

# AURA HCS Heat pumps

Air-cooled heat pumps  
R410A

Installation and operating instruction



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## 1. INTRODUCTION

This manual is intended for qualified operators and contains information on standard functions and operation of units of the HCS product line, it is not intended for unprofessional personnel. Detailed information for controlling the cooling system is given in the **Manual of the ACS control system**.

With the device is supplied this operating instruction and the following documents.: ACS system manual, Technical passport, Wiring diagram, dimensional drawing, device nameplate and, if applicable, operation test protocols. In the case of different information, the supreme documents in terms of technical specifications are documents with marked serial number of the device (e.g. dimensional drawing with attachment points for transport).

Before installing and commissioning the device, it is essential to read the information in this manual. Improper installation can cause very serious injuries - electric hazards, refrigerant leakage, fire, etc. or cause damage to equipment and property.

Installation work, commissioning and regular maintenance of the cooling equipment must be carried out by qualified and trained personnel. All operations must be performed in full compliance with local laws and regulations.

If you have any questions about the documentation, contact an authorized partner or FLOWAIR service organization.

### Meaning of symbols

The following types of informational alerts are used in this document:

(Other symbols of specific safety instructions are explained below)

INFORMATION
Notice of important technical information

! NOTICE !
Warning of important safety information

!!! SAFETY WARNINGS!!!
Strong warning of potential danger

### 1.1. General equipment specification

The air-cooled chiller or condensing unit (CU version) is intended for cooling water (possible glycol mixtures) or, in the case of the CU version, for cooling the evaporator in air-conditioning units. The operating parameters are defined when ordering the device and subsequently confirmed in the Technological Parameters Card (TPC) of the device.

The function of the cooling equipment is based on the heat transfer of condensation and evaporation in the cooling circuit, which is divided into a high-pressure and a low-pressure part. The main functional parts of the device are:

- Scroll type compressor, which increases the pressure of the evaporated refrigerant to the condensing pressure;
- Condenser cooled by forced air flow, in which high-pressure steam condenses and thus transfers latent heat to the surrounding air. Axial fans, fully integrated in the condenser housing, are used to ensure air flow;
- Expansion valve that reduces the pressure of condensate flowing from the condenser from the condensing pressure back to the evaporating pressure;
- Evaporator in which the liquid refrigerant evaporates at low pressure and cools the water (possibly air - CU version - condensing unit).

All cooling units are completely assembled in the factory and tested before shipment - cooling units are filled by refrigerant and tested operationally, condensing units or coolers with a separate evaporator are tested with computer simulation.

### 1.2. AURA HCS model line

Water cooled units can be made with possibilities free-cooling, recuperation, reversible heat pumps or condensing units that allow a wide range of applications

## Use of HCS units

HCS cooling equipment is designed primarily for powering air conditioning systems in commercial and industrial buildings, as well as for cooling in industrial applications. The units are a source of cooling or heating medium for secondary systems.

## Basic description of the standard execution

(A detailed technical description of selected technological parts can be found later in the text of this manual.)

### *Operating limits*

Standard design - cooling works at full load up to 0°C, with fan speed control (EC fans) and low-temperature design up to -20°C. In the summer season, the unit operates up to 45°C. Extreme temperature protection is monitored by the ACS limiting function. The setting of the required water temperature depends on the type of liquid used, the minimum required value for water is 4°C (for further details see the ACS technical documentation).

The heating mode is effective down to -15°C and the water temperature is controlled by a function with restriction at very low temperatures. The maximum set value for hot water heating is 55°C.

### *Condensing unit control*

The CU version is externally controlled by digital or analog signals to the main controller of the unit. One or two levels of digital control are available, depending on the number of compressors or analog control (0-10 V input) with predefined switching levels (see ACS technical documentation for more details).

### *External control*

Each unit can be controlled by an external on / off signal to the master controller and also sends an alarm signal to the superior control system.

### *Control System*

Sophisticated control system ensures data collection and subsequent control in real time, so as to ensure maximum operational efficiency with respect to energy savings and life of technological components of the unit. The main functions of the application are performed:

- Cooling / heating power control based on measured parameters, dynamically adjusting unit power to maximize energy efficiency.
- Limitation of cooling / heating capacity in situations leading to operation at the limit of the technological possibilities of the unit.
- Three-level alarm system protects against damage caused by operation beyond the technological capabilities of the device.

### *Switchboard MaR*

Control panel, components and cabling manufactured in accordance with EN 60204-1. One mains connection point, protection class IP 54, phase sequence protection and optionally heated control box. Main on / off switch installed on the front panel, numbered and marked electrical wires for easy maintenance and service. All power components (compressors, fans, pumps) are thermally protected.

HMI panel with protective cover or supplied for remote installation on request.

### *Control unit*

The main microprocessor controller preconfigured during the factory test with default settings helps you get it up and running quickly. Intuitive user interface with three levels of access - user, experienced user and technician.

The RS485 serial communication port enables remote management via ModBUS® or BacNET® control protocols. Optional Ethernet port.

### *Compressors*

Hermetic scroll compressors from a renowned producer with axial and radial adaptability for excellent reliability and efficiency, equipped with crankcase heaters. Compressors with low noise and vibration levels are installed on anti-vibration silentblocks, optionally equipped with anti-noise casings or structural covers.

Electronic discharge temperature monitoring and integrated motor thermal overload protection. Check valve on discharge. Measuring the operating time and number of compressor starts helps to optimize the switching sequence and service diagnostics.

### *Water heat exchanger*

AISI 316 stainless steel plate heat exchanger, externally insulated with caoutchouc insulation is located inside the chiller structure. The Victaulic grooved or threaded hydraulic water connection is led out of the housing of the unit.

3-step frost protection with differential pressure switch, NTC water temperature sensor and low refrigerant pressure sensor with ACS limiting function.

### *Air heat exchanger with fans*

Long-term reliable plate heat exchanger with aluminum fins and copper tubes, optionally equipped with a protective metal grille.

Fans with the highest efficiency with optimized full diffuser and guide blades (meet the requirements of the ErP 2015 directive). Fan grid installed at the air outlet. The fans are fully installed inside the unit housing - flat-top, reducing noise distribution and increasing condenser efficiency. In a flat installation, the suction point of the fan is closer to the central point of the condenser.

Fan motor protection class F and internal temperature sensor guarantee reliability at high ambient temperatures. Fixed speed and optionally variable speed with EC fans or voltage regulator.

#### Heat recovery

Partial (desuperheater) or complete heat recovery from stainless steel brazed plate heat exchangers located inside the unit structure. The unit is equipped with an additional water heat exchanger mounted on the compressor discharge line in series or in parallel with the air condenser. This solution makes it possible to recover up to 25% of energy with a desuperheater or 100% of condensing heat with complete recuperation. The heated water can be used for sanitary or other purposes.

#### Cooling circuit

Soldering of cooling circuits with a protective atmosphere performed by certified personnel. Before filling with R410A refrigerant, each cooling circuit of the unit is subjected to a pressure test, a leak test and then evacuated.

Each cooling unit is subjected to a complete functional test to ensure operational quality.

The cooling circuit is equipped as standard with a hermetic or replaceable filter-dehydrator cartridge type, solenoid valve, thermostatic or optionally electronic expansion valve, sight glass with humidity indicator, low pressure switch, high pressure switch with manual reset, compressor discharge temperature sensor, high pressure and optionally low pressure sensor, pressure relief valves according to the requirements of EN 378-2 and suction line insulation.

Depending on the version, the device is further equipped with a suction line temperature sensor, a four-way valve, non-return valves, a collector and a liquid separator.

#### Hydraulic circuit

All parts of the hydraulic module are located completely inside the radiator.

Standard components of the chiller hydraulic circuit consist of NTC water inlet and outlet temperature sensors, a differential water switch, a manometer with shut-off valves to measure the pressure difference on the evaporator.

