

ZHK NANO

Instruction manual



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We care for better air

In addition to the instructions in this guide, subject-specific standards, as well as local, national and international regulations must be observed.

The complete instruction manual, which includes all chapters from 1 to 12 is available online, see QR-code beneath.

The full version of the instruction manual must be downloaded, read, and understood by the personnel in charge of the respective work before starting any work (unloading, transport, erection, assembly, installation, electrical connection, commissioning, maintenance).

The online-version always contains the updated version.



After completion of the work, please give this instruction manual to the operating staff. Please keep the complete instruction and operating manual filed with your other documents.



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1 Introduction

1.1 Supplementary instructions to this instruction manual

This is the instruction manual for an air handling unit, hereinafter designated as 'AHU'. This instruction manual is provided as part of the AHU to enable the safe and correct use of an AHU constructed by EUROCLIMA. The target group of this instruction manual are all persons who are directly involved with transport, assembly, commissioning and installation, operation, maintenance, troubleshooting and disassembling (see also **chapter 2.5 (Staff selection and qualification)**). This instruction manual must be kept in the immediate vicinity of the AHU and must always be accessible to personnel. The fundamental requirement for safe and effective operating is that all safety and handling instructions provided in this instruction manual are observed and implemented. This includes local occupational health and safety regulations and general safety regulations for the area of application of the AHU.

1.2 Copyright

This documentation, including all tables and figures, is protected by copyright and pertains only to an AHU of EUROCLIMA.

Passing on content, copying content, publishing content, filming content, editing content in electronic systems, translating content, as well as each further utilization of this documentation outside of the copyright law, also in part and communications of contents without the express consent of EUROCLIMA is inadmissible.

1.3 Limitation of liability

EUROCLIMA assumes no liability or warranty for damages or consequential damages due to the following:

- Non- observance/ adherence to the instruction manual and / or other applicable documents
- Non intended use or misuse
- Use of untrained personnel
- Unauthorized structural changes
- Technical changes
- Use of non-approved spare parts

1.4 Type key

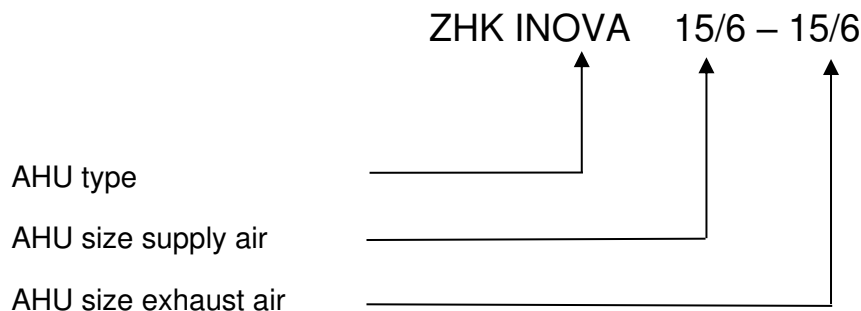


Figure 1: Example AHU type key

Legend used for AHU type

ZHK VISION	casing type with thermally decoupled version T2-TB1
ZHK INOVA	casing type with thermally decoupled version T2-TB2
ZHK 2000	casing type version T3-TB3
ZHK NANO	compact AHU series / casing type with thermally decoupled version T2-TB2
ETA XXX	key ETA: including control
ETA POOL	compact AHU for pool dehumidification with refrigeration circuit (option)
ETA MATIC	control for AHUs

Legend for the AHU size

Example 15/6: the first index (15) corresponds to the clear width, the second index (6) to the clear height. According to the following table, the dimensions in mm are → 15/6 = 1525 x 610 mm (clear width x clear height)

Index	3	4	6	9	12	15	18	21	24
Dimension (mm)	305	457,5	610	915	1220	1525	1830	2135	2440

Index	27	30	33	36	39	42	45	48
Dimension (mm)	2745	3050	3355	3660	3965	4270	4575	4880

This information applies both to the ratios of the supply air and the exhaust air.

1.5 Intended use / foreseeable misuse

1.5.1 Intended use

The AHU is used, depending on the chosen purpose for

- transportation and conditioning of air in and out of habitable buildings or vessels.
- creation of a desired room air quality in living and workspaces
- creation of an acceptable comfort or desired working conditions
- depending on the AHU type, the air conditioning is done primarily by
 - o Air change
 - o Control of air temperature and air humidity
 - o Filtration of normal polluted air
 - o Filtration at specific requirements (clean room and so on)

The AHU is suitable for

- operation in the range of the agreed design data
- an ambient air temperature range of – 20 °C to + 60 °C at installation site and during transportation, if electrical/electronic components are mounted on the outside of the AHU, then + 40 °C maximum
- a minimum temperature of the transported air of -20 °C (if necessary, freeze protection measures must be installed)
- a maximum temperature of the transported air of +60 °C
- inside the AHU at motors and other electrical/electronic components up to +40 °C maximum

The AHU must be used as intended and in the appropriate environment, if not this is categorized as misuse of the device. If there is any case of AHU misuse, then the warranty/ guarantee becomes null and void, which means immediate expiration of the complete warranty and / or guarantee claims.

The operation within other conditions must be agreed in writing. Unless otherwise agreed, the design of the AHU is for a nominal density of the air of 1,20 kg/m³.

Design responsibility for AHUs, are built according to customer specifications

AHUs from EUROCLIMA as described in this manual are designed, built and delivered according to customer requirements and specifications. Therefore, EUROCLIMA can select and offer a number of materials and components, which are varied in quality levels.

Generally, a HVAC specialist, knowing the exact application of the AHU, generates a specification, in which customer requirements for the AHU are defined. The properties of the AHU, specified by EUROCLIMA, are agreed with the customer and are stated on the technical data sheets and drawing of the AHU.

Thus, the assessment of the suitability of the AHU for the specific application (e.g. used materials or filter classes) is not the responsibility of EUROCLIMA. Therefore, a disclaimer applies for EUROCLIMA, if the suitability of the AHU for the specific application and installation site should not be fully stipulated. As an example, the use at highly polluted or corrosive air (e.g. close to the sea, in industry atmosphere or at contaminated/corrosive exhaust air) is mentioned. In this case, corrosion of the AHU or inappropriate filtration of the air could be a result of a planning error, for which EUROCLIMA declines and does not accept any responsibility, because the AHU is built according to the confirmed specifications.

Control accuracy of AHUs with EUROCLIMA control

Maintaining a constant temperature, humidity and/or air flow rate, air quality, etc., depends on a wide variety of operating conditions on site (e.g. water supply, water pressure, temperatures, inlet conditions, current or forecast weather conditions and climate, etc.). If there are fluctuations in these real operating conditions on site, deviations from the set constant values may occur. Therefore, despite the high control accuracy of the AHUs with EUROCLIMA control, EUROCLIMA cannot make any promises about the tolerances or control accuracies of the AHUs with regard to constant temperatures, humidity and/or volume flow, air quality, etc. that must be maintained.

Other applicable documents

The following documents apply in addition to this manual:

- Technical data sheets of the AHU from EUROCLIMA
- AHU drawings
- Order confirmation
- Operating and instruction manuals and, if applicable, data sheets of the supplier components or component manufacturers
- Wiring diagram and operation manual of AHUs with control
- If applicable, further drawings

Components provided by the customer

If it is planned and agreed, that EUROCLIMA installs components in the AHU, which are provided by the customer, EUROCLIMA only accepts liability, if there are significant mistakes in construction. The warranty for proper functionality of the provided components, as well as the component concerned safety requirements, is excluded. It is important to note, the issued EC declaration of conformity applies only for the scope of delivery from EUROCLIMA, not for components provided by the customer.

Changes of the AHU by the customer

Attention!

If there are any changes to the AHU undertaken by the customer after delivery, then the warranty becomes invalid. Subsequent changes of the AHU, which are not authorized by EUROCLIMA, are the sole responsibility of the executing person, concerning functionality as well as all safety aspects.

1.5.2 Foreseeable and considered misuse

Other than the above use, it is considered as damaging and must be excluded totally:

- The commissioning of equipment, prior to performing the steps indicated in the assembly instructions and operation with opened, unsecured service doors is a serious risk and hazard.
- Opening the AHU, without securing the main switch in the off position, represents a significant risk and hazard.
- The operation of an AHU equipped with an electric heater while the fan-motor is cut off, or if the fan is working at a limited airflow (for example, caused by closed dampers or similar and with the electric heater in operation) produces an imminent fire risk.
- The operation in combustible conditions is prohibited.
- Handling of air with corrosive / aggressive components.
- Pressure-sided doors can detach suddenly while opening. So, there is a significant risk of injury for the user. See chapter **5.2 (Doors)**.
- The operation in a location with high relative humidity causes condensation on the unit surfaces.
- The operation in a corrosive ambient atmosphere (e.g. salt water, etc.).

1.6 Modular design

Because of the modular AHU design, the instruction manual covers all the possible sections and components which can be delivered. The ordered range is smaller and can be viewed on the technical data sheet - see **chapter 1.7 (Documentation)**.

In this manual, stated parts/components that are not part of the delivered AHU, can therefore be disregarded.

1.7 Documentation

The AHU will be delivered with the following documentation:

Instruction manual ZHK NANO (This document is an extract of the complete instruction and operating manual and includes chapters 1 to 4.)	There is a marked cardboard box, which contains loosely delivered parts inside of the AHU.
--	--

QR-Code for the download of the complete manual	On the AHU and in the delivered manual on page 1
---	--

Depending on AHU type and execution, the following documentation is included:

Operation and instruction manuals of components	There is a cardboard box containing loosely delivered parts inside of the AHU or can be downloaded from the homepage of the component manufacturers.
---	--

Delivery documentation and packing list (scope of delivery)	will be handed over upon acknowledgement of receipt
---	---

Operation manual control incl. data point list ETA MATIC / ETA POOL / ETA NANO_COM- PACT_FLAT	in control cabinet
---	--------------------

AHU drawing	applied on each delivery section
-------------	----------------------------------

Wiring diagram for ETA	in control cabinet
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Depending on type of accessories, the following documentation is included:

K-value for airflow measurement

There is a cardboard box containing loosely delivered parts inside of the AHU.

The above mentioned documentation must always be available when working on the AHU!

You will also find stickers with danger, warning and caution labels and other instructions on and inside the AHU. In this manual and on labels used symbols:



Indicate safety instructions – or yellow triangle with the corresponding hazard pictogram



Indication to avoid damage



WARNING!

Danger due to illegible labels!

Over time, labels can become illegible and degrade, so that dangers are not recognized, and important operating instructions cannot be followed. It is therefore vital that all safety, warning and operating instruction labels are always kept in clearly legible condition and damaged labels must be replaced immediately.

In addition to the contents of this manual, the instruction manuals of the component manufacturers must be followed. These will be delivered separately or can be downloaded from the homepage of the appropriate component manufacturer. In case of contradiction between this manual and instruction manual of the component manufacturer for safety instructions, the most technically accurate interpretation is valid. At differences between this manual and the instruction manual of the component manufacturer, the instruction manual of the component manufacturer has to be applied. In case of doubt, please contact your EUROCLIMA office.

2 Safety instructions / Guidelines to conformity to laws and directives

2.1 Symbols in this manual

The safety instructions in these operating manuals are marked by symbols. They are highlighted by key words which stipulate the severity and extent of a danger. These safety instructions must be observed and adhered to under all circumstances in order to avoid accidents, personal injury, hazards and damage to property.



DANGER!

Safety instructions with the signal word „DANGER” indicates a hazardous situation which, if not avoided, are certain to result in death or serious injury.



WARNING!

Safety instructions with the signal word „WARNING” indicates a hazardous situation that, if not avoided, could result in death or serious injury.



CAUTION!

Safety instructions with the signal word „CAUTION” indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.



NOTICE!

Safety instructions with the signal word „NOTICE” indicates a non-immediate or potential hazard situation that, if not avoided, could result in damage of property and equipment.

In order to draw attention to special, situation-related dangers, the following warning symbols, among others, are used in the safety instructions:












Warning symbol	Type of hazard
	Warning of general danger
	Warning of electrical voltage
	Warning of pointed objects and sharp edges
	Warning of inflammable substances
	Warning of rotating parts
	Warning of hot surface
	Warning of tilting parts
	Warning of suspended load
	Warning of sudden detachment of unhinged doors
	Warning of UV radiation
	Warning of danger of falling

Table 2: Warning symbols of situation-related dangers

2.2 Personal protective equipment

Personal protective equipment is intended to protect people against a risk to their safety or health at work. Therefore, during the various operations on and with the AHU, personnel must wear the following personal protective equipment (pay attention to correct application!):






Symbol	Description of personal protective equipment
	Protective clothing and ensembles: Protective work clothing is used to protect against being caught by moving or rotating parts, stitches, cuts, dust, etc. Do not wear chains, rings or other jewelry.
	Head protection: Industrial helmets protect the head from falling, swinging, falling or flying objects, as well as from bumping into objects.
	Hand protection: Protective gloves protect hands from injuries caused by cutting, sawing, trapping, etc., as well as from chemical and thermal hazards.
	Foot and leg protection: Foot and leg protection, such as safety shoes, protect against bumping into objects, pinching, kicking or kneeling in pointed or sharp objects, as well as against falling or rolling objects.
	Eye and face protection: Eye and face protection are used to protect against foreign objects and solids, as well as against chemical and thermal hazards.
	Hearing protection: Hearing protection is used to protect against noise that is harmful to hearing.
	Falling protection: Falling protection is used to protect against an increased risk of falling if certain height differences are exceeded. Falling protection, such as safety harnesses, may only be used by specially trained people for this purpose.
	Respiratory protection: Respiratory protection protects against the inhalation of hazardous substances, as well as in the case of insufficient oxygen content.
	Skin protection: Skin protection serves to protect against skin diseases and skin damage.

Table 3: Symbols of personal protective equipment

2.3 Indications for minimizing specific hazards



WARNING!

An improperly performed maintenance can pose a danger, hazard and/or risk!

Hazards due to working at great heights

Unsecured work at great heights and the use of unsuitable or damaged equipment can result in a considerable risk of people falling and materials or tools falling.

When working at great heights:

- comply with the local statutory regulations
- use suitable equipment in perfect condition
- secure materials and tools against falling (fall protection)
- use personal protective equipment: fall protection, safety helmet, safety shoes and protective work clothing



WARNING!



Danger due thin sheets and sharp edges, when working on AHU

During work on AHU (or on parts), there is a substantial risk of injury because of thin sheets and sharp edges. For example, roof sheets, fins of heat exchangers, corners and edges - Use personal protective equipment: wear protective helmet, gloves, safety shoes and long protective clothing.



WARNING!



Lighting

For work on AHU (maintenance and inspection work) make sure there is adequate lighting.

Firefighting in case of fire

In general, the local fire protection regulations must be observed.



WARNING!

- If the AHU is part of the smoke extraction system, then the specifications of this system have to be observed.
- Otherwise, the power supply of the AHU must be shut down immediately at all conductors. In addition, the dampers must be closed to consequently prevent oxygen supply and fire spread.

Exposure to harmful substances in case of fire



WARNING!

In case of fire, some materials can produce harmful substances. In addition, harmful vapors can escape from the AHU. Therefore, severe respiratory protective equipment is required and the danger zone has to be avoided.

Exposure to rotating parts / hot surfaces / electrocution

When working on and/or in the AHU note the following risks:



WARNING!

Indentation of body parts in moving parts (fan impeller, external damper gear wheels ...).



WARNING!

Burns and scalds on hot AHU components such as heat registers, heat exchangers, ...



DANGER!

Electrocution on current-carrying parts such as electric motors, frequency converters, electric heaters, control cabinets, interior lighting etc.

Therefore it must be ensured that prior to working on and/or in the AHU that the following tasks are adhered to:

- all electrical and live parts, such as cable plug connections, fan motors, valves, motors and electric heaters are disconnected from the power supply by using the main switch (emergency stop) and that the switch is locked in position 'off' in order to effectively prevent the re-activation of the device during the work. The housing of the AHU interior lighting (can have separate supply) is not live/active.
- all moving parts, especially the fan wheel, motor and heat wheel have stopped completely. It is important to wait at least 5 minutes after shutting down the device before opening the doors.
- for maintenance of frequency controlled motors, a waiting time of 15 minutes is recommended – it gives time to break down the residual capacitive charge of the frequency converter.
- Remove the keys from the doors with a door lock before entering the interior of the AHU. Keep the key out of reach of all unauthorized persons.
- Check that the hot substance supply, such as steam, is interrupted and all the heat registers, heat exchangers, etc. are cooled to ambient temperature.



WARNING!

In case of standstill of the plant (e.g. power failure), make sure that the main switch is always checked. Only when it is in the off position and secured against unintentional restart, appliance doors can be opened, cable plug connections can be disconnected and work on the device can be carried out.

