

REMAK



Air-handling units

CAKE

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General Information

- CAKE air handling units are manufactured in accordance with valid Czech and European regulations and technical standards.
- CAKE air handling units must be installed and used only in accordance with this documentation.
- The customer is responsible for any damages resulting from use other than intended.
- The installation and operating documentation must be available for the operating and servicing staff.
- It is advisable to store this documentation close to the installed air handling unit.
- When handling, installing, wiring, commissioning, repairing or servicing the CAKE air handling units, it is necessary to observe valid safety rules, standards and generally recognized technical rules. In particular, it is necessary to use personal protective work aids (e.g. gloves) because of sharp edges and corners when performing any handling, installing, dismantling, repairing or checking of CAKE air handling units. All equipment connections must comply with the respective safety standards and regulations.
- Any changes or modifications to individual components of the CAKE air handling units which could affect its safety and proper functioning are forbidden.
- Before installing and using the CAKE air handling units, it is necessary to familiarize yourself with and observe the directions and recommendations included in the following chapters.
- The CAKE air handling units, including their individual parts, are not intended, due to their concept, for direct sale to end customers.
- Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for the proper selection and dimensioning of components concerning their suitability for a given application.
- The installation and commissioning may be performed only by an authorized company licensed in accordance with generally valid regulations.
- When disposing of components and materials, it is necessary to observe the respective environmental protection and waste disposal regulations. In case of final unit liquidation, it is necessary to follow the policy of differential waste disposal. We recommend metal parts be scrapped and other parts be disposed of in accordance with separated waste regulations.
- Further information can be found in the CAKE Catalogue and in the AeroCAD designing software.
- **Up-to-date version of this document is available at website www.remak.eu**

Application, Operating Conditions and Construction

Manufacturer's Notification

CAKE compact units are manufactured in accordance with valid Czech and European regulations and technical standards. These units must be installed and used only in accordance with this documentation. The installation and operating documentation must be available to the operating and servicing staff, and it is advisable to store this documentation close to the installed air-handling unit.

Application and Operating Conditions

CAKE compact units are designed for the ventilation and air-conditioning of building interiors, especially commercial facilities with low air flow rates of approx. 700 to 2,900 m³/h with a rotary heat exchanger and 400 to 3,700 m³/h with a plate heat exchanger (e.g., small commercial premises, offices, restaurants and schools). They are designed to transport air without solid, fibrous, sticky, aggressive, respectively explosive impurities. The inlet air must be drawn from a hygienically wholesome environment. If not stated otherwise, the transported air must be free of chemicals or chemicals corrosive to metal or aggressive zinc and aluminium.

CAKE compact air-handling units can be used in normal rooms (IEC 60364-5-51, resp. ČSN 33 2000-5-51 ed. 3, ČSN 33 2000-1 ed. 2) and in rooms with an extended ambient temperature range ranging from -20 to +40°C without additional measures, respectively -40°C to +55°C (customization). When designing the air-handling assembly lay-out, it is necessary to take into account the temperature and humidity of the inlet and outlet air in relation to the ambient temperature and humidity. This is especially important for sufficient ventilation of the air-handling plant. For outdoor installations where excessively humid air is exhausted from the room (e.g., applications with a humidifier or other source of humidity), it is necessary to consult this environment with the manufacturer (for additional installation of a condensate drainage tray inside the device). Failure to meet these conditions will result in excessive condensation (misting and leaking) and possible freezing. If the device is designed for outdoor environments (outdoor version), it is advisable to protect it with a roof. Degree of protection against foreign matters and water is IP 44. The unit's accessories (M&C) are not included – they must be assessed separately according to their documentation.

CAKE compact air-handling units are designed to be installed on the floor or a supporting structure. CAKE compact air-handling units can be connected to a 1x230V+N+PE /50Hz or 3x400V+N+PE /50Hz power supply system (depending on the motor type). The unit's operation is possible only with a measuring and control system, ensuring control and safety functions. The main precondition is the installation of functional antifreeze protection elements of heat-exchangers, plate or rotary heat exchangers, including active protection of the unit when reaching the final pressure loss of filters.

The user is responsible for safe operation of the device in accordance with the provisions stated in this document. The user appoints persons authorised to handle and operate the device. These persons must be acquainted with the procedures, regulations and guidelines included in this document. Unqualified persons and persons with impaired working capacity are prohibited from handling or operating this device. The safety rules for this device are described in a separate section below (page 5).

Air-Handling unit Construction

This air-handling unit is designed as a panel and compact system. All the panels are of sandwich construction with a total thickness of 50 mm, and are made of hot-dip galvanized sheet steel in accordance with ČSN EN 10 346 Z275 g/m² with basic corrosion resistance for the C2 environment class in accordance with ČSN EN ISO 14713-1. Alternatively, the panels can be provided with additional surface finish:

- Continuous polyester paint 25 µm, RAL 9002 ČSN EN10169, corrosion resistance for the C3 environment class in accordance with ČSN EN ISO 14713
- Powder polyester paint 60 µm, RAL 9002 ČSN EN10169, corrosion resistance for the C3 environment class in accordance with ČSN EN ISO 14713
- Powder EP/PES paint, min. 60 µm, RAL 3020 ČSN EN10169, corrosion resistance for environments with a higher content of chloramine (pools). Insulation of the panels is created by 50mm thick non-combustible mineral wool, 50 kg/m².
- The fixed panels are attached with screw joints – the M6x20 metric Allen screws. To install and remove the panels attached with metric screws, it is necessary to use an Allen wrench, size 5.
- The panels, which are supposed to be regularly used to access the internal assemblies in order to perform checks, periodic maintenance, service operations or unit cleaning, have doors equipped with rotary safety closures. The contact surfaces of the panels are fitted with the 12x3 self-adhesive PE sealing, temperature resistance from -40 °C to +80 °C and rate of volume absorption below 5%. The contact surfaces of the doors are fitted with the moisture-resisting EPDM sealing, temperature resistance from -40 °C to +80 °C. The permanent joints are sealed with non-silicone sealant of temperature resistance from -40 °C to +90 °C.
- If the compact unit includes an integrated control unit, the access to the switchboard box is ensured through the inspection door from the service side. This door can be opened using a special tool (Triangular 8). The box degree of protection is IP44. The complete CAKE compact air-handling unit is manufactured as a compact block, delivered in separate sub-blocks designed to be assembled on the site. Basic versions according to the internal arrangement of CAKE compact air-handling units:
 - VZ** – a vertical unit equipped with a plate heat exchanger (counter-flow version)
 - VR** – a vertical unit equipped with a rotary exchanger

Base Frame

The base frame is an integral part of the compact air-handling unit. It can be equipped with fixed or adjustable support legs. The height of the base frame without legs is 85 mm and the height of the base frame with legs is 185 mm.

Air-Handling Unit Designation

Each block of the compact air-handling unit is provided with a type (name) plate indicating the following data (if applicable):

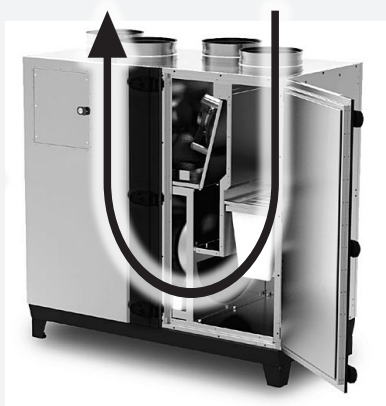
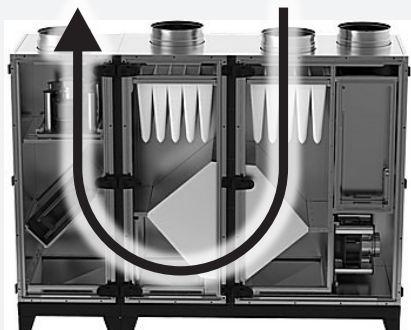
- Manufacturer's name
- Type, size and code designation
- Order number
- Weight
- Power supply connecting data (electric distribution system)

Side Arrangement and Dispatch

Side Arrangement of Air-handling unit

The side arrangement is always determined by the position (side) of the service access (doors) in relation to the inlet air flow.

