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INSTALLATION AND COMMISSIONING MANUAL

AZ KLIMA a.s.

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1. INTRODUCTION

1.1. General

Use for intended purpose
Air handling units supplied by AZ KLIMA a.s. must be only used for transporting and adjusting air. By adjusting is ment filtration, heating, cooling, humidification and dehumidification.

Installation
If units are supplied in separate sections, are to be assembled in accordance with these assembly instructions and all protective devices have to be made effective. Service switch must be placed in the reach of the fan section.

Before commissioning
Air handling unit can be taken into operation after verifying that it meets the conditions of EEC Directive 89/392/EEC machinery safety as 93/44/EWG and standard EN 1886. Before take into commissioning must be checked for the presence of foreign objects in the chamber and clean all surfaces of the unit. It is not allowed to pass and operate the unit with internal impurity.

1.2. Safety instructions

For safe operation, service and maintenance of HVAC equipment is necessary to prepare a local operating regulation according to the size and composition of HVAC equipment and local conditions, involving also various safety equipment and safety signs and notices. Local regulation must also contain provisions:

Warning:
All service work can be carried out after the unit shutdown off electrical power, so as to ensure the safety of workers engaging the maintenance. When shutdown it is necessary to wait at least 90 sec, before stopping of the revolving parts (fans) of units, so as to avoid injury to the maintenance workers. At the same time it is necessary to ensure that it is no possibility of accidental turn on of the unit during service.

It is prohibited to turn the unit on if the service door or service openings are opened.

The service of the device is only allowed if the following points are ensured:
- The power supply is interrupted at all poles
- The device is secured against the switch on (e.g. locking the service switch).
- Still status of all moving parts, especially the fan impeller, belt drive, motor, rotary heat exchanger

After work has been completed, the following **requirements must be ensured before the unit is switched on**:
- Protective devices must be fitted and effective (e.g. protective grille).
- Check that no persons are in the danger area, e.g. inside the unit chamber

When assembling, electrical connection, commissioning, repair and maintenance of units it is necessary to respect the valid standards, related safety regulations and the generally recognized technical rules.

Installing the units, assembling connections of the electrical installation, putting the units into operation, repair, maintenance and servicing must be performed only by qualified experts with a valid permission.

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1.3. Delivery and packaging

Air handling units are supplied on transport pallets or on blocks either partially assembled into blocks, or into individual chambers according to the ordering conditions.

- Delivered products are not packaged, are dry without corrosion

Part of the delivery is the delivery sheet with the list of supplied products.
The technical documentation is passed after the assembly of the unit.

Technical documentation contains:
- Technical specifications of the equipment
- Specifications of motors
- Installation and operation manual, maintenance manual

Technical documentation of other supplied devices is available from the manufacturer:
- electric heaters – assembly and operating regulations
- gas heaters – assembly and operating regulations, Installation instructions for gas burners
- steam moistening section – assembly and operating regulations

1.4. Unloading and transport

Air handling units are supplied on transport pallets or on blocks either partially assembled into blocks, or into individual chambers according to the ordering conditions. Their shipping is possible in a horizontal position. For air handling units AIR FLA and AIR MIN the vertical position for transport is not recommended.

During transport of units the carrier must protect devices against mechanical damage and splashing water. The units can be stored only in dry indoor locations with air temperature from -30 to 50°C.

During transport and subsequent transfers of individual blocks (chambers) or entire unit must be used only forklifts or crane with transport belts. During transport it is necessary to comply with the valid normative provisions relating to the transport and movement of loads.

During the transport and handling with individual blocks (chambers) is only allowed to lift it from the bottom. For handling with units are assigned openings in the corners of the frame for insertion of manipulation pipes.

The carrier is responsible for the transfer of equipment without pollution and without damage. Must not be inserted foreign objects inside the unit, which are not part of the unit. In the case of pollution of the device, the carrier is responsible for the removal of impurities and foreign subject from the unit.

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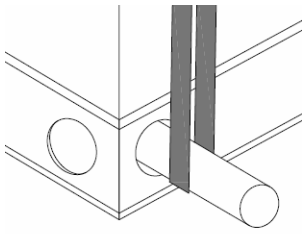
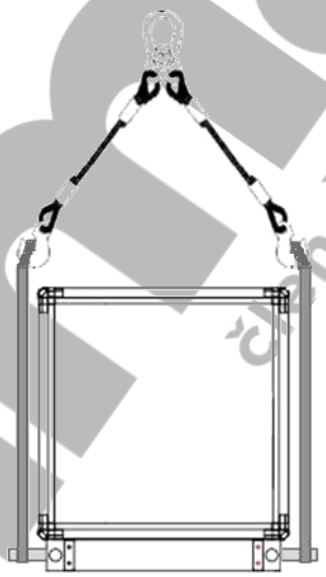
1.4.1. Unloading by crane

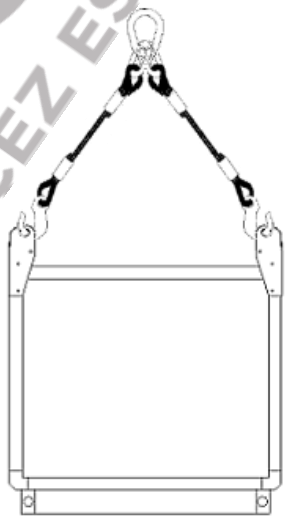
When lifting with the crane is necessary to use strips underneath the unit, or strunged on a manipulating pipe insert in the corners openings of the unit frame or on the special suspension eyelet.



To unload and transport the unit may only be used appropriate and permitted accessories (ropes, chains, belts-straps) according to the valid normative provisions.
Do not use hook to corner openings!
Always use handling pipe for manipulation.



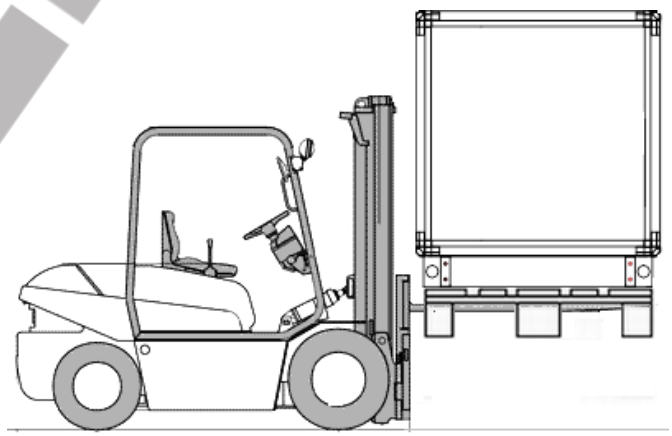
Manipulating pipe



Suspension eyelet

1.4.2. Forklift unloading

When unloading and transport with a forklift truck, it should be equipped with forks, which underneath the load and will be stretched, so as to back up the entire width of the chamber and to prevent tearing of bottom or other damage due to weak support.