Start of the AHU

Ensure after the completion of work and before starting the device that:

- nobody is in the AHU.
- all protective devices are working, (optional safety devices such as the door guard mounted again) and doors equipped with door locks are locked and the keys are removed – refer to **chapter 5.2 (Doors)**.

Storage of potential energy in gases and fluids



WARNING!

All heat exchangers can be operating up to a maximum pressure of 15 bar. If the fluid is under higher pressures, the safety and tightness cannot be guaranteed.

Preventing the risk of explosion and fire spread



WARNING!

To prevent the fire spreading, fire dampers shall be installed into the ducts between the fire compartments.

Prevention of exposure caused by antifreeze agents



WARNING!

Avoid body contact with antifreeze agents, because they may cause burns. Always wear appropriate protective clothing (e.g. gloves, goggles etc.).

**WARNING!**

In case of fire, avoid the danger zone and meet any safeguards and regulations. It is recommended to wear a mouth guard, because of the risk of poisoning by inhaling the vapors.

Prevention of hazards caused by the sudden detachment of door panels while handling removable panels

**WARNING!**

Removable door panels can fall out suddenly after detaching the connections and can lead to injuries. Particular care should be taken when removing pressure sided doors because they can be firmly in place and then suddenly detach. The user must be able to carry the weight of the door. Two persons are needed when handling doors with a surface of > 0.5 m²

Please note the instructions on the AHU and follow subsequent instructions exactly.

2.4 Conformity with directives, regulations and laws / Assembly instructions for safe and compliant operation

2.4.1 EC declaration of conformity in accordance to EC machinery directive 2006/42/EC

For an AHU (or any part thereof) supplied by EUROCLIMA, an EC declaration of conformity in accordance with the EC Machinery Directive 2006/42/EC will be issued.

When the AHU is a part of the building system. For the device's safe, practical and intended operation, it is the responsibility of the customer to make sure that all on site works are carried out before the device can commence operations. This preparation is necessary and vital for the device and system to work effectively. These types of works are described in **chapter 2.4.2 (Installation instructions for a safe and compliant installation in the building system)** and in the following chapters of this instruction manual.

The AHU must be mounted and operated professionally, according to the specifications stipulated in this instruction manual. The safe operation of the AHU in the overall building system is thus the responsibility of the customer.

The CE-conformity / EC declaration of conformity applies for the delivery state of the AHU. In the mounted state, the AHU fulfills the requirements of the specified European directives and harmonized standards only if the instructions and information in this instruction manual are carefully observed and implemented.

The issued EC declaration of conformity declares that due to its concept and type, as well as in design placed into the market by EUROCLIMA, the AHU complies with the fundamental health and safety requirements of the EC Machinery Directive 2006/42/EC. EUROCLIMA thus follows the Eurovent interpretation of the Machinery Directive: [*Eurovent 6/2-2015 "Recommended code of good practice for the interpretation of Directive 2006/42/EC on machinery concerning air handling units", vom 19. Oktober 2015.*]

Applied European directives and harmonized standards:

Every AHU by EUROCLIMA is a customized produced unit. Therefore, please refer to unit specific EC declaration of conformity of the delivered AHU for information on the applied European directives and harmonized standards.

Depending on the particular application and country-specific requirements and laws it is possible, that the AHU does not meet the valid requirements at the ordered state at delivery.

Therefore, you the customer and installer of the AHU are responsible, before commissioning of the AHU, to check the conformity of the entire system to the valid laws and directive.

If there are any doubts about the conformity of the AHU with the local (on site) valid laws and directives, the AHU is only allowed to be put into operation, if the conformity of the AHU in the system is unequivocally guaranteed.

Depending on the chosen purpose of the AHU, in addition to the EC Machinery Directive 2006/42/EC the following European directives can be applied:

- Electromagnetic compatibility directive 2014/30/EU
- Commission regulation Ventilation Units (EU) No. 1253/2014 *)
- Pressure equipment directive 'PED' 2014/68/EU
- ATEX directive 2014/34/EU

*) ErP conformity according to commission regulation (EU) Nr. 1253/2014

„Out of scope“ – AHUs according to technical data – information therefor on technical device data sheets - with the following characteristics are excluded from the area of application of the regulation (EU) 1253/2014:

Exemptions:

- Exemption 1: AHU without fan (valid in the absence of supply air fan or exhaust air fan or both)
- Exemption 2: AHU operates only in recirculation mode
- Exemption 3: AHU for cruise ships/ships
- Exemption 4: AHU for delivery outside the European Union
- Exemption 5: AHU operates only in potentially explosive air conditions, according to EU Directive 2014/34/EU (valid for supply air, exhaust air or both).
- Exemption 6: AHU operates only in toxic, abrasive or flammable air
- Exemption 7: AHU operates only with air temperatures greater than 100 °C
- Exemption 8: AHU contains a heat exchanger and a heat pump for heat recovery in accordance with regulation (EU) 1253/2014. Article 1.1 (g)
- Exemption 9: AHU with HRS system and integrated DX- system for heating purpose

The mentioned exemptions refer only to regulation (EU) 1253/2014. Basically, the instructions in this instruction manual apply. For the special requirements of the specific AHU resulting from the applicable exemption, the special agreements defined in the order clarification apply.

2.4.2 Installation instructions for a safe and compliant installation in the building system

2.4.2.1 On site assembly and installation

For the proper installation of AHU equipment and the safe operation of the system, depending on the configuration of the AHU, before the first start at least, the following points must be implemented or upgraded and is the responsibility of the client:

Assembly of delivery sections

The delivery sections of the AHU must be assembled and linked together, according to the supplied drawing. See the **chapter 4 (Foundation / erection)**.

Secure inlet and outlet openings

All the inlet and outlet openings must be connected to ducts or respectively equipped with grilles, to prevent the risk of persons accessing moving parts (such as fan wheels) during operation.

Main switch

See **chapter 7.2 (EC motors)**.

Installation of filters

See **chapter 5.4 (Airfilters)**.

Temperature limitation

Ensure that a control system is fitted and that the AHU is only operated with a supply air temperature below the allowable maximum (see **chapter 1.5.1 Intended use**, when not stated otherwise in the technical data). For this purpose, the continuous monitoring of the supply air must be ensured on site.

Measures regarding noise attenuation

On request, available sound data can be used, as a basis for the measurement and calculation of sound (such as for sound attenuators). For information regarding the emitted sound power level over the openings see the technical data sheet, which is available on request – refer to **chapter 10 (Information on airborne noise emitted by the AHUs - on request)**.

Measures to minimize the risk of water damage or damage caused by similar media

See **chapter 4.3.3 (Actions to prevent potential risks)**.

Connection to an external protective conductor system

See **chapter 7.1 (Connecting to an external protective conductor system)**.

Electric heater

Installation (if not supplied by EUROCLIMA) and connection of thermostats for safety shutdown, see **chapter 7.4 (Electric heaters)**.

Siphons

Connecting according to **chapter 6.2 (Drain for condensate and excess water)**.

Flexible connection

Installations (if not supplied by EUROCLIMA) refer to **chapter 6.3 (Duct connection – airside connection to AHU)**.

Heat exchanger

For all heat exchangers which are connected on-site, irrespective of the medium used (water, water-glycol mixture), it must be ensured, by the customer, that the resulting assembly meets the pressure equipment directive 'PED' 2014/68/EU.

Field equipment for roof AHUs

Onsite mounted field devices for roof AHUs, for example, damper position motors or pressure switches must be weather-protected in case of insufficient IP class. Furthermore, depending on the installation situation, possible protection against icing.

Freeze protection

The customer must ensure sufficient freeze protection measures. See indications in **chapters 4.3.2 (Potential risks that could arise at the erection site)**, **4.3.3 (Actions to prevent potential risks)**, **6.4 (Freeze protection measures)** and **7.5 (Frost protection for plate heat exchanger)**.

Venting, draining of heat exchangers

See **chapter 8.1.2 (Heat exchanger)**.

2.4.2.2 ErP conformity according to commission regulation (EU) Nr. 1253/2014

The ErP commission regulation (EU) Nr. 1253/2014 (energy related products) determines minimum requirements to the efficiency of air handling units. Important points, for which the system operator is responsible, are:

Multi staged control

All AHU's, except those with double application, have to be equipped with multi staged drive or speed control for fans. See **chapter 7 (Electrical connection)**.

Filter change indicator

If one or more filter stages belong to the AHU equipment, then they have to be equipped with an optical display or an acoustic warning in the control mechanism. They will be triggered if the pressure drop at the filter exceeds the maximum permissible value. See **chapter 9.4 (Air filters)**.

If above mentioned equipment is not included in delivery by EUROCLIMA, it must to be provided on site.

2.4.2.3 Conformity to VDI 6022

The AHU of the series ZHK Nano in basic design complies with the hygiene requirements of VDI 6022.

Basin in the outside-air intake section

The AHU ZHK Nano is not equipped with a basin in the outside-air intake section as standard. In order to fulfill the requirements of VDI 6022 a tub must be installed in the area of the fresh air intake section, depending on the location of the AHU. Additionally, the entrance of water, fog, snow etc. has to be prevented by a measure on site. If necessary, an additional intake plenum with drain-pan has to be provided.

On request an appropriate plenum can be offered. For this purpose, contact your EUROCLIMA-partner.

Maintenance-friendly accessibility of all components

All components of the air handling system have to be accessible on inflow and outflow side. This means that ducts with access doors have to be provided on site in order to provide accessibility.

Intake grids at openings of outdoor AHUs

According to VDI 6022 all intake openings have to be equipped with an intake grid (mesh size 20 x 20 mm).

Such intake grids are optional and can be ordered on request. However, the mounting of intake grids at all intake openings has to be ensured on site.

Door adjustment at outdoor AHUs

Hinged doors at outside AHUs have to be secured by an appropriate fixture against shutting when access is required for tasks or maintenance. Such equipment is optional and can be ordered on request. Furthermore and importantly, the system operator is responsible for ensuring such appropriate measures.

Manometer for filter monitoring

According VDI 6022 at a volume flow > 1000 m³/h manometer have to be installed for filter monitoring. These could be ordered at EUROCLIMA as an option. However, the filter monitoring has to be ensured on site.

2.5 Staff selection and qualification

All persons, who are authorized to work on the air conditioner, must have read and understood the complete manual - in particular **chapter 2 (Safety instructions)**. Until this task is completed, the person should not begin to work on the AHU.

All work must be carried out by professionals who have sufficient technical training, experience and sufficient knowledge of...

- Locally applicable safety and occupational health rules
- Locally valid accident prevention regulations
- Locally applicable standards and approved rules of practice.

All professionals have to understand and assess the work appropriately and recognize and avoid potential hazards.

Execution of the assembly, installation, electrical connection, commissioning and disposal:

- by qualified electricians and AHU technicians.

Execution of maintenance / monitoring of the operation:

- by technical staff or trained personnel and qualified electricians and AHU technicians.

Subsequently, warning triangles indicate information and procedures that must be adhered to minimize risks to persons who are entrusted with the work on the air conditioner.

3 Reception control / unloading / transportation to installation site

3.1 Reception control

- Upon arrival of the equipment, please check immediately that the package is intact, complete and damage free.
- Loose supplied parts and assembly materials are in a nylon bag or a specific box in the AHU.
- If damage is found, immediately complete a damage report and send it to EUROCLIMA. Only then can the transport company make a claim with the insurer (It is important to note the damage on the shipping documents with date and signature in the presence of the carrier). Complaints about apparent damaged or missing parts of the delivery cannot be subsequently accepted, if procedures are not followed. In case of complaints, please inform immediately the EUROCLIMA office.
- Depending on the material used and the environmental conditions, a superficial corrosion may occur on components. For example, motor shafts, fan shafts, pulleys, clamping bushes, sheet cutting edges, and so forth. The resulting corrosion layer protects the underlying material from corroding further and does not represent a defect of the component or the device (see also **chapter 9 (Maintenance)**).



WARNING!

The packaged delivered goods may include multiple parts of the device. In this case, each part is secured against falling over. Attention: narrow parts may tip over after removing the safeguard. Secure narrow parts against tipping over!



WARNING!

Thin sheet metals and sharp edges, like roof edges or fins are a source of injury! Gloves, safety shoes and long work clothes must be used.



In general, the roof of AHUs cannot be walked on

If it is unavoidable to climb on the AHU it is essential that the AHU is adequately protected against damage by taking appropriate measures, e.g. distributing the load by placing boards underneath.



Figure 2: Do not climb on the AHU!

3.2 Lifting by forklift / lift truck

In accordance with the EUROCLIMA drawing the AHU will be delivered as monobloc or more delivery section(s). The AHU parts or the monobloc are delivered on pallets and can be unloaded and moved by forklift or lift truck. Forces must always act on the base frame, see **Figure 3**.

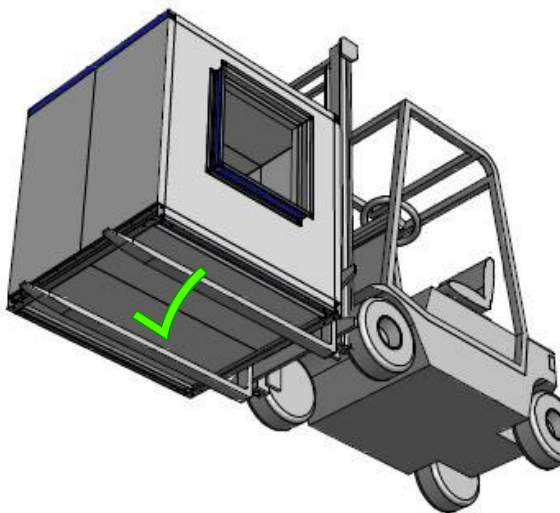


Figure 3: Transport correct

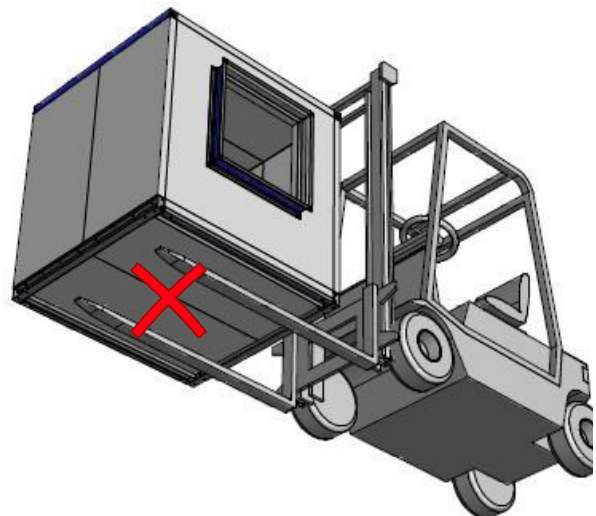


Figure 4: Transport incorrect

Center of gravity must be centrally located between the forks (see **Figure 5**). For larger parts use several lift trucks.

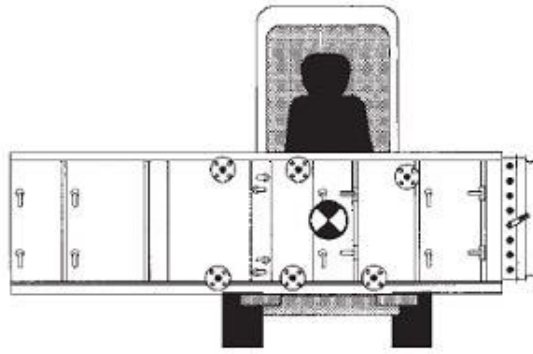


Figure 5: Center of gravity centrally between the forks



WARNING!

For the overlifting directly by crane from the truck, read the following **chapter 3.4 (Lifting of ZHK Nano AHUs)**.

3.3 Further necessary actions for the overlifting of both, delivery sections on crane lugs as well as monoblocs

- Make sure that nobody is under the raised load.
- Before lifting, check that there are no objects on the load.
- Riding and climbing on the load are prohibited!
- The AHU sections or monoblocs must be lifted with appropriate equipment. For example, a Sling/ belt with hook.
- The ropes, hooks and crane lugs used must be suitable for the load, see **chapter 3.4.1 (Weight specifications of ZHK Nano AHUs and additional parts)**. The influence of the temperature on the load capacity must be taken into account.
- The recommended minimum load capacity per load carrying equipment is 50% of the total weight of the delivery section or monobloc.
- Only use lifting hooks with locking device. The hooks must be securely fastened before handling.
- The length of the supporting equipment must allow a favorable and steady course. The load carrying equipment is not permitted to exceed an angle of maximum 15 ° to the vertical and must be spread apart to avoid damage to the casing, refer to **Figure 6**.
- The course of the load carrying equipment must be chosen so that overhanging attachments, roofs and so forth will not be stressed or damaged.
- Load carrying equipment shall not run over sharp edges and must not be knotted or twisted.
- The load carrying equipment must be secured against slippage.
- Before lifting, check the screw connections of the crane lugs and the correct assembly as described in **chapter 3.4.2 (Mounting of crane lugs)**.
- Lift the AHU very slowly and completely horizontally. When lifting, a maximum lifting speed of 10 m/min is permissible.
- After the section is lifted slowly from the floor for a few centimeters, stop the operation. Now check the correct course of the load carrying equipment and that the lifting and fastening elements are all secure and safe.
- Before recommencing the lift, make sure that there are no detected malfunctions on the suspension mechanism and that the load is safe.



