



VENTUS Air-Handling Units

Operation and Maintenance Manual

ventus

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OPENING THE INSPECTION PANELS WHEN THE UNIT IS RUNNING OR STARTING THE UNIT WITH OPEN INSPECTION PANELS ARE STRICTLY PROHIBITED!

BEFORE OPENING THE INSPECTION PANEL TURN OFF THE UNIT AND WAIT TWO MINUTES SO ALL MOVING PARTS WOULD STOP!

SWITCH OFF AND PROTECT THE POWER SUPPLY TO PREVENT THE UNIT FROM UNINTENDED STARTING

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1. INTRODUCTION

In-depth familiarization with the content of this manual, assembly and operation of the air-handling unit in line with the instructions provided and obeying all safety regulations constitute the basis of efficient, safe and non-failure operation of the device.

Works related to unloading packages with AHU subassemblies, transportation of the packages, AHU blocks and elements, connecting AHU-related systems as well as maintenance and repair are carried out by qualified specialists or they are supervised by authorized staff.

The **qualified technical personnel** is understood as the trained specialists, who due to the professional experience, knowledge of the subject-related standards, documentation and regulations concerning operation and safety procedures, have been authorized to perform necessary operations and who are able to troubleshoot any potential problems.

This operation and maintenance manual does not cover all possible variants of the units configurations, examples of their assembly and installation as well as start-up, operating, repairing and maintenance. If the units are used for what they are intended, this documentation and any other materials provided with the unit contain information designed for the qualified technical personnel only.







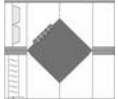
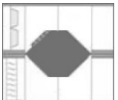






-  **Assembly of the unit, connection of related systems, start-up, operation and maintenance of the device have to comply with the directives and regulations being in force in the country where the unit is installed.**
-  **AHU VS 21-650 assembly and guarantee repairs can be carried out only by VTS Service Provider with appropriate certificates. It is recommended to engage VTS Authorized Service Providers for installation, start-up, maintenance and repairs of the AHU units.**
-  **This manual should always be kept handy for reference and be easily available for the servicing personnel.**

2. APPLICATION AND DESIGN

The 14-size product line is designed for air handling processes in range of capacity from 1200 m³/h to 100 000 m³/h - in case of remaining AHUs. The VENTUS air-handling units are designed for a ventilation system where an access to the rotating parts of the unit (a fan's rotor) is feasible neither from the overpressure nor sub atmospheric pressure side of the unit. The ventilation system is understood as ventilating ducts as well as e.g.: air intake and air exhaust modules in case of the units installed outdoor.

	Fan		Recovery with glycol coils
	Filtering		Recovery with cross flow exchangers
	Water heating		Recovery with rotary exchangers
	Electric heating		Recovery with rotary exchanger
	Water cooling		Recovery with recirculation
	Freon cooling		Secondary air
	Humidification		Attenuation

Table 1. Marking of AHU base modules

Base modules	Module composition	Graphic symbol
V	Fan	
FV	Filter, fan	
H	Filter, heater, fan	
HC/CH HC CH	Filter, heater, cooler, fan	
HCH VS 21-650	Filter, heater, cooler, fan, heater	
C	Filter, cooler, fan	
P	Cross-flow exchanger	
P	Counter-flow exchanger	
R	Rotary exchanger	
F	Secondary filter	
E	Empty box	
M	Mixing box	
S	Silencer	
W	Humidifier	

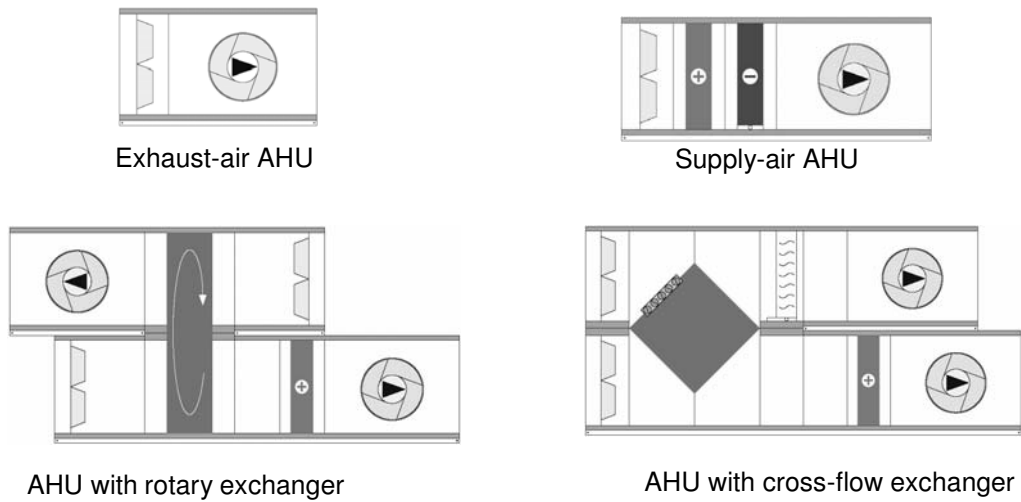


Fig. 1 Examples of AHUs type VS 21-650 functional configurations

Example of basic supply unit consist of a filter, water coils, condensate drain pan (if applicable), direct driven fan assembly. Supply - Exhaust AHUs can be equipped with rotary heat exchanger, cross-flow or counter-flow heat exchanger.

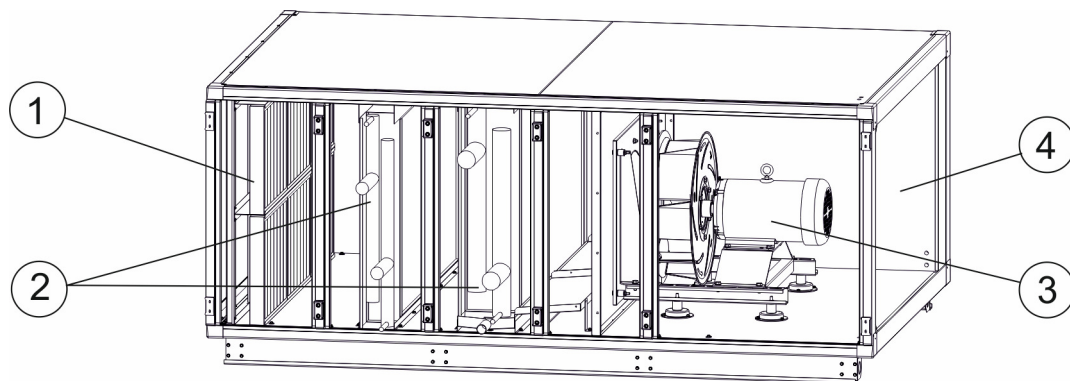


Fig.2. Example of the basic supply unit: 1 – panel filter, 2 - coil, 3 – direct driven fan, 4 – casing

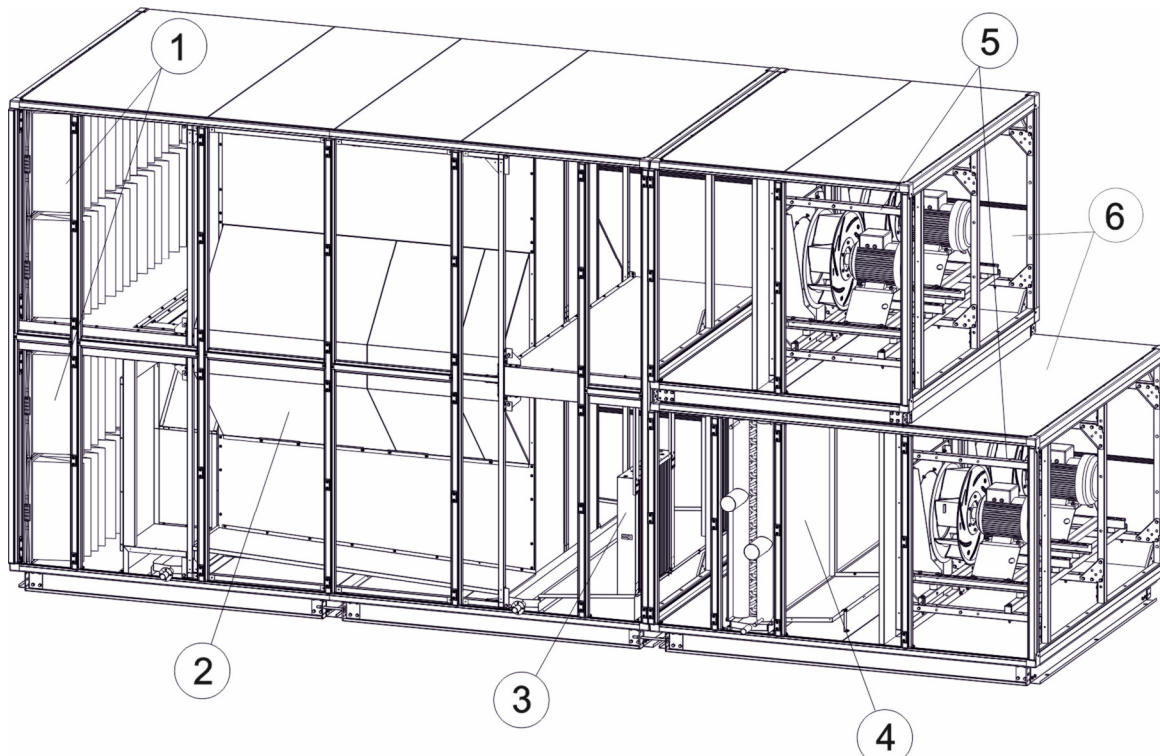


Fig.3. Example of the basic supply-exhaust unit: 1 – bag filters, 2- counter-flow heat exchanger, 3 - droplet eliminator, 4 – coil, 5 - direct driven fans, 6 – casing

Majority of AHU-s configuration is available in left-hand (LH) and right-hand (RH) version (fig. 3 and 4). The version of the unit is determined by the flow direction of the air against the tending side of the unit (the side where the inspection panels are located). In case of supply-exhaust units the version is determined by the flow direction of the air in the supply section.

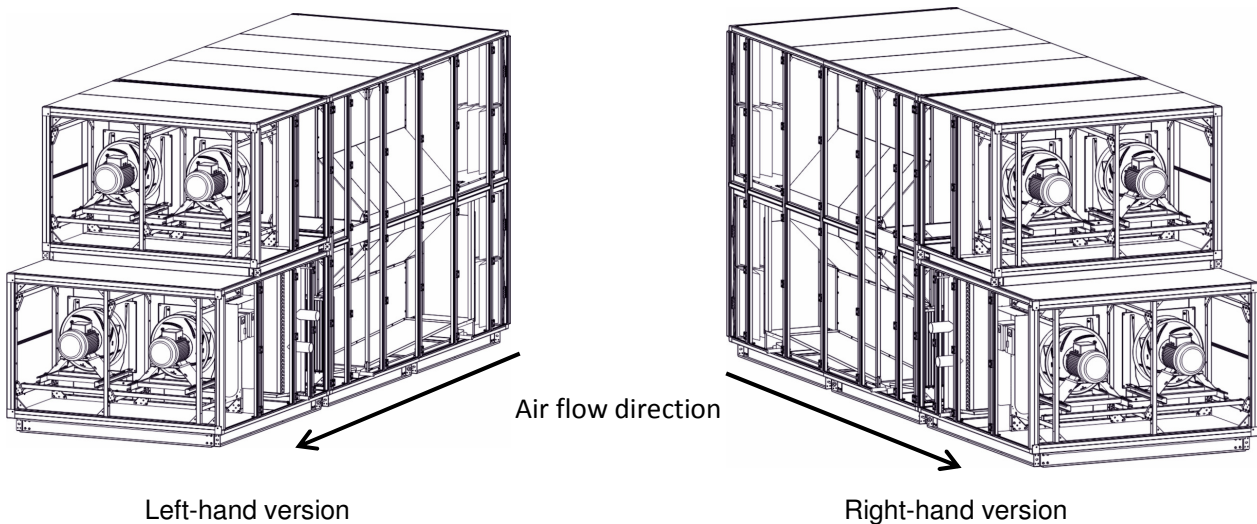









Fig. 4 Versions of the VS 21-650 AHU

3. TRANSPORT AND STORAGE

-  The VENTUS AHUs from size range VS 21-650 are delivered as fully assembled, assembled in sections or in packages, placed on closed pallets, containing elements to be assembled on-site by the Authorized VTS Service. This manual does not contain instructions and guidelines on assembly of the unit.
-  Delivery of AHUs elements, in the closed, properly marked and not broken pallets is going to belong to customer after signing of consignment note by client representative.
-  Open of closed pallets by customer before arrival of Authorized VTS Service is connect with take-over of full responsibility for contents and completeness of delivery.
-  Right after delivery of the unit check the condition of the package and examine if all necessary elements have been delivered - according to the attached specification and consignment note.
-  Unloading packages with AHU subassemblies, transport of the packages to the assembly location and transport of AHU blocks and elements to the assembly location should be carried out using special equipment and qualified staff.
-  Packages onsite must be stored on hardened, dry and protected against any precipitation place. Hardened surfaces are understood as flat, leveled and hard surface, which does not change its properties under influence of atmospheric conditions
-  Packages containing AHU elements should be stored away from places where operate mechanical devices (vehicles, cranes and other construction machinery). They should be stored in places where they will not be subject to any mechanical damages, humidity, aggressive chemical agents, fluids, dusts and other external agents which may deteriorate their condition.

Unloading pallets from means of transport and transporting them to the AHU's assembly site should be performed with the use of a fork lift or crane.

A possibility of transporting assembled AHUs is determined in Table 2.

Table 2. Possibilities of transporting assembled AHUs.

AHU type	Possible to transport	Impossible to transport
VS 21-75 with a base frame	supply, exhaust, supply-exhaust AHUs with the cross-flow heat recuperator, with the rotary regenerator up to 7 modules long (2587mm)	AHUs over 7 modules long (2587mm) and AHUs up to 7 modules supply and exhaust placed one on another, with cross-flow heat recuperator, with rotary regenerator where the top part projects over the bottom one.
VS 100-150 with a base frame	supply, exhaust, supply-exhaust AHUs with the cross-flow heat recuperator, with the rotary regenerator up to 6 modules long (2221mm)	AHUs over 6 modules long (2221mm) and AHUs up to 6 modules supply and exhaust placed one on another, with cross-flow heat recuperator, with rotary regenerator where the top part projects over the bottom one.
VS 180 - 650	supply as well as exhaust up to 6 modules long (2195mm)	supply as well as exhaust AHUs longer than 6 modules (2195mm), supply and exhaust AHUs placed one on another with the cross-flow recuperator, with the rotary regenerator

Transport of assembled blocks of AHUs described in Table 2 as fit for transport should be carried out with the use of a fork lift or a crane (fig. 5).

For the transport of the units VS 21-150 with the crane should be used some metal holder and wooden supports or use the holes in the base frame supports in order to mount an appropriate pipe bar. In the case of transport VS 180-650 units with the use of a crane it is necessary to use holes in the frames in order to mount an appropriate pipe bar. Lifting strings must be spaced with the use of beams of appropriate length.

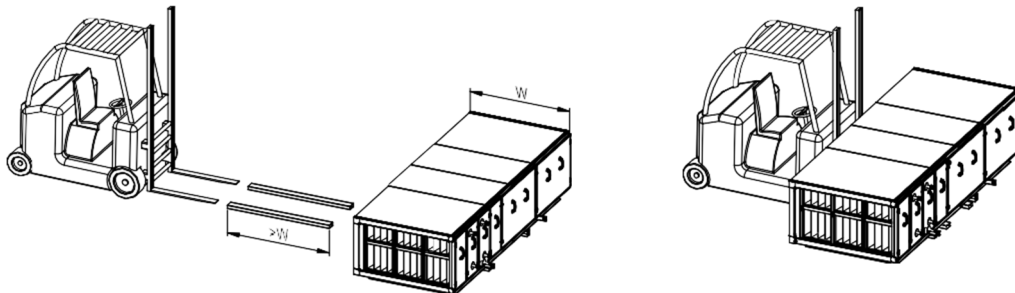


Fig. 5a Using a forklift truck to transport the unit

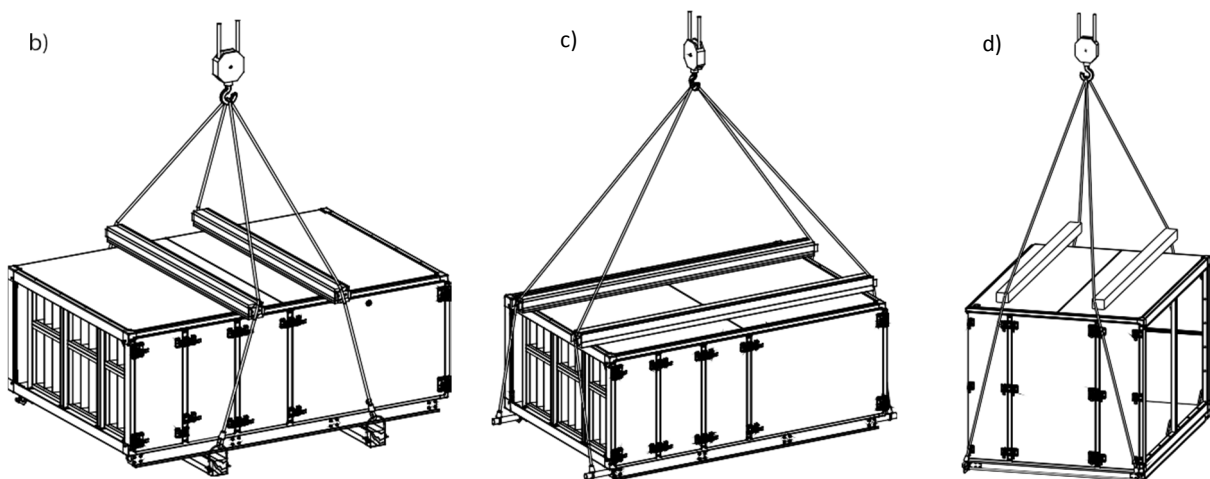


Fig. 5 Transport with the use of a crane

- b) VS 21-150 AHUs with using wooden supports
- c) VS 21-150 AHU sections with using steel pipes
- d) VS 180-650 AHUs

AHU have to be transported in their working position (horizontally) and they should not be stored one on the other.

The units and their components should be stored in rooms characterized by the following conditions:
relative humidity:

$$\varphi < 80 \% \text{ at } t \text{ (temperature)} = 20^{\circ}\text{C}$$

$$\text{ambient temperature: } -40^{\circ}\text{C} < t < +60^{\circ}\text{C}$$

- the devices should be out of the reach of any caustic dust, gas or steam as well as any other chemical substances which may have pro-corrosive influence on the unit and its components.





While storing the unit, its plastic packaging must be unsealed.









Any damages caused by improper transportation, unloading or storage are not covered by the guarantee and any claims laid by way of aforementioned issues will not be examined by VTS.

4. FOUNDATION, ASSEMBLY, CONNECTION OF UNIT-RELATED SYSTEMS

4.1 AHUs supplied in sections

-  Sections connection is out of the standard offer of VTS. It is possible to purchase additional option to connect to the section by Authorized Service VTS.
-  When the customer connect the section himself should follow the separate instructions, supplied with AHU in the mounting set.
-  During connecting the section one should pay attention on the applying glue on the casing locks (section connection without using glue will result in a lack of casing tightness - warranty claims because of this will not be considered).
-  Optionally, in the mounting set provided with AHU can be included butyl tape, to additional seal the connection of section. Additional seal at the connection of section is recommended especially for the external AHUs

4.2 AHUs supplied in packages - for assembly on site

-  Assembly must be carried out on hardened and dry surface. Hardened surfaces are understood as flat, leveled and hard surface, which does not change its properties under influence of atmospheric conditions and is resistant to any damages relating to placing the AHU on it as well as regular operation.
-  Assembly can be carried out in ambient temperature allowing to perform correctly all technical procedures of the assembly, i.e. within temperature range: from +5 to +35°C
-  In case of outdoor assembly, the procedure can be carried out in precipitation-free conditions.
-  It is acceptable to start the assembly provided that all safety and security requirements are met.
-  Minimal dimensions of an assembly location:
 - AHU width + 4 meters (2 meters on each AHU side),
 - AHU length + 4 meters (2 meters on each AHU side).
-  Connecting supplied blocks of VS 21-650 units as well as holding AHU to the foundation, falls within the competence of the Client.

4.3 Ambient conditions for AHUs installation

The Ventus air-handling can be installed as well as inside the building as the outside (except the unit with the humidity sections). Units can be installed and work on the external air with temperature from -40°C to +60°C.

AHUs installed outside the building should be equipped with air intake and outlet equipment.

The unit operated outdoor should be regularly cleaned from the snow. Such units should have barrier for protect against the snow, and base frame should placed on the level not lower than height of snow level in that region.

In condition of the low temperatures, increase the heat lost, what can needs more reserve of the heating capacity of the heaters. The heat node of the heating capacity regulation, three way valves, water pumps, thermo-manometers, valves, as well as frequency converters should be placed in the room with temperature higher than +5°C.

If the unit operate with the low inlet temperature of the air it is recommended to use the mixture of the glycol (up to 45%) as the heating medium. All installation pipes of the water heating, condensate drying, hydraulic valves should be well isolated. The best is use the pre-heater before the heat recovery section.

The air damper actuators should be protected from the atmospheric conditions. If the outdoor temperature is lower than -20°C, the air dampers actuators must be equipped with heating. All equipment and components operating outside the unit must have the required IP.

Units, periodically stopped during periods of low outdoor temperatures, require special attention.

They should be equipped with an automation system, that supports the flow of the liquid through water heaters to prevent it from freezing during AHU downtime. If it is possible that temperature in the fan section fall below -30°C or lower, the sections should be equipped with an internal heating system to ensure reliable start of the motors after shutdown and downtime.

4.4 Conditions of AHU assembly carried out by Authorized VTS Service

In case of AHU delivered in packages VTS provides a charge-free assembly and installation within 200km from the location of the nearest authorized service in a country in which VTS has its representatives. A list of Authorized VTS Services is available a www.vtsgroup.com.

In case when the installation is to be carried out in a place located over 200 km from the business residence of the nearest VTS service, the customer is obligated to cover:

- Transport expenses of the Authorized VTS service arising from the excessive distance
- Accommodation and food for the Authorized VTS service crew.

AHU assembly can be realized only by service which has an appropriate VTS Authorization Certificate allowing it to provide such a service.

