# AIR/WATER CHILLERS AND HEAT PUMPS WITH AXIAL FANS

# USER'S AND INSTALLER'S MANUAL

## Models

| Chillers | Heat pumps |
|---|---|
| HWA1-A 0140 | HWA1-A/H 0140 |
| HWA1-A 0147 | HWA1-A/H 0147 |
| HWA1-A 0260 | HWA1-A/H 0260 |
| HWA1-A 0273 | HWA1-A/H 0273 |
| HWA1-A 0285 | HWA1-A/H 0285 |

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"This manual is a translation from the official italian language version. For reasons of environmental respect the Company will not provide the hard copy in the original language which could be directly requested or downloaded from the Company website at any time. In case of any dispute, the original language manual will be the trusted one".

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The manual of **HWA1-A/HWA1-H** units describes all the necessary information concerning the better use of the appliance under the operator's safety conditions which meets the requirements listed in the 2006/42/CE Equipment Directive and following amendments.

**Note:** The pictures in this manual are for explanation purpose only. They may be slightly different from the unit you purchased. The actual shape shall prevail.

# 1 PURPOSES AND CONTENTS OF THE MANUAL

This manual provides the basic information concerning the selection, installation, operation and maintenance of the **HWA1-A** and **HWA1-H** units. It is addressed to the installer and the user of the appliance and it includes the necessary indications allowing the user to operate the unit efficiently, even without any previous specific knowledge of it.

The manual describes the characteristics of the appliance at the time of its marketing; therefore, it must be considered adequate respecting the state of the art in terms of potentiality, ergonomics, safety and functionality.

The company introduces also technological improvements and is not constrained to update the manuals for previous versions of appliances that could not be compatible. So make sure to use, for the installed unit, the supplied manual.

It's recommended that, the user must follow the instructions contained in this booklet, especially those concerning the safety and routine maintenance.

### 1.1 CONSERVATION OF THE MANUAL

The manual has to be always kept by the user for future reference. It has to be stored in a safe place, away from dusts and moisture. It has to be available and accessible to all users who shall consult it any time they are in doubt on how to operate the equipment.

The company reserves the right to modify its products and related manuals without necessarily updating previous versions of the reference material. It declines also any responsibility for possible inaccuracies in the manual if due to printing or transcription errors.

The customer shall store any updated copy of the manual or parts of it delivered by the manufacturer as an attachment to this manual.

The company is available to give any detailed information about this manual and to give information regarding the use and the maintenance of its own units.

### 1.2 GRAPHIC SYMBOLS

| | |
|---|---|
| | Indicates operations that can be dangerous for people and/or disrupts the correct operation of the equipment. |
| | Indicates prohibited operations. |
| | Indicates important information which should be respected by the operator in order to guarantee the correct and safe operation of the equipment. |

# 2 SAFETY LAWS

The **HWA1-A/HWA1-H** units have been designed in accordance with the following directives and harmonised standards:

- EU Directives 2014/68/UE, 2006/42/EC, 2014/35/UE, 2014/30/EU, 2011/65/EU, 2012/19/EU,
- UNI EN 378-1, 378-2, EN 12735-1,
- UNI EN ISO 12100, EN 60204-1, UNI EN ISO 13857,
- CEI EN 61000-6-3, IEC 61000-6-2.

### 2.1 PERMITTED USES

- The company excludes any contractual and extra-contractual liabilities for damages caused to persons, animals or objects, by incorrect installation, setting and maintenance, improper use of the equipment, and the partial or superficial reading of the information described in this manual.
- These units have been designed only for heating and/or cooling of water. Any other use not expressly authorized by the manufacturer is considered improper and therefore not allowed.
- The location of the plant, the hydraulic and electrical circuits must be established by the planting designer and must take into account both technical requirements as well as any applicable local laws and authorized specifications.
- The execution of all works must be performed by skilled and qualified personnel, competent in the existing rules in different countries.
  The execution of all works must be performed by skilled and qualified personnel and specialist competent in the existing rules in the country in which the appliance will be installed.

# 3 GENERAL SAFETY GUIDELINES

Before beginning to operate on **HWA1-A/HWA1-H** units every user has to be perfectly knowledgeable about the functions of the equipment and its controls and has to have read and understood the information listed in this manual.

| | |
|---|---|
| | It's strictly forbidden to remove and/or tamper with any safety device. |
| | Children or unassisted disabled persons are not allowed to use the appliance. |
| | Do not touch the appliance when barefoot or parts of the body are wet or damp. |
| | Do not clean the unit when the power supply is 'ON'. |
| | Do not pull, remove or twist the electrical cables coming out from the unit, even if it is disconnected from the power supply. |
| | Do not step with your feet on the appliance, sit down and/or place any type of object. |
| | Do not spray or pour water directly on the unit. |
| | Do not dispose of, abandon or leave within reach of children packaging materials (cardboard, staples, plastic etc.) as they may represent an environmental and life hazard. |
| | Any routine and/or not-routine maintenance operation shall be carried out when the equipment has been shut do disconnected from electric and pneumatic power sources and after its pneumatic system has been discharged. |
| | Do not put neither your hands nor insert screwdrivers, spanners or other tools into moving parts of the equipment. |
| | The equipment supervisor and the maintenance man have to receive suitable training for the performance of the tasks in safety. |
| | Operators have to know how to use personal protective devices and have to know the accident prevention guidelines contained in national and international laws and norms. |

### 3.1 WORKERS' HEALTH AND SAFETY

The workplace health and safety laws, including **89/391/CEE**, **89/686/CEE, 2009/104/CE, 86/188/CEE 89/655/CEE,** and **77/576/CEE** should be respected by every employer who must oblige the employees to respect them. It points out that:

| | |
|---|---|
| | Do not tamper with or replace parts of the equipment without the specific consent of the manufacturer. Th manufacturer shall have no responsibility whatsoever in case of unauthorised operations. |
| | Using components, expendable materials or spare parts that do not correspond to those recommended by the manufacturer and/or listed in this manual may be dangerous for the operators and/or damage the equipment |
| | The operator's workplace has to be kept clean, tidy and free from objects that may prevent free movem Appropriate lighting of the work place shall be provided so as to allow the operator to carry out the requi operations safely. Poor or too strong lighting can cause risks. |
| | Ensure that work places are always adequately ventilated and that aspirators are working, in good condition and i compliance with the requirements of the laws in force. |

### 3.2 PERSONAL SAFETY EQUIPMENTS

When operating and maintaining the **HWA1-A/HWA1-H** units, please use the following personal protective equipment.

| | |
|---|---|
| | Protective clothing: Service man or who operates on the plant systems should wear protective clothing that complies with the basic safety requirements currently in force. In case of slippery floors, users have to wear safety shoes w non-slip soles. |
| | Gloves: Protection gloves should be used during maintenance or cleaning operations. |
| | Mask and goggles: Respiratory protection (mask) and eye protection (goggles) should be used during cleaning and maintenance operations. |

### 3.3 SAFETY SYMBOLS

The safety signs indicated on the unit which should be respected:

| | |
|---|---|
| | General hazards |
| | **Electric** shock **hazard.** |
| | Presence of moving organs. |
| | Presence of surfaces that may cause injures. |
| | Presence of hot surfaces that can cause burns. |

# 4 REFRIGERANT SAFETY DATA SHEET

| | |
|---|---|
| Name: | R410A (50% Difluoromethane (R32); 50% Pentafluoroethane (R125). |
| | **RISKS INDICATIONS** |
| Major risks: | Asphyxia |
| Specific risks: | The rapid evaporation may cause freezing. |
| | **FIRST AID** |
| General information: | Never give anything by mouth to an unconscious person. |
| Inhalation: | Move to fresh air.<br>Oxygen or artificial respiration if necessary.<br>Do not administer adrenaline or similar drugs. |
| Eyes contact: | Rinse carefully with water for at least 15 minutes and consult a doctor. |
| Contact with skin: | Wash immediately with plenty of water.<br>Take off immediately the contaminated clothing. |
| | **FIRE PREVENTION** |
| Extinguishing Media: | Whatever. |
| Specific risks: | Increasing in pressure. |
| Specific methods: | Use water spray to cool containers. |
| | **ACCIDENTAL RELEASE ACTIONS** |
| Personal precautions: | Evacuate personnel to safe areas.<br>Provide adequate ventilation.<br>Use personal protective equipment. |
| Environmental precautions: | Evaporate. |
| Cleaning method: | Evaporate. |
| | **HANDLING AND STORAGE** |
| Manipulation<br>Action/technical precautions: | Provide sufficient air exchange and/or suction in work places. |
| Recommendations for safe use: | Do not breathe vapors or aerosol. |
| Storage: | Close tightly and store in a cool, dry and well ventilated place.<br>Store in original container. Incompatible products: explosive, flammable materials, Organic peroxide. |
| | **EXPOSURE CONTROL / PERSONAL PROTECTION** |
| Control parameters: | AEL (8-h e 12-h TWA) = 1000 ml/m³ for each of the two components. |
| Respiratory protection: | For rescue and maintenance operation in storage tanks use self-contained respirator apparatus.<br>The vapors are heavier than air and can cause suffocation by reducing oxygen available for breathing. |
| Eyes protection: | Safety glasses. |
| Protection of hands: | Rubber gloves. |
| Hygiene measures: | Do not smoke. |
| | **PHYSICAL AND CHEMICAL PROPERTIES** |
| Color: | Colorless. |
| Odor: | Light. |
| Boiling point: | -52.8°C at atmospheric pressure. |
| Lighting point: | It does not ignite. |
| Density: | 1.08 kg/l at 25°C. |
| Solubility in water: | Negligible. |
| | **STABILITY AND REACTIVITY** |
| Stability: | No reactivity when used with the appropriate instructions. |
| Materials to avoid: | Highly oxidizing materials. Incompatible with magnesium, zinc, sodium, potassium and aluminum.<br>The incompatibility is more serious if the metal is present in powdered form or if the surfaces were, recently, unprotected. |
| Decomposition products<br>Risks: | These products are halogenated compounds, hydrogen fluoride, carbon oxides (CO, $CO_2$) and carbonyl halides. |
| | **TOXICOLOGICAL INFORMATION** |
| Acute toxicity: | (R32) LC50/ inhalation /4 hours/on rat >760 ml/l<br>(R125) LC50/ inhalation /4 hours/on rat >3480 mg/l |
| Local effects: | Concentrations substantially above the TLV may cause narcotic effects.<br>Inhalation of decomposed products of high concentrations may cause respiratory failure (pulmonary edema). |
| Long term toxicity: | Did not show any carcinogenic potential, teratogenic or mutagenic effects in animal experiments. |
| | **ECOLOGICAL INFORMATION** |
| Global Warming Potential<br>GWP (R744=1): | 2088 |
| Ozone Depletion Potential<br>ODP (R11=1): | 0 |
| Disposal considerations: | Usable with reconditioning. |

# 5 TECHNICAL CHARACTERISTICS

The **HWA1/HWA1-H** air-water chiller/heat pump units are designed for commercial and industrial applications, they are very compact and still equipped with large-surface air side exchangers ensuring a high efficiency with the highest ratings of EER and COP. The use of scroll compressors with high efficiency and particularly robust together with the patented system of oil recovery and distribution used on tandem circuits ensure high reliability with consistent performances.
The units are all equipped with high and low pressure transducers, NTC sensors at the compressors' inlet and a controller with **microprocessor with integrated driver for the management of an electronic expansion valve** to further improve the performances of the units for non-standard applications.

## 5.1 CARPENTRY

The **HWA1-A/HWA1-H** units are all made up of hot-galvanised thick sheet metal, painted with polyurethane powder enamels at 180°C to ensure the best resistance against atmospheric agents. The front panel is hinged to the lift side to allow access to the internal components for inspection and maintenance. The screws and the inserts are made up of galvanized steel.

## 5.2 REFRIGERANT CIRCUIT

The refrigerant circuit has been manufactured according to the UNI EN 13134 directive concerning welding procedures. The refrigerant gas employed in these units is R410A type. The refrigerant circuit includes in its basic version: electronic expansion valve, liquid separator, liquid receiver, check valves for maintenance and control, safety device according to PED regulation (high pressure switch), relief valve for the refrigerant, pressure transducers to accurately measure the evaporating and condensing pressures, high capacity drier filter to avoid the unclogging of lamination valve and to remove any moisture inside the circuit, the liquid indicator for controlling the refrigerant charge. The "**H**" heat pump versions are equipped with 4 way valve for refrigerant cycle inversion and an outdoor air temperature measurement sensor.

## 5.3 COMPRESSORS

The compressors are scroll type, especially designed for operation with R410A refrigerant, and are mounted on a rubber material acting as a shock absorber. The crankcase heater operates when the compressor is off and stops when the compressor restarts operation.
**We recommend to turn ON the unit and to put it in standby mode at least 6 hours before the start-up.**
The inspection of the compressors is possible through the front panel of the unit which allows also the monitoring of the inner components.

## 5.4 AIR-SIDE HEAT EXCHANGER

The air-side heat exchanger for chiller units is made entirely of aluminium with the new **microchannel technology** which allows to reduce significantly both the losses on the air side and the refrigerant charge; with this technology, the heat transfer across the front surfaces is more equally effective compared to conventional heat exchangers. The heat pump models equipped with finned heat exchangers with optimized fin pitch for operation at low temperatures.

## 5.5 FAN MOTOR

The fan motor is axial type with plastic aerofoil blades. It is statically and dynamically balanced and supplied with safety fan guard and inlet and outlet airflow of double flared profile specially shaped to increase the efficiency and to reduce the noise level. The fan motor is AC type designed to operate at one or two speeds with star/delta (Y- 4) connection regulated in pressure, or is a speed modulation brushless EC motor directly coupled and equipped with an integrated overheat protection device. The protection class of the motor is IPX4 according to CEI EN 60529.