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1.5. Check the installation on a construction site

During checking pass on is necessary to check whether:

- If the product is delivered in ordered design and in the desired quantity per delivery sheet
- The product has not been damaged during transport

Note.: The units are not packed by the manufacturer due to condensation under the plastic foils (packaging) which could occur.

If damage has occurred during transport, carrier must without delay:

- Write down range of damage in delivery sheet and in delivery sheet copy.
- Take and send photos of damage

When above instructions are not followed, may lead to a situation, when the complaint about damage caused by the transport will be rejected.

1.6. Storage

The unit is should be stored in a dry and dust free areas at temperatures in the range of -30 to 50°C. Devices must be protected against mechanical damage and corrosion, which can be caused by persistent condensation of water vapor on the surface of the unit. Storage of units should not be exposed to the weather influence (rain, snow).

In the case of long-term storage for the customer it is necessary to rotate the fan shaft and motor by handle, and lubricate bearings to prevent their corrosion.

2. GENERAL PRINCIPLES OF ASSEMBLY

Steps related to the preparation and the start of unit installation:

- Installation of the air handling unit can perform only specialized organization with a valid permission. In case of performing an installation with unspecialized workers, no warranty is provided from the manufacturer.
- Installation work or technical surveillance can be ordered directly from the manufacturer.
- Before commissioning device into operation, it is necessary to check whether, if not release certain parts of the unit (it may happen during transport), or perform a tightening of moving parts.
- Connections and grounding of the electric motor, electrical equipment and all electrical installation must be carried out in accordance with the current normative provisions in relation to the current environment and with regard to work safety and commissioning into operation. Assembly and installation works must be done only by a specialized expert with valid permission.
- Air handling devices are not designed for the location of the footbridges and the distributors of the wiring, electrical switchboards, etc. If regulations above are not complied, no guarantees are provided by manufacturer.
- Devices that are not part of the air handling unit can be placed on the unit only after prior consultation and agreement of the manufacturer of the unit.
- During the assembly and manipulation of the unit it is necessary to use protective and safety equipment.
- **The unit has a limited load capacity and its construction is not intended to put away or and gather any material, in particular material with higher weight. Excessive load could cause deformation of the casing or serious damage to the unit. Such damage is not covered by the warranty.**
- **When handling and moving it is necessary to comply the provisions in part 1.4.**
- **Do not move unit above persons!**

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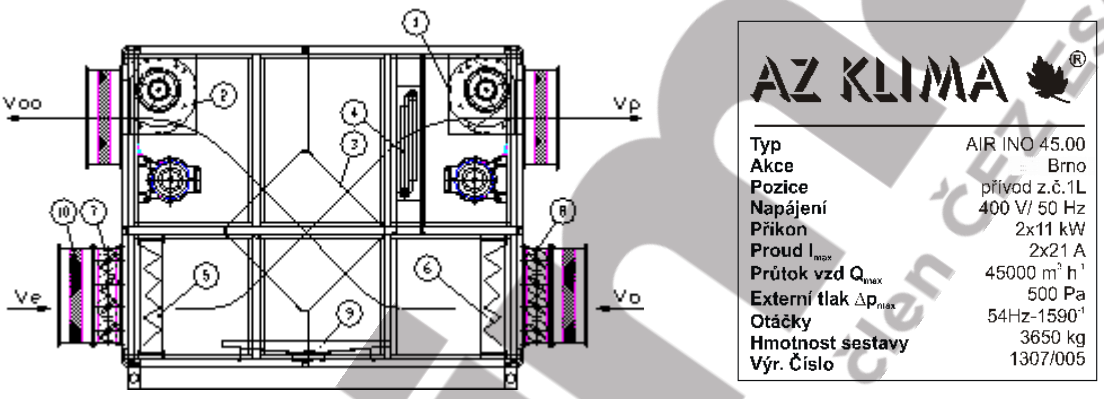
2.1. Technical specification of the device

The technical specification is part of the technical documentation, which is passed after the installation at the construction site. The specification contains a detailed description of the device.

Technical specification includes:

- manufacture number of device
- scheme drawing of device
- performance parameters
- detailed technical description of each part



Scheme drawing a manufacturing label

For the precise identification of the equipment (individual chambers) and for the purposes of the assembly, or the technical specification of the device are used production labels.

2.2. Assembly instructions

2.2.1. Unit installation

The air handling unit may represent any of the functions of the building structures. In case of ignoring regulation above (take any static functions) no warranty claims are provided.

The basis

The unit is to be built on a steel structure, possibly a straight and solid basis, free of inequalities, which could be the cause of the disorderly placement of the frames. Equalization can be made by relevant underlays.

The steel construction or concrete basis must meet the requirements of the construction depends on statics calculation, acoustics and the correct drainage of condensate (from condensate trays.)

Especially for steel structures is monitored its own frequency of the underlying structure, which must have a sufficient distance from the frequency of the fan.

It is recommended to use underlays under the unit to control the transmission of vibration to the structure of the building.

After the establishment of the unit is necessary to remove all temporary transport components that prevents shifting or detaching rotating parts during transport.

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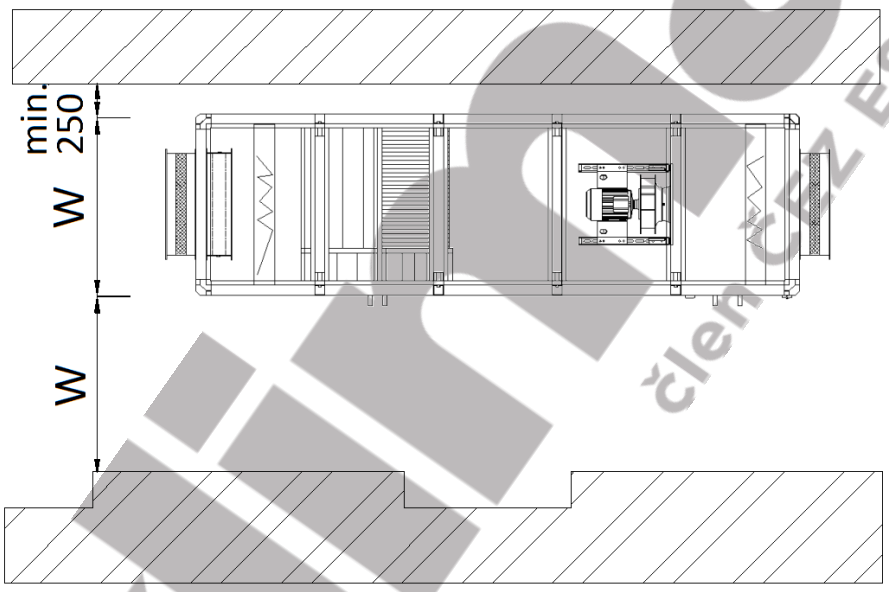
2.2.2. Service distances

In the case of placing units to machine rooms inside the buildings and in all other cases it is necessary to ensure sufficient free space around the unit for maintenance and service. Between the unit and the wall at the back of the unit, it is appropriate to provide the distance from the wall (or other obstacles) of approx. 600 mm (in CZ) for convenient connection of individual chambers from the outside, or approximately 250 mm in the case of the inner mergering of the chambers. From the side of the service is necessary to keep free space in front of the unit for maintenance and service of at least the width of the chamber according to the following drawing.