As per the presented offer to range of service does not include: AHU section connection, connection of the power supply, automation controls (wiring of the unit, control panel, frequency converters for the unit motors, sensors, and valves) to the unit as well as it doesn't include the connection of units to the ventilation ducts.

Preparation for assembling

Before starting AHU assembly VTS shall send to customer a document entitled 'Confirmation of Readiness for Assembly' (enclosure no 1).

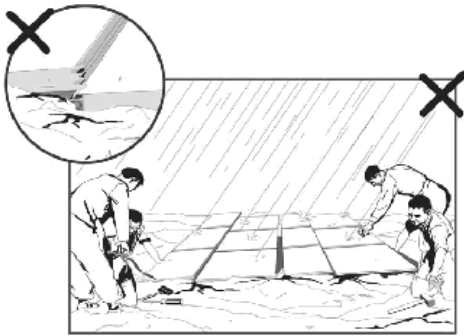
The document contains important information about the installation process. Having satisfied conditions specified in it the document should be signed in the indicated place and sent to the specified VTS office.



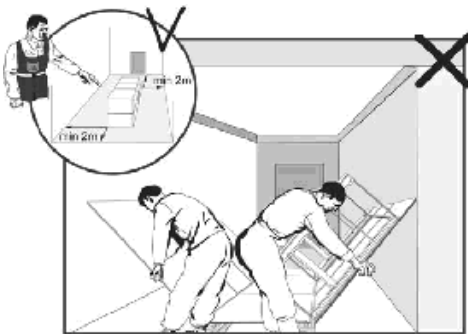
ATTENTION: Sending the 'Confirmation of Readiness for Assembly' is indispensable to start the assembly process by Authorized Service. If real conditions do not correspond to the information given in confirmation VTS shall be entitled to demand reimbursement of the costs incurred due to service stoppages or additional actions performed by the service on site.

Assembly site

Appropriately prepared place of assembly should meet the following conditions:
The right surface – the surface should be hard, dry, protected from atmospheric influence, and damage resistant (placement of the unit, installation works).



- The required installation place area:
- Width of the unit + 4 meters (two meters on each side of the unit)
- Length of the unit + 4 meters (two meters on each side of the unit)



- Base of the unit made in compliance with the requirements described in chapter 4.2.2.
- The 230V power supply should not be located further than 20m from the installation place which should be properly lit.
- The place of installation shall provide a safe environment for the installation crew.

And additionally the following should be provided:

- Availability of individual AHU elements or pallets including packages on the assembly place of a particular AHU. Ensured transport of AHU elements and AHU blocks to the place of installation.
- A possibility of service entering the site and starting assembly immediately after their arrival.
- making the Warranty Card and Delivery documents supplied with a particular AHU available to the service.

Assembly completion

After the installation is completed the service is obliged to:

- notify the client's representative about the fact of finishing assembly.
- put into service a clean AHU labelled with provided pictograms and VTS labels, ready to be connected to a power source (wiring), utilities and control systems,
- Hand control elements over to the client's representative if at his request they were not assembled in the AHU,
- Hand a filled in Warranty Card of a VTS AHU over to the Client
- hand the 'Assembly Acceptance Protocol' documentation to be signed by the client and provide them with a copy of this document,
- put assembly waste in a place indicated by the client's representative not farther than 20 meters away from the place of assembly,
- Leave the assembly place in the state from before the assembly

VTS on-site assembly does not include:

- a. Setting up of electrical wiring, connection to heating or freezing sources and assembly of exchanger valve,
- b. Connection, assembly and start-up of control elements (except for damper actuators, pressure control and anti-frost thermostat) and engines zeroing,

- c. Placing, balancing and anchoring of air handling units,
- d. Connecting air handling units to ventilation ducts, utilities and electricity.
- e. Start-up of air handling units,
- f. Recycling of containers in which air handling units were delivered.

4.5 Foundation

The unit should be placed on:

- a foundation slab
- a steel base frame concreted into the floor
- an appropriate stiff steelwork

The foundation, steel base frame or steelwork have to be flat and leveled and they should be able to support the weight of the unit.

In AHUs situated one on another the part of the upper AHU projecting outside the outline of the bottom one must be supported with the use of an appropriate construction fig. 6a.

Height of the foundation slab or base frame must allow for assembly of the siphon which drains the condensate out of the draining tray. In case of the drain plates installed in the lower AHU sections, the unit has to be mounted onto additional foundation slab or a special hollow must be made directly under the siphon.

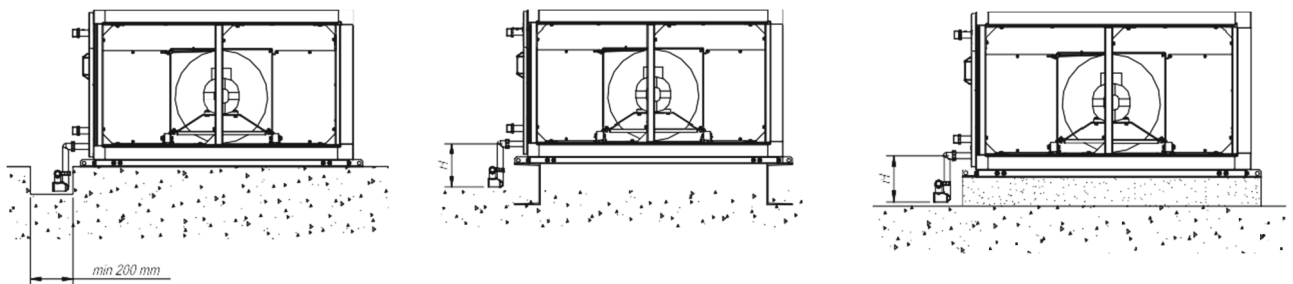
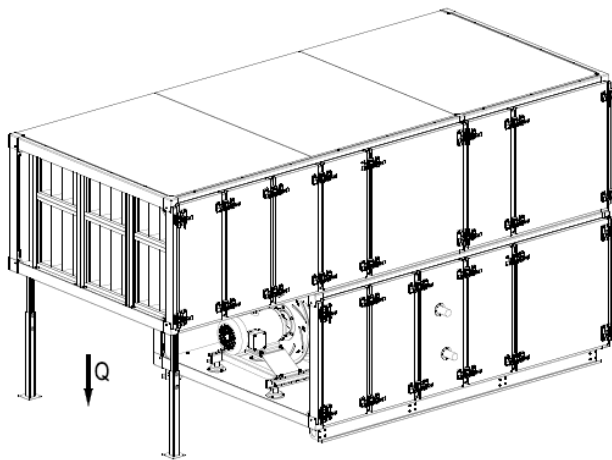


Fig.6. Examples of AHU foundation



AHU size	Max. load [N]
VS 21	500
VS 30	500
VS 40	500
VS 55	1000
VS 75	1000
VS 100	1500
VS 120	2000
VS 150	2000
VS 180	3500
VS 230	4000
VS 300	5000
VS 400	6000
VS 500	8500
VS 650	9000

Fig.6a Sample of supporting of supply-exhaust AHUs' top sections

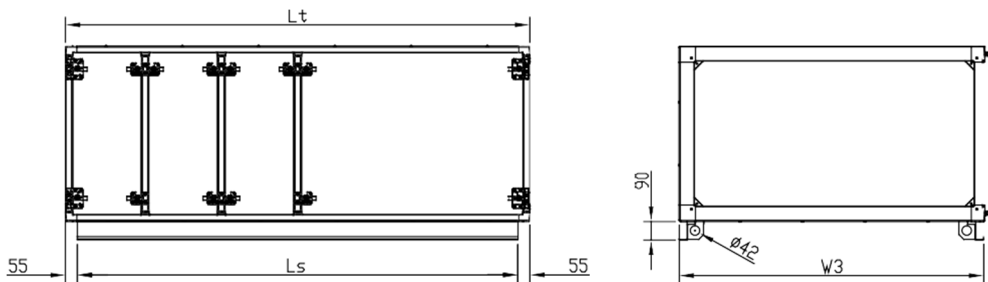


Fig.7a. Base frame of VS 21-75 AHUs

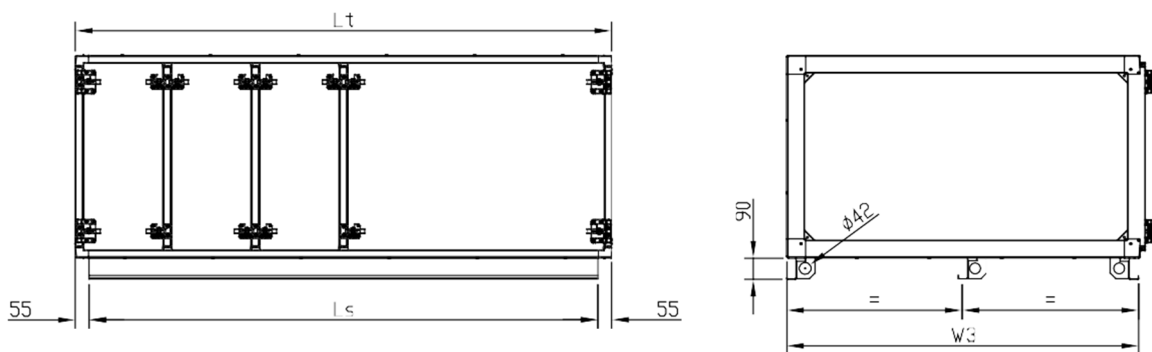


Fig.7b. Base frame of VS 100-150 AHUs

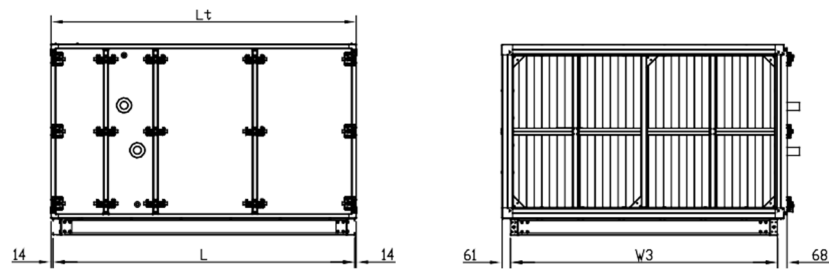
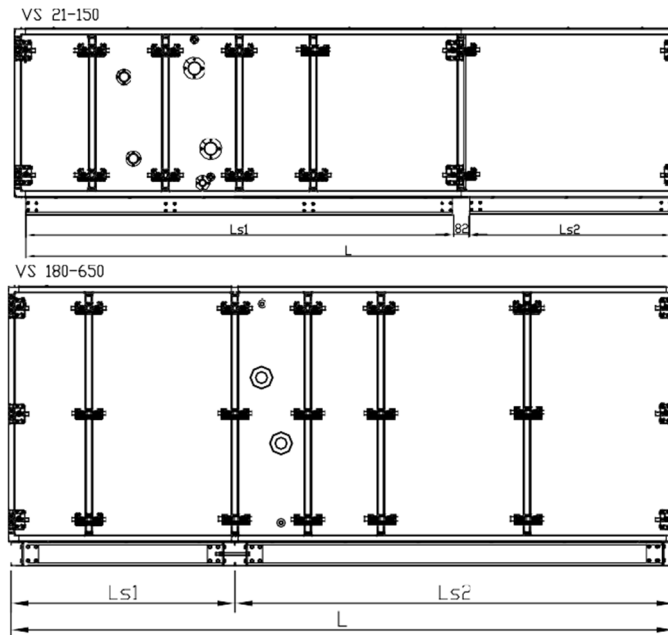


Fig.7c. Base frame of VS 180-650 AHUs



Rys.7d. Base frame of VS 21-650 sectional AHUs

Table 3a External dimensions of VS 21-150 AHUs' transport frames

AHU size	Frame length L_R	W_3
	mm	
VS-21	L = Lt-110	937
VS-30		937
VS-40		1144
VS-55		1315
VS-75		1456
VS-100		1636
VS-120		1867
VS-150		2061
VS-180	L=Lt-28	1960
VS-230		2368
VS-300		2460
VS-400		2960
VS-500		3460
VS-650		3572

Table 3b. Length of the base frame in relation to the AHU section

Length of the AHU section	L_s (VS 21-150)	L_s (VS 180-650)
[Mod]	[mm]	
2	758	649
3	1124	1015
4	1490	1380
5	1856	1746
6	2221	2112
7	2587	2477

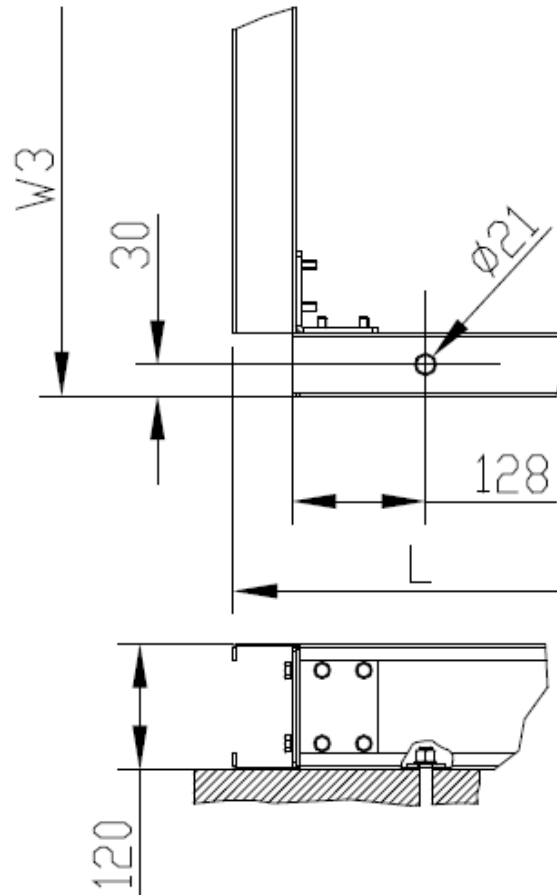


Fig.7e. Location of end foundation holes in base frames of the VS 180-650 AHUs

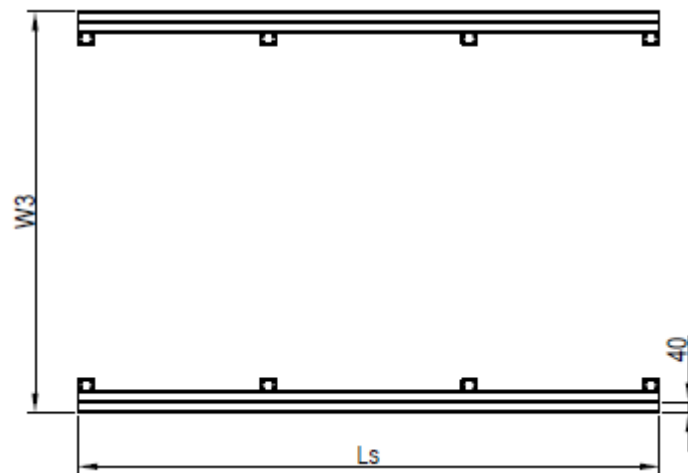
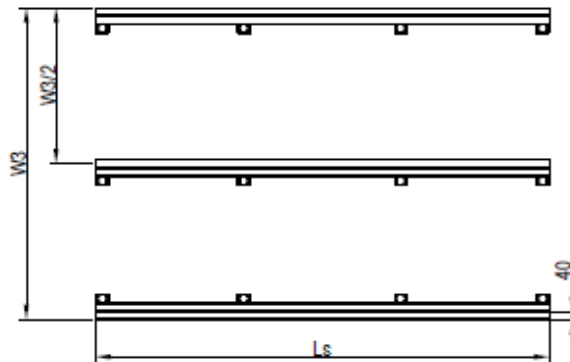
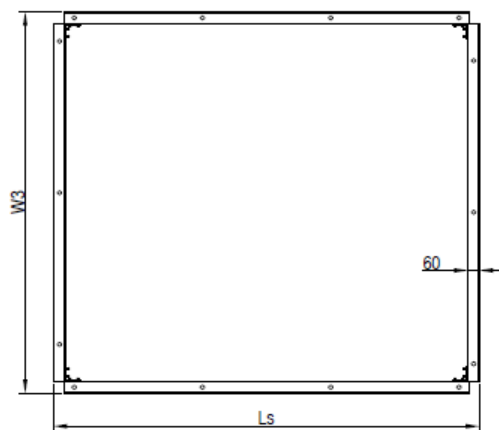


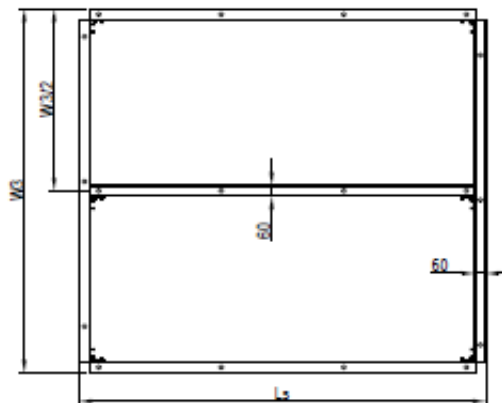
Fig.8. Base frame of the AHU's blocks
a) VS 21-75



b) VS 100-150



c) VS 180-300



d) VS 400-650

All base frame profiles must be supported.


For foundation holding of the VS 21-150 AHUs should be drilled holes in the bottom part of the longitudinal profile of base frame.

For foundation holding of the VS 180-650 AHUs can be used a holes in the ends of longitudinal profiles of base frame (fig.7d). To fix AHU base frame to foundation should be used bolts M10

AHUs must be anchored to the foundation.
Anchoring AHUs is out of VTS delivery.

4.6 Place of foundation

The AHU should be installed so that connections of any related systems (ventilation ducts, pipelines, cabling, etc.) do not collide with the inspection panels.

 **It is forbidden to place any elements on the AHU as well as use the AHU as a support of ventilation ducts and other building components.**

In order to carry out the assembly, operation and maintenance successfully, please keep minimum recommended distance (**fig.9**) between the front side and existing construction elements (walls, pillars, pipelines, etc.).

 **In compact AHUs where the exchangers' pins are led to the side opposite to the access side an appropriate distance required for proper assembly of the power supply installation elements should be maintained.**

This is possible to install other systems, pipelines, pillars in the operation area only if they can be easily disassembled for the maintenance and service procedures.

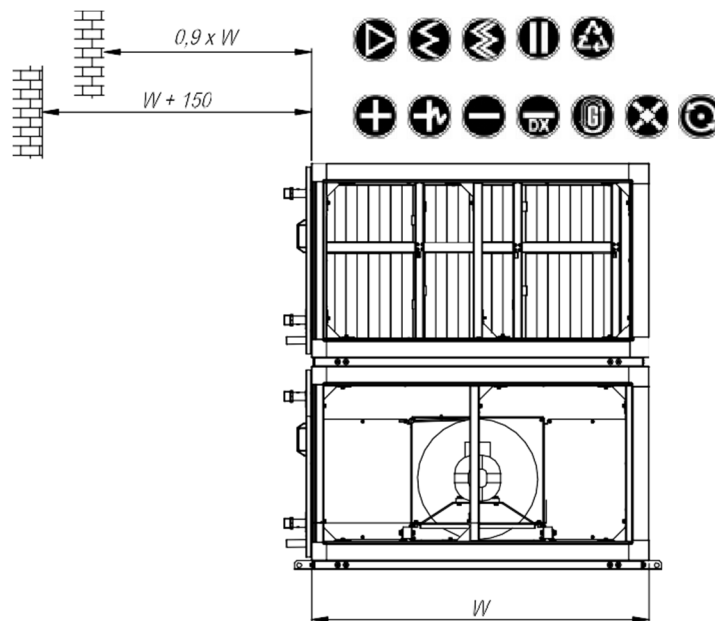


Fig.9. Free space in the front area - the VS 21-650 AHU

4.7 Connecting the ventilation ducts

The ventilation ducts should be connected to the AHU with the flexible connections (optional accessory) which suppress vibrations of the unit and level the coaxial deflection of the duct and the AHU outlets. Flexible connections are equipped with flanges with sealing. The flexible flanges should be connect with ducts with using drilling screws (Fig.10a) or additional clamping elements (Fig. 10b). Materials to connect ducts are not supplied as standard delivery.

Appropriate operation of the flexible connection occurs if it is stretched to about 110 mm.

The ducts connected to the AHU have to be suspended or underpinned with dedicated support elements. Conducting the ducts with the fittings should be done in a way to eliminate possible increase of noise level in the ventilation system.