## 5.6 USER-SIDE HEAT EXCHANGER

The user-side heat exchanger is made up of AISI 316 stainless steel braze-welded plates type, and is factory insulated with flexible close cell material, the heat exchanger could be equipped with an antifreeze electric heater. Each evaporator is equipped with a temperature sensor for antifreeze protection that activates the circulator, even in the case where the unit is turned off when meeting the setting parameters by controller.

## 5.7 ELECTRICAL PANEL

The electrical panel is manufactured according to European Union directives currently in force. To reach the electrical panel, put the disconnecting switch in off position, (presence of a door lock system) and open the front plate of the electrical panel after removing the fixing screws. The protection degree is IP34. The electrical panel is supplied with a terminal block with free contacts for the remote control ON-OFF switch.

## 5.8 CONTROL SYSTEM

The **HWA1-A** and **HWA1-H** units are all equipped with a central system adopting a microprocessor with overheat control logic managed by the signals sent by the pressure transducers and temperature sensors. The CPU also manages the following functions: water temperature regulation, antifreeze protection, compressors' time setting and start-up, management of fan motor and circulating pump (if present), alarms reset, alarms notifications and operation LED. Upon request, the microprocessor can be connected to a BMS remote control system.

The addition of an expansion module allows to manage by mean of the controller beyond to an external modulating or two positions 3-way valve, both the free cooling regulation and the circulators of the desuperheater and of the total heat recovery, and the eventual double pumps with alternating optimized use of them according to the number of unit's working hours.

### 5.9 CONTROL AND PROTECTION DEVICES

The units are standard equipped with the following control and protection devices: 3-phase monitor allows to stop the unit if the phase sequence is incorrect or if the voltage of at least one phase is different with 15% from the others, return water temperature sensor with antifreeze function which is installed on the return water pipe line from the plant circuit, operation sensor installed on the water return pipe from plant circuit, low pressure transducer, high pressure transducer, compressors discharge temperature, relief valve on low pressure side which opens at temperatures higher than 68°C, compressor inlet temperature sensor, suctions compressors suction temperature sensors, air outside temperature sensor (HWA1-H), thermal protection switch for fan motors, thermal protection on each compressor, water side flow switch to protect the evaporator, high pressure HP flow switch with manual reset installed on the outlet pipe of the compressors near the high pressure intake of service. The below components are supplied also as standard:

- The integral protection module which is installed inside the compressors' electrical box which detects by means of an included sensor the real winding temperature and stops the compressor's operation when the limit temperature is reached and is a required protection also for the operation with low evaporation pressures especially when the thermal protection on the power supply circuit is not sure.
- High pressure transducer for condensation control, defrost cycle termination and shutdown of compressors in sequence according to the maximum permitted pressure (allows to produce hot water at 50°C even with outside temperatures above 40°C in bi-compressor heat pump units).

### 5.10 HYDRAULIC CIRCUIT

The **HWA1-A/HWA1-H** series can be supplied with an incorporated hydronic kit which includes: in addition to the flow switch, and the other components already mentioned, pressure gauges at the inlet and pressure intake at the outlet of the heat exchanger to assess the load losses, one pump with AC motor which are suitable for the utilization of chilled water and directly managed by the controller on-board unit in both on-off and modulation operations depending on the adopted solution.

### 5.11 FAN SPEED CONTROL

One-speed fan motors with high pressure transducer as standard, available also for chillers of two-speed fan motors of star/delta (Y- 4 • } v v š ] } v X d Z ] • š Ç ‰ }le 6y the microprocessor is necessary for optimizing the condensation pressure in cooling operation mode in order to allow the correct operation of the unit with a wide outdoor temperatures range. The **modulating control inverter with EC brushless motor** can be supplied as optional particularly for heat pump units or when the chilling operation mode is required at outdoor air temperatures below -5°C, this feature **is supplied as standard on both cooling only and heat pump models HWA1-A 0285 and HWA1-H 0285**.

### 5.12 BT VERSION

The BT-units (Low Temperature) allows to produce chilled water for plant with water-glycol solution between -7°C and +4°C.

| | |
|---|---|
| | The operating temperature range for the units that are equipped with this accessory is different from the one of the standard units, please see section Errore. L'origine riferimento non è stata trovata for BT version units |
| | The glycol concentration should be determined based on the minimum temperature that can be reached by the water, see the table in section 18.2 |
| | The presence of glycol leads to the increase of the pressure drops of the circuit and to the decrease capacity ou shown in the table in section 18.2 |
| | This variant is selectable only during the order of the machine, and cannot be made available for sale later. Make sure that is properly inserted in the confirmation. |

# 6 ACCESSORIES, SIZES AND VARIOUS AVAILABLE VERSIONS

The code of the unit is composed of:

- no. 7 fixed digits (the first two digits are for **HWA1-A** and **HWA1-H** series in its eventual customizations)
- the "#" symbol is as a separator
- no. 16 variables digits (fields) which are for identifying the sizes, versions and the factory mounted accessories.
- no. 3 fixed digits fixed to be 0 which are not used at the moment.

010117#(RV)(PT)(TA)(CI) (KS)(KA)(GI)(FAN)(SIL)(TR)000

| RV# | PT | TA | CI | KS | KA | GI | FAN | SIL | TR |
|---|---|---|---|---|---|---|---|---|---|
| **REFRIG ROOFTOP MOTOCONDENSING** | Output capacity | Water piping configuration | Hydronic configuration | Integrated tank kit | Antifreeze Kit (***) | Plant system management module | Fan motor type | Silencing | Coil treatment |
| 00 Cooling only | 01 40 kW | 0 2 pipes | 0 No parallel ext. pump | 0 Without | 0 Without antifreeze kit | 0 GI Module not present | 0 EC fan motor (*) | 0 Without | 0 Coil without treatment |
| 09 /Reversible heat pump | 03 47 kW | | 7 Integrated AC pump | | 1 With antifreeze kit KA | 1 GI Module present | 1 AC with inverter | 1 Silenced | 2 Coil with 'Fin Guard' treatment |
| 54 BT Version | 05 60 kW | | | | 4 With antifreeze kit KA1 | 2 Modbus | 2 AC fan motor ~ 4 l | 2 Supersilenced(**) | |
| | 06 73 kW | | | | | 3 Modbus + GI | | 4 Ducted (**) | |
| | 07 85 kW | | | | | | | | |

**FIELDS/VARIANTS TABLE**

| Filed | Variant | Description |
|---|---|---|
| **RV** | 0 | Cooling only versions for cooling operation |
| | 9 | Heat pump versions for heating and cooling operations |
| **PT** | 1 | Model 140 |
| | 3 | Model 147 |
| | 5 | Model 260 |
| | 6 | Model 273 |
| | 7 | Model 285 |
| **TA** | 0 | The version of 2 pipes provides only plant circuit water Inlet and water outlet. |
| **CI** | 0 | Provided with only the connection pipes to the heat exchanger with flow switch, safety, air vent and discharge valves and inlet manometer. |
| | 7 | The configuration with integrated on/off pump requires adding an AC pump, suitable for the use of chilled water and directly managed by the unit on-board controller. |
| **KS** | 0 | Without storage tank |
| **KA** | 0 | Unit without anti-freeze kit, standard for cooling only units. |
| | 1 | The anti-freeze kit employs a self-regulating heating cable wrapped around the basement of the unit near the condenser and a PET electric heater placed on the face of the plate heat exchanger (available only for heat pump models). |
| | 4 | PET electric heater placed on the face of the plate heat exchanger (only chillers version). |
| **GI** | 0 | Unit without plant management module. |
| | 1 | The additional module implements some important functions for the plant system management, such as domestic hot water DHW, double setpoint, management of plant electric heaters, double compressor management in sanitary mode for high temperature of air etc. |
| | 2 | Enablement of Modbus registers for remote interfacing. |
| | 3 | Similar to the variant Gi=1, with in addition the enablement of Modbus registers for remote interfacing. |
| **FAN** | 0 | Unit equipped with EC fan motor with speed modulating regulation for condensation control and defrost termination pressure. |
| | 1 | Unit provided with AC fan motor on off 1 speed, condensation regulation and defrost termination pressure. |
| | 2 | 2-speeds AC fan motor (for chilled water cooling only versions) with condensation pressure control. |
| **SIL** | 0 | Standard unit |
| | 1 | Silenced unit (with SL accessory) provided with thermo-acoustic insulator on the compressors. |
| | 2 | Super silenced unit (with SSL accessory) provided with a thermo-acoustic insulator on compressors and with the factory mounted AxiTop device for noise reduction up to 3 dB (A), the EC modulating fan motor is also supplied for cooling operation up to -15°C. |
| | 4 | Ducted version |
| **TR** | 0 | Coil with copper pipes and aluminium fins especially for heat pump utilization. |
| | 2 | Heat exchanger with anticorrosion treatment |

(*) The HWA1-A 0285 cooling only models and HWA1-A/H 0271 and 0285 heat pump models and all models of BT version are provided with EC FAN motor.
(**) Possible selection only with EC FAN
(***) KA for heat pump, KA1 for chillers

### 6.1 OPTIONAL ACCESSORIES

| | |
|---|---|
| **AG** | Anti-vibration rubber pad to be installed in the chassis of the unit for possible shock absorption. |
| **Hi-T2** | Remote control panel. |

**IMPORTANT NOTE**
**ONLY THE OPTIONAL ACCESSORIES CAN BE REQUIRED AFTER THE ORDER OF THE UNIT,**
**WHILE THE FACTORY INSTALLED ACCESSORIES CAN NOT BE REQUIRED AFTER THE ORDER OF THE UNIT.**

# 7 INSTALLATION

| | |
|---|---|
| | WARNING: The minimum temperature for storing the unit is 5°C. |

| | |
|---|---|
| | WARNING: All the operation described in next chapters MUST BE DONE BY QUALIFIED PEOPLE ONLY. Before operation on the unit, be sure that the electric supply is disconnected. |

### 7.1 GENERALITY

When installing or servicing the unit, it is necessary to strictly follow the rules listed in this manual, to conform to all the specifications of the labels on the unit, and to take any possible precautions. Not observing the rules reported on this manual can create dangerous situations.

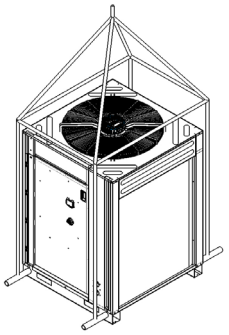
| | |
|---|---|
| | After receiving the unit, immediately check its integrity. The unit left the factory in perfect condition, any eventual damage has to be questioned to the carrier and recorded on the Delivery Note before signing it. |

The company should be informed, within 8 days, of the extent of the damage. The Customer should prepare a written statement of any severe damage.

| | |
|---|---|
| | WARNING: The HWA1-A/HWA1-H units are designed for outdoor installation and for places not directly accessible to unqualified personnel. The place of installation must be entirely far away from fire risk. All the necessary measures should be adopted in order to prevent the fire risk in the place of installation. The outdoor ambient temperature shall not exceed 46°C. Above this value, the unit is no longer covered by the directives in force in the area of pressure equipment. |
| | WARNING: The unit should be installed so that adequate clearance is available for maintenance and repair. The warranty does not cover costs related to platforms or handling equipment necessary for any maintenance. |
| | All maintenance and testing operations should be carried out only by QUALIFIED PERSONNEL |
| | Before any operation on the unit, make sure the power supply is disconnected. |
| | WARNING: MOVING PARTS, RISK OF DEATH<br>Disconnect the power supply and ensure that the fan is stopped before opening the front panel. |
| | The top part and discharge pipes of the compressor operate at high temperatures. Be sure to let the unit to become cool before beginning any maintenance work. |
| | Be careful when working near condensing coils.<br>The aluminum fins are very sharp and can cause serious injuries. |
| | After the maintenance operations, close the panels tightly with the fastening screws. |

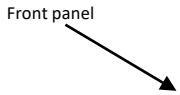
### 7.2 LIFTING AND HANDLING

The handling must be performed by qualified personnel, properly equipped with appropriate tools to the weight and the encumbrance of the unit, in compliance with safety regulations of accident preventing.

| | | | |
|---|---|---|---|
| During the unloading and placement of the unit, it is highly recommended to avoid any sudden or violent motion in order to protect the inner components and the frame. The units can be lifted by mean of a forklift or, otherwise by mean of belts, making sure to not damage the lateral panels and the cover of the unit using a structure of spacers as shown in the drawing. In this context, it is necessary to hook indirectly the unit to the basement but on two steel pipes of adequate dimension that to pass into the appropriate holes situated in the same basement of the unit. It is important to keep the unit horizontal during these operations. | 1) Handling with forklift under the pallet. | 2) Handling with forklift under the unit using the appropriate windows of passing forks. |  <br>3) Handling by mean of belts |

### 7.3 LOCATION AND MINIMUM TECHNICAL CLEARANCES

The **HWA1-A** and **HWA1-H** models are all designed for outdoor installations; any covering over the unit or locating near trees (even if they partially cover the unit) should be avoided in order to allow the air recirculation. It is advisable to realize a supporting basement, with adequate size similar to unit foot-print. The unit vibration level is very low: it is advisable however, to fit a rigid rubber band between basement and unit base-frame. It is also possible to install anti-vibration supports (springs or rubbers) to keep vibrations at a very low level. An absolute care has to be taken to ensure adequate air volume to the condenser. The re-circulation of discharge air has to be avoided; failure to observe this point will result in poor performance or activation of safety controls. For these reasons it is necessary to observe the following clearances:




| MODELS | A | B | C | D |
|---|---|---|---|---|
| **HWA1-A / HWA1-H 0140** | 800 | 800 | 200 | 600 |
| **HWA1-A / HWA1-H 0147** | 800 | 800 | 200 | 600 |
| **HWA1-A / HWA1-H 0260** | 800 | 800 | 800 | 600 |
| **HWA1-A / HWA1-H 0273** | 800 | 800 | 800 | 600 |
| **HWA1-A / HWA1-H 0285** | 800 | 800 | 800 | 600 |

The recommended minimum distance for installation, maintenance and operation.
**N.B.** Avoid suspended installations. If you cannot, use your common sense and follow local regulations, and in the case of doubt, contact your authorized service center.

