Installation and Operation Manual

- OPTIMA (universal sectional device)
- OPAL (suspended device)

DTR ver.: 01/2018

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1. GENERAL INFORMATION

The following Operation & Maintenance Manual is related to the air handling units manufactured by Clima Gold.

The installation of the AHU, connection of technical systems to the appliance, commissioning, operation and maintenance must be performed in accordance with regulations and directives which are in force in the country where the unit is installed.
The O&MM should always be available near the unit and easily accessible to all maintenance services.

! **The user must read and understand the following manual and install and operate the unit in accordance with the safety requirements in order to use the unit properly and safely. The user must read and understand the documentation supplied by the manufacturers of subassemblies installed in the unit such as the automatic control system, heating unit, burners, embedded cooling system, and humidifier.**

! **Only properly trained personnel should conduct individual stages of operation, from transport to the place of installation to operation and maintenance.**

! **Start-up, operation and maintenance works shall be performed by personnel with appropriate technical education and legally required qualification certificates.**

! **Damage and failure of the unit resulting from inappropriate transport, installation, operation and maintenance cause the warranty to become null and void.**

! **Prior to commencing any maintenance, ensure that the unit has been disconnected from the power supply and the main switch has been set to "OFF" position and properly locked against unintentional or unauthorised use.**

! **CAUTION! MOVING PARTS**
Moving parts are present in the unit (such as the fan rotor). Contact with such elements may cause damage or serious injury. Do not begin any maintenance works until all moving parts have stopped.

! **CAUTION! SHARP OBJECTS**
Sharp objects are present in the unit (such as heat exchanger fins). Contact with such elements may cause injuries. Special care should be taken. Use protective equipment.

! **CAUTION! MOVING PARTS**
Hot parts are present in the unit (such as heat exchangers, heaters, motor casing). Contact with such elements may cause burns and other injuries. Special care should be taken. Do not begin any maintenance works until all parts have cooled down to at least 40°C.

2. INTENDED USE AND MACHINE STRUCTURE

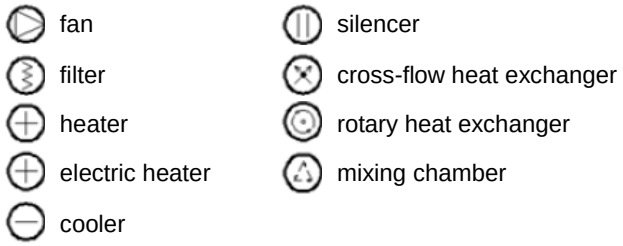
2.1. Intended use

The "OPTIMA" air handling units and "OPAL" suspended air handling units have been designed to provide thermal comfort in various types of human occupied spaces (hotels, restaurants, hospitals, swimming pools etc.) and industrial spaces (storage, warehouses, industrial halls etc.). The required comfort is provided, depending on the needs, by proper air processing (filtering, heating, cooling, humidifying or drying). At the same time, thanks to the application of modern solutions in our products, the processes are accompanied by effective heat recuperation.

"OPTIMA" air handling unit

"OPTIMA" air handling units are modern sectional appliances designed to operate in ventilation and air conditioning systems. Their sectional structure allows us to build a unit with an optimum configuration for a given system, both in terms of external dimensions, assemblies and functions that the unit will perform.

Individual air processing sections in air handling units are marked with graphic symbols located on their access doors and covers on the service side. The sections' graphic symbols are presented below.



Due to various applications, the following types of air handling units are available:

OPTIMA (standard)

Designed for operation in various types of buildings in order to provide appropriate ventilation and air conditioning in premises. The units are built in typical configurations using standard solutions used in a wide spectrum of applications.

OPTIMA KRYSZTAŁ (hygienic)

Designed for operation in hospitals, laboratories, pharmaceutical plants, food industry and other structures requiring "clean rooms".

OPTIMA TURKUS (for swimming pool)

Swimming pool air handling units designed to provide comfortable climatic conditions (temperature and humidity) in swimming pools.

OPTIMA TOP (without ducts)

Heating rooftop air handling units without ducts, designed for heating of large buildings such as production halls, exhibition areas, commercial and storage spaces as well as sport halls.

OPTIMA SPEC (special)

Air handling units built on order to the customer's specification, delivery flow rate over 71,000 m^3/h, with non-standard dimensions etc.

OPAL (suspended air handling units)

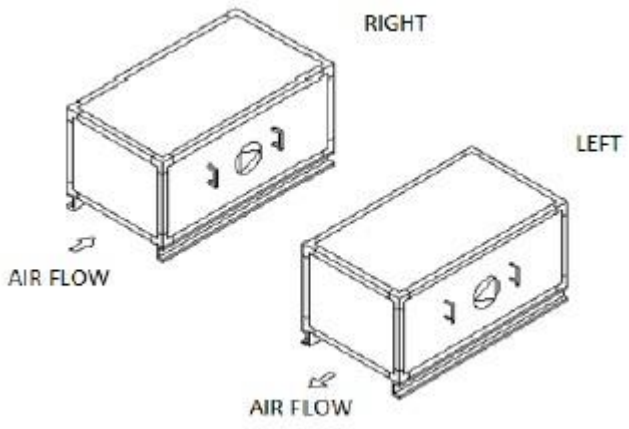
"OPAL" suspended air handling units are designed for use in small and medium facilities such as restaurants, cafes, pubs, stores, cinemas, hotels or offices.

Each of the units listed above (apart from the TOP rooftop unit) is designed for indoor installation, in places where they will not be subject to adverse weather conditions, where there is no explosion hazard and with normal dust concentration. Rooftop units are designed for outdoor installation.

In the case of one-way airflow units (intake or exhaust only), the facility should be equipped with an appropriate intake/exhaust system in accordance with the ventilation system design. An inappropriate compensatory system or the lack of it may cause significant pressure differences between rooms.

2.2. Design

"OPTIMA" air handling units consist of sections performing various functions installed on a common frame in various configurations depending on the requirements, forming together a single, coherent unit. The external casing is formed on a self-supported frame made of aluminum sections joined with plastic elements. The walls and access covers are made of galvanized steel sheet (varnished, acid resistant finish is also available), insulated with mineral wool (or polyurethane foam) in standard thickness of 50 mm. The units are manufactured in two versions depending on the access side (left or right).



All air handling units are equipped with multi-leaf dampers and flexible connections. Air handling units with a drip tray shall be equipped with a condensate traps for removing condensate. In addition, outdoor (rooftop) air handling units are equipped with an additional varnished steel roof, air intakes with droplet eliminator and air exhaust.

The unit's structure is positioned on a 120 mm high frame made of galvanized steel sections or foundry sections. The frame has openings which facilitate the transport and anchoring of the unit.

"OPAL" suspended air handling units are available in two variants: compact, single component units and sectional units, which allow for easy installation and disassembly of the unit's components. The casings of both types of units are based on a light self-supporting panel structure insulated with a 50 mm (other thicknesses are available as well) thick layer of mineral wool dampening all noise. In order to facilitate access during repair and maintenance access panels are installed on the top or on the bottom of the unit (depending on the unit's place of installation). The air handling units are equipped with dampers and flexible connector pipes.

"OPTIMA TOP" rooftop air handling units without ducts are designed for ventilation and heating of large and open rooms, i.e. without partition walls, such as production floors, warehouses, sales halls, gyms. Usually it is unfeasible or very difficult to install a typical duct-type ventilation system. In order to use OPTIMA TOP equipment, the room must be located directly under the roof of a building (single-floor building, the last floor of a multi-floor building).

An air handling units without ducts consists of two combined units:

- external unit (SD) installed on the roof of the building,
- internal unit (SW) [ceiling-mounted] located inside the ventilated room.

The unit can be equipped by Clima Gold with an automatic control system consisting of the following elements:

- intake, exhaust, recirculation damper actuators,
- swirl air vent cylinder (option)
- pressure switches of intake and exhaust filters
- pressure switches of intake and exhaust fans (when using a fan with belt drive in units with an electric heater),
- inverters for plug-in type fans (optional for fans with belt drive),
- temperature sensors: ventilation, room, outside temperature,
- heater return pipe and/or frost protection thermostat temperature sensor,
- three- way valve with actuator,
- electric supply and control cabinet.

The automatic system maintains a desired temperature in the room by controlling the heater recirculation.

Depending on the conditions, the device may operate in the following modes:

- full recirculation with heating – e.g. at night when no fresh air is needed,
- ventilation without recirculation and heating – when no heated air is needed, 100% intake air is fresh air.
- ventilation with recirculation without heating - operation of the device without the heater on. The supply air temperature is controlled by the degree of supply air recirculation. The amount of recirculation air is limited in such a way as not to exceed the minimum amount of fresh air in the supply air,
- ventilation with heating and recirculation - operation of the device with the heater on, with the minimum amount of fresh air.

A detailed description of the device operating modes can be found in the technical and operational documentation of the device automation.

3. TRANSPORT, STORAGE

! **Any damage caused by inappropriate transport, unloading or storage are not covered by the warranty.**

The unit's sections are protected with plastic film during transport.

! **Packaging elements (plastic film, tape, nails, etc.) are potentially dangerous. After use, they must be disposed of in accordance with applicable law.**

The units should be transported in the position in which they will be installed for operation.

! **Unloading of the units from the vehicle and their transport on the worksite must be performed according to the usual OH&S regulations.**

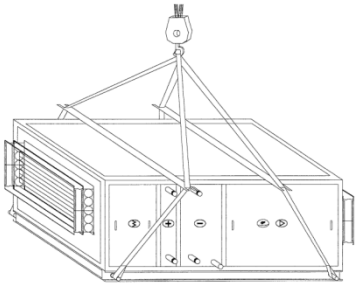
Depending on the dimensions and weight of the unit use a crane or a forklift. Before lifting the section, make sure that the forklift's fork is long enough. Do not transport the sections when bolted together.

