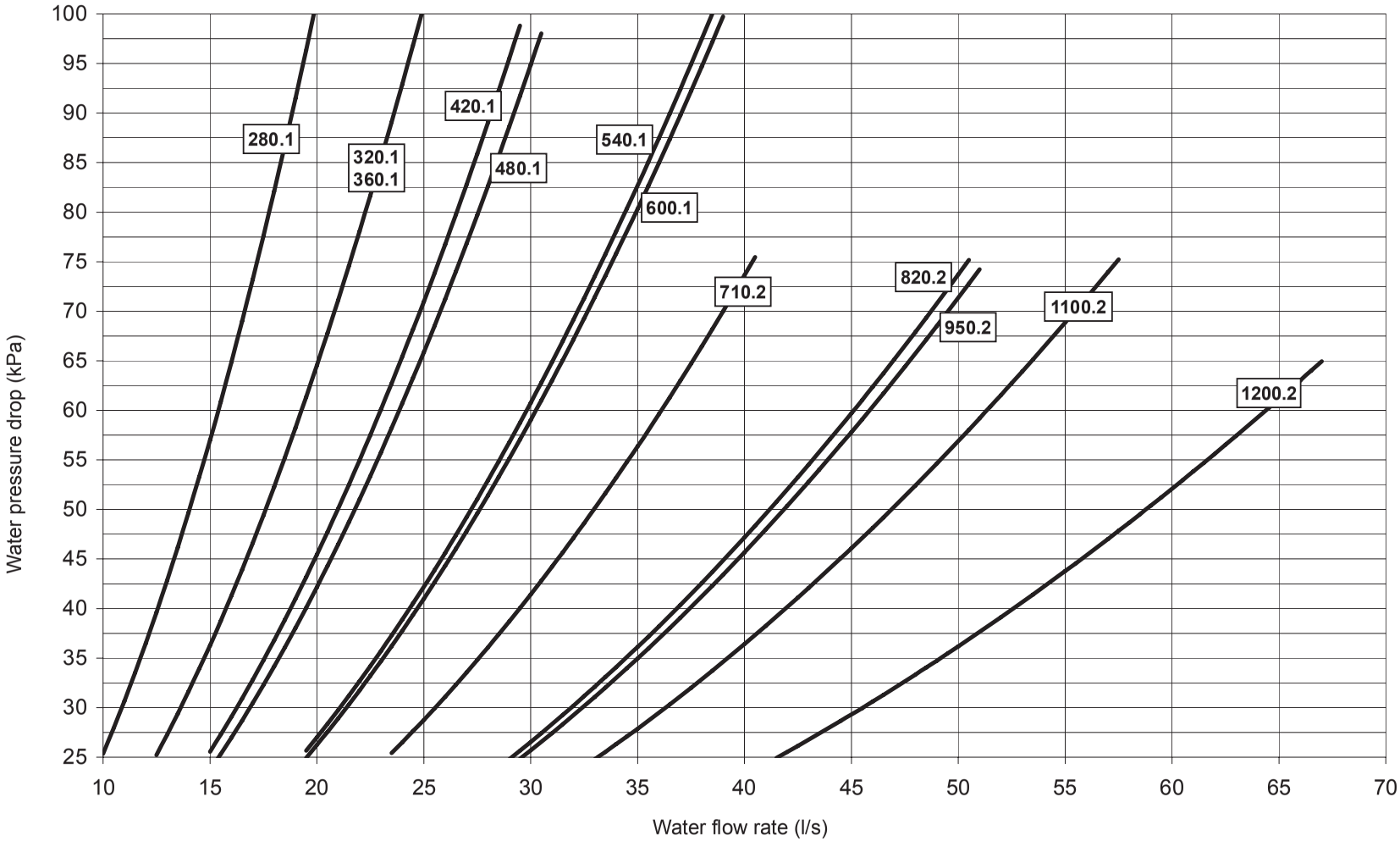
Water thermal gradient*		EVAPORATOR	CONDENSER / RECOVERED	
			Cooling Tower	City Water
Minimum	°C	4	4	8
Maximum	°C	8	8	20



* : Verify that water flow rate is inside the admissible limits.

Water pressure drop Evaporator

The graph below illustrates for the evaporator the water pressure drop values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.

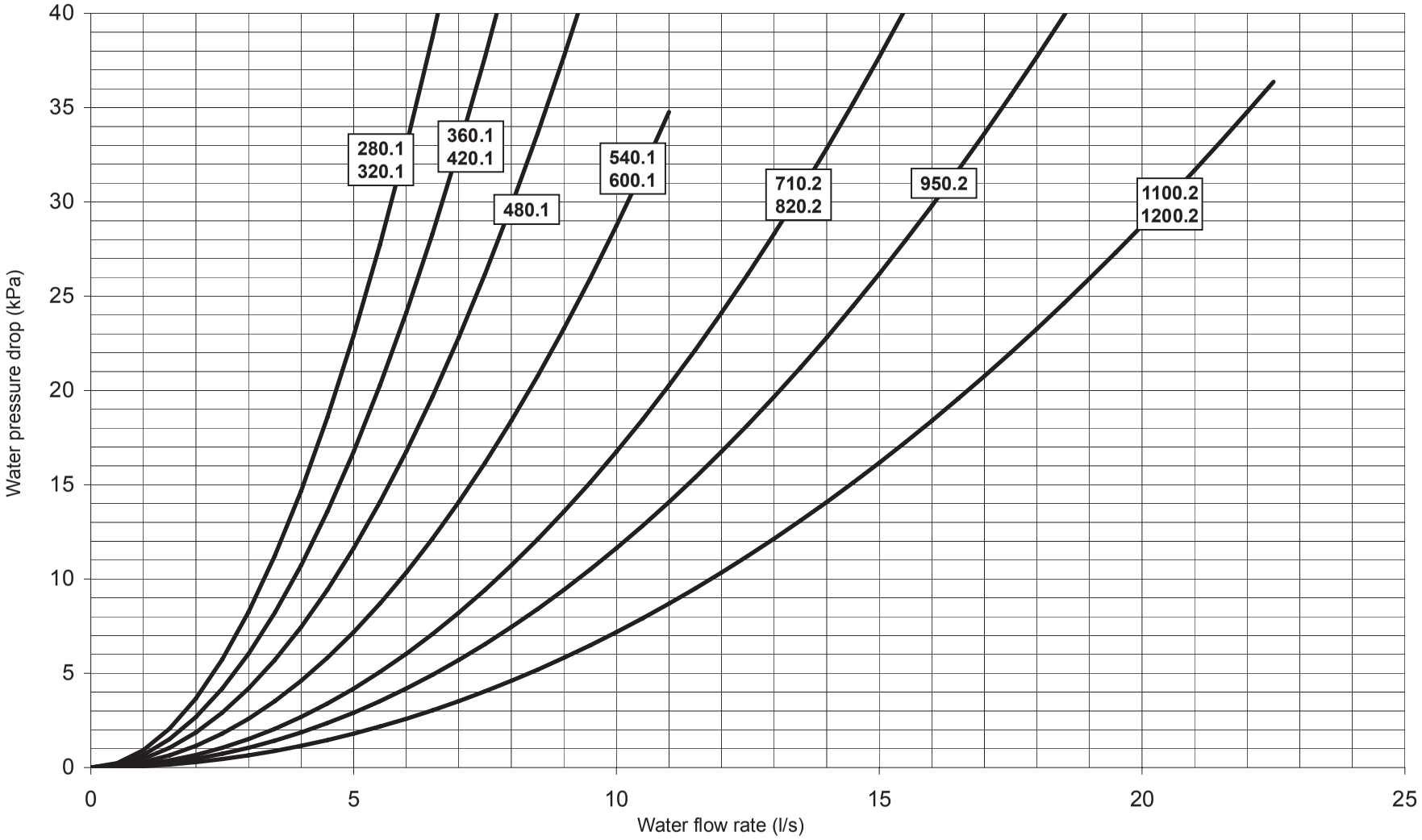


Operating range

MOD.		280.1	320.1	360.1	420.1	480.1	540.1	600.1	710.2	820.2	950.2	1100.2	1200.2	UM	NOTES
Lower limit value	Q	10	12.5	12.5	15	15	19.5	19.5	23.5	29	29	33	41.5	l/s	Q=Water flow rate Dp=Water pressure drop
	Dp	25												kPa	
Upper limit value	Q	20	25	25	29.5	30.5	39	38.5	40.5	50.5	51	57.5	67	l/s	
	Dp	101	101	99	99	98	100	100	75	75	74	75	65	kPa	

Water pressure drop Desuperheater

The graph below illustrates for the evaporator the water pressure drop values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.

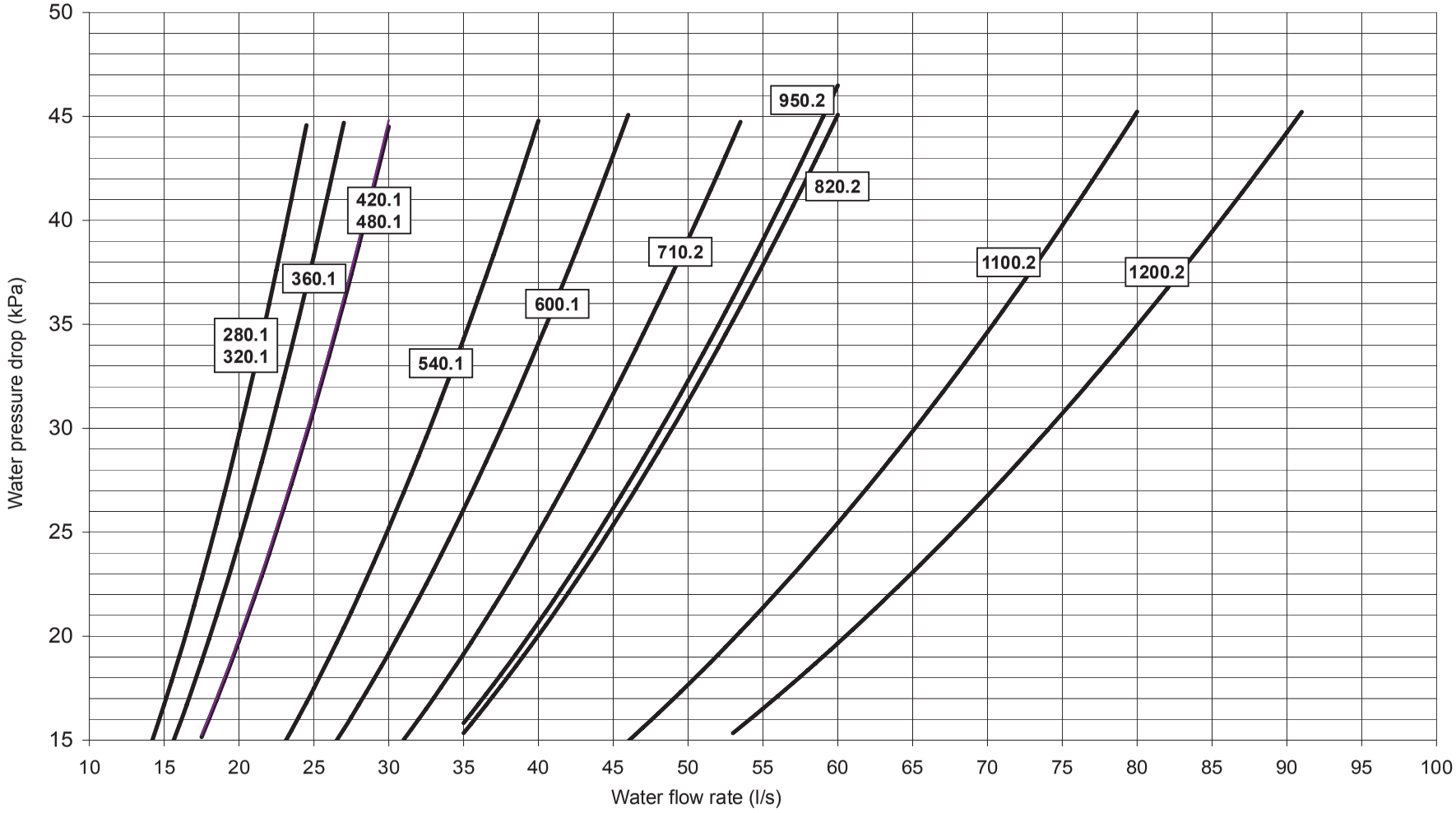


Operating range

MOD.		280.1	320.1	360.1	420.1	480.1	540.1	600.1	710.2	820.2	950.2	1100.2	1200.2	UM	NOTES
Upper limit value	Q	6.5		7.8		9.2	11		15.5			22.5		l/s	Q=Water flow rate
	Dp	40					35		40			36		kPa	Dp=Water pressure drop

Water pressure drop Condenser Cooling tower (4T5) / Total recovery version VR

The graph below illustrates for the evaporator the water pressure drop values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.

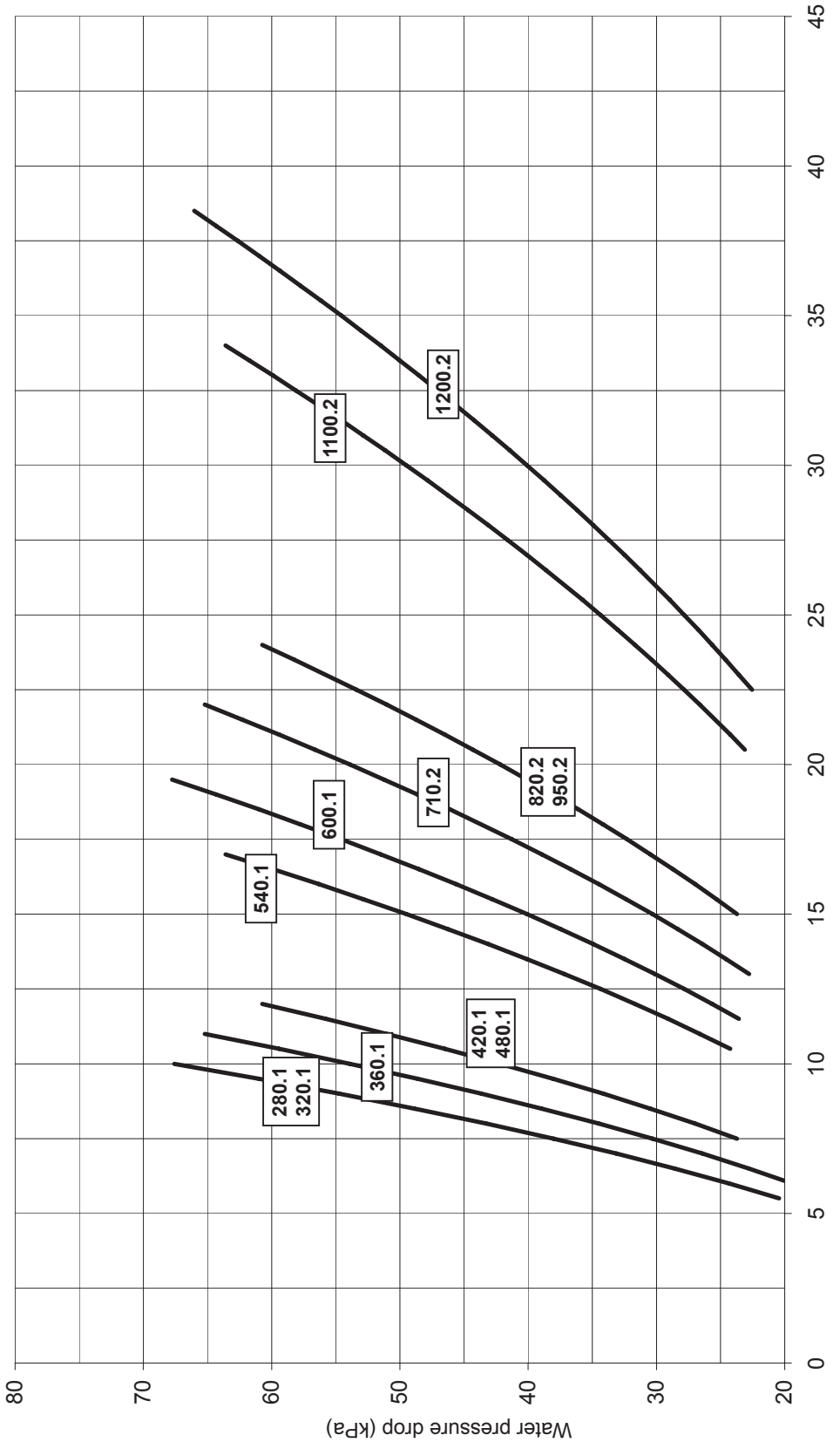


Operating range

MOD.		280.1	320.1	360.1	420.1	480.1	540.1	600.1	710.2	820.2	950.2	1100.2	1200.2	UM	NOTES
Lower limit value	Q	14		15.5	17.5	17.5	23	26.5	31	35	35	46	53	l/s	Q=Water flow rate Dp=Water pressure drop
	Dp	15												kPa	
Upper limit value	Q	24.5		27	30	30	40	46	53.5	60	60	80	91	l/s	
	Dp	45		45	45	45	45	45	45	45	46	45	45	kPa	