### 7.4 HYDRAULIC CONNECTIONS

The hydraulic connections have to be installed in accordance with national and/or local regulations; the pipes can be made up of steel, galvanized steel or PVC. The pipes have to be accurately sized as a function on the nominal water flow of the unit and on the hydraulic pressure drops of the hydraulic circuit. All the hydraulic connections must be insulated with closed-cell material with a proper thickness. The chiller should be connected to piping using flexible joints. It's recommended to install in the hydraulic circuit the following components:

- Hole thermometers for the hydraulic circuit's temperature control.
- Manual gate valves to intercept the unit from the hydraulic circuit.
- Y-shaped metallic filter (mounted on the return pipe from the plant circuit) with a metallic mesh not less than 20 openings.
- Expansion vessel with adequate capacity to the total water content of the plant.
- Anti-vibration joints of adequate diameter to piping in order to prevent vibration transfer to the plant.
- Manometer to read the pressure of water in the outlet and then determining the next water flow.
- Loading group and discharge valve, where it's required.

| |
|---|
| WARNING: Make sure that, when determining the pipe sizes, you should exceed the maximum head loss on the plant side, please refer to the technical data given in the table of Paragraph 0 (see available head pressure). |
| WARNING: In the models of HWA1-A / HWA1-H series, the integrated expansion vessel is not included on the plant side. The real capacity of the plant circuit should be verified by the installer for providing an expansion tank with adequate volume. |
| WARNING: The return pipe from the plant circuit should be in correspondence with the label: "WATER INLET" otherwise the evaporator may freeze. |
| WARNING: It is required to install a metallic filter with mesh not larger than 1mm on the return pipe from the plant circuit with label "WATER INLET". The warranty will no longer be valid if the water flow switch is altered or changed or if the metallic filter is not installed. The filter should be kept clean, so make sure that it is clean after the installation of unit, and then check it periodically. |
| All the units are standard supplied with a factory-mounted water flow switch. Should the water flow switch be altered, removed, or should the water filter not be installed on the unit, the warranty will no longer be valid. Please refer to the wiring diagram for the water flow switch electric connections. |
| The water on the charging/topping up pipe must be opportunely pre-filtered from any suspended particles and impurities through the use a cartridge filter (washable, wrapped wire, etc.) of at least 100 microns. |
| Check the water hardness with which you charge and top up the plant circuit. For particularly hard water, it is necessary to utilize a water softener. For water treatment of the plant circuit, please refer to UNI 8065. |

#### 7.4.1 PLANT'S WATER CHARACTERISTICS

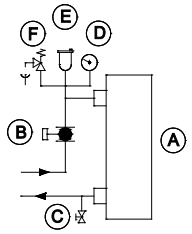
In order to ensure the correct operation of the unit, the water should be adequately filtred (as indicated in the beginning of this paragraph) and the amounts of dissolved substances should be minimal. The maximum permitted values are given in the below table.

| MAXIMUM PHYSICAL AND CHEMICAL CHARACTERISTICS ALLOWED BY THE WATER OF THE PLANT CIRCUIT | |
|---|---|
| PH | 7,5 - 9 |
| Electrical conductivity | 100 - ñ ì ì S/cm |
| Total hardness | 4,5 – 8,5 dH |
| Temperature | Y65°C |
| Oxygen content | Y ì U í ‰ ‰ u |
| Maximum glycol content | 50 % |
| Phosphates (PO4) | Y î ‰ ‰ u |
| Manganese (Mn) | < 0,05 ppm |
| Iron (Fe) | < 0,3 ppm |
| Alkalinity (HCO3) | 70 – 300 ppm |
| Chloride ions (Cl-) | < 50 ppm |
| sulphate ions (SO4) | < 50 ppm |
| Sulphide ion (S) | None |
| Ammonium ions (NH4) | None |

| | |
|---|---|
| Silica (SiO2) | < 30 ppm |

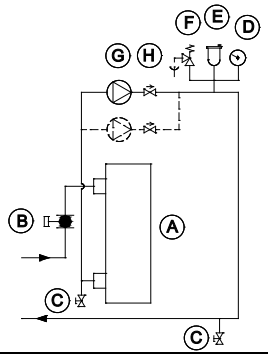
## 7.5 Hydraulic circuit

**Models:** HWA1-A/HWA1-H without pump




| | |
|---|---|
| **A** | Plate heat exchanger |
| **B** | Flow switch |
| **C** | Service valve |
| **D** | Manometer for inlet pressure |
| **E** | Air vent valve |
| **F** | Safety valve |

**Models:** HWA1-A/HWA1-H with pump




| | |
|---|---|
| **A** | Plate heat exchanger |
| **B** | Flow switch |
| **C** | Service valve |
| **D** | Manometer for inlet pressure |
| **E** | Air vent valve |
| **F** | Safety valve |
| **G** | AC centrifugal pump |
| **H** | Europa non return valve |

At the highest point of the plant circuit it is necessary to install an automatic air vent valve.
Provide an auxiliary expansion tank (not supplied) in order to control the volume changes on the plant side.

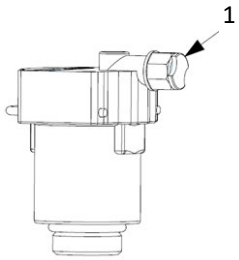
### 7.5.1 Drainage system

The **HWA1-A/HWA1-H** units all of them adopt drainage holes on the basement for the condensate draining which can leach from the pipes of hydraulic and refrigerant circuits, and to discharge the generated water during defrosting cycles.

**FOR THE HEAT PUMP UNITS, ESPECIALLY IN VERY COLD CLIMATE REGIONS, IT'S RECOMMENDED TO INSTALL ELEVATION SUPPORTS IN ORDER TO ALLOW ICE FORMATION UNDER THE UNIT WITHOUT DAMAGING IT BY FREEZING.**

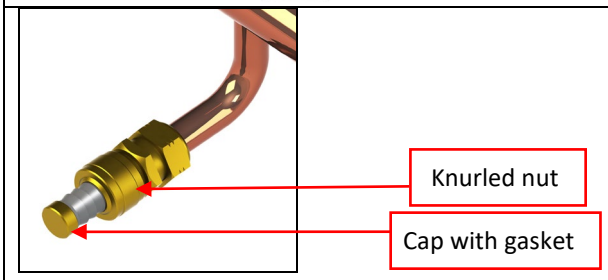
### 7.5.2 Plant circuit loading

| |
|---|
| WARNING: Verify all the charging/topping up operations. |
| WARNING: Before beginning the charging/topping up operation of the plant circuit, disconnect the unit from the electric power supply. |
| WARNING: The charging/topping up of the plant circuit must always be done under controlled conditions of pressure (max 1 bar). Make sure that you have installed on the line of charging/topping up a pressure reducer and a relief valve. |
| WARNING: The water on the charging/topping up pipe must be suitably prefiltered from any impurities and suspended particles. Make sure that you have installed a cartridge filter removable. |
| WARNING: Before beginning the charging/topping up operation, unscrew the plugs of the air vent valve. Tighten the plugs after finishing the operation of charging/topping up of the plant circuit system. |




During the operations of charging/topping up, the plugs of the air vent valves must be partially unscrewed to allow air to flow freely out of the valves.

(1) Plug of the air vent valve



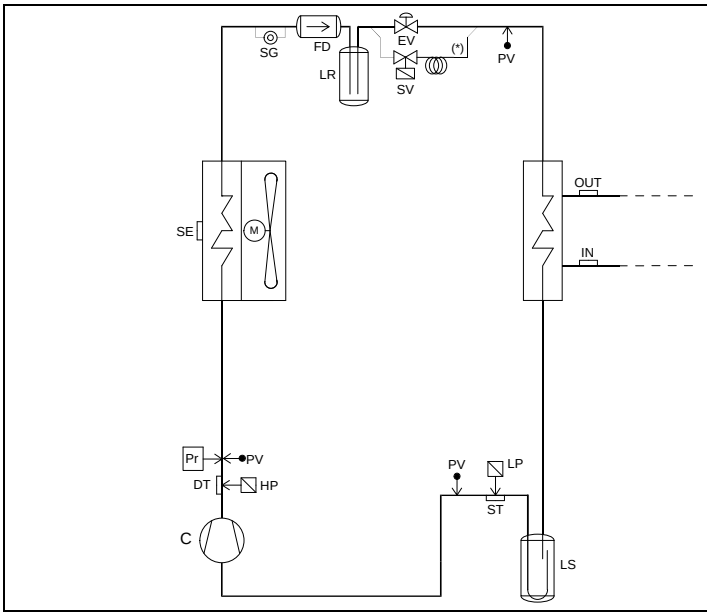

You can use the service valve, when it is necessary to refill the plant or adapt the concentration of glycol. Unscrew the plug (cap) of the service valve and connect to the hose a pipe of 14 mm (inner diameter) connected to the water network, and then fill the system by unscrewing the knurled nut. When the operation is concluded, retighten the knurled nut and screw on the plug. In any case, we recommend you to use for the water loading of the plant an external tap whose arrangement is by the installer.

### 7.5.3 Plant drainage system

In the case when it is necessary to unload the plant, close at first the inlet and outlet manual gate valves (not supplied) and then remove the pipes that are disposed externally on the water inlet and on the water outlet in order to spill away the liquid contained in the unit (in order to make easy the operation, it is recommended to install externally two draining valves, on the water inlet and on the water outlet, between the unit and the manual gate valves).

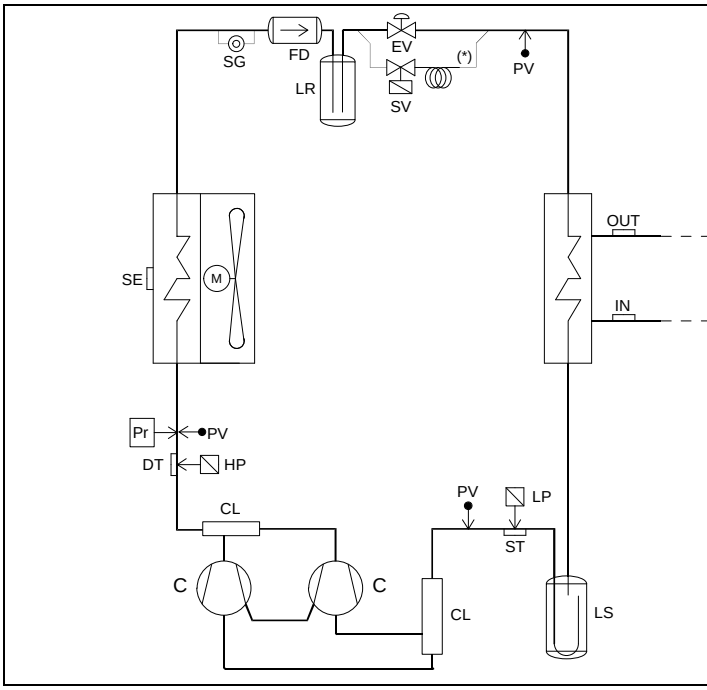
## 7.6 REFRIGERANT CIRCUITS

### 7.6.1 Refrigerant circuit of HWA1-A 0140 – 0147 units



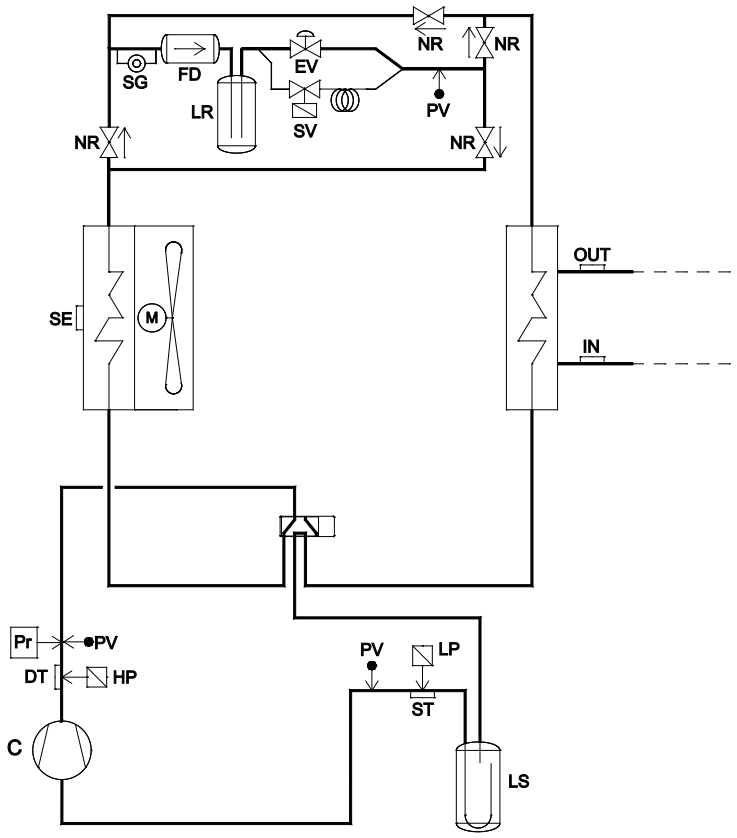

| | |
|---|---|
| **C** | Compressor |
| **DT** | Compressor outlet temperature |
| **EV** | Expansion valve |
| **FD** | Unidirectional filter drier |
| **SG** | Liquid indicator |
| **HP** | High pressure transducer |
| **IN** | Water inlet temperature sensor |
| **LP** | Low pressure transducer |
| **LR** | Liquid receiver |
| **LS** | Liquid separator |
| **M** | Axial fan motor |
| **OUT** | Water outlet temperature sensor |
| **Pr** | High pressure flow switch |
| **PV** | Pressure intake |
| **SE** | Outdoor air temperature sensor |
| **ST** | Compressor inlet temp. |
| **SV** | Solenoide valve (*) |
| (*) | CIRCUIT PRESENT ONLY IN CASE OF HWA1-A 0140 BT (LOW TEMPERATURE VERSION) |

