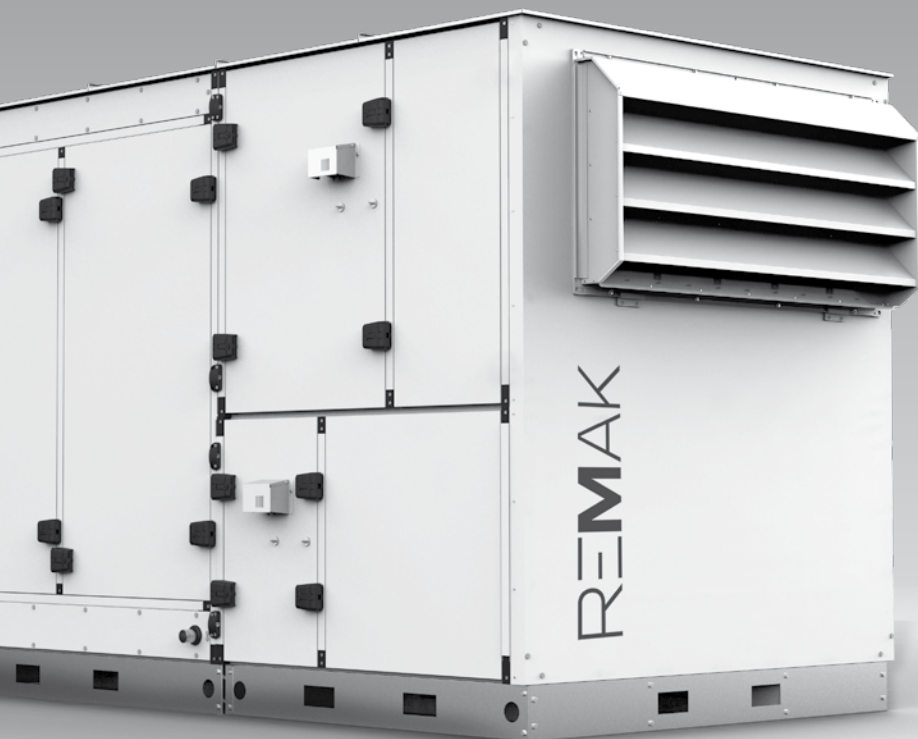


# REMAK



## MODULAR AIR-HANDLING UNITS

Series **X**

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## 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 violation buyer bears all risks.
- 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](http://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<sup>3</sup>/h to 35,000 m<sup>3</sup>/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 °C to +40 °C. 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 60° 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 full-fledged 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<sup>2</sup>, 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/m<sup>2</sup> + 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<sup>3</sup> density. Self-adhesive sealing with temperature resistance from -40 °C to +80 °C 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 °C to +80 °C.

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.

### 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



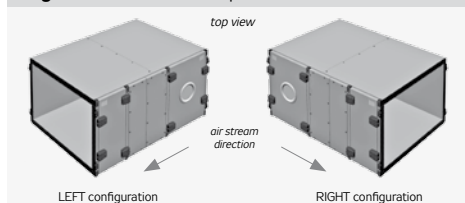
- The label „Warning – Electric shock hazard“ on the particular sections and their service panels alerts the risk of accident caused by electric current

- 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.

### 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. 1).

Fig. 1 – 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.

## Transport and handling of parts

- Plate and rotary heat exchanger sections cannot be stacked.

### Packing

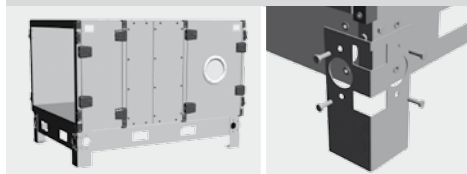
- A block without a base-frame is placed on a pallet as a transportation standard. A block with a base frame and fixed legs is shipped as standard without a pallet (Fig. 2). Blocks with the base frame and without the fixed legs can be equipped with removable factory installed single-use sheet metal legs, intended for handling during dispatch and transport (Fig. 3) or these can be put on a pallet.