The cooler can be optionally equipped with a centrifugal pump (static pressure available approx. 200 kPa), reserve centrifugal pump with operating balance and automatic switching, non-return valves, shut-off ball valves, diaphragm expansion vessel with maintenance shut-off valve, safety valve, automatic air release valve, filter strainer and drain valve. All pipes and vessels are thermally insulated with caoutchouc insulation with closed cell structure technology.

#### Construction

Installing a flat top fan reduces the height of the unit and increases efficiency.

Unit housing made of galvanized sheet steel coated with polyester powder paint RAL 7035. Optional rubber or spring silent blocks limit the transmission of vibrations to the supporting structure.

## Dimensions

The table shows the basic external dimensions of the foundation frames and the total height of the HCS units.

Typoszereg	HCS	HCS	HCS	HCS	HCS	HCS	HCS	HCS
Model	<b>113</b>	<b>219</b>	<b>325</b>	<b>332</b>	<b>444</b>	<b>454</b>	<b>563</b>	<b>575</b>
<b>Wymiary i masa</b>								
Długość [mm]	1150	1550	2000	2000	2000	2000	2200	2200
Szerokość [mm]	1000	1000	1100	1100	1100	1100	1100	1100
Wysokość [mm]	1100	1100	1400	1400	1750	1750	2180	2180
Waga [kg]	283	371	484	508	597	633	779	806

### 1.3. Used refrigerant

HCS units are manufactured with R410A or R134A refrigerants.

#### Properties R410A

HFC refrigerant - classification according to ISO 817 - A1 (non-toxic, non-flammable), GWP (global warming potential) 2 088, critical pressure 49.2 bar, critical temperature 70.2°C. TO

### Properties R134A

HFC refrigerant - classification according to ISO 817 - A1 (non-toxic, non-flammable), GWP (global warming potential) 1 430, critical pressure 41 bar, critical temperature 101.1°C.

## 1.4. Legislation and security

FLOWAIR has implemented and applies a quality system for the design and manufacture of cooling and air conditioning equipment according to ISO 9001: 2015. The design and manufacture of HCS units have been certified in accordance with Directive 2014/68 / EU. The declaration of conformity is given in Annex No. 1 to this manual.

Basic European directives and standards related to ensuring the functionality and safety of cooling equipment:

- |   |             |
|---|-------------|
| • Machine Directive (MD)                        | 2006/42/EC  |
| • Electromagnetic Compatibility Directive (EMC) | 2014/30/EU  |
| • Low Voltage Directive (LVD)                   | 2014/35/EU  |
| • Pressure Equipment Directive (PED)            | 2014/68/EU  |
| • EU regulation Refrigerant Gases               | 517/2014    |
| • European standard for Refrigerating systems   | EN378 1 - 4 |

### !!! SAFETY WARNINGS!!!

**It is essential to follow all safety warnings and precautions contained in this manual. Failure to follow these rules could result in serious injury or death.**

### Specialized operator

The operator must ensure the professional installation, operation, maintenance and servicing of the system by a specialist operator if his organization does not meet the requirements of a specialist operator. The device must be installed and connected to the electrical / hydraulic network by specialized and qualified persons. Maintenance should only be entrusted to those companies that specialize in servicing cooling systems.

Easy maintenance of the device without opening the covers and without interfering with the system can be performed by trained personnel. All other operations must be performed by qualified personnel. Servicing cooling systems can pose a real risk of injury (especially high voltage and high pressure).

Specialized personnel are personnel who have the necessary equipment, facilities and experience, as well as the appropriate qualifications for servicing and operating cooling and electrical equipment, as well as construction equipment.

### !!! SAFETY WARNINGS!!!

**Installation, commissioning and maintenance of cooling equipment are dangerous operations. The basic risks that may occur when operating the equipment (EN ISO 12100 - Safety of machinery) are listed below.**



High pressure is used in the system



The components of the electrical system are live - risk of injury due to contact with terminals and cables



Hot surfaces, pressurized components - there is a pipe with compressed gases in the system, there is a danger - gushing operating media or flying objects



Sharp edges - air condensers have sharp aluminum fins

### INFORMATION

**Each device is equipped with a main / safety electrical switch, which can be used to safely disconnect the device from the electrical network.**

**When operating the device, use protective equipment - gloves, goggles, etc..**

Place of installation


The installation site provided by the operator must comply with the accident prevention regulations for the machinery (EN 294: 1992 - Safety of Machinery) and related regulations. This requirement also applies to the operation, maintenance and service of the equipment.

**1.5. Device identification**

The basic identification, technical and safety parameters are listed on the nameplate located visibly on the outer frame of the device. Basic data and explanations are given below:



<b>WATER CHILLER</b>	Cooling unit
<b>CONDENSING UNIT</b>	Condensing unit
<b>MODEL</b>	Model type
<b>SERIAL N.</b>	Production identification number of the device
<b>YEAR OF PROD.</b>	Year of Manufacture
<b>Power supply</b>	Parameters of the electrical supply network
<b>IP X4</b>	Ingress protection rating
<b>COOL</b>	Cooling mode parameters
<b>HEAT</b>	Heating mode parameters
<b>Pc / Ph</b>	Cooling / heating capacity
<b>Pe</b>	Maximum electrical input
<b>Imax</b>	Maximum allowable electric current
<b>LRA</b>	Maximum starting current
<b>Medium</b>	Type of cooled medium
<b>V</b>	Nominal flow rate of the cooled medium
<b>Dp</b>	Nominal internal evaporator pressure drop
<b>R410a</b>	Type of refrigerant
<b>GWP</b>	Global warming potential of the refrigerant used
<b>Cx</b>	The amount of refrigerant charge in each circuit
<b>Net weight</b>	Weight of the device without packaging and cooled medium
<b>PS HP / LP</b>	Maximum allowable pressure high / low pressure side

TS HP / LP (Min. / Max.) Lowest / Highest allowable temperature high / low side



**WATER CHILLER**  
**MODEL**  
**SERIAL N.**  
**YEAR OF PROD.**  
**Power supply 400/3/N/PE, 50 Hz** | IP X4

	<b>COOL</b>	<b>HEAT</b>	
<b>Pc / Ph</b>			kW
<b>Pe</b>			kW
<b>Imax</b>			A
<b>LRA</b>			A
<b>Medium</b>			
<b>V</b>			m3/h
<b>Dp</b>			kPa
<b>R410a GWP=2088</b>			
<b>C1</b>	kg	<b>C3</b>	kg
<b>C2</b>	kg	<b>C4</b>	kg
<b>Net Weight</b>			kg
<b>PS (HP / LP) bar</b>			
<b>TS (HP / LP) °C</b> <b>Min.</b>			
<b>Max.</b>			

ALPENTA s.r.o.  
Piletická 486, 503 41 Hradec Králové  
**MADE IN CZECH REPUBLIC**

**WARNING!**

AURA HCS is the trade name of the device. The proper identification mark for regulatory and certification purposes is the SAC mark. The table below shows the equivalents of the designations.

Brand	Oznaczenie modelu
Aura HCS 113	SAC1-13HC-1IP4E
Aura HCS 219	SAC2-19HC-2IP4E
Aura HCS 325	SAC3-25HC-2IP3E
Aura HCS 332	SAC3-32HC-2IP4E
Aura HCS 444	SAC4-44HC-2IP3E
Aura HCS 454	SAC4-54HC-2IP4E
Aura HCS 563	SAC5-63HC-2IP3E
Aura HCS 575	SAC5-75HC-2IP4E



## 2. HANDLING AND STORAGE

### 2.1. Receipt of equipment

When transporting the device, it may be damaged by a strong shock or vibration, so the device must be inspected and, if damage is found, photo documentation must be made to agree on further action. In case of more serious damage, it is necessary to perform a technical inspection by an authorized partner of FLOWAIR.

