



Future[®]

Air handling unit

Instructions for operation and maintenance

Version 2.0 2021

www.koja.fi

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1. GENERAL

For efficient and economical ventilation system, the operation of the equipment must be monitored on a regular basis, and the operation and maintenance instructions must be followed. The ventilation system must be designed and implemented in accordance with the statutes and regulations in force.

The documentation of the ventilation system contain the operating principles of the plant and its subsystems, operating programs, connection and control diagrams, location and layout drawings, and adjustment values and operation and maintenance instructions for the equipment.

1.1. Operating conditions

The standard unit is designed for indoor installation. Ambient temperature must be over 0 °C. The air to be handled must not be corrosive or poisonous, warmer than 70 °C or contain significant amounts of water vapour or large particles.

 CAUTION	The permitted operating conditions and any limitations must be checked from the section-specific instructions.
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1.2. CEN standard classification


Air handling unit Future® complies with the CEN standard EN 1886 classification as follows:


- L2 leakage class for casing
- T3 heat transfer coefficient for casing.

1.3. Sound level

For the unit's sound data, please refer to the design calculations supplied with the acknowledgment of order.


1.4. Safety









 WARNING	The component manufacturer's installation and operating instructions must be followed. In case of a discrepancy between these instructions and the component manufacturer's instructions, follow the component manufacturer's instructions. For detailed component manufacturer's operating and maintenance instructions, please refer to our website at http://www.koja.fi/fi/rakennukset/tukimateriaalit/ilmankaesittelykoneet
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 WARNING	The air handling unit includes sharp parts and hot surfaces.
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 WARNING	Observe general and section-specific safety instructions.
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 WARNING	Do not keep extra objects on top of or inside the unit. Do not climb or walk on top of the unit.
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 WARNING	Do not use components other than those specified or approved by the equipment manufacturer in the ventilation unit.
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 WARNING	<p>Before switching on the fan, make sure that the inlet and outlet of the fan section have been connected to the ductwork or that the access to the rotating fan parts, such as the impeller, through an inlet, outlet or access door has been prevented with protective screens or by other appropriate manner. The service switch of the air handling unit must be installed and in service when the unit is switched on. The damper section of the unit must open before the fan starts.</p>
 WARNING	<p>Electrical installations must comply with EMC requirements. For EMC-compliant connections, refer to the instructions in the frequency converter manufacturers' installation guides. Connections made at the Koja factory comply with these requirements. Koja is not responsible for damages, if the connections made by the customer do not comply with general EMC requirements. Such damages include, for example, motor bearing damage due to bearing currents.</p>
 WARNING	<p>The earthing continuity of the frame of the ventilation unit must be assured, and the frame must be connected to the building's earthing system before operation.</p>
 WARNING	<p>The fans have a supply frequency for the maximum rotation speed stated in the fan plate. When using a frequency converter, make sure that the maximum frequency is not exceeded.</p>
 WARNING	<p>The motor and/or frequency converter supply cables must be equipped with a service switch. If the service switch is installed between the motor and frequency converter, the switch must be EMC approved and connected in compliance with the EMC regulations. Pay special attention to the screened 360 degree connection and protective ground continuity.</p>
 WARNING	<p>The earth leakage current from the frequency converters exceeds 3.5 mA. According to standard EN61800-5-1, the frequency converter connection must, therefore, be fixed and the cross-section of the protective earth conductor of the supply must be at least 10 mm² (Cu) or 16 mm² (Al). Alternatively, the frequency converter supply can be equipped with an additional protective earth conductor of the same cross-section than the actual protective earth conductor. Local regulations must also be followed. The earth leakage current from the integrated control unit of the EC motors is no more than 3.5 mA.</p>
 WARNING	<p>The electric motors and frequency converter are serviced according to the manufacturer's instructions. The components must be de-energized and the impeller stopped for the duration of the maintenance. Once opened, the rotors and stators of the permanent magnet motors (EC and PM motors) may cause interference in electrical devices, such as phones and payment cards. Being in close proximity to opened permanent magnet motors constitutes a danger to people with pacemakers.</p>
 WARNING	<p>Permanent magnet motors rotating freely in air flow operate as generators. To prevent the risk of electric shock, the axles of permanent magnet motors must, therefore, be locked for the duration of the maintenance.</p>

 WARNING	<p>Electrical connections must be made by a qualified and authorized electrician only. The condition of the cables connected to the unit must be inspected visually before making any electrical connections and starting the unit. Before starting any installation and maintenance work on the electrical device, make absolutely sure that the device is de-energized. After switching off the power, wait at least five minutes to allow dangerous voltages to discharge from the devices. Electrical devices should be inspected every six months. Any deficiencies and faults must be rectified immediately.</p>
 WARNING	<p>Due to functional reasons, fans/motors may start and stop automatically without warning. This may happen, for example, after a power outage or malfunction.</p>
 CAUTION	<p>The unit must be installed in a space accessible only to qualified personnel. If the unit is installed in a place where it is accessible to persons other than service personnel, the handles of the access doors must be removed and locked in a safe place. Ensure during installation, commissioning and maintenance that only qualified maintenance personnel have access to the danger area.</p>
 CAUTION	<p>The ventilation system and its maintenance routes must be designed and constructed so that the ventilation unit can be serviced and repaired easily and safely. The National Building Code of Finland D2, section 3.8.6.</p>
 CAUTION	<p>The filter pressure difference values must under no circumstances exceed the dimensioning pressure drop in the filter by more than two times. If the pressure difference is exceeded, the components or structure of the unit may become damaged. The warranty does not cover damages due to negligence in replacing the filters.</p>
 CAUTION	<p>If the unit is equipped with drainages for washing water, these must be plugged. If the drainages are sewerred, they must be equipped with a water trap.</p>
 CAUTION	<p>The fan models are not designed to be disassembled. If the fan has to be disassembled, due to, for example, narrow hauling routes, the fan-motor assembly must be balanced and the certificate of balancing must be presented, in order to retain the warranty. If the motor has to be removed or the fan disassembled due to maintenance or repair work, permission is needed from Kojja Ltd's Warranty Handler. Otherwise, the fan warranty will be voided.</p>
 CAUTION	<p>If the fan has to be replaced, the faulty fan is to be returned with a length of the wire attached to the motor.</p>

1.4.1. CE marking

Future® air handling unit series complete with electrification and regulator devices are CE marked at the factory, and the CE mark of the air handling unit can be found in the machine plate on the switchboard door. A declaration of conformity is supplied with the unit.

Future® air handling unit series without electrification and regulator devices are CE marked by the person responsible for taking the unit into use at the installation site. A manufacturer's declaration is supplied with the machine.

The person responsible for taking the unit into use must ensure that all procedures mentioned in these instructions are performed before commissioning the unit. Electrical installations and their installation inspections and measurements must be performed in accordance with standards SFS-EN 60204-1 and SFS 6000-6, and the person responsible for taking the unit into use must compile the testing and installation documents.

1.4.2. Safety equipment

The service (safety) switch installed in the fan section functions also as a unit emergency switch (not included in the delivery).

The protective devices for the electric components must be dimensioned correctly in order to guarantee safe use of the unit.

1.4.3. Fire

In case of fire in the unit, do not use water, but a powder extinguisher or such. The materials used in the unit do not produce harmful amounts of any hazardous gases when burning.

1.5. Safety devices

1.5.1. Anti-freezing thermostat

An anti-freezing thermostat (not included in the delivery) is installed in the water space or on a heat transfer surface of the heat exchanger. The thermostat gives an alarm and stops the unit if the water temperature in the heat exchanger drops below the set point (e.g., +8 °C). Always determine the reason for the tripping of the thermostat. The unit can be restarted by pressing the reset button of the anti-freezing thermostat.

1.5.2. Filter indicator (differential pressure gauge)

A filter indicator (not included in the delivery) is installed in the filter section, so that it can measure the pressure difference across the filter. It indicates the pressure difference and/or gives an alarm. For the purpose of the filter indicator, please refer to the section covering the filters.

1.5.3. Fire thermostat

A fire thermostat (not included in the delivery) is installed in the inlet or outlet duct of the unit. It gives an alarm (and stops the unit) if the supply air temperature exceeds the set point (e.g. +50 °C). Always determine the cause for the tripping of the thermostat, and also check if the fire dampers (if applicable) have been actuated. The unit can be restarted by pressing the reset button of the fire thermostat.



1.5.4. Flow controller

A flow controller (not included in the delivery) is installed in the inlet or outlet duct of the unit. It gives an alarm if the sensor does not detect air flow. Always determine the cause for the alarm immediately.

**CAUTION**

Instructions for the operation and maintenance of safety devices are supplied by the device manufacturers.

1.6. Manufacturer's declaration

	
MANUFACTURER'S DECLARATION	DECLARATION OF INCORPORATION II-B OF PARTLY COMPLETED MACHINERY
Manufacturer Address	Koja Oy Lentokentänkatu 7 FI-33900 Tampere Finland
	Hereby declares that
Products	Future 0603-3630 air handling unit series without electrification and regulator devices
	a) conforms with the essential requirements of the directives listed below, provided that the said products are installed in accordance with the instructions supplied with the unit. Machinery Directive 2006/42/EC EMC Directive 2014/30/EC Low Voltage Directive 2014/35/EC Commission Regulation 1253/2014 implementing Directive 2009/125/EC with regard to ecodesign requirements for ventilation units If any changes are made to the products, this declaration will no longer be in effect. A risk analysis according to the Machinery Directive requirements has been conducted on the product. The products may only be used as part of a machine or system that fulfils the requirements of the aforementioned directives. b) has been manufactured according to the following harmonised standards: SFS-EN ISO 12100, SFS-EN ISO 13857, SFS-EN 60204-1, EN 61000-6-1, EN 61000-6-3, EN 61000-6-4, SFS 6000-6, SFS-EN 13053 Technical file compiled by: Taru Lähteenmäki Product Development Manager, air handling units Address: Lentokentänkatu 7, FI-33900 Tampere, Finland
Date	7 September 2020
	
Signature Position	Joonas Lius Business Director
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**1.7. Declaration of Conformity for Future® air handling unit series
with electrification and regulator devices****DECLARATION OF CONFORMITY**

Manufacturer Koja Oy
Address Lentokentänkatu 7
FI-33900 Tampere
Finland

Hereby declares that

Products **FUTURE 0603...3630 air handling unit series with electrification and regulator devices**

a) conforms with the essential requirements of the directives listed below, provided that the said products are installed in accordance with the instructions supplied with the unit.

Machinery Directive 2006/42/EC
EMC Directive 2014/30/EC
Low Voltage Directive 2014/35/EC
Commission Regulation 1253/2014 implementing Directive 2009/125/EC with regard to ecodesign requirements for ventilation units

If any changes are made to the products, this declaration will no longer be in effect. A risk analysis according to the Machinery Directive requirements has been conducted on the product.

b) has been manufactured according to the following harmonised standards: SFS-EN ISO 12100, SFS-EN ISO 13857, SFS-EN 60204-1, EN 61000-6-1, EN 61000-6-3, EN 61000-6-4, SFS 6000-6, SFS-EN 13053

Technical file compiled by: Taru Lähteenmäki
Product Development Manager, air handling units
Address: Lentokentänkatu 7, FI-33900 Tampere, Finland

Date 7 September 2020



Signature Joonas Lius

Position Business Director


2. COMMISSIONING AND MAINTENANCE


2.1. Commissioning

Before commissioning the air handling unit, make sure that the unit has been installed and cleaned according to the instructions, that the components and safety devices essential for the safe operation of the unit have been installed properly, and that the flow rates have been adjusted.

The commissioning of the air handling unit and the training of the operating personnel are usually carried out by the supplier of the air-conditioning plant in question.

 WARNING	Observe general and section-specific safety instructions.
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 CAUTION	The motor of the fan FFK-xx-AF may become overloaded, if the air volume flow exceeds the designed level. This may happen if, for example, the air handling unit is switched on before all the sections of the unit and the ductwork are installed, if the fan is switched on with the access door open, or if the access door is opened during operation of the fan.
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 CAUTION	The FFK casing fan models are not designed to be disassembled. If the fan has to be disassembled, due to, for example, narrow hauling routes, the fan-motor assembly must be balanced and the certificate of balancing must be presented, in order to retain the warranty. If the motor has to be removed or the fan disassembled due to maintenance or repair work, permission is needed from Koja Ltd's Warranty Handler. Otherwise, the fan warranty will be voided.
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2.2. Maintenance

 WARNING	Observe general and section-specific safety instructions.
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 WARNING	Preventing start-up before starting the maintenance work
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Before starting any maintenance and/or repair work, make sure that the work will not cause an unnecessary disturbance to other activities in the building. Stop the unit and turn the service switch to the zero position. Remove the fuses of both speeds of 2-speed motors (all fuses in case of 3-speed motors) and make sure (via a written notice, for example) that the unit will not be started accidentally during the maintenance.

After completing the maintenance and/or repair work, start the unit and make sure that all shut-off and control devices, instruments and the signal lamp are functioning.