Water pressure drop Condenser City water (4P5)

The graph below illustrates for the evaporator the water pressure drop values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table



Operating range

MOD.		280.1	320.1	360.1	420.1	480.1	540.1	600.1	710.2	820.2	950.2	1100.2	1200.2	UM	NOTES
Lower limit value	Q	5.5		6	7.5		10.5	11.5	13		15	23	23	l/s	Q=Water flow rate Dp=Water pressure drop
	Dp	20		19	24		24	24	23		24	20.5	22.5	kPa	
Upper limit value	Q	10		11	12		17	19.5	22		24	34	38.5	l/s	
	Dp	68		65	61		64	68	65		61	64	66	kPa	

RECEPTION AND POSITIONING

Inspections on arrival

As soon as the appliance is consigned, it is essential to make sure that all the ordered items have been received and that the shipment is complete. Carefully check that the equipment has not been damaged. If visible damage is discovered, immediately inform the haulage contractor and write "**Collected with reserves owing to evident damage"** on the consignment note.
Delivery ex works means that, as established by law, reimbursement of any damages is at the insurance company's charge.

Safety regulations

Comply with the current safety regulations concerning the equipment to use when handling the unit or the required ways of operating.

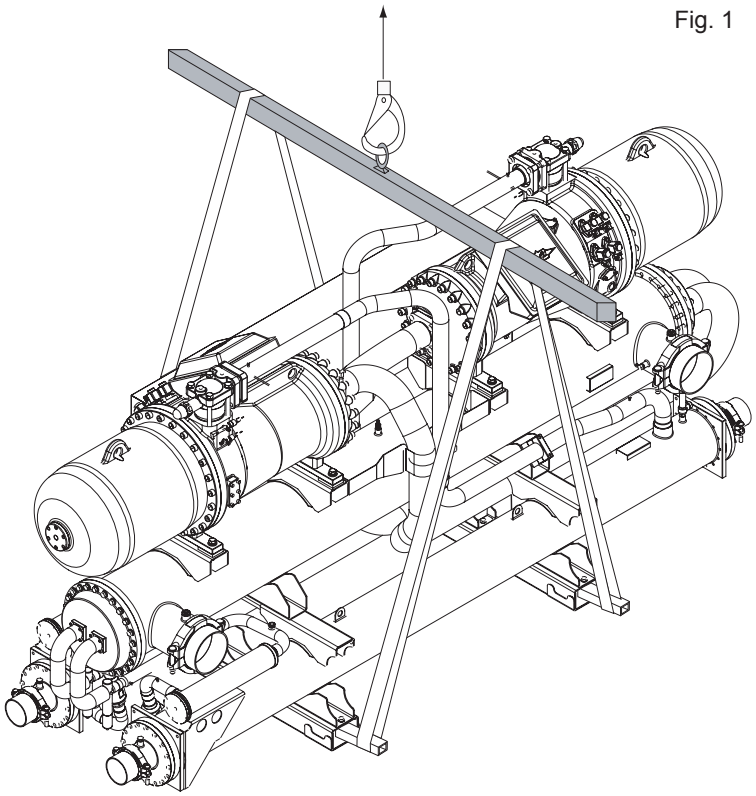
Handling

Check the weight of the appliance before proceeding with the moving and handling operations. The weight is indicated on the data plate of the appliance and in the **WEIGHTS AND CENTERS OF GRAVITY DURING TRASPORT AND OPERATION** section of this manual. Make sure that the appliance is handled with care and without jolting as rough treatment could damage the functional parts of the machine.
Comply with the following instructions when lifting and positioning the appliance:
• Handling and lifting with a crane or similar

NOTE: To correctly lift the machine, the belts used must be longer than 3 meters.

WARNING:
To safeguard persons and property, read the information on the packing that covers the unit before handling. Also make sure to:
• Handle the machine with care
• Do not stack other objects on top of the unit

Fig. 1

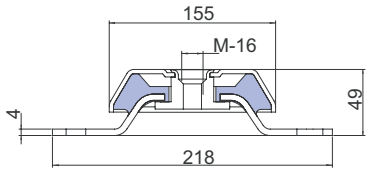


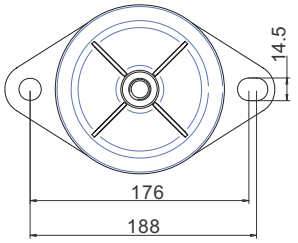
Storage

The units must be stored in a dry place, sheltered from the sun, rain, sand and wind.
Comply with the storage conditions given below:
• Do not stack the units
• Maximum temperature = 60°C
• Minimum temperature = -10°C
• Humidity = 90%

Vibration-damper installation

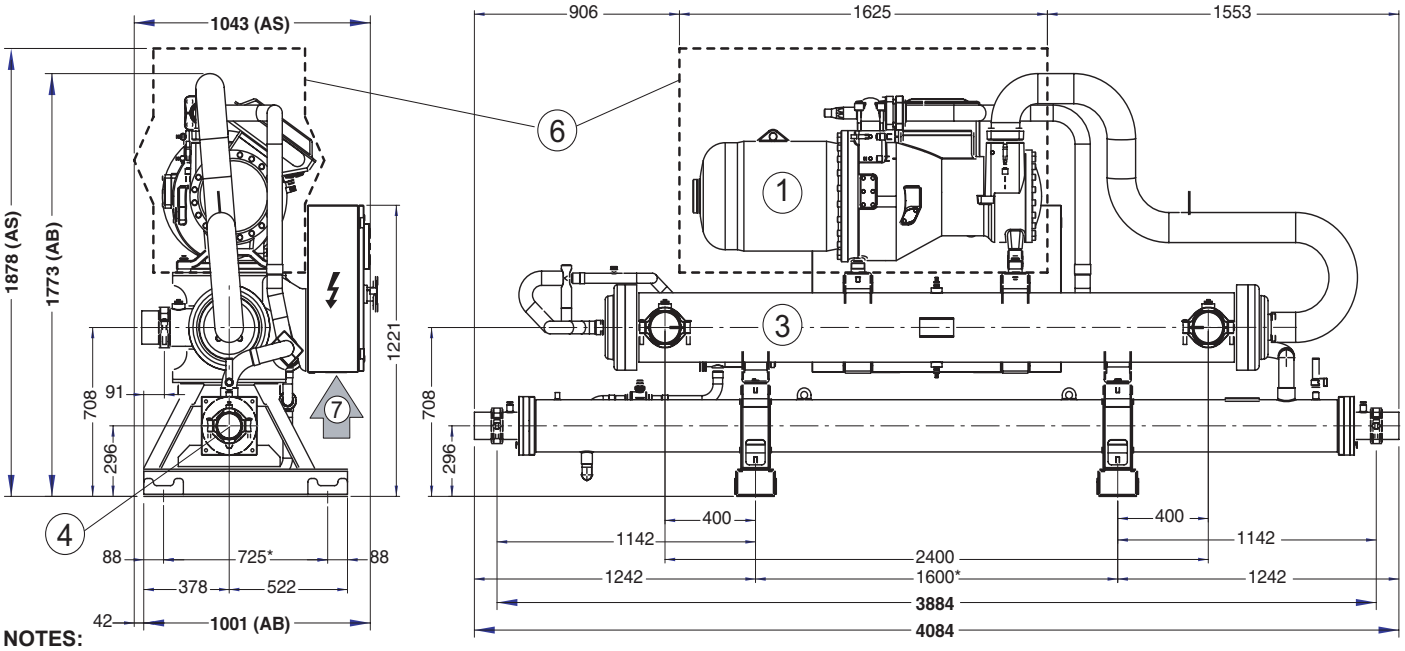
To prevent the operating unit from transmitting vibrations to the bearing structure, vibration dampening materials should be inserted under the bearing points.
The unit can be supplied with the vibration dampening accessory.





DIMENSIONAL AND PHYSICAL DATA

Mod. 280.1 - 320.1 - 360.1



NOTES:

1 - Compressor 1
2 - Compressor 2
3 - Evaporator
4 - Condenser 1
5 - Condenser 2
6 - Compressor Soundproofing Box
7 - Power supply
* - Center distance for vibration damper holes Ø=18mm

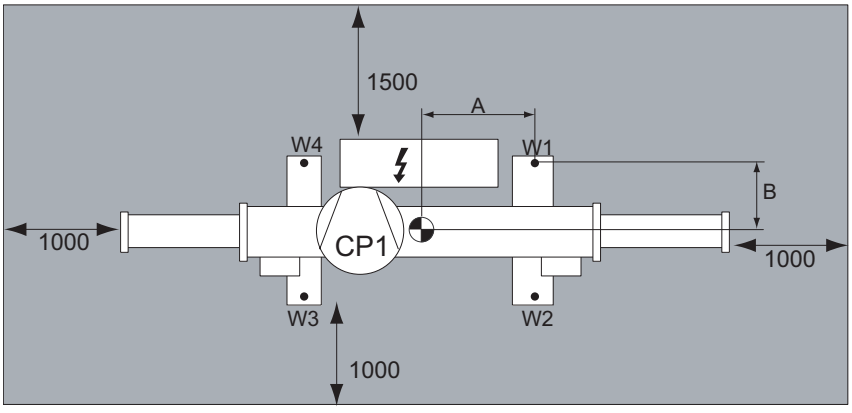
AB - Standard Unit
AS - Low noise Unit
NB: The measures are in mm.

The drawing is referred to unit with cooling tower condensers.

Weights and position of the centre of gravity in transport and operation

Mod.	Version	Acustic version	Operation							Transport		
			A	B	Antivibration dampers				TOTAL WEIGHT	A	B	TOTAL WEIGHT
					W1	W2	W3	W4				
280.1	VB	AB	799	409	393	509	508	392	1803	799	409	1662
		AS	807	417	408	553	562	415	1938	807	417	1797
	VD	AB	795	411	400	524	517	395	1836	795	411	1690
		AS	803	419	414	568	572	417	1971	803	419	1825
	VR	AB	797	415	447	599	594	443	2083	797	415	1910
		AS	801	421	464	644	645	465	2218	801	421	2045
320.1	VB	AB	799	410	396	516	514	395	1821	799	410	1683
		AS	807	418	410	559	569	418	1956	807	418	1818
	VD	AB	795	412	403	530	524	398	1854	795	412	1711
		AS	803	420	417	575	579	420	1989	803	420	1846
	VR	AB	797	416	449	606	600	446	2101	797	416	1931
		AS	801	422	466	651	652	467	2236	801	422	2066
360.1	VB	AB	799	412	399	525	523	398	1844	799	412	1707
		AS	807	420	412	569	579	420	1979	807	420	1842
	VD	AB	795	414	406	541	535	401	1884	795	414	1740
		AS	803	422	420	586	590	423	2019	803	422	1875
	VR	AB	797	418	452	617	612	449	2129	797	418	1958
		AS	801	424	469	662	663	470	2264	801	424	2093

NB: The weight are in kg.



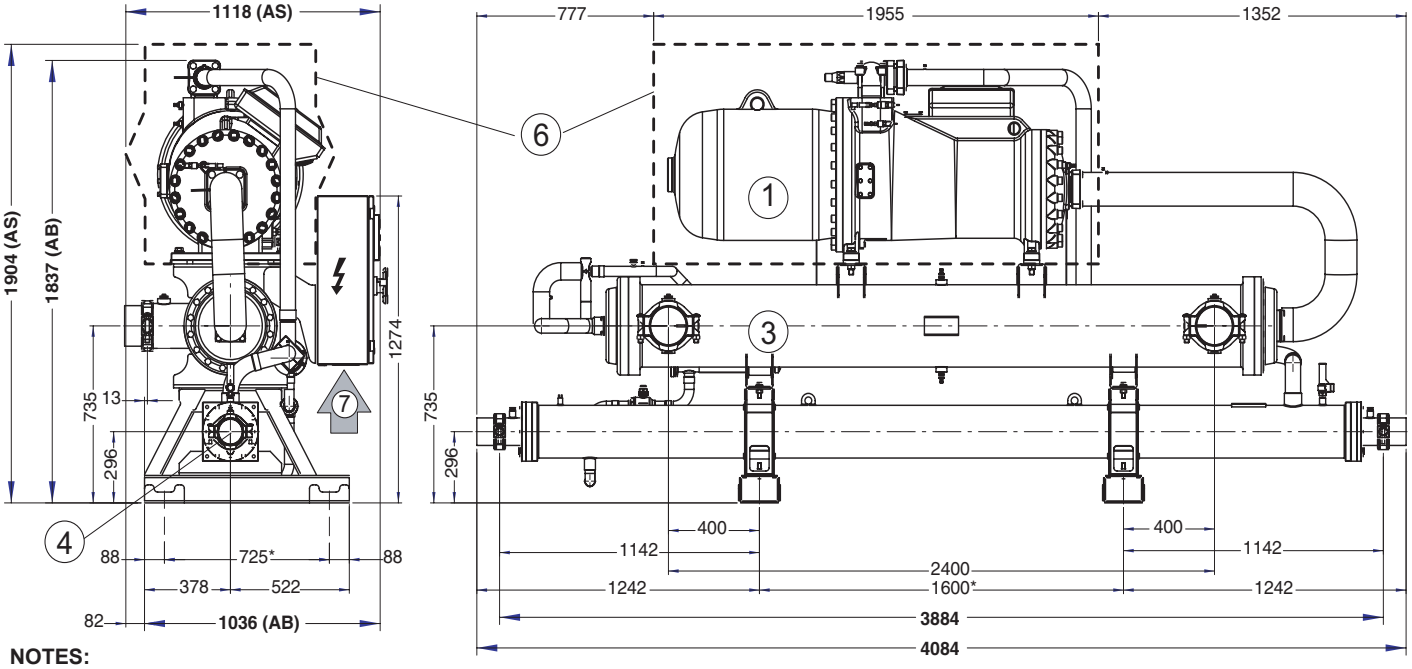
Minimum space required for operation

Refer to the figure alongside for the dimensions of the unit.
To correctly install the unit, comply with the measurements for the free area that must be left around the machine, as shown in the figure. The distances must be doubled if the unit is to be installed in a pit.
NOTE: Allow for a clear area of not less than 1.5 meters above unit.
The areas installation must be doubled if multiple units are installed.

