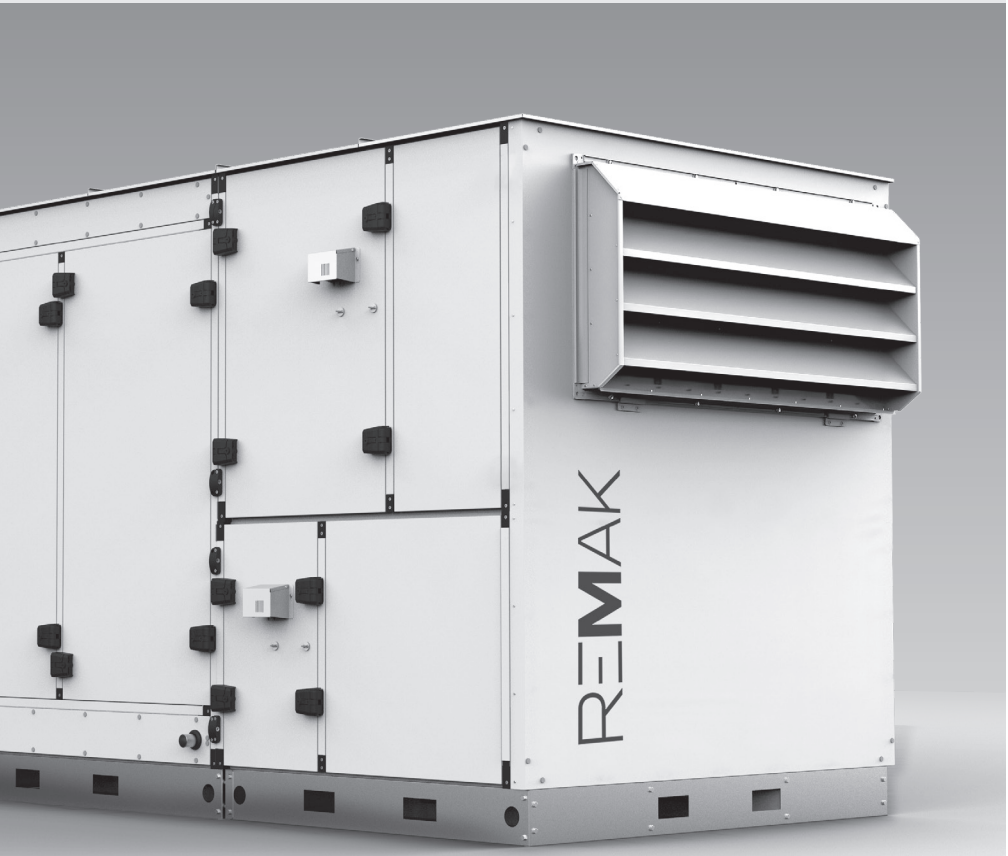
REMAK

09/2026

INSTALLATION AND OPERATING INSTRUCTIONS



Modular air-handling units

Series X

REMAK

Contents

Use and operating conditions 3
Air-handling unit construction 3
Information and safety labels 3
Unit access side 3
Packing and transport 3
Transport and handling of parts 3
Storage conditions 4
Installation 5
Rotary heat exchanger/regenerator section (ROV) 7
Unit blocks assembly 6
Accessories assembly, roof assembly 9
The condensate drainage 11
Air duct connection 11
Connection of heating and cooling media 11
Connection of water and glycol exchangers 12
Connection of direct evaporators 12
Connection of electrical equipment and M&C elements 12
Connecting motors (fans) 12
Electromagnetic compatibility (EMC) 13
Door panel settings - full-fledged hinges 14
Commissioning and putting into operation 14
General Inspection prior to first unit Start-Up 15
First Start-Up checks 15
Operating rules 15
AHU Inspection and maintenance 17
Periodical checks 17
Cleaning 18
Inspection/checks 18
Service, Spare Parts 18
Disposal and recycling 23

General information

- Air-handling units **REMAK series X** are manufactured in accordance with valid Czech and European regulations and technical standards.
- Due to the concept of air-handling units **REMAK X series**, these including their individual parts, are not intended for direct sale to end users. Every installation must be performed in accordance with a professional project created by a qualified ventilation designer who is responsible for the proper selection and dimensioning of components concerning their suitability for a given application.
- Air-handling units **REMAK series X** (or units) must be installed and used only in accordance with this documentation. The manufacturer is not liable for any damage caused by devious usage and in case of vialation buyer bears all risks.
- Units for ventilating swimming pool halls **cannot be** installed in outdoor environments.
- The installation and operating instruction must be available for the operating and servicing staff (it is advisable to place this instruction in the air-handling unit vicinity).
- Units containing water heater sections and/or sections with drain pans must be installed in a way which prevents any accidentally caused damage (e.g. exchanger freezing, condensate drainage not working). It is recommended to install the units in a machine-room with waterproof floor and/or floor trap.
- When handling, installing, wiring, commissioning, repairing or servicing the units, it is necessary to observe valid safety regulations, standards and generally recognized technical rules. In particular, it is necessary to use personal protection means (e.g. gloves) due to sharp edges and corners
- All connected equipment must comply with the respective safety standards and regulations.
- Commissioning as well as every service and maintenance must be noticed in the unit Operations logbook (see Warranty and complaint conditions Remak a.s.)
- Any changes or modifications to individual components of the **REMAK X series** air- handling units which could affect their safety and proper functioning are forbidden.
- Before installing and using the **REMAK X series** air handling units, it is necessary to familiarize yourself with and observe the directions and recommendations included in the following chapters.
- Commissioning may only be performed by an authorized company licensed personnel in accordance with generally and locally valid regulations.
- In case of components and materials disposal, it is necessary to adhere to all locally valid environmental and waste disposal regulations.
- In the case of total unit liquidation, all principles of waste separation must be observed.
- **Up-to-date version of this document is available at website www.remak.eu**

Use and operating conditions, Air-handling unit construction, Packing and transport

Use and operating conditions

REMAK series X air-handling units are designed for comfortable air-handling and air-conditioning in an air flow range from 1,000 m^3/h to 35,000 m^3/h at fan air pressure difference of up to 2,500 Pa.
They are intended for handling of air without solid, fibrous, sticky, aggressive, respectively explosive impurities. The air must be free of corrosive chemicals or chemicals aggressive to zinc and steel, respectively aluminium.
REMAK series X units are supplied with factory-installed base-frame and are primarily intended for installation on floor or steel support construction/frame supplanting the floor.
REMAK series X air-handling units can be used without any additional measures in normal environments (IEC 60364-5-51, resp. ČSN 33 2000-5-51 ed. 3, ČSN 33 2000-1 ed.2) and in rooms with extended ambient temperature ranging from -40 ºC to +40 ºC. When selecting the air-handling unit, it is necessary to take into account the temperature and humidity of the inlet and outlet air in relation with the ambient temperature and humidity. It is especially necessary to analyze the relation of the unit's casing classification pursuant to EN 1886 and the risk of condensation, respectively frost deposit. Ingress protection (objects, water) is IP 44. IP 44 protection level does not refer to accessories and control components (they must be assessed separately based on their particular documentation).
The unit equipped with the outdoor roof is water spray proof (rain up to 60º from vertical) and providing the particular instructions specified further are followed, the unit can be used outdoors.

Air-handling unit construction

Unit construction is modular with casing consisting of panels, bars interconnected by plastic or metal corners and screws. Panels which are expected to enable occasional service access to the internal components are provided with grab handles to make handling easier.
For regular service purposes such as replacement of filter inserts, cleaning of internal components, etc, selected sections are provided with latch-hinges or with swivel locks.
All panels are of sandwich construction with anti-corrosion surface treatment; side panels with a total thickness of 50 mm, bottom and upper panels are 60 mm thick.
The panels are made of steel sheets – galvanized steel sheets (inner and outer skins) or painted steel sheets (inner, outer or both skins), or stainless steel sheets (inner skin only).
The steel sheets are primarily 0,8 mm thick, continuous hot-dip galvanized EN 10 346 Z275 g/m^2, corrosion resistance for C2 environment class as per EN ISO 14713.
Painted panels are made of continuous hot dip galvanized steel sheets EN 10 346 Z275 g/m2 + 25 µm polyester paint (corrosion resistance RC3 according to ČSN EN ISO 14713-1), or polyester powder coated RC4).
The inner panel insulation is made of 50 or 60 mm thick fireproof mineral wool with 50 or 65 kg/m^3 density. Self-adhesive sealing with temperature resistance from -40 ºC to +80 ºC and water absorption below 5%, is applied on the contact surfaces of panels. Casing parts are sealed with a silicone-free sealant of temperature resistance from -40 ºC to +80 ºC.
The REMAK series X air-handling unit consists of sections. The section consists of the casing and inner modules/components. The unit sections can be factory-assembled to so-called „transport- installation" blocks.

Door hinges

- Door panels are equipped with latch-hinges : which can function as a latch or as a door hinge.
- Each door panel is equipped with one (top) latch- hinge on each side with an additional safety function (pressure relief) to prevent it from opening. To open the door, it is always necessary to unlock (see Fig.1).
- Each latch-hinge is equipped with a simple locking function against accidental opening i.e. with a hex key lock, which locks the latch-hinge against tilting (see Fig. 2).

ATTENTION: Door latch-hinges enable the entire panel to be removed. Before doing so , respect the panel weight and other possible risks with its handling!
ATTENTION: The door panels closing the electrical equipment are provided with an additional bonding via PE conductor!

Fig. 1 – security latch

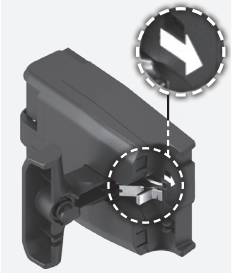


Fig. 2 – locking

Information and safety labels

- Each block is provided with a product label
- REMAK series X air-handling units, respectively particular sections, are provided with information labels indicating information important for connection, commissioning and operation.

- The „Caution - other Danger" label situated on the particular unit service panels indicates the hazard of getting caught by moving parts

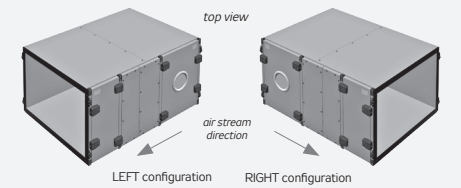
- The label „Warning – Electric shock hazard" on the particular sections and their service panels alerts the risk of accident caused by electric current
- Product label contains technical parameters of the particular section. The user is obliged to ensure that all unit labels stay undamaged and readable throughout the entire unit service life. When damaged, especially in case of safety labels these must be repaired immediately.

Transport and handling of parts

Unit access side

Units' construction enables the energy/media connections and service access of the particular sections to be combined/ placed at different unit sides. The connection side is always understood in the airflow direction (Fig. 3).

Fig. 3 – unit access side options



Packing and transport

Stacking

Transport blocks of REMAK series X units up to the cross section of 1100 x 1100 mm are allowed to be stacked providing the following rules are followed:

- Max. two blocks may be stacked upon each other
- ATTENTION: separation layer (e.g. robust cardboard) must be placed between the blocks to prevent collateral damage
- The block placed in the upper position can be equipped with the base-frame, the legs of any type cannot be mounted at least one edge of the upper section base-frame (front or rear) must be aligned with the corresponding edge of the lower section to ensure the weight distribution; separation layer (e.g. robust cardboard) is also a must.
- The section placed on the upper position must not overlap in any direction over the lower one.
- The fan and gas heater sections must be always situated down.
- Plate and rotary heat exchanger sections cannot be stacked.