Service distance drawing

2.2.3. Unit construction and chambers connection

The unit consists of individual functional chambers, which are put together to form a functional unit, which fulfils the requirements of an air-conditioning system designer. Individual chambers are made of supporting frame consisting of aluminium shapes with chamfered angles, partitions and caskets from galvanized sheet and contain plants or mechanisms for air adjustments. The chamber frame consists of closed aluminium shapes with blunt edges, which are linked to each other by angles from aluminium alloy. The caskets are double cased and between these cases is placed mineral wool with thermo insulation and noise-reducing qualities. Thickness of the caskets is from 25mm to 45mm. The caskets are attached to aluminium frame by screws and gasketed on interfaces with the frame. In places where access is needed the caskets are attached by screws in plastic bushings from outside.
Individual chambers are linked to each other by connections and gasketed by flat seal on interfaces. Chambers can be assembled in one or two horizontal layers, the first layer of chambers is placed on a 100mm high aluminium frame with openings in the corners, enabling easier unit handling.

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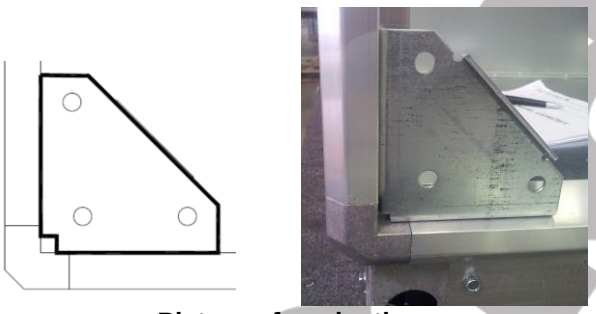
To make the service easier, the unit is equipped with inspection door in places where fans, filters, mixing dampers or other equipment require frequent check- up and service. The inspection door enable easy filter exchange during usual service and access to tightening belts of ventilators or enable the exchange of electric motors in case of breakdown. Moreover the caskets, which cover the exchangers with outputs outside the unit (water heater, water cooler etc.) are equally removable and so enable approach to the exchangers in case of their breakdown or replacement.



Picture of conjuction

2.2.4. Duct connection

Air ducts are attached on units via elastic cuffs, which are installed on suction and exhaust openings, with purpose to avoid the transmission of vibrations to the piping system. Connection of the air ducts must be done without stress, ie. mounting length of flexible cuffs must be shorter that its full stretched length. The optimum installation length is 100-120 mm.

Picture of elastic cuff and connection of air duct via elastic cuff

2.2.5. Equipotential bonding

Connections and grounding of the electric motor, other electrical equipment and all electrical installation must be carried out in accordance with the current normative provisions in relation to the environment and with regard to work safety and commissioning into operation. Assembly and installation work must be carried out only by a specialized expert with a valid permission.

All electrically nonconductive conductive connection must be bridged, ie. elastic cuff, rubber vibration dampers.

Grounding wire

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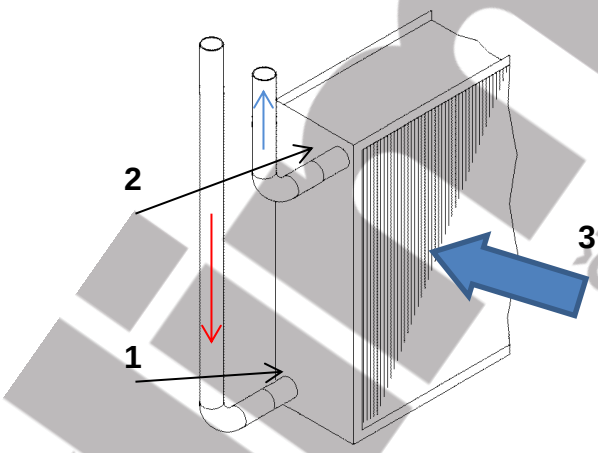
2.2.6. Connection of water heating exchanger

When connecting heating water piping (inlet and outlet), care must be taken to ensure that the inlet and outlet pipes are not confused, to maintain counterflow principle with water inlet on air outlet side). **Counterflow connection must be implemented.**

Instructions for heating water connection:

- When tightening the connections of the heat exchanger is required to hold down the throat of the heat exchanger with second key to prevent the transmission of torque on the body of the exchanger.
- All pipes must be fixed independently from the exchangers. Pipes with the heating water must not load the chamber units with its weight and expansion forces, or on the heat exchangers. Connections must be carried out so that the dilation from temperature of the pipe do not caused excessive load of connection necks.



1 – Heating water inlet, 2 – Heating water outlet, 3 – Directing of air

2.2.7. Connection of water cooling exchanger

When connecting cooling water piping (inlet and outlet), care must be taken to ensure that the inlet and outlet pipes are not confused, to maintain counterflow principle with water inlet on air outlet side). **Counterflow connection must be implemented.**

Instructions for cooling water connection:

- When tightening the connections of the cooling exchanger is required to hold down the throat of the exchanger with second key to prevent the transmission of torque on the body of the exchanger.
- All pipes must be fixed independently from the exchangers. Pipes with the cooling water must not load the chamber units with its weight and expansion forces, or on the heat exchangers. Connections must be carried out so that the dilation from temperature of the pipe do not caused excessive load of connection necks.
- Thermal insulation must be mounted up to the units wall, and ensure a moisture insulation.

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2.2.8. Connection of the condensate drainage

All unclosed drain connection must be fitted with a siphon (with a back-cap and automatic discharge). The height of the siphon is necessary to design with regard to the overpressure or underpressure in the air handling unit, so as to avoid intake or blowing air via connection to drainage pipe. Condensate must flow from drain siphon directly into the sink or floor drain.