W1÷ W4 - they indicate the position where the spring antivibration dampers (accessory) are installed.

DIMENSIONAL AND PHYSICAL DATA

Mod. 420.1 - 480.1



NOTES:

1 - Compressor 1
2 - Compressor 2
3 - Evaporator
4 - Condenser 1
5 - Condenser 2
6 - Compressor Soundproofing Box
7 - Power supply
* - Center distance for vibration damper holes Ø=18mm

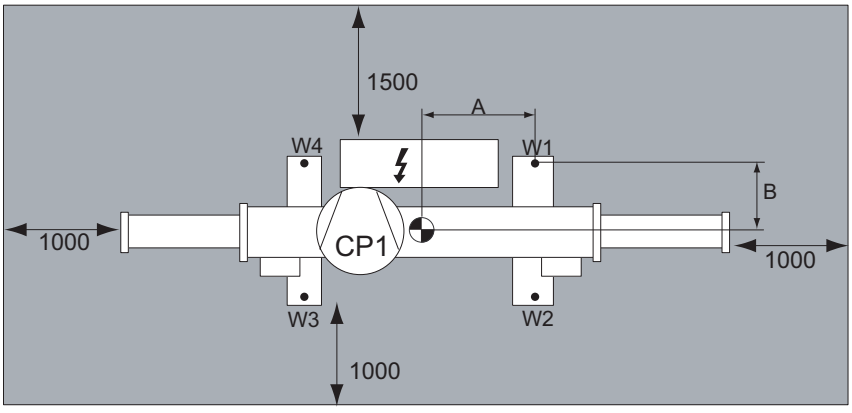
AB - Standard Unit
AS - Low noise Unit
NB: The measures are in mm.

The drawing is referred to unit with cooling tower condensers.

Weights and position of the centre of gravity in transport and operation

Mod.	Version	Acustic version	Operation							Transport		
			A	B	Antivibration dampers				TOTAL WEIGHT	A	B	TOTAL WEIGHT
					W1	W2	W3	W4				
420.1	VB	AB	799	418	522	711	709	521	2462	799	418	2266
		AS	807	426	530	757	770	540	2597	807	426	2401
	VD	AB	795	420	529	729	720	523	2502	795	420	2299
		AS	803	428	537	776	782	541	2637	803	428	2434
	VR	AB	797	424	581	819	812	576	2787	797	424	2554
		AS	801	431	593	867	868	594	2922	801	431	2689
480.1	VB	AB	799	418	529	721	719	528	2496	799	418	2306
		AS	807	426	537	767	780	547	2631	807	426	2441
	VD	AB	795	420	539	742	733	532	2546	795	420	2347
		AS	803	428	546	789	795	550	2681	803	428	2482
	VR	AB	797	424	588	829	822	583	2821	797	424	2594
		AS	801	431	600	877	879	601	2956	801	431	2729

NB: The weight are in kg.



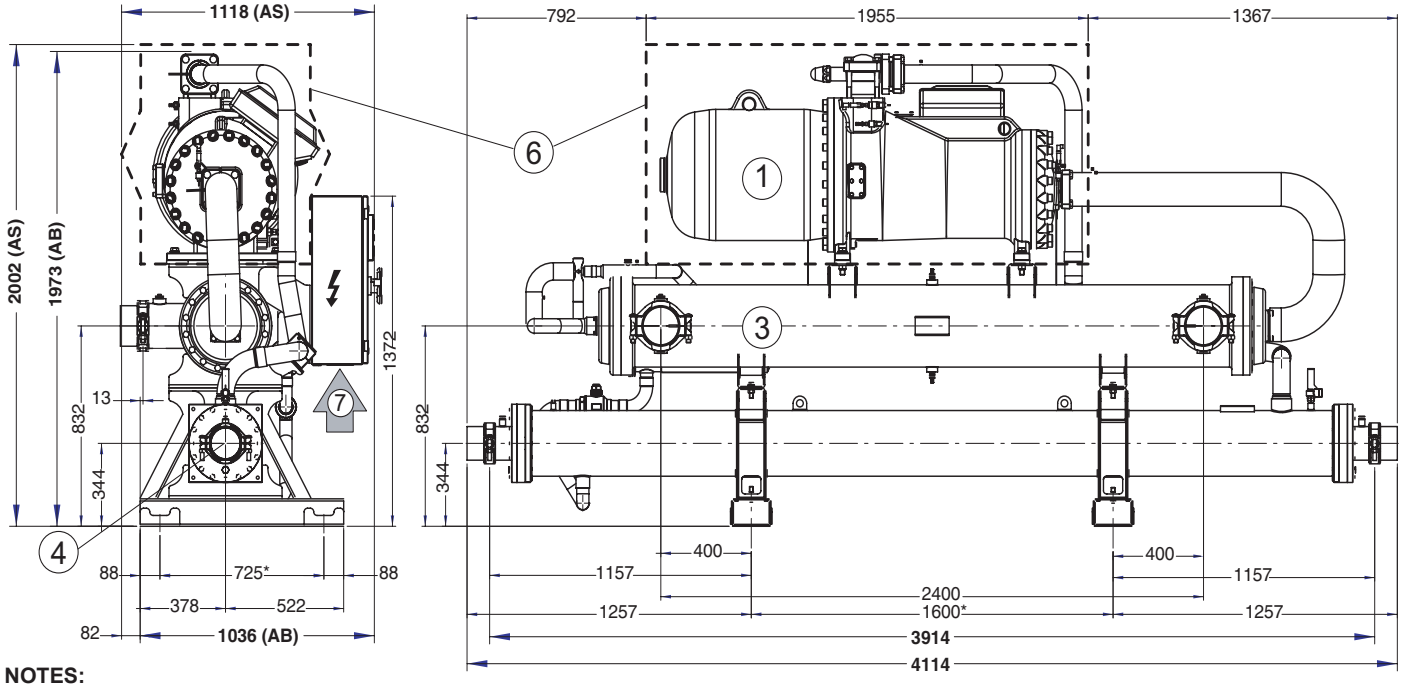
Minimum space required for operation

Refer to the figure alongside for the dimensions of the unit.
To correctly install the unit, comply with the measurements for the free area that must be left around the machine, as shown in the figure. The distances must be doubled if the unit is to be installed in a pit.
NOTE: Allow for a clear area of not less than 1.5 meters above unit.
The areas installation must be doubled if multiple units are installed.

W1÷ W4 - they indicate the position where the spring antivibration dampers (accessory) are installed.

DIMENSIONAL AND PHYSICAL DATA

Mod. 540.1



NOTES:

1 - Compressor 1
2 - Compressor 2
3 - Evaporator
4 - Condenser 1
5 - Condenser 2
6 - Compressor Soundproofing Box
7 - Power supply
* - Center distance for vibration damper holes Ø=18mm

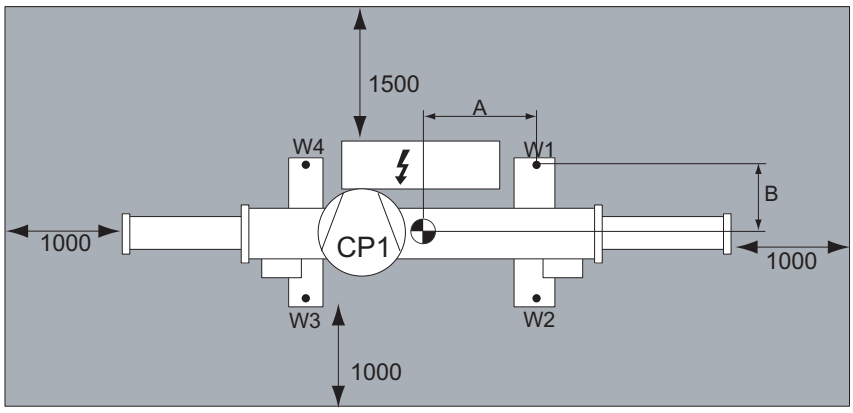
AB - Standard Unit
AS - Low noise Unit
NB: The measures are in mm.

The drawing is referred to unit with cooling tower condensers.

Weights and position of the centre of gravity in transport and operation

Mod.	Version	Acustic version	Operation							Transport		
			A	B	Antivibration dampers				TOTAL WEIGHT	A	B	TOTAL WEIGHT
					W1	W2	W3	W4				
540.1	VB	AB	799	420	562	774	772	561	2669	799	420	2468
		AS	807	428	568	821	836	578	2804	807	428	2603
	VD	AB	795	422	573	799	789	566	2727	795	422	2515
		AS	803	431	579	847	853	583	2862	803	431	2650
	VR	AB	797	426	643	918	910	638	3110	797	426	2856
		AS	801	433	654	967	969	655	3245	801	433	2991

NB: The weight are in kg.



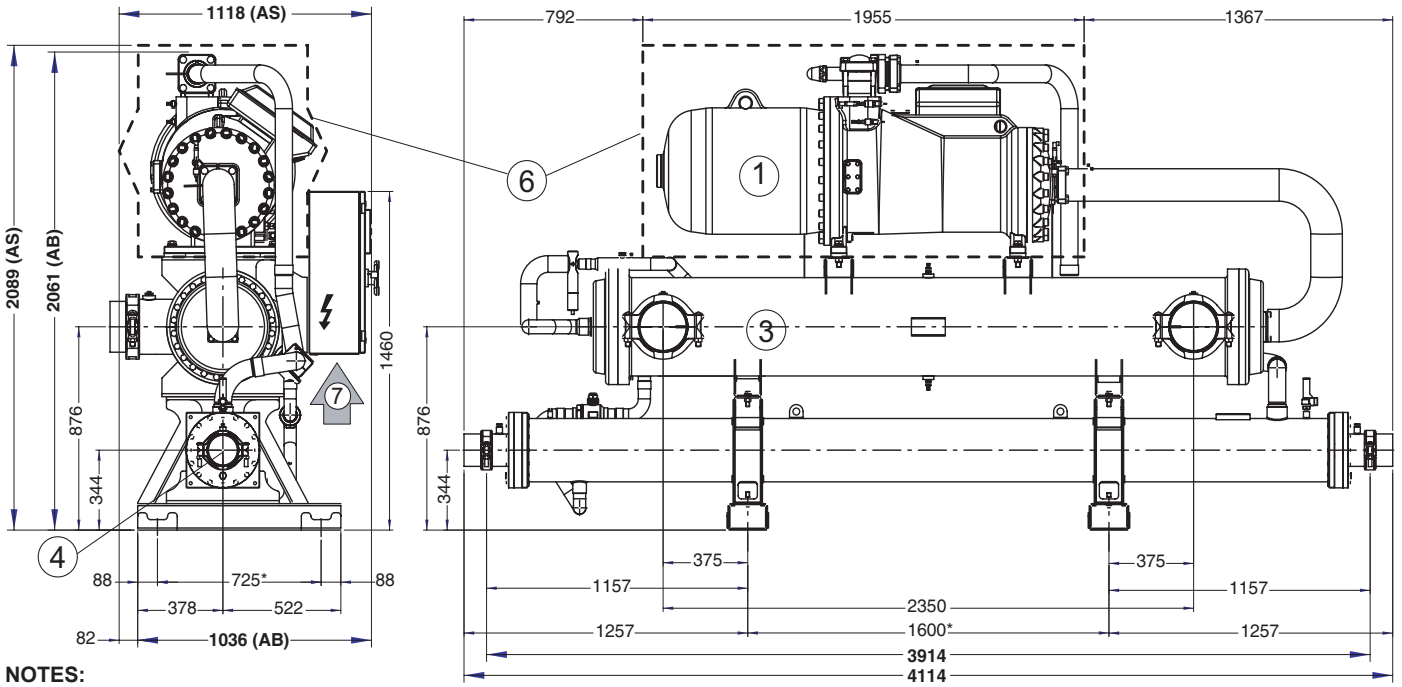
Minimum space required for operation

Refer to the figure alongside for the dimensions of the unit.
To correctly install the unit, comply with the measurements for the free area that must be left around the machine, as shown in the figure. The distances must be doubled if the unit is to be installed in a pit.
NOTE: Allow for a clear area of not less than 1.5 meters above unit.
The areas installation must be doubled if multiple units are installed.

W1÷ W4 - they indicate the position where the spring antivibration dampers (accessory) are installed.

DIMENSIONAL AND PHYSICAL DATA

Mod. 600.1



NOTES:

1 - Compressor 1
2 - Compressor 2
3 - Evaporator
4 - Condenser 1
5 - Condenser 2
6 - Compressor Soundproofing Box
7 - Power supply
* - Center distance for vibration damper holes Ø=18mm

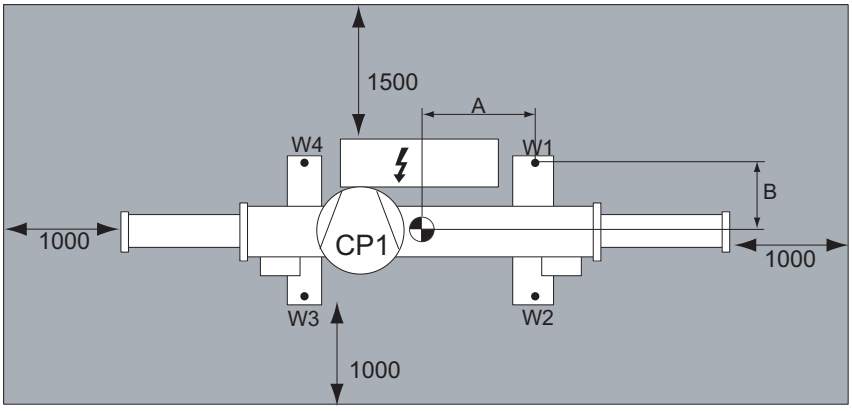
AB - Standard Unit
AS - Low noise Unit
NB: The measures are in mm.

The drawing is referred to unit with cooling tower condensers.

Weights and position of the centre of gravity in transport and operation

Mod.	Version	Acustic version	Operation							Transport		
			A	B	Antivibration dampers				TOTAL WEIGHT	A	B	TOTAL WEIGHT
					W1	W2	W3	W4				
600.1	VB	AB	799	422	633	881	879	631	3023	799	422	2703
		AS	807	430	636	929	946	647	3158	807	430	2838
	VD	AB	795	424	647	912	901	639	3100	795	424	2765
		AS	803	433	650	962	969	655	3235	803	433	2900
	VR	AB	797	428	722	1042	1034	716	3514	797	428	3135
		AS	801	435	730	1093	1095	731	3649	801	435	3270

NB: The weight are in kg.