Figure 1 – Side arrangement



LEFT version displayed.

Information and Safety Labels

CAKE air handling units are labelled with the warning and information stickers and manufacturer's logo on the external side of the casing. Inside the unit, safety labels are fitted, and a summary information label, including a description of components, is fitted on the doors.



The "Other Danger" warning label situated on the face side of the service door indicates the hazard of catching by movable parts.



The switchboard box, block of the electric heater, wiring boxes and service panels covering other electrical equipment are labelled with the "ATTENTION! ELECTRICAL EQUIPMENT" warning label. Spots intended for the grounding connection are labelled with a grounding symbol.



Connecting boxes, terminals in the integrated control unit and the main switch terminals are marked with warning labels: "Attention! The device is under voltage even if the main switch is switched off!"

Dispatch and Packaging

Delivery Contents

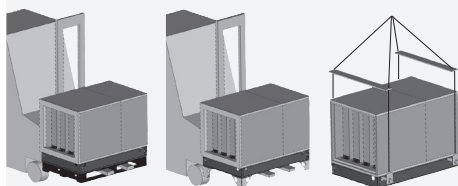
The following items are enclosed to each delivery of the compact air-handling unit:

- Accompanying technical documentation
- Commercial and technical documentation, including the compact air-handling unit assembly drawing
- Connecting material kit
- Installation kit
- Measuring & control components, respectively accessories in accordance with the bill of delivery
- A key to access the integrated switchboard box (if included in the delivery)

Packaging

As standard, the transport blocks of the CAKE compact air-handling unit are packed in PE foil and provided with cardboard and polystyrene protecting guards. If the compact air-handling unit is delivered assembled, it is always equipped with the mounted base frame. If the compact air-handling unit is delivered disassembled, each block is dispatched separately. If the base frame includes fixed support legs, the compact air-handling unit is dispatched without handling means (i.e., on the support legs without the pallet) as standard. Air-handling unit with base frame without support legs is dispatched on the pallet.

Figure 2 – Handling using handling equipment



Transport and Handling of Components

Loading and unloading can be performed by a fork-lift truck or a crane. If a crane is used, the unit (or its parts) can be transported on a pallet (the transported block must be securely attached to the pallet using straps), or suitable handling devices can be used, using the base frame openings to handle the unit.

Spacer bars must be inserted between the lifting wires above the unit to protect the product from being damaged. When handling the unit using a fork-lift truck, the used lifting forks of the fork-lift truck must be long enough to reach across the whole width of the unit (or its block), i.e., they must support both side beams of the base frame.

Air-handling Unit Safety , Installation

Storage Conditions

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

- Maximum relative air humidity must not exceed 85%.
- Condensation must be eliminated and the ambient temperature must be in the range of -20°C to +40°C.
- The air-handling unit must be protected against penetration by dust and caustic vapours, or other chemical substances which could cause corrosion of the air-handling unit's structural components.
- The air-handling unit must not be exposed to the direct effects of solar radiation.
- CAKE compact air-handling unit blocks, as well as its separate blocks, may only be stored in the same position in which they are operated.

Stacking

Stocking of the transport blocks of the CAKE compact air-handling units is prohibited!

Air-handling Unit Safety

Staff qualification requirements:

- This device can only be operated and maintained by adults without impaired physical or mental capacity who are properly qualified (trained) and who must observe these Operating Instructions and applicable local safety regulations.
- Lay operators can only switch the device on and off and view and/or set basic user parameters on the remote controller. They can also perform basic cleaning of the external casing of the device.
- Installation, connection, commissioning, repairs and maintenance can only be performed by properly qualified personnel.
- Electrical wiring, interconnection of individual parts, operation and initial inspection must be performed in accordance with the applicable standards and regulations.

Access restrictions

All the doors and door handles of the device must always be closed and locked to ensure safety, avoid injury and to restrict access by unauthorised persons.

Working on Air-handling Unit

When performing any work, repairs, maintenance or cleaning, the device must always be safely disconnected from the power supply.

Warning: The connecting terminals of the feed from the parent switch are live even when the main switch is turned off
When planning or installing the air-handling unit, observe normative requirements for safe access to the air-handling unit. When reinstalling the covers also restore their conductive connections (properly tighten the screws using fan washers or interconnect them by the grounding wire). Maintain the prescribed degree of protection.

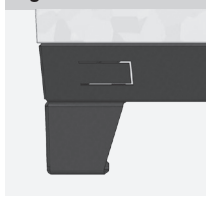
Measures for the protection of persons

- **Protection against Dangerous with Non-Live Parts**

The protection against dangerous contact with non-live parts is performed by mechanical connections ensuring electrical conductivity or by interconnection with a protective conductor (PE) in accordance with ČSN EN 60204-1.

■ Protection against Dangerous with Live Parts

Figure 3



To connect the grounding, a ground connection point is prepared on the base frame on which a lightning conductor clamp can be connected. Another grounding connection point is situated on the upper casing of the unit. The entire unit is conductively inter-connected so there is no need for additional interconnection.

Protection is ensured as follows:

- Integrated removable covers (motor drives, measuring and control elements and terminal boxes) which can only be removed using tools and internal parts accessible only using the service doors of the compact air-handling unit.
- By door of the sheet metal switchboard box (this box serves to place electrical equipment inside the air-handling unit) can only be unlocked using a special tool and are accessible from the service side, degree of protection IP44 (ČSN EN 60529). Protection of the frequency inverters situated inside the air-handling unit against dangerous contact of live parts is ensured by the degree of protection IP20 of the built-in devices in accordance with ČSN EN 60529.

Installation

Location

The surface of the site for the air-handling unit installation must be level and flat. Maximum misalignment of the floor or supporting structure intended for the compact air-handling unit installation must not exceed 1 mm per 1 meter. To eliminate floor slope or other floor inequalities, the adjustable feet must be used (for adjustment, refer to the chapter "Adjustable and Fixed Feet"). Observance of this condition is important for installation as well as for the air-handling unit operation. The CAKE compact air-handling unit does not need any special anchoring. To eliminate possible vibrations, it is advisable to put grooved rubber stripes under the air-handling unit. It is recommended to place the compact air-handling unit so that the gap between the unit and wall will be at least 50 mm (to eliminate growth of mould on the walls). Pay extra attention, if it is necessary to place the air-handling unit close to combustible materials. In this case it must always be assessed maximum temperature of the unit's casing and flash point of the combustible material.

Service Access

When planning the air-handling unit location, it is necessary to keep sufficient space for maintenance, service and operating. It is essential to ensure sufficient space for opening the doors, removing all filtration inserts, full extension of all heat-exchangers, including heat recovery heat-exchangers.

Installation, Media Connection

Pre-installation Inspection

Prior to installation, the following must be checked:

- Intactness of the delivery (completeness according to the bill of delivery)
- Volubility of rotary components (fans, dampers, rotary heat exchanger)
- Parameters of the power supply and connected energy media sources. Any fault must be removed before starting the installation.

Identification of Air-handling Unit Components

The association to the particular purchase order number is indicated on the name plate of the CAKE compact air-handling unit or of each block (if the unit is delivered disassembled), i.e. the device number or block position number. The name plate is visibly situated on the service side of the unit.