WARNING!

- Avoid jerky lifting.
- Loads are to be lifted and lowered in such a way to avoid unintentional overturning, destruction, sliding or rolling of the load.
- Loads can tip or fall over if the load-bearing equipment is not guided correctly or if force is applied incorrectly. Before lifting, it is therefore important to ensure that the load-bearing equipment is correctly routed and that the force is applied evenly, see **chapter 3.4.3 (Lifting of ZHK Nano AHU by crane lugs)**.
- Never lift AHU sections or monoblocs on heat exchanger connections or other attachments.

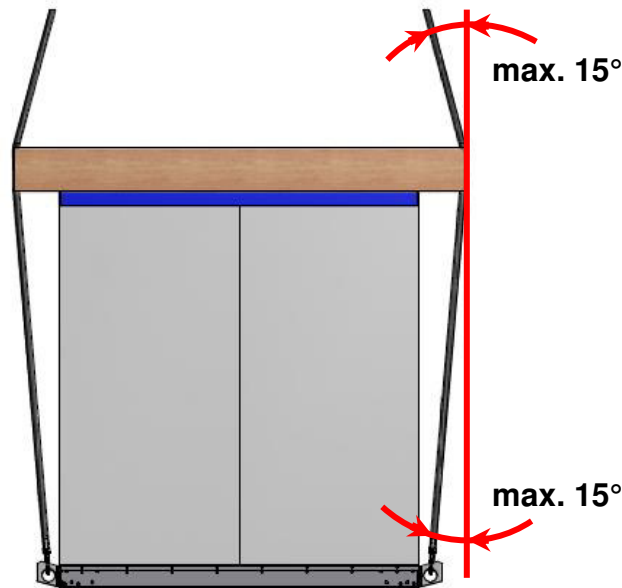


Figure 6: Permitted angle for load carrying equipment guidance

3.4 Lifting of ZHK Nano AHUs

The AHUs ZHK Nano types (sizes) 45, 55 and 65 are usually delivered as monoblocs. Monoblocs are AHUs that can be lifted as a single section. In case of the AHU ZHK Nano series, this applies to variants with plate heat exchanger and heat wheel of the types (sizes) 45, 55 and 65, see **Figure 7**.

However, if it is an AHU ZHK Nano of type (size) 80, the AHU is delivered within two (variant with rotary exchanger) or three (variant with plate exchanger) separated sections, see **Figure 8**. For each individual AHU section and each individual additional part, the same lifting instructions apply as for the AHU delivered as monobloc, as described in this chapter.



WARNING!

- In addition to the measures mentioned in this chapter, the instructions in **chapter 3.3 (Further necessary actions for the overlifting of both, delivery sections on crane lugs as well as monoblocs)** must be observed.
- Crane lugs are only permitted for lifting a monobloc or individual AHU parts - never screw AHU parts together before lifting.
- Each section, option, or additional part, like chiller or E-heating coil, must be lifted always separately.

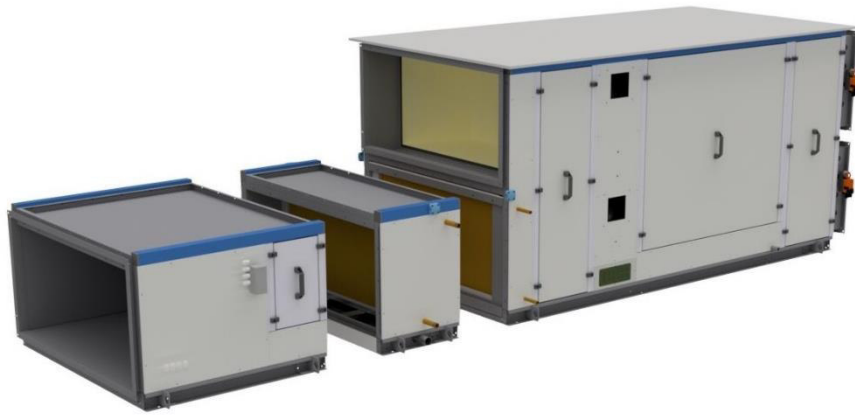


Figure 7: Monobloc ZHK Nano with additional parts (chiller and E-heating coil)

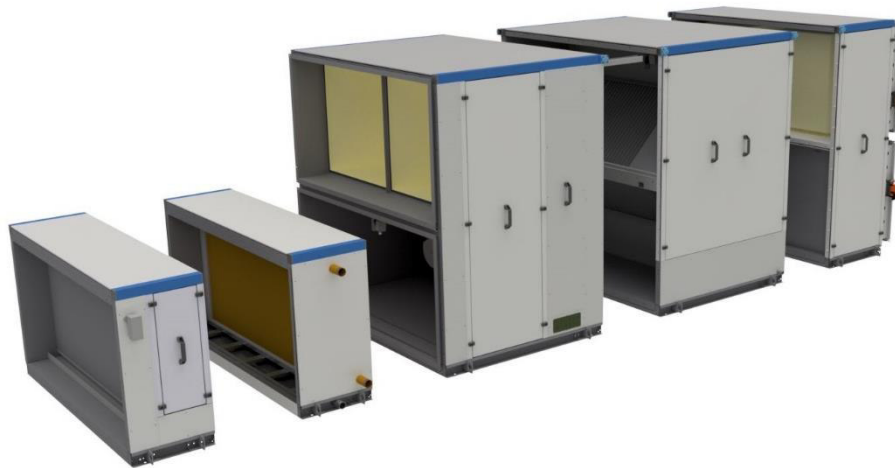


Figure 8: ZHK Nano type 80 sections with additional parts (chiller and E-heating coil)

3.4.1 Weight specifications of ZHK Nano AHUs and additional parts

Depending on the AHU type (size) and variant, the ZHK Nano AHUs have different weights. For the weights of AHUs types (sizes) 45, 55 and 65 see **Table 4**, and for AHUs type (size) 80 see **Table 5**. Up to these maximum weights ZHK Nano AHU's may be lifted by using the delivered crane lugs. The delivered crane lugs may be used for lifting ZHK Nano AHUs up to these maximum weights. It is required, that the weight is equally distributed on all 4 correctly mounted crane lugs. If there are more than one AHU part, they must be lifted separately.

	type 45 weight in kg	type 55 weight in kg	type 65 weight in kg
Variant with plate heat exchanger	440	560	740
Variant with heat wheel	410	530	700
optional chiller (additional part)	80	90	120
optional E-heating coil (additional part)	115	140	155

Table 4: Weight specifications ZHK Nano types (sizes) 45, 55 and 65 and additional parts

	type 80 weight in kg
Variant with plate heat exchanger: section 1	350
Variant with plate heat exchanger: section 2	270
Variant with plate heat exchanger: section 3	250
Variant with heat wheel: section 1	470
Variant with heat wheel: section 2	350
optional chiller (additional part)	140
optional E-heating coil (additional part)	185

Table 5: Weight specifications ZHK Nano type (size) 80 and additional parts

3.4.2 Mounting of crane lugs

4 crane lugs are supplied loose in two - mirror inverted - versions. These lugs must be mounted at the specific positions at the base frame of the AHU.

Execution of the lifting lugs (see **Figure 9**):

1. Right-side type
2. Left-side type



WARNING!

Attention to correct mounting of the crane lug according **Figure 11**.

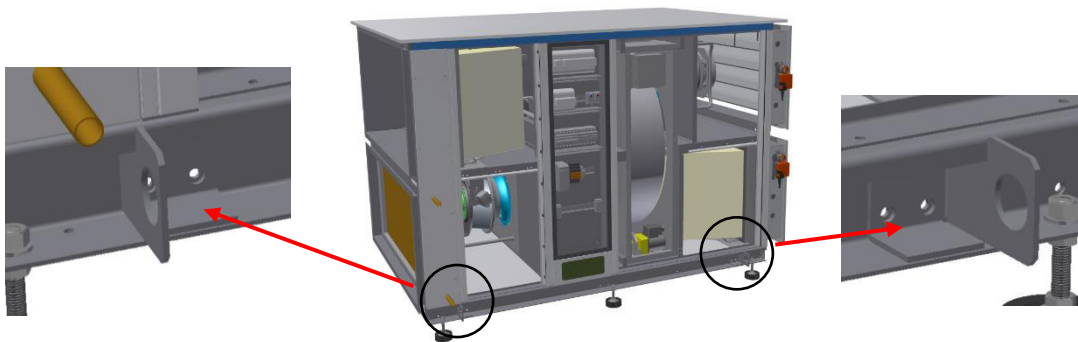
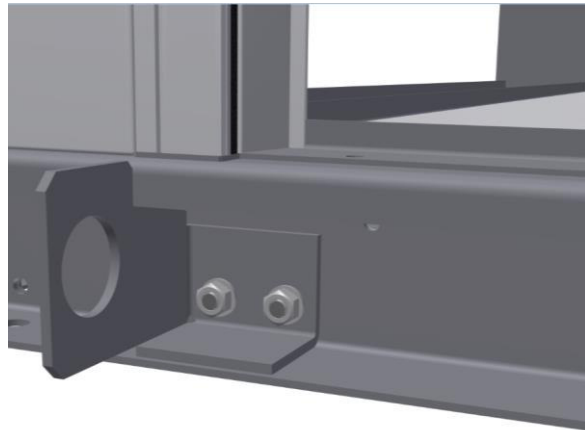
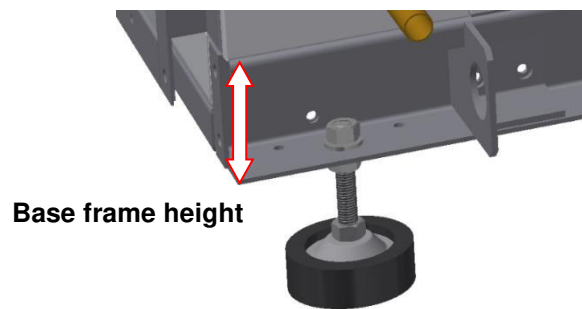


Figure 9: Right-side and left-side crane lifting lug


Figure 10: Crane lug dismantled

Figure 11: Crane lug mounted

Bolts and nuts are delivered with the lifting lugs and must be tightened with the torque according to **Table 6**. If the lifting lugs are already mounted by EUROCLIMA, the bolts must be checked before lifting of the AHU.


Figure 12: Base frame height

Base frame height H (mm)	Bolt type	Nm	Strength class
80	M8x20	10	min. 8.8

Table 6: Tightening torque for bolts

3.4.3 Lifting of ZHK Nano AHU by crane lugs

- The load effect has to take place uniformly across all four crane lugs.
- The definition of the load carrying equipment is the responsibility of the executing company.
- The correct guidance of the load carrying equipment according to **Figure 13** must be observed.
- After the pre-positioning of the delivery section at the desired position, remove the lifting lugs and use them for the next delivery section.

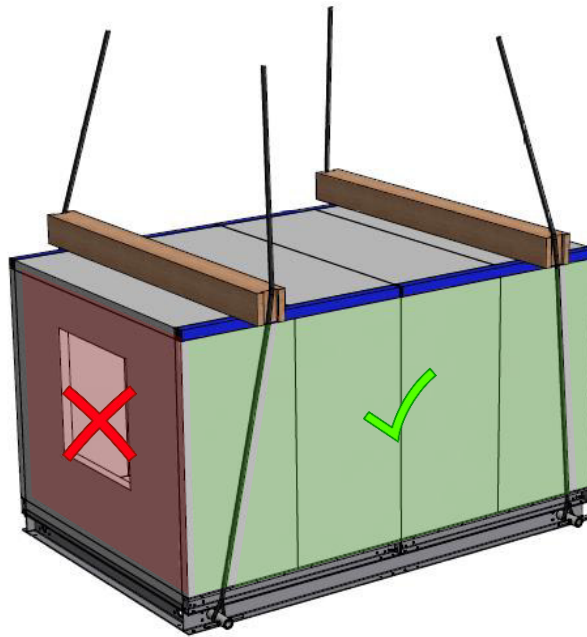


Figure 13: Guiding of load carrying equipment (schematic illustration)

3.5 Storage

The delivery sections are generally packed in nylon. This package is only suitable to protect the AHU during loading and unloading from bad weather, but not for outdoor storage. After unloading, move the device immediately to a storage facility in a dry, well covered area. This is essential for the preservation and protection of the AHU.

Standstill maintenance



Prolonged standstill times can cause damage on motors, fans or pumps.

NOTICE!

To avoid damage on bearings, the rotors should be moved manually a few turns about once per month. If the period between delivery and commissioning is more than 18 months, then the bearing must be replaced. Also components, such as belts, must be checked and if necessary replaced.

Removal of nylon packaging



Remove the nylon packaging after delivery and place the AHUs in a dry, weather protected area: the risk of corrosion due to the lack of ventilation in combination with a higher humidity under the nylon packaging is possible. For example, white rust could form within a short time on galvanized surfaces. It is possible that an excessively high temperature is created under the packaging, which can also cause damages to the components.

NOTICE!

If you would like to satisfy everyone, including yourself, the planner, the owner and other observers of the AHU, then we strongly recommend covering to protect the AHU against dirt and damage during the installation and commissioning process. This is always advisable and good practice and site management. see **Figure 14**.

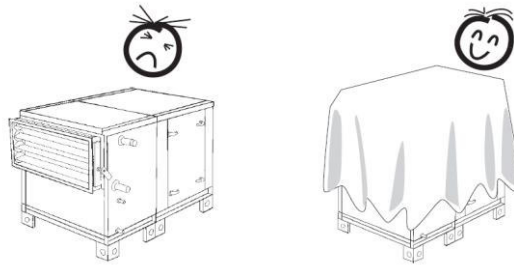


Figure 14: Protection against dirt

4 Foundation / erection

4.1 General notes



DANGER!

The stability of the AHU at the installation site must be ensured. Depending on the installation site and the expected wind load or other external influences, the AHU must be suitably fastened onsite to the foundation/position using the base frame.



NOTICE!

According to EN 13053 and VDI 3803 it is not permitted, that the bottom of the AHU replaces the building roof or take over any other function of the building, neither in terms of statics, tightness nor thermal insulation.



NOTICE!

AHU which are not designed to stack, should not be stacked (one on top of the other).

External or on-site loads

The components of the AHU (doors, panels, duct connections, pipe connections, etc.) must not be subjected to additional loads or stresses from construction work or installations that could cause damage to the AHU, such as:



NOTICE!

- The AHU must not take on any static function within the building or be used to support other installation components.
- Air ducts and pipelines connected to the AHU must be secured to the building structure in such a way that their own weight is not - even partially - transferred to the connection to the HVAC unit, see **Figure 15**.



Figure 15: Improper on-site piping

- The loads from other on-site cable trays, ventilation ducts, pipe racks, control cabinets, and similar components must not be supported by or attached to the AHU but must be supported by other suitable support structures.

Suspension of ceiling AHUs

If floor AHUs are to be mounted on the ceiling, then the device must be fixed with the base frame on an encompassing suspension system (see **Figure 16** right). The handling of the structure-borne noise insulation is resemblant of for floor AHUs.



WARNING!

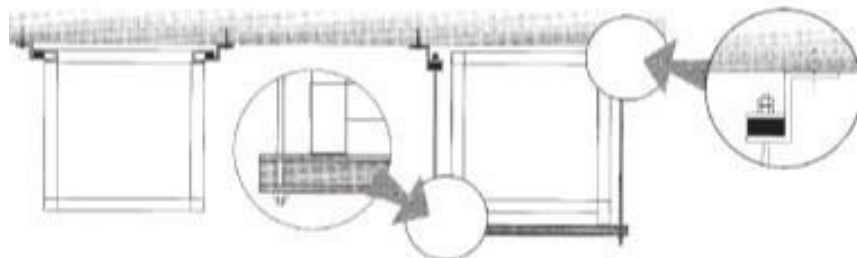


Figure 16: Suspension of ceiling AHUs

4.2 Foundation

Recommended are solid foundations of reinforced concrete, as shown in **Figure 17** left, or strip foundations, as shown in **Figure 17** right. For strip foundations, concrete or steel beams shall be used, see **Figure 17** bottom-right. Steel beams constructions must have an appropriate stiffness in relation to the AHU size. The foundation must be flat and leveled, it should have gradients in any direction or uneven surfaces.

Following conditions must be fulfilled:

- The height difference of the foundation may be **1 mm per meter maximum**. For the entire AHU length and width, a height difference of **5 mm maximum** is acceptable.
- If the conditions mentioned before are not fulfilled due to uneven foundations or sagging of the foundation, measures for rectifying the conditions must be taken (e.g. distance sheets with appropriate thickness).