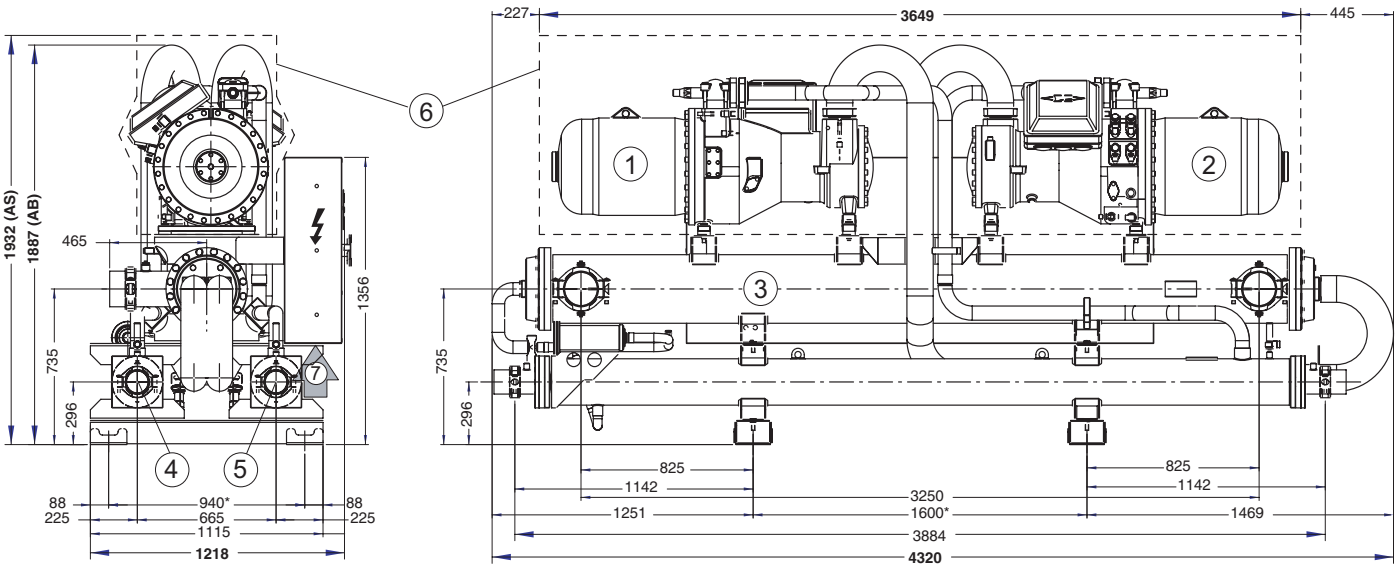
Minimum space required for operation

Refer to the figure alongside for the dimensions of the unit.
To correctly install the unit, comply with the measurements for the free area that must be left around the machine, as shown in the figure. The distances must be doubled if the unit is to be installed in a pit.
NOTE: Allow for a clear area of not less than 1.5 meters above unit.
The areas installation must be doubled if multiple units are installed.

W1÷ W4 - they indicate the position where the spring antivibration dampers (accessory) are installed.

DIMENSIONAL AND PHYSICAL DATA

Mod. 710.2



NOTES:

1 - Compressor 1
2 - Compressor 2
3 - Evaporator
4 - Condenser 1
5 - Condenser 2
6 - Compressor Soundproofing Box
7 - Power supply
* - Center distance for vibration damper holes Ø=18mm

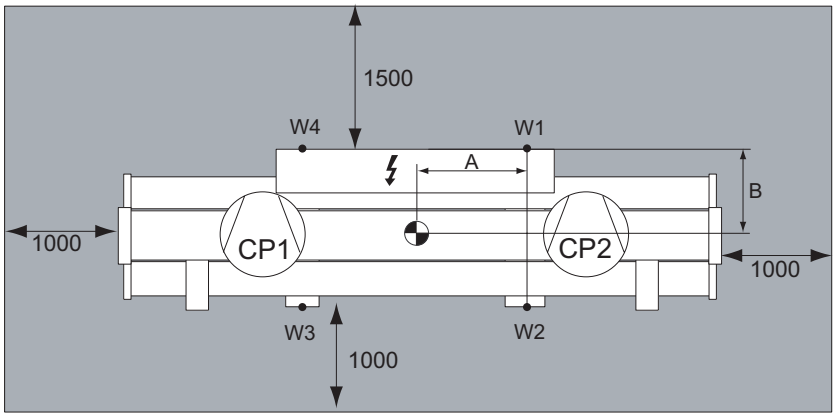
AB - Standard Unit
AS - Low noise Unit
NB: The measures are in mm.

The drawing is referred to unit with cooling tower condensers.

Weights and position of the centre of gravity in transport and operation

Mod.	Version	Acustic version	Operation							Transport		
			A	B	Antivibration dampers				TOTAL WEIGHT	A	B	TOTAL WEIGHT
					W1	W2	W3	W4				
710.2	VB	AB	799	446	925	835	833	922	3515	799	446	3253
		AS	803	457	957	906	913	964	3740	803	457	3478
	VD	AB	795	448	946	862	851	934	3594	795	448	3318
		AS	803	459	973	930	937	980	3819	803	459	3543
	VR	AB	797	453	1063	988	979	1054	4085	797	453	3755
		AS	801	459	1101	1053	1054	1102	4310	801	459	3980

NB: The weight are in kg.



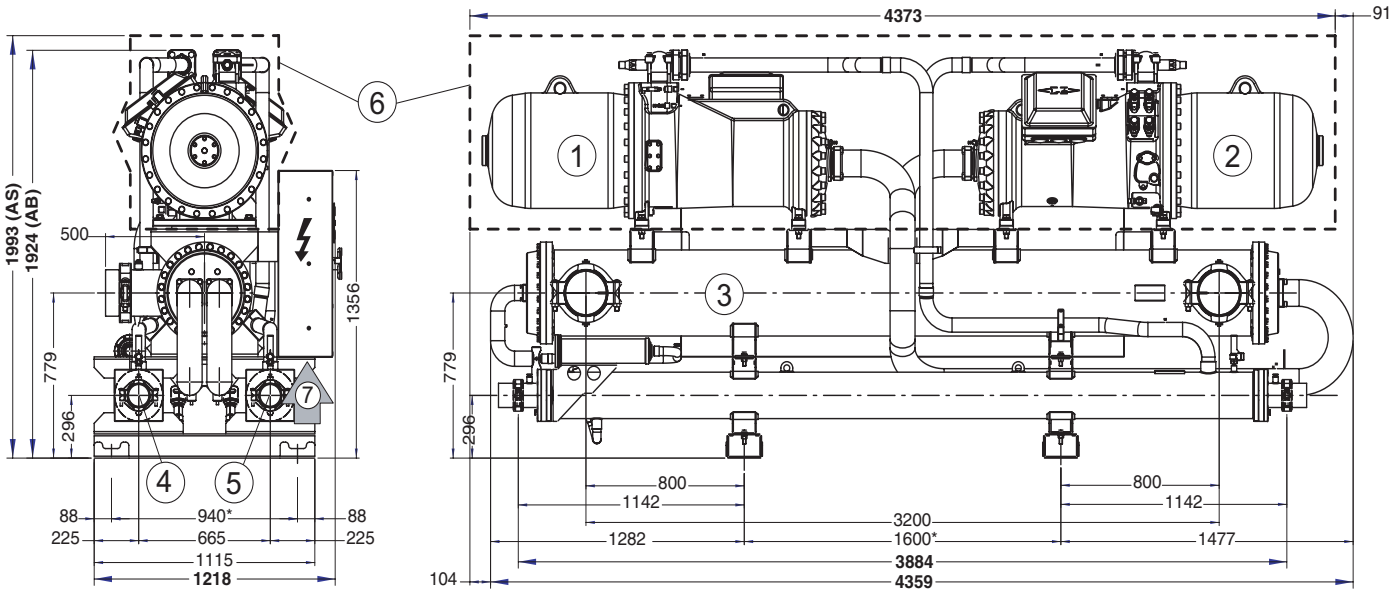
Minimum space required for operation

Refer to the figure alongside for the dimensions of the unit.
To correctly install the unit, comply with the measurements for the free area that must be left around the machine, as shown in the figure. The distances must be doubled if the unit is to be installed in a pit.
NOTE: Allow for a clear area of not less than 1.5 meters above unit.
The areas installation must be doubled if multiple units are installed.

W1÷ W4 - they indicate the position where the spring antivibration dampers (accessory) are installed.

DIMENSIONAL AND PHYSICAL DATA

Mod. 820.2 - 950.2



NOTES:

1 - Compressor 1
2 - Compressor 2
3 - Evaporator
4 - Condenser 1
5 - Condenser 2
6 - Compressor Soundproofing Box
7 - Power supply
* - Center distance for vibration damper holes Ø=18mm

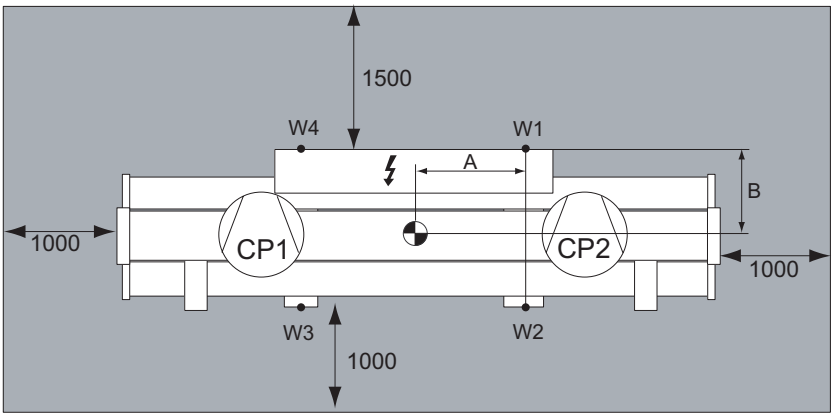
AB - Standard Unit
AS - Low noise Unit
NB: The measures are in mm.

The drawing is referred to unit with cooling tower condensers.

Weights and position of the centre of gravity in transport and operation

Mod.	Version	Acustic version	Operation							Transport		
			A	B	Antivibration dampers W1	W2	W3	W4	TOTAL WEIGHT	A	B	TOTAL WEIGHT
820.2	VB	AB	800	475	1198	1224	1224	1198	4845	800	475	4429
		AS	804	487	1216	1306	1319	1228	5070	804	487	4654
	VD	AB	796	477	1218	1256	1244	1206	4924	796	477	4494
		AS	804	489	1228	1333	1347	1240	5149	804	489	4719
	VR	AB	798	482	1342	1413	1405	1334	5495	798	482	5005
		AS	802	489	1368	1486	1492	1374	5720	802	489	5230
950.2	VB	AB	800	473	1207	1222	1222	1207	4858	800	473	4450
		AS	804	485	1224	1304	1317	1237	5083	804	485	4675
	VD	AB	796	475	1231	1260	1247	1219	4957	796	475	4530
		AS	804	487	1242	1336	1350	1254	5182	804	487	4755
	VR	AB	798	480	1351	1411	1402	1343	5508	798	480	5026
		AS	802	487	1378	1483	1489	1383	5733	802	487	5251

NB: The weight are in kg.



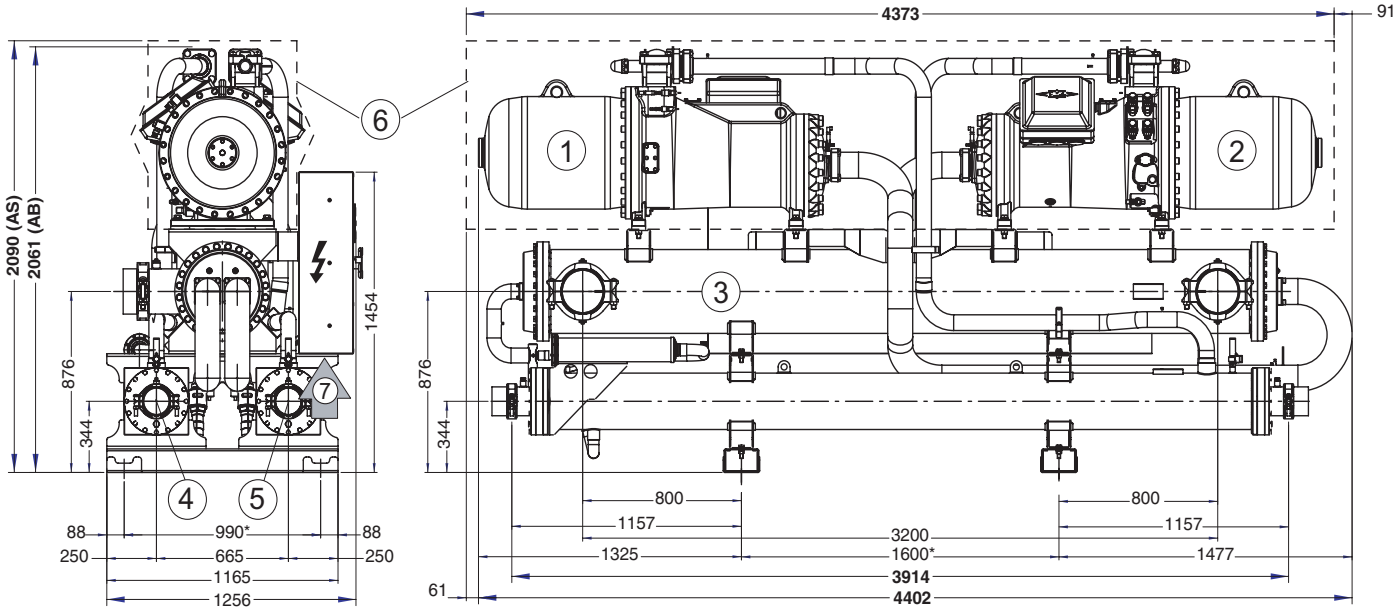
Minimum space required for operation

Refer to the figure alongside for the dimensions of the unit.
To correctly install the unit, comply with the measurements for the free area that must be left around the machine, as shown in the figure. The distances must be doubled if the unit is to be installed in a pit.
NOTE: Allow for a clear area of not less than 1.5 meters above unit.
The areas installation must be doubled if multiple units are installed.

W1÷ W4 - they indicate the position where the spring antivibration dampers (accessory) are installed.

DIMENSIONAL AND PHYSICAL DATA

Mod. 1100.2 - 1200.2



NOTES:

1 - Compressor 1
2 - Compressor 2
3 - Evaporator
4 - Condenser 1
5 - Condenser 2
6 - Compressor Soundproofing Box
7 - Power supply
* - Center distance for vibration damper holes Ø=18mm

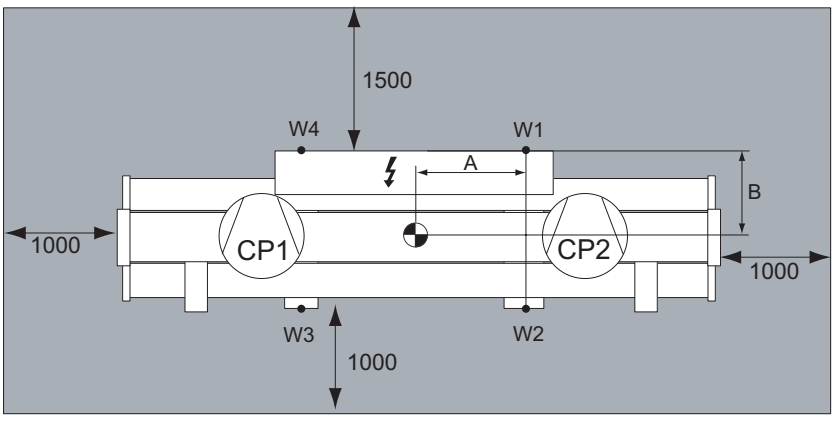
AB - Standard Unit
AS - Low noise Unit
NB: The measures are in mm.

The drawing is referred to unit with cooling tower condensers.

Weights and position of the centre of gravity in transport and operation

Mod.	Version	Acustic version	Operation							Transport		
			A	B	Antivibration dampers				TOTAL WEIGHT	A	B	TOTAL WEIGHT
					W1	W2	W3	W4				
1100.2	VB	AB	796	470	1408	1272	1260	1394	5334	796	470	4914
		AS	800	482	1427	1353	1352	1427	5559	800	482	5139
	VD	AB	792	472	1439	1313	1287	1411	5450	792	472	5008
		AS	800	484	1450	1388	1388	1450	5675	800	484	5233
	VR	AB	794	477	1623	1510	1486	1597	6216	794	477	5690
		AS	798	484	1650	1580	1570	1640	6441	798	484	5915
1200.2	VB	AB	796	470	1452	1312	1299	1437	5501	796	470	5077
		AS	800	482	1470	1393	1393	1470	5726	800	482	5302
	VD	AB	792	472	1493	1362	1335	1464	5654	792	472	5200
		AS	800	484	1502	1438	1438	1502	5879	800	484	5425
	VR	AB	794	477	1693	1574	1549	1666	6483	794	477	5941
		AS	798	484	1719	1645	1635	1708	6708	798	484	6166

NB: The weight are in kg.