Picture of condesate drain

The height of the siphon is determined by calculation or according to the table:

Underpressure in unit:

$$H_1(mm) = \frac{p}{10}$$

$$h(mm) = p \times 0{,}075$$

Overpressure in unit:

$$H_1(mm) = 35\ mm$$

$$h(mm) = \frac{p}{10} + 50$$

p – pressure in unit in Pascal (substitute always positive value)

	Total fan pressure [Pa]	Dimension [mm]	
		H	h
1	< 600	60	45
2	600 - 1000	100	75
3	1000 - 1400	140	105
4	1400 - 1800	180	135

Siphon shall be placed immediately on the drain pipe coupling and filled with water.

Before starting the air handling unit must all siphons be filled with water (not only for dry types), otherwise the condensate will flood the chambers!

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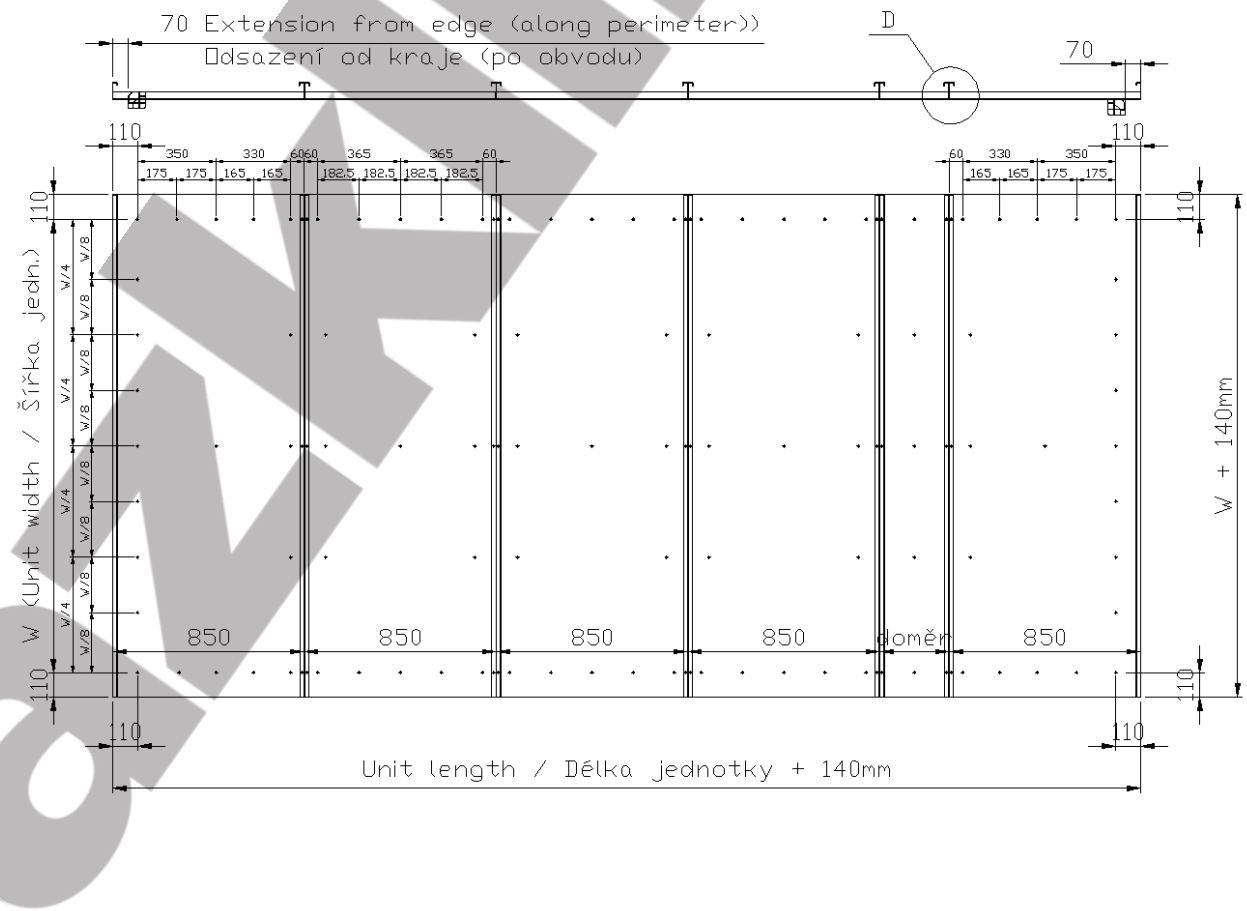
2.2.9. Electrical, measurement and control connection

All electrical devices embedded in the unit (electric heaters, motors, actuators, etc.) are assigned according to the instructions of manufacturers or under the valid normative provisions of the profession. Connection schemes of the electrical heaters and motors are listed on the labels.
Any grounding and equipotential bonding bridge needs to perform a check of the correctness of the connections.
All passages through the panels of the units should be sealed using doubleside glands of the corresponding dimensions.
All work on the electrical equipment must only be carried out by a specialized experts.

2.2.10. Units roof

Roof of ventilation units are mounted after the installation of the units in place. Assembly is carried out (if not agreed otherwise) by unit supplier, which is responsible for the quality of the implementation. Metal roofs are used for the lower unit series units and a plastic roof for the higher unit series.

Roofs of air handling units are mounted after assembly of units in place. Installation is performed (unless otherwise agreed) by unit supplier, which is responsible for the quality made. Metal roofs are used for lower unit series and plastic roofs for higher unit series. Metal roofs are fitted with self-drilling screws 4,8x19 with waterproof washer. On the one square meter is needed at least 7 pieces of self drilling screws 4,8x19 with a waterproof washer based on the static calculation. Individual components for roof units AZ KLIMA are supplied with a standard width of 850 mm.



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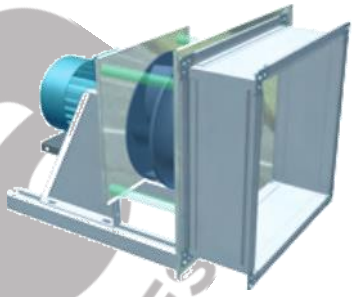
2.2.11. Installation of each section

2.2.11.1. The fan and motor

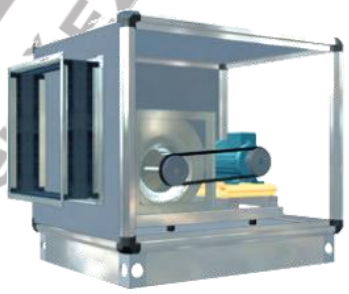


The fan chamber is used to transport the air. It used suction low or medium pressure fans with belt drive, or medium pressure impellers.

Direct drive
The fans impellers are statically and dynamically balanced directly by the manufacturer. The fan is powered by an electric motor. The impeller is located directly on the shaft of the electric motor.

The belt drive
Transfer the power force of the electric motor on the fan is solved by using belt drive and sheaves with interchangeable cartridges.

This drive is due to stress of belts and their maintenance always located on the service side.