Door Closures

The compact air-handling unit service doors are equipped with safety closures. When the door handle is moved down, the safety closure keeps the doors just ajar. To fully open the door, the door handle must be moved back to the horizontal position. Then the door is released. To close the door, proceed in the reverse order of steps. Each door is equipped with one lockable closer.

Figure 4 – Safety door lock



Base Frame

The base frame's adjustable feet are protected by corner covers intended only for the transport and handling of the unit. These covers should be removed after installation.

Assembly of Air-handling Unit Sections

The basic version of the compact air-handling unit is delivered assembled. If the compact air-handling unit is delivered disassembled, the individual parts of the unit are assembled on the site, i.e., the base frames are connected first and then the blocks are connected together. For the recommended installation procedure of the frame adjustable or fixed legs, refer to the appendix to this document. The centre block of the disassembled unit is delivered including the base frame and other parts of the compact air-handling unit are delivered with the base frames and block separated, please see the picture.

Unit Alignment

- Place the unit as close to the installation site as possible* and remove the cover plate from the base frame.
- Set the unit in the installation site* and check the prescribed distances from walls*. If the unit is being assembled from

separate blocks, perform the assembly in accordance with the following chapter "Assembly of Air-handling Unit Sections".

** For the adjustable legs of the base frame, remove the cover plate*

Rotary Heat Exchanger

A rotary heat exchanger is one of the most expensive components in the air-handling assembly; poor and/or incorrect installation can result in costly repairs. During improper handling, transport or if the installation conditions are not met, the heat-exchanger rotor can be misaligned or permanently damaged. To enable service or cleaning of the rotor, it is necessary to ensure sufficient free space in front of the unit so that the rotary heat exchanger can be fully extended from the unit.

Media Connection, Condensate Drainage and Air-handling Duct Connection

Connection of Heating and Cooling Media Feeds

The heating and cooling water feeds are connected to the outer side of the air-handling unit. The internal interconnection is made during production in the factory. External outlets are terminated with external threaded connections. The heat exchangers are counter-current connected to achieve maximum output. The heat exchangers are not equipped with air-venting valves. Therefore, the inlet and outlet line venting must be vented during installation – at the highest points.

Figure 11 – Connection of heat-exchangers (cap nuts)



Connection of direct evaporators is carried out by routing the piping into the air-handling unit through rubber grommets in the casing and connecting it to the cooler necks. Direct evaporators must be connected by a specialized contractor authorized to install refrigerating equipment. The direct evaporators are filled with nitrogen in the factory. The water heat exchanger connections must cause no mechanical stress. Forces arising from the dilatation and weight of feeding pipes and fittings must not be transferred to the air-handling unit.

The corresponding connection points are marked with labels on the unit side panel (heating water inlet, heating water outlet, coolant inlet, coolant outlet).

After connecting the water heat exchangers (heaters and coolers, including mixing sets) to the distributing piping, it is necessary to pressurize (flush with water) and vent the entire circuit, including the heat exchanger. Then it is necessary to perform leak-tightness checks of all pipe joints and of the exchanger itself (including inspection of the unit interior with the water heat exchanger). The manufacturer does not provide any guarantee covering

Media Connection

any damage resulting from liquid leakage from leaky joints or a damaged exchanger, except the internal interconnection which was carried out by the manufacturer.

Steam Humidification

Steam humidification is only delivered as an accessory. Steam humidification is installed into the inlet air duct line. Air ducts leading through cold areas must be insulated to avoid condensation. The entire humidification assembly (steam generators, including steam distribution piping) should be situated in a non-freezing room. Otherwise, anti-freeze protection must be installed.

The following minimum distances (distances between the steam humidifier and the following air-handling unit components, where H represents the minimum evaporating distance calculated for the given conditions) must be observed to ensure proper operation of the steam humidifier:

- Humidistat piping, humidity sensor, temp. sensor: 5x H
- Very fine filter: 2.5 x H
- Heating elements, filter: 1.5 x H
- Duct branch piece, duct elbow, air outlet, fan: 1x H

Notes:

The steam generator can be noisy (switching of solenoid valves); therefore, it is advisable to install it away from quiet areas. 100°C hot and heavily mineralized water is drained from the steam humidifier. If the H value is not known, it is advisable to make the calculation with a minimum value of 1.0 m.

Condensate Drainage

Stainless trays for collection of the condensate are installed inside the compact air-handling unit in places where condensation is expected. The tray outlet is routed through the lower panel and terminated with a neck and the DN40 connection. The condensate drainage system is connected to this outlet.

The condensate drainage kits are available as optional accessories.

A separate condensate drainage kit must be used for each individual block. The siphon height depends on the total pressure of the fan, and ensures its proper functioning. The type of condensate draining kit must be designed in the course of the air-handling unit calculation. The standard CAKE unit condensate drainage is always in negative pressure.

The correct installation and correct minimum level heights have crucial influence on the correct and reliable condensate drainage from the unit. The condensate draining piping must end in free atmosphere, i.e. it must not end directly in the closed sewerage system. Before operating the air-handling unit or after being out of operation for a longer period, it is necessary to fill the siphon in each tray with min. 0.5l of water.

If there is a risk of freezing, 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. If the outdoor version of the unit is specified in the order and includes the manufacturer's control system, the delivery includes a heating cable.

Air-handling Duct Connection

The air ducting must be connected to the air-handling unit via an elastic element to avoid the transfer of vibrations. The connection of the air-handling ducting must be performed so that no load from the air duct will be transferred to the inlet panel of the air-handling unit. The accessories must be installed in accordance with the air-handling unit specification and the Installation Instructions of the manufacturers of such accessories.

No connections, including insulation and associated structures, must prevent opening of the air-handling unit and control unit doors, but they must allow access to the media connections (electric connections, cooling and heating water supply and output) and must not limit the service room needed for proper operation and maintenance. If the compact air-handling unit is delivered disassembled, the internal cable interconnection is made using connectors. These connectors must be connected when the individual unit blocks are assembled.

Figure 12 – Condensate draining

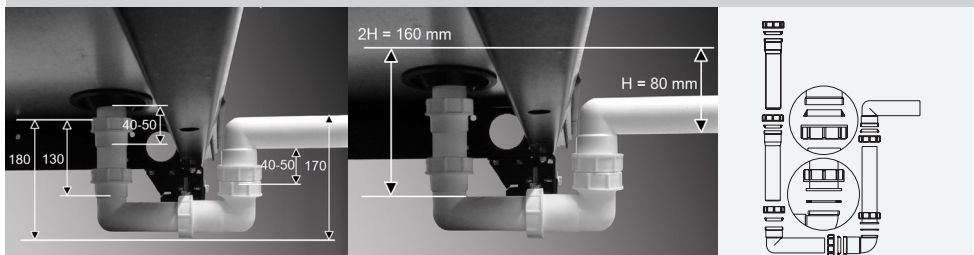
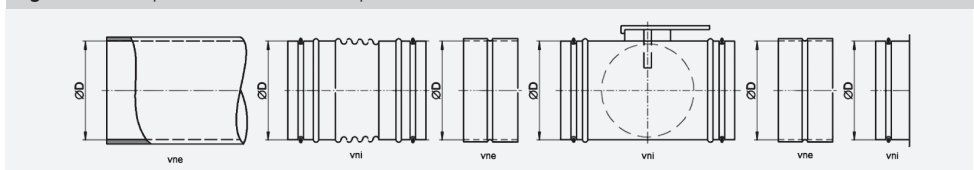


Figure 13 – Composition of the circular output



Wiring

Wiring of External M&C Elements

External measuring and control elements, not firmly attached to the air-handling unit, are installed on site and connected to:

- prepared terminal boxes on the top of the unit casing (CAKE version with an integrated control unit)
- external control units (CAKE version without integrated control unit)

Wiring of Drives and Internal M&C Elements

Variant I: including M&C and an integrated VCS unit

All internal components are connected to the VCS control unit integrated into the CAKE unit in the factory. Connecting terminals for external components (external actuators, circulation pumps, external sensors, etc.) are led out from the control unit to the terminal boxes located on the top of the unit casing.