### 7.6.2 Refrigerant circuit of HWA1-A 0260 – 0273 - 0285



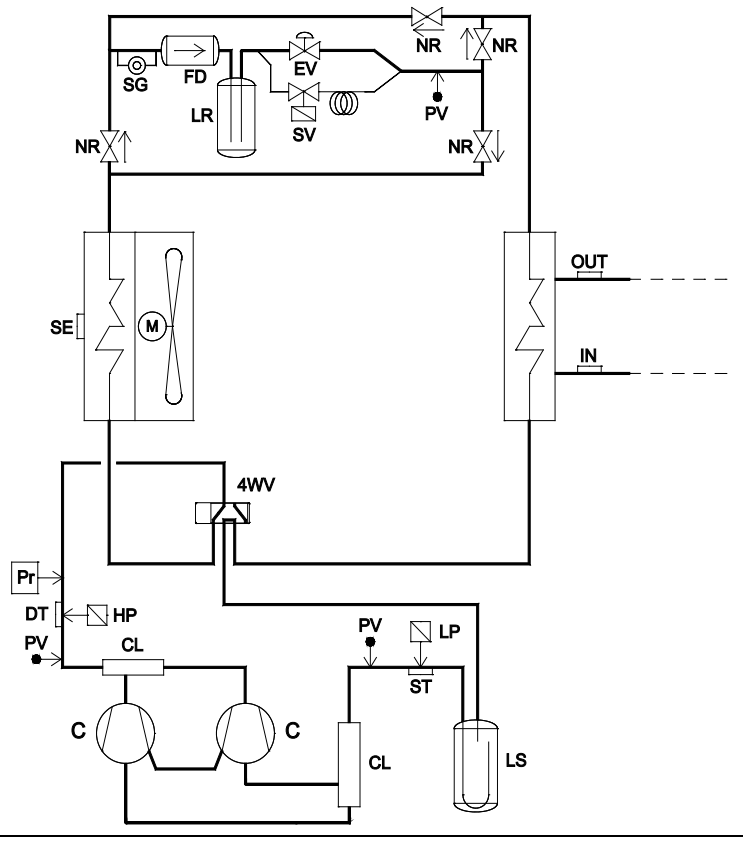

| | |
|---|---|
| **C** | Compressor |
| **DT** | Compressor outlet temperature |
| **EV** | Expansion valve |
| **FD** | Unidirectional filter drier |
| **SG** | Liquid indicator |
| **HP** | High pressure transducer |
| **IN** | Water inlet temperature sensor |
| **LP** | Low pressure transducer |
| **LR** | Liquid receiver |
| **LS** | Liquid separator |
| **M** | Axial fan motor |
| **OUT** | Water outlet temperature sensor |
| **Pr** | High pressure flow switch |
| **PV** | Pressure intake |
| **SE** | Outdoor air temperature |
| **ST** | Compressor inlet temperature |
| **SV** | Solenoide valve (*) |
| (*) | CIRCUIT PRESENT ONLY IN BT VERSIONS |

### 7.6.3 Refrigerant circuit of HWA1-H 0140 – 0147 units




| | |
|---|---|
| **C** | Compressor |
| **DT** | Compressor outlet temperature |
| **EV** | Electronic expansion valve |
| **FD** | Unidirectional filter drier |
| **SG** | Liquid indicator |
| **HP** | High pressure transducer |
| **IN** | Water inlet temperature sensor |
| **LP** | Low pressure transducer |
| **LR** | Liquid receiver |
| **LS** | Liquid separator |
| **M** | Axial fan motor |
| **OUT** | Water outlet temperature sensor |
| **Pr** | High pressure flow switch |
| **PV** | Pressure intake |
| **SE** | Outdoor air temperature |
| **ST** | Compressor inlet temperature |
| **CL** | Tandem collector |
| **SV** | N.C. Solenoid valve |
| **FM** | Mechanical filter |
| **NR** | Non return valve |
| **4WV** | 4 way valve |

### 7.6.4 Refrigerant circuit of HWA1-A/H 0260 - 0273 - 0285 units




| | |
|---|---|
| **C** | Compressor |
| **DT** | Compressor outlet temperature |
| **EV** | Electronic expansion valve |
| **FD** | Unidirectional filter drier |
| **SG** | Liquid indicator |
| **HP** | High pressure transducer |
| **IN** | Water inlet temperature sensor |
| **LP** | Low pressure transducer |
| **LR** | Liquid receiver |
| **LS** | Liquid separator |
| **M** | Axial fan motor |
| **OUT** | Water outlet temperature sensor |
| **Pr** | High pressure flow switch |
| **PV** | Pressure intake |
| **SE** | Outdoor air temperature |
| **ST** | Compressor inlet temperature |
| **CL** | Tandem collector |
| **SV** | N.C. Solenoid valve |
| **FM** | Mechanical filter |
| **NR** | Non return valve |
| **4WV** | 4 way valve |

## 7.7 WIRING

Check if the power supply circuit meets the unit's electric nominal data (voltage, phases and frequency) reported on the label sticked on the right-side panel of the unit. The wiring must be done in accordance to the wiring diagram attached to the unit and in conformity with the national and international norms in force (attempting to provide a general magneto-thermic circuit breaker, differential circuit breakers for each electric line, proper grounding for the plant, etc.). Power cables, electric protections and line fuses have to be sized according to the specifications listed in the wiring diagram enclosed with the unit and in the electrical data contained in the table of technical characteristics.

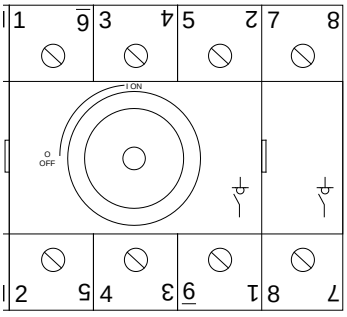
| | |
|---|---|
| ⚠ | Because of the presence of EMC filters for compliance with EMC limits (interference emission and interference immunity) inside the machine, earth fault currents up to 250 mA of intensity can be detected.<br>For proper installation, electrically connect the unit with a dedicated line; if you use a residual current circuit breaker, choose a four-pole one, with a trigger threshold of 300 mA and delayed triggering (super-resistant, characteristic K).<br>The machine must be installed in TT or TN-S power supply grounding systems.<br>The electrical installation must be carried out in accordance with norms in force. |
| ⚠ | WARNING: The supply voltage's fluctuations cannot exceed ±10% of the nominal value. Should this tolerance not be respected, please contact our technical department. |
| | WARNING: The power supply have to respect the listed limits: failing this, warranty will terminate immediately.<br>Before any operation on the unit, be sure that the power supply is disconnected.<br>WARNING: The water flow switch (B component in the previous hydraulic circuit and factory installed) has ALWAYS to be connected following the indications listed in the wiring diagram. Never change the water flow switch connections in the terminal board. The guarantee will not be valid if the water flow switch connections are altered or not correctly fixed. |
| | Install upstream of each unit an adequate protection and disconnection device of the electric power with delayed characteristic curve, with at least 3 mm contact opening and with an adequate capacity of breaking and differential protection.<br>A good grounding is required; the manufacturer is not responsible for damage caused in case of bad grounding.<br>Use cables that meet the regulations in force in different countries. |
| ⚠ | WARNING: The remote control panel is connected to the water chiller by means of no.4 wires having a 1,5 $mm^2$ section. The power supply cables have to be separated from the remote control wires. The maximum length is 50m. |
| ⚠ | WARNING: The remote control panel cannot be installed in areas with strong vibrations, corrosive gases, and excess of dirtiness or high humidity levels. Please let free the area near the cooling openings. |

### 7.7.1 Wiring terminal block

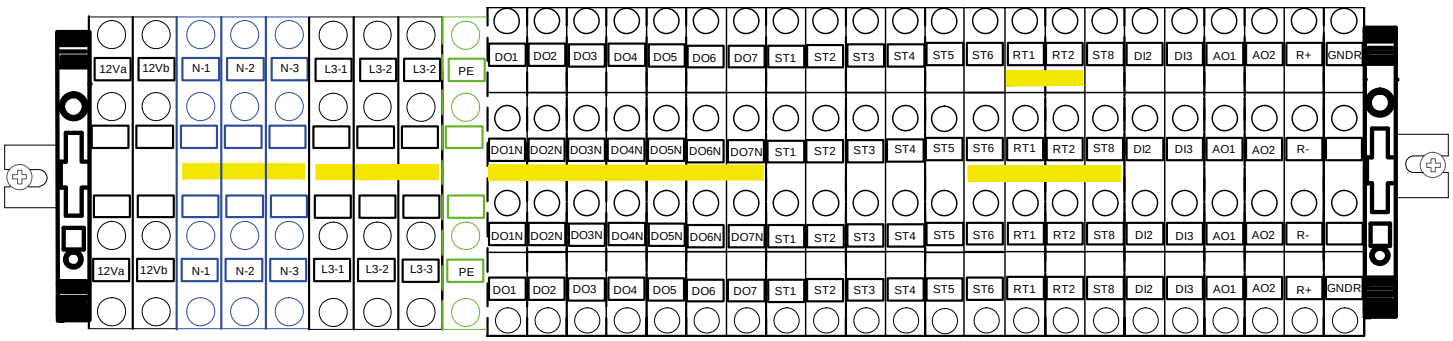
| |
|---|
| Electrical wiring has to be done only by qualified personnel. |
| If the lightning risk is high, the unit must be protected, the risk assessment must comply with the CEI EN 62305-2 regulation.<br>If there is a possibility that a lightning can strike the area around the appliance, stop the operation of the unit and disconnect the system upstream switch<br>Make sure to ground the unit<br>Do not ground the unit with pipes or lightning rods<br>A poor grounding of the unit can result in electrocution.<br>It is required that the electrical connections comply with the regulations in force in the country of installation. |
| Warning: Electrostatic discharges can damage the electronic components, before performing any work; ground the electrostatic charge by touching objects such as water or heating pipes |

**The electrical connections have to be realized by qualified personnel.**

The power supply of the units is 3-Ph/N/PE 400V, 50Hz. The power cables should be brought inside the electrical panel of the unit and connected to the disconnecting switch inside the electric panel itself, in the bottom at the left, as shown in the following figure:




The connections of the power supply cables to the disconnecting switch should be done starting from left to right as follows: L1 for phase conductor 1, L2 for phase conductor 2, L3 for phase conductor 3, N for neutral line, PE earth conductor.



| TERMINAL | TYPE | CONNECTION |
|---|---|---|
| 12Va | Power supply 12 Vac | Power supply for remote control panel (keyboard) |
| 12Vb | Power supply 12 Vac | Power supply for remote control panel (keyboard) |
| DI2 | DI2 digital input | Remote on/off input (closed = unit is ON / open= unit is OFF) |
| GNDR | Serial communication | Modbus ground reference terminal connection for remote supervision |
| R+ | Serial communication | Modbus + signal terminal connection for supervision |
| R- | Serial communication | Modbus - signal terminal connection for supervision |
| *DO5 | Under voltage output 230V ac, 50Hz, 5A resistive, 1A inductive. Should be connected to the relay coil in order to get a free contact. | Undervoltage output for alarm warning |
| N-3 | Neutral for single-phase power supply | |
| L3-3 | Phase voltage 230Vac | |
| PEA | Ground reference | |

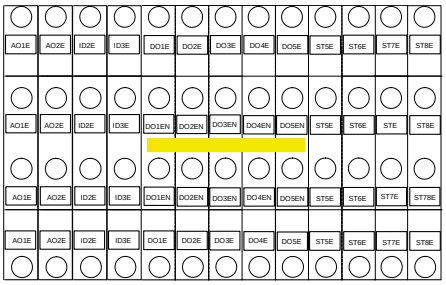
(*) Available for "**HWA1-A**" cooling only versions.

### 7.8 PM MODULE PHASES PROTECTION

The PM module detects the correct sequence of the 3-phases (L1, L2, and L3) power supply. The 3-phases power supply must be connected with the correct sequence of the phases so as to ensure the right direction of rotation at the compressor start-up and during operation. When the PM module acts for lack of phase, the controller will receive a signal to disconnect it from the power supply.