Ventilator and electric motor are placed together on a frame made of aluminum profiles, which is separated from the actual frame of the chamber by vibration absorbers. The tightening of the belts is performed by shifting of the electric motor placed on diagonal aluminum profiles by pair of bolts.

A door equipped with closing, controlled by removable handle on the service side allows easy maintenance.

Fan speed control – ensures measurement and control

To control the electric motors are used frequency inverters according to actual need, located within reach of the fan chamber, it allows to control the speed of the fans. According to the cover of the inverter they are installed outside the chamber, inside the chamber or to the electric or MaC switchboard, where must be maintained the conditions required by the manufacturer (min. temperature, protection against weather, etc.) An alternative to the conventional motors are EC motors that have built-in electronics to control the required fan speed and do not require the installation of additional equipment for the control.

EC motors
Use effective electronically switched motors with permanent magnets, whose speed is controlled by an integrated driver.

Before putting the device into operation check and possibly remove the forgotten tools or other foreign objects and clean the dirt from the chamber.

2.2.11.2. Flaps

Flap section is used to regulate the flow of air or to the mixing of extraction and supply air and to closing of the unit using a regulation flaps. Regulation flaps are made of aluminum frame and aluminum profiled sheets or galvanized frame with zinc-coated sheets in the appropriate class of tightness. Plastic gears are hidden inside the profile and are protected against dirt from clogging of the air. For controlling the flaps are using actuators, or manual handles.

- Flaps controlled by the actuator are supplied with the free end of the shaft (cross-section 12x12mm).
- On the shaft of the flap is marked a line for orientation of the flap sheet. The position of the line and the sheet are parallel.
- For conjuction of the two flaps use the handle and the joints.

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- Before putting the flaps into operation it is necessary to try to remove the actuator and setting the end positions of the valve. It prevent its potential damage

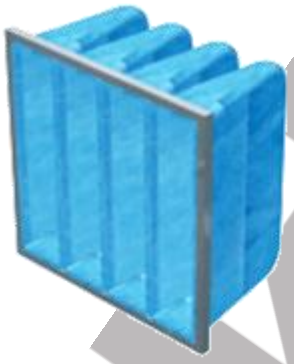
2.2.11.3. Filter

To capture the impurities contained in the transported air are fitted filters. These include filters, which can be:

- pocket
- pocket with pre-filtration
- cassette filter

According to the class of filtration you can choose pocket filters EU 3 to 9, pre-filters EU 2 to EU 5. The length of the filter chambers depends on the lengths of pocket filters, which are standard and 360, 500 and 630 and also depends on the class of filters. The recommended length of the filters is with regard to the class of filtration 360 for the EU 3, EU 4 and 630 for the EU 5 to 6.
Cassette filters, it is possible to deliver in the class of the filtration of the EU 3 – EU 4. Using of the pre-filter extends the life of pocket filter.
Filter and pressure meter (if included) are stored wrapped inside a filter section and fit to unit after installation and cleaning the whole of HVAC equipment

Installation
Filter and pressure meter (if included) are stored wrapped inside a filter section and fit to unit after installation and cleaning of HVAC unit.



Bag filter

Cassette filter

Grease filter

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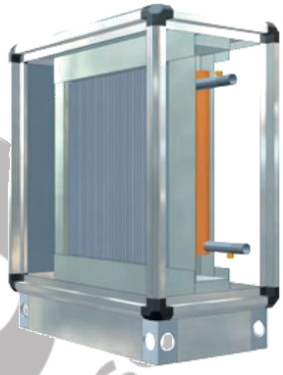
2.2.11.4. Water heater



Checking
It is necessary to perform a check of the connection of the inlet and outlet of heating water.

- Installation of temperature sensors is recommended into the profiles of chambers. Each created hole should be properly sealed.
- It is recommended to place the capillary sensor of freezing protection on metal parts of the output side of the heat exchanger.
- With protection against freezing must equipped all units, even those that are not in permanent use. The recommended way to protect heaters from freezing should be part of the realization project.

Filling
It is possible to fill the heater with specified liquid, in appropriate concentration stated in technical documents.

Venting of excessive air
Air heater must be carefully vented during filling at the highest point of the system by venting screw on the connection, or in case with the separate venting screw.
In case of poorly venting of the heater there is an air space, which leads to a reduction in performance and to corrosion.
It is recommended to use the vent kit (valve with hose).
If it is not fitted with a vent valve, it must be mounted on the highest point of the heating water inlet.

2.2.11.5. Electric air heater

Safety thermostat
Each electric heater must be equipped with an approved safety thermostat.

- Installation and wiring of electrical heaters must only done by person with suitable privileges and qualifications for this activity.
- Electric heaters specification, including electric connections are listed in the technical documentation of the heater, which is included in a plastic bag and comes with a heater.

2.2.11.6. Gas air heater

Each device must be equipped with an emergency switch and a safety thermostat.

Connection
All the necessary information for gas air heaters and burners used in HVAC units are listed in the technical documentation that is attached to each chamber with gas air heater.
Installation and commissioning must only perform professional person with a valid privileges and qualifications.

Flue exhaust
Part of the gas heating is the exhaust of the flue. This must correspond to the valid normative and legislative regulations.

2.2.11.7. Air cooler

Checking

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It is necessary to perform a check of the correctness of connection of the inlet and outlet of cooling exchanger.

- Installation of temperature sensors is recommended into the profiles of chambers. Each created hole should be properly sealed.
- It is necessary to fit syphon for condensate drainage.

It is possible to fill the cooler with specified liquid, in appropriate concentration stated in technical documents.

Venting of excessive air
Air cooler must be carefully vented during filling at the highest point of the system by venting screw on the connection, or in case with the separate venting screw.
In case of poorly venting of the cooler there is an air space, which leads to a reduction in performance and to corrosion.
It is recommended to use the vent kit (valve with hose).
If it is not fitted with a vent valve, it must be mounted on the highest point of the cooling water inlet.

2.2.11.8. Direct cooling

Safety instruction
Installation and connection of direct cooling must be perform with person with valid permission and qualifications for this activity. Attention - Avoid of staining skin by refrigerant!

Instructions for the connection of the direct cooler

- All pipes must be fixed independently from the exchangers. Pipes with the refrigerant must not load the chamber units with its weight and expansion forces, or on the heat exchangers. Connections must be carried out so that the temperature dilation of the pipe do not caused excessive load of connection necks.
- It is necessary to check the correct connection of the liquid and gas pipes of direct coolers
- It is necessary to fit syphon for condensate drainage.