Variant II: including M&C but without integrated VCS

All internal components (motors, dampers, etc.) are connected to the terminals located in the sheet metal switchbox integrated (instead of the control unit) into the CAKE unit.

An external control unit will be connected to the pre-wired switchbox on site.

Variant III: without M&C

Only internal protective interconnections and the installation of terminals in the terminal boxes close to the motors is performed. All the internal wiring, including M&C elements, will be performed on site.

Main Supply Cable Connection

- If the device is equipped with the integrated control unit, the supply cable is connected to the main terminal box (MX) situated on the top of the compact air-handling unit casing.
- If an external control unit is used, the supply cable is connected to the terminal of the main switch situated in the control unit.

Wiring

The wiring and installation of the M&C system's external auxiliary elements must be performed by qualified professionals authorized to perform wiring of the given type of device. The wiring must be performed in accordance with the directives and standards of the country of installation, and in accordance with the Installation and Operating Instructions of individual pieces of equipment (frequency converters, pressure and temperature sensors, etc.). Conformity of the power supply voltage, frequency and protection with the data in the technical documentation and on the type plate of the connected device and cross-section of the connecting cables must be checked before connecting the electrical equipment to the power supply. Before putting the air-handling unit into operation, a wiring inspection must be performed.

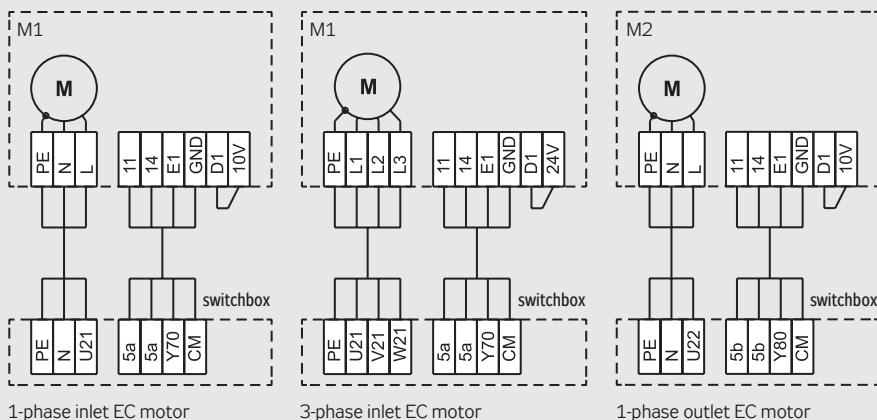
Figure 13 – switchbox



Wiring schemes

Variant I: The wiring diagrams are delivered along with the VCS control unit accompanying and technical documentation.

Variant II: The CAKE unit is delivered with a switchbox

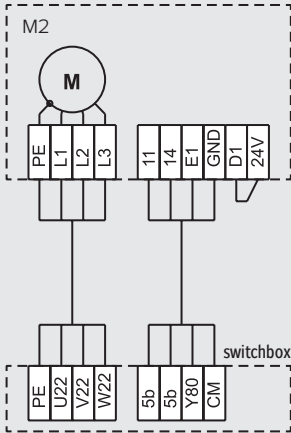


Wiring

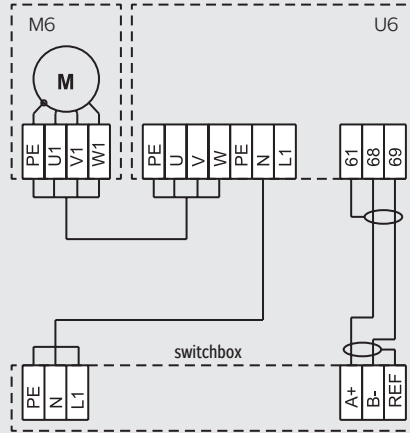
Wiring schemes

Variant II (continuation):

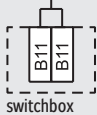
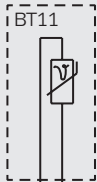
The CAKE unit is delivered with a switchbox



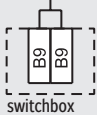
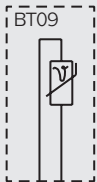
3-phase outlet EC motor



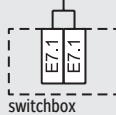
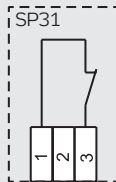
Connection of the motor to the rotary heat exchanger frequency inverter



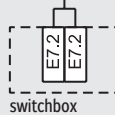
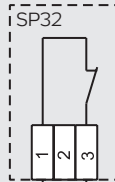
Heat exchanger freeze sensor



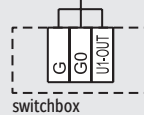
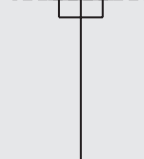
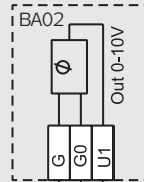
Anti-freeze temperature sensor (return water)



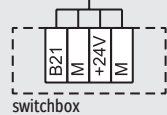
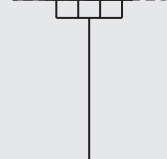
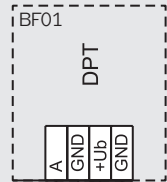
Inlet filter fouling sensor



Outlet filter fouling sensor



Air quality sensor (CO₂, CO, VOC)