Fig. 2 – 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. 3 – transport leg and its disassembly



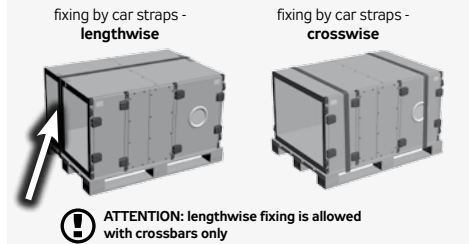
- **REMAK X series** transport blocks are packed in PE foil, and if appropriate, provided with cardboard and polystyrene protection.

- **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.

### 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.

Fig. 4 – fixing by means of straps



- 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 to the base-frames of sections where the service side is protruded (e.g. water heater section with covered inlet pipes)

- 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 integrity of these indicators is a condition of the warranty validity.

Fig. 5 – handling options



## Storage conditions, Installation

### 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 be in the range from -20 °C to +40 °C.
- **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 10°.
- 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

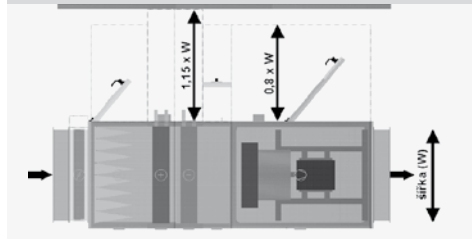
#### ■ Minimal distance to the walls is following:

**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

Fig. 6 – minimal service access space



unit configuration, it is also necessary to ensure a possible extension of the whole section out of the unit assembly.

### Installation setup

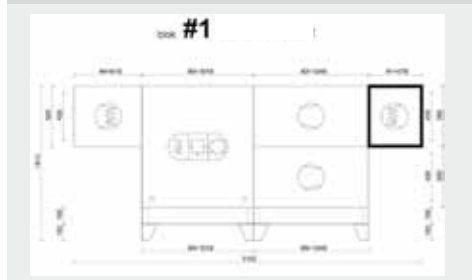
Prior to installation following actions must be performed:

- 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

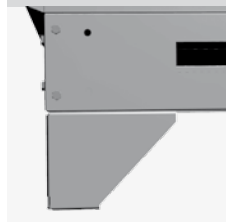
Each block sheet contains information to which unit the particular block belongs, the block designation and its graphically marked position in the unit layout.

Fig. 7 – sheet with unit sections and parts identification



### Base legs installation

Fig. 8 – fixed leg



- 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).

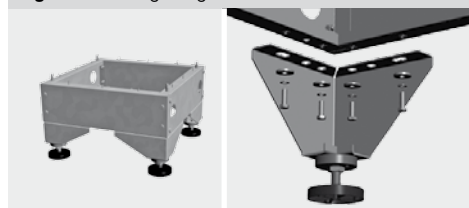
- To mount the fixed or adjustable legs to the base frame, lift and place the section or block on spacer

## Unit blocks assembly

(eg. wooden timber, bricks, etc. of sufficient height according to 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 9).

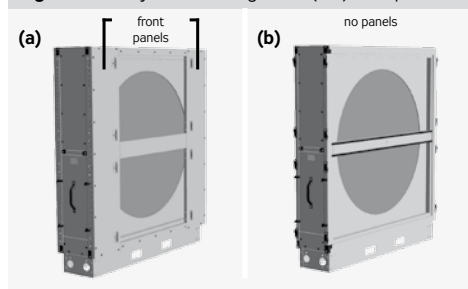
**Fig. 9** – mounting of legs to the base frame



## 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. 10** – Rotary heat exchanger with(out) head panels



## Unit blocks assembly

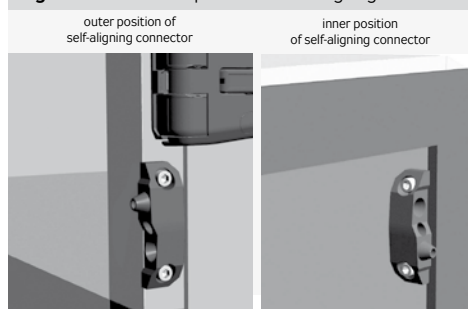
### General information

- 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

**Fig. 11** – inner/outer position of self-aligning connectors



- **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. 12.