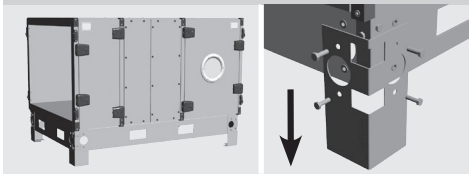
Packing

- A block without a base-frame is placed on a pallet as a transportation standard. A block with a base frame and fixed legs is shipped as standard without a pallet (Fig. 4). Blocks with the base frame and without the fixed legs can be equipped with removable factory installed single-use sheet metal legs, intended for handling during dispatch and transport (Fig. 5) or these can be put on a pallet.

Fig. 4 – transport of sections

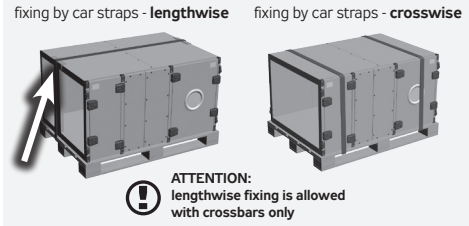
- **ATTENTION:** demountable sheet metal legs for dispatch and transport, have to be dismantled before placing the section on the installation site - 4 x M8 screw (Fig. below).

Fig. 5 – transport leg and its disassembly



- **REMAK X series** transport blocks are packed in PE foil, and if appropriate, provided with cardboard and polystyrene protection.
- **ATTENTION:** Fixing of the REMAK X series units by means of car straps and bands is possible transversely only or it is necessary to use a sufficiently strong spacer which prevents the casing deformation – see Fig below.

Fig. 6 – fixing by means of straps



Transport and handling of parts

- Units REMAK X series are delivered to the installation site in the form of transport blocks which can be also stacked (see chapter Stacking) .
- The loading and unloading can be performed by a fork-lift truck (pallet or transport orifice in the base-frame) or a crane (suspension orifice in base-frame corners)
- If lifted by a crane, spacer bars must be inserted between the lifting ropes to prevent unit damage.
- When handling a unit section without a base frame fork-lift truck, forks of a sufficient length must be used to ensure that the lifted section sits on the forks completely.
- When handling the unit section with a base frame then forks must be inserted beneath both frame beams.
- If the unit section width is over 1000 mm then the base-frame is provided with the third or even fourth inner longitudinal beam.
- These additional beams are also load-bearing and when handled by means of a fork-lift truck (from both the front or rear side), it is sufficient that the forks reach the outer and inner beam i.e. 900 mm.
- In a similar way beams are added the to the base-frames of sections where the service side is protruded (e.g. water heater section with covered inlet pipes).

Storage conditions, Installation

■ When handling the units in the above-described way, it is always necessary to check the centre of gravity by lifting the unit slightly (the centre must always be above the forks) and to be highly cautious during entire handling.

■ **ATTENTION:** When transporting, respectively handling, it is always necessary to pay increased attention to the parts (pipes, electric wiring elements) protruding from the sides of transport block.

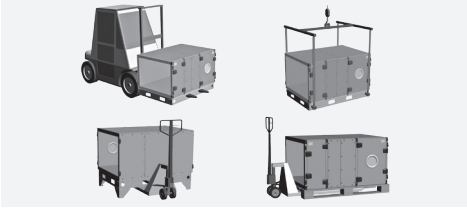
■ **ATTENTION:** All transport blocks may be transported and handled only in their normal operating position!

■ **ATTENTION:** Increased attention must be paid to the safety of persons as well as the product when handling the rotary heat exchanger which is very unstable due to its dimensions (tall and narrow), weight, and high positioned center of gravity. **The manufacturer always recommends fixing the position of the rotary heat exchanger by suitable roping, if it is not assembled to the other unit blocks!**

■ The rotary heat exchanger can be stored, transported or handled ONLY in the vertical position. Any tilting results in rotor misalignment and damage. If the dimensions of the rotary exchanger section exceed the height of the lorry, it is necessary to cover it with an additional tarpaulin.

■ All single piece rotary exchangers are equipped with registered tilt indicators, and starting from a certain rotor diameter also by the impact indicators. The intactness of these indicators is a condition of the warranty validity.

Fig. 7 – handling options



Storage conditions

As standard, the air-handling units are packed in PE foil. These must be stored indoors complying with the following conditions:

■ Maximum relative air humidity must not exceed 85 %. Ambient temperature must range from -20 ºC to +40 ºC.

■ **ATTENTION:** moisture must not condense on the surface and inside the unit, e.g. during a rapid change in temperature and humidity of the surrounding air which would subsequently reach the dew point (intensive, unsightly surface oxidation of the galvanized layer may subsequently occur)

■ The air-handling unit must be protected against dust, gases and caustic vapours, or other chemical substances which could cause corrosion of the unit's structural parts and components.

■ The air-handling unit must not be exposed to the effects of weather and direct solar radiation

■ Sections of air-handling units REMAK X series may only be stored in their operational position.

Installation

Installation site / plane

■ Unit blocks must be assembled - horizontal/leveled, so in case of a unit installed on the base-frame with or without fixed base legs, the installation site must be strictly leveled and flat. Maximum misalignment of the floor or supporting structure intended for the air-handling unit installation must not exceed 1 mm per 1 meter. When using the adjustable legs intended to floor unevenness compensation, the max floor unevenness cannot exceed -20 up to +5 mm. Due to the loading limit the leg tilt must not exceed 10º.

Observance of these conditions is essential for installation as well as for the air-handling unit operation.

The air-handling unit equipped with an integrated base-frame does not need any special anchoring.

It is advisable to ground the air-handling unit with grooved rubber stripes (not part of delivery)

■ ATTENTION: while installing the rotary exchanger section (ROV) it is necessary to adhere to the horizontal position of the frame which affects the rotation of the rotor and the tightness of the section (prevention of rotor misalignment).

Space for service access

■ When planning the air-handling unit location, it is necessary to ensure the sufficient space for maintenance and service (including potential extension of internal components to the service side) . The needed space depends on the particular unit section configuration (internal modules) - see Fig. 6

■ **Minimal distance to the walls is following:**

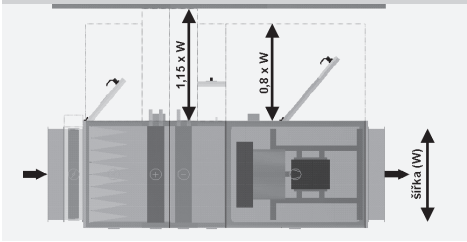
750 mm: filter

0,8 x width (W): fan section

1,15 x width (W): heater, cooler, drop eliminator, plate heat exchanger, rotary heat exchanger

■ For common service, maintenance, and guarantee repairs, it is necessary to ensure access to the rotor of the rotary heat exchanger from both front sides (access from the adjacent sections). Should this not be possible due to the unit configuration, it is also necessary to ensure a possible extension of the whole section out of the unit assembly.

Fig. 8 – minimal service access space



Installation setup

Prior to installation following actions must be performed:

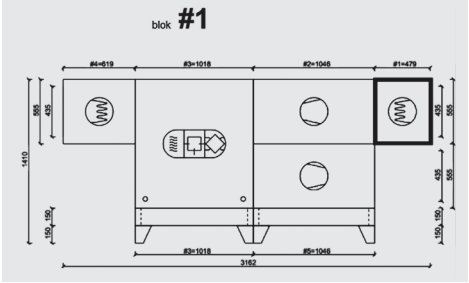
■ check of the rotary parts free rotation (fans, dampers, rotary heat exchanger) disassembly of the block transport legs (see chapter "Transport"

■ check of the power supply and other media (according to the project and technical specification of the delivered unit)
■ **ATTENTION:** Any faults must be removed before starting the installation.

Blocks identification

Each block sheet contains information to which unit the particular block belongs, the block designation and its graphically marked position in the unit layout.

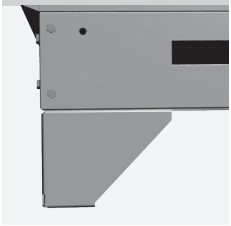
Fig. 9 – sheet with unit sections and parts identification



Base legs installation

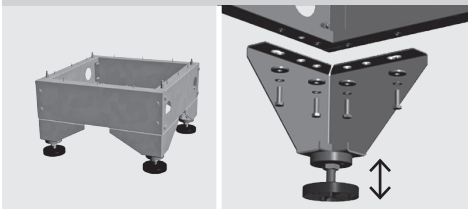
■ By virtue of safety and transport, the fixed or adjustable legs may not be mounted and it is necessary to install them on the site (it has to be done before final set-up and connection to the other blocks).

Fig. 10 – fixed leg



■ To mount the fixed or adjustable legs to the base frame, lift and place the section or block on spacer (eg. wooden timber, bricks, etc. of sufficient height according the height of leg and space needed for mounting)
■ **Attention:** Spacer must be stable to prevent the section from tipping over.
■ Screw the fixed or adjustable legs with 4 M8 × 25 screws, via a fan/tooth and a wide washer to the pre-installed M8 self- clinching nuts in the section base frame – the fixed legs mounting screws are included loose (fig 11).

Fig. 11 – mounting of legs to the base frame

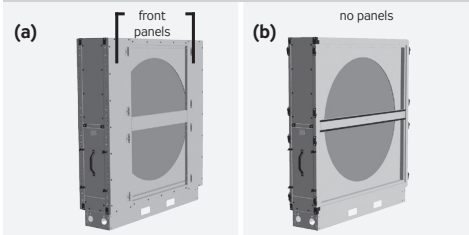


Note: The adjustable leg can be positioned within a range of ±10 mm.

Rotary heat exchanger/regenerator section (ROV)

■ **ATTENTION:** In order to avoid dynamic load on the rotor during transport, the rotor of the despatched exchanger is fastened by means of removable parts. The rotor fasteners must be removed before the final exchanger assembly into the AHU .
■ **ATTENTION:** While installing, it is a must to adhere to the horizontal position of the base frame and the rotor vertical position (ROV). Failure to do so shall cause the rotor misalignment and affects the tightness and lifetime of the entire section..
■ It is recommended to connect the exchanger to the other sections first from one side (see chapter Connecting the unit sections) and to check its vertical position. The gap between the rotor and its sealing on the circumference must be even and the rotor has to spin freely (no signs of friction at any position).
■ The rotor misalignment can occur due to improper handling, transport, or improper installation.
■ **ATTENTION:** If the misalignment prevents the free rotor spinning , the rotor must be re-centered - contact the Remak service.

Fig. 12 – Rotary heat exchanger with(out) head panels



Gas heating section

■ Installation, commissioning and inspection of the section with indirect gas-fired heating as well as of burner are described in detail in a separate designated Operating and assembly instruction , which is a part of the accompanying unit technical documentation.
■ For correct, trouble-free and safe operation, it is necessary to connect the safety and control elements that are supplied with the section.
■ The gas heating section must be connected to the ventilation duct with flexible connector temperature resistant up to 200 ºC.
■ Connection to the smoke flue must comply with all norms and standards of the given state and must be performed by a professionally certified company. The flue is not included in the delivery.
■ In case of being a burner operated outdoors in the temperature range -20 ºC to -40 ºC, a special heated burner cover and a burner with a flange for external air supply must be installed.
■ Burner being operated outdoors in the temperature range 0 ºC up to -20 ºC must be equipped with cover and a thermostatically controlled heating cable has to be installed. This set is standardly part of the delivery.