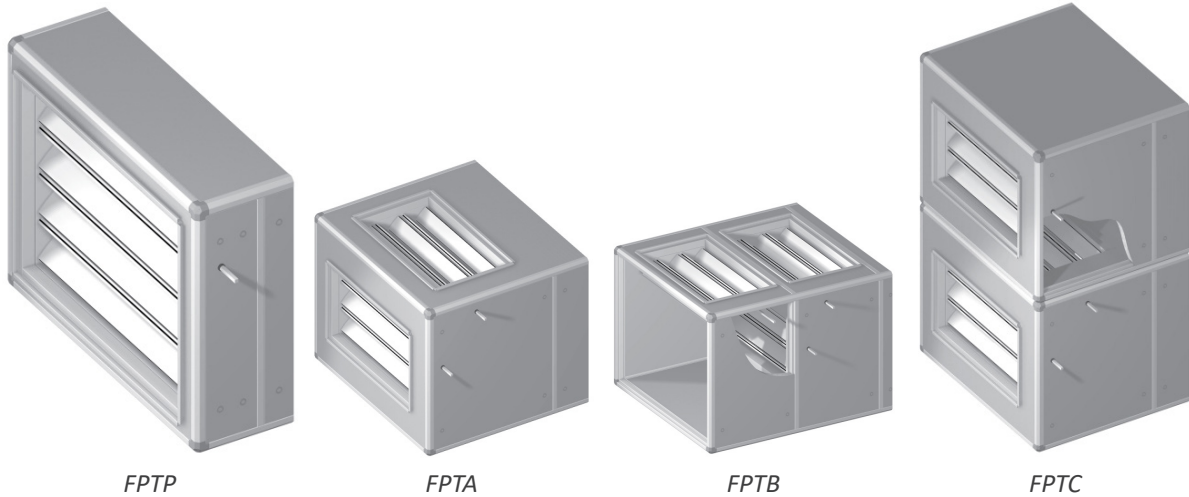
The stated maintenance intervals are only guidelines. The intervals are determined by the utilisation rate of the air-conditioning plant and the ambient conditions. The given intervals apply when the plant is used 8 hours a day in city air environment. The maintenance intervals are longer in cleaner environments (like the countryside) and shorter in dirtier environments (like industrial areas).

It is advisable to have the unit serviced at the beginning (autumn) and at the end (spring) of the heating season. Maintenance activities that can be performed by the plant's own service personnel are cleaning, the replacement of filters, belts and pulleys, and the lubrication of joints and bearings.

Repairs on unit sections, replacement of bearings, and all installation and adjustment operations related to electricity or automation require special expertise. Clean the unit with an ordinary detergent. Solvents must not be used in cleaning sections that include aluminium parts (heat exchangers).

Spare parts mentioned in these instructions are available at Koja or the manufacturer in question. (Koja Ltd reserves the right to changes without prior notice.)

3. DAMPER, MIXING AND RETURN AIR SECTIONS FPTP, FPTA, FPTB AND FPTC

**CAUTION**

The pressure rise of the fan can be higher than the maximum permissible pressure difference of the multiple leaf damper. The multiple leaf damper should open before the fan starts, and close after the fan has stopped.

3.1. Operating conditions

- The operating temperature range is $-40...+80$ °C.
- The maximum permissible pressure difference across the multiple leaf damper is 1,200 Pa.

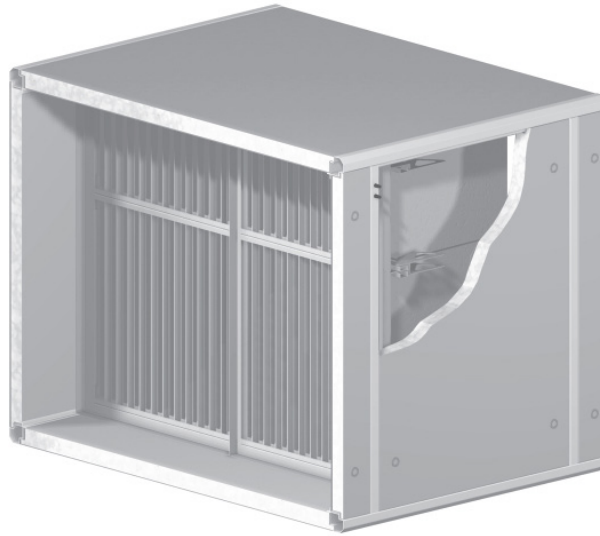
3.2. Commissioning

- Make sure that the dampers of the sections open and close fully and that the actuator works according to the control.

3.3. Maintenance

- The maintenance interval is 6 months.
- Make sure that the leaves open and close unhindered up to the set limits.
- Make sure that the lever mechanisms between the leaves and between the actuators and shafts are not loose or worn.
- Lubricate the joints in lever mechanisms with light oil.
- Tighten screws, if necessary, and replace worn parts.
- Make sure that the leaf and end plate gaskets are intact. Replace damaged and worn gaskets.
- Clean the section, if necessary.

4. FILTER SECTION FSTF



4.1. Structure

The filter section FSTF is available in four lengths. The hygiene type Future® Clean can be equipped with a pull-out filter frame up to unit size 1209.

The filter section has a thermally insulated casing. The particle filters used are disposable filter cassettes of the module's length. The cassettes are pushed into the mounting frame and pressed against the rubber strips made of EPDM. The activated carbon filters have carbon cylinders fixed to the connection plate.

The section has connections for a differential pressure gauge and filter indicator.

4.2. Operating conditions

- The operating temperature range is $-40...+80$ °C.

4.3. Installation

Filter section FSTF is installed in the upright position (see figure above) or in the horizontal position, in which case the air flow can be directed upwards or downwards when using coarse-grain filters G3 and G4 or wide-area filter F7. With other filter grades, the air flow direction is downwards only. The air flow direction is marked on the filter section and on the filters. If there are no markings, the filter section must be installed so that the air must enter the filter from the filter groove side.

4.4. Commissioning

The filters must be installed before test-running the unit. The filters are placed in the mounting grooves with the folds in upright position, and then clamped against the gasket.

- Check that the filters are intact and of the correct type.
- Check that the filters are tight against the frame gasket and that there are no leaks.
- Check that the filters are clamped in place.
- Check that the differential pressure gauge is intact and reset.
- Check that the differential pressure hoses of the filter section are intact and in their places.

At the installation stage, the pressure difference limits for the filter indicators must be set according to the Future® dimensioning program documentation. The filter pressure difference values must under no circumstances exceed the dimensioning pressure drop in the filter by more than two times. If the pressure difference is exceeded, the components or structure of the unit may become damaged. The warranty does not cover damages due to negligence in replacing the filters.

4.5. Maintenance

The filter section is to be serviced and cleaned twice a year, normally in the autumn and spring. The replacement interval of the filters is usually determined by the maximum permissible decrease in the air flow due to increased pressure drop across the filter (normally 10% of the design air flow).

To measure the pressure drop, a filter indicator indicating the pressure difference across the filter (shows the pressure difference or gives an alarm) has been installed on the filter section. When the pressure difference across the filter exceeds the set limit, the filter must be replaced. Refer to the unit design documentation for the recommended filter-specific final pressure drop with design air flow.

The filter pressure difference values must under no circumstances exceed the dimensioning pressure drop in the filter by more than two times. If the pressure difference is exceeded, the components or structure of the unit may become damaged. The warranty does not cover damages due to negligence in replacing the filters.

Replace the filters if the pressure difference limit in the filters has been exceeded, or if the filters are dirty or damaged

- Check that the filters are intact and of the correct type.
- Check that the filters are tight against the frame gasket and that there are no leaks.
- Check that the filters are clamped in place.
- Check that the differential pressure gauge is intact and reset.
- Check that the differential pressure hoses of the filter section are intact and in their places.
- Check that the differential pressure transmitter operates properly and has been calibrated according to the manufacturer's instructions. Check also that a pressure difference limit, which must not exceed the dimensioning pressure drop by more than two times, has been set in accordance with the Future® dimensioning program documentation.

4.6. Replacement of filters

1. Open the access door and the clamping mechanism. Pull the filter (filters) out of the casing.
2. Clean the casing, if necessary.
3. Check the condition of the gaskets. Replace worn and damaged gaskets. **NOTE! Gaskets are not needed between filters that are mounted parallel to each other.**
4. Place new filters in the mounting grooves with the folds in upright position. Clamp the filters against the gasket.
5. Replace the maintenance hatch.
6. Check the operation of the filter indicator once the fan has been restarted.

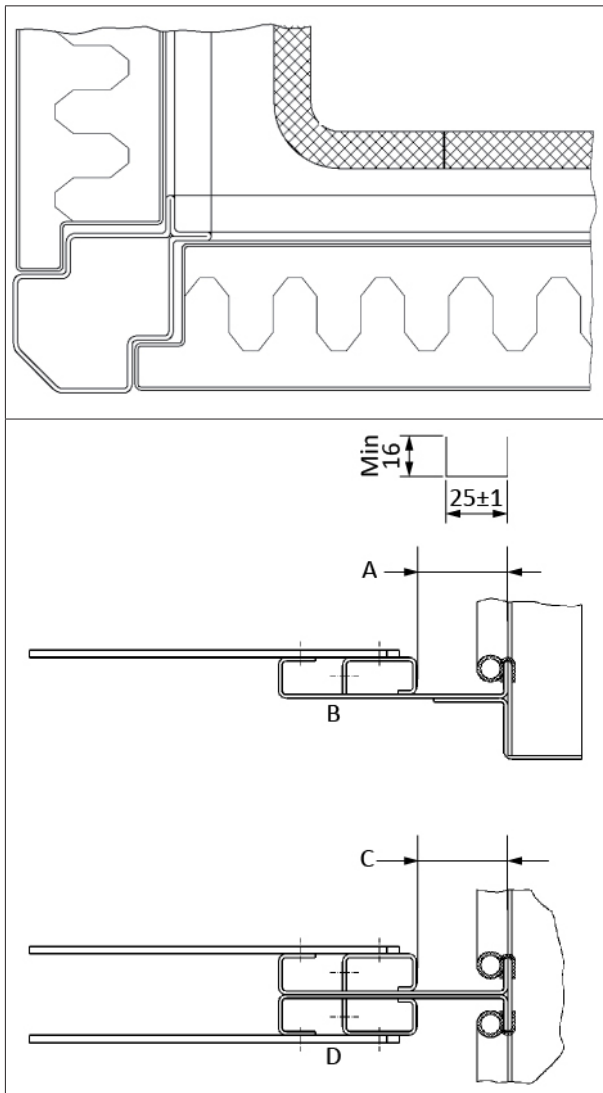
Unit size	Width, mm	Height, mm	Filter cassette sizes / number of cassettes			
			287 x 592	592 x 287	592 x 592	592 x 490
0603	790	470		1		
0605	790	670				1
0606	790	790			1	
0906	1,070	790	1		1	
0909	1,070	1,070	1	1	1	
1,206	1,350	790			2	
1,208	1,350	990		2		2
1,209	1,350	1,070		2	2	
1,210	1,350	1,190				4
1,212	1,350	1,350			4	
1,506	1,670	790	1		2	
1,509	1,670	1,070	1	2	2	
1,512	1,670	1,350	2		4	
1,515	1,670	1,670	2	2	4	
1,809	1,990	1,070		3	3	
1,810	1,990	1,190				6
1,812	1,990	1,350			6	
1,815	1,990	1,670		3	6	
1,818	1,990	1,990			9	
2,409	2,550	1,070		4	4	

Unit size	Width, mm	Height, mm	Filter cassette sizes / number of cassettes			
			287 x 592	592 x 287	592 x 592	592 x 490
2,412	2,550	1,350			8	
2,415	2,550	1,670		4	8	
2,418	2,550	190			12	
2,421	2,550	2,310		4	12	
2,424	2,550	2,550			16	
3,015	3,190	1,670		5	10	
3,018	3,190	1,990			15	
3,021	3,190	2,310		5	15	
3,024	3,190	2,550			20	
3,624	3,790	2,550			24	
3,627	3,790	2,870		6	24	
3,630	3,790	3,190			30	

The thickness of the mounting frame is 25 ± 1 mm.

4.7. Replacement of gasket

Dimensions of the mounting groove and filter cassette frame



A new gasket is mounted, starting from the middle of the frame bottom. Press the gasket against the edge of the plate by hand or carefully with a hammer or some other tool. Use, for example, a 20-mm pipe to bend the corners appropriately. Cut the gasket to a length of about 5 mm too long. Force the ends together and apply sealant between them.