## Unit blocks assembly, Roof assembly

**Fig. 12** – sections connection (connectors + M8 screw)



### 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 (are not needed and can be disposed) and screw the rectangular sheet metal couplings to the loose nuts.

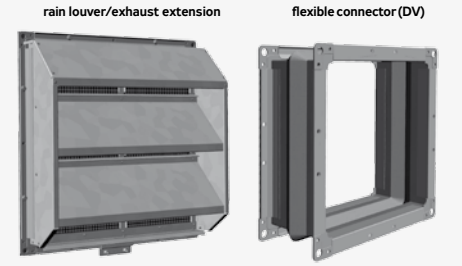
**Fig. 13** – connection by means M8 screws and rectangular couplings



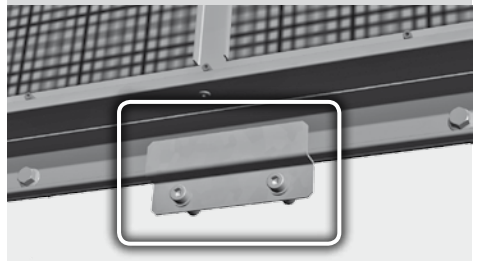
### Accessories assembly

- 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. 14** – accessories



**Fig. 15** – fastening with screws and guide rails(рейсы)



### Roof assembly

In case of the outdoor unit selection, sections are equipped with factory installed outdoor roof as standard. Each section, which after assembly is not covered by another unit upper deck section (airstream branches above each other), is provided with a separate roof part. After sections assembly, the installed roof parts of the individual sections form an intact unit roof.

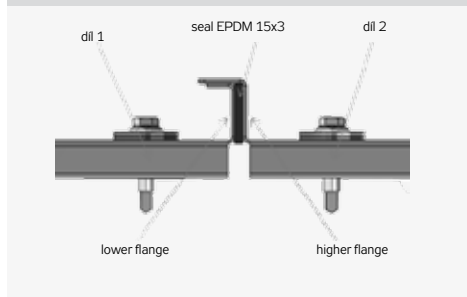
#### Procedure for connecting the roof parts - sections in series

- EPDM 15x3 seal has to be fixed on one of the roof flanges contact surfaces
- After connecting and tightening the sections, the flange with the seal is pressed to the flange of the counterpart (section) and provides a tight connection
- **ATTENTION:** before putting and tightening the sections together the overlapping flange must be put over the counterpart flange - the subsequent correct vertical alignment of the sections is necessary to avoid flange damage.



## The condensate drainage

**Fig. 16** – outdoor roof parts connection



### Procedure for connecting the roof parts – AHU branches arranged side-by-side

Sections of the outdoor units with the branches (air currents) side-by-side arrangement are standardly equipped with factory installed roof.

- Roof parts of sections positioned in series, need to be standardly connected according to the corresponding procedure (see procedure - sections connected in series).

- At mechanically connected sections/branches positioned side-by-side/in parallel a small gap occurs between their roof parts.

- This gap has to be sealed using enclosed PU sealant (PU sealant, it is part of the supplied assembly kit).

### 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:** If there is a risk of freezing (eg. outdoor installation), it is necessary to insulate the siphon and condensate draining piping, respectively keep the ambient temperature above freezing point, e.g. with an electric heating cable!