Attention!

If these structural conditions are not met, this could be the cause problems including of jammed doors and dampers and other problems with the AHU.

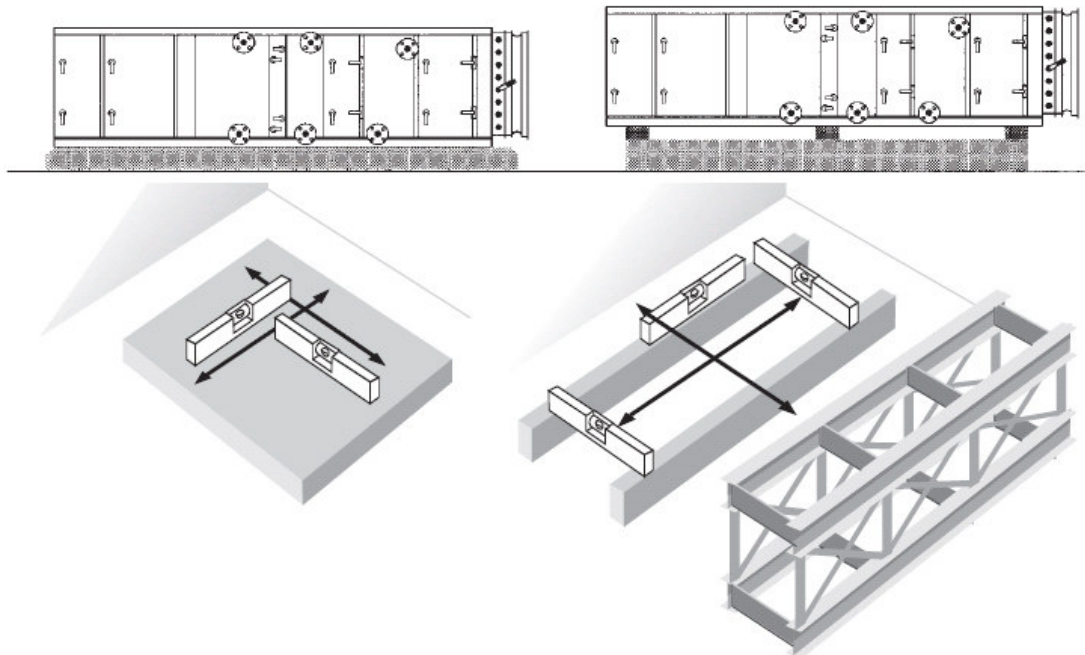


Figure 17: Solid foundation and strip foundation

AHUs must weigh down the foundation on the base frame in longitudinal and cross direction either in strips or points.

The installation of special underlay with impact sound insulation properties and high specifications is highly recommended. It is recommended, depending on the location of the erection, to underlay the AHU with cork, Mafund plates or Sylomer strips. The use of absorbent material must be adjusted to the load to achieve optimum noise insulation and efficiency. Each contact point between AHU and foundation must be noise insulated. Additionally, the respective design criteria of the provider must be complied. For the weight specifications of the AHU see the technical data sheet.

4.3 Erection

4.3.1 Space requirements

At the location, for proper maintenance and installation of components there should be adequate space for the devices. Therefore, a free working space of AHU width + 300 mm needs to be available. At the rear of the machine, a 600 mm width passage should remain free between the machine and the fabric of the building.

4.3.2 Potential risks that could arise at the erection site

- For heating or cooling water or water-glycol circuits these can be connected to the AHU.
- The pipes or hoses and their fittings can leak or become loose, so that inside or outside of the AHU water or other substances are evident through the resulting leakage.

- Cooling processes can cause dehumidification and the associated formation of condensation in the AHU. The AHU is therefore equipped with condensate collecting trays and outlets. Nevertheless, condensate can exit from the AHU in the event of performance issues by the device, under prohibited or extreme operating conditions. Errors on the AHU, prohibited or extreme operating conditions can also cause the formation of condensate on the outer surfaces of the AHU, which may cause dripping.
- Internal and external cleaning (also wet cleaning) can be performed on the AHU. When performing this work, leaking / dripping of the cleaning fluid is possible.
- All parts which are in contact with water inside and outside of the AHU may freeze under certain environmental conditions. Particularly, the following components have an increased risk of freezing:
 - o Condensate pans of heat recovery systems and heat exchangers inclusive pan nozzles, siphons and drains
 - o Freezing condensate directly on the heat recovery system and heat exchanger
 - o Freezing operation fluid of heat exchangers with/without glycol
 - o All areas and parts of the AHU which are exposed to the weather.

4.3.3 Actions to prevent potential risks

These risks can be prevented by the following actions:

- The position/ location of the AHU does not really matter. For example, whether or not it is situated on a floor, heightened on a frame or suspended from the ceiling. The important aspect is that there is guaranteed access and appropriate space onsite for assembling and maintenance of the AHU.
- Depending on the installation, suitable protective actions must be taken to ensure that persons, buildings and equipment are not at risk from falling parts (e.g. tools, screws, etc.) and possible drainage of water or other fluids.
- The ground around the installation site should be watertight and have with a downward gradient to a sufficiently sized outlet for drainage.
- Where this condition is not met, the installation of the AHU in a sufficiently drainage system/ pan with an outlet may be an appropriate solution.
- A humidity sensor with an alarm transmitter can offer additional protective support in critical operating conditions.
- For AHUs suspended from the ceiling, it is recommended, in any case, that a sufficiently dimensioned collecting tray with outlet, positioned under the AHU is acquired.
- To avoid components freezing, the customer must ensure that the AHU is protected against adverse weather conditions and resulting temperature variations, which could lead to such problems. Additionally, the customer must take further measures to provide freeze protection.

Some recommendations for that purpose are:

- o Complete drainage of the heat exchanger when it is not in use
- o Usage of water/glycol mixtures with adequate glycol concentration as fluid for the heat exchanger. (Attention: Performance loss must be considered)
- o Control-technological frost protection (Caution: If parts of the frost protection thermostat are mounted on the outside of the AHU, make sure that the ambient temperature does not fall below the set trigger temperature. Otherwise, false triggering may occur. The instructions of the frost protection thermostat manufacturer must be observed.).

The customer has to make decisions on appropriate actions, through their knowledge of the situation and conditions on site. The installation technician and the operator of the AHU have to ensure preventive actions and protection, in accordance with the instructions mentioned herein. In this context, it is recommended to have insurance against damage caused by water and other liquids.

EUROCLIMA is not liable for damages that may arise due to leakage of the AHU, of fittings, of pipes or hoses or due to condensation.

5 Assembly



In general, the roof of AHUs cannot be walked on

If it is unavoidable to climb on the AHU during installation, for example when connecting the roof panels, it is essential that the AHU is adequately protected against damage by taking appropriate measures, e.g. distributing the load by placing boards underneath.



Figure 18: Do not climb on the AHU!

5.1 Assembly of casing

5.1.1 Actions before the assembly of casing

If several AHU sections must be connected, then the procedure after the pre-positioning of the sections is as follows:

Remove crane lugs

If lifting lugs are mounted, remove them. To set the AHU in the exact assembling position, it can be moved by a rod (leverage). Use the rod only on the base frame profile.

Applying sealing material

The supplied self-adhesive sealing strip (**Figure 19**) must be applied at all section connections evenly before assembling, see **Figure 20**.

Following section connection points must be sealed:

- The flange areas between sections.
- Between duct and casing connection openings.
- Between connection flange and dampers, flexible connection, weather protection grid, sand trap louvre, intake hoods etc.



Figure 19: Sealing strip

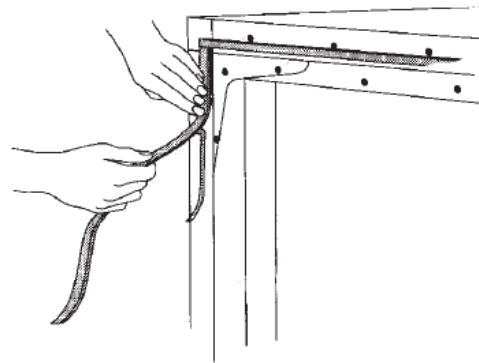


Figure 20: Applying the sealing strip

Section connection points, screw connections between inside and outside, connection openings and bushings, and all other openings, which penetrate or protrude from the casing must additionally be sealed with SIKAFLEX (For example, heat exchanger connections, mounting screws, duct connections, measuring openings, etc.), as shown on **Figure 21** and **Figure 22**.

For roof AHUs as well as at device separations directly before or after a wet area (For example, cooler), special actions must be done for sealing. For that purpose, the supplied sealing agent Sikaflex (Figure 21) must be used. Further information will follow in **chapter 5.1.4 (Special features for roof AHUs and device separations at wet areas)**.



Figure 21: Sealing agent (Sikaflex)

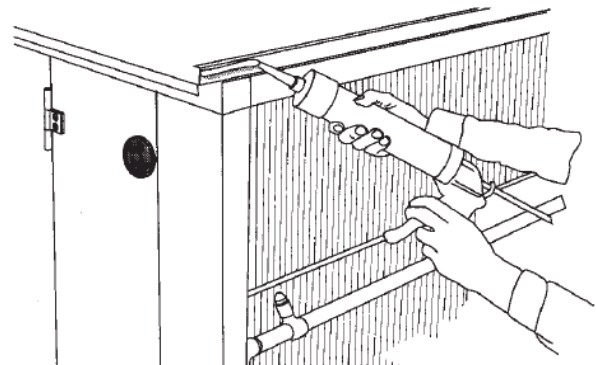


Figure 22: Applying the sealing agent

Connecting the AHU sections

The AHU sections must be aligned precisely and the front sides shall be exactly parallel to the other. If necessary, some minor adjustments can be made by placing steel plates under the section.

The AHU sections can be pulled together with belts/ slings, which attach on the base frame, as shown in **Figure 23** and **Figure 24**.



Figure 23: Pulling AHU sections together



Figure 24: Pulling AHU sections together (detail)

5.1.2 Standard connections and connection components

The connection via base frame must be always made at all AHUs, see **Figure 25** and **Figure 26**.

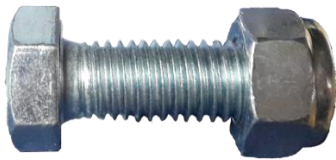


Figure 25: Hexagon bolt with locknut M8x20 / M10x30 / M12x40



Figure 26: Bolt connection of base frames

Additionally, to the base frame, there are other possibilities for connecting AHU parts. These are listed below, ranked by the execution sequence and configuration.

1. Easy Connection, see **Figure 27** and **Figure 28**
2. Connection angle, see **Figure 29** up to **Figure 31**



Figure 27: Easy Connection

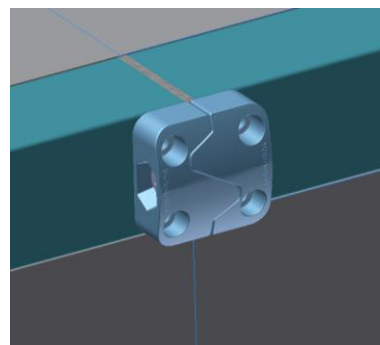


Figure 28: Connection via Easy Connection



Figure 29: Hexagon bolt with locknut M8x20

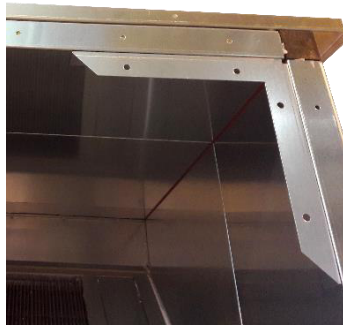


Figure 30: Connection angle



Figure 31: Connection via connection strengthening angle

5.1.3 Establishing the screw connection of AHU parts

The exact alignment of the AHU parts and pulling together AHU sections as close as possible, as described in **chapter 5.1.1 (Actions before the assembly of casing)**, are vital for establishing easier insertions of bolts and screws through the corresponding holes.

The precisely aligned and parallel flanges are connected with the enclosed bolts. Initially, all bolts are only loosely screwed as follows:

- In the base frame profiles (**Figure 32**).
- In the connection angles located in the upper corners of the AHU (**Figure 33**).
- For roof AHUs in the roof flange.

After placing all the screws loosely, they shall be tightened, starting with the base frame, in two stages.



NOTICE!

It is important, to initially tighten the bolt connections at the base frame. This is to ensure an exact connection of the AHU parts.

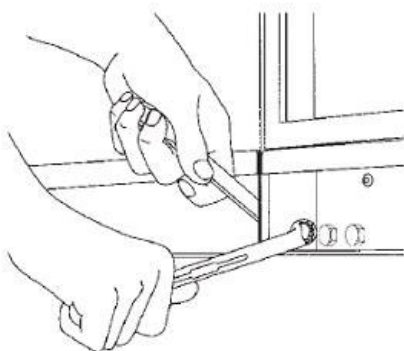


Figure 32: Bolt connection base frame

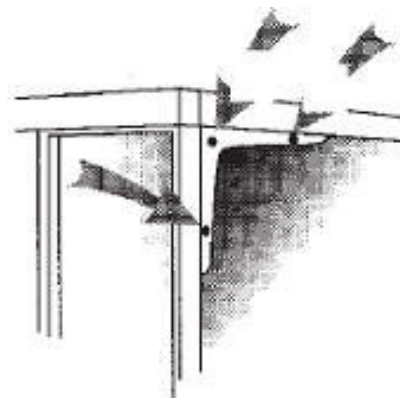


Figure 33: Bolt connection angles

5.1.4 Special features for roof AHUs and device separations at wet areas

For roof AHUs as well as at device separations directly before or after a wet area (e.g. cooler), special actions for sealing the AHU must be carried out:

1. The sealing agent (Sikaflex) has to be applied instead of the sealing strip across the whole flange of the AHU, 5 mm from the inner edge (see **Figure 35**). Immediately thereafter, the relevant delivery sections have to be joined together and then bolted.
2. If the AHU separation is **accessible at the inside via a door** (see **Figure 36**), then the joints (**Figure 37**) have to be closed over the entire outline with the supplied sealing agent (Sikaflex) after bolting together the delivery sections.

Note: To prevent leaks, these actions shall also be performed when extreme operating conditions are expected or wet cleaning is planned!

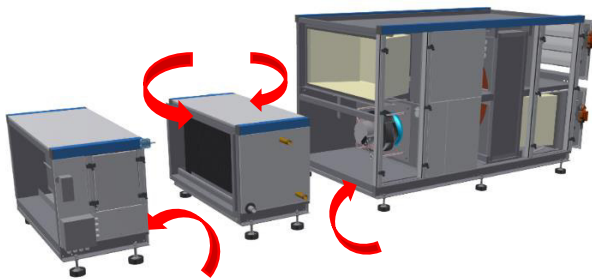


Figure 34: Sealing surfaces

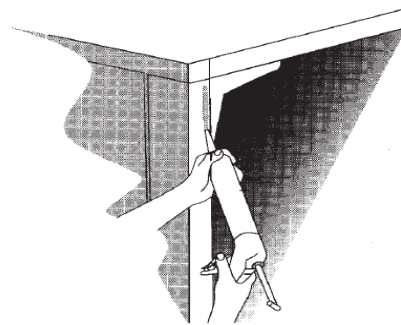


Figure 35: Sealing the frontal joints



Figure 36: AHU separation accessible via door

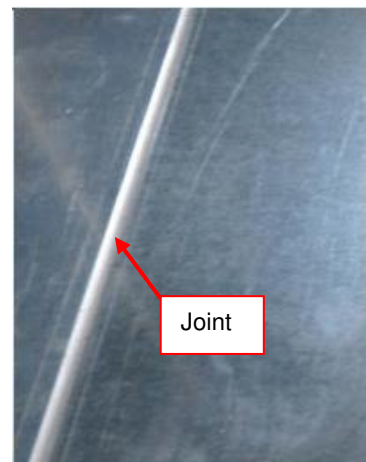


Figure 37: Sealing the section connection (joint) with the sealing agent

For roof AHUs, also the roof flange is to seal, refer to **Figure 38**.

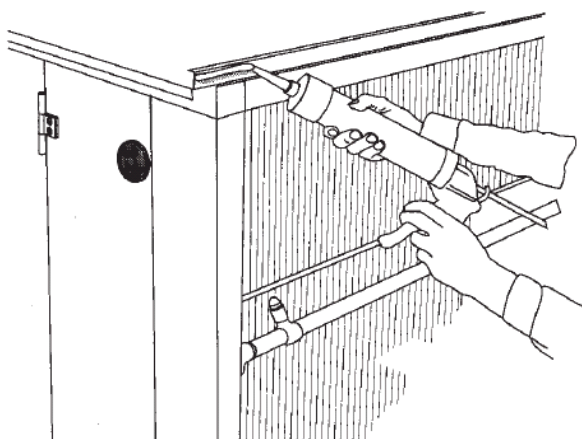


Figure 38: Sealing the roof flange

5.1.5 Securing the position of AHUs



Floor AHUs must be fixed on the foundation to secure the position. Fastening material is not included in the scope of delivery of EUROCLIMA. Suitable fastening material depends on the local conditions and weather/environmental influences and must be retrofitted on site, i.e. in the customer's area of responsibility.