#### **! NOTICE !**

**The cooling equipment must be visually inspected on delivery before unloading from the vehicle. If loose or damaged parts are found, it is necessary to contact the supplier immediately to agree on further action to resolve the situation.**

The company FLOWAIR demonstrates all care to prevent damage during transport of the equipment but is not liable for damage caused during transport of the equipment to the destination.

Immediately after unloading, check the identification data of the device stated on the nameplate (chapter Identification of the device), and the completeness of the received documentation:

The delivery of each device includes: Technical passport, Wiring diagram, drawing with dimensions for transport mounting, production label of the device, or protocols of the operational test. The supreme documents in terms of technical specifications are documents with the serial number of the device (e.g. dimensional drawing with attachment points for transport).

### 2.2. Manipulation

The requirements of the signs (symbols) on the packaging of the device must be observed. The basic dimensions and transport openings and holders are shown in the drawing supplied with the device. The weight of the device is indicated on the nameplate. Follow these rules:

- Use suitable unloading / lifting equipment, lifting belts (with the capacity of the total weight of the equipment for each belt) and other equipment.
- When lifting, check the correct position of the machine's center of gravity.
- Hold the device in a horizontal position. Avoid excessive rotation and tilting of the device.
- The lifting gear must have adequate capacity. The weight of the device is indicated on the nameplate.
- Only equipment up to a maximum total length of 3.5 m can be transported with the forklift truck. The lifting gear (forks) must have a min. the same length as the width of the device itself. Longitudinal holes for forklift forks are located in the devices.
- The crane transports equipment with a length of more than 3.5 m, which must be lifted in accordance with the dimensional drawing supplied with the equipment - a crane with the appropriate number of spreader bars and hinge attachment points, which are located on the equipment frame. side).
- After installing the unit at the installation site, remove the protective film and shipping fasteners.

#### **!!! SAFETY WARNINGS !!!**

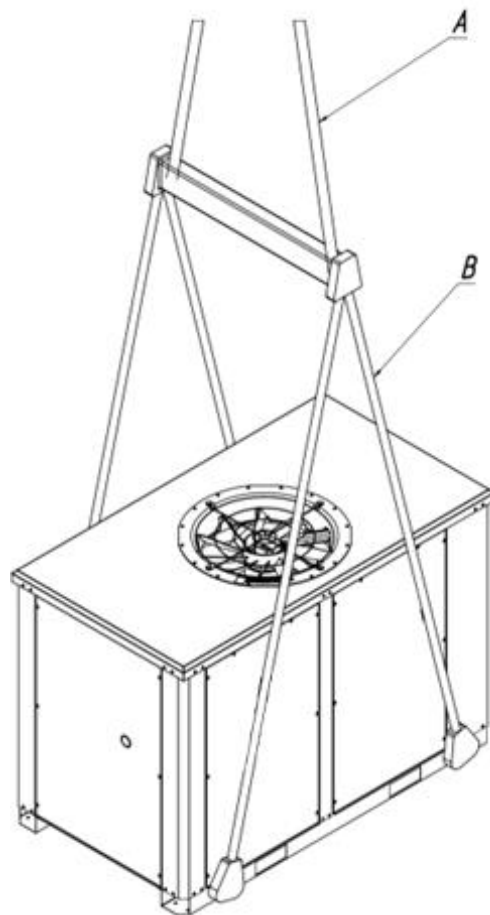
**It must be ensured that no persons are present under the suspended load during transport by crane. There is a risk of loose parts falling.**

Extreme care must be taken during transport, unloading and location of the equipment. Improper handling can damage the device:

- Fall to the ground even from a low height
- Damage to belts and chains - without the use of spacers
- Lifting for unsuitable components
- Sudden jerk by the lifting device
- Lifting the device at an angle - overloading the suspension points

The warranty does not cover this type of damage. In the event of the above event, it is necessary to contact an authorized FLOWAIR partner to perform a technical inspection of the equipment.

The following figure shows the basic diagram of the suspension for vertical transport of the equipment lifted by a crane at 2, 3 and 4 points of the suspension on the frame of the equipment. For standard slings, the maximum angle between the lifting slings (marking A) is 60° and between the chain slings (marking B) 45°.



### 2.3. Storage

If the device is to be stored before installation, several rules for protection against damage must be observed. Storage temperature conditions should be in the range of -25°C to +45°C at a maximum relative humidity of 95%. At high temperatures (above 50°C) refrigerant may leak through the safety valves.

#### ! NOTICE !

**Before storing in winter, when temperatures may drop below 0°C, check that there is no water in the hydraulic circuit and loosen the drain valves and plugs. Parts of the hydraulic circuit and subsequently the cooling circuit could be damaged by freezing the water.**

#### *Short-term storage - within 2 months of delivery*

1. Do not remove protective elements and foils
2. Protect the device from external damage - mechanical, thermal, open flame, damage by animals (e.g. rodents)
3. Protect the device from dust (e.g. from construction work)

#### *Long-term storage - more than 2 months from delivery*

1. Do not remove the protective elements, but replace the foil with another solid material - a tarpaulin
2. Protect the device from external damage - mechanical, thermal, open flame, damage by animals (e.g. rodents)
3. Protect the device from dust (e.g. from construction work)
4. Check that there is no water in the hydraulic section (see previous NOTICE)

#### INFORMATION

**If the storage period exceeds 10 months, it is necessary to perform a complete inspection of the equipment by an authorized FLOWAIR partner before proceeding with the installation.**

### 3. INSTALLATION AND PREPARATION FOR COMMISSIONING

All work specified in this manual (assembly, electrical connection, commissioning, maintenance, operation, etc.) may only be carried out by trained personnel who follow the specified procedures and the relevant local regulations. Skilled workers are persons authorized by the manufacturer of the equipment or people who, based on their training, qualifications, experience and personal training in training establishments, have sufficient knowledge of:

- Corresponding technical standards and norms,
- Occupational safety regulations and accident prevention regulations,
- Laws and regulations concerning environmental protection (equipment contains F-gases),
- Construction, parameters and function of the device,
- Professional technical regulations for the corresponding work tasks.

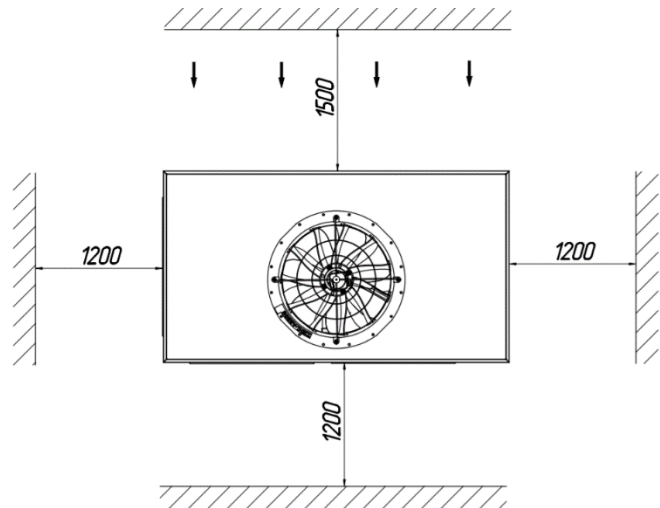
#### !!! SAFETY WARNINGS !!!

**If a dangerous situation has arisen despite compliance with safety regulations, the device must be disconnected from the mains immediately. The mains cable must be secured against unintentional switching on and marked/tagged in such a way that reconnection is not possible.**

#### 3.1. Location

For the correct operation of the equipment intended for operation in an open, usually outdoor, space, as well as its easy operation, maintenance and repairs, it is necessary to ensure access from each side. There should be room around the perimeter of each device for air to flow to the condenser. The minimum clearances are also given in the dimensional drawing, which is part of the set of documentation supplied with the device. Basic rules for free space around the device:

1. A minimum clearance of **1500 mm** is required to ensure airflow.
2. A minimum free space (e.g. from the switchboard) of **1200 mm** is required to ensure operation.
3. The minimum distance between the condensers of two devices placed next to each other is **3000 mm**.