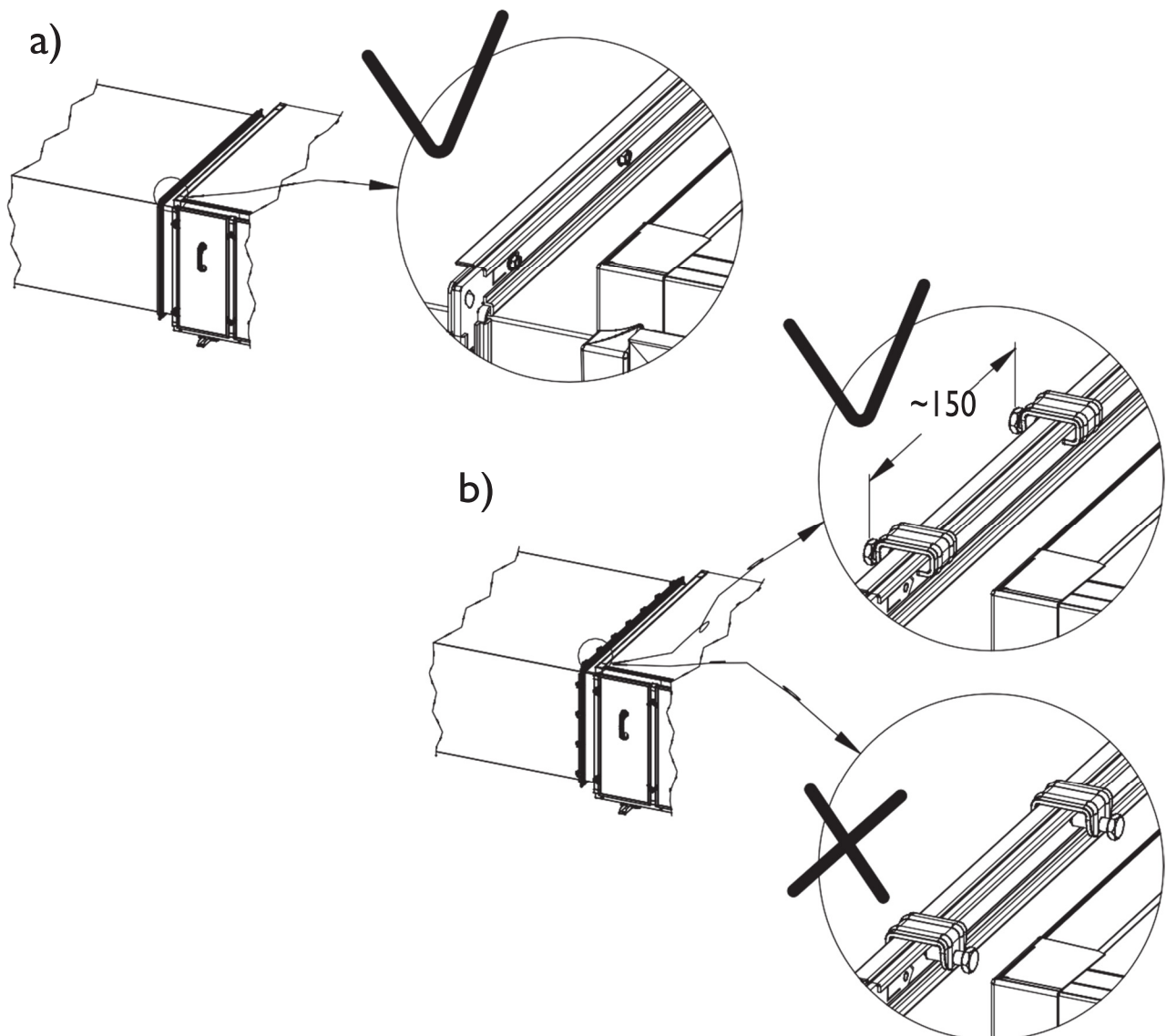


Fig.10. Duct's connection rules

4.8 Connection of heaters and coolers

Connection of the exchangers should be carried out so as not to allow for stresses which may result in mechanical damages or leakage. The pipeline weight and thermal stresses cannot be passed onto the exchanger's connections. Depending on a local conditions please use the compensation at the supply and return of the pipeline system, in order to level the pipeline's linear expansion. During assembly of the supply system to the exchangers equipped with the screwed connections, counter the exchanger's connection with additional wrench (fig.11).

The supply system should be planned so as it does not collide with the other AHU sections. Applied method of connecting the exchangers with the supply system should allow for an easy pipeline disassemble in order to remove the exchanger from the AHU, during maintenance and service operations.

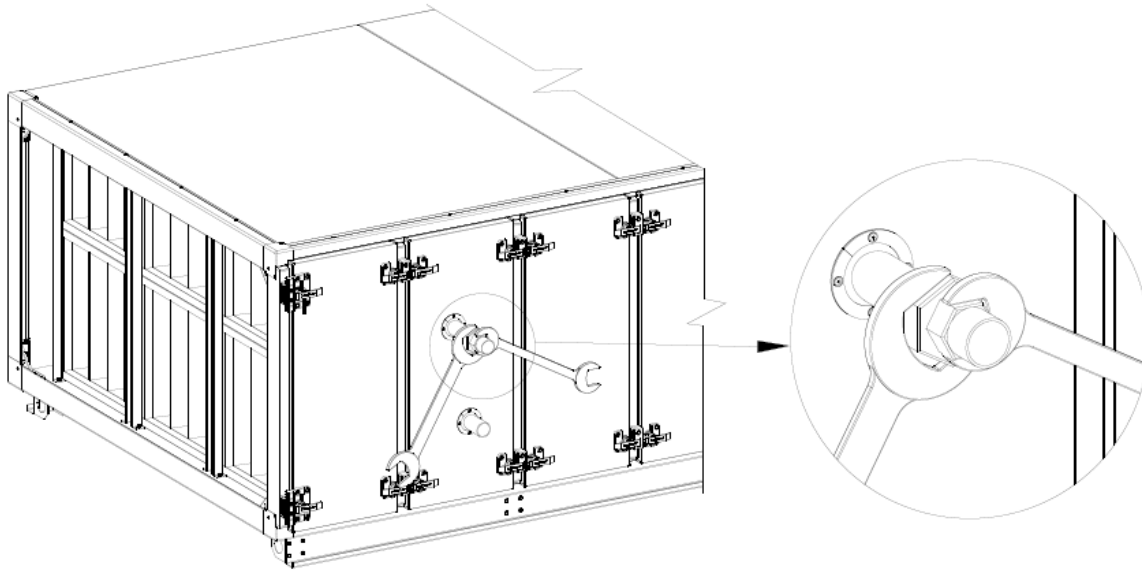


Fig.11. Securing the screwed connections of the exchanger

Table4. Types of exchanger interceptors connections

Rated diameter of the connectors Dn [mm]	Water exchangers	
	Interceptor connection material	Way of connecting the interceptor
20	Brass	R 3/4" thread
25	Brass	R 1" thread
32	Brass	R 1 1/4" thread
50	Steel	R 2" thread
80	Steel	R 3" thread

Freon coolers regardless their rated diameter are equipped with copper connections adapted for hard soldering.

Supply and return exchanger connections should be connected so as the exchanger operates in a counter- current way. Streamwise operation results in lower average temperature difference, influencing the exchanger's performance.

 **In the AHUs sizes VS 400-650 the water heat exchanger is divided for two coils. The supply of these exchangers should be done in parallel**


 **Note! Maximum operating pressure of the medium for water coils is 16 bar, tested pressure – 21 bar.**

Table 5 Requirements of the quality medium for the water coils:

Parameter	Value
Oil and grease	< 1 mg/l
pH at 25°C	8 to 9
Residual water hardness	$[Ca^{2+}, Mg^{2+}]/[HCO_3^-] > 0.5$
Oxygen	<0.1 mg/l (as low as possible)

Examples of connecting supply and return pipelines for various AHU versions shown in the picture.

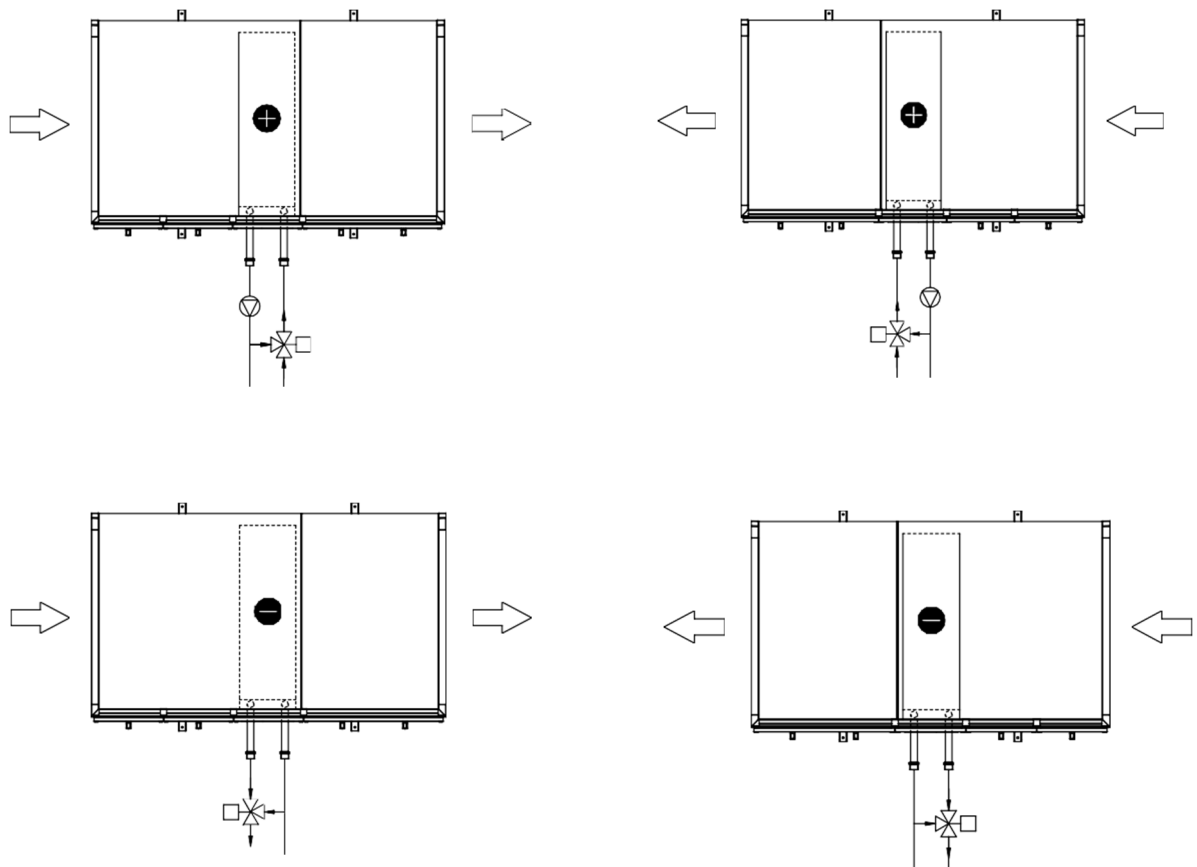


Fig.12. Examples of feeding water exchangers

Connecting the freon cooler to the supply system with a refrigerating unit should be done by a qualified cooling system specialist in accordance with the regulations concerning the freon-driven cooling devices.

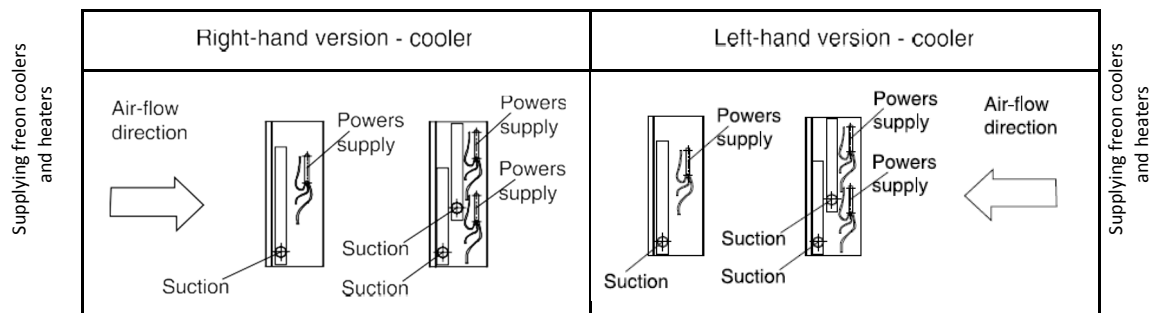


Fig. 13 Supplying freon coolers and heaters

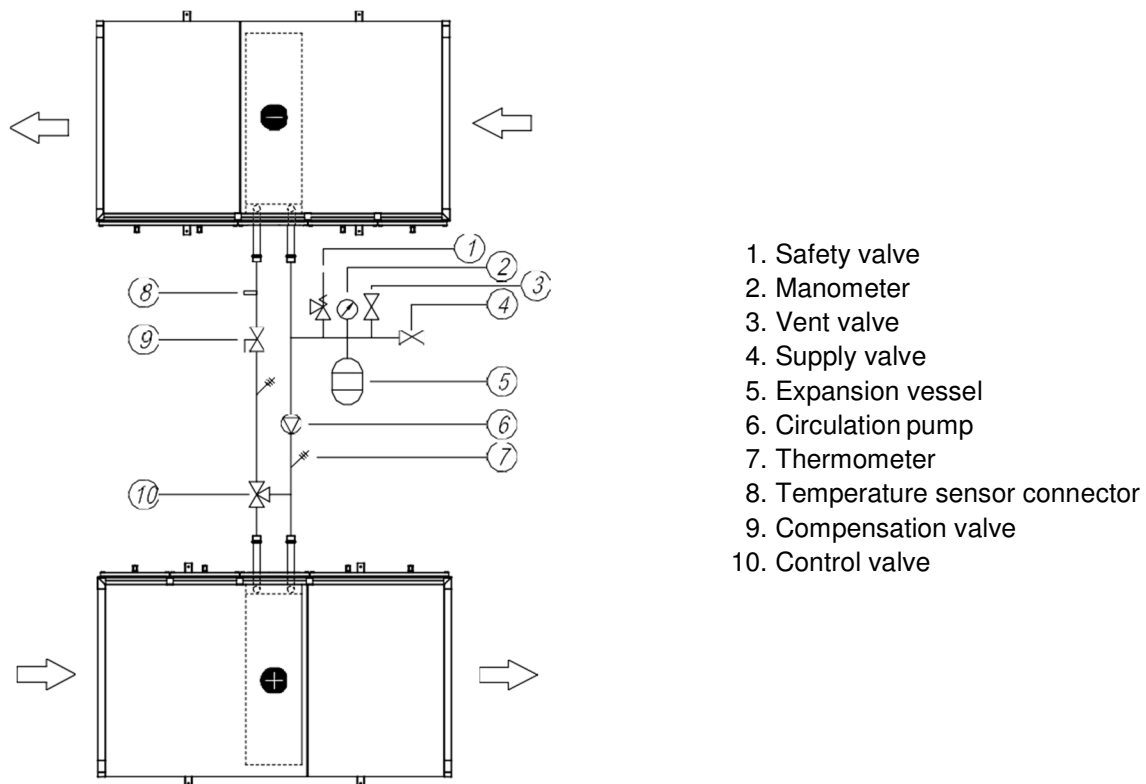


Fig.14. Examples of connecting the exchangers to supply systems

4.9 Connection of evaporative humidifier

AHUs VS 21-650 can be provided with evaporative humidifier. Evaporative humidifier works on the principle transmission of humidity by evaporation of water from the trickling pad into the air flow. Humidify of this type is characterized by high efficiency and reliability.

Depending on the size of AHU, the used humidifiers will work on the water direct supplied (VS-21-55) and circulation (VS 75-650).

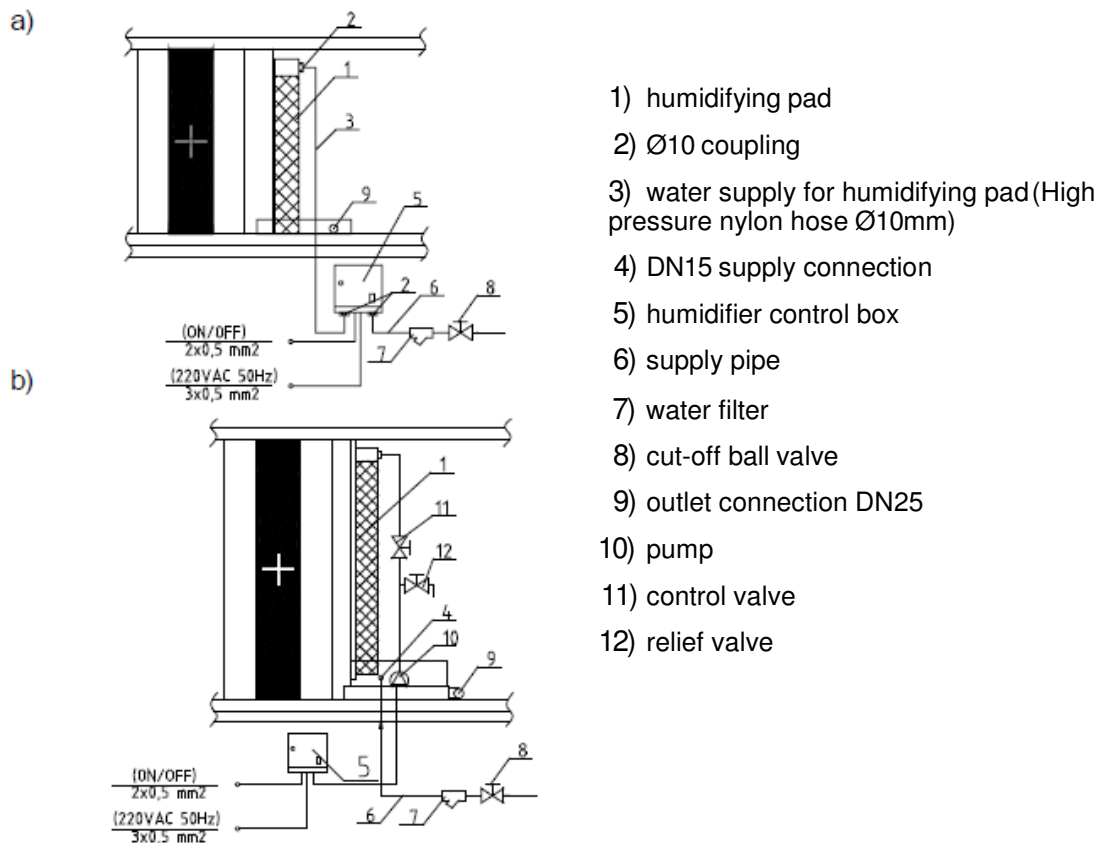


Fig.15. Evaporative humidifiers

- a) Direct drain type VS 21-55
- b) Circulating type VS 75-650

Connection for the water supply and water drainage should be done without mechanical stresses which might result in mechanical damages or leakage. Each humidifying unit is assembled with necessary external piping and tested for water tightness prior to delivery.

The supply system should provide normal quality tap water without excessive deposits of dirt and other particles which could lead to excessive dust build-up on the surface of humidifying pads.

Evaporative humidifiers don't require any special water treatment before feeding the device. Nevertheless a cut- off ball valve and strainer-type filtering device accessible for cleaning should be installed on the supply piping (not included in delivery).

AHUs with humidifiers are supplied with a control cabinet to be installed outside the AHU. Control box installation site must be protected from weather and to ensure temperature in the range from 5°C to 40°C.

Direct drain humidifiers connect directly to the cabinet with a using a high pressure nylon hose Ø10mm (supplied with a humidifier). To connect use the supplied Ø10 coupling. Make a hole in the panel for the crossing humidifier supply pipe. Pipe in the hole protect with a header glands.

In the similar way connect water supply to the control cabinet.

If necessary, the pipe between the humidifier and control cabinet can be extended but not more than 5m.

For the humidifier with water circulating VS 75-650 powering-water should be connected to the connection pipe (DN15) led out outside the inspection panel.

Types of the supply and drainage connection are specified in the table 5.

Table 6. Types of the supply and drainage connection

AHU size	VS 21 - 55	VS 75 - 650
Humidifier type	Direct drain	Circulating
Supply connection	DN15 threaded galvanized pipe	High pressure nylon hose Ø10mm
Drainage connection	DN25 threaded galvanized pipe	DN25 threaded galvanized pipe
L/R side versions	no, universal	yes

Table 7. Parameters of humidifier

Parameter	Limit values
Critical air velocity VS21-55	3.0m/s
Critical air velocity VS75-650	4.0m/s
Water temperature	5..40°C
Water pressure	0,15..0,75MPa
Feed water quality	tap water
Ambient temperature for electric cabinet	5..50°C
Ambient humidity for electric cabinet, max	90%rH

Direct drain humidifier is simplified compact construction for limited space in the AHU. Supply water feeds the humidifying pad from the top and the excessive water falls to the draining pan and goes directly out of the AHU.

Water supply is controlled by means of solenoid valve installed in the control cabinet (included in the delivery).

Circulating humidifier relies on the circulating pump which sits in water tank and feeds water to the humidifying pad. Excessive water falls to the tank and is used again to feed the pad. Due to evaporation, water level decreases and activates the floating valve, which controls the water supply.

Side effect of evaporation is rising concentration of contaminants in the water tank. To control that process, two motorized valves operated by control cabinet cut off the water supply and fully drain the tank. After that the valves switch-over and the humidifier starts operation again with clean water.



Note! For guidelines regarding the water draining, follow the same rules like for drain pans of the heat exchangers, which are described in the next chapter.

4.10 Draining out condensate

The outlet condensate connections, led outside the AHU's casing are assembled in the drain plates of glycol, cross-flow and rotary exchangers (the diameter of drain pan connection pipe is 32mm).

Siphons, which are designed to drain out condensed water from the exchangers at different pressure of the section and environment, should be connected to the drain connections.

For proper drainage of condensate from the unit, the siphon on the drain pan connection pipe must be installed in the AHU sections, where negative pressure occurs. Drain siphons or siphon parts are not supplied as standard delivery. There is no need to apply drain siphons in section with overpressure. In order to minimize air blow-by, you can use a siphon on the system draining out condensate, assembling the siphon made in accordance with fig.16a and table 8.

Siphons usable „H" height depends on the pressure difference between the AHU section, where condensate is drained from during operation and the ambient pressure. „H" dimension is provided in mm and must be higher than the pressure difference expressed in mmH₂O.



Due to various pressure difference values which are present in various AHU sections during operation it is not allowable to connect several condensate outlets into one siphon.

It is allowable to join together siphons of various sections with one drain interceptor provided that the interceptor will be equipped with air-escape. Before starting the AHU, fill the siphon with water. In case of cold environment, insulate the water drain system and eventually apply suitable heating system.

Table 8. Siphons' operational height

No.	Total fan's pressure [Pa]	Size H [mm]
1.	< 600	60
2.	600-1000	100
3.	1000-1400	140
4.	1400-1800	180
5.	1800-2200	220
6.	2200-2600	240

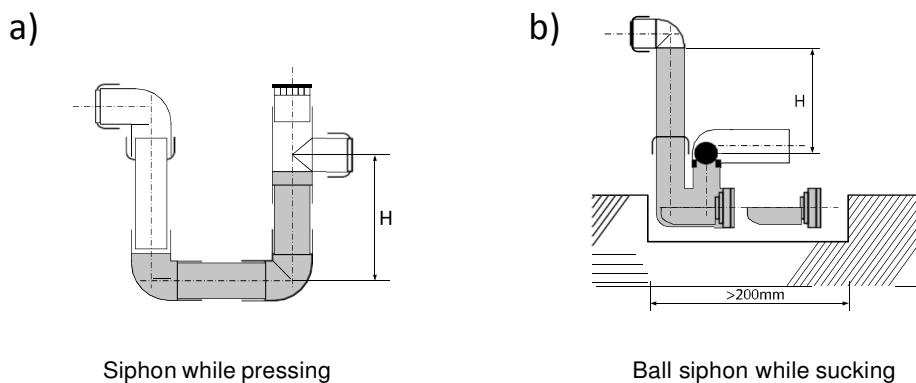


Fig.16. Types of siphons

4.11 Electric connection

Connection of electric AHU elements should be carried out by qualified personnel and should be done in accordance with any standards and regulations being in force in a country where the unit is installed. Cross-section and type of cables (e.g. shielded cable) feeding individual functional segments should be selected basing on nominal current and specific operation conditions (e.g. ambient temperature, way of cabling, distance from the power supply).