### 7.9 PLANT MANAGEMENT OPTIONAL MODUL "GI" TERMINAL BLOCK

Where the plant management kit (optional) is present, a second controller is located inside the electric panel, which acts as I/O ports expansion module. With this controller, it is possible to increase the number of logics that can be managed by the main controller; for the configuration of the functionalities, please check the control manual supplied with the unit.




| TERMINAL | TYPE | CONNECTION |
|---|---|---|
| **ST8E** | NTC sensor -10k Pat 25°C $t_{3435}$ | Plant water remote sensor |
| **ST7E** | NTC sensor -10k Pat 25°C $t_{3435}$ | Domestic water sensor |
| **ID3E** | Voltage free contact digital input | Change of operating mode |
| **DO5E(phase)**<br>DO5E N(neutral) | Under-voltage output 230Vac, 50Hz, 5A resistive, 1A inductive | Double set-point valve |

# 8 START UP

Before start-up:

- Check out the availability of the supplied wiring diagrams and manuals of the installed appliance.
- Check out the availability of the electrical and hydraulic diagrams of the plant in which the unit is installed.
- Check that the shut-off valves of the hydraulic circuits are open.
- Verify that the hydraulic circuit has been charged under pressure and air vented.
- Check out that all hydraulic connections are properly installed and all indications on unit labels are respected.
- Check if all power cables are properly connected and all terminals are tightly fixed.
- Check if the electrical connections are performed according to the norms in force including the grounding connection.
- Check if the voltage is that shown in the unit labels.
- Make sure the voltage is within the limits (±5%) of tolerance range.
- Check if the electric heaters of the compressors are powered correctly.
- Make sure that there is no refrigerant leak.
- Be sure that all the cover panels are installed in their proper positions and locked with fastening screws before start up.
- If the first start-up of the machine does not turn the display on of the controller, you must reverse the phase sequence of the power supply cable.

| | |
|---|---|
| | WARNING: The unit must be connected to the electric network and should be in STAND-BY mode (powered) closing the general switch in order to make operating the crankcase heaters of the compressor for a minimum of 12 hours before start up. (The electric heaters are automatically powered when the main switch is switched off). The crankcase heaters are working properly if, after some minutes, the temperature of crankcase's compressor is about 10°C ÷ 15°C higher than ambient temperature. |
| | WARNING: Never switch off the unit (for a temporary stop) by switching off the main switch: this component should |

| | |
|---|---|
| | be used to disconnect the unit from the power supply only for lengthy stoppages (e.g. seasonal stoppages). Besides, failing the power supply, the crankcase's heaters are not supplied thus resulting in a possible breakdown of the compressors once the unit is switched on. |
| | WARNING: Do not modify the internal wiring of the unit otherwise the warranty will terminate immediately.<br>WARNING: The summer/winter operating mode has to be selected at the beginning of the relevant season. Frequent and sudden changes of the seasonal operating mode have to be avoided in order to prevent severe damages to compressors. |
| | WARNING: When you first install and start-up the unit make sure that the unit is working properly in both cooling and heating modes. |

### 8.1 POWER-ON/OF THE UNIT

For powering ON the appliance, rotate the outer handle of the disconnector to the ON position (indicated with "I").
The display on the machine is turned on only if the phase sequence is correct (verification to be done during initial startup).
Between a shutdown and subsequent power on, wait a minimum time of 1 minute.

## 9 INDICATIONS FOR THE USER

It's important to take note of the identification data of the unit in order to provide them to the Technical Assistance Service in case of assistance request.

| | |
|---|---|
| | The identification plate fixed on the unit shows the technical specifications and the performance of the equipment. In case of manumission, removal or deterioration, please ask a duplicate to the Technical Assistance Service. |
| | The manumission, removal or damaging of the nameplate makes difficult any operation of installation, maintenance and spare parts request. |

It is recommended to keep track of assistance operations that are executed on the unit; this will make easy searching any troubleshooting.
In case breakdown or malfunction situations:

- x check the type of alarm to communicate it to the service center;
- x contact an authorized service center;
- x if required by the service center, turn off the unit immediately without resetting the alarm;
- x Ask the use of original spare parts.

## 10 SHUTDOWNS FOR LONG PERIODS

- Turn off the unit by placing the switch of each unit to "OFF" position.
- Close the water valves.
- Place the general differential circuit breaker to "OFF" position.

| | |
|---|---|
| | If the temperature drops below 0°C there is serious risk of frost: add a mixture of water and glycol in the plant, otherwise drain the hydraulic circuits of the plant and of the heat pump. |
| | WARNING: When the ambient temperature becomes lower than -20°C, if the unit equipped with water pump is turned off and disconnected from power supply even for short periods, in such case, it's necessary to discharge the plant circuit and the hydraulic circuit of the unit from the mixture of water and glycol. Otherwise, the circulator may be irreversibly damaged. |
| | WARNING: with water temperature below than +5°C, although the transient operation is not guaranteed regarding the limits set out in Paragraph 17.4. Before you turn the unit on after a long off period, make sure that the temperature of the mixture of water and glycol is higher than or at least equal to +5°C. |

## 11 PERIODICAL CONTROLS AND MAINTENANCE

| | |
|---|---|
| | WARNING: All the operations described in this chapter HAVE TO BE CARRIED OUT BY TRAINED STAFF ONLY. Before any operation or before entering the inner components of the unit, be sure that the power supply is disconnected. The compressor's heads and discharge pipes are usually at high temperature levels. Be very careful when operating in their surroundings. Aluminium coil fins are very sharp and can cause serious wounds. Be very careful when operating in their nearest. After maintenance operations, reinstall the cover panels, and fix them by means of screws. |
| | The refrigerant circuits must not be filled with different gas other than that indicated on the nameplate. The use of different refrigerant can cause severe damage to the compressor. |
| | It's forbidden to use oils other than those specified in this manual. The use of different oil can cause serious damage to the compressor. |
| | WARNING: MOVING PARTS, RISK OF DEATH.<br>Disconnect the power supply and ensure that the fan is stopped before opening the front panel. |
| | The temperatures of head and exhaust piping of the compressor are usually high.<br>Pay attention to the surfaces of the driver boards heat sinks |
| | Be careful when working near condensing coils.<br>The aluminum fins are very sharp and can cause serious injuries |

It is a good rule to carry out periodic checks in order to verify the proper operation of the unit:

**Recommended routine control periods.**

| OPERATION | 1 month | 4 month | 6 month | 12 month |
|---|---|---|---|---|
| Loading of the water circuit and checking the preload pressure. | x | | | |
| Presence of bubbles in the water circuit. | x | | | |
| Check if the safety and control devices work correctly. | x | | | |
| Check if there is oil leakage from compressor in the refrigerant circuit. | x | | | |
| Check if there is any water leakage from the hydraulic circuit. | x | | | |
| Check the proper working of the flow switches. | x | | | |
| Check that the crankcase electric heaters are properly supplied and functioning. | x | | | |
| Clean the metallic filters of the hydraulic circuit. | x | | | |
| Clean the finned coil by means of compressed air or water jet. | | x | | |
| Check if all the terminals on the electric board as well as on the terminals of the compressor are properly fixed. | | x | | |
| Check the tightening of hydraulic connections. | | x | | |
| Check the tightening and the balancing of the fan blades. | | x | | |
| If the voltage is correct. | | | x | |
| Check the correct electric absorption. | | | x | |
| Check the refrigerant charge and any leaks. | | | x | |
| Check the operating pressure, and superheat and sub-cooling. | | | x | |
| Check of the efficiency of circulation pump. | | | x | |
| Check for corrosion | | | | x |
| Check panel fastening | | | | x |
| Check the water quality (see chapter plant's water characteristics) and the eventually glycol concentration. | | | x | |
| Check the head loss of eventually dehydrator filters on liquid line. | | | x | |
| Check the safety valve on the hydronic side. | | | x | |

ATTENTION: the unit is fitted with safety valves that limit the overpressure of the refrigerant circuit. These devic require specific inspection frequency, in order to check that they are intact and work properly. Each country in the European Union has established the inspection frequency; in Italy, for example, Decree no. 329 of 2004 set th following frequency:

- every 4 years operating check
- every 10 years integrity check.

It is recommended to check the inspection frequency set out by the relevant legislation if the unit is not installed in Italy.

### 11.1 ENVIRONMENTAL PROTECTION

According to the norms dealing with the use of depleting stratospheric ozone substances, it is forbidden to disperse refrigerants fluids in the atmosphere. They have to be collected and delivered to the seller or to proper gathering points at the end of their operating life. Refrigerant R410A is mentioned among controlled substances and for this reason it has to be subjected to the mentioned norms. **A particular care is recommended during service operations in order to reduce as much as possible any refrigerant loss.**

## 12 DISPOSAL PROCEDURE

Once the unit is arrived at the end of its life cycle and needs to be removed or replaced, the following operations are recommended:

- The refrigerant has to be recovered by trained people and sent to proper collecting centre;
- Compressors' lubricating oil has to be collected and sent to proper collecting centre;
- the frame and the various components, if not serviceable any longer, have to be dismantled and divided according to their nature, particularly copper and aluminium, which are present in conspicuous quantity in the unit. These operations allow easy material recover and recycling process, thus reducing the environmental impact.

The user is responsible of the proper disposal of this product, according to national regulations in the country of destination of the appliance. For more information you should contact the installation company or local competent authority.

An incorrect decommissioning of the appliance may create serious environmental damage and endanger people' safety. Therefore, it's recommended that the unit shall be disposed only by authorized persons and technical trainin that have followed training courses recognized by the competent authorities.

It is required to follow the same precautions described in the previous paragraphs.

Pay special attention during the disposal operation of the refrigerant gas.

The illegal disposal of the product by the end user leads to the application of the penalties in accordance with the law in the country where the disposal takes place.

The crossed bin symbol applied on the appliance indicates that the product, at the end of its useful life, must be collected separately from other wastes

# 13 TECHNICAL DATA

## 13.1 COOLING ONLY VERSION "HWA1-A"

| TECHNICAL CHARACTERISTICS | | Unit | Model HWA1-A | | | | |
|---|---|---|---|---|---|---|---|
| | | | 0140 | 0147 | 0260 | 0273 | 0285 |
| Cooling | Cooling capacity (1) | kW | 39,7 | 46,8 | 60,8 | 73,3 | 86,5 |
| | Power input (1) | kW | 12,5 | 15,1 | 19,3 | 24,8 | 29,3 |
| | EER (1) | W/W | 3,16 | 3,11 | 3,16 | 2,95 | 2,96 |
| | Cooling capacity (2) | kW | 54,4 | 63,5 | 81,9 | 99,4 | 116,3 |
| | Power input (2) | kW | 14,3 | 17,0 | 21,9 | 28,0 | 33,3 |
| | EER (2) | W/W | 3,80 | 3,74 | 3,75 | 3,55 | 3,50 |
| | SEER (5) | W/W | 3,80 | 3,80 | 4,05 | 3,98 | 4,14 |
| | Cooling capacity (8) | kW | 22,7 | 27,0 | 36,2 | 42,9 | 51,1 |
| | Total power input (8) | kW | 11,4 | 13,5 | 16,9 | 22,1 | 25,7 |
| | EER (8) | W/W | 1,99 | 2,01 | 2,14 | 1,94 | 1,99 |
| | Water flow (1) | l/s | 1,90 | 2,24 | 2,91 | 3,51 | 4,14 |
| | User side heat exchanger load losses (1) | kPa | 54,08 | 51,68 | 56,79 | 46,43 | 50,41 |
| Compressor | Type | | Scroll | | | | |
| | Number | | 1 | | 2 | | |
| | Capacity steps Std | | 1 | 1 | 2 | 3 | 3 |
| | Refrigerant circuits | | 1 | | | | |
| | Oil (type, quantity) | $dm^3$ | BVC32 / 2,7 | | BVC32 / 5,4 | | |
| Refrigerant | Type | | R410A | | | | |
| | Refrigerant quantity (4) | kg | 7,8 | 7,8 | 12,8 | 13,4 | 14,6 |
| | Tonnellate di $CO_2$ equivalente (4) | ton | 16,3 | 16,3 | 26,7 | 28 | 30,5 |
| | Quantità refrigerante mod. BT (4) | kg | 8,5 | 8,5 | 12,8 | 13,4 | 14,6 |
| | Tonnellate di $CO_2$ equivalente mod. BT (4) | ton | 17,8 | 17,8 | 26,7 | 28 | 30,5 |
| | Design pressure (high/low) | MPa | 4,2/2,7 | | | | |
| External zone fan motors | Type | | AXIAL | | | | |
| | Number | | 1 | | | | |
| | Maximum power | kW | 1,90 | 1,90 | 1,90 | 1,85 | 3,2 |
| | Current input (max) | A | 3,9 | 3,9 | 3,9 | 3,8 | 4,65 |
| | Nominal air flow rate | $m^3/s$ | 4,04 / 5,32 | 3,88 / 5,23 | 4,15 / 5,44 | 4,86 / 6,01 | 7,4 |
| | Pd available for ducted version | Pa | 50 | 50 | 39 | 40 | 39 |
| Internal heat exchanger | Type of internal heat exchanger | | Plate heat exchanger | | | | |
| | N° internal heat exchangers | | 1 | 1 | 1 | 1 | 1 |
| | Water volume content | l | 2,03 | 2,46 | 3,21 | 4,64 | 5,25 |
| Hydraulic circuit | Maximum pressure of hydronic kit | bar | 6 | | | | |
| | Hydraulic connections | Inch | 2" | | | | |
| | Minimum water volume of plant (5) | L | 330 | 380 | 260 | 380 | 490 |
| Noise level | Sound power (6) | dB(A) | 81 | 81 | 82 | 83 | 84 |
| | Sound pressure (7) | dB(A) | 49,3 | 49,3 | 50,3 | 51,3 | 52,3 |
| Electrical data (version without accessories) | Power supply | | 400V/3P+N+T/50Hz | | | | |
| | Max. input power | kW | 17,4 | 19,8 | 26,5 | 32,5 | N.D. |
| | Max input current | A | 29,6 | 34,1 | 46,5 | 55,3 | N.D. |
| | Max starting current | A | 156 | 183 | 155,3 | 204,3 | N.D. |
| Electrical data with EC fan (version without accessories) | Power supply | | 400V/3P+N+T/50Hz | | | | |
| | Max. input power | kW | 17,45 | 19,85 | 26,55 | 33,4 | 39,5 |
| | Max input current | A | 29 | 33,5 | 45,9 | 56,5 | 66,2 |
| | Max starting current | A | 148,3 | 175,3 | 147,6 | 198,3 | 237,3 |
| Dimensions and weight | Dimensions (L×H×W) | mm | 1170x2040x1125 | | 1170x2070x1125 | | |
| | Max. Packing dimensions (L×H×W) | mm | 1200x2180x1150 | | 1200x2200x1150 | | |
| | Shipment weight | kg | 365 | 375 | 470 | 495 | 510 |
| | Operation weight | kg | 350 | 360 | 455 | 480 | 495 |

**Operating conditions:**

(1) Cooling: Outdoor air temperature 35°C; inlet/outlet water temperature 12/7°C.