During transport, do not lift the units using connector pipes or cover plate latches and handles. The units may be stored and transported in one layer only. It is strictly forbidden to place any additional elements on the units.

Data regarding the dimensions of units are attached to the O&MM.

Directly after the delivery to the final destination, check the condition of the packaging and the product itself as well as all attached documents.

Lifting the air handling unit using a crane.



Before lifting the unit check its weight and the strength of the cables. For transport with a crane use the openings or lugs installed in the longitudinal frames and use protective struts for the unit casing.

The length of the struts must exceed the width of the transported section. During transport of the rooftop air handling units the struts must extend beyond the contour of the unit's roof.

It is best to store the units' components in their original containers in dry spaces protected against precipitation. The maximum relative humidity may not exceed 80% at 20°C; the ambient temperature should not be higher than +40°C or lower than -20°C. In the case of elements requiring a different scope of storage temperature this information is submitted to the customer prior to delivery. If elements have been kept in storage for longer than 1 year, check the fan bearings for ease of rotation (rotate by hand).

All appliances should be protected against access of dust, gas, fumes and other chemical substances which affect the materials of which these elements are made of.

INSTALLATION, CONNECTION OF UTILITIES

! **Installation and electric works may only be performed by appropriately educated and trained personnel following the respective regulations as well as manufacturer's recommendations.**

3.1. Air handling unit Room

Leave free space on the service side of the unit, wide enough to allow for ongoing maintenance and opening access covers. The access zone may be shared by neighboring machines. No systems located around the unit should block access to the machine. The unit's location in the future air conditioning plant room should include the following dimensions required for access:

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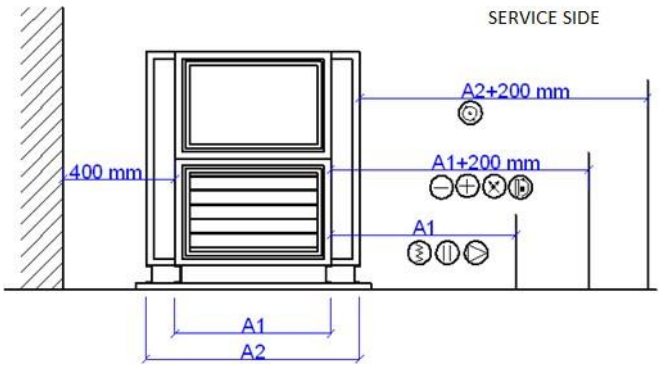


Figure 1. *Example access dimensions for air conditioning plant room planning*

3.2. Foundation

The air handling unit shall be placed on a horizontal surface with load bearing capacity appropriate for the weight of the device. The foundation must be levelled – the acceptable deviation from level is 1 mm/m and the acceptable deflection of the foundation is 1 mm/m. It is advised to use a foundation underlayment, a steel frame inside the concrete floor or a specially prepared steel structure. Such solutions should provide linear support for the unit (frame supplied by the unit manufacturer).

Place rubber straps below the unit frame to provide acoustic and vibration insulation.

The height of the foundation or frame must allow for the use of a condensate trap for the removal of condensate from the cooler drip tray. For a typical trap this height is about 150 mm. If this clearance is smaller the unit should be placed on an additional foundation or a pit must be prepared directly below the condensate trap.

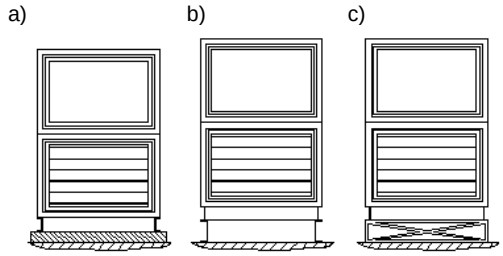
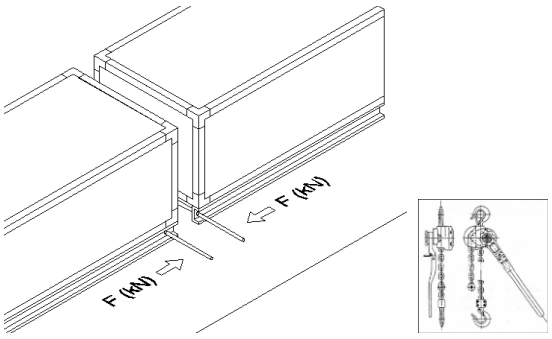


Figure 2. *Various ways of positioning the air handing unit:*
a) concrete foundation, b) steel frame in concrete floor, c) special steel structure

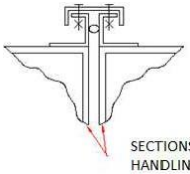
3.3. Joining the sections of the air handling unit

The sections of the unit shall be joined in the following order:

- Place individual parts of the unit as specified in the attached dimensioned drawings on the previously prepared foundation.
- Remove packaging and transport elements (if present).
- Apply adhesive seal along the edges of the places of contact between sections of the unit (the seal is supplied with the product).
- Align the sections vertically and horizontally.
- Pull the neighboring sections together using e.g. a pull hoist, and using lugs as shown in the picture below.



- Join the sections together using the supplied joints.
- Anchor the unit in a way that prevents any movement of individual sections.
- In the KRYSZTAŁ air handling unit the joints between individual sections must be sealed from the inside using silicone.
- Place the joints on the roofs of rooftop units and bolt them to the roof sections using self-tapping metal screws.



3.4. Installation of the suspended air handling unit

The air handling unit shall be installed in a way that enables connection of related systems (ventilation ducts, pipes, cable trays) that do not collide with service covers. In order to facilitate effective installation, operation and maintenance of units and replacement of parts and subassemblies in the case of a failure, provide necessary distance between the service side and permanent objects (such as walls, load-bearing pillars, joists, etc.). Such necessary distance is related to the external dimensions of the supply fittings (heaters and coolers) as well and it should not be lower than +100 mm.

The air handling unit is installed using brackets fixed to the sides of each section (fig. 3). The brackets are fixed to the ceiling or to a supporting structure using M8 threaded rods. The rods must be vertical and located directly over the brackets mounted to the unit. Using M8 threaded rods enables quick and easy installation and levelling of individual sections of the unit (M8 threaded rods, nuts and anti-vibration joints – absorbers – are not included in the scope of delivery).

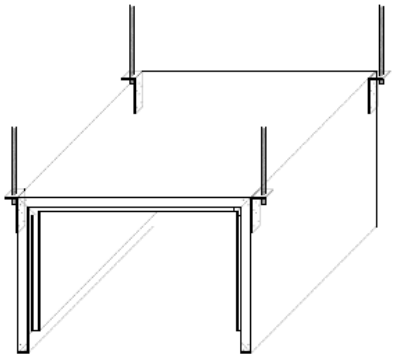


Figure 3. *Fixing OPAL unit to the ceiling*

When installing the unit:

- place an absorber between the bracket and the nut – it will prevent transferring vibrations form the unit to the supporting structure.
- level the unit – it will enable proper operation of the fan assembly and prevent premature wear of the rotor bearing.

3.5. Installation of the switchboard

The switchboard is a very important part that enables the user to control the device. Therefore, its appropriate location is of great importance. The switchboard features a controller and electronic subassemblies that enable the unit to operate. The user shall have unobstructed access to the switchboard. It should be located near the controlled device at a height enabling easy access to the controller and the switches on the switchboard door. Unless the operation and maintenance manual supplied with the unit automatic control system provides otherwise, the switchboard shall be installed indoors, in a dry and ventilated place, and at temperatures ranging from 5°C to 30°C.

If the above requirements have been met, the switchboard can be installed (suspended) on the unit, but it must not hinder its operation. The maintenance personnel must have access to all individual subassemblies of the unit. Sufficient space must be provided for the disassembly of parts. If the switchboard cannot be installed in an accessible location, the controller shall be equipped with an additional referencing unit enabling operation of the controller and the indicator lights should be moved from the switchboard door to a visible location. The switchboard shall feature the following indicator lights:

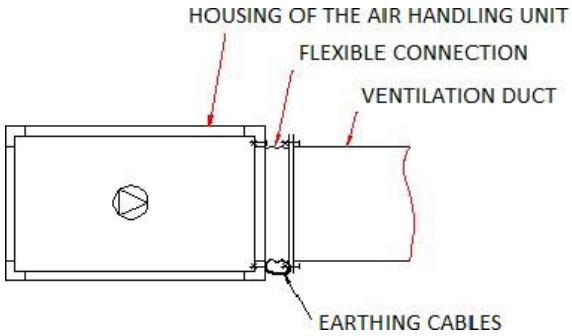
- Power
- Running
- Failure
- Requiring filter replacement

The device can continue operation when filter limits have been exceeded. However, due to increased resistance of airflow, energy consumption by the fan assemblies increases. Prolonged use of a worn filter may cause damage to the device.

Regular filter replacement reduces energy consumption.

3.6. Connection of ventilation ducts

Connect the ventilation ducts to the air handling unit flexible connections located on the intake and exhaust openings. The flexible connection may not be over-extended – the length of the connector after installation must not exceed 0.5-0.9 of their length in the fully extended position. Connect the flanges of the connector pipes and ventilation ducts using bolts located in the corners. In the case of larger diameter components, use additional clampings on the flange profile. The ventilation ducts should not transfer any loads to the air handling unit casing. It is advised that they rest on their own supporting structures. In exceptional cases it is allowed to support ventilation ducts with the unit casing in a way that does not allow for the transfer of vibrations.



Connect the earthing of the ducts to the unit earthing using the earthing cables located next to the flexible connector pipes.

If the device is not used for a longer period (e.g. the device is put aside, long period from installation to start-up) and it is located outdoors or in a room where the temperature is lower than in the ventilated room, the user must prevent air migration (through intake and exhaust ducts) from the room to the device.