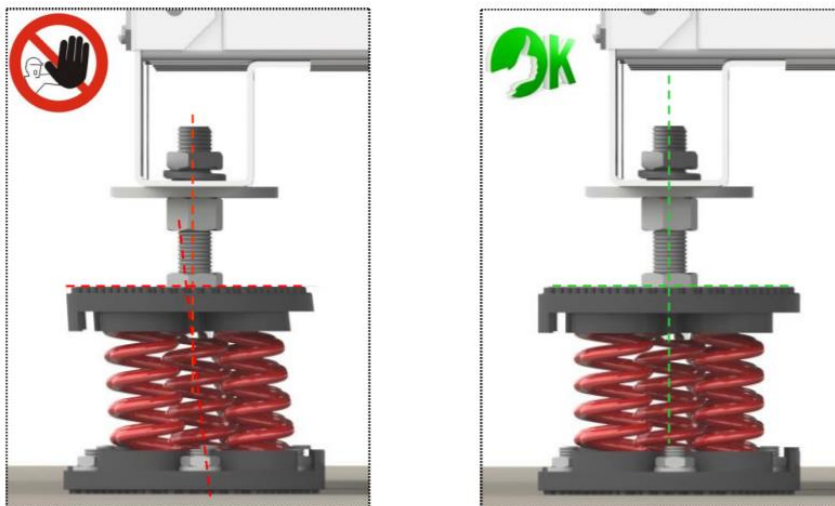
#### INFORMATION

**The above dimensions are minimal to ensure functionality and basic operation. If possible, it is recommended to use, for example, double values in the design of the installation location, taking into account the local possibilities of airflow, prevailing wind direction and sunlight. By optimizing the location of the equipment, better energy efficiency can be achieved as well as reduced maintenance costs (e.g. by reducing dust or dusting).**

The basic rules for the location of air-cooled equipment are:

- The fan directs the air vertically - into the open space. Air circulation must be prevented, hot air flowing through the fans from the device should not be sucked back into the system and led through the condenser.
- For proper operation of condensers, the device should not be installed in places with increased dust or heavy dust (e.g. under trees).
- Do not install the cooling device near heat sources - it is necessary to prevent hot air from being sucked in by the device. Air with a temperature higher than the ambient temperature causes a decrease in the efficiency of the device and, in extreme cases, can cause the high-pressure protection of the cooling circuit to switch on.
- Do not install pipes or silencers on the air inlet or outlet. Modifications to the construction are not permitted. Corresponding construction models of cooling equipment are used for these types of installations.
- The transmission of vibrations to the connected pipe networks must be prevented. The external hydraulic circuit must be guided in part by hoses or by using vibration compensators.
- In case of installation in confined spaces, contact the manufacturer for instructions on choosing the installation location.
- If the device is freely accessible for the movement of people or animals, it is necessary to install protective grilles to protect the device from damage.

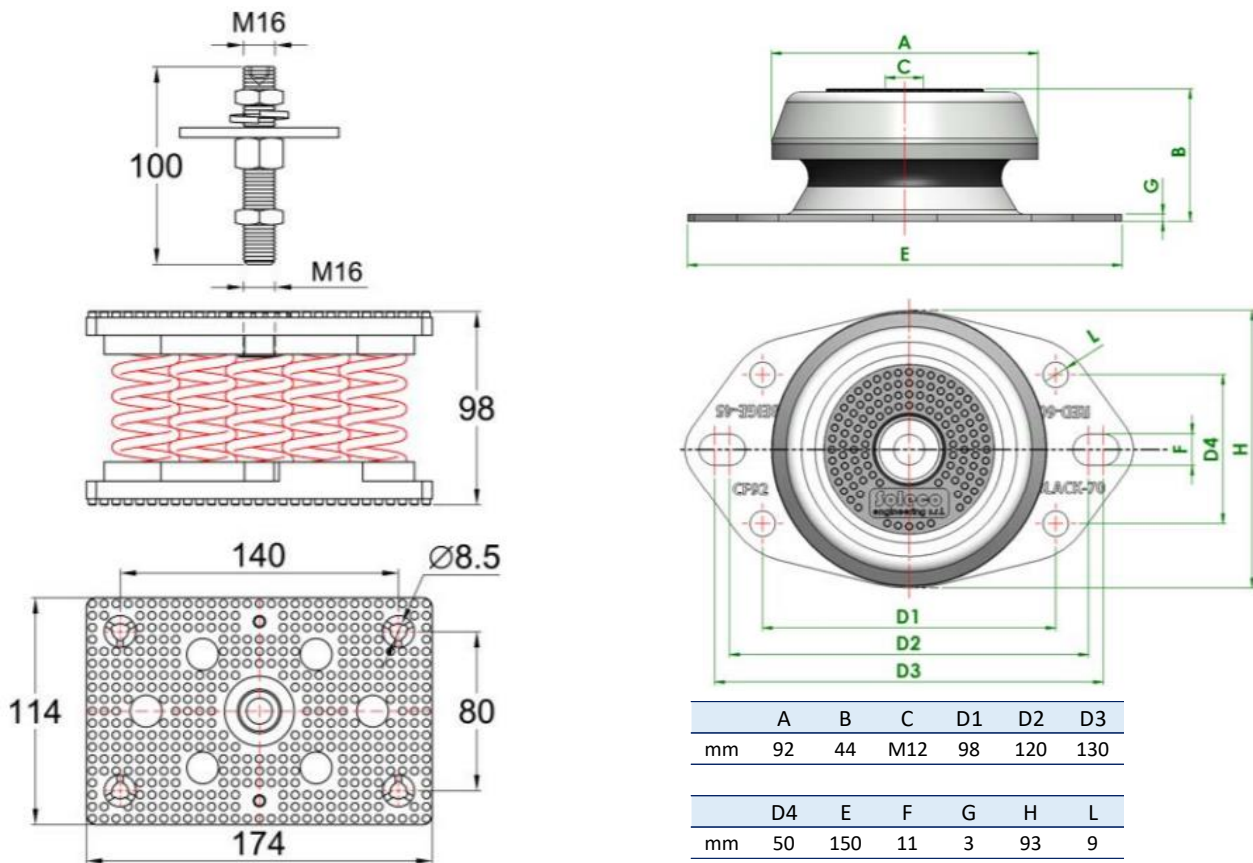
- The device must be installed on a horizontal surface with a maximum deviation of 1.5 mm/m. The foundation structure according to the approved project documentation must be solid, able to support the weight of the block and prevent the accumulation of water.
- Equipment that is located within the building structure of the building must be placed on rubber or spring silent blocks supplied with the equipment or a professional installation company according to the type specified in the project documentation.
- When installing the device, it is first necessary to place the device with loose screws of the spring anti vibration mounts in the pre-prepared dimensions (holes) in the base frame. The final axis of the vibromount must be in a vertical position without tilting. The following figures illustrate the procedure.



- When mounting the device on rubber silent blocks, the screws can be pre-tightened in the base frame of the device and then placed together with the device in the final position on the base frame and then fastened. The following figures illustrate the procedure.



The dimensions of the spring and rubber silent blocks are shown in the following figure. Together with the dimensional drawing of the device, which shows the points for the installation of silent blocks, they allow to prepare the foundation structure under the cooling device.