Before starting connecting power supply, check conformity of the voltage and frequency of a supply network with the data shown on the device's rating plate. Permissible fluctuation of the supply voltage and its frequency to the values shown on the rating plate is $\pm 5\%$. If discrepancy exists, the device cannot be connected.

4.11.1 Rotary exchanger

Drive unit drives the rotary exchanger. It consists of a motoreducer (squirrel-cage motor + worm gear) and frequency converter. Control system is adapted for connecting a standard 0-10V control signal and for operation in the RS485 network with the Modbus protocol. Frequency converter is powered with 1-phase alternating voltage 1x230V/50Hz. Any electric connections and configuration of the rotary exchange drive unit should be done in accordance with guidelines from „**Operation manual of rotary exchanger's drive unit**”.

4.11.2 Evaporative humidifier

Evaporative humidifiers are equipped with control cabinets that operate the components of the humidifier and provide basic functionality and safety of operation (e.g. dry-running protection for pump).

 **Note!** Those control cabinets do not measure or regulate humidity. Control signal to enable the humidification (On/Off) must be worked out by another external regulator.

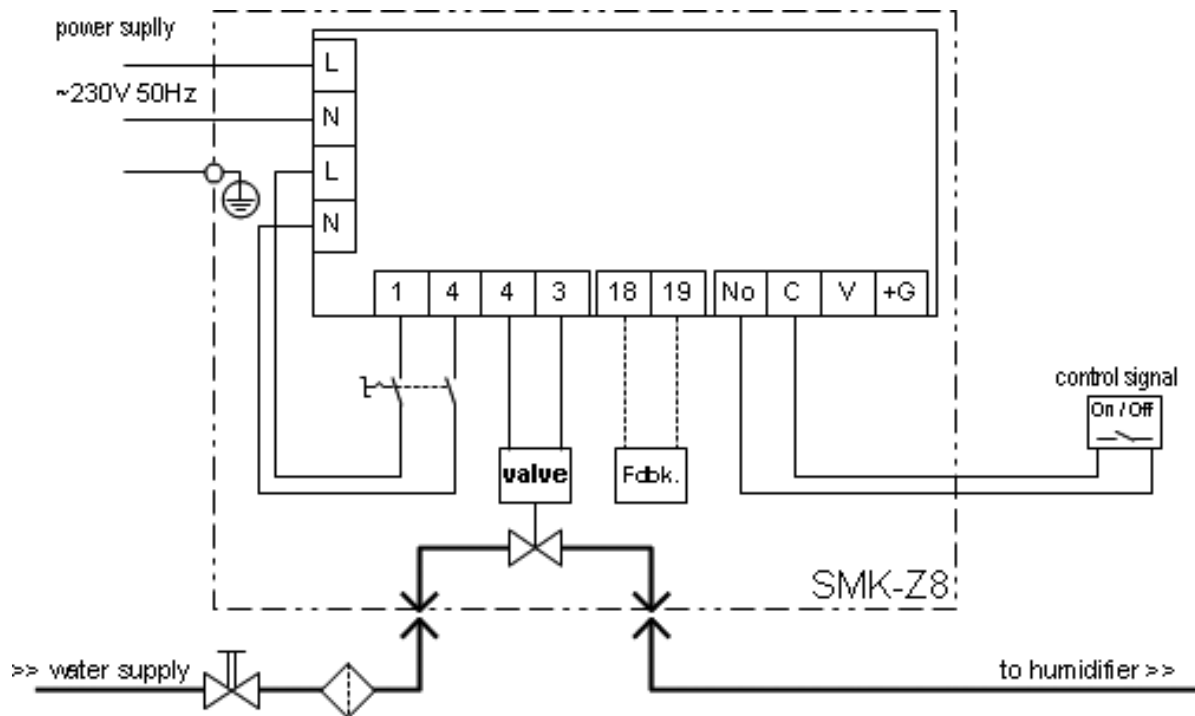


Fig.17.a. Electric connection diagram for direct drain humidifier

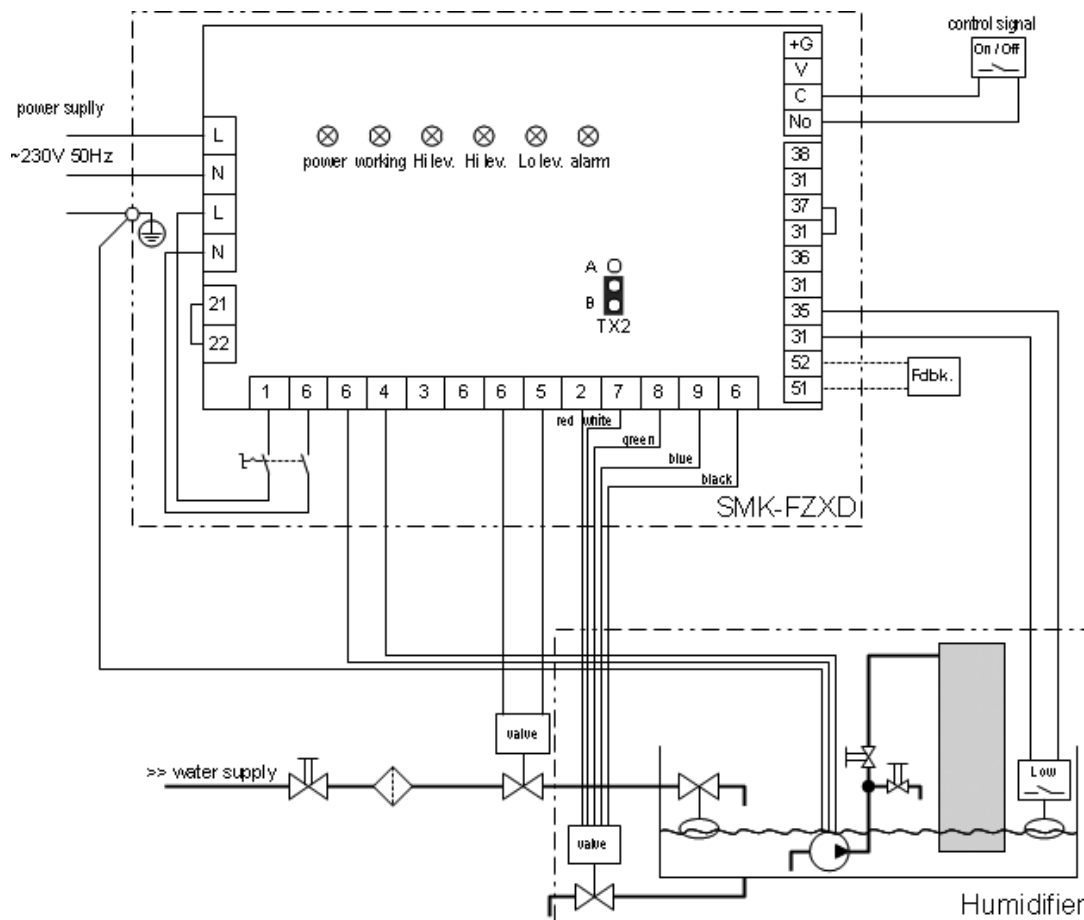


Fig.17.b. Electric connection diagram for circulating humidifier

Electrical connection should be done in accordance to the schemes shown in the fig 17.a. and 17.b.

4.11.3 Electric Heater

Electric heater supply wiring should be let through the fixed panel, at the AHU's back. If the wiring is led through the inspection panel, on the front side, then it should be arranged so as to enable opening the section for maintenance and service operations.

Connecting power supply to the heater with control module should be done directly in the heater section, according to the guidelines of the module operation and maintenance manual. In any other case connecting power supply should be carried out with a separate switchgear, not supplied with the VTS package.

Each heating unit of the heater is connected separately to the terminal strip (fig. 18), which is located sideways of the heating subassembly casing.

Connection of the heater should be done in a way to prevent from possibility of switching on the heater when the fan is not switched on. What is more, if the fan stops, the heater's power supply must be turned off as well.

Depending on the automatics system, the heater's power can be adjusted smoothly or gradually. In order to control the heater gradually, heating units should be arranged with 3 units in a group (fig. 19). Heating units are arranged symmetrically in the heater's window.

Available heater power output depending on the connection type and number of heating units groups are shown in the table 8.

On the terminal strip there are terminals for connecting the ground cable (PE) and neutral (N) (the heater's casing must be connected to the neutral or ground cable) as well as terminals 07.08 and 09

of the thermostat protecting against overheating the air inside the heater caused by drop or lack of air flow. Heating coils of the heater will be damaged if the system is turned on and there is no air flow.

 **The thermostat must be absolutely installed in the heater control system.**

Thermostat functionality is based on the bimetal element properties, resulting in opening the heater control circuit contacts at air temperature near the thermostat up to 65°C. After emergency turn off, the heater turns on automatically once the air temperature goes down by 20°C. After intended or emergency (caused by overheating) turning off the power supply, the supply-air fan has to operate for some time (0.5-5 min), so as the heater's coils reached their normal temperature.

In case of the heater with smooth control of heating power output, all electric connections and configuration of the heater's control should be done in accordance with the guidelines of the 'Electric Heater - Operation and Maintenance Manual'.

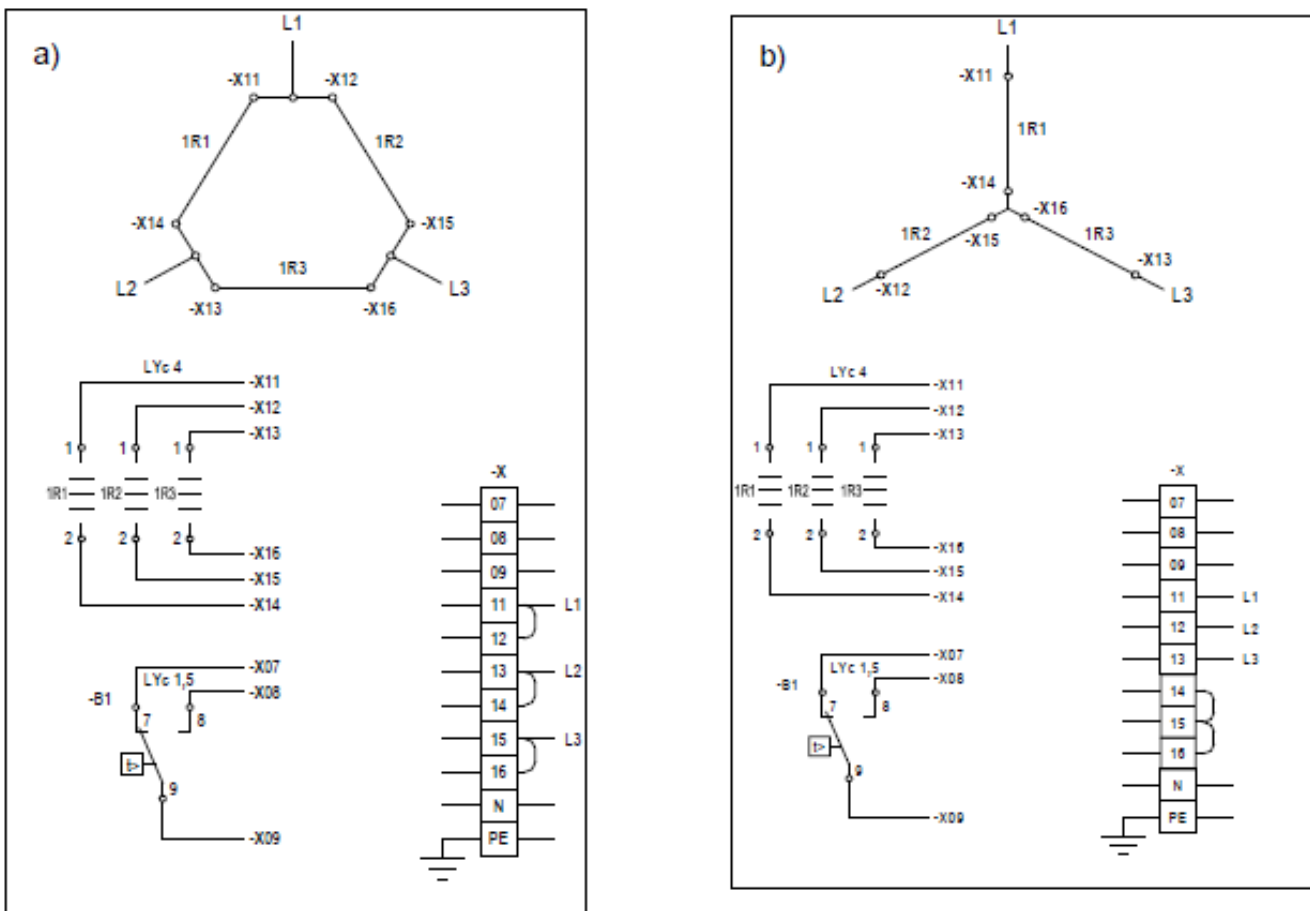


Fig. 18. Examples of connecting one group of heating units (3 pcs) of the electric heater

a) triangle-shaped connection

b) star-shaped connection

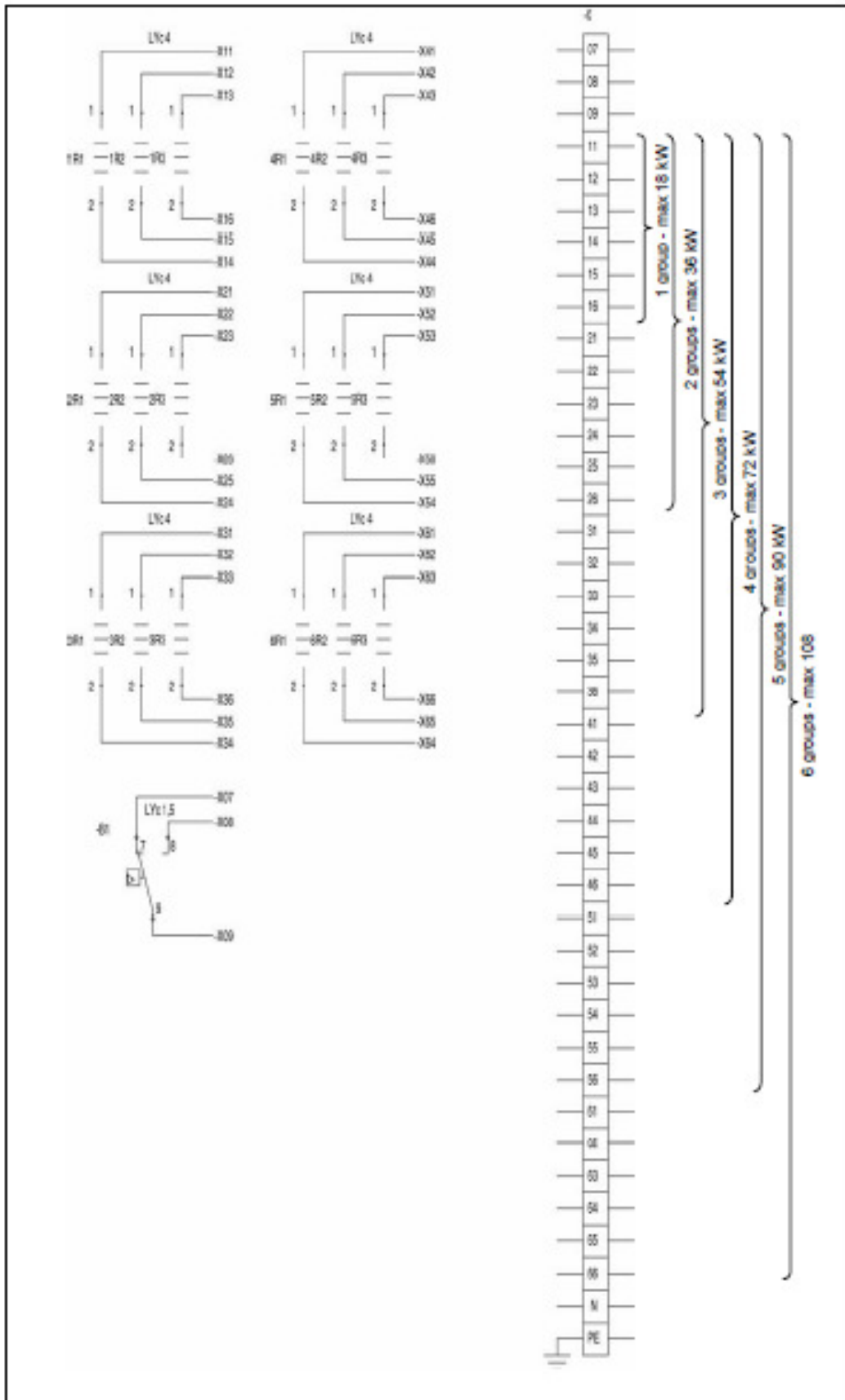


Fig.19. Diagram of connecting the heating units to the electric heater's terminal strip without the heating module

Table 9. Power outputs without the heating module, depending on a way of connecting heating units

Heater's output power in kW		Number of heating unit groups connected in a "Y" star						
		0	1	2	3	4	5	6
Number of heating unit groups connected in a "Δ" triangle	0		6	12	18	24	30	36
	1	18	24	30	36	42	48	
	2	36	42	48	54	60		
	3	54	60	66	72			
	4	72	78	84				
	5	90	96					
	6	108						

4.11.4 Fan's motor

VS 21-30 with motor power till 0,75kW

Ahus are equipped with the fans with the modern and high-performance EC motors. IP protection class of the motors with the controller is 44. The own electronics of the protect them against the overload, phase fail/lose, under and over voltage and phase over current.

The motor can be started by means of digital commands, bus commands, references or local start command whenever the drive is connected to the AC line.

VS 21-30 with motor higher than 0,75kW and VS 40-650 AHUs

Fans' motors are adapted to operation in dusty and humid environment (IP55) and their insulation (F-class) is adapted to cooperation with the frequency converter. No additional means inuring the motor against conditions of the AHU fans' section are required.

Motors used in our AHUs are by default motors with their own cooling system and with fans built into a shaft. Supply cabling must be led to the fan's motor via rubber passes located in the back panel of the AHU casing.



Caution! This is not permissible to lead supply wiring through the inspection panel

Intermediate fan drive

Fans' motors with belt drive are powered by 3x400V/50Hz voltage. The connection should be done through the overload and short-circuit protection suitable for rated current of the motor.



Attention: Fan motors with the power of 4kW can be started directly. Motors with the power of 5.5 kW and more should be started in a ,star - triangle' start-up system.

Direct fan drive

Direct driven fan EC motors are powered with 1x230V single-phase voltage. AC motors with power up to 2.2 kW are powered with 3x230V voltage from frequency converters powered with 1x230V single-phase voltage. Motors with higher powers are powered with 3x400V voltage with the cooperation with frequency converters powered by 3x400V three-phase system.



Attention: before connecting the fan set one should check carefully the rated parameters of both power supply and the converter's output.

One should connect the fan set by means of fault protection appropriate for the applied frequency converter. In the case of use EC motors or AC motors powering with the use of a converter it is not necessary to connect the motor's PTC protection.

Overload protection is realized on the frequency converter by means of activating specified parameters and introducing the motor's rated data in accordance with the manual provided together with the frequency converter.



Attention: In fan sections equipped with more than one fan synchronous operation of fans should be ensured.

The fan control system should be prepared in such a way so as to provide simultaneous start- up, rotary speed control and stoppage.

In case of a breakdown and stoppage of one fan the fan set does not fulfil its function and should be disabled.



Attention! In the inspection door of the fan section is installed limit switch, which cause the fan to stop in case of unauthorized opening of the door. The switch must be connected to the frequency converter, accordance with the wiring diagram attached in the separate manual: "Control and Modbus communication - appendix to the manual of LG iC5 and iG5A frequency converters".

In case of powering the motor from a frequency converter, high-frequency currents or voltage harmonic components in wiring powering the motor can generate some electromagnetic interferences. Connection between the frequency converter and motor should be done using shielded cables, in accordance with guidelines outlined in the operation and maintenance manual of the frequency converter.

Before putting into service and after long time of storage or standstill, the resistance of insulation between the casing and winding should be determined, applying direct current.

Minimal value of insulation resistance for a new, renewed or repaired winding should be **10 MΩ** in relation to the ground.