2.2.11.9. Rotary heat exchanger

General instructions

- They are supplied assembled in smaller section sizes or as one part-section
- Large rotary heat exchangers are supplied disassembled into sections and installation of the together is provided by the manufacturer
- Assembling sections together is carried out by the manufacturer (unless agreed otherwise).
- In the case of the requirement for continuous speed regulation of the heat exchanger rotor is supplied the frequency converter. Instructions for installation and operation of the frequency converter is included with the product.
- After mounting of exchanger it necessary to perfom check, check alignment and settle the of sealing brushes along the perimeter.

2.2.11.10. Plate heat exchanger

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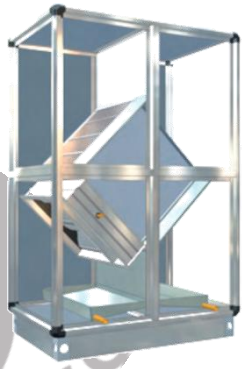
General instructions



- The section of plate exchangers in large sizes (designed in next to or above) are delivered in separated parts. All mounting material is included in the delivery (fasteners, pins, rivets, sealings, connecting sealant).
- Exchangers must be mounted directly on the construction site, it is not possible to handle with them after assembling. For the installation it is important to ensure sufficient space.
- Assembling sections together is carried out by the manufacturer (unless agreed otherwise). Plate heat exchanger is supplied with installation and operating instructions manual.

2.2.11.11. The moistening chamber

General instructions

- Basic and advanced accessories, recommendations and guidelines for the installation and operation of the devices are listed in the installation and operating instructions, which are attached to the product. In the case of the missing manuals is necessary to request at manufacturer.
- Specification about the water or steam moistening section are listed in the relevant documents of the manufacturer.
- Before commissioning, it is necessary to check the quality of fresh water and of the circulation water, so that the value of the quality of those operating fluids were in accordance with the requirements of the manufacturer of the device. It is recommended to perform the analysis of the fresh water, to avoid the high content of calcium and to keep hardness of the water in the desired range.
- Tube of steam humidifier is fitting through the hole in the panel on the side of the section. The required size is cut during installation.
- It is necessary that to fit drain tub and ensure drainage of the condensate inc, siphon.

3. COMMISSIONING AND OPERATION OF THE DEVICE

3.1.1. Fan and motor

Operation – direct drive

Before operation, check the connection of the wheel and the shaft. During the transport may appear change of the gap between the impeller and the flow nozzle change. Before commissioning, it is necessary to check the width of this gap.

Operation – belt drive

For belt drive should be performed checking and setting:

- belt stress
- the alignment of the pulleys

The maximum fan speed and the maximum nominal power of the motor must not be exceeded! (The values of the speed are listed for fans)

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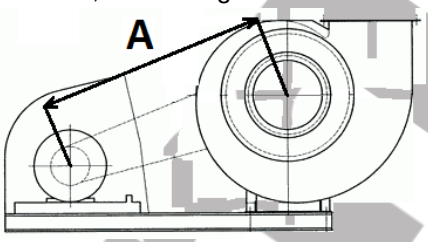
Determination of prestressing force for belt – belt stress

It is recommended to check belt stress set with the appropriate instrument (e.g. belt prestressing force measuring device.) Follow the instructions for the operation of the measuring instrument.
Procedure for determining the prestressing force:

- measure the distance between axis of pulleys (in metres)
- the distance of axis x16 multiply. The result is the deflection of the belt (S) in millimetres
- in the middle distance between axes (A) belt loaded with such force, in order to achieve the calculated deflection
- measure the deflection force

For new drives perform setting for the initial operation of the largest values. After a few hours of operation it is recommended to check deflection force, or set it again.



Drawing – Belt stress scheme

Warning:

The problems caused by insufficient belt stress:

- Excessive wear due to dropping the belt from the pulley groove
- Excessive operational noise
- Excessive belt vibration
- Excessive load

Problems caused by excessive belt stress:

- The increased load on bearings, shafts and on motor engine with shortening their life.
- Increasing load of all other components
- Increase of vibration and noise
- Excessive load

The direction of rotation

The correct direction of rotation of the fan according to the direction of the arrow. Check with short turn on of the motor. In the case of opposite direction of rotation of the motor it is necessary to change voltage phases.

Current consumption

Measure the power consumption of all three phases (when closed all service doors). The measured values must not exceed the nominal value of the manufacturer label and should not be different with each other. Also check the external pressure, the amount of air and the speed of fan.
If the phase current will vary, it is necessary to check the connection of the motor.

After commissioning into operation

After about 10 hours of operation it is recommended to:

- Tighten the belt.
- During tightening be careful on the exact axis alignment of the pulleys, or perform setting of them.
- Check the stability of fastening screws of impeller connection with the shaft, or tighten them

Work in the fan chamber

When working in the fan chamber, such as replacing the bearings, installation of impeller etc. It is necessary to follow the mounting instructions of individual manufacturers (if necessary, ask for

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instructions!). After finishing of work is necessary to check the speed of the vibration of the device and to assess with accordance to the relevant standards.

Shutdown of operation
When downtime is longer than three months, belts must be remove to prevent of local load of bearing. When prolonged downtime (for more than one year), renew the bearing before putting into opetation, or put off old grease of self-lubricated bearing and fill it with new grease. During these works, it is necessary to follow regulations of the manufacturer of the fan.

3.1.2. Flaps

Merged flaps
For merged flaps is necessary to check the join rod strength and check function, i.e. direction of rotation and end position of the flaps.
Furthermore, it is necessary to check the tightness of all screw and of other connections.

- Flaps are using as a smoothly controlled (with actuator) or fixed set (with actuator, or by using the lockable hand lever).
- Operationally they are very reliable, fault function can cause dust and exceeding of the recommended surface temperature of flaps, leading to damage of plastic drive gears of flaps blades
- Flaps with gear wheels don't grease with oil or grease (can cause dust seal)

3.1.3. Air filter

Before commissioning into operation
Before putting into operation, on chamber should be mounted mechanical pressure device and be filled with the antifreeze liquid that comes with a manometer (if included). By the supplier of measurement and controlling profession can be equipped with an electric differential pressure manometer.

Checking
Filters in the frame are mounted in the unit with fastening ties. It is recommended to check the air tightness of filter in the frame.

To check the state of cleanness of the air filter, it is recommended the installation of devices for measurement of pressure difference on the service side of the unit.

Recommendation
For the purposes of maintenance i tis recommended to provide a supply of spare filters, at least one set of spare filters.

Warning:
When fitting fabric pocket filters must not be change with the different length of the filter pockets (for shorter is less impurity collect, or the longer pockets can overlap into next chamber with the possible danger of clogging of the attenuator, or with the danger of ignition when it is close to the heater. The unit must not be turn on without installed filters!
Damages from the operation of the unit without the filters are not covered by the warranty conditions.

3.1.4. Water air heater

Before commissioning into operation

- Check the connection of the heating of the water in the exchanger, shut-off valves and anti-freeze function.
- Venting of heat exchangers repeatedly during commissioning.