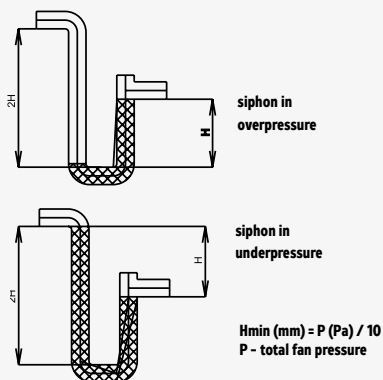
- Dimensioning, water trap/siphon height calculation see fig. 17 below.

- 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 18)

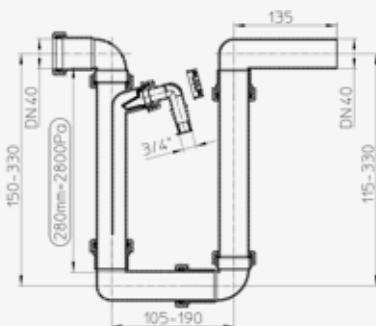
- Before first startup and after prolonged shutdown of the unit, it is necessary to fill the siphon in overpressure with water through the plastic plug.

- The height of the unit above the bottom (sum of base frame below ůlpw height + legs + structural framework , etc.) must be adjusted to the required height of the siphon.

**Fig. 17** – Siphon height calculation



**Fig. 18**



### 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)



# Modular air-handling units, Series X

## Air duct connection, Connection of heating and cooling media, Exchangers

### Air duct connection

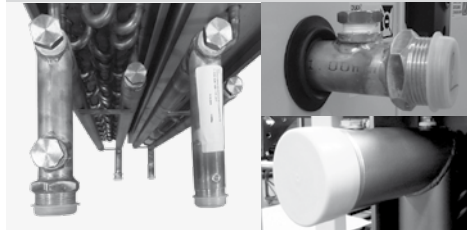
#### Flexible connector (DV)

- 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).

### Connection of heating and cooling media

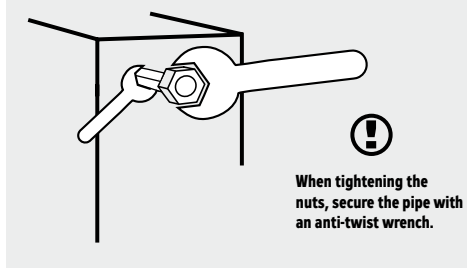
- The exchanger/coil can be connected on the unit outside (directly to the coil header connection), or inside the unit (prepared to the connection of the exchanger or mixing set inside the unit casing)
- Header connections are always equipped with external thread (threaded flanges are not part of shipment)

**Fig. 19** – threaded header input/output for cooling and heating media connection



- **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.

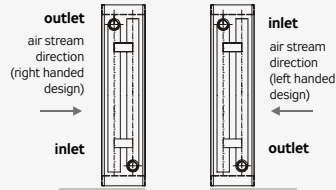
**Fig. 20** – connection of fittings to exchangers



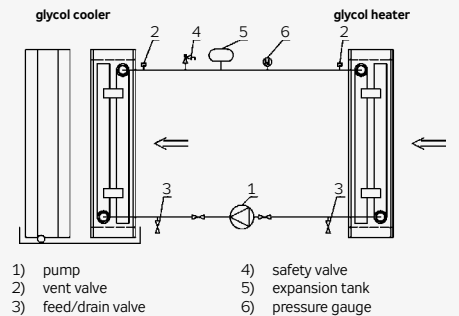
### Water and Glycol Heat exchanger connection

- To achieve maximal output the counter-flow connection of the heat exchangers is required. (Fig 21)
- The corresponding connection points are marked with labels on the unit side panel (heating water inlet, heating water outlet, coolant inlet, coolant outlet).