Minimum space required for operation

Refer to the figure alongside for the dimensions of the unit.
To correctly install the unit, comply with the measurements for the free area that must be left around the machine, as shown in the figure. The distances must be doubled if the unit is to be installed in a pit.
NOTE: Allow for a clear area of not less than 1.5 meters above unit.
The areas installation must be doubled if multiple units are installed.

W1÷ W4 - they indicate the position where the spring antivibration dampers (accessory) are installed.

HYDRAULIC CONNECTIONS

General rules

A mesh filter (hole Ø ≤ 1 mm) must be installed on water inlet connections of all heat exchangers of the unit, otherwise warranty is immediately forfeited. The filter performs the function of blocking any foreign matter in the system's plumbing circuit (shavings, machining debris, etc.). This prevents the shell and tube heat exchanger pipes from clogging then possibly freezing (and therefore bursting).

Comply with the local laws governing safety matters in order to correctly design the hydraulic circuit. The following information gives suggestions on how to correctly install the unit.

1) Standard supply.

• Standard supply includes a differential pressure switch situated between the water inlet and outlet of the shell and tube evaporator to avoid freezing if the water flow stops for any reason.

Activation is calibrated for a **80 mbar ±5 ∆p,** while resetting occurs with a **∆p of 105 mbar ±5.**

The differential pressure switch opens the contact and shuts down the unit when the water delivery decreases and ∆p ≤ 80 mbar ±5.

The differential pressure switch closes and therefore the unit can restart when the water delivery increases and ∆p ≤ 105 mbar ±5.

• The unit can be supplied (accessory) with an antifreeze heater an protection of the evaporator. This enables protecting the unit from winter frost down to an air temperature = -10°C.

2) With hydronic kit accessory.

• Besides the standard accessories, the unit is equipped with all the hydraulic components, as specified in the "**Options and accessories"** section.

General suggestions

• The pipes must have the least possible number of bends to minimize load losses and must be adequately supported in order to prevent the connections of the unit from being excessively stressed.

• Install on-off valves near components that need to be serviced to isolate them when maintenance work needs to be done and to allow them to be replaced without having to discharge the system.

• Before isolating the pipes and charging the system, carry out preliminary inspections to make sure that there are no leaks.

• Isolate all the chilled water pipes to prevent condensation from forming along the pipes themselves. Make sure that the material used is the steam barrier type, failing this, cover the insulation with an appropriate protection. Also make sure that the air venting valves can be accessed through the insulation.

• Do not forget to install or at least allow for the installation of pressure and temperature reading instruments on the inlet and outlet parts of the hydraulic circuit. These instruments will allow you to monitor the operation of the system.

• The circuit can be kept under pressure by means of an expansion tank and a pressure reducer. A plant filling unit can also be used in order to automatically charge the system and keep it at the desired pressure if it drops below a certain pressure value. Install manual or automatic values in the highest point of the system to eliminate air from the circuit.

Fit manual or automatic valves at the highest point in the circuit in order to vent air from the circuit.

• If anti-vibration mounts are installed under the unit, it is recommended to use flexible couplings before and after the water circulation pump and near the unit.

• Install a cock on the outlet of the unit in order to regulate the water flow.

Precautions for the Winter

The water could freeze and damage the exchanger of the unit and other parts of the system during the winter period, if the system was to remain at a standstill. This problem can be obviated in 3 different ways:

1. Drain the system completely, taking care to drain the exchangers and the pumps (if present) in order to drain the unit's plumbing system completely, open the water drain ball valves and the air vent valves.

N.B.

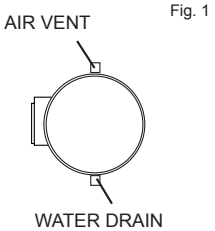
- The shell and tube evaporator is equipped with an air vent and a water drain cock (Fig.1).

- The shell and tube condenser is equipped with a water drain (it is necessary unscrew the bolt) Fig.3.

- For the condenser, it is necessary to install the air valve on the top of the water pipe.

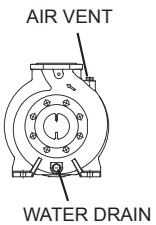
EVAPORATOR

Fig. 1



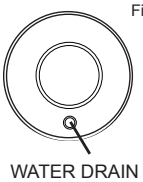
PUMP

Fig. 2



CONDENSER/ HEAT RECOVERY

Fig. 3



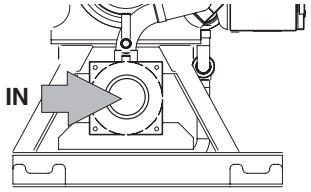
2. Operate with brine mixture taking account, depending on the % of glycol, of the factor of correction of the refrigerating capacity, power input, water flow rate and losses of head (see the paragraphe "Correction factor for the use of glycol" on the section "GENERAL SPECIFICATIONS - IR UNIT FOR COOLING MODE ONLY ").

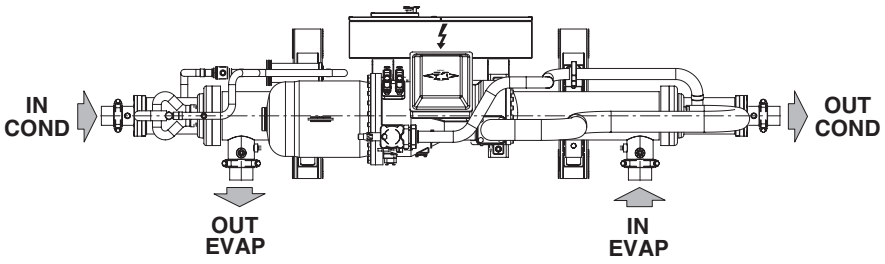
3. If it is certain that the unit will always be powered throughout the winter, the unit is able to protect itself from freezing, down to a temperature of -10°C: this is possible thanks to the antifreeze electric heating element installed on the exchanger and intelligent control of the water pump that must be governed by the microprocessor board (see the "Electric Connections" section).

HYDRAULIC CONNECTIONS

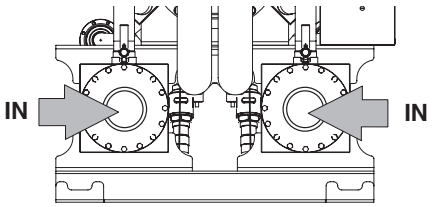
Cooling tower condenser (4T5)

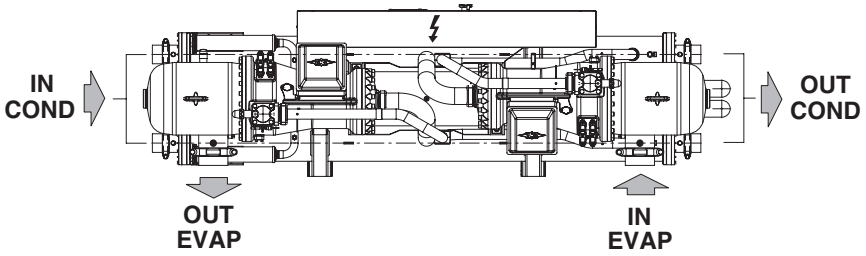
Mod. 280.1 ÷ 600.1





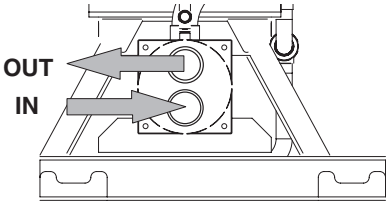
Mod. 710.2 ÷ 1200.2

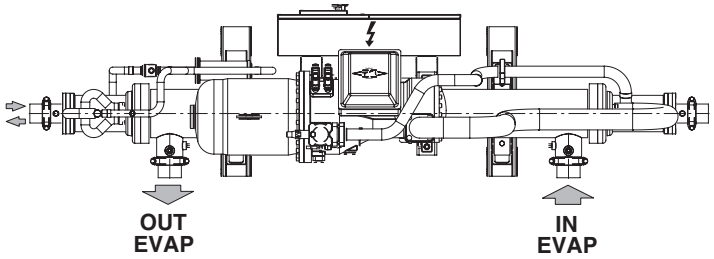




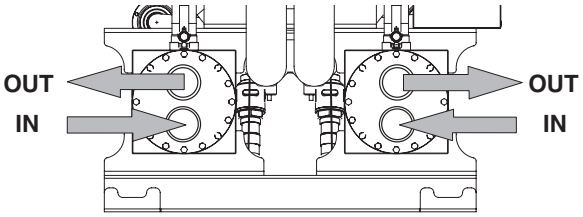
City water condenser (4P5)

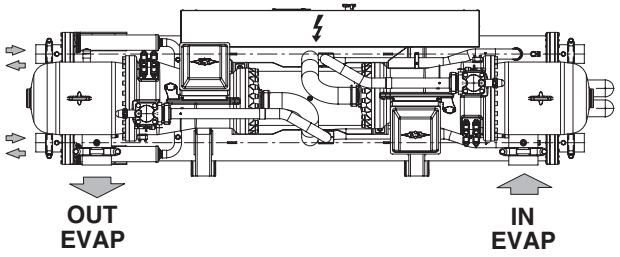
Mod. 280.1 ÷ 600.1





Mod. 710.2 ÷ 1200.2





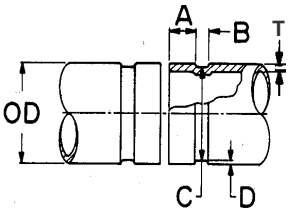
MOD.		280.1	320.1	360.1	420.1	480.1	540.1	600.1	710.2	820.2	950.2	1100.2	1200.2
IN - OUT EVAPORATOR		DN125 VIC	DN125 VIC	DN125 VIC	DN150 VIC	DN150 VIC	DN150 VIC	DN200 VIC	DN150 VIC	DN200 VIC	DN200 VIC	DN200 VIC	DN200 VIC
IN - OUT CONDENSER	TOWER	DN100 VIC	DN100 VIC	DN100 VIC	DN100 VIC	DN100 VIC	DN125 VIC	DN125 VIC	DN100 VIC	DN100 VIC	DN100 VIC	DN125 VIC	DN125 VIC
	CITY	GAS F 2" 1/2	GAS F 2" 1/2	GAS F 2" 1/2	GAS F 2" 1/2	GAS F 2” 1/2	GAS F 3"	GAS F 3”	GAS F 2" 1/2	GAS F 2" 1/2	GAS F 2” 1/2	GAS F 3"	GAS F 3”

HYDRAULIC CONNECTIONS

ISO-G	DN(mm)	EXTERNAL DIAMETER OD(mm)	A	B	O	D	T
1”	25	33.7	15.875	7.137	30.226	1.600	1.651
11/4”	32	42.4	15.875	7.137	38.989	1.600	1.651
11/2”	40	48.3	15.875	7.137	45.085	1.600	1.651
2”	50	60.3	15.875	8.738	57.150	1.600	1.651
21/2”	65	76.1	15.875	8.738	72.260	1.981	2.108
3”	80	88.9	15.875	8.738	84.938	1.981	2.108
4”	100	114.3	15.875	8.738	110.084	2.108	2.108
5”	125	139.7	15.875	8.738	135.500	2.134	2.769
6”	150	168.3	15.875	8.738	163.957	2.159	2.769
8”	200	219.1	19.050	11.913	214.401	2.337	2.769

1) Pipe groove inspections

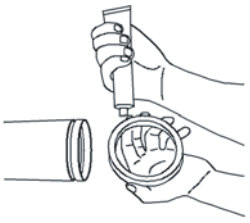
Check the depth and diameter of the grooves and their distance from the pipe ends. Make sure that the work has been carried out with care and that the end surface of the pipes is smooth and not ovalized. Make sure that there are no notches, burrs or other imperfections that could impair the tightness. Groove dimensions in mm A=16-B=8-C=57.2-D=1.6



2) Checking the seal and relative lubrication

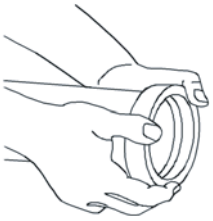
Make sure that the type of seal used is compatible with the nature and temperature of the fluid. Signal green **EPDM** seals are used.

Apply a film of grease to the seal: on the back, on the side flanks and on the inner lips that contact the pipe. Work in conditions of the utmost cleanliness as particles of dirt could damage the seal. Always and only use synthetic grease. Greasing makes it easier to fit the seal on the pipe and improves the tightness. It also allows the seal to slide within the connection, avoiding tensions and projections near the bolts.



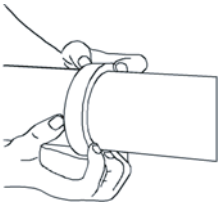
3) How to fit the seal

Fully insert the seal into the end of a pipe. Make sure that the seal lips adhere to the pipe itself.



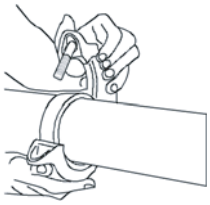
4) Alignment

Align the pipes and move their ends near to each other. Now push the seal, centering it on the two pipe ends. The seal must remain inside the grooves.



5) Joint assembly

Remove one bolt and loosen (without removing) the other one. Seat part of the body of the joint at the bottom, between the pipe ends, inserting and edges of the grooves. Now seat the other part of the body at the top, on the two ends, and close the joint. Make sure that the parts of the body of the joint touch each other.

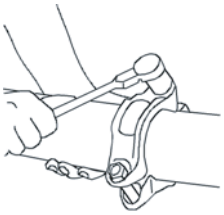


6) Nut torquing

Fit the previously removed bolt back in place and tighten both nuts by hand. Now torque them with the relative wrench, tightening them alternately a few turns.

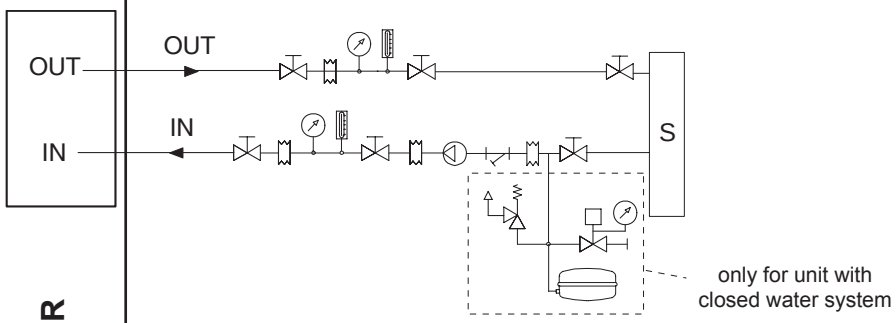
WARNING:

If one nut is fully tightened at a time, the seal could slip between the jaws of the opposite side of the joint.