(2) Cooling: Outdoor air temperature 35°C; inlet/outlet water temperature 23/18°C.

(3) Water temperature reference of internal heat exchanger = 12/7°C.

(4) The data are only indicative and subject to change. For the correct data, refer to the technical label sticked on the unit.

(5) The calculated value of minimum water volume at the plant does take into account the water volume contained in the internal heat exchanger (evaporator). With low outdoor air temperature applications or low average loads required, the minimum water volume to plant is obtained by doubling the indicated value.

(6) Condition (3); value determined based on the measurements taken in accordance with the UNI EN ISO 9614-2, in compliance with the requirements of Eurovent certification.

(7) Calculated value from the sound power level in accordance with ISO 3744: 2010, referred to 10 m away from the unit.

(8) Cooling (BT version cooling): outdoor air temperature 35°C, internal heat exchanger water temperature = -3/-8°C. Fluid treated using (35%) ethylene-glycol.

**N.B. The performance data are indicative and could be subject to change. In addition, the performances declared in apex (1), (2), (8) referring to the instantaneous power according to EN 14511. The declared data stated in the apex (3) are determined according to the UNI EN 14825.**

## 13.2 HEAT PUMP VERSION "HWA1-H"

| TECHNICAL CHARACTERISTICS | | Unit | Model HWA1-H | | | | |
|---|---|---|---|---|---|---|---|
| | | | 0140 | 0147 | 0260 | 0273 | 0285 |
| Cooling | Cooling capacity (1) | kW | 38,6 | 45,6 | 58,6 | 71,2 | 80,2 |
| | Power input (1) | kW | 13,0 | 15,7 | 19,9 | 24,6 | 29,2 |
| | EER (1) | W/W | 2,97 | 2,91 | 2,94 | 2,90 | 2,75 |
| | Cooling capacity (2) | kW | 51,8 | 60,6 | 77,7 | 94,1 | 106,4 |
| | Power input (2) | kW | 14,7 | 17,6 | 22,6 | 28,0 | 33,3 |
| | EER. (2) | W/W | 3,53 | 3,43 | 3,43 | 3,37 | 3,20 |
| | SEER (5) | W/W | 3,82 | 3,8 | 3,94 | 3,98 | 4,07 |
| | Water flow (1) | l/s | 1,86 | 2,20 | 2,83 | 3,41 | 3,84 |
| | User side heat exchanger load losses (1) | kPa | 55,8 | 56,6 | 61,5 | 63,7 | 66,6 |
| Heating | Heating capacity (3) | kW | 43,5 | 48,2 | 64,1 | 80,9 | 88,7 |
| | Power input (3) | kW | 10,7 | 12,3 | 15,6 | 20,0 | 22,7 |
| | COP (3) | W/W | 4,05 | 3,92 | 4,10 | 4,05 | 3,90 |
| | Heating capacity (4) | kW | 42,1 | 47,8 | 63,0 | 74,9 | 84,6 |
| | Power input (4) | kW | 12,8 | 14,8 | 18,8 | 23,3 | 28,5 |
| | COP (4) | W/W | 3,28 | 3,23 | 3,35 | 3,22 | 2,97 |
| | SCOP (6) | W/W | 3,49 | 3,34 | 3,85 | 3,84 | 3,70 |
| | Water flow (4) | l/s | 2,02 | 2,30 | 3,03 | 3,60 | 4,07 |
| | Use-side heat exchanger pressure drops (4) | kPa | 84,4 | 81,6 | 84,1 | 81,5 | 84,1 |
| | Water energy efficiency 35°C | classe | A+ | A+ | A++ | A++ | A+ |
| Compressor | Type | | Scroll | | | | |
| | Number | | 1 | | 2 | | |
| | Capacity steps Std | | 1 | 1 | 2 | 3 | 3 |
| | Refrigerant circuits | | 1 | | | | |
| | Oil (type, quantity) | $dm^3$ | BVC32 / 2,7 | | BVC32 / 5,4 | | |
| Refrigerant | Type | | R 410 A | | | | |
| | Refrigerant quantity (9) | kg | 9,98 | 9,98 | 14 | 15,25 | 15,6 |
| | Quantity of $CO_2$ equivalent (9) | ton | 20,8 | 20,8 | 29,2 | 31,8 | 32,6 |
| | Design pressure (high/low) | MPa | 4,2/2,7 | | | | |
| External zone EC fan motors | Type | | Axial | | | | |
| | Number | | 1 | | | | |
| | Nominal power input (1) | kW | 1,36 | 1,66 | 1,76 | 1,89 | 2,12 |
| | Max. power | kW | 1,95 | 1,95 | 1,95 | 3,20 | 3,20 |
| | Maxi. current input | A | 3,30 | 3,30 | 3,30 | 5,00 | 5,00 |
| | Nominal air flow rate | $m^3/s$ | 4,3 | 5,3 | 6,3 | 6,9 | 7,4 |
| | $\Delta p$ available for ducted version | Pa | 41 | 44 | 35 | 33 | 35 |
| Internal heat exchanger | Type of internal heat exchanger | | Plate heat exchanger | | | | |
| | Number of internal heat exchanger | | 1 | 1 | 1 | 1 | 1 |
| | Water content | l | 2,03 | 2,46 | 3,21 | 4,64 | 5,25 |
| Hydraulic circuit | Maximum pressure of hydronic kit (relief valve calibration) | | 6 | | | | |
| | Hydraulic connections | Inch | 2" | | | | |
| | Minimum water volume of plant (8) | L | 330 | 380 | 260 | 380 | 490 |
| Noise level | Sound power (9) | dB(A) | 84 | 85 | 88 | 88 | 88 |
| | Sound pressure (10) | dB(A) | 52,3 | 53,3 | 56,3 | 56,3 | 56,3 |
| Electrical data (version without accessories) | Power supply | | 400V/3P+N+T/50Hz | | | | |
| | Max. input power | kW | 17,4 | 19,8 | 26,5 | N.D | N.D |
| | Max. current input | A | 29,6 | 34,1 | 46,5 | N.D | N.D |
| | Max starting current | A | 156 | 183 | 155,3 | N.D | N.D |
| Electrical data with EC fan (version without accessories) | Power supply | | 400V/3P+N+T/50Hz | | | | |
| | Max. input power | kW | 17,45 | 19,85 | 26,55 | 33,4 | 39,5 |
| | Max input current | A | 29 | 33,5 | 45,9 | 56,5 | 66,2 |
| | Max starting current | A | 148,3 | 175,3 | 147,6 | 198,3 | 237,3 |
| Dimensions and weight | Dimensions (L×H×W) | mm | 1170x2040x1125 | | 1170x2070x1125 | | |
| | Max. Packing dimensions (L×H×W) | mm | 1200x2180x1150 | | 1200x2200x1150 | | |
| | Shipping weight | kg | 400 | 420 | 520 | 545 | 555 |
| | Operating weight | kg | 390 | 410 | 505 | 530 | 540 |

**Operating conditions:**

(1) Cooling: Outdoor air temperature 35°C; inlet/outlet water temperature 12/7°C.
(2) Cooling: Outdoor air temperature 35°C; inlet/outlet water temperature 23/18°C.
(3) Heating: Outdoor air temperature 7°C DB 6°C WB; inlet/outlet water temperature 30/35°C.
(4) Heating: Outdoor air temperature 7°C DB 6°C WB.; inlet/outlet water temperature 40/45°C.
(5) Cooling: Inlet/Outlet water temperature 12/7°C.
(6) Heating: Normal climatic condition; Tbiv=-7°C; inlet/outlet water temperature 30/35°C.
(7) The data are only indicative and subject to change. For the correct data, refer to the technical label sticked on the unit
(8) The calculated value of minimum water volume at the plant does take into account the water volume contained in the internal heat exchanger (evaporator). With low outdoor air temperature applications or low average loads required, the minimum water volume to plant is obtained by doubling the indicated value.
(9) Condition (3); value determined based on the measurements taken in accordance with the UNI EN ISO 9614-2, in compliance with the requirements of Eurovent certification.
(10) Value is calculated in accordance with the UNI EN ISO 9614-2, referred to 10 m away from the unit.

**N.B. The performance data are indicative and could be subject to change. In addition, the performances declared in apex (1), (2), (3) and (4) refer to the instantaneous power according to EN 14511. The declared data stated in the apex (5) and (6) is determined according to the UNI EN 14825.**

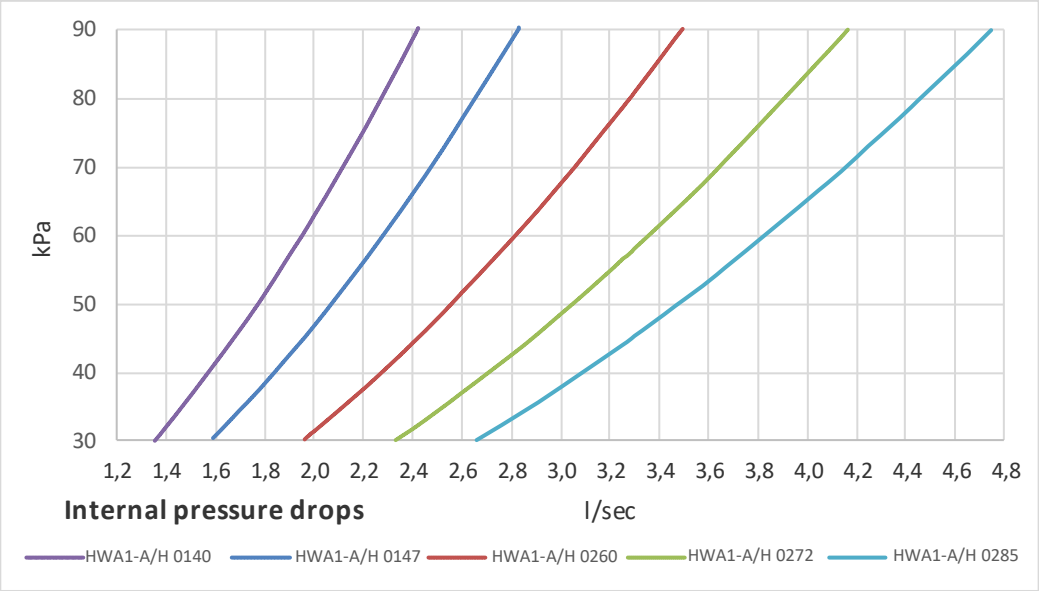
### 13.3 ELECTRIC DATA OF THE UNIT AND AUXILIARY ELEMENTS

| | | | | | |
|---|---|---|---|---|---|
| **Power supply of the unit** | V/~/Hz | 400/3/50 | **Remote control circuit** | V/~/Hz | 12/1/50 |
| **Control board circuit** | V/~/Hz | 12/1/50 | **Fans power supply** | V/~/Hz | 400/3/50 |

**Note: Electric data may change for updating. It is therefore necessary to refer always to the technical data label sticked on right-side panel of the unit.**

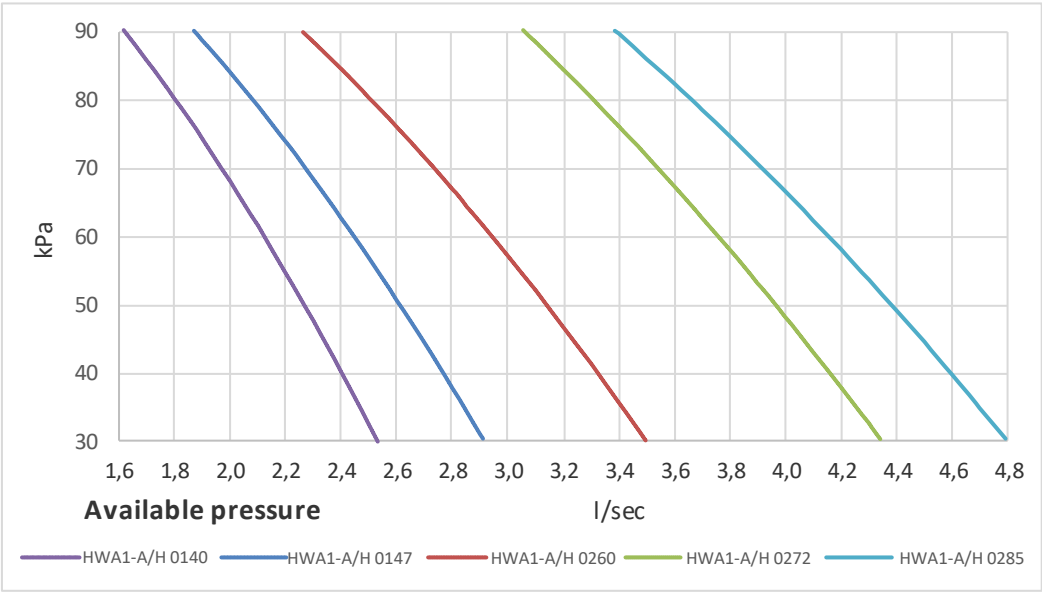
## 14 HEAD LOSS CURVES OF THE HYDRONIC CIRCUIT

The result of the addition of the head losses of the hydronic circuit and the available head pressure of the plant gives us the minimum head of the circulator pump which should be installed.