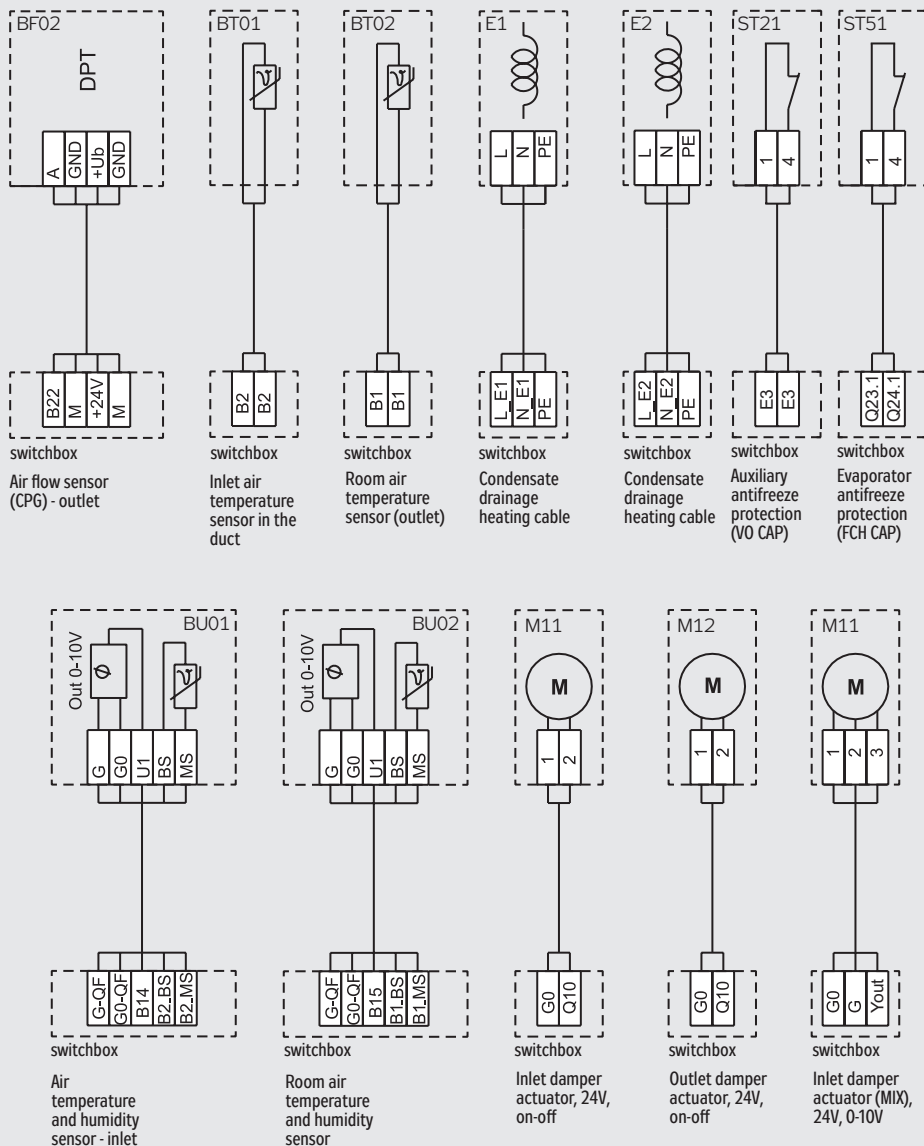
Air flow sensor (CPG) - inlet

Wiring

Wiring schemes

Variant II (continuation):

The CAKE unit is delivered with a switchbox

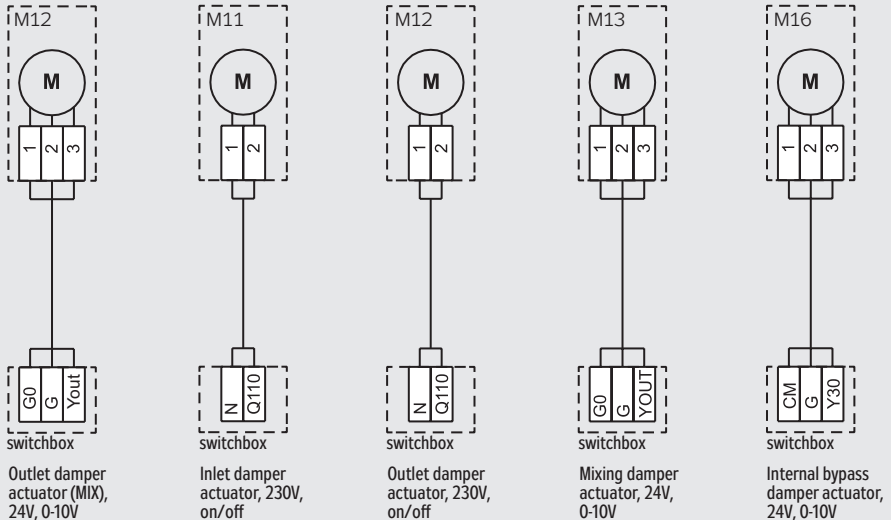


Wiring

Wiring schemes

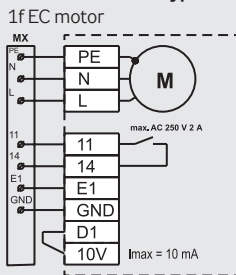
Variant II (continuation):

CAKE unit delivered with a switchbox and control unit / CAKE unit delivered with a switchbox and no control unit

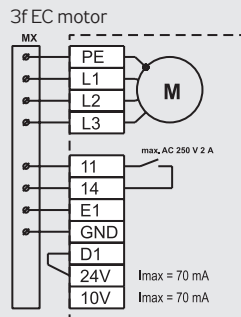
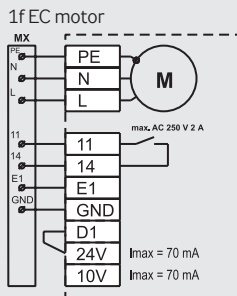


Variant III: CAKE unit w/o switchbox and control unit – Terminal box for integrated components

Fan motor type A



Fan motor type B



Popis a význam svorek

PE	Protective conductor
L1	Power supply
L2	Power supply
L3	Power supply
N	Zero conductor
11	Souhrnná porucha ventilátoru
14	Souhrnná porucha ventilátoru
E1	Input 0-10V
GND	Ground
D1	Digital input (on/off)
24V	24V DC voltage source
10V	10V DC voltage source

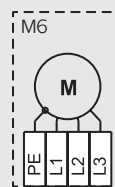
Motor typ A

RH25C 6ID
RH25C 6IK
RH28C 6ID
RH28C 6IK
RH31C 6ID
RH31C 6IK

Motor typ B

RH31C ZID
RH31C ZIK
RH35C ZID
RH35C ZIK
RH40C ZID
RH40C ZIK
RH45C ZID
RH45C ZIK
RH50C ZID
RH56C ZID
RH63C ZIK

Rotary heat exchanger motor



ATTENTION: The standard supply voltage is 3 x 230V. The supply voltage must always be checked against the nominal value on the motor rating plate.

As an option, an integrated frequency inverter can also be ordered for Version III. In this case, please refer to the frequency inverter wiring diagram above.

Note: It may be necessary to remove the centre door pillar to get access to the motor terminal box.

Wiring

Sheet Metal Switchboard Box

If the compact unit delivery includes an integrated control unit, the box for the installation of integrated electrical components of the control unit is integrated into the internal area of the compact air-handling unit and accessible through the door on the service side. The door is equipped with a safety closure opened by a triangular key no. 8 which must be stored on a dedicated place under supervision of a responsible person.

Figure 14 – Box closure with a triangular key

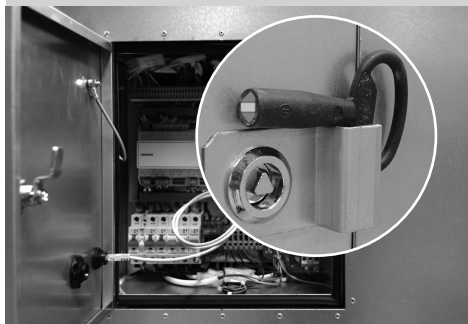


Figure 15



The degree of protection of the sheet metal box is IP IP44 when the door is closed and IP20 when the door is closed.

All box parts are made of bent sheet steel galvanized with a 275 g/m² zinc layer and finished with powder coating.

If the outdoor version of the air-handling unit is ordered, the integrated

sheet metal switchboard box is heated by a heating mat to protect electrical elements.

- The sheet metal box contains all the parts of the control unit and its associated elements, including protection, controller, transformer, connecting terminals and main switch with the red handle in the yellow field.

- If the CAKE compact unit delivery includes M&C components without an integrated control unit (M&C, variant II), the air-handling device is equipped with an integrated sheet metal terminal box – connecting box (switchbox). The degree of protection of the sheet metal box is IP IP44 when the lid is closed. The terminals can only be accessed after opening the air-handling device's service doors and removing the lid attached with screws.

Instructions for Cabling

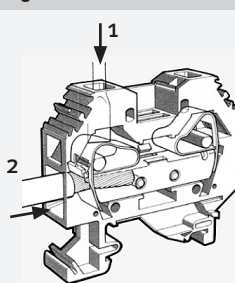
- All interconnections of the distribution board and installed elements must be made using intact double insulated cables which must be properly dimensioned for the given load and lead length.