3.7. Connection of heaters and coolers

The supply and return pipelines of heat exchangers should be connected in a way that allows the heat exchanger to work with counter-flow i.e. with the medium in the heat exchanger flowing in the direction opposite to the airflow direction. The supply system should be connected in such a way as to avoid any stress on the connector pipes of heat exchangers. The supply system should self-compensate. When bolting couplings to the heat exchanger connector pipes, secure the connector pipe with a wrench. The installation method should allow for easy disassembly of pipelines so that it is possible to remove the heat exchanger from the air handling unit for maintenance or repair.

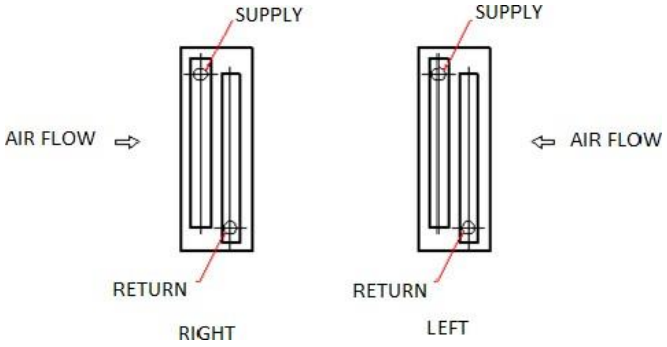


Figure 4. *Connection of a water heat exchanger*

The heat exchanger shall be supplied with a medium of parameters and flow rate as specified on the unit data plate in order to ensure required efficiency.

The water heater should be equipped with frost protection. If the medium temperature after leaving the heater drops below 5°C or the frost protection thermostat detects air temperature below 6°C, the operation of the air handling unit should stop. The control system should provide maximum supply of the heating medium until the heat exchanger temperature rises to a required level.

All details related to the settings and operation of the heater protection system can be found in the operation and maintenance manual of the automatic control system.

CAUTION!
Lack of proper freezing protection system will cause the warranty to become null and void.

If the heat exchanger may come into contact with air temperatures below 5°C while the device is not used, it must be drained of water in order to avoid any damage caused by freezing. Water draining is performed by opening the drain stub pipe and the air vent at the same time. When tightening the bolts, pay attention not to damage the seal. Excessive tightening force of the drain stub pipe/air vent may cause them to leak.

The cooling sections are equipped with droplet eliminators preventing water drops from entering other sections of the unit. Pay attention to the proper positioning of the droplet eliminator in relation to the air flow direction, so that the droplet eliminator is positioned behind the cooler and its blades are properly mounted in their sockets in the frame.

3.8. Connection of the heating medium to water heaters

Recommendations for supplying the heat exchanger with the medium.

Heaters are vital parts of air conditioning systems. Proper selection of their size and effective use of heat supplied to heaters affect investment and operation costs. Therefore, smooth adjustment of power supplied by heaters is of great importance.

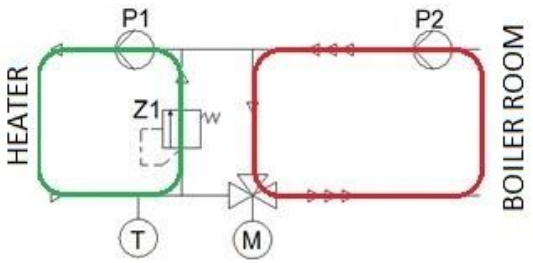
Adjustment of heater power to current needs of the air-conditioned room largely depends on the method of supplying the heating medium to the heater. Two main adjustment methods are distinguished. Quantitative adjustment mans that medium of constant parameters is supplied to the heater while its amount is adjusted. The other type is qualitative adjustment – the same amount of the medium is supplied to the heater, but its temperature is adjusted. Both methods require a three-way mixing valve with two inlets and a single outlet. Depending on the opening level, the medium can flow from inlet A to outlet AB (closed valve), from inlet B to outlet AB (open valve), or from both inlets A and B to AB outlet, while the amount of the medium is adjusted by the opening level. **The valve must not be used as a divide valve.**

Recommended connection of the heating medium to heaters.

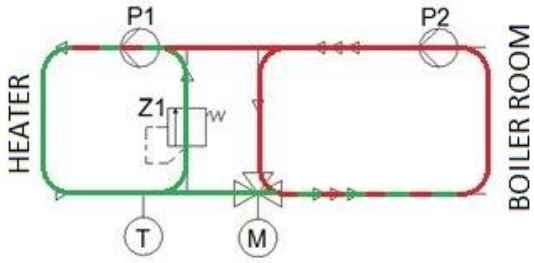
Injection system with a small circuit equipped with an additional circulation pump.

Such a method is characterised by very precise adjustment of heater temperature by opening the mixing valve partially. The heater is supplied with an exact amount of the medium necessary at the moment. As a result, the temperature of medium returning to the boiler room is as high as possible, reducing the cost of reheating.

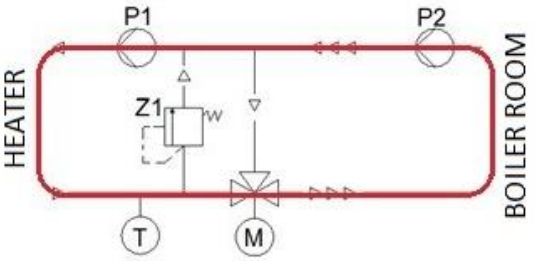
- **Closed valve**
  Into two subcircuits. The temperature of the medium in the heater is sufficient to maintain proper temperature in the room – consequently, the heating medium from the boiler room goes back to the boiler room immediately. As a result, the difference between the inlet and outlet temperature in the boiler room is very minor.



- **Partially open valve**
  High-temperature heating medium enters the small circuit, enabling very precise adjustment of the heater temperature and minimising the medium heating costs.



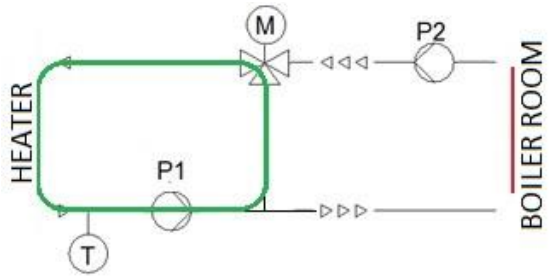
- **Fully open valve**
  The heater temperature is equal to the temperature of the medium in the system maximum heater power



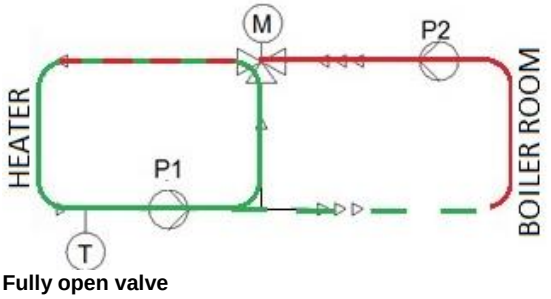
Acceptable connection – Mixing system with a small circuit pump.

This system is very similar in operation to the system described in first section (injection system). However, when the valve is closed in this system, the medium does not flow in the boiler room circuit. We do not recommend this type of connection. The heating medium does not flow in the large circuit and its temperature drops. When the valve is opened, low-temperature medium is supplied for some time. The decrease in temperature depends largely on the connection length, thermal insulation, and the period of closure. Due to the low temperature of supplied medium, the heater may cool down first after the valve has been opened, causing cold air to be blown into the room. This prolongs the time necessary to reach the set temperature and requires more effort of the control system.

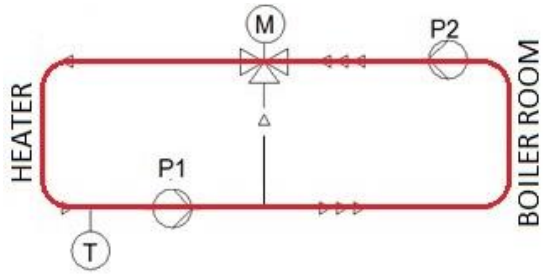
- **Closed valve**
  Small circuit pump ensures constant flow of the medium in the heater. The temperature of the medium in the heater is sufficient to maintain proper temperature in the room. The divide valve separates the medium in the small circuit from the medium in the boiler room circuit.



- **Partially open valve**
  Heating medium enters the small circuit where it mixes with the medium in the heater. The temperature of the medium in the heat exchanger increases, enabling the system to maintain set air temperature.



- **Fully open valve**
  The heater temperature is equal to the temperature of the medium in the system – maximum heater power..



Acceptable connection – Dividing system with a mixing valve without a small circuit pump

This connection method enables temperature adjustment using the flow of the heating medium through the heater. In this system, the heater is supplied with heating medium of constant temperature from the boiler room. The temperature is adjusted by controlling the amount of supplied medium. In this case, the valve does not mix cooled medium returning from the heater with warm medium supplied from the boiler room before it reaches the heat exchanger – this is unfavourable taking into consideration the temperature stabilisation in the air handling unit. The controller adjusts the air temperature by controlling the amount of medium supplied to the heat exchanger, but adjustment of the opening level is more time consuming.

- **Closed valve**
  The heating medium from the boiler room is immediately directed to the boiler room. Therefore, the difference between inlet and outlet temperature is very minor.
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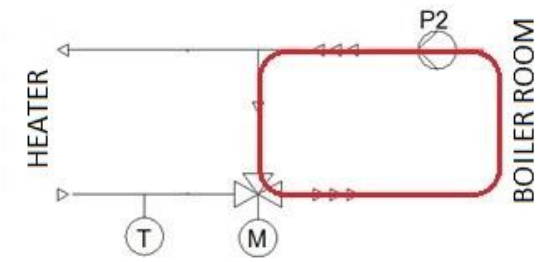
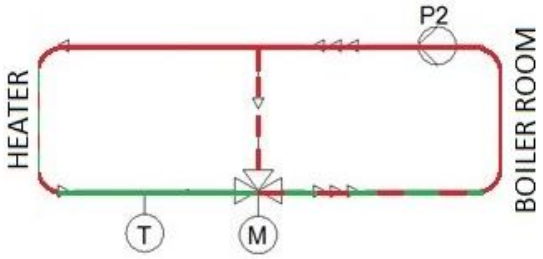


- **Partially open valve**
  The heater is supplied with heating medium of constant temperature and adjustable amount controlled by the valve opening level.