**Fig. 21** – exchanger's connection



**Fig. 22** – connection of glycol circuit



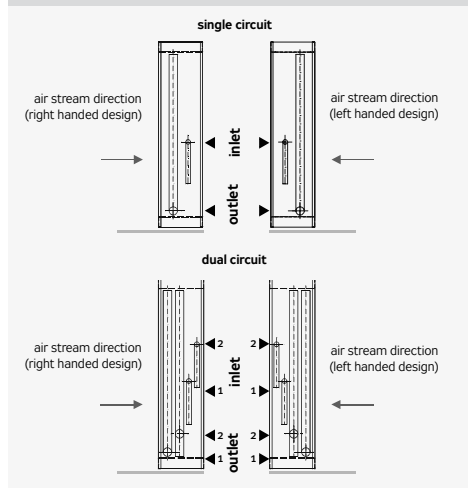
- The water coils are equipped as standard with a manual air vent valve G 3/8", mounted in the upper part of the collector (for direct external connection it is located outside the unit).
- **ATTENTION:** After connecting the exchanger coil (heater and cooler, mixing set including) to the piping, it 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.
- 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

**Fig. 23 – evaporator's connection**



### 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 assure the proper unit function, it is necessary to connect the motors in a way that they revolve properly. The EC and PMBlue motors are equipped with electronics monitoring failures which are signaled by failure contact
- AC motors are protected with thermistors or thermocontacts which protect them against damage.
- 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

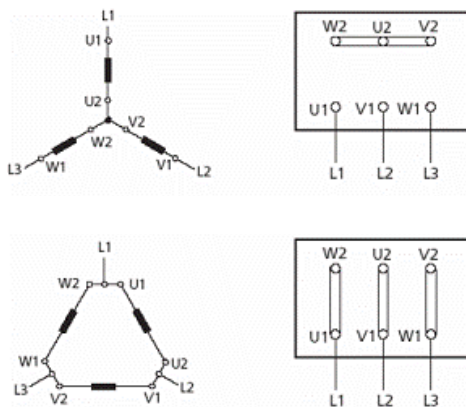
- **ATTENTION:** Service switch is neither main nor emergency switch. After switching the service switch on again, it is necessary to check the state of the STE and STD relays, respectively of the parent control system, and reset the failure of the TK thermo-contacts caused by disconnecting the service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

### Single-Speed AC Motors

- nominal voltage and wiring 230 VD / 400 VY
- nominal voltage and wiring 400 VD / 690 VY

Default power line frequency is 50Hz.

### Single-Speed AC Motors – Wiring Diagrams



### Other Electrical Equipment

Other electrical equipment, not specified in this manual, connect in accordance with the respective documentation (a wiring diagram), which is included in the equipment shipment (VCS control is Remak shipment).

## Electromagnetic compatibility (EMC)

### Electromagnetic compatibility (EMC)

Electrical installations involving frequency converters 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 converter 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 inverter output side ie. between motor and inverter. The shielding must be grounded. Also, any components installed between the inverter and the motor (eg. emergency switches, junction boxes) must also be shielded and grounded. It is also recommended to set up the thermo contacts circuit from the inverter to the motor by using shielded cables.

- Also, the individual unshielded connection wires in the motor terminal box and in the controller must be as short as possible.

- When doing so, the distances between the supply cables, power conductors, and signal wires must be as far 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).

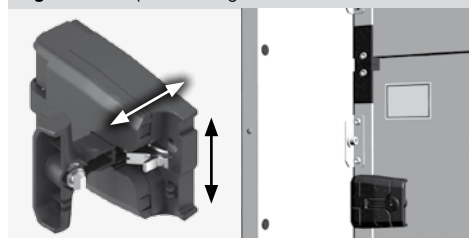
## Commissioning and putting into operation, General Inspection prior to first unit Start-Up

■ **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 (picture below).

Fig. 24 – 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 components 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 and the shutter of the fan chambers must be locked by key to prevent unauthorised access.

■ Before starting any work on the fan section, the main switch must always be turned off and secured to avoid accidental starting of the motor during service

■ When draining a heat exchanger, the water temperature must be below +60 °C. The connecting piping of the heater must be insulated so its surface temperature shall not exceed +60 °C.