A direct coupling, see **Figure 39** left, should be avoided because of structure-borne sound transmission. If you use structure-borne sound insulated underlayment, the fixing by lugs is particularly suitable to avoid the displacement of the AHU in all directions (**Figure 39** right).

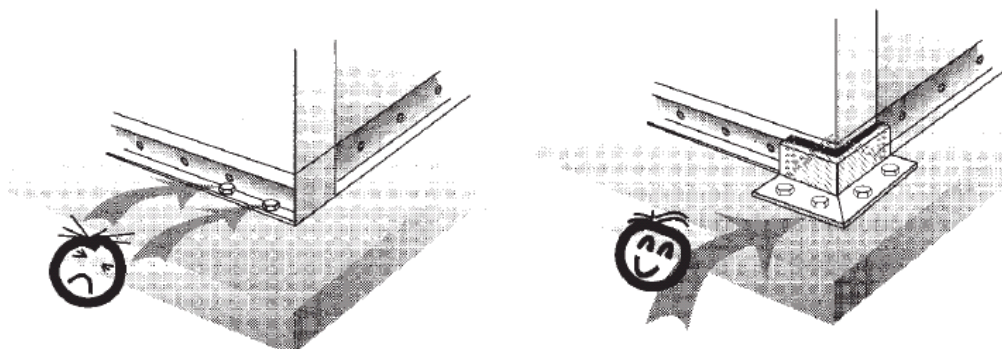


Figure 39: Securing the position on the foundation

If AHUs will be erected on roofs, a structural engineer must design the attachment of the AHU, based on the local situation and weather conditions.

5.2 Doors

Removable door panel ZIB

At this casing execution, the door panels will be fixed at the door frame by screw connections (see **figure beneath**).



Figure 40: Fixing screw with clamp-
ing piece (ZIB)



Figure 41: Fixing mechanism at door
frame (ZIB)



Figure 42: Fixed door panel (ZIB)



WARNING!

Pay attention at removable door panels, because after undoing the connection they could suddenly detach and lead to injuries. Therefore, always use both hands firmly for fixing, removing and handling of door panels!



WARNING!

Attention: Pressure-sided doors represent an increased risk of injury when opening. They can firstly adhere due to the pressure-difference, and then suddenly detach and fall against the user. The user could also suddenly be forced backwards.

Therefore, particularly when opening pressure-sided doors, it must be undertaken very carefully. Open the door panel carefully and detach it slowly from the sealing. When the door panel detaches suddenly, the user must be able to carry the weight of the door. At doors with a surface of > 0,5 m² two persons are necessary.

5.3 Dampers

The closing position of the dampers can be identified in two different ways, see **Figure 43** and **Figure 44**.



Figure 43: Closed position, characterized
by a sheet metal position indicator



Figure 44: Closed position, characterized by a
marking on the gear wheel



NOTICE!

- It is not permitted to drill into the damper, otherwise it may cause damage to the gear wheels and therefore function of the damper is no longer guaranteed.
- The dampers must not be strained or overly burdened.

5.4 Airfilters

5.4.1 General notes

- Filters, with the exception of laterally removable pre-filters are supplied loose and must be installed on site.
- Ensure proper insertion of the filters (the bound filter media side on the unclean air side).
- During the installation it must be understood that the filter bags cannot not be clamped or damaged. Each filter bag must freely adjust itself in the airstream.
- If the filters are not included in the scope of delivery by EUROCLIMA, the procured filters must fulfill the requirements of VDI 6022.



NOTICE!

Incorrectly mounted filters can be sucked in by the fan and lead to considerable damage.

5.4.2 Laterally removable bag filters with clamping mechanism

When inserting and fixing the removable bag filters with a clamping mechanism, proceed cautiously, so as not to damage them. The installation of laterally removable bag filters must be carried out as follows:

1. First, move all levers of the clamping rails toward the door opening (**Figure 45**).
2. Slide one filter after the other in the filter frame (**Figure 46**).
3. Press the last filter of the row against the rear panel. Then press with the lever the filter cells against the sealing (**Figure 47**).



Figure 45: Loosen the clamps



Figure 46: Slide in the filters

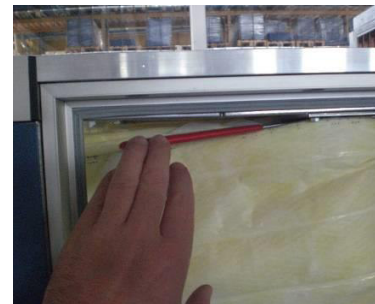


Figure 47: Clamping the filters



NOTICE!

Attention: For soft bags, the lower parts of the bags of the filter cells need to be lifted up in order to prevent damage by the clamping system. Again proceed slowly and carefully with installation (see **Figure 48**)



Figure 48: Lifting the filter bags



NOTICE!

Attention: If different widths of filters are planned for one filter frame with clamping mechanism, then the order of the insertion has to be according to the filter frame raster (see **figure beneath**). Otherwise it leads to an air bypass.



Figure 49: Filter frame for different filter sizes



Figure 50: Consider the order according the filter frame raster



Figure 51: Filter section with inserted filters



NOTICE!

Attention: Filters must be pushed completely to the back, so that all filters fit closely to the filter frame and an air bypass is avoided. Important: Examine if the first filter fits closely to the sealing. (**Figure 53**)

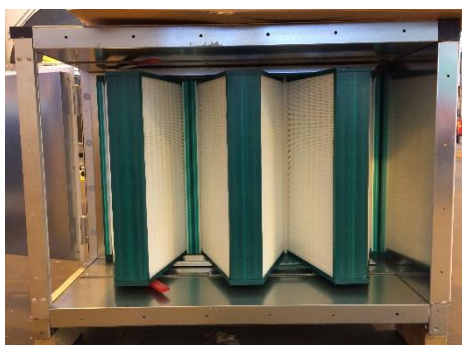


Figure 52: Pushing and clamping of the filters to the rear wall



Figure 53: Check, if filter lie on the sealing

5.5 Component assembly in the duct system

5.5.1 Duct smoke detector

- The smoke detector must be installed in the duct on site in accordance with the manufacturer's operating instructions. **Figure 54** shows an example of mounting the smoke detector in the duct system.

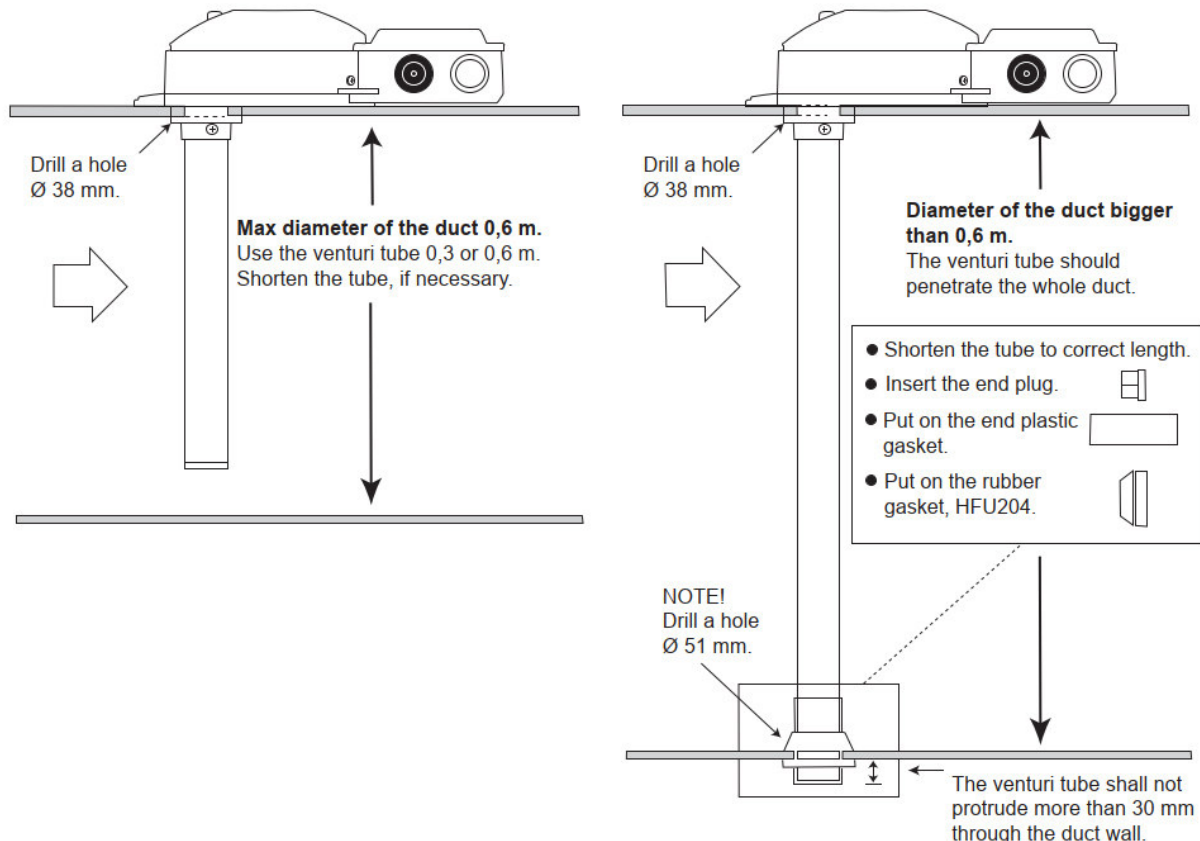


Figure 54: Exemplary mounting duct smoke detector in the duct

- After completing the installation, a function test must be performed.



NOTICE!

If there is a risk of condensation (e.g. when installing outdoors, etc.) the smoke detector should be insulated from the ambient air, for example with a weather-proof housing.

5.5.2 Gas sensor



WARNING!

The gas sensor may only be installed by qualified personnel. When using a gas sensor, the manufacturer's instructions must be followed completely and carefully.

**WARNING!**

The installation surfaces may not be subjected to constant vibrations in order to avoid damage to the connections and electronic devices.

Accessibility to the sensor must be guaranteed. If accessibility in the AHU is not guaranteed, the evaluation unit is mounted on the outside of the AHU and the sensor is supplied loose. If the sensor is supplied loose, it must then be installed on site in the supply air duct by means of an inspection door, as specified in the manufacturer's operating instructions.

Figure 55 and **Figure 56** show an example of the mounting of the gas sensor in the duct.

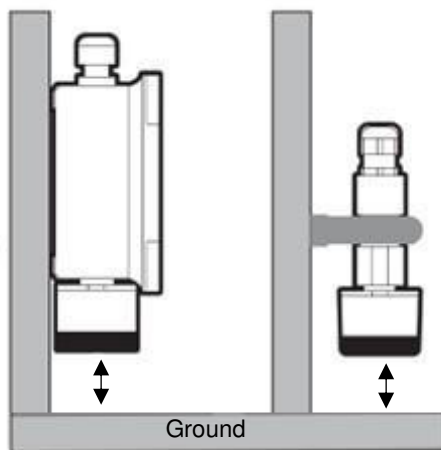


Figure 55: Exemplary mounting gas detector in the lower area



Figure 56: Mounted gas detector

6 Installation

6.1 Heat exchanger connection

Before connecting the heat exchanger, the piping system must be rinsed thoroughly.

**NOTICE!**

An absolutely stress-free connection has to be ensured and the transmission of vibrations and longitudinal expansion between the device and the piping system must be safely prevented.

**NOTICE!**

In order to avoid corrosion due to water, the requirements regarding water quality, professional installation, commissioning and maintenance of VDI 2035 sheet 2 have to be complied.

Connection pipes with thread:

To prevent damage of the heat exchanger connection, it is necessary to hold against with a pipe wrench during the tightening process (**Figure 57**).

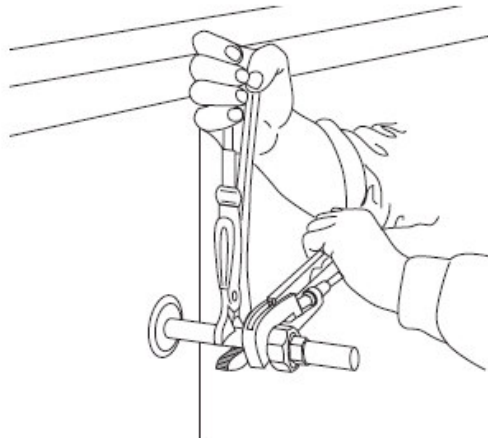


Figure 57: Holding against with a pipe wrench

Recommended sealing material for threaded sleeves:

- Water / glycol heat exchangers, use Teflon tape.

In these cases, hemp cannot be used as sealing material!

Connection pipes without thread:

If the connection pipes are executed without threads, then a mechanical, force-fitting connection (STRAUB coupling) is recommended (**Figure 60**). This coupling could be included optionally in the scope of delivery from EUROCLIMA, if not, then it must be provided on site. In order to avoid damage of the copper pipe of the heat exchanger due to mechanical force, a ring needs to be inserted to reinforce the copper pipe (**Figure 58** and **Figure 59**).



Figure 58: Copper pipe with reinforcing ring



Figure 59: Copper pipe with inserted reinforcing ring



Figure 60: STRAUB coupling



Figure 61: Mounted STRAUB coupling

Other types of connections, for example, welding or soldering are not recommended by EUROCLIMA, because of risk of fire to neighboring materials. If one of those types of connections are chosen, the assembler is fully responsible for this task and associated hazards.

The piping for the heat exchanger should not hinder any maintenance required.

The connection of the heat exchanger is to execute as stipulated on the label on the AHU (connection diagrams in **Figure 62**).

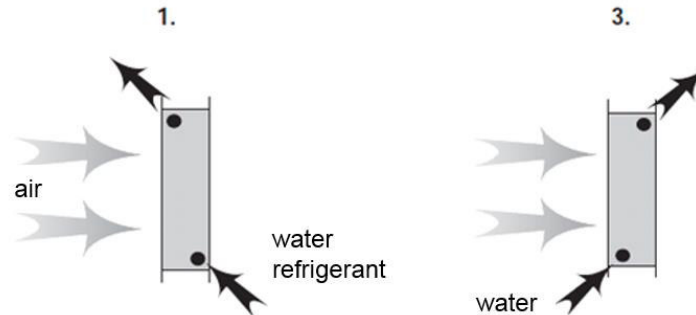


Figure 62: Heat exchanger connection

The heat exchanger operates according to the cross-counter-flow principle. Only a preheat exchanger can be supplied for parallel flow operation on request by the customer.

1. All standard heating and cooling heat exchangers - counter flow
2. A Preheat exchanger is needed if there is a freezing risk and can be requested.

Hydraulic connection schemes of a heating or a cooling coil should be carried out as shown in the scheme **Figure 63** with a three-way valve used as a mixing valve. Compared with a flow control using a gate valve/two-way valve (see **Figure 64**), this connection avoids unequal temperature profiles, in that way air heating or cooling is quite uniform along the coil surface.

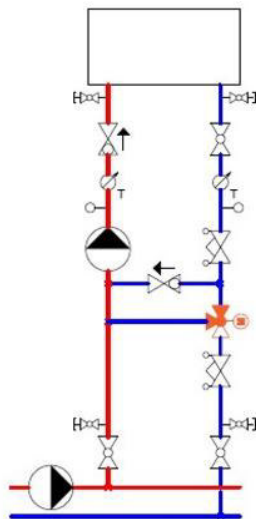


Figure 63: Exemplary hydraulic connection scheme three-way valve

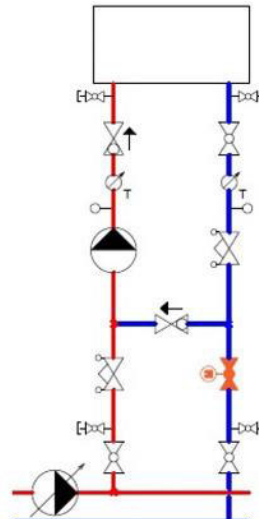


Figure 64: Exemplary hydraulic connection scheme gate valve/two-way valve



NOTICE!

Attention must be paid to the hydraulic adjustment carried out by a specialist company!

In order to vent and drain the heat exchanger connection, valves are mounted (on request). To ensure that the correct operation is undertaken, it is important that the vent is on the highest point of the whole water cycle and the drain at the lowest. Otherwise, the valves need to be mounted on another suitable point on the circuit.



Figure 65: Drain valve



Figure 66: Vent valve

6.2 Drain for condensate and excess water

Each drain must be equipped with a siphon. Siphons are available as accessories from EUROCLIMA.