## 15 HEAT PUMPS AVAILABLE HEAD PRESSURE WITH INTEGRATED PUMP

We report here the characteristic curves of the Head pressure-Water flow without consideration of head losses of the hydronic kit at the maximum speed of the circulating pump.
The circuit's plant must be designed so as to ensure the nominal water flow rate which corresponds to the operating points given in the "TECHNICAL DATA" table and should never be lower than the values given in paragraph 18 table of "Required minimum and recommended maximum water flow rates".




## 16 ACCESSORIES FOR NOISE LEVEL REDUCTION

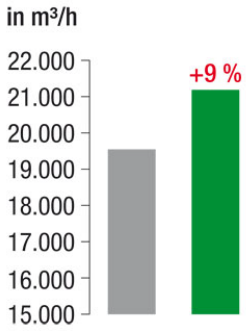
### 16.1 SL

The silenced unit (with SL accessory) is provided with innovating thermo-acoustic shells on compressors. This insulation allows a noise reduction up to 2dB(A). The special multi-layer structure allwos a thermal insulation which reduces the heat losses up to 6% at very low outside temperatures.

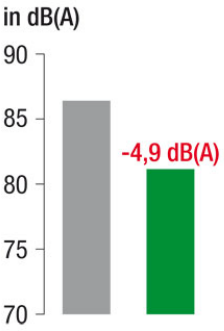
### 16.2 SSL

The super silenced unit (with SSL accessory) is provided not only with the thermo-acoustic insulator on compressors but also with a special diffuser installed on the fan. The diffuser structure improves the air flow efficiency and allows a fan speed reduction, lowering the acoustic pressure by up to 4,9dB(A) and energy consumption by up to 27% with unchanged airflow. That could lead to a saving up of a lot of money in energy costs per fan per year. Alternatively, you can get the greater efficiency to boost air performance by up to 9% at energy consumption parity.

AxiTop Diffuser




Maximum air flow rate at constant energy consumption




Reduced noise at a constant air volume

## 17 OPERATING LIMITS

### 17.1 EVAPORATOR WATER FLOW RATE

The nominal water flow rate is referred to P=5°C, between the evaporator's inlet and outlet temperatures with nominal capacity at 7°C of the produced water. The allowed maximum flow rate is } Œ Œ • ‰ } v ] v P. Higher values may produce too high pressure drops. The allowed minimum water flow Œ š ] • } Œ Œ • ‰ } v ] v P š } P d Ao ô ô v produce too low evaporating temperatures according to the operating status with the intervention of safety devices which would stop the unit and, in some particular cases, the water can freeze in the evaporator coil which can breakdown the refrigeration circuit or causes the increasing of the condensing pressure with the shutdown risk of the appliance and the compressor could be damaged.
We enclosed below a most accurate table showing the minimum water flow that should be ensured for the plate heat exchanger in order to have the proper operation of unit as a function of the model (**note:** the water flow switch is used for preventing the freezing sensor from failure in the case of insufficient water flow but it does not ensure the minimum flow rate required in order the unit can work properly).

| Models | HWA1-A/HWA1-H | | | | |
|---|---|---|---|---|---|
| | 0140 | 0147 | 0260 | 0273 | 0285 |
| Output capacity of reference [kW] | 40 | 47 | 60 | 73 | 85 |
| The required minimum water flow rate [lt/s] | 1,21 | 1,42 | 1,82 | 2,22 | 2,58 |
| Recommended max water flow rate [lt/s] | 2,35 | 2,76 | 3,57 | 4,33 | 5,06 |

As a first approach, and in the absence of other detection systems, the proper flow rate for getting the best performance from your unit can be found at maximum speed of the circulator, using the pressure gauges for controlling the pressure difference between the return and the delivery water on the outside water connections of the unit and make sure that such value is equal or less than the static pressure indicated on the curves shown in paragraph 14 for the respective models and if it's necessary change the settings (for the related circulator) that are reported in the control manual.

### 17.2 CHILLED WATER PRODUCTION (SUMMER OPERATION)

The minimum temperature that is allowed at the evaporator's outlet is 5°C: for lowest temperatures the unit should undergo some necessaries structural modifications and different setting parameters of the micro-processor control. In this case please contact our company for the feasibility study and evaluation of changes to be made according to your needs. The maximum temperature that can be maintained at the outlet of the evaporator is 25°C. Higher temperatures (up to a maximum of 40°C) can anyway be tolerated during transitions and in the start-up stages of the system.

### 17.3 HOT WATER PRODUCTION (WINTER OPERATION)

Once the system is working at the right temperature, the inlet hot water temperature should not be lower than 25°C; the lowest values which are not related to transitional or start-up stages may cause system's failure with possible damages to compressor. The maximum outlet water temperature should not exceed 55°C. At this temperature, the power consumption and performance in terms of C.O.P. are enhanced if the outdoor air temperature is higher than 5°C, even if the unit is still able to work up to the limit of -10°C with hot water production at 50°C.
For higher temperatures than those pointed out, especially if have a concomitant with the reduction of the water flow rate, it may cause abnormalities to the normal operation of the unit, or the safety devices may act in critical situations.

The maximum power consumption will occur during the operation of the unit in chiller mode with outlet water temperature of 25°C and outdoor air temperature of 46°C.

### 17.4 AMBIENT TEMPERATURE OPERATING LIMITS AND RECAPITULATIVE TABLE

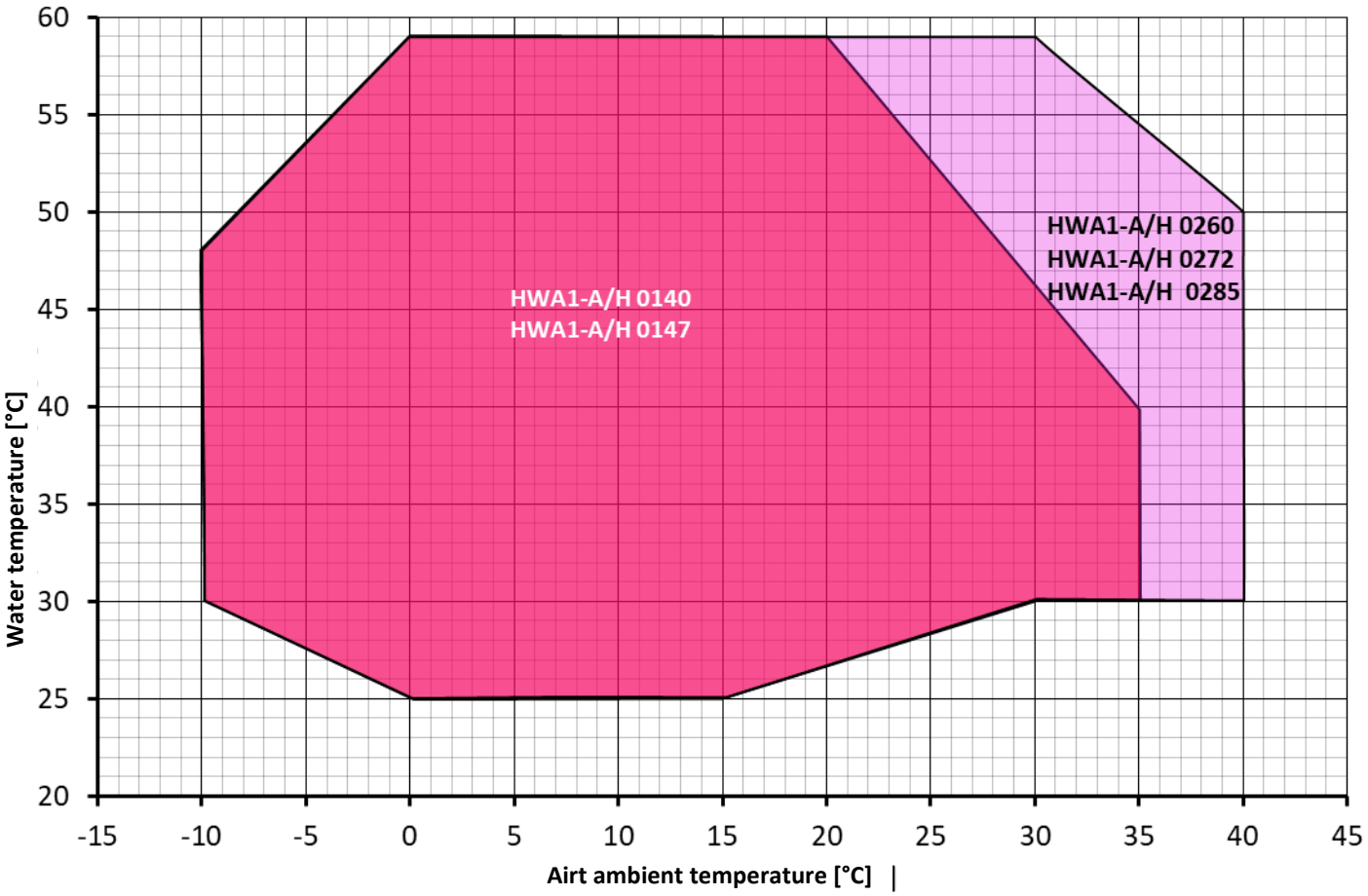
The units are designed and manufactured to operate in summer mode regime, with the condensate control and with outdoor air temperatures included between -10°C and 46°C. In heating mode, the allowed range of the outdoor temperature goes from -15°C to +40°C as a function of the water outlet temperature as indicated in the below table.

| Operation limits | Min. | Max. |
|---|---|---|
| **Water chiller mode** | | |
| Ambient temperature | +10°C (-15°C*) | +46°C |
| Water outlet temperature | +5°C | +25°C |
| **Heat pump mode and domestic hot water** | | |
| Ambient temperature with domestic hot water at 50°C max. | -10°C | 30°C (40°C**) |
| Ambient temperature with domestic hot water at 55°C max. | -7°C | +25°C (35°C**) |
| Water outlet temperature | +25°C(30°C***) | +55°C |

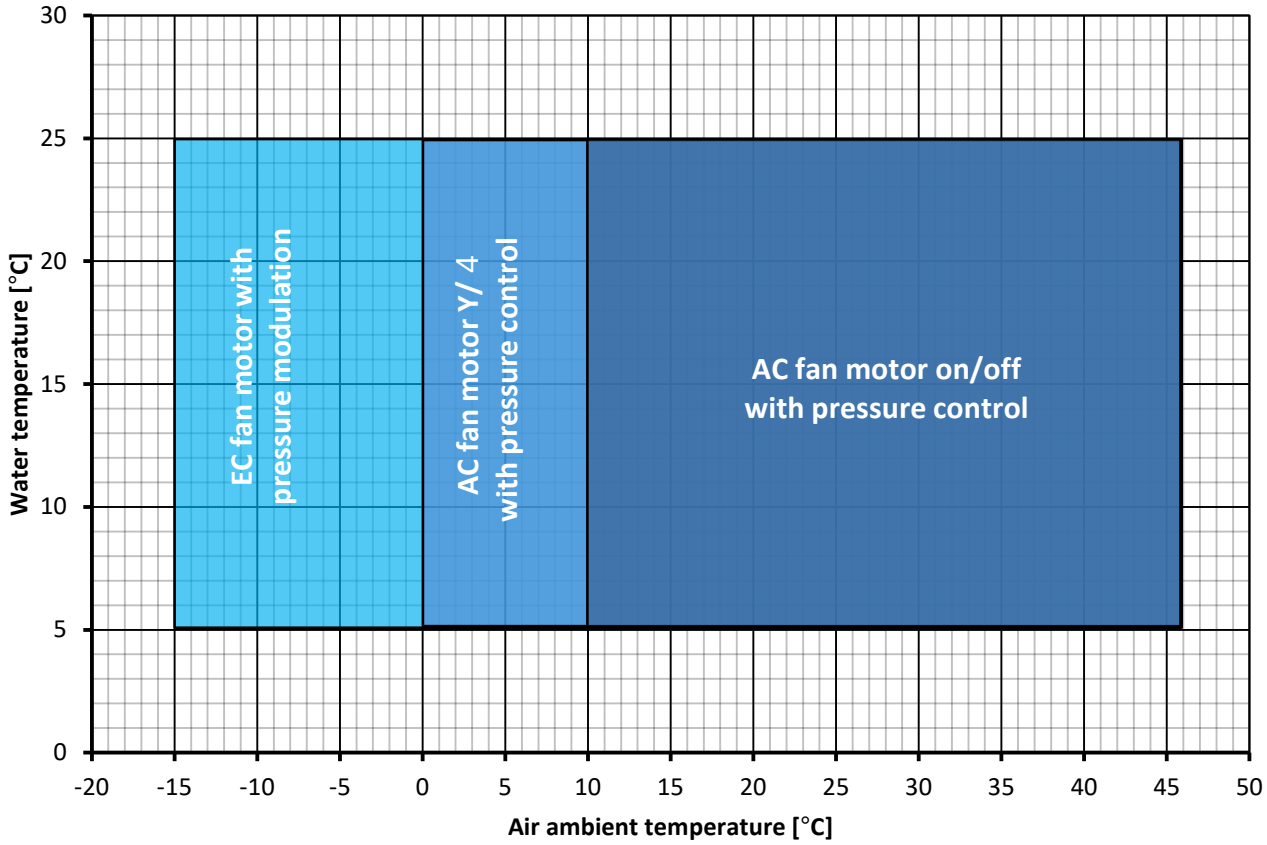
x * 0°C with fan motor of Y- 4connection, -15°C with modulating fan motor.
x ** +40°C/+35°C, max air temperature for domestic hot water production at 50°C/55°C **only for bi-compressor units**.
x *** +30°C, minimum water temperature for air temp. >30°C.