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After commissioning into operation

- After putting into operation it is necessary to check the fittings, screws of flanged joint to airtightness, or tighten.
- When the outside air temperature is below + 5°C must be open inlet of heating water into the heater before running of fan. The temperature of the heated air before the fan, must not exceed + 40°C.
- The maximum temperature of the heating water is 80°C and steam 130°C, maximum operating pressure depends on the type of heat exchanger. All listed in the documentation from the manufacturer.
- When the fan stops shall be provided closing of heating water inlet.
- Heating water for water exchangers must not contain impurities causing fouling, especially products of corrosion of steel and iron parts. To prevent these impurities, it is necessary to use chemically treated water according to valid standards.

Warning: Do not exceed allow pressure level. It is necessary to avoid freezing the heat exchanger in the case of a power downline in the winter! The only reliable protection against freezing is to use antifreeze glycollic acid mixtures in the heat exchanger instead of water.

Due to the temperature of the heat transfer liquid (up to 90°C) before any maintenance is necessary to close the heaters of heating water inlets and let the heater cool down up to approx. 40°C so as to prevent burns.

Wrong connection of the exchanger (not in counterflow) has resulted an approximately 30% lower thermal output.

Anti-freezing protection of water heaters

- It is necessary to design heaters without unnecessary power reserves. In case of overcapacity it increases risk of freezing.
- Ensure backup electric supply for the connection of all devices including the system of measurement and control of anti-freeze protection.
- In the case of mixing outdoor and circulation before air heater it is necessary to bring the fresh air in the upper part of the unit, in the largest possible distance from the heater
- Water heater, which first comes into contact with the outside air, must have its own circulating pump, i.e. regulation of the temperature with constant waterflow. Stable nominal waterflow prevents of freezing during the short decrease of temperature of heating water beside to the values from the project, or when are different pressure losses of the waterways of the heater. Also the distribution of heat over the heater surface is more even.

Shutdown of operation

When prolonged downtime of operation, with regard to the risk of freezing, the air heater must be completely drain out. To do this, you must unmount all of the vent and drain bolts. At the same time it is necessary to draining of each heater with blow air (compressed air, fan, etc.), because in heater remains the rest of the liquid, which is a risk of freezing. Frozen heaters can lead to permanent damage to the heat exchanger.

3.1.5. Electric air heater

Electric heater can be operated only if it is available to check the airflow (fan is running). The flow of air can be control by the differential pressure measurement in the fan chamber i.e. sensor for monitoring the pressure difference.

It is recommended to use regulator to control the power of the heater, which has placed temperature sensors directly behind the electric heater in the direction of the air flow in fan chamber:
- set the maximum value of the temperature through the fan: 40°C
- set the maximum value for temperature behind heater: 70°C

- It is necessary to design regulation to ensure the possibility of switching on the electric heater after start the fan.

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- After switching off the electric heater it is necessary to keep the fan in operation for at least another 3 minutes, let it cool down to the heating elements. If failure to comply this condition, and damage done to the unit or any part caused by the accumulated heat, the manufacturer does not provide any responsibility for the damage or warranty conditions.
- Before commissioning, if pocket filters are before the electric heater filter, they must be checked for not to be in contact with electric spirals and are not damaged.

The electric heater must not be placed in an environment classified as danger of explosion, near an electric heater must not be stored in explosive and easily flammable substances. The electric heater must not be switched on without running the fan.

3.1.6. Gas air heater

Preparing for operation

Before commissioning perform:

- Venting of gas piping
- Check the status of the unit casing, tighten loose screws
- Check set values of the regulator – performs MaC:
  - Operating burner thermostat: approx. 70°C
  - Operating fan thermostat: approx. 40°C
  - Mounting the sensor 10 cm in the direction of the airflow behind the combustion chamber

Checking and testing

Checking and testing of regulation:

- Set the switch to position "Auto"
- Settings of the room thermostat to a value greater than the actual value
- Start the gas burner, heat up the combustion chamber
- When the set limit temperature of fan is 40°C, the fan must turn on
- When the set limit value for burner-heater 70°C, the burner must turn of. This temperature is possible to achieve with air throttling.
- When the temperature drops below 70°C, the burner is switched on and after drops below the set value 40°C, the fan turns off.
- The combustion chamber should be warm again without the fan running (e.g. by covering the inlet opening or the turn off the power supply). The burner must be turned off at a temperature of 100°C and combined controller must be blocked. If it does not occur automatically, use emergency stop switch of burner, replace regulator and do test again

The room thermostat should be set to the designed value, and it is necessary to perform the measurement of the exhaust gases emission.

Emissions must comply with the latest valid normative regulations.
All set values must be listed in the log and put into archive.

Operation

- Gas heater must not be switched on without running the fan. It is therefore important in state of design and installation of controlling. It is necessary to ensure the possibility of switching on the burner of a gas heater after starting of the fan. After turning off the burner of gas heater must be the fan keep in operation for at least another 10 minutes, to cool down the heat exchanger of a gas heating. In case of failure to comply this condition, and in case of damage to the unit or any part caused by the accumulated heat, the manufacturer does not assume any responsibility for the damage and does not provide any warranty.

The gas heater must not be placed in an environment classified as danger of explosion, near an gas heater must not be stored in explosive and easily flammable substances. The gas heater must not be switched on without running the fan.

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3.1.7. Air cooler

Before commissioning into operation

- Check the connection of the heating of the water in the exchanger, shut-off valves and anti-freeze function.
- Venting of heat exchangers repeatedly during commissioning.

After commissioning into operation

- After putting into operation it is necessary to check the fittings, screws of flanged joint to airtightness, or tighten.
- Cooling water for water exchangers must not contain impurities causing fouling, especially products of corrosion of steel and iron parts. To prevent these impurities, it is necessary to use chemically treated water according to valid standards.
- Maximum operating pressure depends on the type of heat exchanger. All listed in the documentation from the manufacturer.

Warning:
Do not exceed allow pressure level. It is necessary to avoid freezing the heat exchanger in the case of a power downline in the winter! Filling and venting must follow the manufacturer's instructions. In the case of the use of brine, prevent from direct contact! Danger of chemical burns!
Protection against freezing of exchanger

- It is necessary to install the heat exchanger for air cooling after the air heater, otherwise there is a danger of frost coolers and irreversible damage. The manufacturer does not assume any responsibility for the damage and does not provide any warranty.
- In the case that in unit is only cooling section, follow instructions below.

Shutdown of operation

- When prolonged downtime of operation, with regard to the risk of freezing, the air cooler must be completely drain out. To do this, you must unmount all of the vent and drain bolts. At the same time it is necessary to draining of each cooler with blow air (compressed air, fan, etc.), because in cooler remains the rest of the liquid, which is a risk of freezing. Frozen cooler can lead to permanent damage to the heat exchanger.