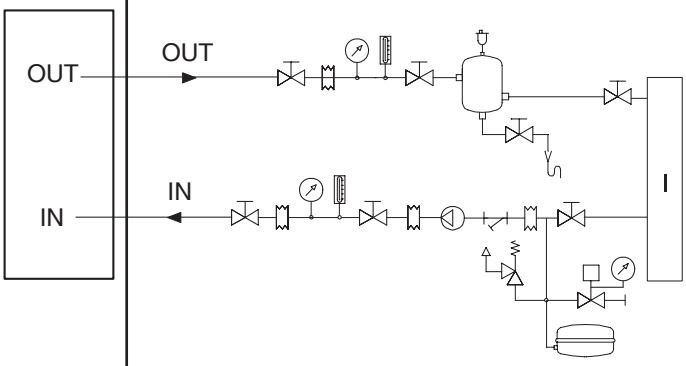
HYDRAULIC CONNECTIONS

Basic diagram Basic Version VB [SOURCE SIDE]



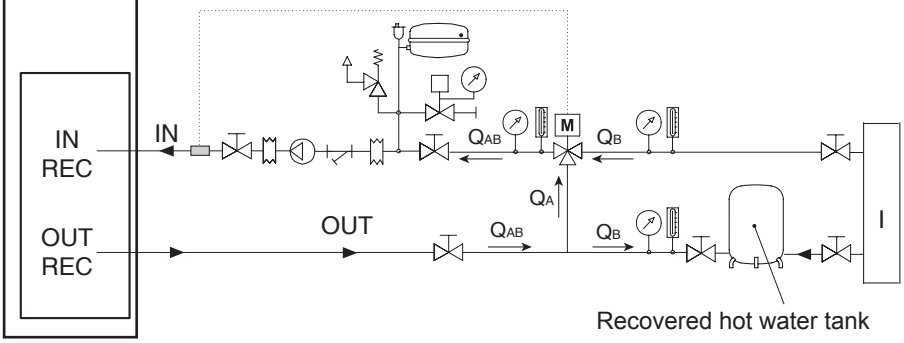
Basic diagram Basic Version VB [USER SYSTEM SIDE]

The following figures represent connections to the evaporator circuit.
IMPORTANT: There must be a constant flow of water to the exchanger .



Basic diagram for units with Heat Recovery [USER SYSTEM SIDE]

The basic diagram given is valid for all the Special Versions VD - VR
The figure below shows the basic diagram of the portion of the system with the heat exchanger used for recovering partially or totally heating power that would otherwise be disposed of in the air.

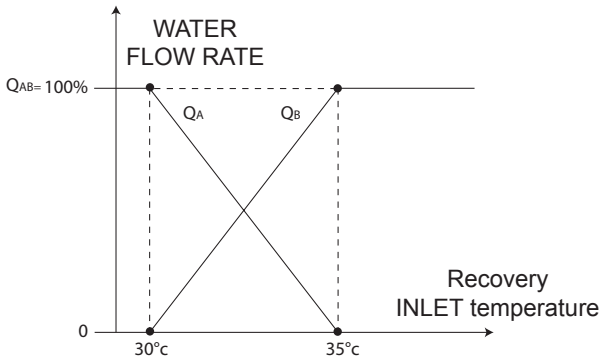


I = User system
S = Source

- Pressure gauge
- Thermometer
- On-off and/or water flow rate regulating valve
- Monitoring electronics (governor)
- Pump
- Filter
- Tank
- Expansion tank
- Air vent valve
- Safety valve
- Coupling
- Water filling unit
- Three-way driven valve
- Recovery water flow inlet probe

Valve regulating diagram Three-way driven valve

To prevent problems from occurring when the machine is started with very cold water, you are strongly advised to install a mixer valve as shown in the diagram.
The valve must be regulated to suit the temperature at which the water flows into the recovery part (see diagram): the graph on the right shows the type of adjustment to use.

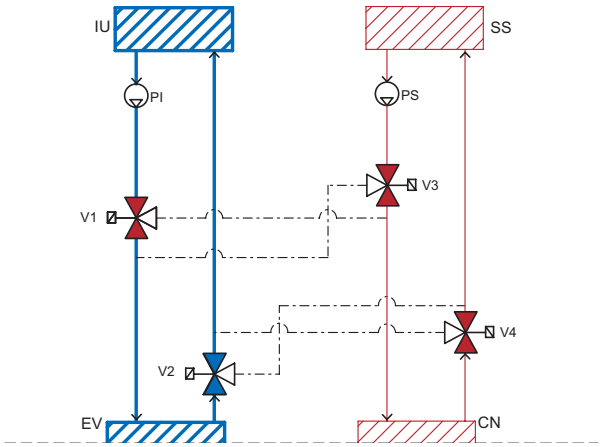


FOR HEAT RECOVERY VERSION (VR) THE MANAGEMENT IS IN CHARGE OF CUSTOMER (PUMPS, VALVES, ECC).

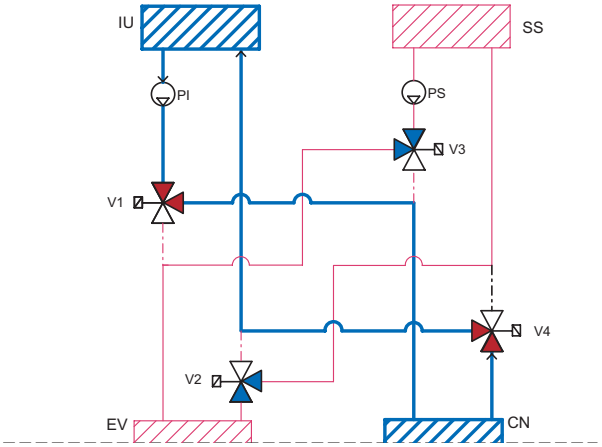
HYDRAULIC CONNECTIONS

Hydraulic circuit for heat pump reversible water side IW-BW

Cooling mode



Heating mode

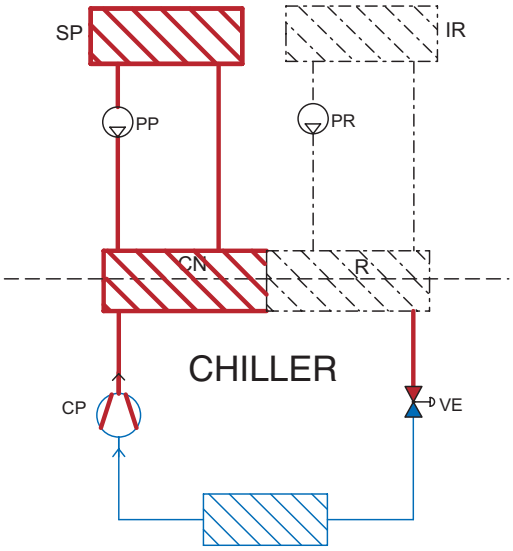


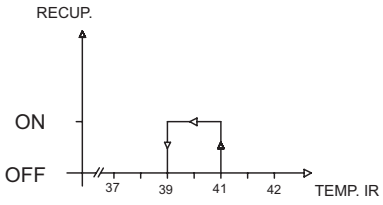
	DESCRIPTION		DESCRIPTION
CN	Condensatore	SS	Scambiatore sorgente
EV	Evaporatore	V1	Valvola a tre vie
IU	Impianto utente	V2	Valvola a tre vie
PI	Pompa impianto	V3	Valvola a tre vie
PS	Pompa sorgente	V4	Valvola a tre vie

USER
SOURCE
NOT USED

Hydraulic circuit for heat recovery version VR

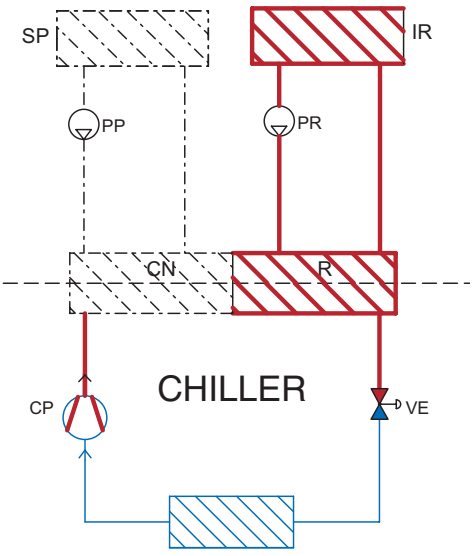
Recovery OFF





Recovery	PS	PR
OFF	ON	OFF
ON	OFF	ON

Recovery ON



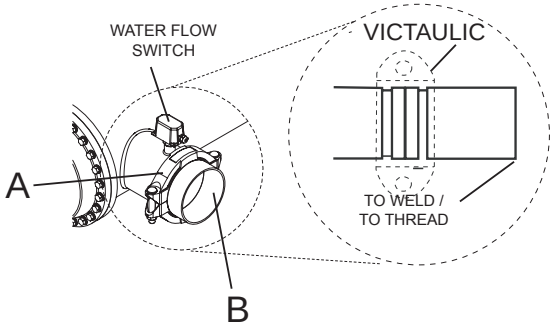
	DESCRIPTION		DESCRIPTION
CN	Condenser	PI	System pump
CP	Compressor	PS	Source pump
EV	Evaporator	PR	Recovery pump
IR	Recovery system	SS	Source exchanger
IU	User system	VE	Expansion valve

USER
SOURCE
NOT USED

Victaulic connections and water flow switch

These comprise two wet connections of the Victaulic type (Fig. 1-A) composed by steel joint (Fig. 1-B) and rubber packing not installed (supplied with the unit). The steel joints are suitable to be welded or threaded.

Nota:
Supplied as accessory (see “Accessory and optional equipment”)



ELECTRICAL CONNECTIONS

General rules

The appliance must be wired in compliance with the laws in force in the country in which it is installed. The units are supplied fully wired in the factory and pre-engineered for connection to the electricity main. The electric panel is made in compliance with the technical standards in force in the European Union.

Structure of the electric panel

All the electrical components are contained in a closed casing protected against the atmospheric agents and inspectionable by opening the front door after removing the front panel. The door for accessing the power section is locked by the mechanism.
Access for the supply cables and earth cable (PE) is permitted through the opening on the botton of the electric panel.

Composition of the system

The system comprises an electromechanical part consisting of the power circuit, with disconnecting device, contactors, fuses or thermal cutouts, transformer, and another part comprising the Microprocessor control system.

NOTES: Refer to the wiring diagram supplied with the unit for the layout of the electric panel.

Electrical connections

All electrical connections must be carried out by qualified personnel in the absence of electric power. The table below gives the electrical specifications of the different constructional configurations of the units.

IR / IW / BR / BW unt, VB / VD / VR version

UNIT		280.1	320.1	360.1	420.1	480.1	540.1	600.1	710.2	820.2	950.2	1100.2	1200.2	UM
Power supply		400 - 3 - 50												V-ph-Hz
TOTAL FLA	AB	162	181	211	232	270	309	340	422	464	540	618	680	A
TOTAL FLI	AB	99	110	129	144	169	190	209	257	287	339	380	418	kW
TOTAL MIC	AB	520	612	665	436	465	586	650	876	668	735	895	990	A

NOTES:
FLA= Power draw at maximum tolerated conditions
FLI= Electric power draw at maximum tolerated conditions
LRA= Surge current
MIC= Maximum surge current of the unit

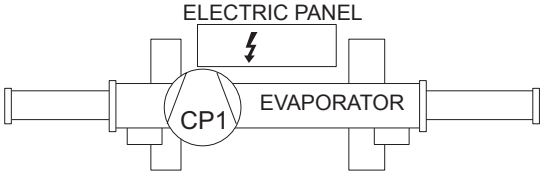
Compressor specification

UNIT		280.1	320.1	360.1	420.1	480.1	540.1	600.1	710.2	820.2	950.2	1100.2	1200.2	UM
Power supply		400 - 3 - 50												V-ph-Hz
FLA	CP 1	162	181	211	232	270	309	340	211	232	270	309	340	A
	CP 2	-	-	-	-	-	-	-	211	232	270	309	340	
FLI	CP 1	99	110	129	144	169	190	209	129	144	169	190	209	kW
	CP 2	-	-	-	-	-	-	-	129	144	169	190	209	
LRA	CP 1	520	612	665	436	465	586	650	665	436	465	586	650	A
	CP 2	-	-	-	-	-	-	-	665	436	465	586	650	

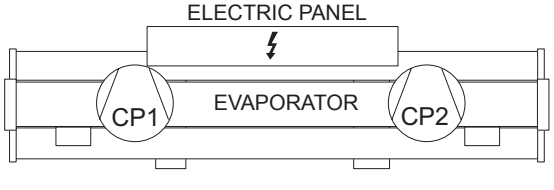
For a complete information see the section “Layout of the main component of the unit”.

LAYOUT OF THE MAIN COMPONENT OF THE UNIT

MOD. 280.1 ÷ 600.1



MOD. 710.2 ÷ 1200.2



ELECTRICAL CONNECTIONS

1) Connection to the electricity main

• Power supply line;
The machine's power supply line must be laid by following a clearly defined route in order to make it as correct as possible any without any breaks. Pass the line through the opening on the button of the electrical panel. Secure the line integral with the structure of the machine. Then continue inside the panel and connect the conductors directly to the input terminals of the main disconnecting device of the machine.
• Power supply system;
The power cables of the machine's supply line must be taken from a system of symmetrical three-phase voltages and of a separate protection conductor.

V= 400V ± 10%
f= 50 Hz

• Protection on supply side:
An automatic switch must be installed on the supply side of the side in order to protect against any overcurrents and indirect contacts that could occur when the machine is operating.
It is advisable to install an automatic current limiter switch in order to limit the effective short-circuit current in the connecting point of the machine. This allows a protection device with a lower breaking capacity than that required in the connection point to be sized like the main circuit-breaker of the machine.
The line and switch must be coordinated in compliance with the current laws governing electrical safety matters, regarding the type of installation and environmental conditions in which the machine must operate.
• Protection conductor (ground wire):
The protection conductor from the feeder line must be connected straight to the ground screw identified by code **"PE",** which ensures the equipotential connection of all metal grounding points and structural parts of the machine.

2) Electric panel

• Protection degree:
The electric panel casing is made from sheet metal and has IP54 protection rating at the doors directly accessible from the outside. The other parts of the casing guarantee a protection degree that is at least equivalent to **IP22**, as established by the current laws in force: this has been achieved since the panel has further protection against the penetration of solid foreign bodies and atmospheric agents thanks to the machine structure in which it is housed.
• Starting and stopping function:
The red handle on the panel door directly acts on the main circuit-breaker. The handle also acts as a door lock since it ensures that the machine is only powered when the door is shut. The stopping function carried out by the main circuit-breaker is classified as type "0" since the machine is stopped by immediately cutting off the power supply.

3) Reference standards

• The provisions established by the following Directives have been complied with to ensure the safety of the electrical products placed on the European Union market:
- Low Voltage Directive **2006/95 EEC** which also includes the following harmonized standards:
CEI EN 60335-1 and 60335-2-40.
Classification:**CEI EN 60204-1.** Safety of machinery. Electrical equipment of machines. Part 1:
General rules.
- Directive **2004/108/EEC** concerning **"Electromagnetic compatibility".**

4) User connection

On the electric panel are available the terminal connection for:
a) control of a pump group with 1 or 2 pumps and relative safety devices (relay 230V-2A)
b) clear contact input for remote ON/OFF of the unit
The following additional connections are present on Heat recovery versions:
c) general alarm relay (SPDT NO/NC 230V-2A)
d) recovery circulating pump control and relative safety devices (relay 230V-2A)
e) remote input for enabling of recovery mode

For more details refer to the wiring diagram of the unit.

R134A PROTECTION DEVICES

Protection devices HIGH PRESSURE

The unit is protected against risk of overpressure by means of 4 levels protection chain.

Each compressor and so each circuit is equipped with:
1) ATC (Cooling Capacity Control)
2) high pressure transducer connected to electronic controller
3) high pressure automatic switch connected to electronic controller
4) high pressure manual switch connected to compressor contactor command and to electronic controller
5) high pressure safety valve

Protection devices technical data

LEVEL	1	2	3	4	5
Device	High pressure transducer	High pressure transducer	High pressure automatic switch	High pressure manual switch	High pressure safety valve
Trip out	17 bar	17.9 bar	18 bar	20 bar	22 bar
Trip in	-	13.9 bar	14 bar	MANUAL RESET	20 bar
connected to	electronic controller	electronic controller	electronic controller	compressor contactor command and electronic cotroller	Discharge the refrigerant to atmosphere to reduce the system pressure
effect	Controls the cooling capacity product by the compressor to have a correct operation inside the admissible limits	stop the compressor and the fans. The electronic expansion valve closed	stop the compressor and the fans. The electronic expansion valve closed	stop the compressor and the fans. The electronic expansion valve closed	Discharge the refrigerant to atmosphere to reduce the system pressure
reset *	Automatic	YES by keyboard after the solution of the problem that generates the alarm	YES by keyboard if the high pressure switch has trip-in and after the solution of the problem that generates the alarm	1) reset the button present on the manual pressure switch 2) then reset the alarm by keyboard	Not Necessary

*: For more details refers to section monitoring basic system.