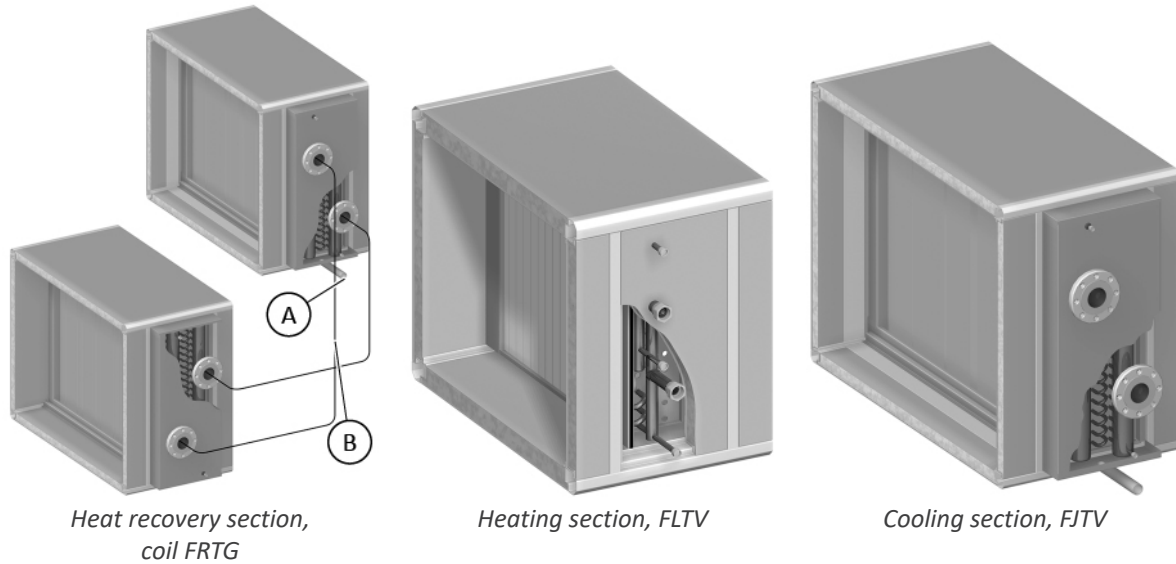
- A. With the clamp closed: 35 ± 1.0
- B. Lower frame
- C. With the clamp closed: 35 ± 1.0
- D. Middle frame

5. COIL SECTIONS

Heat recovery section, FRTG

Heating section, fluid FLTV


Cooling section, fluid FTVJ




- A. Outlet pipe for condensation water
- B. Ductwork for heat transfer agent


5.1. Operating conditions

- The maximum operating temperature is +150 °C.
- The maximum operating pressure is 1.0 MPa.

 CAUTION	<p>The coils of large units have been split in two. The condensation water drain of the coil has to be piped to the sewer, also from behind the unit. Make sure that the water traps and piping have been mounted according to the instructions.</p>
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 CAUTION	<p>Due to the construction, the heat exchanger will never drain completely. If the cooling medium used is water, the heat exchanger may freeze up and become damaged at temperatures below 0 °C.</p>
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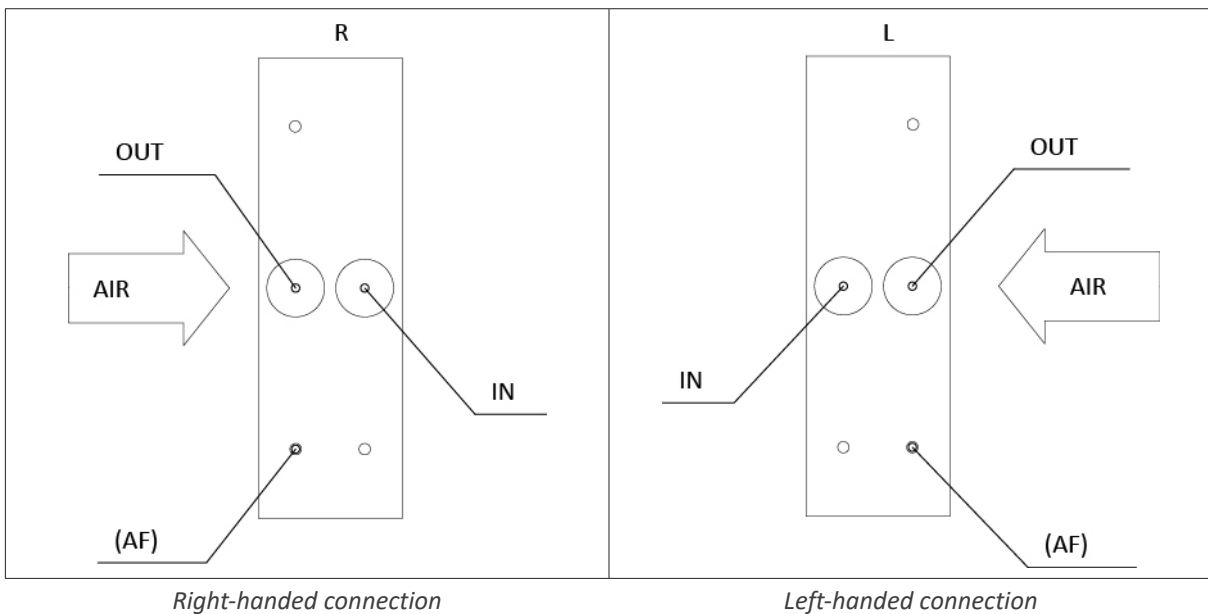
5.2. Installation

 CAUTION	The coils are always connected, so that the fluid flow runs against the direction of the air flow. There is an adhesive label on the coils describing the connection.
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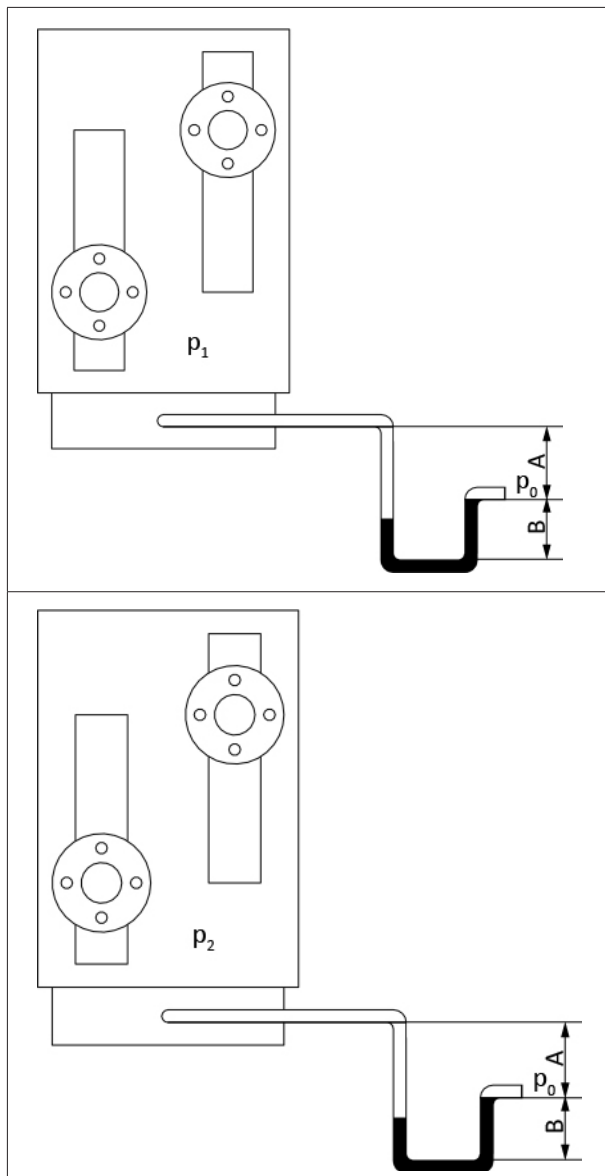
 CAUTION	Pipe connections must be carried out by qualified persons only.
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The right-handed heating section is connected according to the figure *Right-handed connection*, and the left-handed according to the figure *Left-handed connection* (the heat exchanger must be bled carefully in order to ensure proper fluid circulation in the piping).

The connection principle for the left-handed and right-handed heating sections is the same. The heat exchanger has inlet and outlet connections and connections for coil bleeding, draining and the anti-freezing thermostat sensor.



5.3. Dimensioning instructions for water trap

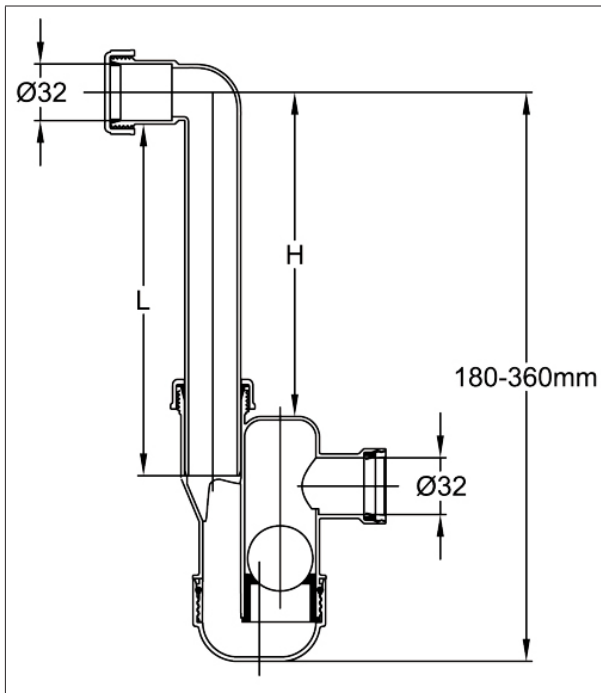


Coil at the inlet side of the fan

$$\begin{aligned} \Delta p &= P_0 - p_1 \text{ (Pa)} \\ A_{\min} &= \Delta p / 10 + 30 \text{ (mm)} \\ B_{\min} &= A / 2 + 20 \text{ (mm)} \end{aligned}$$

Coil at the outlet side of the fan

$$\begin{aligned} \Delta p &= P_0 - p_1 \text{ (Pa)} \\ A_{\min} &= 20 \text{ (mm)} \\ B_{\min} &= \Delta p / 10 + 30 \text{ (mm)} \end{aligned}$$



CAUTION

The water trap must be installed in the position shown in the picture.

5.4. Commissioning

- Make sure that the heat transfer surfaces of the coil are clean and intact.
- Open the line control valves to fill the coil with fluid.
- Bleed the coil.
- Make sure that the water side connections of the coil do not leak.
- Check the rotation direction of the circulating pump (do not run the pump dry).
- If necessary, check the operation of the anti-freezing thermostat.
- Make sure that the control valve functions, and adjust the line control valves, according to the plan. Refer to the manufacturer's manual for further adjustment instructions.
- Check the condensation water discharge system, i.e., drip tray, piping and water trap.
- Flush the piping and fill the water trap.

5.5. Maintenance

- Make sure that the water side connections of the coil do not leak.
- Make sure that the heat transfer surfaces of the coil are clean and intact.
- Clean the coil gently with a brush, compressed air or a vacuum cleaner. If the unit has water drains, the coil can be cleaned with water and a mild detergent. **NOTE! Do not use pressure cleaning.**
- Bleed the coil and check the operation of the anti-freezing thermostat at the beginning of each heating season.
- Check and clean the condensation water discharge system, i.e., drip tray, piping and water trap (traps).
- A damaged coil must be repaired in place, sent to the manufacturer to be repaired or replaced.



CAUTION

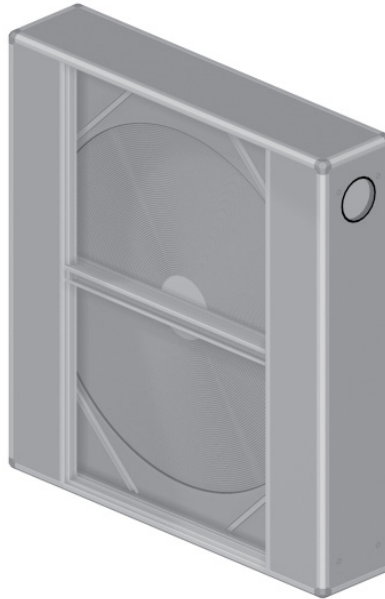
If the coil is not used during the heating season, water must be drained from it or it has to be filled with a water-glycol mixture to avoid freezing. The coil does not drain fully through the drain screw; 20 to 30% of the total water volume remains in the coil. To fully drain water from the coil, you can, for example, blow compressed air through the bleed screw, observing the maximum permissible operating pressure.



CAUTION

The HR circuit must be bled again after 2–4 weeks of heating in order for the energy efficiency in heat recovery to be the best possible.

6. HEAT RECOVERY SECTION, ROTOR FRTR



6.1. Operating conditions

- The maximum permissible operating temperature is +70 °C.

6.2. Commissioning

- The units should not be started during the construction phase. If this cannot be avoided, the fan must not be used without the heat exchanger in operation. Make sure that the filters are in place.
- Make sure that the inlet or outlet ducts are free from foreign objects that could damage the faces of the heat exchanger.
- Use a spirit level on the face of the heat exchanger to ensure that the rotor is upright, and adjust it, if necessary.
- Make sure that the rotor rotates freely.
- Make sure that the rotor belt is tight and running freely in its proper place. Check the tightness of the belt after two weeks of use, and shorten the belt according to the tightening instructions so that the belt will have allowance for stretch with respect to the limit switch, if necessary.
- If necessary, adjust the brush seals on the circumference of the rotor, so that they touch the surface of the heat exchanger. Also check the brush seals on the lower surface of the rotor mid-beams and, if necessary, adjust them so that they touch the surface of the exchanger.
- Check that the rotation guard magnet and sensor are installed correctly.
- Make sure that the seals of the access door are in place and intact. Close the access door and make sure that each latch tightens properly.
- Go through the section-specific instructions, check that the access doors are shut, and then start the unit.
- Looking from the exhaust air side, check that the heat exchanger rotates from the exhaust air side to the supply air side through the purging sector.
- After two weeks of use, check the bolts and belt of the sectorised rotor periphery plates for tightness. Tighten, if necessary.