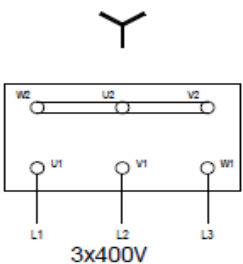
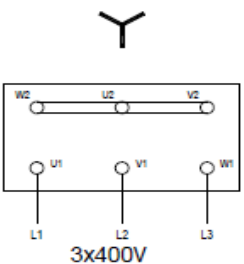
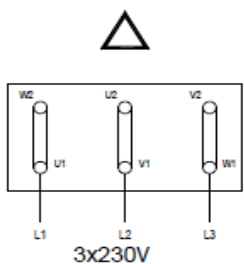
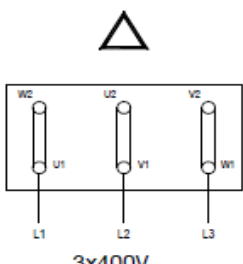
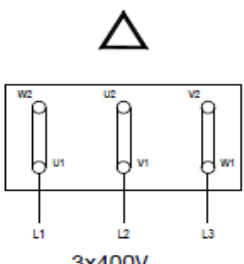

Marking on the engine rating plate	Motor power supply 3x400V/50Hz	Supplying power to the motor through frequency converter	
		Converter power supply 3x400V/50Hz	Converter power supply 1x230V/50Hz
230/400B Δ/Y			
400/690B Δ/Y			

Fig.20. Connecting power cables and clamps in a cable box of one-speed motors

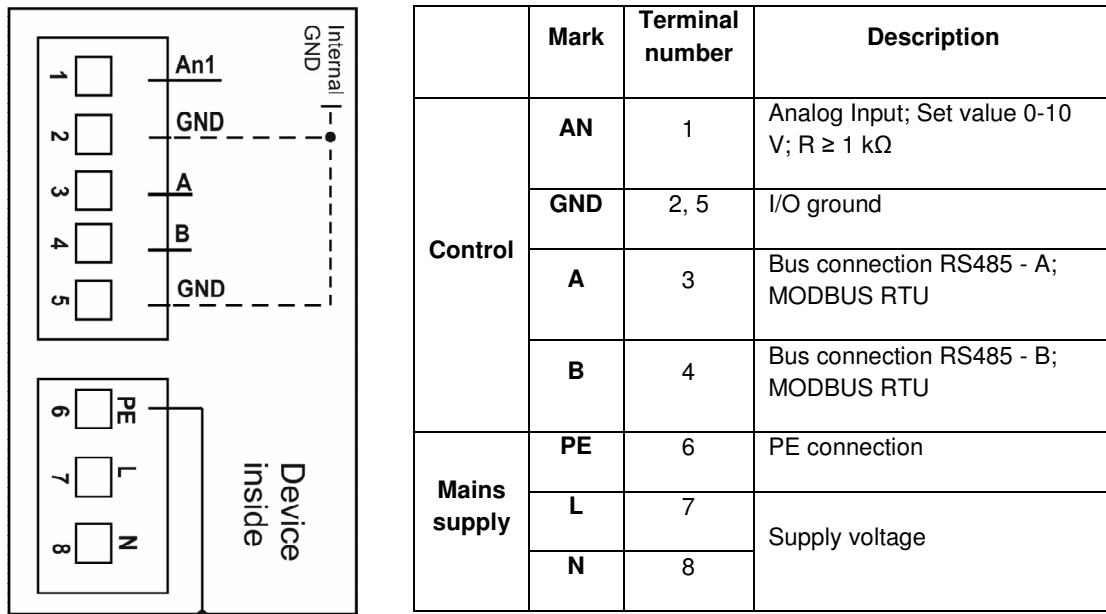


Fig.21a. Terminal strip of the EC motors 370W

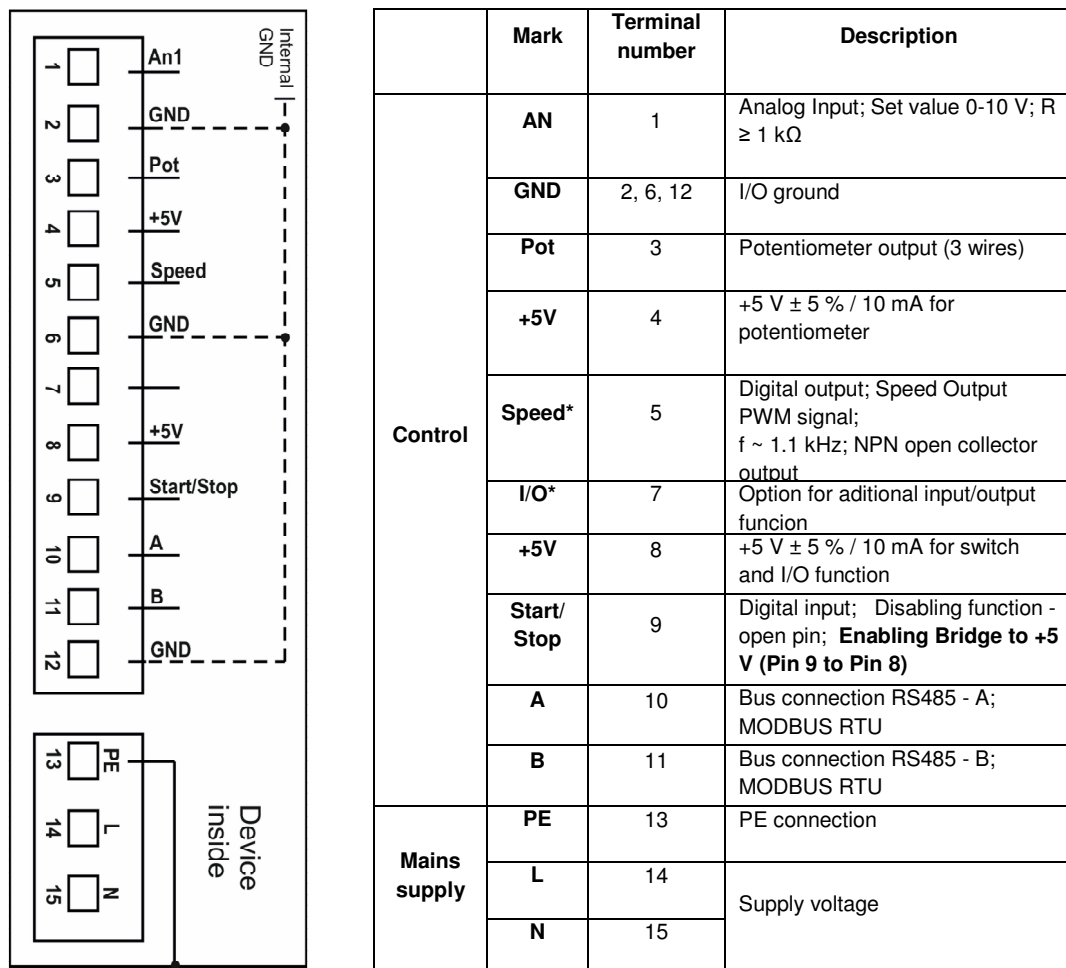


Fig.21b. Terminal strip of the EC motors 750W

4.11.5 Air Dampers

Air dampers applied in VS 400-650 AHUs are equipped with two separate pins as standard, they should be propelled with two actuators. Propulsion of the above mentioned air dampers based on a single actuator (regardless of its maximum torque) can result in inappropriate operation of the damper. In the case of AHUs equipped with water heat exchangers (heaters, coolers, glycol recovery) air damper's actuators of supply units should be equipped with a return spring ensuring its spontaneous closure in case of power cut.

4.11.6 Automatic control

Complete automatic control which should be an integral part of each air-conditioning system, enables continuous operation of a device, in many cases it is an indispensable element and lack of it may lead to serious operational problems or failures.

This documentation does not cover information regarding assembly of automatics, connection, starting-up and operation of the system.

This information can be found in separate documents supplied by VTS with the automatics set. In other cases appropriate information and documentation should be provided by the automatics supplier.

5. PREPARATION FOR START-UP

AHU start-up at putting the ventilation system into service can be carried out only by **qualified and competent personnel**. Before starting-up the system and ducting must be thoroughly cleaned. Check if:

- during assembly operations systems and devices' elements as well as automatics elements and equipment were not damaged,
- all ventilation devices are mechanically installed and connected to the ventilation system,
- ground cables connecting the control gear with ventilation ducts are installed,
- hydraulic and freon systems are fully installed and ready for operation and heating or cooling medium is present during the start-up,
- electric devices are wired and ready for operation,
- siphons and condensate drain-out system from drain plate are installed,
- all automatics elements are installed and wired.

5.1 Electrical system

Before closing connecting boxes of the electric devices check the following:

- basing on appropriate electric diagrams - conformity of connections,
- application of protection units for all electric devices,
- fastening all screws and appropriate assembly of any supporting elements and electric connections (also unused support terminals - if any),
- cables and wiring - for conformity with all relevant safety, functional, cross-section, etc. regulations,
- appropriate ground and protection systems,
- inside of connecting boxes - if there are no loose or redundant cables left,
- condition of sealing's and sealing surfaces.

5.2 Filters

Air filters in AHU prevent from getting dust into ventilated rooms. And what is more, they protect other AHU functional elements (e.g.: heat exchangers) against contamination.



The AHU can only be operated with assembled filters.

Before closing the filtration section please make sure to:

- remove protective foil from filters,
- assemble filters in their slideways so as the bag were in vertical position,
- check filters' condition and leaktightness of fitting in the slideways,
- check settings of differential pressure controls (if they are applied) which determine permissible static pressure difference qualifying a filter for replacement.

Table 10. Permissible pressure difference according to EN 13053

Filter type and class		Permissible pressure difference
P.FLT	G 4	150 Pa
B.FLT	G 4	150 Pa
	M 5	250 Pa
	F 7	250 Pa
	F 9	350 Pa

According to the Ecodesign 2018 Directive the AHU with a filter must be equipped with visual filter dirt indicator or the control system alarm to show when the pressure drop across the maximum value allowed for the filter.

Besides the full control system VTS offer separate device - pressure transducer with a display plate for installation on the filter inspection door. Detailed information can find in the separate document for the differential pressure indicator.

5.3 Water and glycol heaters

Check the following:

- condition of heater's lamellas,
- connection of supply and return pipelines,
- if the anti-frost thermostat's capillary is firmly attached to the heater's casing,
- setting of the anti-frost thermostat (factory setting: +5°C),
- if heater's control valve has been installed in accordance with markings shown on its casing.

5.4 Electric heaters

Check the following:

- electric connections, in accordance with electric diagrams for heaters' connection,
- connection of the protection thermostat,
- if the heating units do not touch other elements within the heating section,
- if the heaters' heating units are not damaged.

5.5 Water and glycol coolers, freon coolers and heaters

As in case of water heaters, check the following:

- condition of the cooler's lamellas,
- connection of supply and return pipelines,
- condenser position towards the air-flow direction,
- assembly of the siphon - fill it with water before starting the AHU up,
- passability of the condensate drainage system.

5.6 Evaporative humidifier

Check the following:

- **correctness and leak tightness of water pipe connections,**
- **electric connections, in accordance with electric diagrams**

5.7 Cross-flow and counter-flow heat exchangers

Check the following:

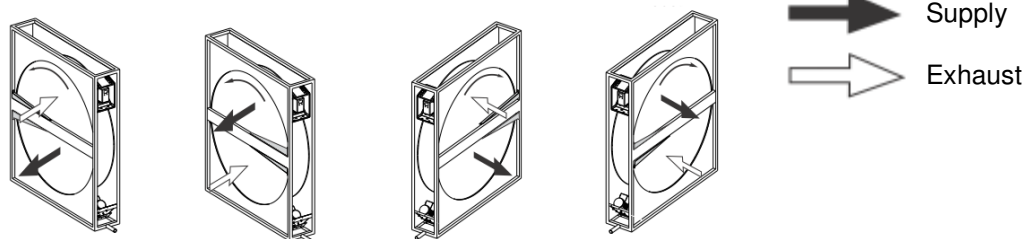
- condition of exchanger's lamellas (contamination, mechanical damages),
- operation of a damper assembled in the plate exchanger section,
- check if the droplet eliminator is firmly attached and if its position with regard to air-flow direction is correct,
- in AHUs with the droplet eliminator on the fan's pressing side check the size (H, fig.16), assembly of the siphon as well as passability of the condensate drainage system,
- before starting up the AHU, fill the siphon with water.

5.8 Rotary exchanger

Before starting up the exchanger, check the following:

- after removing the wedge-shaped belt - if the motor's rotor rotates freely,
- distance between the rotor and casing and adjust the sealing brushes, if needed,
- electric connections,
- if the cleaning air-lock is installed on the side of the supply-air duct,
- once the drive belt is assembled and the exchanger is turned on, make sure that direction of rotor's rotations led from exhaust-air ducts, through the cleaning air-lock and to the supply-air ducts (fig. 22).

VS 21-300:



VS 400-650:

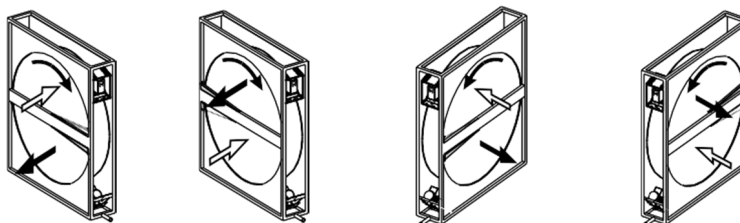


Fig.22. Direction of rotary regenerator rotations

5.9 Fan unit

Check if:

- there are no objects within a range of the fan, which might be sucked into the rotor once the fan is turned on,
- the fan's rotor rotates freely, without any friction against the casing elements,
- the motor is properly positioned and the system as well as operation conditions comply with data shown on the rating plate (supply voltage, current, frequency, winding connections),

- the fan's rotor rotates freely and does not touch the stator,
- air cooling the motor can freely come in and out of the motor's casing,
- ground and protection connection are done correctly,
- the fan's designed rotary speed will not be exceeded (see AHU technical data),
- all screws, supporting elements and electric connections are fasten firmly,
- supply cables located inside the fan section are far from any loose drive elements and they are fasten with appropriate clamps to the electric wiring,
- all dampers on the ventilation ducts network are set in accordance with the design,
- the rotor rotation direction is the same as a direction of the arrow placed on the fan's casing (switch on the fan by pulsing). If they are arrange in different directions, change with each other any two phases in the motor connection box or change rotation direction on the frequency converter,
- tension of the wedge-shaped belts and location of the pulleys is in line with the requirements of point 7.5.3.

Once the aforementioned control activities are performed, close carefully all AHU's inspection panels.



Operation of the device with open inspection panels is forbidden.

6. START-UP AND ADJUSTMENT

The start-up is going to test if the AHU is made in accordance with the design and is ready for operation.

Start up and ventilation/air-conditioning systems adjustment can be done only by qualified and competent start-up personnel, equipped with necessary test devices.

After completing activities described in point 5 you can proceed with the first start-up. In case of AHUs equipped with secondary filtration section it is recommended to start up the system without the secondary filter insert.

The fan should be started with lower load and lead towards parameters similar to the operational ones. Lower load can be achieved by pushing the damper to on the AHU inlet and additionally, in case of powering the motor through the frequency converter, by lowering the rotation speed.

During increasing the load, check all the time current consumed by the motor.



Always make sure that for designed air parameters current intensity powering the fan's motor cannot exceed the rated value.

Ignoring recommendations concerning the first start-up can lead to motor's overload and durable damage to the motor.

After start-up check if:

- there are no suspicious noises and unnatural mechanical sounds,
- there are no considerable AHU vibrations.

The AHU should operate for about 30 minutes. After that time turn it off and inspect individual sections. Pay utmost attention to:

- filters (if they are not damaged),
- condensate drain-out,
- fan unit (belt tension, fans and motors' bearing temperature).



It is recommended to ensure a preliminary opening of damper on AHU inlet in the automatics system before starting up the fan (standard of VTS automatics). It has some impact on the damper durability and operation and eliminates activation of pressure control.

After starting up the AHU replace or clean the preliminary filters.

Achieving required performance of the AHU depends, among the others, on carried out adjustment

and test measurements.

6.1 Measurement of air quantity and AHU output adjustment.

Measurement of air quantity is a primary measurement in case of:

- AHU start-up and technical acceptance,
- when the system does not operate in line with the requirements and expectations,
- periodic control of AHU operation and performance,
- replacement of fan unit elements.

Before starting measurements and adjustment make sure to:

- check if damper at all air grates or registers are adjusted in line with the design.
- set fresh- and recycled-air dampers (if applicable) in end position - 100% of fresh air or full recirculation,
- measure the current consumed by the fan's motor. If it is necessary minimize the air flow with the main damper or reduce the fan rotation speed.

Determining quantitative air stream is based on the measurement of average air-flow speed in the ventilation duct test cross-section. One of the most common ways of determining average speed is the cross-section probing method with the Prandtl pipe and measurement of the speed-related average dynamic pressure.

Crucial factors influencing the measurement accuracy are:

- location of the measured cross-section in relation to the elements,
- quantity and location of test points in the measured cross-section,
- stable and constant air flow.

It is highly recommended NOT to locate the measurement cross-section directly after:

- network elements causing deformation of velocity speed (knees, reductions, three-way connections, dampers, etc.), fan, because in the cross-section some reverse speed may appear.

The measurement should be carried out at the duct's fragment with parallel walls and straight segments at least 6 times longer than the duct diameter or equivalent diameters before the test point and not less than 3 diameters after it. In the real ventilation system finding such a long straight fragment can be a problem. In such a case determine the measurement cross-section in a place where the smallest distortions of air-flow are expected and intensify a network of test points. Location of the measurement cross-section should be determined on the system design stage. Detailed recommendations concerning air-flow measurement and location of test points are defined by the ISO 5221 standard.

We estimate the output being measured as sufficient unless it differs more than $\pm 10\%$ from the designed one. In case of bigger disproportions, the output alike the designed one can be achieved by:

- adjustment of the ventilation ducts network,
- changing adjustment of the main damper,
- changing the fan rotary speed.

While increasing fan's rotary speed you must by all means control motor's power consumption and do not allow to exceed designed rated current value. For durability and permissible operation parameters it is also very important not to exceed maximal rotor speed. In justified situations, when there is a need to increase the air-flow output, it is recommended to apply a more powerful fan's motor.

In systems equipped with dampers which automatically change ratio of fresh, recycled and exhausted air or by-pass flow ratio, output measurements and main damper adjustment should be carried out in end position of the setting. Next check the air ratio and overall output in the other end position and, if necessary, carry out appropriate adjustment in order to achieve proper ration at constant overall output.

6.2 Heat output adjustment of water heater

Heater output adjustment is proceeded by setting appropriate amount of air passing through the AHU.

Heater output adjustment consists in checking the heater's performance from the air's side through temperature measurements in front and behind the heater, at designed supply and return temperature values and amount of heating medium in the system.

Heater's output is controlled by adjustment of water supply temperature. It is achieved by mixing up in the three-way valve supply water with high temperature and water coming back from the heater, with lower temperature. Once mixed, water getting to the heater reaches appropriate temperature - depending on the mixing level.

External conditions, similar to the rated ones occur within an annual cycle during relatively short period. In most cases you have to take into consideration the fact that the adjustment must be carried out in intermediate conditions, which must be recalculated in order to conform to the rated values.

Checking operation of the anti-frost thermostat is possible only when temperature of air supplied onto the exchanger is lower than the thermostat setting (factory setting: +5°C). It is safe to carry out this activity when the supply air temperature is 1-2 degree above 0°C. Then, when the AHU is running, cut for a moment the inflow of heating medium and watch if the thermostat is triggered. This operation should be carried out before putting the AHU into service.

6.3 Adjustment of electric heater

Power adjustment of electric heater is carried out in most cases by means of turning off individual group of heating coils. Multistage control (table.8) is carried out through connecting specific heating coils with each other. Smooth control of heater power is carried out by applying the VTS control module.

Perform simulation of lower power requirement by decreasing the set temperature value so as all electric steps (contactors) were in off position. Next increase significantly the setting and check if all electric steps turn on in the order in accordance with the operation description. Restore the previous temperature setting.

Also check operation of overheating protection in case of lack of air-flow. To do so, reduce the air-flow stream flowing through the heater by pushing to the inlet damper or by reducing the fan's speed.



During AHU operation speed of air flowing through the heater should not be lower than 1.5 m/sec.

Please note that the lower air-flow is the more possible it is to overheat the system.

Bringing AHU to a standstill must involve some delay (0.5-5 minutes), so as to cool down heating coils of the electric heater.

6.4 Adjustment of cooler performance

Adjustment of cooler performance should be carried out in conditions similar to the rated ones. As in case of the heater, the effect from the air side is considered, including temperature and humidity in front and behind the cooler.

Temperature of cooling agent is controlled this way as well. If cooler operation effect is not satisfactory, appropriate adjustment is required. It can be carried out using the following methods:

- adjustment of cooling medium amount (water coolers),
- adjustment of air amount passing through the AHU (water cooler and coolers with direct medium evaporation),
- adjustment through changing evaporation temperature (in case of systems with direct evaporation).

Coolers operate in most cases in complex air-conditioning systems equipped with automatic control. Automatic control devices should be tested not only in extreme conditions but also in intermediate cooler load circumstances.

6.5 Adjustment of humidifier

To the humidifier the water flow should be adjusted. Water consumption must be adjusted for a specific AHU, so that the pad will clearly wet on the entire surface.

Table 10 shows the minimum and nominal value of the water flow for standard work point:

- air inlet temperature 40°C
 - relative humidity 15%
- air velocity in the humidifier pad 2,5m/s

Table 11. Value of the water flow

AHU size	Min. water feed	Nom. water feed
VS	l/min	l/min
21	0,54	1,08
30	0,79	1,58
40	0,97	1,95
55	1,49	2,98
75	1,68	3,37
100	2,24	4,47
120	2,71	5,42
150	3,31	6,61
180	4,16	8,32
230	5,03	10,05
300	6,79	13,58
400	9,64	19,28
500	11,27	22,54
650	15,26	30,53

Increasing the air flow results in a linear increase of water consumption. On the water consumption also affected by temperature and humidity of the air entering the humidifier (Table 12).

Table 12. Influence of temperature and humidity on the water consumption.

T°C \ rH	0%	10%	20%	30%	40%	50%
15	0,64	0,58	0,51	0,44	0,38	0,3
20	0,74	0,68	0,6	0,51	0,44	0,35
25	0,84	0,78	0,68	0,59	0,5	0,4
30	0,95	0,88	0,77	0,66	0,57	0,46
35	1,06	0,98	0,85	0,73	0,63	0,51
40	1,18	1,08	0,94	0,81	0,69	0,56
45	1,29	1,18	1,02	0,88	0,75	0,61
50	1,4	1,28	1,11	0,95	0,82	0,67
55	1,53	1,38	1,19	1,03	0,88	0,72
60	1,65	1,48	1,28	1,1	0,94	0,77

For example: the inlet air temperature of 30°C and humidity of 20% rH, the humidification efficiency and water consumption amount take the 0.77 of the values specified in Table 10.

7. OPERATION AND MAINTENANCE



Personnel in charge of AHU operation should read through this documentation before starting any operation and maintenance activities. When no such personnel with appropriate skills and competence is available, periodic inspections should be carried out by the authorized VTS service providers.



Any damages of the AHU or its parts resulting from not following the guidelines stated in this documentation will not be subject to warranty claims.

Basic AHU technical data such as type, parameters and dimensions of the most significant parts (filters, heat exchangers, fans, electric motors) are provided in the Technical Data Card supplied with each device.



Any AHU maintenance operations should be carried out with the device turned off. In order to ensure safe device operation, a service switch cutting off power supply to the motor during service operation must be installed outside the fan section. Switching off the power circuit with the service switch must be held in non-voltage state. The service switch should be located close to the inspection panels of the fan section.

Thorough and regular maintenance as well as technical inspections of the AHU and its components are necessary in order to find the failures at their early stage - before more serious damages appear.

This documentation only covers general guidelines regarding control periods ensuring error-free operation of the AHU due to various possible external conditions of AHU operation. Control periods must be adapted to local conditions (contamination, number of start-up cycles, load, etc.).

Personnel in charge of the AHU should from the first AHU start-up keep up-to-date records making use of the "Inspections and maintenance table" which is included in the Warranty Card. Any routine works related to the AHU operations should be recorded there. Carefully kept register is the only reliable document stating the unit operation condition, dates of current inspections, identified problems, etc. In case of contact with the VTS representatives always use the AHU factory identification number, located on the casing as well as in the AHU documentation.