Unit blocks assembly

■ A combustion chamber condensate drainage (½" pipe) is installed In the rear part of the section. In the case of outdoor installation, the drainage freezing has to be prevented. A flue drainage also has to be ensured.

Installation of a closed heated burner cover

The external air supply for the burner is to be made by means of flexible duct. To pass the flexible duct through the cover,

Table 1 – included M&C components

Component	Place of installation	
Pt100 – flue-gas temperature sensor	to the flue-gas exhaust (flue-gas duct)	it must be installed during device assembly
ESD3J – triple thermostat	gas heater section (behind the heat exchanger, following the airflow direction)	installed by the manufacturer
TH 167 – emergency thermostat	just preceding the gas heater section	it must be installed during device assembly

a hole is to be made at the appropriate place, in which the hose has to be sealed. The air intake must be out of the heated space.
The TBW 500 burner cover heater has to be attached to the heater panel under the burner valve block using a mount (enclosed with 4 screws). The electrical connection is to the 7-pin burner connector. The heating power supply is taken directly from the burner and therefore it is necessary that the terminal "L" in the burner is always under voltage . The thermostat in the burner cover is set to a temperature 5 ºC. When the temperature in the cover falls below the set value, the heating is switched on.

Unit blocks assembly

General information

■ Assembly of the individual unit sections is performed using the self-aligning connection set, screws and M8 nuts. On the sections outer front and rear sides there are factory installed self-aligning connectors (in case of units with air currents side-by-side arrangement the rear self-aligning connections are installed inside the section). When the blocks are put together the connectors fit into each other. Sealing 50 x 8 mm is factory installed on the block's contact surface.
■ Based on the current site layout the block connectors can be relocated to the casing inner side where the M6 rivet nuts are factory installed.
■ **ATTENTION:** When changing position of the self-aligning connectors (inner–outer), always screw the original M6 screws back into the loose holes.

Blocks assembly procedure

■ Mating sides (with sealing) of the individual blocks constituting the air-handling unit have to be pressed together
■ **ATTENTION:** Check the state and intactness of the factory installed seal before pressing the section together
■ **ATTENTION:** it is absolutely necessary to align the sections vertically (spirit level) and horizontally before you press and screw them together (alignment of the sections has a fundamental impact on the connection quality and tightness as well as on the subsequent flawless unit function as a whole).
■ Aligned and pressed together sections are screwed using the preinstalled self-aligning connectors and tightened by means of M8 screw and nut (M8 x 35 allen head) - M8 screws and nuts are put in the factory installed self-aligning connectors - see fig. 13.

Fig. 13 – inner/outer position of self- aligning connectors

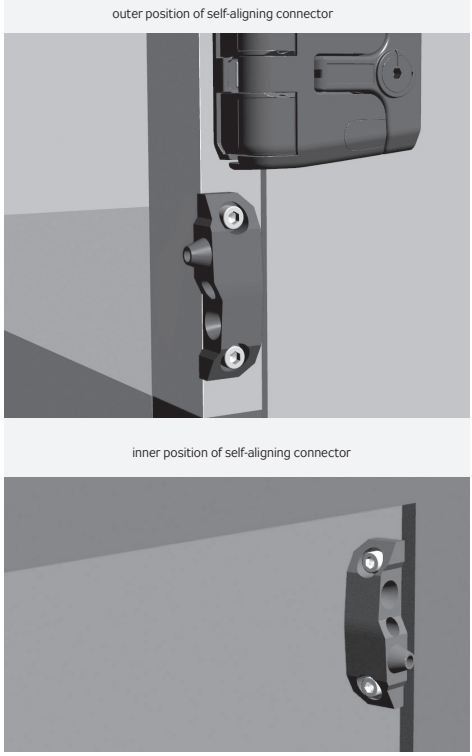


Fig. 14 – sections connection (connectors + M8 screw)

Connection of blocks using internal frames

■ Some units can be factory-equipped with reinforcing internal frames, which can also be used to connect individual sections (as an alternative to the external primary connection, for example due to limited access to the external connection of sections, or for units with side-by-side arrangement of air flows...).
■ The frames have pre-prepared holes that can be used for the internal connection of sections (the holes are covered with plastic plugs).

Fig. 15 – internal frame

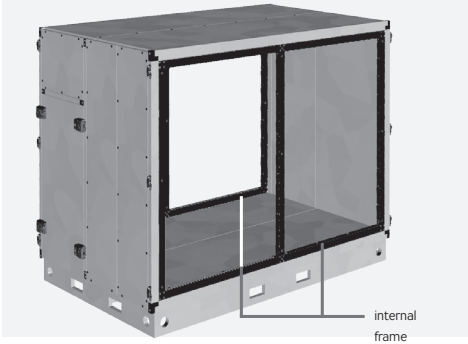
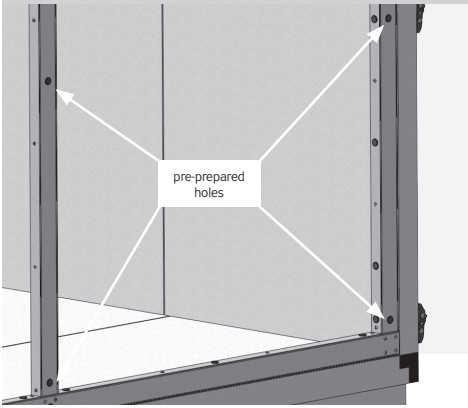
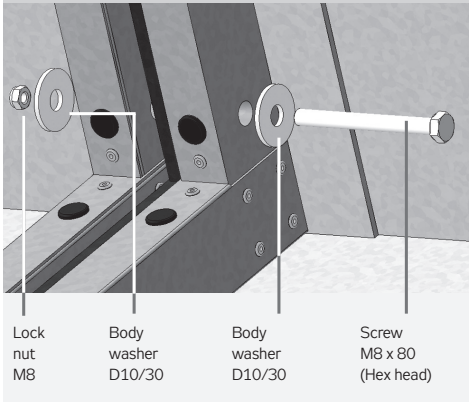


Fig. 16 – pre-prepared holes



■ For connecting the back, front and upper and lower walls of the sections (according to the current need and access)
■ The connection is made through the holes in the frames, after removing the cover plugs, using a screw connection with washers and a nut.
■ The contact surfaces of the sections must be provided with a seal for the connection of the sections (check before connection).

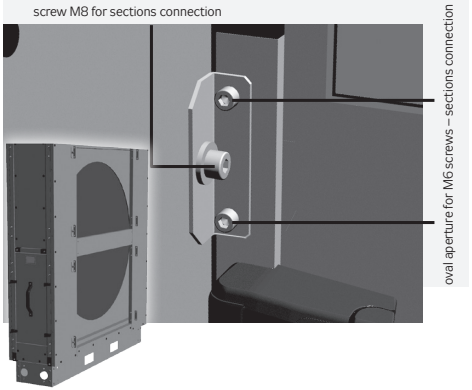
Fig. 17 – screw connection of sections



Rotary exchanger/regenerator external connection - procedure

■ **ATTENTION:** it concerns only sections that protrude the unit width
■ After pressing together and aligning, tighten the connection by means of the preinstalled rectangular sheet metal couplings and M8 screws with washers into the prepared holes in the front panels of the rotary heat exchanger.
■ Rectangular sheet metal couplings are factory pre-installed on the rotary heat exchanger section.
■ Unscrew the self-aligning connectors mounted on the adjacent blocks and sheet metal couplings are connected to their holes. Disassembled couplings can be used for possible internal connections.

Fig. 18 – connection by means M8 screws and rectangular couplings



Unit blocks assembly, Roof assembly

Accessories assembly

■ Accessories (if a part of delivery) i.e. rain louvers, outer dampers are factory installed on the appropriate blocks as a standard. Flexible connectors are delivered in bulk.

■ Accessories can be dismantled, for example, due to the space for handling and transport - fastening with screws and guide rails (louvers, exhaust extension).

Fig. 19 – accessories

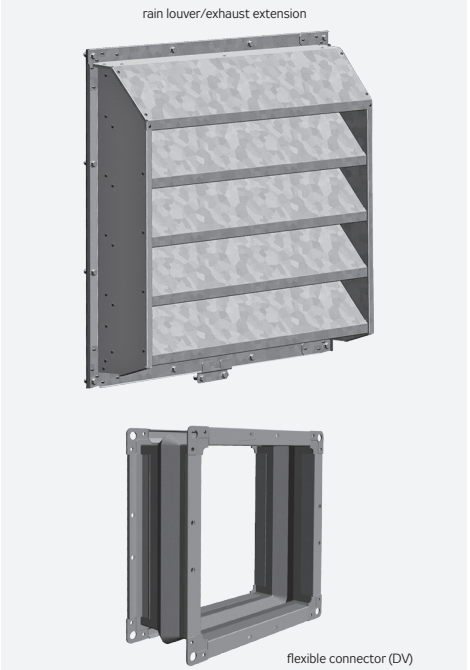
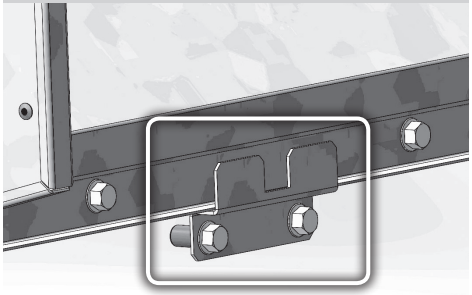


Fig. 20 – fastening with screws and guide rails



Roof assembly

In case of the outdoor unit selection, sections are equipped with factory installed outdoor roof as standard. The marked parts of the roof are included with the specific individual sections of the unit during delivery, including the appropriate connecting and sealing material..

Roof mounting points

■ The installation of the roof is carried out only after the complete setting, connecting and tightening of all connectors of the individual sections of the entire unit.

■ **ATTENTION**, all sealing of parts and joints of the roof is carried out exclusively with PU (polyurethane) sealant - the sealant is included as standard in the delivery.

■ The first and establishing assembled part of the roof is the initial part with the hem down (see detail A),

■ The lock hems must always connect to each other - the lower hem under the higher hem.