**CAUTION**


If the unit is installed in a place where it is easily accessible to persons other than service personnel, the handles of the access doors must be removed and locked in a safe place. Ensure during installation, commissioning and maintenance that only qualified maintenance personnel have access to the danger area.

6.3. First actions in case of an alarm, when the motor has stopped

- Switch off the main voltage supply upstream of the control unit, wait 10 seconds and switch the voltage on again. If the motor starts, the motor guard of the control unit was tripped. Make sure that the exchanger rotates freely.
- Check the fuse upstream of the control unit.
- Check the fuse of the control unit.
- Check that the rotation guard is in place and in operation.
- When the control board of the HR rotor gives an alarm, check that the limit switch does not touch the bottom of the unit (in units that use the Lenze angle gearbox motor).
- If the motor still does not work, leave further troubleshooting to an expert.

6.4. Maintenance

The maintenance interval is 6 months. It is advisable to have the unit serviced at the beginning (autumn) and at the end (spring) of the heating season.

 CAUTION	If maintenance work is neglected, the brush seals, belt and other components may become worn and damaged. If this is the case, the warranty does not cover the spare parts.
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 CAUTION	Depending on the size, the heat recovery section is equipped either with a limit switch or rotation guard with a magnet.
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Twice a year

- Check and clean the heat transfer surfaces.
- Make sure that the brush seals lightly touch the surface of the heat exchanger. Replace damaged brush seals.
- Check the sectorised rotor periphery plate bolts and tighten them to 50 Nm using a torque wrench.
- Check the drive belt. The belt stretches over a year, so shorten it. If the belt is worn, replace it. Check the tightness of the belt after two weeks of use, and shorten the belt according to the tightening instructions so that the belt will have allowance for stretch with respect to the limit switch, if necessary.
- Use a spirit level on the face of the heat exchanger to ensure that the rotor is upright, and adjust it, if necessary.

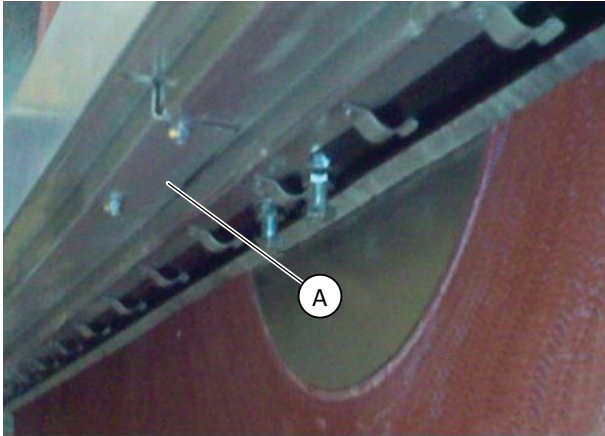
Once a year

- Check the drive motor and lubricate the transmission with grease or oil. For more detailed instructions, see the adhesive label attached to the transmission. Do not mix synthetic and mineral oils or greases.
- Alter the control signal to ensure that the speed control operates properly and that the control signal is connected correctly.
- In the case of a model equipped with a rotation guard with a magnet, check the correct positioning of the rotation guard sensor and magnet by placing the heat exchanger magnet at the sensor. There should be a distance of 5 to 8 mm between them. If the magnet does not give a signal to the sensor, turn the magnet (the S mark must point to the sensor). If the sensor still does not receive a signal, replace the sensor.

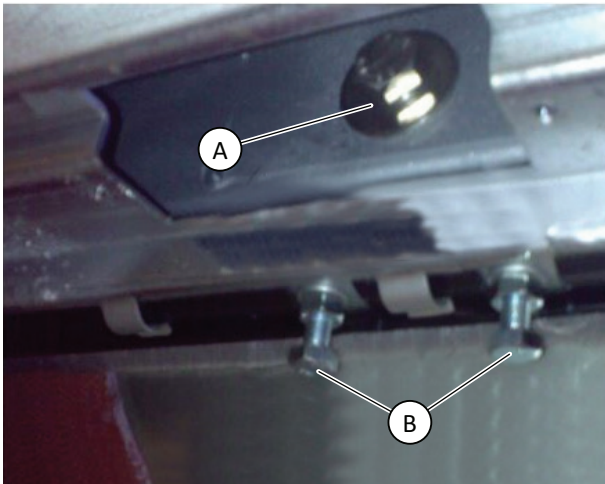
6.5. Cleaning

 CAUTION	Before cleaning, protect the adjacent parts from dirt and water. If the filter section is close by, remove the filters. Use a soft brush, vacuum cleaner or compressed air.
 CAUTION	If you use a brush, make sure not to damage the heat exchanger lamellas.
 CAUTION	If you use compressed air, point the nozzle perpendicular to the lamellas, and blow toward the dirty side from the clean side.
 CAUTION	Loose dirt must be removed from the casing after cleaning.

6.6. Rotor adjustment



A. Protective casing



A. Rotor mounting bolt
B. Rotor adjustment bolts

- Switch off the voltage to the rotor.
- Open the access door.
- Remove the brush seals, if they are worn.
- Remove the protective casing from the rotor mid-beam.

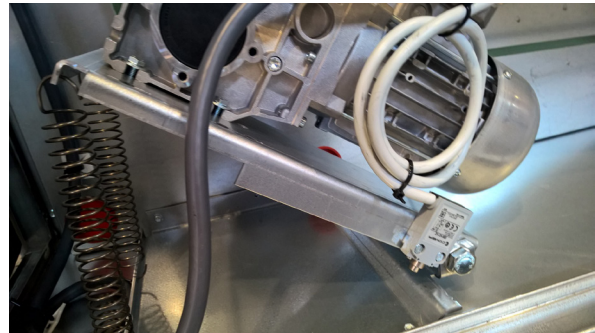
- Loosen the rotor mounting bolt.
- Adjust the rotor position with the rotor adjustment bolts located at the bottom part of the beam.
- Check the rotor position by rotating the rotor by hand from the service side.
- Tighten the rotor mounting bolt (A).
- Tighten the locking screw on the adjustment bolts (B).
- Fix the protective casing to the rotor mid-beam.
- Install new / adjust old brush seals, if necessary.
- Make sure that the rotor rotates freely.

Replacement of drive belt

Tighten the belt around the heat exchanger and pulley. Cut the belt to a length that allows it to fit snugly over the pulley. When fastened, the belt expands automatically to the correct tension, due to the spring load of the motor mountings.



Tightening the rotor belt



The limit switch on the motor bed of the rotor

7. HEAT RECOVERY SECTION, PLATE FRTL




7.1. Operating conditions

- The maximum operating temperature is +80 °C.
- The maximum permissible pressure difference between inlet and outlet air is 1,000 Pa.

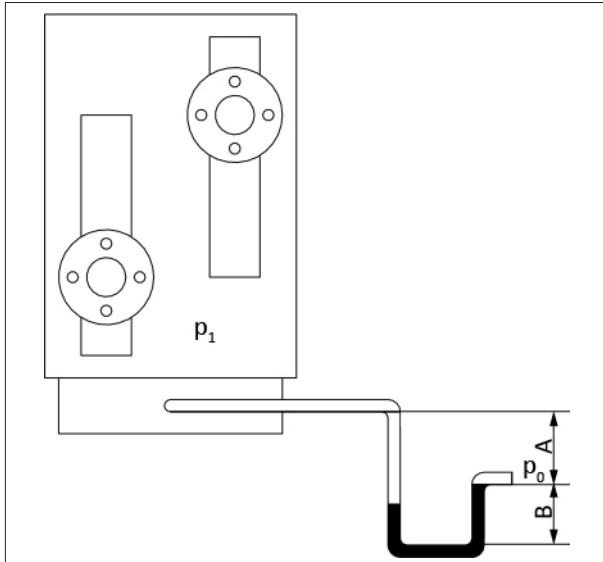
7.2. Installation

 CAUTION	If the exhaust air is moist, constructions with the exhaust air flowing upwards are not recommended.
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 CAUTION	To prevent the risk of freezing, we recommend the use of fresh-air preheating in connection with a plate heat recovery system especially in sites where the exhaust air is moist.
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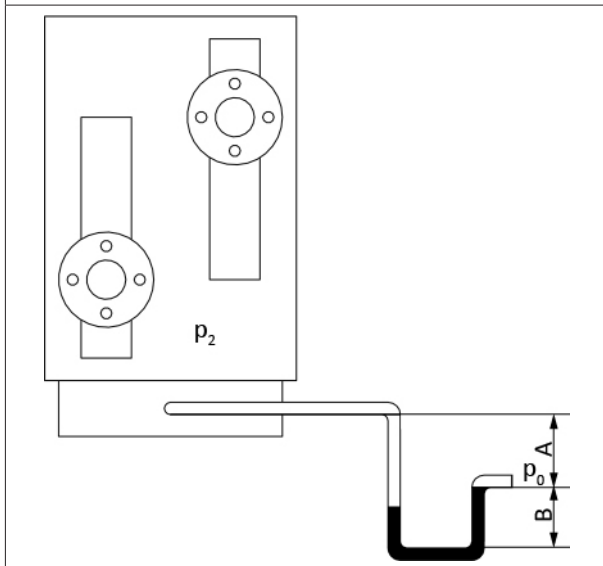
7.3. Dimensioning instructions for water trap

The same principles apply to the dimensioning of the water trap in the heat recovery section as to the water trap in the coil section.



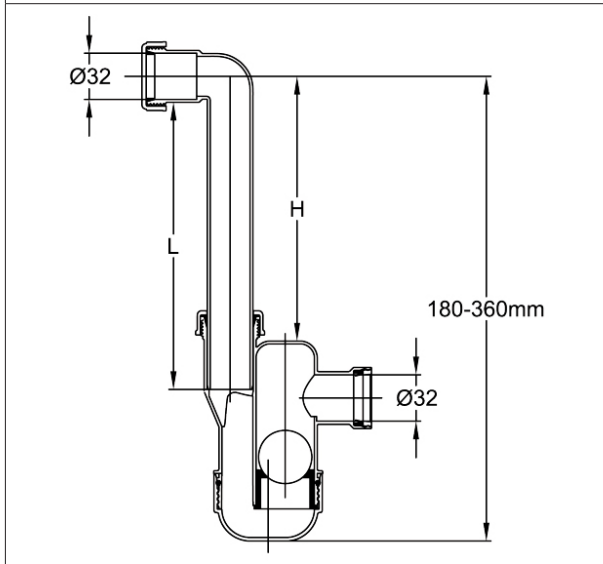
Coil at the inlet side of the fan

$$\begin{aligned} \Delta p &= P_0 - p_1 \text{ (Pa)} \\ A_{\min} &= \Delta p / 10 + 30 \text{ (mm)} \\ B_{\min} &= A / 2 + 20 \text{ (mm)} \end{aligned}$$



Coil at the outlet side of the fan

$$\begin{aligned} \Delta p &= P_0 - p_1 \text{ (Pa)} \\ A_{\min} &= 20 \text{ (mm)} \\ B_{\min} &= \Delta p / 10 + 30 \text{ (mm)} \end{aligned}$$



7.4. Commissioning and maintenance

The maintenance interval is 6 months. It is advisable to have the unit serviced at the beginning (autumn) and at the end (spring) of the heating season.

- Make sure that the heat transfer surfaces are clean and intact.
- Check the operation of the dampers. If necessary, lubricate with a silicone-based lubricant.
- Check that the turning direction of the actuator is the same as that of the dampers.
- Clean the heat recovery cube gently with a brush, compressed air or a vacuum cleaner. If the unit has water drains, the coil can be cleaned with water and a mild detergent. **NOTE! Do not use pressure cleaning.**
- Check and, if necessary, clean the condensation water discharge system, i.e., drip tray, piping and water trap.
- Flush the piping and fill the water trap.
- Make sure that there are no loose pieces, debris etc., that could get into the fan impeller.
- Make sure that the electrical cables are intact.
- Make sure that the seals of the access door and plate heat exchanger are in place and intact. Close the access door and make sure that every latch tightens properly.



CAUTION

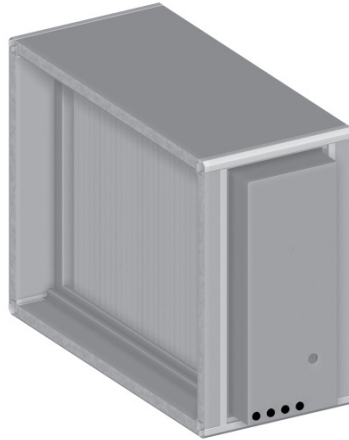
If the unit is installed in a place where it is easily accessible to persons other than service personnel, the handles of the access doors must be removed and locked in a safe place. Ensure during installation, commissioning and maintenance that only qualified maintenance personnel have access to the danger area.



CAUTION

If the heat recovery chamber is pressurised, make sure that the fan has stopped before you open the access door.

8. HEATING SECTION, ELECTRICAL FLTE



8.1. Operating conditions

- The maximum permissible operating temperature is +150 °C.

8.2. Function

The thermostat switches the heating off when the temperature exceeds the set point of 75 °C, and then back on when the temperature falls below the set point. The overheating protector is a safety device that switches off heating if the temperature for some reason, like a fault, rises over the permitted value (147 °C). It is reset to operation manually, but first, the reason for the abnormal operation must be determined.