- **Fully open valve**
  All heating medium flows to the heater – maximum heater power.

3.9. Condensate removal

Condensate trays are located in the following sections: cooling, cross-flow and counterflow exchangers, heat pipe, extraction exchanger in the heat recuperation systems with medium (CZP), humidifying, mixing chambers (optional). The trays are equipped with connector pipes that remove condensate from the air handling unit. Each connector pipe should be equipped with a trap which allows for the removal of condensate from the unit and prevents the flow of air through the condensate removal system (negative pressure when the tray is located on the fan intake side, and positive pressure if the tray is located on the fan exhaust side).
The trap should always be filled with water.

Each condensate connector pipe or overflow pipe must have its own trap. It is not allowed to connect several connector pipes to one trap.

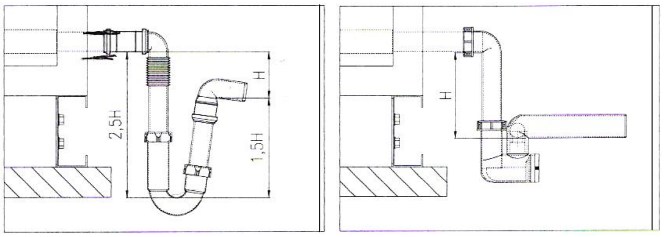
Standard traps and ball traps can be used with CLIMA GOLD units.

Depending on the trap type, its appropriate height should be provided.

The column of water height (H) in the trap must be higher than max. positive or negative pressure (mm H_2O) in the device (1 mm H_2O = 10 Pa). The dimensions should be selected according to the following formula:

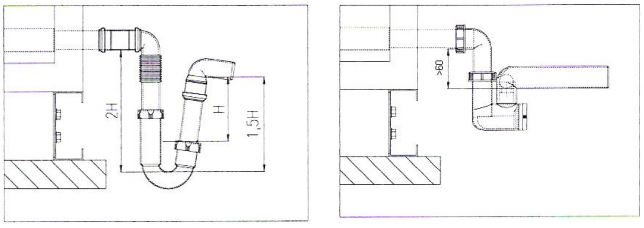
$$H\ (\text{mm}\ H_2O) = \frac{\text{overpressure / underpressure (Pa)}}{10}$$

The difference between the height of the water outlet and the water level in the trap should also be equal to H (mm H_2O).



Standard trap Ball trap

Figure 5. *Height of traps in negative pressure conditions*

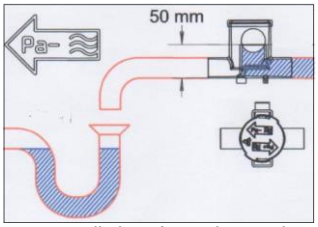


Standard trap Ball trap

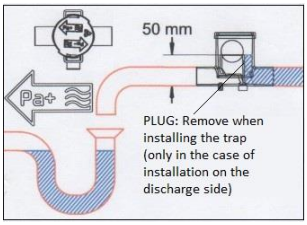
Figure 6. *Height of traps in positive pressure conditions*

Installation of ball traps.

The arrow on the top lid of the trap indicates the flow direction. If the trap is installed on the discharge side of the unit, it should be installed in accordance with the **PA+** arrow. If it is installed on the suction side, it should be installed in accordance with the **PA**- arrow.



Installation of traps in negative pressure conditions



Installation of traps in positive pressure conditions

In the case of the rooftop unit, the condensate can be transferred directly to the roof of the building. We recommend using a coil heater in order to prevent condensate from freezing in winter. The trap can be used with an external coil heater of 11.6 mm diameter (not included in the delivery of CLIMA GOLD).

3.10. Connection of steam heaters

The supply and return pipelines of heat exchangers should be connected in a way that allows the heat exchanger to work with counter-flow i.e. with the medium in the heat exchanger flowing in the direction opposite to the airflow direction.

Steam supply is always connected to the top connector, while the condensate drain – to the bottom connector of the heater.

The supply system should be connected in such a way as to avoid any stress on the connector pipes of heat exchangers.

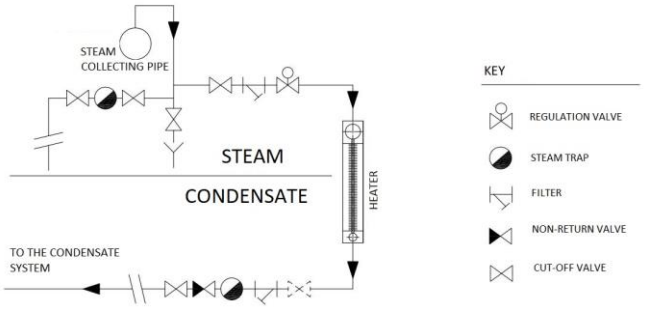
The supply system should self-compensate. Due to high temperatures present in the system that supplies heating steam to the exchanger and related stress in the first stage of system operation, we recommend using special high-temperature flexible connector pipes for the connection of the medium supply system (not included in the delivery). When bolting couplings to the heat exchanger connector pipes, secure the connector pipe with a wrench. The installation method should allow for easy disassembly of pipelines so that it is possible to remove the heat exchanger from the air handling unit for maintenance or repair. The heat exchanger shall be supplied with a medium of parameters and flow rate as specified on the unit data plate in order to ensure required efficiency.

The temperature and pressure of steam must not exceed 5 bar (g) and 160°C in the case of Cu-Al steam heaters.

Higher temperature and pressure values are acceptable if custom steam heaters are used.

The steam system should feature necessary equipment. Steam traps should be installed on the supply and discharge sides, the system should decline towards the discharge side. Steam traps should be located possibly close to the heater. Correct system installation ensures proper condensate drainage. Steam pressure regulation valve should be installed on the supply side, possibly close to the steam heater. The size and type of the valve should be selected on an individual basis depending on the pressure in the system. Steam heat exchanger connector pipes must not be used to support the steam distribution system.

The recommended method for installing the heater and auxiliary equipment is presented below.



Appropriately selected automatic control system should ensure proper operation of the heater, protect the heat exchanger against water hammers, and eliminate accumulation of condensate near the exchanger. We recommend using an anti-frost thermostat that prevents the condensate from freezing in the case of a failure of the steam supply system. Overheating of the unit with a steam heater during fan inactivity poses a potential hazard. Unintentional deactivation of the fan will cause air around the exchanger to reach excessive temperatures (overheating). The automatic control system should be equipped with a device that stops the steam flow to the heater in the case of a fan failure or inactivity.

In the case of longer periods of heater inactivity, remove all water from the heater – condensate and close cut-off valves.
Isolate all pipelines supplying and discharging the medium.
We recommend starting a cold system progressively in order to avoid thermal stress.

3.11. Freon cooler

Connection of the freon cooler to the cooling system may be performed only by a qualified technician. Keep in mind that the exchanger works only with horizontal air stream flow. Proper operating parameters of heat exchangers shall be obtained only if the data indicated in the documentation and on the data plate are in line with actual values.

In particular, it is required to check:

- type of the cooling agent and its physical properties,
- power rating of the cooling unit,
- tightness of the entire system after filling.

3.12. Rotary heat exchanger

In most cases, rotary heat exchangers are supplied in fully assembled conditions. It is, however, possible that large diameter exchangers are supplied in sections to be assembled at the worksite. Such works are performed by the CLIMA GOLD authorised technical service.

3.13. Cross-flow heat exchanger

The cross-flow heat exchanger section is equipped with a condensate tray with a discharge connector pipe to which a trap is attached in order to prevent air from entering the system. The trap must always be filled with water to the height specified in the description above.

The cross-flow heat exchanger is equipped with a double opposite-blade damper for the exchanger and exchanger by-pass. When the unit is turned off using the controller, the exchanger is set to 0%. This means the damper is closed on the exchanger and the by-pass is fully open.

3.14. Glycol heat exchanger

Glycol heat exchangers are used for heat recuperation. The medium circulates in the hydraulic system between the heater located in the intake unit and the cooler located in the exhaust unit. The hydraulic system is installed by a technician at the worksite. While installing the hydraulic system, the following recommendations must be considered: the glycol circulation pump should be suitable for pumping the medium with 50% addition of anti-freeze, for normal operation the volume of anti-freeze should amount to about 35% (depending on design conditions for winter and device location). Facilities for glycol flow rate measurement and adjustment and recovery adjustment should be provided. Counterflow should be provided.
Check the glycol concentration in the circuit periodically..

!!!! Check the glycol pressure in the system periodically. Only activate the system when the pressure is right.

On customer's request, Clima Gold can provide a hydraulic system on site (delivered with operation and maintenance manual).

3.15. Humidifier section

The humidifier should be connected in accordance with the humidifier O&MM attached to the documentation of the air handling unit.

Prior to installing the steam humidifier, consider the following:

- **Access to water** – cold utility water system is used for supplying the humidifier. Water pressure should not exceed 6 bar and should be at least 1 bar. The connection (3/4'') is located on the bottom of the humidifier. Install a cut-off valve and a mechanical filter on the supply side.
- **Water discharge** – provide water discharge from the humidifier and condensate discharge from steam lances. We recommend that each cylinder has its own drain hose and a container with a lid. Drain hoses are supplied with the device. The container and the drain pipe (to the sewage disposal system) must be made of PVC resistant to 100°C. Minimum drainpipe diameter – 60 mm.
- **Distance between the humidifier and steam lances** – the humidifier should be located max. 3 m from the lance. If it is located further, use steel or copper insulated pipes of slightly larger diameter. Minimum bend radius of steam pipes is 250 mm for D=20 mm and 400 mm for D=40 mm Do not allow the steam hose to break. Ensure there is 10 degree decline over the whole length of the hose. Install a tee with a drain pipe (description in the device O&MM) in places where condensate may accumulate (lowest points).