Duration of periods between particular actions have been determined with assumption that the AHU works "non-stop" in low-dust environment and with no other disadvantages deteriorating the operation conditions. In environments with high level of dust in supply or exhaust air, the inspections should be carried out more frequently.

AHU spare parts and accessories can be ordered at local **authorized VTS service provider**. While ordering parts please use the type and factory identification number of the device. This information can be found on the rating plate located on the fan section.

7.1 Dampers

If the damper is contaminated and does not operate freely it should be cleaned in one of the following ways:

- with industrial vacuum cleaner with soft suction nozzle,
- blow through with compressed air,
- wash with water under pressure with cleaning agents which do not cause aluminum corrosion.

The damper should be accurately sealed after re-assembly, first of all from the side of external air, otherwise the water heater can be frozen.

7.2 Filters

In standard AHU operation conditions the filters should be replaced circa each twice a year. Necessity of replacing the filter (beside the visual contamination) is also indicated by pressure drop according to the data shown in Table 9.

The AHUs can be equipped with the following filters:

- B.FLT preliminary bag filters, G 4, M 5, F 7 and F 9 class
- P.FLT preliminary panel filters, G 4 class
- B.FLT secondary bag filters, F 9 class.



Filtration level may vary depending on the filter type and that is why this is very important to install the same filter with the same filtration class.

If the final pressure difference exceeds designed value, it must be replaced. Panel filters - FD and bag filters - FK are disposable elements.

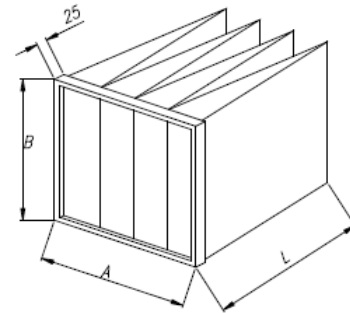
During filter replacement also clean the filtration section - vacuum or dry cleaning.



In case of ordering a new filter set at the VTS authorized service provider, provide filter type, filtration class, AHU size and, if needed, size and number of filters according to the following table. The AHUs always have to operate with installed air filters, otherwise fans power consumption may exceed designed values, which may lead to damage of the motor's wiring.

Table 13. Bag filters used in AHU VS 21-650

AHU size	Number of B.FLT bag filters with AxB dimensions for a filtration section					
	592x287	592x592	428x428	490x490	490x592	428x287
VS 21	-	-	-	-	-	2
VS 30	-	-	2	-	-	-
VS 40	-	-	-	2	-	-
VS 55	-	2	-	-	-	-
VS 75	-	-	3	-	-	3
VS 100	-	-	-	3	-	3
VS 120	3	3	-	-	-	-
VS 150	-	-	-	8	-	-
VS 180	-	-	-	-	8	-
VS 230	-	8	-	-	-	-
VS 300	-	-	-	15	-	-
VS 400	-	-	-	6	12	-
VS 500	-	-	-	7	14	-
VS 650	6	18	-	-	-	-



L=300 for G4 and F5 class filters
L=600 for F7 and F9 class filters

Table 14. Panel filters used in AHU VS 21-650

AHU size	Number of panel filters P.FLT G 4 for a filtration section			
	Size	Amount	Size	Amount
	AxB	pcs	AxB	pcs
VS 21	362 x 441	2		
VS 30	394 x 495	2		
VS 40	495 x 495	1	492 x 594	1
VS 55	394 x 622	3		
VS 75	362 x 441	6		
VS 100	394 x 495	6		
VS 120	391 x 594	6		
VS 150	445 x 622	3	495 x 622	3
VS 180	495 x 495	4	495 x 622	4
VS 230	492 x 594	4	594 x 594	8
VS 300	394 x 622	4	495 x 622	8
VS 400	394 x 495	6	495 x 622	12
VS 500	394 x 495	7	495 x 622	14
VS 650	492 x 594	12	594 x 594	12

7.3 Heat exchangers

7.3.1 Water and glycol heater

Operating water heaters should be equipped with anti-frost system. Optionally, in winter period replace heating medium of the heater with antifreeze medium (e.g.: glycol solution). In case of cutting off inflow of heating medium or operational standstill of the AHU and if air temperature may drop below + 5°C, the heater should be emptied.

In order to do so, please:

- close the valves at the heating agent's inflow and outflow (cut the heater off from the heating system)
- move the inspection panel towards the safety valves
- unscrew the drain and the vent plug from collectors
- connect the outflow hose to the drain to let the water go out of the drained exchanger outside the AHU
- blow through the heater with compressed air connected to the vent

- repeat this procedure several times at short intervals until only air goes out of the drain hose without any visible drops of water
- screw the drain and vent plugs back

Check contamination level of heater's lamellas at least every four months. Dust deposition on the heater surface deteriorates the heater's heating power and lead to pressure drop on the air side. Even if the AHU is equipped with filters, with time from the air supply side, dust settles onto the heater's lamellas. In case of contamination, cleaning should be carried out in one of the following ways:

- with a vacuum cleaner with soft suction nozzle from the air inlet side,
- by blowing through with compressed air in a direction opposite to normal air flow direction, directing air stream in parallel to the lamellas,
- washing with warm water with cleaning agents which do not cause aluminum or copper corrosion.

Before starting washing protect neighboring AHU sections against discharged dirt.

In order to achieve max. heating output of the heater, it must be well vented. Venting plugs are designed to do so and they are placed on heater's collectors.

During the AHU standstill, flow of the heating medium should be reduced to minimum so as temperature inside the AHU does not exceed + 60°C. Exceeding this value may lead to damage of some elements or subassemblies (motor, bearings, plastic elements, etc.) installed in the neighboring sections.

7.3.2 Electric Heater

Electric heater's battery consists of bare heating coils. During AHU operation, when the heater does not work, dust may settle onto the heating coils. Once the heater is turned on again, strong contamination may cause smell of burning dust or even preliminary fire danger may appear. Check regularly (every 4 months) and especially before starting a heating period, any electric connections, condition of heating elements and their contamination level. Any possible contamination should be removed with a vacuum cleaner with soft suction nozzle or with compressed air.



Wet cleaning of electric heater is forbidden!

Also check operation of overheating protection in case of lack of air-flow. Air speed should not be lower than 1.5 m/s.

7.3.3 Water or glycol cooler

Contamination level of the cooler should be checked each four months. If necessary, the cooler can be cleaned applying methods of cleaning the water heater.

Before starting washing protect neighboring AHU sections against discharged dirt.

While checking contamination level, check the condenser status as well as passability of water siphon. The water siphon should be filled with water before starting up the AHU.

If the condenser is contaminated it should be washed with warm water with some cleaning medium.

In case of glycol cooler check level and density of glycol in the system. In order to achieve max. output of the cooler, it must be well vented. Venting plugs are designed to do so and they are placed on cooler's collectors.

7.3.4 Freon cooler and heater

Maintenance of freon cooler covers the same range as the water heater and cooler. While washing the freon cooler with warm water, the cooling system should be emptied by sucking off freon to the container. Otherwise there is a risk of uncontrolled increase of freon pressure and damage of the cooling system.

7.3.5 Humidifier

Periodic maintenance operations of the humidifier boils down to clean the strainer-type filter on the water supply pipe at least twice a year, and at least once a year, check the following:

- all wires about aging, cracks, current leakage, etc
- water pipes and joints about aging, cracks and leakage
- if the water pump has abnormal sound or peculiar smell during the running

7.3.6 Cross-flow and counter flow heat exchanger

Check the exchanger every four months and inspect its technical condition as well as contamination level. Dirt accumulation in plate heat exchangers is often limited to the first 50mm in the exchanger. Before starting washing protect neighboring AHU sections against discharged dirt.

Necessary cleaning should be carried out using:

- vacuum cleaning with soft suction nozzle,
- blowing through the ducts with air stream in a direction opposite to the normal air flow direction,
- washing the air ducts at their whole length with water with cleaning agents which do not cause aluminum corrosion,
- in case of very contaminated exchangers you can use stream of compressed water to clean them.

While cleaning the exchanger using mechanical cleaning agents pay utmost attention not to damage or deform the exchanger's panels.

During exchanger operation in below zero temperature, the exchanger must be thoroughly dried before next start-up.

And what is more, please check:

- damper's operation,
- condenser's condition,
- draining tray's condition,
- passability of the condensate drainage system,
- before starting the AHU, fill the water siphon with water, assembly of anti-frost system (if any),

In the units VS 21-55 counter-flow exchanger is installed as a one piece, similar as cross-flow recuperator, and access to it is directly after opening the inspection door. In the units VS 75-650 hexagonal exchanger is inbuilt vertically and consist on one, two or more pieces assembled in separate construction. Each of that construction is possible to move out of the AHU.

Steps to remove the exchanger from the AHU

- 1) Unscrew the screws fixing horizontal columns (pos.1. fig.23) and remove them
- 2) Unscrew the screws fixing vertical columns at the top and bottom (pos.2. fig.23) and remove them from the unit
- 3) Unscrew the bolts fixing the exchanger cage. Bolts are placed at the top and bottom (pos.3. fig.23) and the middle (pos. 4. fig.23) part of the AHU. In the units VS 75-230 is additional fixing to the ceiling (pos.5. fig.23).
- 4) Remove exchanger cage from AHU (pos.6. fig.23).

Number of columns, screws and bolts necessary to disassembly depend on the size of unit.

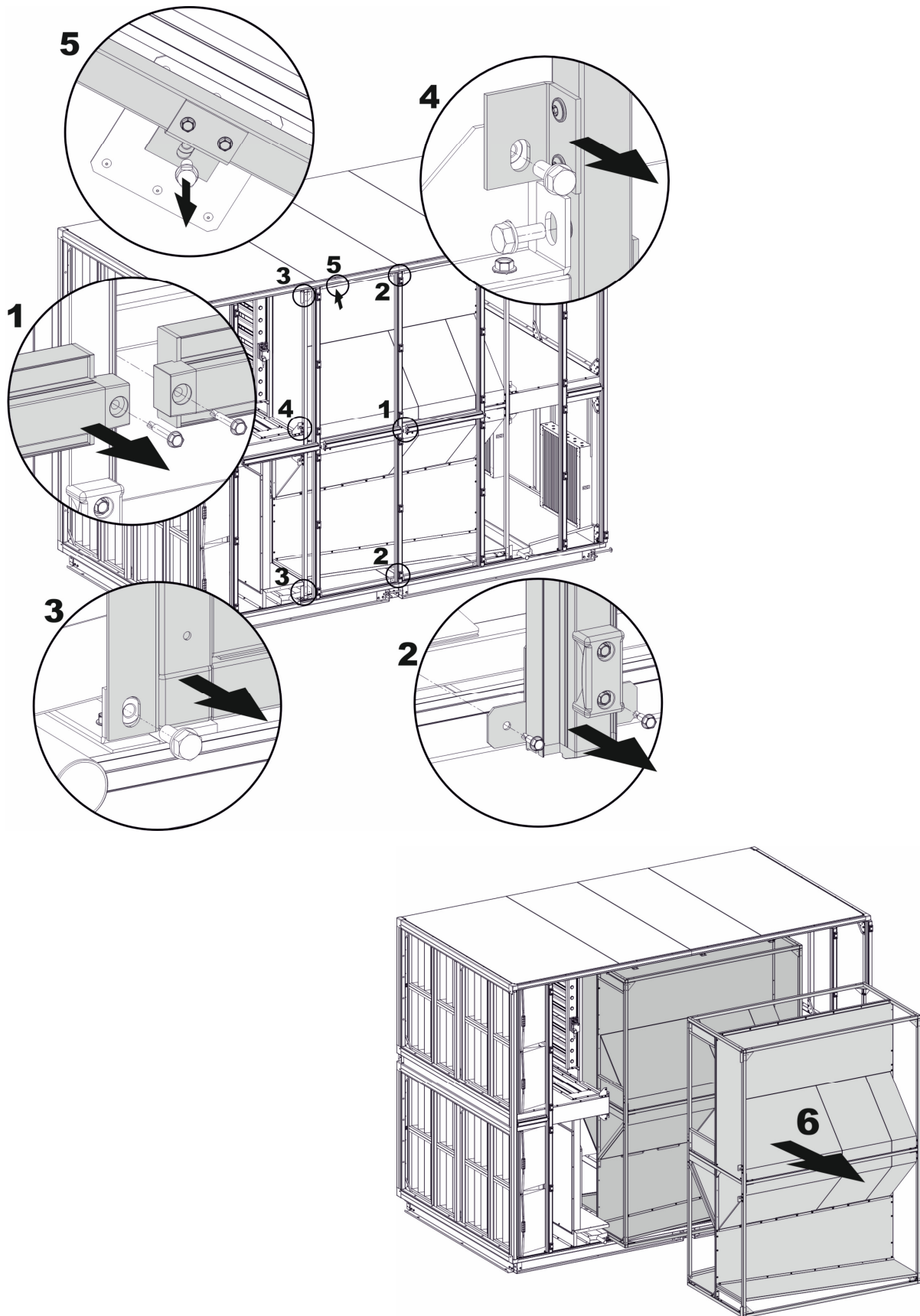


Fig.23. Disassembly of the counter-flow heat exchangers from the unit VS 75-650

7.3.7 Rotary exchanger

Check the exchanger every four months and inspect its technical condition as well as contamination level of the rotor. During maintenance activities of the rotary exchanger check if:

- rotor rotates freely. Sensible resistance can be caused by too excessive hold down of sealing brushes and touching the rotor's edges. In such a situation adjust the brushes properly. Worn out brushes sealing should be replaced. If previously removed brush sealing is to be installed again, it should be installed so that its direction should be in line with the rotor's rotation direction. After replacement or adjustment of sealing brushes, the exchanger should operate 30 minutes so that the brushes could adapt to the rotor's surface.
After this time check the motor's current and compare it with the rated current in order to find out if the motor is not overloaded.
- drive belt is not damaged and if it is clean as well as if it does not slip on the cylindrical part of the rotor. If despite maximal tension by the strain system the clearance still exists, the belt should be replaced or shortened,
- air inlet holes are not covered with dust or contaminated in any other way. In order to clean the rotor apply one of the methods designed for other exchangers.

Rolling bearings of rotor and drive motor are greased in continuous manner during operation. Amount of grease in bearings during the exchanger assembly is enough for long-lasting operation and there is no need to lubricate the bearings during operation. It is recommended to clean the motor and gear from dust so as an insulation layer was not formed on the motor's surface which may lead to increase of drive operating temperate.

7.4 Suppression section

Suppression section is equipped with slotted lever filled with non-flammable mineral wool absorbing acoustic energy. Maintenance procedures entail checking contamination level of suppression inserts. If cleaning is necessary the slotted levers can be removed one after another through the section inspection holes, previously removing screws fastening the levers to the bottom and top. Re-assembly of the slotted levers in the section should be carried out in reverse order.

leaning should be performed with a vacuum cleaner or wet wiping of all surfaces. In case of more serious contamination you can use nylon brushes.

7.5 Fan unit

Before starting any kind of works (failure, maintenance, servicing) with AHU, especially in case opening the inspection panels of fan section as well as removing cover plates under the drive, please make sure if:

- the device has been properly disconnected from power supply. It applies to both main and secondary circuits,
- rotor is not rotating,
- fan is cold and the surface temperate is safe,
- the fan is protected against unintended start-up.

7.5.1 Fans

Fans are designed for transferring dust-free or light-dusted air. They are not designed for aggressive gases, steams or heavy-dusted air. Operating the fan in not suitable environment can lead to damage of bearings, corrosion, unbalanced rotor or vibrations.

The fan and motor in the unit are designed for particular requirements and operation characteristics. Fan rotation speed is adapted so as the air stream and complete fan stress concentration were appropriate for a given ventilation system. Smaller stream of forced air results in disturbances in correct operation and leads to loss of balance of the entire ventilation system. It can be caused by:

- slipping drive belt,
- dust settlings on the fan's rotor blades,
- incorrect direction of fan's rotations. If the centrifugal fan rotates in incorrect direction, the air flow is carried out with significantly deteriorated output.

In case of fan maintenance activities check if:

- the rotor rotates freely,
- the rotor is well balanced,
- the rotor is firmly mounted on pivot,
- did not change a location against the inlet funnel,
- vibroisolators (if any) are firmly installed and they are not damaged,

- flexible connection (if any) is not damaged,
- all screws fastening construction elements of the fan unit are tight.

Lack of rotor's balance can be caused by:

- dust settlings on the rotor's blades,
- detachment of additional balancing weights,
- damage of the rotor's blades.

Checking the contamination level of the casing inside, rotor and motor should be carried out every four months and the following elements should be cleaned:

- casing inside with a vacuum cleaner,
- rotor with a vacuum cleaner or by wet wiping with soft cleaning agent.

In order to achieve required life of the fan, it is necessary to check and clean the bearings regularly. Fan bearings should be checked while carrying out other maintenance procedures.

Rotate with hands the fan's rotor to check if it rotates freely and correctly. If you can hear:

- silent sounds while rotating as a silent, soft and steady murmur - it means that the bearing operates correctly,
- grinding noise - lubrication is required,
- harsh, often irregular noises, scrubbing or metallic, frequent noise - the bearing is damaged. Please replace the bearing.

Check the bearing temperature with a thermometer or by touching the bearing's casing. If the temperature is too high or if it changes violently, it means that the bearing does not work correctly. A possible reason might be:

- lack or excess of grease,
- contamination, overload or damage of the bearing's balls,
- bearing clamping,
- excessive sealing friction,
- external heating

Temperature increase is a normal phenomenon during first 1-2 days after lubrication.

During appropriate operation bearings of direct driven fans do not need to be greased. Bearings of fans with no casing with a belt drive are equipped with grease applicators. In this case bearings should be greased with solid grease for bearings (table 13), in intervals characteristic of the AHU operation intensity and current technical condition of the bearing. It is recommended to grease once per each 9 months if the AHU operates in temperature not higher than 50°C, and in case of higher temperatures every 4 months. Amount of grease depends on the fan size and applied bearings. Excess of grease in the bearing casing results in increase of the bearing temperature, especially in case of high rotation speed. After several greasing procedures, open the bearing casing and remove old grease before applying the new one.

Table 15. Recommended greases for bearings

Manufacturer	Type	Base	Range of operation temperature (min/max)
FINA	Marson HTL 3	Lithium	-30°C / +120°C
SHELL	Alvania Fett 3	Lithium	-20°C / + 130°C
ESSO	Beacon 3	Lithium	-20°C / + 130°C
MOBIL	Mobilux EP3	Lithium	-30°C / + 130°C
SKF	LGMT 2/S	Lithium	-30°C / + 110°C

FANS BEARINGS

Depending on a type, size and shaft power, fans assembled in the AHUs are equipped with various types of bearings.

Fans without a casing equipped with PEAFA..KBT 1 belt drive (table 16 a) are delivered with already greased ball bearings in cast-iron casings.

Amount of grease used for lubrication as well as the lubrication interval depends on a bearing type and its rotary speed.

Replacement of bearings assembled in cast-iron single casings in fans type PEAFA...KBT 1:

1. Ease protection screws 1 and remove protection rings 2 out of bearings with a centre punch and hammer. Remove pins 3 from a cast-iron bearing casing and remove screws 4 fastening the casing. Remove the casing with the bearings out of the shaft. Using appropriate tools, hold the shaft in an appropriate position in order not to damage the inlet funnel or rotor's wheel.
2. Replace the bearings and install new ones in the cast-iron casings.
3. Assemble the casings onto the frame paying attention to preserving coaxiality of the rotor and inlet cone. Tighten up screw fastening the casing. Install protection rings onto the bearings clamping them according to the fan's rotations direction and secure them with fixing screws. Turn the wheel several times in order to check if it rotates correctly.

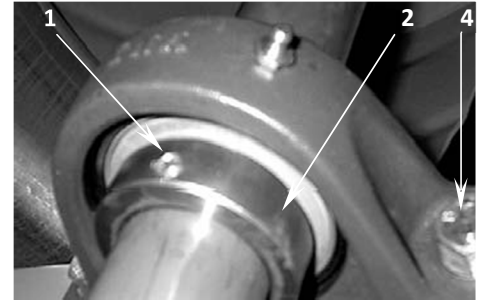


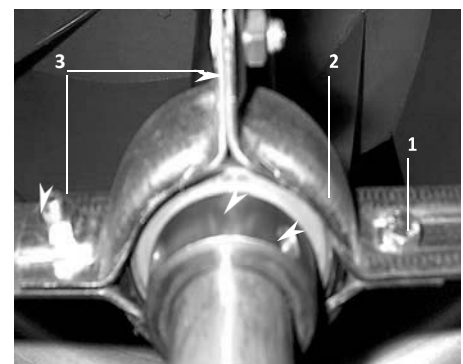
Table 16a. Fans bearings without casing, version PEAFA..KBT 1

Unit	Fan's type	Hole (mm)	INA		SKF	
			Bearing unit type	Bearing type	Bearing unit type	Bearing type
VS 180	PEAF 630 KBT 1	40	PASE 40	GRAE 40 NPPB	SY 40 FM	YET 208
VS 230	PEAF 710 KBT 1	50	PASE 50	GRAE 50 NPPB	SY 50 FM	YET 210
VS 300	PEAF 800 KBT 1	50	PASE 50	GRAE 50 NPPB	SY 50 FM	YET 210
VS 400	PEAF 900 KBT 1	60	PASE 60	GRAE 60 NPPB	SY 60 FM	YET 212
VS 500	PEAF 1000 KBT 1	60	PASE 60	GRAE 60 NPPB	SY 60 FM	YET 212
VS 650	PEAF 1120 KBT 1 (inlet cone site)	60	PASE 60	GRAE 60 NPPB	SY 60 FM	YET 212
	PEAF 1120 KBT 1 (belt drive site)		RSAO 60 FA 106	GNE60-KRR-B	-	-

In fans type TAE ... / TDF ... (table 16 b) balls bearing are installed in the rubber amortizing ring (TAE fans ...) or in the cast-iron casing (TDF fans ...).

Replacement of bearings mounted on cross-bars in TAE type fans :

1. Ease the securing screws (1) and remove the securing rings (2) from bearings with the use of a centre punch and a hammer. Slide the securing rings from the shaft. With the use of appropriate tools hold up the shaft in the correct position in order not to damage the inlet cone or the rotor wheel.
2. Disconnect the cross-bars (3) from side panels and slide them off the shaft together with the bearing. Remove old bearings and rubber rings and fit new bearings and rubber rings on cross-bars.
3. Fix the cross-bars on the side panels paying attention to the coaxiality of the rotor and the entrance cone. Tighten the screws fastening the cross-bars to the side panels. Fix the securing rings on the bearings by tightening them in accordance with the direction of fan rotation and secure them with retaining screws. Next spin the wheel to verify if it rotates properly.