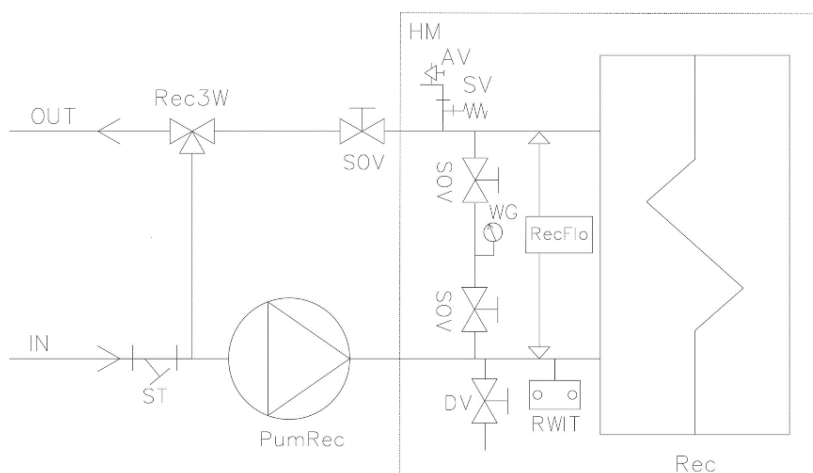


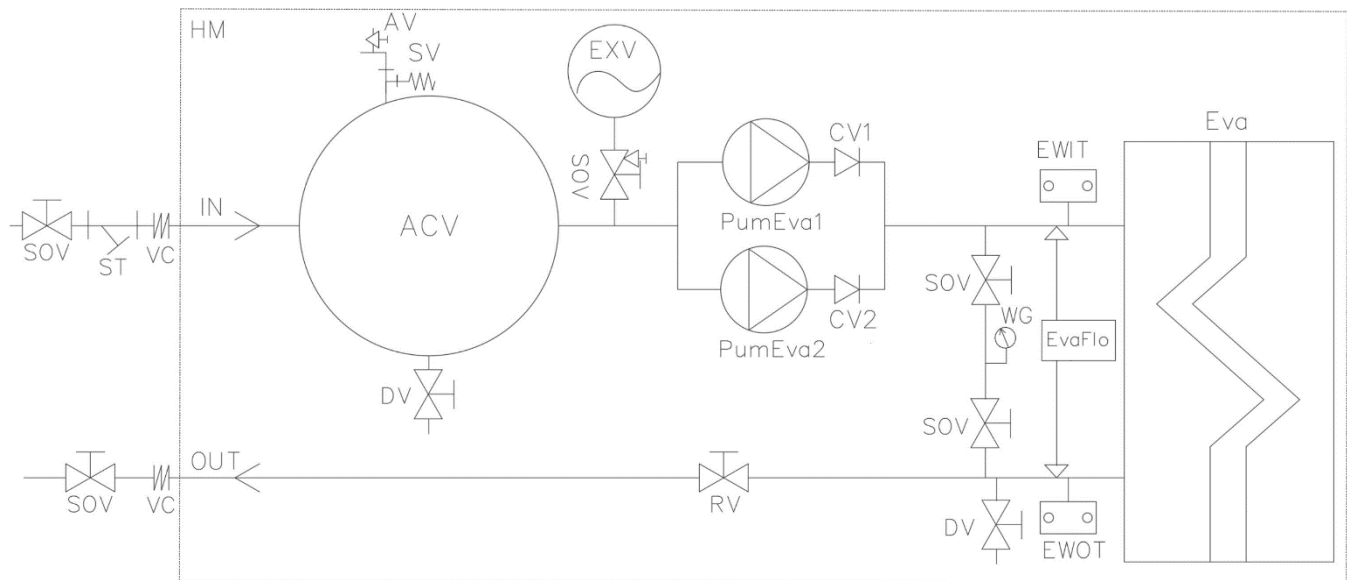
The location of the device also affects the sound pressure level around the device. If the device is installed near the acoustically hard walls of the building, the values of the sound pressure at a distance of 10 m will be higher than the nominal values stated in the Technical Parameters Card supplied with the device documentation. (There is a change of the Directional factor  $Q = 2$  – half space to  $Q = 4$  – quarter space and thus an increase in the sound pressure level  $L_p$  independently of maintaining the sound power level  $L_w$  of the cooling device).

### 3.2. Hydraulic part

The hydraulic part of the cooling equipment (except for the CU version - condensing unit) always consists of the evaporator water circuit together with temperature sensors and flow sensor, other equipment is optional when ordering the equipment.

The technological diagram for the evaporator and recuperation circuit together with the explanations is described in the following figures with a table.





symbol	description	note
ACV	accumulation vessel	optional accessory, with AV and SV
AV	air-vent valve	standard accessory with ACV
DV	draining valve	standard accessory with ACV or EvaPum
Eva	evaporator	Brazed plate or Shell&Tube heat exchanger
EvaFlo	evaporator flow switch	standard accessory - differential or flow switch
EWIT	evaporator inlet water temp. sensor	standard accessory - NTC sensor
EWOT	evaporator outlet water temp. sensor	standard accessory - NTC sensor
EXV	expansion vessel	optional accessory, equipped with SOV
PumEva	evaporator pump	optional accessory, 1 or 2 pumps - 1 reserve
PumRec	recovery pump	optionally supplied for external installation
Rec	recovery heat exchanger	Brazed plate heat exch. For partial or full recovery
Rec3W	recovery 3W valve	optionally supplied for external installation
RecFlo	recovery flow switch	standard accessory with full recovery
RV	control valve	optional accessory
RWIT	recovery inlet water temp. sensor	standard accessory with full recovery
SOV	shut off valve	optional accessory
SV	relieve valve	standard accessory with ACV, opening pressure 6 bar
WG	water gauge	standard accessory with PumEva or ACV
HM	hydronic module	built inside of water chiller
ST	water strainer	optionally supplied for external installation
VC	vibration absorber	optionally supplied for external installation

The flow sensor (differential pressure) provides protection against loss of pressure / flow in the event of a pump failure or a significant reduction in flow through an obstacle in the pipeline. In the case of using a speed-controlled pump, the minimum flow level is defined during commissioning, especially with regard to the function of the flow sensor and, in addition, the efficiency of heat transfer in the heat exchanger.

The device is also equipped as standard with an auxiliary contact in the motor starter of the pump, which activates the flow alarm independently of the flow sensor when the pump is switched off.

#### INFORMATION

**The standard control system configuration (ACS) is set so that the system checks for an open flow sensor contact before starting the evaporator pump. (If necessary - external control of pumps without the possibility of cooperation with the signal from the ACS, the function can be turned off in the advanced settings, but this procedure is not recommended).**



EWIT and EWOT sensors are used to control the medium temperature and at the same time as protection against evaporator freezing (more information - ACS system manual).

#### *Filling the system*

For frost protection and for the correct function of the cooling system, the system (individual parts) must be well vented during commissioning. For proper venting of the system, it is necessary to install automatic or manual release air valves at the highest points of the pipeline, regardless of their presence in the equipment.

The expansion vessel also includes a service valve enabling manual deaeration and disconnection of the vessel from the system for checking the air pressure in the vessel - usually around 1.5 bar.

#### **! NOTICE !**

**The minimum amount of water in the system, including the evaporator, should correspond at least to the amount of water that flows in the system in 2 minutes. If the system does not meet this condition, it is necessary to install a storage tank of appropriate volume in the system.**

Insufficient water can affect:

- Correct function of safety elements - risk of equipment damage
- Faster wearing out of the equipment due to the risk of cavitation on the pumps as well as frequent switching on and off of the cooling circuit
- Cooling capacity due to irregular operation

#### *System downtime in winter*

Equipment using water as a cooled medium must be protected against frost damage to parts of the hydraulic circuit when the outside temperature drops below 4°C.

If the unit is equipped with resistance heat exchanger heating, it is necessary to check the presence of electrical supply during the entire shutdown at low temperatures.