## General Inspection prior to first unit Start-Up

### General Checks

- 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
- proper installation of all condensate draining kits
- proper installation and wiring of all control components

### Electric Wiring

- Check the proper wiring of all individual electrical components of the air-handling unit according to the corresponding wiring diagrams
- Grounding and protective bonding check

### Filter Sections

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

### Water and Glycol Heater Sections

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

### Sections of water/Glycol coolers, Direct evaporators

- Check the heat transfer surface state
- Check the inlet and outlet duct state
- Check the condensate drainage connection
- Check the elements and connection of the cooling circuit
- Check the drop eliminator state

### Plate Heat Exchanger Section

- Check the exchanger fins state
- Check the bypass damper function
- Check the drop eliminator state
- Check the connection of the condensate drainage

### Rotary Heat Exchanger Section

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

### Fan Section

- Check the fan impeller intactness and free rotation
- Check the fan module screw tightening
- Check the fan impeller, inlet and outlet - cleanliness and improper objects free

## First Start-Up checks

■ **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 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.**

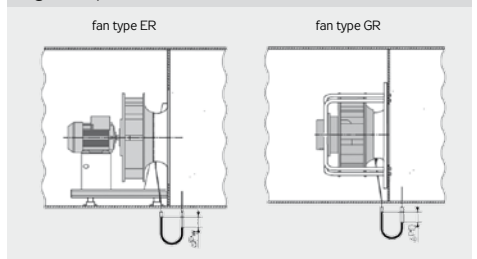
### Check of the fan air flow set up

- 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 (Fig. 26).

Fig. 25 – fan sampling probes



Fig. 26 – pressure difference measurement



### Air flow Rate Determination

Air flow calculation - fan (standard air temperature 20 °C, density 1,2 kg/m³):

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

Air flow calculation at a different temperature than 20 °C

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

qv – air flow rate  
k – fan factor (provided by the fan manufacturer)  
 $\Delta p_w$  – static pressure difference (measured value)  
 $\rho_{op}$  – air density at operating temperature

### 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

## AHU Inspection and maintenance, Periodical checks

- 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.

### 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.

### Operation staff checking actions

- unit operation and function
- check the fans operation by listening test (improper noise and excessive unit vibrations)
- casing, doors and service panels tightness
- media and air temperature
- Check the state and operation of the control system associated with the air-handling unit (see the checklist below), its proper function is necessary for operation of the air-handling unit and the entire ventilation system

### Check of systems

- wiring system
- control
- heating system – circuit tightness, pump function, water
- filter clogging (incl. SUMX)
- cooling system - circuit tightness and function, piping insulation
- sanitary installation – condensate drainage

### 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 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)
- 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)
- Repairs of corroded parts
- General cleaning of the machine-room

## Cleaning, Inspections/checks

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.**

### 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)
- **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 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

- **ATTENTION:** Before opening the fan section door, fan must be switched off (use the service switch) and wait until it fully stops (wait at least 2 minutes)! When breaching, the fan section door can be forced due to overpressure and there is a risk of being caught by the rotating impeller parts!
- **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
- Check the vibrations (imbalance), bearing noise and excessive motor warming
- Check the motor wiring, clamps tightening and bonding (grounding)
- Check/measure the motor current, voltage and symmetry of phases

#### 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):

<b>Course filtration:</b> ISO coarse	<ul style="list-style-type: none"> <li>■ <math>\Delta p_0 + 50 \text{ Pa}</math></li> <li>■ <math>3x \Delta p_0</math></li> </ul>	$\Delta p_0$ ... initial pressure drop of the clean filter
<b>Fine filtration:</b> ISO ePM1 ISO ePM2.5 ISO ePM10	<ul style="list-style-type: none"> <li>■ <math>\Delta p_0 + 100 \text{ Pa}</math></li> <li>■ <math>3x \Delta p_0</math></li> </ul>	■ smaller value applies