6.2.1 Standard siphons

On request, EUROCLIMA can carry out a calculation of the required siphon height to minimize space needs. Contact your sales representative for further detailed information.



NOTICE!

The following conditions are essential for correct operation:

- At each drain, a siphon must be connected.
- Several drains should not be connected to one siphon.
- The water from the siphon must run in a funnel.
- Before starting, fill the siphon with water.
- In the case of outdoor AHUs, an antifreeze mechanism has to be installed and provided on site.

The heights H1, H2 and H3 can be determined from the maximum negative pressure (p) and maximum pressure (p) in the section of the siphon or be determined by the information on the technical data sheet as follows:

Total pressure	p_{ges}	= 1196 Pa
Dynamic pressure	p_{dyn}	= 83 Pa
Total static pressure	$p_{stat} = p_{ges} - p_{dyn}$	= 1113 Pa

$$1 \text{ mmWS} = 9,81 \text{ Pa}$$

$$H1 > 1113/9,81 = 114 \text{ mm} + 15 \text{ mm (Safety)} = \text{about } 130 \text{ mm}$$

$$H2 = 65 \text{ mm}$$

Siphon on suction side (in direction of airflow before the fan), see Figure 67.

$$H1 \text{ (mm)} > p \text{ (mm WS)}$$

$$H2 \text{ (mm)} > p/2 \text{ (mm WS)}$$

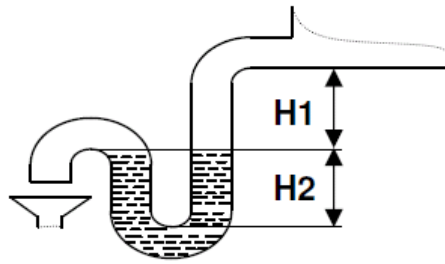


Figure 67: Siphon on suction side

Siphon on pressure side (in direction of airflow after the fan), see Figure 68.

$H3 \text{ (mm)} > p \text{ (mm WS)}$

$H4 \text{ (mm)} \geq 0$

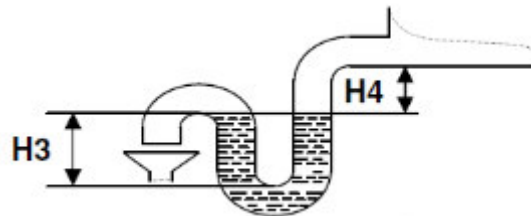


Figure 68: Siphon on pressure side

6.2.2 Ball Siphons

If Ball Siphons with the design shown below are supplied by EUROCLIMA, then the following instructions should be followed during installation:

Depending on the suction side or pressure side mounting position, the siphon body has to be installed so that the direction of the arrow (see **Figure 69**) corresponds to the flow direction.

- Pa = suction side
- + Pa = pressure side



Figure 69: Observe the mounting position - flow direction according to the arrow

Siphon on suction side (in direction of airflow before the fan)

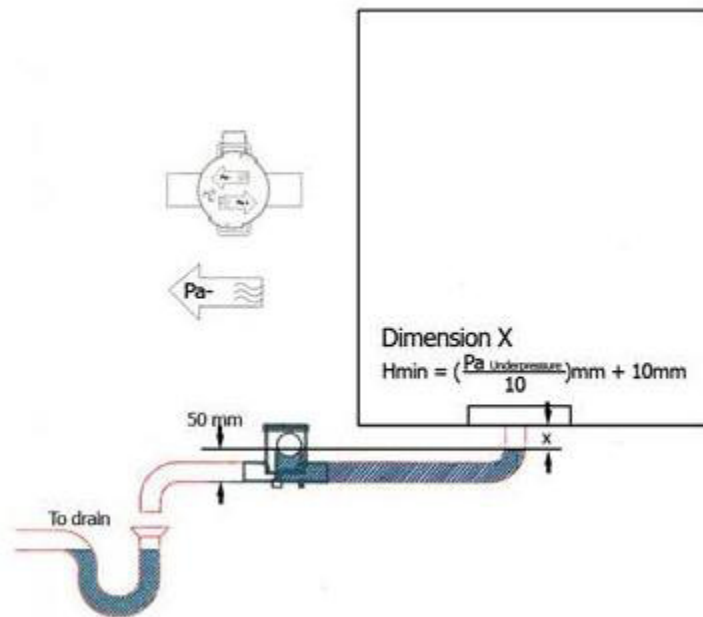


Figure 70: Suction side execution

Siphon on pressure side (in direction of airflow after the fan)

The black plug must be removed for the pressure side installation (see Figure 72).

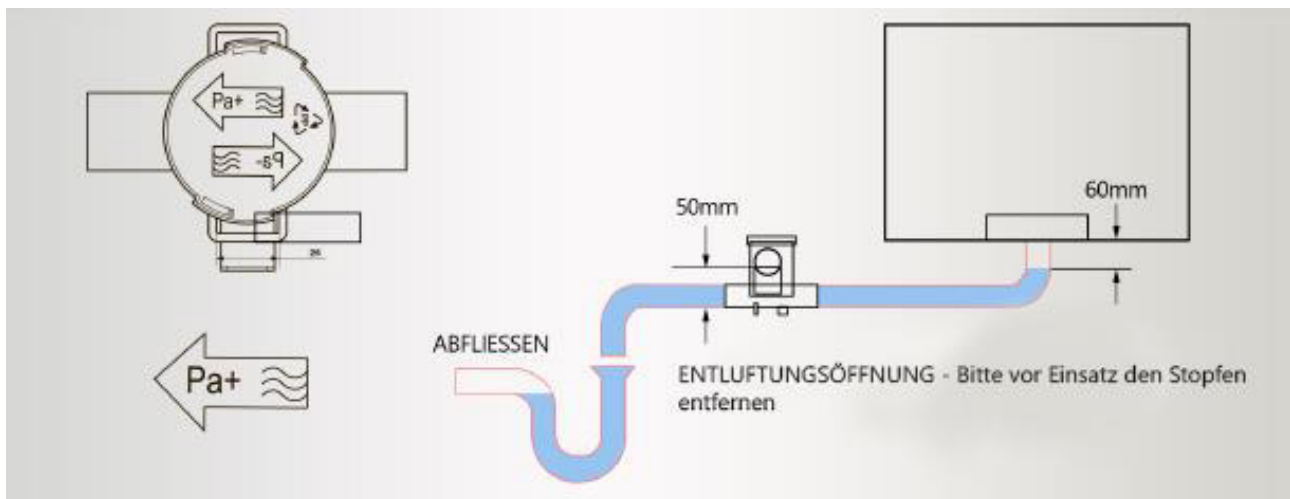


Figure 71: Pressure side execution



Figure 72: Pressure side installation: remove the black closing plug

6.3 Duct connection – airside connection to AHU

Depending on the customer's requirements, EUROCLIMA devices are equipped with various accessories and options for attaching air duct elements like dampers, flexible connections, frames, panel flanges, etc.

If no such accessories are supplied, then the airside mounting of components of the duct system is made directly to the housing of the AHU. Depending on the device opening, this can be done directly on the panel flange or directly on the external panel of the device.

When connecting, make sure that the requirements listed below are followed:

6.3.1 Requirements

- Ensure proper performance of the AHU by avoiding excessive pressure drops in the duct. To minimize the noise, the basic principles of the duct construction and acoustic design must be followed.
- A suitable seal (not included in the scope of supply) has to be installed between the device housing and the component of the duct system.
- The aero-technical connections must be executed free of tension and torsion. For example no forces / loads are allowed to be transmitted to the device housing by means of attached accessories such as ducts etc. The components on the system side must be fastened and supported separately.
- Even if no flexible connection is included in the scope of delivery of the device, an elastic connection must always be installed to prevent structure-borne sound transmission between the device and the duct system. It is recommended to use an interposed elastic connection of at least 140 mm in width, which needs to be installed unstrained between the duct and the AHU.
- This elastic connection must have sufficient flexibility and must be installed in a professional manner in order to avoid transmission of vibrations to the duct system.
- For proper performance of the AHUs, following of the basic rules of the duct construction is necessary. By appropriate planning, dimensioning and execution of the duct system, increased pressure losses and flow noise in the duct can be avoided.

Number of screws

The duct components are screwed as follows,

- each at a distance of 120 mm from the corner
- additional number of screws see **Table 7** and **Figure 73**.

Length or width	Additional number of screws
< 915	0
>= 915 <= 1220	2
>= 1372,5 <= 1830	3
>= 1982,5 <= 2592,5	4
> 2745 <= 3202,5	5
>= 3355 <= 3660	6
> 3812,5 <= 3965	7

Table 7: Information on the screw distances

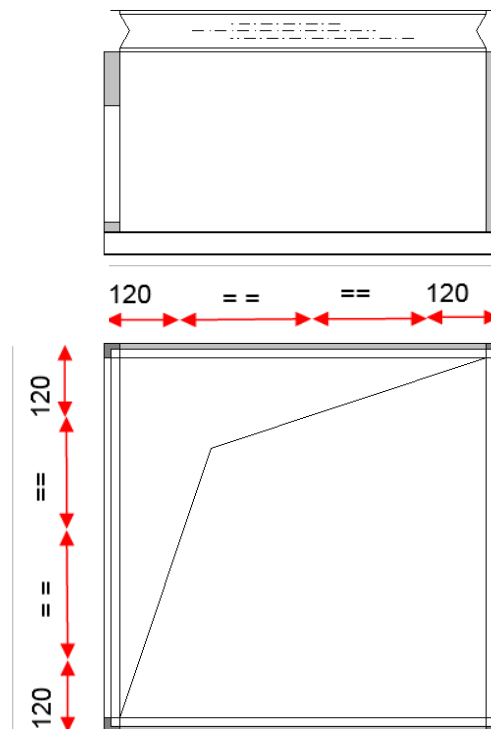


Figure 73: Information on the screw distance

6.3.2 Insulation of fresh air damper

Before connecting the duct section, the flange of the fresh air damper must be fully insulated. This action is imperative to prevent the formation of condensation by heat transfer. If fresh air dampers are not integrated in the AHU casing, then the damper frame must be insulated.

6.4 Freeze protection measures

It is the customer’s responsibility to provide sufficient freeze protection. Some possibilities for that purpose are listed below:

At cooling coils:

- Complete drainage of the heat exchanger
- Usage of water/glycol fluid mixtures with adequate glycol concentration. Performance loss must be considered.

At heating coils:

- Control-technological frost protection: Installation of a thermostat on the air outlet side to trigger alarm or temperature variation alert. (Setting trigger temperature 5 °C). In the event of an alarm, the mixture valve opens (100%), the heating circuit pump gets a signal and the fan is switched off automatically.

7 Electrical connection

- The electrical connection must be executed in compliance with international regulations such as the Low Voltage Directive 2014/35/EU and the requirements of electromagnetic compatibility Directive 2014/30/EU, of national legislation and the requirements of the local electricity provider.
- All electrical connections must be inspected annually and deficiencies (for example, loose cable strands, loose screw and clamp connection, etc.) must be eliminated and repaired immediately.

7.1 Connecting to an external protective conductor system

The AHU must be connected to an external protective conductor system. The AHU shall be either:

- connected at the base frames or
- alternatively, at the Potential Compensation, that is mounted on the flexible connection by EUROCLIMA.

Furthermore, each electrical component must be connected to the protective conductor system.

The connection to the external protective earth system has to be executed according to EN 60204-1, pt. 5.2. The minimum cross-sectional-surface of the earth at frequency converter has to be 10 mm², otherwise 4 mm² at AHUs with control. Depending on the cross-sectional-surface of the outer conductor, the requirements regarding minimum cross-sectional-surfaces of the protective earth system according to EN 60204-1, pt. 5.2, table 1 have to be considered additionally.

After assembling and installation the consistency of the protective conductor system has to be checked and documented according to EN 60201-1, pt. 18.2.

During commissioning, the loop impedance of the entire, completed system must be checked. A maximum permissible limit value of 1 Ω applies here, which ensures that the electrical protective devices are triggered in good time.

Lightning protection for roof AHUs



WARNING!

A lightning protection, especially for roof AHUs, must be professionally installed on site according to national rules and guidance. Otherwise, a fire can be caused, for example, by a lightning strike.

Correct direction of motor rotation is a result of direction of fan impeller rotation which is marked by an arrow: for EC fan refer to **Figure 74**.

Before connecting the motor, check the rotating field of mains connection with a suitable device. Afterwards, connect the phases accordingly to the main switch.



Figure 74: Rotation marking of EC fans

Fastening torque for electrical connections on the control panel refer to **Table 8**:


	Thread	M4	M5	M6
	Ø			
	Nm	min. 0,8	1,8	2,7
	max.	1,2	2,5	4

Table 8: Torques for the motor terminal board



Before connecting to the local power network, check that the local power supply is compatible with the motor requirements from the nameplate. In general the fan motors are designed for continuous operation. Abnormal operating conditions, particularly multiple start-ups at short intervals should be avoided, it could lead to thermal overloading of the motor.

7.2 EC motors

EC motors are variable through an integrated frequency converter. For operation, the supply voltage, a digital enable signal and an analog control signal are required for the speed control.



- The maximum admissible motor speed depends on the maximum admissible fan speed. The maximum admissible fan speed is specified on the order-related technical data sheets. For safety reasons, the maximum admissible fan speed must not be exceeded!
- In order to prevent high vibration loads and damage, critical speeds or operating frequencies must be avoided, see **chapter 8.3.2 (Vibration verification)**.

EUROCLIMA, therefore, recommends that operating conditions are continually monitored and assessed.

When using residual current circuit breakers (RCDs), the supply line must be protected by means of an all-current sensitive (type B or B+) residual current circuit breaker.

Cable type for motor connection

A shielded cable must be used for the motor cable (supply voltage) and the analog input signal, and the shield must be grounded on both ends (main switch & motor).

7.3 Main switch (emergency stop switch)

According to the standards IEC / EN 60204 and VDE 0113, all hazardous facilities have to be equipped with a main switch, which separates the plant from all active conductors of the main supply. This means that every single AHU must be equipped with such a main switch.

The main functions and requirements (in compliance with standards DIN VDE 0660 and IEC 947-3) when using the RED-YELLOW main switch as follows:

1. Is used as a repair, maintenance or safety switch, because the actuation of the switch does not reset the control commands from control system.
2. Has a clearly marked OFF (0) and ON (I) position.
3. The OFF position is lockable, to secure against unauthorized or unintentional restart.
4. For outdoor installation the main switch must be at least IP65.
5. Interrupts the power supply to the AHU (lighting can be excluded, refer to **chapter 7.6 (Lighting)**).
6. Separates the electrical equipment from the main supply.
7. Is easily accessible
8. Mounted within sight of the AHU.
9. The allocation to the AHU can be clearly seen.
10. **Emergency stop function:** The main switch (red switch with yellow background) **must be connected to the control system with appropriate components** in order to ensure the emergency stop function works effectively. Reset means that a manual start command, separate from main switch, must be activated.



Figure 75: Main switch

- Control box is equipped with main switch in execution RED-YELLOW as specified above
- It is the responsibility of the client to ensure that the above specified requirements, according to DIN VDE 0660 and IEC 947-3, are complied with and main switch fulfills the following:
 - a) items 7 to 9
 - b) item 10, implementation of emergency stop function in control system

7.4 Electric heaters

An electric heater is designed to heat the airflow, which is recorded on the technical data sheet, from the specified air inlet temperature to the air outlet temperature. EUROCLIMA provides electric heaters with one or more stages according to customer requirements.

The control of the electric heater provided by the customer can be considered in several ways:

- On-Off at single-stage electric heater (this type of control decreases the lifetime of the electric heater under circumstances significantly)

- On-Off at multistage electric heater
- Continuous (e.g. with suitable thyristor control)



WARNING!

Fire risk!

With the electric heater in operation, the heating elements increase to a temperature of several hundred °C.

In the event of malfunction, for example, a heater in operation without adequate airflow, inadmissible temperatures could occur. Furthermore, plastic parts, for example, filters, gaskets and droplet eliminators etc., which are close to an electric heater could become damaged or even catch fire. This could lead to the spread of fire and significant damages to the wider building.

In order to avoid the above stated risks, EUROCLIMA provides, as standard, electric heaters with two independent safety thermostats.

Units, which are supplied by EUROCLIMA with control, are limiting the supply air temperature to a default value of 35 °C.

This execution and function, as specified below, is supplied by EUROCLIMA.

Control-side limitation of the air temperature beyond the electric heater

The control of the electric heater always regulates the temperature of the air passing through the heater so that it never exceeds the permitted air temperature in the AHU (40 °C, if not differently specified in the technical data). This item must be specially and closely monitored, when the AHU is only operated with a partial air flow. For example, in times of reduced use of the building.



WARNING!

As the heat output of an electric heater is generated very quickly and at full capacity at ON-OFF operation, there is a significant risk of overheating of the AHU, which contributes to the damage of several components. This risk occurs especially at low air flows.