Fig. 21 – roof parts centering, hem down only **-A**

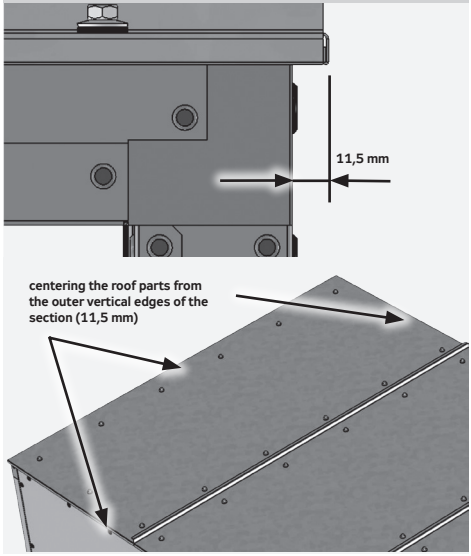
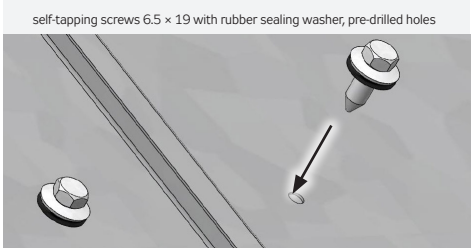


Fig. 22 – fastening roof parts with screws



Roof assembly

Fig. 23 – start/end hem down **-A**

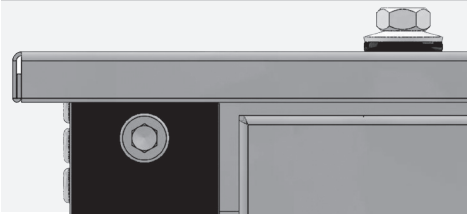


Fig. 22 – connection of roof parts **-B**

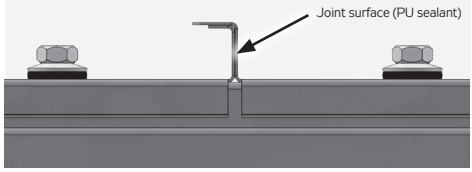


Fig. 24 – roof section joint, above the section joint **-C**

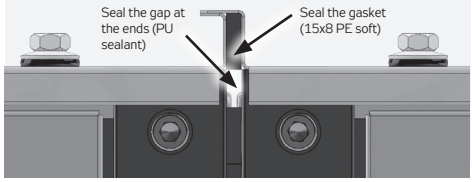


Fig. 25 – Roof connection with the following section **-D**

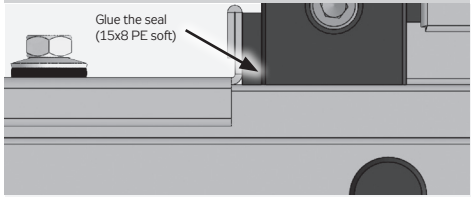


Fig. 26 – installation of the roof cross-joint cover **-E**

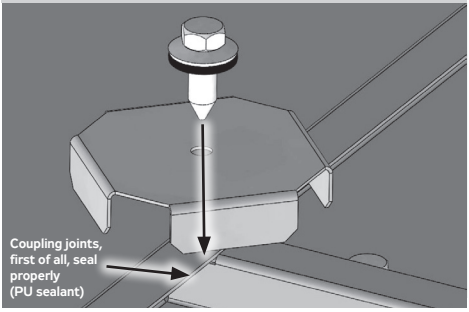
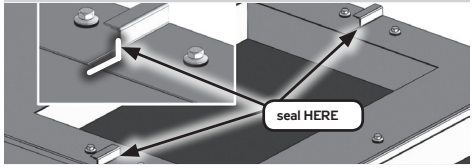


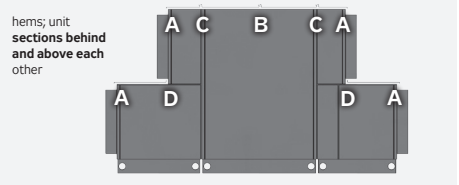
Fig. 27 – sealing of roof parts (PU sealant) **-F**



Installation – branches/sections of the unit in an arrangement behind/above you

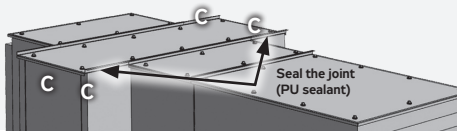
If the unit is arranged in sections one above the other, the part of the roof of the lower section is connected to the beginning of the upper section with one bend upwards (detail **-D**, Fig. 25).

Fig. 28 – example of roof parts layout



■ **ATTENTION**, for units where the RHEX section is wider than the unit, the roof edge is up (detail **-C** , Figure 24).

Fig. 29 – roof; RHEX section wider than unit

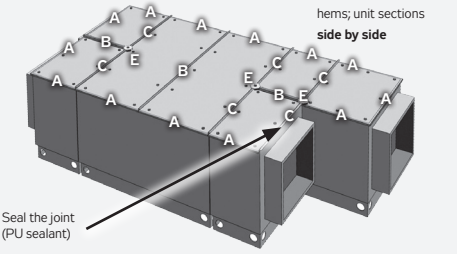


Installation – unit branches/sections in side-by-side arrangement

■ **ATTENTION,** for the first section of the branch, which is shifted in its initial position from the beginning of the unit, the first hem of the roof is locked upwards - this hem is also connected to the hem of the next section.

■ Above the middle cross joints of the roof, the joint caps are fitted with 6.5 x 19 self-tapping screws with a rubber washer (detail **-E** , fig. 26).

Fig. 30 – example of roof parts layout



The condensate drainage, Air duct connection

The condensate drainage

■ Sections (cooling, plate heat exchanger, steam humidification, etc.) with installed sloped stainless steel drain pans to drain condensate, must be fitted with a condensate water trap/siphon kit.

■ Drain pans are connected through the casing by DN40 outlet which enables the drainage kit fitting. The condensate draining kits are available only as optional accessories.

■ A separate condensate draining kit must be used for each individual drainage. The condensate draining piping must be lead into a free atmosphere, i.e. it must not be lead directly into the closed sewerage system.

■ **ATTENTION:** for installations in outdoor and freezing environments (for protection against freezing and for protection against UV radiation), the condensate drain must be additionally shielded and protected with suitable insulation (or tape) with an aluminum cover layer, or add a heating cable to the condensate drain. Condensate drainage is not uv stable.

■ Dimensioning, water trap/siphon height calculation see fig. 31 below.

■ Siphon DN40 type HL 136.2 for drain pans with the option of water refilling. To be used for over- and underpressure. Available as an optional accessory (fig. 32)

■ Before first startup and after prolonged shutdown of the unit, it is necessary to fill the siphon in overpressure with water through the plastic plug.

■ The height of the unit above the floor must be adapted to the required height of the siphon for draining condensate (sum of the height of the base frame, metal legs, supporting structure under the unit, etc.).

Fig. 31 – Siphon height calculation

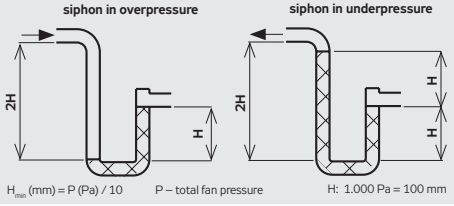
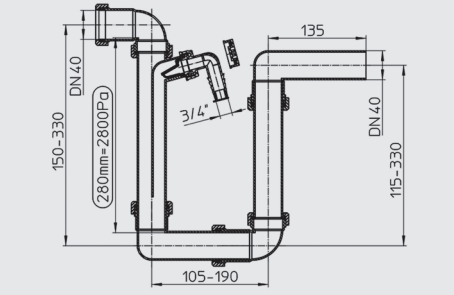


Fig. 32 – siphon (optional accessory)



Siphon in overpressure

■ Location of the outlet in the air duct behind the fan (air is forced).

Siphon in underpressure

■ Location of the outlet in the air duct before the fan (air is sucked)

Air duct connection

Flexible connector (DV)

■ Flexible connector (DV) is always factory installed on the respective AHU inlets/outlets.

■ Ventilation duct must be connected by means of a flexible connector (DV), which prevents the transmission of vibrations and eliminates the potential non-alignment of the duct with the AHU outlet opening.

■ **ATTENTION:** Connected ductwork must not load / deform the flexible connector (DV) and the unit casing.

■ ATTENTION: After ductwork connection and during AHU operation, flexible connectors must not be fully stretched or compressed (there is a risk of its damage). After connection to the ductwork the optimal length of the flexible connector (DV) is about 150 mm (fully stretched DV is 160 mm).

Anchoring the Air Handling Unit

■ The manufacturer does not specify the anchoring method or sizing of the AHU to the building structure, nor assess its structural capacity. Anchoring must be designed and installed to suit site-specific conditions, particularly wind loads and the load-bearing capacity of the supporting structure, in accordance with the project documentation, applicable legislation and technical standards.

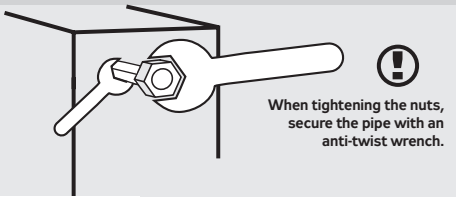
Connection of heating/cooling media

■ The exchanger/coil can be connected on the unit outside (directly to the coil header connection), or inside the unit (prepared to the connection of the exchanger or mixing set inside the unit casing)

■ Header connections are always equipped with external thread (threaded flanges are not part of shipment)

Fig. 33 – input/ouput for cooling and heating media

Fig. 34 – connection of fittings to exchangers



Connection of heating and cooling media, Exchangers

■ **ATTENTION:** weight and dilatation forces of cooling and heating media fittings must not impact the unit casing
■ **ATTENTION:** When connecting the feeding fittings to the heat exchangers, use two wrenches to tighten the screws to avoid the exchanger headers rupture by torsion.

Fig. 35 – exchanger´s connection

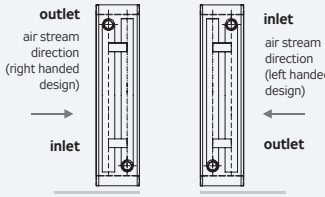
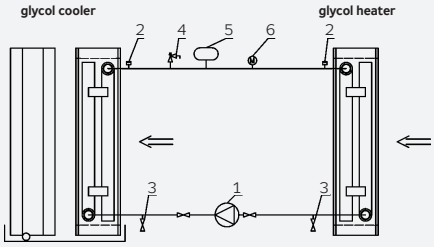


Fig. 36 – connection of glycol circuit



1) pump
2) vent valve
3) feed/drain valve
4) safety valve
5) expansion tank
6) pressure gauge

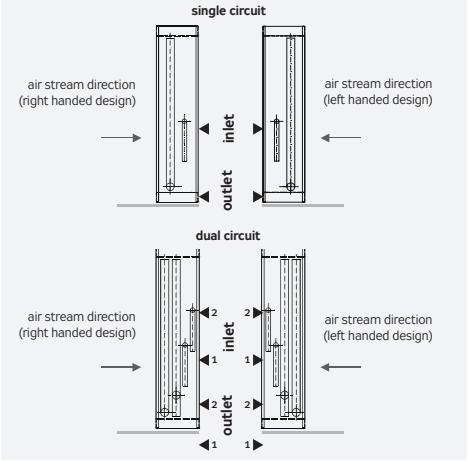
Water and Glycol Heat exchanger connection

■ To achieve maximal output the counter-flow connection of the heat exchangers is required. (Fig 31)
The corresponding connection points are marked with labels on the unit side panel (heating water inlet, heating water outlet, coolant inlet, coolant outlet).
■ The water coils are equipped as standard with a manual air vent valve G 3/8", mounted in the upper part of the collector (for direct external connection it is located outside the unit).
■ **ATTENTION:** After connecting the exchanger coil (heater and cooler, mixing set including) to the piping, it is necessary to pressurize (fill with water) and vent the entire circuit, including the heat exchanger. Consequently, perform a leakage check of all pipe connections as well as the exchanger itself (including the heater/cooler section interior check).
■ The manufacturer is not liable for damage caused by leaky connections or damaged exchangers.

Direct evaporators

■ Direct evaporators must be connected by a professional contractor authorized to refrigerating equipment installment.
■ The direct evaporators are pressure-tested and factory filled with nitrogen.