Obrázek 16 – The switchbox inside the air-handling unit



- Every cable leading out through the sheet metal parts must be led through the preinstalled cable grommets. All unused grommets must be blinded to maintain the degree of protection.
- The main power supply cable harness must be dimensioned for the total current of the unit.
- A central sheet metal cable trough with outlets fitted with grommets is installed along the rear wall to ensure safe leading of the cables.
- When connecting and leading the cables, it is necessary to take into account their properties. The conductors must not be exposed to strains which decrease their service life. Avoid cable slack;
- Always use cable protectors and troughs (wire, plastic, or metal) of sufficient size and length.

Figure 17



metal) of sufficient size and length.

- WAGO screw-free terminals are used to connect the conductors. If stranded conductors are used, it is recommended to provide their insulated ends with cable tubes.

- Properly fix all cables and maintain minimum bending radiuses.

- The M&C cable lines must be led separately from the power cables to avoid their interference. We recommend ru-

nning the power cable lines along the base frame and the M&C cable lines along the front edge of the top panel.

- The cable lines must never interfere with the service panels (doors) of the unit and control unit and obstruct routine operation and servicing. Please respect the reserved servicing space.

Wiring

Wiring Procedure

The wiring of electrical components must be carried out in accordance with the wiring diagrams, please see the previous pages of this manual, respectively in accordance with the project and accompanying technical documentation to the control system while also taking into account the instructions for commissioning and operation included in this manual.

General instructions for connecting the compact air-handling unit to the control unit

- Connect the external M&C sensors
- Complete the conductive connection (grounding) of the insulated elements.
- Connect the main power supply (to the location described in the chapter "Electrical Equipment Wiring").
- Check the completed wiring.
- Check the tightening of the cable grommets, and blind those unused.
- Perform an initial inspection of the electrical equipment.

General instructions for connecting the compact air-handling unit to the external control unit:

- Connect the external M&C sensors
- Connect internal M&C elements and integrated drives by running wires from the control unit to the corresponding terminals in the terminal box.
- Complete the conductive connection (grounding) of the insulated elements.
- Run the main power supply to the main terminal box of the control unit.
- Check the completed wiring.
- Check the tightening of the cable grommets, and blind those unused.
- Perform an initial inspection of the electrical equipment.

Note:

To prevent damage to the cable insulation, use only dedicated grommets in the external casing to route the cables and cable harnesses into the interior of the air-handling unit.

Control Unit and Control Unit Communication

A separate manual is provided for the control unit.

EC motors

- The fans used in the unit are equipped with EC motors.
- If the CAKE unit is delivered without an integrated control unit (and without completed internal wiring - M&C, version I), the fan terminals are led out into the switchbox (M&C, version II) or into the separate connecting terminal boxes close to the fan (M&C, version III - CAKE VZ), respectively the terminals are not led out into other terminal boxes (M&C, version III - CAKE VR) in the factory.
- If access to the motor terminal box is needed, it is necessary to slide out the entire fan from its position (CAKE VR with a rotary heat exchanger) or to remove the motor including the "wire" holder from the sheet metal base (CAKE VZ with a plate heat exchanger).
- Rated voltage 1x230 V AC 50 Hz for outputs up to 1.3 kW.

- Rated voltage 3x400 V AC 50 Hz for outputs above 1.3 kW and up to 6 kW. As standard, they are designed for frequency 50 Hz. A motor can optionally be delivered for a frequency of 60 Hz.

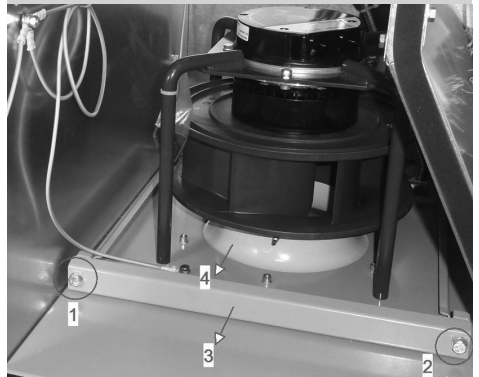
- Installed EC motors are equipped with automatic heat, electronics and overload protections.

Note: If you are considering connecting the air-handling unit to a 60 Hz power supply system, it is necessary to check whether the parameters of the air-handling unit have been designed for this frequency.

To pull out the fan (only CAKE VR):

- Loosen the side screws on the front clamping bar of the base.
- Remove the released clamping bar.
- Pulling the base plate towards you pull the fan out of its seat.
- If needed, it may be necessary to remove the centre door pillar

Figure 18 – Pulling out the fan



- When inserting the fan back, follow the steps above in reverse order.

Size	K-factor
225	-
250	60
280	75
315	95
355	121
400	154
450	197
500	252
560	308
630	381

- If the protective interconnections have been disconnected, reconnect them.

Air Flow Control

If the delivery includes an air flow control sensor, it is fitted inside the unit. As an option, preparation for non Remak sensor installation inside the unit is offered. Holes in the doors are prepared for its connection. Depending on the type of operating pressure or volume, an air-flow rate sensor can be used.

The sensor's inputs are co-

Commissioning Preparation and Commissioning

nected to two hose lines Line (+) is terminated at the sensing terminal in the inlet while the sensing line (-), terminated in the fan diffuser under the impeller. The sensor must be properly set to ensure the correct conversion of the measured pressure to the air flow. This is performed using a specific factor (constant) which is dependent on the impeller size (see the table). Settings are made in the device or in the control unit, depending on the type of device. To increase sensing accuracy, a range of the measured pressure is set in the device. The required setting values are specified in the technical documentation delivered with each device.

Rotary Regenerator

As standard, the rotary regenerator is delivered with an asynchronous motor 3 x 230V/50Hz controlled by the frequency inverter.

If the delivery includes a frequency inverter to control output of the rotary regenerator, the electric connection (input) is 1 x 230V/50Hz (and output for the motor is 3 x 230V Δ).

Main Switch

Figure 19 – Main Switch



If the compact air-handling unit includes the integrated control unit, it is equipped with the main switch (the red handle in the yellow field) on the service side. The compact air-handling unit is situated on the door of the sheet metal switchboard box.

Rules for Separate Installation of M&C Elements

If the unit is delivered without the control unit, it is not equipped with measuring and control elements. The following rules are applied for the installation of these elements:

- If possible, install the sensors in the prepared holders.
- Run the cable routes so that it will not interfere with functional parts of the unit and prevent removal of the components (filters, fans, heat-exchangers and heat recovery). The route to the connection point or installed cable inside the unit should be as short and straight as possible.
- To run the cables through different sections of the unit's, use the cable through with grommets.
- The fans are designed as removable units and the motor cable connection must allow the motor to be pulled out!
- Secure the cable properly using the fixing points or cable protectors and grommets to pass through the sheet metal parts.
- For running the cables in and out of the unit, use the common grommet installed on the top casing of the unit.
- Use grommets of the proper diameter to run the cable through and always run only one cable through each hole in the grommet.
- The precondition for unit operation is the installation of functional antifreeze protection elements of the heat-exchangers, plate or rotary heat exchangers, including active protection of the unit when reaching the final pressure loss of filters.

Preparation for Commissioning

Inspection before First Start-Up, General Routines and Checks

The service panels are provided with hinges and external closures which serve also as handles. One of the safety closures of each door is always equipped with a lock to prevent access by unauthorised persons.

When performing any check, the device must always be safely disconnected from the power supply!