For this purpose, the air handling unit is equipped with a supply air sensor, which directly measures and monitors the air temperature generated by the electric heater. The control engineering is used to ensure that the heating power of the electric heater is controlled so that the temperature remains within the permitted air temperature levels in the AHU.

Avoid overheating of AHU components by residual heat of the electric heater

In order to avoid excessive heating of components by residual heat of the electric heater, this control ensures that fan motor keeps on running for at least 5 min after cutting off of the electric heater! By using an enabling contact (see **Figure 79**) the control engineering also ensures that the electric heater can only start its operation when the fan is running.



WARNING!

If in case of main power failure (for example lightning strike) this automatic running cannot be ensured. The AHU could become damaged by the residual heat of the electric heater.

Therefore, in order to avoid damages, an uninterrupted power supply is recommended. If the AHU is not operated by an uninterrupted power supply after every main power failure, an AHU inspection is required as indicated in **chapter 9 (Maintenance)**.

Safety concept

Electric heater power supply is equipped with two contactors in serial connection!
The two safety thermostats protect the AHU in two independent ways:

Firstly: By hardware via contactors in the power supply.

Secondly: By software via controlling. In the event of failure, contactors can immediately cut off the electric heater from the power supply.

- The two safety thermostats are connected in serial connection.
- The two safety thermostats are equipped with manual reset.
- After triggering (the reason for stopping) must be detected and eliminated before the reset of the thermostat!

Thermostat 1 (Figure 76 and Figure 77)

- Position of thermostat body: attached on the electric heater at the connection side, is accessible by removing the electric heater access panel.
- Triggering temperature: pre-set-value must not be changed.
- Sensor position: between heating bars.
- Function: alarm-triggered-stop in case of temperature levels exceeding set limits because of low airflow issues.



Figure 76: Thermostat with cover cap on the reset button

Cover cap on reset button
Reset button



Figure 77: Thermostat with uncovered reset button

Thermostat 2 (Figure 78)

- Position of the thermostat casing: attached on the outside panel of AHU casing
- Triggering temperature: set to 70 °C – value must not be changed
- Sensor position: downstream of the electric heater in upper area of airflow
- Function: alarm-triggered-shutdown in the event of temperatures exceeding set limits because of lack of airflow



Figure 78: Thermostat 2

Connection box could reach high temperatures. For suitable connection, use heat-resistant cables (admissible operation temperature min. 110 °C), for example silicone, Teflon or glass fiber insulated cables.

Connection scheme for electric heater according to EUROCLIMA:

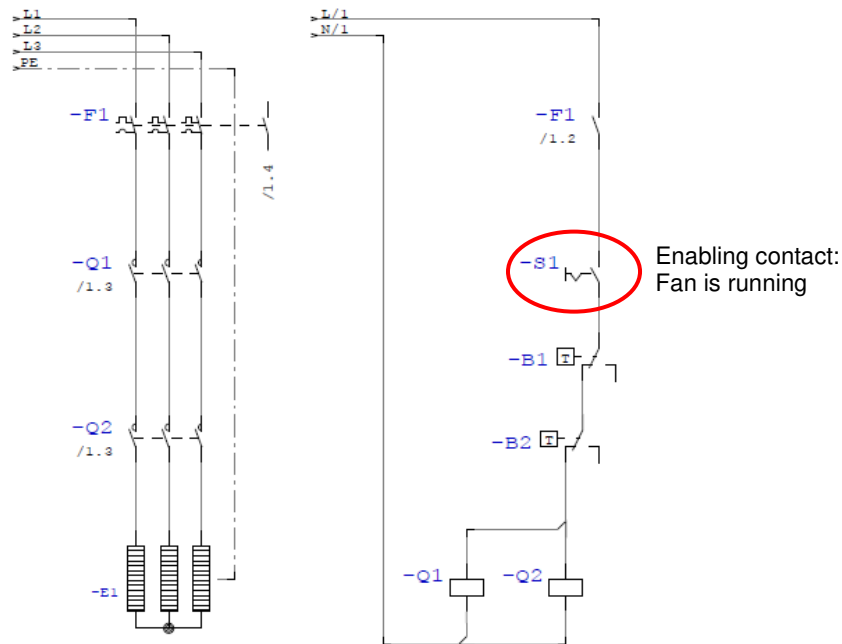


Figure 79: Connection scheme for electric heater

In the event of dehumidification at the wheel downstream of electric heater, it is ensured that control rotates the wheel while electric heater is on (additional enabling contact).

7.5 Frost protection for plate heat exchanger

At low temperatures and high air speeds, the condensate in the plate heat exchanger can freeze and ice over.

For devices supplied by EUROCLIMA with control, this is prevented by pressure monitoring of the plate heat exchanger and the temporary adjustment of the supply air volume flow.

7.6 Lighting

Depending on the number of delivered (optional) lamps, the assignment of the switches and junction boxes can be found below:

1 Lamp	1 switch
> 1 <= 4 Lamp	1 switch, 1 junction box
> 4 <= 8 Lamp	1 switch, 2 junction box
> 8 <= 12 Lamp	1 switch, 3 junction box

The lamps are mounted and supplied with one side connected and one side with loose cables, sufficient in length to be routed to the nearest junction box or the next switch.

The AHU will be delivered in parts, and for this reason the lights have to be connected on site and the client is responsible for the completion of this work.

If the AHU require lights to be fitted on site, make sure that sections with condensate (cooling sections) and wet sections are equipped with lights with appropriate protection of at least IP55. Switches or junction boxes mounted on the outside of rooftop AHUs must also have at least protection class IP55.

For AHUs with integrated control and lighting, an additional power supply for the lighting must be provided and separated from the power supply for the control cabinet. This ensures that the light also can be switched on during repair work, despite the main switch being switched off (prerequisite for access to the AHU).

24V lamps

For 24V lamps, the power supply unit must be installed as close as possible to the AHU. The corresponding resulting current must be considered on site when dimensioning the cables and components.

8 Commissioning and operation of the AHU

8.1 Preliminary steps

- Clean thoroughly the AHU and all components of dust, shavings and any other debris.
- Remove all loose parts like tools, screws, unneeded parts etc. and any documentation from the AHU. Such parts can be sucked in by the fan and lead to its destruction.
- check all bolt connections and electrical connections and retighten if necessary
- Ensure that the duct pressure corresponds to the pressure for the nominal air flow and the pressure specified in the technical data sheet.
- Ensure that all planned filters are mounted. Non mounted filters can overload the fan motor.
- All cables must be checked for damage to the insulation and replaced if necessary.
- Function test of the repair switch (emergency stop switch):
 - o Press the switch
 - o Check that there is no voltage or power
 - o After pressing the switch again, the system should not restart and should remain without power and at a standstill. A manual start command is also required for this process (see **chapter 7.3 (Main switch (emergency stop switch))**).

Here are some important points to consider, which could cause problems after transport or inappropriate AHU handling.

- Rotate the impeller of the fan by hand, to check whether it rotates freely.
- Check the motor connection and the matching of the supply voltage at the rated voltage - a fluctuation of supply voltage between + -5% is permitted.

8.1.1 Airflow measurement by differential pressure measurement at the fan

The delivered airflow rate can be calculated or displayed from the measured differential pressure. A so-called K-value and an associated formula are used for calculation or for input into display or control devices.

Usually, two different formulas and thus two different K-values are in use:

Formula A		Formula B			
In this formula, the respective air density at the fan is taken into account. The air density must be determined as a function of air temperature, air humidity, sea level and atmospheric pressure.		In this formula, a variable air density is not taken into account. Instead, a "fixed" air density of 1.20 kg/m ³ is assumed.			
With the following formulas, the airflow rate can be determined from the pressure signal:					
- Airflow rate calculation		- Airflow rate calculation			
$\dot{V} = K_A \cdot \sqrt{\frac{2 \cdot \Delta p_w}{\rho_V}}$		$\dot{V} = k_B \cdot \sqrt{\Delta p_w}$			
\dot{V}	Nominal airflow rate	m ³ /h	\dot{V}	Nominal airflow rate	m ³ /h
K_A	K_A –factor for formula A	m ² *s/h	k_B	k_B –factor for formula B	m ³ /(h*Pa ^{0.5})
Δp_w	Measured diff. pressure	Pa	Δp_w	Measured diff. pressure	Pa
ρ_V	Air density at the fan	kg/m ³			
If several fans in a fan section are operated in parallel with the same speed, then the total airflow rate is accordingly a multiple of the calculated individual airflow rate.					
With the following formulas, the setpoint Δp_w can be determined for a certain airflow rate (e.g. for dimensioning a pressure sensor, for constant airflow rate control):					
- Target differential pressure calculation			- Target differential pressure calculation		
$\Delta p_{w.set} = \frac{\dot{V}^2 \cdot \rho_V}{K_A^2 \cdot 2}$			$\Delta p_{w.set} = \frac{\dot{V}^2}{k_B^2}$		
$\Delta p_{w.set}$	Target differential pressure	Pa	$\Delta p_{w.set}$	Target differential pressure	Pa
\dot{V}	Target airflow rate	m ³ /h	\dot{V}	Target airflow rate	m ³ /h
K_A	K_A –factor for formula A (s.a.)	m ² *s/h	k_B	k_B –factor for formula B (s.a.)	m ³ /(h*Pa ^{0.5})
ρ_V	Air density at the fan (Nominal value)	kg/m ³			

Table 9: Formulas for airflow rate measurement

The corresponding K-factors of the fan are shown on the fan-motor data sheet or on the technical data sheet for the AHU. The data on the data sheet always refers to one fan.



NOTICE!

The K-values of the fans specified in the technical data sheet apply only to free-suction fans without any components. If components (e.g.: intake protection grille, fan dampers, etc.) are installed on the fan, the K-value of the fans must be re-measured by the customer onsite when the AHU is commissioned.

The air density at the measuring point is to set \dot{V} manually, depending on sea level, temperature and humidity. In most cases, 1.2 kg/m³ is a suitable value.

For AHUs supplied by EUROCLIMA with control, the airflow rate sensors are already preset.

8.1.2 Heat exchanger

The heat exchangers, fittings and valves shall be tested for tightness and integrity.

Water heat exchangers

Normal heating, cooling coils filled with water and additives for freeze and corrosion protection:

- Open vent valve.
- Water valve is initially only to open slightly, so that the coil will be slowly filled with water. To avoid heat stress.
- When the heat exchanger is filled, close the vent valve.
- Subsequently, the entire piping system must be vented properly.

Attention!

During a temporary shutdown of the system because of frost and corrosion, it is important to avoid condensate remaining in the pipes.

8.1.3 Electric heater

Observe specifications of **chapter 7.4 (Electric heaters)** -safety thermostats.

8.1.4 Air filters

- Before the commissioning stage, all filters should be checked for tightness, as otherwise they could be sucked in and therefore lead to damage.
- The mounted differential pressure switches are pre-set according to the final pressure loss on the technical data sheet.
- These ensure the output of a warning message when the final pressure loss is reached. The resulting maintenance actions are described in **chapter 9.4 (Air filters)**.

8.2 Heat wheel

During commissioning, the drive unit and the brushes of the heat wheel must be adjusted on site in accordance with the specifications of the heat wheel manufacturer.

8.3 Test run

8.3.1 General notes

After having completed the preparatory work the AHU can be started for the test run.

- For testing the device, measuring the motor data and the volumetric flow rate, the device must be fully connected to the operational duct system.
- The AHU doors must be closed, to eliminate errors in pressure drop measurement results.



Dampers or duct system

NOTICE!

Always open the dampers or the duct system before starting the AHU. Operating the fan against closed dampers or duct systems can lead to damage to the AHU, dampers or duct system and must be avoided by taking suitable measures.

In addition, the actual power consumption of all phases shall be measured and compared with the nameplate. If the actual power consumption is too high, there could be a faulty connection. Therefore, the system must be shut down immediately.

Measure the volume flow and the pressure difference. Often the measured airflow does not match with the design data of the device.

Possible causes for low airflow:

- The external pressure drop is higher than indicated on the technical data sheet.
- Possible closed fire or VAV dampers in the duct

If the airflow is incorrect and support is required on this matter, please contact EUROCLIMA.

8.3.2 Vibration verification

Check on the quiet running of the fan. There should be no unusual rocking or vibration. Check for unusual bearing noises. To prevent damage, operation above the permissible vibration values is forbidden. The maximum permissible vibration speed according to the specifications of the fan-motor-unit manufacturer must be strictly observed and followed.

Upon commissioning of the AHU, a vibration measurement and resonance point search of all fans across the entire speed control range and all in and out flow conditions (for example, at different damper positions, recirculation rates, etc.) must be conducted. These measurements must be recorded in the acceptance protocol.

Resonance at fans

The operation of fans at the resonant frequency (and multiples of it) must be avoided, in order to prevent high vibration loads. The resonant frequency must be determined at the AHU on site. **Figure 80** shows a typical vibration curve.

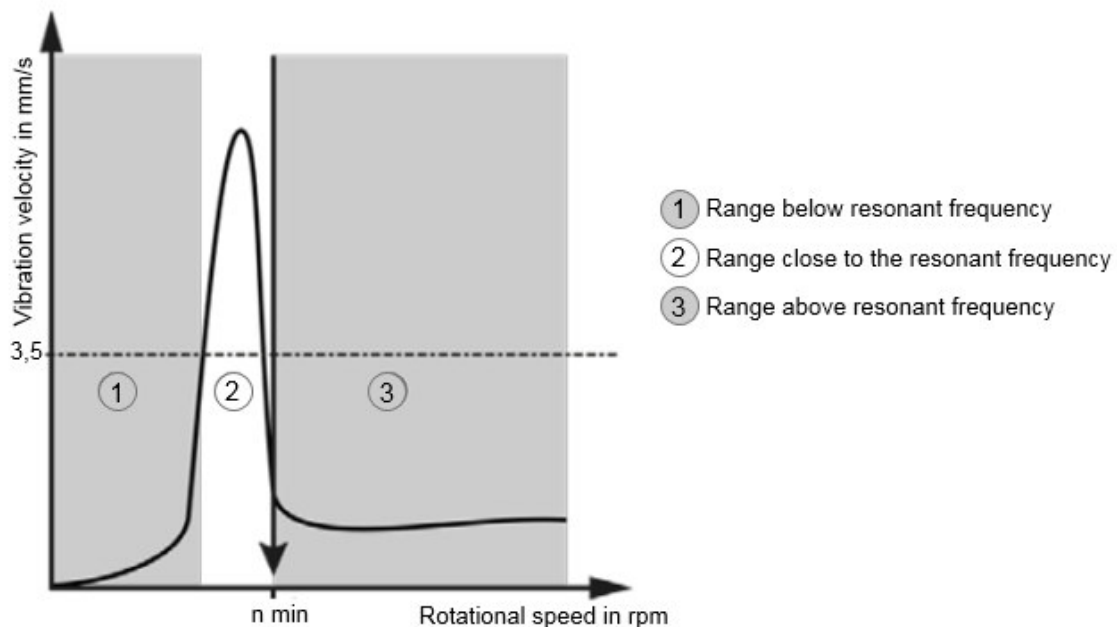


Figure 80: Typical vibration curve

The following generally applies:

- Avoid dropping below the minimum speed
- Pass through the point of resonance quickly on start-up
- No operation in speed ranges of increased vibrations (resonance)

During partial load operations, it could be that the operating point may coincide with the resonant range. In such situations, this operation must be prevented on site through small adjustments to the control. If a frequency converter is used for running the fan, then the resonant range can be suppressed directly there.

At AHUs with EUROCLIMA control, the resonant range can be suppressed. For that purpose, the appropriate setting of the software must be done at the commissioning process.

9 Maintenance



NOTICE!

EUROCLIMA AHUs are built mostly maintenance free and are easy to maintain when required. The maintenance intervals (see **Table 10**) are indicative for normal operating conditions. Widely differing applications may require different intervals, ask EUROCLIMA for details. The execution of the described checks and maintenance, see **chapter 9.11 (Maintenance plan)** needs are necessary to ensure a permanent safety operation and functionality of the AHU.

9.1 General information



WARNING!

Before servicing any electrical parts such as fan motors, damper motors, electric heaters etc. use the emergency-stop control devices, to separate the parts completely from the power supply. Instructions in **chapter 2 (Safety instructions)** have to be observed!