Fig. 37 – evaporator´s connection



■ They can be filled with the following refrigerants - R134a, R152a, R404a, R407c, R410a, R507 (ASHRAE Number). Local refrigerant legislation has to be always respected.

Wiring and control system installation

■ The wiring and control system installation must be performed by qualified professionals authorized to perform wiring of the given type.
■ The wiring must be performed in accordance with locally valid directives and standards, and in compliance with the Installation and Operating Instructions of particular components (frequency inverters, pressure and temperature sensors, etc).
■ **ATTENTION:** Before switching on, it is necessary to check the conformity of voltage, frequency and protection with the data stated on the particular component label and the cross-sections of the connecting cables as stated in project documentation.
■ **ATTENTION:** an initial inspection of the electrical equipment must be carried out before start-up (see chapter Unit commissioning)!

Motor wiring (fans)

■ To ensure the proper unit function, the motors must be connected so that they rotate in the correct direction. The EC and PMblue motors are equipped with electronics that ensure the correct fan rotation direction according to the manufacturer's motor parameter settings to the given impeller and also monitors for fault conditions; fault is signalled by a fault contact.
■ AC motors are equipped with thermistors as standard, which provide information about the faults (overheating) of the motor to protect the motor from overload damage (to be evaluated by the control system). AC fans rotation direction must be ensured by the correct motor phase connection to the mains.

Wiring and control system installation

■ These protections must be connected in accordance with the specified wiring diagram. Fan section can be equipped with the service switch. The service switch placement and connection must be performed in accordance with locally valid directives and standards as well as in compliance with the *Installation and Operating Instructions*.

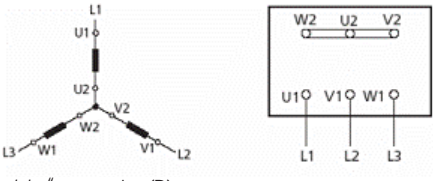
■ The service switch (shipped as an optional accessory) is intended to disconnect the fan and the thermo contacts from the power.
This prevents the unintentional start and presence of voltage on the thermocontacts during maintenance.

■ **ATTENTION:** Service switch is neither main nor emergency switch. After switching the service switch on again, it is necessary to check the state of the STE and STD relays, respectively of the parent control system, and reset the failure of the TK thermo-contacts caused by disconnecting the service switch.

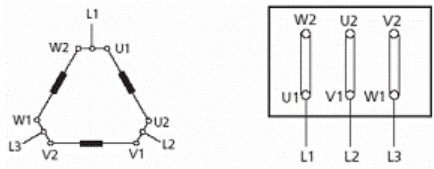
Fan sections with AC motors (single speed)

■ They are alternatively usable/supplied in two possible mains supplies - therefore they must always be connected, or when connecting the wiring, it is necessary to check and possibly reconnect the motor (correct connection of the winding to the star or to the delta (Y/D) in the motor terminal block), in accordance with the project design and the design of the motor winding with regard to the actual operating value of the supply voltage (and frequency) from the mains, or from the frequency inverter.

„star" connection (Y)



„delta" connection (D)



■ As standard, the motors are designed for nominal voltage 230 VD or 400 VY (up to 3 kW) or for 400 VD / 690 VY (above 3 kW) at a mains frequency of 50 Hz.

Rotary heat exchangers with AC motors

■ Similarly as the fan AC motors, exchanger AC motors are always three-phase powered-up either single-phase 230 V or three phase in two possible variants (wye - delta Y/D in the motor terminal box) – therefore they always have to be connected (or run the check the proper connection) in accordance with the project design and motor winding type with regards to the particular supply voltage (and frequency) from the mains, or from the frequency inverter.

■ As standard, the motors are designed for nominal voltage 230 VD or 400 VY at a mains frequency of 50 Hz. See figure above for wye (Y) and delta (D) wiring.

Electric heater connection

■ A heater wiring diagram is enclosed in each electric heater. The control system must provide the heater blocking so that it cannot be switched on without running the fan. After heater switch off, the fan has to be running for at least five minutes.

■ The air flow through the heater must match its designed output to prevent overheating of the heating rods.

Gas heater connection

■ A burner and gas-fired heater/burner wiring diagram is enclosed in each gas heater. The control system has to ensure that the heater cannot be switched on without running the fan. After heater switch off, the fan has to be running for at least five minutes.

■ The air flow through the heater must match its designed capacity to prevent overheating.

IBET electric preheaters

The heater is designed to preheat a part of the internal AHU space and may be operated as a stand-alone heating component without forced airflow. A wiring diagram is included in each electric air heater.

Electromagnetic compatibility (EMC)

Electrical installations involving frequency inverters always require special attention and professional conduct to ensure trouble-free operation (taking into account the project and specific conditions).

■ Frequency inverters are by their nature a significant source of interference to the mains and also the generated voltage for the powered electric motor is not a pure (single-frequency) sine wave.

■ Basic interference suppression is usually implemented by frequency inverter manufacturers, nevertheless electrical installations with frequency inverters require special attention and professional installation to ensure trouble-free operation – meeting the requirements of technical directives and standards for electrical equipment compatibility (EMC interference) as well as to avoid fans electric motors faults, even faults of the frequency inverters itself

■ Motor damage during operation with the frequency inverter can be caused by increased winding insulation voltage stress and by the occurrence of harmful bearing currents.

■ It is always necessary to solve this issue with regard to the project and specific conditions, certain standard measures – general principles have to be always observed.

Frequency inverter output side

■ Shielded power cables must always be used on the output side of the frequency inverter (between the motor and the frequency inverter), and the shielding must be grounded at both ends of the cable (with large area 360º contact) both in the metal clamp on the inverter side and by proper installation of the shielded cable into the metal EMC grommet in the motor terminal box. Also, any devices installed between

the inverter and motor (e.g., emergency switches, terminal boxes) must be shielded and grounded. The motor thermal protection (thermistors) should be always connected to the inverter using shielded cables.

■ The individual unshielded wires in the motor terminal block and in the controller must be as short as possible whereas the distances between the leads, power and signal wires, must be as large as possible.

■ Since high voltage slope steepness and voltage peaks increase the stress of the motor winding insulation when operating with a frequency inverter it is advisable / recommended to limit their influence by output filter elements – a motor choke with the same clock as the switching frequency of the frequency inverter (chokes are intended for specific frequency) or using appropriate output filters (dU/dt filter).

■ These help to reshape the rectangular signal at the inverter output to signal closer to the sine wave.

■ By filtering the output current, it also has a very beneficial effect on reducing the radiation from the motor cable (eg. interference to acoustics). At the same time, they compensate – reduce the capacitive currents that additionally load the power part of the inverter when using long cables (unless the inverter is directly on the AHU casing).

■ To eliminate (max. reduce) negative effects of the winding voltage stress as well as the bearing currents on the motor bearings, we recommend using sinusoidal filters on all poles. These filters reduce voltage slopes steepness and capacitive currents and replace the output (motor) chokes with even greater efficiency.

■ The sinusoidal filter is the most efficient output interference suppression device. It almost completely eliminates the disturbance by pulse width modulation, ie. at the output of the sinusoidal filter the voltage and output current have almost sinusoidal waveform.

■ When using sinusoidal filters on all poles (between all phases and to the neutral wire), it is not necessary to use shielded cables on the motor supply (and EMC bushing) and the electromagnetic motor noise from higher harmonic currents is also reduced.

■ Wires from the inverter to the filter should be as short as possible (centimeters).

Frequency inverter input side

■ The control cables (MODBUS line or 0–10V signal) between the frequency inverter and the control unit should always be shielded (see also VCS control units wiring schemes).

■ External EMC filters or commutating chokes are to be usually used on the input side of the inverter to meet increased EMC requirements (sensitive industrial plants, residential, commercial and light industry premises).

■ Mains-side chokes reduce harmonic noise injected back into the line and extend the service life of the inverter´s rectifier and mainly its capacitors - that is why the chokes are also highly recommended when connecting frequency inverters close to large transformers to limit charging currents (reduces the current inrush when the inverter is plugged in).

Connection and assembly - other accessories

■ Any other accessories have to be installed according to the AHU specification and the installation instructions of the accessories manufacturer.

■ **ATTENTION:** installation of anything that is connected to the AHU and any other structures must not damage the unit (eg tightness, casing due to excessive load, etc.), obstruct the opening of the door panels, operation and maintenance.

Grounding and protective bonding

Protection against electrical injury

After on site installation and before putting into operation (in terms of wiring) the installation company has to assure proper grounding and protective bonding complying with the locally valid standards and corresponding to the risks of environment at the installation site (eg. humidity) as well as the influence of the other equipment and electric lines which are not related to the AHU.

Door panel settings – full-fledged hinges

■ Once the unit sections have been properly placed and connected (or when servicing) there is possible to set / adjust the door panels correct position (within the hinge setting range) and align them to the adjacent columns and bars - the ideal gap size between panels is about 3 mm (diminishing possible scratching when handling the door panel).

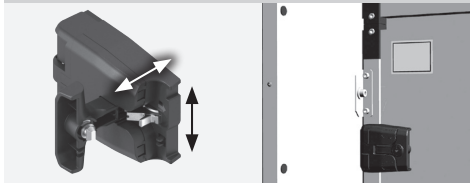
■ The door panel position (gap) is adjusted using the screws hidden under the covers accessible after opening the shutters and oval holes in the hinge (Fig. below).

■ **ATTENTION:** if there is a problem with scratching or the gap size even after adjusting the door panel (within the hinge range), it is necessary to check the section/ base frame planeness (floor).

Door panel (hinges) compression setting

■ The used hinges enable (within their range) the setting of the required door panel compression (tightness).
Adjusting the compression is done by tightening or loosening the screw accessible when removing the cover of the hinge.

Fig. 38 – door panel setting



Commissioning and putting into operation

Preparation to commissioning

- Once the unit installation is finished and all related equipment connected (ductwork , media connections, wiring, condensate drainage, control elements, etc.), it is possible to start with the preparation and commissioning conducting.
- **ATTENTION:** the unit may be put into operation only by an authorized personnel having the required professional qualifications.
- **ATTENTION:** before first putting into operation, the initial electrical inspection (protocol) of all ventilation installation componentes has to be performed by a professional technician.

Safety measures

- Sections, where injury hazards occur (electric shock, rotating parts, etc.) or with connection points (heating water inlets/outlets, air flow direction, etc.) are always labelled with warning or information label.
- It is forbidden to start or run the air-handling unit fans if the panels are open or removed. The hazard of trapping by movable parts is indicated by a label situated on the service door of the air-handling unit. Service doors must always be closed during air-handling unit operation.
- Before starting any work in sections containing electric equipment (fan, electric heater, etc.), it is essential to turn off the main switch and take measures to prevent unintentional circuit switch on during service operation.
- When draining a heat exchanger, the water temperature must be below +60 ºC.
- Under voltage, it is forbidden to disassemble the electri service panelof the heater (except for performing the specific checks described later in this document) and any change of the safety thermostat setting made by the manufacturer.
- It is forbidden to operate the electric heater without the outlet air temperature control and ensuring the transported air constant flow rate.
- Once the gas heating section has been professionally commissioned, the set parameters of the equipment cannot be changed to ensure safety and trouble-free operation.