3.16. Gas heater section

The gas heater section consists of:

- a burner,
- burner fittings (gas valve and a set of protective thermostats),
- waste gas/air heat exchanger,
- power controller with overheat protection and low gas pressure protection.

Clima Gold can supply waste gas discharge system and gas tubing components.

! **The gas heater is selected by Clima Gold in cooperation with the ventilation system designer at the tender submission stage.**

Delivery performer by Clima Gold does not include connecting the fuel supply to the burner or installation of waste gas and condensate discharge systems.

Gas types and parameters are agreed on with the ordering party in accordance with the heater operation manual at the tender submission stage.

The connection of the gas heater and waste gas and condensate discharge systems should be performed in accordance with the technical design and the installation and maintenance manual of the gas heater sections components (O&MM) supplied with the device.

The following conditions must be met when connecting the burner:

Chimney – the chimney should be made of stainless steel, double-walled, and insulated. It should not rest on the chimney flue. Provide an inspection opening (10-12 mm diameter opening on the flue-chimney connector) in the base or the bottom part of the chimney. Distance between the opening and the heat exchanger should be 2xD (where D is the chimney diameter). The opening should be made from the top or from the side in an accessible location. The opening must be threaded and secured with a stainless steel screw.

Gas ramp – Provide access to gas of appropriate parameters for a given burner. Throughout burner operation, gas pressure must not drop below 70% of the given value. At the end of the gas line and before the burner gas ramp, install a cut-off valve and provide two 1'' diameter connector pipes separated with a valve (according to the gas unit O&MM). The connector pipes will be used to connect an external gas meter.

3.17. Fan section

After installing the fan section in the final position, remove the transport protective elements protecting the dampers against damage.

Further description can be found in the chapter on the fan motor electrical connections.

3.18. Electrical connections

! **The electrical connections may be performed only by a person with appropriate qualifications – For example in Poland - Polish Association of Electrical Engineers (SEP) Electrician Certificate (voltage up to 1kV)**

! **The parameters of the electrical supply line and necessary protective equipment must be selected and dimensioned by a technician qualified in the scope of designing electrical installations and in accordance with applicable regulations.**

3.18.1. Fan motor

When commencing work on preparing electrical connections for the fan unit it is required to check the diagrams presented in the table with the data present on the data plate.

In order to provide safe operation of the device, an external service breaker switch must be installed (not included in the delivery) that cuts off the current supply to the fan motor during maintenance works. Disconnection of the circuit should leave it without any current.

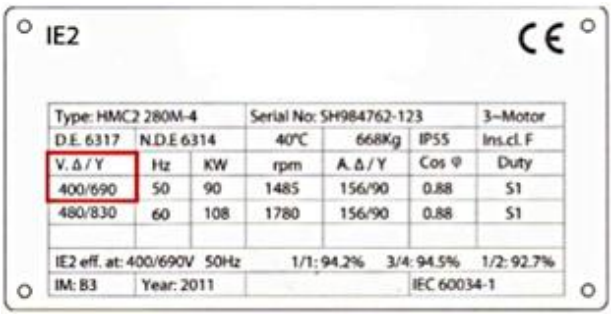
The power cable must be inserted through the glands in the unit's walls. The length of the cable should be selected so that it is not stretched and does not rub against any movable parts in the fan unit. It is advised to protect the cable using an elastic PVC pipe.

We recommend using single-phase or three-phase inverters to control the fan motor. In the case of motors connected directly to the installation, keep in mind that motors with rated power up to 4 kW should be started directly. Motors with rated power greater than 4 kW must be started using a "star-delta starter".

! **The motor must be properly earthed or zeroed.**

! **Before starting the motor, the connections must be checked as they may differ depending on the motor type, inverter and the power supply voltage. All single gear motors are configured by their manufacturer to operate in delta connections. If the technical documentation states the otherwise (star connection) changes must be made before the first start-up.**

Each motor shall be equipped with a data plate indicating the nominal parameters of the device:



Marked information is necessary to determine correct connection of the motor. Nominal voltage for specific types of connection is indicated

- V. – means the voltage that can be supplied to terminals
- Δ – delta connection
- Y – star connection

In this case we have Δ/Y and supply voltage of 400/690, therefore for 400 VAC supply we should apply the delta connection.

In the case of a smaller capacity motor, Δ/Y symbol with 230/400 V supply voltage will be indicated meaning that we should apply delta connection for 230 VAC and star connection for 400 VAC.

When do we have 3x230 VAC and 3x400 VAC?

- Supply voltage of 3x230 VAC is achieved with the use of a single-phase inverter.
- Supply voltage of 3x400 VAC is achieved when the device is supplied with line voltage or using a three-phase inverter.

In order to protect the motor against damage, automatic thermal circuit breakers are required which will disconnect the motor in case of excessive temperature of the motor winding. Standard motor fans are equipped with thermistors with terminals supplied to the motor junction box. Motor current protection is required. The overload safety setting may not be set higher than the motor rated circuit (indicated on the motor data plate).

Check the direction of rotation of the fan. To do so, open the inspection cover and activate the fan in pulses, checking the direction of rotation against the rotation direction arrow on the casing. If the fan rotates in the wrong direction, switch two power supply cables. The fan should operate with its cover open for the shortest period possible, otherwise the motor may burn.

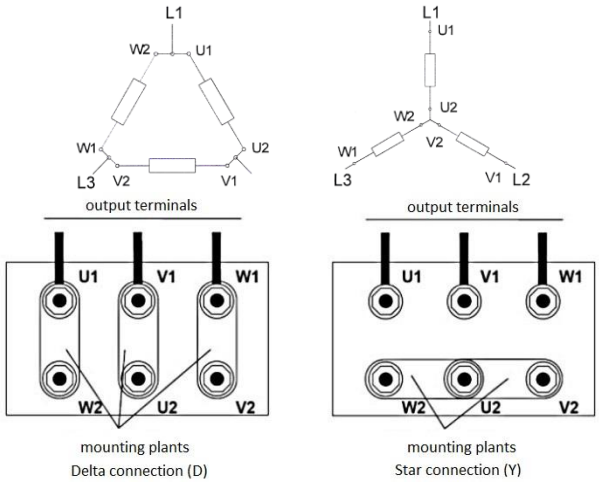


Figure 7. *Single speed, three-phase motors*

3.18.2. EC motors

Electronically commutated motors are permanently connected to the rotor, forming a complete fan assembly. The assemblies are supplied with line voltage of 230/400 V (50-60 Hz) and controlled with 0-10 VDC. The connection diagrams are presented below:

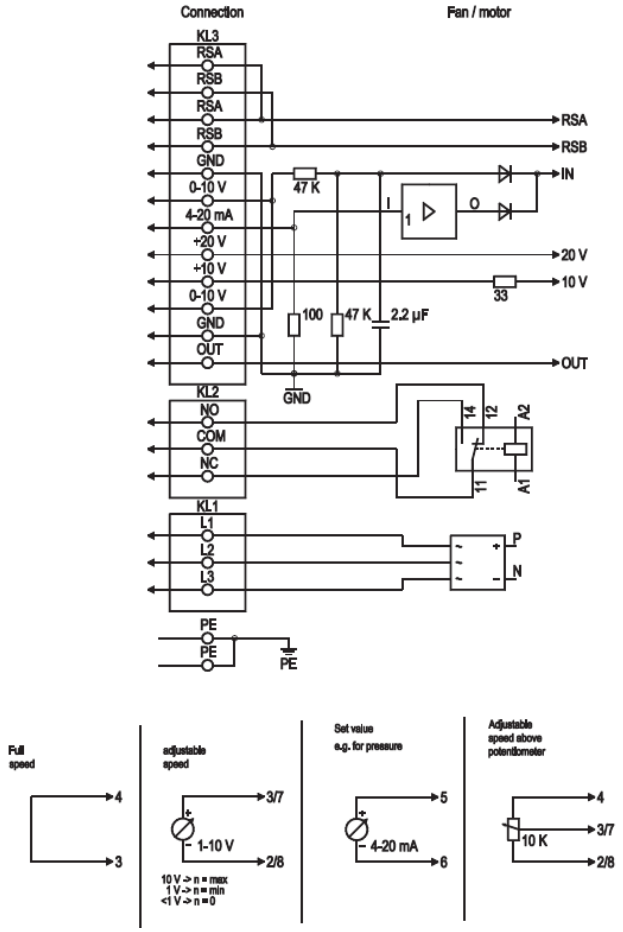


Figure 8. *EC motors – connection (example)*

Signal	Description
PE	Earthing
L1,L2,L3	Power supply (50/60 Hz), voltage indicated on the data plate
NC	Fault relay. Interrupts in the case of a fault
COM	Common fault relay terminal. (2A, max 250 VAC, min10mA, AC1)
NO	Fault relay. Closed in the case of a fault
OUT	Analog output, 0-10 VDC, max 3mA, SELV Output indicates the current motor cycle (PWM): 1V corresponds to 10% PWM 10V corresponds to 100% PWM
GND	Control signal zero, SELV
0-10V	Input 0-10 VDC, impedance 100 Ohm, only as an alternative for 4-20 mA, SELV
+10V	Voltage output 10 VDC (+/.3%), max 10 mA, for example for a potentiometer
+20V	Supply voltage for external 20VDC converter, max. 50 mA, SELV
4-20mA	Control output 4-20 mA, impedance 100 Ohm, only as an alternative for 0-10 VDC signal, SELV
RSB	RS485 terminal tor MODBUS, RSB
RSA	RS485 terminal tor MODBUS, RSA

3.18.3. Electric heater

Electric heaters in the unit are divided into sections of maximum power 18 kW/section. When 18 kW is exceeded in a single section, new coil heaters are installed in a new section. Connection of the power supply, earthing and protection wires to the electric heater's terminal board is performed by a qualified electrician in accordance with attached technical documentation and applicable legal regulations. Pay attention to the direction of air flow through the heaters – it must follow the markings on the casing – and to the conformance of electrical parameters of the electric circuit to the information provided on the data plate.