#### **! NOTICE !**

**Before shutting down the machine in the winter, when temperatures may drop below 0°C, check that there is no water in the hydraulic circuit and loosen the drain valves and plugs or fill the system with antifreeze. Freezing water could damage the device.**

#### *External part of the hydraulic circuit*

The connection of the pipeline network to the equipment, its setting and installation must comply with current legal regulations, technical requirements and requirements for maximum safety. In addition, following the instructions below will prevent damage to the device:

- Avoid unnecessary pressure losses, ensure correct circuit size and tracing.
- The connecting pipe must be fastened to a separate supporting structure so that it does not burden the assembled joints.
- Connect expansion joints to the device to prevent noise and vibration.
- Install shut-off and drain valves on the outside of the unit so that you can shut down and drain the system for maintenance and service.
- Install the drain valve at the lowest points of the water circuit and the vent valve at the highest points of the circuit.
- Install a particulate filter at the inlet to the unit to prevent possible freezing and damage to the evaporator.
- Mount a thermometer and manometer on the inlet and outlet of each heat exchanger for quick inspection and maintenance.
- Hydraulic piping must be insulated to prevent condensation and thus loss of performance. Pipe insulation is only performed after checking the complete system under pressure.

#### Water treatment

The quality and purity of the refrigerated medium play a crucial role in the trouble-free and energy-efficient operation of the cooling equipment.

#### **! NOTICE !**

**The cleanable strainer filter must be installed at the liquid inlet to the evaporator (possibly recuperation), which removes impurities before entering the exchanger. Install a cleaning filter at least 1 000 mm before connecting the evaporator and after all welds (there are no welds between the filter and the evaporator). The filter should have holes no larger than 1.5 mm for models with a plate evaporator or 3.0 mm for a tube evaporator.**

#### INFORMATION

**It is recommended to flush the piping system after its completion by bypassing the cooling equipment.**

#### INFORMATION

**To prolong the life of the components, we recommend the use of additives for antifreeze mixtures, so-called corrosion inhibitors.**

#### *Glycol mixtures*

V případě použití glykolových směsí:

- The freezing point of glycol must be lower than the minimum evaporation temperature
- The concentration of the mixture should not be higher than the calculated one stated on the nameplate, otherwise the cooling capacity of the system will be reduced
- Check the pH of the mixture, which should be approximately between 9.5 - 8
- Check the pH value regularly (during maintenance)
- In the case of an external hydromodule, make sure that the pump used and other circuit elements and seals are suitable for working with refrigerated media (when using glycol).

#### ! NOTICE !

**It is not permissible to discharge a mixture of water and glycol into the sewer. Mixture Must be collected in special packaging and disposed of in accordance with waste disposal regulations.**

### 3.3. Electrical part

The equipment documentation also includes an electrical wiring diagram and the ACS System Manual, which is used to control all functions of the cooling equipment.

The mains voltage and frequency must correspond to the values on the rating plate of the appliance. The supply voltage should not exceed the values given in the wiring diagram for a short time, which is +/- 5% for the voltage; +/- 1% for frequency, unless otherwise stated.

The supply cables must be adequately fused and dimensioned to correspond to the electrical performance characteristics specified on the nameplate and the supplied electrical specifications in the wiring diagram.

The protective earth conductor, which interconnects the protective conductor, the earth lead and the conductive parts, must comply with standard EN 60204-1. The connecting cable (earthed) must have a cross section of at least 10 mm<sup>2</sup>.

#### ! NOTICE !

**It is not permissible to mechanically load the supply terminals of the electrical switchboard.**

#### !!! SAFETY WARNING !!!

**The electrical connection must be carried out by qualified personnel in accordance with the local regulations in force. There is a risk of electric shock.**

Before connecting the equipment or servicing electrical parts, make sure that the main / safety switch is in the OFF position.

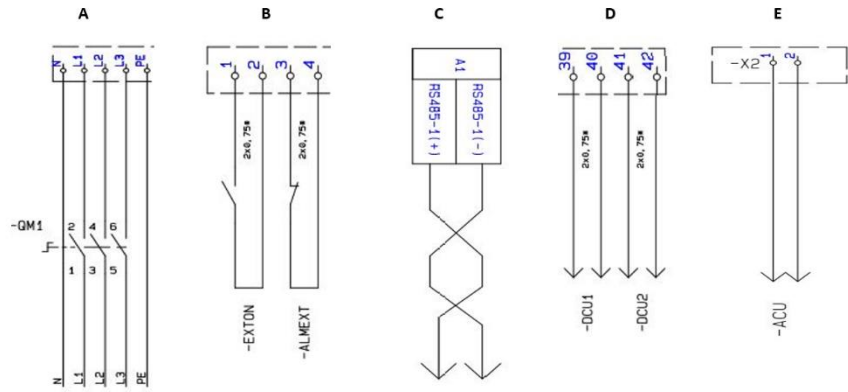
#### ! NOTICE !

**The system operator must ensure that the power supply is equipped with a disconnecter, e.g. a mains switch with an appropriate contact rating, and that the mains supply must also be equipped with a separate fuse and an emergency switch. (all dimensioned according to the relevant approved project documentation of the electrical installation).**



Detailed information on individual inputs / outputs and control unit configuration is given in the ACS Control System Manual.

The table shows the basic parts of the external electrical connection of cooling equipment for electrical installation. Detailed information and wiring diagram are supplied with the device.



- A - Power connection - power supply from the network 400/3 / N / PE, 50Hz
- B - External control - ExtOn signal for remote start, AlmExt signal for information about the alarm status of the cooling device (can be configured in the ACS system)
- C - ModBUS - connection for ModBUS communication via RS485, optionally Ethernet
- D - DCU - digital switching of cooling capacity for versions U - condensing unit
- E-ACU - analog control of cooling capacity for versions U - condensing unit

### 3.4. Cooling circuit

HCS cooling units can have 1 cooling circuit with 1 to 3 compressors as standard.

Soldering of cooling circuits with a protective atmosphere performed by certified personnel. Before filling with refrigerant, each cooling circuit of the unit is subjected to a pressure test, a leak test and then evacuated.

Each cooling unit is subjected to a complete functional test or a functional test by means of a computer simulation (condensing unit type CU or condenser with a remote evaporator).

The cooling circuit is equipped as standard:

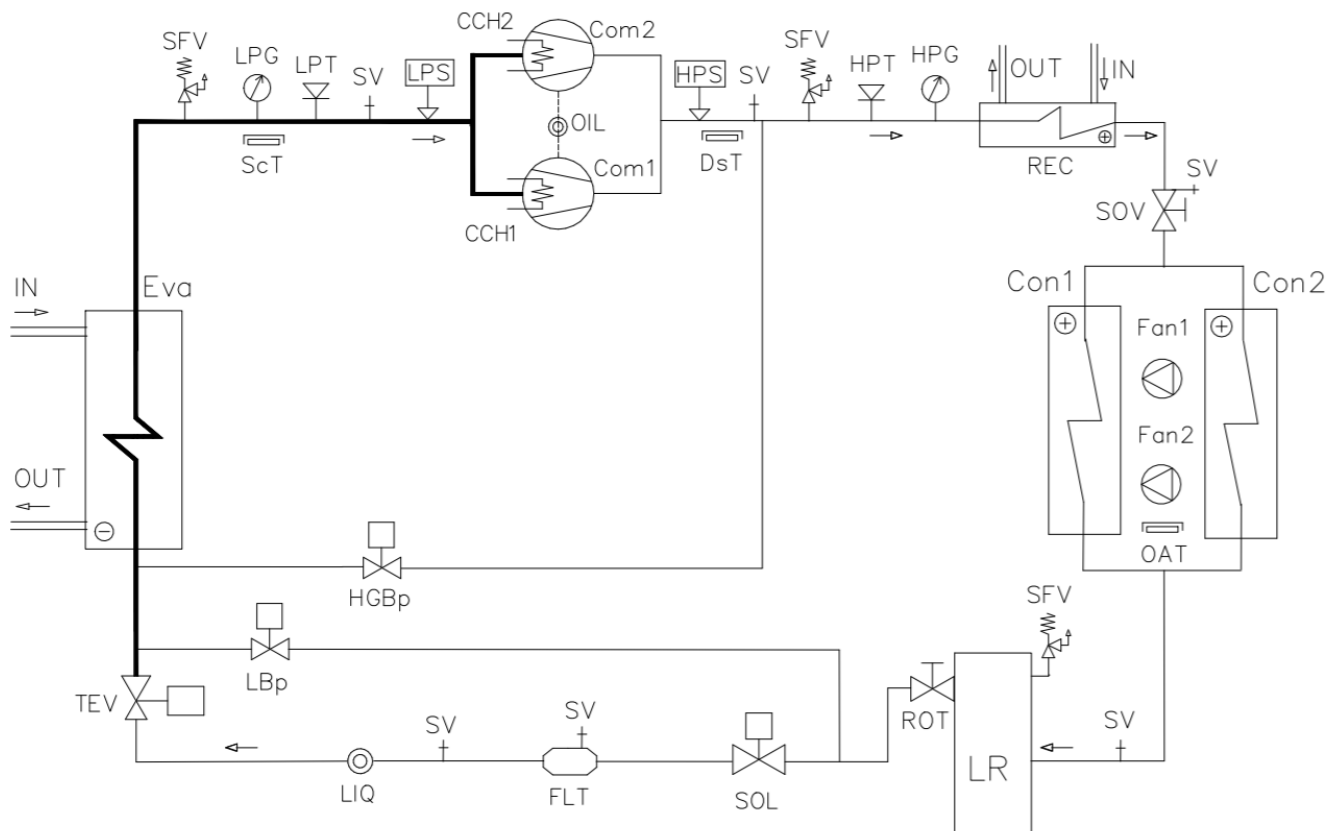
- hermetic or replaceable cartridge type filter-dehydrator,
- solenoid valve, (CU version - included)
- thermostatic or optionally electronic expansion valve, (CU version - included)
- sight glass with humidity indicator, (CU version - included)
- low pressure switch,
- high pressure switch with manual reset,
- temperature sensor on the compressor discharge,
- high-pressure and optionally low-pressure sensor,
- shut-off valve before entering the condenser,
- safety valves for pressure relief according to the requirements of EN 378-2 and suction line insulation.

Depending on the version, the device is further equipped with a suction line temperature sensor, a four-way valve, non-return valves, a collector and a liquid separator.

In preparation for commissioning, it is necessary to check whether the equipment has not been damaged or there has been no refrigerant leakage:

- Visually complete and potential for unwanted mechanical damage to the cooling circuit elements
- Potential refrigerant / oil leak - visually, by leak detector or bubble method
- Tighten screw connections, especially oil lines, manometer nuts and service valves
- The refrigerant pressure in the idle state of the device must correspond to the ambient air temperature on the high pressure side - the pressure can be checked on the device monometers (optional equipment), by connecting a service manometer or on the control unit

The following is the basic technological single-circuit diagram of the cooling circuit together with a table of abbreviations used and explanations.



symbol	description	note
CCH	compressor crankcase heater	heating when the compressor is off
Com	compressor	Scroll compressor
Con	condenser	Cu pipes and Al fins coil
DsT	discharge temp. sensor	discharge high temperature protection
Eva	evaporator	brazed plate or shell&tube heat exchanger
Fan	fan	axial fan with full nozzle
FLT	filter dryer	filter drier with a replaceable cartridge
HGBp	hot gas by-pass	optional accessory
HPG	high pressure gauge	optional accessory
HPS	high pressure switch	safety pressure switch with manual reset PZH (EN 12263)
HPT	high pressure transducer	condensation control and high pressure limitation
LBp	liquid bypass	optional accessory
LIQ	sight glass	sight glass with moisture indicator
LPG	low pressure gauge	optional accessory
LPS	low pressure switch	low pressure protection with automatic reset PSL (EN12263)
LPT	low pressure transducer	optional accessory, low pressure limitation
LR	liquid receiver	optional accessory
OAT	temperature sensor	sensor NTC
OIL	oil equalization	compressor oil equalization with sight glass level indication
Rec	recovery exchanger	plate desuperheater or full recovery
ROT	rotalock valve	optional accessory
SFV	safety valve	pressure relief valve EN 378-2 and EN 13136
SOL	solenoid valve	installed together with thermostatic expansion valve
SOV	shut off valve	installed on discharge line or as an option
SV	service valve	Schrader 1/4" SAE
TEV	thermostatic expansion valve	optionally electronic expansion valve

## 4. COMMISSIONING

### 4.1. Pre-commissioning inspection

Before commissioning the device, it is necessary to check the device and related installations. The basic control activities are listed in the Pre-commissioning inspection protocol (appendix).

Check that the minimum distances are maintained for the correct operation of the device and that the necessary maintenance space is available.

Find out if the device has been damaged or subsequently modified without the manufacturer's authorization, for example by incorrect installation of cable trays or pipes (e.g. they may impede service access or air flow, etc.). There must be no screws or other sharp objects near the condensers that could cause mechanical damage to the heat exchanger due to vibration.

It is recommended to obtain photo documentation from the installation site before putting the device into operation.

#### **! NOTICE !**

**Before switching on the device for the first time or after a longer shutdown, the compressor oil must be warmed up. The crankcase is heated by heating cables at least 12 hours before switching on. To start heating, turn the main switch to the ON position. The crankcase heating function is automatically active when the main switch is in the (ON position).**

### 4.2. Commissioning

The commissioning of the equipment may follow a previous inspection of the entire system (Pre-commissioning inspection) in a situation where the subsequent cooled (heated) heated system can be loaded to at least 60% of the equipment output. In the case of reversible coolers, it is possible to put the device into operation in both modes during the transitional period, otherwise the commissioning process must be completed under suitable conditions.

A detailed description of operating sequences, modes, parameters and alarm messages is given in the ACS Control System Manual. It can be used during commissioning:

- Variable speed fan and pump test modes
- Possibility of manual shutdown of selected compressors during commissioning
- Temporary setting of the desired water temperatures for accelerating / decelerating the operating sequence
- Temporarily switch off the flow control before starting the device (e.g. during external pump control)

#### Commissioning protocol

The commissioning report should contain information on the operating parameters at the first start-up, identification of the equipment, name and confirmation of the qualified service and confirmation of the commissioning customer - a sample is given in the appendix.

The completed Commissioning Protocol is a condition of warranty performance in the event of a device complaint.

#### Operator training

The operator of the cooling system must be trained during commissioning, ie before the formal commissioning, which begins with the signing of the Commissioning Protocol (Annex).

As part of the operator training, the future operator will get acquainted mainly with:

- Safety rules for operating cooling equipment
- Basic tasks of user operation and weekly inspections (chapter maintenance)
- Basic operating sequence
- Temperature and pressure safety elements
- Basics of wiring and safety elements
- Operation of the control unit and setting of basic parameters
- Alarm states and possibilities of their solution
- Documentation for cooling equipment - Operating instructions for the equipment and control system, Wiring diagram
- Obligation to keep operational documentation and protocols (appendix)

## 5. OPERATION AND MAINTENANCE

### 5.1. Principles of traffic safety

Before carrying out any service work, it is necessary to familiarize yourself with safety regulations and measures.

The operator must always be equipped with personal protective equipment that corresponds to the work performed. Personal aids generally include in particular: goggles, gloves, headgear or helmet, protective work footwear. Additional protective equipment must be selected after performing a risk analysis in the appropriate area, according to the type of work performed.



Risk of fatal injury. Disconnect the device from the power supply before opening the electrical switchboard or removing the protective panels. When the main switch is disconnected, the supply contacts L1, L2 and L3 remain energized.



Danger of burns, pipes can reach high temperatures



Risk of frostbite. Do not remove any parts of the cooling circuit piping before depressurizing the system



Wear safety goggles and rubber gloves when handling refrigerants.