Checks and procedures prior to first unit Start-Up

Outside of the air conditioning unit

- The service panels are provided with hinges and external closures. The closure simultaneously serves as a handle. A special tool – a wrench – is needed to open/close the closure, all closures must be fully working.
- proper air-handling unit alignment
- proper connection of all air-handling unit parts to the respective air ducts
- proper connection of all cooling and heating circuits and
- availability of heating/cooling media
- proper connection of all electrical appliances
- all condensate drain kits are installed and flushed
- proper installation and wiring of all control components
- proper conductive bonding and proper earthing is performed
- all parts of the unit are free of foreign objects
- proper insulation of the heat exchanger connection ducts ensuring the surface temperature lower than +60 ºC
- Whether, in the case of a pool unit, the mechanical ventilation of the machine room is functional using temperature-conditioned air at 15 to 35 ºC, with a maximum relative humidity of 65% and a maximum specific humidity of 14.3 g/kg.

Electric Wiring

- all electrical appliances are connected
- all control elements are installed and connected
- proper wiring of all individual electrical components of the air-handling unit according to the corresponding wiring diagrams
- conductive bonding and proper grounding is performed
- grounding and bonding check as a part of the entire building plan

Filter Sections

- state of filters
- mounting of filters
- setting of differential pressure sensor

Fan section

- intactness and impeller free rotation
- tightening of the module screw connections
- cleanliness of the fan impeller, inlet and outlet
- free of foreign objects

Water and Glycol Heater Sections

- heat transfer surface state
- inlet and outlet duct state
- mixing set state
- state, connection and installation of antifreeze protection components

Sections of water/Glycol coolers, Direct evaporators

- heat transfer surface state
- correctness and tightness of the cooling circuit connection
- proper siphon assembly corresponding to the pressure conditions in the chamber
- watering the siphon

Plate Heat Exchanger Section

- exchanger fins state
- functionality of the bypass damper or mixing damper
- proper siphon assembly corresponding to the pressure conditions in the chamber
- watering the siphon
- connection of temperature protection sensors

Rotary Heat Exchanger Section

- exchanger rotor and frame alignment
- checking of the rotor for free rotation
- Belt tension check
- rotor sealing – tight fit check
- correct motor wiring
- motor rotation direction (for the correct rotation see arrow on the motor)
- motor input current (see the product label)

First Start-Up checks

Electric heater section

- mechanical state of the heater and heating elements, cleanliness of the heating coils surface and the heater interior, free of foreign objects
- inspection of all heater connections (power, control and protective wiring)

Gas heater section

- condensate drain connection
- connection of sensors and thermostats and their functionality
- connection of the gas burner
- connection to the flue gas ducting
- bypass damper functionality

IBET Electric preheating

- functionality and blocking check
- safety/operating thermostat check

- **ATTENTION:** Until the complete ventilation system is set up, the air-handling unit can be put into operation provided the unit inlet damper is closed. Operating the air-handling unit while the ventilation system is not set up completely can cause motor overloading and permanent damage. If the air-handling unit includes a second filtration stage, it is advisable to run the pilot operation with the second filter stage inserts removed.

First Start-Up checks

- Check the proper direction of the impeller rotation – see the arrow on the impeller or spiral casing
- Check the rotary heat exchanger proper (see the arrow on the rotor) and free rotation (no signs of scrape)

Check the input current of connected equipment (it must not exceed the maximum permissible value stated on the product label)

- After 5 minutes of operation check the fan bearings temperature. **ATTENTION:** This check may only be performed if the fan is switched off!
- Check the water level in the condensate draining siphon. If the water had been drawn off, it is be necessary to increase the siphon height
- Check the state and mounting of the filters
- During the pilot operation, it is necessary to check the air-handling unit for unusual noise and excessive vibrations. The pilot operation should last at least 30 minutes. After its completion the air-handling unit must be inspected again. Pay special attention to filters (check them for damage), the fan section and the correct function of condensate drainage. In case of excessive vibrations it is necessary to check again the fan module and perform vibration intensity measurement, if necessary. If the vibration intensity of the free impeller fan module exceeds 2.8 mm/s (measured at the motor bearing shield on the impeller side), the fan must be checked and balanced by a professional technician. Before putting the air-handling unit into permanent operation, it is recommended to replace or regenerate the filter inserts.
- **Set up of the entire ventilation system (protocol) must be performed during the pilot operation.**

Electric heater

- **ATTENTION ,** electric heater may be put into operation only after the fan has reached operating speed.
- When commissioning for the first time, the heaters must be burned by switching on for 15 minutes at the fan maximum operating speed ; the unit has to be under surveillance.

Gas heater

- This is a dedicated gas fired appliance/equipment requiring special commissioning procedure.
- After the installation of a gas-fired AHU , it is necessary to order a separate burner commissioning at the burner manufacturer or its service agent.
- The connection of the triple thermostat and the gas burner must be carried out in accordance to the relating documentation.
- In addition to the burner adjustment, connection of the safety thermostats and control elements to the burner control circuits and the air handling unit (fans) shall be checked.
- Burner commissioning protocol has to be drawn specifying the gas heater temperatures settings, emergency and safety elements checks.
- The section is supplied with separate documentation delivered by the combustion chamber manufacturer, which is a part of the technical documentation for the REMAK X series unit.
- **WARNING,** never start the gas heating block when the AHU (fans) is stopped, otherwise, there is a risk of local overheating and damage of some components (e.g. filters, drop eliminator, etc.).

Fig. 39 – fan sampling probes

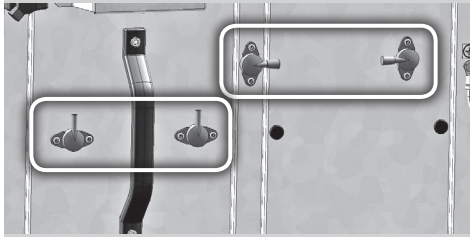
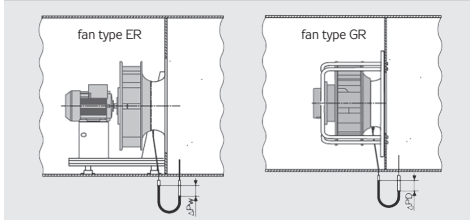


Fig. 40 – pressure difference measurement



AHU Inspection and maintenance, Periodical checks

Check of the fan air flow set up

■ After unit instalment and commissioning air flow can be checked and set up using a simple method of measurement at the diffuser. This method eliminates to some extent faulty results determined by duct air speed measurement which are caused mainly by turbulence and non-linear air flow.

■ For this method of the air flow measuring, sampling probes are installed as standard on the casing of the fan section (provided the section is not equipped with a measuring device).

■ K-factor (data needed to calculate the air flow) of the particular fan type is indicated on the fan section product label.

■ The formulas for air flow calculation and the scheme for determining the measurement of the difference between the static pressure in front of the fan inlet diffuser and the static pressure in the fan diffuser are shown in the figure below.

Air flow Rate Determination – Fan

Air flow calculation (standard air temperature 20 ºC, density 1,2 kg/m^3):

$$\dot{V} = k \cdot \sqrt{\Delta p_w}$$

Air flow calculation at different temperature than 20 ºC

$$\dot{V} = \sqrt{\frac{\rho_{20}}{\rho_{op}}} \cdot k_{20} \cdot \sqrt{\Delta p_w}$$

qv – air flow rate
k – fan factor (provided by the fan manufacturer)
Δpw – static pressure difference (measured value)
ρop – air density at operating temperature

Service Modes of Pool Units

The application software of the VCS_POOL control units includes forced operating modes for the air-handling unit. All installed dampers, components, and devices are gradually checked and adjusted in the following operating modes:

- Off
- "Heating with Heater" Mode
- "Heating with Heat Pump" Mode
- "Air Dehumidification – Stage 1" Mode
- "Air Dehumidification – Stage 2" Mode
- "Ventilation" Mode
- "Summer Operation Mode
- "Cooling" Mode

A detailed procedure for commissioning the pool units is provided in the manual "Initial Start-Up and Subsequent Service of the Pool Unit".

Operating Rules

Before putting the air-handling unit into permanent operation, the plant operator must issue Operating rules in accordance with locally valid regulations.

Following content is recommended:

■ configuration, intended use and a function description in all operating modes

■ description of all safety and protective unit elements and functions

■ health protection principles, safety and operating rules

■ requirements for operating staff qualification and training, a list of personnel authorized to operate the air-handling unit

■ detailed emergency and fault instructions to be followed by the operating staff

■ specific operating situations during different climate conditions (e.g. summer or winter operation)

■ inspection, checking and maintenance schedule, including a list of checking acts, and the way of their recording

■ records of operating staff training, operation inspections and cleaning of the rotary heat exchanger (subject to Remak a.s. guarantee validity)

■ the obligation to log and keep an unit Operations Logbook, with records (and protocols) of regular maintenance, cleaning and performed service actions (required for possible complaints - see Warranty and complaint conditions of Remak a.s.)

AHU Inspection and maintenance

AHU inspection and maintenance can be performed only by adult skilled persons, familiar with the operating and installation instructions for Remak X-Series units.
When performing inspection and maintenance, it is necessary to follow these instructions and regulations; neither manufacturer nor supplier bear responsibility for damage caused by infringement of these instructions and regulations.

Safety measures

■ A warning or information label is always placed on sections with shock hazards (electric current, rotating parts, etc.) or with connection points (heating water inlet-outlet, airflow direction, etc.).

■ It is forbidden to start or operate the unit fans with open or dismantled panels. The risk of entrapment by moving parts is indicated by a label on the unit service door. The service door must always be closed during operation and locked (if available) to prevent unwanted access.

■ Before starting work on the fan section (part), it is essential to switch off the main switch and take measures to prevent the unintentional fan start during the service operation.

■ When draining the heat exchanger, the water temperature must be lower than +60 ºC.

Continuous Operation Checks

Continuous unit operation checks are performed by visual inspection and listening test at least once a week, without intervention in the unit operation.

Operator control checks (during operation):

■ fans and motors operation (noise and vibration) check by listening, ie the unit must not show excessive vibrations as well as inappropriate sounds (strong droning, knocking, whistling, or any other acoustic signs of bearing malfunction).

■ check the filters for blockages via the pressure differential sensor and replace them if necessary - see filter replacement procedure (page 20)

■ checking the functionality of the heat recovery system, if visually possible

■ functionality of the air temperature control

■ the condition and functionality of the control system connected to the unit, the correct functioning of which is necessary for the operation of the unit and the air handling unit as a whole.