Mechanical connection

Before first start-up check the following mechanical parts:

- Check alignment of the air-handling unit.
- Check whether all components of the air-handling unit are installed and connected to the air distributing ducting.
- Check whether all cooling and heating circuits are connected, and whether energy media are available.
- Check whether all condensate drainage kits are connected.
- Check all the condensate drainage siphons for correct setting (positive/negative pressure) and whether they are filled with water.
- Check the installation of all required vibration damping elements.

Electric Wiring

Check the following items (according to the project):

- Check whether all external electrical connections are made.
- Check the proper wiring of all individual electrical components of the air-handling unit.
- Check whether all required external M&C components are installed and connected.
- Check whether all internal connectors are interconnected (applies for deliveries of disassembled units).
- Check the protection conductor interconnection.
- Check the grounding of the unit.

Filter Inserts

Also check:

- Check the filter inserts for cleanliness and intactness.
- Check whether the filter inserts are inserted to the rear end position.
- Check whether the differential pressure sensors are set to the required end pressure loss of the filter. see figure.

End pressure loss recommended by the manufacturer:

- | | |
|---------------------|--------|
| ■ G3, G4 | 150 Pa |
| ■ M5, M6, F7 | 200 Pa |
| ■ F8, F9 | 300 Pa |

Water and Glycol Heaters and Direct Evaporators

- Check the heat-exchanging surface fins for damage.
- Check the condition of the inlet and outlet piping.
- Check the connection and elements of the cooling circuit.
- Check the cooling circuit piping for proper insulation.
- Check the connection of the cooling circuit.

Commissioning, Checks

Plate Heat Exchanger

- Check the exchanger fins for damage.
- Check the bypass damper functionality

Rotary Heat Exchanger

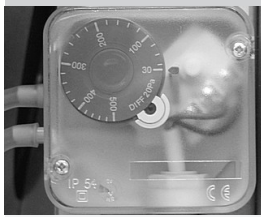
- Check the rotor for free rotation.
- Check the belt tension.
- Check the sealing brushes for close fitting.
- Check the ROV wiring.
- Check the direction of the rotor rotation (refer to the data on the rating plate).

Fans

- Check the fan impeller for intactness and free rotation.
- Check the fan impeller, inlet and outlet for cleanliness and foreign objects (forgotten tools, loose connecting material, etc.).

Differential Pressure Sensor Settings

Obrázek 20



- Remove the transparent cover.
 - Using the rotary selector, set the required end pressure loss of the filter insert (see the section "Regular Inspections").
 - Re-install the cover.
- Note: The rotary selector shows the required end pressure loss, not the actual value.*

Commissioning – Inspection

Commissioning

The air-handling unit may be commissioned only by a properly qualified person. Prior to first start-up of the air-handling unit, an inspection of the wiring of all connected components of the air-handling unit must be performed by a qualified technician. Until the air-handling system is adjusted, the air-handling unit can only be put into operation when the regulating damper in the air-handling unit inlet is closed. Operating the air-handling unit while the air-handling system is misadjusted can cause motor overloading and permanent damage. If the second stage of filtering is included in the air-handling unit, it is advisable to run the testing operation with the second stage filter inserts removed.

Safety Measures

- It is forbidden to start the fans of the air-handling unit if the service doors are open or removed.
- The hazard of trapping by moving 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 on the fan block, the main switch must always be turned off and secured to avoid accidental starting of the motor during service work on the fan block.

- When emptying the heat exchanger, the water temperature must be below +60 °C.
- The connecting piping of the heater must be insulated so its surface temperature will not exceed +60 °C.

Checks during First Start-Up

During First Start-Up

- Check the proper direction of the impeller rotation following the direction of the arrow on the impeller (to carry out this check use run-out of the switched off fan).
- Check the proper direction of the rotary heat exchanger rotor rotation following the direction of the arrow on the rotor and free rotation without dragging.
- Check the input current of connected equipment (it must not exceed the maximum permissible value stated on the rating plate).
- Check the condensate drainage for correct operation, i.e., the level of water in the siphon. If the water has been sucked off, it will be necessary to increase the height of the siphon
- Check the condition and position of the filters.

During the testing operation, it is necessary to check the air-handling unit for unusual noises and excessive vibrations. The testing operation must last at least 30 minutes. If the unit vibrates too much, it is necessary to again check the fan assembly and perform vibration intensity measuring, if necessary. If the vibration intensity exceeds 2.8 mm/s, measured at the motor bearing shield on the impeller side, the fan must be checked and balanced by professional staff. During the testing operation, it is necessary to adjust (regulate) the entire air-handling system. Before putting the air-handling unit into permanent operation, it is recommended to replace or regenerate the filter inserts. After the test operation has finished, the air-handling unit must be inspected. Special attention must be paid to the proper function of the condensate drainage.

Operating Checks and Service Regulations

Service Regulations

The user is responsible for the device operation. When putting the air-handling device into permanent operation, we recommend the supplier (installing company) in collaboration with the designer to issue service regulations in accordance with applicable legal regulations. We recommend including the following in these service regulations:

- Air-handling device assembly description, its intended use and a description of its activities in all operating modes.
- Description of all safety and protective elements and their functions
- Health protection principles, safety and operating rules to be observed when operating the air-handling equipment.
- Requirements for operating staff qualifications and training, a nomenclature list of personnel authorized to operate the air-handling device.
- Detailed emergency and accident instructions to be followed by the operating staff

Regular Inspections

- Operating particularities during different climatic conditions (e.g. summer or winter operation).
- Inspection, checking and maintenance schedule, including a list of checking steps, and their recording
- Records of operating staff training, operation, inspections and cleaning of the rotary heat exchanger (subject to guarantee validity).

Unit Operation Screening Checks

The operating staff's checking activities must be focused on the following:

- The air-handling unit operation and functioning, leak tightness of connections, inspection doors and service panels, temperature of energy media and transported air.
- The condition and operation of systems associated with the air-handling unit, whose proper functioning is needed for proper operation of the air-handling unit as well as for operation of the entire air-handling system. These are:
 - Wiring
 - M & C system
 - Water heater (VO) system – circuit, pump operation and water filters (also in SUMX)
 - Cooling system
 - Sanitary installation - condensate drainage

Regular Inspections

The user will determine the intervals for regular inspections of the air-handling unit according to the operating conditions, however, at least once every three months. Within the framework of the inspection, check the following:

Overall Check

Cleaning of all parts of the air-handling unit:

- Min. 1x per year or more frequently, if needed (recommended cleaning solution – 10 parts of a dish washing cleaner or similar agent, 45 parts of Isopropanol, 45 parts of water – pH 5–9, do not use cleaners containing active chlorine).
- Max. 50°C when a steam cleaning equipment is used.
- When a high-pressure cleaning equipment is used, there is a risk of paint damage, especially in the elbows.
- To remove heavy dirt and clean the corners, use soft brushes to avoid damage to the metal or painted surface. Using wire, hard plastic (rice) brushes of other abrasive agents is prohibited.
- First test clean a small area of the surface and then carry it out on evenly on the whole surface to prevent possible differences in colour

Check the functionality of the condensate drainage

Obrazek 21



- No traces of stagnant water must be found inside the unit.
- Pour 1 litre of water into the tray. This water must be safely drained through the drainage from the tray.

Fan Inspection

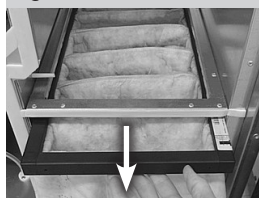
- Check the fan operation (strange noises and excessive vibrations of the unit) and, if needed, balance the fan, refer to the section Unit First Start Inspection.
- Check the impeller for cleanliness.
- Check the impeller for integrity and free rotation.
- Check the assembly screw connections for tightening.
- Check the silent blocks for condition (damage).