Replacement of bearings mounted on cross-bars in TDF type fans :

1. Deflect the securing washer (1) with the use of a screwdriver and unscrew the nut (2).
2. Knock out the inside sleeve (3) with the use of a copper hammer and remove screws (4) fastening the casing. Slide the casing together with the bearing off the shaft. With the use of appropriate tools hold up the shaft in the correct position in order not to damage the inlet cone or the rotor.
3. Replace bearings by fitting new ones in cast iron casing (you should pay attention to the fact that the inside diameter of the bearing is cone-shaped and the bearing should be installed with the bigger diameter from the side of the fan's rotor).
4. Fix the casings on the frame paying attention to the coaxiality of the rotor and the entrance cone. Tighten the screws fastening the casings. From the side of the cone drive the sleeve previously slid on the shaft with the use of the copper hammer. Fix a blocking washer with a nut and deflect the washers blocking pawl with the use of a screwdriver. Next spin the wheel to verify if it rotates properly.

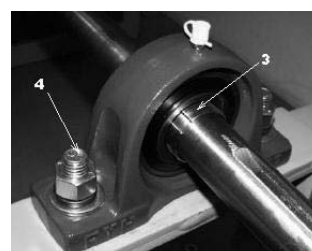
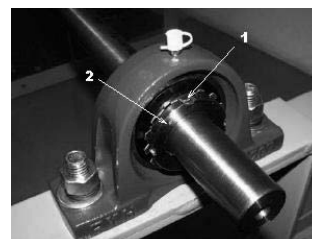


Table 16b. Fan bearings in casings version TAE... / TDF...

Unit	Fan's type	Hole (mm)	PEER / FYH		
			Bearing unit type	Bearing housing type	Bearing type
VS 21	TAE160/D	12			FH204 -12G
VS 30	TAE200/D	12			FH204 -12G
VS 40	TAE225/D	12			FH204 -12G
VS 55	TDF280/HM	25	UKP206	P206	UK206
VS 75	TDF315/GM	35	UKP208	P208	UK208
VS 100	TDF355/GM	40	UKP209	P209	UK209
VS 120	TDF400/GM	40	UKP209	P209	UK209
VS 150	TDF450/GM	45	UKP210	P210	UK210
VS 180	TDF500/HM	45	UKP210	P210	UK210
VS 230	TDF560/HM	45	UKP210	P210	UK210
VS 300	TDF560/GM	55	UKP212	P212	UK212
VS 400	TDF630/GM	60	UKP213	P213	UK213
VS 500	TDF710/GM	65	UKP215	P215	UK215
VS 650	TDF900/GM	70	UKP216	P216	UK216

After inspection and maintenance check the fan's rotations. If the fan's rotations direction is not correct, the air will flow in a correct direction but the fan's output will significantly decrease. The fan's rotations direction may change due to some electric changes in the electric system and that's why it should be controlled.

7.5.2 Motors

Thorough and regular maintenance and motor's condition check is necessary in order to detect faults before serious damages occur.

Before starting any kind of works related to the motor or its subassemblies, particularly before removing covers protecting against unintended contact with spinning elements or electric shock, the device should be disconnected from power supply. What is more all additional and secondary circuits should be disconnected as well.

Please follow the safety regulations below:

- disconnect power supply,
- apply protection module against unintended switching on the device,
- check if source of power supply is not in contact with the device in any way,
- apply covers for neighboring live devices.

All precautions listed above should be maintained till all maintenance activities are finished and the motor is fully assembled and ready for work.

In case of fan's motor maintenance activities check if:

- designed technical data are met (power consumption, winding and bearing temperature),
- grease leakage occur,
- the motor operates correctly and if there are any noises related to the motor and bearings operation,
- all mechanical and electric connections are firmly fixed,
- windings' resistance is correct,
- cables and insulation is in a good condition and if there are no changes in their color.

Any noticed changes and abnormalities should be fixed immediately. And what is more:

- check the bearings according to the point describing checking the fan's bearings,
- check if the motor is firmly installed and fastening screws tighten up,
- check contamination level of the motor casing.

Excessive contamination deteriorates motor's cooling and in turn it can lead to overheating of the motor's winding and its damage. The motor can be cleaned with a dry brush or blow through with compressed air.

MOTOR'S BEARINGS

Motors as standard are equipped with ball bearings of 62.... series which are equipped with a shield. During bearing replacement or lubrication the motor must be disassembled. While doing so all individual parts must be clearly marked according to disassembling order. For disassembly of aligned elements a puller or other appropriate tool must be used.

Remove the bearing, clean the shaft's pin, clean or replace the bearing and install it with new grease. The bearing should be evenly heated till it reaches 80-100°C and then push it. Avoid strong blows (e.g. with a hammer). All worn sealing elements should also be replaced.

All empty bearing spaces should be filled with grease. In order to avoid too excessive lubrication, do not apply grease onto bearing casing and covers.

In case of motors operating in rated conditions at ambient temperature up to 40°C grease life is:

- about 20 000 working hours for rotation speed up to 1500 rpm
- about 10 000 working hours for rotation speed up to 3000 rpm For operation at 25°C these times are longer by about 100%.

Regardless of number of working hours, grease should be replaced every 3 years due to ageing effect. In such a case the bearing should be disassembled from the motor, cleaned and lubricated again.

Type of grease used for motor bearing: **ESSO/UNIREX N3**.

Provided grease life and lubrication intervals correspond to this grease only.

Do not mix different grease types!

Table 17. Specification of „Siemens” motors' bearings - fans with intermediate drive

Mechanical motor's size	Bearing at the drive side	Bearing at the motor's back
71	6002-2Z-C3	6002-2Z-C3
80	6004-2Z-C3	6004-2Z-C3
90	6205-2Z-C3	6004-2Z-C3
100	6206-2Z-C3	6205-2Z-C3
112	6206-2Z-C3	6205-2Z-C3
132	6208-2Z-C3	6208-2Z-C3
160	6209-2Z-C3	6209-2Z-C3
180	6210-Z-C3	6210-Z-C3
200	6212-Z-C3	6212-Z-C3
225	6213-Z-C3	6213-Z-C3
250	6215-Z-C3	6215-Z-C3

Table 18. Specification of motors bearings „VTS”- fans with direct drive

Mechanical motor's size	Bearing at the drive side	Bearing at the motor's back
71	6202-ZZ-C3	6202-ZZ-C3
80	6204ZZ-C3	6204ZZ-C3
90	6205ZZ-C3	6205ZZ-C3
100	6206ZZ-C3	6206ZZ-C3
112	6206ZZ-C3	6206ZZ-C3
132	6208-ZZ-C3	6208-ZZ-C3
160	6309-C3	6309-C3

For EC motors are used bearings type: 6202 ZZ C3E

7.5.3 Belt transmission

During operation activities of the fan unit you have to check tension of wedge-shaped belts and their parallel alignment. Factory-set belts tension should be checked after first 50 working hours and then carry out regular adjustment every 4 months. Too loose belt can fall off the pulley or slide on it and in turn may wear out quickly, but on the other hand too tight belt may result in bearing overheating and damage as well as motor's overload.

Tension check should be carried out in the following way:

1. Measure a distance between wheels' axes (A size. fig.24).
2. Measure power P needed in order to bend the belt by $S=16$ mm for each running meter of a distance between the axes, more or less in halfway between the axes (fig.24).
3. Increase the belt tension if the power has got a smaller value or decrease - if the power has got bigger value than the one shown in the table.
4. Recommended belt tension is equal to $0.8 \times P_{max}$

In case of incorrect belts tension, stretch them by moving the motor with a stretching screw located in the motor panel (fig.26), and compare tension values with the values shown in the table 18

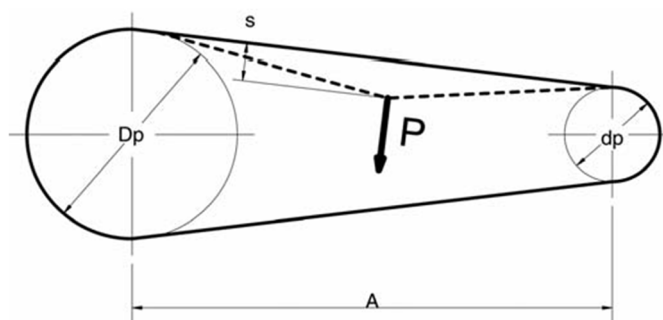


Fig.24 Deflection of a wedge-shaped belt

Table 19 Deflection power value P* depending on type and diameter „d_p” of the smaller wheel

Diameter of the smaller pulley d _p [mm]	SPZ		SPA		SPB	
	67-95	100-140	100-140	>140	160-236	>236
Deflection force P* [N]	10-15	15-20	20-27	28-35	35-50	50-65
Deflection force P* [Kg]	1.0-1.5	1.5-2.0	2.0-2.7	2.8-3.6	3.6-5.1	5.1-6.6

*power required to deflect a belt by s=16mm at wheel spacing A=1000mm

In order to eliminate redundant calculations, a diagram with belts deflection values „S” have been provided with various Axle base of pulleys.

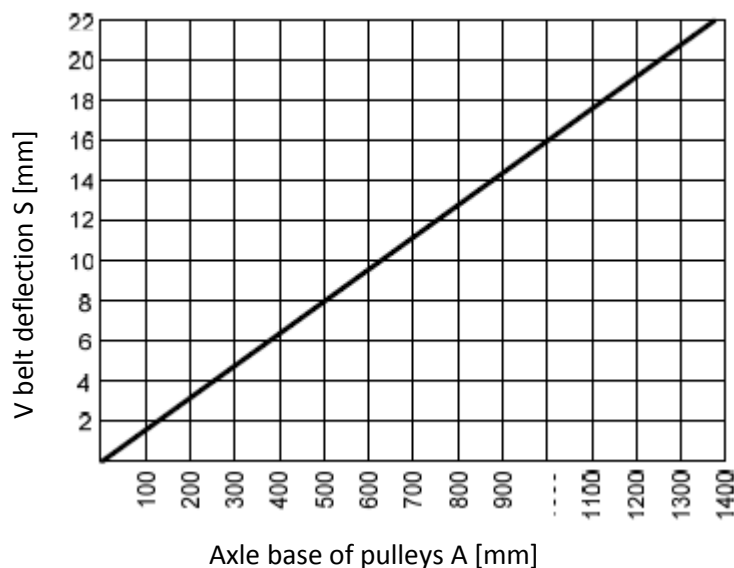


Fig.25 Deflection of wedge-shaped belt depending on axle base of the pulleys

Also check if the wedge-shaped belt is not broken, cracked, dried or damaged in any other way. Damaged wedge-shaped belt must be replaced. In case of multi-belt drive, even if just one belt is worn out, you have to replace all the belts making sure that they have the same length and fit the grooves of the pulley. If you do not replace all the belts, the new ones will transfer bigger overloads since they are a bit shorter than the old ones. During belts replacement ease the stretching screws of the motor panel (fig.26) so that the belts can be removed and replaced with new one manually without applying force. In no circumstances you are allowed to install the belts by force, with a screwdriver or with any other tool. During belt replacement check if the pulleys' contact surfaces are not worn out. New belts should be stretched so as the required deflection force P (fig. 24) was as close to the P value shown in the table 18 as possible.

Once the new belts are assembled, verify the pulleys' alignment, checking with a gauge if they are parallel to each other and if their grooves are in a line. (fig. 27). Once they are adjusted, rotate the drive without any load to allow the belts to lay down in the grooves accurately. New belts should be stretched again after 50 hours of operation.

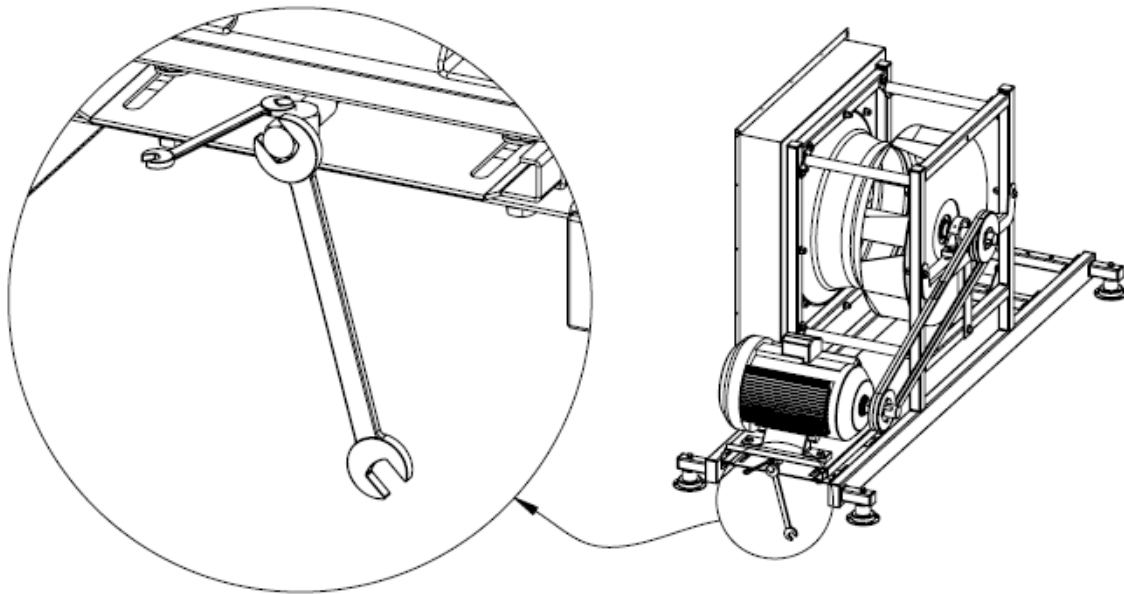


Fig.26. Adjustment of wedge-shaped belts tension

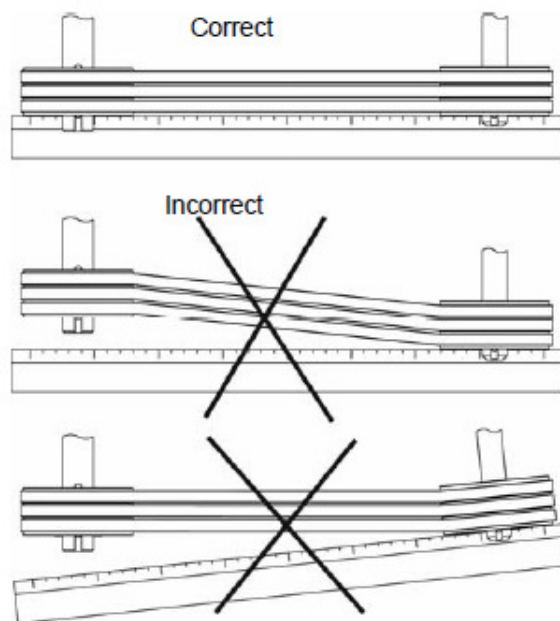


Fig.27. Pulleys adjustment

In order to correct alignment of the motor and fan's shafts you have to accurately locate the motor onto the stretching panel. If the pulleys' grooves are not aligned, move one of the pulleys (fan or motor's) along the shaft in order to align the surfaces. This procedure is enabled thanks to the „Taper-Lock" pull sleeve.

In order to move the pulleys for adjustment or replacement of the pulley with the „Taper-Lock" sleeves, follow the steps below:

1. remove hexagon-socket screws from the holes marked with „A" (fig. 32 or 33)
2. screw in the same screws into the holes marked with „B" . Keep screwing in the screw till the pulley and sleeve on the shaft become loose
3. move the sleeve on the motor or fan's shaft pin (in case of replacement remove the sleeve with the pulley and install a new set)
4. Screw in again the screws into the holes marked with „A" till a refusal

5. Adjust the pulley (fig. 27).
6. Tighten up the screws firmly in turn in order to clamp the sleeve with pulley onto the shaft's pin.

1. Pulley
2. „Taper-Lock” sleeve
3. Hexagon-socket screws

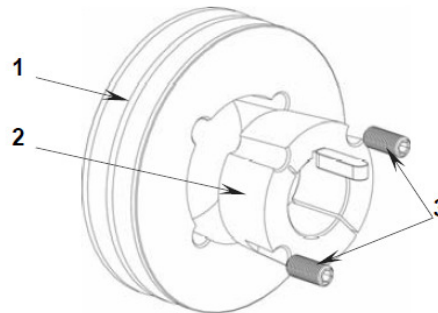


Fig.28. Pulley and „Taper-Lock” sleeve

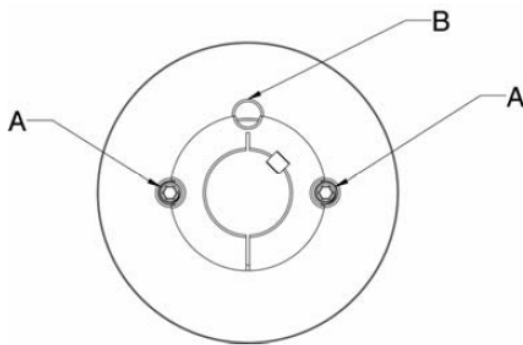


Fig. 29 Pulley with sleeves with numbers from 1008 up to 3030

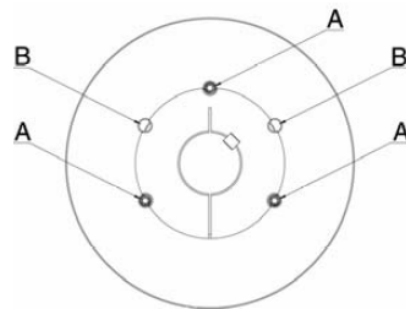


Fig. 30 Pulley with sleeves with numbers from 3535 up to 5050

7.6 Test measurements

Once the inspections and maintenance procedures are over, check and adjust operation parameters according to the guidelines stated in point 6

Please report the maintenance and measurement activity in the inspections and maintenance table.

8. SAFETY INSTRUCTIONS

1. Connection and start-up of the AHU should be carried out by qualified personnel in accordance with recommended and designed regulations and guidelines regarding operation of electric devices.
2. In no circumstances you are allowed to connect the device to power supply before connecting the protection system.
3. In no circumstances you are allowed to carry out repairs or maintenance works if the device is connected to power supply.
4. Operation of the AHU with removed inspection panel is strictly forbidden.
5. Personnel operating, repairing or providing maintenance services on the AHU must be qualified and authorized to carry out these activities in line with regulations being in charge in a country where the AHU is assembled.
6. AHU assembly location must be equipped with necessary safety and fire protection equipment in line with local regulations.



9. INFORMATION

Routine inspections carried out by qualified technical personnel or by VTS Authorized Service Providers guarantee long-term, reliable and failure-free operation of the device. Our service personnel is always available to accompany you during the start-up, maintenance and in case of any other emergency related to the device operation.

VTS Authorized Service Providers sell spare parts and accessories for our AHUs. While ordering parts please provide the AHU type and size as well as its serial number.

You can find more info regarding the network of VTS service providers at www.vtsgroup.com

10. TECHNICAL INFORMATION TO THE REGULATION (EU) No 327/2011 IMPLEMENTING DIRECTIVE 2009/125/EC

Model:	22/0,55/2 VSD10 +55 °C	22/0,75/2 VSD10 +55 °C	25/0,75/2 VSD10 +55 °C	25/1,5/2 VSD10 +55 °C	31/1,1/2 VSD10 +55 °C	31/1,5/2 VSD10 +55 °C	31/2,2/2 VSD10 +55 °C	35/1,5/4 VSD10 +55 °C	35/2,2/2 VSD10 +55 °C
1.	57,90%	57,10%	56,40%	60,70%	54,90%	58,70%	60,30%	60,20%	59,40%
2.	A								
3.	Static								
4.	62								
5.	VSD - yes. A variable speed drive must be installed with this fan.								
6.	2018								
7.	ALLTS Sp. z o.o., CRN 0000236306, Poland								
8.	1-2-0204-0002	1-2-0204-0003	1-2-0205-0006	1-2-0205-0007	1-2-0291-1111	1-2-0207-0006	1-2-0207-0007	1-2-0208-0006	1-2-0208-0007
9.	0,23kW, 1001m³/h, 424Pa	0,25kW, 1010m³/h, 451Pa	0,45kW, 1419m³/h, 580Pa	0,42kW, 1400m³/h, 590Pa	1,34kW, 3000m³/h, 854Pa	1,33kW, 2900m³/h, 899Pa	1,32kW, 2990m³/h, 890Pa	0,3kW, 2000m³/h, 290Pa	2,4kW, 4150m³/h, 1167Pa
10.	2790RPM	2855RPM	2855RPM	2860RPM	2845RPM	2860RPM	2880RPM	1420RPM	2880RPM
11.	1								
12.	<p>Disassembly of the machine must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.</p> <p>Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the machine and provision of the components.</p> <p>Dismantle the machine using the general procedures commonly used in mechanical engineering.</p> <p>WARNING</p> <p>Machine parts can fall The machine is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury, or material damage.</p> <p>Follow the safety rules:</p> <ol style="list-style-type: none"> 1. Disconnect all electrical connections. 2. Prevent reconnection. 3. Make sure that the equipment is at zero voltage. 4. Cover or isolate nearby components that are still live. <p>To energize the system, apply the measures in reverse order.</p> <p>Components:</p> <p>The machines consist for the most part of steel and various proportions of copper, aluminum and plastics (impeller made of SAN - styrene, acrylonitrile, construction material with 20% glass fiber). Metals are generally considered to be unlimitedly recyclable.</p> <p>Sort the components for recycling according to whether they are:</p> <p>Iron and steel, aluminum, non-ferrous metal, e.g. windings (the winding insulation is incinerated during copper recycling), insulating materials, cables and wires, electronic waste, plastic parts (impeller, winding cover ect.). The same goes for cloths and cleaning substances which have been used while working on the machine.</p> <p>Dispose of the separated components according to local regulations or via a specialist disposal company.</p>								
13.	<p>Long failure-free operation depends on keeping the product/device/fan within performance limitations described by selection software or maintenance manual.</p> <p>For proper operation, read carefully maintenance manual, with special attention on "installation", "start-up", and "maintenance" chapters.</p>								
14.	no additional elements								