■ the presence of water in the siphon with refilling if necessary

Cleaning, Inspections/checks

Periodical checks

The user shall determine the air handling unit periodical inspection intervals based on to the operating conditions (eg enhanced dust nuisance atc) , however, at least:

a) a) Once every three months (protocol)
Check for contamination and possible damage to the basic functional groups of the air-handling unit:

- filters (hygiene condition, clogging rate, unacceptable damage or perforation)
- heat recovery, heat-exchangers (functionality, fouling, leakage or damage)
- humidification system (hygiene condition, functionality, circuit tightness, nozzle or honeycomb clogging)
- condensate drainage (no residual water in the pan or elsewhere, condensate drainage permeability)

b) Once every six months (protocol)

- Check all the functional groups of the air-handling unit for functionality, failure-free state, potential corrosion, cleanliness and hygiene, including necessary maintenance, cleaning and repair and/or replacement of damaged parts
- It is usually carried out in the spring and autumn, i.e., before the winter and summer season during a short unit shut-down

c) Once a year (protocol)

- General service inspection of the air-handling unit focused on functionality, flawlessness, corrosion, cleanliness and hygiene, including casing and roofs, combined with general maintenance, cleaning, disinfection, repair and/or replacement of damaged parts
- It is carried out mainly in the summer months during a longer unit shut- down

Basic service check topics

- cleaning of the external casing and all covering parts/ roofs (see the chapter Cleaning)
- cleaning of inlet and outlet chambers
- replacement of filter inserts and cleaning of the chamber
- inspection and cleaning of fans
- inspection and cleaning of the plate or rotary heat exchanger
- inspection and cleaning of heat exchangers, circuit leakage check
- cooling system inspection, including potential refrigerant refilling performed by a cooling technician
- inspection and cleaning of the humidification system (disinfection, nozzle cleaning, inspection of steam generator containers)
- inspection and cleaning of the drain pan and condensate drainage system
- inspection and cleaning of closing dampers (including set up)
- electric heater state and connection check
- gas fired heating section check (adjustment of the burner by an expert technician)
- check of the steam generator and steam distribution system states
- checking the weight (saturation state) of the activated carbon cartridges
- inspection of elastic connections tightness
- cleaning of air ducts and all accessory elements, insulation check
- cleaning of other areas of the air-handling unit (service and air mixing sections, etc.)
- inspection of fire dampers (by an authorised technician)
- treatment of damaged surfaces or already corrosion-affected parts by a suitable method (painting)
- general cleaning of the machine-room

The cleaning procedure is described in the respective chapters.

Cleaning

- Inspection of unit cleanliness and removal of coarse dirt must be performed at least twice a year
- It is advisable to perform general cleaning as part of the service inspection at least once a year while the air-handling unit shut-down
- When cleaning the air-handling unit, remove all dirt from external and internal parts of the unit, including the roof (if installed)
- All components intended to be opened, released, or easily disassembled must be put into a position that enables thorough unit interior cleaning
- Deposited and not removed dirt can be a source of bacterial contamination and cause corrosion (In case of corrosion, the corroded surface must be immediately treated with suitable anti-corrosion agent
- **ATTENTION: cleaning is allowed only if the unit is switched off and ensured against accidental start.**
- **ATTENTION to foreign voltages (such as electric heating and preheat elements power supply, etc.)**

Dry cleaning

- Dry cleaning can be performed by wiping with a dry cloth, hand brushing, or vacuuming with a mild suction
- Compressed air cleaning (blowing) – can be performed only on the unit parts dismantled from the unit casing, so that dirt is not to be blown to other unit parts
- **ATTENTION:** dry cleaning must be carried out only in a way that prevents damage, especially to sealed joints and painted surfaces, without the use of abrasives. In the event of damage, affected surface and sealings must be repaired immediately.

Wet cleaning

- Wet cleaning is performed by wiping with a wet mop ,wet brush brushing and/or drops vacuuming under mild suction It is possible to use a common detergent, free of chlorine, solvents and abrasives
- Water jet cleaning can be performed using conventional jet cleaners and exclusively to sections equipped with a condensate drain pan - max water jet pressure must not exceed 0,25 MPa.
- Chemical cleanup (disinfection) can be performed by applying of disinfecting agents (liquid, gaseous) (not dry agents) using hand wiping (mop, jet cleaner or gas generator
- **ATTENTION:** wet cleaning and water jet cleaning cannot be applied to absorbent surfaces (eg splitters of the sound attenuators).

Inspections/checks

■ **ATTENTION:** during wet cleaning, it is necessary to ensure safe disconnection of electrical components from the supply voltage.
■ **ATTENTION:** chemical cleaners used for wet cleaning and disinfection must not affect materials used.
■ **ATTENTION:** all cleaning must be conducted with closed inlet and outlet dampers, it is recommended to have an inlet filter fitted/placed.
■ **ATTENTION:** for cleaning, do not use any brushes or similar harsh, surface-damaging tool.

The basic methods of cleaning the individual specific installations of REMAK X ahus are described further in the relevant chapters of this manual.

Inspections/checks

Unit casing check

■ State and cleanliness check of the casing external and internal surface - clean the surface (see chapter Cleaning)
■ Anti-corrosion protection check (galvanized, painted surface...)
■ Service and door panels seals check – state, intactness, tightness
■ Hinges, handles state and function check including pressure adjustment
■ Roof state and tightness check (outdoor design)
■ Unit bonding and grounding check (central ground contact)
■ Check of the ductwork connection, flexible connectors tightness and state check

Fan module check

Inspection of the equipment when disconnected from the power supply:

■ **ATTENTION:** Mind the extraneous voltage (such as electric heating and preheating external power supply.
■ **ATTENTION**, while checking, the fan must be first switched off (use the service switch) and wait for the fan to come to a complete stop (wait at least 2 minutes) before opening the door! Failure to do so may result in the door being blown off due to overpressure in the unit and the risk of being trapped by the rotating part of the fan impeller!
■ **ATTENTION**, Before starting inspection and maintenance, it is necessary to prevent the unprompted/spontaneous fan start up and to ensure that it cannot be started by another person!
■ Impeller and the entire fan module cleanliness check - vacuum rough dirt and dust, wipe off fine dirt with a damp mop
■ Check the fan impeller intactness and free rotation
■ Check the fan module screw tightening
■ Check silent block state and module mounting
■ Check the flexible connection (DV) state and tightness
■ Check the motor wiring, clamp tightening in the terminal box and bonding (grounding)

Fan Inspection after a short test run:

■ Check the vibrations (imbalance), bearing noise and excessive motor warming
■ At the perceived higher level of fan module/components vibrations , a control measurement should be performed and, if necessary, the fan module should be rebalanced to complying parameters.
■ Check the motor wiring, clamps tightening and bonding (grounding)
■ Check/measure the motor current, voltage and symetry of phases

Motor bearings

Bearings do not require (and do not allow) lubrication maintenance during their lifetime. The expected life time of a motor ball bearing, calculated by the standard calculation method, is determined by the F10h grease lifetime and range approximately 30,000–40,000 operating hours for standard use. When the lifetime of the F10h grease is reached, the bearing must be replaced. This expected bearing lifetime can be significantly reduced if operated under other conditions such as higher vibration, higher shock, higher or lower temperatures, moisture, impurities in the ball bearing, or improper regulation. To achieve trouble-free operation, replacement of motor bearings is recommended after approximately 20,000 hours, but no later than 3 to 4 years or as specified by the motor manufacturer. Shutdown or inactivity of the equipment does not extend this period.

Important:

■ The standard lifetime data refers to normal, expected operating conditions. Effective bearing lifetime is fundamentally affected by real operating conditions. Therefore, continuous and regular inspections and prescribed service intervals are essential.
■ Attention must be also paid to undesirable long-term still standing (long-term unilateral loading of the bearing without lubrication and lubricant mixing leads to bearing damage and lubricant degradation), this also refers to long-term storage (6 months or more). In this case, compulsory motor start must be executed (according to the motor and/or fan manufacturer instruction). It is recommended to replace bearings after 2 years of storage.
■ The motor or fan may be only disassembled in justified cases such as bearings replacement. Disassembly and servicing may be only carried out by a qualified person. It is recommended to carry out repairs by a qualified workshop or service center of the motor/fan manufacturer.
■ Whenever the fan/motor section is disassembled and reassembled, the fan module must be rebalanced.

Damper check

■ Damper cleanliness check – vacuum the dirt and dust, wipe off fine dirt with a damp mop
■ Free damper blades rotation check
■ Proper damper closure check
■ Proper actuator connection and function check

Filter module check

■ **ATTENTION:** dust captured on the filter inserts can cause breathing problems and skin, mucous membranes or eyes allergic reactions. Therefore it is always necessary to use suitable protective equipment and to avoid direct contact with trapped dust while maintaining and replacing filters.
■ Check the filters insert state and clogging degree
■ Filter module fastening check (seals state check or replacement)

Inspections/checks

■ Filter section and filter module cleanliness check - vacuum the dirt and dust, wipe fine dirt with a damp mop (it is recommended to put the profiled seal out of the horizontal rails)

■ Check the function and settings of the differential pressure sensors

■ Maximal filter inserts (pocket and frame filters) replacement interval can be given by a local legislation (e.g EN 16798-3 or VDI 6022 + DIN 1946-4), regardless of clogging and current pressure loss: 12 months - 2000 hours for the first stage filtration, for further filtration stages and filters in the air outlet a maximum of 24 months - 4000 hours is recommended)

■ If the filter inserts are at the end of their service life (according to the operating instructions or the valid standards), damaged or clogged (see the value of the static pressure drop), it is always necessary to replace them.

Maximal static pressure difference for particular filter classes (according to EN13053:2020):

Course filtration: ISO coarse	■ Δp0 + 50 Pa ■ 3x Δp0	Δp0 ... initial pressure drop of the clean filter ■ smaller value applies
Fine filtration: ISO ePM1 ISO ePM2.5 ISO ePM10	■ Δp0 + 100 Pa ■ 3x Δp0	

Replacement of filter inserts

■ **ATTENTION:** when replacing filters, it is necessary to avoid contamination of the unit and new filters by dust trapped in the old ones

■ **ATTENTION,** wear protective gloves when changing the filters.

■ **ATTENTION:** metal filters and grease traps can be washed with hot water and a suitable degreasing detergent.

■ **ATTENTION:** Disposal of used filter inserts must be ensured in an environmentally friendly manner

■ Replacement filter inserts need to be always ordered from the manufacturer as a complete set. To order, it is necessary to indicate filter type (pocket, frame, etc.), as well as type and size of the AHU unit and the relevant filtration class. It is not necessary to specify the dimensions of the individual inserts of which the filter module/wall consists.

Filter replacement procedure

■ The filters are replaced by pulling out the individual inserts from the rail towards the service side, without the need for a tool. In the case of a lever system, it is necessary to first release their grip by pulling back the lever (Figure 41). The reverse procedure applies for assembly.

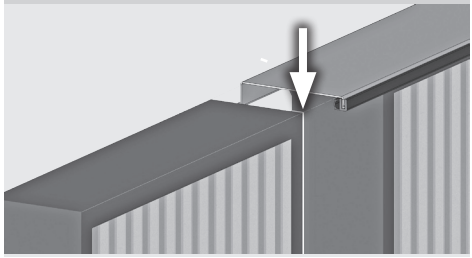
■ Metal filters and trays for catching grease can be washed with hot water and a suitable detergent, which promotes degreasing.

Frame seal installation

■ Does not apply to filter inserts held by a lever mechanism, Figure 40.

Fig. 41 – filter locking lever mechanism

Fig. 42 – seal sticking on the filter frame and filter insert replacement



■ When replacing and before inserting each new filter insert, it is necessary to stick a seal to its frame in the following way: The seal (soft foam self-adhesive PE tape) is always glued to the rear vertical edge of the plastic frame of each inserted insert on the side closer to the horizontal seal that is on the frame of the structure (see Fig. 41).