WARNING

The overheating protector is a safety device that must never be by-passed. The activation of the overheating protector can be indicated with an alarm.

A case-specific electrical connection diagram is supplied with the delivery.

8.3. Commissioning

- Make sure that the heat transfer surfaces of the coil are clean and intact.
- Make sure that there is no flammable material inside the coil within 100 mm of the coil's lamella surface.
- Make sure that the capillary tube of the overheating protector is intact.
- Check the electrical connections and joints and the direction of air flow, which must be according to the arrow marked on the section.
- Give the coil a test run. If the overheating protector trips during the test run, there is a fault in the unit. Locate and rectify the fault immediately. After that, reset the protector.
- Make sure that the fan starts before or at the same time with the heating power, and that it stops at the same time with the heating power switch-off or after the switch-off.

8.4. Maintenance

- Before you start maintenance work, make sure that the coil voltage is switched off.
- Make sure that the heat transfer surfaces of the coil are clean and intact.
- Clean gently with a brush, compressed air or a vacuum cleaner, **DO NOT USE WATER**. Bent lamellas can be straightened with a lamella comb, available from the heat exchanger supplier.
- Make sure that there is no flammable material inside the coil within 100 mm of the coil's lamella surface.
- Make sure that the capillary tube of the overheating protector is intact.
- Check the operation of the coil during the test run. If the overheating protector trips, there is a fault in the unit. Locate and rectify the fault immediately. After that, reset the protector.
- Make sure that the fan starts before or at the same time with the heating power, and that it stops at the same time with the heating power switch-off or after the switch-off.

9. DROP SEPARATOR, FPTE



9.1. Operating conditions

- The operating temperature range is $-20\dots+100$ °C.

9.2. Commissioning

- Make sure that the drop separator units are intact and that they have been mounted correctly with regards to the air flow direction (arrow).
- Check the condensation water discharge system, i.e., drip tray, piping and water trap. Flush the piping and fill the water trap.

9.3. Maintenance

- Make sure that the drop separator units are clean and intact.
- Clean, if necessary. Clean the coil gently with a brush, compressed air or a vacuum cleaner. If the unit has water drains, the coil can be cleaned with water and a mild detergent. **NOTE! Do not use pressure cleaning.**
- Check and clean the condensation water discharge system, i.e., drip tray, piping and water trap.
- Damaged drop separator units must be repaired in place, sent to the manufacturer to be repaired or replaced.
- Make sure that the drop separator units have been mounted correctly with regards to the air flow direction (arrow).



CAUTION

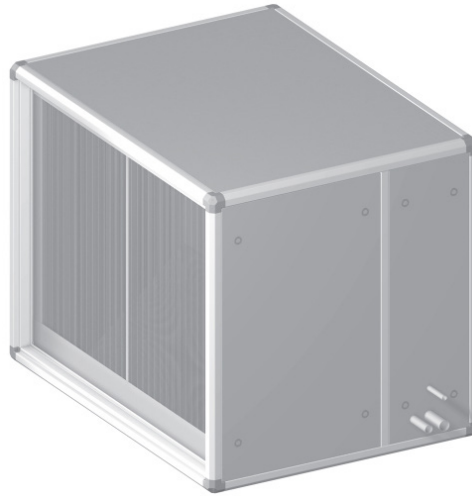
If the units are not used during the heating season, we recommend that they should be removed.



CAUTION

If the drop separator section is located on the outlet side downstream of the fan, make sure that the fan is stopped before you open the access door.

10. HUMIDIFYING SECTION, EVAPORATION FKTK



10.1. Operating conditions

- The maximum permissible temperature for air and water downstream from the humidifier is +40 °C.
- The required minimum/maximum permissible water pressure at the connecting point is 500/1,000 kPa (0.5/10 bar) for circulating water and 150/1,000 kPa (0.15/10 bar) for once-through water.

**CAUTION**

Observe also the manufacturer's instructions for commissioning.

10.2. Commissioning

Before commissioning the humidifier, make sure that the air-conditioning plant including the humidifier in question has been cleaned and that the filters are installed in their places. Connect the humidifier to the water supply and let the cells and tray fill up with water. At the same time, make sure that there are no leaks and check the operation of the overflow pipe.

If circulating water is used, start the pump when the tray is full of water.

When the air-conditioning plant is in operation, monitor the operation of the humidifier and control system first daily and then once a month as follows:

- Check for water leaks.
- Check for water drops on the humidifier cells. If there are drops, consider using a drop separator.
- Check the operation of the water distribution system (water should be distributed evenly on the cells).
- Make sure that the amount of overflow water is within the designed rate. Decreased overflow rate may cause calcification in the cells, reducing the performance and shortening the lifetime of the cells.
- Check the condensation water discharge system, i.e., drip tray, piping and water trap. Flush the piping and fill the water trap. Check that the over-flow water flows freely into the drain.

**CAUTION**

Observe also the manufacturer's instructions for commissioning.

10.3. Maintenance

- Make sure that the drop separator units are clean and intact.
- Clean, if necessary. Clean the coil gently with a brush, compressed air or a vacuum cleaner. If the unit has water drains, the coil can be cleaned with water and a mild detergent. **NOTE! Do not use pressure cleaning.**
- Check and clean the condensation water discharge system, i.e., drip tray, piping and water trap.
- Damaged drop separator units must be repaired in place, sent to the manufacturer to be repaired or replaced.



CAUTION

Also observe the manufacturer's instructions for maintenance.

11. HUMIDIFYING SECTION, STEAM FKTH

11.1. Installation

The steam humidifying section is installed on the Future® inspection section FTTT, according to the humidifier manufacturer's instructions.

11.2. Commissioning

Check the condensation water discharge system, i.e., drip tray, piping and water trap. Flush the piping and fill the water trap.

**CAUTION**

Commission the humidifier, according to the manufacturer's instructions.

11.3. Maintenance









Check and clean the condensation water discharge system, i.e., drip tray, piping and water trap.




**CAUTION**

Service the humidifier, according to the manufacturer's instructions.

12. FAN SECTION, MOTORS AND FREQUENCY CONVERTERS

Future® unit series' fans are available with a short circuit motor, EC motor or permanent magnet motor (PM). Short circuit motors are available, with or without a frequency converter. Permanent magnet motors always come with a parameterised frequency converter, also available ready-connected. The EC motors are always equipped with an integrated control unit.

 WARNING	The component manufacturer's installation and operating instructions must be followed. In case of a discrepancy between these instructions and the component manufacturer's instructions, follow the component manufacturer's instructions.
 WARNING	Electrical installations must comply with EMC requirements. For EMC-compliant connections, refer to the instructions in the frequency converter manufacturers' installation guides. Connections made at the Koja factory comply with these requirements. Koja is not responsible for damages, if the connections made by the customer do not comply with general EMC requirements. Such damages include, for example, motor bearing damage due to bearing currents.
 WARNING	The frame of the ventilation unit must be connected to the building's earthing system before operation.
 WARNING	The fans have a supply frequency for the maximum rotation speed stated in the fan plate. When using a frequency converter, make sure that the maximum frequency is not exceeded.
 WARNING	The motor and/or frequency converter supply cables must be equipped with a service switch. If the service switch is installed between the motor and frequency converter, the switch must be EMC approved and connected in compliance with the EMC regulations. Pay special attention to the screened 360 degree connection and protective ground continuity.
 WARNING	The earth leakage current from the frequency converters exceeds 3.5 mA. According to standard EN61800-5-1, the frequency converter connection must, therefore, be fixed and the cross-section of the protective earth conductor of the supply must be at least 10 mm ² (Cu) or 16 mm ² (Al). Alternatively, the frequency converter supply can be equipped with an additional protective earth conductor of the same cross-section than the actual protective earth conductor. Local regulations must also be followed. The earth leakage current from the integrated control unit of the EC motors is below 3.5 mA.
 WARNING	The electric motors and frequency converter are serviced according to the manufacturer's instructions. The components must be de-energized and the impeller stopped for the duration of the maintenance. Once opened, the rotors and stators of the permanent magnet motors (EC and PM motors) may cause interference in electrical devices, such as phones and payment cards. Being in close proximity to opened permanent magnet motors constitutes a danger to people with pacemakers.
 WARNING	Permanent magnet motors rotating freely in air flow operate as generators. To prevent the risk of electric shock, the axles of permanent magnet motors must, therefore, be locked for the duration of the maintenance.

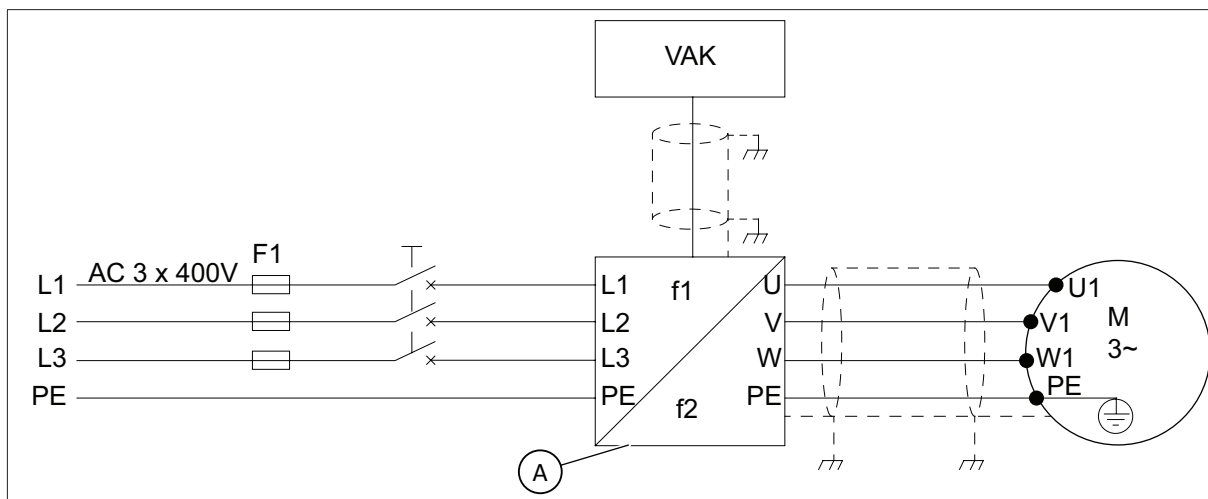
 WARNING	<p>Electrical connections must be made by a qualified and authorized electrician only. Before starting any installation and maintenance work on the electrical device, make absolutely sure that the device is de-energized. After switching off the power, wait at least five minutes to allow dangerous voltages to discharge from the devices. Electrical devices should be inspected every six months. Any deficiencies and faults must be rectified immediately.</p>
 WARNING	<p>Due to functional reasons, fans/motors may start and stop automatically without warning. This may happen, for example, after a power outage or malfunction.</p>
 WARNING	<p>If the units have been in storage for an extended time, make sure that there is no moisture in the link boxes of the motors.</p>

12.1. Short circuit motors

Depending on the model selected, the three-stage short circuit motors used by Kojas comply with IE2 or IE3 class efficiency requirements. The motors' maximum permissible ambient temperature during use is + 40 °C. If the ambient temperature exceeds this, the motor load must be decreased. For more information about the temperature range, refer to the manufacturer's instructions. The motors are also available with separate thermistors or temperature switches. The motors are suitable for frequency converter control.

Most motors have sealed bearings. Motors of frame size IEC-160 and the larger IE3 classified motors have open bearings over the transitional phase (up to the beginning of 2015). Lubrication is carried out according to the separate lubrication instructions supplied with the motor.

Short circuit motors have a ready-connected screened motor cable with number- or colour-coded conductors. See the figure below for a principle of frequency converter connections to the supply mains and building automation system, as well as motor connections to the frequency converter. The frequency converter is also available ready-connected with the motor cable connected to the frequency converter and the frequency converter fixed to the fan section casing.



A. Frequency converter
PE min 10 mm² or two wires




The frequency converter control cable must be screened. The control cable screen is connected on the frequency converter end only. A service switch must be installed on the frequency converter supply cable.

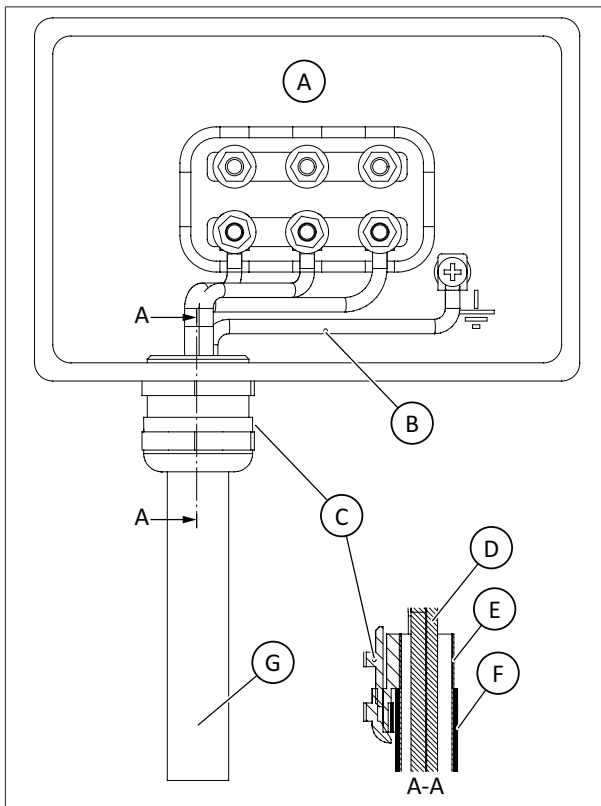
If the short circuit motor frequency converter is ordered ready-parameterised, it comes complete with motor plate values, a current limit, acceleration/deceleration ramps (60 s), minimum frequency instructions (10 Hz) and maximum frequency instructions (specific to the fan in question). Other parameters are according to the factory settings of the frequency converter in question, and if necessary, they are set as desired at the site.