Technical information to the regulation (EU) No 327/2011 implementing Directive 2009/125/EC									
Model:	35/3/2 VSD10 +55 °C	40/1,5/4 VSD10 +55 °C	40/2,2/4 VSD10 +55 °C	40/3/4 VSD10 +55 °C	45/2,2/4 VSD10 +55 °C	45/4/4 VSD10 +55 °C	45/5,5/4 VSD10 +55 °C	50/4/4 VSD10 +55 °C	50/5,5/4 VSD10 +55 °C
1.	60,70%	61,60%	62,20%	60,10%	60,90%	63,60%	64,70%	62,70%	63,80%
2.	A								
3.	Static								
4.	62								
5.	VSD - yes. A variable speed drive must be installed with this fan.								
6.	2018								
7.	ALLTS Sp. z o.o., CRN 0000236306, Poland								
8.	1-2-0208-0008	1-2-0209-0008	1-2-0209-0006	1-2-0209-0007	1-2-0211-0008	1-2-0211-0006	1-2-0211-0007	1-2-0212-0006	1-2-0212-0007
9.	2,41kW, 4300m³/h, 1156Pa	0,29kW, 1910m³/h, 300Pa	0,48kW, 2500m³/h, 388Pa	3,26kW, 5600m³/h, 1200Pa	0,89kW, 4000m³/h, 448Pa	0,89kW, 4100m³/h, 456Pa	0,9kW, 4000m³/h, 481Pa	1,58kW, 5900m³/h, 564Pa	1,6kW, 5775m³/h, 594Pa
10.	2835RPM	1420RPM	1420RPM	2673RPM	1420RPM	1440RPM	1455RPM	1440RPM	1455RPM
11.	1								
12.	<p>Disassembly of the machine must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.</p> <p>Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the machine and provision of the components.</p> <p>Dismantle the machine using the general procedures commonly used in mechanical engineering.</p> <p>WARNING</p> <p>Machine parts can fall The machine is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury, or material damage.</p> <p>Follow the safety rules:</p> <ol style="list-style-type: none"> 1. Disconnect all electrical connections. 2. Prevent reconnection. 3. Make sure that the equipment is at zero voltage. 4. Cover or isolate nearby components that are still live. <p>To energize the system, apply the measures in reverse order.</p> <p>Components:</p> <p>The machines consist for the most part of steel and various proportions of copper, aluminum and plastics (impeller made of SAN - styrene, acrylonitrile, construction material with 20% glass fiber). Metals are generally considered to be unlimitedly recyclable.</p> <p>Sort the components for recycling according to whether they are:</p> <p>Iron and steel, aluminum, non-ferrous metal, e.g. windings (the winding insulation is incinerated during copper recycling), insulating materials, cables and wires, electronic waste, plastic parts (impeller, winding cover ect.). The same goes for cloths and cleaning substances which have been used while working on the machine.</p> <p>Dispose of the separated components according to local regulations or via a specialist disposal company.</p>								
13.	<p>Long failure-free operation depends on keeping the product/device/fan within performance limitations described by selection software or maintenance manual.</p> <p>For proper operation, read carefully maintenance manual, with special attention on "installation", "start-up", and "maintenance" chapters.</p>								
14.	no additional elements								

Technical information to the regulation (EU) No 327/2011 implementing Directive 2009/125/EC									
Model:	50/7,5/4	56/4/4	56/5,5/4	56/7,5/4	20763	63/4/4	63/5,5/4	63/7,5/4	63/11/4
	VSD10	VSD10	VSD10	VSD10	VSD10	VSD10	VSD10	VSD10	VSD10
	+55 °C	+55 °C	+55 °C	+55 °C	+55 °C	+55 °C	+55 °C	+55 °C	+55 °C
1.	64,70%	61,50%	62,50%	63,50%	64,60%	60,60%	61,50%	62,50%	63,50%
2.	A								
3.	Static								
4.	62								
5.	VSD - yes. A variable speed drive must be installed with this fan.								
6.	2018								
7.	ALLTS Sp. z o.o., CRN 0000236306, Poland								
8.	1-2-0212-0008	1-2-0213-0007	1-2-0213-0008	1-2-0213-0009	1-2-0213-0006	1-2-0214-0007	1-2-0214-0008	1-2-0214-0009	1-2-0214-0006
9.	1,58kW, 5800m³/h, 592Pa	2,82kW, 8190m³/h, 723Pa	2,86kW, 8200m³/h, 744Pa	2,81kW, 8180m³/h, 745Pa	2,8kW, 8500m³/h, 726Pa	4,75kW, 11380m³/h, 876Pa	5,09kW, 12000m³/h, 905Pa	5,0kW, 11600m³/h, 935Pa	4,98kW, 11600m³/h, 945Pa
10.	1455RPM	1440RPM	1455RPM	1455RPM	1460RPM	1414RPM	1455RPM	1455RPM	1460RPM
11.	1								
12.	<p>Disassembly of the machine must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.</p> <p>Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the machine and provision of the components.</p> <p>Dismantle the machine using the general procedures commonly used in mechanical engineering.</p> <p>WARNING</p> <p>Machine parts can fall The machine is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury, or material damage.</p> <p>Follow the safety rules:</p> <ol style="list-style-type: none"> 1. Disconnect all electrical connections. 2. Prevent reconnection. 3. Make sure that the equipment is at zero voltage. 4. Cover or isolate nearby components that are still live. <p>To energize the system, apply the measures in reverse order.</p> <p>Components:</p> <p>The machines consist for the most part of steel and various proportions of copper, aluminum and plastics (impeller made of SAN - styrene, acrylonitrile, construction material with 20% glass fiber). Metals are generally considered to be unlimitedly recyclable.</p> <p>Sort the components for recycling according to whether they are:</p> <p>Iron and steel, aluminum, non-ferrous metal, e.g. windings (the winding insulation is incinerated during copper recycling), insulating materials, cables and wires, electronic waste, plastic parts (impeller, winding cover ect.). The same goes for cloths and cleaning substances which have been used while working on the machine.</p> <p>Dispose of the separated components according to local regulations or via a specialist disposal company.</p>								
13.	<p>Long failure-free operation depends on keeping the product/device/fan within performance limitations described by selection software or maintenance manual.</p> <p>For proper operation, read carefully maintenance manual, with special attention on "installation", "start-up", and "maintenance" chapters.</p>								
14.	no additional elements								

Technical information to the regulation (EU) No 327/2011 implementing Directive 2009/125/EC									
Model:	22/0,55/2 IE2	22/0,75/2 IE2	25/0,75/2 IE2	25/1,5/2 IE2	31/1,1/2 IE2	31/1,5/2 IE2	31/2,2/2 IE2	35/1,5/4 IE2	35/2,2/2 IE2
1.	61,50%	61,40%	60,60%	64,10%	58,30%	61,90%	63,10%	64,70%	62,10%
2.	A								
3.	Static								
4.	62								
5.	VSD - yes. A variable speed drive must be installed with this fan.								
6.	2018								
7.	ALLTS Sp. z o.o., CRN 0000236306, Poland								
8.			1-2-0200-0049	1-2-0200-0050		1-2-0200-0051	1-2-0200-0052	1-2-0200-0053	1-2-0200-0054
9.	0,217kW, 1001m³/h, 424Pa	0,233kW, 1010m³/h, 451Pa	0,419kW, 1419m³/h, 580Pa	0,399kW, 1400m³/h, 590Pa	1,264kW, 3000m³/h, 854Pa	1,263kW, 2900m³/h, 899Pa	1,264kW, 2990m³/h, 890Pa	0,28kW, 2000m³/h, 290Pa	2,299kW, 4150m³/h, 1167Pa
10.	2790RPM	2855RPM	2855RPM	2860RPM	2845RPM	2860RPM	2880RPM	1420RPM	2880RPM
11.	1								
12.	<p>Disassembly of the machine must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.</p> <p>Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the machine and provision of the components.</p> <p>Dismantle the machine using the general procedures commonly used in mechanical engineering.</p> <p>WARNING</p> <p>Machine parts can fall The machine is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury, or material damage.</p> <p>Follow the safety rules:</p> <ol style="list-style-type: none"> 1. Disconnect all electrical connections. 2. Prevent reconnection. 3. Make sure that the equipment is at zero voltage. 4. Cover or isolate nearby components that are still live. <p>To energize the system, apply the measures in reverse order.</p> <p>Components:</p> <p>The machines consist for the most part of steel and various proportions of copper, aluminum and plastics (impeller made of SAN - styrene, acrylonitrile, construction material with 20% glass fiber). Metals are generally considered to be unlimitedly recyclable.</p> <p>Sort the components for recycling according to whether they are:</p> <p>Iron and steel, aluminum, non-ferrous metal, e.g. windings (the winding insulation is incinerated during copper recycling), insulating materials, cables and wires, electronic waste, plastic parts (impeller, winding cover ect.). The same goes for cloths and cleaning substances which have been used while working on the machine.</p> <p>Dispose of the separated components according to local regulations or via a specialist disposal company.</p>								
13.	<p>Long failure-free operation depends on keeping the product/device/fan within performance limitations described by selection software or maintenance manual.</p> <p>For proper operation, read carefully maintenance manual, with special attention on "installation", "start-up", and "maintenance" chapters.</p>								
14.	no additional elements								

Technical information to the regulation (EU) No 327/2011 implementing Directive 2009/125/EC									
Model:	35/3/2 I E2	40/1,5/4 IE2	40/2,2/4 IE2	40/3/4 IE2	45/2,2/4 IE2	45/4/4 IE2	45/5,5/4 IE2	50/4/4 IE2	50/5,5/4 IE2
1.	63,10%	66,20%	65,90%	63,20%	64,50%	66,30%	67,00%	65,40%	66,20%
2.	A								
3.	Static								
4.	62								
5.	VSD - yes. A variable speed drive must be installed with this fan.								
6.	2018								
7.	ALLTS Sp. z o.o., CRN 0000236306, Poland								
8.	1-2-0200-0055	1-2-0200-0056	1-2-0200-0057	1-2-0200-0058	1-2-0200-0059	1-2-0200-0060	1-2-0200-0061	1-2-0200-0062	1-2-0200-0063
9.	2,322kW, 4300m³/h, 1156Pa	0,27kW, 1910m³/h, 300Pa	0,454kW, 2500m³/h, 388Pa	3,107kW, 5600m³/h, 1200Pa	0,841kW, 4000m³/h, 448Pa	0,854kW, 4100m³/h, 456Pa	0,869kW, 4000m³/h, 481Pa	1,516kW, 5900m³/h, 564Pa	1,545kW, 5775m³/h, 594Pa
10.	2835RPM	1420RPM	1420RPM	2673RPM	1420RPM	1440RPM	1455RPM	1440RPM	1455RPM
11.	1								
12.	<p>Disassembly of the machine must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.</p> <p>Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the machine and provision of the components.</p> <p>Dismantle the machine using the general procedures commonly used in mechanical engineering.</p> <p>WARNING</p> <p>Machine parts can fall The machine is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury, or material damage.</p> <p>Follow the safety rules:</p> <ol style="list-style-type: none"> 1. Disconnect all electrical connections. 2. Prevent reconnection. 3. Make sure that the equipment is at zero voltage. 4. Cover or isolate nearby components that are still live. <p>To energize the system, apply the measures in reverse order.</p> <p>Components:</p> <p>The machines consist for the most part of steel and various proportions of copper, aluminum and plastics (impeller made of SAN - styrene, acrylonitrile, construction material with 20% glass fiber). Metals are generally considered to be unlimitedly recyclable.</p> <p>Sort the components for recycling according to whether they are:</p> <p>Iron and steel, aluminum, non-ferrous metal, e.g. windings (the winding insulation is incinerated during copper recycling), insulating materials, cables and wires, electronic waste, plastic parts (impeller, winding cover ect.). The same goes for cloths and cleaning substances which have been used while working on the machine.</p> <p>Dispose of the separated components according to local regulations or via a specialist disposal company.</p>								
13.	<p>Long failure-free operation depends on keeping the product/device/fan within performance limitations described by selection software or maintenance manual.</p> <p>For proper operation, read carefully maintenance manual, with special attention on "installation", "start-up", and "maintenance" chapters.</p>								
14.	no additional elements								

Technical information to the regulation (EU) No 327/2011 implementing Directive 2009/125/EC									
Model:	50/7,5/4 IE2	56/4/4 IE2	56/5,5/4 IE2	56/7,5/4 IE2	56/11/4 IE2	63/4/4 IE2	63/5,5/4 IE2	63/7,5/4 IE2	63/11/4 IE2
1.	66,80%	64,20%	64,80%	65,60%	66,30%	63,20%	63,70%	64,50%	65,10%
2.	A								
3.	Static								
4.	62								
5.	VSD - yes. A variable speed drive must be installed with this fan.								
6.	2018								
7.	ALLTS Sp. z o.o., CRN 0000236306, Poland								
8.	1-2-0200-0064	1-2-0200-0066	1-2-0200-0067	1-2-0200-0068	1-2-0200-0065	1-2-0200-0070	1-2-0200-0071	1-2-0200-0072	1-2-0200-0069
9.	1,532kW, 5800m ³ /h, 592Pa	2,706kW, 8190m ³ /h, 723Pa	2,762kW, 8200m ³ /h, 744Pa	2,724kW, 8180m ³ /h, 745Pa	2,731kW, 8500m ³ /h, 726Pa	4,558kW, 11380m ³ /h, 876Pa	4,916kW, 12000m ³ /h, 905Pa	4,848kW, 11600m ³ /h, 935Pa	4,858kW, 11600m ³ /h, 945Pa
10.	1455RPM	1440RPM	1455RPM	1455RPM	1460RPM	1414RPM	1455RPM	1455RPM	1460RPM
11.	1								
12.	<p>Disassembly of the machine must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.</p> <p>Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the machine and provision of the components.</p> <p>Dismantle the machine using the general procedures commonly used in mechanical engineering.</p> <p>WARNING</p> <p>Machine parts can fall The machine is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury, or material damage.</p> <p>Follow the safety rules:</p> <ol style="list-style-type: none"> 1. Disconnect all electrical connections. 2. Prevent reconnection. 3. Make sure that the equipment is at zero voltage. 4. Cover or isolate nearby components that are still live. <p>To energize the system, apply the measures in reverse order.</p> <p>Components:</p> <p>The machines consist for the most part of steel and various proportions of copper, aluminum and plastics (impeller made of SAN - styrene, acrylonitrile, construction material with 20% glass fiber). Metals are generally considered to be unlimitedly recyclable.</p> <p>Sort the components for recycling according to whether they are:</p> <p>Iron and steel, aluminum, non-ferrous metal, e.g. windings (the winding insulation is incinerated during copper recycling), insulating materials, cables and wires, electronic waste, plastic parts (impeller, winding cover ect.). The same goes for cloths and cleaning substances which have been used while working on the machine.</p> <p>Dispose of the separated components according to local regulations or via a specialist disposal company."</p>								
13.	<p>Long failure-free operation depends on keeping the product/device/fan within performance limitations described by selection software or maintenance manual.</p> <p>For proper operation, read carefully maintenance manual, with special attention on "installation", "start-up", and "maintenance" chapters.</p>								
14.	no additional elements								

Technical information to the regulation (EU) No 327/2011 implementing Directive 2009/125/EC									
Model:	22/0,55/2 IE3	22/0,75/2 IE3	25/0,75/2 IE3	25/1,5/2 IE3	31/1,1/2 IE3	31/1,5/2 IE3	31/2,2/2 IE3	35/1,5/4 IE3	35/2,2/2 IE3
1.		64,10%	63,30%	66,40%		64,10%	65,20%	66,70%	64,20%
2.	A								
3.	Static								
4.	62								
5.	VSD - yes. A variable speed drive must be installed with this fan.								
6.	2018								
7.	ALLTS Sp. z o.o., CRN 0000236306, Poland								
8.			1-2-0205- 4001	1-2-0205- 4003		1-2-0207- 4002	1-2-0207- 4003	1-2-0208- 4001	1-2-0208- 4002
9.	" 1001m³/h, 424Pa"	0,223kW, 1010m³/h, 451Pa	0,402kW, 1419m³/h, 580Pa	0,385kW, 1400m³/h, 590Pa	3000m³/h, 854Pa	1,219kW, 2900m³/h, 899Pa	1,225kW, 2990m³/h, 890Pa	0,272kW, 2000m³/h, 290Pa	2,227kW, 4150m³/h, 1167Pa
10.	2790RPM	2855RPM	2855RPM	2860RPM	2845RPM	2860RPM	2880RPM	1420RPM	2880RPM
11.	1								
12.	<p>Disassembly of the machine must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.</p> <p>Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the machine and provision of the components.</p> <p>Dismantle the machine using the general procedures commonly used in mechanical engineering.</p> <p>WARNING</p> <p>Machine parts can fall The machine is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury, or material damage.</p> <p>Follow the safety rules:</p> <ol style="list-style-type: none"> 1. Disconnect all electrical connections. 2. Prevent reconnection. 3. Make sure that the equipment is at zero voltage. 4. Cover or isolate nearby components that are still live. <p>To energize the system, apply the measures in reverse order.</p> <p>Components:</p> <p>The machines consist for the most part of steel and various proportions of copper, aluminum and plastics (impeller made of SAN - styrene, acrylonitrile, construction material with 20% glass fiber). Metals are generally considered to be unlimitedly recyclable.</p> <p>Sort the components for recycling according to whether they are:</p> <p>Iron and steel, aluminum, non-ferrous metal, e.g. windings (the winding insulation is incinerated during copper recycling), insulating materials, cables and wires, electronic waste, plastic parts (impeller, winding cover ect.). The same goes for cloths and cleaning substances which have been used while working on the machine.</p> <p>Dispose of the separated components according to local regulations or via a specialist disposal company.</p>								
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14.	no additional elements								

Technical information to the regulation (EU) No 327/2011 implementing Directive 2009/125/EC									
Model:	35/3/2 IE3	40/1,5/4 IE3	40/2,2/4 IE3	40/3/4 IE3	45/2,2/4 IE3	45/4/4 IE3	45/5,5/4 IE3	50/4/4 IE3	50/5,5/4 IE3
1.	65,00%	68,30%	67,80%	64,90%	66,40%	67,90%	68,50%	67,00%	67,60%
2.	A								
3.	Static								
4.	62								
5.	VSD - yes. A variable speed drive must be installed with this fan.								
6.	2018								
7.	ALLTS Sp. z o.o., CRN 0000236306, Poland								
8.	1-2-0208-4003	1-2-0209-4003	1-2-0209-4001	1-2-0209-4002	1-2-0211-4004	1-2-0211-4002	1-2-0211-4003	1-2-0212-4001	1-2-0212-4002
9.	2,255kW, 4300m³/h, 1156Pa	0,262kW, 1910m³/h, 300Pa	0,441kW, 2500m³/h, 388Pa	3,03kW, 5600m³/h, 1200Pa	0,818kW, 4000m³/h, 448Pa	0,835kW, 4100m³/h, 456Pa	0,851kW, 4000m³/h, 481Pa	1,482kW, 5900m³/h, 564Pa	1,513kW, 5775m³/h, 594Pa
10.	2835RPM	1420RPM	1420RPM	2673RPM	1420RPM	1440RPM	1455RPM	1440RPM	1455RPM
11.	1								
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14.	no additional elements								

Technical information to the regulation (EU) No 327/2011 implementing Directive 2009/125/EC									
Model:	50/7,5/4 IE3	56/4/4 IE3	56/5,5/4 IE3	56/7,5/4 IE3	56/11/4 IE3	63/4/4 IE3	63/5,5/4 IE3	63/7,5/4 IE3	63/11/4 IE3
1.	68,10%	65,70%	66,20%	66,90%	67,50%	64,70%	65,10%	65,70%	66,30%
2.	A								
3.	Static								
4.	62								
5.	VSD - yes. A variable speed drive must be installed with this fan.								
6.	2018								
7.	ALLTS Sp. z o.o., CRN 0000236306, Poland								
8.	1-2-0212- 4003	1-2-0213- 4002	1-2-0213- 4003	1-2-0213- 4004	1-2-0213- 4001	1-2-0214- 4002	1-2-0214- 4003	1-2-0214- 4004	1-2-0214- 4001
9.	1,503kW, 5800m³/h, 592Pa	2,645kW, 8190m³/h, 723Pa	2,704kW, 8200m³/h, 744Pa	2,673kW, 8180m³/h, 745Pa	2,684kW, 8500m³/h, 726Pa	4,455kW, 11380m³/h, 876Pa	4,812kW, 12000m³/h, 905Pa	4,757kW, 11600m³/h, 935Pa	4,773kW, 11600m³/h, 945Pa
10.	1455RPM	1440RPM	1455RPM	1455RPM	1460RPM	1414RPM	1455RPM	1455RPM	1460RPM
11.	1								
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14.	no additional elements								

Technical information to the regulation (EU) No 327/2011 implementing Directive 2009/125/EC				
Model:	22/0,37 EC	22/0,75 EC	25/0,37 EC	25/0,75 EC
1.	66,60%	66,20%	66,00%	69,30%
2.	A			
3.	Static			
4.	62			
5.	Yes			
6.	2018			
7.	VTS, Poland			
8.	1-2-0294-1547	1-2-0294-1548	1-2-0205-4001	1-2-0205-4003
9.	379W, 1300m ³ /h, 700Pa	747W, 1550m ³ /h, 1150Pa	423W, 1550m ³ /h, 620Pa	780W, 1950m ³ /h, 1000Pa
10.	3600RPM	4500RPM	3000RPM	3800RPM
11.	1			
12.	<p>Disassembly of the machine must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.</p> <p>Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the machine and provision of the components.</p> <p>Dismantle the machine using the general procedures commonly used in mechanical engineering.</p> <p>WARNING</p> <p>Machine parts can fall The machine is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury, or material damage.</p> <p>Follow the safety rules:</p> <ol style="list-style-type: none"> 1. Disconnect all electrical connections. 2. Prevent reconnection. 3. Make sure that the equipment is at zero voltage. 4. Cover or isolate nearby components that are still live. <p>To energize the system, apply the measures in reverse order.</p> <p>Components:</p> <p>The machines consist for the most part of steel and various proportions of copper, aluminum and plastics (impeller made of SAN - styrene, acrylonitrile, construction material with 20% glass fiber). Metals are generally considered to be unlimitedly recyclable.</p> <p>Sort the components for recycling according to whether they are:</p> <p>Iron and steel, aluminum, non-ferrous metal, e.g. windings (the winding insulation is incinerated during copper recycling), insulating materials, cables and wires, electronic waste, plastic parts (impeller, winding cover ect.). The same goes for cloths and cleaning substances which have been used while working on the machine.</p> <p>Dispose of the separated components according to local regulations or via a specialist disposal company."</p>			
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14.	no additional elements			