Protection devices LOW PRESSURE

LEVEL	1	2
Device	Low pressure transducer	Low pressure automatic switch
Trip out	1 bar	0.4 bar
Trip in	1.5 bar	1 bar
connected to	electronic controller	electronic controller
effect	stop the compressor and the fans. The electronic expansion valve closed	stop the compressor and the fans. The electronic expansion valve closed
reset *	YES by keyboard after the solution of the problem that generates the alarm	YES by keyboard if the low pressure switch has trip-in and after the solution of the problem that generates the alarm

Protection devices DISCHARGE TEMPERATURE

LEVEL	1	2
Device	Liquid Injection (if present)	Discharge Temperature
Trip out	110°C	130°C
Trip in	100°C	120°C
connected to	electronic controller	electronic controller
effect	activates the liquid injection to the compressor, until the discharge temperature decrease down to the maximum admissible value	stop the compressor and the fans. The electronic expansion valve closed
reset *	Automatic	YES by keyboard after the solution of the problem that generates the alarm

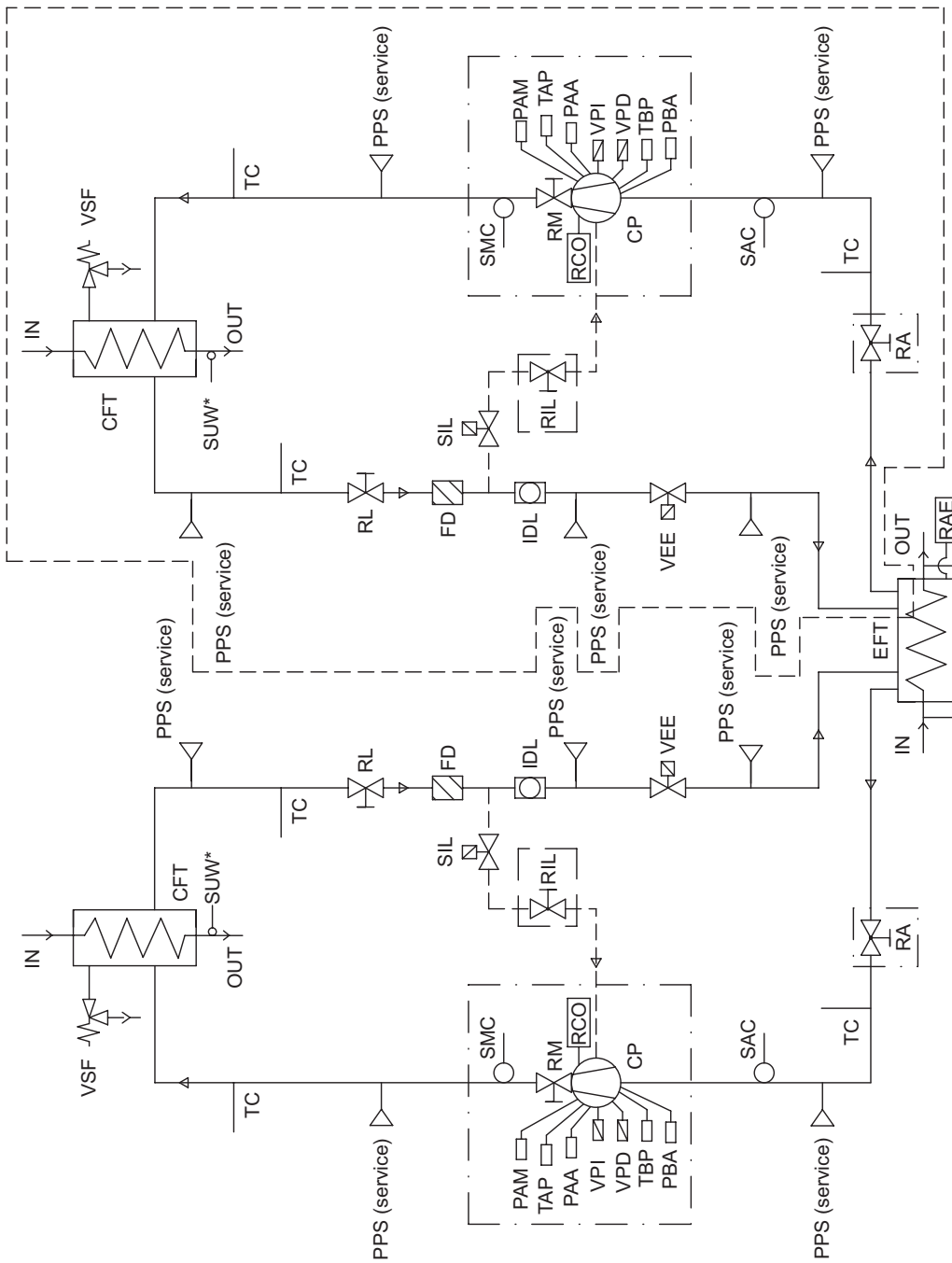
Protection devices LOW PRESSURE - MOP (Maximum Operation Low Pressure)
The electronic valve's controller limits the maximum operation valve the low pressure as indicadet in the table.

	LOW PRESSURE
MOP (Maximum Operation Low Pressure)	3.9 bar (15°C)

REFRIGERANT FLOW DIAGRAM

Refrigerant flow diagram basic version VB

	Description
CFT	SHELL AND TUBE CONDENSER
CP	SCREW COMPRESSOR
EFT	SHELL AND TUBE HEAT EVAPORATOR
FD	DRIER FILTER
IDL	LIQUID AND MOISTURE INDICATOR
PAA	AUTOMATIC RESET HIGH PRESSURE SWITCH
PBA	AUTOMATIC LOW PRESSURE SWITCH
PAM	MANUAL RESET HIGH PRESSURE SWITCH
PDW	DIFFERENTIAL WATER PRESSURE SWITCH
PPS	PRESSURE GAUGE WITH SCHRAEDER
RA	SUCTION VALVE (OPTIONAL)
RAE	EVAPORATOR ANTIFREEZE HEATER (OPTIONAL)
RCO	OIL CRANKASE HEATER
RIL	LIQUID INJECTION BALL VALVE (OPTIONAL)
RL	LIQUID VALVE
RM	DISCHARGE VALVE
SAC	SUCTION TEMPERATURE PROBE
SIL	LIQUID INJECTION SOLENOID VALVE (OPTIONAL)
SIW	WATER INLET PROBE
SMC	DISCHARGE TEMPERATURE PROBE
SUW	WATER OUTLET PROBE
TAP	HIGH PRESSURE TRANSDUCER
TBP	LOW PRESSURE TRANSDUCER
TC	PIPE FOR REFRIGERANT FILLING
VEE	ELECTRONIC EXPANSION VALVE
VPD	DECREASING CONTROL CAPACITY VALVE
VPI	INCREASING CONTROL CAPACITY VALVE
VSF	REFRIGERANT SAFETY VALVE



* :solo per unità IW/BW, only for IW/BW units

[ ] :solo per unità bicompressore / Only for units with 2 compressors

— — :Iniezione liquido (optional) / Liquid injection (optional)

· — :Rubinetto aspirazione (optional) / Suction valve (optional)

— · - :Gruppo compressore / Compressor group

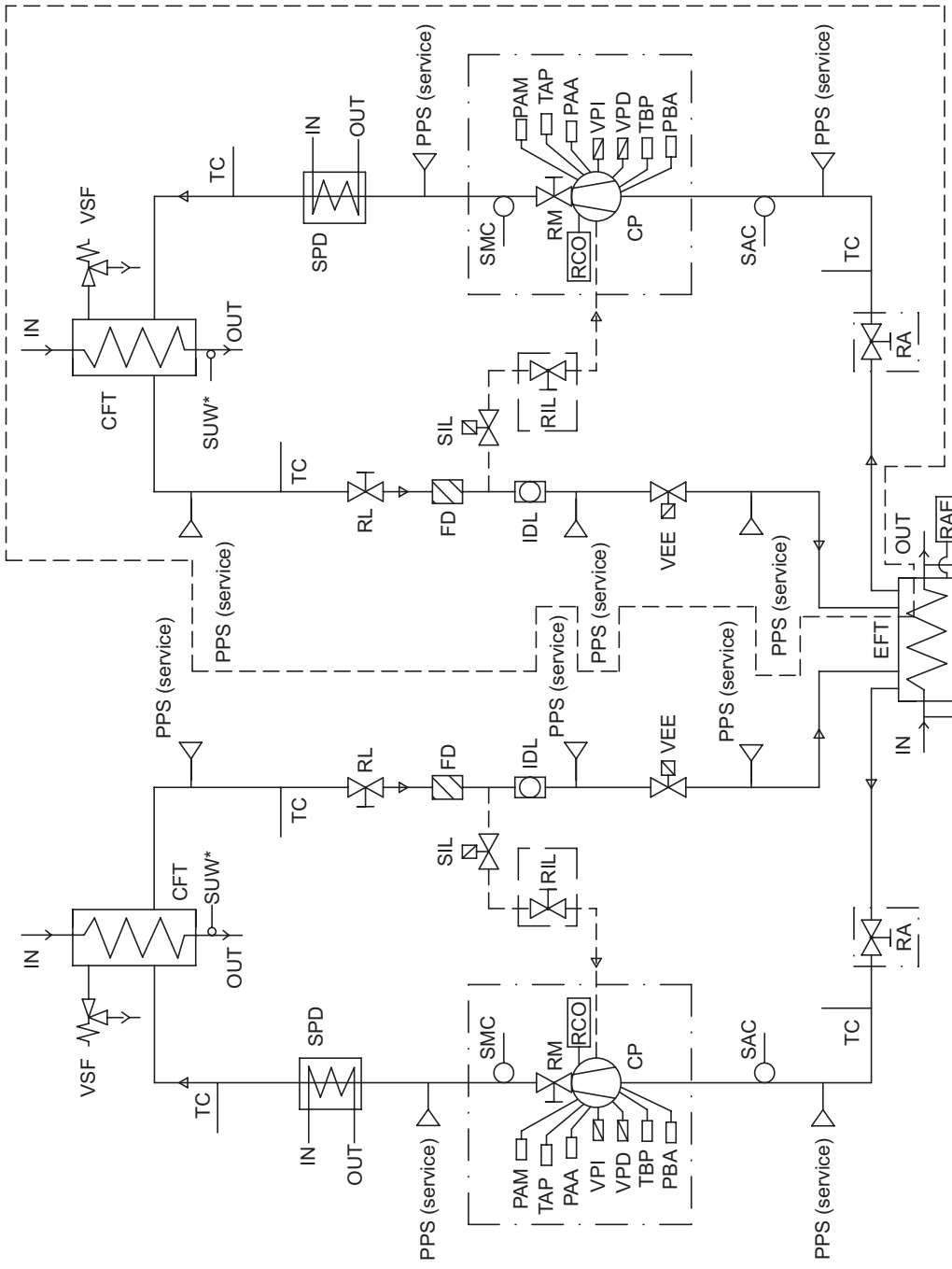
——— :Tubazioni e componenti da isolare / Insulated pipes and components

——— :Tubazioni e componenti da isolare solo per unità IW/BW / Insulated pipes and components only IW/BW units

REFRIGERANT FLOW DIAGRAM

Refrigerant flow diagram Desuperheaters Version VD

	Description
CFT	SHELL AND TUBE CONDENSER
CP	SCREW COMPRESSOR
EFT	SHELL AND TUBE HEAT EVAPORATOR
FD	DRIER FILTER
IDL	LIQUID AND MOISTURE INDICATOR
IN	WATER IN
OUT	WATER OUT
PAA	AUTOMATIC RESET HIGH PRESSURE SWITCH
PBA	AUTOMATIC LOW PRESSURE SWITCH
PAM	MANUAL RESET HIGH PRESSURE SWITCH
PDW	DIFFERENTIAL WATER PRESSURE SWITCH
PPS	PRESSURE GAUGE WITH SCHRAEDER
RA	SUCTION VALVE (OPTIONAL)
RAE	EVAPORATOR ANTIFREEZE HEATER (OPTIONAL)
RCO	OIL CRANKASE HEATER
RIL	LIQUID INJECTION BALL VALVE (OPTIONAL)
RL	LIQUID VALVE
RM	DISCHARGE VALVE
SAC	SUCTION TEMPERATURE PROBE
SIL	LIQUID INJECTION SOLENOID VALVE (OPTIONAL)
SIW	WATER INLET PROBE
SMC	DISCHARGE TEMPERATURE PROBE
SPD	DESUPERHEATER PLATE HEAT EXCHANGER
SUW	WATER OUTLET PROBE
TAP	HIGH PRESSURE TRANSDUCER
TBP	LOW PRESSURE TRANSDUCER
TC	PIPE FOR REFRIGERANT FILLING
VEE	ELECTRONIC EXPANSION VALVE
VPD	DECREASING CONTROL CAPACITY VALVE



* :solo per unità IW/BW, only for IW/BW units

[_ _ _] :solo per unità bicompressore / Only for units with 2 compressors

— — :Iniezione liquido (optional) / Liquid injection (optional)

— · — :Rubinetto aspirazione (optional) / Suction valve (optional)

— · - :Gruppo compressore / Compressor group

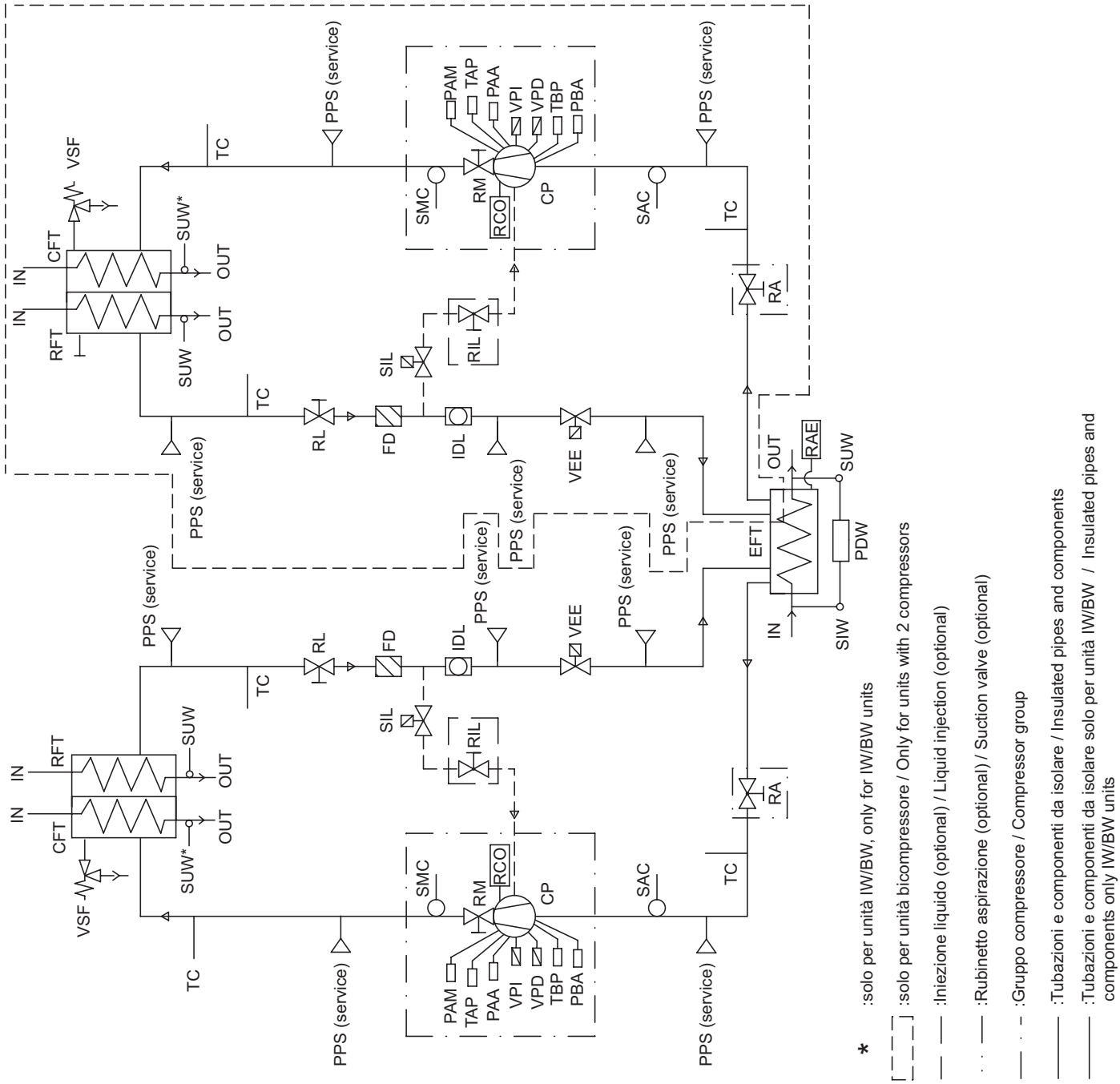
——— :Tubazioni e componenti da isolare / Insulated pipes and components