The electric heater is protected by a separate thermal circuit breaker. The circuit breaker will cut off the power supply of the heater (via the control system) when the temperature exceeds 75°C. At the same time, fans should be switched to their full speed for at least 300 seconds.

The protection must be reset manually by pressing a button in the control distribution board. This function must be included in the air handling unit's automation design.

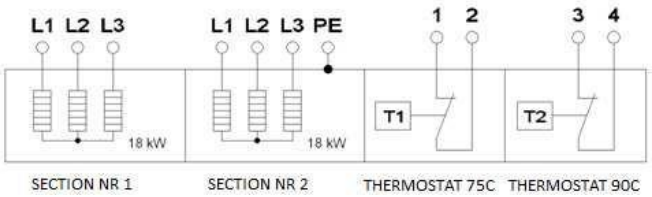
Standard heater is designed for operation with 230 V or 400 V voltage.

The minimum air flow rate through the electric heater is: 1.5 m/s.

In the case of electric heaters it is required to cool down the heater before turning off the device i.e. the air fan must keep running after turning off the heaters until they cool down. This function shall be implemented in the unit automatic control system. After turning off the air handling unit, the intake and exhaust fans keep working for approx. 3 minutes in order to cool down electric heaters.

Unit dimensions	Maximum output of electric heaters [kW]]
1	27
2	54
3	72
4	108
5	144
6	216
7	252
8	on request
9	
10	
11	

Example electric connection diagram for the electric heater:



When using the Clima Gold automation, in Section 1 the heating output can be adjusted smoothly.

Example – adjustment of heater power in CLIMA GOLD automatic control system.

Electric heater, rated power 36 kW.

The automation system adjusts heating power smoothly up to 18 kW in section 1. When the heating power requirement exceeds 18 kW, the system activates section no. 2 with a constant output and adjusts the output by controlling section no. 1 in the range 0 to 18 kW. Using this solution, the system is able to adjust the output smoothly in the range from 0 to 36 kW.

The system works the same way in case of heaters with greater output.

3.18.4. Automation

If the automation is supplied by Clima Gold, the required information is supplied in a separate documentation set.

3.19. Installation of OPTIMA TOP units

3.19.1. Rooftop base

The rooftop base should be provided in the form of a concrete layer or a steel structure, taking into consideration strength parameters appropriate for the weight of the device.

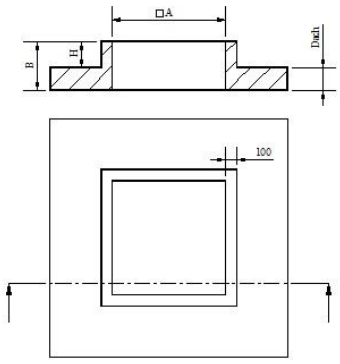


Figure 9. Rooftop base – dimensions

Device size	A	B	H
	mm		
TOP - 1	915	450	min. 200
TOP - 2	1225	520	min. 200

Before providing the base, consider methods of supplying utilities (electricity, cooling/heating agent) to the device while designing the rooftop base.

! The rooftop base must be levelled.

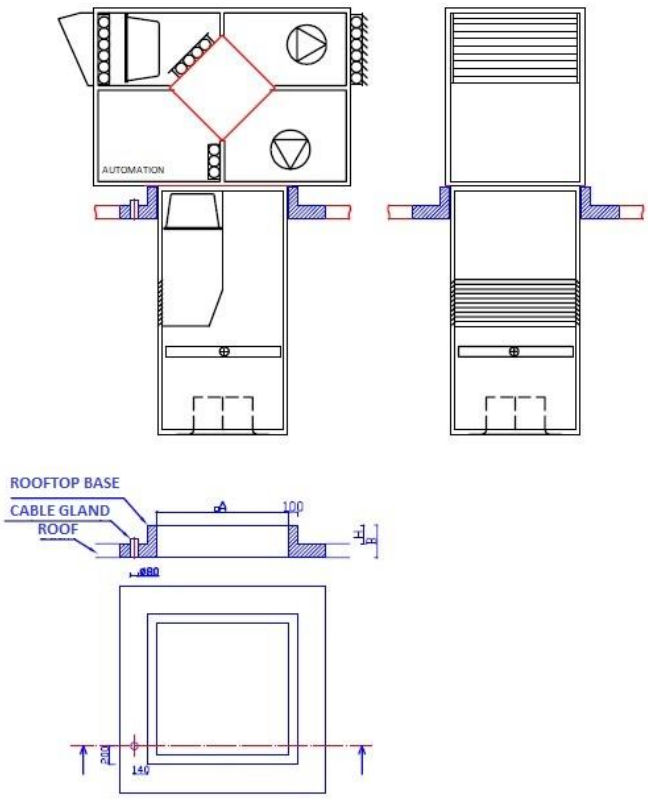


Figure 10. *TOP- example*

3.19.2. Transport and installation of OPTIMA TOP units

Loading and unloading onto and from means of transport can be performer using a lift or a crane. The external (SD) and internal (SW) units are transported separately on pallets. Both parts of the unit are installed on the roof using a crane.

The internal unit features transport brackets that should be removed after placing the unit on the rooftop base. Transport belt used for handling the section must not pull the brackets towards each other. If necessary, use a strut.

Make sure that the carrier plate of the internal section rests on the roof opening frame with even weight distribution.

After setting the unit in its place, it should stay in the roof frame under its own weight. During installation, seal the joints between the internal unit flange and the roof frame and between the internal and external unit flanges. The gasket that should be located between sections is supplied with the installation kit. Use the dedicated gasket only – otherwise it will not be feasible to bolt the sections together.

Next, place the external unit on the carrier plate of the internal section so that the service side of the unit is on the same side as heater connector pipes in the internal unit. Align mounting holes. Bolt the units together and remove transport elements. Regardless of the base type, each corner of a rooftop section should be supported.

Water heater is equipped with connector pipes located within the unit contour so that they do not hinder the installation of the internal unit on the roof frame/in the roof opening.

! **Pay attention to the location of water heater connector pipes: they should be located on the inspection side of the roof section. Different installation will cause heated air to be discharged out of the building.**

! **Pay attention to tightness of all connections and ensure the unit has been properly fixed to the roof.**

4. PREPARATION FOR START- UP

! **The start-up shall be performed by personnel with appropriate technical education and in possession of required qualification certificates.**

! **If the start-up is performed at least 6 months after the purchase, it shall undergo a pre-commissioning check.**

List of basic tasks to be performed before starting the air handling unit:

1. Check the technical condition of all parts – check for possible damage resulting from installation..
2. Check whether no dirt or moving parts are present inside the unit section – they could damage the device.
3. Check whether the device has been levelled, the connections are tight, and in the case of rooftop units – whether unit roof connectors and external unit automation guards have been installed.
4. Check if the unit is mechanically installed and connected to the ventilation duct network.
5. Check the connection of grounding wires between the units and ventilation ducts.
6. Check whether the connection of water, glycol or Freon systems is complete. Open the chilled water and heating medium circuits.
7. Check if electric devices are properly wired and whether they are signaling readiness for work.
8. Check whether all drip trays are equipped with traps and the traps are properly filled with water and connected to the condensate removal system.
9. Check if the automation components are installed and wired. Check if the power supply is consistent with the unit power supply diagram.
10. Clean up the worksite and the inside of the air handling unit.

Other tasks to be performed before starting the unit in relation to various components are listed below.

Dampers

Check if all dampers in the duct network are open. Leave only the air handling unit damper closed – when the machine is not working it should be left in this position. The actuator should open the air handling unit damper when the unit is started (if the damper is equipped). Check if the damper opens and closes completely.

Filters

Remove the film covers from the filters if they have been packed this way. Check whether the filters are installed properly and if their class is in accordance with the recommendations in the technical documentation of the device. Frames of individual filters should be separated from each other and from unit guards with a gasket. Properly installed filters constitute an air-tight partition inside the section. Any holes and leakages enabling the air to by-pass filters indicate incorrect installation or damage – such a filter must not be used. In the case of bag filters, check if the bags are positioned vertically and are not twisted or bent. Check if the pressure controls are installed correctly and if their settings are correct.

Filter class	Pressure control setting / Pa / The maximum final pressure drop at the filter according to PN-EN 13053.
G 4	150
F 5	200
F 7	200
F 9	300

Air handling units equipped with secondary filters should be started without the filter inserts in place.

After start-up, replace or clean pre-filters. The unit must not be started without filters in place.

Heat exchangers

In case of heat exchangers check if their surfaces are not covered, if the fins are not damaged, and if the connector pipes are properly connected to the medium supply according to the O&MM. Check if the heat exchangers are filled with the medium and vented. If the heat exchanger is equipped with a freeze protection thermostat, check if its capillary tube is not damaged and whether it is permanently attached to the exchanger casing. Check the proper installation of the droplet eliminator and if the discharge connector pipe is connected to the trap. Then, check if the trap is of appropriate height and whether it is filled with water and unobstructed.

Check whether the regulating valves have been installed correctly (in accordance with markings on the valve body).

Electric heaters

Check if the heaters are not damaged or soiled. Remember that they may not contact with any element located inside the air handling unit. Check the heaters for correct electrical connections (against the diagram) and correct connection of the protective thermostat.