If the frequency converter parameterisation is finalized at the site, minimum frequency instructions must be set to approx. 10 Hz and maximum frequency instructions according to the fan-dependent maximum frequency. The current limit is set close to the rated current. The frequency converter motor parameters are set according to the plate values.

The frequency converter takes care of motor output protection and frequency converter overload protection. The short-circuit protection for the frequency converter and overload protection for the installation must be provided with, for example, a fuse protection. Protective earth must be provided, according to the regulations. Check the rotation direction of the fan before final commissioning.

12.2. Connection of electric motor and frequency converter

 WARNING	<p>The incorrect connection of the frequency converter may damage the bearings of the motor. Only an authorized electrician is allowed to carry out the connection. Koja Ltd does not compensate for motor damage caused by an incorrect connection, if the connection was made by anybody else than a person authorized by Koja Ltd.</p>
 WARNING	<p>The fan has a frequency for maximum rotation speed stated in the fan plate. Make sure not to exceed the maximum frequency for the frequency converter.</p>
 WARNING	<p>The component manufacturer's installation and operating instructions must be followed. In case of a discrepancy between the manufacturer's instructions and this manual, the instructions of the manufacturer must be followed.</p>




The electric motor is operated and serviced, according to the manufacturer's instructions. Check the electric motor connection from the link box and/or the type plate of the motor. The electric motor is connected to the electrical network with a shielded connector and equipped with a service switch.

If a frequency converter is used, the motor and frequency converter of the fan are connected with a uniform screened cable (EMC). EMC approved inlet sleeves are used for the motor and link box lead-in. In every inlet, the protective sheath of the cable must have a 360° grounding with an EMC sleeve. Make sure that the EMC sleeve tightens properly around the cable.

The service switch (accessory) installed between the motor and frequency converter must be EMC approved and installed according to the EMC regulations.

- | | |
|---|--|
| <p>A. Check the position of the motor connection plates from the connection instructions of the motor.</p> <p>B. If there is no separate protective earth conductor, the protective sheath of the cable is braided, marked with yellow-and-green tape or heat shrink and connected to the motor's earth connector.</p> <p>C. ECM sleeve</p> | <p>D. Electric conductor</p> <p>E. Protective sheath of the cable (the jacket of the electrical cable is stripped approx. 15 mm without damaging the protective sheath)</p> <p>F. Wire jacket</p> <p>G. Screened cable</p> |
|---|--|

12.3. PM motors

 WARNING	<p>Risk of electric shock! Due to the permanent magnet rotor, permanent magnet motors rotating freely operate as generators. Therefore, the connectors of the motor may be energized, even with the power supply switched off. For safety reasons, the impeller must be locked for the duration of maintenance.</p>
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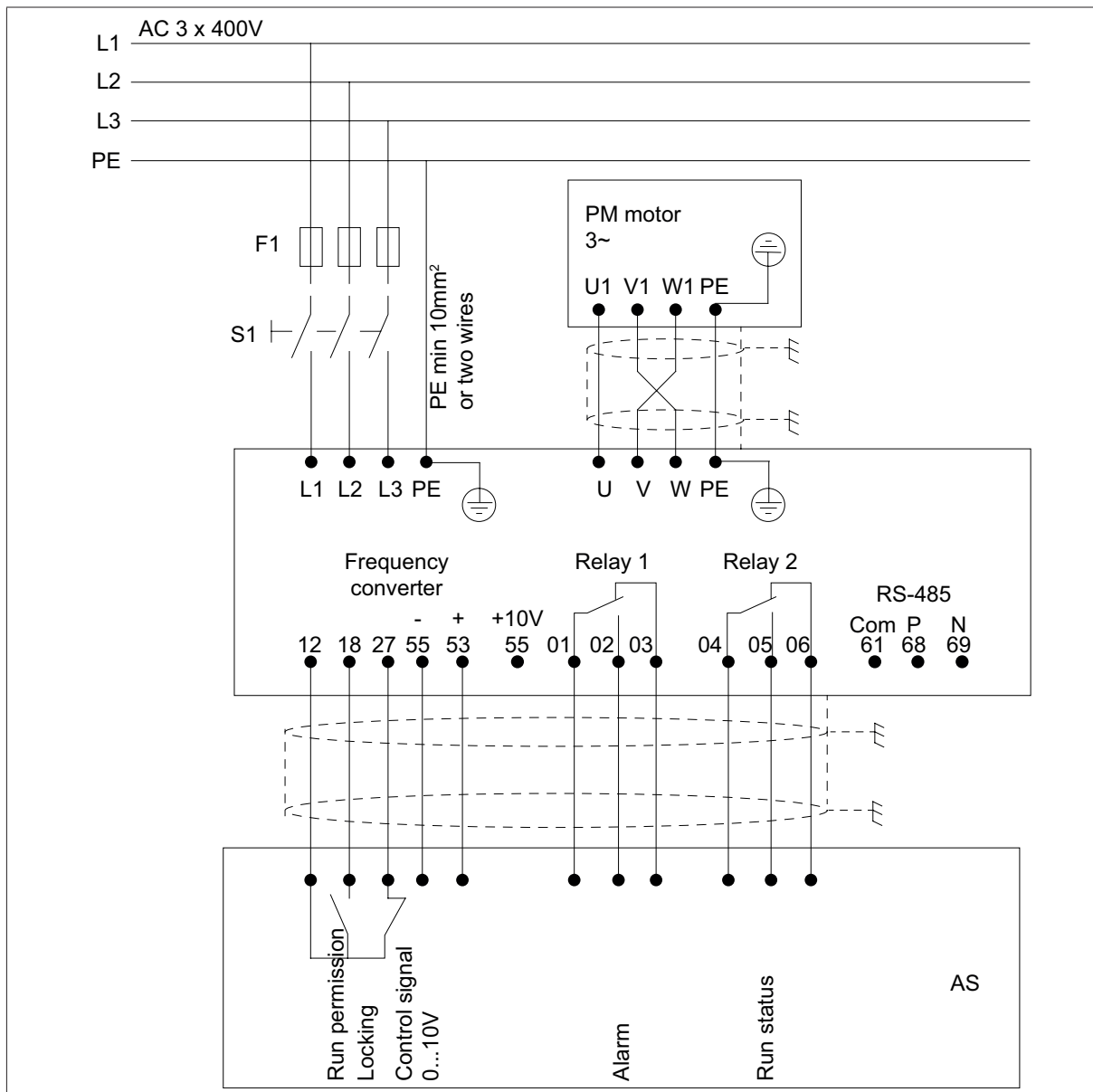
The permanent magnet motors comply with efficiency class IE4 requirements. The permanent magnet motors do not work connected directly to the network; they must always be controlled by a compatible frequency converter. PM motors supplied by Koja always include a separate or fixed (integral motor) frequency converter. Integrated frequency converters are available up to 7.5 kW, and separate frequency converters up to 11 kW. Depending on the model, the type of the frequency converter is Danfoss FC101-106.

User environment	Engine	Separate frequency converter	Integrated frequency converter
Protection class	IP55	IP54	IP55
Minimum ambient temperature	-15 °C	0 °C	-10 °C
Maximum ambient temperature	40 °C	40 °C	40 °C

To ensure the optimal operation of the permanent magnet motor, all frequency converters are parameterised at the factory to suit the motor in question. Parameterisation includes the motor plate values, ramps, speed and frequency limits, as well as settings for starting and stopping. The parameters related to the frequency converter motor control or the motor must not be changed, for this could lead to a motor starting failure or unstable operation. The main menu password is 100, the shortcut menu password 200. The parameters are saved on the frequency converter panel, from which they can be reloaded to the frequency converter, if necessary. Integrated frequency converters have an optional control panel.

The programmable inputs and outputs of the frequency converter can be used to connect the building automation system and the frequency converter. The field-bus physical layer is RS-485, and the built-in communication protocols are Modbus RTU, BACnet MSTP, N2 Metasys and the FC protocol. For more information about the frequency converter connections and bus communication, refer to the frequency converter manufacturer's instructions.

The key inputs and outputs of the frequency converter are described in the figure *PM motor*. The enable device input is delivered by a potential-free contact to connectors 12 and 18. Locking can be actuated via connectors 12 and 27. If locking is open, the motor will not start, even from the control panel. The speed set point can be provided by a 0...10 V signal to connectors 55 (-) and 53 (+). Relay output one provides a frequency converter alarm, and relay output two running information.



PM motor

If Hand On mode is selected on the frequency converter control panel, the motor can be run from the panel. Even in this case, the locking must be disabled (connectors 12 and 27 connected). To enable bus control or control connectors, activate Auto On mode from the control panel.

Control cables between the building automation system and frequency converter must be screened, and the screen is connected on the frequency converter end only. If the motor cable has to be replaced with a longer one, the connection must be made according to the general EMC requirements. The length of the motor cable must not exceed 10 meters.


The frequency converter supply cable must be equipped with a service switch. If necessary, the service switch can also be installed on the motor cable, in which case the service switch must be EMC approved. Connections must be made according to the EMC requirements.

The frequency converter takes care of the motor output's short circuit and leakage protection and frequency converter overload protection. However, the frequency converter must be protected against a short circuit with, for example, fuses. In addition, installations (like cables, etc.) upstream of the frequency converter must also be provided with overload protection. The protective earthing of the frequency converter must comply with both the above-mentioned and national requirements.

The rotation direction of PM motors equipped with separate frequency converters must be checked before final commissioning. If the rotation direction is incorrect, it can be reversed by interchanging the two motor cable

phases on either the motor or frequency converter end. Before this, you must switch off the power supply, lock the motor axle and allow the frequency converter voltage to discharge.

12.4. EC motors

 WARNING	<p>An EC motor rotating freely generates voltage to the internal motor connections. These voltages can be dangerously high. After the motor has stopped, wait at least five minutes to allow dangerous voltages to discharge.</p>
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The EC motors have an integrated control unit. EMC requirements do not apply to the EC motor power cabling. Nevertheless, it is advisable to use screened cable control wires. The bus conductors must be screened and of the twisted pair type. Any control cable screens are connected on the EC motor end only. The supply cable must be equipped with a service switch. The equipment must be protected against short circuits and the installations against overloading with, for example, fuses.

Koja offers fans equipped with EC motors from EBM Papst / Fläkt Woods and Ziehl Abegg. The connections vary between the manufacturers, and also depend on the number of control unit phases. See the table below for EC motor information.

EC motor	EBM / Fläkt		Ziehl	
Supply voltage	AC 1 x 230 V	AC 3 x 400 V	AC 1 x 230 V	AC 3 x 400 V
Ambient temperature during use	-25...40 °C	-25...40 °C	-25...60 °C	-35...60 °C
Protection class	IP44	IP54	IP54	IP54

If not specifically prevented, the EC motor may start automatically after a malfunction. This may happen, for example, if the set point is saved on the fan memory.

The EC motor control unit parameters and the operation of the control connectors can be changed via the Modbus bus. Refer to the fan manufacturer's instructions for more information about the parameter changing and how it affects the operation of the fan. With factory settings, the rotating speed of the motor is controlled with a 0...10 V signal. The motors start when they receive the enable device input and the voltage control is approx. 1...1.5 V. When the motor is rotating, it can be controlled with a voltage of approx. 1 V at minimum. With factory settings, control voltage of 10 V corresponds a 100 per cent rotating speed.

In case of failure or malfunction, the integrated control unit stops the motor.