——— :Tubazioni e componenti da isolare solo per unità IW/BW / Insulated pipes and components only IW/BW units

REFRIGERANT FLOW DIAGRAM

Refrigerant flow diagram Total heat recovery VR

	Description
CFT	SHELL AND TUBE CONDENSER
CP	SCREW COMPRESSOR
EFT	SHELL AND TUBE HEAT EVAPORATOR
FD	DRIER FILTER
IDL	LIQUID AND MOISTURE INDICATOR
IN	WATER IN
OUT	WATER OUT
PAA	AUTOMATIC RESET HIGH PRESSURE SWITCH
PBA	AUTOMATIC LOW PRESSURE SWITCH
PAM	MANUAL RESET HIGH PRESSURE SWITCH
PDW	DIFFERENTIAL WATER PRESSURE SWITCH
PPS	PRESSURE GAUGE WITH SCHRAEDER
RA	SUCTION VALVE (OPTIONAL)
RAE	EVAPORATOR ANTIFREEZE HEATER (OPTIONAL)
RFT	SHELL AND TUBE HEAT RECOVERY
RCO	OIL CRANKASE HEATER
RIL	LIQUID INJECTION BALL VALVE (OPTIONAL)
RL	LIQUID VALVE
RM	DISCHARGE VALVE
SAC	SUCTION TEMPERATURE PROBE
SIL	LIQUID INJECTION SOLENOID VALVE (OPTIONAL)
SIW	WATER INLET PROBE
SMC	DISCHARGE TEMPERATURE PROBE
SUW	WATER OUTLET PROBE
TAP	HIGH PRESSURE TRANSDUCER
TBP	LOW PRESSURE TRANSDUCER
TC	PIPE FOR REFRIGERANT FILLING
VEE	ELECTRONIC EXPANSION VALVE
VPD	DECREASING CONTROL CAPACITY VALVE



* :solo per unità IW/BW, only for IW/BW units

[_ _ _] :solo per unità bicompressore / Only for units with 2 compressors

— — :Iniezione liquido (optional) / Liquid injection (optional)

· · — :Rubinetto aspirazione (optional) / Suction valve (optional)

— · - :Gruppo compressore / Compressor group

——— :Tubazioni e componenti da isolare / Insulated pipes and components

——— :Tubazioni e componenti da isolare solo per unità IW/BW / Insulated pipes and components only IW/BW units

START-UP

General Rules

To validate the contractual warranty, the machine must be set at work by technicians from an authorized assistance center. Before they are called, check to make sure that all parts of the installation have been completed, the unit levelled, the wet connections made with the relative air vent and the electrical connections made.

MAINTENANCE

General Rules

Maintenance is of extreme importance if the plant is to operate in a regular way and give fade-free service. Have extraordinary maintenance work done by qualified and authorized personnel. Comply with the safety precautions given in the relative section of this manual and take all the necessary precautions.
The following information is only a guide for the end user.

Routine maintenance

The inspections described below, to which the unit must be subjected, do not require specific technical know-how.
They merely include a few simple inspections involving certain parts of the unit.
Call an authorized assistance center if actual maintenance work is required.
The table below gives a recommended list of inspections which should be carried out at the indicated intervals.

DESCRIPTION	WEEKLY	MONTHLY	EVERY SIX MONTHS
Visual inspection of the unit			•
Inspection of hydraulic circuit		•	
Inspection of electrical system		•	
Inspection of condensing system		•	
Inspection and adjustment of operat. parameters	•		

• Visual inspection of the structure of the unit
When checking the condition of the parts that form the structure of the unit, pay particular attention to the parts liable to rust.
If traces of rust are noted, they must be treated with rust-inhibitor paint in order to eliminate or reduce the problem.
Check to make sure that the external panels of the unit are well fixed.
Bad fixing gives rise to noise and abnormal vibrations.
• Inspection of hydraulic circuit
Check visually to make sure that there are no leaks in the hydraulic circuit. If the pumping module accessory is installed, it is advisable to make sure that the water filter is clean.
• Inspection of electrical system
Make sure that the power cable that connects the unit to the distribution panel is not torn, cracked or damaged in a way that could impair its insulation.
• Inspection of the condensing system
WARNING: The finned pack exchanger has fins made of aluminium or some other thin material, thus even accidental contact could cause cuts. Comply with the instructions in the relative section.
• Condensing coils
In view of the function of this component, it is very important for the surface of the exchanger to be as free as possible from clogging caused by items that could reduce the fan's air flow rate and, thus, the performances of the unit itself.
The following operations may be required:
- Remove all impurities (such as paper scraps, leaves, etc.) that could be clogging the surface of the bank either by hand or using a brush (comply with the above mentioned safety prescriptions).
- If the dirt has deposited on the fins and is difficult to remove by hand, use a jet of compressed air or pressurized water on the aluminium surface of the coils, remembering to direct the jet in a vertical direction to prevent the fins from being damaged.
- "Comb" the coils with the relative tool, using the appropriate comb spacing for the fins if some parts of them are bent or squashed.
• Helical electric fans
Visually inspect these parts to make sure that the electric fans are well fixed to the bearing grille and that this latter is fixed to the structure of the unit. Bad fixing gives rise to noise and abnormal vibrations.
• Reading and adjustment of the operating parameters
This control can be done using the pressure gauges (if installed) of the refrigerant circuits and using the pressure and temperature gauges (if installed) of the hydraulic circuits of the unit (evaporator + heat recovery - if present)

MAINTENANCE

General considerations

The machine has been designed with a view to reducing the risks to persons and the environment in which it is installed, to the minimum. To eliminate residue hazards, it is therefore advisable to become as familiar as possible with the machine in order to avoid accidents that could cause injuries to persons and/or damage to property.

a. Access to the unit

Only qualified persons who are familiar with this type of machine and who are equipped with the necessary safety protections (footwear, gloves, helmet, etc.) may be allowed to access the machine. Moreover, in order to operate, these persons must have been authorized by the owner of the machine and be recognized by the actual Manufacturer.

b. Elements of risk

The machine has been designed and built so as not to create any condition of risk. However, residue hazards are impossible to eliminate during the planning phase and are therefore listed in the following table along with the instructions about how to neutralize them.

Part in question	Residue hazard	Mode	Precautions
Compressor and delivery pipe	Burns	Contact with the pipes and/or compressor	Avoid contact by wearing protective gloves
Delivery pipes, heat recovery exchanger	Explosion	Excessive pressure	Turn off the machine, check the high pressure switch and safety valve and condenser water pump
Pipes in general	Ice burns	Leaking refrigerant	Do not pull on the pipes
Electrical cables, metal parts	Electrocution, serious burns	Defective cable insulation, live metal parts	Adequate electrical protection (correctly ground the unit)

c. Pollution

The unit contains refrigerant gas and lubricating oil. When scrapping the unit these fluids must be recovered and disposed of in compliance with the regulations in force in the country where it is installed. The unit must not be abandoned during the scrapping stage.

SAFETY AND POLLUTION

General recommendations about the R134a refrigerant used

COMPOSITION / INFORMATION ON INGREDIENTS

Substance / Preparation : Substance.
Components / Impurities : R134a : Not classified as dangerous product.
Contains no other components or impurities which will influence the classification of the product.

HAZARDS IDENTIFICATION

Hazards identification : In high concentrations may cause asphyxiation.
Liquefied gas.
Gas/vapour heavier than air.
May reduce oxygen.

FIRST AID MEASURES

First aid measures
- Inhalation : In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/ consciousness. Victim may not be aware of asphyxiation.
Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
If breathing is difficult, give oxygen.
- Skin contact : Flush with plenty of water.
Clothing that has become saturated with the product must be removed immediately because the product is absorbed through the skin.
- Eye contact : Flush with lukewarm water for 15 minutes.
Seek medical advice.
- Ingestion : Ingestion is not considered a potential route of exposure.
General information : Obtain medical attention.

FIRE-FIGHTING MEASURES

Flammable class : Non flammable.
Specific hazards : Exposure to fire may cause containers to rupture/explode.
Hazardous combustion products : None.
Extinguishing media
- Suitable extinguishing media : All known extinguishants can be used.
Specific methods : If possible, stop flow of product.
Move away from the container and cool with water from a protected position.
Special protective equipment for fire fighters : In confined space use self-contained breathing apparatus.

ACCIDENTAL RELEASE MEASURES

Personal precautions : Evacuate area.
Ensure adequate air ventilation.
Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
Environmental precautions : Try to stop release.
Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
Clean up methods : Ventilate area.

HANDLING AND STORAGE

Precautions in handling and storage : With air may form oxydant mixtures.
Personal protection : Protect eyes, face and skin from liquid splashes.
Technical protective measures : Good ventilation of the workplace required.
Storage : Keep container below 50°C in a well ventilated place.
Handling : Open valve slowly to avoid pressure shock.
Suck back of water into the container must be prevented.
Do not allow backfeed into the container.
Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt.
Refer to supplier’s container handling instructions.

EXPOSURE CONTROLS / PERSONAL PROTECTION

Personal protection : Ensure adequate ventilation.
- Respiratory protection : In case of insufficient ventilation, wear suitable respiratory equipment.
- Hand protection : Use rubber gloves.
- Skin protection : Skin protection appropriate to the conditions of use should be provided.
- Eye protection : Face shield.
- Head protection : Protective helmet.
- Foot protection : Steel pointed safety shoes (metatarsal protection is recommended).
Industrial hygiene : When using, do not eat, drink or smoke.
Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.
Occupational Exposure Limits : 1,1,1,2-Tetrafluoroethane (R 134a) : OEL (UK)-LTEL [ppm] : 1000

Simbology

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 20 °C : Liquefied gas.
Colour : Colourless.
Odo(u)r : Ethereal.
pH value : Neutral.
Boiling point [°C] : -26.5
Vapour pressure, 20°C : 666.1 kPa
Vapour pressure, 50°C : 1319.0 kPa
Relative density, liquid (water=1) : 1.21 Kg/l
Viscosity at 25°C [mPa.s] : 0.205
Solubility in water [mg/l] : 0.15 wt %
Flash point [°C] : Not flammable.
Auto-ignition temperature [°C] : > 750
Other data : Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

STABILITY AND REACTIVITY

Stability and reactivity : Stable under normal conditions.
Hazardous decomposition products : Halogenous acid, halogenous carbide.
Materials to avoid : Explosives and flammable materials.
Organic peroxide.
Alkaline metals, Al, Zn, Be etc in powder.
Conditions to avoid : Not flammable with air in normal temperature and pressure conditions.

TOXICOLOGICAL INFORMATION

Undesirable human health effects : Heart arhythmia.
Heart sensibility: 312’975 mg/m3.
Anaesthetic effects: 834’600 mg/m3.
- Inhalation : Lung edema.
Rat inhalation LC50 [mg/l/4h] : 567
CCTN Carcinogenicity category (Italy) : Does not show any cancerogenic, teratogenic and mutagenic effects.
Narcosis : Narcotic effets above TLV.

SAFETY AND POLLUTION

ECOLOGICAL INFORMATION

Ecological effects information : No known ecological damage caused by this product.
Environmental precautions : Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
Ozone depletion factor [R11=1] : 0
Global warming factor [CO2=1] : 0.28

DISPOSAL CONSIDERATIONS

General : Do not discharge into any place where its accumulation could be dangerous.
Contact supplier if guidance is required.
Disposal method : Consult supplier for specific recommendations.

TRANSPORT INFORMATION

UN No. : 3163
H.I. nr : 20
ADR/RID
- Proper shipping name : LIQUEFIED GAS, N.O.S. (1,1,1,2-Tetrafluoroethane (R 134a))
- ADR Class : 2
- ADR/RID Classification code : 2 A
- Labelling ADR : Label 2.2 : Non flammable, non toxic gas.
Other transport information : Avoid transport on vehicles where the load space is not separated from the driver's compartment.

Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.
Before transporting product containers :
- Ensure that containers are firmly secured.
- Ensure cylinder valve is closed and not leaking.
- Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
- Ensure valve protection device (where provided) is correctly fitted.
- Ensure there is adequate ventilation.
- Compliance with applicable regulations.

REGULATORY INFORMATION

EC Labelling : Not classified as dangerous preparation/substance.
- Symbol(s) : None.
- R Phrase(s) : None.
- S Phrase(s) : None.

OTHER INFORMATION

Asphyxiant in high concentrations.
Keep container in a well-ventilated place.
Do not breathe the gas.
The hazard of asphyxiation is often overlooked and must be stressed during operator training.
Receptacle under pressure.
Ensure all national/local regulations are observed.
This Safety Data Sheet has been established in accordance with the applicable European Directives and applies to all countries that have translated the Directives in their national laws.
Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.
Details given in this document are believed to be correct at the time of going to press. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted.

First aid

• Move the victim away from the toxic source, keep him warm and allow him to rest.
• Administer oxygen if necessary.
• Proceed with artificial respiration if necessary.
• Give heart massage in the case of heart failure.
• Immediately seek medical help.

Contact with the skin:
• Immediately thaw the affected parts under running lukewarm water.
• Remove contaminated clothing (garments may stick to the skin in the case of ice burns) if they have not adhered to the skin.
• Seek medical assistance if necessary.

Contact with the eyes:
• Immediately rinse the eyes with physiologic eyewash or clean water for at least 10 minutes with the eyelids pulled open.
• Seek medical assistance if necessary.

Swallowing:
• Do not make the victim vomit. If the victim is conscious, have him rinse his mouth out with clean water and then drink 200, 300 ml of water.
• Immediately seek medical help.
• Do not administer adrenaline or sympathomimetic drugs after exposure owing to the risk of cardiac arrhythmia.
For further information about the characteristics of the refrigerant, consult the technical briefs that can be obtained from manufacturers of refrigerant products.

NOTE

NOTE

Ferroli

Codice 3QE27781

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