Inspection of Dampers

- Check the dampers for cleanliness.
- Check the damper flaps for free rotation.
- Check the damper flaps for full closing.

Filter Inspection and Replacement

Figure 22



- Check the filters for condition and fouling (if fouled or damaged, the filter inserts must be replaced).
- The used filter inserts must be disposed of in an ecological way. When replacing filter inserts, always check the condition of the sealing;

if damaged, replace the sealing with a new one. When checking or replacing the filters, observe the following steps:

When replacing the filter inserts, pull out them from the guiding bars towards the service side of the unit. Check the sealing in the grooves. Insert the new filter insert in the same way into the groove under the sealing until it is seats on the end stop. When inserting a bag filter, be careful not to catch the bags and damage or tear them. It is advisable to perform regular inspections of the frame filters, especially if high air humidity is present or if it fluctuates through the day.

Checking the Exchangers (Heaters, Coolers)

- Clean the dirty heat exchanging surfaces of the heat-exchangers using a vacuum cleaner or hot-water cleaner.
- It is important to check the air-venting of the exchangers.
- Permanently check the functionality of the condensate draining system (coolers).

Important:

Be very careful when cleaning the exchanger's fins to avoid mechanical damage to the fins and injury caused by the sharp edges of the fins. If taking the exchanger out of operation during the winter season, the water must be completely drained from the exchanger, and possible water residuals must be removed, e.g. by blowing out the exchanger with pressurised air; or the exchanger must be filled with a safe antifreeze solution of water and glycol. Water residuals can freeze in the exchanger and damage the copper pipes.

Steam Generator Check

All prescribed checks are included in the Installation Instructions attached to the steam generator. Please follow these instructions, especially the following:

Regular Inspections

- During the first several hours of operation: Check the water conductivity (min. 5 refills per water exchange cycle, sparking and max. current checking), check the cylinders for condition (water leakage) and operation and check the tightening of electrical connections.
- Each 3 months of operation: Check the steam generator operation (number of water fillings per cycle) and the condition of the cylinders (water leakage, condition of electrodes and inner casing of the cylinder).
- Each year or after 2500 operating hours: Replace the boiling cylinders, check the condition and shape of hoses, check the sealing of the distributing tubes inside the chamber and check the tightening of electrical connections.

Warning:

Electrical equipment! The steam generator cylinder can be hot. In case of water leakage, the hazard of burning and/or electric shock exists! The intervals of inspections and service life of parts can vary depending on the water quality and operating conditions.

Rotary Heat Exchanger Inspection

Rotary heat exchanger condition inspections must be performed regularly; checking the rotor for cleanliness is the most important part of these inspections. The user will determine the intervals for regular inspections according to the operating conditions, however, at least once every 3 months. At the same time, the user must perform the following checks:

- Check the rotor for free rotation
- Check the rotor for cleanliness.
- Check the condition and tightness of the brushes and free rotation of the rotor.
- Check the rotor condition and tension of the driving belt.
- Check fouling of filters; inlet and outlet.

Important:

If fouled or damaged, the filters must be replaced with new ones immediately. If any fouling of the rotor is found, the user must ensure its expert cleaning. The rotary heat exchanger rotor can be cleaned by pressurized air, steam or pressurized water. Failure to perform maintenance can result in permanent damage to the rotary heat exchanger rotor and very expensive repairs. If the proper procedure of cleaning is not observed, there is a high risk of serious damage to the rotary heat exchanger rotor!

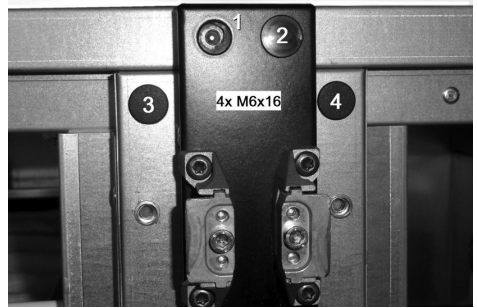
Centre Pillar Removal

In some cases, it is necessary to remove the centre pillar to make enough space to access the rotary heat-exchanger motor or to remove some parts of internal assemblies (heat recovery exchangers, fans, heaters and coolers).

- Remove the covers from the upper and lower part of the pillar.
- Remove the screws. (Attention! The screws are fitted with fan-washers to ensure conductive connection.)
- Remove the pillar

Attention! the side pillars support the doors!

Figure 23 – Centre pillar replacement



Check of Cooling and Heating Circuit Liquids

Recommended water quality used in heat exchangers working with low-pressure heating water or cooled water:

- Use good quality water – e.g. drinking water without salt and calcium compounds – to prolong service life and increase efficiency of the heat exchanger.
- Once a year, check the limit values included in the table below to prevent damage to the hydraulic system and its components.
- If needed, add water softening agents.

Note: These water quality limit values are only intended for information purposes and cannot be used for the equipment's guarantee!

Description	Designation	Values	Effects if different from recommendation	
Concentration of hydrogen ions	pH	7,5 - 9	< 7 > 9	Corrosion Deposit creation
Calcium and magnesium content	Tvrdost (Ca/Mg)	4 – 8,5 °D	> 8,5	Deposit creation
Chlorine ions	Cl ⁻	< 50 ppm		Corrosion
Iron ions	Fe ³⁺	< 0,5 ppm		Corrosion
Magnesium ions	Mg ²⁺	< 0,05 ppm		Corrosion
Carbon dioxide	CO ₂	< 10 ppm		Corrosion
Hydrogen sulphide	H ₂ S	< 50 ppb		Corrosion
Oxygen	O ₂	< 0,1 ppm		Corrosion
Chlorine	Cl ₂	< 0,5 ppm		Corrosion
Ammonia	NH ₃	< 0,5 ppm		Corrosion
Content in volume of carbonates/sulphates	HCO ₃ ²⁻ / SO ₄ ²⁻	>1	<1	Corrosion

1/1,78 °D = 1 °F, kde 1°F = 10 g CaCO₃/m³

ppm = parts per million (mg/l)

ppb = parts per billion (µg/l)

Disposal and Recycling

Spare Parts and Service

Spare Parts

Spare parts are not included in 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, specify the unit serial or purchase order number, and the parts needed.

Replacement filter inserts

For multipart filters, the filter inserts are delivered as a complete set. Specification of the filter type (bag or frame), serial number and filtration class will suffice. There is no need to specify the types of individual filter inserts of the filter.

The filtration class G3 125 x 125mm filtering textile cuts are used for vents of the integrated control unit (if included in the compact air-handling unit).

Service

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

Disposal and Recycling



Information for disposal in other countries outside EU

Observe the applicable local environmental protection and waste disposal regulations.

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 from the Czech Republic

Observe the applicable local environmental protection and waste disposal regulations. Active carbon which contains toxic substances, radioactive impurities or PCB must be disposed of in accordance with applicable legal regulations. After exceeding its service life limit, proceed according to the Waste Act (No. 352/2005 Sb. as amended).

Waste Classification

(in accordance with Directive No. 3/2016 Sb.)

Packaging used:

- 15 01 01 cardboard box
(paper and cardboard packaging)
- 15 01 02 polyester packaging pads
(plastic packaging)
- 15 01 03 pallet (wooden packaging)

Disabled device and its parts:

- 13 02 06 Waste engine, transmission and lubricating oils (synthetic engine, transmission and lubricating oils)
- 16 01 17 Iron metals
- 16 01 18 Non-iron metals
- 15 02 03 Filter material
- 16 02 14 Disposed parts
not included under numbers 16 02 09 – 16 02 13
- 16 02 15 Electric parts
(dangerous compounds removed from disposed devices)

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Always observe local laws and regulations.

REMAK

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