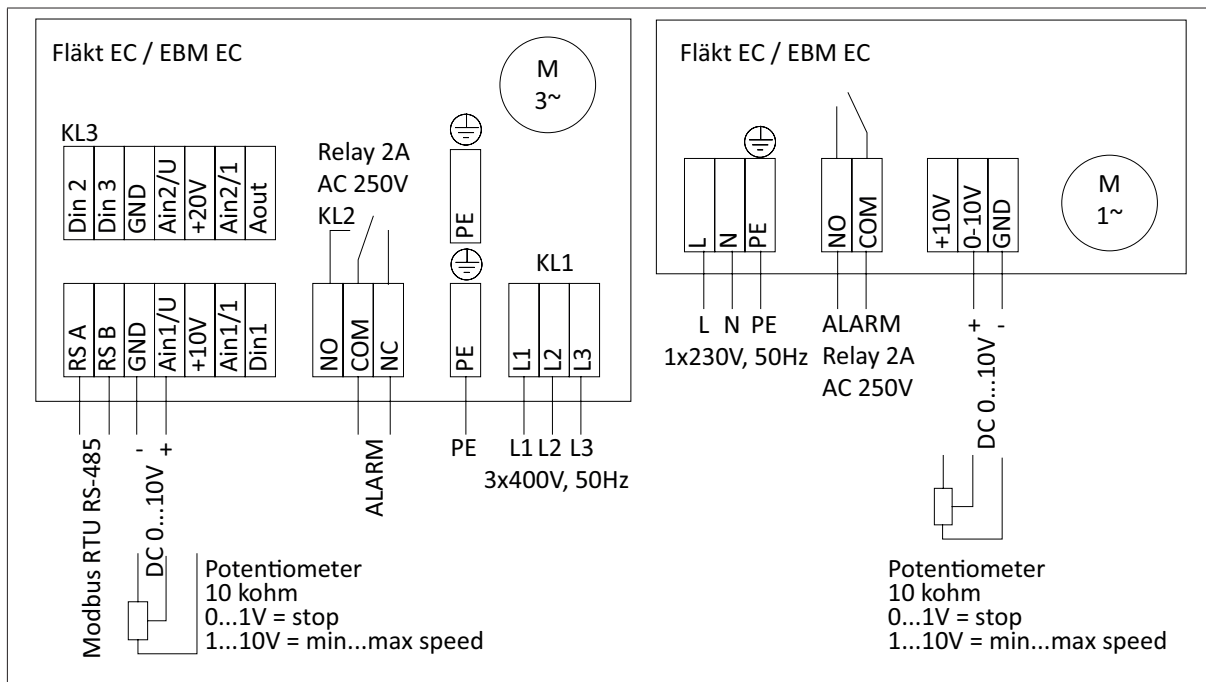
The operating voltage of the EC motor varies depending on the power of the motor. The operating voltage must be the same as that stated on the nameplate.

12.5. Connection of the EBM / Fläkt EC motor

The connection of the three- and one-phase EBM Papst EC motor is described in the figure *EC motor*. In both cases, the speed set point is delivered between the connectors GND and Ain1/U. The speed set point can also be generated using the motor's own 10 V output. The motor starts, when the speed set point voltage exceeds 1.4 V.

There is no separate enable device input; the control unit is allowed to start when the control voltage exceed one volt. A voltage signal must be used to control the motor on and off. On/off control must not be done using the supply voltage, which must be kept switched on at all times.

Alarm data is received from the motor via a potential-free contact, the maximum load of which at alternating voltage is 250 V / 2 A.



EC motor

The three-phase EC motors also have a Modbus RTU bus interface.

Digital input Din2 makes it possible to switch between two parameter settings. With the factory settings, both parameter settings are the same.

Available as an accessory, the three-phase motors can be equipped with a voltage-controlled relay that can be used to receive running information from the fan. The relay is connected to the control unit connectors GND, +20V and Aout. The need for the relay has to be determined when ordering the fan, so that it can be included in the delivery.

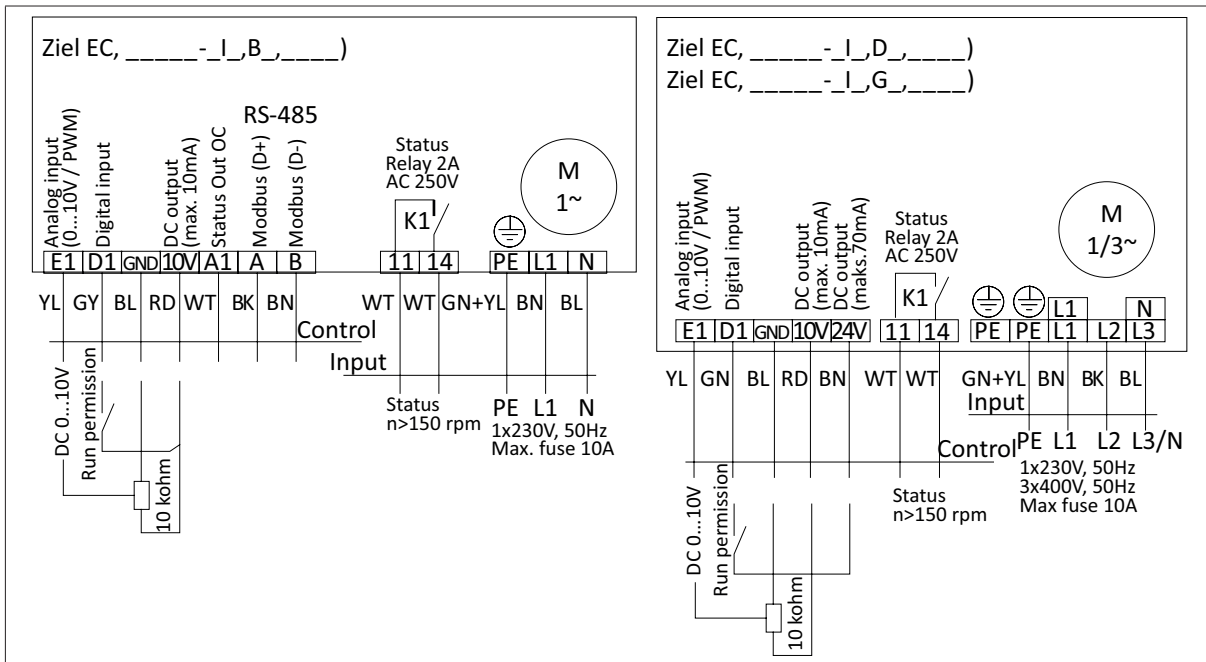
The current limits are 10 mA for the +10 V output and 40 mA for the +20 V output. Do not connect output connections of various devices with each other.

12.6. Connection of the Ziehl EC motor

The connection of the three- and one-phase models of the Ziehl Abegg EC motor is described in the figure *Ziehl motor*. The connection depends on the motor size (B, D or G). The protection class of the motor and control unit is IP54. Ziehl EC motors are ready-cabled. Check the motor supply voltage from the nameplate.

In all models, the speed set point is delivered between the connectors GND and E1 by a 0...10 V signal. The speed set point can also be generated, using the motor's own 10 V output.

The enable device input is delivered to connector D1 and generated, for example, using the contact from the motor's own 24 V or 10 V output. The motor will not start to rotate without the enable device input, even when the speed set point exceeds the starting limit. The motor can be controlled on or off, using either the enable device input or the speed set point. The power supply should never be switched off; the motor heating activates automatically when the temperature inside the control unit is -19 °C.



Ziehl motor

The smaller one-phase motors (motor size B) have a Modbus RTU bus interface. With an additional Modbus card, the bus is available for larger motors as well. The need for the bus has to be determined when ordering the fan, so that it can be included in the delivery.

Motor size B also includes connection A1 that switches to the GND potential inside the device, according to a certain sequence. Refer to the device manufacturer's instructions for different sequences and their explanations.

A running indication is received from the motor via the potential-free contact K1, the maximum load of which at alternating voltage is 250 V / 2 A. The relay is activated when the rotating speed of the motor exceeds 150 rpm.

The current limits are 10 mA for the 10 V output and 70 mA for the 24 V output. Do not connect output connections of various devices with each other.

12.7. Maintenance, spare parts and warranty

 WARNING	<p>The operation of components relating to safety must be checked regularly, and any faults must be rectified immediately. Maintenance work relating to the electrical devices must only be performed by qualified and authorized service personnel. The components must be de-energized and the impeller stopped for the duration of the maintenance. The equipment must be measured to ensure that it is de-energized.</p>
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Fans should be checked every six months. All faults must be rectified immediately. If the faults can cause an immediate danger, the equipment must not be used before the fault is rectified.

Only use spare parts that have been approved by the manufacturer of the motor, fan and frequency converter in question. For other Future® unit series' electrical installations (service switches, lights, cables, etc.), you can use spare part components with an identical electrical rating and operation.

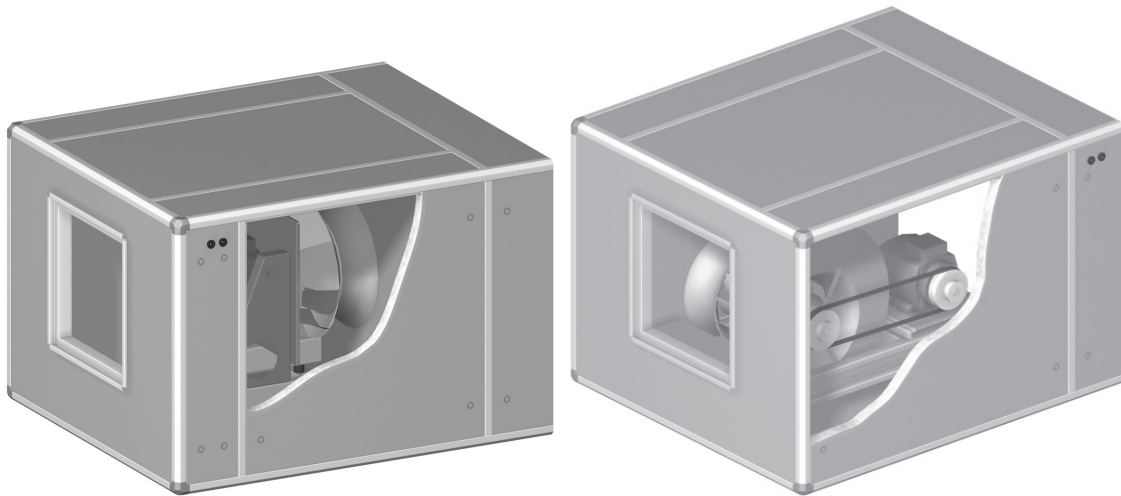
Do not make arbitrary or structural alterations to the fans. Such alterations will void the equipment manufacturer's warranty. An impeller replacement must be performed by personnel authorized by the manufacturer.

After maintenance and commissioning work, check the equipment for reliable and correct operation.

Refer to the component manufacturers' websites for detailed component-specific maintenance and operating instructions. The instructions prepared by the component manufacturer have always priority.

Koja Ltd and component manufacturers do not compensate for damage arising from installation, use, transport or storing of devices without following the instructions.






13. FAN SECTION, FFTS AND FFTK








13.1. Operating conditions

- The maximum permissible air temperature upstream of the fan is +40 °C.



13.2. Fan section

 CAUTION	Leave space for maintenance. The ventilation system and its maintenance routes must be designed and constructed so that the ventilation unit can be serviced and repaired easily and safely. The National Building Code of Finland D2, section 3.8.6.
 CAUTION	The fan section must be equipped with a service switch that can be used to stop it from running for the duration of the maintenance work.
 CAUTION	The component manufacturer's installation and operating instructions must be followed. In case of a discrepancy between these instructions and the component manufacturer's instructions, follow the component manufacturer's instructions. For detailed component manufacturer's operating and maintenance instructions, please refer to our website at http://www.koja.fi/fi/rakennukset/tukimateriaalit/ilmankaesittelykoneet
 CAUTION	The fan models are not designed to be disassembled. If the fan has to be disassembled, due to, for example, narrow hauling routes, the fan-motor assembly must be balanced and the certificate of balancing must be presented, in order to retain the warranty. If the motor has to be removed or the fan disassembled due to maintenance or repair work, permission is needed from Koja Ltd's Warranty Handler. Otherwise, the fan warranty will be voided.
 CAUTION	If the fan has to be replaced, the faulty fan is to be returned with a length of the wire attached to the motor.

13.3. Safety

 WARNING	Before switching on the fan, make sure that the inlet and outlet of the fan section have been connected to the ductwork or that the access to the rotating fan parts, such as the impeller or drive, through an inlet, outlet or access door has been prevented with protective screens or other appropriate manner.
 WARNING	Upon starting the unit, the service switch of the unit must be installed and operating and the access doors closed.
 WARNING	The damper section of the unit must open before the fan starts.
 WARNING	The FFTS fan casing is pressurized. Make sure that the fan has stopped before you open the access door!
 WARNING	Do not open the access doors of the unit when the fan is in operation. If the unit is installed in a place where it is easily accessible to persons other than service personnel, the handles of the access doors must be removed and locked in a safe place. Ensure during installation, commissioning and maintenance that only qualified maintenance personnel have access to the danger area.

13.4. Safety equipment

 CAUTION	The service (safety) switch installed in the fan section also functions as a unit emergency switch (accessory).
 CAUTION	When possible, use safety protective gloves when handling lubricants. Regular exposure to paraffin products may cause allergic reactions.

13.5. Commissioning




- Make sure that the inside of the fan section and the fan are free from loose parts, debris, etc. that could get between the belts or the impeller.
- Make sure that the flexible joint and the vibration dampers are intact and that the fan and motor are supported by the vibration dampers only and that they move freely by hand.
- Check that the electrical cables are intact and routed to the motor flexibly and so that they cannot come into contact with rotating parts, and that the type of the cable is correct.
- Ensure that all components used in electrical installations have EMC shielding.
- Check that the drive and fan operate freely by turning the impeller a couple of turns by hand.
- Start the fan for a moment and check that the rotation direction corresponds with the arrow on the fan. **Note! Be very careful when doing this, and make sure that there are no people or loose objects near the fan or the drive. Before starting the fan, make sure that the access door of the fan is closed.**
- All filters, louvres, valves and other parts of the air-conditioning plant must be installed and preset before long-term operation. The fan must not be started with the inlet, outlet and fire dampers closed.
- The units must not be started before ensuring that the ducts are clean and that there are no loose objects in the ductwork.
- If necessary, clean the fan casing and impeller with a brush, vacuum cleaner or damp cloth. If the unit is equipped with drainage for washing water, the casing can be washed with extra care using water. **Note! Make sure that the washing water drainage plugs are removed for the duration of the wash.**
- Check the drive and the mounting of the bearings, according to the component manufacturer's instructions.
- Check the condition of the motor visually.
- Make sure that the seals of the access door are in place and intact. Close the access door and make sure that every latch tightens properly.
- If the unit is installed in a place where it is easily accessible to persons other than service personnel, the handles of the access doors must be removed and locked in a safe place. Ensure during installation, commissioning and maintenance that only qualified maintenance personnel have access to the danger area.