Rotary heat exchanger

Remove the heat exchanger driving belt and manually check if the rotor rotates freely and without any resistance. Check if the heat exchanger surfaces are not covered or soiled and whether the fins are not damaged. Check if the sealing brushes on the rotor adhere to the casing of the rotary heat exchanger. Check whether the direction of rotation of the rotor is identical to the direction indicated on the rotor. Check if the motor has been properly connected to the inverter. The motor and the inverter are normally installed in the exchanger section.

Cross- flow heat exchanger

Check the condition of the heat exchanger fins for soiling and mechanical damage as they may affect heat recuperation. Before starting the unit, check if the by-pass is closed and whether a trap is connected to the tray outlet connector pipe. Then, check if the trap is of appropriate height and whether it is filled with water and the system is unobstructed.

Fan section (applies to all air handling units, appliances and devices)

The following fan assemblies can be installed in the fan section:

- radial/axial fan with a rotor mounted directly on the electric motor shaft, powered by an inverter (plug-in), with 200-1,120 mm rotor (standard – OPTIMA)
- fans with electronically commutated motors (EC) with improved efficiency and infinite RPM adjustment.

Check if there are no moving objects around the fan that may be blown away. Check if the fan rotates freely, without obstructions, and in the direction indicated on the fan casing (activating it with a single pulse). Check the motor and its electrical connections: the motor's rated voltage should be identical to the voltage in the electric grid. The power supply cable should be placed away from any moving elements of the drive system. Starting and operating the device without the protective conductor (zeroing or earthing) connected is strictly prohibited.

Fans with a rotor mounted directly on the motor shaft (plug-in) are maintenance-free.

Prior to start-up, check the rotor and confusor alignment. In order to do so, check at least in three locations (with the unit turned off) whether the distance between the rotor and confusor is the same. Then, taking the necessary safety precautions, activate the motor with a single pulse in order to check whether the rotor does not rub against the bell. If the alignment is incorrect, loosen the bolt fixing the holder to the slide. Pushing the fan motor downwards, move the holder until the assembly is aligned. Tighten the bolts and repeat the test.

When checking all elements, make sure to review the device as a whole i.e. whether all covers are closed, locked and secured and whether the connector pipes are properly connected to the ducts.

If everything is OK, proceed with the start-up.

5. START-UP, ADJUSTMENT

! Start the unit only after it has been connected to the ventilation duct system or after installing a protective grille (special protective grilles may be supplied on order).

! Only use the air handling unit for its intended application and within the power, temperature and humidity range specified on the data plate.

! The start-up shall be performed by personnel with appropriate technical education and in possession of the required qualification certificates.

Start the device paying attention to the motor power consumption and temperature.

It is advised to open the air handling unit exhaust dampers partially before starting the fan – this prevents the activation of the pressure control signaling lack of compression. When starting the unit, pay attention to unusual noises or mechanical sounds. Check whether the unit vibration is not excessive.

Leave the unit operating for about 30 minutes. After that time switch it off and check individual components. Pay particular attention to filters, condensate outlets and the fan section (assembly fixing, fan bearing and motor bearing temperature).

An important part of the start-up process is checking the efficiency of the unit working in the ventilation system.

It is possible that the pressure drop in the ventilation system is higher than anticipated in the design. If it is lower, the efficiency of the fan is too high and this results in excessive electric power consumption. In that case lower the fan efficiency using the inverter. If the ventilation system pressure drop is greater than anticipated in the design, the air handling unit does not obtain required efficiency. The fan RPM must be increased by changing the inverter frequency.

Remember to check if the motor rated current has not been exceeded. Motor overload may lead to damage.

! Replacement of any components must be consulted with the manufacturer. If the user changes the unit configuration without authorisation, the warranty becomes null and void.

The assessment of the operation and quality of the device should be made after thorough adjustment in the ventilation duct system that should be performed e.g. after all premises are equipped in furniture as specified in the interior arrangement design.

After start-up, check the condition of filters and replace them if necessary.

If the air handling unit is equipped with a gas heater, an authorised technician of the heater supplier must be called in order to prepare the device for start-up and to perform the start-up. The Gas Unit Start-Up Request Form is available on CLIMA GOLD website.

6. OPERATION, MAINTENANCE

The maintenance intervals of the unit depend on the cleanness of the location where it is placed and on work intensity. Every conducted maintenance procedure should be entered in the Unit Maintenance Log.

This section contains instructions related to the operation of the device. In section 8, activities have been divided into those performed by the user and those performed by authorized service technicians during obligatory inspections.

Regular service inspections enable the user to identify possible faults at an early stage and prevent serious failures.

If a fault or incorrect operation has been identified, turn off the device and call authorised service technicians.

All repairs should be performed by authorised technicians using only genuine parts.

Basic technical specification of the device is included in the Unit Sheet. The specification includes device type and dimensions, dimensions of major components (filters, heat exchangers, fans, electric motors). Please read and understand the specification and the operation and maintenance manual of the unit, automatic control system, and additional assemblies prior to commencing any operation or maintenance.

!!!! Before commencing any maintenance works and opening the unit's covers:

- completely stop the fans and other electrically powered components and disconnect all wires from the power grid,
- wait until all rotors stop (at least two minutes),
- after disconnecting the power supply from the fan, do not touch the electric components of the motor (internal components may contain residual currents),
- protect against accidental activation,
- close the water circuit and protect against accidental opening,
- wait for the heat exchangers to cool down,

6.1. Dampers

Check the cleanness of the damper leaves and their drive. Check the air tightness of the dampers, especially the external air damper in order to minimise the risk of heater freezing during the unit's down time. If the damper is equipped with an actuator, check whether it reacts correctly to the signal sent by the controller and if it enables the damper to fully open and close.

6.2. Filters

As the unit operates, the filters become soiled, check the filters one to four times per month depending on their location. If the filters are equipped with pressure controls informing of their soiling, the checks may be limited to once a month. Exceeding the allowable filter soiling level may cause the air handling unit's output to drop and even result in the filters breaking out and damaging the fan.

A soiled filter should be replaced with a new one or, in case of metal/grease filters, cleaned in water with the addition of a household (dish washing) detergent. A newly installed filter should have the same filtering class. The filter service life depends on the conditions in the environment where the air handling unit is used. The optimum operation of filters is obtainable with the use of pressure controls signaling the need to replace a particular filter in the system. The use of automation does not permit to skip periodical visual inspection of the filter technical condition as in case of the filter material being torn the pressure control will not operate correctly.

New filters should be installed as indicated by the air flow direction mark placed on casing. Pay attention not to damage the filtering material during transport, unpacking and installation.

Filter size should be selected for a unit on an individual basis.

The size for a given unit is indicated on the data plate on the filter section of a unit.

6.3. Fan section

During fan assembly maintenance, check the following:

- correct installation of the assembly,
- bolts in the assembly – tighten loose bolts,
- clean the rotor if necessary,
- check electrical connections of the motor, measure the current and check whether nominal values have not been exceeded.

During maintenance works, check if the fan rotates freely without any run-out, check the noise made by the fan/motor bearings, check the proper installation of the fan/motor - bolt tightening, check the soiling of the fan/motor.

The rotor may be cleaned using compressed air or a mild detergent and the motor may be cleaned with a wet cloth but it is required to exercise extreme caution while doing so. Do not start the motor for at least 30 minutes after cleaning.

In the case of fan sections equipped with a belt drive, check the condition of the drive and the tensioning of the drive belts and pulleys after the first 50 hours of the unit's operation. Repeat the inspection procedure **every 3 months**. After installing new drive belts, check their tension (after 2 minutes of operation, after 50 hours of operation, during periodical inspections). If as a result of wear one of the belts in a multiple belt drive is to be replaced all other belts must be replaced as well. This allows for their uniform wear and protects against a sudden, unexpected failure of the fan unit.

Fans with direct drive are equipped with maintenance-free bearing with a calculated service life of 40 thousand working hours. After that time they must be replaced.

Larger fans have individual bearing lubricating nipples and additional instructions are provided which inform on the method and frequency of lubricant application. The lubricating procedure must be conducted at least 2 times per year.

Detailed information regarding the motor and fan maintenance may be found in the technical documentation of those devices provided by their manufacturers.

6.4. Heat exchanger

6.4.1. Water or glycol heat exchangers

Water heat exchangers should be protected against freezing. If the system is properly installed and set up there is no risk of heat exchangers freezing. It is only required that the heating medium maintains the design parameters and the control distribution board must be powered constantly. If the ventilation system is to be turned off for the winter (with ambient temperatures below +4°C), water must be removed from the heater by opening the drain valve and the vent valve and by blowing compressed air through the heater.

Apart from that, the operation of the heater requires periodical inspection of the device for damage and leaks of the medium in places where components are connected. If soiled, the fin block may be cleaned using compressed air blown in the direction opposite to the ventilation air flow. In the case of coolers, check the cleanness of the droplet eliminator and the cleanness of the condensate tray and check if the drain is not clogged (refill the trap before restarting the air handling unit). Before commencing cleaning, protect the neighbouring sections of the air handling unit.

In the case of excessive soiling of the heat exchange surface, clean it using compressed air and in the case of more resistant soiling, clean using a detergent that does not affect aluminium. Inspect the heat exchangers **every 6 months**. During the inspection also check the leak tightness of the hydraulic connections and check if the exchanger is not air locked.

During the down time reduce the flow of the heating medium through the heat exchanger in order to prevent excessive increase of temperature in the device which may have a negative impact on other assemblies in the unit.

Water coolers must be completely drained of water during winter.

Once per year, check the freezing temperature of the glycol mixture and the pressure in the system.

6.4.2. Electric heater

Inspect the electric heater **every 6 months** after disconnecting the power supply **or after each longer inactivity period**. If the heaters are soiled excessively, clean them with compressed air in the direction opposite to the ventilation air flow or remove the dust in another way – do not clean using water! Check the technical condition of the heater and their electrical connections. To do so, remove the connections cover on the heater (standard – OPAL) or remove the heater from the section (OPTIMA), uncover the wires and check for melted insulation. During the inspection, also check the operation of the thermal protection device.