### 17.5 OPERATION'S BOUNDARIES

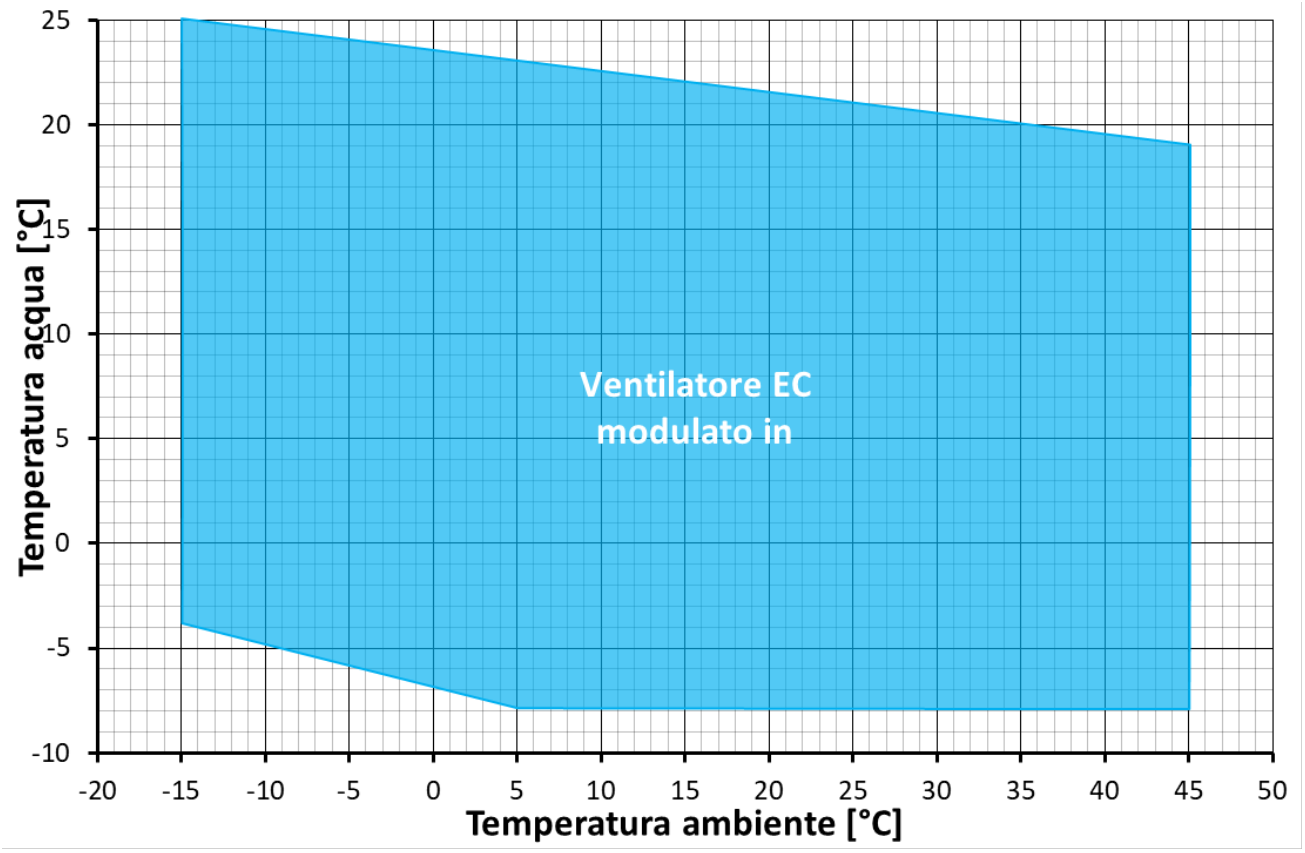
**Operation's boundaries for heat pump mode**



**Chiller mode**




**For the units of BT version**



# 18 CORRECTION FACTORS WITH THE USE OF GLYCOL

The water flow rate and pressure drop correction factors should be applied directly to the values given for operation without glycol. The water flow rate correction factor is calculated in order to get the same temperature's difference that would be obtained without glycol. The pressure drops' correction factor takes into account the different water flow rate obtained from the application of the water flow rate correction factor.

**CCF: Capacity correction factor**
**IPCF: Power input correction factor**
**WFCF: Water flow rate correction factor**
**PDCF: Pressure drops correction factor.**

### 18.1 CORRECTION FACTOR FOR STANDARD UNITS

| Glycol rate | Freezing point (°C) | CCF | IPCF | WFCF | PDCF |
|---|---|---|---|---|---|
| 10% | -3,2 | 0,985 | 1 | 1,02 | 1,08 |
| 20% | -7,8 | 0,98 | 0,99 | 1,05 | 1,12 |
| 30% | -14,1 | 0,97 | 0,98 | 1,10 | 1,22 |
| 40% | -22,3 | 0,965 | 0,97 | 1,14 | 1,25 |
| 50% | -33,8 | 0,955 | 0,965 | 1,2 | 1,33 |

### 18.2 CORRECTION FACTOR FOR "BT" UNITS

| ETHYLENE GLYCOL | | | | | |
|---|---|---|---|---|---|
| Percent concentration of glycol | 0% | 10% | 20% | 30% | 40% |
| Minimum temperature of produced water (°C) | 5°C | 2°C | -5°C | -10°C | -15°C |
| Mixture freezing temperature (°C) | 0°C | -4°C | -14°C | -18°C | -24°C |
| Capacity output correction factor 1,000 **CCF** | 1,000 | 0,998 | 0,989 | 0,981 | 0,970 |
| Input power correction factor **IPCF** | 1,000 | 1,000 | 0,995 | 0,990 | 0,985 |
| Water flow correction factor **WFCF** | 1,000 | 1,047 | 1,094 | 1,140 | 1,199 |
| Pressure drops correction factor **PDCF** | 1,000 | 1,157 | 1,352 | 1,565 | 1,776 |

| PROPYLENE GLYCOL | | | | | |
|---|---|---|---|---|---|
| Percent concentration of glycol | 0% | 10% | 20% | 30% | 40% |
| Minimum temperature of produced water (°C) | 5°C | 2°C | -5°C | -10°C | -15°C |
| Mixture freezing temperature (°C) | 0°C | -4°C | -14°C | -18°C | -24°C |
| Capacity output correction factor 1,000 **CCF** | 1,000 | 0,991 | 0,981 | 0,968 | 0,951 |
| Input power correction factor **IPCF** | 1,000 | 0,995 | 0,988 | 0,978 | 0,963 |
| Water flow correction factor **WFCF** | 1,000 | 1,022 | 1,043 | 1,070 | 1,098 |
| Pressure drops correction factor **PDCF** | 1,000 | 1,111 | 1,307 | 1,532 | 1,748 |

# 19 CONTROL LOGICS

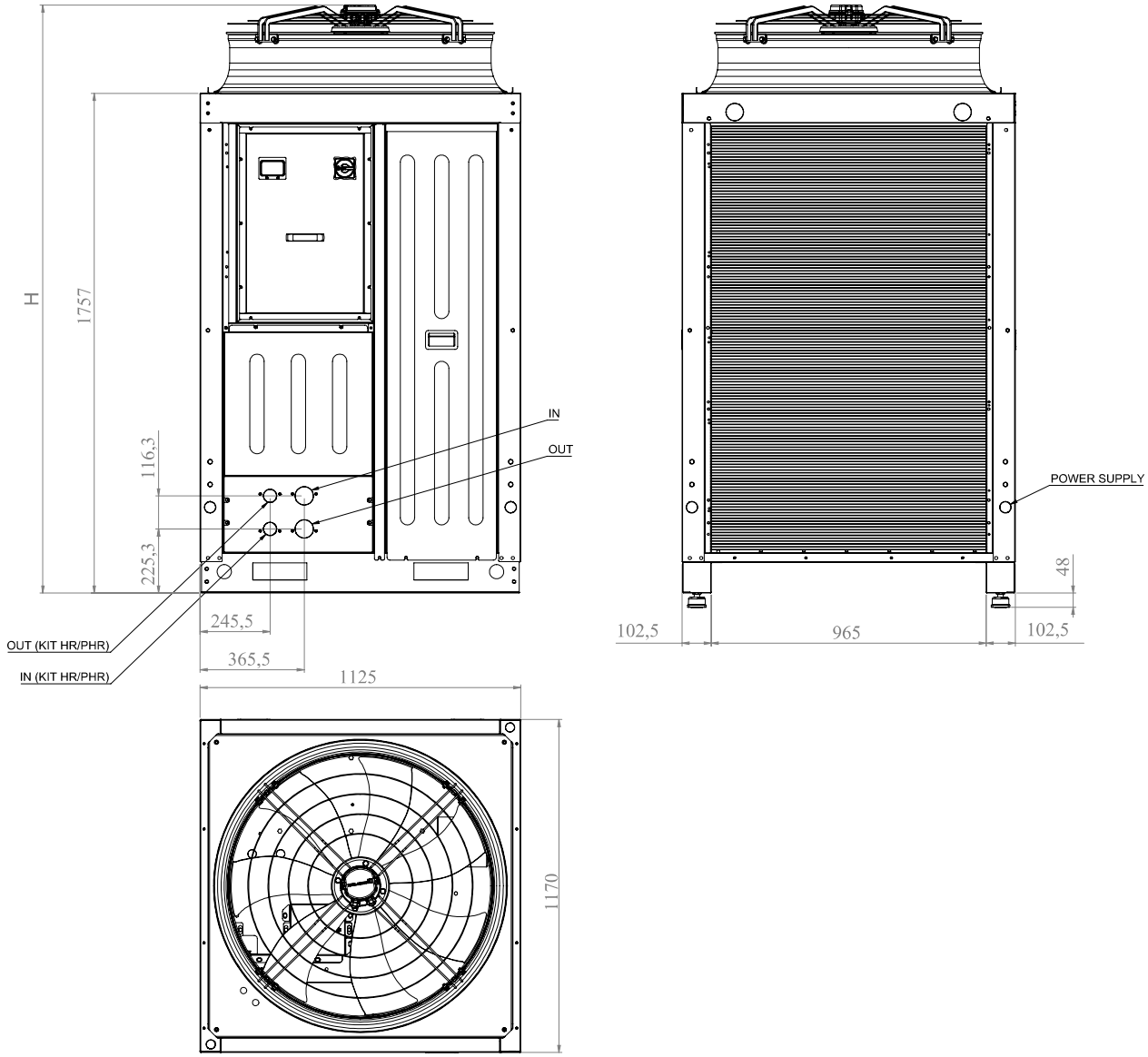
For the control logics see the supplied control manual of the unit.

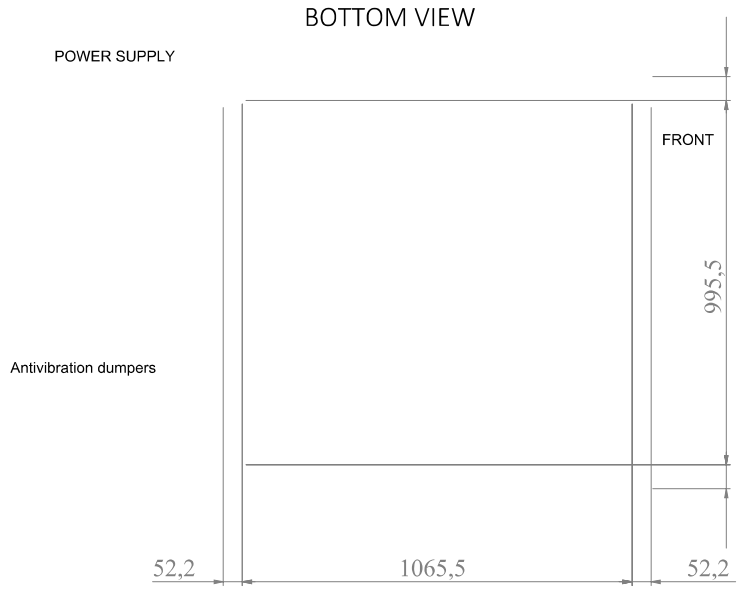
# 20 HANDBOOK FOR SOME CONFIGURATIONS OF INSTALLATION

For more information about some possible configurations, contact our office and ask for the handbook which collects a series of recommended drawings of plants that have been highlighted regarding the installation configuration of our high efficiency heat pumps. The "Handbook" shows also the symbiotic potential with some of our products in the catalogue.

# 21 DIMENSIONS

## 21.1 COOLING-ONLY AND HEAT PUMP VERSIONS




## 21.2 POSITION OF THE ANTIVIBRATION DUMPERS