Inspections/checks

Fig. 43 – bag filter clamps

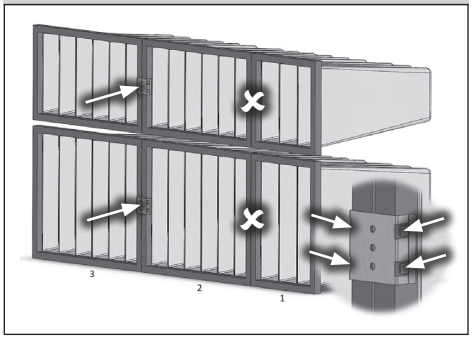
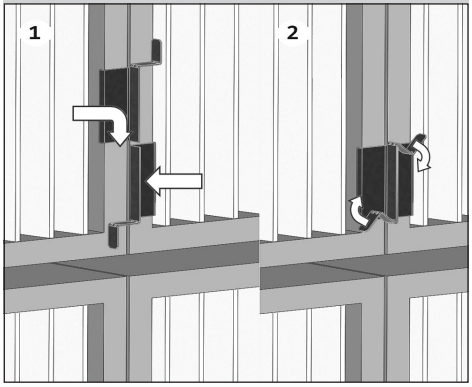


Fig. 44 – frame filter clamps



■ **ATTENTION:** The filter inserts of the pocket or frame filter module have to be inserted in the vertical position, with the pockets in the flow direction.

Activated carbon cartridge check

■ The pressure drop of the activated carbon filter wall does not change during clogging.

■ The most effective way of saturation checking is the periodic filter cartridge weighing. When the maximum adsorption capacity is reached, i.e. an increase of the coal net weight between 20 to 50% is reached (depending on the type of coal and the gas to be captured, data available on request from the manufacturer), the coal must be reactivated. When this limit is exceeded, the filtration efficiency decreases. The total weight of a standard cartridge 450 mm long in the clean state is 2,500 g, the weight of the cartridge 2,000 g (max. recommended increment 400 to 1,000 g).

■ The charcoal reactivation is carried out including the cartridge. It is therefore advisable to have a spare set.

■ Further replacement intervals can be determined on the basis of the aforementioned control measurements.

Water exchangers (heaters, coolers) check

■ **ATTENTION:** Operational surface temperature of the heater and its connections may exceed a safe contact/ touch temperature of 60º C; before servicing, maintenance and inspection, it is necessary to wait for sufficient cooling

■ **ATTENTION:** when treating, using and applying heating and cooling media (additives, mixtures) of heaters/coolers, observe the manufacturers safety recommendations and regulations

■ Check water exchanger state check (fins damage, clogging ...)

■ Removal of dirt from the heat exchanger surfaces - cleaning by vacuuming or steam cleaning - cleaning must be carried out with the utmost care to avoid mechanical damage to the water exchanger fins .

■ It is important to check the heat exchanger venting

■ Regular check of the entire condensate drainage system cleanliness, function and patency is necessary (drain pan, siphon and its respective other connections / outlets...)

■ Tightness of the fittings and entire system

■ Frost protection function

■ Mixing set function and state check

■ Cleanliness of the drop eliminator (if the eliminator is installed in a section)

■ **ATTENTION:** when operating the exchanger with a water circuit, or even when shutting it down in winter, the exchanger must be filled with a safe antifreeze solution of water and glycol or water must be completely drained and removed, for example by blowing the exchanger with compressed air.

■ **Warning: Residual water in the heat exchanger can freeze and cause the copper pipes rupture.**

Description	Symbol	Values	Effects in vent of deviation	
Hydrogen ion concentration	pH	7,5 - 9	< 7 > 9	Corrosion Fouling
Calcium and magnesium content	Hardness (Ca/Mg)	4 – 8,5 ºD	> 8,5	Fouling
Chloride ions	Cl^-	< 50 ppm		Corrosion
Carbon dioxide	Fe^{3+}	< 0,5 ppm		Corrosion
Iron ions	Mg^{2+}	< 0,05 ppm		Corrosion
Carbon dioxide	CO_2	< 10 ppm		Corrosion
Hydrogen sulphate	H_2S	< 50 ppb		Corrosion
Oxygen	O_2	< 0,1 ppm		Corrosion
Chlorine	Cl_2	< 0,5 ppm		Corrosion
Ammonia	NH_3	< 0,5 ppm		Corrosion
Ratio of carbons/ sulphates	HCO_3^{2-} / SO_4^{2-}	>1	<1	Corrosion

Recommended water quality for heat exchangers that operate using low pressure hot water and chilled water:

■ A good water quality – e.g. salt and lime free drinking water – increases the lifetime and efficiency of the heat exchanger

■ Check the limiting values (shown in the table above) annually to prevent damage to the hydraulic system and its components

■ If necessary inhibitors must be added.

■ **ATTENTION:** stated limiting water quality values are orientation only and are not a warranty subject!

Inspections/checks

Direct evaporator module check

- **ATTENTION:** check the function and state of the entire refrigeration circuit system (state and amount of refrigerant, tightness, expansion valve, condensing unit...), it may be performed by an authorized refrigeration technician only
- Evaporator check (fins damage, clogging...)
- Removal of dirt from the exchanger surfaces - cleaning by vacuuming or steam cleaning - cleaning must be performed with the utmost care to avoid mechanical damage to the evaporator fins
- Regular check of the whole condensate drainage system cleanliness, function and patency (drain pan , siphon and its respective other connections / outlets...) is necessary
- Functionality and tightness of the entire cooling circuit
- Cleanliness of the drop eliminator (if the eliminator is installed in a section)

Plate heat exchanger - (DEV)

- Plate heat exchanger state check (fins damage, clogging)
- Removal of dirt from the heat exchanger plates - cleaning by vacuuming, compressed air or steam cleaner - cleaning must be performed with the utmost care to avoid mechanical damage to the heat exchanger plates
- By-pass damper cleanliness and blades rotation check Mixing damper cleanliness and blades rotation check (if the mixing damper is installed in the section)
- Cleanliness of the drop eliminator (if the eliminator is installed in a section)
- Regular check of the entire condensate drainage system cleanliness, function and patency (drain pan siphon and its respective other connections / outlets ...)

Rotary heat exchanger (ROV)

- **ATTENTION:** before starting the check and/or maintenance, it is necessary to wait for the complete stop of the rotor and prevent unintentional start-up or start-up of the rotor by another person
- Exchanger rotor check (rotor foil damage, clogging, torsion bars damage...)
- Removal of impurities from the exchanger rotor - cleaning by vacuuming (bristle dust attachment), compressed air, steam - cleaning must be performed with the utmost care to avoid mechanical damage to the rotor foil
- Rotor seal state and tightness check, circumferential and radial
- The rotor free rotation and wobble check
- Rotor drive (cables connection and tightening in the terminal box) and the belt tension check
- Filter clogging check on the air supply and exhaust side
- **ATTENTION:** In case of any rotor damage, wobble, or drive failure, always contact the service department Remak a.s.
- Checking and tightening electrical connections and checking the condition of the insulation of the conductors. The condition of the heating coils is checked by measuring the phase resistance at the supply terminals.

Steam humidifier check

All required checks are specified in the Instruction delivered with the humidifier. Follow these instructions.

Yearly or no later than 2500 operation hours:

- replacement of cylinders, state and form of pipes, distribution pipes check and tightening, electric connection tightening check

IMPORTANT: Electric parts! Steam cylinders can be hot and contain boiling water. In case of water leakage there is a risk of scorch or electric burn! Check frequency and component lifetime are subject of change based on water quality and operating conditions

Adiabatic evaporative humidifier check

All required checks are specified in the Instruction delivered with the humidifier. Follow these instructions.

- evaporative module and drop eliminator check
- water pan/tank cleanliness check
- Check of the water installation incl. evaporative module water supply lines
- Float function check (in case of circulation systems)

In case of apparent pollution or clogging, thorough cleaning of the whole system is necessary. Clogged evaporative module has to be replaced.

Electric heater

- **ATTENTION**, electric appliance! Access allowed only if switched off from the power supply and safely cooled down!
- **ATTENTION**, fins of the heating coil are sharp and there is a risk of injury!
- Heating coils cleanliness check. Dirt and dust can be vacuumed.
- Check and tightening of electrical connections and check of the conductors insulation state. State of the heating coils is has to be made by measuring the phase resistance at the supply terminals.

IBET electric preheating

- the mechanical condition of the heater and heating elements, the cleanliness of the surface of the heating coils
- the outer surface and the interior of the heater
- checking the functionality of the equipment
- checking the function of safety/operating thermostat
- tightening of the wires in the terminal and screwed connections

Sound attenuation - splitters

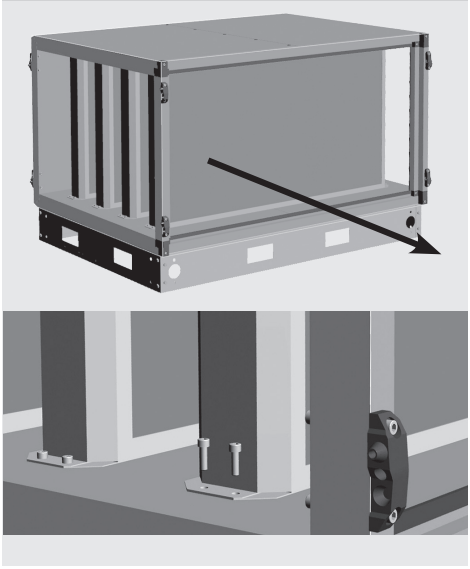
- Splitters state check, especially laminated fabric damage check
- Removal of dirt and dust from the splitters surface - cleaning is performed by vacuuming - it is necessary to prevent damage, tearing of the laminated fabric
- Attenuation module splitters fixation check (screws)
- If necessary, the splitters can be removed from the section by removing service panels and unscrewing of the fastening screws.

Flexible connector (DV)

- Flexible connector state and tightness check
- Removal of dirt - clean by vacuuming and wiping by a damp mop
- DV galvanic coupling check

Spare Parts and Service, Disposal and recycling

Fig. 45 – removing of splitters from the section



Accessories – rain louvers, intake and exhaust extension

- State and attachment to the unit check
- Cleaning and removal of trapped dirt from of the protective grid

Spare Parts

Spare parts are not a part of the air-handling unit delivery. If any spare parts are needed, they can be ordered from REMAK a.s. or the regional distributor.
In your order please specify the unit serial or purchase order number, and the parts needed.

Spare Filter Inserts

A complete set of filter inserts can be ordered. Please specify the filter type (bag, compact, ...), REMAK X unit size and filtration class. There is no need to specify the types of particular filter inserts of which the filter consists.

Service

Guarantee and after sales service can be ordered from REMAK a.s. or the regional distributor.
The manufacturer can authorize trained service providers to perform this service; their list can be found at www.remak.eu

Disposal and recycling

For users from EU countries

When disposing of components and materials, observe Directive No. 98/2008/EU and its subordinate Directive No. 2012/19/EU, applicable national and local environmental protection and waste disposal regulations.

For users outside the EU

Observe the applicable local environmental protection and waste disposal regulations.

Warning

The manufacturer reserves the right to make changes and amend the documentation due to technical innovations and changes to legislation without prior notice.

Printing and language mistakes are reserved.
These Installation and Operating Instructions (as a whole or a part) must not be printed or copied without prior written permission from REMAK a. s., Zuberská 2601, Rožnov pod Radhoštěm, Czech Republic.
These „Installation and Operating Instructions" are the sole property of REMAK a. s.
The up to date version of this document is available at our website: www.remak.eu
Changes reserved.
Issued: 4. 9. 2026

Always observe local laws and regulations.

REMAK

REMAK a.s.
Zuberská 2601, 756 61 Rožnov pod Radhoštěm,
tel.: +420 571 877 778, fax: +420 571 877 777,
email: remak@remak.eu, internet: www.remak.eu