13.6. Maintenance

- Make sure that the inside of the fan section and the fan are free from loose parts, debris, etc. that could get between the belts or the impeller.
- Make sure that the flexible joint and the vibration dampers are intact and that the fan and motor are supported by the vibration dampers only and that they move freely by hand.
- Check that the electrical cables are intact and routed to the motor flexibly and so that they cannot come into contact with rotating parts, and that the type of the cable is correct.
- Ensure that all components used in electrical installations have EMC shielding.
- Check that the drive and fan operate freely by turning the impeller a couple of turns by hand.
- All filters, louvres, valves and other parts of the air-conditioning plant must be installed and preset before long-term operation. The fan must not be started with the inlet and outlet dampers closed.
- Check the V-belt pulleys and V-belts for wear. There are groove gauges for the easy and reliable measurement of the condition of the grooves. The gauges are available from the V-belt manufacturers.
- If the fan has grease fittings, lubricate the bearings according to the enclosed instructions.
- Replace worn V-belt pulleys and V-belts. If the drive has several grooves, all the belts must be replaced at the same time.
- Tighten the fixing screws of the V-belt pulley conical sleeve.
- Check the belts for alignment and tightness, according to the component supplier's instructions.
- If necessary, clean the V-belt pulleys and V-belts.
- If necessary, clean the fan casing and impeller with a brush, vacuum cleaner or damp cloth. If the unit is equipped with drainage for washing water, the casing can be washed with extra care using water.
Note! Make sure that the washing water drainage plugs are removed for the duration of the wash. Contaminants on the impeller may cause imbalance and vibration and ultimately damage the fan.
- Check the drive and bearing mounting tightness, according to the component supplier's instructions.
- Check the condition of the motor visually.
- Start the fan for a moment and check that the rotation direction corresponds with the arrow on the fan. **Note! Be very careful when doing this, and make sure that there are no people or loose objects near the fan or the drive. Before starting the fan, make sure that the access door of the fan is closed.**
- Make sure that the seals of the access door are in place and intact. Replace, if necessary. Close the access door and make sure that every latch tightens properly.
- If the unit is installed in a place where it is easily accessible to persons other than service personnel, the handles of the access doors must be removed and locked in a safe place. Ensure during installation, commissioning and maintenance that only qualified maintenance personnel have access to the danger area.

Regular maintenance can be scheduled for the beginning and end of the heating season. It is advisable to monitor the operation of the fan and, in particular, the drive between regular maintenances. During commissioning of the air-conditioning plant, check the tightness and alignment of belts weekly.

14. AIR FLOW METER FIZM

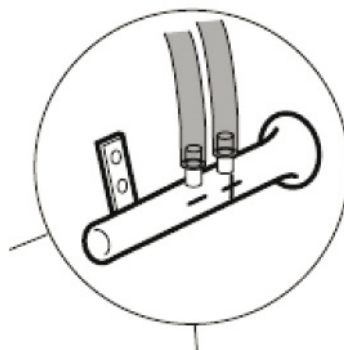
 CAUTION	Install and connect the air flow meter, according to the manufacturer's instructions. For detailed component manufacturer's operating and maintenance instructions, please refer to our website at http://www.koja.fi/fi/rakennukset/tukimateriaalit/ilmankaesittelykoneet
 CAUTION	On the HK Instruments' DPT-Flow flow transmitter, select the Common Probe operation mode independent of the fan type. Set the K-factor, according to the information on the fan plate. For air flow unit, select m ³ /s.
 CAUTION	The accuracy of the air flow measurement is $\pm 10\%$

If the air flow meter indication is incorrect, check the following:

- That the hoses are in place and intact.
- That the hoses are not flattened out.
- That there are no blockages in the hoses or pressure joints.
- Indicator air flow meter: that the air flow meter has been reset and the reset screw plug has been closed properly (see figure *Reset screw plug on the air flow meter*).
- Indicator air flow meter: that the air flow meter scale corresponds with the fan size.
- That the hoses are connected correctly:
 - FFTK fan sizes 022...100 from the measuring ring of the fan to the “-” joint and from the casing to the “+” joint.
 - FFTK fan sizes 112...140 from the measuring pipe (q-DYSA) of the fan according to the figure *Measuring pipe q-DYSA on the fan FFTK*.
 - Depending on the model, the calibration of the digital meter is either manual or automatic. Take care of the calibration of the meter and other maintenance work according to the manufacturer's instructions.



Reset screw plug on the air flow meter



Measuring pipe q-DYSA on the fan FFTK



Digital air flow meter

14.1. Fan malfunctions and their possible causes

14.1.1. Casing fans (AC, EC, PM)

Fault condition of the AC fan. The fan vibrates, produces noise or resonates.

- Check that the impeller rotates freely by rotating it by hand and that it does not come into contact with the shaped inlet or other parts of the unit.
- Check that the impeller is clean and has no external damage. If necessary, clean the impeller with a vacuum cleaner that has a soft brush nozzle. Contaminants on the impeller may cause imbalance and ultimately damage the fan.
- Rotate the impeller by hand and listen to the sound from the bearings. A broken/damaged bearing makes an abrasive or rasping sound.
- Check the condition of the bearings by pulling the upper edge of the impeller back parallel to the shaft. The shaft should not move. If the shaft moves inside the motor frame, it is likely that the bearing is broken.
- Check that the EMC shielding applies to the whole connection chain (see Instructions for operation and maintenance, page 31).
- Check that the cover of the motor bearing box is tightly attached and the mounting bolts have been tightened properly.
- Check the condition of the vibration dampers. The material of the rubber dampers should be soft, and the fan should 'float' on the rubber. This can be checked by swinging the fan laterally, whereupon the rubber dampers should follow the movement of the fan. When the rubber hardens, it loses some of its damping capacity and the vibration in the fan is transferred to the frame of the unit.
- Check that the flexible connector of the fan is installed correctly so that the connector allows movement in both directions. If the connector is installed incorrectly, it will stress both the shaped inlet in the fan and the fan wall.

Fault condition of the EC fan. The fan vibrates, produces noise or resonates.

- Check that the impeller is clean and has no external damage. If necessary, clean the impeller with a vacuum cleaner that has a soft brush nozzle. Contaminants on the impeller may cause imbalance and ultimately damage the fan.
- Check the condition of the vibration dampers. The material of the rubber dampers should be soft, and the fan should 'float' on the rubber. This can be checked by swinging the fan laterally, whereupon the rubber dampers should follow the movement of the fan. When the rubber hardens, it loses some of its damping capacity and the vibration in the fan is transferred to the frame of the unit.
- Check that the flexible connector of the fan is installed correctly so that the connector allows movement in both directions. If the connector is installed incorrectly, it will stress both the shaped inlet in the fan and the fan wall.

The EC motor does not rotate/start

- Check that the supply voltage is in accordance with the nameplate.
- Check that the motor has the enable device input (Ziehl EC only) and external speed set point (0...10 V).
- Check that the impeller is not stuck.

Fault condition of the PM fan. The fan vibrates, produces noise or resonates.

- Check that the impeller is clean and has no external damage. If necessary, clean the impeller with a vacuum cleaner that has a soft brush nozzle. Contaminants on the impeller may cause imbalance and ultimately damage the fan.
- Check the condition of the vibration dampers. The material of the rubber dampers should be soft, and the fan should 'float' on the rubber. This can be checked by swinging the fan laterally, whereupon the rubber dampers should follow the movement of the fan. When the rubber hardens, it loses some of its damping capacity and the vibration in the fan is transferred to the frame of the unit.
- Check that the flexible connector of the fan is installed correctly so that the connector allows movement in both directions. If the connector is installed incorrectly, it will stress both the shaped inlet in the fan and the fan wall.

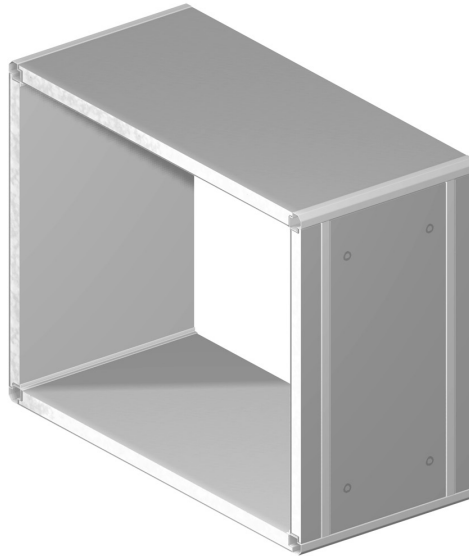
14.1.2. Belt-driven fans

Failure or problem

1. Broken belt.
2. A soft, stretching area in a belt.
3. Belt/belts turn in the grooves.
4. Drive is noisy or vibrates.
5. Belt sides wear quickly.
6. Scratched or slightly torn belt sides.
7. Soft belt sides, burnt rubber stuck in the grooves.
8. Torn and/or cracked belt sides.
9. Scratched and torn outer surface.
10. Sticky and lumpy belt surfaces, loose rubber on the belt and pulleys.
11. Hard belt surface, cracks on the bottom rubber side.

Reason	Action	Failure/problem											
		1	2	3	4	5	6	7	8	9	10	11	
Loose belts	Replace and tighten according to the instructions.	X		X	X	X		X					
Belts at different depths in the grooves, worn pulleys	Replace the pulleys and belts.	X		X	X	X		X					
Belt forced in the groove	Install new belts, according to the instructions.	X	X										
Hard particles in the grooves	Check the guards, replace the belts.	X	X										
Belts unequally tensioned	Follow the installation instructions.	X	X	X	X			X					
Belts are of different lengths	Check the product codes, replace the belts.	X		X	X	X							
Cracks or flaws in the grooves	Replace the pulleys and belts.						X						
Belt touches fixed structures	Check the space, replace the belts according to the instructions.			X	X					X			
Dust gets in the drive	Check the guards, replace the belts and pulleys.					X							
Drive is under-dimensioned	Redesign the drive.	X				X	X	X					
Pulley is too small	Redesign the drive. Replace the pulleys and belts.					X		X	X				X
Short belt, high speed	Check for alternative profiles and redesign the drive.							X	X				
Belts have been tight during drive standstill	Loosen the belts, if the drive is out of operation for more than 2 months.				X								
Lubricant or fuel on the belts, belts have been waxed	Clean the drive and repair any leaks. Replace the belts.							X				X	
Belts stored in sunshine	Store the belts, according to the instructions.											X	X

15. CASING MODULE FMOD



15.1. Maintenance

Wipe the inner and outer casing surfaces with water and a mild detergent during the annual maintenance or when necessary.

Those parts of the unit that have water drains can be washed from the inside with running water.



CAUTION

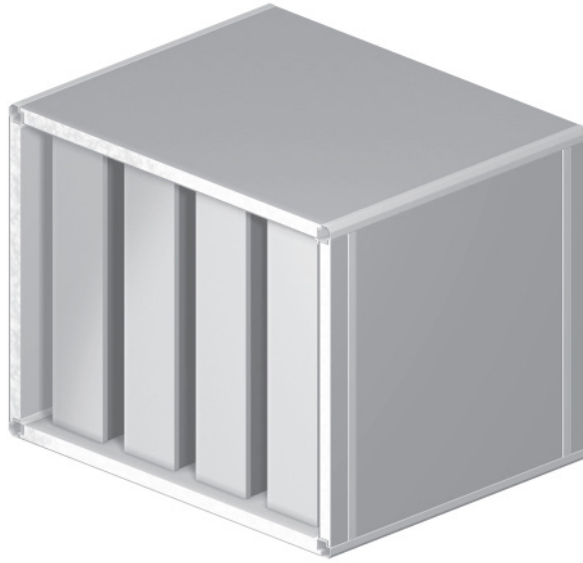
Make sure that the unit base adjustment feet are adjusted, so that the unit is tilted approx. one degree toward the service side.



CAUTION

Make sure that the washing water drainage plugs are removed for the duration of the wash.

16. SOUND ATTENUATOR SECTION FVTK



16.1. Commissioning

The sound attenuator section FVTK is an absorption damper. The lamellas must be in vertical position (see the figure). Make sure that the lamellas are intact and that the coating is not damaged.

16.2. Maintenance

- Check that the sound attenuator lamellas are intact and the coating is not damaged.
- The lamellas are removable, so they can be cleaned by vacuuming them lightly.
- The surface of the wet-wipeable sound attenuating elements can be wiped with a damp cloth.



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