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6.4.3. Freon heat exchanger

In general, act the same way as in case of water heat exchangers.

Clean the Freon heat exchangers using a medium of temperature not higher than 36°C (in order to avoid causing an excessive pressure increase in the cooling device).

6.4.4. Cross- flow heat exchanger

The maintenance of a cross-flow heat exchanger calls for checking its technical condition. Check if the exchanger is not damaged and whether the damper on the by-pass rotates freely. If the heat exchanger is equipped with a freeze-protection system, check whether the components of the system are properly and securely installed. In addition, check the droplet eliminator and the condensate tray and check if the trap is not clogged (refill the trap before restarting the air handling unit). Periodical inspection of the cross-flow heat exchanger should be performed **every 6 months**. In particular, check the condition of the heat exchange surface after the winter period. Verify if the heat exchanger walls did not lose their leak tightness as a result of faulty automation operation.

Clean the heat exchanger if necessary. Pay attention not to damage the exchanger plates. Cleaning may be done by removing the dust with a soft cloth, blowing the exchanger with air in the direction opposite to the regular air flow, or with water with detergent that does not affect the exchanger.

6.4.5. Rotary heat exchanger

The rotary heat exchanger must be inspected **every 6 months**. The guidelines for cleaning the heat exchanger surfaces are identical to those related to water coolers and heaters. After cleaning the rotor, dry it thoroughly. Then, clean the motor surface of dust and dirt, check the connections and measure the current. Pay particular attention to checking the tension of the drive belt and the ease of rotation of the rotor as well as the adherence of the sealing brushes of the rotor to the rotor casing walls. The drive belt should be inspected more frequently in the first period, after starting, paying attention to its tension. Once a month, pull the rotary exchanger cover with the unit operating (taking all necessary precautions) and check whether the exchanger rotates. If the belt slips on the exchanger surface, tense the belt by changing the position of the drive assembly mounting plate. If this is not sufficient, adjust the belt length. If the belt is worn, replace it. After removing the belt, clean the surface of the exchanger (contacting the belt) with solvent and dry before installing a new belt. Also, act in accordance with the requirements listed in the documentation provided by the manufacturer of the heat exchanger.

6.4.6. Air intakes

Check the soiling of the air intakes once per month (remove leaves, plastic film bags, paper etc.).

6.4.7. Silencers

Check the soiling of the silencer every 3 months.

Clean the noise insulation panels using compressed air or by vacuum cleaning. Do not clean the noise insulation panels with water.

6.4.8. Gas heater

Basic maintenance of the gas heater is performed during periodic inspections. Operation and maintenance of the gas heater section shall be performed in accordance with the operating manual and the installation and maintenance manual for the assemblies of the gas heater section.

Annual technical inspections of the device are required – at the beginning of the heating season. Such inspections can be performed by:

- CLIMA GOLD service technicians,
- Service personnel holding a certificate of the burner manufacturer after notifying CLIMA GOLD of such a fact.

7. REPAIRS AND PERIODICAL INSPECTION

The table presents the components of Clima Gold devices which are subject to periodical inspection. The table contains information on inspection frequency and lists the actions related to the above mentioned components if their technical condition makes them unsuitable for further operation.

! Each unit inspection and identified irregularities as well as each service personnel visit shall be recorded in the Unit Maintenance Sheet.

! Prior to removing the inspection cover, ensure that the unit has been turned off and secured against unintentional activation.

List of components and the frequency of their periodical inspections (performed by the user):

Item	Component type	Inspection	Type of service procedures
1	multi-leaf damper	Once a month; visual inspection	• Check if the dampers close properly • Cleaning with a damp cloth if necessary
2	filter	Once a month *	• Remove the filter – check the fabric for damage • Check the pressure switches for cracks and dirt • Replace the filter if necessary • Make sure there are no gaps between the filters
3	heat exchangers.	every 3 months; visual inspection	• Check for leakages • In the case of coolers, check whether the drip tray drainage is unobstructed and unclog if necessary
4	fan section	every 3 months; visual inspection	• Check for excessive vibrations • Check if the rotor rotates freely on the motor shaft (power off) • Check if no foreign objects got into the rotor and if there is no water in the fan chamber
5	electric heaters	every 3 months; visual inspection	• Check the condition of heaters • If necessary, remove dust 10 minutes after turning off the unit
6	cross-flow heat exchangers	Once a month, visual inspection	• Check whether the drip tray drainage is unobstructed and unclog if necessary
7	rotary heat exchanger	Once a month, visual inspection	• Check whether the exchanger rotates. If there is no inspection opening in the casing, do so with the unit operating, taking all necessary precautions
8	silencers	every 3 months; visual inspection	• Check if the surfaces of silencers are not soiled • If necessary, clean with compressed air or vacuum
9	air intakes	Once a month	• Mechanical cleaning – remove leaves, film, etc.

* Metal filters acting as grease filters – adjust frequency depending on the filter use

List of activities performed by the service personnel during obligatory periodic inspections (every 6 months):

Item	Component type	Type of service procedures
1	multi-leaf damper	• checking the technical condition of the dampers • checking the technical condition of actuators (spindle condition, scope of movement) • checking the presence of dirt (cleaning if necessary)
2	filter	• replacing filters • checking the tightness of the filter frame-guiding rail joint • checking the settings and testing pressure switches
3	heat exchangers.	• checking the technical condition of the exchanger • checking the presence of dirt on fins (cleaning if necessary) • checking the exchanger heating/cooling (bleeding if necessary) • checking the condition of droplet eliminator and drip tray (cleaning if necessary) • checking the technical condition of the heater and cooler valve actuator (depending on the season)
4	fan section	• checking the technical condition of the fans and motors • checking proper installation and setting of the fan assembly • checking the technical conditions of bearings and belts (replacing the belts if necessary) • checking the connection and measuring motor currents

Item	Component type	Type of service procedures
5	electric heaters	• checking the technical condition of the heater • checking the correct setting of the heater • cleaning electric heaters
6	cross-flow heat exchangers	• checking the technical condition of the exchanger • checking the level of dirt in the exchanges (cleaning if necessary) • checking the technical condition of the by-pass damper in the exchanger • checking the technical conditions of the droplet eliminator and drip tray (cleaning if necessary)
7	rotary heat exchanger	• checking the technical condition of the exchanger • checking the level of dirt in the exchanges (cleaning if necessary) • checking the technical condition of the inverter and motor • checking the belt tensioning, replacing the belt if necessary
8	silencers	• checking the condition of the fabric surface
9	air intakes	• mechanical cleaning

8. OH&S MANUAL

- The installation and start-up of the appliances should be performed in conditions which are in line with the regulations in force, especially those related to the operation of electric appliances.
- It is forbidden to connect the device to the power grid if it is not connected to the protective system.
- It is forbidden to perform any repair or maintenance works unless the electric power has been cut off beforehand.
- The operation of the device with and of the covers removed or any access doors open is strictly prohibited.
- The person affecting the maintenance or repair works on the unit should have appropriate qualifications and a certificate listed in the regulation by the Minister of Mining and Power Industry on the qualifications of persons employed in the operation of power equipment.
- The person operating the unit should have appropriate qualifications and a certificate listed in the regulation by the Minister of Mining and Power Industry on the qualifications of persons employed in the operation of power equipment.
- The operator's station should be equipped with the required protective equipment allowing for the safe operation of the device.
- Information regarding any irregularities in the unit operation should be provided in writing on a Malfunction Notification Sheet.

9. DISASSEMBLY AND DISPOSAL

DISASSEMBLY

! Disassembly must be performed by qualified personnel in a proper and eco-friendly way and in accordance with applicable regulations.

Prior to the disassembly, disconnect the device from the power source. All media must be removed from the device (heating and cooling media that may contain anti-freezing agent, cooling agent).

Pay attention to perform all recycling activities safely and in accordance with OHS requirements. Maintain clean working environment. Dispose of electrical components (motors, controller, relays, transformers) as whole parts.

NECESSARY TOOLS:

- Screwdriver or a drill-driver with a set of bits
- Pliers
- Set of fork spanners: 8-17 mm
- Drill
- Metal shears
- Rotary cutter with a steel-cutting wheel, min. diameter 300 mm

DISPOSAL

The disposal must be performed by specialised organisations.
After disassembly, all parts should be divided into the following groups:

- Electrical components (motors, controllers, transformers, relays, fuses) – must be forwarded for recycling to organisations specialising in recycling electrical devices
- Cables and wires – standard elements treated as non-ferrous metals
- Heat exchangers – made of copper and aluminium and shall be submitted to non-ferrous and light metals collection points
- Guiding rails, drip trays, internal structure components are usually made of stainless or galvanised steel of various thicknesses. These elements should be transported to junkyards along with steel sheet from disassembled side guards.
- The unit supporting structure is made of aluminium sections and should be treated as light metals
- Other elements such as fan rotors, corners, brackets, gaskets, pads, and dampers are made of plastic materials (PA6, EPDM, polyethylene, rubber) and should be transported to the closest waste management facility
- Waste material – mineral wool from side guards, noise insulation panels, and dirty filtering material should be transported to the closest waste management facility.

Over 90% of materials used for manufacturing of our devices can be reused after recycling.

10. RELATED DOCUMENTS

- Unit Sheet with Technical Specification
- Device Operation Sheet
- Warranty Sheet
- Attestations and certifications
- Device Sheet (subassembly selection sheet + dimensional drawing)
- Malfunction Notification Sheet
- Unit Commissioning Protocol
- Operation and Maintenance Manuals of all assemblies with their own documentation: automatic adjustment system, heating unit and/or burner, embedded cooling device, humidifier

! All documents related to the device, including service personnel intervention protocols, shall be kept with the unit O&MM (in a pocket at the end of the O&MM). This document and all appendices must be made available to the service personnel during interventions.