Danger of suffocation. Ventilate the area when working with refrigerant gases. Smoking is strictly forbidden.



It is forbidden to discharge refrigerant into the environment. It must be collected in bottles and reused or returned to a specialized company.



Risk of injury. If fan maintenance is required, prevent body parts or clothing from entering moving parts .



Insurance devices. It is forbidden to switch off or interfere with the operation of safety devices, such as flow switches, pressure sensors, safety valves, etc.



Changes to the software or electrical system may only be made after consultation with the manufacturer. Any wiring changes must be made according to the wiring diagram.

### 5.2. Operation

#### Operator responsibility

The operator of the cooling equipment is obliged to provide qualified personnel familiar with the characteristics of the installed equipment. From the point of view of basic information about the device, it is a thorough acquaintance with the instructions for the device (especially this manual and the ACS manual) and the operator is obliged to keep the documentation necessary for the operation of the device:

1. Pre-commissioning inspection report, Commissioning report (model in annex)
2. Cooling equipment inspection book (see NOTICE below)
3. Service book or Service maintenance protocols (sample in the appendix) - records from maintenance and service interventions (contains date, description of the action, if necessary, with measured parameters and confirmation of a qualified person performing service intervention)

In the event that the operator detects unusual operating conditions or equipment failure, it is recommended to contact an authorized FLOWAIR partner to agree on further action.

#### **! NOTICE !**

**According to Regulation (EU) 517/2014 of the European Parliament and of the Council on fluorinated greenhouse gases: The operator of an installation that contains F-gases in an amount of more than 5 tonnes of CO<sub>2</sub> equivalent is required by law to ensure regular leak tests. Inspections may only be performed by certified persons holding a category I certificate (EU Implementing Regulation 2015/2067).**

### 5.3. Troubleshooting

To solve the failure of the cooling equipment, it is necessary to know the information given in the technical documentation of the equipment - Instructions for operation of the equipment, Instructions for the ACS control system and specifications of technical parameters. Furthermore, the appropriate qualification for the operation and operation of cooling equipment is required, which is described in more detail in the introduction to this manual.

When troubleshooting, it is essential to follow all safety recommendations in this manual.

It is always necessary to approach the solution of a fault condition with caution, especially with regard to finding out the real cause of the fault, not only the elimination of its consequences. Failure to determine the true cause of the fault can lead to escalation of the consequences and further damage to the device. The cause of a fault often depends on many factors, which can only be assessed by a qualified service technician familiar with the interaction of the various functions of the device. This manual is not an exhaustive source of information on cooling equipment failures. In terms of the initial detection of the fault, the faults can be divided into:

1. Alarm states - the fault is reported by the ACS control system and is classified on the display of the control unit. The ACS System Manual is intended for resolving the alarm condition, in which the alarm states are described in detail.
2. Other faults - fault not detectable by the control system.

The basic causes of failures can be divided into three groups:

- Structural, mechanical or hydraulic system defects - these defects can usually be rectified by a qualified user.
- Electrical Defects - A qualified electrician with the appropriate authorization can repair these defects
- Defects in the cooling circuit - this type of defect can only be repaired by a specialist cooling service

Any intervention in the cooling circuit should be carried out by a qualified service organization (warranty repairs only by an authorized FLOWAIR service center or the written consent of an authorized FLOWAIR partner):

- replacement of the dehydrator filter or its replacement insert
- Appropriate inert gas pressure tests
- Appropriate leak tests
- restart the device in accordance with the procedure described above in this manual
- measurement of equipment operation parameters
- fill in the Pre-commissioning inspection report, Commissioning report (sample in the appendix)

Selected basic fault conditions are listed in the following table.

part	manifestations of malfunction	possible causes
cooling circuit - high pressure	switching of the high-pressure switch /HPS/; often switching of high-pressure limitation /HPL/	<p>very high air temperature compared to design value</p> <p>polluted condenser</p> <p>failure of the fan or its electrical connection</p> <p>non-condensed gases in the condenser</p> <p>closed shut off valve on the high-pressure side</p> <p>refrigerant overloading</p> <p>very high water temperature compared to design value</p> <p>failure or incorrect setting of the high pressure transducer (HPT)</p> <p>failure of the high-pressure switch (HPS) or its cable connection</p>
cooling circuit -low pressure	switching of low pressure switch /LPS/; part switching of low-pressure limit /LPL/	<p>very low air temperature compared to design value (very adverse weather conditions)</p> <p>fan malfunction</p> <p>blockage in the liquid line - valve failure (solenoid, expansion), strained filter dehydrator</p> <p>lack of refrigerant, cooling circuit leakage</p> <p>polluted evaporator or clogged water filter, low water flow</p> <p>very low temperature or low water flow compared to design value</p> <p>failure or incorrect setting of low pressure sensor (LPT)</p> <p>failure of the low-pressure switch (LPS) or its cable connection</p>
cooling circuit	noise and vibration	<p>the weight distribution of the unit on the base frame or its position is not optimal</p> <p>damage to the fan or cleansing on the impeller</p> <p>failure of the mechanical part of the compressor, the clickable sound of the compressor return valve when switching off does not have to indicate a failure</p> <p>suction fluid or wrong direction of compressor rotation</p> <p>loose compressor fixing screws</p> <p>insufficient vibration compensation or incorrect pipe fixing</p>
cooling circuit	switching of thermal protection or discharge temperature protection	<p>lack of compressor oil</p> <p>failure of the mechanical parts of the compressor</p> <p>electromechanical failure of the compressor motor, phase failure</p> <p>see. high pressure</p>
hydraulic system	noise and vibration; underperforming	<p>small amount or presence of air in the cooled medium</p> <p>setting the pump operating point outside the characteristics</p> <p>failure of mechanical parts of the pump</p> <p>presence of contaminants in the hydraulic circuit</p> <p>wrong setting or failure of the pump frequency inverter</p> <p>mechanical failure of the check valve</p>

## 5.4. Maintenance

### Regular service inspections

These service intervals and procedures are based on experience and may be changed depending on the complexity of the installation. In some cases, it is necessary to shorten the service intervals (e.g. during continuous operation of the device, difficult dust or climatic conditions, etc.).

Basic service maintenance is described in the Service Maintenance Protocol (Appendix). Service activities are divided according to the planned period into Weekly inspections, Quarterly service maintenance and Annual service maintenance.

Weekly inspections can be realized by trained operators. Quarterly and annual inspections must be performed by a qualified service technician with the completion of a report (appendix or similar form or service book of the equipment).

**! NOTICE !**

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## 5.5. Product life cycle and disposal

### Cooling equipment life cycle

The device is designed so that its minimum service life without the need for major modifications exceeds 12 years. Provided proper operation and regular maintenance, the equipment should operate for 15 to 20 years. In addition to operation, the service life cycle of the equipment is fundamentally affected by the method of operation - working parameters and complexity of the environment, the dynamics of changes in the thermal load (stable load prolongs the service life cycle), etc. The resulting service life cycle of the equipment thus depends not only on the manufacturer but also on the technological project of installation, method of operation and compliance with the principles of proper operation and maintenance.

### Disposal

The cooling device is made of metal, plastic and electronic components. All parts of the equipment must be disposed of in accordance with the applicable local laws, in accordance with Directive 2012/19 / EU (WEEE) (EU Directive - Waste Electrical and Electronic Equipment). At the end of the operation, it is recommended to consider the possible modernization, reuse, disassembly and recycling of the equipment.

**! NOTICE !**

**The pumped out refrigerant is considered hazardous waste and therefore this activity must be entrusted to a professional organization authorized to work with cooling systems and in accordance with the laws in force in the country where dismantling takes place. Refrigerant gases must be prevented from escaping into the environment by using suitable pressure vessels for the transport of compressed gases.**