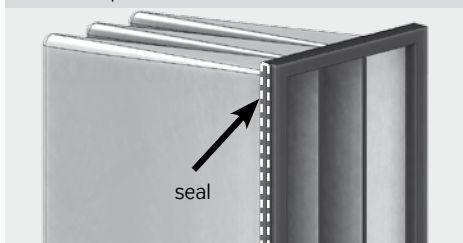
### Replacement of filter inserts

- **ATTENTION:** when replacing filters, it is necessary to avoid contamination of the unit and new filters by dust trapped in the old ones
- **ATTENTION:** 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.
- A spare seal is included with the supplied filter replacement kit.

### Filter replacement procedure

- Filter replacement is done by sliding the individual filter wall inserts out off the rail towards the service side, no tools are needed.
- When replacing and before inserting each new filter insert, it is necessary to stick a seal to its frame in the following way:
  - 1) The seal has to be sticked to the rear vertical side of the filter insert that enters the chamber first and along the rear edge from perspective of air flow direction - see fig below
  - 2) After sticking the seal, the filter insert is inserted into the filter module rails (see Fig. below)
- **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.

**Fig. 27** – seal sticking on the filter frame and filter insert replacement



**Fig. 28** – filter insert replacement



### Water exchangers (heaters, coolers) check

- **ATTENTION:** Operational surface temperature of the heater and its connections may exceed a safe contact/touch temperature of 60° 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 putting the heat exchanger out of operation for winter season, water must be completely drained and removed, for example by compressed air blowing through the exchanger or the exchanger must be filled with a safe antifreeze solution of water and glycol. Residual water in the heat exchanger can freeze and cause the copper pipes rupture.
- Recommended water quality for heat exchangers that operate using low pressure hot water and chilled water:

## Inspections/checks

Описание	Обозначение	Пределы	Эффекты при отклонении
Концентрация ионов водорода	pH	7,5 - 9	< 7 > 9 Коррозия Образование осадков
Содержание кальция и магния	Жесткость (Ca/Mg)	4 - 8,5 °D	> 8,5 Образование осадков
Ионы хлора	Cl <sup>-</sup>	< 50 ppm	Коррозия
Ионы железа	Fe <sup>3+</sup>	< 0,5 ppm	Коррозия
Ионы магния	Mg <sup>2+</sup>	< 0,05 ppm	Коррозия
Диоксид углерода	CO <sub>2</sub>	< 10 ppm	Коррозия
Сероводород	H <sub>2</sub> S	< 50 ppb	Коррозия
Кислород	O <sub>2</sub>	< 0,1 ppm	Коррозия
Хлор	Cl <sub>2</sub>	< 0,5 ppm	Коррозия
Аммиак	NH <sub>3</sub>	< 0,5 ppm	Коррозия
Доля содержания карбонатов/сульфатов	HCO <sub>3</sub> <sup>2-</sup> /SO <sub>4</sub> <sup>2-</sup>	>1	<1 Коррозия

- 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 below) 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!

### 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...)

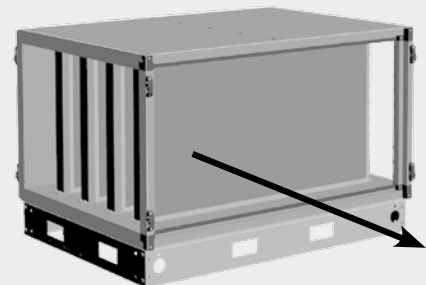
### Rotary heat exchanger (ROV)

- **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, 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.

### 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.

Fig. 29 – removing of splitters from the section



## Spare Parts and Service, Disposal and recycling

### 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

### 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](http://www.remak.eu)

### Disposal and recycling



#### For users from EU countries

When disposing of components and materials, observe the 2012/19/EU Directive, 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.

# Modular air-handling units, Series X

## 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.*

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Always observe local laws and regulations.

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