Shutdown of operation

- **The operator personal is committed to check the siphones and their filling at least twice a year, in particular, their patency and leaks. The tightness of the underpressure siphons and their connection on unit incl. fitting of marble.**
- **Siphons are used individually for each chamber. Never combine drainage from several together and then into the one siphon!**
- **The pipeline for a single siphon must be led to outside after maximum 1m (e.g. ended above drainage gully, where condensate will flow). It must not be connected directly to the sewerage – venting must always be ensured.**
- **Condensate siphons outlet pipes can be combined into one pipe. This pipe length must be a maximum of 1 m and ended to the drainage (must not be connected directly).**
- **Siphon must always be fitted on prepared connection for condensate drain.**
- **In the winter period must be ensured at tempering of condensate pipeline including the siphons, for freeze protection, e.g. heating electric cables.**

3.1.8. Direct cooling

General statements
The following instructions are only general statements and without warranty to completeness. **In any case, it is necessary to keep and follow the individual operating and assembly instructions. In case that they are not included, you must request it at manufacturer!**

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Conditions for warranty

A general condition for the warranty is the conclusion of a service contract with a qualified professional company in the field of cooling and establish proper maintenance include relevant protocols.

Commissioning into operation

Must comply with all site requirements such as accessibility, finished assembly of the unit and air ducts and preparation of the required media and devices. Furthermore, it must be appropriate surrounding conditions for operation of the device.

Operation of direct cooler should be together with running of the fan, in order to avoid of freezing of unit during downtime of the fan. The failure can cause freezing of the next water heat exchanger!

Installation and connection of direct cooling must be performed only by specialized person with permissions and the qualifications for this activity.
When handling refrigerant follow current existing valid legislative and normatives about the protection of the environment.

3.1.9. Rotary exchanger

Before commissioning into operation

- It is necessary to ensure that no items will blocking running rotor
- Check the adhesion of sealing bars that must be moved as close as possible to the acumulation area, also must be preclude direct abrasion
- Open the revision opening and check whether the belt is sufficiently stress, if needed shorten: open lock, reduce the belt length, close the lock then close the revision opening.
- Put motor into operation – follow instructions for the operation of the rotor and its regulation.
- Check the direction of rotor rotation (by arrows), or change phases connections.

General operating instructions

- The Rotary heat exchanger section has its own installation and operating instructions included with the product. Or, it can be from the manufacturer on request.
- It is necessary to follow instructions for setting the maximum speed and pressure loss, in order to prevent displacement of the wheel of the rotor and subsequent abrasion of the sealing brushes.
- Wheel of rotating heat exchanger must rotate during operation.

3.1.10. Plate heat exchanger

Before commissioning into operation

- Check for presence of foreign objects and impurities from construction site, which might must be cleaned.
- Check the tightness of the connection to next chamber
- Orientation of by-pass flap blades is marked by guideline on the shaft. The position of the guideline and the flap blades is parallel.

Plate exchanger does not have specific requirements for the operation except the occasional blow plates with compressed air.

3.1.11. Moistening chamber

General operating instructions

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- Temperature resistance (90°C permanently, 110°C ocasionally)
- Before putting into operation it is necessary to read installation and operating instructions, included with device
- Before putting into operation must be checked whether the chamber is clean inside or no objects were forgotten inside the chamber. Dirt must be cleaned and must be the eliminated any pollution in chamber, in order to avoid damage of the pump. In case of visible pollution and failure of the pump, no manufacturer's warranty cannot be use.
- During the operation of the steam humidification must be ensured the delay between turning off the humidifier and the fan for at least 3 minutes to ventilation the chamber.

Warning:

- Run the pump without load is not allowed!
- At temperatures lower than 5°C is recommended to ensure the installation of equipment by the manufacturer or by autorized company.
- During maintenance of steam generators is not allowed to emit acid steam, or other cleaner into the air handling unit!
- Evaporating humidifier must be installed, operated and maintained in accordance with the installation and operational instructions of the manufacturer. Otherwise, the contamination could occur situation, which could cause the spread of Legionella.

- To prevent water stagnation and bacterial contamination should always be evaporating humidifier switched on continuously. In case of switch the system is off for a longer period of time, pipes should be disinfected, including risk assessment, in order to ensure safe operation.

3.1.12. Measuring and controlling (MaC)

General instructions before commissioning into operation

- All required conditions for construction site must be kept for the commissioning into operation: access to devices, finished installation of units, distribution installations and must be ensured supply of needed media.
- Device must be able to operate in the required operating conditions for the operation of the HAVC device (operating points of the device)
- Commissioning into operation must be performed by a qualified professional of MaC. The workers that will be putting the device into operation, must have instructions about local issues in advance, this will ensure the person named by the customer.

It is recommended to perform following works:

- Check the peripheral devices for correct installation
- Check the connection between switchboard and peripherals
- Check the function of the sensors, transducers, transmitters and other elements of the regulation
- Configure the regulators. complete and install the relevant programs
- Put into operation together with the related controlling systems.
- Set parameters according to operating conditions of equipment, settings, and control according to the required values and constants.
- Check the control system.
- Make a backup of the settings of the entire controller device and pass a copy to the customer.
- Train maintenance personal named by customer during commissioning into operation.

4. ENVIRONMENTAL PROTECTION

- Dispose of all packing materials considering safety of the environment.
- Packaging materials of cardboard can be turned in for recycling.
- Defective or disposed electrical devices must be left at appropriate collection points.
- In the cooling devices may be used only by authorized refrigerant, which is safety to the environment

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- Take care during handling with refrigerant, follow valid normatives and legislative provisions about the protection of the environment.
- The assembly organization is responsible for compliance with the valid normative and legislative provisions about protection of the environment. Compliance with these regulations is obligatory for both the assembly organization, so for a subcontractor.

5. WARRANTY

- Warranty is included in purchase contract (see General business and delivery conditions) and is valid only when following conditions listed in this manual.
- Subject of the warranty are NOT:
    - Heat exchangers damaged by frost
    - Clogging, spent, reared filters
    - Transfers of fans damaged by operation in the non set state.
    - Casing damaged by corrosion, if the roof has not been installed by a professional assembly company in accordance with the assembly and operating instructions.
    - A white layer of zinc oxide is on the surface of galvanized parts.
    - Further damage of HVAC units or chambers and their parts due to improper assembly or operation and maintenance in conflict with this installation and operational manual.
- In the case of recognised claim where there is no sure of the transport route for most of the spare parts (or non-compliance with the recommended service distance from the HVAC equipment) only material warranty is held without the right to make the exchange of spare parts.