- The entire AHU and all components must be checked regularly for pollution, corrosion, damage and fastening and be cleaned, and if necessary appropriate measures must be taken.
- In order to avoid corrosion, in the case of components made of stainless steel like drain pans or bases, ensure that any located fragments of carbon steel are removed and stainless steel parts are cleaned from swarf of carbon steel.
- The AHU housing must be checked inside and outside for pollution, deposits, damage, corrosion and fastening and be cleaned, and if necessary repaired.
- Check door seals for tightness and integrity, and if necessary, replaced.
- Depending on the material used and the environmental conditions, it can lead to a superficial corrosion on components. For example, motor, fan shafts, pulleys, bushings, sheet metal cutting edges etc. The resulting corrosion layer protects the underlying material from further corroding and does not represent a deficiency of the component or the device. The removal of surface corrosion and treatment of the corresponding sites are generally not required. Depending on the material used, a superficial oxidation can be removed as part of regular maintenance and the appropriate site treated with suitable protective measures.
- Please note that EUROCLIMA is not responsible for damage caused by improper handling of solvents and cleaning agents, and our company would not be liable for resulting mechanical damage. Solvents and cleaning agents should not contain alcohol for use on coated surfaces.
- EUROCLIMA recommends, depending on the specified AHU execution, performing checks, maintenance and repair work in compliance to specifications according to VDI 6022 sheet 1, requirements regarding operation and maintenance.
- To order spare parts please contact your EUROCLIMA sales partner.

9.2 Electrical connection, control cabinet

- All electrical connections must be inspected annually and deficiencies (e.g. loose cable strands, loose screw and clamp connection etc.) must be identified, repaired and eliminated immediately.
- The function test of the main switch (see **chapter 8.1 (Preliminary steps)**) must be carried out regularly (see **Table 10**).
- The following maintenance work is recommended for the control cabinet of AHUs with integrated control:
 - o annual change of the filter
 - o annually check the function of the fan for the control cabinet ventilation (if present)
 - o annually check the function of the heater (installed in outdoor AHUs)
 - o annually check of screw connections and electrical connections and if necessary re-tighten and secure.
 - o cleaning of possible dust deposits

9.3 Fan / motor group

The function test of the repair (main) switch (see **chapter 8.1 (Preliminary steps)**) must be carried out regularly (see **Table 10**).

9.3.1 Vibrations



WARNING!

Permanent operation of the fan-motor-unit at inadmissible high vibrations or at resonant frequency (and multiples of it) can lead to severe damage of the AHU and can subsequently lead to damage to property and/ or injury to personnel.

During operation of the AHU, an excessive vibration level can occur due to an unfavorable air flow, accumulation of dirt and dust, lack of and / or incorrect cleaning and maintenance. Furthermore, vibrations can be transmitted from and to external system components.

The fan-motor-unit must be monitored regularly for mechanical vibrations according to the fan-motor-unit manufacturer's specifications. During this vibration measurement, the entire speed range and all in and out flow conditions (for example, at different damper positions, recirculation rates, etc.) must be monitored. The measurement results must be documented. The maximum vibration speed according to the fan-motor-unit manufacturer's specifications must be strictly observed and followed. If the admissible vibration values are exceeded, the cause must be identified immediately and urgent, appropriate measures put in place to rectify the situation.

9.3.2 Fan

- Check for dirt, debris, damage and corrosion, clean if necessary.
- Coat surface damage of the housing and impeller with zinc dust paint.
- Flexible connections are to be checked for damage through visual inspection.
- Check the protection grid (Fan in and/or outlet) if available for correct installation / damaged (visual inspection).
- Test the wheel by rotating it by hand and listen for abnormal noises.
- After dismantling and reinstalling an impeller, the fan must be checked for mechanical vibrations. It may be necessary to rebalance this for efficient use.
- Danger: Deposits on the wheel can cause damage (risk of fatigue fracture) and the impeller can be damaged!

- Visual inspection: Check the wheel for any particular weld cracking.

9.3.3 Motor

- Check the motor for cleanliness and clean if necessary.
- Measure current consumption, which must not exceed the rated current stipulated on the nameplate.

9.4 Air filters

- All filters should be checked for tightness and fit, because otherwise they could be sucked in and could lead to damage and/ or poor functioning and quality.

EUROCLIMA recommends, in accordance with the REHVA (*Federation of European Heating, Ventilation and Air Conditioning Associations*), to wear safety gloves and FFP3 respirator when changing air filters, and to dispose of the dirty filters in a sealed bag



NOTICE!

To ensure the performance and the energy-efficient operation of the AHU, the air filters must be replaced regularly. Use only filter types and filter sizes, which are suitable and intended for assembly and purpose. To gain this information, view the technical data (**Figure 81**).

TF	Bag Filter	610,0 [mm]	2,41 [m2]	94,00 [kg]	101 [Pa]
Manufacture	Camfil	Filter surface [m2]		8,20	
Type	Basic-Flo-M5 tmax.=70°C	Cells pcs x size [mm]		2 x 592,0 x 592,0	
Init.-Dim.-Final [Pa]	48-99-150				
Airflow [m³/h]	6.000				
Bag length [mm]	520,0	Stainless steel frames AISI 316L (front removable) clean air sid			

Figure 81: Extract (filter section) of technical data

If AHUs are equipped with EUROCLIMA control, then a corresponding warning message is displayed on the HMI (see **Figure 82**) when the differential pressure limitation is reached.

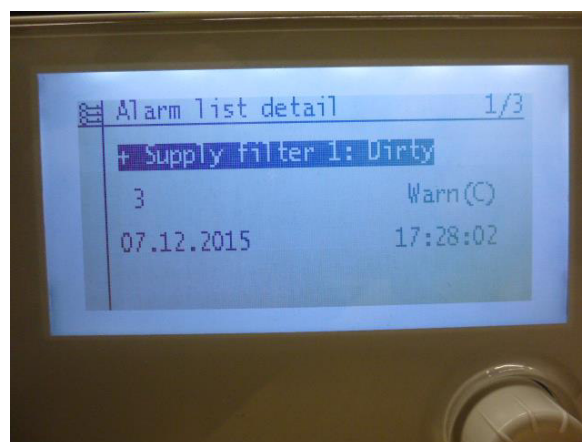


Figure 82: Warning message filter

If such a warning message is displayed, then appropriate actions have to be taken immediately (e.g. change of air filters).

9.4.1 Panel filters

- The contamination level of the filter can be controlled by the differential pressure drop (check every 14 days to 1 month). When reaching the pressure difference indicated in the technical data sheet, cleaning or replacement is required immediately.

9.4.2 Bag filters

- The contamination level of the filter can be controlled by the differential pressure drop (check every 14 days to 1 month). When reaching the pressure difference indicated in the technical data sheet, cleaning or replacement is required.

9.5 Heat exchangers

- For prolonged standstill periods, we recommend the complete emptying of the heat exchanger.
- At each refill, the heat exchanger must be vented properly.

The manual of the component manufacturer must be read and adhered to for cleaning works.

9.5.1 Medium water

Special maintenance for heat exchangers is not required, only timely cleaning is recommended. Approximately every three months, depending on the hours of operation and filter maintenance. The heat exchanger fins should be checked for dust contamination, debris and cleaned if necessary. The piping is to be checked for leaks and integrity.

Cleaning

Cleaning is to be carried out on the mounted state with a strong vacuum cleaner from the dust air-side. For strongly adhering dust, the heat exchanger can be dismantled and cleaned with water. Galvanized steel coils can be cleaned with a steam cleaner or by washing the fins with a strong water jet. A soft brush might help, but be extra careful not to damage the fins.



NOTICE!

The fins of copper-aluminum heat exchangers are particularly sensitive, therefore, use, with extra care, water with low-pressure for cleaning. Damaging the fins by mechanical force leads to premature deterioration of the heat exchanger.

Corrosion spots must be cleaned and protected with zinc dust paint.

Antifreeze protection

Check antifreeze activity before each winter season. Also check the frost protection thermostat to make sure that the setting is accurate and correct.

Drain pan

The Drain pan and drain should be checked for debris and cleaned, if necessary – **Figure 83**.

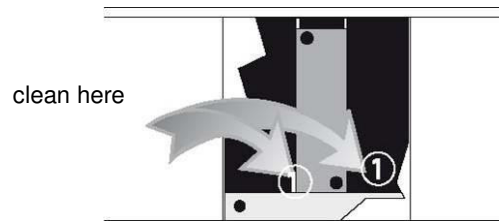


Figure 83: Cleaning of air coolers

Droplet eliminator

Check the droplet eliminator about once per year for contamination. Remove fins and clean it if necessary. Please make sure that the fins are installed properly and are not bent or have popped out of the frame.



NOTICE!

Pollutants can cause poor performance of the AHU as well as damage to the device, air functioning and components.

9.5.2 Electric Heater

- When working on the electric heater, refer to the instructions in **chapter 2 (Safety instructions)**.
- Check electric heaters for dirt and corrosion, clean heating elements if necessary.
- Check built-in safety devices and electrical parts for proper functioning.
- Check the device part for thermal damage after each power failure and take appropriate measures if necessary.

9.6 Dampers

EUROCLIMA dampers of Type J are nearly maintenance free. Check for dirt, damage and corrosion, clean if necessary with compressed air or steam jet. Check the function and correct rotation. Spray the wheels with silicone spray if necessary.

Warning!

Gears cannot be treated with organic oils! Check linkages are functioning, tighten the screws if necessary.

9.7 Weather louver

Check for dirt, damage and corrosion and that it is free from leaves, paper, etc.

9.8 Energy recovery systems

The manual of the component manufacturer must be read and followed when undertaking cleaning works.

9.8.1 Plate heat exchangers

Plate heat exchangers are made of highly corrosion-resistant high-grade aluminum and have no drive or moving parts. The lifetime is nearly unlimited, as long as the differential pressure between the plates does not exceed the maximum allowed and operating instructions are followed.

The only maintenance required is cleaning:

- Clean the condensate drain, inspect and fill the U-trap. The plate pack is normally self-cleaning.
 - o Remove fibers and dust at the exchanger inlet with a brush.
 - o Clean oils and fats with hot water, household cleaners or degreasing steam.
- If there is a bypass damper, please refer to **chapter 9.6 (Dampers)**.



NOTICE!

Attention!

Heat exchanger must not be damaged mechanically or chemically through cleaning.

9.8.2 Heat wheels

Maintenance and inspection must be carried out in accordance with the specifications of the manufacturer of the rotary heat exchanger.

9.9 Duct smoke detector

The duct smoke detector must be cleaned, checked, and maintained regularly according to the manufacturer's instructions.

9.10 Gas sensor

To guarantee permanently the safety function of the gas sensor, it must be cleaned, checked, and maintained regularly according to the manufacturer's instructions.

9.11 Maintenance plan

The maintenance intervals specified in **Table 10** are based on empirical values for normal operating conditions. They are designed for continuous operation (24 hours / day) in moderate temperate climates and low dust areas, such as in offices or shopping malls. Widely differing operating conditions, particularly with respect to air temperature, humidity and dust can significantly shorten the intervals.

Ch = Check and take appropriate measures if necessary, **CI** = Clean, **M** = Maintenance

Component	Action	Section	monthly	¼ year	½ year	year	Reference chapter
AHU, all components	Ch / CI / M	The entire air handling unit and all components, general			X		9.1 General information
	Ch / CI	Housing inside and outside			X		
	Ch / M	Door seals				X	
Electrical connection, control cabinet	Ch	Electrical connections and bolts				X	9.2 Electrical connection, control cabinet
	Ch	Main switch				X	
	M	Filter					
	Ch	Fan				X	
	Ch	Heater				X	
	Ch	Function of the electrical components		local, national and international rules and regulations must be observed			
Fan / motor group	Ch	Repair switch				X	9.3 Fan / motor group
	Ch	Vibration check	according to specification of the manufacturer				9.3.1 Vibrations
	Ch / CI / M	Fan, general			X		9.3.2 Fan
	Ch	Flexible connection			X		
	Ch	Protection grid			X		
	Ch / CI	Impeller			X		
	Ch / CI / M	Motor, general			X		9.3.3 Motor
	Ch	Check current consumption		X			
Filter	Ch	Filter, general	X				9.4 Air filters
	Ch / CI / M	Panel filters	X				9.4.1 Panel filters
	Ch / CI / M	Bag filters	X				9.4.2 Bag filters
Heat exchanger	Ch / CI	Heat exchanger, general			standstill/refill		9.5 Heat exchangers
	Ch / CI	Fins				X	9.5.1 Medium water
	Ch	Frost protection				X	
	Ch / CI	Drain pan				X	
	Ch / CI	Droplet eliminator				X	
Electric heater	Ch / CI	E-heater			X		9.5.2 Electric Heater
		Check e-heater section for thermal damages after mains supply failure!					
Dampers	Ch / CI	Dampers				X	9.6 Dampers
Weather louver	Ch / CI	Weather louver, grid and hood				X	9.7 Weather louver
Energy recovery	Ch / CI	Plate heat exchanger			X		9.8.1 Plate heat exchangers
	Ch / CI	Heat wheel	according to specification of the manufacturer				9.8.2 Heat wheels
Duct smoke detector	Ch / CI	Duct smoke detector				X	9.9 Duct smoke detector
Gas sensor	Ch / CI / M	Gas sensor				X	9.10 Gas sensor
	M	Replacement gas sensor		at least every 5 years			

Table 10: Maintenance plan

10 Information on airborne noise emitted by the AHUs - on request

Sound data can be printed on request on the technical data sheet, sample see **Figure 84**. The sound power is specified as A-weighted sound power level:

- **Line 1:** Sound power over the casing
- **Line 2:** Sound power inlet
- **Line 3:** Sound power outlet

The sound through the openings (sound power level in line 2 and 3) is the basis for the calculation of the on-site sound emissions from the environment.

AHU sound levels	63	125	250	500	1000	2000	4000	8000	Tot db (A)
1> Sound power level casing [db] +/- 4 dB	88,0	81,0	78,4	62,0	56,2	50,7	41,1	32,6	71,9
2> Sound power level air inlet [db] +/- 4 dB	93,2	90,0	96,0	87,0	77,0	74,0	72,0	66,0	89,7
3> Sound power level air outlet [db] +/- 4 dB	97,0	98,0	99,0	89,0	86,0	82,0	79,0	75,0	93,8
4> Sound press. for 1 [m] distance from AHU	68,7	61,7	59,1	42,7	36,9	31,4	21,8	20,0	52,6
5> Sound press. for 1 [m] distance from air inlet	85,8	83,3	90,0	81,5	71,7	68,8	67,1	61,1	83,9
6> Sound press. for 1 [m] distance from air outlet	89,6	91,3	93,0	83,5	80,7	76,8	74,1	70,1	88,1

Calculated sound pressure levels are indicative only. It corresponds to : free field hemispheric sound radiation from the unit casing (4), the inlet (5) and the outlet (6) opening. Other sound sources, acoustic character of the room, air flow noise, duct connections and vibrations can influence the sound pressure in dependence. In practice, therefore measured values on site may be different from the calculated ones.

Figure 84: Sound data information

11 Disassembly and disposal

11.1 Disassembly

At disassembly, the safety instructions of **chapter 2 (Safety instructions)** must be considered. It also applies to the instructions in **chapter 3 (Reception control / unloading / transportation to installation site)**. The housing can be disassembled relatively easy:

Disassembly of the housing:

- Disassembly of the external panels and removal of the insulation.
- Loosening of the screw connections.
- Loosening of the rivet connections by drilling out the rivets.

Disassembly of the built-in parts:

- Secure slender and or larger components against tipping over.
- Use of appropriate scaffolds and load carrying equipment.
- The AHU components must be raised with suitable load carrying equipment (e.g. strop/ belt with hook or shekel with chain) and have to be secured until the components are safely fixed in the AHU – see **Figure 85**.
- Handling: securing with belt/ strop– see **Figure 86**.


Figure 85: Lifting with chain hoist

Figure 86: Securing with belt

11.2 Disposal

The operator is responsible for the disposal of the shipment (packing material), operation (filters, tools, spare parts etc.), and for the disposal of the AHU itself.

The disposal of the material must be carried out by qualified technicians according to the international, national and local regulations.

A standard AHU consists of 95 % recyclable metallic materials.

Components (examples)	Material	CER / EWC European Waste Code
Casing panels, built-in components, base frames, heat exchangers	VZ and VZB sheet metal	170405
	Stainless steel	170405
	Aluminum	170402
	Copper tube	170401
Copper cable	Copper cable	170411
Casing insulation	Mineral wool	170604
Air filter	Plastic, metal	150106
	Filters which have caught toxic and/or pathogenic pollutants must be disposed of as chemical waste. National rules and regulations apply.	
Droplet separator slats	Plastic	150102
Insulation profile		
Sealing tape		
Piping		
EC – motor	Guidelines for the disassembly and instructions for the disposal can be found in the appropriate previous chapters of this instruction manual or on the homepage of the component manufacturer. Detailed information of the component manufacturer can be found on the component.	
Electronic components		

Table 11: Information for disposal

Electrical and electronic components



Electrical and electronic components can contain substances that are hazardous to health and the environment. These must not be disposed of in domestic or commercial waste facilities. Furthermore, electrical and electronic components may contain valuable materials (e.g. precious metals). They must therefore be sorted for recycling or disposal by a specialist disposal company for electrical and electronic equipment.

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